

No appropriation was made for 1877-78.

During the summer of 1877 the repairs of cribs were completed, and a superstructure, limited by lack of funds to 4 feet in height, was added, except over crib No. 1.

In October and November violent gales did much damage to this work, most of which would have been avoided had the superstructure been completed to its full height.

An allotment of \$2,500 was made for repairs from the appropriation for "repairs, preservation, extension, and completion of river and harbor works."

Notwithstanding these repairs, the breakwater was left in a very bad condition at the end of the year. Seven of the cribs had no superstructure remaining, and the portions which had not been carried away were much injured.

After removing the broken timbers and projecting bolts, to obtain an even top on which to build, the mean depths of the cribs below water were as follows: No. 1, 9 feet; No. 4, 5 feet; No. 5, 4 feet; No. 6, 4 feet; No. 7, 7 feet; No. 8, 5 feet; No. 9, 3 feet. The stone was washed out to much greater depths. (See Plate No. 5, with Annual Report for 1879.)

Amount appropriated for 1878-79:

Outer harbor.....	\$50,000
Inner harbor.....	25,000

In accordance with letter from the Chief of Engineers dated June 27, 1878, Capt. G. J. Lydecker, Corps of Engineers, transferred this work to Maj. F. A. Smith, Corps of Engineers.

During the year all the cribs were cleared of broken and projecting timbers and bolts. Crib No. 1 was raised 5 courses, and the remaining 550 feet of breakwater to its full height of 8 feet above water, filled with stone, and the top covered with plank.

A Board of Engineers was constituted by Special Orders No. 80, Headquarters Corps of Engineers, July 24, 1878, and adopted a method of sinking the cribs upon a foundation of piles driven through the sand into the clay.

In the following winter and spring 4 cribs were constructed according to the new design. (Sheet No. 2, Annual Report, 1879.)

Piles were driven and cut off for foundations of 2 cribs, and one of the cribs was put in position and filled with stone.

CC 2.

IMPROVEMENT OF THE HARBOR AT NEW BUFFALO, MICHIGAN.

No work has been done during the year, and no appropriation for future work is recommended.

On the 1st of July, 1878, there remained available from former appropriations the sum of \$5,000, none of which has been expended.

As the money was appropriated for the construction of a harbor at the south end of Lake Michigan, the location being finally changed in favor of Michigan City, it is recommended that it be made available for the latter work.

Money statement.

July 1, 1878, amount available.....	\$5,000 00
July 1, 1879, amount available.....	5,000 00

APPENDIX D D.

ANNUAL REPORT OF MAJOR S. M. MANSFIELD, CORPS OF ENGINEERS, FOR THE FISCAL YEAR ENDING JUNE 30, 1879.

UNITED STATES ENGINEER OFFICE,
Detroit, Mich., July 16, 1879.

GENERAL: I have the honor to forward herewith my annual reports relating to the works of harbor improvements under my charge for the fiscal year ending June 30, 1879.

Very respectfully, your obedient servant,

S. M. MANSFIELD,

Major of Engineers and Bvt. Lieut. Col., U. S. A.

Brig. Gen. H. G. WRIGHT,
Chief of Engineers, U. S. A.

D D 1.

IMPROVEMENT OF CHARLEVOIX HARBOR, MICHIGAN.

Contract was made August 7, with Hervey S. Dale, of Chicago, for doing the work of pier extension (5 cribs) and repairs, according to terms of advertisement and specifications dated July 5, 1878.

Under this contract work began August 19. By the 30th of November (close of season 1878) the 5 cribs, each 50 feet by 20 feet by 10½ feet, were placed and secured in position, of which 3 extend the north pier 150 feet and 2 extend the south pier 100 feet. In addition, the outer crib on each pier was decked over with 3-inch pine plank, for protection during the winter, and intervals between cribs were carefully filled. On the south side of channel brush protection (fascine mattress) work, extending shore connection inward 140 feet, was placed, and 64 $\frac{6}{128}$ cords of stone used to ballast the old north pier.

The contractor has not yet resumed work of building the 6 courses of superstructure over these cribs, and asks for an extension of 3 or 4 weeks, when work contracted for will be completed.

The permanent work built by the United States comprehends—

	Crib-work.	Brush-work.
	Feet.	Feet.
North side of channel and extensions.....	150	299
South side of channel and extensions.....	290	
Total.....	440	299

The channel near shore line has contracted so by action of the sea upon the unprotected banks of sand and gravel as to leave but 7 feet water available at present for navigation—this with the level of the lake 14 inches lower than its normal level.

Plans heretofore submitted for the improvement of this harbor call for the following-named work:

Dredging inside channel, &c., 130,000 cubic yards; removing old pier (south); building 950 feet north pier (cribs); building 550 feet south pier (cribs); building 2,550 feet pile revetment—	
At an estimated cost of	\$186,000
Appropriated (1876-'79)	31,000
Unappropriated balance	155,000

In continuance of the work of improvement here \$30,000 could be profitably expended in the fiscal year ending June 30, 1881, in pier extension and widening and deepening the channel as originally contemplated.

OPERATIONS CONTEMPLATED FOR YEAR 1879-'80.

Under the contract of June 3, 1879, awarded to Carkin, Stickney & Cram, of East Saginaw, Mich., the north pier will be extended by 3 cribs (150 feet), each crib to be 50 feet by 20 feet by 18½ feet; and, in addition, dredging (deepening and widening channel) will be done to an estimated amount of 25,000 cubic yards.

The contractors begin the work of their contract immediately.

The work is located in the Michigan collection-district, Michigan. It is situated at the mouth of Pine River, which empties itself into Lake Michigan between Little and Grand Traverse Bays. The nearest port of entry is Grand Haven, Mich. The nearest light-station is at Grand Traverse.

STATEMENT OF VESSELS ENTERED AND CLEARED FROM JUNE 1, 1878, TO JUNE 1, 1879.

Entered:	
Number	163
Tonnage	14,384
Cleared:	
Number	171
Tonnage	14,647

HISTORY OF THE WORK.

In 1868 (July 10-16) a survey was made of this harbor, and it was reported that—

From the location of this harbor and the width of channel that we are obliged to adopt in improving it, the interests of commerce do not require this place to be made a harbor of refuge.

The improvements recommended and cost of same are as follows:

1,504 feet crib-work	\$116,925 42
2,466 feet close piling	23,849 95
94,077.83 cubic yards dredging	57,268 77
Total cost	198,044 14

In 1873 a special examination of this harbor was ordered by the Chief of Engineers, and made July 25-27 (see Report Chief of Engineers, page 281-6, 1873), the result of which showed that—

This region is being rapidly settled, and had already reached a prominence parallel with other points along the shore of the lake receiving government aid. The people now ask a moderate appropriation from the general government to carry on improvements here to the extent

that shall be requisite to meet the growing commercial wants of the country. A harbor of refuge is not required, as the proximity of Grand Traverse Bay affords a refuge for the large vessels passing here.

ESTIMATE FOR IMPROVEMENT ACCOMPANYING REPORT OF EXAMINATIONS.

175,000 cubic yards dredging	\$70,000
1,600 feet crib-work	70,250
2,550 feet revetment	20,400
Contingencies and superintendence	32,132
	192,782

January 11, 1876, a report was rendered by Major Mansfield, in reply to resolution of the Senate:

That the Secretary of War be, and hereby is, directed to report to the Senate upon the importance of improving the harbor at Charlevoix, in the State of Michigan, and to transmit a revised estimate of the amount necessary to complete the same.

In which he said (as previously reported, October 26, 1875, to the Chief of Engineers):

At present I would recommend a slight modification of the work, which, in the light of experience, I deem essential, viz, to discard the use of pile pier and substitute therefor crib-work; and I give herewith a careful estimate of the cost, which differs but little from the original estimate in its total, viz:

Excavations in Pine River outside shore-line to a depth of 12 feet, 130,000 cubic yards	\$39,000
Removing old pier	700
Crib-work, 1,850 feet	94,900
Pile revetment, 2,550 feet	20,400
Contingencies and superintendence	31,000
Total	186,000

At the same time this report was accompanied by a modification of this plan and estimate, both piers to rest in 12 feet water, and the channel of the river to be dredged to 12 feet for a width of 50 feet, viz:

Excavations in river, &c., 44,300 cubic yards	\$13,290 00
Removing old pier	696 25
North pier, 12 cribs (600 feet)	32,400 00
South pier, 12 cribs (550 feet)	29,700 00
Contingencies, &c	15,217 25
	91,303 50

Soundings taken May 17, 1876, from Round Lake through center of channel in Pine River to a point opposite shore end of north pier, as traced on the map, show that the entrance was barred to 6 feet water, and in channel in river and between the piers the water-way was from 9 to 12½ feet, with the stage of water about 6 to 9 inches higher than usual average.

By act of Congress approved August 14, 1876, a first appropriation was made for the improvement of this harbor of \$10,000.

Work commenced June 30, 1877, and by the end of October, 1877, there had been accomplished the removal of 23,436 cubic yards sand, gravel, &c., from the channel (deepening and widening it), and the building and placing of 3 cribs, each 50 feet by 20 feet by 10½ feet, in (new) south pier, by contract with Carkin & Stickney, of East Saginaw, Mich. One crib in old south pier was found serviceable and was removed into line of new work (40 feet), and connection with the shore, a distance of 159 feet, was made with brush-matress laid on the beach and weighted with gravel and stone. The old north pier (left standing and utilized), of a length of 4½ feet from shore-line, was partially refilled

with brush and stone, received a few minor repairs, and was planked over.

September 25, 1877, after dredging was discontinued, soundings taken developed a channel-way of good width of 9 feet between the piers and in the river.

May 5, 1878, soundings taken showed an available depth through center of channel between piers and in river of 8 feet.

Appropriated 1876.....	\$10,000
Appropriated 1878.....	12,000
Appropriated 1879.....	9,000
	31,000

Money statement.

July 1, 1878, amount available.....	\$12,021 05	
Amount appropriated by act approved March 3, 1879.....	9,000 00	
	\$21,021 05	
July 1, 1879, amount expended during fiscal year.....	6,022 06	
July 1, 1879, outstanding liabilities.....	11,572 06	
	17,594 12	
July 1, 1879, amount available.....		3,426 93
Amount (estimated) required for completion of existing project.....		155,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1881.....		30,000 00

Abstract of proposals received and opened July 26, 1878, for furnishing the requisite materials, &c., for continuing improvements, Charlevoix Harbor, Michigan.

Bidders.		Hemlock, per cubic foot.	Pine, per cubic foot.	Drift-bolts and spikes, per pound.	Stone, per cord.	Brush, per cord.	Aggregate.
Names.	Residences.						
N. Stanton Gere.....	Geddes, N. Y.....	\$0 20	\$0 20	\$0 02 ³ / ₄	\$6 00	3	\$8,445 40
Chicago Dredging and Dock Co.....	Chicago, Ill.....	26	28	3	7 00	3	10,092 89
Hervey S. Dale*.....	do.....	19	19	2 ³ / ₄	5 50	3	7,687 67
See & Ingalls†.....	Charlevoix, Mich.....	17	20	5	6 00	10	
Henry Morgan†.....	do.....	16	26	10	10 00	3	
John Nicholls.....	do.....	18 ¹ / ₂	20 ¹ / ₂	3 ¹ / ₂	5 50	3	8,059 39
Duncan Dewar.....	Ludington, Mich.....	19	20	3	6 50	3	8,463 09
James Caldwell.....	Fulton, N. Y.....	21	23	3 ¹ / ₂	9 00	3	10,525 30
Thomas Keeler.....	do.....	20	23	3	8 50	4	10,190 99
Robert M. Steel.....	Saint Johns, Mich.....	20	23	2 ³ / ₄	5 00	3	8,126 40
James McArthur.....	Chicago, Ill.....	22	24	4	8 00	3	11,504 62
Carkin, Stickney & Cram.....	East Saginaw, Mich.....	21	27	4 ¹ / ₂	5 80	8 ¹ / ₂	8,941 63

Contract awarded to Henry S. Dale.

*Lowest.

† Informal.

Abstract of proposals received and opened May 26, 1879, for furnishing the requisite materials, &c., for continuing improvements at Charlevoix Harbor, Michigan.

Bidders.		Hemlock, per cubic foot.	Pine, per cubic foot.	Drift-bolts, per pound.	Stone, per cord.	Brush, per cord.	Dredging, per cubic yard.	Aggregate.
Names.	Residences.							
W. S. Grant Lynn.....	Rochester, N. Y.....	\$0 24	\$0 26	\$0 16	\$15 00	\$10	\$0 20	\$15,814 64
Hervey S. Dale.....	Chicago, Ill.....	18	18	2 ³ / ₄	5 50	12	17 ¹ / ₂	9,048 03
Carkin, Stickney & Cram*.....	East Saginaw, Mich.....	16	24	3	6 40	13	13	8,513 92
Squier & White.....	Grand Haven, Mich.....	18	20	2 ³ / ₄	5 50	3	17 ¹ / ₂	9,095 93
Christopher H. Starke.....	Milwaukee, Wis.....	18	20	3	8 00	20	20	10,558 95
Harry Fox & Co.....	Chicago, Ill.....	22	24	4	8 50	8	22	12,075 54

Contract awarded to Carkin, Stickney & Cram.

*Lowest.

DD 2.

IMPROVEMENT OF FRANKFORT HARBOR, MICHIGAN.

The contract entered into August 7 with Mr. Hervey S. Dale, of Chicago, according to terms of advertisement and specifications dated July 5, 1878, covered the work of constructing and sinking 2 cribs, refilling old work, and making certain necessary repairs to the piers.

On the 30th August the timber for the cribs arrived at the harbor, and by the 27th September both cribs were built, one 50 feet by 20 feet and 12 courses high, and the other 50 feet by 30 feet and 14 courses high. The smaller crib (20 feet) was successfully placed in full 12 feet of water, in good alignment and level in extension of north pier. The larger crib (30 feet) was carried into the channel by a storm on the morning of the 30th September, after an attempt was made to secure it in place in the south-pier extension.

Work ceased for the season early in December (after authority was received to extend completion of the whole work of contract to June 30, 1879), by securing old work in south pier, using 64,327 cords of stone.

Work was resumed June 5, 1879, and is not yet completed. Allowing time for crib settlement, the work should be completed by August 10.

Work constructed from July 1, 1867, to June 30, 1879.

	Crib-work.	Pile-work.
	Feet.	Feet.
North side of channel and extensions.....	548	620
South side of channel and extensions.....	943	445
Total.....	1,491	1,065

The south pier farther advanced by 200 feet than the north pier. The depth of water available for navigation 9 feet.

Recommendations heretofore submitted contemplate pier-extension at this point. The balance remaining unappropriated of the amended estimate of 1875 is \$9,200.

Original estimate (1866), amended (1875).....	\$223,156 00
Appropriated and allotted (1866-'79).....	213,659 85

To carry out project as designed—to complete it and make a harbor of refuge for deep-draught vessels—the estimate of 1872 (amended 1875) is found to be inadequate. To reach and maintain the depth required, viz, 14 feet, will necessitate extension of piers, about 200 feet addition to each, at an estimated cost of \$26,851.44, and dredging in channel, \$10,000 (report of 1873). Total, \$36,851.44 + \$3,685.14 for contingencies, &c., = \$40,536.58.

Twenty thousand dollars could be profitably expended in the fiscal year ending June 30, 1881, in extending piers.

OPERATIONS CONTEMPLATED FOR YEAR 1879-'80.

To extend the south pier 50 feet, viz, adding to it one crib 50 feet by 30 feet by 20¹/₂ feet. The work to be done by contract after advertising proposals in the usual way.

The work is located in the Michigan collection-district, Michigan. The nearest port of entry is Grand Haven, Mich. The nearest light-house is at Point Betsy (Point Aux Bees Seies). A light is shown near head of south pier.

STATEMENT OF VESSELS ENTERED AND CLEARED FROM JUNE 1, 1878, TO JUNE 1, 1879.

Entered:	
Number.....	171
Tonnage.....	35,579
Cleared:	
Number.....	167
Tonnage.....	35,279

HISTORY OF THE WORK.

First appropriations made June 23, 1866, of \$88,541. Original plan contemplated dredging a new outlet through a strip of land which separated Lake Aux Becs Scies from Lake Michigan, 750 feet south of old outlet in a direction due west, and the building of 2 parallel piers to extend from 12 feet water in inner lake to the same depth in outer one, with a width of 200 feet between piers. Continuation of history begun and published in report of Chief of Engineers for 1876, as follows: In July, August, and September, 1875, the end crib of south pier was superstructured, ballasted with stone, planked over, and protected with fenders, and the three cribs east of it received an additional course of superstructure and stone filling. On the 1st of December, 1875, the north pier had received a further extension of 100 feet (2 cribs), and in May, 1876, the filling of intervals and some stone-filling in superstructure and plank-decking of the outer crib left this pier in good condition. Some stone-filling was also added to south pier. The United States dredging apparatus during August and September, 1875, removed 18,195 cubic yards of sand from between piers to obtain a channel.

Soundings of April 25, 1876, give available water-way between piers at 11 feet, but at places near entrance and outside in line of south pier, only 9 feet could be carried.

In 1876-77 some necessary repairs—filling slabs and edging behind south pier—were made.

Soundings of May 14, 1877, show an available water-way of 11 feet between piers; outside, and nearly on a line with the north pier, only about 10 feet depth was found for a distance of 100 feet.

By 20th October, 1877, the south pier was further advanced 50 feet (1 crib); and additional courses of timber were framed over the cribs next east (inward) of this crib, and 70,526 cords of stone were placed in old crib-work. The south pile revetment near shore line received a plank sheathing and refilling, and in both pier-heads additional ballast was placed.

In the spring of 1878 a bar with but 9 feet of water on it covered the approach to the harbor, while the channel between piers had at least 11 feet.

Appropriated 1866	\$88,541 00	Appropriated 1874	\$10,000 00
Appropriated 1867	10,000 00	Appropriated 1875	10,000 00
Allotted 1868	10,000 00	Appropriated 1876	3,000 00
Allotted 1869	29,318 85	Appropriated 1878	8,800 00
Appropriated 1870	10,000 00	Appropriated 1879	4,000 00
Appropriated 1871	10,000 00		
Appropriated 1872	10,000 00		
Appropriated 1873	10,000 00	Total	213,659 85

Money statement.

July 1, 1878, amount available.....	\$8,877 02	
Amount appropriated by act approved March 3, 1879	4,000 00	
		\$12,877 02
July 1, 1879, amount expended during fiscal year.....	2,547 35	
July 1, 1879, outstanding liabilities	3,763 90	
		6,311 25
July 1, 1879, amount available.....		6,565 77
Amount (estimated) required for completion of existing project	40,536 58	
Amount that can be profitably expended in fiscal year ending June 30, 1881.	20,000 00	

Abstract of proposals received and opened July 26, 1878, for furnishing the requisite materials, &c., for continuing improvements at Frankfort Harbor, Michigan.

Bidders.		Pine, per cubic foot.	Oak, per cubic foot.	Drift-bolts and spikes, per pound.	Screw-bolts and washers, per pound.	Stone, per cord.	Brush, per cord.	Piles, each.	Aggregate.
Names.	Residences.								
Chicago Dredging and Dock Company.....	Chicago, Ill.....	\$0 28	\$0 35	\$0 03	\$0 04	\$7 00	\$2 00	\$15 00	\$6,365 96
Robert M. Steel.....	Saint John's, Mich..	22	30	02	03	8 50	2 00	10 00	6,138 79
Hervey S. Dale.....	Chicago, Ill.....	19	19	02	03	7 90	2 00	5 00	5,508 14
James Caldwell.....	Fulton, N. Y.....	22	30	03	10	9 00	4 00	12 00	6,502 91
James McArthur.....	Chicago, Ill.....	30	40	04	08	8 00	8 00	12 00	7,236 22

*Lowest. Contract awarded to Hervey S. Dale.

D D 3.

IMPROVEMENT OF MANISTEE HARBOR, MICHIGAN.

According to the terms of advertisement and specifications dated July 5, 1878, contract was entered into with N. Stanton Gere, of Geddes, N. Y., for doing the work of pier-extension (4 cribs) and repairs.

The contractor commenced work in August by collecting a sufficient quantity of material—timber, iron, stone—to proceed vigorously with the work. At the close of October the 2 cribs (each 50 feet by 24 feet and 16 courses high) for north pier extension were securely in place, and at the same time the 2 cribs (each 50 feet by 24 feet) for south pier extension were framed 12 courses high ready for sinking.

After placing 13½ cords of stone in new work to replace filling washed out, the application of the contractor to defer sinking cribs in south pier extension until June 30, 1879 (to complete contract), was approved.

On May 31 and June 11, 1879, the 2 cribs were placed at end of south pier and now are in very good shape, level, and a little over a foot out of water. The contractor proposes to commence building the superstructure over these cribs about the middle of July and expects to close his contract not later than the 15th of August, proximo.

Last fall a schooner-scow struck the sunken crib at the end of north pier and sunk alongside of same pier about 500 feet from the outer end. She had 65,000 brick on board. Several attempts were made to raise this scow, both in the fall and winter, but without success, and at the

opening of navigation this spring was found quite an obstruction to navigation, causing a bar to form from her box-like bow across the harbor with scarcely 9 feet of water over it. I was authorized to expend \$700 in its removal. At the present time it is not completely removed, but has ceased to be a serious obstacle, as only parts of the bottom remain where she laid. Since the sides of the wreck have been removed the water has slightly improved, and now vessels drawing 10 feet can pass in or out without the least trouble.

WORK CONSTRUCTED FROM JULY 1, 1867, TO JUNE 30, 1879.

	Crib-work.	Pile-work.
	Feet.	Feet.
North side of channel and extensions	888	1,338
South side of channel and extensions	888	495
Total	1,776	1,833

The north pier 100 feet farther advanced than the south pier.

Recommendations submitted since 1873 call for the expenditure of appropriations in pier extension. The balance of the estimate made for such work is \$51,771. Of this sum, \$30,000 could be very profitably expended in the fiscal year ending June 30, 1881, in extending piers.

Original estimate (1866) amended (1875)	\$234,771
Appropriated and allotted (1866-79)	183,000
Unappropriated balance	51,771

OPERATIONS CONTEMPLATED FOR YEAR 1879-'80.

To extend piers (each pier 100 feet, if practicable with funds available) by cribs 50 feet by 24 feet in plan, and dredge from channel about 16,000 cubic yards of sand. Work to be done by contract, after advertising proposals in the usual way.

The work is located in the Michigan collection-district Michigan. The nearest port of entry is Grand Haven, Mich. The nearest light-house is the Manistee light (discontinued October 15, 1875). A light is shown near head of south pier.

STATEMENT OF VESSELS ENTERED AND CLEARED FROM JUNE 1, 1878, TO JUNE 1, 1879.

Entered:	
Number	1,446
Tonnage	347,752
Cleared:	
Number	1,495
Tonnage	356,341

HISTORY OF THE WORK.

The survey of 1861 shows the harbor to be barred about 600 feet out from outer end of south slab-pier, the water on this bar (250 feet in width) being from 5 to 8 feet. From bar to entrance, the water varied from 7 to 9 feet; between the piers, from entrance inward, a distance of 800 feet, was an available channel of 10 feet. The survey of September, 1866, fails to show the existence of this bar above mentioned, and indicates 3 12-foot curves, the first 960 feet out from lake-end of south slab-

pier, the second beyond this 190 feet, and the third 90 feet still further out. Beyond this last-mentioned curve 140 feet ran the general 18-foot water-line. Between the 1 and 2 inch 12-foot curves the available depth was 12 to 13 feet; between the 2 and 3 inches, from 10 to 12 feet outside, at the entrance, and inward, between piers and in river, for distance of 1,100 feet, a water-way of 9 feet appears; and further inward to Lake Manistee, available water-way of 7 feet.

Plan of improvement (based upon survey of September, 1866) adopted, was to extend south pier 960 feet (in direction as commenced); to commence the extension of north pier at a point opposite the outer end of south slab-pier, and extend it in a direction parallel to the south pier a like distance of 960 feet, to 12 feet water, to cut off a point of slab-works inside of south pier and widen the channel; to cut down all slab-work to water surface, and build crib-work on old foundations, and to dredge channel to a depth of 12 feet.

After the survey (of 1866) 100 feet of north pier was washed away. This caused a slight change in the plans, the north pier being thrown 20 feet further to the north, and the work upon it commenced at end of old pier.

In 1867 (September) the bar in front of entrance had 8½ feet of water on it, and between the piers the channel had a depth of from 9½ to 10 feet, and in the river above the piers from 7½ to 8 feet.

The first appropriation was made by act of March 2, 1867, \$60,000.

Work began in July, 1867.

Continuation of history begun and published in Report of Chief of Engineers for 1876, as follows:

Available water-way between piers 9½ feet in October, 1875.

In 1875-'76 each pier was extended 150 feet (6 cribs, each 50 feet by 24 feet).

Soundings May 12 and 13, 1876, show an available channel between piers of 10 feet, with strong current running in river. North pier-end rested in 15 feet, and south pier-end in 13 feet of water.

In 1876-'77 the south pier was raised an additional course of timber for a length of 450 feet, and slight repairs—rehandling stone for ballast—were made as required.

Also an obstruction of sand at the bend of the river was removed, affording temporary relief for navigation. Soundings of May 3, 1877, showed an available channel-way of 10 feet between the piers.

In 1877-'78 the point of sand in the bend of river on north side was dredged away, and the exposed bank faced with a pile revetment for a length of 420 feet, and 32 cords of stone were put into the pier as ballast.

December 13, 1877, the channel soundings showed not less than 9 feet of water available, and this depth only at one point about 450 feet inward from end of north pier.

In the spring of 1878 a bar with but 8 feet of water over it obstructed the entrance to the harbor. With the small balance of funds on hand, a channel was dredged through it, leaving a channel of good width and with a depth of 14 feet.

Appropriated, 1867	\$60,000	Appropriated, 1875	\$25,000
Appropriated, 1870	20,000	Appropriated, 1876	14,000
Appropriated, 1871	9,000	Appropriated, 1878	15,000
Appropriated, 1872	10,000	Appropriated, 1879	10,000
Appropriated, 1873	10,000		
Appropriated, 1874	10,000	Total	183,000