

Money statement.

July 1, 1878, amount available.....	\$8,036 99	
Amount appropriated by act approved March 3, 1879.....	3,600 00	\$11,636 99
July 1, 1879, amount expended during fiscal year.....	4,758 45	
July 1, 1879, amount available.....	6,878 54	

Abstract of proposals received and opened August 10, 1878, by F. U. Farquhar, Major of Engineers, U. S. A., for furnishing stone at Niota Chute, near Fort Madison, Iowa.

Name.	Residence.	For furnish- ing and putting in place stone.	Pr. cu. yd.
Archibald McArthur*	Chicago, Ill.		\$1 25
Edwin H. Rand	Pontoosuc, Ill.		1 40
Wells, Timberman & Co.	Keokuk, Iowa		2 25
Charles Dover	Fort Madison, Iowa		1 50
Samuel S. Sample	Keokuk, Iowa		1 19
Michael Cahill	do		1 48
H. S. Brown	Hamilton, Ill		1 39

* Contract awarded to Archibald McArthur.

Q 10.

REMOVAL OF BAR IN THE MISSISSIPPI RIVER OPPOSITE DUBUQUE, IOWA.

The work this year consisted in the removal of a portion of the bar in front of the steamboat landing at Dubuque. The work offered no difficulties, and has resulted in a material relief to steamboats landing at the city. The upper limit of dredging extends in an oblique direction up stream from the upper wharf boat.

The grade-line of excavation is 3½ feet below the surface of the water at low-water, on the Dubuque Bridge (Signal Service) gauge, or 4½ feet below low-water of 1864, according to recent determinations. At ordinary low-water there will, therefore, be 5½ to 6 feet for navigation over the dredged area.

A casual examination with a sounding-pole showed that no filling had taken place, though there may have been one or two lumps above grade, caused by the action of some steamboat's wheels.

The excavated material was deposited along the Illinois shore, ½ mile below the site of dredging operations. The dredging was a continuation of the work begun the preceding year.

A Board of Engineers met May 17, at Dubuque, and considered the subject of further improvements. In accordance with their suggestions no work will be done during the season of 1878.

SUMMARY OF WORK DONE TO DATE.

	Cubic yards.
Dredged during the year ending June 30, 1878.....	39,261
Dredged during the year ending June 30, 1879.....	37,042
Total to date.....	76,303

Table showing cost of dredging 37,042 cubic yards of material.

Items of expense.	Cost per cubic yard.	Total.
37,042 cubic yards, at 25 cents per cubic yard.....	\$0.25000	\$9,260 69
Total cost of superintendence and office expenses.....	0.02097	776 72
Total cost of work.....	0.27097	10,037 41

Cost of dredging 37,042 cubic yards in harbor at Dubuque, Iowa.

Items of expense.	Cost per cubic yard.	Total.
37,042 cubic yards, at 25 cents per cubic yard.....	\$0.25	\$9,260 69
Total cost of superintendence and office expenses.....	0.021	776 72
Total cost.....	0.271	10,037 41

ABSTRACT OF APPROPRIATIONS MADE FOR REMOVAL OF BAR IN MISSISSIPPI RIVER OPPOSITE DUBUQUE, IOWA.

By act approved August 14, 1876.....	\$15,000 00
By act approved June 18, 1878.....	10,000 00
By act approved March 3, 1879.....	4,000 00
	29,000 00
Original estimate for existing project.....	35,221 70
Remaining to be appropriated.....	6,221 70

Money statement.

July 1, 1878, amount available.....	\$10,033 17
Amount appropriated by act approved March 3, 1879.....	4,000 00
	\$14,033 17
July 1, 1879, amount expended during fiscal year.....	10,037 41
July 1, 1879, amount available.....	3,995 76

Amount (estimated) required for completion of existing project.....	8,672 24
Amount that can be profitably expended in fiscal year ending June 30, 1881.....	8,672 24

Abstract of proposals received and opened August 10, 1878, by Maj. F. U. Farquhar, Corps of Engineers, U. S. A., for dredging a bar in the Mississippi River, opposite Dubuque.

Name.	Residence.	For dredging per cubic yard measured in scoops.	Remarks.
Archibald McArthur.....	Chicago, Ill.....	\$0.25	Contract awarded.
Andrew J. Whitney.....	Keokuk, Iowa.....	27	
H. S. Brown.....	Hamilton, Ill.....	28½	

REPORT OF BOARD OF ENGINEERS.

DUBUQUE, IOWA, May 19, 1879.

GENERAL: In accordance with Special Orders No. 43, current series, Headquarters Corps of Engineers, the Board of Engineers constituted by said orders met on May 17, in this city, and, in compliance with letter of instructions, have the honor to submit the following report: On the meeting of the Board, they were called upon by the mayor of

the city of Dubuque and members of the city council and citizens, with whom they made a personal examination of the river front from Eagle Point to Waples Cut.

The opinions expressed by the citizens pointed to two methods of improving the harbor:

1st. To close the opening into the main river at Seventh Street and New Barney Cuts, and to enlarge the openings through Seventh Street and Third Street Causeways, so as to concentrate all the water flowing through Lake Peosta and the slough east of it into one stream, that should issue into the river through Waples Cut, or, instead of enlarging the opening through Third Street Causeway, to close it and make a new opening at the water end of Third Street Causeway, and discharge the same water into the main river parallel to the lower or present landing.

2d. To close the head of Lake Peosta and the slough east of it, and also Seventh Street and New Barney Cuts, and only permit the discharge of the natural drainage from the city to pass out of Waples Cut.

Some time previous to 1844 there was a channel through the sloughs from below the city of Dubuque past the city front, and up through the slough east of Lake Peosta, through which steamers passed. In 1844, as shown by the map of Capt. T. J. Cram, this channel was so shoal as to prevent navigation at low stages of water, and a plan was made to improve it by dredging, and by opening a new channel from the then landing through Bass Island to what was called the "outlet." This plan was never fully carried out, and subsequently modifications were made in 1852 and 1853, but none of the plans were executed fully. In 1853 a bar was reported to the southeast of the outlet (Waples Cut) with a deep channel between it and the outer island, with its head just opposite the outlet. In 1854 the Board of Engineers for Lake Harbors and Western Rivers submitted a plan for the improvement of the harbor, which contemplated a causeway embankment from the foot of First Street across the islands and sloughs to the bank of the main river. In 1855, Lieutenant-Colonel Long, Topographical Engineers, caused a survey to be made to determine the location of this causeway, but no money was appropriated to construct it. It is inferred that the Board of Engineers considered an improvement of the sloughs not permanent, and therefore deemed it necessary, in order to insure a permanent landing place, to locate it on the bank of the main river. This view seems to have been accepted by the citizens of Dubuque, as between 1855 and 1858 they constructed this causeway and landing place, now known as the lower landing, as well as the Third and Seventh Street Causeways and the levee connecting their outer ends. In 1858, during high-water, breaches were made through the outer island on the upper side of Seventh Street Causeway and at the New Barney Cut.

From the best evidence the Board could collect, there was a good channel along the upper levee previous to the breaks, and immediately after them when the water subsided the present bar was discovered. An examination of the results of the surveys made under the direction of Maj. G. K. Warren in 1866, and Col. J. N. Macomb in 1877 does not show any material change between those dates in the condition of the bar which extended from the lower side of Seventh Street Cut to about 1,600 feet below Waples Cut. From Seventh Street to the upper side of Waples Cut the bar was attached to the shore, but below it tailed out into the stream, leaving a channel from 150 to 250 feet between it and the lower landing. In 1877 dredging was commenced at the lower end of the bar and carried upstream. The depth of the dredging was 4 feet below low-water. This dredging was continued in

1878, and carried up to just above the prolongation of Jones Street. The dredging has rendered the approach to the lower landing by vessels easy, and so far there has not been any perceptible shoaling over the areas dredged.

Referring to the first plan proposed by the citizens in its two modifications, the Board do not think it would remove the existing bar or maintain a deep channel between it and the landing, for the following reasons:

1st. It is found from the survey made by Capt. T. J. Cram in 1844 that at that time there existed an interior channel of greater capacity than now exists. The steamboats used this channel at times, but it was then insufficient for purposes of navigation, and plans involving large expenditures were made for the purpose of deepening the interior channel and connecting it with the main river. These plans were only partially carried out, and were finally abandoned.

2d. In order to obtain a current at the mouth of Waples Cut sufficient to maintain an adequate channel in front of the steamboat-landing, it would be necessary to widen and deepen the interior channel from its head at Eagle Point to Waples Cut, and to maintain it by dredging, as it would continually shoal up from sediment from the river and from surface drainage.

3d. The first cost would be large, and the cost of maintaining such a channel would be greater than that of periodic dredging of the bar, and the beneficial effects would be much less.

4th. If the current issued from Waples Cut at right angles to the main river, an eddy would very likely form just below, giving a bar against the present landing, while if the current were parallel to the landing, and between it and the bar, it would not remove the bar.

The fact that in 1844, as shown by Capt. T. J. Cram's map, the river bank was where the shoal in front of the landing now is, seems to indicate that this shoal is one step in the process of the river's returning to its old condition, and as from 1866 to 1877 the shoal changed but little, the river bed would now seem to be nearly in a state of equilibrium, so that if the bar was removed, as has been partially done by dredging, its re-formation at some future time might be expected.

The following plan is proposed for the permanent improvement of the harbor:

To prevent the re-forming of the bar it is proposed to diminish the present low-water cross-section of the river at the landing by constructing two low spur-dams on the Dunleith shore, as shown on the tracing hereto attached, rising only a foot above low-water, and extending out to the 3-foot curve at low-water, or further if found necessary. The effect of these spurs on the opposite shore should be carefully watched, and no more contraction should be produced than is necessary to secure the desired effect.

The cost of the spurs is estimated at \$12,668.

But as the dredging already nearly completed has secured easy access to the landing, and as for two years the dredged space has shown little or no tendency to fill up (although indeed there have been no marked high-water periods in this time), it is not proposed to begin contraction until the present dredged area shows signs of filling up, when the work should be done without delay.

The construction of the spurs will force the current against the bar and Dubuque shore, but the shore below the bar is already protected by stone, either loose or in paving, hence any serious cutting of it is not

anticipated. The spurs may cause a slight shoaling at the Dunleith Ferry Landing, but the cost, should it be necessary, of a short causeway 200 to 300 feet in length to the new shore-line, would be very small.

As the bar is now so far removed as to meet the present requirements of commerce, it is proposed to discontinue dredging, and the available appropriation can be retained to commence the proposed spurs. In case there should be no filling up in the next high-water, the dredging should be continued in accordance with the recommendation of Major F. U. Farquhar in his report of July 2, 1878.

C. B. COMSTOCK,
Major of Engineers and Bvt. Brig. Gen.
D. C. HOUSTON,
Major of Engineers.
F. U. FARQUHAR,
Major U. S. Engineers.

To the CHIEF OF ENGINEERS, U. S. A.

Q 11.

PROTECTING PIERS AT ROCK ISLAND BRIDGE BY MEANS OF SHEER-BOOMS.

On July 1, 1878, the sheer-booms were turned over to the commanding officer of Rock Island Arsenal, it being thought that they could be cared for by the persons already employed in taking care of the government bridge.

On July 16 a good deal of drift floating on the river caught in between the rudders, and on the 17th so much was lodged there as to prevent any working of the rudders, and the boom broke away from its moorings and lodging against the piers of the bridge was broken in three pieces. Before the mooring chain gave way at the point where it was attached to the anchoring bolts, a large piece of the rock in which one of the bolts was fastened was pulled out of place.

By authority of the Chief of Engineers, United States Army, the boom was repaired and replaced, and has since remained in charge of the Engineer Department. Major Hoffmann's report hereto appended gives a very detailed report of the workings of the booms, and clearly shows their usefulness.

The Rock Island bridge offers less obstruction to navigation than most of the others, and therefore the usefulness of the booms is not so apparent as if they had been placed, say, above the bridge at Clinton, Iowa.

It is respectfully recommended that Congress be asked for authority and money to take the rudder-boom, now above the Rock Island bridge, to above the Clinton bridge. The ordinary annual expense of operating the booms and taking care of them during the winter is about \$1,000. To tow the large boom to Clinton and return, and to make the proper anchorage above the Clinton Bridge, would cost not to exceed \$3,000.

ABSTRACT OF APPROPRIATIONS MADE FOR PROTECTING PIERS, ROCK ISLAND BRIDGE.

By act approved August 14, 1876..... \$15,000

Money statement.

July 1, 1878, amount available.....	\$3,282 05
July 1, 1879, amount expended during fiscal year.....	2,558 31
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July 1, 1879, amount available.....	723 74
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Amount (estimated) required for completion of existing project for operating booms.....	1,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1881, for taking boom to Clinton, Iowa.....	3,000 00

REPORT OF MAJ. E. F. HOFFMANN, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Rock Island, Ill., June 30, 1879.

MAJOR: I have the honor to submit to you my annual report of operations upon the work of protecting piers at Rock Island bridge by means of sheer-booms.

On the 1st of July, 1878, the sheer-booms of the Rock Island bridge were turned over by you to Maj. D. W. Flagler, commanding United States Arsenal, in accordance with orders received from the higher authorities in Washington, D. C.

On the 17th of July, 1878, the rudder-boom, 750 feet in length, above the government bridge, broke from its moorings and being thrown by the strong current of a high stage of water against the piers of the bridge, was broken in three pieces. These pieces were caught by steamers and towed to the shore of the island.

The accident was caused by floating driftwood, which accumulated and wedged itself between the rudders to such a degree that the strong pressure of the overloaded boom detached a large piece of rock from the bottom of the river in which the ring-bolt on the Illinois side was imbedded, whereupon the connection between the ring-bolt on the Iowa side and the anchor-chain also gave away, and caused the disaster.

To give an idea of the compactness of the accumulated driftwood between the 16-foot long rudders, I will state that the heaviest man could walk upon this wedged driftwood clear to the end of the rudders. The driftwood settled upon the boom for 48 hours, and if the boom had been swung downstream, the accident would not have happened. It is said that an attempt was made to unloose the rudders by the crabs, but it had been in vain. Without casting any degree of blame upon the guard on the boom, or the superintendent of the government bridge, I think the attempt to loose the rudders was made too late. The boom did not fill with driftwood at once, but gradually.

You received orders, on the 29th of July, to repair the sheer-boom, and have it brought back to the old place.

The pieces of the sheer-boom were towed from the island to the boat-yard on the 4th of August, and hauled out of water upon the ways on the 8th of August.

You concluded to have the boom, instead of one single length of 750 feet, divided into 3 parts, each part 250 feet in length. These parts were to be connected by heavy iron hinges and bolts. Some delay occurred in getting the necessary bolts and iron plates, and at the boatyard, because of the work on hand, it was the 12th of September before parts of the boom could be towed up to their place above the bridge and be hung to their moorings.

The present construction is far superior; the parts of 250 feet in length are easily towed, connected and disconnected. Another ring-bolt was made and imbedded in the bottom of the river, and the connections between anchor-chains and ring-bolts improved. A half ball of cast-iron of 9 inches diameter lies against the opening of the ring-bolts, and through this ball a heavy clevis of 1½-inch iron is held by two strong nuts to the anchor-chains.

You furthermore ordered the ¼-inch iron chains between the rudders to be replaced by ½-inch iron rods, which were fastened to the rudders by movable clevises of malleable iron. The rudders move easily and the boom is considerably improved by the above changes.

The boom remained in position until November 12, when you ordered both the booms to be taken into winter quarters at the slough of the so-called "Sylvan Water."

After the ice had disappeared in March, 1879, both booms were brought into position above and at the bridge again, where they are at the present date.

In the following, I respectfully submit certain points which experience has taught me by frequent observations of the actions of the boom:

1. The sheer-boom above the government bridge has been struck 21 times by large