historic structure report

august 1984

CUYAHOGA VALLEY
OHIO AND ERIE CANAL

NATIONAL RECREATION AREA / OHIO

HISTORIC STRUCTURE REPORT

OHIO AND ERIE CANAL
CUYAHOGA VALLEY NATIONAL RECREATION AREA
Ohio

by

Harlan Unrau
and
Nick Scrattish, Ph D
Branch of Historic Preservation
Midwest/Rocky Mountain Team

with the research assistance of

Ms. Llyn Conrad
Ohio Historical Society

U.S. Department of the Interior / National Park Service

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

The authors wish to express gratitude for special assistance given by a number of individuals. Ms. Llyn Conrad, Archivist, Local Government Records, Ohio Historical Society, Cincinnati Branch, went far beyond the requirements of her research contract to provide a steady supply of primary source materials from depositories in Cincinnati and Columbus. Mrs. Arlene Peterson, Graphic Materials Specialist, Ohio Historical Society, Columbus, could not have been more cooperative. Both Ed Plentz, Chief Graphics Specialist, and Kathleen F. Leary, Audiovisual Archivist--Ohio Historical Society, Columbus--made possible the reproduction of the 1892 color plats sent to the park.

GRAPHICS

CHAPTER ONE: IMPACT AND ORIGINS OF THE OHIO AND ERIE CANAL

A. Commercial Activity in Northeastern Ohio

1. Conditions Before the Canal

Construction of the Ohio and Erie Canal was the single most important historical development in the Cuyahoga Valley. Before 1825 the valley and territory surrounding it constituted a nearly unbroken wilderness. At uneven intervals, a crude dwelling or two--framed on an irregular patch of denuded land--tentatively poked through the forest. The valley's economy, like the rest of Ohio's interior, was grounded on barter. Farmers grew corn and raised swine to subsist. Meager surpluses were occasionally exchanged for staples to augment this mean state of affairs. Nevertheless, landowners and squatters alike lived from hand to mouth. Roads were few, and invariably became quagmires in inclement weather. The region's waterways furnished a series of passageways, but were connected only by portages dating back to prehistoric times.

Subsistence agriculture, then, was the economic backbone of the Cuyahoga Valley. And it inhibited the development of better communications, the growth of major commerical enterprises, and the accumulation of working capital. The overall result was what William Ellis has called "the anomalous spectacle of a superior population rapidly heading for financial disaster."[1] Settlers and squatters who ventured into the wilds of northeastern Ohio lived little better than animals. Poverty--exacerbated by the near absence of money--characterized life in the region. All of the pioneers' energy was soaked up by the elemental need to survive.

2. New Conditions Attributable to the Canal

Between 1825-27 construction of the Ohio and Erie Canal through the Cuyahoga Valley dramatically changed this scene. The transition from barter to cash was swift. Cash disbursements to canal contractors were passed on to canal laborers, and, in turn, to local

---

1. William Ellis, The Cuyahoga (New York, 1966) p. 77.

merchants. Pressing needs for stone and wood to build canal components spawned quarrying and lumber industries. Quarries in the vicinity of Peninsula supplied most of the Berea sandstone used in lock construction between Akron and Cleveland. White oak was greatly in demand to build gates, culverts, and aqueducts. This resulted in a proliferation of saw mills along the valley. As a by-product of new industries, local labor acquired new skills. During the early years of the canal era, stone masons, sawyers, carpenters, shipwrights, blacksmiths, and animal care specialists abounded.

Even so, economic stimuli derived from the canal's construction were only transitory. The long-term impact of the canal in northeastern Ohio, as elsehwere, was a function of its actual operation.[2] By extension, the slower, secondary economic effects of the canal's presence were less dramatic but more far-reaching. Urban growth at the sector's terminal points was, of course, determined by the need to develop facilities for handling canal commerce. Akron and Cleveland responded to this need with alacrity and profited from it.

Within the Cuyahoga Valley the shift from the subsistence farming of corn and swine to the commerical production of wheat and cattle dates from 1827.[3] After the canal opened settlers began to clear lands they owned to produce cash commodities.[4] Until 1827 the price of wheat near

---

2. Harry N. Scheiber, Ohio Canal Era: A Case Study of Government and the Economy, 1820-1861 (Athens, Ohio, 1969), pp. 90-91.

3. David S. Brose, "Proposal to the National Park Service, Midwest Archaeological Center." Cleveland Museum of Natural History. May 1979. Re: scope of work for archaeological investigations at CUVA., p. 108. Hereafter cited as P(MWAC). In individual cases, the shift may have been financed by wages earned on canal construction. Farmers did use their canal wages to pay taxes. See Scheiber, Ohio Canal Era, p. 208, n. 10.

4. "This is manifested . . . in the increased downstream erosion seen at many of the settlers' archaeological sites . . . ." Brose, P(MWAC), p. 106.

Akron had been 20-30 cents a bushel. By 1833 it was 75 cents.[5] The trend to produce cash commodities was particularly pronounced in counties and townships that bordered the canal. Harry Schieber has calculated that in the six counties on the Ohio and Erie's northern division, urban property values rose 360 percent between 1832-40.[6] The appreciation of mostly rural property in the valley was not as striking, but the point is that significant economic differences began to appear between settlers and squatters--the latter having far fewer opportunities to accumulate cash.[7] It was especially between 1827-40 that material prosperity accrued to settlers as a group. Having new-found wealth settlers invested in personal possessions, more elaborate homes, and in internal improvements of a local nature, such as plank roads.

Plenty of evidence exists to support the view that settlers living in townships bordering the canal became wealthier. The excavation of valley homesteads known to have been inhabited by settlers between 1827-40 has revealed a marked proclivity among them for the ownership of fine imported goods--most of which originated in Great Britain. Archeological evidence from these sites also elucidates a changing dietary pattern among settlers, who began to consume more beef and less pork. A study of Probate Inventories for this period reveals that settlers, unlike squatters, assiduously built personal libraries.[8]

Most of the imposing residences, commercial structures, and churches owned or supported by settlers in the Cuyahoga Valley date from the late 1820s through the 1840s. Nearly all brick construction in the valley dates from this period, as reflected in the increased tax value of individual properties. Road development in the valley was actively sponsored during the 1830s. Settlers wanted quicker access to the canal

---

5. Scheiber, Ohio Canal Era, p. 192.

6. Ibid., p. 198.

7. Brose, P(MWAC), p. 105.

8. Ibid., pp. 106-107.

for the shipment and importation of goods. This resulted in the proximity of roads to the residences of settlers but not necessarily to those of squatters. The economic need for better transportation to the canal, then, decreased the isolation indiscriminately imposed on settlers and squatters alike before the canal era.

The social effects wrought by the canal can also be discussed conveniently in terms of immediate and secondary developments. As early as July 22, 1825s the Cleveland Herald described the arrival of "the hardy sons of Erin" from New York State.[9] These men were the vanguard of a larger movement of laborers into the area, which later included German immigrants.[10] After completion of the Akron-Cleveland sector, some made their homes in settlements along the valley.

A social effect of a more gradual nature resulting from the canal was the breaking down of social mechanisms designed to insulate settlers from squatters. After 1827 church membership became more fluid. The dominance of settler membership in non-religious societies also became less pronounced, with the noteworthy exception of boards of educational institutions. During the 1830s and 40s marriages between settlers and squatters were more frequent, providing that the squatter family was of the same economic status. There was, for example, a significant incidence of marriage between the eldest daughters and second sons of land speculator families, whether settler or squatter in origin.[11] In the aggregate the artificial social mechanisms so prevalent from 1800-25 were much less important during the canal era. Henceforth social status was usually a function of a family's economic importance.

---

9. Cited by Scheiber, Ohio Canal Era, p. 208. n. 10.

10. Harlan Hatcher, Western Reserve (New York, Indianapolis, 1949), p. 106.

11. Brose, P(MWAC), pp. 107-108.

3. Early Recognition of the Need for Improved Waterways

Soon after Ohio was granted statehood in 1803, the need for an adequate transportation system became apparent to her political leaders. One of these, Thomas Worthington--later Governor and Canal Commissioner--actively supported roads and canals in the United States Senate in 1807-08.[12] On the state level an attempt to improve waterborne transportation in northeastern Ohio can be traced to 1807. In that year a scheme was devised to raise money for the improvement of "Cuyahoga and Muskingum Navigation." Local citizens thought that by raising $12,000, the Cuyahoga and Tuscarawas River channels could be cleared of logs and trees, and the portage between made passable for the traffic of loaded wagons. To raise $8,000 of the needed funds, a lottery--sanctioned by the Legislature of the State of Ohio--was scheduled for the first Monday in January 1808. The drawing never came off. Not more than a fourth of the lottery tickets was even sold.[13] So ended the first attempt to improve the waterways of northeastern Ohio.

B. Antecedents: Canal Building in the East

Up to the conclusion of the American Revolution, there were practically no public improvements in the United States. Several cities had crude waterworks and a little rough paving, but these were the exceptions. Primitive means of communication linked even the most important urban centers. Efforts to ameliorate the situation consisted of a handful of plans and reports, but few were even partially implemented. The lack of incentive shown by Americans to improve their communication systems during this period has been attributed to the enormous financial and physical difficulties and the country's colonial status.[14]

---

12. Frank W. Trevorrow, Ohio's Canals (Oberlin, Ohio, 1973), p. 1.

13. Charles Whittlesey, Early History of Cleveland (Cleveland, 1867), p. 420; Crisfield Johnson, History of Cuyahoga County, Ohio (Cleveland, 1879), p. 54; and William H. Perrin, History of Summit County (Chicago, 1881), p. 322.

14. Richard Shelton Kirby and Philip Gustave Laurson, The Early Years of Modern Civil Engineering (New Haven, 1932), p. 40.

Notwithstanding this inertia, it is the case that as the Revolution approached Americans began to demonstrate increased interest in the construction of canals. In August 1772 Benjamin Franklin, writing from Great Britain to the mayor of Philadelphia observed:

> Rivers are ungovernable things, especially in hilly countries. Canals are quiet and always manageable . . . I warmly wish success to every Attempt for Improvement of our dear Country. . . .[15]

Franklin then proceeded to outline a complex canal system--one he had devised. Its purpose was to bring wealth to Philadelphia from the city's agricultural hinterland and coal mines.

During the early 1770s George Washington began promoting the idea of connecting the Potomac and Ohio River valleys by means of river improvements and canals. Throughout the Revolution, Washington maintained his interest in developing water routes to the West. Even before the formal cessation of hostilities (1783), Washington toured the Mohawk Valley. Here he examined portages and noted places where canals might be built.

Shortly afterward, in the early fall of 1784, Washington traveled to Western Pennsylvania. On October 10 of that year Washington wrote to Benjamin Harrison, Governor of Virginia. Washington expressed his desire to develop the fur trade of the Great Lakes by opening a communications network to the area.[16] In correspondence to Washington, dated November 14, 1784, Harrison replied favorably to Washington's proposal of October 10.[17] When Washington wrote to Richard Henry Lee, President of Congress, on December 14, 1784, he informed him that the

---

15. Cited by Seymour Dunbar, A History of Travel in America (New York, 1937), p. 772.

16. Jared Sparks, ed., The Writings of George Washington (Boston, 1846), IX, pp. 64-65.

17. Ibid., pp. 68-69.

Assemblies of Virginia and Maryland had taken under consideration the feasibility of opening the Potomac and James Rivers to the "western waters."[18] Washington, however, was not merely satisfied with investigations on the part of individual states:

> Would it not, at the same time, be worthy of the wisdom and attention of Congress to have the western waters well explored, the navigation of them full ascertained, accurately laid down, and a complete and perfect map made of the country. . . . The expense attending such an undertaking could not be great, the advantages would be unbounded; for sure I am, nature has made such a display of her bounties in those regions, that the more the country is explored, the more it will rise in estimation, consequently the greater will be revenue be to the Union.[19]

Earlier in the year Washington had queried Thomas Jefferson about the distance from New York to the Cuyahoga River. Using "Hutchins' map,"[20] Jefferson furnished the following information:

---

18. Ibid., p. 80.

19. Ibid., pp. 80-81.

20. Thomas Hutchins was not only an accomplished cartographer, but "one of four pioneer British authors of accounts of the interior of North America, based on personal experience." Peter J. Guthorn, British Maps of the American Revolution (Monmouth Beach, N.J., 1972), p. 30. Jefferson did not specify which of Hutchins' maps he used. It was most likely "A scetch [sic] of the several Indian roads leading from Port Pitt to Scioto, Lake Erie & c," drawn in 1762. Jefferson could have easily calculated distances farther east. Jefferson's knowledge of the "western country" can be traced to 1781, when he wrote "Notes on the State of Virginia."

From New York to Albany		164 miles
[Albany to]	Oneida	165
[Oneida to]	Oswego	171
[Oswego to]	Niagara	180
		680
From Niagara to Cuyahoga		140
		820 [21]

Washington's last known correspondence on the subject was directed to Jefferson on February 13, 1789:

> You have been made acquainted, my dear Sir, with my ideas of the practicability, importance, and extent of that navigation, as they have been occasionally, though fully expressed, in my several letters to you. Notwithstanding my constant and utmost endeavors to obtain precise information respecting the nearest and best communication between the Ohio and Lake Erie, I am not yet able to add any thing more satisfactory to the observations, which I have had the honor to make on that subject. . . .[22]

Soon after winning independence from Great Britain, Americans in many different eastern locales trained their attention on the improvement of water-borne transportation. A growing number of Americans voiced the conviction that a viable United States meant an end to the heavy isolation imposed on towns, villages, and farms for lack of roads and usable waterways. By 1793 some 30 canal companies had been chartered in eight of the thirteen states.[23]

In 1794 two very short canals were opened to navigation. The South Hadley Canal, somewhat more than two miles in length, and sporting five

---

21. Andrew A. Lipscomb, et al., eds., The Writings of Thomas Jefferson (Washington, 1905), III p. 448.

22. Sparks, Writings of George Washington, IX, p. 471.

23. Harry Sinclair Drago, Canal Days in America (New York, 1972), p. 42.

locks, was dug around a 50' fall on the Connecticut River in Massachusetts.[24] The Dismal Swamp Canal, designed to connect Norfolk, Virginia, with the Albemarle Sound in North Carolina, was begun in 1787. Only the sector joining the lower end of Chesapeake Bay with the Pasquotank River was navigable for small boats by 1794.[25]

Two other canals were started as early as 1785 to facilitate trade within the Potomac and James River valleys. The Potomac Canal, begun at Great Falls, some 15 miles above Washington, was later absorbed by the Chesapeake and Ohio Canal. The James River Canal operated around the falls above Richmond. This waterway later became part of the James River and Kanawha Canal.[26]

During the last few years of the eighteenth century, two canals--the longest yet attempted in America--were dug contemporaneously. Chartered in 1786, and completed in 1800 at a cost of $700,000, the 22-mile Santee Canal in South Carolina provided a waterway between Charleston Harbor and the Santee River.[27] The Middlesex Canal in Massachusetts, built between 1794 and 1803, connected the environs of Boston with the Merrimack River, a short distance above the future city of Lowell. This 27-mile canal, constructed at a cost of $600,000, enabled the importation into Boston of forest products from New Hampshire.[28]

---

24. Fred W. Powell, "First Canals on the American Continent," Journal of American History, IV (1910), pp. 407-416.

25. George Armroyd, A Connected View of the Whole Internal Navigation of the United States (Philadelphia, 1826), pp. 150-151.

26. Archer Butler Hulbert, Historic Highways of America (Cleveland, 1904), XIII, pp. 33-64.

27. Henry S. Tanner, A Description of the Canals and Railroads of the United States (New York, 1840), pp. 171-172.

28. Caleb Eddy, Historical Sketch of the Middlesex Canal (Boston, 1843), pp. 3-21.

Following completion of Great Britain's Bridgewater Canal in 1761, a boom in canal construction took place throughout that nation. Following completion of the eastern canals noted above, however, no such boom occurred in the United States. Canal construction in America required huge expenditures and engineering expertise. Neither was readily available. Moreover, the first canals built proved unsuccessful ventures--prompting little encouragement among investors. In particular, both the Santee and Middlesex Canal companies subjected their stockholders to onerous assessments during and after the period of construction. At the end of 10 years of operation, neither was really profitable; nor did either prove to be the boon to regional transporation their promoters had envisioned.[29]

Despite the unsuccessful Cuyahoga and Muskingum Navigation scheme in 1808, and the unenviable financial record of early eastern canals, enthusiasm was not dampened in Northeastern Ohio for internal improvements to enhance the area's commerical potential. New York's Erie Canal Commission was set up by Governor De Witt Clinton in 1810. The War of 1812, and the project's daring nature, held up construction until 1817. Afterward westward progress was rapid. By the early 1820s the canal had pierced the Mohawk Valley toward Buffalo on Lake Erie. Ohio, then, was shortly to have access to the Hudson River and the burgeoning port of New York. Yet, the commercial benefits accruable to Ohioans depended on a dramatic improvement of the state's own roads and waterways.[30]

Influential New Yorkers themselves were convinced that a statewide canal system was inherently superior to a network of turnpikes. Calculations proved that in a day's time four horses could draw a

---

29. George Rogers Taylor, The Transportation Revolution: 1815-1860 (New York, 1951), p. 32.

30. On the economic necessity for a canal in Ohio see Chester E. Finn, "The Ohio Canals: Public Enterprise on the Frontier." Ohio State Archaeological and Historical Quarterly, LI (January-March, 1942), pp. 3-4.

wagonload of goods, weighing a ton, 12 miles over an ordinary road. Using a turnpike, the same team could pull 1-1/2 tons a distance of 24 miles. Such economy in horsepower, wages, and time implied that bulky goods could be taken to market with comparative efficiency. It is worth stressing that these were not merely paper calculations. Their validity had been proven in Europe by the end of the eighteenth century.[31]

As early as April 1811 New York asked Ohio's Congressional cooperation to secure federal aid for the Erie Canal. In January 1812 the Ohio Legislature resolved that New York's canal was a project of national concern. The argument ran that it was bound to strengthen the bond of union between individual states by encouraging agriculture, manufacturing, and internal commerce. The Legislature held to the view that the federal government should help defray the canal's cost.[32] Encouraged, New York--in 1815--invited Ohio to join her in building the Erie Canal.[33]

C. Early Movement for a Canal System in Ohio

1. Worthington Administration

As Governor of Ohio from 1814-18 Thomas Worthington helped introduce into American politics the policy of proposing and pushing for the construction of internal improvements. On December 11, 1816, Governor Worthington sent to the Ohio Legislature a letter from De Witt Clinton--then President of the New York Board of Canal Commissioners--that stressed the benefits the Erie Canal was likely to render to Ohio. Clinton thus requested that Ohio participate in the expense.[34] A committee was appointed to consider the matter, and, on

---

31. Historical Account of the Rise, Progress and Present State of the Canal Navigation in Pennsylvania (Philadelphia, 1795), pp. 3-65.

32. January 15 and 17, 1812, Ohio Senate Journal, 1812.

33. Rufus King, First Fruits of the Ordinance of 1787 (Boston, New York, 1888), p. 347.

34. C. C. Huntington and C. P. McClelland, History of the Ohio Canals (Columbus, 1905), p. 2.

January 9, 1817, offered a resolution that Worthington correspond with Clinton to obtain more information. Four days later the State Senate deleted that section of the resolution implying that Ohio would offer New York financial aid. Other forms of cooperation were approved. The January 1817 resolution was noteworthy in one other respect: it actually specified the need for a canal from Lake Erie to the Ohio River.[35]

On December 7, 1818, Governor Worthington's message to the Legislature stressed the need for internal improvements, especially the improvement of roads and construction of canals.[36] Worthington is known to have corresponded with President James Monroe's Secretary of State, William H. Crawford, on the subject. For example, in a letter to Crawford, dated October 1, 1818, Worthington described the desirability and practicality of constructing Ohio canals.[37]

2. Brown Administration

From 1818-22 Ohio's next Governor, Ethan Allen Brown, zealously carried forward the mission. In his Inaugural Address of December 14, 1818, he stated that:

> If we would raise the character of our state by increasing industry and our resources it seems necessary to improve the internal communications, and open a cheaper way to market for the surplus produce of a large portion of our fertile country.[38]

A few days later Ohio Senator John Thompson of Columbiana County reported a bill:

---

35. Ibid., p. 3.

36. Ohio Senate Journal, 1818, p. 10.

37. Ibid., p. 20.

38. Ibid., p. 84

> . . . to incorporate a company vested with powers to connect by canals the waters of Lake Erie with those of the Ohio River.[39]

Thompson's resolution was not destined to get very far. Members of the State Assembly were adamant that Ohio canals should only be built by the State of Ohio.[40] It was also in December 1818 when Nathaniel Beasley, Senator from Brown County, offered a resolution to provide for the establishment of a joint committee of three senators and five representatives. Their sole assignment was to draft a bill authorizing the governor to employ engineers to survey four potential canal routes: Miami-Maumee, Scioto-Sandusky, Muskingum-Cuyahoga, and Grand-Big Beaver Rivers.[41]

Throughout the depression year of 1819 the canal issue permeated Ohio politics. During the year both houses of the State Legislature approved a resolution for the purpose of selecting the most favorable route.[42] A committee was then instituted to draft a bill providing funds to cover the expense of surveys. The bill itself never became law. This particular issue characterized canal acts in the Legislature. As a rule one or the other of the houses was disposed to work with Governor Brown. Only rarely did the two work in conjunction. Much of the friction stemmed from regional jealousy. Individual legislators were willing to throw in their support only when the constituents they represented stood to benefit directly from a particular proposal.[43]

---

39. Ibid., p. 139.

40. Finn, "The Ohio Canals," p. 7.

41. John S. Still, "Ethan Allen Brown and Ohio's Canal System," Ohio Historical Quarterly LXVI (January 1957), p. 24.

42. This move can only be appreciated properly when it is stressed that Ohio was hit hard by the national depression. See Scheiber, Ohio Canal Era, p. 5 and Schieber's "The Ohio Canal Movement, 1820-1825." Ohio Historical Quarterly LXIX (July 1960), p. 233 ff.

43. Still, "Ethan Allen Brown," pp. 24-25.

Governor Brown deserved as much credit as any individual for seeing to it that legislative activity was translated into legislative action.[44] In his second annual address, on December 14, 1819, Brown minimized the effects of regional jealousy by emphasizing internal improvements in general rather than canals alone.[45] His greater contribution was to draft a comprehensive report on the practicality of connecting Lake Erie with the Ohio River. Legislators were informed that three routes were serious candidates. One of these would follow the Cuyahoga and Tuscarawas Rivers, as well as the portage that connected them.[46]

Brown's report estimated that a canal could be constructed for $2,500,000, regardless of the route. In Brown's opinion Ohio was in no position to undertake such a massive project without assistance. The most likely source for aid appeared to be the federal government. If Congress would sell to Ohio some 4,000,000 acres of land recently acquired from the Indians at $1.00 per acre for 10 years without interest, the state could resell the land for $3.00 per acre once the canal opened. In this way, as Brown saw it, the canal could be paid for.[47]

The real significance of Brown's report is that it maintained public interest in a canal at a time when the project began to appear unworkable. Ohio's first legislative act regarding "navigable communication between Lake Erie and the Ohio River" did follow Brown's report by only four weeks. Likely stimulated by Brown's efforts, the Legislature appropriated funds for a canal survey, but made the survey contingent on a land grant from Congress. Congress, however, was not willing to

---

44. Ibid., pp. 24, 43,

45. Ibid., p. 25.

46. Ibid., p. 26.

47. Ibid., pp. 26-27.

give Ohio land under this condition. Consequently the surveys were not performed.[48]

During the 1820-21 session of the Legislature, Brown continued to press for survey appropriations. In this he was unsuccessful. For the fourth consecutive year, Brown's 1821 message to the Legislature proposed a canal survey. This time the Assembly appointed a special committee to study the issue, and selected Micajah T. Williams of Cincinnati as chairman. Williams had long been a proponent of internal improvements. On January 3, 1822, his committee's report was presented to the Assembly. Its thesis was that Ohio's economic well-being depended on a Lake Erie-Ohio River canal. The committee strongly recommended the canal be built by the state.[49]

Ohio newspapers gave the Williams Committee Report plenty of favorable attention. To its credit the report was vague enough to defuse local jealousy. It was for this reason, and others based on economics,[50] that the Legislature took action. On January 31, 1822, a bill was enacted to:

(1) Establish a canal commission of seven members to direct surveys,

(2) Authorize the commission to hire a competent civil engineer, and

(3) Survey five possible routes from Lake Erie to the Ohio.[51]

---

48. Ibid., p. 28.

49. Ibid., p. 33. For an extract from this important document see John Kilbourn, comp., Public Documents Concerning the Ohio Canals (Columbus 1832), pp. 16 ff.

50. For example, Williams cleverly played up the potential profits. See Still, "Ethan Allen Brown," pp. 33-34.

51. Kilbourn, Public Documents, pp. 26-27.

CHAPTER TWO: THE OHIO CANAL SURVEYS: 1822-25

A. Introduction

On July 4, 1827, the 38-mile section of the Ohio and Erie Canal between the Portage Summit, just north of Akron, and Cleveland, on the shores of Lake Erie, was opened for operation. That day gala ceremonies were conducted to initiate this first completed section of the West's first canal. The purpose of this chapter is to present data on the significant role that the Board of Canal Commissioners played in superintending the preliminary surveys and securing the passage of necessary legislation for the construction, by October 1832, of the waterway that would ultimately extend some 308 miles via the Tuscarawas, Muskingum, Licking, and Scioto river valleys to Portsmouth on the Ohio River.[1]

B. Ohio Canal Surveys: 1822-25

As discussed in Chapter One, it was because of the Williams Committee Report, which presented a powerful argument for canals in the promotion of the argricultural, manufacturing, and commercial interests of Ohio, that the state legislature responded on January 31, 1822, enacting a bill to initiate the first canal surveys. This legislation specifically authorized the governor to employ an experienced engineer and to appoint a seven-member Board of Canal Commissioners to direct the surveys and estimates of five possible canal routes from the Ohio River to Lake Erie with an appropriation of $6,000. The commissioners appointed by the legislature represented a broad cross-section of the state's regional, commercial, and political interests. Those named to the commission included: Ethan Allen Brown, who recently had been elected to the United States Senate; Alfred Kelley, a banker, lawyer, and real estate speculator from Cleveland; former Governor Thomas Worthington of Chillicothe, a long-time canal proponent who was now a merchant, farmer, land speculator, and manufacturer; Ebenezer Buckingham, a wealthy

---

1. Ohio Canal Era, p. 48; Still, "Ethan Allen Brown," pp. 52-53; George White Dial, "The Construction of the Ohio Canals, Ohio Archaeological and Historical Publications, XIII (1904), pp. 472-473; History of the Ohio Canals, p. 30; and Frank Wilcox, The Ohio Canals (Kent, 1969), p. 37.

merchant and salt manufacturer from the Muskingum Valley; Benjamin Tappan, a lawyer and former federal judge from Steubenville; Isaac Minor, a former member of the Madison County judiciary in west-central Ohio; and Jeremiah Morrow, a farmer and one-time Congressman from Warren County in southwest Ohio. The five possible routes for the lake-to-river canal that were to be surveyed were: (1) from Sandusky Bay to the Ohio River; (2) from the mouth of the Cuyahoga River at Cleveland to the Ohio via the Muskingum and Tuscarawas Rivers; (3) from the mouth of the Black River to the Ohio via the Muskingum; (4) from the mouth of the Grand River northeast of Cleveland to the Ohio via the Mahoning; and (5) from the mouth of the Maumee via the valleys of the Auglaize and Miami to the Ohio at Cincinnati, then the largest city in the state with a population of some 25,000.[2]

One of the board's first decisions in 1822 was agreement that the projected lake-to-river canal should pass through as many settled regions of the state as possible to command support from the maximum number of people. Toward that end, the commission hoped to prove the practicability of a "diagonal canal" running from Cincinnati north through the Miami Valley and then eastward to the Scioto region and from thence northward to Lake Erie via the Muskingum River. A branch line would run from the main trunk to the Ohio River, near Steubenville.[3]

In March 1822 James Geddes, one of the senior engineers on the Erie Canal and one of the nation's most prominent civil engineers, was engaged

---

2. Scheiber, Ohio Canal Era, pp. 16-17; Scheiber, "The Ohio Canal Movement," p. 238; Finn, "The Ohio Canals," p. 9; Kilbourn, Public Documents, pp. 26-27; and History of the Ohio Canals, pp. 14-15. Of the seven commissioners, Kelley was to play the most prominent role in directing the surveys and later superintending the construction of the Ohio canals. Biographical data relative to his contributions may be found in Harry N. Scheiber, "Alfred Kelley and the Ohio Business Elite, 1822-1859," Ohio History, LXXXVII (Autumn, 1978), pp. 365-392; Alfred Yaple, Reminiscences of Alfred Kelley (Cincinnati, 1875), pp. 1-26; and Dictionary of American Biography, V, pp. 296-297.

3. Scheiber, Ohio Canal Era, p. 19, and Scheiber, "Ohio Canal Movement," p. 240.

for the Ohio canal surveys through the cooperation of Governor De Witt Clinton, an active supporter of the lake-to-river canal. Governor Clinton saw the canal as a means of increasing trade between the Ohio River Valley and New York City via the Erie Canal.[4] The surveys did not begin until mid-April, but over the next eight months some 900 miles were examined and the level of 800 miles was taken. While Geddes surveyed all of the five proposed routes, he conducted careful instrument surveys of two: one extended from the Scioto Valley directly northward across the Scioto-Sandusky portage and thence down to the lake, and the other, which he favored, stretched from the Scioto eastward to the upper Muskingum River and then northward to Lake Erie by way of either the Black or Cuyahoga Rivers. The latter route, which had not been called for in the legislation, had been ordered by the commissioners when it was realized that the "diagonal route" might not prove practicable because the country between the Scioto and the Miami presented serious engineering and water supply problems. The Scioto-Muskingum line, which it was hoped would command equally wide support, later became the general route of the Ohio and Erie Canal which followed the Cuyahoga River to its termination in Cleveland.[5]

On January 3, 1823, the Board of Canal Commissioners submitted its first annual report, consisting of a summary of its findings and tentative conclusions, to the state legislature. In addition to reiterating the economic advantages of a lake-to-river canal, the commission observed that based on Geddes' surveys there was some possibility of success on all of the five routes originally suggested. Hope was kept alive even for the central "diagonal route," as Geddes had tentatively endorsed the idea

---

4. A short biography of James Geddes may be found in the Dictionary of American Biography, IV, pp. 204-205.

5. The "Hon. James Geddes' Report," December 1822, was printed as an appendix to the "First Annual Report of the Canal Commissioners" and may be seen in Kilbourn, Public Documents, pp. 40-48, 51.

that the headwaters of distant streams might possibly be turned to supply its summit.[6]

The general assembly complied with the commissioners' request for an additional $4,000-appropriation to provide for additional surveys and a thorough study of the comparative advantages of each route surveyed. The commission was instructed to name two of its members as "acting commissioners" with a fixed salary to serve in a supervisory capacity and spend full time in the field. The legislators transferred from the governor to the commission the authority to hire another engineer to replace Geddes, who had returned to New York where he was needed for the completion of the Erie Canal. The commissioners were also granted the authority to apply for donations of land or money from the landholders through whose property the future canal might pass.[7]

Because construction of the Erie Canal was reaching its climax in early 1823, the Ohio commissioners found it impossible to engage a prominent civil engineer to succeed Geddes. Thus, the commissioners sent Alfred Kelley, Micajah T. Williams, who had been named to succeed Morrow on the commision after Morrow's victory in the Ohio gubernatiorial election in the autumn of 1822, and Samuel Farrer, a Dayton surveyor who had been engaged to work for the commission, to New York. The three were to study the engineering technology employed on the Erie Canal, for the purpose of applying its construction technology to the planning for an Ohio canal.[8] In June 1823 Kelley and Williams were appointed as acting commissioners; thus, the two men who later were called upon to supervise the construction of the first Ohio canals initially assume a

---

6. "First Report of the Canal Commissioners," January 3, 1823, Kilbourn, Public Documents, pp. 31-32, 35-40.

7. Still, "Ethan Allen Brown," pp. 38-39, and Kilbourn, Public Documents, pp. 52-53.

8. A short biography of Samuel Farrer may be seen in Trevorrow, Ohio's Canals, pp. 67-68. Also see Alfred Kelley to Mary Kelley, January 15, 1823, Alfred Kelley Papers, Manuscript Collection #151, Box 1, Folder 2, Ohio Historical Society, Columbus.

managerial role in mid-1823, and began a decade in which they provided a noteworthy continuity to the administration of both the surveys and construction phases of the work.[9]

With the aid of their staffs, Kelley and Williams accomplished three major engineering tasks in 1823. First, Kelley gauged the streams in the Sandusky-Scioto portage region. Second, Williams struck out on a new course, locating a line from Cincinnati northward to the Maumee River and thence east to the river's mouth at the present location of Toledo on Lake Erie. Third, both Kelley and Williams made further surveys of the Scioto-Muskingum-Lake Erie line, favored by Geddes the previous year. This line ran eastward from the Scioto Valley over the Walnut-Licking summit to the Muskingum's headwaters and then northward. Accordingly, the Killbuck-Black River and Tuscarawas-Cuyahoga River routes, whereby a canal would be carried from the Muskingum's sources to the lake, were explored.

In January 1824 the commissioners reported to the state legislature concerning their findings during the previous year. The board declared that the Sandusky-Scioto route was "extremely doubtful" as a feasible canal route because of an inadequate water supply, but that both the Cincinnati-Maumee-Lake Erie and the Scioto-Muskingum-Lake Erie routes were found to have favorable terrain and water supplies. The latter route was the more promising of the two because of its topography and the fact that it was calculated to attract the most public support, since it passed through more settled areas of the state than did the Cincinnati-Maumee route. Because it would be impossible to connect the populous Miami Valley with the most favorable route, as had been hoped, it was recommended that a relatively inexpensive canal could be built to serve the western portion of the state, following the general route northward from Cincinnati as surveyed by Williams. Attached to the annual report was a letter written by David S. Bates, a prominent senior

---

9. Scheiber, Ohio Canal Era, pp. 20-21; Scheiber, "Ohio Canal Movement," 242; and Still, "Ethan Allen Brown," p. 39.

Erie Canal engineer, concurring in the view that the Sandusky-Scioto route was doubtful while both of the other two routes were feasible canal lines from an engineering standpoint.[10]

With publication of the January 1824 report, it became obvious that all the surveys to date favored the Scioto-Muskingum-Lake Erie route, and that the Cincinnati-Maumee route was gaining support as an ancillary project. The resultant coalition of local interests was strong enough to secure enactment of further appropriations to fund more exact surveys. To allay discontent in the regions threatened with being bypassed by the two routes, the legislature required the commissioners to engage an experienced engineer to supervise the final surveys, draw up estimates of work to be done and construction costs and provide a disinterested comparison of the varying merits of the routes. Finally, the commission was ordered to report upon the completion costs of such harbor facilities on Lake Erie as would need to be constructed at Cleveland or at the mouth of the Black River.[11]

Throughout 1824 the canal commission worked to produce a final report preparatory to the construction of a lake-to-river canal, pinning all of its hopes on the successful location of a line on the Scioto-Muskingum-Lake Erie route. The key engineering question was whether the water supply would permit a canal to penetrate the divide on the Licking Summit between the Scioto and the Muskingum watersheds, for such a route would bind together the interests of those two valleys. To assure that the board's final recommendations would carry the weight of scientific authority, David S. Bates returned to review the canal

---

10. Scheiber, Ohio Canal Era, p. 21; Scheiber, "Ohio Canal Movement," pp. 243-245; Still, "Ethan Allen Brown," p. 39; "Second Annual Report of the Board of Canal Commissioners," January 21, 1824; Kilbourn, Public Documents, pp. 54-64, 67-80, 83-96. A short biographical sketch of David S. Bates may be found in Committee on History and Heritage of American Civil Engineering, American Society of Civil Eingineers, A Biographical Dictionary of American Civil Engineers (New York, 1972), pp. 7-8.

11. Kilbourn, Public Documents, pp. 96, 99.

commission's work. During the summer of 1824, the field surveys were directed by staff engineers in Ohio. One line was laid from Portsmouth, at the mouth of the Scioto, to Coshocton and from there to the lake by three different routes: the Killbuck and Black Rivers; the Killbuck, Chippewa, and Cuyahoga Rivers; and the Tuscarawas and Cuyahoga Rivers. Another line was located from Cincinnati to the foot of the rapids of the Maumee River by way of Middletown, Dayton, and the Great Miami River. Bates arrived in the autumn and found that the engineers had solved the problem of the Licking Summit, approving their plan for an elaborate "deep cut" at the summit and the construction of an extensive reservoir. He fully endorsed the full lake-to-river canal lines surveyed by the Ohio engineers.[12]

C. Passage of the "1825 Canal Bill," February 4, 1825

On January 10, 1825, the Board of Canal Commissioners issued a report that contained numerous recommendations based on its three years of survey work. Its principal recommendations included:

(1) The construction of two lake-to-river canals--the Ohio and Erie Canal, via the Scioto-Muskingum-Lake Erie route, costing between $2,801,709.85 and $3,061,368.47, and the Miami and Erie Canal, via the Miami and Maumee Rivers, costing some $2,929,957. Of the two routes, the commissioners recommended the former for immediate completion and the latter for construction only for the 50-mile section from Cincinnati to Dayton at a cost of $673,000.

(2) The establishment of a newly-constituted canal commission to supervise the construction and manage the operation of the canals.

(3) The creation of a separate commission to finance the public works by issuing bonds backed by the credit of the state.

---

12. Scheiber, Ohio Canal Era, pp. 22-25; Scheiber, "Ohio Canal Movement," pp. 245-249; Still, "Ethan Allen Brown," p. 40; and "Third Annual Report of the Canal Commissioners," January 8, 1825; Kilbourn, Public Documents, pp. 103-112, 115-128, 131-144, 147.

(4) A major state tax revision which would assess property ad valorem, instead of classifying land without reference to market value, thereby increasing state revenues and placing a larger share of the tax burden on localities where land values would rise quickly because of the canals.

(5) The formation of a sinking fund to pay the principal on the canal debt, the fund to be accumulated from a special state canal tax on land and by allocation of other revenues as needed.

Aside from the specific recommendations, the report argued that both the Ohio and Erie and the Miami and Erie canals would be profitable enterprises. The waterways would provide inexpensive transportation between the Ohio Valley and New York, promote settlement in sparsely populated regions, and permit commercialized agriculture to replace subsistence farming. The report stressed the advantages of canal construction by the state instead of by private enterprise because of the commissioners' opinion that public works should not be entrusted to monopolies and that the state was in a better position to command the necessary capital in eastern money markets.[13]

In response to this report, the state legislature passed a law, commonly referred to as the "1825 canal bill," that embodied virtually all of the commissioners' principal recommendations.[14] The chief features of the measure were:

---

13. Scheiber, Ohio Canal Era, pp. 25-27; Scheiber, "Ohio Canal Movement," pp. 249-250; Finn, "The Ohio Canals," pp. 11-12; History of the Ohio Canals, pp. 15-16; and "Third Annual Report of the Canal Commissioners," January 8, 1825, Kilbourn, Public Documents, pp. 104-112, 115-128, 131-144, 147.

14. On the day before the legislature passed an act changing the Ohio taxation system to one based on an ad valorem assessment. The linking of the canal bill with a tax reform measure that promised to throw a large part of the state's financial burden upon the localities that would benefit from canal construction assured the political success of the canal bill. Scheiber, Ohio Canal Era, pp. 26, 28-30.

(1) A new seven-man Board of Canal Commissioners was appointed to supervise the construction and operation of the canals. The responsibilities of the board included the letting of contracts, superintending the construction operations, and providing for payment to the contractors for work accomplished. The legislature named to the new board six of the old commissioners--Worthington, Tappan, Minor, Kelley, Williams, and Beasley (General Nathaniel Beasley had been added to the group in 1824)--and also a new member, John Johnston, a former federal official and farmer in the upper Miami Valley. The board was authorized to appoint up to three "acting commissioners" to be paid a salary to supervise the work in the field.

(2) The canal commissioners were authorized to construct two canals: the Ohio and Erie via the Scioto-Muskingum route and the Miami and Erie between Cincinnati and Dayton via the Miami-Maumee route. While the routes were specified, the commissioners were given a great deal of leeway in regard to the exact details of the routes, particularly in relation to the line of the Ohio and Erie north of Coshocton.

(3) A Canal Fund, in the form of a sinking fund which was to be kept separate from all other funds in the state treasury, was created for the purpose of financing the construction of the canals and paying the interest on the debt incurred for their construction. The fund was to consist of all appropriations, grants, and donations to be made by the legislature and individuals, as well as money raised by the sale of tax-free state stock boards, the interest upon which would be paid by the pledge of state taxes until the income from the canals themselves should be sufficient to meet those payments unassisted.

(4) A three-man Board of Canal Fund Commissioners was established to manage the Canal Fund, cash orders issued by the Canal Commission for the construction work, and borrow money on the credit of the state at a rate not exceeding six percent. The board was authorized to borrow $400,000 in 1825 and $600,000 each year in 1826 and 1827 for which the commissioners were to issue transferable certificates of tax-free stock redeemable at the pleasure of the state at a time to be determined by the

Canal Fund Commissioners between 1850 and 1875. Appointed as fund commissioners were Brown and Buckingham of the old canal commission, both of whom had influential political and business contacts in Ohio and on the eastern seaboard, and Allen Trimble, a former governor and prominent political leader in southwestern Ohio, who had lost the governorship to Morrow in 1822.

(5) The canal commissioners were given the right of eminent domain over all lands they might need for the construction of the canals and the reservoirs to be used as feeders. Machinery was set up to handle land acquisition and compensation disputes in the form of independent boards of arbitration consisting of from three to five men whose decisions were to be final, subject only to appeal to the state legislature.[15]

---

15. History of the Ohio Canals, pp. 63-66; Scheiber, Ohio Canal Era, pp. 28-29; Scheiber, "Ohio Canal Movement," pp. 252-253; Finn, "The Ohio Canals," pp. 12-13; and Kilbourn, Public Documents, pp. 158-160, 163-166.

CHAPTER THREE: ACTIVITIES OF THE BOARD OF CANAL COMMISSIONERS AND THE BOARD OF CANAL FUND COMMISSIONERS IN SUPPORT OF CANAL CONSTRUCTION: 1825-27

A. Introduction

During the 1825-27 construction period, when the 38-mile sector of the Ohio and Erie Canal between Cleveland and Akron was built, the Board of Canal Commissioners and the Board of Canal Fund Commissioners undertook numerous activities to provide for the construction of the waterway. The principal responsibilities undertaken by the boards included providing for the (a) financing of the venture, (b) organization of the technical personnel, (c) determination of the final route, design, and specifications of the canal, and (d) acquisition of land and building materials for construction purposes.

B. Financing the Venture: 1825-27

Enactment of the "1825 canal bill" was a major political triumph, but formidable obstacles to the success of the project lay ahead, the chief of these being the crucial problem of obtaining adequate financing. While the canal surveys had been underway during 1822-24, the canal commissioners had explored possible ways to finance the project. At first they had been hopeful that the federal government would grant a large tract of land to the state, the sale of which would help to finance the canals. In the absence of such a grant specifically for canals they recommended that large tracts of land that had been granted to Ohio by the federal government for revenue to establish schools be sold and the money invested in the canals to draw interest. Finally, the commissioners had investigated the possibility of borrowing money from sources outside of Ohio such as eastern banking and investment houses, and they received assurances from some of those contacts that future financial support would be forthcoming.[1]

---

1. Finn, "The Ohio Canals," pp. 10-11; Scheiber, Ohio Canal Era, pp. 17-25; Scheiber, "Ohio Canal Movement," pp. 237-249; Still, "Ethan Allen Brown," pp. 36-37; and History of the Ohio Canals, pp. 14-16. Because of the repeated efforts by the commissioners to obtain federal financial assistance for the canal project, the U.S. Army Corps of

Although the canal commissioners had received encouragement from eastern financiers, bankers, and investment houses, and the State of New York had proven that a state government could borrow capital for canal purposes in both domestic and foreign money markets, the State of Ohio in 1825 could hardly compare with New York in 1815, when the first of the Erie Canal bonds had been sold. A brief review of the resources that Ohio had to support the canal undertaking illustrates the relative weakness of the state's finances for such a project. With a population (581,295 in 1820 census) of less than one-half that of New York in 1815, Ohio was sparsely settled and only one-sixth of its area was cleared and cultivated, resulting in public revenues that were considerably smaller than those of New York in 1815. The value of the real estate in Ohio was $45,025,000 and that of the personal property was $13,992,000. Thus, the projected $6,600,000 cost of the canals was more than one-tenth of the total wealth of the state. During 1826, the first year that the new ad valorem taxation system was initiated, the state received $103,800 as a return from the tax on land, and the total amount paid into the treasurery was approximately $157,000. While the population of the state increased from 581,295 in 1820 to 937,903 in 1830, the tax for state purposes decreased from 27 cents per person to 16 cents per person during the decade. The real estate tax in 1826 did not exceed 3-1/2 mills on each dollar of valuation, which was but 80 percent of the true value, thus indicating that the state legislature was hesitant to place an immediate burden on the state's population, despite the heavy financial drain that would be placed on the treasury by canal construction.[2]

To enhance the prospects of successful financing, the state legislature appointed men of high standing and ability to the three-man

---

1. (Cont.) Engineers surveyed various routes between the Ohio River and Lake Erie in 1824. Three renowned engineers, General Simon Bernard, Major Joseph G. Totten, and John L. Sullivan, reported that their surveys indicated that such routes were practicable. Trevorrow, Ohio's Canals, p. 125.

2. History of the Ohio Canals, pp. 66-67; Finn, "The Ohio Canals," p. 13; and Scheiber, Ohio Canal Era, p. 36.

Board of Fund Commissioners given responsibility for obtaining loans and managing canal funds. As already mentioned, the three commissioners--Brown, Buckingham, and Trimble--all had influential contacts with political and financial leaders in Ohio as well as on the eastern seaboard. Brown, a United States Senator and a long-standing friend of Governor De Witt Clinton of New York, quickly became the dominant member of the board. When Trimble resigned in 1826 after being elected speaker of the state senate, Simon Perkins, the Ohio agent of the Connecticut Land Company and a leading Ohio banker, was appointed to replace him.[3]

Aside from appointing able commissioners with a wide range of business contacts in the eastern financial community, the legislature further enhanced the prospects of successful financing by placing the full faith and credit of the state behind the authorized bond issues. Such a policy, adopted on the advice of De Witt Clinton, assured potential bond purchasers in the east that if construction failed, or the canals produced inadequate revenues, the general taxing power of the state would be employed to pay interest and principal on the canal debt. This policy proved to be important, because soon after the canal law passed the fund board solicited subscriptions to the authorized $400,000 bond issue of 1825 among the banks of Ohio without success. Unable to obtain support within the state for the project, the fund board was forced to turn to the eastern capitalists for support.[4]

A number of influences favored the fund board's mission to secure financing in the east. First, the leading New York financiers recognized the potential value of an Ohio canal system in expanding their trade into the western reaches of the Great Lakes region and the Ohio River Valley via the Erie Canal. Second, many New York businessmen had made handsome gains from buying Erie Canal bonds and reselling them later in Great Britain and America, and thus they were predisposed to assume that profits might also be made from dealing in Ohio bonds. Third, the

---

3. Still, "Ethan Allen Brown," pp. 42-43.

4. Scheiber, Ohio Canal Era, p. 37.

great rise in New York City's foreign trade since 1815 had increased the resources of her investment banking firms, and the year 1825 was especially auspicious for a new American bond issue because a sudden rise in U. S. exports was temporarily reversing the normally unfavorable balance of trade.[5]

With these influences favoring its quest for capital, the Ohio fund board in April 1825 advertised in Baltimore, Philadelphia, New York, and Boston for a loan of $400,000 to bear interest at the rate of five percent. The board accepted the highest of several bids made by New York capitalists, each of which offered to take the entire issue. The highest bid, offered by the banking firm of John Rathbone, Jr., and Eleazar Lord, was 97-1/2 (i.e., 97-1/2 cents on the dollar of redemption value) on bonds yielding five percent interest payable semiannually in New York. This meant that the fund board agreed to an effective interest rate of slightly over five percent on the $390,000 that Rathbone and Lord paid. The firm agreed to advance the $390,000 in three installments--ten percent or $39,000 at the time of consummating the contract on April 12; forty percent or $156,000 on August 1; and fifty percent or $195,000 on November 1.

The borrowed funds were deposited by the fund commissioners in the Manhattan Bank of New York City. It was agreed that that institution would receive the installments and hold them subject to the order of the commissioners. The Manhattan Bank allowed an interest of five percent on such deposits while they remained undrawn with one exception. As long as the deposits should continue the sum of $2,000 would be exempt from the interest charge as a compensation for the services of the bank in handling the loan. As the money was needed to pay the costs of construction, it was transferred by order of the fund commissioners to one of three local banks in Ohio--Western Reserve Bank of Warren, Franklin Bank at Columbus, and Bank of Lancaster--which had been designated as the disbursing agents. A canal commissioner drew upon

---

5. Ibid., p. 38.

these accounts by submitting certificates signed both by himself and the payee to the fund commission, members of which then made out checks to the contractor for work accomplished, the landowner from whom land was being purchased, or an individual whose property had suffered damage. The terms of the loan compared favorably with those obtained by New York in its initial Erie Canal bond issue a decade earlier, and Ohio's future financing prospects were enhanced by the fact that a prominent New York investment house had lent its prestige to the project and acquired a stake in its completion.[6]

After the rapid advancement of construction on the Ohio canals during the summer and fall of 1825, the state legislature, advised by the canal commission that building operations could readily be accelerated, voted to increase the authorizations for new loans. For 1826, the fund board was permitted to issue $1,000,000 in bonds, and for 1827 and 1828, $1,200,000 each year, thereby approximately doubling the amount stipulated in the original canal bill.[7]

In early 1826, however, the market for low-yield securities, such as the Ohio canal bonds, was depressed as a result of heavy cotton speculation in New York and new issues of joint-stock company securities in London. Both of these developments in the money markets took up available funds and drove interests rates up from six to seven percent. This short-term movement in the British and American money markets coincided with a springtime increase in construction activity in Ohio. Since the fund board paid contractors monthly for work as it was completed, demands of the canal fund proved heavy, thereby forcing the fund commissioners to turn to Ohio banks for $500,000 in short-term loans

---

6. Ibid., pp. 38-39; History of the Ohio Canals, pp. 27-29, 67; Still, "Ethan Allen Brown," pp. 43-46; Finn, "The Ohio Canals," pp. 23-24; "Report of the Commissioners of the Canal Fund," December 9, 1825, pp. 1-4; and "Report of the Committee on Finance," [December 1827], pp. 1-9. The Western Reserve Bank was designated as the disbursing agent for all contracts between Cleveland and Akron.

7. Scheiber, Ohio Canal Era, pp. 45-46; Still, "Ethan Allen Brown," p. 48; and Kilbourn, Public Documents, pp. 222-223.

(not to exceed two years in duration) to carry them through the period of difficulty in the eastern money market. The short-term loans were to be repaid with the first money that would be obtained from permanent loans.[8]

Only $130,000 was obtained from the Ohio institutions before pressure in the New York City capital market began to ease in June. The board quickly advertised for bids on its $1,000,000 issue on July 17, and John Jacob Astor, a wealthy New York businessman with extensive real estate and western fur trade interests, offered to take the entire issue. Rathbone and Lord also bid par value for some of the bonds, and, recognizing the importance of cultivating their association with that firm, the fund commissioners decided to sell $180,000 to them and $800,000 to Astor. The remaining $20,000 were sold to Lewis Cass, then governor of Michigan Territory. Cass later became Andrew Jackson's Secretary of War and was the Democratic Party candidate for President in 1848. According to the contract, which was concluded on July 20, the sale was in six percent securities redeemable at the pleasure of the state after 1850 with the purchasers paying a premium of $8,474.76, a price slightly higher than par value at nearly 101. Although the effective rate of interest was thus higher than the five percent rate carried by the 1825 bonds, the competition for capital had become more intense, with Pennsylvania, New Jersey, and Delaware having authorized construction of vast internal improvement projects in 1825-26 and other states planning internal improvements as well.[9]

At the end of 1826 none of the canal lines under construction had been completed. This was the result of competition primarily from

---

8. Still, "Ethan Allen Brown," pp. 48-49; History of the Ohio Canals, p. 68; Scheiber, Ohio Canal Era, p. 46; "Report of the Commissioners of the Canal Fund, December 11, 1826," p. 1; and Kilbourn, Public Documents, pp. 222-223, 229.

9. Scheiber, Ohio Canal Era, pp. 46-47; History of the Ohio Canals, p. 67; and "Report of the Commissioners of the Canal Fund," December 11, 1826, pp. 1-4.

Pennsylvania, as both Pennsylvania and Ohio vied for the services of engineers, laborers, and experienced contractors--a situation which led to labor shortages, higher wages, increasing contract prices, and delays in readying new work for contract. These problems had an adverse effect on the interest of potential investors in Ohio bonds, and the fund board was informed in New York that to sell additional bonds in 1827, it would soon have to open a portion of the system to navigation. Hence the canal commission decided to concentrate all its available labor and funds on the northern part of the Ohio and Erie Canal between Cleveland and Akron. After rushing that part of the line to completion, the 38-mile section between those two towns was opened to navigation on July 4, 1827, thus setting the stage for the fund commission that fall to successfully sell its $1,200,000 bond issue to a syndicate of Philadelphia bankers, the Bank for Savings of New York, and the New York investment firm of Prime, Ward and King.[10] In succeeding years, other eastern financial interests and British bankers, seeking to capitalize on the largely untapped economic potential of the West, supported Ohio's venture to complete its comprehensive program of internal improvements.[11]

C. Organization of Technical Personnel: 1825-27

Shortly after the canal bill was passed in February 1825, the new Board of Canal Commissioners met in Columbus and adopted a scheme of organization for its technical personnel, virtually taking the entire Erie Canal organization as a model. All responsibilities for construction of the canals were in the hands of the board, but the commissioners assigned most of their powers to Alfred Kelley and Micajah T. Williams as "acting commissioners" to oversee the actual construction in the field. The two men had observed Erie Canal engineering technology first-hand and had worked with Erie Canal engineers in Ohio making the surveys, thus

---

10. "Third Annual Report of the Canal Fund Commissioners," December 27, 1827, Kilbourn, Public Documents, pp. 270-272; "Report of the Committee on Finance," [December 1827], pp. 1-18; and Scheiber, Ohio Canal Era, pp. 47-48.

11. Scheiber, Ohio Canal Era, pp. 371-379.

giving them as much on-the-job training as most practicing civil engineers of that day. In their capacity as "acting commissioners" they had charge of locating the final lines, adopting specifications, awarding contracts, acquiring land for the canal rights-of-way, obtaining supplies and materials for construction, and supervising the engineering corps that would provide technical expertise during the building operations. Kelley, who soon became the more dominant partner of the two men, was assigned to the northern portion of the Ohio and Erie Canal between Lake Erie and Coshocton, while Williams was appointed to the southern part of that canal as well as to the Miami and Erie.[12]

The canal commission organized the engineering corps to enable the "acting commissioners" to carry out their duties. In the hierarchical organization that was adopted, a principal engineer was appointed to head the corps and advise the commissioners on policy-level technical questions as well as supervisory work in the field. His salary was set at $2,000 a year plus expenses, or nearly twice that of the "acting commissioners," who were given a salary of only $3 per day plus $1 per day for expenses. Resident engineers, who were to be appointed as the work required, were responsible for laying out the actual canal lines, making plat maps, plans, and profiles that would serve as construction documents, preparing cost estimates and contract specifications, supervising the work of the contractors, and certifying to the "acting commissioners" the amount of work done by the contractors. The board set their salary at $1,000 per year, and allowed them $3 per day while locating and superintending in the field. Other ranks in the hierarchy, in descending order of seniority, were those who would serve as staff to the Resident Engineers: senior assistant engineers with pay of $45 a month; junior assistant engineers and surveyors at $35 a month; and rodmen, axe-men, and common laborers, all paid lower wages on a per diem or hourly basis.[13]

---

12. Trevorrow, Ohio's Canals, p. 14; Still, "Ethan Allen Brown," pp. 42-43; Scheiber, Ohio Canal Era, p. 40; and Scheiber, "Alfred Kelley and the Ohio Business Elite," p. 374.

13. "Fourth Annual Report of the Canal Commissioners," December 10, 1825; Kilbourn, Public Documents, p. 176, 195; History of the Ohio

Because of the large number of canal projects in the eastern states and the relatively small number of trained civil engineers to superintend the construction of those projects, there was a critical shortage of trained engineers in the United States. This was especially true of a western state such as Ohio. The completion of the Erie Canal in 1825, however, enabled the Ohio board to attract to its staff two men with New York experience. David S. Bates, who had played an influential role in the Ohio canal surveys and had held the positions of assistant engineer on the middle division of the Erie Canal (1817) and division engineer in charge of the work in the Irondequoit Valley (1819-24), accepted the appointment as principal engineer.[14] Another New Yorker, William H. Price, about whom little is known but who served in various engineering capacities for several decades on Ohio canals and railroads, was named a resident engineer and assigned to the northern portion of the Ohio and Erie.[15] Also appointed as a resident engineer and assigned to the southern portion of the Ohio and Erie as well as the Miami and Erie was

---

13. (Cont.) Canals, pp. 26-27; Daniel Hovey Calhoun, The American Civil Engineer: Origins and Conflict (Cambridge 1960), pp. 35, 48-49, 168-171; and Scheiber, Ohio Canal Era, p. 62.

14. Committee on History and Heritage of American Civil Engineering, A Biographical Dictionary of American Civil Engineers, pp. 7-8; Douglass to Bates, May 12, 1825, Vertical File Manuscripts #2393, Ohio Historical Society, Columbus; and Bates to Kelley, February 5, and April 3, 1826, Manuscripts, C212, RM, Folder 1; Cincinnati Historical Society.

15. Dial, "Construction of the Ohio Canals," p. 468; and "Fourth Annual Report of the Canal Commissioners," December 10, 1825; Kilbourn, Public Documents, p. 176. In later years, Price served as an engineer on the Walhonding Canal (1836-42), the Lancaster Lateral Canal (1838), and the Hocking Canal (1839). He was elected as chief engineer of the Marietta and Cincinnati Railroad Company in March 1848, and surveyed routes for the Hillsborough and Cincinnati Railroad Company in July 1848. Alfred Kelley to Mary Kelley, December 28, 1828, Alfred Kelley Papers, Manuscript Collection #151, Box 1, Folder 2, Ohio Historical Society, Columbus; N. N. Hill, Jr., comp., History of Coshocton County, Ohio: Its Past and Present, 1740-1881 (Newark 1881), p. 286; History of Ross and Highland Counties, Ohio, With Illustrations and Biographical Sketches (Cleveland 1880), p. 155; and "Reports of Surveys Made for the Hillsborough and Cincinnati Railroad Company, by Wm. H. Price, Esq., Engineer, July 20, 1848, pp. 1-8.

an Ohio resident, Samuel Forrer, who had been on the Ohio commission's staff since 1822 but who had also traveled to the Erie Canal in 1824 to perfect his engineering skills.[16]

During the spring of 1825 the board employed Nathan S. Roberts, another prominent Erie Canal engineer, to aid in the surveys for the final route of the Ohio and Erie Canal between Coshocton and Lake Erie. There is some evidence that the board would have liked to employ Roberts in a senior position in the engineering corps on a permanent basis. He, however, left Ohio in early 1826 for employment as the principal engineer on the western division of the Pennsylvania Canal because of better pay in that state.[17]

The shortage of experienced and qualified civil engineers in Ohio had confronted the canal commission since its inception. As early as 1823, Alfred Kelley, who was unable to hire a prominent engineer in New York to succeed Geddes in directing the Ohio canal surveys, had written that "We must train some for ourselves."[18] In the spring of 1826 Micajah T. Williams voiced those same sentiments in a letter to Kelley:

> We shall be compelled to rely on home made engineers in a great measure I presume, and to make residents of the most experienced and best qualified citizens we can find. I have one in view . . . who with a little experience I shall be willing to take as a resident engineer if the service requires it.[19]

Accordingly, the canal commissioners relied primarily on the surveyors who had been on the Ohio staff during the 1822-25 surveys, and promising local talent, in naming assistant engineers, surveyors, and

---

16. "Fourth Annual Report of the Canal Commissioners," December 10, 1825; Kilbourn, Public Documents, p. 176, and Scheiber, Ohio Canal Era, pp. 63-64.

17. Roberts to Kelley, April 5, 1826, Manuscripts, C212, RM, Folder I, Cincinnati Historical Society, and "Fourth Annual Report of the Canal Commissioners," December 10, 1825; Kilbourn, Public Documents, p. 179.

18. Quoted in Scheiber, Ohio Canal Era, p. 242.

19. Williams to Kelley, April 2, 1826, Manuscripts, C212, RM, Folder I, Cincinnati Historical Society.

their helpers for the engineering corps.[20] They also depended on their contacts in New York to aid in recruiting young men with technical and engineering skills who had the potential to advance in the ranks of the corps.[21] In addition, contacts through informal family relationships and personal friendships were used in recruiting engineering talent, as in the case of the hiring of John Bates--the son of David S. Bates--as a resident engineer.[22] Subsequently, many of the men who were hired into the lower echelons of the corps learned the skills of civil engineering and canal construction technology through on-the-job training and rose to senior positions in the corps.[23]

---

20. Some correspondence in the Kelley papers indicates that he recruited young men of promise in Ohio with the thought of training them. One such man was Samuel Carpenter, a surveyor in Lancaster who was conducting surveys on the salt reservations in the vicinity of Delaware when approached by Kelley in March 1826. Carpenter, who admitted his "total ignorance of the nature of the [engineering] service" and "a want of a proper idea of my own qualification or the fitness of the employment with genius of my mind," was loathe to give up his business unless he could "make the requisite proficiency in acquiring a knowledge of the science, and the nature or character of the employment such as to justify such a course." Carpenter to Kelley, April 1, 1826, Manuscripts, C212, RM, Folder 1, Cincinnati Historical Society. Other correspondence appears to give evidence that Kelley advertised for prospective engineering talent in areas through which the canal would pass. One such example was found in a letter written by G. Hughes of New Lisbon to Kelley on May 6, 1826. Hughes, who asked for a job as an assistant engineer, noted that his qualifications were a "considerable knowledge of business and the oversight of workmen" and a "tolerable knowledge of the contemplated rout [sic]" through that part of the country. Hughes to Kelley, May 6, 1826, Manuscripts, C212, RM, Folder 1, Cincinnati Historical Society.

21. One such effort to recruit in New York occurred in March 1826 when Kelley wrote to J. Hurd mentioning his need of experienced engineers. J. Hurd passed the letter on to his brother Isaac N. Hurd of Middleburg Village in Genessee County who had served as an assistant engineer in the Erie Canal for three years. Isaac wrote immediately to Kelley of his interest in being a resident engineer or an assistant engineer in Ohio if there was promise of fairly rapid advancement. He promised to send letters of recommendation from David Thomas and other prominent engineers on the Erie Canal, and ultimately Isaac was hired as an assistant engineer and served in the engineering corps until the summer of 1829. Hurd to Kelley, March 30, 1826, Manuscripts, C212, RM, Folder 1, Cincinnati Historical Society.

22. Douglass to Bates, May 12, 1825, Vertical File Manuscripts #2393, Ohio Historical Society, Columbus.

23. Scheiber, Ohio Canal Era, pp. 63-64.

As the "acting commissioners," who in effect superintended the work of the engineering staff, Kelley and Williams began a process of administrative development that involved the growth of bureaucratic organization, as the canal commission unvariably followed their recommendations in mapping the framework of the corps and delegation of powers within it. Despite the establishment of an engineering corps, Kelley's style, as the "acting commissioner" of the northern section of the Ohio and Erie Canal, was one of constant and detailed personal involvement, which led to a mingling of the duties of that of a engineer and that of an "acting commissioner." His tendency was to do all the work himself, resulting in close, often heavy-handed supervision of his subordinates. Williams, who was more sensitive than Kelley to the need for developing a bureaucracy capable of carrying on the work, finally urged him in February 1832 to stay away from the lines occasionally and let his staff do the work:

> You have superintending engineers on the line who are mostly of your own selection. . . . To these it is proper to commit its charge. . . . The state will soon be under the necessity of confiding the entire change and responsibility of the two canals to these very men.[24]

This appeal was timed to coincide with the adoption by the board of a highly detailed and formal set of guidelines. These set down the rules and specifications governing construction of the various canal components on the Ohio and Erie. They were intended for the superintending engineers on the lines, and were issued on January 30, 1832.[25]

The available records do not indicate which members of the lower echelons of the engineering corps served on the Cleveland-Akron sector of the Ohio and Erie Canal during the 1825-27 construction period. The

---

24. Quoted in Scheiber, "Alfred Kelley and the Ohio Business Elite," p. 376. Also see Calhoun, American Civil Engineer, p. 63.

25. The guidelines entitled "Rules and Specifications, Relating to the Construction of the Ohio Canal: And the Estimatiang of Work Performed Thereon" will be treated more fully in the next section of this chapter.

"Eighth Annual Report of the Board of Canal Commissioners," issued on January 9, 1830, is the first document to provide a listing of the members of the engineering corps. The list is broken down into two parts: "Engineers formerly in the service of the State, removed, by resignation or death" and "Arrangement of the Corps of Civil Engineers in the service of the State of Ohio: January, 1830--On the Ohio Canal."[26]

D. Determination of Final Route, Design, Specifications, and Plans: 1825-27

After funds were assured and the nucleus of the engineering corps had been recruited in the spring of 1825, the principal policy issue to be formally resolved was the selection of a route for the northern portion of the Ohio and Erie Canal line between Coshocton on the Muskingum River and Lake Erie. The legislature had given the canal commission discretion to select the most favorable of three proposed routes--the Cuyahoga and Tuscarawas, the Killbuck and Black, and the Killbuck, Chippewa, and Cuyahoga. Thus, the commissioners ordered two of their engineers, William H. Price and Samuel Forrer, to accompany Nathan S. Roberts, who had been hired to lend his considerable prestige in canal engineering circles to the final determination of the line. These three engineers were to submit a detailed analysis of the merits and cost estimates of each of the three routes. Despite this effort, the commissioners apparently had decided as early as the latter part of February to build on the Tuscarawas and Cuyahoga route. The information was suppressed, however, until after the Roberts' survey, apparently to encourage donations of land from Cuyahoga Valley landholders who thought they might influence the board's decision. The report by Roberts, issued on May 5, confirmed the earlier views of the commissioners in recommending the Tuscarawas and Cuyahoga route to Lake Erie because it would be more accessible, incur less expensive

---

26. "Eighth Annual Report of the Board of Canal Commissioners," January 9, 1830; Kilbourn, Public Documents, pp. 385-386. Copies of the two lists may be seen in Appendixes A and B, respectively. Also see Henry Howe, Historical Collections of Ohio in Two Volumes (2 vols., Cincinnati, 1907), pp. 119-121.

construction costs, and have a more adequate water supply than the other two routes.[27]

At their policy meeting in May 1825 the canal commissioners also decided to adopt the specifications used on the Erie Canal for the construction of the Ohio canals.[28] The latter became a part of the basic text of all the contracts that were let for canal construction. The original specifications were:

GRUBBING AND CLEARING

> First, in all places where the natural surface of the earth is above the bottom of the canal and where the line requires excavation, all the trees, saplings bushes, stumps and roots shall be grubbed and dug up at least sixty feet wide; that is, thirty three feet on the towing path side of the canal, and together with all logs, brush and wood, of every description, shall be removed at least fifteen feet beyond the outward line of the said grubbing on each side; and on said space of fifteen feet on each side of said grubbing, all trees, saplings, bushes and stumps shall be cut down close to the ground, so that no part of any of them shall be left more than one foot in height above the natural surface of the earth, and shall also, together with all logs, brush and wood of every kind, be removed entirely from said space. And the trees, saplings, and bushes shall also be cut down twenty feet wide on each side of said space so as to be cleared, and also all trees which in falling would be liable to break or injure the banks of the canal. And no part of the trees, saplings, bushes, stumps, wood; or rubbish of any kind, shall be felled, laid or deposited on either of the sections adjoining this contract.

CANAL PRISM AND BANKS

> Second: The canal and banks shall be so contructed [sic] and formed, by excavation or embankment, as either or both may be necessary, in order to bring the same to the proper level, as designated by the engineers or either of them in the employ of said commissioners, so that the water may in all

---

27. Scheiber, Ohio Canal Era, p. 40; Scheiber, "Ohio Canal Movement," p. 254; History of the Ohio Canals, p. 20; and "Fourth Annual Report of the Canal Commissioners," December 10, 1825; Kilbourn, Public Documents, pp. 179-180, 196-203. The portion of Roberts' report that deals with the Cuyahoga-Tuscarawas route may be seen in Appendix C.

28. The influence of Erie Canal technology on the Ohio system is discussed in Carter Goodrich, ed., Canals and American Economic Development (New York, 1961), pp. 173-74.

places be at least forty feet wide in the canal at the surface, twenty six feet wide at the bottom, and four feet deep: each of the banks shall be at least two feet, perpendicular measurement, above the top water line; and such a slope shall be preserved on the inner side of the banks, both above and below the top water line, that every foot perpendicular rise in said banks shall give a horizontal base of one foot nine inches: the towing path, which shall be made on such side of the canal as said commissioners or either of them, or any engineer in their employe may direct, shall be at least ten feet wide at its surface, and not more than five feet in any place above the top water line; and whenever a difference in the elevation of the towing path shall occur, the ascent or descent shall not be greater than one foot rise or fall in any sixty feet in length, and shall be gradual: the towing path shall be smooth and even, shall be composed of the best materials which the adjoining excavation will furnish, and shall be so constructed that the side next the canal will be six inches higher than the opposite side, at the surface, with an uniform and regular slope, so that the water may run off from said path: in all cases where the materials excavated shall raise a spoil bank immediately back of the towing path above its exterior surface, sluices or passages for the water shall either be left or cut through said spoil bank as frequently as one in every five chains, so that the water may readily drain off from the towing path in an opposite direction from the canal: the bank opposite the towing path shall in no place be less than five feet wide at the surface; shall be smooth and even; and neither of said banks shall have a slope of lesser base in proportion to its height on the outer than on the inner side, except where there is a redundance of stuff increasing the width of the bank beyond the requisition aforesaid: all loose and porous materials, and those which are perishable or permeable to water shall occupy the outer extremities of the banks, and for the distance of at least ten feet, measured outwardly from extremity of the top water line on each side, the banks will be composed, both above and below the top water line, of the most pure, solid, compact and water tight earth which the adjoining excavation can supply; and no vegetable mould, leaves, roots, grass, weeds, herbage, logs, sticks, brush, or any other substance of a porous or perishable nature, shall be left, laid or in any way admitted into the said space of ten feet last described.

EMBANKMENTS

Third: In all cases of embankment, and where the bottom line of canal is above the natural surface of the earth, all the trees, bushes, saplings and stumps, on the space to be occupied by the canal and its banks, shall be cut close to the ground, and, together with all logs, brush and wood of every description, shall be removed from a space of at least forty five feet wide on each side of the centre of the canal; and from a strip fifteen feet wide under each bank to be so situated that

the inner side of said strip shall be perpendicularly under the outer extremity of the top water line, all the trees, bushes, stumps and roots shall be thoroughly grubbed, and, together with all the logs, brush, roots, grass, herbage, vegetable and porous earth, shall be removed entirely without said banks, so that the banks may unite securely with the solid earth beneath.

LOCKS

The lock shall be so constructed that the chamber will be 90 feet in length and 15 in breadth in the clear. The walls of the lock shall be of solid masonry laid in water cement, and well grouted with water cement as frequently as once in every two feet, as the walls progress in height from the bottom. The walls shall be five feet in thickness at the bottom of the lock, and four feet at the top water line of the upper canal, with buttresses firmly united and connected with the main wall, and rising from the bottom of the lock to the top water line, four feet in length each and extending back from the main wall four feet. These buttresses shall be 12 feet apart, (measuring from centre to centre.) Buttresses shall be so built that 20 feet in length of the walls opposite the upper gates, and 17 feet in length opposite the lower lock gates shall be 9 feet thick at bottom and 8 feet at the top water line. The face of the walls shall be laid in courses; the stone forming each course to be of uniform thickness throughout the course, well bedded and the joints well cut, so as to make tight joints at least six inches back from the face of the wall. The face of the stones shall be rough cut or hammered dressed, except the hollow quoins, which shall be cut smooth and true, agreeably to a pattern to be furnished by the engineer. When the face stone are of coarse sandstone or freestone, each course shall be at least one foot in thickness, and in all other cases not less than 10 inches. No face stone shall have in any place less than one foot bed, and in no case less bed than face. Binders or headers shall be placed in each course, extending from the face back through the main wall, so as not to leave more than ten feet in any place between headers. The headers in each successive course shall be placed over the space between the headers in the next course beneath; and the face stones shall not be more than half an inch thinner on the back than on the face: culverts, to be formed with stone cut to the proper pattern, shall be constructed in the walls to pass the water from the upper canal into the chamber of the lock, with proper gates, all to be of such form and dimensions as the engineer having charge of the work may direct. The walls shall be covered with a copeing [sic] of firm, solid stone, of not less than three feet in width, well cut, jointed and bedded, and those next the gates securely cramped together with iron cramps. The lock gates, paddle gates, and mitre sills shall also be formed and made agreeably to the plan to be furnished by David S. Bates, Esq. or other engineer in the employ of the commissioners [plans were not located]; and all the gates shall be formed of such materials as such engineer may direct. The

> foundation of the lock unless a smooth and firm rock foundation can be obtained, shall be composed of solid white oak timber, hewed square, and one foot in thickness, to be laid horizontally across the foundation, level and even, as near together as such engineer may direct, and well puddled [i.e., a tempered mixture of clay or similar material and water used as a watertight canal lining] between the timbers, and covered with three inch white oak or pine plank, free from knots, rots or shakes, well jointed and firmly trunneled [i.e., synonomous with treenail, a cylindrical pin of hardwood for fastening together timbers in ships, etc.] or spiked to the timber beneath; a flooring composed of two inch white oak or pine plank, free from rots, knots or shakes, well jointed and securely spiked with spikes ten inches in length, shall be laid throughout the whole chamber of the lock. Wherever the resident engineer or other engineer in the employ of the commissioners, may direct, piles of such dimensions and in such numbers and places as the said engineer may direct, shall be driven into the lock pit, in order to form a firm and secure foundation for the lock. One or more rows of sheet piling, as the principal engineer, or other engineer in the employ of the said commissioners, may direct, to be formed of good, sound white oak, well jointed, and of such length as such engineer may direct, shall be driven into the ground across the foundation of the lock, and the bank at the breast and sides of the lock shall be well puddled with good, solid, water tight materials, agreeably to the directions of such engineer.

In addition, the original specifications provided for the construction of stone culverts and moles, massive structures especially of stone set up in water to serve as breakwaters, or piers. The culverts were to be built

> in such place or places, and of such form, dimensions and plan, as the commissioners or either of them, the resident engineer, or any other engineer in the employ of said commissioners, may direct, which shall in all cases be built of good substantial stone, laid in water cement, and made true and smooth, on the outer as well as in the inner side.

The moles or piers were to be constructed

> of such breadth and height as said commissioners or the engineer having superintendence of the work under them may direct, along the wash or slate banks on said section. Said mole shall be formed of good, solid, durable timber, of which that forming the sides of the mole shall be well hewed, and shall be at least twelve inches square and at least 25 feet in length; the sides shall be laid perpendicularly and securely connected together with ties not less than 10 inches in diameter,

> clear of bark, which shall be let into the side timbers with a dove tail and square shoulder at each end well fitted to said timbers so as to prevent their moving or sliding upon each other. Each tie shall be let into the timbers, on which it rests, half the thickness of the dove tail at the end, and the other half shall be let into the side timber next above, so that the side timbers will meet and form a tight joint, and the ends of the ties shall be cut off smooth and even with the out side of the mole. The cribs so formed shall be filled with slate, soap stone, or other stone or gravel, and a bank shall be formed on the inner side, next the canal, of the usual slope, of good solid earth as in other cases. The moles so formed shall at each end be securely united with the bank of the canal.[29]

As can be seen, the original specifications covered such canal components as the prism, embankments, and locks in detail. They, however, provided little or no specific data for the construction of culverts, aqueducts, waste structures, feeder dam complexes, bridges, and protective walls. A study of the contracts for the Ohio canals during the 1825-32 period indicates that the plans and specifications for those structures were handled on a case-by-case basis and that the specifications were generally handwritten in the contracts by an "acting commissioner" or engineer.

E. Acquisition of Land and Building Materials for Canal Construction: 1825-27

The canal act of 1825 gave the canal commissioners the right of eminent domain over all lands they might need in the construction of the canals and the reservoirs to be used as feeders. In addition, the commissioners were empowered to seize timber and stone required for construction purposes. In case of a dispute between the board and the owner of the land over the compensation for his property, it was to be referred to an impartial board consisting of three to five men appointed by the commission that was empowered to settle the case. The settlement was to be final and the decisions of the appraisal boards could only be

---

29. "Fourth Annual Report of the Canal Commissioners," December 10, 1825, Kilbourn, Public Documents, pp. 212-216. A general discussion of engineering factors involved in canal excavation and lock construction may be seen in Wilcox, The Ohio Canals, pp. 10-22.

appealed to the legislature. Once a settlement was made the commissioners were required to pay the owner the specified price in return for which the state received title in fee simple to the property. The legislation also authorized the board to accept donations of land or money from any individuals or municipalities along the routes of the canals.[30]

The canal commissioners reported in December 1825 that the land acquisition program in the Cuyahoga Valley, as well as that for the other areas where the canals were to pass, had been largely successful. The commissioners noted that:

> Applications have, in most instances, been made to the owners of the lands through which the canal passes, for cessions of so much thereof, as will be necessarily occupied by the canal and the works connected therewith. Cessions from most of the proprietors have been obtained for such parts of the canals as are now under contract. It is believed that there are few instances in which the owners of lands, through which the canals will pass, will set up claims for damages; and still fewer in which they will be allowed by judicious men, if claimed.
>
> Liberal donations, in land and money, to the canal fund, have been obtained from several individuals. To these donations conditions have usually been attached in favor of particular routes; and the bonds have been made payable, on the completion of the canal to certain points therein designated. . . .[31]

The commissioners included a "Schedule of Donations to the Canal Fund" in their report. Altogether, the donations of land and money up to December 1 totalled an estimated sum of $25,006. Of this sum $12,070 had been received along the line between Cleveland and New Philadelphia and $12,936 from the area around Chillicothe. Between December 1 and 10 donations amounting to more than $5,000 were received from Cleveland,

---

30. Finn, "The Ohio Canals," p. 13 and Scheiber, Ohio Canal Era, pp. 67-68.

31. "Fourth Annual Report of the Canal Commissioners," December 10, 1825, Kilbourn, Public Documents, p. 190.

but these donations were not added to the schedule. The board indicated its anticipation that further donations would be made.[32]

Despite the apparent success of the land acquisition program, local landowners along the canal right-of-way nevertheless were unhappy over the methods used to assess the damages for the land taken from them and for the building materials removed from their land for construction purposes. The discontent in the Cuyahoga Valley, as well as that exhibited by landowners along the canal routes in other parts of the state, resulted in organized efforts to petition the state legislature to revise the existing procedures for settling disputes over proper compensation for property taken.[33] Although the state legislature opposed any changes in the existing law, it applied pressure on the commissioners to establish the appraisal boards provided for in the original canal legislation for different sections of the canal to review the damage claims submitted by the local residents. Accordingly, a three-man appraisal board, consisting of Owen Brown of Portage County, Rufus Ferris of Medina County, and Nehemiah Allen of Cuyahoga County was appointed by Alfred Kelley and sworn into office on September 27, 1827, to assess damages claimed by various persons between the Portage Summit and Cleveland.[34]

Typical of some of the claims that were filed with the appraisal board were those of Oliver Dewey, Jr., of Northampton, the Joshua Post estate in Northfield, Titus Street and Samuel Hughes of Newburg, and William Brannan of Boston. Dewey claimed that a total of 3,645 bushels of lime

---

32. Ibid. A copy of that portion of the "Schedule of Donations to the Canal Fund" covering the donations from the area between Cleveland and New Philadelphia may be seen in Appendix D.

33. The "Report of the Canal Committee of the House of Representatives, Concerning Damages, 18th January 1827" in response to one such petition by the citizens of the Miami Valley may be seen in Kilbourn, Public Documents, pp. 260-262.

34. "Appraisement of Damages," 1827, pp. 1-2, Records of the Board of Public Works of Ohio, Series 1279, Ohio Historical Society, Columbus.

had been burned on his property (Lot no. 42) in Northampton by orders of the contractors working at Peninsula, in addition to the cutting of timber to burn with the lime, for which he hoped to receive $414.50 in damages. The Joshua Post estate claimed $400 in damages because the farm had been divided by the canal, necessitating the construction of a bridge over the waterway. Street and Hughes alleged that some 12,000 feet of hewing and piling timber had been cut in their property for the construction of Lock No. 38 and other canal structures in the vicinity of Newburgh. William Brannan complained that 3,000 perches of stone had been removed from his property in Boston for the construction of locks and culverts in the vicinity.[35]

At its meeting on October 31, 1827, the appraisal board for the line between Portage Summit and Cleveland awarded the sum of $2,687 for assessed damages. Most of the money was awarded on account of building materials taken, lots to be occupied by houses for lock tenders, bridges to be built where farms had been divided by the canal, and flooding of land and crops as a result of construction.[36]

In addition to the acquisition of building materials under the law of eminent domain, the canal commissioners also obtained some building materials through contracts. One such example was a contract let to John McMillan, Jr., and Erastus Torrey on July 19, 1825, for 60,000 bushels

---

35. "Bill of Damage, Oliver Dewey;" "Posts Estate Application for Damages, July 12, 1826;" "Titus Street and Samuel Hughes Acct, October 1, 1827;" Brannan to Kelley, November 29, 1826; "Contracts," Records of the Board of Public Works of Ohio, Series 1231, Ohio Historical Society, Columbus. Also see "Abstract of Awards for Damages," Series 1199, in the same collection.

36. "Sixth Annual Report of the Board of Canal Commissioners," January 17, 1828, Kilbourn, Public Documents, p. 287. A notebook entitled "Appraisement of Damages" was found in the Records of the Board of Public Works of Ohio at the Ohio Historical Society in Columbus. The notebook (Series No. 1279) contains extracts of the claims submitted to this panel and the actions it took in settling the disputes at its meeting on October 31, 1827. A copy of the entries in this book may be seen in Appendix E.

(bushel of 70 pounds) of water lime. The terms of the contract provided that the two men would "quarry, burn and grind" the water lime "in a suitable and proper manner" so that it would be prepared "in every respect" for "making into mortar, grout, & water cement, fit and proper to be used in laying the walls of locks, culverts, aqueducts, & other works which may require the use of water lime on the Ohio Canal." The terms were conditioned on the premise that the contractors' quarry near the junction of the outlet of Summit Lake and Williams Run in Portage Township would yield enough lime to produce 60,000 bushels. Furthermore, the contractors agreed to haul the stone to the mill, about one-half mile from their quarry, and secure the finished product, in proper houses or sheds, until they delivered it to the canal contractors who had orders from the commissioners. Of the 60,000 bushels, 10,000 were to be ready for delivery between September 1 and November 1 and the remainder after April 1, 1826. The lime contractors would receive 14 cents per bushel for the lime that could be recovered from the upper six feet of the quarry, and would receive additional money to cover the cost of quarrying the lime below that level.[37]

In summary, it appears that virtually all of the building materials used to build the Ohio and Erie Canal in the Cuyahoga Valley were acquired locally. In addition to the aforementioned lime contract, the commissioners also obtained lime from the Hale Farm west of the canal between Lock No. 26 and Furnace Run. Quarries in Peninsula, Akron, and Independence yielded the Berea Sandstone used to build the locks and other stone structures. Hardwood, such as white oak, was obtained from the region around Peninsula.[38]

---

37. Articles of Agreement, John McMillan, Jr., and Erastus Torrey, and Canal Commissioners, July 19, 1825, "Contracts," Records of the Board of Public Works of Ohio, Series 1231, Ohio Historical Society, Columbus. The commissioners charged the canal contractors 15 cents per bushel for the delivery of water lime to their project.

38. "Cuyahoga Valley History for Volunteer-In-Parks Tour Guides," pp. 12-14; Hudson Times, October 11, 1978; "Deep Lock Quarry Metropolitan Park," Green Islands: Your Metropolitan Parks, III (May 1963), n.p. and "The Mechanics of Deep Lock Quarry Operations," Green Islands: Your Metropolitan Parks, XIX (June 1979), n.p.

CHAPTER FOUR: CONSTRUCTION OF THE OHIO AND ERIE CANAL IN THE CUYAHOGA VALLEY: 1825-27

A. Introduction: Preparations for Construction

After the major technical questions had been settled, the canal commission confronted the delicate political matter of establishing construction priorities. The 1825 canal law had not required that the Ohio and Erie and the Miami and Erie lines be built simultaneously. The limited labor then available in Ohio made it imperative that the projected 308-mile Ohio and Erie be built in segments. Because future funding was uncertain, the best strategy seemed to be one of building from the projected termini inland by stages, thus resulting in partially-built canals that would be capable of sustaining navigation in case of forced abandonment or curtailment.[1]

In determining construction on the Ohio and Erie the commissioners and the engineering corps were presented with a difficult challenge, since the canal was to cover 308 miles, over which it would rise and fall a total of some 1,207 feet and involve the construction of 146 locks and 14 aqueducts.[2] Since it was impossible to build the entire canal at once, the commissioners decided to complete at least one sizable segment before beginning others. It would be most advantageous to build the southern division down the Scioto Valley to the Ohio River before undertaking the remainder of the work, because of the large population and highly active citizenry demanding immediate construction in that area. The commissioners, however, determined to concentrate their resources initially on the northern division in the sparsely-settled Cuyahoga Valley and thus fulfill one of the principal goals of the canal movement: the opening of a route from the interior of the state to Lake Erie and the lucrative New York market. The board also decided to begin construction

---

1. Scheiber, Ohio Canal Era, p. 42.

2. In determining construction priorities on the Miami and Erie, it was decided to begin with the 44-mile stretch between Cincinnati and Middletown because most of that line would pass through fairly flat country and require the lowest expenditures per mile on the project.

on the 11-mile line of the Licking Summit because the heavy excavations for the "deep cut" there would require more time for completion than any other segment of the canal.[3]

Thus, the stage was set for commencement of the construction of the first segments of the Ohio and Erie Canal. On July 4, 1825, groundbreaking ceremonies were held at Licking Summit, three miles south of Newark. In attendance was a large group of state officials and visiting dignitaries. After a variety of preliminary events, including a review by the state militia and the playing of the bands, principal speeches were given by Ohio Senator Thomas Ewing and Governor De Witt Clinton of New York. Then Governor Clinton and Governor Jeremiah Morrow of Ohio took shovels and dug the first spades-ful of earth for the Ohio and Erie amid the cheers of the crowd estimated at 6,000. Later, on July 21, a similar ceremony was held at Middletown to break ground for the Miami and Erie.[4]

For the purpose of organizing the material for the construction phase of the project, this chapter will be divided into four main sections: locating the final canal line, letting of contracts for construction, the labor force, and progress and problems during the 1825-27 construction period.

B. Locating the Final Canal Line

Immediately after the final route of the Ohio and Erie Canal between Coshocton and Lake Erie was determined, a careful location of the line from the Portage Summit to Cleveland was commenced under Resident Engineer William H. Price, preparatory to putting it under contract. He prepared plat maps, surveys, plans, and profiles of the line and the locks and wrote detailed specifications for each section, accompanied by cost and work estimates. In addition, the engineers dug or bored into

---

3. Scheiber, Ohio Canal Era, pp. 42-44.

4. Finn, "The Ohio Canals," pp. 1-2.

the ground at intervals of every five chains "to disclose the true character of the earth to be excavated, and to prevent disappointment to contractors as to the value of the work." According to the annual report of the canal commissioners in December 1825, the final location of the line was

> necessarily a work requiring much time, and involving great responsibility. The surveys previously made were for the purpose of ascertaining the general practicability and probable expense of constructing a canal on the routes located. But in preparing a line for work it is necessary to keep constantly in view the cheapness of construction--the safety of the canal when made--its convenience and utility--the shortness of the line between any given points--a proper location and distribution of locks, so as to adapt the level, in the best possible manner, to the face of the country and character of soil, without making them of so small lift as to occasion unnecessary expense and delay on one hand, or of so great lift as to render them inconvenient and unsafe on the other. Reference must also be had to the convenience and certainty of obtaining, at all necessary points, the requisite supply of water. One additional day spent in surveying and levelling, in order to determine the best possible line, will sometimes save hundreds, and even thousands of dollars in the expense of constructing a canal. To ascertain where a canal may be made, often requires little time or skill; but to determine where it can be best made, requires much of both.[5]

C. Letting of Contracts

Once the final line of the canal was located and the property for the right-of-way was acquired preparations were made to let the contracts. The projects were subdivided into sections (usually one-half mile of level line, or an entire lock or aqueduct) for contract purposes to assure that the capital requirements of construction would not exceed the means of small enterprisers and that competitive bidding would be stimulated.

As soon as it was determined that a portion of the line was ready for construction, public notices were placed in local newspapers,

---

5. "Fourth Annual Report of the Canal Commissioners," December 10, 1825, Kilbourn, Public Documents, p. 181. None of the original surveys, profiles, or plans prepared by Price are extant.

indicating the time and place at which bids would be received. Advertisements were also sent to New York where construction on the Erie Canal was coming to an end. The effort to lure experienced New York contractors to Ohio was considered very important by the board

> as some apprehension was entertained that the citizens of this state [Ohio] would be unwilling to undertake, at fair prices, large jobs of work with which they were unacquainted, and the value of which they were consequently unable to determine.

As a result of this effort a large number of contractors from New York traveled to Ohio, assuring the board of heavy competitive bidding for contracts which augured well for letting contracts on terms that were advantageous to the state.[6]

According to Harry Scheiber, the professional canal contractor "was an unusual breed of entrepreneur." Characteristically, he

> migrated from state to state as new projects were begun, carrying with him a small fund of capital, a large store of practical "canalling" knowledge, and a packet of letters of reference from officers on the lines where he had worked. . . . Contractors often formed partnerships, and one man might have different partners for each of several bids on various jobs. Whether he sought contracts individually or in partnership, the professional met competition in Ohio from numerous "active, enterprising citizens, living near the canal and in the neighboring counties," including farmers, merchants, bankers, land dealers, and lawyer-capitalists. When outbid, whether shrewdly or recklessly, by an amateur, the professional often hired himself out as a foreman. Some solicited subcontracts. Indeed the practice of employing experienced "canallers" as foremen was encouraged by a canal commission rule requiring all bidders, "if not expert themselves, [to] hire a superintendent approved by the Acting Commissioner or Principal Engineer." The commissioners also gave preference to professional

---

6. Ibid., pp. 182-183, and Scheiber, Ohio Canal Era, pp. 44-45, 70. The large influx of New York contractors on the line of the canal within the present boundaries of Cuyahoga Valley National Recreation Area is evidenced by the fact that of the 52 contracts let to complete that portion of the canal 19 were let to men from New York, 14 to men from Ohio, one to men from both states, and 18 to men from unidentified states. See "Contracts," Records of the Board of Public Works of Ohio, Series 1231, Ohio Historical Society, Columbus.

> contractors when local amateurs submitted bids far lower than the more educated bids of professionals; however, when a notably wealthy local capitalist was low bidder, he usually received the contract even if the commissioners knew full well he would lose by it.[7]

Bids were received for the work in the Cuyahoga Valley on three separate dates in 1825. On June 10 proposals were received for the 14-mile line north of Portage Summit to Lock No. 28. A month later on July 9 about seven miles of additional line extending northward to Lock No. 35 were put under contract. On August 29 the remainder of the line between Lock No. 35 and its termination near the lake at Cleveland was contracted, with the exception of about one mile at the northern end which required further surveying and examination.[8]

The contracts for the work between Portage Summit and Cleveland were printed in a standard form. All of the contracts let in June, July, and August 1825 provided that the work would be completed by September 1 or October 1, 1826. The contracts were signed by the contractor and by the acting commissioner on behalf of the state. The contracts were made in triplicate, one copy going to the contractor, one copy to the acting commissioner, and one reserved as a public document. The contracts were entered into on the part of the contractor with the express understanding that no greater prices for work of any description would be paid other than those specified in the contract. Once construction would begin, the resident engineers would play an inspectoral role, overseeing the quality of the materials used by the contractors and of labor performed. The contractors were to be paid

---

7. Scheiber, Ohio Canal Era, pp. 70-71.

8. Ibid. A list of the contractors for Sections Nos. 35-91 of the Ohio and Erie Canal (the sections of the waterway that are located in Cuyahoga Valley National Recreation Area) may be seen in Appendix F. Copies of the full text of all of the contracts, which are located in the Records of the Board of Public Works of Ohio at the Ohio Historical Society in Columbus, will be sent to Cuyahoga Valley NRA for deposit in the park's historical reference file.

monthly for the estimated value of work performed, with only the acting commissioners authorized to issue warrants for payment. The Western Reserve Bank at Warren was specified as the disbursing agent for all funds to be paid the contractors who performed work on the canal north of Akron.[9]

The entire extent of the canal north of the Portage Summit that was placed under contract by August 1825 comprised 33 miles, 55 chains, and 80 links. The work contracted for included the construction of 40 stone masonry locks. The aggregate cost of the work, based on the specified work in the contracts, amounted to $366,939.67. In addition, it would be necessary to build some 15 road bridges over the canal and that part of the line at an estimated cost of $3,000, thus making the total cost of that section of the canal to be $369,639.67. That sum was $67,639.07 less than the estimates submitted by the canal commissioners to the state legislature in 1824. The board estimated that the costs of preparing the line, superintending the construction, and future cost increases occasioned by small changes of the line or plans of work would cost some $27,000. The commissioners felt that this sum should be added to the cost of the line, thereby making the total cost of the canal north of Portage Summit about $40,000 less than the 1824 estimates. The low contract prices were attributed to the competition for the work, as some lettings received 23 bids per job--a situation in which some contractors underestimated the work simply to obtain a contract.[10]

---

9. "Fourth Annual Report of the Canal Commissioners," December 10, 1825, Kilbourn, Public Documents, p. 182, 188-189; History of the Ohio Canals, p. 25; Scheiber, Ohio Canal Era, p. 70; and "Contracts," Records of the Board of Public Works of Ohio, Series 1231, Ohio Historical Society, Columbus. A copy of the standard form for the contracts entitled "Form of an Agreement," which was appended to the aforementioned "Fourth Annual Report," may be seen in Appendix G.

10. History of the Ohio Canals, pp. 25-26; Scheiber, Ohio Canal Era, p. 45; and "Fourth Annual Report of the Canal Commissioners," December 10, 1825, Kilbourn, Public Documents, pp. 182-183. An appendix of the latter report contains data on the total amount of work, average prices, and total amount of money of the contracted work north of the Portage Summit. This appendix may be seen in Appendix H of this report.

D. Labor Force

Work began on the northern division of the Ohio and Erie Canal soon after the initial contracts were let and the pace of operations was unexpectedly quick. Irish immigrant workers who had toiled on the nearly-completed Erie Canal began arriving at Cleveland in large numbers to take advantage of the job opportunities in the Cuyahoga Valley. The Irish coming from New York were joined by local farmers and laborers, eager to work for cash wages. Although the Irish made up the bulk of the work force, Germans also entered the state to work on the canals. For their efforts, the laborers at first received 30 cents and a jigger of whiskey per day plus food and a shanty to live in, although wages later rose as high as $26 per month plus board. The workers were expected to labor from sunup to sundown six days a week. By November 20, 1825, the number of workers on the northern division was estimated at between 1,500 and 2,000.[11]

The work of digging the canal consisted of long hours of back-breaking and often dangerous labor. One writer has described some of the various features of the work of digging the canal prism as:

> Digging up and moving the dirt was a big proposition in the construction of the waterways. Primitive plows drawn by mules or oxen loosened the dirt and then throngs of men with wheelbarrows came along to carry the dirt up and out of the ditch. The laborers who pushed the wheel-barrows out of the canal wore iron band creepers attached to the soles of their boots to prevent them from slipping backward on the plank into the ditch and water. There were no pneumatic drills, no steam shovels or other back saving devices. It was just a slow, tedious process. Powder holes were drilled by hand into the blocks of stone in the pathway of the canal. . . .[12]

---

11. "Fourth Annual Report of the Canal Commissioners," December 10, 1825, Kilbourn, Public Documents, p. 184; Scheiber, Ohio Canal Era, p. 45; T. H. Findley, "One Canaller's Enthusiasm," p. 15; Jim Baker, The Big Ditch, 2nd ed. (Columbus 1975), n.p.; and Robert Hull, "The Boats That Walked Up Stairs," Ohio Bell Voice, (2nd qtr., 1972), n.p.

12. Cleveland Plain Dealer, May 22, 1932.

According to another writer, digging the pits for the lock chambers also proved to be back-breaking labor:

> To allow for the use of retaining piling and the thickness of the intended walls, these had to be dug much wider and deeper than the contained water volume. This meant pick-and-shovel work, with the use of much planking and pile driving, which was at that time a matter of sheer muscle power. There were then no power shovels, pumps or rubber hoses to be had. All pumping of water had to be done with simple hand-pumps like those used on the ships of the day. The grubbing out of massive roots and hardpan was a large part of the task.[13]

E. Progress and Problems of Construction

Work on the Ohio and Erie Canal north of the Portage Summit began in early July 1825. By December 1 the construction was progressing rapidly according to the canal commission, who reported that $63,279.00 had been already paid to the contractors. In its annual report on December 10, the board observed:

> One section, of twenty-four chains in length, which was put under contract in July, has been completely finished. Another of thirty chains has been finished, except the building of a small culvert; and the excavation and embankment on several others has progressed, as far as can be done previous to the finishing of the locks with which they are connected. The excavation and embankment have been commenced, and are progressing with great rapidity, on much the greater number of sections under contract; and near twenty-two and an half miles of the line had been grubbed and cleared before the twentieth of November last. Many of the lock pits had been dug; the foundations of six locks laid; the walls of three commenced, one of which lock No. 3, on the job of Beecher and Watson, is now completed, except the gates. Upwards of forty-six thousand feet of stone, suitable for the face stone of locks, in addition to those already laid, have been taken from the quarry; more than 18,000 feet of which have been cut fit for laying, and 22,000 feet delivered at the sites of the locks. More than one hundred and sixty-four thousand yards of earth, and seven hundred of rock, have ben excavated; forty-five thousand yards of embankment formed. Sixty-five thousand feet of timber prepared for laying, or already laid, into moles, for protecting the banks of the canal, and prepared for the foundations of locks and culverts, besides the timber already

---

13. Wilcox, The Ohio Canals, p. 14.

placed in the foundations of the locks; between six and seven thousand perches of stone, besides those already laid into the walls of locks, have been quarried, upwards of four thousand perches of which have been delivered ready for use. . . .

The work has now progressed so far, that its fair value is well ascertained. Work of almost every description, required in the construction of a canal, has been performed, and some of the jobs taken at the lowest rates have been completed. Most of the contracts have been taken at prices, which with judicious management, will yield a handsome profit to the contractors some of the sections have, however, been taken at prices which will require strict economy, and good management, to nett [sic] even a small profit.[14]

Only one major problem had impeded work in the Cuyahoga Valley during the first five months of construction. In September and early October an epidemic swept through the labor force in Portage and Northampton townships. The canal commission attributed the outbreak to the fact that most "of the laborers employed were unaccustomed to the climate, and neglected to take the necessary precautions for preserving health." Where the laborers had used "proper means" to avoid the diseases "incident to the season and climate," they were reportedly healthy, even on those parts of the line that were most exposed to sickness.[15]

---

14. "Fourth Annual Report of the Canal Commissioners," December 10, 1825, Kilbourn, Public Documents, p. 184. An appendix of the commission report showed the amount of work performed on the line of the canal north of Portage Summit prior to November 20. A copy of this appendix may be seen in Appendix I of this report.

15. "Fourth Annual Report of the Canal Commissioners," December 10, 1825, Kilbourn, Public Documents, p. 184. The disease among the laborers, then commonly referred to as "canal fever," has been diagnosed by modern doctors as malaria because of the common symptoms of breakbone fever, ague, and shakes. During the canal construction era ministers preached from the pulpit that the disease was the result of God's wrath for man daring to meddle with nature, while the medical profession believed the fever was due to the early morning miasmic air ("deleterious exhalations") or fog along the river bottoms. Cabins were built high on hillsides so that people could get as far away from those dreaded morning mists as possible. Over the years the fever epidemics drove many of the local farmers and laborers from the canal, and the Irish increasingly became the backbone of the labor force. The Irish

The construction of the canal prism between Cleveland and Kendall was far enough along by May 1826 that a contract was let to Amos Seward, Aaron Hine, and Ephraim Clark of Tallmadge to seed the canal bank slopes. The contractors agreed

> to furnish seed and sow . . . the top, the inward & outward slopes of the Canal banks between Cleaveland [sic] & Kendal [sic] with grass seed and well & thoroughly rake the same into the ground with iron tooth rakes. The seed to be used shall be Timothy, spear grass, red top, foul meadow, white clover, and such other kinds of grass seed as may . . . be considered proper for the purpose. . . . The different kinds of seed shall be sowed on such parts of the banks or slopes thereof as shall be directed by the Acting Commissioner or Engineer having charge of the work. The quantity of seed to be sowed shall be in proportion of half a bushel of Timothy seed to each acre, and of the other kinds of seed so much as will be equivalent thereto . . . according to the quantity of each kind usually sowed by farmers.

The work was to start by mid-June and the contractors were to continue their operations on other sections of the canal as they were completed.[16]

When the commissioners issued their next annual report on December 19, 1826, the document mentioned a number of factors that had impeded the construction work in the Cuyahoga Valley and had prevented the line north of Portage Summit from being completed by October 1 as specified in the original contracts. Inclement winter weather, floods, a labor shortage, and outbreaks of typhoid, as well as the fact that some contractors had absconded from their contracts leaving their workers unpaid, all had played a role in delaying the work. In addition, Pennsylvania was now vying with Ohio for the services of engineers,

---

15. (Cont.) laborers were sometimes referred to as the "Wild Irish Bog Trotters" because it was thought that their rugged constitutions could withstand the periodic epidemics, but many of them also died along the lines of the Ohio canals. There was said to be "a dead Irishman for every mile of canal" in Ohio. Findley, "One Canaller's Enthusiasm," p. 15 and Baker, The Big Ditch, n.p.

16. Articles of Agreement between Amos Seward, Aaaron Hine, and Ephraim Clark and Canal Commissioners of State of Ohio, May 13, 1826, "Contracts," Records of the Board of Public Works of Ohio, Series 1231, Ohio Historical Society, Columbus.

laborers, and experienced contractors, and competing for capital. As a result competition for bids among contractors for new work became less intense. At the same time, the low prices bid on contracts made in 1825 exposed contractors to financial pressures when many workers left Ohio to obtain higher wages in Pennsylvania. This caused a shortage of workers and an increase of wages in Ohio.[17]

The heavy rains and freshet that struck the Cuyahoga Valley in late June 1826, while not causing serious damage to the construction operations, were nevertheless a portent of future problems for the Ohio and Erie Canal. According to the commissioners, the flooding and its effect on the canal were described as follows:

> The heavy rains which fell in the later part of the month of June, produced a freshet in the Cuyahoga river and its branches, which occasioned some damage to contractors, whose work in the valley of that river, was in an unfinished and insecure state, and exposed to the violence of the flood. The amount of damage thus sustained, has not been precisely ascertained; it is believed, however, that the aggregate amount will not vary materially from two thousand dollars. The crib work of hewn timber, designed to protect the bank of the canal from the abrasion of the current, where the canal occupies part of the bed of the river, at the Pinery narrows, suffered most materially from the freshet. Several of the contractors, contrary to the advice of the engineers and acting

---

17. "Fifth Annual Report of the Canal Commissioners," December 19, 1826, Kilbourn, Public Documents, pp. 236-238; and Scheiber, Ohio Canal Era, p. 47. During 1826 five contracts for work on the line within the present boundaries of Cuyahoga Valley National Recreation Area were abandoned. The contracts covered the construction of: (1) Sections Nos. 15, 16, 42, 45, 46/Locks Nos. 17, 18; (2) Sections Nos. 64, 67; (3) Sections Nos. 79, 80/Culvert; (4) Sections Nos. 86, 105/Lock No. 38; and 95) Lock No. 39. See Appendix L of this report for more data on the abandonment and reletting of contracts in 1826. One of the most protracted and best-documented legal disputes between the Board of Canal Commissioners and a contractor concerned the contract of Stephen Snyder, Samuel Rosseter, John C. Pease, and Paul Snyder of the State of New York signed on September 10, 1825, for the construction of Sections Nos. 86 and 105 and Lock No. 38. The contract was abandoned in September 1826 and relet to Harvey Wellman of Cleveland, Ohio, on October 10, 1826. The legal proceedings were not finally settled until 1830. See "Contracts," Records of the Board of Public Works of Ohio, Series 1231, Ohio Historical Society, Columbus.

commissioner, had extended their crib work along the whole, or nearly the whole length of these wash banks, without raising it to the proper height; and had suffered it to remain unfilled, or but partially filled with stone and gravel, instead of raising the work to the full height required, as they advanced, and filling the cribs; which would have given security against the operation of the floods. The consequence, as had been anticipated, was the displacing and loss of a large quantity of timber by the freshet; whilst the works along the river, which were finished or nearly so, and those which had been conducted in a prudent and careful manner, though unfinished, sustained no material damage.[18]

Despite the delays and problems encountered in construction, the canal commission found reason to be optimistic that the work north of Portage Summit would be completed and ready for navigation by June 1827. The board took solace in the fact that:

Although these causes, combined with others of less note, have prevented the finishing of the canal between the Portage Summit and the Lake, within the time limited by the contracts for its completion, an event which had been expected with some confidence by the commissioners, still it is believed that few if any instances have occurred in our country, where an equal amount of work, of a similar kind, has been performed in so short a time. It will be recollected that this part of the Ohio canal comprehends a much greater amount of lockage than any other portion of equal length. In proceeding from Lake Erie to the Portage summit level, a distance of 37 miles, an ascent of 395-feet is encountered, requiring to overcome it, 44 locks; several points presenting considerable obstructions to the making of a canal, also occur in this distance, contributing to increase the difficulty and expense of the work. The Cuyahoga river is turned out of its course, and a new channel for its waters formed, in four different places, to make room for, and give security to the canal; and in several other places, part of its channel is necessarily occupied, requiring protection walls to secure the banks of the canal from the action of the current in the river. The main river and two of its branches are also crossed by aqueducts; two other branches are crossed by dams of cansiderable [sic] extent.

---

18. "Fifth Annual Report of the Canal Commissioners," December 19, 1826, Kilbourn, Public Documents, p. 238.

The commissioners also based their optimism for an expected June 1827 completion date on the fact that most of the heavy items of work as well as a large proportion of the "ordinary work" on the canal were already done. According to their report:

> Most of these heavy items of work have already been performed, besides the ordinary work required in the construction of a canal. The walls of 32 of the locks are laid, and the other work appertaining to them, is nearly or quite completed. Six of the remaining locks are in a state of great forwardness, and would have been finished, but for the approach of cold weather, which made it proper to suspend the further progress of the mason work until the ensuing spring. The foundations of three more are laid; and nearly all the materials necessary for the completion of all the locks which now remain unfinished, between the Portage summit and the Lake, are prepared and delivered in places convenient for the vigorous prosecution, as early in the spring as the state of the weather will admit; except for two locks, at the northern termination of the canal. Circumstances, which it is unnecessary here to detail, have operated to retard the fixing on the precise plan and location of these two locks, and it was not considered necessary here to urge their immediate completion, as the commercial business of the succeeding year on the canal, will suffer no material inconvenience on account of this delay.
>
> On this part of the line, nine culverts of stone, six of wood, three dams, and two aqueducts across branches of the Cuyahoga river, have been erected; and the aqueduct over the river at the Peninsula, is in a state of forwardness, which renders the work safe, and promises its early completion in the spring. Seven road bridges and a number of towing path bridges have also been erected.
>
> Of the more ordinary work, appertaining to the construction of a canal, such as excavation and embankment, a large proportion is entirely finished and taken off from the hands of the contractors. Far the greater part of the remainder is as nearly finished as the season will admit, only requiring for its completion a little work in trimming the banks, after the frost shall have left the ground in the spring. The work on a few of the sections is more backward, but should the winter prove favorable to the prosecution of the work, little, except masonry, will remain to be done in the spring. It is impossible to ascertain the precise amount of work which remains unfinished on this part of the canal, without a very minute examination and estimate; nearly nine-tenths, however, of the whole amount of work necessary to the completion of this division of the Ohio canal is done, and it is believed, in a neat, substantial and permanent manner.

> Moreover, a moderate depth of water had been admitted into several parts of the canal north of the Portage summit, to the length of some miles, and has by its unerring test demonstrated the correctness of the levels taken by the engineers. The banks of the canal so far as they have been tried by water prove to be as substantial and tight as had been anticipated.[19]

The fact that none of the lines under construction had been completed by the end of 1826, as called for in the original contracts, had an adverse effect on potential investors' interest in Ohio lands. Thus, the Board of Canal Fund Commissioners was told in New York that to sell additional bonds in 1827, it must soon have a part of the line navigable. Hence the canal commission decided to concentrate all its available labor and funds on the sector of the Ohio and Erie Canal north of Portage Summit.[20]

There were other compelling reasons why the commissioners were anxious to have the Portage Summit-to-Cleveland sector of the canal completed at an early date. The commissioners mentioned some of these considerations in their annual report issued on January 17, 1828, as follows:

> The time had arrived when the people of the state had been assured of having an opportunity of witnessing some of the effects of their exertions, some of the fruits of their labor. The public now expected at least a partial proof of the correctness of the opinions, plans and calculations of their agents, in which they had been asked to place confidence, and on which the ultimate success of the work must necessarily depend. For whatever confidence the public may place in the judgment of their agents, doubts must ever exist as to the correctness of untried plans and unproven theories until those doubts shall be dissipated by proof. A considerable amount of property had been deposited at Akron, with the design of transporting it by the Canal to Cleaveland [sic], on the

---

19. Ibid., pp. 237-238. As of December 1, 1826, the contractors had been paid the sum of $356,548.17 for work performed north of Portage Summit, meaning that a total of $293,269.17 worth of work had been performed on that part of the line since December 1, 1825. Ibid., p. 240.

20. Scheiber, Ohio Canal Era, p. 47.

assurance of the Acting Commissioner that this part of the Canal would be ready for navigation in July. In the event of being unable to forward this property by the Canal, the owners would be under the necessity of transporting it to its place of destination by land, over roads exceedingly bad, subjecting them to great expense and much inconvenience.[21]

The change in strategy succeeeded in renewing the pace of activity on the line in the Cuyahoga Valley. Where the work had been hampered by dilatory tactics and poor workmanship on the part of some contractors, the canal commission took over the jobs and relet them at higher prices, setting a short time limit for completion. In their annual report of January 17, 1828, the commissioners described their problems with some of the contractors and the policies they adopted to speed the work:

> At the date of the last annual report of the board, the work on that part of the Ohio canal which extends from the Portage summit to Cleaveland [sic], was in such a state of forwardness as to warrant the expectation that it might be completed early in the ensuing season, as will be seen by referring to that report. The winter proved less favorable to the prosecution of the work than usual; and the unfinished jobs were consequently less advanced at the opening of the spring than had been anticipated.
>
> Soon after the season for the commencement of vigorous operations had arrived, it was discovered that some of the contractors whose jobs were in the most backward state, were prosecuting their work with so little energy, and, in some instances, were doing it in so unfaithful a manner as to render it necessary ot put in their places more faithful as well as more efficient men.
>
> A resort to this course is always unpleasant: It generally increases the expense of the work, as in most cases the jobs are necessarily re-let at enhanced prices, in consequence of the shortness of the time given for their completion, and the necessity of making extensive preparations for finishing an amount of work comparatively small. A corresponding loss to the first contractor is the unavoidable consequence. These considerations have induced the acting commissioners to avoid

---

21. "Sixth Annual Report of the Board of Canal Commissioners," January 17, 1827[8], Kilbourn, Public Documents, p. 275.

> the changing of contracts, except in cases where it has been imperiously required by the public interest; and in many instances a resort to this measure has been delayed longer than comported with the interest of the state or with that of the individuals concerned.
>
> In some of the cases referred to, this course was adopted as the only alternative to insure a correct and faithful performance of the work, and in all of them as the only means of insuring its completion at the time required by the public interest. Although the loss sustained by the contractors, whose jobs were declared abandoned, is a subject of regret, they have no just cause of complaint, as the time limited by their contracts had expired, and they had been frequently warned of the consequences of their remiss and unfaithful manner of prosecuting their work.[22]

The quickened pace of construction activity north of Portage Summit succeeded to the point that the 38-mile sector of the canal to Lake Erie was ready for navigation by early July 1827. On the morning of the 3rd the canal boat, State of Ohio, a barge specially-built at Akron for the occasion, was boarded by Governor Trimble, members of the canal fund board and the canal commission, various state officials, and other dignitaries for the voyage to Cleveland. En route the only problem occurred when the bank of the canal gave way in one place, causing a delay of several hours. At the village of Boston, the north-bound dignitaries were joined by another boat named for the governor. Meanwhile, the people of Cleveland had borrowed an Erie Canal boat, named Pioneer, from New York. Gaily bedecked for the occasion, she proceeded up the canal six miles where the three boats met amid great fanfare on the morning of July 4--two years from the day when the original groundbreaking ceremonies had been held. Arriving to the welcoming throngs at Cleveland, the three boats were the focal point of

---

22. Ibid., pp. 272-275. During the early part of 1827 six contracts for work on the canal within the present boundaries of Cuyahoga Valley National Recreation Area were abandoned. The contracts covered the following work: (1) Sections Nos. 2, 3, 37, 38/Locks Nos. 1, 2, 26/Culvert; (2) Sections Nos. 52, 53/ Locks Nos. 29, 30/Peninsula Aqueduct/Towing Path Bridge; (3) Section No. 54; (4) Section No. 68/Culvert; (5) Sections Nos. 78; and (6) Section No. 91. See Appendix F of this report for further information on the subject.

appropriate ceremonies, followed by a memorable state dinner at Belden's Tavern. A few hours later the first freight canal boat, Enterprise, arrived at Cleveland from the Akron district, carrying a cargo of flour and whiskey consigned to W. H. Price of Franklin Mills (Kent) through Merwin, Giddings & Co.[23]

In their efforts to complete the Cleveland-to-Akron sector of the canal at the earliest possible date, the commissioners had postponed parts of the work that "were esteemed of less pressing importance." The postponed work included:

> The construction of feeders from the main Cuyahoga, that had ever been esteemed necessary to insure an adequate and permanent supply of water for this division of the canal, was accordingly postponed. The sluices or feeders designed to pass the water round the locks from one level to another were also left unfinished, and reliance was placed on passing the water through the culvert gates of the locks as a temporary expedient.

The short-cuts taken to guarantee an early completion date, however, had a detrimental effect on the functioning of the canal. The adverse effect of the short-cuts upon the operation of the waterway was described:

> The canal was filled and supplied with water, while the rainy season continued, by the small streams naturally flowing into the canal, or which were easily turned in together with a temporary supply from the main river readily introduced while the stream continued swollen with floods. The supply furnished by the small streams was found deficient, as had been anticipated, when they had shrunk to their usual low water mark. This deficiency was increased by the difficulty of passing the water onward through the culvert gates of the locks, with sufficient regularity to keep the water of equal depth in the numerous short levels which occur on this part of the canal. The culvert gates were liable to be shut by accident or design, or to be choaked [sic] with floating substances, which would raise the water in the level above and throw it over the waste wiers [sic]; thus occasioning a loss of water even where the supply was most deficient.

---

23. Still, "Ethan Allen Brown," pp. 52-53.

> From these causes the navigation of the canal necessarily sustained considerable interruption.

The interruption to canal navigation led to efforts to remedy the problem as quickly as possible. According to the canal commissioners, the following work was carried out after July 4:

> As soon as the banks of the canal had become sufficiently firm to admit raising the water in the canal with safety, and the attention of the engineers could be diverted from the constant watchfulness necessary to prevent accidents on the first filling of a new canal, means were taken to introduce a more ample supply of water. A feeder from the main Cuyahoga was introduced at the place where the canal first enters the valley of that river in its descent northwardly from the summit. The work of forming and securing sluices or feeders round the locks so as to pass the water regularly from one level to another, was also commenced. . . .

In January 1828 the commissioners reported that:

> After these feeders were so far completed as to admit of the introduction of water, the canal was abundantly supplied from a point above one mile and a half below Akron to Cleaveland [sic]: and the navigation continued without interruption, except that occasioned by a few small breaches, until late in December.[24]

---

24. "Sixth Annual Report of the Board of Canal Commissioners," January 17, 1827[1828], Kilbourn, Public Documents, pp. 275-276. The construction of the "wears" and the feeders will be treated more fully in Chapter 6.

CHAPTER FIVE: COMPLETION DATA ON THE OHIO AND ERIE CANAL: 1832

A. Completion of the Ohio and Erie Canal: 1827-32

Construction operations continued along the line of the Ohio and Erie Canal, after the opening of the 38-mile sector between Akron and Cleveland on July 4, 1827. In August 1828 the canal was opened south from Akron across Portage Summit to Massillon. Nearly two years later, in July 1830, the section of the canal across the Licking Summit to Newark was completed. In October 1831 the canal was opened as far south as Chillicothe, and the work was finally finished to Portsmouth on the Ohio River in October 1832.[1]

All told, the Ohio and Erie Canal extended 308.14 miles from Cleveland, where the Cuyahoga River emptied into Lake Erie, to Portsmouth, where the Scioto River discharged into the Ohio. The canal stretched some 38 miles through the Cuyahoga Valley, from Cleveland to the north end of the Portage Summit at Akron--rising some 395 feet above the level of the lake via 44 locks (this section of the canal will be treated more fully in the next section of this chapter). The length of the Portage Summit level was about nine miles, and from the south end of that level the canal descended some 238 feet via 29 locks along the Muskingum River Valley, 102 miles to the Dresden Side-Cut at Websport, near the mouth of Wakatomaka Creek, a small westerly branch of the Muskingum. From Websport, the canal extended some 42 miles to Newark, ascending 160 feet via 19 locks up the Wakatomaka and Licking Valleys. Five miles south of Newark at the Licking Summit (317 feet above the level of Lake Erie), which separated the tributaries of the Scioto from the streams running down to the Muskingum, a 2,500-acre reservoir was located to supply water for a "deep cut." From the 14-mile Licking Summit level, the canal descended 202 feet via 30 locks in a southward direction, some 30 miles through the Little Walnut Creek Valley to Lockbourne, where the 11-mile Columbus Feeder entered the main trunk.

---

1. Scheiber, Ohio Canal Era, pp. 48-52.

The canal then descended 211 feet via 24 locks through the Scioto River Valley, some 87 miles to Portsmouth, where it entered the Scioto, some 200 yards above the confluence of the Scioto and the Ohio.[2]

Along the entire line of the canal, there were 146 lift locks providing a total rise and fall of 1,207.35 feet. In addition, there were 5 guard locks, 14 aqueducts, 153 stone culverts, 50 wood culverts, 8 dams for crossing streams, and 6 feeder dams. Five principal feeder lines connected into the main trunk of the canal: Tuscarawas Feeder (3.2-miles); Walhonding Feeder (1.3); Muskingum Side-Cut (2.58); Granville Feeder (6.14); and Columbus Feeder (11).[3]

In their Eleventh Annual Report issued on January 22, 1833, the canal commissioners described the general specifications and characteristics of the Ohio and Erie and the Miami and Erie Canals. According to the board, the completed waterways had been constructed as follows:

> The main trunks of the Ohio and Miami Canals have each a minimum breadth of 40 feet at the water line, and 26 feet at bottom with 4 feet depth of water. A large proportion of both, particularly of the Ohio Canal, is of much larger dimensions, having a breadth at the water line varying from 60 to 150 feet, and a depth of from 5 to 12 feet. In many places, it even exceeds, for considerable distances, these dimensions, both in breadth and depth. It has been a standing rule in the construction of the canals, to increase their dimensions beyond the minimum, in all places where it could be done without materially enhancing the cost.

---

2. Dial, "Construction of the Ohio Canals," pp. 472-473; "Eleventh Annual Report of the Canal Commissioners," January 22, 1833, pp. 7-8, 10-11, 15-17, 19-23; Trevorrow, Ohio's Canal, pp. 140-145; and Wilcox, The Ohio Canals, pp. 44-60.

3. "Eleventh Annual Report of the Canal Commissioners," January 22, 1833, p. 6. The Miami Canal, including the Hamilton Side-Cut, was 66.54-miles in length and consisted of 32 lift locks, having a total rise and fall of 296.96-feet, 6 aqueducts, 27 stone culverts, 5 wood culverts, and 2 feeder dams. A copy of the chart in the aforementioned report that lists the structural data on the Ohio and Erie and the Miami and Erie Canals may be seen on the following page.

Names of Canals & Branches	Length mls	chs.	Lift Locks No.	Rise and Fall Feet	100 ths.	Guard Locks No.	Aqueducts No.	Stone Culverts	Wood Culverts	Dams for Crossing Streams	Feeder Dams
Ohio Canal main trunk	308	14	146	1207	35	5	14	153	50	8	6
Tuscarawus Feeder	3	20	"	"		1	"	"	"	"	1
Walhonding Feeder	1	30	"	"		1	"	"	"	"	1
Musk'g side cut	2	58	3	28	70	"	1	"	"	"	"
Granville Feeder	6	14	1	10		1	1	1	3	1	1
Columbus Feeder	11	00	2	13	00	1	"	1	2	1	1
Total Ohio Canal,	333	36	152	1250	04	9	16	155	55	9	10
Miami Canal, Hamilton side cut	66	00 54	32	296	96	"	6	27	5		2
Grand Total	100	10	184	1547	00	9	22	182	60	9	12

The walls of the Locks are of solid stone masonry, resting on floors composed of timbers laid crosswise of the pit covered with planks three inches in thickness, both in the chambers and under the walls, and between the walls with an additional floor of two inch plank well jointed, and secured with spikes to the timbers on which they rest.

The face of the walls are of cut stone laid in regular range work, and in lime mortar, the whole wall grouted with the same material. The breadth of the locks is fifteen feet between the walls, and the length of the Chambers, being the space between the upper and the lower gates, 90 feet--admitting boats 78 feet in length and 14 feet 10 inches in breadth, to pass freely through.

Aqueducts are constructed with wooden trunks, supported by piers of stone masonry, which, on the Ohio Canal, with the exception of two small structures in the Cuyahoga Valley, is of the same character as that used in the locks. The masonry of the others is of uncut, or hammer dressed stone.

The stone Culverts on the Ohio Canal, with the exception of a few of a small class, erected soon after commencement of the work, are composed of arches, formed of stone, cut in regular segments, and laid in range work, with wing and parapet walls of cut stone. Those on the Miami Canal and a few on the Ohio canal, are composed of rough or uncut stone.

Wood Culverts are used for land drains, and to pass small spring runs under the canal, in situations where they will always be kept under water, so as not to be liable to decay.

Large Aqueducts and culverts, as well as dams, are founded on piles, except where rock or other secure foundations could be had.

Where it has been found necessary to erect locks, in situations where the earth at the bottom of the pit was composed of light alluvion, mud, or quicksand, bearing piles have in some instances been used to form a secure and firm foundation. But mature reflection, confirmed by numerous experiments, has produced the conviction that a more secure, as well as more cheap foundation can be obtained by excavating the pit to an extra depth, and covering it with a stratum of coarse gravel of from one to two feet in thickness, wrought into puddle, in which the floor timbers are to be imbedded. This plan has therefore, in most instances, been adopted.[4]

---

4. Ibid., pp. 6-7.

Whereas the original estimate of the cost of the Ohio and Erie Canal had been set at $3,081,880.93, the total cost of constructing the waterway, including early post-completion repairs to December 1, 1832, amounted to $4,244,539.64. More than one-half of the excess cost, or $675,711.64, was due to the expense of work not included in the original estimate. The additional work included projects not contemplated in the original plans, modifications of the plan of work, changes of location to sustain local interests, additional embankments necessary to secure the canal from the effects of floods, work necessary to secure the canal after being received from the contractors, and ordinary post-completion repairs.[5]

The additional work which contributed to the cost overruns was described at length by the canal commissioners in their annual report issued in January 1833. The subject of additional work, some of which was carried out on the Cleveland-to-Akron sector, was considered under eight subject headings. First, "regulating wears" were constructed around 90 percent of the locks as necessary water control mechanisms to maintain the equitable flow of water from one level to another.

Concerning the "wears" or "tumbles" the commissioners noted that

> 67 are of cut stone masonry, resting on foundations similar to those of the locks; the walls, in most cases, connected with the lock walls--and 67 of the regulators have tumbles of wood, or are constructed either on rock foundations, or on gradual slopes of earth, secured from abrasion by timber, brush, and stone.
>
> These regulators were not included in the original plan, or estimate of the canal; and we believe they were first adopted as a general appendage of locks on the canals of this State.
>
> The cost of their construction cannot be accurately estimated, as in many instances they are connected with and

---

5. Ibid., pp. 24-31. The additional work done on the canal between July 4, 1827, and December 1, 1832, was charged to the original construction of the waterway. The details of this work will be treated more fully in Chapter 6.

form a part of the structure of the lock, and in many other cases they have been erected by superintendents of repairs at times when no more pressing duty required their attention. Those which have tumbles of stone masonry may be estimated at $250 each, the others at $150 each, and the cost of the whole at $26,800.

Second, various measures were taken to prevent continuous injuries to the canal. These efforts included:

> Sowing the banks of the canal with grass seed, to prevent their being washed by rains; driving piles at the head of locks to secure them from injuries from the violent concussion of boats; paving the banks with stone in places to secure them from the effects of the surge, occasioned by the rapid motion of boats and paving the bottom and sides of the canal at the foot of all the locks which are not founded on rock, to secure the canal at these places from the violent action of the water which passes through the lock gates, are items of work not originally contemplated or estimated, but which are of great importance to prevent serious and continual injuries. As much of this work has been executed by Superintendents of repairs, when not otherwise employed, the cost cannot be accurately stated. It will not, however, vary materially from $17,500.

Third, four of the twelve feeders that were built to supply the canal with water were north of Akron. Regarding the feeders, the commissioners noted:

> At the time of making the original surveys and estimates of the costs of canals, the means which existed of ascertaining the quantity of water flowing, at periods of the greatest drought, in streams relied on as feeders, were not such as to enable the Engineers, or Commissioners to determine with accuracy how far these streams would supply the canal: nor had they at that time the data for determining what length of line could be safely and conveniently furnished with water from one source, however abundant that source might be.
>
> Experience has shewn [sic] that some of the streams do not furnish, in dry seasons, as much water as they were expected to yield; and that levels or parts of a canal, situated remote from the source of supply, are liable to great fluctuations, and occasional scarcity of water, owing to interruptions in the flow arising from breaches or other accidental occurrencies [sic], to which all canals are more or less subject.

The four feeders north of Akron and their approximate costs were: Pinery Feeder ($2,500); Peninsula Feeder ($900); Little Cuyahoga Feeder ($989.70); and Messele Feeder ($3,521.03).

Fourth, cut stone was substituted for rough or hammer dressed stone in many structures. The commissioners explained that:

> At the time of forming the original estimates, it was proposed to construct the arches of culverts, the abutments and piers of aqueducts; the abutments of dams, guard gates, feed gates and head gates of rough or hammer dressed stone. These structures have however, with very few exceptions, been constructed of cut stone masonry of the most substantial character, which renders them much more permanent and less liable to breaches, leaks, and other accidents. The increase of cost growing out of this modification, cannot be stated with certainity. It cannot, however, be less on the whole line, than $35,000 00.

Fifth, where cheaply-constructed dams had originally been contemplated for crossing small streams, aqueducts or culverts had been constructed. Moreover,

> stone culverts, of the most perfect character, have, in many instances been adopted in lieu of aqueducts with wooden trunks. These changes operate to secure a more uninterrupted navigation; and the substitution of culverts for aqueducts, materially diminishes both the waste of water, and the expense of repairs. The additional cost of adopting these modifications may be estimated at $25,000 00.

Sixth, additional embankments had been found necessary to secure the canal against flood damage. The commissioners observed:

> At the time of locating and forming the original plan of the canal, it was found difficult, and in some cases impossible to determine the height to which floods rise in the various streams near which the canal is constructed. Subsequent observation has proved, that, in many places, the rise of floods is considerably greater than was then supposed. As the country becomes cleared, and the low grounds drained, and the various obstructions which previously prevented the rapid escape of the water from the surface of the ground after heavy rains are removed, it seems to be the natural consequence that the rivers rise more suddenly, and to a greater height.

To secure the canal, as far as possible, from being injured by high floods, it has been found necessary to raise the banks on a large proportion of its entire length, considerably higher than was at first supposed to be necessary.

This cause alone has increased the cost of the Ohio canal at least $150,000, and may be considered one of the principal causes of the excess of the actual, over the estimated cost.

Seventh, various measures were required to secure the canal once it had been received from the contractor. The commissioners commented:

On the introduction of water, many defective place [sic] are discovered that were previously unknown. Banks formed of loose and porous earth when they become saturated with water frequently assume a semi fluid character, and slip so as to occasion breaches, or at least to require much labour to give them security--such banks also settle, and unless they have been previously raised to an elevation considerably greater than that at which they are designed to remain, a large additional quantity of earth is required to sustain them at the necessary height.

Defective places places [sic] in the natural earth on which the canal is constructed are frequently disclosed on the introduction of water, which, notwithstanding the adoption of all reasonable precautions occasion breaches; and where the prism of the canal is excavated in the face of hills and sideling grounds, slips into the canal from the upper side, frequently occur, which require the removal of large quantities of earth.

On those parts of the canal which were first constructed, the expenses chargeable to this account were very heavy; but a more perfect execution of those divisions which have subsequently been finished has greatly diminished the cost of giving permanency to the work.

As much of this labour has been performed by the Superintendents of repair, when not otherwise engaged, the expenses of its execution have not been kept separate from those of making ordinary repairs, and cannot be accurately stated. They may however, be estimated at an average of $300 per mile, which on 333 1-2 miles, the aggregate length of the Ohio canal and its navigable branches, will amount to the sum of $100,000.

Eighth, all ordinary post-construction repairs made to the various sections of the canal between July 4, 1827, and December 1, 1832, were properly chargeable to the cost of the canal's construction in the view of the commissioners. These repairs, which totaled approximately $55,000 from July 1827 to December 1832, included

. . . the cost of repairing breaches which occur after the canal shall have been filled so long that the banks may be said to have acquired that degree of solidity which results from their being saturated with water, and well settled; and after such defects as are only discoverable from the filling of the canal with water, shall have been disclosed and repaired.--The replacing or repairing of lock gates, head gates and trunks of aqueducts which are decayed,--the repairing of accidental injuries sustained by the various structures on the canal from the careless management of boats, or from other causes,--and the removal of bars of deposites [sic] of earth in the canal, or other obstructions to navigation.[6]

In summary, the commissioners discussed the principal reasons for the cost overruns on the canal. Among their comments were:

This excess is in part attributable to the influence which the making of the canal has had on the commercial and agricutural prosperity of the State. As different portions of the Canal, from time to time, have been opened for navigation, a channel has been presented to the inhabitants of the interior for the cheap and convenient transportation to market, of the productions of their farms, their forests and their mines. Labour has consequently yielded a greater profit, and both provisions and wages have risen in value. This state of things has necessarily increased the expense of constructing the canal, and yet it has operated beneficially to the people of the State. For, while the cost of the canal has been enhanced, the excess has been paid to them for their labour and provisions, and the surplus sent abroad for sale, has been, at the same time increased in value, in consequence of the diminished expense of transporting it to market.

The increased amount of money which has been thrown into circulation by the heavy disbursements on the public works, has also had an effect to raise the price, both of labour and provisions.

The extensive works of internal improvements which have been prosecuted with so much energy in the adjoining states, particularly in Pennsylvania, and by the National Government in our own State, have drawn up a great number of mechanics and common laborers, who otherwise would have sought employment on our canal, and have consequently enhanced the price of labour--the cost of the canal, and at the same time have retarded its completion.

---

6. Ibid., pp. 24-31.

The frequent abandonment of jobs by contractors, in some cases from dishonest motives, but much more frequently from errors in judgment as to the value of work, or as to their own skill and ability, to perform it with economy, leading them to contract at prices below those at which they could complete it without serious losses, produced the necessity of frequent re-lettings at rates above the actual value of the work. This consequence resulted from the limited time in which the public interest required the completion of these jobs at the time of their being relet, and the scarcity and high price of labour attendant upon the extraordinary exertions necessary to accomplish a large amount of work in a short period.

The prices fixed on the work of various kinds, in the original estimates were generally sufficient to cover the expense of its execution--but the quantities were in many, indeed in most cases materially deficient--and experience has shewn [sic] that a far greater amount of work was necessary even to finish the canal on the plan originally designed, than was then estimated.

In relation to this subject, it should be observed, that the surveys on which the first estimates of cost were formed, were made in a much more hasty, and consequently less perfect manner, than would have been required to serve as a basis of correctly estimating quantities, or than would have been done had more time been given.

During the season in which these surveys were principally made, upwards of six hundred miles of canal lines were located by two parties. Under these circumstances, minute examinations and surveys could not be expected. They were in fact mostly confined to ascertaining the elevations and depressions of the surface on a longitudinal line along the centre of the ground proposed to be occupied by the canal; and even on this line, the smaller irregularities of the surface were not ascertained. The result of forming an estimate from such imperfect surveys, was, that the quantities of earth necessary to be removed in order to construct the canal were much underrated, particularly on uneven and sideling grounds. In a hasty estimate, predicted on such imperfect surveys, many structures of various kinds, necessary to render a canal substantial and convenient, were either entirely omitted, or small and cheap works were supposed to be sufficient where subsequent examination has shewn [sic] that much larger and more expensive structures were necessary. It is however probable, that much of this additional cost would have been covered by the very liberal prices generally affixed, in the first estimates to the work, had the prices of labour and provisions remained as they then were. But this state of

things, owing to the causes previously noticed, did not continue to exist.[7]

B. Completion Data on the Cleveland-Akron Sector of the Ohio and Erie Canal

The Eleventh Annual Report of the Canal Commissioners, published on January 22, 1833, was the first document to discuss the component structures on the 38-mile Cleveland-to-Akron sector of the canal in a comprehensive manner. Although this overview included data on work that had been carried out since the line opened on July 4, 1827, it nevertheless provides the first description of the significant structural elements of that portion of the line.

The northern terminus of the canal was in southwest Cleveland, on the east side of the Cuyahoga River, about one-half mile south of the confluence of the river and Lake Erie. Between the terminus of the canal and the lake there were a harbor, two sloop locks, dry docks, warehouses, and other improvements that were designed to facilitate the transfer of goods between lake vessels and canal barges. The works at Cleveland were described:

> That section of the river which extends from its mouth to the bridge, about 300 yards above the termination of the canal, forms the harbor into which schooners, sloops, and steam boats enter from the Lake to discharge and receive their cargoes from ware houses, or meet with canal boats for the mutual exchange of their lading.
>
> The average breadth of the river is here about one hundred yards, its depth from twelve to twenty feet. It opens into the lake by a safe and straight channel, in no place less than ten feet in depth: this channel is secured from the deposition of moveable sand by two parallel piers, about 180 feet apart, extending from the shore on each side of the river about 1200 feet into the lake.

---

7. Ibid., pp. 31-32. Also see History of the Ohio Canals, pp. 30-34, for a short study of the completion, extent, and cost of the Ohio and Erie Canal.

> These works were erected by the United States, and completely answer the contemplated purpose, forming one of the most safe and commodious harbours on the lake, which is accessible in any state of the wind or weather. A small light house, erected on the extremity of the eastern pier, enables vessels to enter the harbor with safety during the night. This improvement does credit to the enlightened policy of our national government, and to the fidelity and skill of the officers and agents by whom it was executed.
>
> Two locks, each of six feet lift, the chambers of which are 25 feet wide and 100 feet long, having eight feet depth of water on the mitro [sic] sills, connect the canal with the river, and admit the largest class of sloops and schooners which navigate the lake to pass from the river into a large basin of near a quarter of a mile in length, with a medium breadth of 120 feet, and a depth of eight feet. Dry docks are so constructed as freely to admit lake vessels and canal boats, to pass into them, from this basin, for the purpose of receiving repairs. The economy, expedition, and safety with which these repairs are thus made, greatly encourage and facilitate the commercial operations connected with canal navigation.[8]

From the basin at Cleveland the canal ascended the Cuyahoga Valley on the east side of the river some 24 miles to Peninsula, where it crossed the river via the Peninsula Aqueduct to the western side. It followed along the western side of the river ten miles, after which the line left the valley of the main river and ascended the Little Cuyahoga River Valley four miles to the outlet of Summit Lake. Here it reached the north end of the Portage Summit level at Akron, 38 miles from Cleveland.

On this division of the canal there were 44 locks that enabled the canal to ascent 395.5-feet above the Cleveland basin. Of the 44 locks, 21 were within three miles and 16 were within 1-1/2 miles of the north end of the Summit level.

There were three aqueducts on this division, including a single-span structure across Mill Creek, nine miles from Cleveland, a two-span structure across Tinkers Creek, thirteen miles from Cleveland, and a

---

8. A more detailed study of the canal works at Cleveland appears in Trevorrow, Ohio's Canals, pp. 41-45.

two-span structure across the Cuyahoga River at Peninsula, 24 miles from Cleveland. The trunk of the Mill Creek Aqueduct was 40 feet in length, and was supported by two abutments of uncut stone masonry resting on a floor of hewn timbers which extended across the bed of the stream and under each abutment. The wooden trunk of the Tinkers Creek Aqueduct was 95 feet in length and was supported by one pier and two abutments of uncut stone masonry. The abutments rested on a floor of hewn timbers which extended from the center of the pier across each waterway. Concerning the two aqueducts, the commissioners observed:

> The floors or platforms on which these aqueducts are erected, are secured from being undermined by means of rows of sheet piling extending across the stream, both at the head and at the foot. And also by means of placing on the bed of the stream, both above and below the aqueducts, large quantities of stone intermixed with brush. Similar precautions have been adopted in all cases where foundations of aqueducts and large culverts have been constructed on this plan.
>
> It will probably be deemed advisable to substitute culverts for both these aqueducts, particularly that across [sic] Mill creek, when the trunks shall become so much decayed as to require rebuilding.

The Peninsula Aqueduct was built in a more substantial manner than the other two aqueducts. The trunk was about 100 feet in length, and the abutments and pier consisted of cut stone masonry laid in regular range work, resting on the clay slate bed of the Cuyahoga River.

The 38-mile sector of the canal was supplied with water by four feeders. The feeder lines were described:

> Immediately below lock no. thirty six, north of Portage summit, seventeen miles from Cleveland, a copious and constant supply of water is introduced from the Cuyahoga by means of a feeder of twelve chains in length, called the "Pinery Feeder." The surface of the rock which forms the bed of the river having about the same elevation as the water line of the level, into which the feeder is introduced, the dam at its head is required to be of no greater elevation that is necessary to divert the proper quantity of water from the river into the canal, and is formed by bolting timbers to the rock. Besides furnishing water for navigation, this feeder furnishes a large quantity which may be used for hydraulic purposes, both at Cleveland and at the intermediate locks, round which an ample stream constantly flows from one level to another.

About half a mile below the aqueduct at the Peninsula, water is also introduced into the canal from the river, through a feeder of about two chains in length, called the "Peninsula Feeder." A low dam of brush and stone across the river diverts the necessary quantity of water into this feeder.

Both these feeders are secured from the influx of too great a quantity of water, in times of flood, by head gates, supported by walls of cut stone masonry, founded on rock.

Two feeders are also introduced from the Little Cuyahoga, one below Lock twenty one, thirty five miles from Cleveland, the other below Lock No. sixteen, thirty six and a half miles from Cleveland. Head gates, supported by walls of stone masonry, are also constructed on these feeders, to regulate the introduction of water. By means of the former, the water of the Main Cuyahoga may be commanded, should it ever be found necessary.

The generally narrow and precipitous confines of the Cuyahoga Valley and the steep ascent of the valley just north of Akron made some sections of this division difficult to locate and more expensive to construct. The commissioners noted that:

On this division the river has been diverted from its natural channel in four different places, to make way for the canal, so as to avoid the necessity of encountering sliding side hills, and at the same time materially diminish the length of the line.

A great extent of narrows, and wash banks, was also encountered; rendering it necessary to construct the canal in the channel of the river, for an aggregate distance of more than a mile, and to secure its banks from the abrasion of floods by walls of timber or stone. The near approach of the river to the hill, which skirts the valley, in many places, and the serpentine course of both, occasion numerous short curves on this part of the canal, and consequently render it less easy to navigate.

With the exception of these obstructions, and the great amount of ascent to be overcome by locks, this division occupies ground tolerably favourable for its construction. The great number of locks which occur in so short a distance, being far greater than on any other division of equal extent, operated to swell the cost of this part of the canal considerably above the average cost of the whole; and for the same reason, the amount and expense of ordinary repairs will also be greater.[9]

---

9. "Eleventh Annual Report of the Canal Commissioners," January 22, 1833, pp. 7-10.

C. Detailed Rules and Specifications for Construction of the Ohio and Erie Canal

The aforementioned Eleventh Annual Report of the Canal Commissioners included as an appendix the "Rules and Specifications, Relating to the Construction of the Ohio Canal: And the Estimating of Work Performed Thereon."[10] Since this set of specifications was far more detailed than the original set which had been printed in 1825, it can be presumed that it represents the accumulated engineering expertise gained over seven years of actual canal construction as the Erie Canal technology was applied to the Ohio and Erie. The "Rules and Specifications" undoubtedly were printed to serve as a record of how the canal had been constructed, but also to serve as a standard reference guide for the engineering corps and superintending canal personnel as they sought to operate and maintain the waterway. The specifications provided detailed data on the procedure and building materials used to carry out various kinds of work and to construct the different component structures on the canal.

1. Canal Prism

The first portion of the "Rules and Specifications" related to the construction of the canal prism and its ancillary embankments. The specifications and construction procedures for this component of the canal were:

Grubbing and Clearing Canal Right-of-Way Preparatory to Excavation

> 1st., In all places where excavation will be required between the banks of the canal, the whole breadth to be occupied by the canal and the banks thereof shall be thoroughly grubbed, and all trees, saplings, bushes, stumps, roots and wood of every description whether above or below the surface of the ground, shall be entirely removed therefrom, before the excavation or embankment shall be commenced thereon. On a space or strip of twenty feet wide on each side of the space so to be grubbed, all the trees, saplings and bushes shall be cut down close to the ground so that no part of

10. Ibid., pp. 43-53.

any stump thereof shall remain more than one foot above the natural surface of the earth; and shall together with all logs, brush, rubbish and wood of every description above ground, (except low stumps as aforesaid) be removed entirely from said last mentioned space or destroyed thereon.

2d. In all places where no excavation is required, but where the canal is to be formed, entirely by embankment, the whole space to be occupied by the canal and its banks, and also a space of twenty feet wide on each side of the space so to be occupied, the ground shall be low chopped and cleared as herein specified: and on a space not less than fifteen feet broad under each bank throughout the whole length thereof, the centre of which space shall be under the centre of the bank, all trees, stumps and roots shall be thoroughly grubbed out, and removed as above specified. And all ground which will be flowed by raising the water to the contemplated height in the canal shall be low chopped and cleared in the manner above described.

On a space of fifteen feet wide on each side of the spaces so to be cleared, all the trees, saplings and bushes shall be felled or cut down together with all trees which in falling will be likely to injure the banks of the canal or impede the navigation thereof. No trees, saplings, brush, logs, stumps, roots or rubbish of any kind shall be felled, laid or deposited on any adjoining job, nor in any adjacent river or stream, nor on any adjoining fields or grounds, without the consent of the owner thereof, when the same can be avoided. And such trees as unavoidably fall into any adjacent stream, river or field, or on any adjoining job, shall be removed therefrom by the contractor.

Dimensions of the Canal Prism

The canal shall be at least twenty six feet wide at bottom, and forty feet wide at top water line, unless from the peculiar, difficulties of particular situations it shall be deemed expedient by the acting Commissioner or Engineer having direction of the work to diminish the breadth. In all cases where the canal is formed by the construction of a single bank near the base of a hill or natural bank, and also when the excavation to the depth and breadth above required, is not sufficient to raise the banks to the necessary height, the depth and breadth of the canal shall be increased beyond the limits above prescribed, to such extent as the acting commissioner or superintending engineer shall deem expedient, provided the cost of the canal shall not be materially increased, nor the safety of the canal materially diminished thereby.

Mucking and Ditching

In all places where it is deemed necessary to raise the banks of the canal, or either of them, above the natural surface of the earth all wood and rubbish of every kind all vegetable matter, all muck, all loose and porous earth, shall be removed from a space at least ten feet wide, or more (if required by the Engineer having charge of the work) under each bank; so that the artificial bank may rest upon and unite securely with the solid and imperishable earth underneath. And whenever in the opinion of the acting Commissioner or any Engineer having charge of the work it may be necessary a ditch shall be dug lengthwise under the centre of each or either bank or in such other positions as said Commissioner or Engineer may direct, and of such breadth and depth as they shall deem necessary. Whenever such ditch shall be required it shall in all cases be filled with good solid imperishable earth, before the bank above shall be commenced. And in all cases where mucking and ditching are required, the same shall be at all times kept at least fifty feet in advance of the bank, to be raised thereon, until the contractor arrives at the end of his section or job, and then shall be carried at least five feet beyond the extreme end of the foot of the bank, unless the contractor on the adjoining job shall previously have caused the same to be done.

Embankment and Excavation

The towing path bank shall be at least ten feet broad at the top, and the opposite bank not less than six feet. When either bank is raised above the natural surface of the earth both the inner and outer slope thereof shall have a horizontal base of one foot, nine inches for every foot in perpendicular height, unless otherwise directed by the acting commissioner or engineer having charge of the work; and if so directed, the contractor shall form the banks with such slope as may be prescribed by said commissioner or engineer. The surface of the towing path shall be nine inches higher on the side next to the canal than on the other side, and the opposite bank six inches higher on the side next the canal, in all cases when there is not a spoil bank in the read of said banks, and when the natural surface is not above the bank.--But when a spoil bank or the natural surface of the earth is higher than the towing path or opposite bank, each of said backs [sic] shall in such case be so constructed as to be at least one foot higher at the face than at the back side. Both banks shall be so constructed as to remain at least two feet above the top water line after they shall have become solid and well settled, except in such places as the acting commissioner or engineer having charge of the work may direct the bank to be left lower in order to serve as a waste wear or place fothe escape of flood waters; and in such cases the contractor shall reduce or leave the bank at the height so required. Whenever the natural

surface of the earth under the centre of the bank, is at or below the level of the bottom of the canal, the bank shall be so made as to remain at least two and a half feet above top water line, and when the natural surface of the earth under the centre of the bank is three feet or more below bottom of canal, such banks shall be raised so as to remain at least three feet above top water line, after having settled so as to become compact and substantial. The banks shall be raised to the height prescribed by the acting commissioner or engineer, having charge of the work, in all cases where it may be deemed necessary to secure the canal from the floods of adjacent rivers or streams.

Whenever it is necessary to form spoil banks in order to dispose of the surplus earth of deep cuttings, these banks shall be so formed as to produce no unnecessary injury to the lands adjoining the canal; but the spoil bank shall be extended to an equal distance from the canal, and raised to an equal height as nearly as may be, according to the quantity of surplus earth to be disposed of. When there is but a small quantity of surplus earth, the engineer having charge of the work, may at his option direct that it shall be placed on the banks, raising them above what would be otherwise required; or he may direct the surplus earth be thrown in the rear of the banks and reduced below the level of the banks.

All embankments shall be built from the surplus earth furnished by such adjacent parts of the line as contain more than sufficient to form the banks at such place, so far as such surplus earth may extend, (provided the removal of such surplus earth more than twenty chains will not be required thereby,) unless the acting commissioner or engineer having charge of the work shall from the peculiar circumstances of this case dispense with this rule. And in no instance shall earth to form any embankment be taken from behind the towing path bank or the bank opposite thereto, where either shall rest on natural earth below the level of top water line, nor be so taken as to reduce the surface of the earth behind any such bank below such level, except by the express direction of the acting commissioner or superintending engineer, and under such restrictions as such commissioner or engineer, shall prescribe.

All embankments shall be formed by commencing them at full breadth on the bottom and continuing the bank at full breadth as it advances in height, keeping the sides at all times at least as high as the centre. No part of any embankment shall be built by throwing, rolling or casting the earth down on a slope at the end of side thereof from a height of more than two feet. And no bank shall at any time as it advances show a greater descent than two feet in any length of ten feet.

All loose and porous materials and all muck and vegetable earth used in the construction of any bank shall occupy the outward slope thereof only, and ten feet in breadth of each

bank from top to bottom shall be formed of the most solid, compact, durable and water tight earth which the adjoining excavation will furnish; and that kind of earth which will form the driest, best and most durable towing path shall be placed on and near the surface of the towing path bank.

The bottom of the canal shall be level and smooth and the sides, regular true and smooth, except when from extra depth or breadth, it may be unnecessary to observe this rule at the bottom and on the berm bank; and in such cases no stumps, stones or other substances shall be so left as to endanger the safe navigation of the canal.

Draining

Draining.--In all cases of deep cutting no part of the surplus earth or spoil bank shall be deposited within fifteen feet of the cutting stakes on the towing path side, nor within ten feet on the opposite side of the canal, unless it be directed by the acting commissioner or superintendent engineer for the purpose of raising the bank of the canal above the natural surface of the earth in order to throw the water back from the canal. Spoil banks shall in all cases be so formed that the water which falls thereon will drain back from the canal as much as possible, and not run down upon the towing path or berm bank opposite thereto. In forming spoil banks which are raised higher than the immediate banks of the canal, gaps or spaces ten feet wide at bottom shall be left in said banks as frequently as one in every two chains in order to facilitate the draining of the water from the towing path, and berm banks. Drains shall also be dug in order to turn the water off from said banks as frequently, as one in every two chains where the height of the natural earth and comparative height of the banks will admit of their being drained in this manner. And where this method cannot be adopted, ways or drains paved with stone, and thoroughly secured from undermining by means of small stones and gravel underneath, well puddled, shall be constructed as frequently as the acting Commissioner or superintending engineer shall deem necessary, in order to permit the drainage water to flow into the canal without cutting the banks or carrying earth into the canal. Both the towing path and berm banks, and the side ditches immediately in their rear shall have a uniform descent of at least six inches to the chain toward the ditches or paved ways, which shall be made at the lowest points of said banks or ditches, so that the water will in no instance stand on either bank, or in the ditches, but will readily drain off.[11]

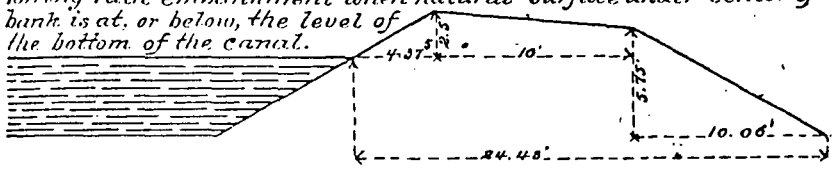
---

11. Although none of the original plans or plats for the construction of the Ohio and Erie Canal are extant, the Ohio Canal Commission in 1901 prepared cross sections of the canal prism and banks based on the original specifications. The cross sections, which may be seen on the following pages, illustrate the specifications of the prism and banks as applied to various types of terrain.

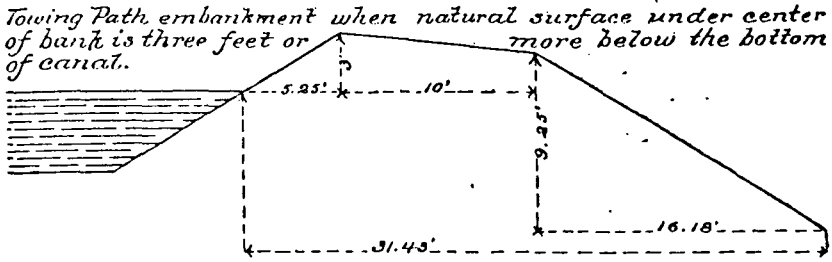
CROSS SECTIONS.

Minimum Towing Path embankment when natural surface of adjacent land is on a level with top water line of Canal.

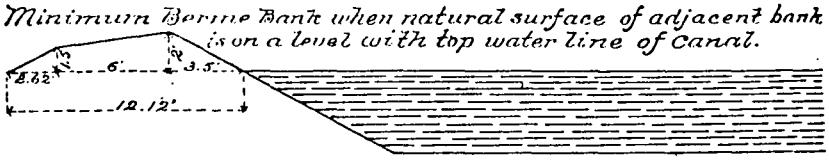
Towing Path embankment when natural surface under center of bank is at, or below, the level of the bottom of the Canal.



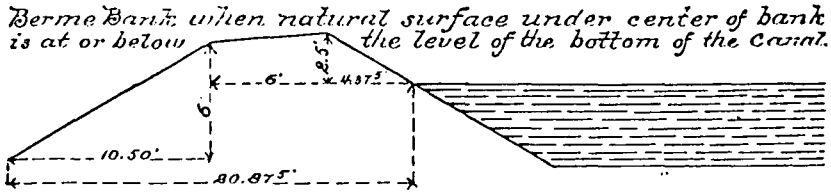
Towing Path embankment when natural surface under center of bank is three feet or more below the bottom of canal.



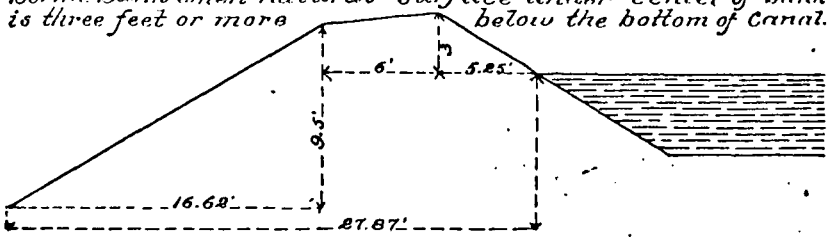
Minimum Berme Bank when natural surface of adjacent bank is on a level with top water line of Canal.

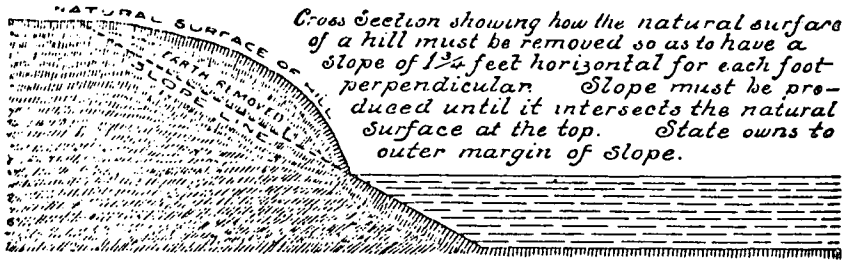


Berme Bank when natural surface under center of bank is at or below the level of the bottom of the Canal.

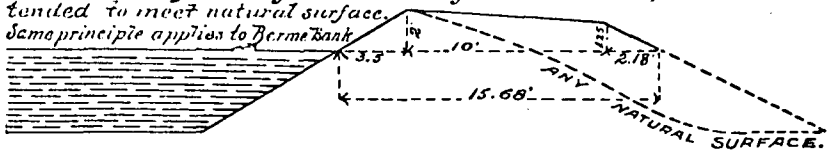


Berme Bank when natural surface under center of bank is three feet or more below the bottom of Canal.

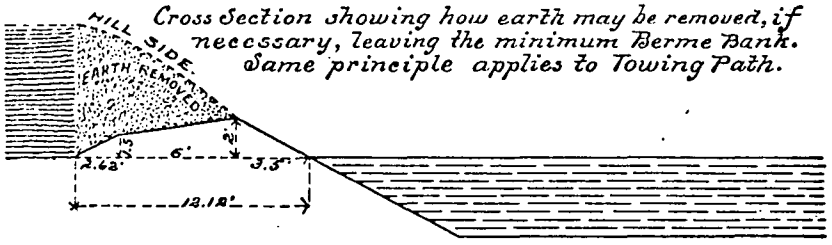




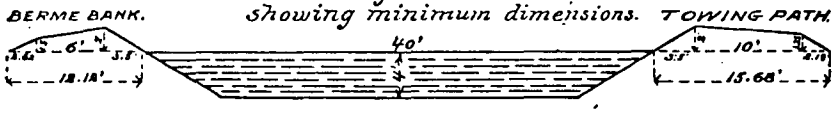
Cross Section showing how the natural surface of a hill must be removed so as to have a slope of 1¾ feet horizontal for each foot perpendicular. Slope must be produced until it intersects the natural surface at the top. State owns to outer margin of slope.



Cross Section of Towing Path showing how outer slope must be extended to meet natural surface. Same principle applies to Berme Bank



Cross Section showing how earth may be removed, if necessary, leaving the minimum Berme Bank. Same principle applies to Towing Path.



Cross Sections of Canal and Banks showing minimum dimensions.

All slopes are 1¾ feet horizontal to 1 foot perpendicular

Annual Report of the Ohio Canal Commission, 1901.

2. Locks

The locks, by which the canal barges were raised and lowered from one level to another, were given extensive coverage in the "Rules and Specifications" as follows:

Dimensions

Locks shall be 90 feet long in the chamber between the upper and lower gates, and 15 feet broad in the clear.--When the lift of the lock does not exceed eight feet, the walls shall be six and a half feet in thickness at the bottom, and laid with such batter on the backside as will reduce them to four feet six inches in thickness immediately under the copeing [sic]. When the lift of a lock shall exceed eight feet lift, three inches in thickness at the bottom shall be added for every foot of excess, in the lift of the lock above 8 feet, and the walls shall be laid with such batter on the back side as will reduce the thickness to 4 1-2 feet immediately under the copeing [sic]. The top of the copeing [sic] shall be at least two feet above the top water line of the canal above the lock, and higher when the Acting commissioner or superintending engineer shall deem it necessary, and shall direct the same to be done.

Foundations

The foundation shall be laid at such level or elevation as said commissioner or engineer may prescribe, but in all cases so low that the top of the lower mitre sill will be four feet below top water line of the canal below the lock. When a good even foundation of solid, compact, and durable rock can not, in the opinion of the commissioner and engineer having charge of the work, be procured at the proper elevation, the foundation shall be composed of good, sound, hard and durable timber hewed square, and not less than one foot in thickness which shall be laid horizontally cross wise of the lock pit, level and even, not less than three nor more than five inches beyond the outward base of the walls. This timber shall rest on a bed of good gravel puddle of such depth as the said commissioner or engineer may deem necessary and shall direct, into which it shall be driven or sunk at least one inch, and the spaces between the timbers shall also be perfectly filled with good puddle composed of gravel and such other suitable materials as said commissioner or engineer may designate, which shall be thoroughly rammed and packed, beginning at the bottom of each space. Two or more rows of sheet piling to be composed of good, sound, straight and square edged white oak plank, set close together and battened if necessary, extending to such depth as said commissioner or engineer may deem necessary, and shall designate, shall be set into the ground across the foundation, in a ditch to be cut for the purpose, which shall be thoroughly filled with good puddle well rammed.

Flooring

A floor to be composed of good sound three inch white oak plank free from shakes, well jointed as far as to form tight joints, both at the sides and ends shall be laid over the whole foundation of timber above described, and thoroughly trunnelled and spiked down to the timber underneath. The whole space between the walls of the lock, extending from the breast at least ten feet below the lower mitre sill, shall also be covered with a tight well laid floor to be composed of good sound and firm white oak plank, two inches in thickness, free from shakes, rots and unsound knots, jointed both at the sides and at the ends, which shall be thoroughly spiked down with spikes of the proper size, and not less than ten inches in length. At least five spikes in every ten square feet shall be used in laying this floor.

Facing of Walls

The face of the lock walls shall be laid in courses or range work, composed of cut stones; the stone forming each course to be of equal thickness, through the whole course. No fact stone shall be less than one foot in thickness, unless from the peculiar circumstances of the case the acting commissioner or superintending engineer, shall admit stone of less thickness to be used. Every face stone shall be at least fourteen inches in breadth thoughout [sic] its whole length, and in no instance shall be of less breadth than thickness. No face stone shall be more than half an inch thicker at the face than at the back, and shall be as nearly of uniform thickness throughout as may be. The joints or edges of face stone shall be straight and square both on the beds and at the ends, and the corners full, making close joints at the ends from the face back six inches at least. Headers not less than two feet broad and four feet six inches in length, and as large throughout the whole length as at the face, shall be prepared and laid into each course except the bottom and top courses of the face wall, not more than ten feet apart, measuring from centre to centre, in any place; and so arranged that the headers in each successive course will be placed over the space between headers in the course beneath.

The face stone of the locks shall be laid in good well wrought mortar, free from pebbles and lumps of raw lime, which shall in all cases be mixed or made at least one week previous to its being used. The mortar shall be composed of proper proportions of good quick lime and clean sharp sand, together with the proper quantity of waterlime, when the same can be procured; the proportions of each to be determined by the superintending Engineer. The stone shall be laid with close joints not exceeding, in any case, one quarter of an inch in thickness--and both the horizontal and perpendicular joints shall be thoroughly and completely filled with mortar, extending from the face of the wall at least eight inches back. The face

stone shall be thoroughly wet before being laid, and the walls shall be kept constantly wet during the time of their being built, and the face stone shall break joints in all cases at least eight inches. The copeing [sic] stone shall be at least 3 feet in breadth of uniform thickness as near as may be at the face and on the back, and those next the hollow quoins shall be cramped together with iron cramps of the proper form and size. The head of the lock on each side shall be defended by placing a heavy stone of at least two feet in thickness; two and a half feet in breadth, and five feet in length in the upper course extending from the gate recess to the head, provided the quarries used will furnish stone of that size.

Backing

All parts of the Lock walls not occupied by the face stones shall be composed of good solid stone, well shaped so as to form a strong bond throughout the whole, none of which shall be of less than 200 pounds weight except such as are necessary to fill the crevices between stone of the size above defined, when closely laid.--Headers not less than eight inches in thickness and 18 inches in breadth throughout their whole length, and extending from the back, into the wall four feet (or at least so far as the face stone will permit them to extend) shall be so placed as to correspond with each course of the face wall and so that one header from the back side shall extend into each space between the headers of the face; the back and face headers interlocking with each other so as to bind the whole wall firmly together. All the crevices in the walls not occupied by stone, shall be thoroughly filled with good well wrought grout, composed of lime and sand with a proper portion of waterlime (where that material can be procured) so as to make the whole as solid and tight as possible. The wall shall be grouted, throughout its whole extent, after laying each course of face stone and raising the back wall even therewith from time to time as the wall advances in height and more frequently if the Engineer having charge of the work shall direct.

Stone

All stone used in building Locks shall be solid, firm and durable, not liable to be affected by the action of water and frost--especial care must be taken to see than all face stones are of this character.

Gates and Mitre Sills

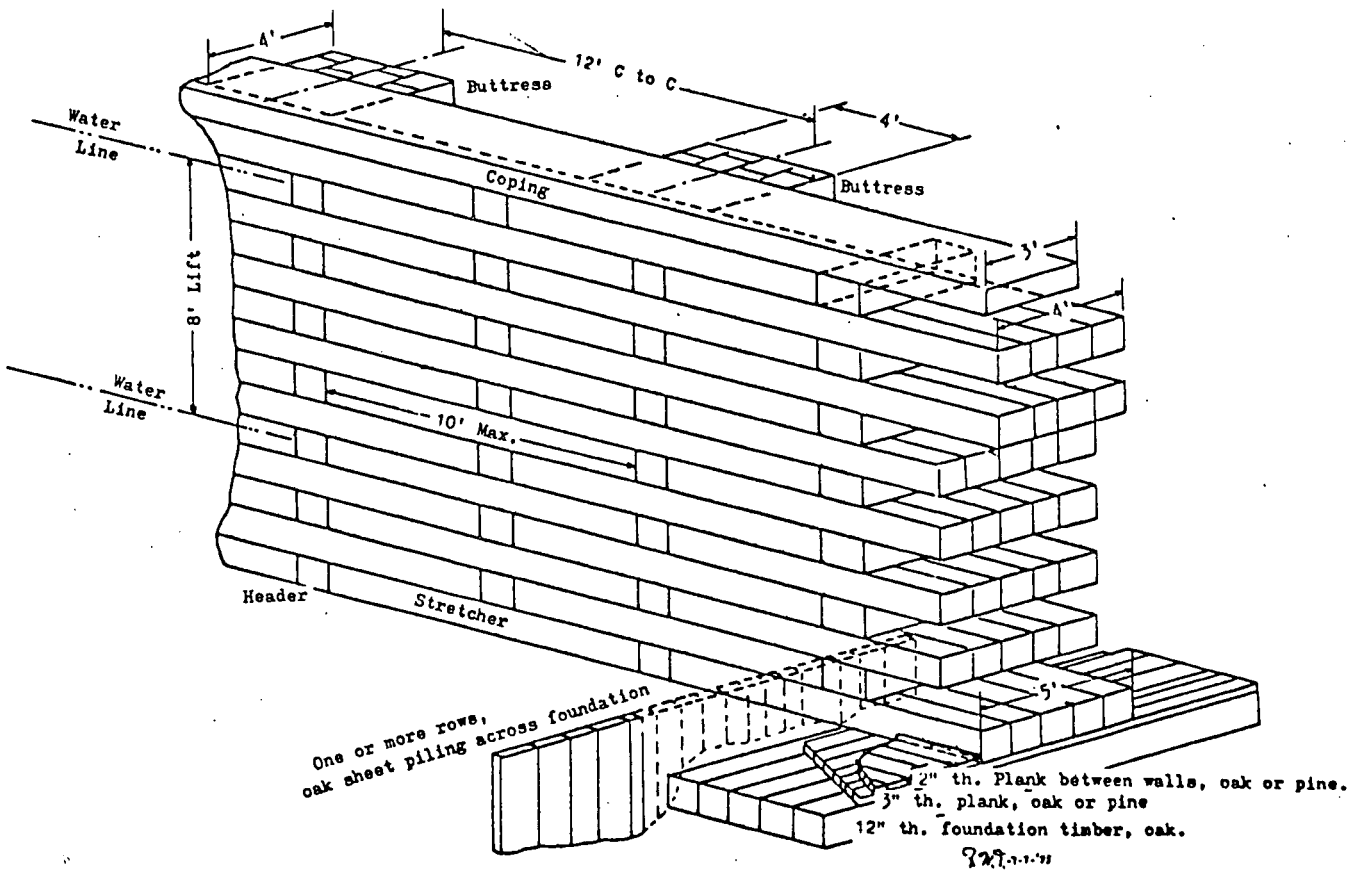
The lock gates and mitre sills shall be made agreeably to plans to be furnished by the Engineer having charge of the work, and shall be composed of good, sound, solid white oak

timber and plank, and thoroughly secured with iron of good quality, and proper dimensions made and formed agreeably to bills and plans to be furnished by said Engineer.

Fender beams and posts of the proper size and dimensions, of good sound white oak timber shall be placed and secured, at the head of the Locks agreeably to a plan to be furnished, and the directions which shall be given therefor by the Engineer having charge of the work.

The bottom and sides of the canal, extending from the foot of the lock at least forty feet, shall be secured from the action of the water passing through the paddle gates, by being paved with rough stone; or by rough stone thrown loosely thereon, as may be directed by the superintending Engineer. A tumble to be built agreeably to a plan to be furnished of cut or hammer dressed stone shall also be built if required by the engineer or acting commissioner, to pass the water from the level above to that below the lock.[12]

12. An article that discusses the details of lock construction on several American canals, including the Ohio and Erie, is F. W. Trevorrow, "Early Lock Construction," Towpaths, XVI (1978), pp. 37-47. Included in the article is an isometric drawing entitled "Lock Wall Construction In Accordance With Contract Specifications, 1825." A copy of this drawing may be seen on the following page.



Lock Wall Construction In Accordance With Contract Specifications, 1825.

3. Culverts and Aqueducts

Along the line of the canal, culverts were constructed to carry smaller streams under the trunk of the canal, while aqueducts were designed to carry the canal over larger bodies of water. The specifications for these structures were:

Stone Culverts

Stone Culverts shall be formed of good, solid, firm and durable stone, not subject to be affected by water or frost. The stone forming the arch shall be well cut so as to form sections of the required arch, agreeably to a plan to be furnished, and so as to form regular range work. The wing and parapet walls shall be of the form, height and thickness required by the plan, and shall be composed of the same kind and style of masonry, required in lock walls. The mortar and grout shall also be of the same description as that required for locks, and shall be used in the same manner. The mason work of culverts shall be erected on a floor of solid, firm and durable hewed timber, laid cross wise of the pit, and close together so as to form a complete floor, and well secured by two rows of sheet piling, one at the head and the other at the foot of the culvert, to be put in in the same manner required in lock foundations, & securely spiked at the head of the piles to the floor timbers above described, unless a solid, firm and durable rock foundation can be procured at the proper elevation. The ends of the culverts and the adjoining banks of the canal shall be secured from undermining, by defending the bottom and sides of the stream with the requisite quantity of rough stone. The quantity, quality, size and position of which shall be determined by the acting commissioner or superintending engineer. A sufficient number of strong and durable posts or large stakes shall also be set or driven firmly into the ground around the head of each culvert, in order to prevent drift wood or ice from loding against or under the culvert so as to obstruct the passage of the water. The necessary size, height, number, position and quality of said posts or stakes, and the manner of setting and securing them at the bottom, to be determined by the said commissioner or engineer.

Abutments and Piers of Aqueducts

Abutments and Piers of Aqueducts, shall be composed of the same kind and style of masonry required in locks. No mason work requiring the use of mortar or cement shall be laid after the 15th day of October nor before the first day of April

in any year except by the express permission of the acting commissioner.

Puddling for Culverts and Aqueducts

All culverts shall be covered with a coat of good puddle, at least two feet in thickness throughout their whole length, as well at the sides as on the crown of the arch. And in all cases when the banks of the canal comes in contact with or rests against lock walls, head or wing walls of aqueducts, or any other walls of masonry, the face of such wall next such bank shall be laid true and smooth and without any overhanging or projecting stones, and the bank next the walls for at least three feet in breadth or thickness, shall be formed of proper materials for puddling, and shall be well puddled.

Puddle shall in all cases be composed of gravel, which shall be mixed with clay, loam, or such other convenient materials as can be conveniently procured; and such as the acting commissioner or superintending engineer shall direct. Puddling shall be performed by spreading the material of which it is composed, level and even, and not more than six inches in thickness at once, in which state it shall be thoroughly saturated with water, and trodden with cattle or horses, or thoroughly punched with hand-spikes or bars, so as to make it as solid and compact as possible. Another layer or course shall then be laid on, wetted and trodden or punches in the same manner, and so on with successive courses until the whole is completed; confining the puddle in its place by the necessary embankment or walls as it is progressing.

Wood Culverts

Wood Culverts to be composed of broad pieces of timber rabbitted together at the corners, so as to leave a sufficient aperture for the passage of the water (from 8 to 16 inches square,) and secured together with gripes at proper distances, may also be ordered to serve as land drains under the canal in order to prevent the flowing of low grounds adjacent to the canal.[13]

4. Protective Embankments

To give the outer embankments of the canal more solidity against sliding and security against abrasion from adjoining streams,

---

13. The contract documents for the construction of the canal contain the handwritten specifications for the Tinkers Creek Aqueduct and the Peninsula Aqueduct. Both of these detailed specifications may be seen in Appendix J.

measures were taken to construct protective embankments. These embankments were built:

> Detached stone and fragments of rock obtained in excavating the canal, shall be thrown on the outward slope of the banks on any part of the same section, whenever the same may be adjudged necessary by the acting commissioner or superintending engineer, to prevent the bank from sliding, or from being washed by the current of an adjoining river or stream. And in no case shall detached stone be placed or thrown into the centre of any bank in such quantities and manner as to occasion leaks or liability to breaches.
>
> The outward slopes of such banks as are liable to be washed away or injured by the current of adjoining streams, shall be protected with stone of suitable size, quality and shape, either laid into a regular slope wall, resting upon the bank, or thrown loosely thereon, as the acting commissioner or superintending engineer may deem most expedient, and shall direct; such commissioner or engineer being the judge of the necessary quantity, size and quality of the stone, and of the places where such protection may be required.

5. Road Bridges

Bridges were built at various points along the canal to carry roads over the waterway. The specifications provided that these structures would be built as follows:

> Road bridges across the canal shall be erected at such places as the acting commissioner shall designate. They shall be built of good sound white oak timber, (or of other timber equally firm and durable,) and covered with plank of the same description, with the necessary embankments at the ends thereof. The whole to be done agreeably to a plan to be furnished for that purpose.

6. General Regulations of Construction

In addition to the specifications for the various component structures along the canal, the "Rules and Specifications" also enumerated some general regulations that governed the overall construction operations of the waterway. These regulations included:

> The work generally on the canal shall all be done in a neat substantial and workmanlike manner, agreeably to the levels, lines, marks and plans established or which may from time to time be established by the acting commissioner or any engineer, who may have charge of the work or line of canal or any part

thereof. All work of every description shall be at all times subject to the inspection of the acting commissioner or any other commissioner or any engineer in the employment of the Board. The contractor shall at all times be bound to conform to any alteration or deviation from the line or level, plan, manner or style of doing the work or any part thereof, which may at any time previous to the completion of the job be determined on by the board of commissioners, the acting commissioner or any engineer having charge of the work under them.--And if any contractor, or any person under him shall at any time have performed or be in the act of performing any part of the work on his job or under his contract, contrary to the rules and specifications established, or contrary to instructions given by such acting commissioner or engineer, in relation to the manner of doing the work, the acting commissioner or engineer in the employ of the Board, shall have full authority to order all further prosecution of such work to be stopped; which order the contractor or any person under him employed in the work shall be bound to obey.

No job will be accepted at any time between the first day of November and the first day of April.

7. Procedures for Measuring and Estimating the Various Kinds of Work on the Canal

The "Rules and Specifications" also detailed the standardized procedures the engineering corps took in measuring and estimating the various kinds of work on the canal. The steps that were taken in this regard were:

Grubbing and Clearing

Grubbing and Clearing, will be estimated by the chain in length, measuring the whole length of the section, and extending the price specified in the contract to each chain alike, without regard to the relative amount of work to be done on the several chains, and without regard to the breadth to which the line is to be grubbed or cleared. The contractor must take notice of the breadth to be grubbed and cleared as staked out and regulate his bid accordingly at his own peril. Nothing will be allowed for any additional grubbing or clearing which is done merely to obtain earth for embankment.

Excavation

Excavation, is in all cases to be estimated by the cubic yard.--Earth excavation includes all the various kinds of earth which may occur in the space to be excavated, as well as

detached pieces of rock or stones measuring less than one cubic foot.

Mucking and Ditching

Mucking and Ditching, where required by the rules and specifications, or directed to be done by the acting commissioner or superintending engineer, are to be measured and estimated as excavation in the canal, and to be paid for at the same price. No distinction will be made between the various kinds of earth excavation which may occur in a section. The contractor must judge as to the difficulties attending the excavation and regulate his bids accordingly.

Embankment

Embankment, is to be measured in the bank after it shall have become settled and compact, so that the canal can be safely filled with water; or, if the bank is measured previously to its having become thus compact and solid, a due allowance shall be made for shrinkage, according to the materials of which it is composed and the manner in which it shall have been constructed.

Where a part or the whole of any embankment is composed of materials necessarily excavated in constructing adjacent parts of the canal, or where it can be so formed, nothing shall be allowed for such embankment as shall be or may be so formed, unless the earth to form the same shall necessarily be removed over one hundred feet to form the same. In places where the average cutting at the centre, and the two sides of the canal is less than three feet, and when the line is located along the steep declivity of a bank or hill side, it shall be at the option of the resident or superintending engineer, to estimate the earth necessarily removed to form the canal either as excavation or as embankment.--Contractors will therefore graduate their bids accordingly. Nothing will be allowed for the excavation of earth, excavated beyond the necessary limits of the canal, for the purpose of forming embankments, provided the embankments which it composes is estimated, even though the earth may be moved over one hundred feet.

Mason Work

Mason Work of every description shall be measured and estimated by the perch when completed; sixteen and a half cubic feet making a perch.

Locks, Culverts, Aqueducts

In estimating Locks and Culverts and Aqueducts, nothing is to be allowed for the timber and sheet piling placed in the foundation, nor for puddling about the Lock, Culvert or Aqueduct.--Nothing is to be allowed for the centres used in building Culverts, nor for the gates, paddle gates, floors, fender posts and beams, nor for the iron, or iron work of any kind used in the construction and completion of the Lock. The prices attached to the mason work of Locks, Aqueducts and Culverts, is understood to include and cover the expense of all the items here enumerated.--The price of excavation of the Lock pit, culvert pits, the embankment about lock, above the natural surface of the earth, and bearing piles driven, under the foundation timbers, when necessary--are not included in the price of the mason work, but are to be estimated and paid for separately, under their proper heads. Where it is necessary to procure gravel or other materials for puddling from a distance exceeding five chains, a reasonable compensation, to be determined by the resident Engineer, will be allowed for its transportation.

Rock Excavation

Rock Excavation, whether of solid or detached rock, shall be estimated by the cubic yard, and the contractor shall be allowed such price as the resident Engineer shall deem just and reasonable, after its quality and situation shall be determined, and when the same shall be removed over one hundred feet, for the purpose of protecting banks from abrasion or sliding, the contractor shall be allowed a reasonable compensation therefor to be determined by said Engineer.

Trunks of Aqueducts

Trunks of Aqueducts, are to be estimated by the foot run when completed, and are understood to include the towing path bridge connected therewith.

Road Bridges

All the wood work of bridges is to be estimated and paid for in gross; and the embankments at the ends by the cubic yard, as other embankments.

Protection Stone

Stone for Protection about Locks, Culverts, Aqueducts, or on the outward slope of banks are to be estimated by the perch (or 16 1-2 cubic feet) when corded or piled as closely as they can be laid together, without breaking them for that purpose.

General Policies Relating to Contracts

For all work done agreeably to the plan adopted for the canal, or done by direction of the Acting Commissioner or any Engineer under him, and for which a price is not specified in the contract, the contractor shall be paid a fair and reasonable price to be determined by the Resident Engineer.

All work of every description is to be considered at the risk of the contractor until his whole job shall be finished and accepted.--The contractor having no right to demand that any part of his work shall be estimated until the completion of all the work contained in the contract.

Whenever in the opinion of the Resident Engineer, the amount or value of any work to be performed under any contract shall be materially increased or diminished by conforming, in obedience to the direction of the Acting Commissioner or Engineer having charge of the work, to any alteration or deviation made after the execution of the contract from the line level, plan, manner or style of doing the work previously established, such increase or diminution, both in the amount and comparative value of the work occasioned by such alteration shall be determined by the Resident Engineer, and the sum to be paid to the Contractor, shall be increased or diminished accordingly.

D. Component Structures on Cleveland-to-Akron Sector of the Canal

All of the original contracts for the construction of the Ohio and Erie Canal between Cleveland and Akron during the 1825-27 period are in the Records of the Department of Public Works of Ohio, Series 1231, at the Ohio Historical Society. According to the contracts, the following component structures were built on that portion of the line that is now within the boundaries of Cuyahoga National Recreation Area between 1825 and 1827:

Sections No. 35	-	Lock No. 24 Culvert
Section No. 36	-	Lock No. 25 Culvert
Sections Nos. 37-38	-	Lock No. 26 Culvert
Sections Nos. 39-40	-	

Section No. 41	-	Dam Waste Weir Towing Path Bridge
Sections Nos. 42, 45-46	-	Culvert
Section No. 43	-	Lock No. 27 Culvert
Section No. 44	-	Culvert
Section No. 47	-	
Section No. 48	-	Culvert
Sections Nos. 49, 51, 63	-	
Section No. 50	-	Lock No. 28 Culvert Protection Wall
Sections Nos. 52-53	-	Locks Nos. 29-30 Culvert Peninsula Aqueduct Towing Path Bridge
Section No. 54	-	
Section No. 55	-	
Section No. 56	-	Lock No. 31 Culvert Pier or Mole Across River
Sections Nos. 57-59, 65	-	Culvert
Section No. 60	-	Lock No. 32 Culvert
Section No. 62	-	Lock No. 33 Culvert
Sections Nos. 64, 67	-	Culvert
Section No. 66	-	
Section No. 68	-	Culvert
Sections Nos. 69-70	-	
Sections No. 71	-	Lock No. 35 Culvert Mole or Pier

Sections Nos. 72, 75, 76	-	Mole or Pier
Sections Nos. 73-74	-	Lock No. 36 Culvert Mole or Pier
Sections Nos. 77, 78, 81	-	Culvert Mole or Pier
Sections Nos. 79-80	-	Culvert
Section No. 82	-	Lock No. 37 Culvert Protection Wall
Section No. 83	-	
Section No. 84	-	Tinkers Creek Aqueduct Culvert Mole or Pier Protection Wall
Sections Nos. 85, 88	-	Culvert Mole or Pier Protection Wall Road Bridge
Section No. 86	-	Lock No. 38 Culvert
Section No. 87	-	
Section Nos. 89-90	-	Culvert
Section No. 91	-	Lock No. 39

CHAPTER SIX: OPERATION OF THE OHIO AND ERIE CANAL AFTER 1827

A. Problems Encountered and Solutions Used After Initial Opening of Canal: 1827-32

During the five-year period from July 4, 1827, to October 1832, when the Ohio and Erie was completed to Portsmouth, a number of problems requiring remedial action were encountered on the Cleveland-to-Akron sector of the waterway. As was mentioned in Chapter 4, the canal commissioners rushed the completion of the Cleveland-to-Akron sector of the canal during the spring and early summer of 1827 to improve their chances of obtaining further loans in the eastern financial markets. Thus, they postponed certain work, such as feeders to the main trunk and sluices or waterways around the locks, until after that section of the canal was opened to navigation on July 4. The postponment of such work, however, caused frequent interruptions to the operation of the canal because of the inadequate supply of water which resulted and lack of necessary water control mechanisms.[1]

The interruptions to canal navigation during the summer of 1827 led to immediate efforts to remedy the problem of an inadequate water supply. As soon as the banks of the canal had become sufficiently firm to permit the canal engineers to raise the water in the prism to operating levels, plans were laid to construct two feeders in the Cuyahoga Valley to enhance the water supply. The two feeders were built at the "Pinery" just below Lock No. 36 and at a point just below Lock No. 21, where the canal entered the Cuyahoga Valley on its northward descent to Lake Erie.[2]

---

1. All costs relating to new construction and repair work between July 4, 1827, and December 1, 1832, were charged to the original construction expenditure of the canal.

2. "Sixth Annual Report of the Board of Canal Commissioners," January 17, 1827 [1828], Kilbourn, Public Documents, pp. 275-276.

In July 1827 a temporary feeder from the Cuyahoga River was constructed to enter the canal below Lock No. 36 at the "Pinery," while plans were developed for a permanent feeder complex. On July 26 a contract was let to Henry R. Burnam to build a permanent dam and feeder that would become known as the "Pinery Feeder Dam Complex" at that same location. According to the terms of the contract, Burnam would

> construct a dam across the Cuyahoga River near the head of the first rapids below the mouth of Chippewa Creek, & a feeder from thence to the canal below the Lock [No. 36]. . . . The walls at the head or guardgates to be built of stone masonry in the same manner as to the kind of work as Lock walls are required to be built on the Canal, the dam to be formed by timber bolted to the rock at the bottom of the river. . . .[3]

The "Pinery Feeder Dam Complex" was completed to the point that it was put into use during the fall of 1827. Apparently, the contract for the complex was abrogated, for on December 6 a new contract was let to William Brown and Merrick Sawyer to complete the work. Later in January 1833, the canal commissioners described the feeder complex:

> Immediately below lock no. thirty six, north of Portage summit, seventeen miles from Cleveland, a copious and constant supply of water is introduced from the Cuyahoga by means of a feeder of twelve chains in length, called the "Pinery Feeder." The surface of the rock which forms the bed of the river having about the same elevation, as the water line of the level, into which the feeder is introduced, the dam at its head is required to be of no greater elevation than is necessary to divert the proper quantity of water from the river into the canal, and is formed by bolting timbers to the rock. Besides furnishing water for navigation, this feeder furnishes a large quantity which may be used for hydraulic purposes, both at Cleveland and the intermediate locks, round which an ample stream constantly flows from one level to another.[4]

---

3. Articles of Agreement between Henry R. Burnam and Alfred Kelley, July 26, 1827, "Contracts," Records of the Department of Public Works of Ohio, Series 1231, Ohio Historical Society, Columbus.

4. "Eleventh Annual Report of the Board of Canal Commissioners," January 22, 1833, p. 9, and Articles of Agreement between William Brown and Merrick Sawyer and the Canal Commissioners of the State of Ohio, December 6, 1827, "Contracts," Records of the Board of Public Works of Ohio, Series 1231, Ohio Historical Society, Columbus.

The feeder below Lock No. 21 was also constructed during the summer and fall of 1827. Head gates, supported by walls of stone masonry, were built to control the flow of water on this complex as well as that at the "Pinery."[5]

By the end of the boating season in 1827 the canal commissioners were pleased to announce that the Cuyahoga River was providing a more than adequate supply of water for the Cleveland-to-Akron sector. In January 1828 they observed that:

> During the driest part of the past season, about one third part of the medium quantity of water, then flowing in the Cuyahoga, was received into the canal through the feeders, and was found to be an abundant supply. Indeed, while this portion of the river was introduced, a large quantity of water was almost constantly flowing out of the canal, at the waste weirs on the various levels.[6]

Immediately after the canal opened, the inadequate water supply was complicated by the difficulty of passing water through the culvert gates of the locks with sufficient regularity to maintain equal water depths in the numerous short levels on the Cleveland-to-Akron sector. The culvert gates were easily shut by either accident or design and frequently clogged with floating debris, thus raising the water in the level above the lock and forcing it to overflow the waste weirs. Such occurrences caused further losses of water in an area that already had an inadequate water supply.

Thus, the engineering staff drew up plans to build "regulating wears" around the locks to pass the water regularly from one level to another. During the summer and fall of 1827 the "wears" were constructed at an average cost of $250 for those of cut stone masonry resting on foundations similar to those of the locks, and $150 for those of

---

5. Ibid.

6. "Sixth Annual Report of the Board of Canal Commissioners," January 17, 1827 [1828], Kilbourn, Public Documents, p. 278.

wood and constructed either on rock foundations or on gradual earthen slopes secured from abrasion by timber, brush, or stone. Later in January 1833 the canal commissioners described the "wears" as channels

> by which the water is passed round each lock from a higher to a lower level, and a tumble of stone or wood erected to prevent the water in its descent from cutting away the earth and depositing it in the canal below, have been constructed at all the locks on the Ohio canal, with the exception of a few where the peculiar location prevented their erection, or rendered them unnecessary.
>
> These regulations are of great importance in preserving the equable flow of water from one level to another, and keeping it at an uniform height in each; at the same time greatly diminishing the trouble and expense attendant upon passing water through the locks.
>
> As the water flows over those tumbles from the surface of each level to the next below, the upper [sic] level is not liable to be too much exhausted, and no attention is required, except to keep the regulators clear from drift wood.[7]

The construction of the additional feeders and the "wears" made it possible for the newly-opened section of the canal to operate without major interruption until late December. The operation of the canal, however, continued to be hampered by various problems. One of the principal causes of interruption to canal navigation resulted from the heavy rains in late October which caused flooding and torrential stream flow in parts of the Cuyahoga Valley. The breaches in the canal banks caused by the high water and the measures taken to repair those breaches were described by the commissioners:

> The water of the Little Cuyahoga rose to a very unusual height; overflowed its banks and broke into the canal, at a place where a new channel had been formed for the stream, in order to avoid the necessity of crossing and recrossing it with the canal, and having passed along the canal about one fourth of a mile broke out by overflowing and cutting down the bank. The current of Tinker's creek, by a partial change of its

---

7. "Sixth Annual Report of the Board of Canal Commissioners," January 17, 1827 [1828], Kilbourn, Public Documents, pp. 275-276, and "Eleventh Annual Report of the Board of Canal Commissioners," January 22, 1833, p. 24.

course, was directed against the bank of the canal, where it was not sufficiently protected to resist the force, and by cutting away the earth, occasioned by a breach into the canal. Both these breaches were repaired in a few days after the high water had far subsided, as to permit work to be advantageously applied to that purpose. Means have been taken to prevent a repetition of these or similar accidents by enlarging the channel of the Little Cuyahoga and raising the adjacent banks of the canal, so as to prevent their being overflowed in one case and by thoroughly protecting the banks with brush and stone in the other.

The expense of repairing these breaches and of securing the canal against their recurrence, has not been ascertained; it however does not probably exceed seven or eight hundred dollars.[8]

Other defective parts of the line were discovered and remedied during the first year of operation. In some places the soil through which the prism was dug was found to be "insufficiently firm" to resist the pressure of the water, thus causing leaks which undermined the banks on either side of the prism. It was also found that the embankments, especially those that were "raised to a considerable height and not well packed" during construction, settled and shrank after being saturated with water.

Hence it became the job of the engineering staff to raise and strengthen the embankments of the canal, particularly those in locations where they were exposed to the strong currents of the Cuyahoga River. In some of those places where the water was deep

strong piles have been driven and interwoven with brush, in order to ward off the violence of the current, until a more permanent protection could be made. Slope walls of stone resting on the slope of the bank, or walls of hewn timber firmly secured to the bank by means of ties, have been built where the current was so rapid as to render the cheaper method of protecting the banks insufficient. In most places the plan of throwing rough heavy stone on the outward slope of the bank, has been found a cheap, effectual, and, it is believed,

---

8. "Sixth Annual Report of the Board of Canal Commissioners," January 17, 1827 [1828], Kilbourn, Public Documents, pp. 275-276.

permanent method of preventing it from the abrasion of the current.

> Some of these jobs were delayed with the view of using the canal itself for the transportation of stone from places where they can be easily procured to places where they are wanted for protecting the banks. The expense of these works is much diminished by this operation below what it would otherwise have been. Those points exposed to the greatest danger have already been secured, and ample provision has been made for securing all those which remain unfinished.

Despite the problems with the defective embankments, the commissioners observed that:

> On the whole, the banks and other works on this part of the canal have proved to be as firm and secure, and as few breaches or other accidents have occurred during the past season, as were anticipated--fewer it is believed than usually occur on the first trial of new canals equally exposed to the operation of floods, and to injury from other causes.[9]

In January 1828 a major flood struck the Cuyahoga Valley, causing damage to the canal and leading to the adoption of measures to protect the waterway from similar floods in the future. The commissioners described the effects of the flood:

> The damages occasioned by the great flood of January last, were principally sustained by that part of the Canal which extends from the Portage Summit, north along the valley of the Cuyahoga. This river in many places, rose from one to two feet higher than had ever been previously witnessed by the oldest inhabitants residing near its banks. Such an extraordinary rise of water was not indicated by any water marks which were discoverable at the time of locating the Canal, nor by the recollections of the first settlers in the country; and was not fully provided against by the erection of guard banks, of the requisite height.

---

9. Ibid., pp. 276-277. A number of contracts were let between March and November 1827 for the transportation of stone (each perch was to weigh more than 50 pounds) to various sections of the canal between Cleveland and Akron to strengthen and secure the embankments of the waterway. A list of the contracts that were found may be seen in Appendix K.

> Very little damage was sustained from the flood, except in places where the water rose above the top of the banks, and even in these cases, the injury was less at the points where the water flowed into the Canal, than at those where it passed out. Between these points, little or no damage was occasioned by the flowing of the water along the Canal. In several instances, this operation was evidently beneficial, by sweeping from the bottom of the Canal, the deposit of earth, which had washed down from the newly formed banks.

The damage to the canal was repaired at a cost of approximately $6,000. In addition to the repairs, measures were taken to prevent the canal from similar flooding in the future. The steps taken included:

> Guard banks have been raised from one to two feet above the highest rise of the last winter's flood, wherever they were necessary. Extensive waste ways have also been formed by reducing the height of the towing path bank, at places where the natural surface of the earth is nearly on the same level with top water line in the Canal, where the waters of the river do not rise above the level, and where the situation and quality of the earth is such as not to be washed away by the water's flowing over it. Any quantity of water which may be thrown into the Canal by floods or other accidental occurrence, and which can possibly pass forward between the banks, may escape at these places without injury to the Canal. At those places, on the contrary, where a breach would be attended with great damage, on account of the height of the artificial embankment above the natural surface of the earth, the banks have been raised to such a height above top water line in the Canal, as will, in any event, secure them from being overflowed. This method of securing the banks from injury, in consequence of high water within the Canal, is attended with small comparative expense, whilst it is believed to be more effectual than any plan heretofore adopted.

In the wake of the flood, the commissioners were proud to announce that the component structures on the canal had remained secure during the high water. They observed that

> all the locks, aqueducts, culverts and other important structures on the Ohio Canal, so far as they have been tested, prove to have been founded and built in a very permanent and substantial manner, and to answer fully the purposes for which they were designed. No instance has occurred in which any of these important works have been undermined, or otherwise seriously injured by floods. The locks and culverts, particularly those which have been more recently erected, are

believed to be as substantial and durable, as any works of the kind in the United States.[10]

The canal between Cleveland and Akron was prepared for its first full season of navigation during the early months of 1828. At least three contracts were let in February and March to make various structural modifications along the canal. These were to enable the waterway to be opened for navigation in early April. The contracts provided for the following work:

a. To protect the locks from serious damage caused by boats entering the lock chambers, a contract was let to Frederick A. Sprague on February 13

> to prepare and put in to each of the Locks (for which provision has not otherwise been made) between Akron & Cleveland an extra bumping beam to be laid on a level with the upper mitre & to be connected with the lower bumping beam by means of a plank or timber of four inches in thickness & 20 inches in breadth boxed in to each of the bumping beams . . . & firmly spiked on, also to trim the gates & put in two snubbing posts to each lock where necessary--[11]

b. To improve the operation of the lock gates, a contract was let to John Wright of Akron on February 15 to

> make two new wrenches to each lock, north of Portage Summit, to repair the gate stems & so fix them as to fasten a wrench on each-work over the old wrenches when necessary & do such other iron work as may be necessary to put the locks in a state convenient for navigation. . . .[12]

c. In places where the towpath and berm embankments were still too low, efforts were made to raise them to sufficient grade to allow for

---

10. "Seventh Annual Report of the Board of Canal Commissioners," January 6, 1829, Kilbourn, Public Documents, pp. 325-326.

11. Agreement between Frederick A. Sprague and Canal Commissioners of State of Ohio, February 13, 1828, "Contracts," Records of the Board of Public Works of Ohio, Series 1231, Ohio Historical Society, Columbus.

12. Agreement between John Wright and Canal Commissioners of State of Ohio, February 15, 1828, "Contracts," Records of the Board of Public Works of Ohio, Series 1231, Ohio Historical Society, Columbus.

optimum operating conditions. Accordingly, contracts were let to perform such work, one being let to John Armstrong and N. T. Daly on March 15 to raise the towpath on Section No. 71 near Lock No. 35.[13] In addition to these contracts, some unspecified changes were made to secure the lock embankments that had been found to be susceptible to damage from "accidental floods" because of the rapid descent of the canal in the Cuyahoga Valley and the "contracted limits of the valley" itself.[14]

The canal north of Portage Summit operated in good order throughout the 1828 boating season with only one major breach interrupting canal traffic. Nevertheless, additional steps were taken to protect the locks north of Akron from being "injured by the careless or unskillful navigation and management of boats." To regulate the course of a boat in entering a lock chamber and "prevent its coming in violent contact with the walls," a contract was let to Justus and Chester Hamilton on May 1, 1828, to deliver piles at both the head and foot of the majority of the locks between Akron and Cleveland. According to the terms of the contract, the Hamiltons were

> to deliver at each of the Locks between Lock No. 17 & Lock No. 42 inclusive thirty piles, except at Locks 28, 29, 30, 35, 36 & 14 piles at each of the Locks last enumerated, each pile to be 12 feet long 9 inches in diameter clear of bark, to be sharpened agreeably to a plan given, to be straight & sound of white or red oak, black walnut or red elm & to be delivered within fifty feet of the Locks respectively . . . to deliver at each of the Locks between said Lock No. 17 & the Summit when piles can be driven at the head & foot of the Lock . . . thirty two piles, 28 of which are to be of the description above mentioned, & where piles can be driven only at one end of the Lock 16 piles at each Lock, 14 of which are to be of the description above mentioned & the others to be 16 feet in length & in other respects of the same description--and also to deliver 4 piles of 16 feet in length at each of the Locks below Lock No. 17 inclusive, where thirty short piles are to be delivered by the first clause of this agreement & 2 piles 16 feet long at each of the other Locks first

---

13. Agreement between John Armstrong and N. T. Daly and the Canal Commissioners of the State of Ohio, March 15, 1828, "Contracts," Records of the Board of Public Works of Ohio, Series 1231, Ohio National Society, Columbus.

14. "Seventh Annual Report of the Board of Canal Commissioners," January 6, 1829, Kilbourn, Public Documents, p. 327.

mentioned all to be sharpened as aforesaid & to be of the same description first above mentioned except as to length. . . .[15]

The piles were driven by "a machine fixed upon a flat boat." The piles, together with the construction of the "regulating wears" that had been built around the locks in 1827, enabled the canal commissioners to dispense with regular lock tenders along the line of the canal.[16]

Besides the measure to protect the lock walls, the canal commission continued to work toward raising and strengthening the canal embankments. At least two contracts were let during the year to secure the canal embankments by depositing stone, in the form of perches of rough stone weighing a minimum of 40 pounds and measuring a minimum thickness of four inches, on the outer slopes of the towpath and berm embankments.[17]

By 1830 it was determined that another feeder was needed to insure an adequate water supply for the Cleveland-to-Akron sector of the canal. During that year the Peninsula Feeder was constructed about one-half mile below the Peninsula Aqueduct. The feeder complex consisted of a canal, approximately 135 feet in length, and a low brush and stone dam across the river that diverted water into the feeder. The short waterway was protected from flood waters by head gates, supported by walls of cut stone masonry founded on rock. According to the canal commissioners, the feeder was built to provide a permanent and ample supply of water "to the northern sector of the canal and also "to replenish in the shortest

---

15. Agreement between Justus and Chester Hamilton and Canal Commissioners of the State of Ohio, May 1, 1828, "Contracts," Record of the Board of Public Works of Ohio, Series 1231, Ohio Historical Society, Columbus.

16. "Seventh Annual Report of the Board of Canal Commissioners," January 6, 1829, Kilbourn, Public Documents, p. 326.

17. Agreement between David L. Brown and Canal Commissioners of State of Ohio, June 16, 1828, and Silas N. Owen and Canal Commissioners of State of Ohio, November 1, 1828, "Contracts," Records of Board of Public Works of Ohio, Series 1231, Ohio Historical Society, Columbus.

possible time" any portion of that line "from which the water may be partially or wholly drawn off, in consequence of breaches, or other accidental occurrences."[18]

Within 2-1/2 years after the Cleveland-to-Akron section of the canal was put into operation, most of the initial post-construction engineering and structural problems on that part of the line apparently had been solved. In January 1830 the canal commissioners reported that the northern division of the canal had "acquired such a degree of permanency and strength as to need very small expenditures for repairs." They were happy to note that during the 1829 navigation season the cost of repairing breaches and removing bars and slips on the division had been less than $500. The locks, aqueducts, and other structures along the line of the canal had "so far fully answered the purposes for which they were designed" and "no serious injury" had been "sustained by any of them since their completion."[19]

B. Traffic on the Canal: 1827-1850

The Cleveland-to-Akron sector of the canal quickly went into active operation after it was opened on July 4, 1827. By mid-December an amount of cargo equivalent in weight to more than 10,000 barrels had been transported northward, while the equivalent of more than 8,000 barrels had been moved southward. The principal products carried in the northward trade were flour, tobacco, whiskey, beef, butter, and cheese, while those in the southward trade were general merchandise, salt, and fish. Near the end of 1827 coal began to be shipped from Tallmadge to Cleveland, and it was confidently expected that the coal trade would become a major part of the northward commerce once the canal reached the Muskingum River and its branches where extensive coal fields were located near the waterway. Large quantities of stone and

---

18. "Ninth Annual Report of the Board of Canal Commissioners," January 11, 1831, Kilbourn, Public Documents, pp. 404-405, and "Eleventh Annual Report of the Board of Canal Commissioners," January 22, 1833, p. 9.

19. "Eighth Annual Report of the Board of Canal Commissioners," January 9, 1830, Kilbourn, Public Documents, pp. 355-356.

other materials for lock construction and canal bank protection were also transported without charge. All told, the amount of tolls received by the collector at Cleveland between July 4 and December 17 was $909.69, while that received by the collector at Akron was slightly less than $600.[20]

During its first full year of operation in 1828, the Cleveland-to-Akron sector of the canal handled increasing traffic. Despite a light wheat harvest in the valley, the amount of tolls received on the Ohio and Erie totaled $4,000 and the majority of that sum was collected on the line north of Portage Summit. Coal, wool, cloth, and timber products were the principal items transported on the canal during the year, and the increase in the trade of those articles gave promise for the future success of the Ohio and Erie:

> Mineral coal has formed a considerable item of transportation on the Canal, though the low rate of toll charged upon this article, has added little to the revenue. Coal, after having been conveyed three miles over land, to the bank of the Canal, and having passed on the Canal about 35 miles to Cleaveland [sic], has been transported thence in schooners, to the Island of Mackina [sic]. Several boat loads destined for Buffalo, in the State of N. York, have also been conveyed from the coal beds, in Stark county, through the northern section of the Canal. The transportation of this article, promises to form, at no distant day, a very important and profitable item of commercial business.
>
> A large amount of wool and cloths, have been conveyed over land, from Steubenville to Massillon, thence on the Ohio Canal, to Cleaveland [sic], across the Lake, through the grand Canal of New York, and by way of the Hudson river and Atlantic Ocean, to the cities of New York and Boston. It is understood that the owners, Messrs Wells & Dickinson, made a considerable saving on the cost of transportation, by adopting this rout [sic] in preference to that of sending by wagons, directly to Baltimore or Philadelphia. Even the Oaks which have formed part of the ancient forests of the country, 30 miles from the south shore of Lake Erie, have found their way in the shape of pipe staves, to the city of New York. These facts demonstrate the great advantages of Canal navigation.
>
> The treasures which have been concealed in our hills, the forests which for ages have clothed their summits, and which, but for the Canal, would have remained comparatively useless,

---

20. "Sixth Annual Report of the Board of Canal Commissioners," January 17, 1827 [1828], Kilbourn, Public Documents, p. 278.

for centuries to come, will now be made subservient to an active commerce, and sources of wealth to the interior of our State.[21]

During the next several years trade increased on the canal as a result of opening navigation southward to Massillon in 1829 and to Newark in 1830. According to the Board of Canal Commissioners in January 1831, the canal was beginning to have the beneficial effect on the growth and development of the state economy that had been predicted some years before. The stimulus of the canal to the agricultural interests in the Cuyahoga Valley and north-central Ohio was described:

> Notwithstanding the short period of time which has elapsed since the commencement of navigation south of Massillon, the advantageous effects of opening this great channel of internal commerce, have been very obvious. The cash value of wheat, which forms a principle staple for exportation, has been advanced in the vicinity of the canals, nearly one hundred per cent; while many articles of importation, comprising some of the most important necessaries of life, have been much reduced in price. Nor have the benefits of canal navigation been confined to its immediate neighborhood; but have extended their influence more than one hundred miles from the extreme point, to which the navigation has as yet been opened. The stimulus given to industry, by the increased value of the productions of our soil, is already felt, and its effects are seen in the great increase of agricultural productions destined for a foreign market in those districts of country, which have enjoyed the great facilities offered by the canal, for commercial purposes, a sufficient length of time to produce these results.
>
> The amount of property, chiefly agricultural productions, which has been exported by the way of the Canal, during the past year, has been five fold greater than that of any preceding year. This great increase has been chiefly from those sections of country, to which the Canal navigation had been previously opened. The stimulus given to the agricultural interests south of Tuscarawas county, by the Canal, has not as yet had time to produce its effects; after the farmer is convinced that the surplus productions of his fields will meet with certain and ready sale, and command a fair price, time is

---

21. "Seventh Annual Report of the Board of Canal Commissioners," January 6, 1829, Kilbourn, Public Documents, pp. 327-328.

required to cultivate his lands, to raise his crops and prepare them for market.[22]

After the Ohio and Erie was completed to Portsmouth on the Ohio River in October 1832, the commissioners reported on the continuing growth and future prospects of the canal trade as well as the direct and indirect political and socio-economic benefits of the waterway to the state. The commissioners observed that:

> The primary object of undertaking these works, was, to furnish the means of transporting the surplus productions of our agriculture, our forests, and our mines to market, at a cost which would notconsume [sic] their whole value at the place of sale, and leave nothing to compensate [sic] the labour and the capital employed in their production.
>
> As the expense of transporting any article to market is diminished, its value at the place from whence it is sent is increased. Thus we find the present price of wheat in the centre of our State from fifty to seventy cents per bushel, where it was formerly worth from twenty five to thirty seven and a half cents, and where its value at this time would be no greater than formerly had not the Ohio canal been constructed. The same remark is equally applicable to various other productions. Many articles to which no value whatever could be attached, as articles of exportation, are now advantageously sent abroad for sale. . . .
>
> When it is considered that much of the property which has been exported would not have been produced, had not the facilities for conveying them to market existed, which the canals now afford. And when the stlmulus [sic] given to business of various kinds of consequence of canal navigation, is also taken into view, the actual pecuniary gain to the state will appear much greater than is exhibited in the statement given above.
>
> Nor does the pecuniary advantage end here. The construction of our canals has induced many men of wealth and enterprise to locate themselves among us who would not otherwise have become citizens of our state--and by these means, a large addition has been made to our active capital. The flourishing towns which have sprung into existence along the line of our canals--the rapid advancement of those which

---

22. "Ninth Annual Report of the Board of Canal Commissioners," January 11, 1831, Kilbourn, Public Documents, pp. 407-408. Also see "Eighth Annual Report of the Board of Canal Commissioners," January 9, 1830, ibid., pp. 356-357. A copy of the "Rates of Toll" adopted for the year 1830 may be seen in Appendix L.

were previously commenced--the mills and manufactories which owe their origin to the canals--the improvements of various kinds which every where in their vicinity meet the view, and the rapid increase of the value of real property, all speak of the pecuniary benefits growing out of our system of internal improvements, in a language not to be misunderstood.

These advantages have not been confined to the immediate vicinity of the canals. Even those parts of the State situated remote from the canals, and near the Ohio river, have participated in them. Much of the produce which was formerly forced into the same market, and tended to depress the price, now finds an outlet in another direction, and prices are enhanced by a competition between purchasers.

But pecuniary advantages are not the only benefits resulting from the opening of these great commercial channels through our state. They serve to bind together, by the strong ties of interest, different parts of our state and the nation. They induce intercourse between remote districts, and bring the people to associate with each other. They tend to destroy sectional feelings, local jealousies and unfounded prejudices; making the useful arts, the knowledge and the virtues of each portion of community, the common property of all. In short, they tend, by these and various other means, to make us a homogeneous people, more united, more prosperous, and more happy.[23]

To justify their optimistic report of the beneficial economic effects that the canal was having on the agricultural, mining, and manufacturing interests of the state, the commissioners provided a detailed statistical abstract of trade on the canal during 1832, concluding that the completed waterway had saved the state a total of $231,004.05 in shipping costs for the year.[24]

In 1833, the first full year of operation for the entire Ohio and Erie Canal, trade again experienced a healthy increase. The continued growth in the volume of traffic on the canal encouraged the commissioners to observe in January 1834 that

---

23. "Eleventh Annual Report of the Canal Commissioners," January 22, 1823, pp. 4-5.

24. Ibid., pp. 37-40. A copy of the abstract may be seen in Appendix M.

> The amount of exports from the State, by way of the canals, consisting mostly of the surplus productions of our soil, have increased in an equal ratio with tolls. . . .
>
> It is worthy of remark, that the ratio of the increase of transportation on the canals, for the last year, has been equal to that of any preceding year, making due allowance for the extent of new canal opened for navigation during each period; and that the increase of exports from those districts or ports to which canal navigation was first extended, has been as great during the past, constrasted with any previous year, as from those districts to which navigation has been more recently opened.
>
> These facts prove that the benefits conferred on the country by the construction of the canals, are not of a temporary character, but are calculated to give a permanent stimulus to industry and enterprise, and to produce lasting improvements.--That the resources of our state are yet very far from being fully developed; and that we may safely calculate on a rapid increase of the business and revenue of the canals for many years to come.[25]

Trade on the Ohio and Erie Canal continued to increase until 1840. During the 1827-40 period much of the region served by the canal had no alternative routes of transport to the eastern seaboard and depended almost exclusively on the waterway for both imports and exports. The canal was the only water transport link between Lake Erie and the Ohio River during this period and thus it held a virtual monopoly position for long-haul freight between the two major market areas of the West.[26]

While the Ohio and Erie Canal held its monopoly position, it was a spectacular success in its contribution to population growth and economic development in the region it served. As the opportunities for exporting

---

25. "Twelfth Annual Report of the Board of Canal Commissioners," January 13, 1834, p. 2. A copy of the "Rates of Toll" established for that year may be seen in Appendix N. By 1833 toll collector's offices had been established at Cleveland, Akron, Massillon, Dover, Roscoe, Newark, Columbus, Circleville, Chillicothe, and Portsmouth. Navigation and the collection of tolls were regulated by two acts of the state legislature passed on February 23, 1830, and March 10, 1831, and printed in Kilbourn, Public Documents, pp. 393-402, 440-445.

26. Scheiber, Ohio Canal Era, p. 191.

to cash markets became more attractive, settlers, both foreigners and eastern emigrants, began to come into the Ohio and Erie Canal region to take advantage of the large tracts of cheap and fertile Congressional lands available at $1.25 per acre. Hence population in the counties through which the canal ran in northern and central Ohio gained by 70,000 in the 1820s and by another 100,000 in the 1830s, far exceeding the rate of gain in order settled sections of the state.

A brief look at the statistics of the canal trade indicates the beneficial effect of the waterway on the growth and development of northern and central Ohio. Immediately after the canal was opened to traffic in 1827, farmers in the newly populated Cuyahoga Valley commenced the commercial production of wheat for the first time as the price received for the crop more than doubled in the next six years. Except for years when crops failed because of drought or floods, Cleveland's grain trade increased steadily as receipts of wheat by canal at that city increased from about 300,000 bushels in 1832 to more than 2,500,000 in 1851 and arrivals of flour by canal rose from 54,000 barrels to nearly 650,000 during the same period. Thus, the earlier expectations that the Ohio and Erie would make the northern and central sections of the state a vast granary and emergent Wheat Belt serving the growing urban population of New York and the Atlantic Coast were fulfilled as the growing trade made Cleveland the principal market for grain in the Great Lakes by 1840.

The northern and central sections of the Ohio and Erie also proved a boom to coal mining in those areas of the state through which it passed as Cleveland and later Akron developed into large markets and termini of the coal traffic. In 1827 the first coal to be shipped to Cleveland, amounting to some 30 tons, was carried from Tallmadge, about one mile east of present-day Akron. By 1829 more than 600 tons of coal was being shipped from Tallmadge to Cleveland to be used by the latter's homes, businesses, and lake steamers. Although Cleveland was slow to change over from the use of wood to coal, it consumed about 80 percent of the coal shipped over the canal by the mid-1840s. In 1833 "Massillon coal" from the area around Canal Fulton, Massillon, and Navarre began to arrive in Cleveland, followed by New Castle and Trenton coal in 1835-36.

The opening of the Pennsylvania and Ohio Canal in 1840 allowed coal from Trumbull and Mahoning counties to reach Cleveland. Quinton and "Rouges Hollow" coal was sent to Cleveland in 1844. The coal trade to Cleveland steadily increased until 1855 when a record 6,339,404 bushels were received. It was estimated that nearly 25 percent of the coal mined in Ohio in 1850 was transported over the Ohio and Erie to the developing grain and steel industries at Cleveland and Akron.[27]

The Ohio and Erie Canal also played a major economic role as a channel for the increasing demand of imported items from the eastern seaboard, such as hardware, textiles, clothing, farm implements, machinery, processed foods, and finished goods, all of which were classified as "merchandise." Cleveland was the one economical entryway for such goods destined for northern and central Ohio, and as a result merchandise shipments by canal from that city to the interior rose from some 5,200,000 pounds in 1832 to nearly 20,000,000 in 1839. The second largest import item on the canal was New York salt, a basic dietary item and a necessity for meat-packing, which had been in short supply in northern Ohio before the canal but which now came to Cleveland in increasing quantities from Buffalo. The total imports of salt rose from just under 30,000 barrels in 1832 to nearly 110,000 barrels in 1839.

Northern and central Ohio also relied on the canal as a conduit for the export and import of other products. Corn, pork, and whiskey were major staples of the northward trade to Cleveland for export, while gypsum and lumber were significant in the southward trade for the developing region.

Thus the Ohio and Erie played an impressive role in the growth and development of the Cuyahoga Valley and other parts of northern and central Ohio. According to Scheiber's Ohio Canal Era, the canal trade, which reached its peak in 1851, benefited those areas as follows:

> Together with the surge in population came the anticipated increase of land values, reflecting both agriculture's new

27. Earl Heydinger, "Early Coal Traffic on the Ohio & Erie," Towpaths, XII (1974), pp. 34-36.

profitability and the rising total acreage of land in cultivation. But perhaps the most striking features of development were the growth of cities and the prominence of commerce and industry in the central and northern canal regions. . . .

This rapid rate of urban growth was also reflected in the occupations by which the people earned their livelihood. In the regions where urbanization was taking hold, along the central and northern portions of the canal, the proportion of all nonprofessional workers engaged in manufacturing, trades, and commerce was 22 percent--as compared to less than 15 per cent in Ohio counties lacking canal facilities. . . .

This degree of diversification in the local economies of the northern and central regions was all the more remarkable considering the near-frontier status of most of those areas two decades earlier. Apparently the model of development postulated by the early canal advocates had been realized: rising farm income and population brought new business to the commercial towns, and also a larger "home market" for local goods produced in shops and factories which had the advantage of canal transport for raw materials. A diversified economic structure produced an interaction between agricultural growth and urban-based commerce and industry that pushed the canal counties ahead in the race for economic development.[28]

C. Boats on the Canal: 1827-1860

The size of the lock chambers, which were 90 feet long and 15 feet wide, determined the maximum dimensions of the boats that could be used on the canal.[29] Boats 78 to 80 feet long by 14 feet wide and 4 to 4-1/2

---

28. Scheiber, Ohio Canal Era, pp. 191-200, 391-397; Dial, "Construction of the Ohio Canals," pp. 478-480; and Finn, "The Ohio Canals," pp. 25-27. A copy of the "Principal Commodities in Ohio and Erie Canal Trade at Cleveland: 1832-1860" may be seen in Appendix O. Further data on the direct and indirect benefits of the Ohio and Erie Canal to the State of Ohio may be found in History of the Ohio Canals, pp. 109-111, 119-134.

29. The process of "locking" a canal boat through a lock required about 10 minutes and 40,000 gallons of water. The chamber was filled with water to the level of the canal on the upstream side. While the gate on the downstream side remained closed, the gate on the upper side was opened, the boat hauled in, and the gate closed. After the boat was moored securely, the water was permitted to pass through the wicket valves or gates on the down side until the level in the lock was to same as that of the canal on the down side. The lower gate was opened and the boat moved out. In reverse, a boat from the downstream side moved into the lock, the gate was closed, and the water passed through valves from above until the lock was filled, thus lifing the boat which was then ready to move out when the upper gate was opened. "Cuyahoga Valley History for Volunteer-In-Parks Town Guides," pp. 7-8; Wilcox, The Ohio

feet deep, drawing up to 3 feet of water when loaded, soon became standard on the canal. The boats were pulled via a towline 80 to 100 feet long stretching from the boat to two or three mules or horses walking in tandem on the towpath under the direction of a driver or "hoggie." The "itemized cost for one of the first boats used on the Ohio canal totalled $2,123.34, including six horses for towing . . . and two gallons of whisky . . . for the 'hands.'"[30] The earliest boats, fuller of line and more blunt in the bow and the stern, enabled them to haul cargoes up to 80 tons.[31]

Although there is little specific documentary information on the boats that traveled on the Ohio and Erie Canal, the laws that were passed to regulate their navigation indicate some features of their design and mode of operation. On February 23, 1830, the state legislature passed the first comprehensive act regulating the navigation and collection of tolls on the canals of the state. The provisions of the law prohibited boats that did not have a "firm and permanent bow" which was "at least as sharp or acute as a semi-circle" from navigating the canal. Rafts or floats, built of unknown timber, were also prohibited from the canals. The speed of the boats was restricted to three miles per hour on canal sections that had been opened to navigation for less than a year and to four miles per hour on older canal lines. The name of the boat and the name of the town where it was registered were to be painted on the outside of the boat in letters at least four inches in height.

The law also provided for the rules of navigation by which the operation of the boats was to be governed. The navigational rules were:

> Sec. 5. When a boat or other float shall overtake any other boat or float on either of the Canals, it shall be the duty

---

29. (Cont.) Canals, pp. 21-22; and James D. Robinson, "Headway," Towpaths, X (No. 1, 1972), p. 10.

30. A. N. Doerschuk, "The Last Ohio Canal Boat," Ohio Archaeological and Historical Society Publications, XXXIV (1926), p. 112.

31. Editorial Staff, "The Ohio and Erie Canal," Towpaths (1975), p. 12, and Baker, Big Ditch, n.p.

of the master or manager of the latter, to turn from the towing path, and give to the former every practicable facility for passing, and to stop whenever it shall become necessary, until the boat or float first mentioned, shall have fully passed.

Sec. 6. When any float in passing on either of the Canals, shall meet any other float, passing in an opposite direction, it shall be the duty of the master of each to turn to the right hand, so as to be wholly on the right side of the centre of the Canal; and the horses or other moving power of the boat, which in turning to the right as aforesaid, shall turn from the towing path; shall be stopped so as to allow the moving power of the other and the float itself to pass freely over the towing rope of the float so turned from the towing path.

Sec. 7. Whenever two or more floats, moving in opposite directions on either of the Canals, shall at the same time approach any place, where, from the contracted breadth of such Canal, or other cause, they cannot safely pass each other; it shall be the duty of the master of every such float, going from Lake Erie on the Ohio Canal, or from the Ohio river on the Miami Canal, or from Columbus on the Columbus Feeder, to stop at such distance from such place, as will permit the float or floats moving in the opposite direction conveniently to pass by, and there to wait until such passage is effected.

Sec. 8. Any float moving on either of the Canals, which shall have arrived within one hundred yards of any lock, in which the water is on the same level with such float, shall be permitted to pass such lock, before any float not on the same level.

Sec. 9. If on the arrival of any two or more floats, at or near to any lock, a question shall arise between their respective masters as to which shall be first entitled to pass, such question shall be determined by the lock keeper, or any other agent of the State having charge of such lock, if any such lock keeper or agent be present; and each float shall be passed in the order and manner in which such lock keeper or other agent of the State shall direct.

Sec. 10. No setting pole or shaft, pointed with iron, steel, or other metal, shall be used in the navigation or management of any float on either of the Canals of this State.

Sec. 11. No person shall attempt to pass any float into any lock, or out of any lock, until the main gates at the head or foot of said lock, as the case may be, between which gates such float shall be about to pass, shall first be entirely opened into their respective recesses, nor until all paddle and culvert gates of such lock shall be closed.

Sec. 12. Neither of the main gates at the head or at the foot of any lock shall be closed, or allowed to close of their own accord, while either of the paddle or culvert gates at the opposite end of said lock shall remain open.

Sec. 13. When any float shall pass out of any lock, the main gates of such lock, through or between which such float shall have passed out, shall be left entirely open, and completely within their respective recesses; and all the paddle and culvert gates of such lock shall be left closed: Provided, however, That where the Acting Commissioner or Superintendent having charge of that part of the Canal in which such lock is situated, shall direct any paddle, culvert, or other gate to be left open for the purpose of passing water through the same, such direction shall be complied with and obeyed by all lock keepers, masters of floats, boatmen, and all other persons concerned in navigating such Canal.

Sec. 14. No boat or other float shall be permitted to pass into any lock nor to strike against any part thereof, with such force as to injure, or be liable to injure, any part of such lock, or any gate or other work or devise appertaining thereto, or designed to protect the same.

Sec. 15. No lock-gate, culvert-gate, or paddle-gate, shall be closed, nor permitted to close itself with such violence, as to injure, or be liable to injure the same.[32]

On March 10, 1831, a supplementary act for the regulation of boat design, canal navigation, and toll collection was passed. Two provisions of this act pertained to new requirements of boat design as follows:

Sec. 1. . . . That every boat navigating upon either of the Canals of this State, shall, by means of a guard or plate of iron firmly attached to the keep and extending back under the rudder, or by means of some other permanent device, cover and secure the opening between the keel or stern post and the rudder, so as effectually to prevent the towing line of any other boat from entering said opening.

Sec. 2. That it shall be unlawful for any boat, having any bolt, spike, nail, hook, or other instrument, or any end of any wale, plank, timber, board, or pin, projecting from the bottom or side thereof, in such a manner as to be liable to injure any other boat, or the towing line thereof, or any work

---

32. "An Act to regulate the Navigation and Collection of Tolls on the Canals of this State," February 23, 1830, Kilbourn, Public Documents, pp. 393-395. Violations of these provisions carried a fine of $10.

or device appertaining to the Canal, to navigate on either of the Canals of this State. . . .[33]

In addition to those two laws, the Board of Public Works issued further regulations affecting the design and operation of the canal boats. The new regulations included:

> 6. No boat or other float, strapped or faced with iron on the front part of the stem, or other most prominent part of the bow thereof, so as to be liable to strike with such iron facing against any part of any lock, lock-gate, guard-gate, bridge, or other work or device appertaining to the canal, shall be permitted to navigate, or be moved, on either of the canals of this state, unless there shall be suspended, and thoroughly secured in front of the stem, or other most prominent part of the bow of such boat or float, in such a manner as effectually to prevent the iron facing or strap, thereof from striking upon or against any lock, lock-gate, guard-gate, bridge, or other work or device appertaining to the canal, a good and sufficient fender, composed of rope or rope yarn, at least six inches in diameter.
>
> 7. The master of any boat or float, which shall be found navigating or moving on either of the canals of this state, in contravention of the preceding order, shall forfeit and pay the sum of five dollars for each offence; and each mile that a boat or float shall be moved in contravention of the provisions thereof, shall be considered a new offence. . . .
>
> 22. Every boat passing on either of the canals of this state, or on any feeder of either of them, is required, at all times during the night, to carry conspicuous lights on the bow of the boat; and every infraction of this order shall subject the master, owner, or navigator to the penalty of ten dollars.[34]

While a variety of craft plied the canal waters, three principal types of boats evolved over the years. The most familiar type was the "freighter" or "three-cabin-freighter," generally a squat and squarish hold simply built and braced but designed to carry bulk cargoes. Typically, the front portion of the boat consisted of a forward cabin for

---

33. "An Act supplementary to the Act to regulate the navigation and collection of tolls on the Canals of this State," March 10, 1831, Kilbourn, Public Documents, p. 440.

34. Laws for the Protection of the Canals of the State of Ohio . . . March 20, 1844 (Columbus, 1844), pp. 14-15, 41-43.

the steersman and crew and passengers. Behind the forward cabin were a forward cargo area and an amidships cargo area separated by the stable cabin that contained space for several mules or horses. Behind the rear cargo area was the aft cabin for the captain's quarters, containing bunks, a cookstove, and storage chests, and to the rear of the cabin was the tiller for steering the rudder. A catwalk extended from stem to stern in the center and along the sides of the boat, and in the middle of the catwalk was a capstan winch used for raising and lowering the gangplank at the side of the boat. In the post-Civil War era, after railroad competition had driven off most of the passengers and fast freight business, the freighters became known as "family boats" with the captain, who was often the owner of the craft, and his family setting up housekeeping in the stem cabin.[35]

A second type of canal boat was the "line boat," a versatile craft designed primarily as a utility boat. Having one long enclosed cabin, the boat carried cargo that required protection from weather. This boat sometimes carried passengers but generally at low economy fares with no food or bedding provided.

The third type of boat was the relatively-luxurious flat-bottomed packet that carried some 40 to 60 passengers. The packets maintained published schedules, were generally drawn by well-groomed horses, and had priority over all other boats at locks and ports and when passing in mid-canal. After a temporary packet line was tested successfully between Cleveland and Hebron in 1836, a private company was established to start a "first rate daily line of Packets" between Lake Erie and the Ohio River the following year. Passengers slept in three-tier fold-away canvas beds in the main cabin, which was generally some 45 feet long and 6 feet high above the hull. The roof of the cabin served as a promenade deck in

---

35. Cleveland Plain Dealer, June 5, 1932, and July 3, 1966; Akron Beacon Journal, November 24, 1968; Baker, Big Ditch, n.p.; The Ohio Historical Society, Scenes & Songs of the Ohio - Erie Canal (Columbus, 1971), n.p.; L. W. Richardson, "John Malvern: Canal Boat Captain," Towpaths, IV (October, 1966), pp. 37-40; Mary G. Smith, "Grandpa & Peninsula, Ohio," Towpaths, II (No. 3, 1973), pp. 27-30; and Wilcox, The Ohio Canals, pp. 25-27.

good weather, while the passengers huddled around the pot-bellied stove in the center of the main cabin in cool weather. The fore-cabin in the bow of the craft housed the 4-to-9-member crew. Behind this was the ladies cabin and dressing room, and aft of this the main cabin which served as the dining area, drinking room, and men's dormitory. A kitchen was located in the stern. The packets traveled the 308-mile distance between Cleveland and Portsmouth in 80 to 90 hours and charged an average of 4 cents a mile per passenger.[36]

One of the best descriptions of a packet was written by John Quincy Adams on November 1, 1843. During a journey from Boston to Cincinnati, he boarded a packet at Cleveland and passed down the Ohio and Erie. His vivid description of the features of the boat and the trip were:

> We were advised by all means to take the canal route . . . and took passage in the canal boat, Rob Roy. This boat is 83 feet long, fifteen feet wide and had about 20 other passengers. It is divided into six compartments, the first in the bow, with two settee beds, for the ladies, separated by a curtain from a parlor bed-chamber, with an iron stove in the center, and side settees on one of which four of us slept, feet to feet; then a bulging stable for four horses, two by two by turns, and a narrow passage, with a side settee for one passenger to sleep on, leading to the third compartment; a dining hall and dormitory for thirty persons and lastly, a kitchen and cooking apparatus with sleeping room for cook, steward and crew and necessary conveniences.
>
> So much humanity crowded into such a compass was a trial such as I had never before experienced . . . and I reflected that I am to pass three nights and four days in it. . . .
>
> The most uncomfortable part of our navigation is caused by the careless and unskillful steering of the boat in and through the locks, which seem to be numberless. . . . The boat scarcely escapes a heavy thump on entering every one of them. She strikes and grazes against their sides, and staggers along like a stumbling nag. . . .[37]

---

36. Baker, Big Ditch, n.p.; Editorial Staff, "The Ohio and Erie Canal," p. 12; Wilcox, The Ohio Canals, pp. 23-24; "Cuyahoga Valley History for Volunteer-In-Parks Tour Guides," pp. 9-10; "First Annual Report of the Board of Public Works of Ohio," January 18, 1837, pp. 4-5; and Cleveland Plain Dealer, May 22, 1932.

37. James and Margot Jackson, The Colorful Era of the Ohio Canal (Akron, 1977), p. 18.

As the railroad began to offer increasing competition to the state canals, in the 1850s, authorities in Ohio began to study ways in which to increase the speed and tonnage of the boats traversing the state's waterways. In 1858 the Board of Public Works recommended that steam-propelled boats replace the older boats driven by horses or mule power. Basing their estimates on models of boats then in use on the Erie Canal, projections were made that such boats would be capable of increasing the speed and tripling the cargo tonnage of the older boats.[38]

The following year the Board of Public Works reported on experiments with steam-propelled boats on the Ohio and Erie by a Captain Duell of Peninsula. According to their report, Duell had constructed and had

> in active use the past season, on the line of the Public Works, a steam canal propeller, designed for freight. The past summer's experience with this boat, has demonstrated the fact, that steam propellers can be so constructed as to draw but three feet of water when loaded with a sixty ton cargo, and at the same time be able to make a speed of three miles per hour, at an expense of running of one-half the amount paid for towing by the present method. The boat of Capt. Duell, being, as it is, the first to undertake the experiment of substituting steam for horse power, has been found to be defective in model, as well as in the style of wheel that would be necessary to make it a perfect and complete success: although it has, with these imperfections, been able to make equally as great speed, with as large a load, and with one-half the cost of running, as the horse power boats.

Furthermore, the board observed that:

> The cost incurred in constructing the steam propeller, has been found to be no greater than that of building and equipping one of the canal boats now in use. Contracts have been entered into at Cincinnati, by parties, to construct a steam propeller of sixteen feet in length, and capable of towing two canal boats, each carrying sixty tons, at the rate of three

---

38. "Twentieth Annual Report of the Board of Public Works of Ohio," December 1858, pp. 63-65. Short histories of earlier experiments with steam-propelled boats appear in L. W. Richardson, "A Controlled Experiment," Towpaths, XII (No. 4, 1974), pp. 2-3, and F. W. Trevorrow, "Steam Powered Canal Boats," ibid., pp. 3-5.

> miles per hour. The State, so long as she remains in possession of her Public Works, is deeply interested in all enterprises of this character which tend to increase the facility, and reduce the cost of transporting property on the lines of her canals. Should any considerable number of these steam propellers be introduced upon the canals the coming year, the Board would feel themselves authorized to extend to them all the encouragement within their power. The cost of cutting and removing the grass from the canals the past year has amounted to over $8,000, which expense of the wheel, and to the extent of the benefit thus derived, the Board would be willing to make an exception on the toll sheet in favor of the steam propeller.[39]

D. Maintenance Operations: 1827-1913

During the early summer of 1827 when the line between Cleveland and Akron was nearing completion, the canal commissioners devised a plan of organization for the personnel who would oversee the maintenance needs of the waterway. The relatively simple organizational framework, coupled with the assignment of certain responsibilities to various personnel in the organization, served as a model throughout the operating period of the canal. Available documentary records indicate that in June and July Acting Commissioner Kelley contracted with five individuals, most of whom had been canal contractors, to serve as superintendents of repairs along the line. The contracts for the superintendents provided that they would direct state maintenance crews in performing repairs on the waterway as needed. The superintendents were to receive a monthly salary of $26 in return for which they would provide the following services:

> to carefully watch and examine every part of said portion of canal and the works appertaning [sic] thereto, to prevent if possible any breaches in the bank or any other injury thereto, and to repair as speedily as possible, any such breaches or injuries as may unavoidably happen, in doing which he shall employ the necessary labourers and implements and when not employed, as above, he shall employ himself and labourers under him in making such permanent improvements and works

---

39. "Twenty-First Annual Report of the Board of Public Works," December 1859, pp. 76-77. By the late nineteenth century electric canal boats had been introduced on the Ohio canals, but most of the boats appear to have operated on the Miami and Erie Canal. "Statement on Canals. Compiled and Edited Under the Direction of the Board of Public Works of Ohio, By Charles E. Perkins, Chief Engineer," March 3, 1902, pp. 16-17.

on, or appertaning [sic] to said Canal as the Acting Commissioner, or any Engineer who may have charge of said portion of the Canal, or any part thereof my [sic] direct; in all which acts, doings and things said party . . . shall conform to such instructions as he may from time to time receive from said Acting Commissioner or Engineer.

The said party . . . agrees to keep and render to the Acting Commissioners, as frequently as once in three months, (and oftener if required by him) an accurate account of all payments and disbursements made by him in execution of the above specified works and trust accompanied by proper receipts and vouchers in such form as said Acting Commissioner may from time to time direct.

The five individuals who signed such contracts were:

John McCarthy, Sections Nos. 1-24, signed June 25, 1827
Francis S. Manter, no sections specified, signed June 25, 1827
John McWhiney, no sections specified, July 2, 1827
Theophilus Pherson, no sections specified, July 10, 1827
Bela Brockway, no sections specified, July 18, 1827.[40]

By January 1830, when the canal had been opened as far south as the Licking Summit, a more elaborate organization had evolved to handle the maintenance chores along the waterway. Upon the initiative of Acting Commissioner Micajah T. Williams, the canal commission had appointed members of its engineering staff as "superintending engineers" of the line then opened to traffic. Each engineer was given full responsibility for maintenance and orderly navigation on his division of the line. As of that month, there were three "superintending engineers" on the line:

Richard House -- Lake Erie to Massillon -- 67 miles
Levander Ransom -- Massillon to Caldersburgh -- 68 miles
Bryon Kilbourn -- Caldersburgh to Deep Cut -- 55 miles

---

40. "Contracts," Records of Board of Public Works of Ohio, Series 1231, Ohio Historical Society, Columbus.

Each of the men received an annual salary of $720, an annual subsistence of $156, and an annual allowance of $52 for horsekeeping fees.[41]

Under the "superintending engineers" were "superintendents of repairs," who directed the state crews which performed various maintenance activities as required. The early activities of the superintendents of repairs were described:

> Superintendents, with a competent number of laborers and the necessary tools, are employed and stationed on given sections of the Canal, whose duty it is to prevent breaches where indications of them are perceived and to repair those which may occur. When not thus engaged, they are employed in strengthening weak places in the banks, or raising those which have become too low in consequence of the shrinkage and settling of the earth of which they are composed, and in protecting such places as may be exposed to injury from the effects of floods, or strong currents of water. This arrangement, which is deemed necessary to insure prompt and efficient aid in cases of emergency, and at the same time the greatest economy in the accomplishment of both those objects, renders it extremely difficult to separate the expenses of ordinary repairs from those properly chargeable to the account of construction, or permanent improvements. . . .[42]

In June 1832 the line north of Chillicothe was divided into four districts, each having a resident engineer as superintendent and several assistant engineers as aides. By this time the general duties of the superintendents had become standardized to the point that repairs were henceforth classified as "ordinary" and "extraordinary." Whereas the

---

41. Scheiber, Ohio Canal Era, p. 76, and "Eight Annual Report of the Board of Canal Commissioners," January 9, 1830, Kilbourn, Public Documents, p. 385. Howe remained in this position for some thirty years.

42. "Ninth Annual Report of the Board of Canal Commissioners," January 11, 1831, Kilbourn, Public Documents, p. 408. The superintendent had boats at their personal dispoal to direct the work and by the early 1850s they had under their supervision state boarding boats on which the maintenance crews for their divisions were housed. "Eleventh Annual Report of the Board of Public Works of Ohio," December 1847, pp. 7-10, and "Fifteenth Annual Report of the Board of Public Works of Ohio," December 1851, p. 10.

latter consisted of major renovation or reconstruction work, the former included:

> repairing breaches which occur after the canal shall have been filled so long that the banks may be said to have acquired that degree of solidity which results from their being saturated with water, and well settled; and after such defects as are only discoverable from the filling of the canal with water, shall have been disclosed and repaired.--The replacing or repairing of lock gates, head gates and trunks of aqueducts which are decayed,--the repairing of accidental injuries sustained by the various structures on the canal from the careless management of boats, or from other causes,--and the removal of bars of deposites [sic] of earth in the canal, or other obstructions to navigation.
>
> As these repairs have mostly been made by superintendents of repairs, who, when not thus employed, are engaged in the making of improvements, and other works of a permanent character. . . .[43]

After the canal had been completed to Portsmouth in October 1832, the maintenance organization was extended over the full length of the canal. In their annual report issued in January 1834 the canal commissioners congratulated themselves for establishing such a system:

> It is in the power of the state or its agents to render the transportation of goods by way of the canals and the lake, expeditious and certain, as to time so far only as our canal is concerned. Thus far it may be done by the use of due means to prevent, as far as practicable, breaches or other obstructions to navigation; and should they unavoidably occur, to repair the one or remove the other in the shortest possible time. It is believed that the system adopted for superintending the canals and keeping them in good repair is as perfect as any which has elsewhere been devised, in regard both to its efficiency and economy.[44]

Over a period of years the classification of "ordinary repairs" came to include numerous other maintenance activities. Such work included:

---

43. "Eleventh Annual Report of the Board of Canal Commissioners," January 22, 1833, pp. 30-31. Also see Kilbourn, Public Documents, p. 452.

44. "Twelfth Annual Report of the Board of Canal Commissioners," January 13, 1834, p. 4.

a. periodic renewal of wooden structures

b. periodic resheeting, regrouting, and repointing of masonry structures

c. strengthening of canal embankments

d. building protection walls to secure exposed or weak points in the canal embankments

e. mowing of "water grass" that grew in the prism

f. dredging and cleaning silted or debris-filled portions of the feeders and canal prism

g. cleaning of culverts

h. cutting of brush along the towpath and berm banks

i. filling and plugging of muskrat holes in the embankments

j. placing of new gates, paddles, quoins, and balance beams, heel posts and snubbing posts in locks

k. periodic graveling of dams

Most of these "ordinary repairs" were carried out during the winter season, which generally extended from late November or mid-December to mid-March or early April, depending on the weather, when ice formed on the canal and stopped navigation. Often the canal would be drained for an extended period in early spring to enable the maintenance crews to carry out their work.[45]

---

45. Baker, Big Ditch, n.p.; "Seventh Annual Report of the Board of Public Works of Ohio," December 1843, pp. 3-4; "Eleventh Annual Report of Board of Public Works of Ohio," December 1847, pp. 4, 10; and "Twentieth Annual Report of Board of Public Works of Ohio," December 1865, p. 12. During the winter months, ice-cutting operations were the principal economic activity on the canal. Ice blocks were cut and stored in ice houses such as those erected at Stumpy Basin. In the spring the ice was shipped to Cleveland via the canal boats. Ice skating on the frozen canal became a favorite winter recreational activity in the Cuyahoga Valley. For more information on the subject of winter activities on the canal, see Fred W. Bishop, "Winter at Stumpy Basin," and "Along the Canal In Winter From Conservations with James Dillow Robinson," Towpaths, XVI (No. 1, 1978) n.p.

During the early years of the canal, Acting Commissioners Kelley and Williams performed a valuable service toward the maintenance of the waterway by scrupulously evaluating applications for appointments to canal posts. As of 1835 the operating canals required five superintending engineers, fifteen division superintendents, and numerous toll collectors, locktenders, and common laborers, thus creating the possibility of a machine based on personal, partisan, or political favors. Instead, the acting commissioners set a precendent for professional competence by resisting political pressures and attempting to fill the new bureaucracy with capable men based on their personal reputation and work experience.[46]

The political controversies and rivalries between the Whigs and Democrats in Ohio during the 1830s and 1840s, however, weakened the administration and maintenance operations on the state canals. The period of the 1830s witnessed the takeover of the state legislature by the Jacksonian reform-oriented Democratic Party, and as a result the Board of Public Works was established permanently in 1839 to replace the Board of Canal Commissioners as the agency in charge of operating and maintaining the canal. The successive reorganization and reforms between 1836-39 that led to the formation of the Board of Public Works had a serious impact on the maintenance operations of the canal by the early 1840s, as policies were implemented to reduce the size of the engineering staff and lower the salaries of administrative, maintenance, and engineering personnel. Although the new policies caused some experienced engineers to leave the state or seek employment with the emerging private railroad corporations in Ohio, they did not deter political hacks from applying for vacant posts, and throughout the 1840s party patronage and the "spoils system" increasingly became the touchstones in the selection of staff personnel. Thus flagrant partisanship led to a demoralized engineering corps, corrupt and incompetent administration, and inefficient maintenance operations.

---

46. Scheiber, Ohio Canal Era, pp. 77, 165.

Although the Board of Public Works passed through several reorganizations, the various commissioners made few modifications in the basic staff organizations, thus failing to adjust either their administrative procedures or their hierarchical arrangements to new requirements. Under the board, after the late 1830s, decentralization of responsibility and failure to exercise checks prevailed in the supervision and maintenance of the canals. Although the full board met occasionally to appoint collectors and other officials and to set canal tolls, there was no inspection of financial accounts for maintenance work and little attention given to systematic and periodic surveys of the canals, to determine the long-range maintenance requirements to keep the canals operating at peak efficiency. Consequently, many abuses occurred in the awarding of repair contracts, which were not subject to competititve bidding, and maintenance problems were often overlooked until they became critical.

Mounting public criticism of the Board of Public Works impelled the state legislature to reassert its jurisdiction in certain areas of canal administration. While some of the legislative interference had good effects on exposing abuses or inefficiency in operational and personnel policies, sometimes the interference caused difficulties. Examples of such problems included the reduction of the size and salaries of the engineering staff in charge of canal maintenance operations--policies which led to an exodus of experienced engineers from state employment.

Beseiged with petitions for better maintenance of the public works during the 1840s and 1850s, the legislature occasionally made special appropriations for major reconstruction or renovation work. Such action was often carried out with support from the board, because it was often reluctant to undertake major repair projects requiring large expenditures without prior legislative approval. For regular maintenance and light repairs, however, the board relied upon its discretionary authority and drew upon general canal funds. The costs of maintenance varied considerably from year to year, influenced by weather conditions and the occurrence of natural disasters. Ordinarily, a new canal would require high maintenance for a few years, until the weaknesses were corrected

and necessary minor alterations made. The record of the Ohio and Erie conformed to that pattern: its combined maintenance and supervision costs averaged $511 per mile annually during 1835-39, $349 during 1840-44, $322 during 1845-59, and $316 during 1850-55.[47]

In 1856 the system of providing for ordinary repairs under the direction of division superintendents was replaced by a new system in which such services were contracted out to private firms under multi-year agreements. The inauguration of this system by the state legislature was accompanied by a drastic reduction in the number of state personnel assigned to oversee the maintenance of the canals. After the first year of operation under this system, the Board of Public Works reported on the dire consequences such a policy was having on the physical condition of the waterways:

> So far, the contractors have generally met their engagements with a reasonable degree of promptness. Whenever their direct interest is at stake, due vigilance is usually exercised, but it can not be denied that the experience of the past year shows that the primary interest of the contractors is to avoid the expenditure of money, except where such expenditure will bring an immediate return, secure a tangible advantage to them, or guard against an evident danger. In case where these results are not secured, such as regulating a uniform flow of water, removing obstructions from weirs or gates, cutting and removing grass, and many other small matters of every day occurrence, requiring the immediate and prompt attention of the subordinates in charge, and the neglect of which will not affect the subsequent safety of the canal, or enhance the cost of its repair, there has too often been a want of attention which, even in these apparently minor matters, is necessary to insure free and unobstructed navigation. The result has been well grounded complaints on the part of the boatmen and occupants of water power. It may be said, these difficulties could be easily prevented by a resort to that provision of the contracts which authorizes the agents of the State to employ persons to perform any labor which has been neglected by the contractors. If the agents of the State were numerous, this might be done, but so long as one or two persons only are charged with the care and superintendence of from one hundred and fifty to two hundred miles of line, it is

47. Ibid., pp. 164-177.

> totally impossible. Under the old system, there was seldom more than from twenty-five to forty miles of line under the care of one superintendent, and although the want of a direct interest on his part to prevent the expenditures of money in repairs of this kind, was liable to lead to abuses, yet it unquestionably aided to secure a much more prompt attention to them, and in consequence to insure a more uniformly good navigation.[48]

Available records reveal little about the organization of the staff assigned the task of maintaining the canals under the Board of Public Works. The first complete list of the entire organization assigned to that task to appear in an annual report of the board was that submitted for the year 1858. In that year the Cleveland-to-Akron sector of the Ohio and Erie was administered and maintained as part of Division No. 1 of the state public works. Division No. 1 included both the northern divisions of the Miami and Erie Canal, extending from Toledo to Defiance, and of the Ohio and Erie Canal, covering the 207-mile distance from Cleveland to Lockville, as well as the Western Reserve and Maumee Road. The organizational list included the following personnel categories: resident engineer, engineer to gauge surplus water, special superintendents, superintendents of repairs (who supervised the actual maintenance crews), lock tenders, inspectors, and weigh masters and deputies. Those portions of the list that apply to the northern division of the Ohio and Erie may be seen in Appendix P.[49]

In accordance with an act "to provide for leasing the Public Works of the State," passed on May 8, 1861, the Public Works were transferred to Kent Jarvis, William J. Jackson, Joseph Cooper, Thomas Brown, Arnold Medbury, and Thomas Moore under a 10-year lease at an annual rent of

---

48. "Eighteenth Annual Report of the Board of Public Works of Ohio," December 1856, p. 19.

49. "Twentieth Annual Report of the Board of Public Works of Ohio," December 1858, pp. 18-23.

$20,075. Under the terms of the lease, which was later extended, the lessees were to make repairs and maintain the canals as required by the personnel of the Board of Public Works and to return the lines to the state at the end of the lease in the same condition as they received them. Most maintenance activities, however, except for those that were critical to the ongoing operation of the waterway, fell into serious decline over the next 17 years.[50]

After the public works were returned to the state in 1878, the legislature passed a law on May 15 redefining the powers of the Board of Public Works and clarifying the duties of its employees in operating and maintaining the canals. The law, which provided the organizational framework for the maintenance and administration of the state canals until their official closing in 1924, called for a board that would consist of three members each of which would serve as the acting commissioner of one division of the public works. Furthermore, the law provided that each acting commissioner would have the following personnel under his supervision:

> A Chief Engineer appointed by the Governor, one Assistant Engineer, Secretary and Clerk, the pay of this force together with the pay of the Board of Public Works and expense for the care of the office amounting to about $10,500.00 annually.
>
> Besides the above regularly employed force is as follows:
>
> 7 Superintendents of Repairs at $1,400 per annum each.
>
> 23 Collectors, 13 on the Ohio Canal and 10 on the Miami and Erie Canal, at an average pay per year each of $418.27.
>
> 83 Locktenders, 29 on the Ohio and 54 on the M. & E. Canal; average compensation per month each $16.06.

---

50. "Twenty-Third Annual Report of the Board of Public Works of Ohio," December 1861, pp. 3-4.

17 Foremen of Repairs, 10 on the Ohio and 7 on the M. & E. Canal, monthly pay $50.00.

6 Dredge Foremen, 3 on each canal, receiving from $50.00 to $83.00 per month depending on the character of the work.

During the summer, each foreman was allowed to employ four or five common laborers at $1.50 per day. In addition, more laborers were hired in cases of emergency, for early spring cleaning activities, and for performing specialized tasks such as carpentry and stone masonry.[51]

During the last years of the canal's operation, the regular maintenance crews, consisting of four to five men, lived on state-owned boarding boats that accompanied the dredge boats assigned to various sections of the canal. The families of the crew foremen often lived in the stern cabin of the boats. Two such boats were generally on active duty between March and October between Cleveland and Akron. The chief duties of the crews, particularly in the early 1900s, were to cut the grass along the canal towpath, dig muskrat holes out of the path, keep the locks in repair, close leaks and breaches in the embankments, and dredge silted or debris-filled portions of the waterway.[52]

Research in the Records of the Board of Public Works of Ohio turned up two contracts for the construction of state-owned boarding boats in 1887, and one contract for the construction of a state-owned dredge boat

---

51. "Statement on Canals. Compiled and Edited Under the Direction of the Board of Public Works of Ohio, by Charles E. Perkins, Chief Engineer, March 3, 1902," p. 28. That part of the act relating to resident engineers was later repealed and one assistant engineer was authorized.

52. The Cleveland Press, September 3, 1977; Robert L. Hunker, comp., The Cuyahoga Valley and the Ohio Canal (Hudson 1974), n.p.; and "On the Ohio & Erie Canal in 1908 as told to Mrs. J. H. McNally of Parma, Ohio, by Mrs. Carl Gundling of Parma," Towpaths, XI (No. 2, 1973), pp. 16-18.

in 1908. The contracts for the boarding boats were let to R. C. Soliday of Baltimore, Ohio, on May 20, 1887, and to C. H. Payne of Akron on May 27, 1887. The contract for the dredge boat was let to the Marion Steam Shovel Company on May 9, 1908.[53]

Although lock tenders were not considered to be part of the formal maintenance force on the canal, they served a vital function in the operation of the waterway. Little documentation is available, however, concerning their responsibilities, the conditions under which they were hired, and the procedures they were to follow in operating the locks.[54] The only early document to deal with the responsibilities of the lock tenders, and then in a cursory manner, was a law passed on February 23, 1830, to provide for the regulation and operation of the canal. The act contained five sections that prohibited certain actions by the lock tenders, the violation of which would cost $10 per offense. The five sections were:

> Sec. 11. No person shall attempt to pass any float into any lock, or out of any lock, until the main gates at the head or foot of said lock, as the case may be, between which gates such float shall be about to pass, shall first be entirely opened into their respective recesses, nor until all paddle and culvert gates of such lock shall be closed.
>
> Sec. 12. Neither of the gain gates at the head or at the foot of any lock shall be closed, or allowed to close of their own accord, while either of the paddle or culvert gates at the opposite end of said lock shall remain open.

---

53. The specifications for all three boats may be seen in Appendix Q.

54. There are scattered references throughout the annual reports of the Board of Canal Commissioners and the Board of Public Works concerning the acquisition of land and the construction of lock houses, but no documentation is available that specifies where the land parcels were located or what plans and specifications were used to build the structures.

Sec. 13. When any float shall pass out of any lock, the main gates of such lock, through or between which such float shall have passed out, shall be left entirely open, and completely within their respective recesses; and all the paddle and culvert gates of such lock shall be left closed: Provided, however, That where the Acting Commissioner or Superintendent having charge of that part of the Canal in which such lock is situated, shall direct any paddle, culvert, or other gate, to be left open for the purpose of passing water through the same, such direction shall be complied with and obeyed by all lock keepers, masters of floats, boatmen, and all other persons concerned in navigating such Canal.

Sec. 14. No boat or other float shall be permitted to pass into any lock nor to strike against any part thereof, with such force as to injure, or be liable to insure, any part of such lock, or any gate or other work or devise appertaining thereto, or designed to protect the same.

Sec. 15. No lock-gate, culvert-gate, or paddle-gate, shall be closed, nor permitted to close itself with such violence, as to injure, or be liable to injure the same.[55]

It is apparent that lock tenders were not assigned to every lock along the canal. In January 1829 the canal commissioners announced that the construction of the "regulating wears" around the locks in 1827 and the installation of piles at the head and foot of each lock in 1828 had enabled them to dispense with the employment of lock tenders.[56] In 1858 and 1859, which are the only years for which lists of the lock tenders could be located, salaried tenders were at the following locks between Cleveland and Akron:

---

55. "An Act to regulate the Navigation and Collection of Tolls on the Canals of this State," February 23, 1830, Kilbourn, Public Documents, pp. 394-395.

56. "Seventh Annual Report of the Board of Canal Commissioners," January 6, 1829, Kilbourn, Public Documents, p. 326.

1858

E. Truly	Cleveland locks
Terrance Harvey	" "
James Lamb	Pinery feeder locks
John McGrotty	Peninsula locks
Henry Monroe	Yellow Creek "
D. Allen	Akron "
J. B. Dreshell	" "
R. McGinn	" "
Wm. Merritt	" "

1859

T. Harvey	Cleveland locks
James Lamb	Pinery feeder lock
John McGotty	Peninsula "
Henry Monroe	Yellow Creek "
Robert McGinn	Akron "
Daniel Allen	" "
J. R. Dreskill	" "
John McGinn	" "

The number of lock tenders was further reduced in 1860 when the state legislature passed a law providing for the appointment of tenders only "at bulkheads or feeder locks." Commenting on this law, the Board of Public Works described the immediate and long-range effects on the northern division of the Ohio and Erie:

---

57. "Twentieth Annual Report of the Board of Public Works of Ohio," December 1858, p. 22, and "Twenty-First Annual Report of the Board of Public Works of Ohio," December 1859, p. 25.

> On the passage of this law, each and every lock-tender was promptly discharged on this division, except those authorized to be appointed by this act, and no one has been employed to discharge the duty of lock-tender and paid for such services under any other name.
>
> The economical policy which governed the Legislature in the passage of this law, was a mistaken one; no engineer, superintendent, or other person connected with the canals of this State for any length of time can be found who, under any circumstances, could possibly justify it.
>
> A person in charge of each lock is indispensably necessary for the hasty and prompt passage of boats, and for the safety of the locks and gates. Far more damage will yearly be done to the locks on the line of the canals by reckless and careless boatmen than the expense attending the employment of suitable persons to take charge of the locks; to say nothing of the damages resulting to owners of boats by detention, and the carelessness of leaving wickets open, thereby drawing off the level above, and not unfrequently so reducing the water as to prevent the passage of boats, until the level can again be filled.[58]

E. Major Repair/Reconstruction Operations and New Construction: 1833-1975

During the operating period of the Ohio and Erie Canal, a number of major repair/reconstruction operations were required to maintain the waterway as a viable and functioning navigable artery. Damage from floods and severe weather, deterioration from heavy use of the canal, and the decay of some original weather, that had been built defectively all played a role in making such major operations necessary. At the same time, new engineering technology and theories led to the building of new structures along the line to solve operational difficulties and to make the canal function more efficiently. The purpose of this section is to summarize the major repair and new construction on the canal between Cleveland and Akron during the operating period.

---

58. "Twenty-Second Annual Report of the Board of Public Works of Ohio," December 1860, pp. 8-9.

1. Renewal of Wooden Structures--1834-35

Expenditures for repairs in 1835 were the highest to date in the operating history of the canal. While the cause of this cost increase was partially attributed to the rising price of labor, a significant part of the expenditures was the result of necessary repairs to the numerous deteriorating wooden structures built along the line, especially those between Cleveland and Akron. In 1836 the commissioners discussed this problem in light of their experiences with wooden structures:

> The experience of the last two years has shown that aqueducts, lock gates, water gauges or tumbles, head and waste gates, and towing path bridges, composed of timber, will require entire renewal or extensive repairs in periods of from six to nine years; and yet, to a considerable extent, the evil cannot be remedied.
>
> In some cases stone aqueducts may take the place of those of timber, and in all cases where wooden tumbels have been built, others of stone may be substitued.
>
> By the increased facilities afforded by Canal transportation for procuring suitable stone at many points along both Canals, it will be much less expensive to erect stone structures in the place of those of wood, than it would have been when these advantages did not exist.
>
> Although the cost of stone structures would considerably increase the annual expenditures on the Canals for a time, yet the perpetual expense of repairing wooden structures, and the frequent interruptions to navigation during that part of the business season when serious evils must necessarily ensue, indicate in strong terms, it is believed, the propriety of substituting stone in the place of wood structures; as it shall become necessary to rebuild them whenever it shall be considered practicable, after exercising a proper discretion in regard to cost and the revenues of the Canal.

Recognizing that the factors of cost and the availability of stone would require that some wooden aqueducts be rebuilt with timber, the commissioners determined that such structures be reconstructed in a more durable manner, based on models then in construction on the Miami and Erie Canal. The plans for the aqueducts, which presumably would henceforth be used on the Ohio and Erie, provided that the principal bearing timbers and side frames within the trunk be entirely covered with water to make them more secure against premature decay. The cross

beams were to be suspended under the floor so that either of them could easily be removed and replaced without interference to the other parts of the trunk.[59]

2. Protection Walls and Embankment Walls Along the Cuyahoga River--1836-38

The protection walls and embankments along those sections of the Ohio and Erie Canal that were close to the Cuyahoga River were subject to continued washing and undermining by the action of the rushing river water. To make those sections of the canal more secure, additional crib work, protection walls, and embankments were built along the river during the years 1836-38 at a cost in excess of $20,000.[60]

3. Tinkers Creek Aqueduct Rebuilt--1837

In 1837 the Tinkers Creek Aqueduct was rebuilt, presumably on a plan similar to that discussed by the commissioners in 1836.[61]

4. Lock Protection--1840-41

Numerous locks between Cleveland and Dover were protected by a cribwork, placed at the head and in some instances at both the head and the foot, formed of hewn timber and filled with stone or gravel. The purpose of the cribwork was to protect the wing walls of the locks from injury by approaching boats.[62]

---

59. "Fourteenth Annual Report of the Board of Canal Commissioners," January 2, 1836, pp. 6-7.

60. "Fifteenth Annual Report of the Board of Canal Commissioners," January 17, 1839, pp. 4-6; "First Annual Report of Board of Public Works of Ohio," December 1836, p. 5; and "Second Annual Report of Board of Public Works of Ohio," December 1837, p. 5.

61. "Second Annual Report of the Board of Public Works of Ohio," December 1837, p. 5.

62. "Fourth Annual Report of the Board of Public Works of Ohio," December 1840, pp. 4-5, and "Fifth Annual Report of the Board of Public Works of Ohio," December 1841, p. 5.

5. First Major Renovation Effort--1841-42

During 1841-42 a major renovation effort was undertaken to enable the canal to function efficiently. Some of the principal projects that were carried out in 1841 on the Cleveland-to-Akron sector were:

a. Rebuilding of piers and other repairs to Tinkers Creek Aqueduct

b. Repairs to secure Cuyahoga River feeder dams

c. Repairs to locks and lock gates

d. Repairs to guard gates and culverts

e. Increase height and width of canal embankments

f. Removal of bars and deposits from canal prism and feeders

The renovation effort continued during the winter and spring of 1841-42. The canal was given a thorough cleaning out by removing bars and deposits from the canal prism where it had not been done previously or recently, thus enabling the barges to carry maximum cargoes weighing more than 60 tons compared to previous averages of 30-40 tons. Other projects included additions to the height and width of embankments, extensions and repairs to culverts, protective walling where the canal was exposed to the action of the river, repairs to locks and lock gates, and the construction of new gates.[63]

6. Flood Repairs--1843-44

A succession of floods along the Cuyahoga River and its tributaries in June 1843 caused considerable damage to the Cleveland-to-Akron sector of the line. The rain was so heavy and rapid that the culverts could not handle all the water in the streams passing under the canal. As a result, the streams flowed across the canal, sweeping away both banks in many places. The Cuyahoga River also rose over the canal embankments and overflowed portions of the canal,

63. "Fifth Annual Report of the Board of Public Works of Ohio," December 1841, p. 5, and "Sixth Annual Report of the Board of Public Works of Ohio," December 1842, pp. 5-6. The specifications for the lock repair work may be seen in Appendix R.

resulting in nearly one-half of the line between Cleveland and Akron being under water. Sand from the hills and high embankments in the vicinity of Cleveland were swept into the canal and in many places the prism was filled entirely. The canal was closed while the prism was cleaned out and the canal banks restored. Later in the summer, several waste gates and culverts were constructed to facilitiate the draining of the water from the canal in places where bars and deposits required frequent removal.

During 1844 more extensive repair operations were undertaken to renovate the line of the canal between Cleveland and Boston that had been damaged most seriously by the great flood during the previous summer. Numerous deposits were removed from the prism and other improvements were made to insure a depth of four feet throughout that portion of the line. The tops and slopes of the canal embankments were repaired, drains and drain ditches reopened, protective measures at exposed points taken, and a waste weirs, locks, and lock gates renewed. The feeders in the Cuyahoga Valley were improved, head gates and embankments repaired, and drain culverts inserted through the canal banks to facilitate draining the waterway when making future repairs at various points along the line.[64]

7. Reconstruction of Peninsula Aqueduct--1843-44

The Peninsula Aqueduct had deteriorated to the point that it was considered a serious risk. Thus, it was rebuilt in 1843-44.[65]

8. Construction of New Tinkers Creek Aqueduct--1844-45

The Tinkers Creek Aqueduct, as originally constructed, had proven to be "deficient in water-way for the creek during floods," and at various times the water from the creek had broken over the aqueduct's embankments, causing damage to the canal. Moreover, the wood and

---

64. "Seventh Annual Report of the Board of Public Works of Ohio," December 1843, pp. 3-5, and "Eighth Annual Report of the Board of Public Works of Ohio," December 1844, pp. 8-9.

65. Ibid., pp. 3-5.

stone structure had become so dilapidated as to require reconstruction. A contract was let during the summer of 1844 to build a new aqueduct several chains to the north of the old structure, because the new location provided "a better direction" for the passage of the creek. The new aqueduct, which was completed in the spring of 1845, was designed to provide a "sufficient water-way" and thus prevent its overflow in the future by placing the timber foundation four feet lower than the former structure.[66]

9. Construction of Yellow Creek Culvert--1844

At Yellow Creek the canal originally crossed the stream by means of an embankment extending across the valley. Flood water was passed around the embankment by a timber dam and waste weir. Their economical method of construction served the canal well for about a decade, but by the early 1840s the bed of Yellow Creek became so filled with mud and sand deposits, brought down by floods, that navigation was frequently held up and extensive removal operations were necessary. During 1844 the difficulty was remedied by the construction of a cutstone culvert having a chord of 20 feet for the passage of the creek under the canal. A short feeder from Yellow Creek was also built to supply the canal with water.[67]

10. Introduction of Cast-Iron Arched Culverts--1846

The commissioners announced in January 1847 that a successful attempt had been made the previous year to substitute cast-iron arches in culverts whose stone arches had deteriorated. Such a procedure was cheaper than reconstructing the culvert with stone and avoided the necessity of opening the banks of the canal during repairs. The cast-iron arch, combined with stone, would result in a more durable structure.

---

66. "Eighth Annual Report of the Board of Public Works of Ohio," December 1844, pp. 8-9, and "Ninth Annual Report of the Board of Public Works of Ohio," December 1845, p. 5.

67. "Eighth Annual Report of the Board of Public Works of Ohio," December 1844, pp. 8-9.

One of the first culverts to be built according to this plan was a new culvert at Cleveland. It carried off the drainage and wash from a hill behind the canal, from which large quantities of sand were frequently deposited in the prism during heavy rains. The new culvert was designed to carry the deposit directly into the Cuyahoga River.[68]

11. Problem of Grass in Canal Prism--1851-53

In 1851 problems arising from the growth of grass became a major concern of the Board of Public Works. According to the Board's annual report issued in December 1851, the problem was described:

> The obstruction to navigation from the growth of grass in the levels has been greater this year than at any former period. In some instances the growth was so vigorous and rank, that it was a most serious obstruction to the regular flow of the water. Boatmen were subject to great inconvenience from it, requiring, as they did, from this cause alone, additional power to move their boats, and compelled, as they were, to occupy from one-fifth to one-sixth more time to make their trips. The canal was also in danger, the obstruction to the flow of the water having the effect to reduce the water at the foot of a level from six to ten inches below the true line, while, at the head of the same level, the water would be as much above the true line, thus endangering the safety of the banks.
>
> The steady annual increase in the quantity of grass which appears in the levels of the Ohio Canal is well calculated to cause solicitude in the minds of those in whose charge this canal is placed. All reasonable efforts have been made to relieve the navigation from this evil, but without any satisfactory result. In many instances last season, the Superintendents cut the grass three different times, and it was generally cut twice; but in a few days it would appear again, and was stronger and thicker each successive growth. The hydraulic power was also injuriously affected by the grass, and the item of superintendence and repairs increased, the operation of cutting the grass and removing it from the levels being a very expensive one.

The growth of grass in the canal prism was again a major factor in impeding the flow of water in the canal between Cleveland and Roscoe in

---

68. "Tenth Annual Report of the Board of Public Works of Ohio," December 1846, p. 8.

1852. To insure that navigation could continue, the grass was cut and removed from the canal three times during the boating season. It was the expressed desire of the board that a remedy could be devised to eliminate that expensive problem.

By 1853 the problem of "water grass" had become even more serious. The board described the problem:

> The grass, of which so much has been said in former reports of the Board, has caused much trouble, and increased expense during the past year. It has grown to be so serious an obstruction to the free passage of the water as to overflow the banks, impede the passage of boats, and greatly reduce the value of the water power furnished by the canal. It has been cut and drawn out, on some portions of the line, six times during the past season, and even when the roots have been entirely removed, by excavating the bottom of the canal, in the Spring, the grass has appeared again before the close of navigation. We may deem it advisable to employ a Dredging Machine, more effectually to remove this and other obstructions from the channels of the canals.

The growth of "water grass" again became a serious problem in 1859 and continued to be a major hindrance to canal navigation in the later years of the canal's operation.[69]

12. Feeder Dams and Peninsula Aqueduct Rebuilt and Repaired--1857-58

Floods during the winter of 1856-57 took a devastating toll on the deteriorating feeder dam complexes between Cleveland and Akron, as well as the already-crumbling Peninsula Aqueduct. The Peninsula and Pinery feeder dams, which had been in a state of decay before the floods, were repaired in 1857. As part of the work, the west half of the Pinery feeder dam was rebuilt. Contracts were let in August 1857 for

---

69. "Fifteenth Annual Report of the Board of Public Works of Ohio," December 1851, pp. 7-8; "Sixteenth Annual Report of the Board of Public Works of Ohio," December 1852, p. 6; "Seventeenth Annual Report of the Board of Public Works of Ohio," December 1853, p. 7; "Twenty-First Annual Report of the Board of Public Works of Ohio," December 1859, p. 16; and "Forty-Fifth Annual Report of the Board of Public Works of Ohio," December 1883, pp. 30, 39.

rebuilding the Yellow Creek and Little Cuyahoga feeder dams. The latter dam was reconstructed with stone to provide for a more secure dam, and the work was completed in early 1858 at a cost of some $2,700. The work on the Yellow Creek feeder dam that had been contracted to D. S. Alexander was abandoned in 1858 because it was determined that the amount of water that Yellow Creek could supply to the canal in dry seasons, which was the only time that that source would be required, was insufficient to justify the expense of reconstruction.[70]

13. Protective Measure Against Encroachment of Cuyahoga River on Canal Embankments--1858-59

The high water levels of the Cuyahoga River in 1858 seriously undermined the embankments of the canal at many points between Cleveland and Lock No. 35. Hence an appropriation of $3,000 was requested to use approximately 600 piles, which averaged a length of 30 feet, and 1,400 perches of protection stone on that part of the line "to prevent the more exposed portions of the canal" from "being entirely swept away." The appropriation was not granted in 1859 and the Board reported in December that:

> Each year the inroad made upon the embankments by the river, is more noticeable, and the expense for this improvement must be soon met, or the embankments along the stream will be swept away. The experiment has been tried of driving piles at the base of the embankment, and filling the space between them and the bank with brush and stone, which has proved entirely successful. . . .71

14. New Lock Gates with Enlarged Paddle Gates--1859

During 1858-59 the Board of Public Works determined to install new lock gates with enlarged paddles along the length of the Ohio and

---

70. "Nineteenth Annual Report of the Board of Public Works of Ohio," December 1857, pp. 10-11; "Twentieth Annual Report of the Board of Public Works of Ohio," December 1858, pp. 13-15; and Articles of Agreement, Board of Public Works of Ohio and D. S. Alexander, August 13, 1857, "Contracts," Records of the Board of Public Works of Ohio, Series 1231, Ohio Historical Society, Columbus.

71. "Twentieth Annual Report of the Board of Public Works of Ohio," December 1858, pp. 12-13, and "Twenty-First Annual Report of the Board of Public Works of Ohio," December 1859, p. 14.

Erie Canal. The rationale for the new paddle gates, which were to be installed first on the northern portion of the canal, was given:

> The original number and capacity of the paddle-gates along this canal have been found to be entirely inadequate to pass, with that degree of facility, the boats navigating the canal. It has now become apparent that the number and size must be increased, in order to keep pace with the improvements and facilities in the transportation of property that are offered by other competing channels. The original size of the gates was two feet square, and the number in each lock was four. The size now adopted, and which will hereafter be used on this line, is two and a half feet square, and eight in number. Was this improvement extended the entire length of the Ohio Canal, it would materially reduce the cost to the producer of forwarding his surplus produce to market, and be a gain of two days to each canal boat making the round trip from Cleveland. This would incur an expense to the State, in addition to the old plan, of about forty-five dollars for each lock.[72]

During 1859 thirty-two new lock gates were built and placed in the locks between Cleveland and Peninsula at an expense of $3,200, and twenty-six between Peninsula and New Portage at a cost of $3,500. The annual report of the Board of Public Works issued in December went on to elaborate about the new gates:

> In the original construction of this canal each lock had four paddle gates, one to each gate two feet square. Experience has demonstrated the fact, that not only the size but the number of these paddles were too small, and consequently occupying too much time in lockage, (especially so, as many of the structures are now more than thirty years old) and do not admit of meeting successfully the competition of the Railroads for the freight.
>
> With these facts presenting themselves, as they did with so much force to those in charge of this division, the number and size of paddles in each lock, which has received new gates during the past year, have been increased from four to eight in number, and from two to two and a half feet square in size, thereby increasing the capacity to discharge the water in lockage three hundred per cent, adding to the cost of each lock forty-five dollars. Should this improvement go on until the increased size paddle has taken the place of the original and smaller size, it would be a gain to the boats navigating the Ohio Canal, from Cleveland to Portsmouth, of two days on the round trip.

---

72. "Twentieth Annual Report of the Board of Public Works of Ohio," December 1858, p. 13.

All told, 164 lock gates had been rebuilt according to the new plan for the canal between Cleveland and Lockville at a cost of $3,700.[73]

15. Construction of Furnace Run Aqueduct--1858-60

In July 1858 a twenty-foot section of the cut stone Furnace Run Culvert collapsed and was "temporarily repaired" to provide for continuing navigation that season. Additional repairs were made during the winter and spring of 1858-59 but the culvert continued to pose serious difficulties to the force maintaining the canal. In their annual report issued in December 1859, the Board of Public Works stated:

> The Furnace Run Culvert, has, by constant watchfulness, together with temporary repairs, been made to sustain navigation during the past season. The culvert, as originally located and constructed, was of necessity placed much below the surface of the ground. The rapid and increasing quantity of water passing down this stream over a gravel and sandy soil, has been for many years making deposits in the culvert and the channel below, until the obstruction is so great as to make the culvert entirely inadequate to pass the volume of water coming down the stream during the freshets of the fall and spring. During the past season, the water raised to a height upon the berm or upper end of the culvert, so as to pass over the embankment into the canal, submerging a large number of acres of cultivated lands, and materially damaging the growing crops in the vicinity of the canal. This difficulty can only be obviated by removing the old structure and substituting a forty foot span aqueduct, which will require an appropriation of $3,000.

The following year, in December 1860, the Board of Public Works reported on the construction of the new Furnace Run Aqueduct, which had been completed earlier that year to replace the former culvert. The report contained the following data on the new structure:

> Among the new structures on . . . the canal, particular attention is called to a wrought iron aqueduct built during the last winter, on Mosley's patent, across Furance Run, ten miles north of Akron. In the construction of the canal at this point, an expensive cut stone culvert was put in to carry the stream under the canal. The culvert was necessarily so low that it

---

73. "Twenty-First Annual Report of the Board of Public Works of Ohio," December 1859, pp. 14-16.

failed to answer the purpose. At almost every freshet, either the culvert or some portion of the canal was damaged by the accumulation of water above the head of the culvert, owing to its incapacity to pass freely the water in the creek. The culvert having failed entirely, it was thought advisable to substitute in its place an aqueduct which would furnish at all times sufficient water for the stream. The commissioner in charge entered into a contract with Moseley & Co., of Cincinnati, to put up one of these patent wrought iron aqueducts of forty feet span, with twenty-one feet water way, four feet in depth, to be placed upon stone abutments, furnished by the State. The aqueduct was completed in April last, at an expense of twenty-five hundred and twenty-three dollars and sixty-one cents. It is believed to be the most perfect and the best adapted to the purpose of any thing yet resorted to. In point of economy and durability it presents advantages which highly commend it to the consideration of those in charge of the public works. The aqueduct rests upon abutments and towers of heavy stone masonry, and is as durable as stone and iron can make it. There was used in the abutments over two hundred and fifty perches of masonry, of a superior quality, which cost, together with removing the old culvert and other labor required in the work, about two thousand dollars, exclusive of the iron trunk.[74]

16. Tinkers Creek Aqueduct Rebuilt--1863

The trunk of Tinkers Creek Aqueduct, consisting of two spans of 42 feet each in the clear, was rebuilt in 1863. A few timber pieces that were found to be sound were left in the trunk. During the reconstruction the old and unsafe braces were not removed, but new ones were inserted to provide sufficient support for the whole weight of the trunk.[75]

17. Repairs to Peninsula Aqueduct--1864

It was reported in December 1863 that the Peninsula Aqueduct needed repairs. As early as 1857 the north abutment wall had begun to

---

74. "Twenty-First Annual Report of the Board of Public Works of Ohio," December 1859, pp. 16-17; "TwentySecond Annual Report of the Board of Public Works of Ohio," December 1860, pp. 7-8; Articles of Agreement, Board of Public Works of Ohio and Mosely & Co., December 13, 1858, "Contracts," Records of the Board of Public Works of Ohio, Series, 1231, Ohio Historical Society, Columbus.

75. "Twenty-Fifth Annual Report of the Board of Public Works of Ohio," December 1863, p. 11.

crumble because of the defective quality of the stone and the poor workmanship of the original construction. Its condition was described:

> The trunk of the aqueduct will need replanking before long, and the masonry is also getting out of order--the west wing of the north abutment pretty seriously so. The east wing of the south abutment is not so bad, yet it will also soon need considerable repairs. The water-way for the river under this aqueduct is not, and never was, of sufficient capacity, and it is necessary to be careful to keep it free from all lodgments of drift, &c., to prevent the canal bank to the northward being cut through by the river at times of high water.

Some of the required repairs, such as on the east wing of the south abutment, were carried out in 1864, but the aqueduct still needed further attention. The west wing wall of the north abutment needed to be rebuilt and additional planking was necessary.[76]

18. Reconstruction of Furnace Run Aqueduct--1866

During 1866 a series of heavy rains caused flooding along the length of the Ohio and Erie. There were numerous breaches in the canal banks and navigation was often suspended by the formation of sand bars in the canal prism. On April 1 a flood swept down Furnace Run, razing the north abutment of the cast iron aqueduct down to its foundation. Because of the difficulty in building a new solid foundation on which to erect the abutment, several rows of heavy piling were driven to provide a stable base on which to build. Navigation was suspended for 20 days while the work was underway.[77]

19. Repairs Necessitated by Ice Freshet--1868

During the winter of 1867-68 a thick layer of ice formed on the Cuyahoga River. When the heavy ice broke up in early spring, it was accompanied by an unprecedented rise of water in the river. The heavy

---

76. "Twenty-Fifth Annual Report of the Board of Public Works of Ohio," December 1863, pp. 11-12, and "Twenty-Sixth Annual Report of the Board of Public Works of Ohio," December 1864, pp. 13-14.

77. "Twenty-Eighth Annual Report of the Board of Public Works of Ohio," December 1866, pp. 4-5, 15.

flow raked the bed of the river "like a seine, carrying with it every movable object in its onward way." The Pinery and Peninsula feeder dams, as well as large sections of the protective canal embankments along the river, were damaged. Numerous breaks and bars occurred between Cleveland and Akron, and extensive portions of the towpath were inundated. The canal was repaired to the point that navigation was opened by April 20.[78]

20. New Change Bridge at Peninsula, and Additional Piling Along Cuyahoga River--1869

In 1869 a new change bridge was built at Peninsula and some 300 to 400 piles were driven along the east bank of the Cuyahoga River near the foot of the towpath bank to protect it from the encroachment of the river.[79]

21. Reconstruction of Superstructure of Tinkers Creek Aqueduct--1870

The superstructure of Tinkers Creek Aqueduct was reconstructed in 1870.[80]

22. Reconstruction of Peninsula Aqueduct--1872

The Peninsula Aqueduct was rebuilt in 1872.[81]

23. Lock Repairs -- 1872

During 1872 many locks in the Cuyahoga Valley received new sheeting and were regrouted and repointed. A new wing wall and one pair of gates were built at Lock No. 29.[82]

---

78. "Thirtieth Annual Report of the Board of Public Works of Ohio," December 1868, p. 11.

79. "Thirty-First Annual Report of the Board of Public Works of Ohio," December 1869, p. 10.

80. "Thirty-Second Annual Report of the Board of Public Works of Ohio," December 1870, p. 11.

81. "Thirty-Fourth Annual Report cf the Board of Public Works of Ohio," December 1872, p. 5.

82. Ibid., p. 12.

24. Ice Freshet Damage to Peninsula Feeder Dam--1873

An ice freshet in the spring of 1873 carried out 70 feet of the Peninsula Feeder Dam, but the damage was repaired quickly by maintenance forces.[83]

25. New Towpath Bridge Built at Peninsula and North End of Peninsula Feeder Dam Rebuilt--1874

In 1874 a new towpath bridge was built at Peninsula. That same year 100 feet of the north portion of the Peninsula Feeder Dam was taken out and rebuilt.[84]

26. Pinery Feeder Dam Rebuilt--1875

In 1875 about one-half of the Pinery Feeder Dam was rebuilt. The slope of the dam was resheeted and a stone abutment on one side of the dam was also reconstructed.[85]

27. Realignment of Lock Masonry Above Water Line--1876-77

As early as 1864 it was reported that the masonry in many of the locks was deteriorating. According to the Board of Public Works, the

> wing walls, the upper courses of stone on the chamber walls, and the cribbing are very imperfect; and many of the wing and chamber walls have been forced by the pressure of the banks from their former erect position and are inclining inwards.[86]

However, the records appear to indicate that little was done to remedy this problem until 1876 and 1877. During the spring repairs in those years, work crews set back the two top courses of masonry above

---

83. "Thirty-Fifth Annual Report of the Board of Public Works of Ohio," December 1873, p. 11.

84. "Thirty-Sixth Annual Report of the Board of Public Works of Ohio," December 1874, pp. 16-17.

85. "Thirty-Seventh Annual Report of the Board of Public Works of Ohio," December 1875, p. 19.

86. "Twenty-Sixth Annual Report of the Board of Public Works of Ohio," December 1864, pp. 12-13.

the water line in the chambers and wing-walls of the locks on the division between Cleveland and Hebron. Such action was required because most of the locks were constructed "without any frost-batter," thus allowing frost action to cause the lock chambers to become more contracted each year.[87]

28. Reconstruction of Pinery Feeder and Furnace Run Aqueduct--1877

During 1877 the Pinery Feeder, including the large sluice and wasteway, and the Furance Run Aqueduct were rebuilt. Boat navigation was closed at the latter site during the reconstruction effort.[88]

29. Construction of New Culvert Below Lock No. 39--1879

A small culvert was constructed below Lock No. 39 during 1879.[89]

30. Reconstruction of Lock No. 29--1880-82

During the winter of 1880-81 stone, cement, and timber were brought to the site of Lock No. 29 at Peninsula for the purpose of reconstructing the lock. The stone was provided under the terms of a contract let to the Peninsula Stone Company. The reconstruction, however, was postponed for a year because of the severe winter weather and the fact that the lock's condition was not bad enough to justify the suspension of navigation during the summer.[90]

Between January 1 and April 11, 1882, Lock No. 29 was reconstructed at a cost of $13,385.07. In December the Board of Public Works commented on the cost and quality of the work:

---

87. "Thirty-Eighth Annual Report of the Board of Public Works of Ohio," December 1876, p. 18. Later in 1881, the two upper courses of Locks Nos. 32-33 were taken down and rebuilt in a similiar manner.

88. "Thirty-Ninth Annual Report of the Board of Public Works of Ohio," December 1877, p. 22.

89. "Fortieth Annual Report of the Board of Public Works of Ohio," December 1878, p. 37.

90. Ibid., pp. 17, 39.

. . . Considering that the locks cost, when the canal was built, about $7,000 each, with prices of labor not over one-third what they are now . . . we believe the State to be well served in getting this work done for less than $13,500.

There has been paid out since the beginning of work in 1880, on account of this new lock and for tearing out the old one:

Stone and cutting by contract	$5,689.00
Labor and teams	5,558.61
Lumber and hardware	735.77
Sand and cement	799.15
Storage and freight	367.69
Miscellaneous items	72.95
Derricks, coal, etc.	161.90
TOTAL	$13,385.07. . . .

It is universally acknowledged to be one of the finest structures on the Public Works. The stone are very large and carefully selected.[91]

31. Furnace Run Aqueduct Repaired, Protective Stone At Locks Nos. 26 and 39, New Towpath Bridge at Pinery Feeder, and New Cribs at Locks Nos. 30, 33-34--1882

During 1882 a series of repair projects were carried out on the canal structures in the Cuyahoga Valley. The trunk of the Furnace Run Aqueduct was repaired. It was reported that the substantial character of the iron structure after 20 years' use demonstrated that if the state intended to maintain its works with true economy it must provide for iron aqueducts. About 150 yards of protective stone were put into the breakwater north of Lock No. 39, and 60 yards of stone left over from the reconstruction of Lock No. 29 were put in near Lock No. 26. A new towpath bridge was built at the Pinery Feeder, and new cribs were built on both sides of Locks Nos. 30, 33, and 34.[92]

---

91. "Forty-Fourth Annual Report of the Board of Public Works of Ohio," December 1882, pp. 24, 29.

92. Ibid., pp. 30-32.

32. Extensive Flood Damage Repaired--1883

During 1882 and 1883 heavy rains fell on the sector of the Ohio and Erie Canal between Cleveland and Akron. In February 1883 the highest flood on record for that part of the state occurred. From November 1882 to November 1883 a total of 32.54 inches of rain fell at Akron, and on February 3, 1883, a downpour of 3.66 inches occurred there in less than 24 hours. The heavy rain fell on frozen ground, breaking the thick ice and causing serious flood damage to the Cleveland-to-Akron sector of the canal. The repairs that were made to the waterway in the wake of the flood included:

a. New waste gates were put in at the Pinery Feeder, and new waste weirs were constructed at Locks Nos. 6 and 21.

b. The dams at Lock No. 16 and Akron were swept away and were replaced by more substantial structures, while temporary dams diverted water into the canal during the reconstruction operations. The Peninsula dam was damaged also, and its repair cost $250.

c. The aqueducts at Peninsula, Furnace Run, and Yellow Creek were all damaged. The repairs to the Peninsula Aqueduct cost only $131.50, but the Furnace Run Aqueduct was carried off and one abutment was washed out. A substantial abutment was built on a pile foundation, whereas the earlier one had rested on mud sills. A long row of protection piling was driven near the aqueduct to afford it better protection. An abutment and the trunk of the Yellow Creek Aqueduct were washed out and rebuilt, and its superstructure was replaced.

d. Protective piles and stone were placed in areas damaged by the flood. Such materials were put behind the collector's office at Cleveland, at Lock No. 29 in Peninsula, south of Lock No. 29, and at Lock No. 16.

e. The Pinery Feeder was damaged badly by the flood. New head gates and frames were put in, the walls were relaid, and the race cleaned out.

f. One dredge was employed to repair the breaks caused by the floods on the northern division. The principal locations of the dredging work were as follows: guard lock at Akron; Locks Nos. 4, 8, 36; three-mile level south of Lock No. 41; and the paper mill at Cleveland.

g. Virtually all the locks were damaged to some extent and received repairs, although the most serious damage occurred at the Akron guard lock and Locks Nos. 1, 4, and 15.[93]

33. Extensive Flood Damage Repaired--1884

During the winter of 1883-84 another flood struck the Cuyahoga Valley, causing numerous breaks in the canal embankments and the formation of bars in the prism. In the spring of 1884 a narrow ridge of earth was put on various portions of the canal embankments over the 10-mile stretch of the waterway south of Cleveland. In June repair crews hauled earth to raise and widen the towpath to its proper dimensions. The amount of earthwork required for this work was:

From Lock No. 38 to 41 -- 1,650 yards
From Lock No. 33 to 37 -- 3,220 yards
From Pinery Feeder to Peninsula Feeder -- 3,405 yards
From Akron to Lock No. 26 -- 350 yards

Other flood damage that was repaired included the reconstruction of 80 feet of riprap wall at the Pinery Feeder, 120 feet at the Peninsula Feeder, and 150 feet at the Akron locks. The east abutment to the feeder dam at Lock No. 16 and the entire Peninsula feeder dam were reconstructed. Nearly all of the locks required repairs since many of the lock walls had settled, contracting the width of the chamber on top and necessitating the relaying of the top courses.[94]

---

93. "Forty-Fifth Annual Report of the Board of Public Works of Ohio," December 1883, pp. 25, 28, 36-39.

94. "Forty-Sixth Annual Report of the Board of Public Works of Ohio," December 1884, pp. 32-33.

34. Protective Levee Built at Lock No. 29 and Tinkers Creek Aqueduct Shored Up--1885

In 1885 a levee, measuring 900 feet in length, 5 feet in height, and 4 feet in width, was built from Lock No. 29 at Peninsula to a point on the hill nearby. Because the Tinkers Creek Aqueduct was about ready to fall down in the spring, new timbers and plank were put in to make it safe for navigation.[95]

35. Repairs to Locks, Dams, and Bridges--1886

During 1886 numerous repairs were made to the walls of the locks in the Cuyahoga Valley. The walls of Locks Nos. 27, 31, and 32 and the Peninsula Feeder Lock were straightened up and set back. Because of the "very leaky condition" of Lock No. 39, it was "recemented throughout." The walls of Lock No. 28 were dressed down and the bottom repaired. In addition to the lock repairs, the bridge at Tinkers Creek Aqueduct, measuring 60 feet in length and 9 feet in width, was replanked, and the Pinery and Peninsula feeder dams were renovated with brush and gravel.[96]

36. Construction of Telegraph Line Along Canal--1887

In 1887 the Baltimore and Ohio Telegraph Company constructed a telegraph line adjacent to the towpath of the Ohio and Erie between Cleveland and Massillon. The work was done under the direction of the Chief Engineer and division superintendents of the canal.[97]

37. Lock Repairs--1887

During 1887 a major repair effort was undertaken to make the northern division of the Ohio and Erie Canal operate at a modicum of efficiency. The repairs made in that year were:

---

95. "Forty-Seventh Annual Report of the Board of Public Works of Ohio," December 1885, pp. 26-27.

96. "Forty-Eighth Annual Report of the Board of Public Works of Ohio," December 1886, pp. 19-20.

97. "Motion of Baltimore and Ohio Telegraph Company," April 13, 1887, "Contracts," Records of the Board of Public Works of Ohio, Series 1231, Ohio Historical Society, Columbus.

Locks Nos. 24-26, 28 and Peninsula Feeder Lock--stone set back

Lock No. 37--new pair of lower gates, new bucking beam, and coping stones set back entire length of lock on both sides

Locks Nos. 25 and 30--gates and waste weir repaired, 90 yards of sheet piling used in waste weir of Lock No. 31

Locks Nos. 32, 38--two courses and coping stones set back for entire length

Pinery Feeder Lock--new set of flood gates with ratchets to hoist them, ratchets put on four feeder gates

Despite the aforementioned repairs, the chief engineer of the Public Works reported that further work was necessary on the locks. The tail walls of some were so badly out of plumb that boats were chafed in passing. Some chamber walls needed repairing where the stone had crumbled. Much of the work could be done by using hard-burned brick and cement or good concrete, materials that had been used for the first time in 1887. Before that year grout and wood had been used for repairs. Stone work repairs were needed at Locks Nos. 24, 25, and 27, and on the Peninsula Feeder Dam.[98]

38. New Waste Weir Constructed Between Locks Nos. 24 and 25--1887

A new waste weir was constructed between Locks Nos. 24 and 25, composed of sheet piling backed up with 65 yards of protection stone.[99]

---

98. "Forty-Ninth Annual Report of the Board of Public Works of Ohio," December 1887, pp. 32-33, 37.

99. Ibid., p. 36.

39. Repairs to Peninsula Towpath Bridge and Feeder Dam--1890

During 1890 a new floor (100 feet long and 8 feet wide) was put in on the Peninsula towpath bridge. The Peninsula Feeder Dam was raised 6 inches for a distance of 100 feet with 2-inch plank. The west end of the dam was graveled and the feeder bank protected by a new riprap wall 43 feet long and 4-1/2 feet high.[100]

40. Miscellaneous Repairs--1892

A variety of repairs was performed on the canal between Locks Nos. 24-39 during 1892. The major items included:

a. Piers of Peninsula Aqueduct repaired

b. New dam built in berm bank at entrance of Sand Run or Yellow Creek

c. Surfaces of chambers adjusted and aligned on Locks Nos. 32-35 and 39

d. Wing wall rebuilt at Lock No. 27

e. Wood and iron Furnace Run Aqueduct repaired and repainted.[101]

41. Miscellaneous Repairs--1893

Numerous repairs were carried out on the northern division of the canal during 1893. The principal items of work included:

a. Tinkers Creek Aqueduct--1,150 feet of new 2-inch plank on sides and bottom, approaches caulked

---

100. "Fifty-Second Annual Report of the Board of Public Works of Ohio," December 1890, pp. 33-36.

101. "Fifty-Fourth Annual Report of the Board of Public Works of Ohio," December 1892, pp. 34-36.

b. Peninsula Aqueduct--new iron band and protection plank around center pier in river

c. Furnace Run Aqueduct--new towpath bridge

d. Peninsula Feeder Dam--graveled and caulked for distance of 125 feet, logs and other debris removed

e. Lock No. 37--two upper courses of stone set back 4 inches, stone under upper mitre sill taken up and relaid in cement

f. Lock No. 36--new upper wing wall, part of other upper wing wall rebuilt, and 1,000 feet of 2-inch oak plank put in floor

g. Locks Nos. 34, 38--stones set back or chipped off

h. Waste gates on Long Pinery Level--new stone wall laid in cement under mud sill, and 1,000 feet of new 2-inch oak plank put in waste weir

i. New waste gate and sluice put in on Goose Pond Level above Lock No. 35, using 3,000 feet of 2-inch oak plank

j. Waste weir at Lock No. 36 reconstructed with 4,000 feet double breast timber and planking

k. Yellow Creek waste weir repaired with two boat loads of stone, two of gravel, and one of dirt

l. Waste weir above Lock No. 27 broke and was repaired with 1,000 feet of 2-inch oak plank and 100 yards of gravel

m. New bridge built over Pinery Feeder

n. Footbridge at Lock No. 24 replaced

o. New wooden trunk sluice placed under towpath on Goose Pond Level to wash Murphy's Bar.[102]

42. New Bridges Constructed--1894

Three new bridges were built on the northernmost sector of the Ohio and Erie Canal in 1894. The new bridges were at the high water waste weir on the Short Pinery Level, Lock No. 29 at Peninsula, and the Peninsula Feeder.[103]

43. Major Repairs--1895

During 1895 a major effort was undertaken to bring the Ohio and Erie Canal to an optimum level of operating efficiency. The repairs included:

a. Stone work on Locks Nos. 34, 37, and 28 and the Peninsula Feeder Lock

b. All lock valves, sheeting, and mitre sills were repaired on Locks Nos. 1-28

c. Tinkers Creek and Peninsula Aqueducts repaired (trunk carrying water around the latter was rebuilt)

d. Furnace Run Aqueduct rebuilt

e. Protection stone placed in river in several places between Peninsula and Cleveland to protect banks from being washed where the river and canal were in close proximity

f. Galley Run Dam or mud catcher and one on Long Pinery Level built.[104]

---

102. "Fifty-Fifth Annual Report of the Board of Public Works of Ohio," December 1893, pp. 32-36.

103. "Fifty-Sixth Annual Report of the Board of Public Works of Ohio," December 1894, p. 60.

104. "Fifty-Seventh Annual Report of the Board of Public Works of Ohio," December 1895, pp. 45-48.

44. Major Repairs--1896

Major repairs or reconstruction activities on the Ohio and Erie Canal in 1896 included work on the aqueducts, catch basins, dams, and locks in the Cuyahoga Valley. The principal items of work were:

a. Tinkers Creek Aqueduct rebuilt

b. New trunk and bottom placed in one span of Peninsula Aqueduct (48 feet)

c. Construction of new catch basin built of brush at mouth of run on Short Pinery Level

d. 61 feet of Peninsula Feeder Dam renewed

e. New brush and stone dam (38 feet long and 6 feet high) built at Solomon's above Peninsula

f. Wing walls of Locks Nos. 37 and 38 rebuilt.[105]

45. New Catch Basin on Long Pinery Level--1897

A new catch basin was built at Burns' upper bar on the Long Pinery Level between Locks Nos. 36 and 37 in 1897.[106]

46. Major Repairs--1898

During 1898 numerous major repairs were carried out on the northern division of the Ohio and Erie Canal. Among the principal projects in the Cuyahoga Valley were:

---

105. "Fifty-Eighth Annual Report of the Board of Public Works of Ohio," December 1896, pp. 38-40.

106. "Fifty-Ninth Annual Report of the Board of Public Works of Ohio," December 1897, p. 38.

a. New trunk lining was put on the bottom and part of the sides of the Peninsula Aqueduct. Four new needle beams, eight new rods, new ends to the center pier, and a new end to the south abutment were constructed.

b. The walls of Locks Nos 24 and 28 and the Peninsula Feeder Lock were repaired. The floors of Locks Nos. 24-39 were repaired, and new mitre sills were placed in Lock No. 36.

c. New bridges were built at the Goose Pond waste weir and the Peninsula Aqueduct.[107]

47. Major Repairs--1899

Various repairs were carried out on the canal in the Cuyahoga Valley in 1899. These included extensive stone work repairs and new sheeting on Locks Nos. 27, 28, and 32, and repairs to the Pinery Feeder Dam. New flooring, floor timbers, and needle beams were placed on the Tinkers Creek Aqueduct, and the Peninsula Aqueduct was reinforced with supports by placing bents under it. The Furnace Run Aqueduct, having been displaced by floods lifting it off its foundation, was placed in position and repaired. New plank was put on the Tinkers Creek Aqueduct bridge (120 feet), the Goose Pond waste weir bridge (300 feet), and the Furnace Run Aqueduct bridge (140 feet).[108]

48. Supporting Bents Installed in Peninsula Aqueduct--1900

Supporting bents were placed under the north span of the Peninsula Aqueduct in 1900.[109]

---

107. "Sixtieth Annual Report of the Board of Public Works of Ohio," December 1898, pp. 33, 45.

108. "Sixty-First Annual Report of the Board of Public Works of Ohio," December 1899, pp. 43-45.

109. "Sixty-Second Annual Report of the Board of Public Works in Ohio," December 1900, p. 55.

49. Major Repairs--1901

A variety of significant repairs were carried out on the Ohio and Erie Canal in the Cuyahoga Valley in 1901. A new wing wall and gate recess were placed on the towpath side of Lock No. 27 and concrete was poured under the lock. The north span of the Peninsula Aqueduct was rebuilt and the south span and the structure's masonry were repaired. New footbridges were built at Locks Nos. 34 and 35, and new bridges were built at the Goose Pond waste weir and Lock No. 36.[110]

50. Major Repairs--1902

Major repairs during 1902 included the placement of new flooring in the bottom of Locks Nos. 27, 28, and 29. The walls of Locks Nos. 27, 28, 31, 32, 36, and the Peninsula Feeder Lock were realigned. A new towing bridge was built above Lock No. 39. The Pinery Feeder Dam was raised one foot, and the Peninsula Feeder Dam was repaired.[111]

51. Major Improvement of Northern Division of Ohio and Erie Canal: 1904-09

Since the 1861-78 period, when the Ohio canals had been leased to private interests, the physical condition of the waterways had deteriorated. In December 1902 Chief Engineer Charles Perkins described the physical condition of the canals as follows:

> I believe that your officers and employees on the line of the canal have at all times exercised excellent judgmnt [sic] in th [sic] work performed and economy of expenditure in their care of the State property, and a decided improvement in the physical condition of the public works, as an entirety, has been accomplished during the year.
>
> However, it remains true, as I have stated at length in former reports, that the canals have suffered a slow decay that commenced at the time they were permitted to be leased, and that they are still undergoing constant deterioration which, if not soon arrested, will, in my opinion, lead to irreparable ruin.

---

110. "Sixty-Third Annual Report of the Board of Public Works of Ohio," December 1901, pp. 57-59.

111. "Sixty-Fourth Annual Report of the Board of Public Works of Ohio," December 1902, pp. 51-52.

> This gradual decline will continue so long as your department is forced to pursue the policy thrust upon it by insufficient appropriations for the maintenance of the Public Works, which necessitates the patching of structures rather than their substantial reconstruction, and which inspires a want of confidence on the part of navigators, mill-owners and all other parties having financial interests at stake, which to say the least is not wholesome--a policy, in fact, that, "if applied to any of our great railway systems would result in forcing them into the hands of a receiver without delay."[112]

In November 1904 Perkins elaborated on the continuing deterioration of the Ohio canals:

> Owing to the bad showing, both physical and financial, which resulted from seventeen years of abuse of the public works while under lease to a private corporation which misused them for its own selfish ends, the people lost confidence in their future stability, and that attitude of the public, together with the fact that the appropriations made by the Legislature have ever since been utterly inadequate to restore the public works to their former degree of physical efficiency, account perfectly for their steady decline until they have reached their present deplorable condition, and explain why so many parts have been suffered to be abandoned and forsaken.
>
> It is a well understood axiom that buildings of the poorest construction, or any structures that have been allowed to decline for want of proper attention, require the largest comparative outlay for their maintenance. It has been the experience of builders, especially where common carriers are concerned, that it is decidedly the best policy from an economical standpoint to require the best construction and the highest standard of physical efficiency, as that insures the maintenance of operating expenses at a minimum cost. That policy, which is now admitted to be of paramount importance, was sadly neglected in the early history of the eletric road. It is in recognition of that policy that steam railroads are spending millions of dollars in betterments in order to save expense of operation, thereby insuring the greatest earning capacity and correspondingly the best actual business showing. The utter disregard of this principle by the Legislature as applicable to the public works is, more than any other cause, the reason for their wrecked condition and their indifferent record for some twenty years past.

---

112. Ibid., p. 38.

> If the Legislature, which in fact directs the affairs and policies of the department, instead of neglecting the public works after their surrender by the lessees, had provided sufficient funds to restore them to a proper state of efficiency, or if it had enforced the fulfillment of the provisions of the lease as to their restoration to the same physical excellence in which they were turned over to the lessees in 1861, the history of the public works would have been one of progression instead of retrogression.[113]

Because of such policies, Perkins observed that the "present material body of the Public Works of the State is, in the abstract, worn out." Unless the decline of the canals was soon arrested, they would soon be forced out of business as freight carriers and as sources of water supply for various manufacturing interests. The conditions of the canals had become

> such as to render it in some sections a menance to the safety of our people and a source of constant damage to abutting property. Owing to neglect, necessitated by the indigency of the Department, many of the walls were overhanging more than a foot; the feeder dams were leaky and some of them out of commission; many aqueducts and other minor structures had become in bad physical condition, until it was a common saying of your employees that they could not understand what kept these structures standing unless it was "force of habit," and the falling in of a canal prism which became a hindrance to navigation.

Thus, Perkins pressed the state legislature to appropriate funds to rehabilitate the Miami and Erie and the northern division of the Ohio and Erie canals so as

> to insure their maintenance at a minimum cost. All new masonry to be of first-class character; the foundation timbers of locks and the unlaid portions of the lock walls to be fully grouted and faced, where required, with Portland cement concrete; new gates and mitre sills to be supplied where required; the timber entering into any kind of work to be sound and durable; all new aqueducts of over 20 feet span to be of a combination of steel and wood; present timber aqueducts

---

113. "Sixty-Sixth Annual Report of the Board of Public Works of Ohio," December 1904, pp. 43-44.

that will stand the test to be repaired in a good substantial manner; all dams and waste-ways to be rebuilt and repaired with timber and concrete where necessary, and all work of every character and kind to be done in a good and workmanlike manner, so as to insure stability; the entire channel of the canal, where required, to be newly excavated so as to admit the free passing of boats loaded to their maximum capacity; the improvement to be confined to the present canal right of way, the ownership of which is held by the State in fee simple.[114]

After serious discussion about the physical condition and the future use of the Ohio canals, the state legislature responded by passing "An Act to provide by appropriation for the Improvement of the Northern Division of the Ohio and Erie Canal" in 1904. It was contemplated that the improvement would enable boats carrying a net weight of 115 tons to travel on the canal. The law, which was signed by Governor Myron T. Herrick on May 6, 1904, contained the following provisions:

Section 1. That as part of a continuing appropriation hereby begun, for the improvement of the Ohio and Erie canal, there is hereby appropriated from any moneys to the credit of the general revenue fund, not otherwise appropriated for the year 1904, the sum of seventy-five thousand ($75,000) dollars, and for the year 1905 the sum of one hundred and twenty-five thousand ($125,000) dollars, the same to be expended by the state board of public works, under the direction of the state engineer, and substantially in accordance with plans and specifications prepared by said engineer, and now on file in the office of the state board of public works, for the reconstruction of the northern division of the Ohio and Erie canal, beginning at its northern terminus at Cleveland, Ohio.

Provided, that the appropriation herein made shall not be available until new water leases have been made between the state of Ohio and the present water lessees along the said northern division of the Ohio and Erie canal, aggregating in rentals at least the sum of thirty thousand ($30,000) dollars per annum. Such new water leases shall not be for a greater term than five years, and shall become operative and payable at (the) new rates, as agreed upon in such new leases, as soon as the state of Ohio shall have begun said improvement of the Ohio and Erie canal, which will substantially involve an expenditure of five hundred and seventy-three thousand, sixty-four and thirty-three one-hundredths dollars ($573,064.33) in accordance

---

114. "Sixty-Ninth Annual Report of the Board of Public Works of Ohio," December 1907, pp. 41-45.

with said plans and specifications prepared by the state engineer and now on file in the office of the state board of public works. All new leases, before becoming operative under the provisions of this act, shall be approved by the governor, the state board of public works and the chief engineer of public works.[115]

By January 1905 it had been determined that the necessary increased water rentals had been secured, and thus the $200,000 appropriation was made available for the improvement of the northern division of the Ohio and Erie Canal. T. D. Paul was appointed Engineer in Charge of the Improvement on January 12, two days after advertisements for bids were published. On February 14 three contracts were let for the work on locks, sluices, waste weirs, and other minor structures: Locks Nos. 22-28 to McGarry & McGowen of Akron; Locks Nos. 28-36 to P. T. McCourt of Akron; and Locks Nos. 36-42 to George W. Carmichael & Co. Before the contracts were signed, the latter firm enjoined the Board of Public Works from formally entering into the three contracts, claiming that they were the lowest bidders for all the work and that the Board had deprived them of their rights. The Court of Common Pleas and the U. S. District Court both upheld the Board, and thus the injunction was finally negated on April 22. The Board was obligated to give 30 days' notice before withdrawing water from the canal, and thus the improvements could not begin until the latter part of May.[116]

A number of other contracts were let during 1905 to augment the aforementioned agreements in providing for the improvement of the northern division of the Ohio and Erie. On February 14 a contract was

---

115. "Sixty-Sixth Annual Report of the Board of Public Works of Ohio," December 1904, pp. 43-44.

116. "Sixty-Seventh Annual Report of the Board of Public Works of Ohio," December 1905, p. 181 and Contract for the Improvement of the Northern Division of the Ohio Canal between the Board of Public Works of Ohio and McGarry & McGown, February 14, 1905, and Contract for the Improvement of the Northern Division of the Ohio Canal between Board of Public Works of Ohio and P. T. McCourt, February 14, 1905, "Contracts," Records of the Board of Public Works of Ohio, Series 1231, Ohio Historical Society, Columbus. A copy of the specifications and drawings attached to the contracts may be seen in Appendix S.

let to Murphy and Miles of Columbus to provide 5,000 barrels of Atlas brand Portland cement for use in the improvement work. That same day a contract was let to Russell & Co. of Massillon to provide an 8 x 10, 15-horsepower traction engine to facilitate the work. On June 14 two contracts were let: one to the Atlantic Foundry Company of Akron for "cast and wrought iron, spikes, bolts, etc., for locks, lock-gates and repairs to dams and other structures" and one to the King Bridge Co. of Cleveland to construct steel superstructures and wooden trunks for the Mill Creek, Tinkers Creek, and Peninsula Aqueducts.[117]

The progress of the northern division improvement project was described at length in the reports of T. D. Paul in 1905 and 1906. On December 1, 1905, Paul submitted his first report to Chief Engineer Perkins. In the report, Paul mentioned the problems concerning the acquisition of labor and materials for the work:

> We . . . found that it was as impossible for us to procure good laborers and mechanics as it was for the contractors to secure them. There was plenty of work for them at high wages in Cleveland and Akron; and they generally preferred to stay there rather than go down along the canal and do rougher and dirtier work. They also preferred to stay at home where there were amusements and attractions they wanted.
>
> We did all that we could to aid the contractors by furnishing any men we could, or putting in sub-contractors for them, but the work could not be pushed to completion under those circumstances.
>
> It was especially difficult to secure good timber, which should have been cut during the winter. We have succeeded in getting extra white oak timber for our lock-gates, however.
>
> We believe that they are well framed also.

---

117. "Contracts," Records of the Board of Public Works of Ohio, Series 1231, Ohio Historical Society, Columbus. A copy of the specifications attached to the contracts with the Atlantic Foundry Company and the King Bridge Company may be seen in Appendix T. The dimensions of the three reconstructed aqueducts and the drawings of the Tinkers Creek Aqueduct may be seen in the following pages.

Dimensions of Mill Creek, Tinkers Creek, and Peninsula Aqueducts as Reconstructed in 1905-06

Mill Creek

Length of Trunk - 42 feet
Space between face of Abutments - 30 feet
Waterway - 22 feet
Towpath - 8 feet
Number of Spans - one

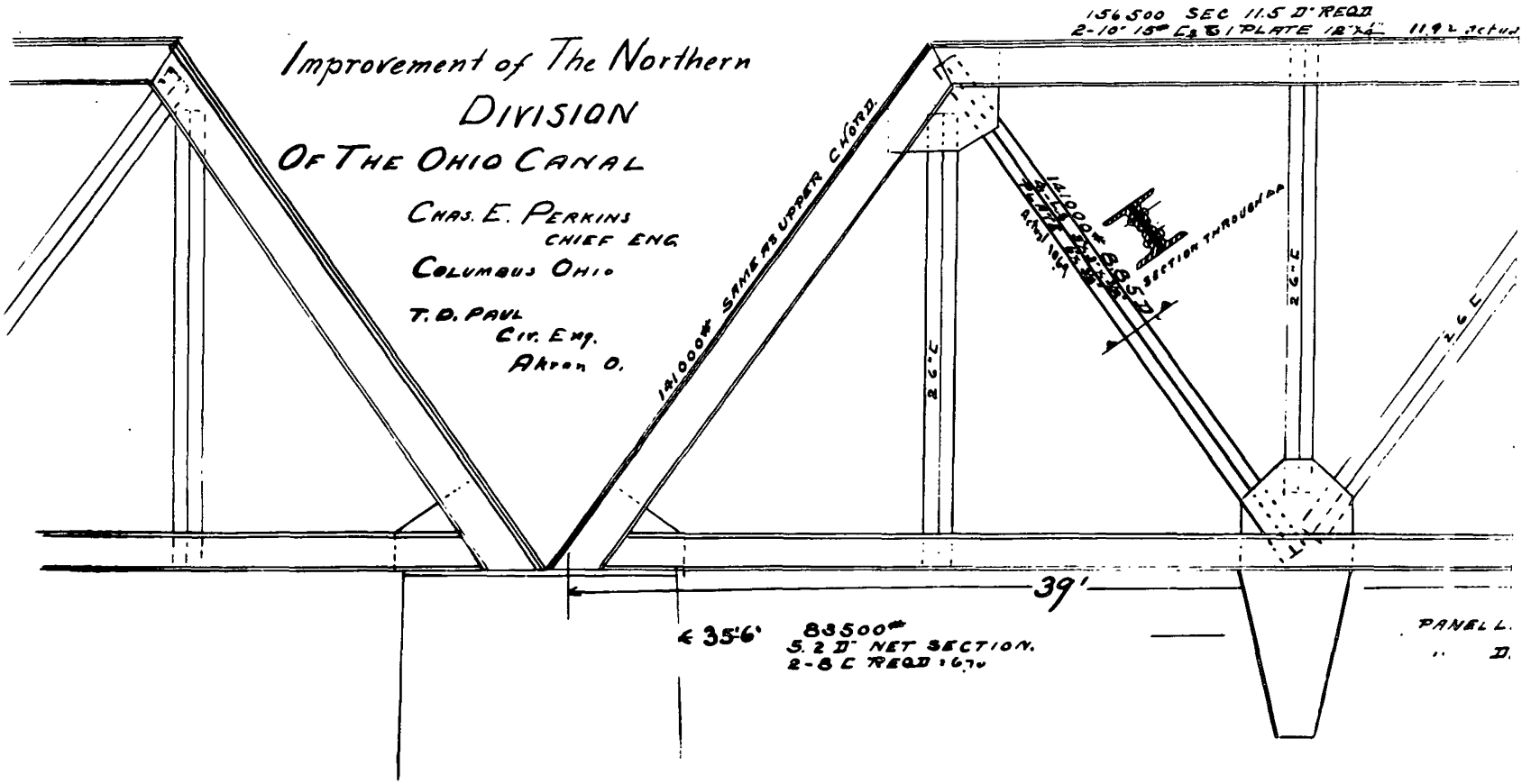
Tinkers Creek

Length of Trunk - 95 feet
Space between face of Abutments (2 each) - 35.6 feet
Waterway - 22 feet
Towpath - 8 feet
Number of Spans - two

Peninsula

Length of Trunk - 102 feet
Space between face of Abutments - 85 feet
Waterway - 18 feet
Towpath - 8 feet
Number of Spans - one

Tinkers Creek

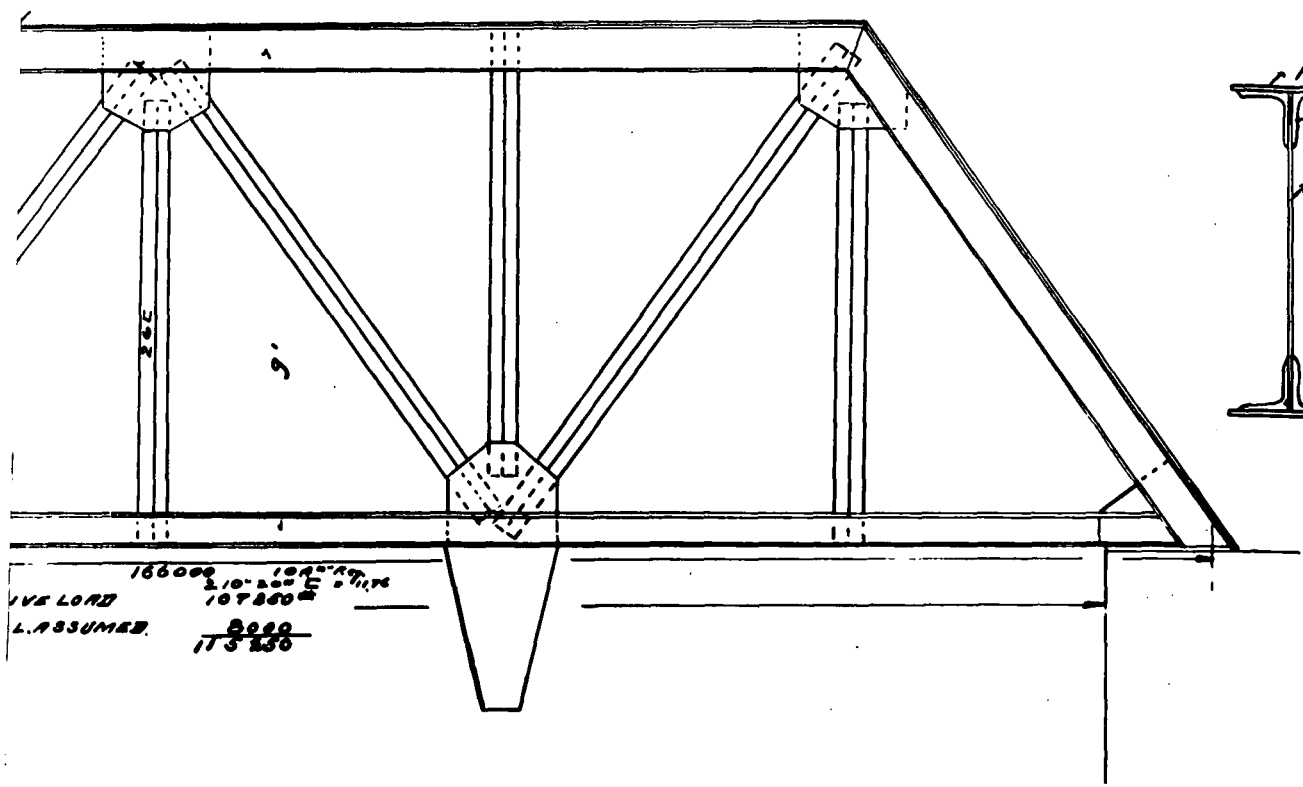


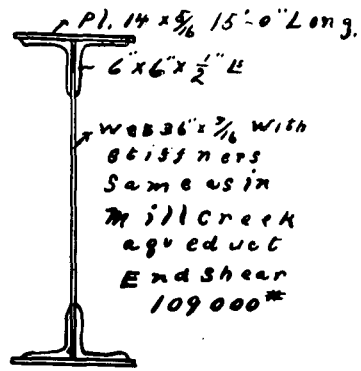
Agueduct

2 spans

Width of Water Surface 22'

Load 16500 lbs per running foot





Relative to the progress of the improvements, Paul commented:

The old upright, butterfly valves; or wickets, in the gates required 30 inches between the arms of the gate at the bottom, where the space should be least, and weakened the arm above them.

A new design of horizontal wickets has been substituted, which requires but 16 inches between the arms.

The old style of sluice-gates were of a cheap construction; but were unhandy and insufficient.

It has been deemed best to substitute a style having masonry sides and bottoms; with open slides, or gates, which are at all times accessible and workable. Probably there are no structures which will more amply repay their cost in decreased operating expenses, than well-planned sluice-gates; and we will therefore expend in their construction about $13,000, not anticipated in the original estimate.

Concrete spillways have ben [sic] planned to take the place of the old wooden structures at nearly every lock. They are made with a curved front so as to discharge the water with less undermining tendency. Timber is on hand for rebuilding the Pinery Feeder Dam at Lock 36; and for rebuilding about 200 feet in length of the west end of the Peninsula Dam, but owing to the high water it has not been practicable to rebuild them, and work has been deferred to next season.

The head-gates, sluice-gates and weir at the canal were rebuilt at the Pinery Feeder, with neat but massive concrete structures, resting on rock foundations, at the cost of about $2,500.

They are about five feet higher than formerly; so as to largely avoid the high floods.

New culverts were put in three-quarters of a mile north of Lock 40, and three-quarters of a mile south of the same lock; and also, one three-quarters of a mile south of Lock 39.

They are built entirely of concrete, with flat tops, reinforced with steel rods, and cost about $1,800 for the three.

Twelve sluice-gates have been built to date at a cost of about $7500 and ten more are under contract.

Locks 22, 23, 24, 25, 26, 28, 29, 30, 31, 32, 33, 36, 37, 38, 39 and 40 have been rebuilt and Locks 34 and 35 are being rebuilt.

Neither Locks 27 nor 41 have been touched yet, but will be finished in the spring.

The rebuilding consists of tearing out the old defective masonry, and cleaning out and filling the spaces between them with concrete, and the new walls are built of the same material.

New sheeting and miters are then placed and new gates are being placed in every lock. The wood work for the gates will cost about $8,000 and the iron about $2,000.

The abutments for Mill Creek Aqueduct have been rebuilt at a cost of about $1,500, and about $500.00 expended in repairing those at Tinker's Creek; making them better than ever.

The abutments of Peninsula Aqueduct are being rebuilt from bed-rock up and will cost about $6,000.

We have increased the width of the aqueduct trunks two feet at Peninsula and four feet on the other two.

New superstructures are being placed by the King Bridge Co.

They consist of steel trusses supporting wooden trunks.

Peninsula Aqueduct was formerly two spans of 39 feet each; we have removed the center pier, making one span of 85 feet.

This greatly increases the effective flow section of the stream and diminishes the danger of the river breaking through and across the canal below the lock as it did in 1883. At that time Lock 29 had just been rebuilt; but it was undermined by the flood, and walls were now found to be crowded in at the top.

We had hoped that some cheaper method than relaying the walls could be adopted, but on a more close and careful examination than was possible before, it was deemed necessary to relay the entire walls of the lock. The foundation timbers have sunk in the center, allowing the walls to lean inward at the top.

We found that the foundation timbers were about 5 feet above the shale rock, which extends under the lock in a nearly level sheet, and that under the walls, beneath the timbers, were rough walls extending down to the rock; and between these walls across the lock was a gravel and earth filling. This gravel and earth was entirely taken out and refilled with concrete up to the top of the timbers.

The extra cost was about $6,000. . . .

A survey and cross-section of the canal bed has been made from Lock 22 to Lock 42, and an estimate of the amount of excava-tion necessary to secure a five foot depth, with 30 feet bottom, and proper slopes to the banks was made.

The distance is 30 miles, and the excavation necessary is about 7,000 cubic yards per mile.

A contract has been let to D. E. Sullivan & Co. at 15 cents per yard and the necessary machinery is now nearly completed for beginning the work. Said dredging work, when completed, will cost about $33,000.00.

A 15 horse power traction engine with hoister attached, together with a pulsmeter pump, and two small conrete force-pumps for grouting lock-walls have been purchased. By the use of these concrete pumps we are enabled to grout considerable of the old walls and save tearing out and rebuilding to that extent.

These will be available for other work after finishing this section.

The cost of the work has been increased partially by the injunction, and partly by the increase of price of materials; and labor, due to the great amount of the construction work now being carried on everywhere; but more especially because we believed it to be good economy, to rebuild the work on a better scale than originally contemplated; spending more money on the aqueducts, and sluice-gates, and on the Peninsula lock, than was originally contemplated; but getting better results.

It will be necessary to take out all of Lock 41 and lower the bed timbers about 14 inches. This entails an expenditure not contemplated at first, as the lock is apparently in nice condition, and only needed slight repairs. But it was found impracticable to get a depth of five feet on the miter sill except by sinking the lock.

The cost of work done to date is $101,169.59 and the estimated cost of the same completed is $174,179.27 excluding Dresden Locks, or, including Dresden Locks, distributed as follows:

	Total cost to day	Estimated total cost when completed
Preliminary engineering	$ 479 27	$ 479 27
Construction engineering	3,308 67	4,500 00
Inspection	3,010 25	4,000 00
Advertising and printing	600 00	650 00
Miscellaneous supplies	1,000 00	1,250 00
Engine and pumps	1,800 00	1,900 00
Hardware	522 43	650 00
Lock gates	2,974 00	8,000 00
Aqueduct superstructures	4,582 00	9,300 00
Lumber and sheeting, dams and repairs	3,500 00	4,000 00
Rip-rap stone	2,500 00	3,000 00
Freight and teaming	600 00	800 00
Cement	6,500 00	6,000 00
Iron 123,623 lbs. to date, including blacksmithing	4,300 00	4,700 00
Excavation 4,849 cubic yards to date	1,251 00	1,600 00
Concrete 7,522 cubic yards to date	35,016 58	50,000 00
Labor by contractors	8,000 00	11,000 00
Use of contractor's machinery	4,100 00	5,600 00
New stone, 156 cubic yards to date	1,170 00	1,500 00
Old stone, 1,329 cubic yards to date	6,645 00	8,000 00
Excavation canal bed	1,500 00	1,500 00
Sluice gate lumber	3,000 00	4,000 00
Labor on dams		500 00
Head-gates		1,500 00
Dredging		33,000 00
Labor state forces and miscellaneous items	4,810 38	6,750 00
	$101,169 59	$174,179 27
Dresden locks estimated		14,230 15
Miscellaneous work		11,590 58
Grand total		$200,000 00

The section of the canal repaired is the most costly and difficult of the Northern Division; being subject to floods from the Cuyahoga River and embracing 22 locks having a fall of 198 feet out of a total lockage of 843 feet, very nearly one-third of the entire Northern Division from Cleveland to Dresden.

This includes all the cost of the work whether incurred by the Engineer through contracts or expense accounts or by the State forces working under the direction of Superintendent Chas. Hatch.

Mr. Hatch organized several gangs of laborers and mechanics; framing and placing new miter sills, trimming lock walls, and refilling embankments taken out, and at one time had about thirty laborers cleaning out the prism of the canal, with shovels and wheelbarrows.

A section three-quarters of a mile long extended south from Lock 39 was deepened to 5 feet with a bottom width of 30 feet and nicely trimmed slopes, but the work was found to be too costly, cisting [sic] us about 45 cents per cubic yard, so the force was discharged, leaving the balance to be dredged.[118]

On November 5, 1906, Paul submitted another report to Perkins, detailing the improvements made to the northern division of the Ohio and Erie that year. Among his comments were the following:

We have constructed four additional sluice gates and one waste way 60 feet long with reinforced concrete tow path bridge.

The five mile lock No. 41 was entirely taken out and rebuilt. It was necessary to take out the bed timbers and replace them 18 inches lower than they were. Ever since the removal of the 3 mile lock the five mile lock has been too shallow for even a four foot canal; and to get a five foot depth, the only feasable [sic] plan was to lower and rebuild the entire lock.

The cost was $10,750.00 exclusive of the gates. The dam at Brechsville [sic] on 17 mile feeder was entirely rebuilt and the old part of the Peninsula dam was also taken out and rebuilt.

At the Peninsula feeder new head gates, sluice and a tow path bridge were built of stone and concrete in a very substantial manner making a better and more efficient arrangement than it ever was before. This will ensure a better water supply from Peninsula, north. Locks 27, 34, and 35 were also rebuilt during the year.

Gates have been completed for all the locks from 22 to 42.

Eleven miles have been dredged under a contract with D. E. Sullivan & Son from Brecksville to one mile south of Lock 41. The amount removed was 71,355 cubic yards at 15 cents per yard.

They have had a dredge constructed at Marion, Ohio.

It is a much better machine than the State dredges which were built over 30 years ago. A still better dredge could be built by the State; and in my opinion no better investment could be made, than to supply the Northern Division with dredges of proper construction, and place them in service by our own forces.

---

118. "Sixty-Seventh Annual Report of the Board of Public Works of Ohio," December 1905, pp. 181-183.

We have raised the County bridges over the canal at Alexander, Tinker's Creek, 12 mile lock, South Park and Zimmerman's, so that all the County bridges in Cuyahoga County will have 10 feet clearance.

Considerable time had been devoted to a survey of the canal; and canal lands through Akron. A base line has been laid out conforming to the canal lines; and measurements have been made with steel tapes, corrected for strain and temperature.

Angles have been checked very carefully; and the whole connected with street and block lines; which have also been surveyed and marked; so that the survey can always be retraced.

Considerable measuring has been done to locate the property lines permanently.

The canal property in Akron was merely taken by the State and there are no deeds. Nor were there any maps or plans made showing what was taken. The evidence on which we must base our title, is largely the occupation; every year encroachments are made, and evidence obliterated by adjoining owners. A complete survey should have been made years ago, as the lands are quite valuable and considerable has been lost. During the coming season we expect to finish the work in a very complete manner.[119]

Apparently, the state legislature was impressed with the accomplishments to date because during the 1906 session it made an additional appropriation of $250,000 for the northern division improvements, thereby bringing the total appropriations for the work to $450,000. Virtually all of the work under the additional appropriation was for improvement of the canal south of Lock No. 22.[120]

John A. Hanlon, who had been appointed field engineer of the northern division in 1906, submitted the third annual report of the improvement work on the northern division on December 17, 1907. By that time, most of the reconstruction work in progress was south of Lock

---

119. "Sixty-Eighth Annual Report of the Board of Public Works of Ohio," December 1906, pp. 58-59.

120. Ibid., pp. 41-42.

No. 22, but some dredging operations north of that point were still underway. The dredging was being done by the contracting firm of D. E. Sullivan & Son. According to Hanlon:

> Their contract, comprising 29.7 miles extending from Cleveland to Lock 22, had been completed on December 1st from Cleveland to the B. & O. bridge crossing the canal north of Peninsula, a distance of 20.4 miles, leaving yet to be dredged on this contract, 9.3 miles.
>
> In October a second dredge was installed on this contract, but up to December 1st less than one-fourth of one mile had been dredged.
>
> If both dredges are kept in operation at the speed of the first dredge since July, they would complete their contract about May 1, 1908, but this can scarcely be expected through the winter season. . . .
>
> The average excavation per mile from Cleveland to the present location has been 10,800 cubic yards.[121]

In his report, Hanlon discussed the manner in which the locks had been rebuilt on the northern division. He stated that an effort had been made "to utilize to the fullest extent all of the material in place, or removed and replaced, which will at the same time be consistent with good workmanship."[122]

52. General Repairs--1905-09

While the northern division of the Ohio and Erie Canal was undergoing rehabilitation during the years from 1905 to 1909, the state

---

121. "Sixty-Ninth Annual Report of the Board of Public Works of Ohio," December 1908, p. 69. The contract was completed in 1908 with the exception of dredging at the entrances to locks and under bridges across the canal. The story of life on one of the dredging boats in this operation is provided in "On the Ohio & Erie Canal in 1908 as told to Mrs. J. H. McNally of Parma, Ohio, by Mrs. Carl Gundling of Parma," Towpaths, XI (No. 2, 1973), pp. 16-18.

122. Ibid., p. 74. This annual report contained drawings showing the typical cross section of the reconstructed canal compared with the original and proposed cross sections as well as a typical plan and cross section of a lock. Copies of these drawings may be seen on the following pages.

was also undertaking a separate program of extensive general repairs and new construction on the canal. These repairs, which were performed by the regular maintenance crews, were far-reaching in scope and more thorough than had been attempted for more than forty years. The work conducted under this program for each year was:

1905

Aqueducts

Tinkers Creek Aqueduct, 40 feet in length, 8 feet wide.
Peninsula Aqueduct, 50 feet in length, 10 feet wide.
Sand Run (Yellow Creek) Aqueduct, wing walls extended with concrete.

Locks

Lock No. 38, four courses of stone trimmed off and set back, 50 feet long, 2 to 4 inches deep.
Lock No. 37, two courses, 30 feet long, 2 to 4 inches deep.
Lock No. 36, three courses, 40 feet long, 2 to 4 inches deep.
Lock No. 35 (both sides), 50 feet long, 8 feet high, 2 to 6 inches deep.
Lock No. 34 (both sides), 70 feet long, 4 feet high, 2 to 6 inches deep.
Lock No. 33 (both sides), 30 feet long, 6 feet high, 2 to 4 inches deep.
Lock No. 32 (one side), 20 feet long, 4 feet high, 2 to 4 inches deep.
Pensinula Feeder Lock (both sides), 40 feet long, 8 feet high, 2 to 4 inches deep.
Lock No. 28 (both sides), 60 feet long, 8 feet high, 2 to 3 inches deep.
Lock No. 24, four courses, 30 feet long, 8 feet high, 2 to 4 inches deep.

Lock Gates

New chafing plank put on upper gates of Locks Nos. 37 and 35 and the Peninsula Feeder Lock.
New chafing plank put on the lower gates of Locks Nos. 38, 37, 35, and 33 and the Peninsula Feeder Lock.

Dams

Pinery Feeder Dam repaired with 220-foot timbers braced with stone.

Exhibit D.

Typical Cross Section of Canal

Showing present contacted channels at many places and comparative size of boats. A condition necessarily adding to cost of carriage

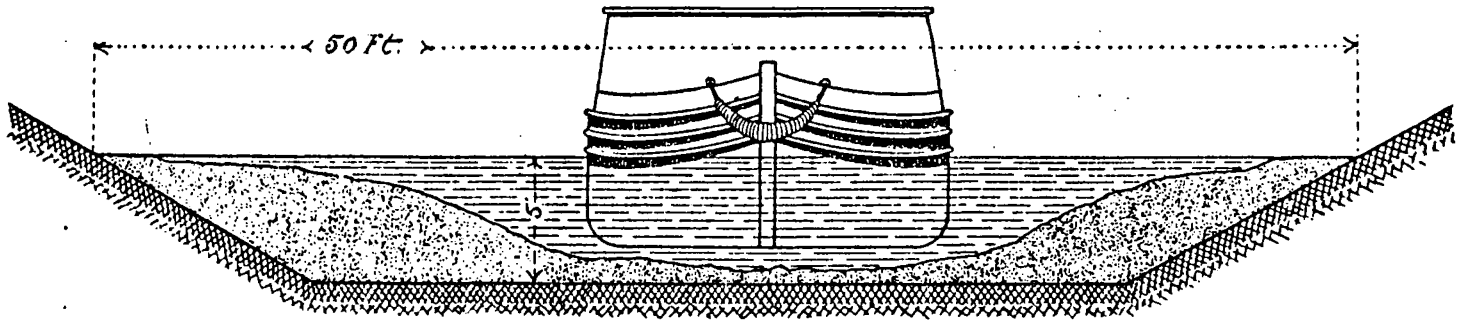


Exhibit "C."

Original and Proposed Cross Section for Canal

Confined to the minimum width of 40 feet water-way.

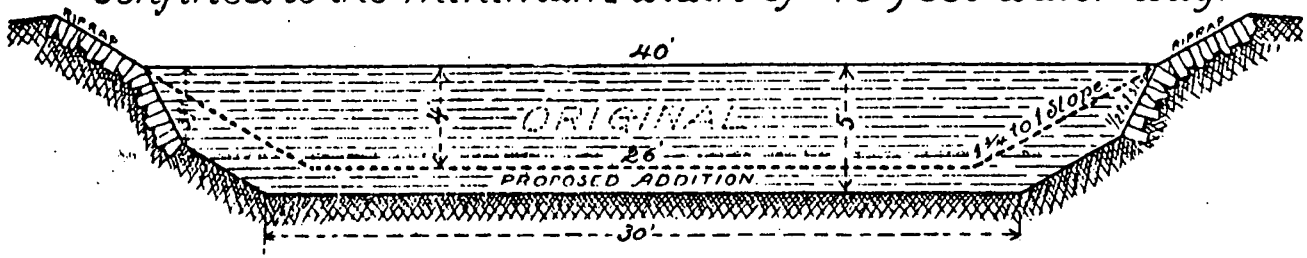


Exhibit "F."

Typical Plan and Cross Section of Lock

Showing pressure displacements inwardly of upper portions of side walls. Sections "B" "B" and floor "C" "C," as shown, to be entirely rebuilt. Balance to be properly repaired by use of concrete.

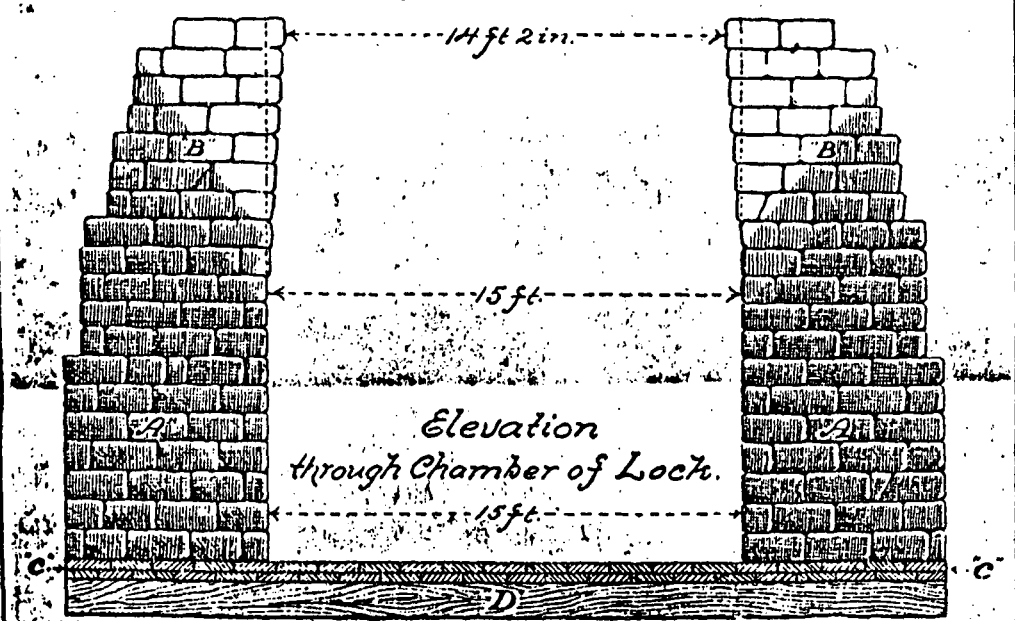
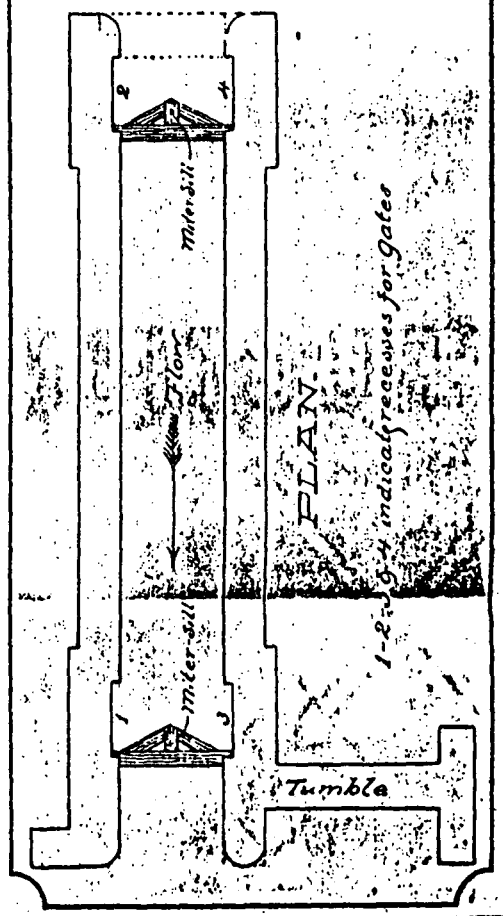


Exhibit "F F"



Banks Raised

On 14-mile level, 4 boat loads of shale to raise towpath.
On Long Pinery Level, 10 boat loads of shale to raise 200 feet of towpath.
On Short Pinery Level, 4 boat loads of shale to raise 80 feet of towpath.
North of Lock No. 35, 2 boat loads of shale to raise 75 feet of towpath.

Waste Weirs

Waste weir on Yellow Creek Level, backed with stone.
Waste weir on Yellow Creek Short Level, backed with stone.

Waste and Feed Gates

New Gates put in wooden sluice on Yellow Creek.

Sluices

Concrete sluice put in at Yellow Creek.

1906

Locks:

Lock No. 35 received two bucking beams, old stone miter sill left in and faced up with 4 x 8 timbers, lower miter sill put in and grouted also 35 x 15 ft. of lower end was sheeted with 2 in. plank.

90 ft. of the old stone wall left in on the tow-path, also 60 ft. in berm side was trimmed off from 1 to 4 in., then pointed and grouted.

Lock No. 34 received 2 new bucking beams, steel miter sill put in at upper end of locks and grouted, 18 x 15 ft. at upper end was sheeted with 2 in. plank, 50 x 15 ft. of lower chamber of locks was sheeted with 2 in. plank, 70 ft. in berm side and 60 ft. in tow-path side of the old walls were trimmed off from 1 to 5 in.

The lock was cleaned of debris left in by contractors, and water pumped out 3 times on account of springs.

Lock No. 33 received 2 new bucking beams at upper end, steel miter sill put in at upper end. 42 x 15 ft. of lower chamber was sheeted, 16 x 15 ft. of lower chamber was sheeted with 2 in. plank.

65 ft. of berm side and 50 ft. in tow-path side of old stone wall was trimmed off 2 courses from 1 to 4 in., it was then pointed and grouted, the sand had to be wheeled in wheel-barrows across old river bed and hauled with 4 horses across plowed ground.

Lock No. 32 received 2 new bucking beams at upper end, steel miter sill at upper end and grouted 18 x 15 ft. at upper end was sheeted, 40 x 15 ft. of lower chamber was sheeted with 2 in. plank.

Ninety ft. on tow-path side and 70 ft. on berm side of old walls were trimmed off 2 courses from 1 to 5 in., it was then pointed and grouted.

Lock No. 31 received 2 new bucking beams at upper end steel miter sill at upper end and grouted. 40 x 15 ft. of lower chamber was sheeted, 18 x 15 ft. of upper end was sheeted with 2 in. plank.

Ninety ft. of tow-path side and 90 ft. of berm side of old stone walls were trimmed off three courses from 1 to 6 in., it was then pointed and grouted.

Peninsula Feeder Lock received 2 new bucking beams at upper end, steel miter sill at upper end 60 x 15 ft. of lower end of chamber was sheeted, 16 x 15 ft. of upper end of chamber was sheeted with 2 in. plank, lower miter sill put in and grouted, 90 ft. on berm side and 110 ft. on tow-path of old stone walls were trimmed off 2 to 3 courses from 1 to 5 in., then pointed and grouted.

Lock No. 29 received 2 new bucking beams at upper end, lower miter sill put in and grouted. 115 x 15 of lower chamber was sheeted with 2 in. plank.

Lock No. 27 50 x 15 ft. at lower chamber sheeted, 16 x 15 ft. at upper end of lower chamber sheeted, 16 x 15 ft. at upper end of lock was sheeted with 2 in. plank.

Seventy ft. on tow-path side, 60 ft. on berm side of old stone walls were trimmed off 2 to 3 courses from 1 to 4 in. in depth, then pointed and grouted.

Grouted back of all hollow quoins of Locks Nos. 24-29.

Banks Raised and Repaired:

On 11-mile Level at ends of culvert, towpath side, 36 x 18 x 9.
On 11-mile Level, retaining wall, berm side, 36 x 8 x 7.

Waste Weirs:

New concrete waste weir at Lock No. 39, cut down 1 foot.

Towing Bridges:

Towing bridge on Long Pinery, new plank put on.
Towing bridge at Peninsula, 2 stone abutments 15 ft. long 9 ft. high with concrete covering 1 ft. thick, 12 ft. wide, 11 ft. long, also reinforced with steel rails and wire netting.

Dams:

Pinery Feeder Dam repaired with 3 one ft. timbers, also filled with concrete and planked, length 150 ft.

A false dam was built at Brecksville 150 ft. long, 4 ft. high.

Peninsula Feeder Dam was torn out at west end, a distance of 45 ft. and repaired with 1 ft. sq. timbers which were 3 timbers high in front, 2 timbers high in back, it was then cross tied with 4 x 12 timbers 12 ft. long, paved with stone and graveled.

A false dam built 75 ft. long, 5 ft. high.

Feed Gates:

At east end of Peninsula the old floor gates and stone abutments were torn out and relaid. The walls are 4 ft. thick, 12 ft. long, 12 ft. high, also 2 new flood gates.

At upper end of Peninsula Feeder 2 new concrete walls were built, one 3 ft. thick, 16 ft. long, 12 ft. high; one 3 ft. thick, 28 ft. long, 12 ft. high; one new feeder gate. Piled back of feeder walls.

Aqueducts:

Tinkers Creek Aqueduct was cleaned of debris left in by contractors, twice during summer.

Peninsula Aqueduct repaired as follows: new plank and concrete at north end, timber for gate to rub against, cut holes in for gates and concreted around timber, timber put from walls to top of aqueduct to clear tow-lines, and built concrete blocks to hold railing at end of towing bridge.

Furnace Run Aqueduct, rods replaced.

1907

Aqueducts:

New gates post on Tinkers Creek Aqueduct.

Banks Raised:

Banks raised, strengthened, and repaired on 11-mile, 14-mile, and Yellow Creek Levels.

Embankment Protection:

Embankment north and south of Lock No. 37 protected against encroachment of river.

1908

Locks:

Backfill with proper grading behind Locks Nos. 24, 26, and 27.

Banks Raised:

Bank along Goose Pond Level raised.

Tumbles:

Tumbles at Locks Nos. 33 and 34 lowered.

Sluice Gates:

Sluice gates north and south of Lock No. 26, south of Lock No. 24, and north and south of Botsum were each earth-filled.

Bulkhead Walls:

Concrete bulkhead wall across Galley Run on east side of canal above Lock No. 36.

1909

Culverts;
Culvert near Lock No. 26, ditch cut to river.
Culvert south of Botzum, ditch cut to river (400 feet long, 2 feet deep, 4 feet wide).

Locks:

Locks Nos. 24 and 27 backfilled and graded.
Lock No. 29, masonry and concrete repairs

Lock No. 28:

Both chambers were chipped off with chipping machine from 6 to 10 inches deep, 90 feet long, 16 feet high. On both sides the top was blown off 4 feet, 3 feet wide, 90 feet long.

Casing was built, poured with concrete, reinforced with half-inch iron rods 20 feet long, 12 inches apart, then 18-inch rods were driven into the old backing and bent around upright rods.

The east wing wall was extended to hold dirt to make the fill 20 feet long, 4 feet thick, from 6 to 12 feet high. The old stone wall at lower end was torn down and rebuilt with stone 20 feet high, 35 feet long.

The west wing wall, top course and coping was relaid. A protection wall 4 feet high, 18 feet long, was built of old stone.

The upper wing walls were dug under from 2 to 3 feet deep to get solid foundation, and were filled with concrete.

There was a double bulkhead put across canal at upper end of lock, 6 feet high, to keep water in Johnnycake level; also dam at lower end of lock. After lock was completed, dams were removed, casing removed, taken apart and rubbish taken away. On tow-path side it was graded from 16 to 20 feet wide.

Two new snubbing posts were set in concrete.

Lock Gates:

New wooden wicket stops placed in gates of Lock No. 28.
Gates in Locks Nos. 28 and 39 remitered.
Collars on all lock gates from Locks Nos. 28-39 threaded, oiled, and adjusted.

Bridges:

New bridge crossing Lock No. 28.

Embankments:

Embankments raised and strengthened along 11-mile and Goose Pond Levels.

Tumbles:

Tumble at Lock No. 35 was rebuilt and stone protection walls placed along the embankment on both sides of channel.

Wing walls and apron of tumble at Lock No. 28 lengthened.

Tumble at Lock No. 27 cut down from 6 to 10 inches.

Dams:

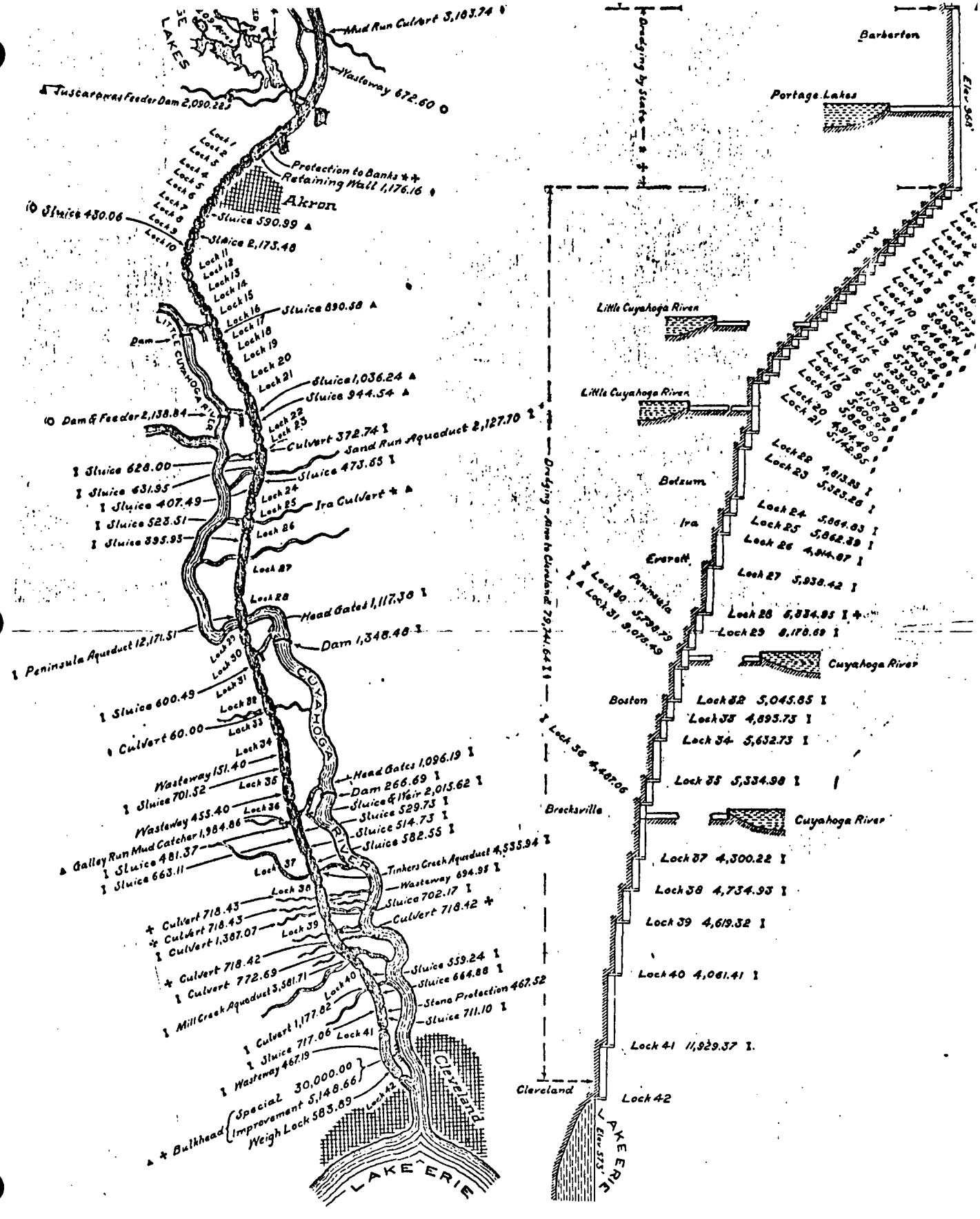
Peninsula Feeder Dam caulked with gravel.

Sluice Gates:

New sluice gate on Johnnycake Level and four on Yellow Creek Level.[123]

---

123. "Sixty-Seventh Annual Report of the Board of Public Works of Ohio," December 1905, pp. 207-213; "Sixty-Eighth Annual Report of the Board of Public Works of Ohio," December 1906, pp. 65-68; "Sixty-Ninth Annual Report of the Board of Public Works of Ohio," December 1907, pp. 87-89; "Seventieth Annual Report of the Board of Public Works of Ohio," December 1908, pp. 59-62; "Seventy-First Annual Report of the Board of Public Works of Ohio," December 1909, pp. 99-104; and Likens to Hatch, July 1, 1908, and "Agreement, by and between Chas. Hatch, Superintendent, and A. A. Likens," May 17, 1909, "Contracts," Records


Mud Run Culvert 3,183.74
Wasteway 672.60
Tuscarawas Feeder Dam 2,090.28
Protection to Banks
Retaining Wall 1,176.16
Akron
Sluice 590.99
Sluice 2,175.48
Sluice 890.58
Dam
Sluice 1,036.24
Sluice 944.54
Dam & Feeder 2,138.84
Culvert 372.74
Sand Run Aquaduct 2,127.70
Sluice 628.00
Sluice 631.95
Sluice 407.49
Sluice 523.51
Sluice 395.93
Sluice 473.83
Ira Culvert
Head Gates 1,117.36
Peninsula Aqueduct 12,171.51
Dam 1,348.48
Sluice 600.49
Culvert 60.00
Wasteway 151.40
Sluice 701.52
Wasteway 453.40
Galley Run Mud Catcher 1,984.86
Sluice 481.37
Sluice 663.11
CUYAHOGA RIVER
Head Gates 1,096.19
Dam 266.69
Sluice & Weir 2,015.62
Sluice 529.73
Sluice 514.73
Sluice 582.55
Tinkers Creek Aqueduct 4,535.94
Wasteway 694.95
Sluice 702.17
Culvert 718.42
Culvert 718.43
Culvert 718.43
Culvert 1,387.07
Culvert 718.42
Culvert 772.69
Mill Creek Aquaduct 3,581.71
Culvert 1,177.82
Sluice 717.06
Wasteway 467.19
Special 30,000.00
Improvement 5,148.66
Weigh Lock 583.89
Sluice 559.24
Sluice 664.88
Stone Protection 467.52
Sluice 711.10
Cleveland
LAKE ERIE
Dredging by State
Barberton
Portage Lakes
Elev. 968'
Little Cuyahoga River
Little Cuyahoga River
Dredging - Akron to Cleveland 72,741.64
Botzum
Ira
Everett
Peninsula
Lock 30 5,738.79
Lock 31 9,075.49
Lock 28 6,834.85
Lock 29 8,178.69
Cuyahoga River
Boston
Lock 32 5,045.85
Lock 33 4,893.73
Lock 34 5,632.73
Lock 35 5,334.98
Lock 36 4,487.06
Brecksville
Cuyahoga River
Lock 37 4,300.22
Lock 38 4,734.93
Lock 39 4,619.32
Lock 40 4,061.41
Lock 41 11,929.37
Cleveland
Lock 42
LAKE ERIE
Elev. 573'

53. Reconstruction of Furnace Run Aqueduct--1912

During 1912 Furnace Run Aqueduct was wrecked when its north abutment was undermined. A new abutment was built on a piling foundation; and the south abutment was also repaired. The truss was replaced, the trunk was resheeted, and new retaining walls were constructed.[124]

54. Reconstruction of Tinkers Creek Aqueduct--1975

In 1975 the Tinkers Creek Aqueduct was reconstructed with funds provided by the United States Steel Corporation. The aqueduct, which had last been rebuilt during the 1940s, was found to be leaking, and hence a crew was hired to repair the structure. White fir logs were used in the reconstruction effort. The structure was important to U. S. Steel since that corporation leases an 8-mile section of the canal from just south of Harvard Road, S.E., to State Highway 82 in Brecksville to channel water to the mill operations at its Cuyahoga Works.[125]

---

123. (Cont.) of the Board of Public Works of Ohio, Series 1231, Ohio Historical Society, Columbus. A copy of a map showing the location and cost of the improvements to each structure on the northern division during the 1905-09 period may be seen on the following page. A full report on the reconstruction of Lock No. 28 may be seen in Appendix U.

124. "Seventy-Fourth Annual Report of the Board of Public Works of Ohio," December 1912, p. 83.

125. Akron Beacon Journal, November 6, 1975.

CHAPTER SEVEN: HEYDAY AND DECLINE OF THE OHIO AND ERIE CANAL IN THE CUYAHOGA VALLEY

A. Progressive Prosperity

From the initial year of its operation, in 1827, until 1840, the Ohio and Erie enjoyed a special role in the development of Ohio's economy. In northeastern Ohio, for example, there was no alternate route of transportation to or from the East.[1] During the period 1827-40, the canal thus enabled this part of Ohio to raise farm prices and increase population--two of its primary goals.[2] Because of the Ohio and Erie, northeastern Ohio soon found its place in an emergent regional wheat belt. Cleveland became the center of this important export trade.[3]

As discussed in Chapter I, the canal generated commerce that materially aided the inhabitants of the Cuyahoga Valley. Some, of course, prospered more than others--but the issue is that the valley was transformed dramatically. Before the canal, the valley was in a frontier sprinkled with members of a second wave of immigration.[4] After the canal, the valley was integrated into one of the most economically progressive areas of the state. By 1840, Ohio itself was recognized as the "Third State of the Union"--ranking only behind New York and Pennsylvania in measurable criteria of economic development.

B. The Decline (I)

1. Interregional Canals

Often overlooked, however, is the fact that the heyday of the Ohio and Erie was short. And one may well suspect this materially

---

1. Scheiber, Ohio Canal Era, p. 191.

2. Finn, "The Ohio Canals," p. 26.

3. Scheiber, Ohio Canal Era, pp. 192, 194.

4. Finn, "The Ohio Canals," p. 40, who cites Frederick Jackson Turner, The Frontier in American History (New York 1920), p. 19ff. in this context.

affected the economic development of the Cuyahoga Valley. It is generally accepted that from 1827 until the 1850s the Ohio and Erie supported the economy of northeastern Ohio, and--by extension--that of the Cuyahoga Valley. Afterward, railroad competition supposedly began to adversely affect the basic conditions of commerce. As Scheiber has argued, the facts say otherwise. Before extensive railroad competition with interregional canals in the 1850s, two changes occurred in the 1840s. One was the proliferation of new canal routes. The second was a resultant decline of freight rates charged on all major waterways, whether old or new.[5]

In 1840, the opening of the Pennsylvania and Ohio Canal between Akron and Youngstown broke the monopoly of the Ohio and Erie between Akron and Cleveland. Three major commodities from the Mahoning Valley then began to pass through the Cuyahoga Valley on their way to Cleveland, namely: coal, wood and dairy products. Although augmenting Cleveland's export of these products, the Pennsylvania and Ohio was a threat to Cleveland's export of goods to Ohio's interior. Henceforth, consumers in northeastern Ohio were free to import commodities by way of the Ohio River, the Pennsylvania and Ohio, and the Ohio and Erie. Pittsburgh took advantage of the situation, retarding the development of an ironware industry in northeastern Ohio.[6]

The Pennsylvania and Ohio Canal definitely stimulated dairy production in the Mahoning Valley. Before 1840, farmers in this area had to transport their cheese by wagon, eastward to the Ohio River, or westward to the Ohio and Erie in Akron. The Pennsylvania and Ohio's facilitation of transportation to both markets coincided with an increased demand for Ohio cheese in New York, Canada, and, after 1849, in far-away California.[7] Though statistics are lacking for comparative

---

5. Scheiber, Ohio Canal Era, p. 212.

6. Ibid., pp. 215-217.

7. Ibid., p. 216.

purposes, it must be assumed that dairy production in the Mahoning Valley blunted the large-scale production of cheese and butter in the Cuyahoga Valley. It is known that the volume of cheese transported on the Pennsylvania and Ohio Canal increased 600 percent between 1841-50.[8]

Freight rates on the Ohio and Erie declined during the 1840s, because of interregional competition from Pennsylvania, Indiana, and Illinois canals. Yet, even while these lines were under construction, the Mississippi River system that served New Orleans showed remarkable resiliency. The expansion of steamboat capacity, and the hardy competition given steamboats by river flatboats, kept rates down. Between 1841 and the late 40s, shipments from Cincinnati to New Orleans fell from 50 cents per 100 pounds to 20-28 cents. This situation gave the canal commissioners of Ohio all the more incentive to cut tolls on the Ohio and Erie. Naturally, the proliferation of canals and staying power of the southern river system forced boat operators on the Ohio and Erie to pare their rates during the 1840s.[9]

2. Competition with Railroads

In the 1840s, then, interregional competition from waterways severely restricted profits on the Ohio and Erie. Although other factors contributed, the development of the Ohio railroad system was the primary cause of the Ohio and Erie Canal's demise. Trouble for the canals loomed as early as 1837, when the Loan Law of March 24, 1837, allowed the investment of state funds in railroad companies.[10] The Loan Law of 1837 is significant, because it marked a change of official state policy toward internal improvements. For three years, state construction of public works was abandoned in favor of state aid to private enterprise engaged

---

8. Ibid., p. 216, n. 13.

9. Ibid., pp. 213-214. "The interregional rate decline of the forties was greater, in fact, than any further decrease that occurred when east-west railroads challenged the water lines in the 1850s." Ibid., p. 214.

10. Finn, "The Ohio Canals," p. 28.

in such work. The era of privately owned internal improvements in the State of Ohio had dawned.

To be sure, the Loan Law of 1837 was repealed on March 17, 1840. One cause was public outcry over a plundering of the state treasury to finance loans for fly-by-night companies. The deeper cause, however, was the general distrust of state participation in internal improvements. On March 13, 1843, the trend was underlined when the State Assembly forbade state aid of any kind to private companies constructing internal improvements. The logical conclusion was embodied in the State Constitution of 1851, which prohibited the state from extending credit to, or becoming a stockholder in, any private company.[11]

The absence of public support was noticeably detrimental to Ohio's canal system, but did not abate the proliferation of railroads in the state. By 1851 Ohio was no longer poor. Indeed, Ohio entrepreneurs were eager to invest their own capital in internal improvements. The decade 1850-60 was characterized by furious railroad construction throughout the country--but in no state was the rate of construction greater than in Ohio. In 1850 there had been only a little more than 300 miles of track in Ohio. By 1860 there were approximately 3,000.[12]

Reasons for the preference of private capital to invest in railroads rather than canals are easily found. For one thing, areas of the state initially by-passed by the canals burned to match or exceed the transportation networks installed in favored areas. For emotional as well as logical reasons, these areas were not about to invest in canals. Another advantage that from early on accrued to the railroads was the Ohio public's underestimation of how much competition railroads were going to offer canals. Few in the early 1840s thought railroads would do

---

11. Ibid., p. 29.

12. Scheiber, Ohio Canal Era, p. 290.

more than act as connecting lines between towns served by canals. Only in the later 1840s, was the seriousness of railroad competition with the canals properly appraised.[13]

By the time the Ohio Board of Public Works recognized the situation in 1851, it was too late. Discriminatory rates advocated by the board against railroads in favor of canals were blithely ignored.[14] In 1851, and thereafter, the Legislature refused to generate canal appropriations.[15] Competitively, the bottom line had been reached: the horse and mule could not compete with the iron horse. The canals had become all too quickly an anchronistic transportation system.[16]

From about 1850 on, arguments to save the canals thus begged the issue. Farmers, merchants, and travelers who could choose between railroads and canals usually picked the former. Rails offered the public speed. Shipments of goods from Ohio's water routes to the Atlantic coast were en route several weeks. Rail shipment for the same distances took only a few days. Rail transport was also usable the year round; whereas, the canals and Lake Erie were closed for as many as four or five months annually. Even when navigable, floods, drought, or damage to canal components halted traffic for weeks. Railroads were not, of course, immune from operational problems--but rerouting rail traffic through connecting lines was comparatively expeditious. After telegraphic communication became widespread, railroads permitted their clients to reap the advantages of short-term price movements in interregional markets.[17]

---

13. Finn, "The Ohio Canals," pp. 32-33.

14. Ibid., 34-35.

15. Scheiber, Ohio Canal Era, p. 299.

16. Finn, "The Ohio Canals," 35.

17. Scheiber, Ohio Canal Era, pp. 320-327.

3. Public Disenchantment

Nothing came of a proposal in the 1852-53 session of the Legislature to sell the canals.[18] After 1853, however, declining tonnage on the trunk lines eroded the public's confidence in the future of Ohio's canals. In 1855, increased expenditures for maintenance induced the Board of Public Works to conclude a five year contract with private firms for maintenance and repair of the canals. The plan was a failure. In 1857, the General Assembly declared the 1855 contracts fraudulent. Ensuing lawsuits dragged on, allowing the canals to fall into an even greater state of disrepair.[19] Their condition in 1856 has been described aptly by Scheiber:

> mud was allowed to slip down the banks into the water, culverts collapsed, and vegetation clogged reservoirs, feeder lines, and the main ditches themselves. Never had navigation been so uncertain or difficult, and this was disasterous at a time when the railroads were competing successfully against even the best of America's canals.[20]

During the 1850s, Ohio's canal system suffered one misfortune after another. Droughts in 1851 and 1856 bottled up traffic on the Ohio and Erie for weeks.[21] In the mid-1850s, the Pennsylvania and Ohio Canal was essentially put out of business when it was sold to the Mahoning Railroad.[22] For 17 years this canal had acted as the only feeder for the

---

18. Finn, "The Ohio Canals," 35.

19. Scheiber, Ohio Canal Era, pp. 302-303.

20. Ibid., p. 303.

21. Ibid., p. 327.

22. "When the Mahoning Railroad was built in 1852 to Cleveland it largely destroyed the usefulness of the canal [the Pennsylvania and Ohio], which was bought up by the railroad. The state sold its share of $30,000, but stipulated that the canal should be kept in a navigable condition. The railroad soon after raised the tolls so high that the traffic ceased, and after the boats ceased to run, they cut the embankments and let the water out. After much litigation the courts finally declared the canal abandoned." Ernest L. Bogart, Internal Improvements and the State Debt in Ohio (New York: 1924), p. 126. Naturally, before the proliferation of railroads in northeastern Ohio, a defunct Pennsylvania and Ohio Canal would have enhanced the status of the Ohio and Erie between Akron and Cleveland.

northernmost sector of the Ohio and Erie. Loss of the Pennsylvania and Ohio to the main line was followed by serious floods in 1858 and 1860.[23]

Disgust with the canal's performance became widespread among Ohio's politicans. Governor Salmon P. Chase advocated sale of the canals in his annual addresses of 1857, 1859, and 1860. The Assembly balked at selling, but the act of April 6, 1859, authorized leasing the state's entire public works system for an annual rental of not less than $54,000. Railroads were excluded from submitting bids. No other bids were received, however, and the state continued to struggle with its down-at-the-heels canal system.[24]

Public dissatisfaction, a Republican Legislature, and active lobbying by the railroads resulted in the act of June 2, 1861. It provided that the public works of the state be leased to the highest bidder for 10 years. A syndicate of six operators submitted the higher of two bids received. For $20,075 per annum, Ohio's canals were handed over to these men.[25] For a time, Ohio was out of the public utility business.

Between 1861-77, the private operation of the canals was "neither brilliantly good nor terribly bad."[26] The syndicate's record was sufficiently competent to win another 10-year lease. Even so, traffic kept declining, especially in the summer of 1875. On December 1, 1877, after two half-hearted years of operation, the syndicate surrendered its lease. The main reason was undoubtedly the canals' unprofitableness.[27]

---

23. Scheiber, Ohio Canal Era, p. 327.

24. Finn, "The Ohio Canals," pp. 35-36.

25. Ibid., p. 36.

26. Ibid., p. 36.

27. "The alleged reason was 'that the act of April 24, 1877, authorizing the City of Hamilton upon certain specified conditions to fill up a part of the canal basin in that city amounted to, or operated in causing an eviction of them from what they the lessees claimed to be a valuable part of the leased property.'" Bogart, Internal Improvements, p. 115.

After a short period of receivership, from December 1, 1877 to May 15, 1878, the Board of Public Works again took charge of the canals. The act of May 14, 1878, reorganized the board, so it could better administer the canals. Nevertheless, between 1878 and 1902 the system continued to deteriorate. Traffic kept slipping, and canal sections were even abandoned or acquired by railroads.[28] As early as 1875, the Ohio and Erie's northern terminus in Cleveland had been relocated three miles farther south. At that time, Lock 42 was rebuilt to provide access to the river. The Valley Railroad--then slated for construction through the valley--acquired the canal bed from Locks 42 to 44 as part of its right-of-way.[29]

The c. 1880 exhaustion of coal mines near Akron caused gross tonnage for coal--the principal article hauled through the Cuyahoga Valley--to plummet. Debilitating floods struck in 1882 and 1884. These left the canal full of debris, and damaged feeder components--especially dams. On November 15, 1882, there was only $689 in the canal fund for maintenance and repair.[30] By this date the Valley Railway ran through the valley, and it attracted business normally received by the canal. The 1880s and early 90s were characterized by the abandonment of almost all of Ohio's branch and feeder canals. In 1894 only the two trunk lines and a few feeders had survived--and these were mostly in deplorable condition.[31]

C. Rehabilitation

The roots of a movement to save Ohio's canals can be traced to 1878, when Governor Thomas L. Young stressed in his January 7 message that

---

28. Ibid., pp. 115-116.

29. James and Margot Jackson, The Colorful Era of the Ohio Canal, p. 21.

30. Bogart, Internal Improvements, p. 117.

31. Ibid., pp. 130-131.

the state could not afford to abandon them.[32] Two years later, Governor Richard M. Bishop echoed Young's sentiments, adding that:

> Efforts by corporations or individuals to dismember them [the canals] or reduce their capacity for usefulness by cutting off portions of them under the pretense of affording greater facilities for commerce are generally vicious in their tendency and ought to be discouraged by the Legislature.[33]

Following Governor Joseph B. Foraker's pro-canal message of January 2, 1888, a three-man canal survey commission was established by the act of March 28, 1888. Its principal task was

> to establish the boundaries and lines of canals, canal basins, reservoirs, etc., by an accurate survey--and to define and protect the ownership and titles of the state in and to all lands belonging to and connected with said canals.[34]

Between 1888 and 1902, the commission--reduced to two men in 1892--worked to overcome myriad obstacles. The results of their exhaustive investigations did, however, produce results beneficial to the state.[35] The Legislature was sufficiently impressed with the commission's efforts to pass the act of April 9, 1902. It stated

> that it is hereby declared as the settled policy of this state that the Miami and Erie, together with its water supplies, etc.,--shall be retained and maintained as a public canal; also that the same policy is hereby declared as to the northern division of the Ohio Canal--from Cleveland to Dresden.[36]

This act also included provisions for the investigation of the condition of the Ohio and Erie's southern division.

---

32. History of the Ohio Canals, p. 51.

33. Ibid., p. 52.

34. Bogart, Internal Improvements, p. 132.

35. Ibid., pp. 132-133.

36. Ibid., p. 138.

In 1903 the extensive report of Chief Engineer Perkins of the Board of Public Works helped implement a rehabilitation program described fully in Chapter 6. The main purpose of this program was to adapt the canals to the demands of modern traffic. As noted in Chapter 6, Perkins furnished cost estimates for improvements to individual canal components. Sufficient state-wide sympathy motivated the Legislature to make financial allotments from the General Revenue Fund in 1904. For the improvement of the main line canals, $75,000 was appropriated for 1904, $125,000 for 1905, $250,000 for 1906, and $356,000 for 1907.[37] To make practicable the improvements from Cleveland to Dresden--which included a canal with a minimum of five feet of water--Perkins calculated it would be necessary to secure $30,000 worth of water leases along the Ohio and Erie's northernmost division.[38]

As described in Chapter 6, the Ohio and Erie from Akron to Cleveland was dredged in 1905-06 at a cost of $79,741.64.[39] In addition to dredging and lock repair, almost all of the canal's components in the Cuyahoga Valley from Locks 21 through 38 were scheduled for refurbishment.

D. The Decline (II)

1. Continued Lack of Public Support

Despite material improvements to the canal in the valley and elsewhere along the Ohio and Erie's northern division, the Chief Engineer of Public Works' annual report for 1911 is evidence that public opinion toward the canals had not really changed. In Chief John I. Engineer Miller's words:

> I have discovered a tendency which is crystallized into public opinion in many parts of the State, to further the

---

37. Ibid., pp. 138-139.

38. History of the Ohio Canals, p. 51.

39. James Dillow Robinson, "Canal Maintenance and Recollections," Towpaths, XVII (1979), p. 10.

> process of decadence of the state's valuable canal properties by encroachment, and by a strong spirit of opposition to any movement that seeks to rehabilitate these water-ways and rather desires their absolute abandonment.[40]

In his 1911 report Miller confirmed that the Ohio and Erie from Cleveland to Dresden had been rebuilt for most of the way. Yet, no aqueduct existed at Roscoe, a few miles north of Dresden--and "dredging was discontinued at Tuscarawas on account of lack of funds." In Miller's opinion, these deficiencies put the whole system out of commission.[41]

Miller's December 1911 report concluded with a plea for the state to settle on a fixed policy in its attitude toward the canals:

> The history of canals in this state for the past 50 years shows that there has been anything but a consistent policy in this respect, unless it has been the policy of indecision and disintegration. One legislature will decide to improve the canals and make an appropriation to that end; the next General Assembly will adopt a different policy and refuse to make appropriations. The result is, that work started under the authority of the first appropriation is not completed until the money is all spent, and there is nothing granted by the succeeding legislature nor until the work thus partially completed is old and has to be done again. Succeeding legislatures ignore the canals and hence a piece-meal policy that gets nowhere is the result.
>
> Either take the necessary steps to restore the canals in the minimum of time that it would require, or abandon them outright. Why delay?[42]

Events just before the disastrous flood of March 1913 show that no reversal of the state's or the public's attitude toward the canals was in the cards. In 1912 Miller was promoted to the Superintendency of the Board of Public Works. As superintendent, he vigorously prosecuted two

---

40. Executive Documents: Annual Reports for 1912, Part I, p. 871.

41. Ibid., p. 876.

42. Ibid., pp. 877-878.

interrelated projects. One of these was the continuation of surveying and platting canal lands. The other involved Miller's attempt to dispose of major lawsuits in which the board was attempting to recover state property.[43]

The canal survey commission established by Governor Foraker in 1888 had determined quickly that the state did not have a clear title to all of the canal lands. Many of the early records kept by the canal commissioners were simply missing. These had contained the proceedings by which the state originally acquired canal property, in the form of appropriations, donations, purchases, and--in western Ohio--grants from the federal government. The dearth of original titles compelled the commission to resort to a compilation of second-hand information. Whenever germane, information was gleaned from records of the awards of damages in the Board of Public Works Office--or from records in the State Auditor's or County Recorders' offices.[44] As a last resort, the testimony of engineers and contractors who had participated in canal construction was taken down. Of course, many of these people were now dead.[45] Particularly disconcerting to the commission was the discovery that there were no plats of state owned canal lands. Either they had never been made or, if made, were lost or stolen.[46]

By 1912 the state had managed to compile a partial survey of canal lands undoubtedly in its possession. It was far more difficult, though, to ascertain what lands in the possession of other parties really belonged to the state. Even when the board thought it had a good argument, court decisions were likely to go against it. Such was the case in 1912,

---

43. "Seventy-Fourth Annual Report of the Board of Public Works, 1912," Executive Documents: Annual Reports for 1912, Part I, p. 839.

44. "Sixty-Third Annual Report of the Board of Public Works, 1901," p. 8.

45. Bogart, Internal Improvements, pp. 132-133.

46. "Seventy-Fourth Annual Report . . . 1912," Executive Documents: Annual Reports for 1912, Part I, p. 835.

when the Ohio Supreme Court ruled in favor of the Cleveland Terminal and Valley Railroad. At issue was the state's attempt to recover approximately three miles of abandoned Ohio and Erie property--formerly between Locks 42 and 44. Subsequent to its abandonment in 1875, the land was granted to Cleveland by Ohio's General Assembly for the city's municipal needs. Soon after, Cleveland leased the property to the railroad company for 99 years--said lease renewable in perpetuity. The state thus received no compensation for this property. Miller considered the 1912 Valley Railroad decision the "most humiliating defeat" ever administered to the Board of Public Works.[47]

2. The March, 1913, Flood

Seen in this perspective, the March 1913 flood only accelerated the demise of Ohio's unpopular canal system. To be sure, the flood wrought unprecedented devastation. One of the two scenes of maximum damage on the Ohio and Erie was the Portage Summit at Akron north to Brecksville. Between these two points--a distance of 16 miles--the canal was literally destroyed. The sub-sector from Brecksville to Cleveland was considered salvageable. But it was only considered desirable to salvage it because it had a good supply of water, and furnished it to "several important industrial establishments."[48]

Following the March flood, Ohio's 1913 canal commission was appointed to make recommendations for the disposition of the state's canal system. The commission's report stressed the feasibility of reconstructing part of the old system--with federal aid--as a barge canal across Ohio. There was, however, no hint that any part of the Ohio and Erie from Cleveland to Portsmouth was eligible for this modernization.[49] The commission's following recommendations were the death sentence of the Akron-Cleveland sector:

---

47. Ibid., p. 840.

48. "Seventy-Fifth Annual Report of the Board of Public Works, 1913," p. 5.

49. "Seventy-Sixth Annual Report of the Board of Public Works, 1914," pp. 11-12.

2nd. The Commission finds that the rehabilitation of the canals of the State on the original basis or standard of construction is impracticable and highly inadvisable.

3rd. In the event a barge canal is not feasible, and inasmuch as it would not be advisable to rehabilitate the canal into the original standard of construction and specifications, the Commission advises that the State retain its ownership in the rights of way in the sections of canal that are producing revenues in the way of water rentals.

4th. The Commission recommends that the water-ways, both natural and artificial, be developed and improved for water power and industrial purposes wherever possible; that the canals be drained at such points where the revenues do not justify the cost of maintenance, and placed in such condition as to prevent their becoming nuisances to the communities through which they pass.[50]

3. Conclusion

For 20 or so years, the Ohio and Erie contributed mightly to the economic development of the Cuyahoga Valley. With the multiplication of railroads, however, the slower mode was destined to yield. No one in the early 1820s was prophetic enough to realize that canals would outlive their usefulness so quickly. From the 1850s on arguments to save them were either based on the assumption that canals offered railroads a modicum of intraregional competition, or that the state was under some sort of moral obligation to preserve the canals, because the canals had done so much for the state. The first argument was more difficult to defend than the second. Then as the Ohio and Erie and her sister, the Miami and Erie, fell into an advanced state of disrepair, the second argument, too, lost its force.

---

50. Ibid., p. 12.

APPENDIXES

APPENDIX A

Engineers formerly in the service of the State, removed, by resignation or death.

Names.	*Rank.*	*Remarks.*		
James Geddes	Principal	Term of service expired in		1822
David S. Bates	do	Discharged in	March,	1829
Alexander Bourne	Exploring	Resigned,	Spring,	1827
John Bates	Resident	Left service	do	1826
William R. Hopkins	do	Resigned	do	1826
Joseph Ridgway, jun.	do	do	do	1829
Isaac Jerome	Assistant	do	do.	1822
Seymour Skiff	do	Died	Fall,	1823
Thomas J. Matthews	do	Resigned	do	1824
John Forrer	do	Died	Spring,	1827
James M. Buckland	do	Resigned	Fall,	1827
John Brown	do	Died	Summer,	1829
Peter Lutz	do	do	do	1827
Robert Anderson	do	do	do	1828
Dyer Miner	do	do	Fall,	1827
William Lattimore	do	do	do	1829
Isaac N. Hurd	do	Resigned	Summer,	1829
Charles E. Lynch	do	do	do	1828
Philo N. White	do	do	Spring,	1827
James H. Mitchell	do	do	January,	1829
John S. Beasley	do	do	December,	1829

"Eighth Annual Report of the Board of Canal Commissioners," January 9, 1830, Kilbourn, Public Documents, p. 386.

Arrangement of the Corps of Civil Engineers in the service of the State of Ohio:

JANUARY, 1830—ON THE OHIO CANAL.

Names.	*Rank.*	*Annual pay.*	*An'l sub-'nce.*	*An'l h'rse k'p'g*	*Length of district.*	*Where, and how employed.*
Richard Howe	Resident	$720	$156	$52	67 miles	From Lake Erie to Massillon, as Superintending Engineer.
Leander Ransom	do	720	156	52	68 "	Massillon to Caldersburgh, as Superintending Engineer.
Gardner Field	Senior Assistant	540	156			
Andrew Young	do	540	156			
John B. Warren	Junior Assistant	360	156			
Lewis Roberts	do	360	156			
Byron Kilbourn	Resident	720	156	52	55 "	Caldersburgh to Deep Cut, as Superintending Engineer.
Sebried Dodge	do	720	156	52	29 "	Deep Cut to Columbus Feeder, as Constructing Engineer.
Wm. H. Knapp	Junior Assistant	360	156			
Darius Lapham	do	360	156			
Nathaniel Medbery	Resident	720	156	52	27 "	Columbus Feeder and Main Line to Circleville, as Constructing Engineer.
John M'Carthy	Junior Assistant	360	156			
	do	360	156			
Jesse L. Williams	Resident	720	156	52	24 m 52 c	Circleville to Paint Creek, as Constructing Engineer.
O. P. Jennison	Junior Assistant	360	156			
Wm. R. Williamson	do	360	156			
Wm. H Price	S. Resident	1200	200		24 m 64 c	Paint Creek to Pee Pee Bluffs, as Constructing Engineer.
Thos. B. Adams	Senior Assistant	540	156			
Charles Voorhies	Junior do	360	156			
Francis Cleaveland	Resident	720	156	52	23 m 10 c	Pee Pee Bluffs to Ohio River, as Constructing Engineer.
Stearns Fisher	Junior Assistant	360	156			
Timothy G. Bates	Senior do	540	156			

"Eighth Annual Report of the Board of Canal Commissioners," January 9, 1830, Kilbourn, Public Documents, p. 385.

APPENDIX C

REPORT OF NATHAN S. ROBERTS, ESQ. CIVIL ENGINEER.

To the Honorable the Board of Canal Commissioners of the state of Ohio:

GENTLEMEN—In compliance with a resolution of your board, and at the special request of David S. Bates, Esquire, your principal engineer, I have accompanied Messrs. Price and Forrer, engineers named in said resolution, for the purpose of making the necessary examinations and surveys to enable the board to determine which of the proposed routes between Coshocton and Lake Erie ought to be adopted as the line of the canal.

For this purpose, we have examined each of those routes, and compared the difficulties and most expensive parts on each line; and also have examined the route of the feeders, and the sources of their supply for the summits and other parts of these several routes. We first examined the Cuyahoga and Tuscarawas route.

We find that this line is located on ground very favorable for a canal, being mostly along alluvial bottoms, or on plains, of a soil composed of sandy or gravelly loam, which can be, in most places, readily excavated by the plough and scraper, which is the best way of constructing the banks of a canal.

The depth of cutting is very uniform, having but a small proportion of deep cutting or embankmen ; and the locks and other artificial works can be located, in most cases, to good advantage.

The quality of the grubbing on this route, is very favorable; about thirty miles of which, being on the plains, is very light—being of such description as the farmers get grubbed and cleared, fit for ploughing, for four or five dollars the acre; the remainder of the grubbing is usually heavy.

This line has a number of wash-banks and slip banks, of some difficulty. Along the Cuyahoga, their united length is one and three fourths of a mile; and on the Tuscarawas, they amount to four miles and six chains. In many cases, the materials, (earth and stone,) are near at hand, to form the canal by such places; in others, the materials are more distant and attended with more expense.

Most of these wash-banks must be protected by a stone facing or wall, on the out-side, to counteract the abrasion of the water, in time of freshes in the rivers. These are items of considerable difficulty and expense, and have been estimated accordingly.

A few rocky points are to be cut through, but of small amount. The artificial works, such as waste-weirs, aqueducts, culverts, dams, and guard locks, are neither numerous nor are they remarkably expensive; the materials, as stone of a suitable quality, are found very convenient in most places on this line.

The locks are estimated at the same price by the perch, on each of the lines. Lock stone are found on the Cuyahoga and Tuscarawas line, of the first quality, for size and durability; they are a sand-stone, easily quarried and cut for useful purposes. The water-lime is found of good quality, near the canal line, in the valley of the Cuyahoga; this we examined and saw specimens of the cement.

As water is an indispensable article in all canal calculations, a certain and abundant supply of that element must be a primary consideration with every engineer, in locating a line of canal; and great caution should be made use of to ascertain the dependence which can be placed on those supplies by the public, for extensive commercial purposes; as the expense of constructing a great public canal is wholly predicated on enjoying, to its greatest extent, this safe, pleasant, easy, and cheap mode of transportation.

The Tuscarawas and Cuyahoga line is remarkable for the facilities by which it can be supplied with water, at the most favorable and necessary points. The line crosses the Tuscarawas river, which it takes in as a feeder, near the centre of the Portage summit. This stream is very durable, receiving its permanent supplies from a number of small lakes. These, together with the Portage lake, we have calculated will at all times afford an abundant supply for the summit and the lockage at each end. These feeders supply 2 00 cubic feet per minute, at low water; and in case of great emergency, a reservoir can be made, immediately adjoining the canal, by which the Tuscarawas, for four months, may supply 832 feet per minute more than its usual quantity. Such a reservoir, if practicable, could be equally applied to either route.

After descending north or south from the Portage summit, the canal is, at all necessary points, replenished by the streams which it takes in, or by feeders admitted from the Cuyahoga and Tuscarawas rivers; all which, except the Tuscarawas reservoir, are included in the estimates, as reported by the engineer and canal commissioners.

AN ABSTRACT,

Shewing the amount of each item of expense to be incurred in constructing the Ohio Canal, from Coshocton to Lake Erie, by each of the proposed routes.

BY THE FIRST ROUTE.—TUSCARAWAS AND CUYAHOGA.

First Section—from Coshocton to Portage Summit, 94m. 13ch. 55.

Grubbing and clearing, preparatory	3,643—at 7 50—27,322 50	
On barrows	3,044—at 5 00—15,220 00	
		$42,542 50
Excavation	2,460,517 cubic yards	277,297 39
Embankment	895,776 ditto	147,446 70
Protecting walls, at wash-banks, &c.	28,050 00 ditto	28,050 20
Culverts; in number	25. from 4 to 20 feet chord,	9,420 41
Lockage, 205 feet	205 ft. lift, 37,691 perches,	131,746 39
Aqueducts; in number	2	24,931 09
Dams and feeders		2,421 00
Road bridges	18	2,180 00
		$666,035 68

Distance 94 ms. 13 chns. 55 lks. the average cost per mile is $7,072 69 cts.

Second Section—from Portage Summit to the Lake at Cleaveland.

Grubbing and clearing, preparatory	2,005 chains, at $7 50—	17,123 25
Excavation	1,087,162 yards, at various—	125,839 86
Embankment	274,648 do. at do. —	44,235 06
Protecting walls to wash-banks	12,522 do. at $1 00—	12,522 00
Culverts; in number	12, from 4 to 10 ft. chord,	4,309 13
Lockage, 394 feet	70,716 57 perches, at $3 50—	247,661 96
Aqueduct	1 at Peninsula	2,706 00
Dams and feeders		700 00
Road bridges; in number	11 and changing road	1,410 00
Tow-path down Cuyahoga		4,690 00
Harbor, at mouth of Cuyahoga		5,000 00
	Total	$468,197 26

Distance 38 miles, 8 chains; $12,236 14 average, per mile.

Total distance from Coshocton to the Lake, by this route, is 132 miles, 21 chains, 55 links; total amount of lockage is 599 feet; and the total amount of expense is estimated at $ 1,132,232 94; the average cost per mile is 8,560 00.

To the above estimates should be added ten per cent. for contingencies and superintendence. By examining the book of estimates, it has been ascertained that several omissions had happened in carrying out &c. Some addition to the estimated price of the protecting walls has been made. It is believed that the above statements contain a fair and correct valuation of the several items of expense, (with the additions above mentioned) and of the distance and amount of lockage, on each of the proposed canal routes.

Having duly examined and compared the relative merits of the three routes of the canal, from Coshocton to Lake Erie, and compared the expense of constructing them, it appears that the route by the vallies of the Tuscarawas, Portage lake, and Cuyahoga river, is the most feasible, and can be constructed at a less expense by the mile, and for the whole distance, than either of the other routes in question; and I have good reason to believe can be completed for the sum at which it is estimated.

As it respects an ample supply of water on these several routes, I would observe, that the LINE above described can be supplied with greater certainty than either of the others; requiring no additional expense; and its feeder will always be perfectly safe, and can never be diverted from the canal into any other channel.

Kilbourn, Public Documents, pp. 196-197, 201, 203.

APPENDIX D

SCHEDULE

Of Donations to the Canal Fund.

SIMON PERKINS—Agreement to convey to the state one equal third part of the town plat of Akron, Portage county, on condition, that the canal should be located and made on the eastern route, between the Summit Lake and the Little Cuyahoga and a basin made in said town; which has been done. The town contains about 160 acres, and is divided into 306 lots, estimated, from sales already made, to be worth an average of fifty dollars each. One fourth part of this town plat is owned by Paul Williams, who is bound to comply with the above agreement. Date of agreement, May 26, 1825.

Estimated value of 102 lots, at fifty dollars each	$ 5,100 00
Simon Perkins—Bond, dated 25th May, 1825, for $500, cash, payable when the canal shall be completed, and in use as far south as the Portage Summit	500 00
Harmon Bronson—Deed for fifty acres of land; undivided right in a tract of land, situated on the canal line, in the township of Boston; conditioned, for making the Ohio canal on the Tuscarawas and Cuyahoga route, estimated at four dollars per acre; redeemable for $200	200 00
James Duncan—Deed for the north-east quarter of section twenty-one, range nine, township ten, in Stark county, containing 160 acres, redeemable for $300; conditioned for construction of the canal on the east side of Tuscarawas, at Kendal	300 00
James Duncan—Bond dated Nov. 23, 1825, for the laying out of a town plat, at the point where the Wooster and Canton road crosses the canal, and deeding to the state one third part thereof; conditioned for laying out and making a basin and making the canal on the east side of Tuscarawas at that place, and estimated at	1,000 00
Alfred Kelly—Deed dated May 6, 1825, for one equal third part of thirty-four rods, on the Cuyahoga river, near its mouth, in the village of Cleaveland, and running back from the river a convenient distance for water-lots; conditioned for making the canal south from Cleaveland to the Muskingum, and redeemable in four years at $1,000, at the option of the donor; estimated at	800 00
Joseph Mich. Bimeler—Bond for $1,000, dated May 3, 1825, payable three months after the canal shall be made from the Lake as far south as Lawrenceville, Tuscarawas county, in land, labor or provisions	$ 1,000 00
J. H. Brinton—Bond dated April 5, 1825, for $200, payable six months after the canal shall be completed from the Lake as far south as the mouth of Sandy, in Stark county	200 00
Jonathan W. Condy—Bond dated March 9, 1825, for $200, payable six months after the canal shall be completed from Cleaveland as far south as the mouth of Sandy	200 00
Henry Laffer—Bond dated May 5, 1825, for $100, payable six months after the canal shall be completed from Cleaveland as far south as New Philadelphia	100 00
Miner Spicer—Deed dated October 20, 1825, for one acre of land, lying on the south side of the road between Akron and Middlebury; estimated at,	20 00
Jacob Wallz—Bond for twenty-five dollars, dated April 4, 1825, payable six months after the canal shall be completed from Cleaveland as far south as New Philadelphia	25 00

William Campbell—Bond dated May 4, 1825, payable within six months after the canal shall be completed from Cleaveland as far south as New Philadelphia	25 00
Nathaniel Colver—Bond dated April 4, 1825, for $50, payable when the canal shall be completed from Cleaveland as far south as Gnadenhutten	50 00
John Williams—Bond dated May, 4, 1825, for $50, payable six months after the canal shall be completed from Cleaveland as far south as Goshen township; provided the canal be made on the west side of the Tuscarawas river through said township	50 00
Elias Wade—Bond dated May 3, 1825, for $100, payable six months after the canal shall be completed from Cleaveland as far south as Dover, in Tuscarawas county; provided the same be made on the west side of the river through Dover township.	100 00
Christian Deardorff—Bond dated April 30, 1825, for $1,500, payable in land, in Tuscarawas county, in town lots in Dover, six months after the canal shall be completed from Cleaveland as far south as Dover; provided it be made on the west side of the river through said township	1,500 00
Abraham Shane—Bond dated April 30, 1825, for $500, payable six months after the canal shall be completed from the Lake to Dover; provided it be made on the west side of the Tuscarawas through said township	500 0
William Henderson—Bond dated April 30, 1825, for $50, payable at the same time and on the same conditions as the last	50 00
William Bower—Bond dated April 30, 1825, for $50, payable on the same conditions and at the same time as the above	$ 50 00
Propositions have also been received from three gentlemen, owning the land at the several places near Cleaveland where it is proposed to terminate the canal, for conveying to the state from three to eight acres of land as a donation, in order to give the state the uncontrolled use of the water power, which will be there created by the construction of the canal. The land estimated at	300 00
	$12,070 00

"Fourth Annual Report of the Canal Commissioners," December 10, 1825, pp. 50-52.

APPENDIX E

David Long

Claims damage for about three acres of land occupied by a part of the basin at Cleveland above the first stop lock.

As respects the above claim: it is _____--land has been taken. Yet we are of opinion that D. Longs property about said basin is greatly enhanced by the construction thereof, & therefore benefited beyond the damage or loss of sd. three acres.

Abraham Hickiox

Claims for anticipated damage in the probable slide of a bank forming a side of the canal.

As the above claimant has sustained no damage, we give him nothing.

Horau Perry

Claims damage for lands, waters, streams & materials taken & applied & other injuries by him sustained . . . on and about his farm through which the Ohio Canal passes.

Taking into consideration the advantages & disadvantages arising to the sd. Perry from the construction of the Ohio Canal we are of opinion he is entitled to receive towards erecting a bridge seventy five dollars.

Alphonso Haroby

This claim is for occupying land by the canal, severing a small piece of land from the rest of his farm, and for stopping the usual passage of a small drain of water & thereby flowing two or three acres of ground--on Lot 281.

It is represented to us that there is about to be a ditch cut by which the land now flowed will be drained. Therefore, we say that said Haroby has sustained damage & is entitled to receive if said ditch be dug by the first day of May 1828--thirty eight dollars; but in case sd. Haroby receive the above named sum, he shall quit claim his right & title to the small piece of about three fourths of an acre of land lying between sd. canal & the Cuyahoga River to the State of Ohio.

Samuel Dille

Claims damage for stopping a drain by which the waters accumulate and flow several acres of improved land, also for so locating the canal as to cut off & have between said canal & the Cuyahoga River of 8 or 10 acres, all of which is on the lot on which sd. Dille now lives.

Inasmuch as there is a ditch partly constructed & which we are assured will in due time be finished & drain & leave said farm as respects the flowing in as good condition as before, the location of said canal; Therefore for the flowing already done & the severing of one part of said Dille's farm from the other we are of opinion he has sustained damage beyond any benefit to one hundred and sixty six dollars.

Jedidiah Hubbell

Claims for damage done on Lots No. 298 & 299 & 295 in cutting & carrying away timber, digging large & deep holes outside of the embankment and for locating the canal across an old river bed & neglecting to put a culvert in the propper [sic] plan thereby causing a large & offensive body of water to accumulate & steep rot as also for throwing open to the common his improved field.

We are of opinion that sd. Hubbell has sustained a damage beyond any benefit from the construction of the Ohio Canal--therefore he is entitled to receive and his damage over & above his benefit is estimated to be two hundred dollars.

Marvin Cochran

Claims for timber taken from lot No. 5 for Lock & pier on Section 99 for the use of eighteen acres of improvement & for having 8 or 10 acres of improved land between the canal & the River.

Taking the variety of damages sustained by the sd. Cochran in to view and the advantages accruing to him in consequence of the construction of the Ohio Canal, we are of opinion he should receive & be paid eighty dollars.

Joseph A. Paine

Claims for 30 sticks for having timber from Lot 5 for Lock & pier on Section 99.

We are of opinion that sd. Paine has not derived a benefit from the construction of the Ohio Canal equal to his loss of timber; therefore we give him ten dollars.

Bela Brockway

Claims for timber taken for Lock & pier on sections 98 & 99 and damages done on land west of canal.

In estimating the advantages & disadvantages in the construction of the Ohio Canal--we say the sd. Brockway has sustained damage to fifty dollars--but if he _____ sd. sum he shall quit claim to the State one acre for lock house to be erected by the acting commissioner.

Jonathan Edmonds	Claims damage for timber taken for lock & pier on section 99 of the Ohio Canal.
	For the said timber we give the sd. Edmonds nothing for in our opinion his advantages over balance his loss of timber.
Lyman Hammond	Claims for timber used on section 99 of the Ohio Canal.
	We give the said Hammond nothing as he is benefited by the construction of sd. canal more than his loss.
William Green	Claims damage for flowing the fields & separating one part of the farm on which the claimant now lives from the other.
	After a patient investigation of the above claimant's damages and due consideration of the advantages accruing to him from the construction of the Ohio Canal, we consider him entitled to receive and as having sustained damage to one hundred & twenty five dollars provided a bridge be built on sd. Green's farm within a reasonable time by sd. Green & a land of three rods in width be thrown uppon !sic1 & kept open from each end of sd. bridge to the south line of sd. Green's farm.
Jarms Gillmore and Smith Turner	Claims damage for Lands occupied by the Canal, digging holes beyond the embankment, for having a large quantity of grubs on the farm--destroying grain, dividing farm, and other wrongs, &c &c.
	As respects the sd. Gillmore & Turner and also the sd. Turner for himself in view of the above damages except for dividing farm, we do not think them or either of them entitled to receive for any damage they or either of them have sustained because of the great advantages and increase of value brought to the farms & property of the sd. Gillmore and Turner by the construction of the Ohio Canal--but for dividing farm we give them seventy five dollars to assist in erecting bridge & to be paid at the request of sd. Gillmore.
Edmond Gillmore	Claims for lands occupied by the Ohio Canal & for a quantity of gravel taken & dividing farm.
	We consider the farm of the sd. Gillmore much benefited by the construction of the sd. canal and in as much as we have provided the claimant a way by which he may cross from one part of his farm to the other by lanes to & over Green's bridge we give him nothing more than the privilege then reserved to him in the setling [sic] of Green's demand or claim.

Titus Street & Saml. Hughes	Claim for a large quantity of timber used on section 86, Ohio Canal. Considering the great advantages derived to the claimant from the construction of the Ohio Canal, we allow them nothing for their timber.
Stephen Frazee	Claims damage for dividing his farm, for taking earth without the embankments, letting water over corn & grass-all on the farm on which the sd. Frazee lives. After a propper [sic] understanding of the nature of the several claims of the last applicant, we appraise his damage over his benefits and think him entitled to receive on hundred & thirty dollars--provided he quit claim to the state one acre of land to be situated by Commissioner Kelley for lock house.
Jared Skinner	Claims for stone for Lock on section 99 & for aqueduct on 98. Taking the said Skinner's claim in to consideration we consider that the advantages to sd. Jared arising from the construction of the Ohio canal exceed the damage sustained by taking stone as set forth in his claim.
Jared Fuller	Claims damages on amount of road across his farm while the _____ were on it. As to the last applicant we are of opinion that he has sustained damages to ten dollars without any advantage.
Ephraim T. Bailey	Claims for locating & constructing the Ohio Canal through his premises of about three acres and also for excavating a large & deep ditch through his garden. The damage sustained by sd. Bailey above any advantage accruing to him is in our opinion is one hundred & thirty three dollars.
Ezra Wyatt	Claims for stone for quick lime. As quick lime was an article in market, the commissioner says he assigned no lime or limestone owned by sd. Wyatt; therefore we can give him nothing.
William Brannan	Claims for stone taken from his land in Boston.

	Whatever the stone taken were worth--the stone left are more valuable than the whole were before the construction of the Ohio Canal. Therefore, benefits beyond his damage or loss.
Harmon Bronson & Tomlinson	Claim for stone & timber taken from their lands in Boston. It is evident many stone & much timber has been taken from the applicants for the construction of the Ohio Canal. It is also evident vast quantities of stone remain & in a peculiarly favorable situation--and although they or one of them has made a donation of fifty acres of land to the State to aid in the great object, yet their property is so greatly enhanced in value from the construction of sd. canal that in our opinion they nor either of them are entitled to receive any further compensation for materials taken as above.
Joseph Croninger	Claims for land occupied in Northamption by the Ohio Canal--part of Lot No. 4. The application not in season.
Hannah Mather	Claims for land occupied--timber taken & damages in flowing land in the township of Boston. In as much as the claimant's premises are greatly benefited by the construction of the Ohio Canal far exceeding any damage above represented to have been sustained we allow her nothing.
David Jackson	Claims for stone taken for the use of the Ohio Canal. We are of opinion the advantages to sd. Jackson accruing from the construction of sd. canal exceed the value of sd. stone.
Edwin Foote	Claims for lands destroyed by turning the Cuyahoga River across a point of the farm on which he lives & for timber taken. In view of the advantages & disadvantages the construction of the Ohio Canal has been to sd. Foote we think him entitled to receive from the State sixty dollars for damages done--and if he receive sd. sum he shall if required quit claim his right & title to the lands lying east of sd. river.
L. Ingersol	Claims for stone taken by Brown. As sd. Ingersol's claim we say he has sustained damage to fifteen dollars beyond his benefit or advantage.

Sarah Mather	Claims for land occupied by the Ohio Canal--for dividing farm, for stopping drain--for timber taken--Lot No. 2., Boston. The application not in season as respects the occupation of the land by sd. canal or for materials taken but taking the advantages & disadvantages of the Ohio Canal to said Sarah we give towards obtaining a road to a bridge near said premises twenty five dollars.
John Taylor	Claims for a quantity of stone taken from his lot in Newburgh. Taking sd. Taylor's claim in to consideration it is considered he has sustained damage to thirty dollars.
The Administrator on the Estate of Joshua Post, decd., in Northfield	Claims for land occupied by the Ohio Canal--for dividing sd. Posts Farm & for timber taken. As there is a bridge but a short distance from said farm, we allow & say said Adm. is entitled to receive to assist the widow and heirs in getting a road to & from said bridge & for all other damages fifty dollars.
Joshua Post	Claims for timber taken from his premises in Northfield. Considering the advantages to said Post from the construction of the Ohio Canal, we think him entitled to receive from the State of Ohio nothing.
Andrew Johnston	Claims for having stone chips on his field for diging [sic] drain & damand a finer or the charges for making one on each side of the Canal through his farm. We are of opinion the sd. Johnston is not entitled to any thing on his claim because of the great advantages the con-struction of the Ohio Canal has been to him.
Oliver Dewey, Jr.	Claims for lime burnt on lot 42, Northampton. The application says he has not a title to the S. lot and the acting comm. having assigned no lime or stone from sd. premises we can allow him nothing.
George Stamford, Exr. James Stamford of Boston	Claims for dividing farm, taking timber--& opening a waste weir & for land occupied. Taking the several claims of the above Stamford into consideration--the advantages & disadvantages--we are of opinion that the sd. Stamford is entitled to

	receive towards enabling him to build a bridge seventy five dollars provided the sd. Green through open & next open a lane from each and of sd. bridge three rods in width to the North line of said premises for the accommodation of the farm before.
Gipson Gates	Claims for destroying grain on Lots 11 & 12, Northampton, and asks for a bridge and for occupying ground with stone chips. As the bridge above sd. Gates is about to be moved--we give him nothing if sd. bridge be moved--but if it be not moved within one year then we give him fifty dollars.
Samuel Flemelling	Claims for pine timber taken from lot 93 in the township of Northfield. From the variety of evidence before us as to the actual owner of sd. lot together with the vast quantity of timber carried away from and destroyed upon sd. lot before the location of the Ohio Canal; it is some what difficult to ascertain what timber has been taken--and further it is represented to us, & we have good reason to believe, that the sufferer from the loss of timber from sd. lot 93 has other lands & property greatly benefited by the construction of sd. canal--Therefore, taking this claim into consideration and viewing it in the variety of shapes in which it presents itself we give the said Flemelling nothing.
George Wadsworth	Claims for pine & oak timber taken from lot 95 in the Pinery, Northfield. The damage sustained by the last applicant over his advantages from the construction of the Ohio Canal is in our opinion two hundred & fifty dollars.
James Fowler	Claims for timber & stone taken from 92 in Northfield. Making a proper allowance for advantages, we are of opinion that sd. Fowler has sustained damages to the amount of two hundred and fifty dollars.
William McBride	Claim for land destroyed by new river channel--for cutting & timber, overflowing land & for causing stagnant water in the old river bed--cutting of land.
William McBride & J. W. & G. G. Wallace	Claim for damage done Mill Run & Saw Mill--destroying site for grist mill, depriving them of use of saw mill.

J. W. & G. G. Wallace

Claim for destroying land at the upper end of new river bed--destroying land below the saw mill and turning the river in such a manner as to keep a continual wearing and destroying the land in high water.

The three last mentioned claims are so intimately connected; that we have thought it best to put them down in the manner we have, and give the whole claim that attention it deserves; and then endeavour to apportion the damage among the parties as should be just and equitable; without entering in detail the several claims and our opinion of the particular merits of each. Therefore we say William McBride has sustained no individual damage above the benefits accruing. William McBride & J. W. & G. G. Wallace have sustained a damage in our opinion above any benefit they have derived to the amount of three hundred dollars. J. W. & G. G. Wallace in our opinion have sustained no individual damages above their benefits.

David Wadsworth

Claims for lands taken up by the Ohio Canal for dividing his farm & for taking stone, timber, &c.

As respects the occupation of claimant's land, the application is not in season nor is that for taking timber & stone but for dividing farm we give him towards erecting a bridge one hundred and twenty five dollars.

James Dickson

Claims for dividing farm-land occupied--loss of the use of land for want of ____ all on the farm on which he lives.

We are of opinion said premises have suffered a damage in being separated by the Ohio Canal and to assist in building a bridge on sd. farm we give one hundred dollars.

Abel Woodard, Guardian of the Minor Heirs of David Parker, deceased and David Younglove

Claim for camage sustained on Lots 6 & 7 in the township of Northampton in flowing lands by detaining the waters of Yellow Creek by the Ohio Canal embankment--also for timber taken.

As the sd. Guardian & said Younglove put in their claims separately but without pointing out the line between them by which we could determine the amount of land respectively flowed--Therefore we give for the damage done by flowing one hundred and thirty dollars to be directed in the proportion of land flowed belonging to the respective parties.

The Heirs of Jeremiah Wilcox, deceased.	Claims for lime taken by sundry canal contractors from the Wilcox tract in the township of Richfield. Having taken this claim into consideration we are of opinion sd. claimants have suffered damage over & above their benefit derived to sixty dollars.
Clarke Morton	Claims for dividing his farm by the Ohio Canal. Not being satisfied as to the actual owner of the premises on which said Morton's claims that damages has been sustained--we refuse to give an opinion till better advised.
Paul Williams	Claims for flowing land by the waters of the basin at Akron and for stone & timber taken in the construction of the Ohio Canal. Taking into consideration the great advantages of the Ohio Canal & especially sd. basin to said Williams we are of opinion he should receive nothing more than he has done by the construction of said canal.
A. W. Wadsworth & David Long	Claim damage for the heirs of John Wadsworth for dividing farm by the Ohio Canal. We allow the heirs of sd. John Wadsworth seventy five dollars toward enabling them to erect a bridge.
Jared Wells	Claims for dividing farm. We are of opinion that sd. Wells is entitled to receive from the state fifteen dollars towards enabling him to get a road to the bridge above.

"Appraisement of Damages," 1827, Records of Board of Public Works of Ohio, Series 1279, Ohio Historical Society, Columbus.

APPENDIX F

List of Contractors for Sections Nos. 35-91 of Ohio and Erie Canal: 1825-27

Sections and Structures	Contractor	Residence	Date of Contract
26, 35/Locks 22, 23, 24/Culvert	Abraham L. Beaumont and Henry F. Guy	Lyons and Lockport, New York, respectively	June 14, 1825
36/Lock 25/ Culvert	Reuben Brackett	Lockport, New York	June 14, 1825
2, 3, 37, 38/Locks 1, 2, 26/Culvert	Robert Blackstock and Daniel Van Slyke	State of New York	June 13, 1825
Completion of above contract	John Mason Fuller	?	March 15, 1827
28, 39, 40/Culvert on Section 28	Theophilus Pherson, John McWhiney, Henry W. McCormick, and Daniel McKeever (Theophilus Pherson & Co.)	?	June 13, 1825
41	Stephen Snyder	Lyons, New York	June 13, 1825
Dam, Waste Weir, and Towing Path Bridge on Section 41 (across Furnace Run)	William Van Slyke	State of New York	May 26, 1826
15, 16, 42, 45, 46/Locks 17, 18	James Alcott, Caleb B. Merrill, Richard Fitch, George Darrow, Jabez Gilbert 2nd, Ezra Gilbert, Nerum Taylor, and Jacob Kaufman (James Alcott & others)	?	June 13, 1825
Completion of above contract	Erastus Torrey	Portage, Ohio	August 15, 1826
43/Lock 27	James Steward and Alexander McFarlan (executed by McFarlan only; managed by William Van Slyke)	Montgomery County, New York	June 17, 1825

Sections and Structures	Contractor	Residence	Date of Contract
18, 21, 44/Culvert	John Hartwell and William Hartwell	Pittsford, New York	June 14, 1825
47	James V. Cole (assigned to John Hassett, n.d.)	?	June 13, 1825
48/Culvert	Volney Wallace and James W. Wallace	Boston, Ohio	June 13, 1825
49, 51 (grubbing and clearing only)	William Lampson and Jason Hubbell	?	June 27, 1825
49, 51, 61, 63	Patt McNamara, Hugh McNamara, and John Gallagher (rescinded as to Sections 49, 51 on October 22, 1825)	?	July 13, 1825
49, 51 (excavating and embanking)	Volney Wallace and James W. Wallace	Boston, Ohio	November 1, 1825
50/Lock 28	Samulel Y. Potter and Stephen N. Sergeant	Medina County, Ohio	July 12, 1825
52, 53/Locks 29, 30/ Peninsula Aqueduct/ Towing Path Bridge	John Johnson and John Flinn	Rochester, New York	July 13, 1825
Completion of above contract	Alanson Sweet and Horace Wood	?	May 9, 1827
Completion of above contract	William Stow, Jr.	?	November 3, 1827
54	Thomas Gannon, John Somers, and James Doyle	State of New York	July 13, 1825
Completion of above contract	Marshall Tompkins	Medina, Ohio	May 20, 1827
55	Jeremiah Smith	Sandusky, Ohio	July 14, 1825
56/Lock 31/ Pier across river	Harvey Wellman	Cleveland, Ohio	July 14, 1825
57, 58, 59, 65/ Lock 34	Asa Randolph, William Brown, and Patrick Frederick Brannan	State of New York	July 12, 1825

Sections and Structures	Contractor	Residence	Date of Contract
60/Lock 32	Patrick Mitton and James Whalen	?	July 12, 1825
62/Lock 33/ Culvert	Elias Cozad	Euclid, Ohio	July 14, 1825
64, 67	Reuben Smith and Daniel Washburn	Cleveland, Ohio	July 12, 1825
Completion of above contract	William Brown and Merrick Sawyer	?	November 6, 1826
Culvert on 67	Samuel Judson	Hiram, Portage County, Ohio	August 4, 1826
66	Archibald McEnaspy	Buffalo, New York	July 13, 1825
68/Culvert	Alanson C. Stewart	Rochester, New York	July 12, 1825
Completion of above contract	William Brown and Merrick Sawyer	?	April 5, 1827
69, 70	James Whalen	Buffalo, New York	July 12, 1825
71/Lock 35/ Culvert/ Pier	Andrew Johnston and Samuel R. Richards	Boston, Ohio, and Lockport, New York	September 8, 1825
72, 75, 76	John Drake, Jr., William Patrick, Henry F. Guy, and Sylvanus Lathrop	State of New York	October 21, 1825
73, 74/Lock 36/ Culvert/Pier and Mole	Rufus Wright and Spencer Wright	Rockport, Cuyahoga County, Ohio	September 7, 1825
Pinery Feeder Dam Complex	Henry R. Burnam	Boston, Ohio	July 26, 1827
Mole/Culvert	Hilley Mercer, David Long, and Asa H. Baker		
Completion of north end of 78	Theophilus Pherson and John McWhinney	?	May 10, 1827
79, 80/Culvert	John Wightman and Frederick Ingram	?	September 25, 1825
Completion of above contract	Theophilus Pherson & Co.	?	October 15, 1826

Sections and Structures	Contractor	Residence	Date of Contract
82, 99, 102, 103/ Locks 37, 40/ Culvert	Augustus Southworth	Holley, New York	September 8, 1825
83	Willian Van Slyke (assigned to John Dunne and Michael Hickey, November 7, 1825)	State of New York	November 4, 1825
84/Tinkers Creek Aqueduct/Protection Wall	Leander Ransom, John Flinn, and John Johnson	Rochester, New York	September 17, 1825
85, 88/Protection Wall/Road Bridge	James Orr, Daniel O'Brien, Terah Meech, and James Titus	?	September 8, 1825
86, 105/Lock 38	Stephen Snyder, Samuel	State of New York	September 10, 1825 Rosseter, John C. Pease and Paul Snyder
Completion of above contract	Harvey Wellman	Cleveland, Ohio	October 10, 1826
87	John Smith, Connor Clark, James Doyle, and Patt McGuire	Boston, Portage	September 5, 1825 County, Ohio
89, 90	Joel Rosseter and Lawrence Barclay	?	September 26, 1825
91/Lock 39	William A. Harper (rescinded as to Lock 39 on May 4, 1826)	Harpersfield, Ohio	September 7, 1825
Completion of Lock 39	Alexander McFarlan and William Van Slyke	State of New York	May 16, 1826
Completion of 91	George S. Rathbun and John Milliman	?	March 1, 1827

"Ohio Canal Ledger, A. Kelley's Register," [1825-1827], Series 1239, and "Contracts," Records of the Board of Public Works of Ohio, Series 1231, Ohio Historical Society, Columbus.

FORM OF AN AGREEMENT.

ARTICLES OF AN AGREEMENT, made and concluded this —— day of —— in the year —— between —— of the one part, and the canal commissioners of the state of Ohio, for and on behalf of the said state, of the other part, whereby it is covenanted and agreed as follows, to wit: the said part —— of the first part contract and agree to construct, in a good, substantial, and workmanlike manner, all that part of the line of the Ohio canal, which is included in section —— reference being herein had to the location and map of the said line made by —— engineer agreeably to the following plan, that is to say: First, in all places where the natural surface of the earth is above the bottom of the canal and where the line requires excavation, all the trees, saplings bushes, stumps and roots shall be grubbed and dug up at least sixty feet wide; that is, thirty three feet on the towing path side of the centre, and twenty-seven feet wide on the opposite side of the centre of the canal, and together with all logs, brush and wood, of every description, shall be removed at least fifteen feet beyond the outward line of the said grubbing on each side; and on said space of fifteen feet on each side of said grubbing, all trees, saplings, bushes and stumps shall be cut down close to the ground, so that no part of any of them shall be left more than one foot in height above the natural surface of the earth, and shall also, together with all logs, brush and wood of every kind, be removed entirely from said space. And the trees, saplings, and bushes shall also be cut down twenty feet wide on each side of said space so as to be cleared, and also all trees which in falling would be liable to break or injure the banks of the canal. And no part of the trees, saplings, or brush, stumps, wood, or rubbish of any kind, shall be felled, laid or deposited on either of the sections adjoining this contract. Second: The canal and banks shall be so contructed and formed, by excavation or embankment, as either or both may be necessary, in order to bring the same to the proper level, as designated by the engineers or either of them in the employ of said commissioners, so that the water may in all places be at least forty feet wide in the canal at the surface, twenty six feet wide at the bottom, and four feet deep: each of the banks shall be at least two feet, perpendicular measurement, above the top water line; and such a slope shall be preserved on the inner side of the banks, both above and below the top water line, that every foot perpendicular rise in said banks shall give a horizontal base of one foot nine inches: the towing path, which shall be made on such side of the canal as said commissioners or either of them, or any engineer in their employ may direct, shall be at least ten feet wide at its surface, and not more than five feet in any place above the top water line; and whenever a difference in the elevation of the towing path shall occur, the ascent or descent shall not be greater than one foot rise or fall in any sixty six feet in length, and shall be gradual: the towing path shall be smooth and even, shall be composed of the best materials which the adjoining excavation will furnish, and shall be so constructed that the side next the canal will be six inches higher than the opposite side, at the surface, with an uniform and regular slope, so that the water may run off from said path: in all cases where the materials excavated shall raise a spoil bank immediately back of the towing path above its exterior surface, sluices or passages for the water shall either be left or cut through said spoil bank as frequently as one in every five chains, so that the water may readily drain off from the towing path in an opposite direction from the canal: the bank opposite the towing path shall in no place be less than five feet wide at the surface; shall be smooth and even; and neither of said banks shall have a slope of lesser base in proportion to its height on the outer than on the inner side, except where there is a redundance of stuff increasing the width of the bank beyond the requisition aforesaid: all loose and porous materials, and those which are perishable or permeable to water shall occupy the outer extremities of the banks, and for the distance of at least ten feet, measured outwardly from extremity of the top water line on each side, the

banks shall be composed, both above and below the top water line, of the most pure, solid, compact and water tight earth which the adjoining excavation can supply; and no vegetable mould, leaves, roots, grass, weeds, herbage, logs, sticks, brush, or any other substance of a porous or perishable nature, shall be left, laid or in any way admitted into the said space of ten feet last described. Third: In all cases of embankment, and where the bottom line of canal is above the natural surface of the earth, all the trees, bushes, saplings and stumps, on the space to be occupied by the canal and its banks, shall be cut close to the ground, and, together with all logs, brush and wood of every description, shall be removed from a space of at least forty five feet wide on each side of the centre of the canal; and from a strip fifteen feet wide under each bank to be so situated that the inner side of said strip shall be perpendicularly under the outer extremity of the top water line, all the trees, bushes, stumps and roots shall be thoroughly grubbed, and, together with all the logs, brush, roots, grass, herbage, vegetable and porous earth, shall be removed entirely without said banks, so that the banks may unite securely with the solid earth beneath.

And the said part of the first part further covenant and agree to build, found and erect, in a good, substantial and workmanlike manner, lock number — as designated on the surveys, plans, and profiles of ——— engineer, in the following manner, viz: The lock shall be so constructed that the chamber will be 90 feet in length and 15 in breadth in the clear. The walls of the lock shall be of solid masonry laid in water cement, and well grouted with water cement as frequently as once in every two feet, as the walls progress in height from the bottom. The walls shall be five feet in thickness at the bottom of the lock, and four feet at the top water line of the upper canal, with buttresses firmly united and connected with the main wall, and rising from the bottom of the lock to the top water line, four feet in length each and extending back from the main wall four feet. These buttresses shall be 12 feet apart, (measuring from centre to centre.) Buttresses shall be so built that 20 feet in length of the walls opposite the upper gates, and 17 feet in length opposite the lower lock gates shall be 9 feet thick at bottom and 8 feet at the top water line. The face of the walls shall be laid in courses; the stone forming each course to be of uniform thickness throughout the course, well bedded and the joints well cut, so as to make tight joints at least six inches back from the face of the wall. The face of the stones shall be rough cut or hammer dressed, except the hollow quoins, which shall be cut smooth and true, agreeably to a pattern to be furnished by the engineer. When the face stone are of coarse sandstone or freestone, each course shall be at least one foot in thickness, and in all other cases not less than 10 inches. No face stone shall have in any place less than one foot bed, and in no case less bed than face. Binders or headers shall be placed in each course, extending from the face back through the main wall, so as not to leave more than ten feet in any place between headers. The headers in each successive course shall be placed over the space between the headers in the next course beneath; and the face stones shall not be more than half an inch thinner on the back than on the face: culverts, to be formed with stone cut to the proper pattern, shall be constructed in the walls to pass the water from the upper canal into the chamber of the lock, with proper gates, all to be of such form and dimensions as the engineer having charge of the work may direct. The walls shall be covered with a coping of firm, solid stone, of not less than three feet in width, well cut, jointed and bedded, and those next the gates securely cramped together with iron cramps. The lock gates, paddle gates, and mitre sills shall also be formed and made agreeably to the

plan to be furnished by David S. Bates, Esq. or other engineer in the employ of the commissioners; and all the gates shall be formed of such materials as such engineer may direct. The foundation of the lock, unless a smooth and firm rock foundation can be obtained, shall be composed of solid white oak timber, hewed square, and one foot in thickness, to be laid horizontally across the foundation, level and even, as near together as such engineer may direct, and well puddled between the timbers, and covered with three inch white oak or pine plank, free from knots, rots or shakes, well jointed and firmly trunneled or spiked to the timber beneath; a flooring composed of two inch white oak or pine plank, free from rots, knots or shakes, well jointed and securely spiked with spikes ten inches in length, shall be laid throughout the whole chamber of the lock. Wherever the resident engineer or other engineer in the employ of the commissioners, may direct, piles, of such dimensions and in such numbers and places as the said engineer may direct, shall be driven into the lock pit, in order to form a firm and secure foundation for the lock. One or more rows of sheet piling, as the principal engineer, or other engineer in the employ of the said commissioners, may direct, to be formed of good, sound white oak, well jointed, and of such length as such engineer may direct, shall be driven into the ground across the foundation of the lock, and the bank at the breast and sides of the lock shall be well puddled with good, solid, water tight materials, agreeably to the directions of such engineer.

And the said part — of the first part further covenant and agree to erect and build, in a good, substantial and workmanlike manner, a culvert or culverts in such place or places, and of such form, dimensions and plan, as the commissioners or either of them, the resident engineer, or any other engineer in the employ of said commissioners, may direct, which shall in all cases be built of good substantial stone, laid in water cement, and made true and smooth, on the outer as well as in the inner side. And the said part — of the first part further agree to construct a mole or pier of such breadth and height as said commissioners or the engineer having superintendence of the work under them may direct, along the wash or slate banks on said section. Said mole shall be formed of good, solid, durable timber, of which that forming the sides of the mole shall be well hewed, and shall be at least twelve inches square and at least 25 feet in length; the sides shall be laid perpendicularly and securely connected together with ties not less than 10 inches in diameter, clear of bark, which shall be let into the side timbers with a dove tail and square shoulder at each end well fitted to said timbers so as to prevent their moving or sliding upon each other. Each tie shall be let into the timbers, on which it rests, half the thickness of the dove tail at the end, and the other half shall be let into the side timber next above, so that the side timbers will meet and form a tight joint, and the ends of the ties shall be cut off smooth and even with the out side of the mole. The cribs so formed shall be filled with slate, soap stone, or other stone or gravel, and a bank shall be formed on the inner side, next the canal, of the usual slope, of good solid earth as in other cases. The moles so formed shall at each end be securely united with the bank of the canal. All of which shall be done agreeably to the directions of the engineer having charge of the work.

And it is mutually agreed that the said works, during their progress, shall be carefully examined and inspected, by the commissioners and the engineers in their employ, or either of them; and to prevent all disputes and misunderstandings, it is agreed that ——— or some other competent engineer, to be selected by said commissioners or one of them, shall be the inspector of said works, and shall estimate the number of cubic yards of excavation and embankment of each of the various descriptions herein specified, the number of perches of mason work in said lock and the number of piles, if any, in the foundation thereof, the number of perches of mason work and square feet of timber in any culvert or culverts to be erected under this agreement, and his estimate shall be final and conclusive between the parties to this contract. And the said part — of the first part further agree that during the progress

of the work he will from time to time conform to such deviations from the present canal line or level, and to such alteration in the form, slope and dimensions of the banks, towing path, berm, extent and manner of grubbing and clearing, or any other of the works, as the commissioners or either of them, or any engineer in their employ, shall direct. And it is further agreed that if, in the opinion of the inspector aforesaid, the said part — of the first part shall refuse or unreasonably neglect to prosecute the work specified in this contract, such inspector shall have the power of determining that he has abandoned the contract, and such determination shall exonerate the commissioners from every obligation imposed upon them by this contract, and they may immediately thereafter proceed to dispose of the said section in the same manner as if this contract had never existed: and it is further agreed, that whenever this contract, in the opinion of the inspector aforesaid, shall have been completely performed, in every respect, on the part of the said part — of the first part, the said inspector shall certify the same in writing under his hand, together with his estimate of the amount of the various kinds of work herein specified, which shall have been done under this contract; and thereupon the said commissioners hereby covenant and agree to pay, within ten days after notice of said certificate and estimates, to the said part — of the first part, the sum which, according to this contract, shall be due, agreeably to said estimates of the engineer, at the following rates or prices, to wit: For the grubbing ——— for clearing and removing the vegetable substances, agreeably to the terms of this contract, ———, for earth excavation, estimated all earth necessarily excavated between and under the banks, including loose pieces of rock, or stones, of less than one fourth of a cubic yard each, (which are to be estimated as earth excavation,) ——— cents per cubic yard: for the excavation of all solid rock which may occur in this contract, ——— cents per cubic yard: for excavation of loose or detached pieces of rock or stones, (those only to be estimated under this item which are over one fourth of a cubic yard each,) at the rate of ——— cents per cubic yard: for each cubic yard of embankment necessarily made, (to be measured in the bank,) ——— cents: provided, that where any embankment is or can be formed in whole or in part from earth necessarily excavated in the construction of the adjoining parts of the canal, nothing shall be allowed for such embankment, or such part thereof as is, or can be so formed, unless the earth to form the same shall be necessarily removed over one hundred feet: for each perch of mason work (of $16\frac{1}{2}$ cubic feet) laid into the lock, agreeably to the plan furnished, or the direction of the commissioners or either of them, the resident engineer, or other engineer in the employ of said commissioners, to be measured in the wall, the sum of ——— which price is understood to include the expense of the foundation, lock gates, timber and iron work connected with the lock, sheet piling, puddling and securing the head, sides and foundation of the lock, from the passage of the water around or under the lock; but does not include the expense of bearing piles for the foundation, if necessary, nor the excavation of the lock pit or embankment about the lock, which are to be estimated under their proper heads; for each pile driven into the foundation of a lock, by direction of the commissioners or engineers as aforesaid, (except sheet piling) ———: for each perch (of $16\frac{1}{2}$ cubic feet) of mason work, in any culvert or culverts to be erected under this agreement, ——— and whenever the grubbing, clearing, excavation of any of the different kinds herein specified, embankment, or any other work to be done under this contract, shall be increased or diminished by conforming to any alteration of the line, level or plan of the work now made, agreeably to the direction of the commissioners or either of them, or any engineer in their employ, as herein before agreed, such increase or diminution of any or all the kinds of work herein specified, shall be estimated by said inspector agreeably to the foregoing rules, and the sum to be paid to the contractor, shall be increased or diminished accordingly, agreeably to the rates and prices herein

before specified: provided, however, and it is hereby expressly covenanted and agreed, on the part of the said part — of the first part, that this contract shall be fully performed and completed on — part by the — day of

It is further understood that all payments made by the commissioners, under this contract, are to be by draft or check on —— or other bank or agent of the commissioners of the canal fund, where, or with whom, deposites of money may from time to time be made for the construction of the canal.

In testimony whereof, we, have hereto set our hands, the day and year first above written.

[Signed triplicates hereof.]

"Fourth Annual Report of the Canal Commissioners," December 10, 1825, Kilbourn, Public Documents, pp. 212-216.

RECAPITULATION, *shewing the aggregate amount of work of the various kinds under contract north of Portage Summit, the average price, and total amount in money.*

DESCRIPTION OF WORK CONTRACTED.	AMOUNT OF EACH KIND OF WORK.	AVERAGE PRICE OF THE VARIOUS KINDS OF WORK.	Tot. amt. of each item in money.
Grubbing and clearing	2695 chs. 50 lks. 75 lns. 56 8–10 chs.	$6.65 per chn.	$ 17,931 89
Earth excavation	865,169 cubic yards	08 57–100 per cub yard	73,318 87
Rock excavation	12,500 do. do.	,24 88–100 do. do.	3,110 80
Embankment	345,106 do. do.	,11 3–4 do. do.	40,615 45
Lock-pit excavation—earth	59,976 do. do.	,16 61–100 do. do.	9,592 69
do. do. rock	3,489 do. do.	,70 9–10 do. do. [ft lift	2,473 75
Locks	67,014 perches, 373 feet lift	2,87 8–10 pr pch 517,12 35–100 pr	192,838 10
Aqueducts, mason work, abutments and piers	3,531 perches	1,87 8–10 per perch	6,632 00
Wood trunks of do.	Length 296 feet	4,66 9–10 per foot	1,382 00
Foundations of square timber		Aggregate	210 00
Culverts, mason work	3,014 perches	1,96 42–100	5,920 12
Square timber in foundations	10,460 feet	,02 63–100 pr foot when laid	275 20
Protection moles of crib work { Square timber	94,863 feet	,03 82–100 do. do. do.	3,626 07
Round do. for ties	43,854 feet	,01 78–100 do. do. do.	770 02
Filling cribs with stone and gravel	16,681 cub. yards	,16 2–10 per cubic yard	2,701 39
Protection walls of stone	3,510 perches	,28 8–100 per perch	985 90
Piles for protection of banks	1,325 piles	,35 85–100 pr pile when driven	475 00
Piles in lock-pits	1,050 do.	,81 do. do.	850 00
Dam and waste weir			250 00
Miscellaneous items, not included under the above heads,		Aggregate amount	2,540 42
		TOTAL	366,939 67
To the above should be added the expense of building fifteen road bridges over the canal, not yet contracted, and not included in the above abstract, at an average cost of $180,00, including embankment for abutments,			2,700 00
			$369,639 67

Average cost per mile, including locks	$10,971 19	
Average cost per mile, exclusive of locks	4,151 44	
The estimated cost of the line from the old Portage Bridge to Lake Erie, agreeably to the estimates submitted to the last General Assembly,		$446,033 21
To which add ten per cent. to cover expenses of superintendencies and contingencies, agreeably to last winter's report,		44,603 32
Total amount of cost, agreeably to the original estimates,		490,636 53
From which deduct the estimated expense, per original estimate, of line between the above points not under contract	$48,509 31	
Also ten per cent. on the amount to cover contingencies, &c.	4,850 48	
Total amount to be deducted for line not under contract		53,360 79
Cost of line now under contract, agreeably to the estimates submitted to the last General Assembly,		437,275 74
Estimated cost of line now under contract, agreeably to late surveys, at contract prices, including estimate for road bridges		369,639 67
Saving to the state from the original estimates		$67,636 07

"Fourth Annual Report of the Canal Commissioners," December 10, 1825, Kilbourn, Public Documents, pp. 204-205.

RECAPITULATION.—*shewing the aggregate amount of each of the various kinds of work performed on 33 miles 55 $\frac{60}{100}$ ch ins. of canal line, under contract, north of Portage summit, previous to Nov. 20, 1825.*

Kinds of work performed.	Amount done.	
Grubbing and clearing	1,797 $\frac{60}{100}$ chains 22m. 37 $\frac{60}{100}$ ch.	
Earth excavation, in canal,	13 .313 cubic yards	
Ditto, in lock pits,	28, 40 ditto	
Total amount of earth excavation		164,453 cubic yards
Rock excavation, in canal	70 cubic yards	
Ditto in lock pits	640 ditto	
Total amount of rock excavation		710 ditto
Total amount of excavation		165,163 yards
Embankment	44,760 cubic yards	
Ditto, stone and gravel in crib work	393	
Total amount of embankment;		45,153 yards
Locks commenced, three; stone-work laid in ditto 1,744 perches		
Foundations of locks laid, three; walls not commenced		
Face stone for locks, cut and delivered	17,102 feet	
Ditto, cut and not delivered	1,334 do.	
Total amount cut and not laid		18,436 feet
Ditto quarried and delivered, not cut	5, 40 feet	
Ditto, ditto, not delivered, not cut	22,678 feet	
Total amount quarried and not cut		27,318 feet
Total amount of face stone quarried, not laid		46,254
Stone for backing lock walls and for aqueducts delivered		4,140 perches
Ditto, quarried and not delivered		2,235 ditto
Total amount of ditto, quarried and not laid		6,375 perches
Timber procured and laid into cribs	5,540 feet	
Ditto, hewed for cribs and culverts	22,900 feet	
Ditto, ditto, for lock foundations	37,400 feet	
Total amount of timber not laid		60,300 feet
Total amount of timber prepared		65,840 feet
Piles for lock foundations, delivered	600	
Castings for lock , delivered	5 tons and 750 pounds	
Clearing for basons	28 acres	

"Fourth Annual Report of the Canal Commissioners," December 10, 1825, Kilbourn, Public Documents, p. 206.

APPENDIX J

"Specification for the construction of the Aqueduct on Section No. 52--

Masonry. 2 abutments each 30 feet long at bottom of canal & six feet wide with a batter of 3/4 of an inch per foot rise from the foundation on the sides & ends--

1. Pier 30 feet long at bottom of canal & six feet wide with a batter of 3/4 inch per foot rise from the foundation which must be excavated at least 6 inches in the rock at the bottom of the River. The distance between the pier & either abutment at bottom of canal will be 40 feet--

2. Wing walls to be connected with the north abutment to describe each 1/4 of a circle 5 feet wide on top at the abutment 3 feet at the ends & 40 feet wide. To rise 5-1/2 feet above bottom of canal with a batter of 3/4 inch per foot from the foundation. All the above work to consist of stone of suitable size laid in lime mortar & that part of the abut-ments & pier below high water line in the River to be laid in water cement & well grouted all joints on the surface must be pointed with lime mortar & the ends & corners of the abutments & pier & the face of the wing walls rough hewn or hammer dressed.

Trunk of wood, to consist of

8 string pieces, 12 by 16 inches, 48 feet long between two of which on each side are to be secured the foot of the Posts

14 string pieces, 10 by 16 inches, 48 feet long

60 posts, 8 by 16 inches, 5 feet long--the foot of each post to be inserted between the two outer string pieces on each side & firmly trenailed through

44 braces, 10 by 12 inches, 11 feet long

4 caps, 8 by 16 inches, 48 feet long in which the tops of the posts are to be firmly secured by mortise & tenon

4 balance timbers on pier, 12 by 12, 30 feet long [and] 7 balance timbers on pier, 10 by 12, 30 feet long--on these the string pieces will rest & be secured & connected with them by bolts or piers

5 levelling pieces, 8 by 10 inches, 20 feet long to be placed lengthwise on the abutments & piers for the balance timbers & ends of string pieces to rest on

2300 feet white oak or pine plank, 2 inches thick

--Towing Path Bridge--

6 string pieces, 10 by 12 inches, 48 feet long 21 posts for railing six by four inches, 4 feet long--Railing 6 by 4 inches, 96 feet long--1000 feet, 2 inch white oak plank.

The timber for the trunk of the aqueduct is to be the best white oak well hewed & counter hewed. The posts caps, the outside string pieces, balance timbers and braces, & the outside string piece & posts & Railing for the Towing path Bridge must be planed, sawed, or so counter hewed as to efface all hacks & score marks--Tha plank for the trunk of the aqueduct, white oak or pine free from knots, shakes, rots & wane, well jointed & secured to the string pieces and posts by sufficient wooden pins. The plank for the towing path bridge good white oak well laid & pinned.

Articles of Agreement between John Johnson and John Flinn and the Board of Canal Commissioners, July 13, 1825, "Contracts," Records of the Board of Public Works of Ohio, Series 1231, Ohio Historical Society, Columbus.

SPECIFICATION FOR THE TINKERS CREEK AQUEDUCT

To found and erect a good substantial aqueduct over Tinkers Creek on said Section No. 84 the abutments & pier of which shall be built of good substantial stone properly laid and cemented with water cement, with a wood trunk, & a foundation of good sound durable square timber under the whole. The abutments, pier, trunk, sheetpiling and all other things pertaining thereto shall be built on such place and of such shape, size, & dimensions as may be directed by the Acting Commissioner or any Engineer in the employ of the board having charge of said work.

Articles of Agreement between Leander Ransom and John Flinn and the Board of Canal Commissioners, September 17, 1825, "Contracts," Records of the Board of Public Works of Ohio, Series 1231, Ohio Historical Society, Columbus.

APPENDIX K

CONTRACTS FOR DELIVERY OF STONE TO SECURE CANAL EMBANKMENTS

Date	Contractor	Location	Amount of Stone
March 13, 1827	Johnson Patrick and Henry L. Bangs	Sections Nos. 74-75	100 perches each section
April 2, 1827	Johnson Patrick and Henry L. Bangs	Section No. 88	300 perches
May 5, 1827	Calvin Barns and Samuel Stewart	Sections Nos. 78-80	150 perches on Section No. 78 and 500 perches on Sections Nos. 79-80
July 10, 1827	Mason T. Newell	Sections Nos. 71 and 76	150 perches on Section No. 71 and 100 perches on Section No. 7
August 10, 1827	William A. Brower	Tinkers Creek Aqueduct	600 perches
November 28, 1827	Calvin Barnes and	Section No. 80 and 82	300 perches and 1,000 perches respectively

"Contracts," Records of the Board of Public Works of Ohio, Series 1231, Ohio Historical Society, Columbus.

RATES OF TOLL.

At a meeting of the Board of Canal Commissioners, at Columbus, 23d February, 1830:

"*Ordered*, That the following rates of toll shall be charged and collected, on the Ohio and Miami Canals, from and after the first day of March, 1830:

	C.	M.
On all kinds of merchandize, except as hereinafter stated, for the first 100 miles, or any lesser distance, per ton per mile,	4	0
Ditto, for each mile, in addition to 100, per ton per mile,	3	0
On hollow glass-ware, window glass, manufactured tobacco, castings of every description, cordage, nails, dye-stuffs, leather, iron, lead in bars, candles, burblocks, writing and wrapping paper, when transported in lots, unaccompanied by merchandize belonging to the same owners, for the first 100 miles, or any lesser distance, per ton per mile,	2	0
Ditto, for each mile, in addition to 100, per ton per mile,	1	5
On flour, wheat, beans, peas, whisky, all kinds of seeds, salted and fresh provisions, pot and pearl ashes, black salts, beer, porter, cider, lard, butter, cheese, tallow, beeswax, soap, wool, flax, hemp, cotton, leaf tobacco, hides, skins, rags, potter's ware, salt, tar, rosin, household furniture, baggage over 30lbs. for each passenger of 12 years of age or upwards, coopers' ware, carpenters' and joiners' work prepared for building, wagons, ploughs and all other agricultural implements, and on domestic animals for the first 100 miles, or any lesser distance, per ton per mile,	1	5
Ditto for each mile, in addition to 100, per ton per mile,	1	0
On corn, oats, rye, barley and buckwheat, whether ground or unground, and on bran or shorts, per ton per mile, for the first 100 miles, or any lesser distance,	1	0
Ditto, for each mile, in addition to 100, per ton per mile,	0	7
On all mill stones, tomb stones, and other cut stone, grindstones, pig metal, gypsum, clay and lime, for the first 100 miles, or any lesser distance, per ton per mile,	1	0
Ditto, for each mile, in addition to 100, per ton per mile,	0	7
On mineral coal, and iron ore, for the first 100 miles, or any lesser distance, per ton per mile,	0	5
Ditto, for each mile, in addition to 100, per ton per mile,	0	3
On bricks for any distance, per thousand per mile,	1	0
On stone for building, and stone for lime, and other rough stone, per perch per mile,	0	5
On staves and heading, for the first 100 miles, or any lesser distance, per ton per mile,	0	5
Ditto, for each mile, in addition to 100, per ton per mile,	0	3
On boards, plank, scantling, and other sawed stuffs, (reduced to inch board superficial measure,) for the first 100 miles, or any lesser distance, per 1000 feet per mile,	1	0
Ditto, for each mile, in addition to 100, per 1000 feet per mile,	0	5
On timber squared or round, if transported in boats, for any distance, per 100 cubic feet, per mile,	1	0
On square timber, when transported in rafts, per 100 feet, per mile,	3	0
On shingles and laths, per 1000 per mile,	0	2
On posts and rails, for fencing, per 1000 per mile,	2	0
On wood for fuel, and tanners' bark, per cord per mile,	1	0
On charcoal, hay, straw, and vegetables, for any distance, per ton per mile,	1	0
On all articles not enumerated, per ton per mile,	3	0
On boats used chiefly for freight, per mile,	2	0
On each passenger, conveyed in any boat, per mile,	0	5

The ton shall be computed by the net hundred."

"Kilbourn, Public Documents, pp. 402-403.

APPENDIX M

ABSTRACT OF CANAL TRADE IN 1832

During the past year there arrived at Cleaveland, by way of the canal, from the interior, the following articles, on which there has been a saving in the expense of transportation, and a consequent increase of value to the owner, as here stated, to wit:

288,722 bushels of wheat, and 54,404 barrels of flour, equal, in all to 560,742 bushels of wheat, on which there has been an average saving of at least 20 cents per bushel,			$112,148 40
13,801 barrels of pork, saving at least of	$1 25	per bbl.	17,151 25
353,101 bbls. lard,	do	do 1 cent per pound	3,531 01
666,949 lbs. butter, saving of one cent per pound			6,569 49
2,150 barrels whiskey,	do	$1 per barrel	2,150 00
85,711 lbs. cheese	do	1-2 cent per pound	428 55
969 hhds. tobacco	do	$1 per hhd.	969 00
656,949 feet lumber	do	$2 per thousand	1,313 89
261,026 lbs. pot and pearl ashes saving 1 cent per lb.			2,610 26
Mineral coal (12,900 bushels,) building and rough stone, cord wood, oil, flax seed, corn, oats and other coarse grain, and various other articles not enumerated—at least			10,000 00
Aggregate saving on articles of export northwardly by Ohio canal			$186,871 85
During the same period, there has been transported on the Ohio canal, from Cleveland to the interior of the state 29,939 barrels of Onondaga salt, which (at 5 bushels of 56 lbs. to the barrel) is equal to 149,697 bushels. This the farmer and packer of provisions have been able to purchase at a reduction from former prices of at least 20 cents per bushel, and at the same time have procured a better article—saving			29,939 00
5,260,535 lbs. Merchandise, on which there has been an average saving in the cost of transportation, and consequently in the price to the consumer, of at least 5 mills per lb.			26,302 67
7,661 barrels of fish,	saving 1 dollar per bbl.		7,661 00
190,800 lbs. Gypsum,	do	1-2 cent per lb.	954 00
113,954 feet of lumber,	do	2 dollars per thousand	227 90
On various articles, not enumerated, at least			2,000 00
On Pork and other articles transported to the Ohio river, on salt and other articles transported from Portsmouth to the interior—on salt, mineral coal, Iron ore, and various other articles tranported between in intermediate points, at least			10,000 00
Aggregate saving to the State by diminished cost of transportation on Ohio canal			$233,956 42

A different method of computation will give nearly the same result.

Of property chargeable with toll by weight, there has arrived at Cleveland, by way of the canal during the past year	*bls.*	43,694,694
Sent from Cleveland on the canal during the same period	do.	18,724,522
Making an aggregate of property paying toll by weight of	do.	62,419,216

A saving in transportation of an average of one third of one cent per pound on this amount of property, will give a total of	$208,064,05
Add for property not paying toll by weight, such as lumber—shingles—wood, and articles not enumerated, and for property transported to and from the Ohio river, and between places in the interior of the State, an aggregate saving of	23,000,00
Total saving on Ohio canal	$231,004.05

"Eleventh Annual Report of the Canal Commissioners," January 22, 1833, Kilbourn, Public Documents, pp. 37-40.

APPENDIX N

Rates of Toll.

At a meeting of the Board of Canal Commissioners, held in Columbus, February 21, 1833, it was ordered,

That on each article of property transported on the Canals of this State, there shall be charged and collected the rate of toll herein affixed to such article, to-wit:

FIRST—PROPERTY CHARGED WITH TOLL ACCORDING TO WEIGHT.

On each thousand pounds, and in the same proportion for any lesser or greater weight:—

	Cts.	Mills
Of flour, bread or other article manufactured from flour		
Wheat		
Beans		
Peas		
Whiskey, high wines, and other spirits manufactured in the United States		
Flax-seed and all other kinds of domestic seeds		
Salted and fresh provisions, including lake fish, or other fresh water fish		
Oysters and clams in the shell		
Salt		
Pot and pearl ashes		
Black and white salts of lye		
Beer and porter		
Lard		
Butter		
Cheese		
Tallow		
Beeswax		
Tallow candles		
Soap		
Rags		
Wool		
Hemp		
Flax		
Raw cotton in bales		
For each mile not exceeding 100 miles	0	7½
For each mile in addition to 100 and not exceeding 200	0	5
For each mile in addition to 200	0	3

	Cts.	Mills.
Leaf tobacco; Ginseng; Salts; Hides and skins; Horns, horn tips and cattle's tails; Paper's ware; Dried fruits and nuts, the product of the United States; Fur, rosin and pitch; Cooper's ware; Carpenter's and joiner's work prepared for building; Wagons, carts and other carriages; Plows, harrows, and other agricultural implements; Domestic animals; Burr block, the product of the United States, and mill stones made thereof		
	For each mile not exceeding 100 miles	0	7½
	For each mile in addition to 100 and not exceeding 200	0	5
	For each mile in addition to 200	0	3

	Cts.	Mills.
Grain of Corn; Rye; Oats; Barley; Buckwheat; Meal and shorts; Vinegar; Cider; Apples and other undried fruits; Potatoes; Turnips and other vegetables; Grind stones; Comb stones; Cut stone for buildings, or mechanic's uses; Pig or scrap iron; Gypsum; Lime, clay, sand and other earths; Manure; Wood ashes; Charcoal; Hay, straw, and other fodder; Living trees, plants or shrubs; Tanner's bark; Staves, heading and hoop-poles — whether ground or unground.		
	For each mile not exceeding 100	0	5
	For each mile in addition to 100	0	3

	Cts.	Mills
Of mineral coal, iron ore.....		
For each mile not exceeding 50	0	2
For each mile in addition to 50	0	1
Of writing, wrapping, and printing paper manufactured in this State		
Foreign bulk blocks and mill stones made therefrom		
Whetstones and scythe stones.....		
Feathers		
Brooms, broom handles, and broom corn		
	Cts.	Mills
For each mile not exceeding 100	1	0
For each mile in addition to 100	0	7
Hops, the produce of this State....		
Flags for chair bottoms, or other manufactures		
Hollow wood ware		
Window glass and hollow ware, manufactured in this State.....		
Iron castings of every description except pig iron and scrap iron..		
Linseed and rapeseed oil.....		
Machinery and mechanic's tools...		
	Cts.	Mills.
Of raw cotton in bales.....		
Sugar in hogsheads or barrels.....		
Tobacco, (not manufactured).....		
If transported throughout the whole length of the Ohio Canal from the Ohio River to Lake Erie, per mile.....	0	5
	Cts.	Mills
Castings, iron, nail rods, sheet and hoop iron		
Nails and spikes.....		
Anvils, sleages, crow bars, axes and other iron tools weighing over 5 lbs. each.....		
Lead in pigs, sheet or bars.....		
Stone or other		
Cordage		
Dry woods		
Cocks		
Cotton yarns		
Manufactured tobacco		
If transported on the Ohio Canal in a direction from the Lake, for each mile not exceeding 100	2	0
For each mile in addition to 100 and not exceeding 200	1	5
For each mile in addition to 200	1	0
If transported on the Miami Canal, or on the Ohio Canal towards the Lake, for each mile not over 100.....	1	5
For each mile in addition to 100	1	5
Dry goods, groceries, hard and hollow ware, cutlery, crockery and glass ware		
Household furniture and baggage, over 50 lbs. per each passenger of 12 years or upwards, of the family to which the baggage or furniture belongs		
And all other articles not herein specified		
	Cts.	Mills.
For each mile not exceeding 100	2	0
For each mile in addition to 100 and not exceeding 200	1	5
For each mile in addition to 200	1	0

SECOND—ARTICLES CHARGED WITH TOLL BY NUMBER OR MEASURE.

		Cts.	Mills.
On each 1000 superficial feet of boards, planks, scantling and other sawed lumber, (reducing to inch-board measure all such as is over one inch in thickness)..	For each mile not exceeding 50	1	0
	For each mile in addition to 50	0	5
On each 1000 shingles or laths....	For each mile not exceeding 50	0	2
	For each mile in addition to 50	0	1
On each 1000 bricks, for each mile		2	0
On each 100 posts or rails for fencing, for each mile		1	0
On each 100 cubic feet of timber, hewed or round transported in boats	For each mile not exceeding 50	1	0
	For each mile in addition to 50	0	5
On each cubic foot of hewed timber transported in rafts, (round timber in rafts prohibited) for each mile		3	0
On each cord of wood for fuel....	For each mile not exceeding 15	1	0
	For each mile in addition to 15	0	5
On each perch (of 16½ cubic feet) of rough stone for building purposes, for lime, or other purposes	For each mile not exceeding 20	0	5
	For each mile in addition to 20	0	2

THIRD—ON BOATS.

	Cts.	Mills.
On each boat used chiefly for the transportation of freights per mile	2	0
On each boat used chiefly for transportation of passengers, per mile	5	0

FOURTH—ON PASSENGERS.

	Cts.	Mills.
On each passenger of 12 years old and upwards, per mile	0	5

In ascertaining the amount of toll chargeable on any article the weight of the cask, box, bag, crate, vessel or thing in which said article is contained shall be added to the weight of such article, and the toll charged accordingly.

If two or more articles chargeable with different rates of toll shall be contained in the same cask, box or thing, the whole shall be chargeable with the highest rate of toll chargeable on any article so contained.

In case any article the product of this State, or the United States, shall be chargeable with a lower rate of toll than a similar article the product of other countries, the Collector shall charge the rate of toll which would be chargeable on such article if of foreign product, unless the owner, shipper, or master of the boat, shall produce satisfactory evidence to the Collector that such article is the product of the State or of the United States.

Attest: JOHN A. BRYAN,
Clerk of the Board of Canal Commissioners.

History of the Ohio Canals, pp. 163-167.

APPENDIX O

PRINCIPAL COMMODITIES IN OHIO AND ERIE CANAL TRADE AT CLEVELAND: 1832-1860

Year	Arrived via the Canal.					Cleared	
	Wheat Bushels	Corn Bushels	Coal Bushels	Flour Barrels	Pork Barrels	Salt Barrels	Merchandise Pounds
1833	386,760	74,913	49,131	98,202	22,758	28,447	9,896,444
1834	333,868	2,653	95,634	105,326	33,884	36,803	10,127,613
1835	387,232	53,373	50,473	132,319	19,814	46,139	14,839,095
1836	464,756	392,281	84,924	167,539	13,496	22,334	13,394,081
1837	549,141	280,234	183,484	203,691	42,057	62,977	8,776,154
1838	1,229,012	107,514	73,292	287,465	39,055	63,465	18,875,286
1839	1,515,320	65,272	134,881	264,887	30,717	109,916	19,125,852
1840	2,155,407	72,569	172,206	505,461	23,017	77,254	10,783,514
1841	1,564,421	245,018	478,370	441,425	29,704	59,773	15,164,747
1842	1,311,665	218,756	466,844	492,711	53,272	49,456	10,091,803
1843	813,536	227,694	387,834	577,369	13,177	44,310	13,250,758
1844	976,551	263,508	540,305	494,099	36,561	73,325	11,552,460
1845	229,105	146,273	878,785	378,182	18,722	54,918	10,801,868
1846	1,597,597	557,872	850,931	342,210	43,134	58,864	8,243,412
1847	2,195,581	1,382,219	1,212,887	656,999½	16,313½	35,004	10,754,407
1848	1,573,427	615,094	1,959,210	413,437½	26,262½	72,734	10,728,746
1849	862,810	527,464	1,827,040	375,680	21,114½	73,868	10,395,235
1850	1,192,559	331,704	2,347,844	367,737	18,859	61,468	9,711,472
1851	2,529,699	998,059	2,992,342	645,730	12,011	57,864	10,847,118
1852	2,920,534	861,807	3,940,749	760,475	12,198	46,984	8,430,775
1853	1,817,677	168,713	4,969,174	589,486	15,582	39,959	7,495,968
1854	657,267	428,823	4,885,003	297,045	40,618	38,856	5,907,293
1855	.....	196,345	6,339,404	210,168	.....	39,606	3,438,253
1856	384,007	222,125	5,184,344	230,147	9,651	29,009	3,156,080
1857	289,446	164,873	4,055,011	157,724	5,092	21,444	1,576,042
1858	353,895	239,755	2,242,029	253,265	6,271	15,510	1,414,183
1859	29,433	29,762	1,920,961	147,585	6,318	25,241	1,364,530
1860	211,674	78,495	2,018,175	158,243½	456	12,761	1,684,024
	28,532,886	9,253,257	50,341,268	9,754,788½	610,293	1,362,209	261,847,082

Scheiber, Ohio Canal Era, p. 193; "Twelfth Annual Report of the Board of Canal Commissioners," January 13, 1834, p. 13; and History of the Ohio Canals, pp. 175-176.

APPENDIX P

SUPERVISORY AND MAINTENANCE FORCE OF NORTHERN DIVISION OF OHIO AND ERIE CANAL, 1858

RESIDENT ENGINEERS.

Salaries fixed by law. Allowances by Commissioner.

Names.	Location.	Salary.	Allowances.	Time employed.	Amount paid.
Richard Howe	N. D. Ohio Canal	1,500		3½ "	437 50
H. H. Dodge	do	1,500		8½ "	1,062 50

ENGINEER TO GUAGE SURPLUS WATER.

Salary allowed by Commissioner.

Names.	Location.	Salary.	Time employed.	Amount paid.
James G. Haly	Nor. Div. Miami & Erie Canal	$1,500	3 months	$375 00
Same	Nor. Div. Ohio Canal	1,500	3 "	375 00

SPECIAL SUPERINTENDENTS.

Salaries and allowances by Commissioner.

Names.	Location.	Salary.	Allowances.	Time employed.	Amount paid.
M. J. Becker	N. D. Ohio Canal	$1,000 p. annum.		4½ months	375 00

SUPERINTENDENTS OF REPAIRS.

Salaries fixed by law. Allowances by Commissioner.

Names.	Location.	Salaries.	*Allowances.	Time employed.	Amount paid.
	N. D. Ohio Canal.				
A. Medbery & Co.	"Section No. 1"	2,100 00		6 "	1,050 00
Doyle & Miller	"Section No. 2"	1,500 00		6 "	750 00
Wm. E. Mead	Roscoe to Lick'g Dam	720 00		6 "	
S. C. Doan	----------	720 00		6 "	
Jno. Douglass	----------	720 00		6 "	
R. H. Nugen	----------	720 00		6 "	
M. Haviland	----------	720 00		6 "	
D. McCarthy	----------	720 00		6 "	

LOCK TENDERS

Salaries fixed by Commissioner. No Allowances.

Names.	Location.	Salaries.	Time Employ'd	Am't Paid.
	NORTHERN DIV. OHIO CANAL.			
E. Truly	Cleveland locks	132	3 "	66 00
Terrence Harvey	" "	250	4 "	83 36
James Lamb	Pinery feeder locks	312	6 "	156 00
John McGrotty	Peninsula locks	264 288	4 " 3 "	160 00
Henry Monroe	Yellow Creek "	264		91 26
D. Allen	Akron "	264	7 "	154 00
J. B. Dreshell	" "	264	7 "	154 00
R. McGinn	" "	264	6 "	132 00
Wm. Merritt	" "	360	6 29-30"	209 00
N. Smith	Clinton "	240		
Jacob Rinehard	Zoar "			96 62
P. Rosenbaugh	" "	300	3 "	75 00
Benj. Blickensdefer	Trenton "	264	8 12-30"	184 50
R. Stuart	Roscoe "	264		71 00
D. McCarty	" "			40 10
James Murphy	Adams' Mills "	264		150 66
H. Cochran	Dresden "	264	8 "	176 00
Robt. Hamilton	Holmes "	264	5 1-2 "	121 00
W. B. Pryor	Frazeysburg "	264	1 1-2 "	33 00
W. Pinney	Licking dam "	240		142 00
D. Dowling	Rocky Fork "	240	3 "	60 00
S. Doyle	" "	240	4 1-2 "	90 00
P. Heffner	Newark "	264		101 93
Andrew Blaney	Lockport "	200	7 "	116 66
Samuel Keenan	Taylor's "	200	7 "	116 66
B. Johnson	Reservoir "	200	8 1-2 "	141 54
Webb	" "	200	1-2 "	8 33
Richard Paul	Deep cut "	200	9 "	150 00
Wm. McDonnell	Baltimore "	200	8 8-30 "	127 50
James Bryan	" "	200	1 "	16 66
D. Smith	Lockville "	240	8 "	165 00

INSPECTORS.

Salaries fixed by law. No allowances.

Names.	Location.	Salary.	Time Employed.	Am't Paid.
Ed. F. Wilson	Cleveland, Ohio Canal	600	5 1/6 "	258 33
R. J. Loomis	" "	450	6 5/6 "	256 25
John L. Robertson	Akron, "	600	5 "	250 00

WEIGH MASTERS AND DEPUTIES.

Salaries fixed by law. No Allowances.

Names.	Location.	Salary.	Time Employed.	Am't Paid.
Geo. P. Upton	Cleveland, Ohio Canal	$480	2 1/3 Months	$100 00
Daniel Dunton	" "	600	7 "	350 00
C. Patrick (Dep.)	" "	500	3 1/4 "	141 85
W. D. Nott, (Dep)	" "	500	4 1/4 "	187 50

"Twentieth Annual Report of the Board of Public Works of Ohio," December 1858, pp. 18-23.

APPENDIX Q

Specifications for building State boat for the Ohio Canal.

Hull	The hull will be 76 feet in length & 13 ft. 6 inches in width, and four (4) feet deep all the above dimensions are over all or from out to out. Sides and bottom of hull to be constructed of good sound White Oak. The sides to have good boat clasps well secured. The floor timbers to be 2" x 8". The support of the _____ and deck will consist of two fore-and-aft bulkheads made of 2½" inch planks, full length of quarter deck in each price, the planks resting on each other on edge, all well braced, stayed and bolted; the inside of gunwales near top of hull to have plank bolted upon which ends of _____ rest
Quarter Deck	The quarter deck will be made from good sound 2" inch southern yellow pine, laid lengthwise of the boat, and over the gunwales at each side flush, and having a crown of 4" inches in the centre. The entire hull to be thoroughly caulked as well as salted
Cabins	There will be two cabins one on the bow and one on the stern. The stern cabin will be 15 feet in length and the bow cabin will be built back 12 feet from the grub beam and forward to the bow stern. There will be two windows in each side of each cabin Each cabin to be wainscotted up to bottom of windows, and furnished with necessary bunks; stern cabin to have good locker and cupboard both cabins to be decked with good, clear 1½ inch pine
Painting	All to be thoroughly painted inside and out with three (3) good coats of paint including the priming. All material and labor to be first class

"Contract of C.H. Payne of Akron to build State Boat ($900.00 Price)," "Contracts," Records of the Board of Public Works of Ohio, Series 1231, Ohio Historical Society, Columbus.

Specifications for the construction of boarding boat to accompany a dredge on the Ohio Canal.

Hull

The hull will be 76 feet in length over all. 13 feet 6 inches in width over all, and four (4) feet deep over all. Sides @ bottom of hull to be constructed of white oak. The sides to have good boat clasps well secured. The floor timbers to be 2 x 8.

The support of the _____ and deck will consist of two fore-and-aft bulk heads made of 2½" inch planks full length of quarter deck in each piece, the planks resting on each other on edge all well braced, stayed and bolted; the insides of gunwales near top of hull to have plank bolted upon which ends of _____ rest. Hull to be well salted.

Quarter Deck

The quarter deck will be made from good sound two (2") inch southern yellow pine, laid lengthwise of the boat, and over the gunwales at each side, and having a crown of 4" inches in the center. The entire hull to be thoroughly caulked.

Cabins

There will be two cabins one on the bow and one on the stern. The stern cabin will be 18 feet in length and the bow cabin will be built back 15 feet from grub beam and forward to bow stern.

There will be three (3) windows on each side in the stern cabin, and two (2) on each side in bow cabin.

Each cabin to be wainscotted up to bottom of windows, and furnished with the necessary bunks; Stern cabin to have good locker and cupboard.

Both cabins to be decked with good clear 1½" inch pine.

Painting

All to be thoroughly painted inside and out with three (3) good coats of paint including the priming. All material and labor to be first class.

"Contract With Soliday to Build a Boat for the State ($1,000.00)," "Contracts," Records of the Board of Public Works of Ohio, Series 1231, Ohio Historical Society, Columbus.

General Specifications for Construction of Dredge Boat

1 - 3/4 yd. dipper dredge for canal service

Capacity--400-800 cu. yds, in 10 hours

Excavate 12 feet below water, dump at height 15-18 feet above water, and deposit material on either side 45-50 feet from center of the machine.

Hull--65 feet long, 14 feet wide, 4-1/2 feet in depth

Equipped with vertical spuds

"Contract between the Marion Stream Shovel Company and the State Board of Public Works," May 9, 1908 ($6,600), "Contracts," Records of the Board of Public Works of Ohio, Series 1231, Ohio Historical Society, Columbus.

APPENDIX R

Specifications for Rebuilding Canal Locks--1842

The following extract from the specifications, published at the time of soliciting bids for rebuilding locks, will show the manner of constructing the work:

"Face stone shall not be less than twenty four inches in breadth throughout their whole length. They shall be well and evenly bedded, so as to be of uniform thickness throughout the width of the stone. The joints or edges of the face stone shall be straight and square, both on the beds and at the ends, and the corners full, making close joints, the whole distance from the face back. Headers not less than two feet broad and five feet long, and as large throughout the whole length as at the face, shall be prepared and laid into each course, (except the bottom and top courses of the face wall,) alternately, forming what is termed 'header and stretcher,' and so arranged that the headers in each successive course shall be placed over the spaces between headers in the course beneath. The top of each course shall be leveled and trimmed, and the backing so laid as to form a complete bond, and a firm level bed for the headers and stretchers of the course above, and entirely obviate the necessity of 'chinking or pinning.' The perpendicular joints of the face stone are to be made tight by the process generally termed 'sawing.' The materials must be prepared during the summer and fall, and the work of rebuilding commenced at such time, after the close of navigation, as the Resident Engineer or Acting Commissioner shall designate. The work to be completed and in readiness for navigation by the 10th of April. To insure the faithful performance of the work, and its being completed by the time specified, a bond, with good and sufficient security, is required of the contractor."

"Sixth Annual Report of the Board of Public Works of Ohio," December 1842, p. 6.

APPENDIX S

SPECIFICATIONS AND DRAWINGS FOR THE IMPROVEMENT OF THE NORTHERN DIVISION OF THE OHIO CANAL (ATTACHED TO CONTRACTS) WITH MCGARRY AND MCGOWN AND P.T. MCCOURT, FEBRUARY 14, 1905

GENERAL STATEMENT.

The contract will comprise; first — supplies of lumber, stone, cement, sewer-pipe, machinery, and iron-work, to be used by the State employees in repairs; and secondly — of work, and materials complete, to be done and furnished by contract, consisting of aqueduct super-structures, concrete and stone-work for rebuilding and repairing lock-walls, abutments, piers, wing-walls, gate-walls, culverts, and other structures, paving and excavating for culverts, gates and minor structures, and wood, and iron-work, for lock-gates, sluice gates, waste gates, tow-path bridges, and minor structures, and for riprap and protection stone, according to plans and specifications hereto annexed, and special plans and instructions to be furnished as the work progresses.

The quantities of material and the amount of work of any kind will be subject to increase or decrease by order of the Engineer as the nature and exigencies of the work may make it advisable and the rates of payment will remain the same.

The work will be divided into separate parcels, and contracts will be let for all or part of each parcel, or for any number of parcels, as separate contracts, or for the entire work as one contract.

Parcel Number One will be for Portland cement purchased.

Parced Number Two will be for machinery purchased.

Parcel Number Three will be for timber purchased but not placed in structures.

Parcel Number Four will be for riprap and protection stone.

Parcel Number Five will be for three aqueduct superstructures complete.

Parcel Number Six will comprise all the lock-gates, feeder and waste gates, and other minor structures, paving, concrete, and stone-work, for abutments, lock-walls, gate-walls, culverts and minor structures, with all the excavating and materials required therefor, between the north end of the Canal and the highway bridge first south of Lock 36.

Parcel Number Seven will include like items to those of Number Six between said highway bridge and the railroad bridge first south of Lock 28.

Parcel Number Eight will include like items from said railroad bridge to the south end of Lock 22.

The State reserves the right to make any repairs to locks, wing-walls, piers, abutments, or to any work or structure that the engineer may direct, by its own force of workmen, and only such work shall be done by the contractor as he may be directed to do by the engineer.

The repairs to the walls of Lock 29 and some of the other lock and aqueduct walls and all the walls and foundations of the other locks below the usual surface of the water in the lower level at each lock will be made by the State.

Contractors shall take down such upper portions of each wall as they are directed to take out, and then leave the work free from rubbish, or encumbrances and in the best possible condition for the repair men to work to the best advantage on the foundations and lower parts of the walls.

TIMBER DELIVERED.

Timber for raising and resheeting dams, at or near Locks 30 and 36 to be of sound white oak, free from loose knots, sap-wood or decay to be delivered on the site of the work where required and to be sawed to dimensions specified.

Timber for resheeting locks — consisting mostly of two-inch planks, free from sap-wood, loose knots or decay and to be of oak, elm or other acceptable hard wood — to be delivered and distributed to the locks as required; to be in lengths of not less than fourteen feet and all delivered at any one lock to be of the same width, none being less than 10 inches wide and sawed straight and of exact width.

SEWER PIPE.

All sewer pipe to be hard, well-burned No. 1 pipe of double strength and 24 inches in diameter — to be free from cracks, blisters or other imperfections and to be made of shale, and salt glazed, and not to vary in diameter over two inches in any place.

The amount to be used will be determined after work has been begun.

It is now intended to use about 40 feet at each lock, and price bid must include freight on small lots shipped to different stations nearest the work as required.

STONE PROTECTION.

About 5000 tons of protection stone is desired, to be delivered on banks of Canal at points designated, in boat load lots.

Prices will be taken for stones weighing less than 1000 pounds each, and for protection stone ranging from 1000 pounds up and averaging 2000 pounds.

CEMENT.

All cement used on the work by the contractor, or purchased by the State, shall be of some well and favorably known brand, and shall be fresh and in good condition.

Any brand of cement, which is known to the engineer to have entered into work, and which has proved to be of poor quality may be rejected by the engineer.

It shall meet any tests heretofore made or prescribed by the American Society of Civil Engineers, or any other proper tests; all of which shall be open to the inspection of the contractor.

The tests which will be considered of greatest importance will be those for checking and cracking and for fineness. Not less than 95 per cent shall pass through a fifty mesh sieve, and not less than 90 per cent through a hundred mesh sieve. The tensile strength must not be less than 400 pounds to the square inch, for neat cement, one day in air, and six days in water.

Any barrel or lot of cement may be conspicuously marked "condemned" and it shall at once be removed from the work by the contractor.

The contractor shall so arrange his supplies as to give ample time for testing or rejection without delaying work.

Any cement received or purchased, which does not stand these requirements will be rejected and not allowed to be used.

In addition to the cement to be sued by the contractor an additional supply of the same quality estimated at 5000 barrels is desired.

It must be delivered in car load lots, at any designated railroad stations, in or between Cleveland and Barberton, upon the written requisition of the engineer, which shall designate the station to which it is to be shipped.

Shipments must be made from some point not further away than 300 miles, within five days of the mailing of the requisition. The price bid is to include all freight charges to the designated point.

The right is reserved to take from the car and store and to test at any place desired, and such action will not be an acceptance.

If it fails to meet any of the tests or requirements hereinbefore specified, it shall be rejected, and not paid for, nor used on the work. Thereupon the contractor furnishing the same must at once remove it and replace it with acceptable cement.

STONE WORK:

If it is determined to take out any stone work in any lock wall, pier, abutment, or other structure, and rebuild or relay said wall with stone masonry under this contract, it shall be paid for at the price bid, which shall include the cost of tearing out the old work, and all necessary excavation connected with the work. It shall include the cost of cutting or re-cutting all the old stone used and thoroughly cleaning the same. It shall also include all pumping to keep the pit dry.

The contractor will use all the stone which is suitable from the old work, and dispose of the balance so as not to obstruct the channel of the stream or the Canal and when desired the State may remove the stone not used and use it for protection stone. All new stone shall be sound, durable, and well shaped, free from cracks and other defects, and must be equal to the best quality of Peninsula stone.

The face stone shall be accurately squared, jointed and bedded and laid in regular horizontal courses to correspond with the old work or drawings and each course must carry a uniform thickness through the work. Each course must be completed before the next course is commenced.

The stones shall consist of headers, and stretchers, so arranged that not more than two stretchers shall be placed between alternate headers. Foundation courses shall contain no stretchers except such as carry a full bed 3½ feet back from the face of the wall.

Each stone must be laid on its natural bed, which must be properly dressed before laying.

Joints must be true and square with face and must not exceed ½ inch in width at the face or within 6 inches thereof.

Stretchers must not be less than 4½ feet long and carry full beds back 2½ feet. Headers must not be of less width than 1¼ nor more than 1½ times their height; and must be 4½ feet long, except in walls under 6 feet thick, where they must extend through the wall. Stones shall be so arranged as to form the best possible bond, and shall break joints at least 12 inches. Backing shall be of as large stones as the face stones, and similarly arranged, so as to tie the whole wall together. All stones furnished new are to conform to these specifications, and all old stone used, as nearly as possible. All stones are to be laid in full cement mortar beds, and vertical joints filled with same, back 6 inches from face and rear.

Balance of the interstices will be filled with concrete, and no spalls allowed except they be fully bedded in soft concrete or mortar.

EXCAVATION.

The excavation for culverts, and for walls of gates, and other minor structures, shall be of sufficient dimensions to give one foot of clear space beyond the paving. The trenches must be level and smooth in the bottom, and must be kept clear of water by the contractor at his own cost so as not to interfere with the proper construction of the work. All old stone taken up shall belong to the State, and shall be piled up at contractor's cost, in such a manner as to be conveniently reached for removal by boat after the work is completed.

Where a sufficient foundation for the walls and pavement is not found at the proper depth, shown by drawings, the earth shall be removed to such depth as may be required and kept clear at the price bid and a foundation of hewn timber or concrete shall be put in as directed by the engineer. For such extra work on foundations the contractor shall receive the price bid.

CEMENT MORTAR.

Cement mortar will be made of the same materials, in the same proportions, and mixed in the same method, as is required for cement concrete mixed by hand before the gravel or stone is added except that smaller batches will usually be made. Grout will be the cement mortar made wet and thin so as to flow freely.

Neither cement-mortar, grout nor concrete, will be allowed to be used, or remain upon the works, after it has taken its initial set; but all such must be at once removed by the contractor, and destroyed.

CONCRETE.

Concrete will be composed of one part of Portland cement, of the quality specified, by measure, and three times the volume of clean, sharp lake sand, screened over a number 4 screen, and three parts of clean, hard gravel, free from slate, shale or dirt, passed over the same screen, and two parts of clean, hard crushed stone; no piece of stone or gravel to be over 2½ inches or under ½ inch greatest dimension.

MIXING.—In mixing concrete, if hand labor is used, a tight floor of planks, iron or stone, must be used for a mixing floor.

The sand must be dry, and be shoveled into a bottomless box placed thereon, until it is level full, and measures three times what a bag of cement will fill. The box is then to be removed, and a sack of cement poured on top of the sand. The mass must then be shoveled over thoroughly, until the mixture is uniform in color and without streaks.

Sufficient water will then be added, to make a stiff mortar, which shall then be thoroughly shoveled over and mixed. The stone and gravel properly wet down will next be measured in a box of proper size, and added to the mass, which must now all be so thoroughly mixed that all parts of every stone will be coated with mortar.

CONCRETE.

All concrete for lock-walls, culverts, piers and abutments for aqueducts put in under this contract shall be mixed in a machine.

The machine must be of a design approved by the engineer, and in good condition, and operated in every way as he may direct.

The sand, stone, gravel, and cement, must be measured in the same manner as for hand mixing, before being shovelled into the mixer, or by some method equally certain, and must be approved by the engineer before it can be adopted. The amount of mixing that it requires will be designated by the engineer, and it must be such as will at least produce as perfect results as are given in the requirements for hand mixed concrete. No concrete, which in fact, or in the opinion of the engineer, falls below this standard will be accepted or allowed to be used.

In walls other than lock walls, culverts and arches, hard-boulders, or fragments of hard, sound sandstone, well cleaned and not exceeding one foot in any dimension, may be placed by hand in the soft concrete, providing that no stone comes nearer to the surface of the wall, nor to any other stone so placed than three inches.

DEPOSITING.—Concrete shall be deposited in layers not exceeding six inches in thickness, before ramming. In joining new concrete to old work or to concrete already set, precaution shall be taken to secure a perfect bonding, by cleaning and washing the old work, and by spreading over the surface a thin layer of mortar before the new concrete is placed.

SEPARATE BATCHES.—In any layer the batches shall follow each other so closely that each one shall be placed and rammed before the succeeding ones have set, so that each day's work will constitute a monolith. After any concrete has set nothing shall be done to disturb it, by placing new concrete over it, or allowing any tamping or weight thereon for 48 hours.

Lock walls shall be formed in sections of not over 20 feet each in length, each of which shall constitute a monolith, if possible; each shall be made against end forms, so as to lock together as shown on drawings.

The arches of culverts will be divided into not less than three parts by partitions, set lengthwise of the arch, and radially with it, and so arranged that after one division is finished, the partition will be removed and the next division built, and so arranged, if possible, that each section will constitute a monolith.

TAMPING.—The concrete shall be well tamped, and shall be put in as wet as it can be tamped, without separating the water too much from the other materials, and no wetter or drier, unless so directed by the engineer.

DEFECTIVE MATERIAL OR WORK.—No plastering will be allowed on the surface and any defective or porous work or any work made of condemned or improper material shall be cut out or torn down at once when directed by the engineer and replaced with proper materials and work at the expense of the contractor.

Concrete will be used in constructing new parts of lock walls, culverts, sluice-gate walls and other structures, where designated.

The price bid will be for the concrete set in place, and will cover the cost of material and work and all forms connected therewith.

It will include the tearing out of the old lock and aqueduct walls, where used and piling up the stone taken out, in convenient form as directed. Such stone taken out will be the property of the State except as hereinafter specified. It will also include all excavation necessary to place the new work in position. In culverts and gate walls, the contractor will be paid for the amount or excavation directed to be made.

In rebuilding lock walls, or aqueduct walls, the contractor will be allowed to use old stone taken from the walls for the following purpose only: The stone so used to be thoroughly cleaned with a wire brush and washed; these stones shall be used to form the back of the wall, and shall be laid in such shape as to run in even parallel courses having no joint or bed of less than two inches. Beds and joints must be well filled with cement mortar. No part of any stone shall come nearer to the face or ends of the wall than eight inches, or within three feet of the top. One course may be placed above the upper back course, which in no place shall come nearer to the back, front or end of the wall or to any other stone in the course than eight inches or within eighteen inches of the top of the wall.

Stones laid in the back shall be so placed as to break joints, at least eight inches, with the courses below, and so as to make the best possible bond. One-fourth in number shall be headers extending to within eighteen inches of the face of the wall.

The contractor shall use only such stone, and place the same, as directed by the Engineer.

FORMS.—The contractor shall construct suitable forms, and centering, the cost of which for material and labor shall be included in the price per cubic yard for concrete. The interior shape and dimensions of forms shall be such that the finished work shall be of the form and dimensions shown on the plans, or as ordered by the engineer. All forms shall be set true to the line designated.

They shall be so built as to remain firm and true until the concrete has set and hardened perfectly. Forms must be satisfactory to the engineer. They shall remain in place until he directs their removal. In no case shall they be removed before 48 hours from the time concrete was placed.

EXPOSED FACES.—The exposed faces and copings of all concrete shall be formed of cement mortar, identical with the mortar used in the concrete back of them and shall not be less than two inches thick.

A plate or grating of thin metal with convenient handles shall be used to guage the thickness of the facing. The facing mortar will be deposited between this plate and the form and the concrete placed immediately back of it. The plate will then be withdrawn and before setting the whole mass shall be thoroughly rammed so as to blend them together. The face of the wall next to the stone must then be thoroughly rammed with a spade, or other suitable tool, so as to insure a dense even surface.

After the forms have been removed, the entire surface shall be washed over with a thin coating of neat cement as directed.

SPRINKLING.—All finished or unfinished work shall be kept moist by sprinkling and shall be kept covered with canvas or other approved covering for two weeks after setting.

FREEZING.—No concrete will be allowed to be laid between November 1st and March 15th except by special permission of the engineer; and none will be allowed to be laid in freezing weather or when such weather is threatened, under any circumstances.

Any work laid under such special permission shall be protected from frost by such methods as the engineer may direct.

TIMBER FOR SLUICE GATES, FEEDER GATES, WASTE GATES, frames for same, tow-path bridges and minor structures shall be of the same quality as that required for lock-gates and shall include the material and all work necessary to attach iron work, whether new or old, thereto, and to frame and dress and place the same in position ready for use.

Timber in foundations may be of any sound wood properly hewn or sawed; if sawed, or hewn on two sides only it will be measured as it would measure fully squared.

New iron furnished shall be paid for at the price bid.

LOCK GATES.

At each lock there will be required one set of short gates, and one set of long gates with hollow quoins for each gate and at the weigh lock one set of gates, the gates for outlet lock being of special size, all to be complete and set in place for the price bid. The timber used shall be of the best quality of seasoned white oak, free from sap wood, knots, shakes, and dead or decayed wood. It shall be sized and planed so as to form close, tight joints. The whole surface shall be planed and covered with two coats of best iron clad paint in linseed oil; the hollow quoin before, and the gates after hanging. The price bid to include all timber, paint and labor to complete said gates and to place either old or new iron work thereon. When new iron is required, the contractor will receive an addition, according to the weight furnished.

SHEET PILING.

At the end of sluice gate walls, culverts and other designated places, sheet piling five feet deep will be required, to be of sound, durable 2-inch plank. A trench will be dug to the proper depth, and the sheet piling set on end therein and so that the edges will remain in close contact. The trench will then be filled up with stone from the old work, or with rip rap stone, and the interstices filled with concrete, as directed. The price bid for sheet piling to cover the excavation of the trench, and the stone and concrete used in rebuilding, as well as the timber and labor.

IRON WORK.

Iron work shall be furnished for rack and pinion hoisting gears for flood gates, lock gates, and wherever required, similar to the drawings, and fitted together in a proper workmanlike manner. Iron for wickets, slides and frames must be planed, bored, dressed and fitted so as to make tight joints and easily working parts, and as shown on drawings, and so that the whole will be of the best material and workmanship.

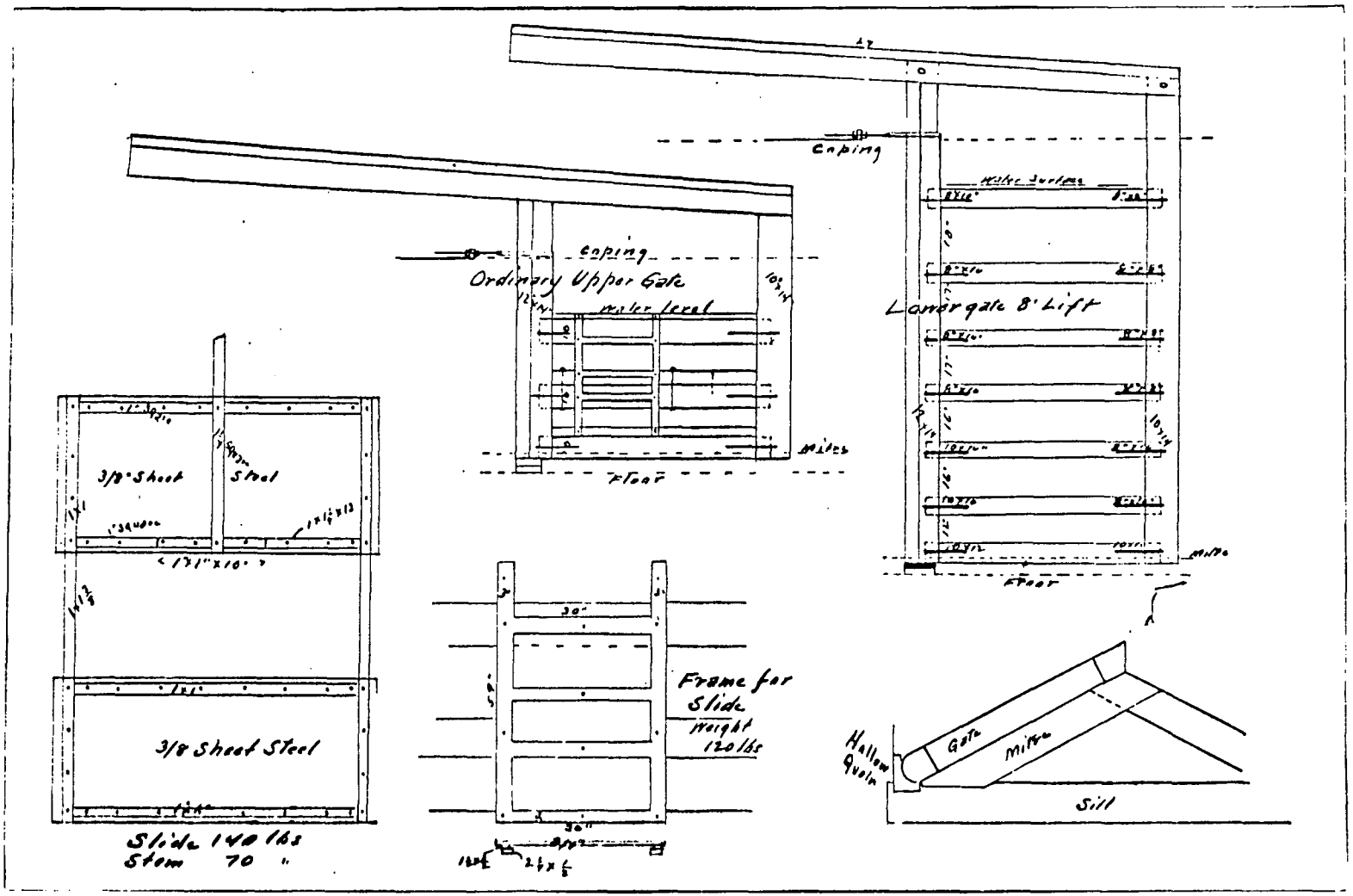
PAVING.

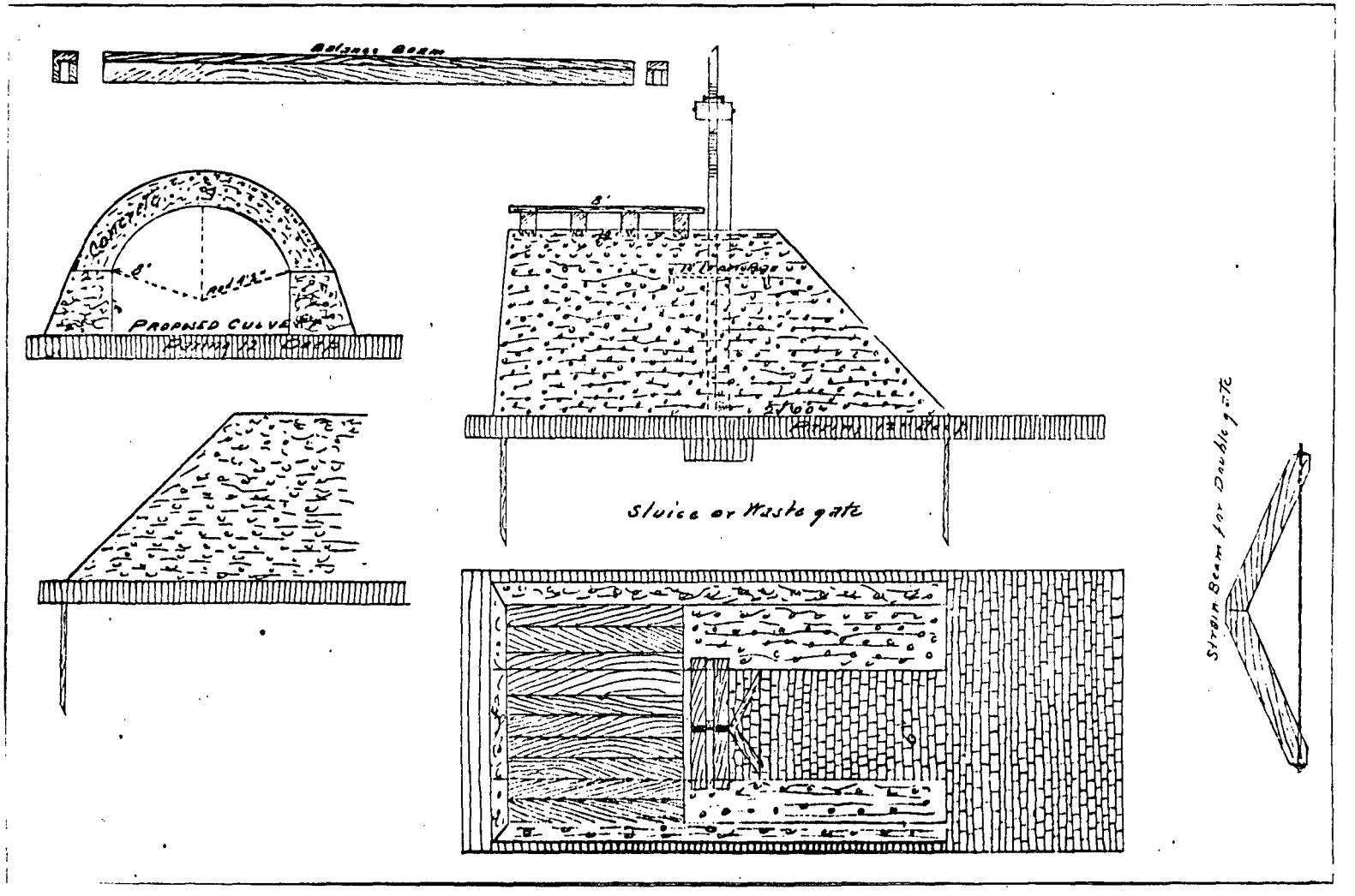
Stone paving shall be made where required for culverts, and gate walls, using durable stone approved by the engineer. Stones may vary from two to six inches in thickness and must be flat in front and back and each stone must have a width of not less than twelve inches and must not be less than eight inches long. The stones shall be laid on edge in straight parallel courses at right angles to the walls and placed closely together. The top of pavement must be even, with no inequalities exceeding one inch. After being laid the whole surface must be flushed with grout so as to fill all interstices.

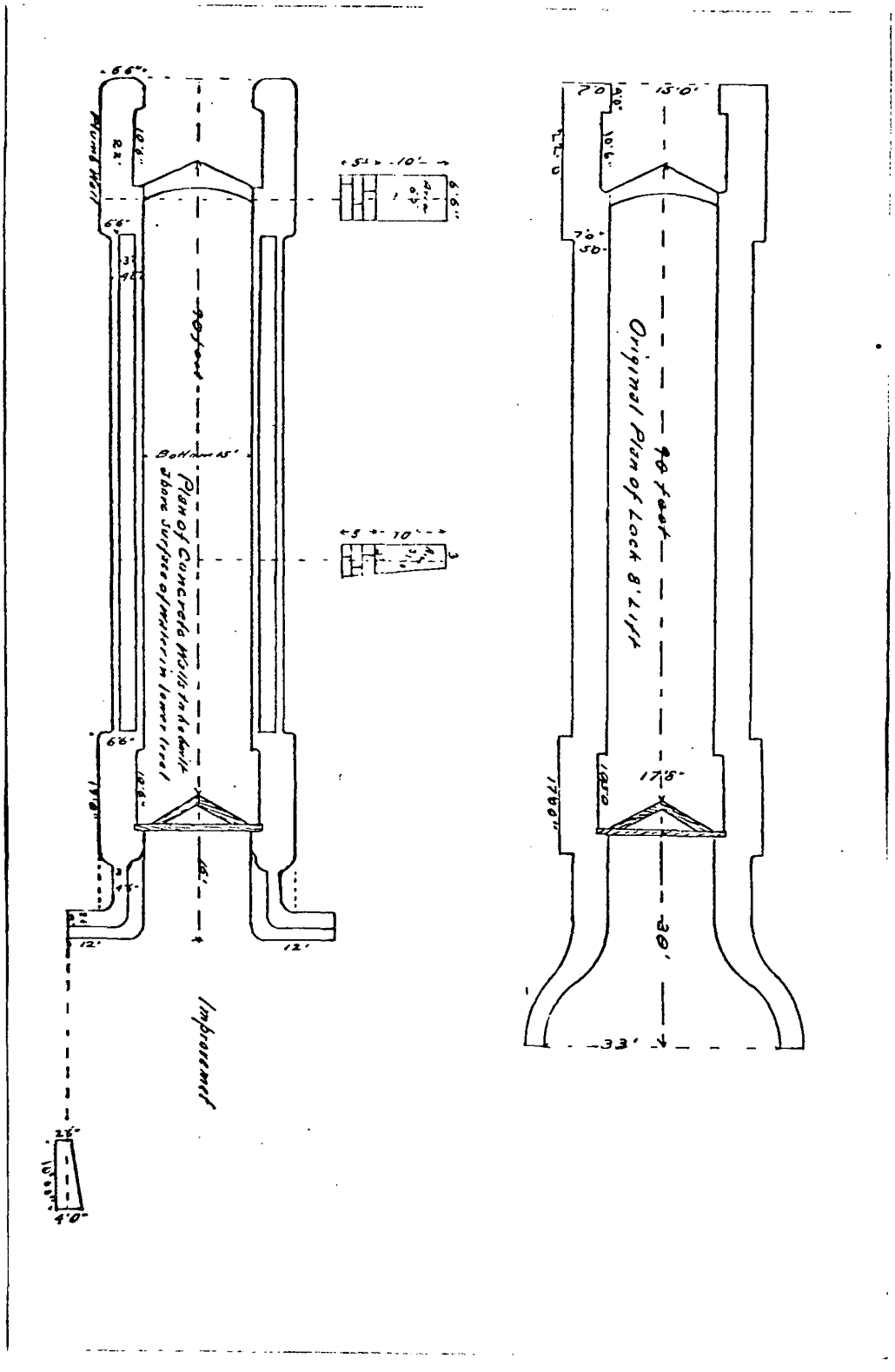
AQUEDUCTS.

Three aqueducts will be required; one at a point about seven miles from the Cleveland weigh lock, which shall have a clear span of about thirty feet, and shall have a trunk forty feet long, and twenty-two feet wide across inside of trunk; one at Tinker's Creek about ten miles from the weigh lock, to have two spans of about thirty-five feet clear each, or one span of about seventy-six feet clear and to be of the same width; and one at Peninsula, having two spans of about thirty-eight feet each, or one clear span of about eighty-four feet, and a width of eighteen feet of water. Aqueducts to be of steel or combination, per plans and specifications to be submitted by bidders. Suggestions as to plans and specifications will be furnished by engineer on request. The price bid includes erecting complete, ready for traffic; but does not include removal of old structures, nor repair of stone work. All parts are to be built so as to sustain a weight of four hundred pounds per square foot of water surface, in addition to weight of structure; with a factor of safety of six. Full working drawings and complete strain sheet to accompany each bid.

The State will give contractors sixty days notice setting the time at which it is proposed to have the abutments and piers ready, and after they are prepared the two aqueducts nearest to the weigh lock must be completed within thirty days and the one at Peninsula within sixty days. . . .


Coping
Ordinary Upper Gate
Water level
Floor
Lower gate 8' Lift
Coping
Floor
3/8" Sheet Steel
3/8" Sheet Steel
Slide 140 lbs
Stem 70 "
Frame for Slide
Weight 120 lbs
Hollow Quoin
Gate
Mitre
Sill


Balance Beam
Concrete
8'
PROPOSED CULVERT
Sluice or Waste gate
Strain Beam for Double gate



Contract for Improvement of the Northern Division of the Ohio Canal between the Board of Public Works of Ohio and McGarry & McGown, February 14, 1905, and Contract for the Improvement of the Northern Division of the Ohio Canal between Board of Public Works of Ohio and P.T. McCourt, February 14, 1905, "Contracts," Records of the Board of Public Works of Ohio, Series 1231, Ohio Historical Society, Columbus.

APPENDIX T

SPECIFICATIONS FOR THE IMPROVEMENT OF THE NORTHERN DIVISION OF THE OHIO AND ERIE CANAL (ATTACHED TO CONTRACTS WITH THE ATLANTIC FOUNDRY COMPANY AND THE KING BRIDGE CO., JUNE 14, 1905)

GENERAL STATEMENT.

The contracts will comprise: *First,* (a) All the cast iron to be used at or on the locks and lock-gates, and (b) All the wrought iron or steel, including bolts, nails, lag screws, hoisting attachments, etc., required at locks, lock-gates and dams; *Second,* One aqueduct about 7 miles from Cleveland Weigh Lock known as the Mill Creek or Nine Mile Aqueduct, having a clear span of 30 feet; *Third,* One aqueduct at Tinker's Creek 10 miles from Weigh Lock, having two clear spans of 35 6-10 feet each; *Fourth,* One aqueduct at Peninsula, having a clear span of 84 feet or two spans of 42 feet each.

IRON WORK.

Iron work shall be furnished for rack and pinion hoisting gears for lock gates, and wherever required, similar to the drawings, and fitted together in a proper workmanlike manner. Iron for wickets, slides and frames must be planed, bored, dressed and fitted so as to make tight joints and easily working parts, as shown on drawings, and so that the whole will be of the best material and workmanship.

IRON.

Castings must be of tough, gray iron, free from cold sheets, or injurious blow-holes, true to form and dimensions, and of a workmanlike finish. Sample pieces, cast from the same heat of metal, in sand molds, shall be capable of sustaining, on a clear span of 12 inches, a central load of 2400 pounds, when tested in the rough bar. A blow from a hammer shall produce an indentation an a square edge of the casting without flaking the metal. They shall be machine worked where plans call for same.

WROUGHT IRON OR STEEL.

All steel work must be of medium steel, having an ultimate strength of not less than 60,000 lbs. per square inch and an elastic limit of not less than one-half its ultimate strength.

Before or after heating to a low cherry red and cooling in water at 82° degrees Fahrenheit this steel must stand bending to a curve whose inner radius is one and one half times the thickness of the sample, without cracking.

No work shall be put upon any steel at or near the blue temperature or between that of boiling water and of ignation of hard wood sawdust.

The finished bars, plates and shapes must be true to dimensions, free from cracks on the faces or corners and have a clean, smooth finish.

The contractor shall furnish without charge such specimens (prepared) of iron or steel proposed to be used as may be required to determine their character.

Full sized parts may be tested at the option of the engineer, but if tested to destruction, such material shall be paid for at contract price, if it proves satisfactory. If it does not stand the specified tests it will be considered rejected material and will be solely at the cost of the contractor.

AQUEDUCTS.

Mill Creek and Tinkers Creek aqueducts shall have trunks with a clear water surface 22 feet wide, and Peninsula aqueduct shall have a width of 16 to 18 feet in the clear. Bids will be considered for superstructures of reinforced concrete or other material, made in accordance with plans submitted by bidder with their proposals. Preference may be given to proposals made for aqueducts conforming to general plans and specifications on file at the office of the Board, and at the Canal Office, Lock 1, Akron, Ohio. Said plans contemplate riveted steel trusses and wooden trunks. All parts to be built so as to sustain a weight of ~~900 to 1000 pounds per square foot of water surface~~ in addition to weight of structure with initial strains of 15,000 pounds per square inch in compression and 16,000 pounds in tension for steel of prescribed quality. Working drawings showing full details must be furnished by the contractor and approved by the Engineer before construction. If drawings are not so furnished when required, or if the same are not approved by him, the Engineer shall have drawings prepared and when approved by him the contractor shall make his work conform thereto. The price bid includes erecting complete, ready for traffic; but does not include removal of old structures nor repair of stone work.

Cooper's specifications for steel highway bridges 1901 edition, shall apply as far as pertinent, except where plans and specifications determine otherwise. The State will give contractors thirty days' notice setting the time when it is proposed to have the abutments and piers ready, and after they are prepared the two aqueducts nearest Cleveland must be completed in thirty days and the one at Peninsular in sixty days. . . .

Contract for Improvement of the Northern Division of the Ohio Canal between the Board of Public Works of Ohio and the Atlantic Foundry Company, June 14, 1905, and Contract for Improvement of the Northern Division of the Ohio Canal between the Board of Public Works of Ohio and the King Bridge Co., June 14, 1905, "Contracts," Records of the Board of Public Works of Ohio, Series 1231, Ohio Historical Society, Columbus.

APPENDIX U

REBUILDING PENINSULA DEEP LOCK NO. 28.

AND REFERENCE TO OTHER DEFECTIVE WORK ALONG THE BIG CUYAHOGA RIVER, NORTHERN DIVISION OHIO CANAL.

Lock No. 28, north of the Portage Summit, commonly known as Peninsula Deep Lock, was constructed by P. T. McCourt as awarded to him by contract under date of February, 1905, and work completed during the same year.

This lock was, unfortunately, constructed of gravel taken from the Cuyahoga River, which gravel, after a careful examination by the engineer and inspector in charge of the field work, was pronounced suitable for the work, but which afterwards proved, by chemical analysis, to contain ingredients causing deterioration of the concrete when exposed to the elements.

There was also found faulty construction caused by the improper cleaning of the large stone placed in the wall, as provided for in the specifications, and the sagging of the forms which so affected the alignment of the walls as to interfere with the utility of the lock, all due in a large measure to the inexperience of the contractor, in the precision required in canal work of this kind, and the newly appointed and yet unorganized condition of the engineering force in the field. Therefore, after careful consideration by the department, it was deemed advisable by the board and chief engineer to maintain a uniform standard of efficiency to rebuild this lock.

Actual work was commenced after first having all the material (sand and cement) entering into its construction, given laboratory tests by the Osborn Engineering Co., of Cleveland.

It being deemed advisable, for economical reasons, to make use of as much of the old structure as possible, therefore, the bottom 14′ of the lock comprising five feet of the original stone lock and nine feet of the lock constructed by McCourt was refaced, the average thickness of the facing being about 12 inches, which was thoroughly reinforced with 1/2 inch steel rods.

The upper or top six feet, which is most subjected to thrust and wear of passing crafts together with the ravages of the elements, was rebuilt the entire thickness of the wall.

In addition to the rebuilding of the defective portions of the old lock, the wing walls were extended, backfilling and grading completed, lock gates reset, wasteway extended, that was not included in the specifications of the McCourt contract, and all minor details properly arranged to insure the perfect working of the lock.

The entire amount of money expended in the rebuilding and extensions being $4,500, of which amount, by careful application, $2,250 is chargeable to defective work and the balance for extensions. The funds used both in the rebuilding of the defective work and all extensions were drawn from the earnings of the canal, and not from the improvement appropriations.

To have rebuilt the entire lock with the extensions as made, and all appurtenances thereto belonging, as computed from unit prices now in force and comparing same with like structures, would cost approximately $9,000.

The work of rebuilding of this structure was done by your superintendent of repairs under the personal direction of your assistant engineer, Mr. H. W. Meacham, the latter attesting to the correctness of this statement as taken from his report on file in this office.

In extenuation of mistakes made in these premises, resulting in the rebuilding of the defective work, I beg to submit, that the unit price for concrete in place as done under the McCourt contract amounted to $4.65, and excavation at 27 cents, while, as will be seen by a statement herewith given under the heading of "appropriations and expenditures, etc.," the average price paid for concrete in place since that time was for the Miami & Erie work, $5.41, and for the continued work on the Ohio canal, the 21 locks at Akron and south of Akron, at an average rate of $5.40 per cubic yard of masonry in place, while prices paid for excavation on these latter improvements amounted to 51 and 47 cents respectively.

I have further to say in this connection that "the sagging of the forms affecting the alignment of the chamber walls of the lock" was not discovered until the locking of a close-fitting steam dredge hull, after the final estimate was made.

Regarding the use of unsuitable gravel and sand that not only entered into the building of the "Peninsula Lock," but on some other works along the Cuyahoga Valley, that was passed upon by the engineer and inspectors in charge of the field work, and "afterwards proving to contain ingredients causing deterioration of the concrete," the important element causing the physical defects, I have to offer the following brief statement having to do in the premises, to-wit:

Quoting from the opinion of a well-known expert, "The peculiarities of the Cuyahoga River gravel are of a nature that might readily deceive the most careful engineer or contractor. The material generally looks so good, sometimes even on a careful examination, and the injurious effects of the impurities are of such an insidious nature, that many people have been deceived in their judgment as to the value of such gravel for concrete material."

Also from Mr. T. D. Paul, assistant engineer, who was in charge of the work, "Upon the appearance of these defects in 1906, I held up the balance due contractors and demanded that they remove and make good those portions of their work which seemed to be defective. They refused to do so, alleging that we had specified and accepted sand and gravel and cement not suitable for good work, and it was our fault and not theirs." The contractors sustaining their position and the best settlement that could be made them followed, as final estimates will testify. Mr. Paul cited a railroad case in the same valley that suffered in like nature.

"Seventy-First Annual Report of the Board of Public Works of Ohio," December 1909, pp. 76-78.

GENERAL BIBLIOGRAPHY

A. Primary Sources

"Canal" in this bibliography means the Ohio and Erie Canal.

Throughout the bibliography, the Ohio Historical Society will be abbreviated OHS. This organization houses the official Ohio State Archives (OSA), which should not be confused with the Ohio State Library. The Cincinnati Historical Society will be abbreviated CHS. This organization was established in 1831 by the Ohio General Assembly as the Ohio Historical and Philosophical Society. Most of the primary source materials used in this report were located in these two institutions.

1. Public Records

The present Ohio Department of Public Works has descended from a long line of boards and commissions created to oversee the Ohio canal system:

1822-36	Board of Canal Commissioners
1836-38	Board of Public Works
1838-39	Canal Commission
1839-1912	Board of Public Works
(1888-1906)	Canal Survey Commission
1912-21	Superintendent of Public Works
1921-27	Department of Highways and Public Works
1927-Present	Department of Public Works

Most public records pertaining to the Cuyahoga Valley's Ohio and Erie Canal originated in one of these agencies. Such records include:

Annual Reports (1822 to present) -- Most of these can be found at the OHS in Columbus and at the CHS. The reports sometimes include special annual reports by the Chief Engineer, as well as information on types of canal work done, costs, personnel, use of the canals, and pertinent legislation.

Public Works Documents -- Records of the Department of Public Works and its predecessors that deal with the Ohio canals are housed in the OSA. These records include:

Series 1199 -- Abstract of awards to property owners for damage incident to construction of the canal.

Series 1231 -- Contracts made for the construction of the Ohio and Erie, detailing construction materials, methods, and estimated costs.

Series 1239 -- Canal Commissioner Alfred Kelley's "Ohio Canal Ledger" for the years 1825-27.

Series 1279 -- Appraisal of damages to property owners for the year 1827.

Series 1353 -- Plats of the canal drawn in 1892, including locations and dimensions of all structures along the canal, and survey lines and periodic cross-sections. Volume I covers that sector of the canal in the Cuyahoga Valley National Recreation Area. See Special Appendix.

Series 1362 -- Field notebooks from surveys of the canal dated 1890-92 and 1907-04. Books 2 through 5, "South of Cleveland," dated 1890, cover that sector of the canal in the CUVA.

Commissioners of the Canal Fund (1825-52) -- Most of these annual reports can be found at the OHS and the CHS.

Ohio General Assembly Executive Documents -- Bound collections of documents and reports presented to the Assembly each year. The series, located in the State Library, began c. 1834 and ended in 1916.

Ohio General Assembly House and Senate Journals -- All matters brought before the General Assembly. The Ohio State Library has a complete set from 1860 to the present. The Cincinnati Public Library has a semi-complete set from 1808 to the present.

2. Non-public Records

Bates Family Letters. 3 letters, 1825-28, including information on David and John Bates, engineer and surveyor of the canal respectively. Vertical File Manuscript (VFM) No. 2393, OHS.

Kelley, Alfred. Three collections of Commissioner Kelley's letters, providing information on his work for the canal, are the:

Alfred Kelley Papers. 61 letters. Manuscript (MSS) No. 151, OHS.

Canal Letters. 6 letters, 1829-38, the majority to Kelley. VFM No. 2297, OHS.

Letters on Canals. 205 letters, 1826-53, most to Kelley, MSS C212 RM, OHS.

3. Newspapers

Akron Beacon Journal. November 24, 1968.

_____. November 6, 1975.

Cleveland Plain Dealer. May 22, 1932.

_____. June 5, 1932.

_____, July 3, 1966.

Hudson Times. October 11, 1978.

The Cleveland Press. September 3, 1977.

4. Unpublished Material

Brose, David S. "Proposal to the National Park Service, Midwest Archaeological Center." Cleveland Museum of Natural History. May 1979.

B. Secondary Works

1. Articles, Newsletters, and Pamphlets

Bishop, Fred W. "Along the Canal in Winter From Conversations with James Dillow Robinson," Towpaths, XVI, No. 1, 1978.

_____. "Winter at Stumpy Basin," Towpaths, XVI, No. 1. 1978.

"Cuyahoga Valley History for Volunteer-In-Parks Tour Guides," n.d. 1975-77 n.p.

Dial, George White. "The Construction of the Ohio Canals," Ohio Archaeological and Historical Publications, XIII, 1904.

Doerschuk, A. N. "The Last Ohio Canal Boat," Ohio Archaeological and Historical Society Publications, XXXIV, 1926.

Editorial Staff, "The Ohio and Erie Canal," Towpaths, XIII, 1975.

Findley, T. H. "One Canaller's Enthusiasm."

Finn, Chester E. "The Ohio Canals: Public Enterprise on the Frontier," Ohio State Archaeological and Historical Quarterly, LI, January-March, 1942.

Green Islands: Your Metropolitan Parks (Akron Metropolitan Park District), III May, 1963.

_____, XIX, June, 1979.

Heydinger, Earl. "Early Coal Traffic on the Ohio & Erie," Towpaths, XII, 1974.

Hull, Robert. "The Boats That Walked Up Stairs," Ohio Bell Voice, 2nd Quarter, 1972.

"On the Ohio & Erie Canal in 1908 as told to Mrs. J. H. McNally of Parma, Ohio, by Mrs. Carl Grundling of Parma," Towpaths, XI, No. 2, 1973.

Powell, Fred W. "First Canals on the American Continent," Journal of American History, IV, 1910.

Richardson, L. W. "A Controlled Experiment," Towpaths, XII, No. 4, 1974.

_____. "John Malvern: Canal Boat Captain," Towpaths, IV, October, 1966.

Robinson, James Dillow. "Canal Maintenance and Recollections," Towpaths, XVII, 1979.

Scheiber, Harry N. "Alfred Kelley and the Ohio Business Elite, 1822-1859," Ohio History, LXXXVII. Autumn, 1978.

_____. "The Ohio Canal Movement, 1820-1825," Ohio Historical Quarterly, LXIX, July, 1960.

Smith, Mary G. "Grandpa & Peninsula, Ohio," Towpaths, II, No. 3, 1973.

Still, John S. "Ethan Allen Brown and Ohio's Canal System," Ohio Historical Quarterly, LXVI, January, 1957.

Trevorrow, Frank W. "Steam Powered Canal Boats," Towpaths, XII, No. 4, 1974.

2. Books, Collections, and Monographs

A Biographical Dictionary of American Civil Engineers. New York: 1972.

Armroyd, George. A Connected View of the Whole Internal Navigation of the United States. Philadelphia: 1826.

Baker, Jim. The Big Ditch. 2nd ed. Columbus: 1975.

Bogart, Ernest L. Internal Improvements and the State Debt in Ohio. New York: 1924.

Butler Hulbert, Archer. Historic Highways of America. Cleveland: 1904. XIII.

Drago, Harry Sinclair. Canal Days in America. New York: 1972.

Dunbar, Seymour. A History of Travel in America. New York: 1937.

Eddy, Caleb. Historical Sketch of the Middlesex Canal. Boston: 1843.

Ellis, William. The Cuyahoga. New York: 1966.

Guthorn, Peter J. British Maps of the American Revolution. Monmouth Beach, New Jersey: 1972.

Hatcher, Harlan. Western Reserve. New York, Indianapolis: 1949.

Hill Jr., N. N. comp. History of Coshocton County, Ohio: Its Past and Present, 1740-1881. Newark: 1881.

Historical Account of the Rise, Progress and Present State of the Canal Navigation in Pennsylvania. Philadelphia: 1795.

History of Ross and Highland Counties, Ohio, With Illustrations and Biographical Sketches. Cleveland: 1880.

Hovey, Calhoun, Daniel. The American Civil Engineer: Origins and Conflict. Cambridge, Massachusetts: 1960.

Howe, Henry. Historical Collections of Ohio in Two Volumes. 2 vols. Cincinnati: 1907.

Hunker, Robert L. comp. The Cuyahoga Valley and the Ohio Canal. Hudson, Ohio: 1974.

Huntington, C. C. and C. P. McClelland. History of the Ohio Canals. Columbus: 1905.

Jackson, James and Margot. The Colorful Era of the Ohio Canal. Akron: 1977.

Johnson, Allen. ed. Dictionary of American Biography. New York: 1946. IV and V.

Johnson, Crisfield, History of Cuyahoga County, Ohio. Cleveland: 1879.

Kilbourn, John. comp. Public Documents Concerning the Ohio Canals. Columbus: 1832.

King, Rufus. First Fruits of the Ordinance of 1787. Boston, New York: 1888.

Kirby, Richard Shelton and Philip Gustave Laurson. The Early Years of Modern Civil Engineering. New Haven: 1932.

Laws for the Protection of the Canals of the State of Ohio . . . March 20, 1844. Columbus: 1844.

Lipscomb, Andrew A. et al. eds. The Writings of Thomas Jefferson. Washington: 1905. III.

Perrin, William H. History of Summit County. Chicago: 1881.

Scheiber, Harry N. Ohio Canal Era: A Case Study of Government and the Economy, 1820-1861. Athens, Ohio: 1969.

Sparks, Jared. ed. The Writings of George Washington. Boston: 1846. IX.

Tanner, Henry S. A Description of the Canals and Railroads of the United State. New York: 1840.

Taylor, George Rogers. The Transportation Revolution: 1815-1860. New York: 1951.

The Ohio Historical Society. Scenes & Songs of the Ohio-Erie Canal. Columbus: 1971.

Trevorrow, Frank W. Ohio's Canals. Oberlin, Ohio: 1973.

Whittlesey, Charles. Early History of Cleveland. Cleveland: 1867.

Wilcox, Frank. The Ohio Canals. Kent, Ohio: 1969.

Yaple, Alfred. Reminiscences of Alfred Kelley. Cincinnati: 1875.

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

Publication services were provided by the graphics staff of the Denver Service Center. NPS 2216