

time, to dredge a cut through the bar at the entrance to the harbor. Work was commenced July 28, 1877, and completed September 14, 1877, during which time the dredge worked 308 hours and removed 4,945 cubic yards of material at a cost of about 40½ cents per cubic yard. A channel was made through the bar 1,300 feet long, 25 feet wide, and 8 feet deep at mean low-water, where formerly the least depth was about 3 feet at the same stage of the tide.

By act of Congress approved June 18, 1878, \$8,000 was appropriated for continuing the improvement.

*Money statement.*

July 1, 1878, amount available.....	\$8,954 88	
Amount appropriated by act approved March 3, 1879.....	5,000 00	
		\$13,954 88
July 1, 1879, amount expended during fiscal year.....		8,882 05
		<hr/>
July 1, 1879, amount available.....		5,072 83
		<hr/>
Amount (estimated) required for completion of existing project.....		15,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1881.		15,000 00

COMMERCIAL STATISTICS.

CUSTOM-HOUSE, PORT JEFFERSON, N. Y.,  
*Surveyor's Office, July 4, 1879.*

SIR: This port is a port of delivery only. The marine-hospital tax collected last year amounts to about \$1,200 and \$400 miscellaneous. About 1,500 vessels of all descriptions have passed in and out either for repairs or engaged in carrying away the products of the farmers.

I have a total of 112 vessels documented at this port, amounting to about 13,000 tons. Very few vessels put in here for a harbor on account of the narrow channel. If we had the present channel 150 feet wide, thousands of the coasting vessels would come in here for a harbor, as there is no other between this and the east end of the island on this shore; 12 feet is the largest draught of vessels which entered during the last year.

Very respectfully, your obedient servant,

SAMUEL R. DAVIS,  
*Surveyor of Customs.*

Col. J. W. BARLOW,  
*Major, Corps of Engineers, U. S. A.*

REPORT OF OBSERVATIONS MADE ON CURRENTS AND THE MOVEMENT OF MATERIAL  
IN AND OUT OF THE HARBOR OF PORT JEFFERSON, LONG ISLAND, NEW YORK.

In accordance with an order from Col. J. W. Barlow, Corps of Engineers, a series of observations was made to determine the line of direction of currents making in and out of the mouth of the harbor.

The method employed was by floats made of pieces of scantling from 1 foot to 6 feet in length, which were weighted at one end till the other was brought down to the level of the water. In this way the floats were acted on solely by the currents, and not affected by the wind. Along the line of high-water mark on the east and west beaches, and also on the island, stakes were placed 200 feet apart and located on a tracing of the harbor. A float being placed in the water, it was followed closely by a boat. The stakes on shore serving as ranges, the position of the float from time to time could be readily located by the observer in the boat.

By joining the points thus found a curve was formed which gave the course of the float. It was thought desirable to make observations at three periods in both the ebb and flood tides, viz, first hour, half-tide, and last hour. The flood-tide comes in from the northwest, and is in fact a back current of the main tide in the sound, caused by the putting out of Old Field Point.

The abrupt angle formed by the breakwaters and the shore causes a mass of dead water to the west of the west breakwater and to the east of the east breakwater.

A current setting through the west breakwater during flood-tide might lead one to suppose that there was a current from west to east along the shore west of the breakwater. After careful examination I have failed to find such a current. That through the breakwater is probably due to the difference in level of the water outside from that inside the entrance, a difference which is at times very apparent. The material which causes this constant change in the harbor comes from Mount Misery, the eastern point of the bay. There is some material brought from Old Field Point by westerly winds, but it is banked against the west breakwater, and is but little in comparison to the amount that is brought from the other direction. There is comparatively little movement of material from the eastward during moderate weather. The great influx occurs during heavy storms, when tons of material are carried across the beach or washed through the breakwater. The movement of material takes place in a belt about 200 feet wide extending along the shore and up the channel. I think it doubtful if there is any movement more than the 200 feet from high-water mark, as the line of muddy water is very distinct and seems to be about 50 feet beyond low-water mark.

All the material which finds its way into the channel goes through the east breakwater or is carried across the beach at high-water. From the inshore position of the belt of muddy water and the appearance of the shoal on the east side, I feel convinced that no material goes around the end of the breakwater. The material that is constantly shifting in and out of the harbor ranges in size between fine sand and gravel the size of a walnut. This movement of material takes place, for the most part, along the shore between high and low water marks, although a considerable shifting occurs between wind and water. It is probably due to the waves which, acting by impulse and not by pressure, keep the sand alive between the limits, so that as the tide rises it is free to the action of the current. The heavy cobbles seem to be brought in during northeast storms.

Along the bottom and in the deeper water large patches of seaweed may be seen growing on the large stones and cobbles, to which it is firmly attached. This seaweed, being free to the action of the currents set in motion by storms, greatly facilitates the loosening of the bedded cobbles, and then, acting like floats, the stones are drifted about and at length washed up on the shore, very much as a waterlogged piece of timber would be. The coarse sand follows the water line, passing in and out of the harbor, according as it is ebb or flood tide, by a series of zigzags. These are produced by the swash and the current acting at right angles to each other, rolling the sand and fine gravel obliquely to the shore, when the under-tow carries it back again, and the operation is repeated. The fine sand, and some of the coarse (according to the swiftness of the current), is held in suspension by the current. This is proved, 1st, by the grating sound heard when a boat is forced against the current; and, 2d, the ridges of sand that are seen on the bottom toward the last of either tide in places where, for some reason, the current has slackened.

These ridges are, for the most part, oblique to the current, the side in the direction from which the sand comes being composed of coarse material, which then gradually grades off into the finer. The flood-tide coming obliquely strikes the east breakwater and follows the shore, the strength of the current lying in the dredged channel.

After leaving the point of the east beach it strikes across to the point of the west beach, when it turns to the east and takes a straight course up the harbor. The ebb-tide is composed of three branches, uniting at the cut. The main current comes down the middle of the bay, and is composed of all the water from Setauket Harbor, part of that from Conscience Bay, and about two-thirds of that from Port Jefferson Harbor.

One branch comes in from the west through the beach channel, bringing a part of the water from Conscience Bay. The other branch comes from the east through the old mouth of the harbor, bringing part of the water from Port Jefferson Bay and the water from an inlet that makes up close to Mount Misery. The current setting out of this channel is perceptible three-fourths of a mile up the bay, and, setting along the eastern shore, is one of the most powerful agents in shaping the mouth of the harbor.

The main current coming down the bay runs parallel with the island till it is joined by the water from the beach channel, which bends it towards the east, when it is again bent to the west by the current out of the old mouth, and does not regain its general direction till it has passed the point of the east beach.

The shear last given causes the strength of the ebb-tide to lie to the west of the dredged channel. From what precedes, we should infer that the flood-tide was the greatest force acting on the east beach, while the ebb-tide was the most powerful agent on the west beach. This is in reality the case, as may be proved by the following facts. On the east beach the ridges of sand have the coarser material on the seaward side. The gravel has a decided tendency to lie at an angle like the trend of buoys in a current. The inner point of the beach is a bank of coarse sand, rising gradually on the seaward side and abruptly ending on the side washed by the water out of the old mouth. At the point of the east breakwater a shoal makes off at an angle of about 45 degrees and extends to the channel. This shoal is made by the material that is washed through the breakwater and carried out by the ebb-tide.

The water is deep and the shoal quite bold on its north side; owing to the wash of the heavy seas that sweep around the end of the breakwater, the shore is flat below half-water mark. It is caused by material that has washed through the breakwater, and as the ebb-tide is too far to the west, and the flood after being contracted by the two breakwaters has not spread out, this current is not strong enough to wash it away. Going still farther in, we find the flat falling away, the water deeper, and the shore more abrupt; this is the result of the combined action of both tides. The flood here spreads, striking the shore at a greater angle. The ebb after being cut to the west makes an eddy which strikes the shore perpendicularly and, splitting, forms a back current and a true current out of the harbor. The inner point of the east beach is high, bold on the south side, and flat nearly to the channel, carrying about a foot of water at low-water.

The shore has no doubt receded between high and low water mark. The ebb-tide is prevented from action on this flat by the current from the east. This current is very strong and sets close against the beach.

The flood-tide during heavy storms washes much material up over the point, which is cut away by the easterly current and deposited on the flat. The shoal on the north side of the island is due to the fact that the strength of the current follows the bend in the beach and leaves a large part of the old mouth but little influenced by tides. The northwest point is made entirely by the ebb-tide and a back current forms the main flood-tide as there is very little or no current in the old mouth during flood-tide. During flood-tide there are slight currents setting out of the old mouth and the west beach channel. These are probably due to suction. The inner point of the west beach is a bold shoulder of gravel with but few large cobbles, and having deep water on all sides. It is the most exposed point on either beach, standing as it does the full force of both tides. The existence of this shoulder is probably due to a strong eddy directly on the point during both tides. This may be seen by reference to the charts accompanying the report.

The other features of the west beach are the same as those of the east beach, being the result of identically the same forces.

Respectfully submitted.

FREDERICK N. OWEN.

### C 9.

#### IMPROVEMENT OF NORWALK HARBOR, CONNECTICUT.

By act of Congress of June 18, 1878, \$6,000 was appropriated for continuing this improvement. With this sum it was proposed to complete the removal of the middle ground at the upper end of the harbor, to widen the river at the various bends, and at such other places as would most benefit navigation.

Proposals for dredging were invited. The bids, of which the following is an abstract, were opened on the 6th of August, 1878:

Name.	Address.	Price per cubic yard.		To commence.	To complete.
		On the middle ground.	Below the rail-road wharf.		
John M. Seward.....	Albany, N. Y.....	\$0 40	\$0 14	No date.....	June 30, 1879
Henry D. Dennison.....	Syracuse, N. Y.....	40	15	Sept. 1, 1878	June 30, 1879
P. W. Myers.....	New York, N. Y..	45	16	Aug. 20, 1878	Dec. 1, 1878
James Calet*.....	do.....	34½	22	No date.....	No date.....
McDermott & Daley.....	Cohoes, N. Y.....	74	17	Mar. 15, 1878	June 30, 1879
H. W. & A. J. Beardsley.....	Bridgeport, Conn..	75	20	No date.....	No date.....

\* Guarantee not certified.

Mr. John M. Seward, of Albany, N. Y., being the lowest bidder, the contract was awarded to him at the rate of 40 cents per cubic yard for

work at the middle ground and 14 cents for work below the railroad wharf. Operations were begun August 27, and the work was completed December 20, 1878. 6,307 cubic yards of gravel and sand were removed from the middle ground, and an aggregate of 19,773 cubic yards were excavated in widening to 100 feet the channel opposite Ferry's Point, to 100 feet opposite Jennings's wharf, to 100 feet opposite Oystershell Point, and to 85 feet opposite the Danbury and Norwalk Railroad Docks at South Norwalk. At all points dredged the depth was made 6 feet at mean low-water. With the sum of \$10,000 appropriated for the fiscal year ending June 30, 1880, it is proposed to complete the removal of the middle ground at Norwalk, to improve the "cross-over" midway between South Norwalk and Gregory's Point, and to dredge at such other places as will most benefit the navigation of the river.

It is extremely desirable that these funds be applied as early as practicable, as much difficulty is encountered by vessels at the shoals above mentioned.

The following sums have been appropriated for improving this river:

June 10, 1872.....	\$10,000
March 3, 1873.....	10,000
June 23, 1874.....	10,000
March 3, 1875.....	7,000
June 18, 1878.....	6,000
March 3, 1879.....	10,000
Total.....	53,000

The bars in this river usually form at the bends, and it is quite probable will continue to do so, owing to the soft nature of the banks, which are composed almost exclusively of marsh mud. Hence, small annual expenditures will be required to preserve intact the channel now nearly completed under the present plan of improvement. To complete these improvements \$20,000 will be required, of which sum \$10,000 can be profitably expended during the next fiscal year.

Norwalk is in the Fairfield collection-district; Bridgeport is the nearest port of entry, where the amount of revenue collected during the fiscal year ending June 30, 1879, was \$5,436.20.

Norwalk light, on Sheffield Island, is opposite the mouth of the river.

The nearest works of defense are the fortifications at Throg's Neck, 29 miles distant.

No commercial statistics of the past year have been received. Following is an account of the business of this river for the year ending June 30, 1878:

Number of American vessels arrived from coastwise ports.....	764
Number of American vessels cleared for coastwise ports.....	333
Total number of vessels of all classes entered and cleared during the fiscal year ending June 30, 1878.....	1,097
Total tonnage.....	98,795
Estimated value of cargoes received and shipped during the year, from \$2,000,000 to \$2,250,000.....	
Draught of water; average, 7 feet 6 inches.	
Number of vessels of all classes entering the harbor for refuge during the year (estimated), 100.	

#### HISTORY OF THE IMPROVEMENT TO 1879.

By act of Congress approved March 2, 1829, the sum of \$80 was appropriated for making a survey of the harbor of Norwalk, with a view to its improvement.

By act of Congress approved March 3, 1871, a survey of Norwalk Harbor was directed. During the month of August a survey was made,

extending from the stone bridge at Norwalk to Gregory's Point, by Mr. John H. Dager, assistant engineer, under direction of Gen. G. K. Warren, Corps of Engineers. In General Warren's report, dated December 16, 1871, an estimate was submitted for widening the channel to 100 feet, with a depth of 6 feet at mean low-water.

The amount to be removed to complete this channel was estimated at 153,879 cubic yards.

By act of Congress approved June 10, 1872, \$10,000 was appropriated for commencing the improvement, limiting the work to that portion of the river above the railroad bridge. Proposals were invited and opened July 30, 1872. The contract was awarded to Mr. G. H. Ferris, of Brooklyn, N. Y. Work was commenced September 19, 1872, and completed March 13, 1873, during which time 35,175 cubic yards of material were removed and deposited in deep water at the mouth of the river. The channel was made 40 feet wide and 6 feet deep, at mean low-water, from Danbury and Norwalk railroad docks at South Norwalk to Jennings' wharf, a distance of 2,800 feet, and 60 feet wide and 6 feet deep above Jennings' wharf, for a distance of 400 feet.

By act of Congress approved March 3, 1873, \$10,000 was appropriated for continuing the improvement of the harbor. Proposals were invited for dredging from the head of the channel dredged in 1873, to the stone bridge, and bids were opened May 6, 1873.

The contract was awarded to Mr. E. R. Seward, of Albany, N. Y., at the rate of 45 cents per cubic yard. Work was commenced July 7 and stopped October 8, 1873, during which time 19,895 cubic yards of material had been removed. The channel was extended 1,300 feet towards the stone bridge, being made 60 feet wide and 6 feet deep at mean low water. In the annual report for the fiscal year ending June 30, 1874, it was estimated that to make the 6-foot channel 60 feet wide from Gregory's Point to the stone bridge at Norwalk would require the removal of about 45,000 cubic yards of material. This work was transferred from General Warren to the charge of Col. J. W. Barlow in July 1874.

By act of Congress approved June 23, 1874, \$10,000 was appropriated for continuing this improvement. With this sum it was proposed to widen and deepen the channel between the Washington bridge and New York and New Haven railroad bridge; above the railroad bridge and opposite Oyster Shell Point; and to extend the channel through the middle ground at Norwalk. Proposals for dredging were invited and were opened August 26, 1874. The contract was awarded to Mr. E. R. Seward, of Albany, N. Y., at the rate of 23 cents per cubic yard.

September 22, 1874, work was commenced, and stopped August 11, 1875. During this time 36,715 cubic yards of material were removed and the channel made 60 feet wide and 6 feet deep, at mean low-water, from New York and New Haven Railroad bridge to the stone bridge.

By act of Congress approved March 3, 1875, \$7,000 was appropriated for continuing this improvement. Proposals for dredging were invited for making the channel 60 feet wide and 6 feet deep above Gregory's Point, and opened June 22, 1875. The contract was awarded to Messrs. H. N. & A. J. Beardsley, of Bridgeport, Conn., at the rate of 13½ cents per cubic yard. Work was commenced September 28, 1875, and completed November 17, 1875; 44,444 cubic yards of material having been removed. The channel from Gregory's Point to Washington bridge was made from 100 to 120 feet wide with a depth of at least 6 feet at mean low-water, and 60 feet wide and 6 feet deep from Washington bridge to New York and New Haven Railroad bridge, covering a distance of 420

feet.

*Money statement.*

July 1, 1878, amount available.....	\$6,000 00
Amount appropriated by act approved March 3, 1879.....	10,000 00
	\$16,000 00
July 1, 1879, amount expended during fiscal year.....	5,916 91
	10,083 09
July 1, 1879, amount available.....	10,083 09
Amount (estimated) required for completion of existing project.....	20,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1881.	10,000 00

## APPENDIX D.

ANNUAL REPORT OF COLONEL JOHN NEWTON, CORPS OF  
ENGINEERS, FOR THE FISCAL YEAR ENDING JUNE 30,  
1879.

UNITED STATES ENGINEER OFFICE,  
New York, July 15, 1879.

SIR: I have the honor to transmit herewith the annual reports upon the river and harbor works in my charge for the fiscal year ending June 30, 1879.

Very respectfully, your obedient servant,

JOHN NEWTON,  
Col. of Engineers, Bvt. Maj. Gen., U. S. A.  
The CHIEF OF ENGINEERS U. S. A.

## D 1.

## IMPROVEMENT OF HUDSON RIVER, NEW YORK.

Lieut. J. H. Willard, Corps of Engineers, is in superintendence of the works, which he has efficiently and economically managed.

Partial surveys were frequently made for the location of dikes, of lines to be dredged, and of the same after completion for comparison.

## REPAIRS.

The west dike at New Baltimore was secured by additional piles, and the settlement of the stone filling readjusted.

The dikes at Van Wie's, at Douw's, Pada Hook, and Coeymans have been leveled up with stone for most of their lengths.

A small cut was made in Papscannee Dike to accommodate boats.

The first, second, and part of the third dam appertaining to the three sections of dikes on the east side of the Overslaugh have been removed. These dams were temporary and useful only until funds were available to connect the sections together.

A wreck on the cross-over from Douw's Point was also removed. Amount expended for repairs, \$2,495.90.

Lieutenant Willard estimates for the repairs necessary for the present fiscal year the sum of \$2,500.

## NEW WORK.

Contracts dated October 23, 1878, made for pile dikes and for driving lines of piles, the last where it was thought that the more expensive dike might be dispensed with, but it was foreseen that circumstances might arise rendering it expedient to convert a portion of the piling into a dike, which could easily be effected by depositing stone on one or both sides of the line.