B 12.

PRELIMINARY EXAMINATION OF CHANNEL FROM GOOSE POINT, IN PLYMOUTH HARBOR, MASSACHUSETTS, TO THE WHARF OF THE CORDAGE COMPANY.

BOSTON, MASS., *September* 4, 1884.

GENERAL: In compliance with instructions contained in your letter of July 31, 1884, I have the honor to submit the following report of a preliminary examination of the proposed "channel from Goose Point, in Plymouth Harbor, to the wharf of the Cordage Company," provided for by the river and harbor act of July 5, 1884.

Goose Point Channel is a branch of the Main Ship Channel of Plymouth Harbor, extending in a southwesterly direction for a distance of about 1,980 yards. Its general location is shown in the sketch map of Plymouth Harbor, accompanying my letter to the Department, dated March 17, 1884.

The average width of this channel is 180 feet, and its average depth 12 feet at mean low water. The proposed improvement consists in the extension of this channel by dredging from the point where it now terminates to the wharf of the Plymouth Cordage Company.

A survey of the channels in Plymouth Harbor was made during the months of December, 1883, and January, 1884, by authority of Department letter, dated November 10, 1883. My report, dated January 30, 1884, was submitted to the Department, and the proposed extension of the Goose Point Channel was discussed therein. The details of the project considered are shown on Tracing No. 2, accompanying that report. The line of the proposed excavation is taken through the flats of sand and mud along the line of deepest water. There is at present along that line an average depth of 1½ feet at mean low water; so that no low-water channel now exists. The length of the proposed excavation is 5,940 feet. It is 100 feet wide and 5 feet deep at mean low water. These

dimensions have been adopted in order to permit vessels drawing 12 feet to work up through the channel at high water. The project requires the excavation of 103,000 cubic yards, and is estimated to cost about $42,000.

I am of the opinion that a channel thus constructed would be permanent, since the outflowing tide moves in the direction of its axis, and since the material is the same as that already dredged in the extension of the main ship-channel, in which the cut has remained open.

Shorter lines were considered, but none were found which would not, in all probability, rapidly deteriorate.

In my report of January 30, 1884, I remarked as follows:

> It does not appear that such a channel is required by any vessels other than those going to the wharf of the Plymouth Cordage Company.

Subsequently I received letters from other parties claiming to be more or less interested in the proposed improvement.

These letters were transmitted to the Department, and my accompanying letter, dated March 17, 1884, considers in detail the character and amount of the interests supposed to be involved. A copy of a letter from the collector of the port of Plymouth, more recently received, is herewith respectfully transmitted.

In connection with this subject I need here only remark that the opinion expressed in my report, to the effect that the proposed improvement is required only for the convenience of the Plymouth Cordage Company, still appears to me to be substantially correct.

Plymouth is a port of entry, and it appears from the letter of the collector that the Plymouth Cordage Company pays about three-fourths of the total revenue there received. While, therefore, there seems to be few or none who are directly interested in the proposed improvement, there are doubtless many who desire the encouragement of an establishment without which the collection district would greatly diminish in importance or possibly even cease to exist.

It appears that the Plymouth Cordage Company was established in 1824, since which time it has managed to transact its business without any low-water channel. During the three years ending June 30, 1883, 51 vessels with cargoes from foreign ports arrived at this company's wharf, being an average of 17 vessels per year.

There are many points along the shore of Plymouth Harbor which are now inaccessible at low water, but to which channels might be dredged at less expense than that required for the one under consideration. Such property can, of course, be cheaply obtained. Should a company locate itself at one of these points, and pay sufficient revenue and transact sufficient business to interest the people of Plymouth, it might with considerable reason demand that the United States construct a channel to *its* wharf, should the channel now proposed be executed for the benefit of the Plymouth Cordage Company.

It is now my duty to give my judgment, based upon the above facts, as to whether or not the harbor is worthy of improvement.

I understand the question to be whether the particular improvement proposed is of such a character and promises such benefit to commerce as to justify the necessary expenditure by the United States.

I am of the opinion that "the harbor is not worthy of improvement."

Very respectfully, your obedient servant,

CHAS. W. RAYMOND,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

LETTER OF THE COLLECTOR OF CUSTOMS AT PLYMOUTH, MASSACHUSETTS.

CUSTOM-HOUSE, PLYMOUTH, MASS.,
Collector's Office, February 19, 1884.

SIR: As the Corps of Engineers under your orders have this winter been making surveys for the improvement of the harbor, and you have been pleased to recommend an appropriation therefor, and have later made additional surveys with the view of excavating a channel from Goose Point Channel (so called) to the wharf of Plymouth Cordage Company, I deem it merely an act of justice to that company for me to say that about three-fourths of the revenue received at this port is received from them.

In furtherance of the wishes of that company, *but not from any request on their part*, I think I now state to you the sentiment and wish of the large majority of the disinterested of this community when I say that, if an appropriation should be granted, no part thereof should be otherwise expended till the aforesaid channel was completed, always excepting the repairs on Long Beach, the which, but for the skillful engineering and plans executed by that department, would have been long since partially destroyed and Plymouth Harbor left but little better than an open roadstead.

Very respectfully, your obedient servant,

SAMUEL H. DOTEN,
Collector.

CHARLES W. RAYMOND,
Major of Engineers.

B 19.

PRELIMINARY EXAMINATION OF GOOSE POINT CHANNEL, PLYMOUTH HARBOR, MASSACHUSETTS, TO PUBLIC WHARF AT KINGSTON.

UNITED STATES ENGINEER'S OFFICE,
Boston, Mass., October 27, 1888.

GENERAL: In compliance with instructions contained in your circular letter of August 28, 1888, I have the honor to submit this my report of the preliminary examination of Goose Point Channel, Plymouth Harbor, to public wharf at Kingston, provided for in the river and harbor act of August 11, 1888. Plymouth Harbor is practically composed of three different bays, Duxbury Bay on the north, Kingston Bay on the west, and Plymouth Bay and Harbor on the south. These three bays have a common anchorage at the outer entrance, called the Cow-Yard, from which diverge distinct channels leading to their respective local wharves. Goose Point Channel is a small depression in the Plymouth Flats, and forms the western branch of the Plymouth Harbor main channel. It is somewhat over a mile long, has a width of 180 feet, and a depth at mean low water of 12 feet. It may be regarded as a blind flood-channel, leading nowhere in particular except toward a shoal beach, and is only used at high water by vessels which may desire to go by a direct course to the wharf belonging to the Plymouth Cordage Company, in North Plymouth.

There are only four wharves between Plymouth and Kingston: Robins Wharf and wharf of the Plymouth Cordage Company, North Plymouth; wharf at Rocky Neck, 4,000 feet to the westward, and one inside of Johns River. All of these wharves have a limited use. The first three are on the south shore, and are separated from the deep-water channel of the adjacent bay by wide flats, bare at low water. The Goose Point Channel does not give access to any one of them at any stage of the tide except to small vessels, and to make a communication with one or all of them by a water-way excavated from the terminus of the Goose Point Channel would be to dig a channel along a sloping beach where the existing depth is nowhere greater than 1½ feet at mean low water, and across which the ebb tides would race almost at right angles in their course to the deep water outlet located at the foot of the fore-shore of the beach. It is apparent that such a chan-

nel, once opened, would rapidly decline, and would require constant dredging for its maintenance.

The river and harbor act of July 5, 1884, provides for the examination of "Goose Point Channel in Plymouth Harbor to the wharf of the Cordage Company."

The examination was made in August, 1884, and a report submitted by the engineer officer in charge, dated September 4, 1884 (Annual Report Chief Engineers, 1885, Part 1, page 508). The officer stated in the report that the Goose Point Channel is not a low-water channel, and the opening of a water-way by dredging 5,940 feet long, 100 feet wide, and 5 feet deep at mean low water would cost $42,000.

An inspection of the chart accompanying the letter of the local officer January 30, 1884, will indicate, I think, that the improvement thereon indicated will benefit the Plymouth Cordage Company only.

The shoal covered by bowlders, which projects 700 feet beyond the high-water line, at a point 1,500 feet east of the wharf of the Plymouth Cordage Company, requires the proposed channel in extension of the Goose Point Channel to be located at a distance of 1,200 feet from the general high-water line of the shore at the nearest point, thereby rendering such an improvement unserviceable to any wharf but that of the Cordage Company.

Even supposing the Goose Point Channel to be extended to the Cordage Company, it would not be expedient or advisable to attempt to reach any wharf to the westward by a new extension, for such a work would but make of the whole channel, from its beginning at Goose Point, to its terminus at the last wharf, an intercepting channel of uncertain maintenance along the whole shore, executed at unreasonable cost, and furnishing but slight advantages over those already afforded by the existing deep-water channel which traverses the bay.

For the foregoing reasons I do not think the extension of the Goose Point Channel "worthy of improvement." The scheme, if executed, will benefit one corporation only at an estimated cost of $40,000, and if extended to include other wharves and other interests, the estimated cost will not be less than $75,000, for which the General Government and the local interests would receive no adequate return.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
Lieut. Col. of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

B 25.

PRELIMINARY EXAMINATION OF KINGSTON HARBOR, MASSACHUSETTS.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., November 1, 1890.

GENERAL: In compliance with instructions contained in letter from your office dated September 20, 1890, I have the honor to submit the report of a preliminary examination of Kingston Harbor, Massachusetts, with a view to its improvement, provided for in the river and harbor act approved September 19, 1890.

Kingston Harbor is one of the three divisions which together constitute the inner harbor of Plymouth. To the northward is Duxbury Harbor; to the westward is Kingston Harbor, directly opposite the entrance from Plymouth Bay; and to the southward, Plymouth Harbor.

From the common anchorage near the entrance, called the "Cow Yard," channels of deep water diverge in several directions and lead to landings near the towns of Duxbury, Kingston, and Plymouth. These channels are circuitous indentations in the extensive flats of this basin, and afford the only means of communication between the towns and Plymouth Bay.

The channels to both Duxbury and Plymouth have been improved by the General Government to accommodate vessels of light draft.

Kingston is a small town situated about 1 mile inland on the Jones River, a small and crooked stream of little navigable importance. One small wharf at Rocky Nook is in Kingston Harbor proper, but just across the boundary line between Kingston and Plymouth Harbors, and about 2 miles from the center of Kingston, is located the extensive works of the Plymouth Cordage Company. Here the company have constructed and own the only wharf of any importance in the vicinity.

It is understood that the purpose of the applicants for the Government improvement of Kingston Harbor is to secure a deeper channel of approach to this wharf, which it is claimed will greatly benefit, not alone the cordage company, but the inhabitants of Kingston and North Plymouth, by enabling them to obtain supplies of coal and building materials at cheaper rates. They say in their petition:

> The locality has large and important manufacturing interests, employing about 800 persons from a population of 4,000 in the immediate neighborhood of the desired improvement. The materials used are principally imported by the proprietors from foreign ports, the duties on the same being paid on withdrawals from the bonded warehouses, of which there are four located on the premises of the factories. The supply of coal for the mills, as also the residents with lumber and other articles of domestic use, calls for the use of about fifty vessels each year, the masters of which are put to great inconvenience and delay, the channel being of insufficient depth to float them except at high course tides. The largest vessels have to lighten their cargoes at great expense.

The usual approach to this wharf is from the south through Goose Point Channel, which leads out of the channel to Plymouth near the head of Long Beach. For a distance of about three-fourths of a mile from the wharf the passage has not more than 1½ feet water at low tide.

The river and harbor act of 1884 provided for an examination of "Goose Point Channel in Plymouth Harbor to the wharf of the Cordage Company." The report of the engineer officer who made the examination will be found on page 538 of the Report of the Chief of Engineers for 1885. This officer discusses the proposed extension of Goose Point Channel, refers to a former communication, and says the project requires the excavation of 103,000 yards, and is estimated to cost about

$40,000, to permit vessels drawing 12 feet to work up through the channel at high water. He thinks that the channel would be permanent, and expresses the opinion that the proposed improvement is required only for the convenience of the Plymouth Cordage Company, and concludes that "the harbor is not worthy of improvement," as it does not promise sufficient benefit to commerce to justify the necessary expenditure by the United States.

The river and harbor act of 1888 provided for an examination of "Goose Point Channel, Plymouth Harbor, Massachusetts, to public wharf at Kingston."

The report of the officer who made this examination will be found on page 596 of the Report of the Chief of Engineers for 1889. He, likewise, does not think the extension of Goose Point Channel "worthy of improvement."

The scheme if executed will benefit one corporation only at an estimated cost of $40,000, and if extended to include other wharves and other interests, the estimated cost will not be less than $75,000, for which the General Government and the local interests would receive no adequate return.

The river and harbor act of 1890 provides for an examination of "Kingston Harbor, with a view to its improvement." The same object is here sought, viz: A deep-water channel to the wharf of the Plymouth Cordage Company. I have endeavored to learn to what extent the general public will be benefited by the improvement demanded, aside from that which will accrue to the cordage company.

Mr. G. F. Holmes, treasurer of the company, replies to my inquiries that owing to the extra rate of freight on account of being able to accommodate only the lightest draft vessels, the employés of the company have to pay an extra price for their coal.

In addition to this, our dock is used for the accommodation of parties who have no connection with our works, consequently any improvement in this part of the town would be for the benefit of the public and not for our exclusive good.

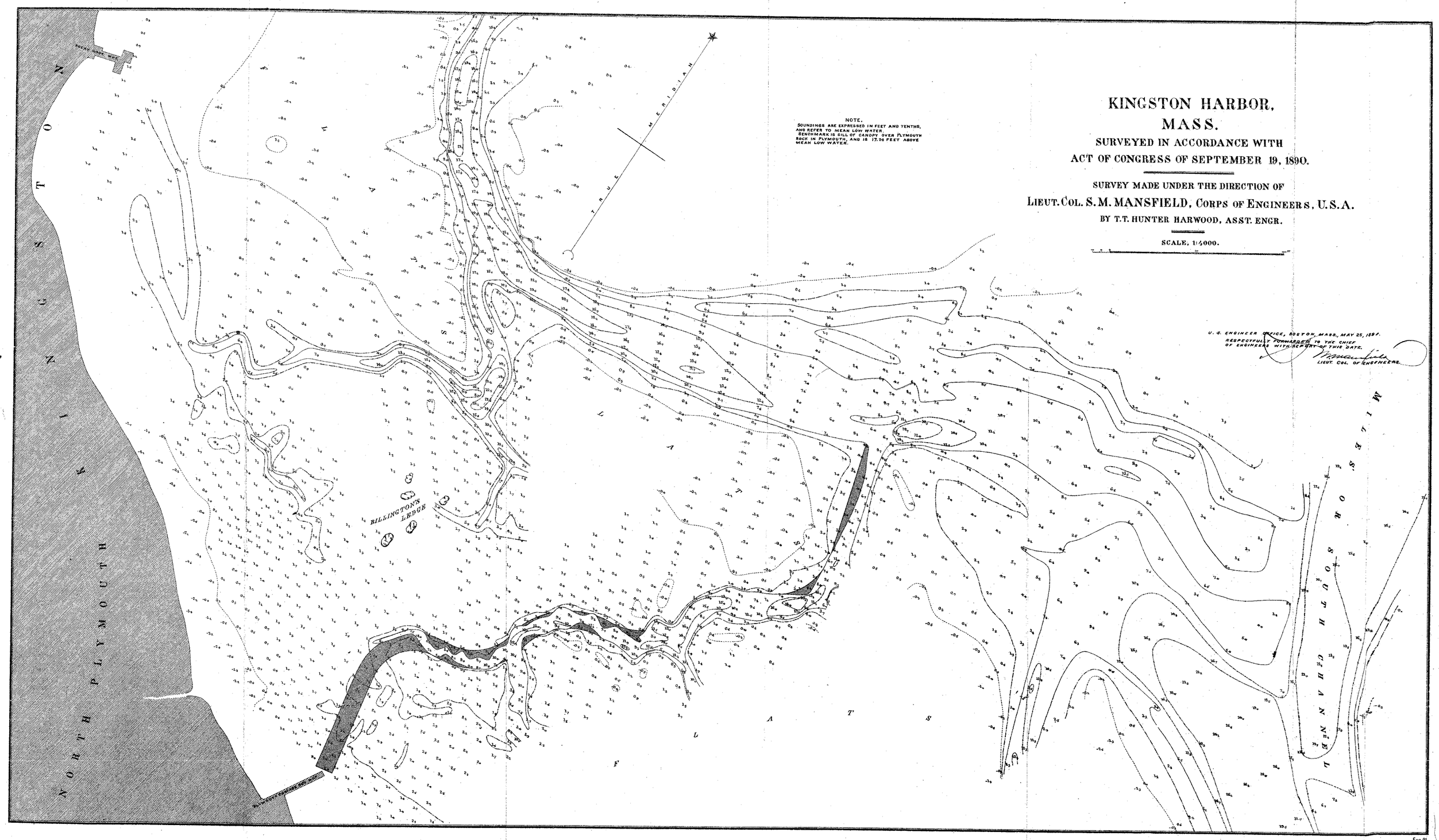
Mr. Philander Cobb, ex-collector of Plymouth, writes: "There is no place, in my opinion, where an appropriation could be more judiciously applied to benefit commerce than the improvement of the harbor of Kingston and of the approaches to the public wharves of said port and of North Plymouth; all of the wharves are as public as any in Plymouth or Boston."

I am satisfied that the wharf of the Plymouth Cordage Company is as public as any other, and that it is the wharf upon which the inhabitants of Kingston depend for transportation by water. It would appear that the benefits to follow an improvement of the channel leading to it will benefit the people of Kingston in affording better and cheaper facilities for transportation, while at the same time it will be a great benefit to the cordage company.

The petitioners for this improvement state that—

The duties paid by the manufacturers at North Plymouth and Kingston from July 1, 1886, to July 1, 1889, amount to $188,490.94. The records of the custom-house show that during the last 8 years 98 foreign vessels of the burden of 100 to 1,500 tons entered with cargoes for the locality your petitioners respectfully request to have improved.

A simple examination of Kingston Harbor is not sufficient to determine if it can be improved to meet the requirements, within a practicable outlay. There would seem to be sufficient in the above review to warrant my saying that the harbor is worthy of improvement, but a survey alone will enable me to determine if a channel adequate to the wants of the people can be made and maintained at reasonable cost


KINGSTON HARBOR,
MASS.
SURVEYED IN ACCORDANCE WITH
ACT OF CONGRESS OF SEPTEMBER 19, 1890.
SURVEY MADE UNDER THE DIRECTION OF
LIEUT. COL. S. M. MANSFIELD, CORPS OF ENGINEERS, U.S.A.
BY T.T. HUNTER HARWOOD, ASST. ENGR.
SCALE, 1:4000.
NOTE.
SOUNDINGS ARE EXPRESSED IN FEET AND TENTHS, AND REFER TO MEAN LOW WATER.
BENCHMARK IS SILL OF CANOPY OVER PLYMOUTH ROCK IN PLYMOUTH, AND IS 17.24 FEET ABOVE MEAN LOW WATER.
U. S. ENGINEER OFFICE, BOSTON, MASS., MAY 25, 1891.
RESPECTFULLY FORWARDED TO THE CHIEF OF ENGINEERS WITH REPORT OF THIS DATE.
LIEUT. COL. OF ENGINEERS.
TRUE MERIDIAN
BILLINGTON'S LEDGE
NORTH PLYMOUTH
KINGSTON
FLATS
MILES OR SOUTH CHANNEL

Eng 91

through the channel leading westward from the anchorage (Cow Yard), into Kingston Harbor.

An allotment of $1,000 is respectfully requested for this purpose.

Very respectfully, your obedient servant,

S. M. MANSFIELD,
Lieut. Col. of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

[Second indorsement.]

U. S. ENGINEER OFFICE,
Boston, Mass., November 6, 1890.

Respectfully returned to the Chief of Engineers, U. S. A.

In accordance with first indorsement hereon, I have the honor to state that in my opinion Kingston Harbor, Massachusetts, "is worthy of improvement."

S. M. MANSFIELD,
Lieut. Col. of Engineers.

SURVEY OF KINGSTON HARBOR, MASSACHUSETTS.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., May 25, 1891.

GENERAL: I have the honor to forward herewith a report of Mr. T. T. Hunter Harwood, assistant engineer, on the survey of Kingston Harbor, Massachusetts, made in accordance with Department instructions of November 7, 1890, and to comply with the provisions of the river and harbor act of September 19, 1890.

A tracing of the survey is also submitted.

The report of the preliminary examination is dated November 1, 1890, and I respectfully invite attention to it for a general description of the harbor, for its commercial importance, and the reasons for making the survey.

The survey shows that to improve the channel leading to Rocky Nook Wharf, Kingston, so as to obtain 6 feet depth at mean low water in a channel 100 feet wide, would cost $15,000.

A channel of these dimensions can be obtained leading to the Cordage Company Wharf in North Plymouth, the only one of any importance in the vicinity, at a cost of $10,000, as indicated on the accompanying tracing, and as stated in the preliminary examination such an improvement would benefit the town of Kingston.

The estimate of the cost of this improvement is as follows:

Dredging 30,000 cubic yards, at 30 cents	$9,000
Contingencies	1,000
Total	10,000

I respectfully invite attention to the accompanying report of Mr. Harwood for the details of the survey and a general description of the harbor.

Kingston is in the collection district of Plymouth, Mass., of which Plymouth is the port of entry; the nearest light-house is Duxbury Pier light.

Very respectfully, your obedient servant,

S. M. MANSFIELD,
Lieut. Col. of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

REPORT OF MR. T. T. HUNTER HARWOOD, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., May 20, 1891.

COLONEL: I have the honor to submit the following report on the survey of Kingston Harbor, Massachusetts, made in November and December, 1890, in accordance with your instructions, and therewith a map of the survey drawn to a scale of 1:2000.

TOPOGRAPHY.

The distance between two triangulation points of the survey made in Plymouth Harbor in 1888 was taken as the base line of this survey. From this base, 10845.7 feet in length, a system of 9 triangulation stations was established along the shore. From these stations radiating ranges were laid out, on which soundings were taken. The high-water and low-water lines shown are from this survey.

HYDROGRAPHY.

The area covered by the survey embraces the channels of approach to the wharf of the Plymouth Cordage Company in North Plymouth, and Rocky Nook Wharf in Kingston, west of the Miles or South Channel leading to Duxbury; 108 ranges, aggregating 29 miles in length, were sounded, on which 9,417 soundings were taken, 1,512 of which were located by intersections from suitable shore stations.

The bench mark is the sill of the canopy over Plymouth Rock in Plymouth, and is 17.24 feet above mean low water.

DESCRIPTION OF CHANNEL AS DEVELOPED BY SURVEY.

The Miles or South Channel to Duxbury starts from the west side of the common anchorage ground of Plymouth, Kingston, and Duxbury Harbors, known as the "Cow Yard," and extends westerly for about three-quarters of a mile, and then swings to the northwest toward Duxbury. At this bend the channel covered by the survey branches off, and continues in a west course for a further distance of 1 mile; then turning to the north it follows a tortuous course along the shore, at a distance of about one-half mile, to the mouth of Jones River in Kingston. This channel is 6 feet deep with a least width of 200 feet to east of Rocky Nook Wharf, where this survey ends.

From this channel, at about one-half mile west of its junction with the Miles Channel, a narrow shallow channel branches off to the south leading to the wharf of the Plymouth Cordage Company in North Plymouth. A narrow 6-foot thread of water winds through this channel to within 800 feet of the wharf. The greatest continuous depth to the wharf is 1.7 feet.

The channel leading to Rocky Nook Wharf branches from the main channel at its turn to the north, extends south about 800 feet, then, turning abruptly to the west, extends west 1,700 feet, where it turns north and follows along the shore to the wharf. The greatest continuous depth to this wharf is 1.5 feet.

The banks of the channels are generally sharply defined in the flats through which they flow, the material of which is sand and mud.

A comparison of these channels with those delineated on the U. S. Coast Survey manuscript map of 1870 proves them to be almost identical.

Very respectfully, your obedient servant,

T. T. HUNTER HARWOOD,
Assistant Engineer.

Lieut. Col. S. M. MANSFIELD,
Corps of Engineers, U. S. A.

1893

18. Kingston Harbor, Massachusetts.—Kingston Harbor is one of the three divisions which together form Plymouth inner harbor.

The wharf at which supplies are landed for the town of Kingston is about 2 miles south from the center of the town, and is known as the Plymouth Cordage Company's Wharf. No low-water channel of navigable dimensions existed to this wharf.

The project for the improvement was submitted May 25, 1891. It proposed to dredge a channel 100 feet wide, 6 feet deep at mean low water from deep water to the Cordage Company's Wharf, at an estimated cost of $10,000.

The total appropriations to date have been $10,000.

On September 16, 1892, a contract was entered into for the completion of the project. Operations under this contract were commenced in April, 1893, and satisfactorily completed in June, 1893.

At the date of this report the improved channel is completed in accordance with the project.

Amount appropriated by act approved July 13, 1892	$10,000.00
June 30, 1893, amount expended during fiscal year	1,374.54
July 1, 1893, balance unexpended	8,625.46
July 1, 1893, outstanding liabilities	7,563.10
July 1, 1893, balance available	1,062.36

(See Appendix B 18.)

B 18.

IMPROVEMENT OF HARBOR AT KINGSTON, MASS.

Kingston Harbor is one of the three divisions which together constitute Plymouth inner harbor. North of it, at a distance of 3 miles, is Duxbury Harbor, and 4 miles south Plymouth Harbor.

The wharf at which supplies are landed for the town of Kingston is about 2 miles south from the center of the town, and is known as the Plymouth Cordage Company Wharf.

The object of the improvement is to obtain a channel of approach to this wharf.

The project for the improvement of Kingston Harbor was submitted May 25, 1891. It proposed to dredge a channel 4,000 feet long, 100 feet wide, 6 feet deep at mean low water, from deep water to the Cordage Company Wharf, at an estimated cost of $10,000.

The act approved July 13, 1892, appropriated $10,000 for this work.

On July 18, 1892, it was recommended that the available funds be expended in completing the improvement; this was approved July 25, 1892.

On August 6, 1892, an advertisement was issued inviting proposals for this work. The bids received were opened September 6, 1892, and an abstract of them will be found in the annexed table.

On September 16, 1892, a contract was entered into with the National Dredging Company, of Wilmington, Del., to dredge 30,000 cubic yards.

Operations under this contract were commenced in April, 1893, and satisfactorily completed in June, 1893.

The improved channel is at the date of this report 100 feet wide, 6 feet deep at mean low water, or as proposed by the project.

Kingston is in the collection district of Plymouth, Mass., of which Plymouth is the port of entry; the nearest light-house is Duxbury Pier Light.

Commercial statistics are included in the statement for Plymouth, Mass.

But one appropriation has been made for this work, viz: By the act of July 13, 1892, $10,000.

Money statement.

Amount appropriated by act approved July 13, 1892	$10,000.00
June 30, 1893, amount expended during fiscal year	1,374.54
July 1, 1893, balance unexpended	8,625.46
July 1, 1893, outstanding liabilities	7,563.10
July 1, 1893, balance available	1,062.36

Abstract of proposals for dredging from Kingston Harbor, Massachusetts, opened September 6, 1892, by Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Bidders.	Price bid for—		Total yards at price bid.	Remarks.
		Dredging per cubic yard.	Removal of bowlders over 3 tons.		
		Cents.			
1	National Dredging Co., Wilmington, Del	24	$15	37,500	Lowest bid.
2	Charles H. Souther, Boston, Mass	38½	5	23,376	
3	Augustus R. Wright, Portland, Me	44	3	20,454	
4	Augustus B. Martin, Boston, Mass	46	10	19,565	

The contract was awarded to the National Dredging Company, with the approval of the Chief of Engineers.

18. Kingston Harbor, Massachusetts.—Kingston Harbor is one of the 3 divisions which together form Plymouth inner harbor.

The wharf at which supplies are landed for the town of Kingston is about 2 miles south of the center of the town, and is known as the Plymouth Cordage Company's wharf. No low-water channel of navigable dimensions existed to this wharf.

The project for the improvement was submitted May 25, 1891. It proposed to dredge a channel 100 feet wide, 6 feet deep at mean low water from deep water to the Cordage Company's wharf, at an estimated cost of $10,000.

The total appropriations to date have been $10,000.

The expenditures to June 30, 1893, were $8,937.64, and at that date the project had been completed.

No operations were in progress during the fiscal year, and at the date of this report the improved channel is in good order.

July 1, 1893, balance unexpended	$8,625.46
June 30, 1894, amount expended during fiscal year	7,565.55
July 1, 1894, balance unexpended	1,059.91

(See Appendix B 18.)

B 18.

IMPROVEMENT OF HARBOR AT KINGSTON, MASSACHUSETTS.

Kingston Harbor is one of the three divisions which together constitute Plymouth inner harbor. North of it, at a distance of 3 miles, is Duxbury Harbor, and 4 miles south, Plymouth Harbor.

The wharf at which supplies are landed for the town of Kingston is about 2 miles south from the center of the town, and is known as the Plymouth Cordage Company Wharf.

The object of the improvement is to obtain a channel of approach to this wharf.

The project for the improvement of the harbor was submitted May 25, 1891. It proposed to dredge a channel 4,000 feet long, 100 feet wide, 6 feet deep at mean low water, from deep water to the Cordage Company Wharf, at an estimated cost of $10,000.

The act approved July 13, 1892, appropriated $10,000 for this work.

The total expenditures to June 30, 1893, were $8,937.64, and on that date the project had been completed.

No operations were in progress during the fiscal year, and at the date of this report the improved channel is in good order.

Kingston is in the collection district of Plymouth, Mass., of which Plymouth is the port of entry; the nearest light-house is Duxbury Pier Light.

Commercial statistics are included in the statement for Plymouth Harbor.

Money statement.

July 1, 1893, balance unexpended	$8,625.46
June 30, 1894, amount expended during fiscal year	7,565.55
July 1, 1894, balance unexpended	1,059.91

18. Kingston Harbor, Massachusetts.—Kingston Harbor is one of the three divisions which together form Plymouth inner harbor.

The wharf at which supplies are landed for the town of Kingston is about 2 miles south of the center of the town and is known as the Plymouth Cordage Company's wharf. No low-water channel of navigable dimensions existed to this wharf.

The project for the improvement was submitted May 25, 1891. It proposed to dredge a channel 100 feet wide, 6 feet deep at mean low water, from deep water to the Cordage Company's wharf, at an estimated cost of $10,000.

The total appropriations to date have been $10,000.

The expenditures to June 30, 1894, were $8,940.09, and at that date the project had been completed.

No operations were in progress during the fiscal year, and at the date of this report the improved channel is in good order.

July 1, 1894, balance unexpended	$1,059.91
July 1, 1895, balance unexpended	1,059.91

(See Appendix B 18.)

B 18.

IMPROVEMENT OF HARBOR AT KINGSTON, MASSACHUSETTS.

Kingston Harbor is one of the three divisions which together constitute Plymouth inner harbor. North of it, at a distance of 3 miles, is Duxbury Harbor, and 4 miles south, Plymouth Harbor.

The wharf at which supplies are landed for the town of Kingston is about 2 miles south from the center of the town, and is known as the Plymouth Cordage Company's Wharf.

The object of the improvement is to obtain a channel of approach to this wharf.

The project for the improvement of the harbor was submitted May 25, 1891. It proposed to dredge a channel 4,000 feet long, 100 feet wide, 6 feet deep at mean low water, from deep water to the Cordage Company's Wharf, at an estimated cost of $10,000

The act approved July 13, 1892, appropriated $10,000 for this work.

The total expenditures to June 30, 1894, were $8,940.09, and on that date the project had been completed.

No operations were in progress during the fiscal year, and at the date of this report the improved channel is in good order.

Kingston is in the collection district of Plymouth, Mass., of which Plymouth is the port of entry. The nearest light-house is Duxbury Pier Light.

Commercial statistics are included in the statement for Plymouth Harbor.

Money statement.

July 1, 1894, balance unexpended	$1,059.91
July 1, 1895, balance unexpended	1,059.91

1906

59TH CONGRESS, 1st Session. | HOUSE OF REPRESENTATIVES. | DOCUMENT No. 176.

KINGSTON HARBOR, MASSACHUSETTS.

LETTER

FROM

THE SECRETARY OF WAR,

TRANSMITTING,

WITH A LETTER FROM THE CHIEF OF ENGINEERS, REPORT OF EXAMINATION OF KINGSTON HARBOR, MASSACHUSETTS.

DECEMBER 13, 1905.—Referred to the Committee on Rivers and Harbors and ordered to be printed.

WAR DEPARTMENT,
Washington, December 6, 1905.

SIR: I have the honor to transmit herewith a letter from the Chief of Engineers, U. S. Army, dated August 21, 1905, together with copy of a report from Col. W. S. Stanton, Corps of Engineers, dated May 26, 1905, of a preliminary examination of Kingston Harbor, Massachusetts, made by him in compliance with the provisions of the river and harbor act of March 3, 1905.

Very respectfully,

WM. H. TAFT,
Secretary of War.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, August 21, 1905.

SIR: Under the authority conferred by section 9 of the river and harbor act of March 3, 1905, I have the honor to submit herewith for transmission to the Public Printer a report, dated May 26, 1905, by Col. W. S. Stanton, Corps of Engineers, on preliminary examination of Kingston Harbor, Mass., ordered by the said act.

It is the opinion of Colonel Stanton, concurred in by the Board of Engineers for Rivers and Harbors and by me, that Kingston Harbor is not worthy of further improvement by the United States.

Very respectfully,

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

Hon. WM. H. TAFT,
Secretary of War.

PRELIMINARY EXAMINATION OF KINGSTON HARBOR, MASSACHUSETTS.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., May 26, 1905.

GENERAL: I have the honor to submit the following report of a preliminary examination of Kingston Harbor, Massachusetts, made in compliance with Engineer Department letter of March 16, 1905, and a provision in section 9 of the river and harbor act of March 3, 1905.

Kingston, Mass., is a village of about 1,900 inhabitants, on the Old Colony Railroad, 4½ miles north of the city of Plymouth, and 1 mile from Kingston Bay, its only harbor. The bay (tracing[a] herewith from Coast Survey chart No. 338, of 1875) is a broad expanse of flats, bare at low water except a few small and shallow tidal channels.

On the railroad at the shore of Plymouth Harbor, at North Plymouth, about midway between Plymouth and Kingston, are the extensive works of the Plymouth Cordage Company, established in 1824. About one-fifth of a mile across flats of mud and sand from the wharf of that company a tidal channel is reached (A, B, C, tracing), having a natural minimum depth of 8 to 11 feet at mean low water and about 1¾ miles long to its junction with the main channel of Plymouth Harbor. The wharf of the company, the intervening flats, and the tidal channel are not in Kingston Harbor, but are all on the Plymouth side of the boundary line between Kingston and Plymouth.

In 1893, at a cost of $8,940 (Annual Report, Chief of Engineers, 1894, p. 47), appropriated for "Improving harbor at Kingston, Mass., and the approaches to the public wharves of said port and of North Plymouth," the United States dredged a channel 6 feet deep at mean low water and 100 feet wide, from the wharf of the Plymouth Cordage Company across the flats, extending it to that depth and width in the tidal channel, a total length of about 4,200 feet.

The Plymouth Cordage Company state that in the last few years they have expended about $18,000 in redredging and straightening the channel that was dredged by the United States. The minimum depth of the channel to the company's wharf is now 6 feet at mean low water.

The improvement now sought is the dredging of this channel from the wharf of the company to the width of 100 feet and depth of 10 feet at mean low water, a total distance of 1.4 miles, to that depth and width in the tidal channel.

The extent to which the channel that was dredged by the United States had deteriorated when redredged and straightened by the Plymouth Cordage Company can not now be ascertained; but the deterioration of the channels dredged by the United States in neighboring localities, to the wharves at Duxbury and Plymouth, is an example of the deterioration that may be expected in the channel to the Plymouth Cordage Company's wharf, the conditions being substantially alike in the three localities, except that the discharge of a creek into the basin at the wharves at Plymouth hastened deterioration there.

In 1899, at a cost of $12,000, the United States dredged to the width of 40 to 80 feet, and the depth of 6 feet at mean low water, a channel

[a] Not printed.

3,600 feet in length to the wharves at Duxbury, which is reported to have deteriorated so that the maximum continuous depth is now only about 2 feet.

The channel and basin 150 feet wide and 9 feet deep at mean low water to the wharves at Plymouth, dredged by the United States and completed in 1893, at a cost of $50,514.89, had shoaled in 1899 so that their restoration then cost $9,917.48. In 1902 the basin had again shoaled to the depth of 6 feet, and was redredged at a further cost of $3,954.42; the cost of maintenance for ten years amounting to more than one-quarter of the first cost of the improvement.

It is stated by the Plymouth Cordage Company that they received by water at their wharf last year 8,982 gross tons of soft coal, costing $31,910, which is brought in schooners in cargoes of about 550 tons to 600 tons. They state:

> If we had sufficient water, we should like to have much larger schooners come in, and we should like to have steamers come to our dock bringing sisal from Mexico, sailing vessels and steamers coming from Manila bringing hemp. We are very sure that we could have regular deliveries by tramp steamers of sisal from Mexico if we could get sufficient water.

They also state that in 1903 they received 44,679, in 1904, 50,979, and in 1905, 47,978, an average for the three years of 47,878 tons of hemp, sisal, cordage, oil, tar, soft coal, burlap, and grease, "which, under favorable depth of channel, might be brought by water and delivered at wharf belonging to the Plymouth Cordage Company." (Letter [a] of May 13, 1905.)

In a letter [a] of April 21 they state that of about 53,000 tons received annually and amounting in value to about $7,000,000, more than half and probably most would come by water if the channel be improved. They further state:

> To get the hemp and other supplies here for this year will cost us in the way of freight about $50,000 in round numbers. With a straight channel of proper depth and width, we should feel warranted in building a dock that would enable us to take large quantities of our hemp and other material without being obliged to have them go to Boston, particularly sisal, hemp, cordage, and oil, which during the present year have cost us in the way of freight from Boston to Plymouth nearly $30,000. This sum, however, includes what we should expect to save in the way of freight on our coal by being able to bring in larger vessels and in many cases barges. We are somewhat in doubt as to what we could accomplish in the way of bringing Manila hemp direct to our dock. The freight on this article during the present year amounts to about $13,000. If we could bring in one-half of this direct, it would represent a matter of over $6,000 in freight. Of course all the material that is brought in has to go out in the shape of a finished product, less what waste there may be in working the fibers. We fancy we should feel obliged to continue to ship most of our goods by rail. It is possible, however, that an occasional shipment could be made from our dock. This quantity, of course, will have to be estimated, but think that six to ten thousand dollars would be conservative.

If the cost of increasing and maintaining the depth to 10 feet in the channel leading to the Plymouth Cordage Company's wharf would be a paying investment, that company, by making the improvement at its own expense, upon application in accordance with law, can reap directly and exclusively the profits that would arise from the expenditure. If the cost of such improvement and maintenance would not be a paying investment, I can find no reason for recom-

[a] Not printed.

mending that in aid of the company the cost be defrayed by the United States.

The town of Plymouth has a population of about 9,500. To this date the United States has expended the sum of $64,610 in dredging and maintaining a channel 9 feet deep at mean low water to the wharves at Plymouth, and has further expended, for the preservation of Long Beach, essential to the preservation of that channel, the sum of $209,000, an aggregate of $273,610.

In my opinion Kingston Harbor is not worthy of improvement by the United States.

A report, with a map, of a survey of this channel, is in the Annual Report of the Chief of Engineers for the year 1891, page 687; and reports of examinations of other channels in Kingston Harbor are in the Annual Report for 1885, page 538, and for 1889, page 596.

* * * * * * *

Very respectfully, your obedient servant,

W. S. STANTON,
Colonel, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U. S. A.

[Second indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., June 19, 1905.

Respectfully returned to the Chief of Engineers, United States Army.

The Board of Engineers for Rivers and Harbors has reviewed the within report of the district officer on a preliminary examination of Kingston Harbor, Massachusetts, and in connection therewith has considered the former reports of examinations at this locality, and a recent communication from the Plymouth Cordage Company, which is the only commercial establishment known to be interested in this improvement. While the law calls for an examination of Kingston Harbor, the channel leading to the wharves of the Cordage Company is believed to be the one contemplated by Congress, although these wharves and the channel leading thereto are on the Plymouth side of the boundary line between Plymouth Harbor and Kingston Harbor.

In obedience to acts of Congress, preliminary examinations were made in 1884 and 1888, with a view to providing a channel from Goose Point, at the entrance to Plymouth Harbor, to the wharves of the Plymouth Cordage Company at North Plymouth, the recommendation of the district officer in each case being unfavorable to the proposed improvement. The following is quoted from the district officer's report of September 4, 1884:

> In connection with this subject, I need here only remark that the opinion expressed in my report, to the effect that the proposed improvement is required only for convenience of the Plymouth Cordage Company, still appears to be substantially correct.

In his report of October 27, 1888, the district officer states:

> The scheme, if executed, will benefit one corporation only at an estimated cost of $40,000, and if extended to include other wharves and other interests the estimated cost will not be less than $75,000, for which the General Government and the local interests would receive no adequate return.

The act of September 19, 1890, provided for an examination of "Kingston Harbor, with a view to its improvement," and a favorable report being submitted thereon, a survey was made and a plan presented for a channel 6 feet deep and 100 feet wide, leading to the Plymouth Cordage Company's wharf, at a cost of $10,000, which sum was appropriated by the act of July 13, 1892. The improvement now desired is an increase in depth to 10 feet at mean low water.

The commerce involved, so far as the Board has been able to learn, is confined to the business of the Plymouth Cordage Company, whose interests, as explained within, are extensive, the receipts of material amounting to over 50,000 tons annually, valued at about $7,000,000. The proposed increase of depth, it is claimed, would effect a saving to the company in freight charges of from $30,000 to $50,000 annually.

In reaching a conclusion as to the advisability of undertaking any proposed improvement, the Board is required by law to have in view the "public commercial interests involved, and the public necessity for the work and propriety of its construction, continuance, or maintenance at the expense of the United States." While some benefit to the community at large might indirectly result from the proposed improvement, it appears to the Board that the more direct and substantial benefits would in this instance be confined to the Plymouth Cordage Company.

After due consideration, the Board is constrained to believe that the benefits which the proposed improvement would afford to the public commercial interests are not sufficiently distributed or of sufficient magnitude to warrant the General Government in undertaking the work. The Board therefore concurs with the district officer in the opinion that Kingston Harbor is not worthy of further improvement by the United States.

For the Board:

D. W. Lockwood,
Lieut. Col., Corps of Engineers,
Senior Member of the Board.

O

KINGSTON HARBOR.

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(Plymouth Harbor.)

1826.

"The repair of Plymouth beach has progressed in a satisfactory manner during the present year. The results produced fully sustain the favorable anticipations of last year. Not a doubt now exists in regard to the adequacy of the work when completed to fulfil its destination. The work will be finished next year. The works have been conducted efficiently and with great economy."

Report of Chief Engineer for year 1826. Engineer Department, Nov. 18, 1826, Sen. Doc., 2nd Sess., 19th Cong., 1826-7, Doc.1, p.214.

Money statement opposite page 226 of this document shows $9,864.85, "Amount applied corresponding with accounts rendered and settled to the 30th Sept., 1826."

1827.

"The means adopted for the preservation of Plymouth Beach, have afforded the most satisfactory results. The work was found fully adequate to withstand the violence of the sea during the exposure of last winter, and is daily gaining strength by additional accumulations of sand; parts of the work, which, in 1825, were five feet under water at high tide, are now perfectly secure from the effects of the sea at all times."

Report of Chief Engineer for Year 1827. Washington City, November 20th, 1827. Sen.Doc.,1st Sess.,20th Cong.,1827-8, Doc.1,p.58.

Money statement opposite page 50 of this document shows $4,294.84, "Amount applied, corresponding with accounts rendered and settled to the 30th September, 1827." Same statement shows balance unexpended of $534.12.

1828.

"Preservation and repair of Plymouth Beach, in the State of Massachusetts. - The sea wall, and other works constructed for the purpose, have had the desired effect, and are generally in a good condition. Some additions may be necessary at a future time, to maintain the advantages resulting from them."

Report of Chief Engineer for Year 1828. Washington, Nov.

1828 (cont.)

19, 1828. Sen.Doc., 2d Sess., 20th Cong., 1828-9, Doc. 1, p.45. Money statement, p.50 of this document, shows "$575.07 From balances of appropriations undrawn from Treasury, and those remaining in hands of agents, Sept.30, 1827", etc. Also "$389.15, Amount applied, corresponding with accounts rendered and settled to the 30th Sept.1828."

1829.

"Plymouth Beach, Massachusetts.- The expenditures on the work for the preservation of this beach have, for two years past, been very small; about $500 having been applied to keeping them in repair; and it is desirable to have a small sum disposable, to be used in checking the encroachments of the sea, until, by the effect of natural causes, constantly operating, the work shall have acquired complete permanency." *

Report of Chief Engineer for Year 1829. Washington, Nov. 18, 1829. Sen.Doc., 1st Sess., 21st Cong., 1829-30, Doc.1, p.74. (Financial statement, p.82 this doc., shows no money account.)

1830.

"Plymouth Beach, Massachusetts.- The security and growth of this beach, though aided by artificial means, are chiefly the result of natural causes, the beneficial effects of which continue to be perceived."

Report of Chief Engineer for Year 1830. Washington, Nov. 19, 1830. Sen.Doc., 2d Sess., 21st Cong., 1830-31, Doc.1, p.94. Money statement, p.104 of this document, shows "$1,850.00 Aggregate available" and "$1,512.55, Am't applied, corresponding with accounts rendered and settled to the 30th Sept., 1830."

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* Same report in State Papers, 1st Sess., 21st Cong., 1829-30, Doc. 2, p. 86, Vol. 1.

(Plymouth Harbor.)

1831.

"Plymouth Beach, Mass. - The fascine work, and the planting of grass for the preservation of this beach, have been in constant progress, as dictated by the circumstances of the case. The beneficial effects of what has been done can be fully shown and secured only by the lapse of time, and by constant attention to the repairs of the work, which now affords a perfect shelter to the harbor.

Report of Chief Engineer for the year 1831. Washington, Nov.4, 1831. House Doc. 1st Sess., 22d Cong.,1831. Doc.2, p.81. Money statement p.106 of this document shows "$ 337.45 From Balances of appropriations undrawn from Treasury, and those remaining in hands of agents, Sept.30,1830",etc. Also "$ 1742.67, Amount applied, corresponding with accounts rendered and settled to the 30th Sept., 1831."

1832.

"Plymouth Beach, Mass. - The operations at this place have been confined, principally, to the northeastern extremity of the beach, where a wall has been erected, to the extent of 450 feet, in the most substantial manner. The planting of grass, and other means of protecting the beach, have also been continued. The general condition of the beach is very good; the grass is increasing and flourishing in a remarkable degree; and the works seem to have produced the desired effect.

Report of Chief Engineer for the year 1832. Washington, Nov.13, 1832. House Doc. 2d Sess.,22d Cong., 1832. Doc.2, p.92. Money statement p.106 of this document shows " $1414.78 From Balances of appropriations undrawn from Treasury, and those remaining in hands of agents, Sept.30,1831",etc. Also "$1707.31, Amount applied, corresponding with accounts rendered and settled to the 30th Sept.,1832."

(Plymouth Harbor.)

1833.

"Plymouth Beach, Mass. - The operations at this place have been of the same character as those of the previous year. They have been directed to the extension (about five hundred and ten feet,) of the stone wall to the west of the breakwater, and to repairing the beach by planting grass. The grass is represented as doing well, and the condition of the beach, generally, as being good.

Report of the Chief Engineer for the year 1833. Washington, Nov. 23, 1833. Senate Doc., 1st Sess., 23rd Cong., 1833. Doc.1, p.78. Money statement, p.90 of this document shows " $ 2207.47 From Balances of appropriations undrawn from Treasury, and those remaining in hands of agents, 30th Sept.,1832," etc. Also "$ 2438.33, Amount applied, corresponding with accounts rendered and settled to the 30th Sept.1833"

1834.

"Plymouth Beach, Mass. - Five hundred feet of stone wall have been constructed, since my last report, on the west side of the breakwater at this place. Grass, to arrest the drifting sand, has been set out at various places on the beach, to the extent of about 50000 feet; and 1870 feet of brush fence, having the same object, have been constructed The general condition of the beach is represented as good. The local superintendent says his operations are attended with success; and believes that the estimate now submitted, amounting to $ 700, will be sufficient to provide every thing necessary to place the beach in a condition to require but little more, unless the inroads of the sea should produce a new state of things.

Report of the Chief Engineer for the year 1834. Washington, Nov.1, 1834. Senate Doc., 2d Sess., 23d Cong., 1834-5, Doc.1, p.106 Money statement, p.118 of this document shows "$369.14 From Balances of appropriations undrawn from Treasury, and those remaining in hands of agents, 30th Sept.1833",etc. Also "$1766.06,Amount applied,corresponding with accounts rendered and settled to the 30th Sept.1834".

(Plymouth Harbor.)

1835.

"Plymouth Beach, Mass. - Nine hundred feet of stone wall have been constructed on the west side of the breakwater at this place since my last report, and 1500 feet of brush fence, for the purpose of arresting the drifting sand. Grass, for the same object, has been set out at various points along the beach, to the extent of 1000 feet, which, together with the general state of the beach, is represented by the agent to be in good condition.

Report from the Engineer Department for the year 1835. Wash., Nov.15, 1835. Senate Doc., 1st Sess., 24th Cong., 1835. Doc.1, p.106. Money statement p.118 of this document shows " $ 603.09 From Balances of appropriations undrawn from Treasury, and those remaining in hands of agents, Sept.30,1834", etc. Also, " $1042.02, Amount applied, corresponding with accounts rendered and settled to the 30th Sept., 18 1835".

1836.

"Plymouth Beach, Mass. - The amount of last year's appropriation, $ 500, has been applied to repairing the breakwater and brush fence, injured by the storms of last winter. The grass that has been planted to protect the beach and arrest the drifting sand is represented to be increasing, and the estimate asked for by the local agent for next year, he states can be applied to much advantage in extending the wall on the northeast side of the breakwater, planting grass, and repairing fence.

Report of the Chief Engineer for the year 1836. Washington, Nov. 30, 1836. Senate Doc., 2d Sess., 24th Cong., 1836, Doc.1, p.198. Money statement p. 217 of this document shows " $ 261.07 From Balances of appropriations undrawn from Treasury, and those remaining in hands of agents, Sept.30, 1835", etc. Also "$ 329.99, Amount applied, corresponding with accounts rendered and settled to the 30th Sept., 1836".

(Plymouth Harbor, Mass.)

1836.

"Plymouth Beach, Mass. - March 3, 1836. Mr. Smith, of Maine, from the Committee of Ways and Means, reported the following communication, which was ordered to lie on the table and be printed. [See bills 307 and 308].

War Department, Feb.19,1836.

Sir: I transmit a communication of the chief engineer on the subject of an increase of the appropriation for Plymouth Beach, and recommend his suggestions to the favorable notice of the Committee of Ways and Means.

Very respectfully,
Your most obedient servant,
Lew. Cass.

Hon. C. C. Cambreleng,
Chairman Com. Ways and Means,
House of Representatives.

Engineer Department,
Washington, January 26,1836.

Sir: By the enclosed communication from Col. Totten, of the corps of engineers, you will perceive that a further estimate of $ 1000.00 for Plymouth Beach becomes necessary, to repair a breach in the breakwater at that place, occasioned during a late severe gale, and otherwise to strengthen it. By the statement of Col.Totten, it appears that unless these additions are made the benefits already attained by these improvements will be jeopardized if not destroyed. I have, therefore, to request that the estimate now before Congress for that place, amounting to $ 500.00 may be increased to $ 1500.00, and that the Committee of Ways and Means of the House of Representatives may be informed accordingly.

I have the honor to be,
Sir, your most obedient servant,
C. Gratiot.

Hon. Lewis Cass,
Secretary of War.

(Plymouth Harbor.)

1836,(-2).

("Plymouth Beach,Mass.-March 3,1836,--continued-)

Newport, January 19,1836.

Sir: I have the honor to enclose herewith a copy of a letter just received from the United States agent at Plymouth, mentioning a breach made in the breakwater at Plymouth Beach by the late severe gale of wind. This"breakwater" is of timber filled with stones, and has been erected several years. The worms having eaten the timber about the low water line considerably, it was found advisable to place the stone work (H) in order to keep the timber together, while the sand was in course of banking up against it. The wall (H) was not, it seems, carried far enough to the south, or the breach would not have been made, as appears from the stability of the more exposed part of the breakwater, marked (A.)

The course suggested by the agent in his letter is the proper one, and the additional appropriation asked by him is indispensable to the preservation of the beach. The great bank of sand, composing the beach, is, in this vicinity, constantly enlarging. It widens much faster than was anticipated, but does not rise so fast; and it is for this last reason that the timber breakwater now requires the support from a stone wall, which, it was thought, would, ere this, be afforded by the elevation of the sand bank.

I have the honor to be,
Very respectfully,
Your most obedient servant,
Jos. G. Totten,
Lt. Col. Eng.

Brig.Gen.Gratiot,
Chief Engineer, Washington.

(Plymouth Harbor.)

1836,(-3).

("Plymouth Beach,Mass.-March 3,1836,--continued)

Plymouth,Mass.,January 14,1836.

Sir: I am sorry to be obliged to report to you that some injury was caused to the breakwater at Plymouth Beach during the storm which ceased on Monday last. A breach was made of twenty-seven feet through the breakwater, a short distance southerly from the termination of the sea wall, a sketch of which I annex. This storm has been the most trying to the beach of any we have had for years. The tides were high, and a continuous east wind for a week swelled them unusually; and notwithstanding I regret extremely the injury above alluded to, I am glad to have it in my power to say that no other part of the beach has sustained any injury. I am making the attempt, and think I can temporarily secure the breakwater in the present state, with what funds I have; but I would suggest the expediency of having my estimate, forwarded to you some time ago, for the ensuing year, increased so much as to enable me to continue the wall, on the seaward side, about four hundred feet, which will secure the remainder of the work. I would avail myself of this opportunity to say, that soon after you were here last a town meeting was held, at which the subject relative to cattle being allowed to trespass on the beach,was brought up and caused much interest, and measures were adopted to arrest the evil in future, by authorizing two suitable persons to take possession of and impound all such cattle as should be found trespassing; the present statute, in such cases, it is believed, will fully remedy the difficulty; at any rate it has thus far had the desired effect.

I should think it would require an addition of about 1000 dollars to my estimate of $ 500, for the purpose of fully repairing and securing the breakwater, by a stone wall extending southerly, from C, on the sketch, about 400 feet.

I am respectfully, sir,
Your obedient servant,
Joseph Bradford.

To Col.Totten,
U.S. Corps of Engineers, Newport.

(Plymouth Harbor.)

1836,(-4).

("Plymouth Beach,Mass.-March 3,1836,- continued--)

House Doc., 1st Session, 24th Cong., 1835-36, vol. 4, Doc.no.142, with one folded diagram.

(Plymouth Harbor.)

1836.

"Plymouth Beach,Mass.-On the 26th of May,1824, Congress appropriated $ 20000.00 for the repairs of this beach, (page 286,vol.7,Laws of the United States,) which was referred to the Engineer Department for execution, no previous survey or estimate having been made. (See instructions to Lieut.Chase, June 28, 1824, marked E.) On the 20th of August, following, Lieutenant Chase, in obedience to instructions, reported the result of his examination, and furnished a project for the application of the appropriation, which required in addition, $ 1592.00. (Document 27, 2d session, 18th Congress.) On the 30th of October, as had been intimated in his previous report, he submitted a further estimate of what he considered necessary to be done,amounting to $ 40000.00. (Document 27, 2d session, 18th Congress.)

Under date of the 21st of November,1825, it was reported in substance, that the works for the security of the beach, which had been commenced late the previous season under an officer of engineers, had been continued under the general supervision of Colonel Totten, and the immediate superintendence of a gentleman of that place; that the appropriation of the preceding session had been advantageously applied and though limited, had produced important results. That the appropriation then asked for ($ 25000.00,Document 24,vol.3,1st sess., 19th Congress), if granted, would complete the work, and afford permanent security to the beach. $ 13184.90 were this year appropriated.

Under date of November 18, 1826, the favorable results attained were stated, and that the work would be finished next year. It was finished as anticipated, and under date of November 20,1827, was reported to have been found fully adequate to withstand the violence of the sea the previous winter, and was daily gaining strength by the accumulation of sand.

Under date of November 19, 1828, it was reported that the works were in good condition, and that some additions might be necessary at a future time to maintain the advantages resulting from them.

Under date of November 18, 1829, it was reported that the small expenditures for this beach for the last two years, about $ 500.00, were applied to keeping them in repair, and that from the nature of

1836,(-2).

("Plymouth Beach,Mass.-continued-)

the work, it was desirable to have a small sum at command to check the encroachments of the sea, until by the effect of natural causes, constantly operating, the work should have acquired complete permanency.

Under date of November 4, 1831, it was reported that the fascine work and planting of grass had been in constant operation, as dictated by the circumstances of the case, and that the beneficial effects of what had been done, could be fully shown and secured only by the lapse of time, and by constant attention to the repairs of the work, which afforded a perfect shelter to the harbor. The reports of 1832,'33,'34, and '35, all go to show that the experiment for the preservation of the beach, had so far succeeded; that the benefits anticipated had been attained; that, as was to have been expected, the fascine work, beach grass, and stone wall, occasionally required extension and repairs; and that they accordingly received them from the small appropriations made from time to time by Congress. It was never supposed that the feeble means adopted for the preservation of the harbor, could have, without damage, resisted the violence and irresistible power of the sea, or stood uninjured the effects of time and storms. It has been seen that the estimate first submitted to Congress, amounted to $ 61592.00

The appropriations by Congress up to this time,

viz: in 1824	$ 20000.00	
in 1825	5712.00	
in 1826	13184.90	
in 1830	1850.00	
in 1831	2820.00	
in 1832	2500.00	
in 1833	600.00	
in 1834	2000.00	
in 1835	700.00	$ 49366.90

Leaving an excess of the estimate over the expenditure of $ 12225.10

(Plymouth Harbor.)

1836,(-3).

("Plymouth Beach,Mass.-continued-)

Letter from the Secretary of War, transmitting The information required by a resolution of the House of Representatives of the 2d instant, in relation to certain works of internal improvement.
April 14, 1836. Read, and laid upon the table. House Doc., 1st Session, 24th Congress, 1835-36, vol. 5, Doc. 212, pp 6-7, appendix "D" on pages 50-52 contains "Letter of instruction to Col. Totten".

Plymouth Harbor.

1836.

"Plymouth and Provincetown Harbors. - These are the only harbors on the northeastern section of the coast, south of Boston. They have a commerce of some consequence of their own; but they are particularly interesting in reference to the port of Boston, and to the Transition from the middle to the eastern section of the coast, in which respect they would become still more important, should the proposed canal from Buzzard's to Barnstable Bay ever be executed. While these harbors are undefended, an enemy's squadron, blockading Massachusetts Bay, will have ports of refuge under his lee, of which he would not fail to avail himself to maintain his blockade, even throughout the most stormy seasons, knowing that the wind which would compel him to seek shelter, would be adverse to outward bound,and fatal,should they venture near the cape,to inward bound vessels. While in the possession of these harbors,an enemy would have constantly under his eye the harbor of Boston,the passage round Cape Cod,and that through the canal. To these considerations,going to establish the necessity of securing these harbors by proper defences, it must be added,that,being thus deprived of the shelter afforded by these ports,an enemy would be unable to enforce a rigorous investment In the first place,he would be often deterred from taking a station n near the land, lest he should be caught embayed by the violent easterly winds,prevailing at certain seasons: in the next place,he would always take a good offing on every distinct indication of these winds thereby leaving a clear coast to be profited of by our own vessels at the first instance of a change of weather.Our own vessels, coming in from sea, and finding an enemy interposed between them and Boston,or being turned from their course by adverse winds,would,in case of the defence of these harbors,find,to the south of Boston, a shelter equivalent to that provided to the north by the fortifications of Marblehead, Salem, Gloucester, and Portsmouth.

The surveys of these harbors have not been handed in, and no plans Have been formed for their defence.Plymouth Harbor may be suitably defended,it is thought,by the occupation of Gurnet Point, and at no great expense;while it is thought that,to fortify Provincetown Harbor in such a way as to cover vessels taking shelter therein,and

(Plymouth Harbor.)

1836, (-2).

("Plymouth and Provincetown Harbors.) - continued --

at the same time to deprive an enemy of all anchorages, will involve considerable expense; probably no nearer estimate can be formed, at present, than that offered by the Engineer Department, which gave $ 100,000.00 to Plymouth and $ 600,000.00 to Provincetown.

Should the canal above mentioned be executed, it will be necessary to place a small work at each of its outlets, to prevent the destruction of the means by which the transit of vessels in and out of the canal must be accomplished.

Message from the President of the United States,
To the Senate of the United States; accompanied with Reports from the Secretaries of War and Navy relative to the Military and Naval defences of the country. April 8, 1836.
House Doc., 1st Session, 24th Congress, 1835-1836, vol. 6, Doc.243, pp. 37-38.

(Plymouth Harbor.)

1837.

"Plymouth Beach, Mass. - A small remnant of appropriation has been expended this season, in repairing the breakwater and securing and putting in place the drift sea-weed, to prevent the drifting of the sand.

The whole extent of Plymouth Beach is represented to be now in fine condition; the brush fence is covered with five or six feet of sand and a growth of beach grass. The wooden foundation sills of a portion of the breakwater having been nearly destroyed by the worms, an estimate for the amount necessary to replace a length of 320 feet with a substantial stone wall is herewith submitted.

Report from the Engineer Department for the year 1837. Washington, Nov.30,1837. Senate Doc.,2d Sess.,25th Cong.,1837. Doc.1, p.290. Money statement, p.439 of this document shows "$ 431.08 From Balances of Appropriations undrawn from Treasury, and those remaining in hands of agents, Sept.30,1836",etc. Also, "$ 269.50,Amount applied, corresponding with accounts rendered and settled to the 30th Sept.,1837".

1838.

"Plymouth Beach, Mass. - The appropriation of the last session has been expended in the construction of a granite wall outside a portion of the wooden breakwater, and laying an additional course of heavy stone upon the whole wall. This is deemed by the agent sufficient to preserve the breakwater, should the worms destroy the wooden sills.

The condition of the beach, the agent reports, as "constantly improving". A small annual sum will be necessary for securing and placing sea weed, and for setting beach-grass. For this purpose an estimate will be submitted.

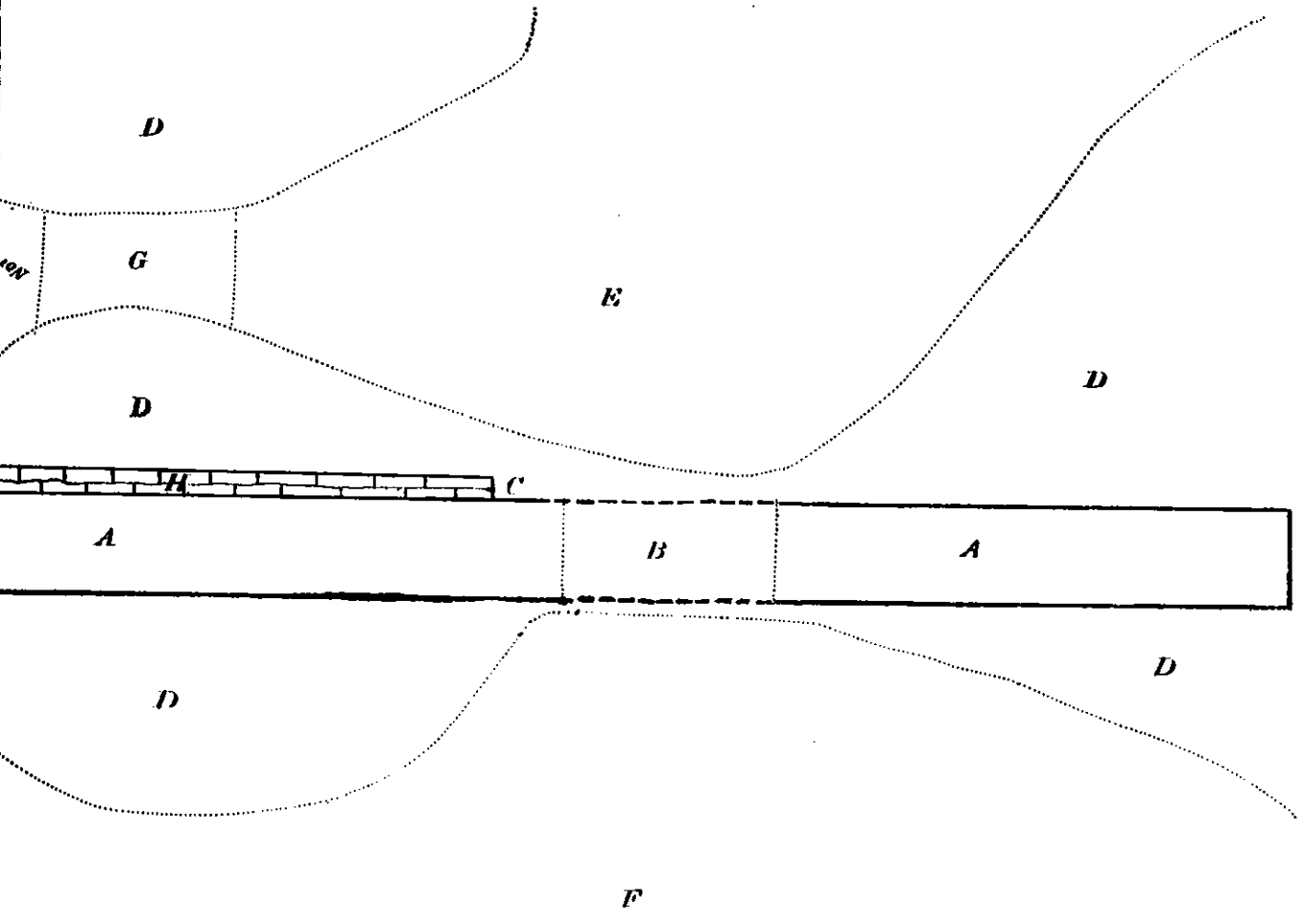
Report of the Chief Engineer for the year 1838. Washington, Dec.1, 1838. Senate Doc.,3d Sess., 25th Cong., 1838-9. Doc.1, p.184 Money statement, p.346 of this document shows, no amount "From Balances of appropriations undrawn from Treasury; on the 30th Sept.,1837; but "Balances in the hands of agents at that date, $ 161.58", Also,Amount disbursed in the 4th quarter of 1837, and in the 1st and 2d quarter of 1838, $ 1361.58".

1838.

"No. 47. Preservation of Plymouth Beach".- The preservation of this beach has been effected by brush fences, about which the sand has accumulated, and a breakwater of wood and stone.

It was commenced in 1824, and $ 49866.90 have been appropriated. Nothing was appropriated at the last session. The worms have now nearly destroyed a large portion of the work of the breakwater, and it is necessary to replace it with stone; for this purpose another appropriation is required.

"Harbor and river improvents". [To accompany bill H.R.No.394.] January 12, 1838. Laid before the House by the Chairman of the Committee of Ways and Means, and ordered to be printed. House Doc., 2d Session, 25th Congress, 1837-1838, vol. 5, Doc. 90, page 8.



A. *Breakwater.*
B. *Breach about 27 feet.*
C. *Southerly termination of Sea Wall.*
D. *Flats.*
E. *Channel East of Breakwater.*
F. *Harbor Channel.*
G. *Nearly dry at low water.*

" Plymouth Beach". 1836

House Doc., 1st Session, 24th Congress, 1835-36, vol. 4, Doc.142.

(Plymouth Harbor.)

1839.

"Plymouth Harbor, Mass. - Captain W. H. Swift, the inspecting officer, says of this harbor: "It is formed in a manner very similar to that of Duxbury, that is to say, by a long, low, and narrow sand beach on its eastern side. The difficulties, too, are nearly similar. The importance of this harbor long since attracted the notice, and received the fostering care, of the State. Between the years 1806 and 1824, there had been expended upward of $ 40,000 for the preservation of the beach; and even as early as 1702, the settlers inflicted a penalty on any one who should fell trees on, or set fire to the beach.

"In 1824 Congress appropriated $ 20,000, in 1825 the sum of $ 5712, in 1826, $ 13,184.90, and various other sums from that time to the year 1838, inclusive, amounting to the total sum of $ 51,766.90.

"Major Chase, of the Corps of Engineers, made a plan, in 1824 for the preservation of the beach. The plan was adopted, and carried into execution. It consisted of a breakwater composed of triangular frames of wood filled with stone, and extended about 1400 feet in length, from the northern extremity of the beach southerly. The frames were of three sizes, each forming an isosceles triangle. The first size had sides of 12 feet, and a base of 14 feet; the second size had sides of 10 feet, and a base of 12 feet; the third had sides of 7 feet, and a base of 10 feet, made of timber one foot square, morticed and tenoned together, and secured to each other by trenails. The frames were laid upon three longitudinal sills, and filled with stone. On the western or bay side, 5 triangular pieces, of the same description as the breakwater, were placed a few feet distant, and connected by means of ties with the body of the work. These were intended to subserve the purposes of counterparts to resist the effect of the heavy swells occasioned by gales from the east. A portion of the breakwater, of about 400 feet in length, was laid upon an embankment formed of stone, carried to the height of highwater mark. This stone work was placed across a channel which had been formed through the beach. The end of the breakwater is of stone, in rather a rough state, with a beacon erected upon it. That part of the wood

work of the breakwater which is exposed to the water has been much injured by worms; and to prevent the entire destruction of the frames, three courses of split granite, 1 1/2 feet square, have been laid upon the outside of the work, and two of the same on the inside. This will prevent the stones on the interior of the frames from pushing out the timbers from the sills, when the worms shall have caused the destruction of the same. In addition to the above, fascines and hurdles have both been used to collect the drifting sand. The effect of all has been a great accumulation of sand. Seaweed has also been scattered over the surface of particular portions of the beach, serving a good purpose in collecting and retaining the sand also.

"The extreme point of the breakwater being now protected by the stone work, it will be an easy matter hereafter to raise the sand by means of the hurdle work or brush fence. Indeed, a large bed of sand has been deposited outside of the breakwater, near the northern extremity, and where last year vessels employed in transporting stone to place at the foot of the frame work laid at anchor.

"The operations at this beach have been confined this season to the placing of 150 tons stone around the pier erected at the northern extremity of the breakwater, to the planting of a small quantity of beach grass, and to the placing of seaweed to collect the drifting sand; all of which have answered a good purpose.

"The sum of $ 1500 will be required for the year 1840. I would further recommend that provision be made for a suitable compensation for the agent at this place. The commissions amount to little; and the constant supervision of some trusty individual is absolutely necessary, in order that the occasional breaches which take place in the beach may be arrested in season, and before serious damage is sustained. A few dollars, judiciously expended in the first stages of a breach, may save hundreds, or even thousands, applied at a later period.

"In estimating the commercial interests involved in the preservation of this harbor, it is necessary to consider Kingston, (the adjoining town to Plymouth). It lies upon the same bay north of Plymouth. Taking the towns of Kingston and Plymouth together, we shall have the

1839, (-3).

following number of vessels employed in the fisheries of whale, cod, and mackerel, for the year ending the 1st of April, 1837: Number of vessels employed, 68; tonnage of the same, 6248; value of oil and fish caught, $ 203076. For the five years preceding the 1st of April, 1837, the number of vessels built in both towns was 41; the tonnage of the same, 7222; the value of the same, $ 386700. Anchors and cordage manufactured in one year prior to April 1, 1837, amounted in value to $ 197225. If we add to this the value of articles manufactured of iron and steel, for the same time, ($ 230400,) it exhibits a gross result of upwards of $ 700000 annually. These facts warrant the conclusion that the preservation of this harbor is an object of great importance in a commercial point of view alone, if in no other."

Annual report. Bureau of Topographical Engineers. Washington, Dec. 30, 1839. Senate Doc., 1st Sess., 26th Cong., 1839-40. Doc.58, p.34-36. Money statement p.247 of this document shows " $ 1200.00 Balance undrawn from the Treasury, Sept.30,1838; Balance in the hands of disbursing agents at that date, $ -- ; $ 1200.00 Total amount under each head of appropriation applicable to expenditure in this bureau." (No amount " applied".)

(Plymouth Harbor.)

1840.

. . . "Having, in the report of last year, described these several works in much detail, in reference to plan and probable cost of ultimate completion, (which report will be found printed in Senate Doc. No.58, and House of Rep. Doc. No.2,) it leaves me no more to say on the subject at present, than respectfully to refer to that report".

Report of the Chief Topographical Engineer for the year 1840. Washington, Nov.12, 1840. Senate Doc., 2d Sess., 26th Cong.,1840-41 Doc.1, p.173. Money statement, p.178 of this document shows " $ 291.09 Balance in hands of disbursing agents Sept.30, 1839, and " $ 292.59 Total amount of appropriation applicable to expenditure in this bureau".

Plymouth Harbor.

1841.

"Plymouth and Provincetown Harbors. - These harbors have a commerce of some consequence of their own; but they are particularly interesting in reference to the port of Boston. While these are undefended, an enemy's squadron blockading Massachusetts Bay will have ports of refuge under his lee, which would enable him to maintain his blockade, even throughout the most stormy seasons: knowing that the winds which would force him to seek shelter would be adverse to outward-bound, and fatal to such inward vessels as should venture near the cape. Were the enemy deprived of these harbors, he would be unable to enforce a rigorous investment, as he would be constrained to take an offing on every approach of foul weather. Our own vessels coming in from sea, and finding an enemy interposed between them and Boston, or being turned from their course by adverse winds, would, in case of the defence of these ports, find to the south of Boston shelter equivalent to those provided in the east, at Marblehead, Salem, Gloucester, and Portsmouth. Plymouth Harbor has not been fully surveyed. Provincetown Harbor has been surveyed, but the projects of defence have not been formed. The former, it is thought, may be suitably covered by a work of no great cost on Gurnet Point; while, to fortify Provincetown Harbor in such a way as to cover vessels taking shelter therein, and at the same time to deprive an enemy of of safe anchorages, will involve considerable expense. Probably no nearer estimate can be formed at present than that offered by the Engineer Department some years ago, which gave $ 100000.00 for Plymouth, and $ 600000.00 for Provincetown.-(Statement 1, tables D, and E.)

Report of the Chief Engineer in answer to the resolutions of the Senate of March 3, 1841, respecting the defences of the country. Engineer Department, Washington, July 1,1841. Jos.G. Totten,Colonel and Chief Engineer. Senate Doc., 2d Session, 27th Cong.,1841-42, vol. 1, Doc.2, pp 16-17."

(Plymouth Harbor.)

1842.

"Plymouth Beach. - The improvements at this important harbor, are for the most part, temporary in their character. Frequently an expenditure of $ 50, or even a less sum, judiciously made, has been the means of preventing serious breaches at the beach. $ 200 should be placed in the hands of the former agent, Schuyler Sampson, Esq., for such puroses. And $ 50 per annum should be allowed him for his superintendence of the same.

" Plymouth Beach, Mass. - The works at this place are, from the nature of the materials used (principally wood), going to decay. A little money, judiciously expended, may preserve the beach, which forms the harbor, for a few years, but good policy would require the expenditure of at least $ 10000 to renew, or rather to replace, the rotten wood work with stone. I have recommended $ 200 for present use, but it is obvious that this small sum can do little more than to stop breaches in the beach by means of brush, &c.

Report of the Chief of the Bureau of Topographical Engineers for the year 1842. Washington, October 31,1842. Senate Doc., 3d Sess., 27th Cong., Doc. 1, pp 315 and 320. (Money statement on the same pages of this document).

1852.

"Repairing the injuries done to the government works on Plymouth Beach in the great storm of 1851. - An examination of the locality has been made, and a report is soon expected.

Report of the Colonel of Engineers for the year 1852. Washington, Nov.30, 1852. Senate Doc., 2d Sess., 32d Cong., 1852-53. Vol.2, Doc. 1, p. 159. No money statement inserted in this document.

1853.

"Repairing the injuries done to the government works on Plymouth Beach in the great storm of 1851. - The beach which protects Plymouth Harbor is weak, through an extent of nearly two miles, and subject to incursions of the waves in heavy gaves. In this extent, some six or seven breaches were formed by the gale of 1851. The most serious of these have been closed by a structure of triangular frames or brush fence, amounting in all to about 2400 running feet, but upwards of 1000 feet of breach yet remain unclosed. The whole weak portion, about 8500 feet, should be protected by a brush fence, to complete which an appropriation is asked.

(For report of officer in charge, etc., see appendix "K".)

Balance in Treasury October 1, 1853	$ 4000.00
Probable amount to be expended by June 30,1854	4000.00
Estimate of amount required to be appropriated for fiscal year ending June 30, 1855	13000.00

Report of the Chief Engineer for the year 1853. Washington, Nov.30, 1853. Senate Doc., 1st Sess., 33d Cong., 1853-54, vol.2, Doc. 1, p. 206-7. (Money statement on p. 207).

(Plymouth Harbor.)

1854.

"Repairing the injuries done to the government works, on Plymouth Beach, in the great storm of 1851. - The closing of operations, the means being exhausted was reported last year. The works, where not repaired last season, are in a state needing attention; but further means are necessary, and for repair of injuries arising from the ordinary action of the elements and the lapse of time."

Report of the Chief Engineer for the year 1854. Washington, Nov.29, 1854. Senate Doc., 2d Sess., 33d Cong., 1854-55, vol.2, Doc.1, p.159, (no money statement inserted in this document).

Plymouth Harbor.

1858.

"Repair of works in Plymouth Harbor"- Letter from the Secretary of War, transmitting Estimates for the repair of works in Plymouth Harbor. Jan.27,1858.-Referred to the Committee on Commerce.

Washington, War Department, Jan.25,1858.

Sir: I have the honor, in answer to a resolution of the House of Representatives of the 20th instant, to transmit herewith a report of the officer in charge of the engineer department, with enclosures, which furnish the estimates for the repair of the works in Plymouth Harbor, Massachusetts, for the preservation of the same, in compliance with the resolution.

Very respectfully, your obedient servant,

John B. Floyd,
Secretary of War.

Hon. J. L. Orr,
Speaker House of Representatives.

Engineer Department,
Washington, Jan.23,1858.

Sir: I have the honor to acknowledge the reference to this office of a resolution of the House of Representatives dated 20th instant, in which a call is made for estimates and other information in relation to the improvement of Plymouth Harbor, Massachusetts.

I transmit herewith a copy of a report from Captain H.W.Benham of his examination of the beach of Plymouth Harbor, with an estimate of the sum he deems necessary for the construction of works adequate to its protection. The amount of his estimate is $ 22,000.00.

This examination was made in conformity to the views expressed in your reply to a letter from the Hon. R. B. Hall, of Plymouth, in which you say that " I shall immediately cause the examination you suggest to be made and reported upon, and I will take pleasure in aiding to carry out the views you have expressed in regard to the protection and preservation of the works in question".

The works recommended by Captain Benham for the protection of the "beach", and his estimate of the probable cost of their construction, were approved by the chief engineer on the 4th of November,1857.

The resolution of the House of Representatives is returned here-

"Repair of works in Plymouth Harbor"-continued-) -2.

with.

I am, very respectfully, your obedient servant,

H.G.Wright,

Captain of Engineers in charge.

Hon. John B. Floyd,

Secretary of War.

New Bedford, Massachusetts,

October 26, 1857.

Sir: In compliance with the instructions of the department of the 30th of september, I have, during the past week, made the examination required of the "Beach of Plymouth Harbor", and would respectfully submit the following report in relation to its present condition, with the estimate of the amount of funds which I deem necessary to be appropriated to provide for its protection, to give a reasonable certainty of its security for the future.

This beach projects from the shore at the head of Plymouth Bay, at about from one to two miles southeast of the town, and with a width varying from 150 to 400 feet; it continues northwards, east of, and parallel nearly to the line of shore of the central part of the town, and at about two miles distant, extending for about three miles to the channel entrance of Plymouth and Duxbury harbors.

The beach, though in some places, particularly in its southern portions of gravel or "shingle", is for the most part composed of the drift sand thrown up in storms from the outer bay, and though the upper part of the harbor, protected by this beach for the southern half or two-thirds portion of its length, is available only for vessels of a smaller size, as those engaged in the coast coasting or fishing trade; the remaining third of this beach at the north, gives ample protection to a good anchorage for vessels of the larger class in ordinary commerce; there being, as by the representations made to me at the place, which is corroberated by the charts of the coast survey, a space of some three fourths of a mile in extent, and of ample width for vessels to seing at their

Plymouth Harbor - 1858.

("Repair of works in Plymouth Harbor", continued-) -3.

cables, having a depth of fifteen feet and upwards at low water, which would be increased to twenty-five feet at high tide, which, as the bottom is good, might even make this anchorage a desirable retreat in storms for mercantile vessels of the largest class.

The northern portion of this beach, which protects this anchorage I would state, is that which appears in former years to have received the most extensive artificial protection, to which, indeed, its actual existence, (and of course this anchorage,) appears now to be due. But it not only exists, but is in very good condition, having a width as shown between high water lines on the sketch, and of this a part is covered with grass from 50 to 150 feet wide, and from 6 to 12 feet above high water line.

For the greater part, this northern portion does not need any repairs or protection of consequence now, these being required only in some places of limited extent. While the remaining two-thirds south, which until recent years, from the information given me there had remained from all tradition uninjured, high and unbroken, and with a forest growth upon it even, is now, with a general average of height in its best parts, some three or four feet lower than the greater part of the northern third, and broken up or seriously injured, through nearly its whole extent, to such a degree that there are very few parts that I feel could be relied upon as at all secure without a protection of one or the other of the kinds I have to propose for this locality. The sea at high spring tides passing over it now in different places, gives the assurance, almost, that in gales the greater portion of it might be swept away, not only into the narrow channels abreast of, or west of this part, but even into the deeper water opposite the northern part of the beach. This would leave that part as an island only, affording but little protection to the anchorage above described, even if its depth of water were not seriously diminished.

The means of protection I would propose are a sort of plank box of triangular section, filled with sand, for the worst portions, which has been already found to answer a very excellent purpose here in past repairs; or for the parts requiring less defence against the

Plymouth Harbor,1858.

("Repair of works in Plymouth Harbor,-continued-)-4.

sea, a simple plank fence, such as has been found very effective as a"catch sand" and beach defence near Cape Cod.

The first is composed of posts of eight or ten inches in diameter, and seven to ten feet long, (according to the size of box required,) which are halved together by threes, making triangular frames,which being set up about four feet apart, with one side horizontal,are planked with two-inch plank all round, and the box is filled with sand before the planking is finished; this box being laid upon the surface at the lowest parts, or in trenches where the beach is somewhat higher. This construction, by its weight, is secure from undermining, while the sea has never been found yet to disturb its position horizontally, or to filter through. In the three or four places where it has been tried upon this beach, I found no part where it had been injured, though the sea had forced its way around the ends in some parts, as I fear, from defects in their lines of directions, or in the manner of making their terminations. The cost of this construction, as my close inquiries have led me to estimate, and which I found corroborated by the experience of the town authorities, who have executed some work of this kind on this beach, and in the most economical manner they could devise, is about $ 2.50 for a linear foot for boxes of ten feet on a side, and as I judge of about $ 2 a foot for boxes of seven or eight feet on a side, which may suffice in some parts.

The plank fence I would propose to make with posts of the same size as above, set four feet apart, and four or five in the sand,and planked with two-inch plank for the remainder of the height, each post, or each alternate post being braced on the rear or inner side with oblique braces, resting in the ground or against other short posts; the expense to this construction, including the excavations for posts, bracing, &c., I estimate at $ 1 per linear foot.

Without giving in this report the details of each particular portion where each kind of protection is required, which I have in my notes, and which is better shown in the accompanying sketch, but which I presume might not be desired here, I would state that I have

Plymouth Harbor, 1858.

("Repair of works in Plymouth Harbor", - continued) - 5.

carefully gone over every part of this beach myself, for its whole extent, from the beacon on the north, to the bluffs on the hill, just below the "Clifford Hotel" on the south; that I have carefully noted the measurements, distances, &c., and used my best judgment as to the expediency of the greater or less expensive of the modes of protection, and their extent for the different places. The measurements were made with a cord, and of course are approximate, but it is not doubted are sufficiently accurate for the purposes of the estimate.

The estimate of the heights and the grassed portions of the beach are for the most part, though not altogether, by the eye.

The portions of the beach for which I have estimated the more efficient protection now, or the box, having frames of triangles of ten feet on a side, are altogether about 6,530 feet. I cannot, of course, say what the extent of such portions may be by the time an appropriation can be made and become available; it must, however, if changed, be greater in extent. I estimate though only for 6,530 feet, which, at $ 2.50 per foot, is $ 16,325.00.

The portions, added up, for which I have thought the smaller box will suffice, are 690 feet, which, at $ 2 per foot, would be $ 1380, additional.

The parts which I have thought would be sufficiently protected by the plank fence amount, altogether, to 3,905 feet, which, at $ 1 the foot, would be $ 3,905 more; and allowing for increased injuries by another year, and for contingencies, say $ 390, I judge that it is not safe to estimate for less than in all twenty-two thousand dollars which is the least sum that I could advise to be appropriated to put this beach in such condition as to render it capable of resisting, effectually, the effects of the gales in this vicinity. I would state that though the estimate, as made in detail, was put at the very lowest sum that it was thought safe or judicious to rely upon, yet I would deem it advisable that the person who might eventually superintend the work should exercise his best judgment, that if possible, as it may be in some cases, during its progress, the less expensive protection may be used if deemed prudent, to a greater extent

("Repair of works in Plymouth Harbor", - continued-) - 6.

than here estimated; that a small amount of the appropriation might be reserved for one, two, or three seasons, to repair thoroughly and without delay any possible injuries or breaches which may occur in positions entirely unexpected after the best judgment shall have been used by the engineer in deciding upon the parts needing protection.

And I cannot too strongly urge, that if any appropriation is made, it should be for the whole amount necessary for this work. By this means the protection to the different parts of the beach can be given according to some general plan, and in such a way that the different constructions shall mutually strengthen and support each other, or at least not do injury to the works, or the parts of the beach adjacent, such as, I regret to say, appears to have been, to a great extent, the case in the recent constructions attempted, with insufficient means, and with the endeavor to stop existing injuries, in detached parts, without regard to the future or to any plan for the whole. The result being continued and increased injuries to the beach, such as to give me the conviction that the appropriation of any sum essentially less than that here estimated, or the appropriation and expenditure of even the whole of that sum in different years, would be a virtual throwing away of the whole amount.

I need not say that the fact of this being the only harbor or anchorage, land locked from every wind, or approaching the depth of water described above, in the long stretch of coast from Boston to Cape Cod, and as I believe it is, from Cape Cod round to Long Island Sound, with the exception of the harbors of New Bedford and Newport, must make it of incalculable advantage as a refuge in cases of necessity to the shipping of the immense amount of commerce passing into Massachusetts Bay, (a large portion of it coming as it does from the southward,) and must fully justify the expenditure of the sum now estimated for its protection.

Very respectfully, your most obedient servant,

H.W. Benham, Captain Engineers.

General J. G. Totten,
Chief Engineer

Plymouth Harbor, 1858.

("Repair of works in Plymouth Harbor", - continued-) - 7.

House Doc., 1st Session, 35th Cong., 1857-1858, vol.9, Ex.Doc.48, pp. 1-5.

(Plymouth Harbor.)

1866.

"Plymouth Beach. - Brevet Lieut. Col. G. H. Mendell reports, under date of March 17, 1866: " I receieved instructions to visit Plymouth Beach to examine and report upon its condition, submitting a plan and estimate for such repairs as might be deemed necessary. Upon this report the department caused the sum of $ 8300.00 to be placed in my hands for the work.

No vouchers for expenditure have as yet been submitted, but a contract has been made with James and William Hall, of Plymouth, Mass. to built and place 1300 feet of breakwater for the sum of $ 4736.00 . This breakwater is to consist of parallel triangular frames, placed 4 feet from centre to centre securely anchored in the sand, planked with two-inch plank.

These frames are from 9 to 10 in height, and stand above the level of the beach about 6 feet. This mode of protection has been long in use on this beach, and has served to collect the sand and form a firm beach, which in time dispenses with the necessity of the timber protection.

Besides this, it is contemplated to build a jettee out from the beach seaward, with a view to increase the deposits of sand, and thus serve to widen the beach.

The frame work is to be completed by the terms of the contract on or before 31st of October proximo.

Balance on hand June 30, 1866, on account of repairs of harbors on the sea-board, to be applied to Plymouth Beach, $ 8300.00."

Report of the Chief of Engineers for the year 1866. Washington, October 20, 1866. House Doc., 2d Sess., 39th Cong., 1866-67, vol.3, Doc.1, p.441, money statement on same page of this document.

1870 31

41st Congress, 2d Session. } HOUSE OF REPRESENTATIVES. { Ex. Doc. No. 18.

HARBOR AT PLYMOUTH.

LETTER

FROM

THE SECRETARY OF WAR,

SUBMITTING

The report of the Chief of Engineers upon the public works and improvements in the harbor of Plymouth, Massachusetts.

DECEMBER 15, 1869.—Referred to the Committee on Appropriations and ordered to be printed.

WAR DEPARTMENT,
December 14, 1869.

The Secretary of War, in obedience to the resolution of the House of Representatives of December 8, 1869, has the honor to submit the accompanying report to the Chief of Engineers upon the protection and improvement of Plymouth Harbor, in the State of Massachusetts.

WM. W. BELKNAP,
Secretary of War.

ENGINEER OFFICE, UNITED STATES ARMY,
Newport, Rhode Island, October 12, 1869.

GENERAL: I have the honor to submit the following report in relation to the preservation of Plymouth Beach, Massachusetts:

The reports made by the officers who preceded me in charge of this work sufficiently describe the character of the beach, rendering it unnecessary for me to repeat in detail what has been said.

The harbor of Plymouth is protected by a tongue of land about three miles long, running in a direction north-northeast from the mainland, as shown by the Coast Survey chart. This tongue is composed almost entirely of sand, except near the southern end, where the beach is covered with stone of various size. The existence of the harbor of Plymouth depends upon the preservation of this peninsula. The action of easterly gales has at various times cut through this tongue of land, carrying the sand into the harbor, thus diminishing its capacity. These breaks have been at points all along the beach, and different modes have been adopted to close them up. In some instances breakwaters have been constructed of triangular frames of timber placed in juxtaposition, and filled with sand or stone, or the frames have been placed at intervals, and covered

with plank; in others parallel rows of stakes have been driven and filled with brush. Most of these works have been constructed by the general government. From a recent inspection of the beach I find that these plans seem to be a sufficient protection, except at the northern end of the peninsula for a distance of about twelve hundred feet. The rest of the point consists principally of sand hills, generally covered with beach grass, and very little if any work seems necessary to its protection. The northern portion, however, is nearly covered at high water, and in storms the waves sweep over it. It is this portion that now requires attention, and I have endeavored to devise or suggest the most efficient means for its protection. The want of an accurate survey of the beach as it exists at present renders it difficult to give the exact location of the proposed works; but this is of less importance than is generally the case, because the line of the beach is continually shifting, so that a survey in detail at one season might be useless the next, and the exact location of any work for its protection can only be determined at the time of construction. The accompanying tracing* from the Coast Survey chart of the harbor, slightly varied, will enable me to indicate sufficiently the location of the proposed work.

In the fall of 1867 a breakwater, composed of triangular frames of timber placed at intervals, covered with plank and partially filled with sand, at the north end of the beach, was carried away by a storm for a length of about 1,000 feet. This is indicated by the line B D on the accompanying sketch. Both ends of this breakwater connected with the sand hills, but the storm carried off the sand hill at the northern end. This breakwater was entirely exposed to the full force of storms from the east and northeast. In the fall of 1868 a more substantial breakwater was commenced by Major Smith, corps of engineers, on the site of the one carried away. This work consists of cribs of timber, each one hundred feet in length, partially filled with stone. The dimensions of the cross-section are given in this sketch. [See original.] Two of these cribs were placed in position; a third crib and part of a fourth were framed on the main land, but on account of the lateness of the season, and accidents, the funds available ($7,000) were exhausted before they could be put in place. The finished cribs were placed at the extreme northern end of the contemplated work, and occupied about the position of the sand hill which was carried away by the storm of 1867. South of this, and connected with it, Major Smith also put in place a breakwater composed of triangular frame-work, covered with plank on the seaward side, and loaded with sand. These works have stood well, but I am informed that there have been no serious storms to which they were exposed. There remains now an interval of nine hundred feet to be closed up. The objection which I have to these works is that they do not hold the sand which is carried up by the waves and wind, and hence are liable to be undermined both by the action of the sea and wind. The works recently constructed at Provincetown for the protection of the beach, by Brevet Major General J. G. Foster, corps of engineers, consisting of a bulkhead made of three parallel rows of stakes filled with brush and loaded with stone, with jetties similarly constructed every fifty feet, have successfully accomplished this object, and have withstood the action of one of the most severe gales known on the New England coast, that of September 8, 1869. The jetties not only catch the sand, but apparently they serve to break the force of the waves by destroying their continuity.

* Printing of tracing not ordered.—PRINTER.

A structure of this kind seems to me more suitable for the protection of the beach at Plymouth than the rigid structures above referred to, and more economical. It also has the advantage of not requiring skilled labor, and can be more rapidly executed. I would therefore recommend this plan as the best temporary structure for the purpose, modifying it, however, by placing jettees on both sides of the bulkhead, as it is desirable to collect the sand in rear as well as in front to prevent undermining. The sand carried by the wind from the sand hills will, it is thought, be caught by the rear jetties. They also give additional strength without interfering with the "open and flexible" character of the structure.

I have considered the question of permanent works for the preservation of this beach. The expense of a stone breakwater for this purpose, owing to the extent of the beach, would be much greater than the importance of the harbor seems to demand, and it would be as satisfactory and more economical to construct temporary structures like those at Provincetown, and to keep them in repair by means of a fund always available. I am, however, inclined to the opinion that a breakwater constructed of concrete in some form as of béton coignet, a building material to which my attention was called by Brevet Colonel Casey, corps of engineers, and the official report on which, by Mr. Beckwith, of the United States commission at the Paris Exposition, I have carefully read, would be exactly what is desired, both in point of economy and power of resistance for the protection of beaches. This material, composed of one part (by measurement) of common lime, and five parts of sand, with only sufficient water to enable it to be packed in molds or cribs of planks, will, it is claimed, after being allowed to harden for a few days in the air, resist the action of water, and by adding a small quantity of lime or cement, the time required before exposure can be diminished at pleasure.

This material has been used for various purposes in Paris for the last fifteen years, and the properties claimed for it are so valuable, in view of its economy, that it would be very desirable to make a personal examination of the works constructed of it, especially the experimental works, to determine its adaptation to the construction of breakwaters. A breakwater of this material, being a solid mass, would resist the force of the most powerful waves, and if it will withstand the abrading and chemical action of the sea, and the effect of frost, all the requirements of a breakwater would be satisfied.

I estimate that this material can be constructed at Plymouth beach for five dollars per cubic yard, or less, all the materials but lime being on the spot. At this rate the cost per running foot of a breakwater having a cross-section would be less than twenty dollars; less than the cost of the crib-work constructed by Major Smith, and not much greater than the temporary structure I have recommended.

Any appropriation for the preservation of this beach should be sufficient not only to construct the work now deemed necessary, but sufficiently large to leave a balance adequate to defray the expense of repairs, which ultimate economy demands should be made at the first sign of weakness in the works constructed.

In addition to the works above proposed, it will be probably necessary before a great while to repair the stone breakwater at the extreme northern end of the beach. An inspection of the Coast Survey chart shows that the harbor at Plymouth at low water is very limited, but as the mean rise and fall is ten and two-tenths feet, vessels of considerable tonnage are enabled to approach the wharves. The effect of storms, however, is to fill up the harbor with sand from the beach, and thus diminish its capacity. The estimate I submit for the work proposed is

1869 1870.

twenty dollars per running foot of the beach, which will cover any plan that may ultimately be decided on; either the crib-work filled with stone, the bulkhead filled with brush, with jetties on both sides, as indicated in the sketch, or the *béton*, should it be deemed advisable to use that material.

The estimate, therefore, of the amount required, is 1,200 feet of breakwater, at $20 per running foot	$24,000 00
And for repairs and balance available to remedy injuries at the time of occurrence, and contingencies of storms during the progress of the work	6,000 00
	30,000 00

In conformity with circular of June 12, 1869, I report as follows:

1st. Construction and repairs of breakwater as explained in report.

2d. Owing to the nature of the beach at Plymouth, it is impossible to make any estimate of the total amount required for the completion of the work for its preservation, as it is so exposed to the action of the sea that injuries may occur at any time, as heretofore.

3d. $30,000.

4th. District of Plymouth.

5th. Plymouth, Mass.

6th. $32,833 21.

7th. Plymouth harbor is of considerable importance as a harbor of refuge for coasters and fishing vessels, of which quite a number belong to Plymouth. The supplies of iron and coal for the use of the manufactories and town are brought by coasters.

There are several manufacturing establishments, consisting of one steam cordage company, employing half a million capital and some 300 hands; several smaller manufactories of twine and small rope; one rolling mill and nail factory combined, with $100,000 capital, using steam and water power; one tack factory, with about the same amount of capital; two cotton duck factories; one woolen mill; three batting mills; one thread factory; one rivet factory and machine works; one iron foundery; one hammer factory; one plaster mill; one spool factory; two zinc-rolling mills and shoe-nail factories. Estimated amount of capital employed in above mentioned factories, $3,300,000. Population of Plymouth 6,500.

11th. Amount received during the fiscal year ending June 30, 1869, $7,000.

Amount expended during the fiscal year ending June 30, 1869, $6,936 12.

Amount required for the fiscal year ending June 30, 1871, $30,000.

I am, general, very respectfully, your obedient servant,

D. C. HOUSTON,
Major of Engineers, Bvt. Col. U. S. A.

Bvt. Maj. Gen. A. A. HUMPHREYS,
Chief of Engineers U. S. A.

22. *Plymouth Harbor, Massachusetts.*—The plan adopted for the preservation of this harbor consists in the construction of bulk-heads and jetties, which, for the most part, are made of a frame-work filled with brush and ballasted with stone, but where most exposed to the sea they are built of stone. This work serves to form a new bank of sand, which is eventually enlarged and straightened by planting beach-grass upon it. Thus far it has been attended with very satisfactory results. But in order to ensure the preservation of this harbor, it is necessary to keep this work in good condition, as well as to strengthen and extend it in several places.

Under the appropriation of June 10, 1872, about 200 linear feet of brush bulk-head and jetties have been rebuilt to replace that damaged by the great storm of November, 1871; the outer part of the stone bulk-head, which connects the beacon with the "point," has been much strengthened; over 500 linear feet of small brush and stone jetties built, and over 10,000 hills of beach-grass planted. Under the appropriation of March 3, 1873, this work will be continued to the extent found necessary.

Amount expended during the fiscal year ending June 30, 1873	$2,858 62
Amount available July 1, 1873	4,288 35
Amount required for the fiscal ending June 30, 1875	5,000 00

(See Appendix X 22.)

X 22.

IMPROVEMENT OF PLYMOUTH HARBOR, MASSACHUSETTS.

The work projected for the preservation and improvement of this harbor consists in the construction and repair of bulk-heads and jetties,

* Mr. Cummiskey completed his contract August 22, 1873.

composed either of stone or else of timber and brush balasted with stone, built for the preservation of Long Beach, and for its protection from the storms to which it is exposed. This beach serves as a breakwater, and affords to the harbor its only protection from the easterly storm.

The following appropriations have been made by Congress for this work, viz:

By act approved July 11, 1870	$10,000 00
By act approved March 3, 1871	10,000 00
By act approved June 10, 1872	2,500 00
By act approved March 3, 1873	3,000 00
Total	25,500 00
Amount expended during the fiscal year ending June 30, 1873	2,858 62
Amount available July 1, 1873	4,288 85

Up to July 1, 1872, the work done upon the bulk-heads and jetties is shown on the sketch accompanying my report of January 1, 1873.

In addition to which a large quantity of beach-grass has been planted at various places above on Long Beach. In the extraordinary gale of November 15, 1871, the strength of the bulk-heads and jetties was most severely tested, and very little injury was done thereby, except to that portion of the bulk-head between jetties Nos. 28 and 32, and to jetties Nos. 29 and 30, (as shown on sketch above referred to,) but these were not so much injured as to require immediate attention.

In conformity with the project of June 22, 1872, which was approved by the Department, work was resumed about the middle of July, 1872, under the appropriation of June 10, 1872, in the repairs on the bulk-head and jetties on Long Beach, and they were completed the last of August to the extent then deemed necessary. This work was done by hired labor and with materials purchased in open market and consisted—

1st. In making about 200 linear feet of brush bulk-head and jetties to replace that damaged by the storm in November, 1871;

2d. In strengthening the outer part of the bulk-head with 613 tons of stone purchased for that purpose;

3d. In making 300 linear feet of single brush jetties and 250 linear feet of small stone jetties; and,

4th. In planting 10,800 hills of beach-grass.

Under the appropriation made by act of March 3, 1873, work will be resumed about the 1st of August, 1873, to be applied to enlarging and extending inward the stone bulk-head; to the repair of the brush bulk-head and jetties; to the planting of beach-grass, and to the extension of the stone jetties where found necessary. This work will be done by hired labor and with materials purchased in open market, and will probably be completed before the close of the season.

A resurvey of Long Beach was made by Mr. Sophus Haagensen, civil engineer, in July, 1872, a drawing of which was submitted to the Department January 1, 1873, on which were shown the improvements previously made for the protection and preservation of the beach, as well as the change in the high and low water lines that had occurred since the survey made by the Engineer Department in 1870, and also since the survey of 1856 made by the United States Coast Survey.

The great value of these works becomes very apparent on an examinations of these drawings.

For the continuation of these works, and for such repairs as may from time to time become necessary, the following estimate is submitted, viz:

1. Extending stone bulk-head and jetties, 1,500 tons of rubble-stone, at $2 per ton	$3,000 00
2. Repairs of brush bulk-heads and jetties and planting beach-grass	1,500 00
Adding for contingencies, say	500 00
Total	5,000 00

which amount is required for the fiscal year ending June 30, 1875.

18. *Plymouth Harbor, Massachusetts.*—The work projected for the improvement of this harbor consists in the construction and repair of bulkheads, jetties, and groins built for the protection and preservation of Long Beach, which serves as a breakwater, and affords to the harbor inside the only shelter it has from easterly storms. These bulkheads and jetties are built either of stone or else of crib-work and brush ballasted with stone, and the groins of stone and of brush, and sometimes of the two combined.

This work has been carried on at intervals during the past year with results as follows, viz: Built twenty-three groins of brush and stone, having an aggregate length of 3,000 feet, ten groins of brush alone, having an aggregate length of 534 feet; over 10,000 hills of beach-grass planted, and repairs made where necessary upon the bulkheads and jetties. This work will be continued with the appropriation of June 23, 1874

Balance in Treasury of United States July 1, 1873	$3,000 00
Amount in hands of officer and subject to his check	1,288 85
Amount appropriated by act approved June 23, 1874	5,000 00
Amount expended during the fiscal year ending June 30, 1874	3,860 90
Amount available July 1, 1874	5,427 92
Amount required for the fiscal year ending June 30, 1876, (as revised in this Office)	28,000 00

(See Appendix Y 18.)

Y 18.

IMPROVEMENT OF PLYMOUTH HARBOR, MASSACHUSETTS.

The work projected for the improvement of this harbor, consists in the construction and repair of bulk-heads, jetties, and groins, built for the protection and preservation of Long Beach, which serves as a breakwater, and affords to the harbor inside the only shelter it has from easterly storms.

These bulk-heads and jetties are built either of stone, or else of crib-work and brush ballasted with stone; and the groins of small stones, with and without brush, intermixed.

The following appropriations have been made by Congress for this work, viz:

By act approved July 11, 1870	$10,000 00
By act approved March 3, 1871	10,000 00
By act approved June 10, 1872	2,500 00
By act approved March 3, 1873	3,000 00
By act approved June 23, 1874	5,000 00
Total	30,500 00
Amount available July 1, 1873	4,288 85
Amount expended during the fiscal year ending June 30, 1874	4,237 93

The work for the preservation and improvement of this harbor was resumed on the 1st of August, 1873, and continued until the latter part of November, when it was suspended until about the 1st of May following, and continued until near the end of the fiscal year.

During this period the work done was as follows, viz:

Twenty-three groins of brush and stone, having a total length of about 3,000 feet, and 10 groins of brush alone, having a total length of 534 feet, were constructed on the outer extremity of Long Beach. The brush and stone groins were made by placing brush flat on the surface of the beach and piling upon it beach bowlders to a height of about 18 inches. These groins are about 5 feet wide. The brush groins were made by digging a trench 2 feet by 2 feet, and placing brush in it upright and as close as practicable, the brush being held by sand being thrown into the trench and well rammed down, and sometimes further protected by small bowlders placed in a row along the sides of the groin. The brush rises about 2 or 3 feet above the surface of the beach. These groins are located as follows: Eleven brush and stone groins and three brush groins on the outside of the breakwater, perpendicular to it, and in the first 800 feet from the beacon; ten brush and stone groins and six brush groins on the outside of the plank bulk-head, perpendicular to it, and along a distance of 300 feet, commencing at a point about 1,800 feet from the beacon; one brush and stone groin at the beacon, on the inside of the bulk-head,

and perpendicular to it; one on the inside of and nearly parallel to the plank bulk-head, about 500 feet long, commencing about 400 feet from the beacon; and one brush groin fills an interval in the plank bulk-head about 1,700 feet from the beacon. In constructing these groins 1,583 tons of small bowlders were used.

In addition to this, over 10,000 hills of beach-grass have been planted, and repairs have been made where necessary upon the bulk-head and jetties on Long Beach.

Amount available for additional work July 1, 1874	$5,050 92

This amount is to be applied to building additional brush and stone groins outside and inside the main bulk-head, and to the repairs of the brush bulk-head and jetties and the planting of beach-grass where most necessary.

For the further improvement and preservation of this harbor the following sums will be required, viz:

1. For completing the work projected for the preservation of Long Beach, and for such repairs, planting of beach-grass, &c., as may be necessary	$2,000
2. Should it be decided to improve the harbor by dredging, as described in my special report to the Department, dated February 14, 1874, (a copy of which is hereto appended,) it is therein estimated that the cost thereof will be	28,000
Total	30,000

Financial statement.

Balance in Treasury of United States July 1, 1873	$3,000 00
Amount in hands of officer and subject to his check	1,288 85
Amount appropriated by act approved June 23, 1874	5,000 00
Amount expended during the fiscal year ending June 30, 1874	3,860 90
Amount available July 1, 1874	5,427 92
Amount required for the fiscal year ending June 30, 1876	30,000 00

43D CONGRESS, 1st Session. } HOUSE OF REPRESENTATIVES. { Ex. DOC. No. 161

PLYMOUTH HARBOR, MASSACHUSETTS.

LETTER

FROM

THE SECRETARY OF WAR,

RELATIVE TO

The survey of Plymouth Harbor, Massachusetts.

MARCH 4, 1874.—Referred to the Committee on Commerce and ordered to be printed.

WAR DEPARTMENT,
February 24, 1874.

The Secretary of War has the honor to transmit to the House of Representatives, in reply to House resolution of December 10, 1873, letter of the Chief of Engineers, and report of Lieut. Col. George Thom, Corps of Engineers, of a survey of Plymouth Harbor, Massachusetts, with an estimate of the cost of dredging and improving the same so as to afford protection and facilities to commerce.

WM. W. BELKNAP,
Secretary of War.

OFFICE OF THE CHIEF OF ENGINEERS,
Washington, D. C., February 21, 1874.

SIR: In compliance with the following resolution of the House of Representatives of December 10, 1873, referred to this office for report, viz.: "That the Secretary of War be requested to cause an examination or survey to be made of the harbor of Plymouth, Mass., with a view to dredging and improving the same so as to afford greater protection and facilities to commerce, and that he report upon the feasibility of making such improvement, and the probable cost thereof, to the House of Representatives," I beg leave to submit herewith a copy of a report (and accompanying map) made by Lieut. Col. George Thom, Corps of Engineers, under whose supervision the survey directed by the resolution was made.

To improve the harbor by dredging would, as stated by Colonel Thom, require the extension of the present main channel from a point one mile above "the Beacon," where it deflects abruptly to the westward, up to the outer end of Long Wharf, so as to have a depth of not less than 6 feet at mean low water, or 16 feet at mean high water, with a width of not less than 500 feet, requiring an excavation of about

produced the existing shoals would, it is more than probable, reproduce them.

Should it be decided to improve this harbor by dredging, it is recommended that it should be applied to the opening of a channel 100 feet in width and 6 feet in depth at mean low-water, from the end of Long Wharf outward in continuation of the present main channel, above the "Middle Ground," as shown on the accompanying drawing. A channel of this width would enable vessels to be towed up to the vicinity of the wharves of the town, and would probably be kept open by the scour of the ebb-tide deflected into it from "Town Brook."

The probable cost of this channel is as follows, viz:

64,000 cubic yards of dredging, at 40 cents per cubic yard	$25,600
Adding for contingencies, say	2,400
Total	28,000

Further details and information in regard to this harbor, as obtained by survey, will be found in the accompanying map and report.

The extent to which the commerce of the country would be promoted by the improvement of this harbor, as above projected, is stated in the accompanying communication of the collector of customs of the port of Plymouth.

Respectfully submitted.

GEO. THOM,
Lieut. Col. of Engineers, Bvt. Brig. Gen., U. S. A.

Brig. Gen. A. A. HUMPHREYS,
Chief of Engineers, U. S. A.

Report of Mr. Sophus Haugenson, Assistant Engineer.

UNITED STATES ENGINEER OFFICE,
Portland, Me., February 14, 1874.

GENERAL: In pursuance of your instructions of January 10, I proceeded to Plymouth, Mass., on January 12, and made an examination of the harbor, with a view to improving the same by dredging. I have the honor to submit the following report upon this examination, as well as a drawing of the harbor on a scale of 1:10,000:

The part of the harbor embracing the main channel, and the approaches to the wharves in the town of Plymouth, was surveyed, and the characteristic soundings platted on the accompanying map. The northern part of Plymouth Beach is taken from the survey made in 1872, in connection with the improvement of Plymouth Beach; the rest of the map is taken from United States Coast-Survey charts of 1854 to 1857.

The plane of reference, to which the soundings are reduced, is the mean low-water, as determined from previous surveys, the bench-mark of which is a spike in a wharf-pile at the end of Long Wharf. Said spike is in ref. 7.56 above mean low-water. Levelings were made from this to the floor of the monument over Plymouth Rock, (sill between columns,) which is a permanent bench in ref. 17.24 feet above the plane of reference. The mean rise and fall of tide is 10.1 feet.

Vessels entering Plymouth Harbor from the "main ship-channel," and the "Cow Yard," have a continuous 12-foot channel at low-water, of a width not less than 150 feet to within a distance of half a mile from the wharves in Plymouth. It runs close to the low-water line of Plymouth Beach to a point a mile distant from Plymouth Beacon, where it turns and runs for half a mile in a direction perpendicular to the beach; thence it runs parallel to the wharves in the town, distant about half a mile from the same. Between the channel and the wharves are flats more or less dry at low-water.

Of the numerous drains or gullies in these flats, the "Town Brook" is the most important, making from one to two feet depression in the flats in front of the wharves in Plymouth.

The depth along the mid-line of the channel varies greatly. For the first half mile from the "Cow Yard" it does not average more than 16 feet at low-water. Here are the so-called "tussocks"—small hills or bunches of sand scattered over the bottom.

The shoalest sounding found in them was 9½ feet at mean low-water. As soon as the point of Plymouth Beach is passed the channel, sheltered by the bold shore of the beach, deepens, so that a continuous 18-foot channel, (in places as deep as 29 feet,) at mean low-water, can be followed as far as to the "Middle Ground." This shoal divides the main channel in two narrower channels. The northernmost of these is the best, being at least 150 feet wide between the 12-foot curves, and having from 15 to 31 feet soundings along its mid-line. The channel south of the "Middle Ground" has only half the width of the former, and has 6 feet less water in it.

The width of the "main channel" at low-water is not large enough for a beating-channel, and no reasonable amount of dredging would make it a beating-channel at low-tide.

To improve the channel, so that vessels drawing 16 feet could beat up its whole length at high-water, would require the removal of two shoals, viz, "Splitting Knife" and "Middle Ground," to a depth 6 feet below mean low-water. Both these shoals are banks formed of hard white sand, and the above-named improvement would require at least 80,000 cubic yards of dredging, at a cost of not less than $40,000. To make this work of any value to navigation would, moreover, necessitate the continuation of a channel of the same width (500 feet between the 6-foot curves) through the flats, up to the town wharves, a work which would require the additional removal of 320,000 cubic yards of mud and clay. It is not probable that such a channel would be permanent. The shoals would very likely form again, especially the "Middle Ground," of which the greatest part would be left undisturbed below the 6-foot plane, and there would not be sufficient scouring-power to keep an artificial channel of 500 feet width through the flats open. A good beating-channel from the "Cow Yard" to the wharves in Plymouth would thus involve an expense of not less than $176,000, without any likelihood of permanency; whereas a good towing-channel could be made for vessels of the same class at a comparatively small expense, and with greater promise of permanency.

To obtain a good towing-channel for vessels drawing 16 feet from the "Cow Yard" up to the wharves in Plymouth, no improvement is needed in the natural channel up to within 2,400 feet of the wharves; from here a channel would have to be excavated through the flats to a depth of 6 feet below mean low-water—that is, 16.1 feet below mean high-water. This channel would connect the depression in front of the town wharves with the natural channel, and it is through that the scour of the "Town Brook" would be sufficient to keep a channel of 100 feet width open.

Borings were made along the line of this proposed channel, showing that the material to be excavated is soft clay. Below the 6-foot plane the bottom is harder and gravelly.

The amount of material to be excavated to obtain a channel through the flats of a width of 100 feet, and a depth of 6 feet at mean low-water, (16.1 feet at mean high-water,) is estimated at 50,700 cubic yards *in situ*, or with an increase of 25 per cent. by loosening, at 64,000 cubic yards measured in the scows. The cost of removal and dumping the same (the nearest dumping-place is the "Cow Yard," two miles from the place of dredging) is estimated at 40 cents per cubic yard, as measured in the scows.

64,000 cubic yards of excavation, at 40 cents	$25,600
Contingencies, say	2,400
Cost of improvement	28,000

Very respectfully, your obedient servant,

SOPHUS HAAGENSEN,
Assistant Engineer.

Bvt. Brig. Gen. GEO. THOM,
Lieut. Col. of Engineers.

Commercial statistics.

CUSTOM-HOUSE, PLYMOUTH, MASS.,
Collector's Office, February 12, 1874.

SIR: Your letter of January 30 is received, and in answer I beg leave to say that during the last year the amount of duties paid in Plymouth was $27,571. The number of vessels belonging to the port, and documented here, is 58, amounting to 3,154$\frac{75}{100}$ tons. A large proportion of these vessels are engaged in the fisheries, the product of which in 1873 was about $180,000. A few are engaged in the coasting-trade, carrying coal, iron, and assorted cargoes of furniture, hollow ware, plaster, sugar, molasses, and fish, to and from Plymouth. The total coasting-trade of the port during last year comprised 59 cargoes of coal, amounting to 12,000 tons; 18 cargoes of iron, amounting to 2,321 tons; 31 cargoes of lumber, amounting to 3,100,000 feet; 3 cargoes of gypsum,

molding-sand, and stone; two cargoes of corn, amounting to 8,000 bushels; 18 cargoes of salt, amounting to 23,000 bushels.

Besides these there are sundry cargoes of wood, ashes, and other articles difficult to enumerate.

The great difficulty of entering the harbor and reaching the wharves necessitates the more expensive importation of lumber, iron, and corn by rail, the amount of the latter article reaching about 60,000 bushels the past year. It is difficult to estimate the advantage which would be derived from a channel 6 feet deep to the wharves at low-tide, but it is clear to all persons of any experience in navigation here that many obstacles would thus be removed which cause delay and expense in receiving and discharging cargoes, and that new inducements would exist for a large increase of our commerce. Plymouth is already a place of considerable importance as a manufacturing town, its products reaching the sum of $3,000,000 per annum; its water-power and general facilities for a large increase of business promise the best results from the improvement of the harbor which is now contemplated.

I trust, sir, that the enterprise will not end with a mere survey, but that it may be carried on to a successful and speedy completion.

I am, with respect, your obedient servant,

THOMAS LORING,
Collector.

GEORGE THOM,
Lieut. Col. of Engineers, Bvt. Brig. Gen., U. S. A.

15. *Plymouth Harbor, Massachusetts.*—The several appropriations heretofore made for this harbor have been applied to the construction of bulk-heads, jetties, and groins for the preservation and strengthening of Long Beach, upon which the harbor depends for its existence. During the past year these works have been repaired and strengthened where most necessary, being now in a very good and effective condition. Repairs will, however, be required hereafter upon these works from year to year, as heretofore, for which Congress will continue to be called upon for suitable appropriations. Under an appropriation of $10,000 made by act of March 3, 1875, for improving the harbor itself, a contract was made May 13, 1875, for about 35,000 cubic yards of dredging, whereby the projected improvement of the harbor will be about half completed. To complete this channel and make the necessary annual repairs will require an additional appropriation of $10,000, as estimated by the engineer officer in charge.

Balance in Treasury of United States July 1, 1874	$5,000 00
Amount in hands of officer and subject to his check July 1, 1874	427 95
Amount appropriated by act approved March 3, 1875	10,000 00
Amount expended during the fiscal year ending June 30, 1875	4,352 25
Amount available July 1, 1875	11,075 67
Amount required for the fiscal year ending June 30, 1877	10,000 00

(See Appendix BB 15.)

BB 15.

IMPROVEMENT OF PLYMOUTH HARBOR, MASSACHUSETTS.

The existence of this harbor depends entirely upon the protection and preservation of Long Beach, which is a narrow strip of land that extends two and three-fourths miles out from the main land in a northwesterly direction, nearly parallel to the shore of the town of Plymouth, and distant from it about one mile. It affords to the harbor its only shelter from easterly storms. In late years it has been washed away in some places, and much weakened in others, to an extent seriously threatening the ruin of the harbor. For the protection and preservation of this beach various works have been built from time to time, until finally they have proved efficient and successful.

During the last six years appropriations have been made annually by

Congress for this harbor, amounting in the aggregate to $40,500, including the sum of $10,000 appropriated by act of March 3, 1875.

These several appropriations have heretofore been applied to the construction of bulk-heads, jetties, and groins, and the planting of beach-grass where most necessary for protecting and strengthening the beach. These bulk-heads and jetties have generally been built either entirely of stone, or else of a frame-work filled with brush and ballasted with stone, and the groins of small stones intermixed with brush, and sometimes of brush alone. The bulk-heads and jetties have already accumulated a large quantity of sand, on which beach-grass has been planted throughout its whole extent, forming a ridge of sufficient height for the purpose intended. But, with a view to increasing its thickness and strength at its outer end, 33 parallel groins have been built out perpendicularly from the main bulk-head or ridge on the seaward side, varying in length from 75 to 265 feet, (aggregating 5,250 feet in length,) and in their distances apart from 50 to 100 feet, whilst others have been built inside of the bulk-head, in such places as would add most to the strength and efficiency of the beach.

Under the appropriation of $5,000, made by act of June 23, 1874, work was continued upon these groins from the 1st of August until the latter part of November, 1874, when it was suspended for the winter, during which period the following work was done, viz: 2,840 linear feet of stone and brush groins, and 320 linear feet of brush groins, built outside the main bulk-head, and about 250 linear feet of stone and brush groins built inside of it; also, a frame-work bulk-head filled with brush and stones, 110 feet in length, built half-way up the beach, in order to strengthen it in the place where broken through by the great storm of November, 1873. In these groins and bulk-head, built in August–November, 1,617 tons of small bowlders were used.

Operations were resumed upon the beach in June, 1875, and during that month the work done was as follows, viz:

Five hundred and four tons of small bowlders have been delivered, and the greater part of them placed on the outer stone bulk-head on Long Beach, whereby its efficiency has been much increased. Some have also been used in the repairs and extension of some of the groins. Brush-groins have also been built on the inside of the bulk-head, and beach-grass has been planted where most necessary. The work projected for the repairs and preservation of the improvements on Long Beach has thereby been nearly completed for this season.

With a view to improving the channel leading from the Middle Ground up to Long wharf in Plymouth, a survey was made in February, 1874, from which it was estimated that 64,000 cubic yards of dredging would be necessary to excavate the channel for a width of 100 feet, for a depth of 6 feet at mean low-water, giving 16.1 feet at mean high-water.

Under the appropriation of $10,000, made by act of March 3, 1875, a contract was made May 13, 1875, with Mr. Augustus R. Wright, of Geneva, N. Y., the lowest bidder, at 23 cents per cubic yard, as measured in the scows, for 35,000 cubic yards, more or less, of dredging to be applied to the partial excavation of the projected channel.

To complete this channel will require the additional sum of about	$7,000 00
And to make the necessary annual repairs of the works on Long Beach the additional sum of	2,000 00
Adding for contingencies, say	1,000 00
Amount required for the fiscal year ending June 30, 1877	10,000 00

Abstracts of proposals received and contracts made are hereto appended.

Financial statement.

Balance in Treasury of United States July 1, 1874	$5,000 00
Amount in hands of officer and subject to his check July 1, 1874	427 92
Amount appropriated by act approved March 3, 1875	10,000 00
Amount expended during the fiscal year ending June 30, 1875	4,352 25
Amount available July 1, 1875	11,075 67
Amount required for the fiscal year ending June 30, 1877	10,000 00

Abstract of proposals received May 5, 1875, for dredging in Plymouth Harbor, Massachusetts.

Number for reference.	Names and residences of bidders.	Nature of work.	Price per cubic yard.	Remarks.
1	Augustus R. Wright, Geneva, N. Y.	Dredging	$0 23	As measured in the scows.
2	William S. Fretch, jr., W. S. Fretch, and Thos. H. Crosby, Boston, Mass.	Dredging	25	
3	Curtis, Fobes & Co., Portland, Me.	Dredging	25	
4	Morris & Cumings Dredging Company, New York, N. Y.	Dredging	30	

Abstract of contracts made during the fiscal year ending June 30, 1875, for improvement of Plymouth Harbor, Massachusetts.

Date of contract.	Name and residence of contractor.	Nature of work.	Price per cubic yard.	Remarks.
1875. May 13	Augustus R Wright, Geneva, N. Y.	Dredging 35,000 cubic yards, more or less.	$0 23	As measured in the scows.

14. *Plymouth Harbor, Massachusetts.*—The several appropriations heretofore made for this harbor have been applied to the construction of bulkheads, jetties, and groins for the preservation and strengthening of Long Beach, upon which the harbor depends for its existence. During the past year these works have been repaired and strengthened where most necessary, being now in a very good and effective condition. Repairs will, however, be required hereafter upon these works from year to year as heretofore, for which Congress will continue to be called upon for suitable appropriations.

By act of March 3, 1875, the sum of $10,000 was appropriated for this harbor, to be applied in part to improving the harbor itself. The project adopted consists in opening by dredging a channel leading from the middle ground up to the wharves of Plymouth, to a depth of 6 feet at mean low-water, or 16 feet at mean high-water, and for a towing width of 100 feet. Under a contract made May 13, 1875, dredging operations were commenced in April and finished in June, 1876, resulting in 34,985 cubic yards in completion of the contract, by which the projected channel has been opened for a width of 50 feet and to the depth required. For completing this channel as now recommended by the engineer in charge, and for the annual repairs of the works built for the preservation and protection of Long Beach, an additional appropriation of $30,000 will be required.

Amount available July 1, 1875	$11,075 67
Amount expended during fiscal year ending June 30, 1876	10,748 25
Amount available July 1, 1876	327 42
Amount (estimated) required for completion of existing project	30,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1878	30,000 00

(See Appendix A 14.)

A 14.

IMPROVEMENT OF PLYMOUTH HARBOR, MASSACHUSETTS.

The existence of this harbor depends entirely upon the protection and preservation of Long Beach, which is a narrow strip of land that extends

2¾ miles out from the main land in a northwesterly direction, nearly parallel to the shore of the town of Plymouth, and distant from it about 1 mile. It affords to the harbor its only shelter from easterly storms. In late years it has been washed away in some places, and much weakened in others, to an extent seriously threatening the ruin of the harbor. For the protection and preservation of this beach, various works have been built from time to time, until finally they have proved efficient and successful.

The total amount that has been appropriated by Congress for the preservation and improvement of this harbor, from 1824 up to and including 1875, as shown by statement furnished under date of February 1, 1876, by the Chief of Engineers, for the information of the Committee on Commerce of the House of Representatives, is $97,766.

Of this amount there has been allotted to and appropriated for this harbor, since the resumption of works on rivers and harbors, in 1866, the sums as follows, viz:

Amount allotted in 1866 from appropriation made for harbors on the Atlantic coast	$8,300 00
Amount allotted under act of July 25, 1868	7,500 00
By act approved July 11, 1870, appropriated	10,000 00
By act approved March 3, 1871, appropriated	10,000 00
By act approved June 10, 1872, appropriated	2,500 00
By act approved March 3, 1873, appropriated	3,000 00
By act approved June 23, 1874, appropriated	5,000 00
By act approved March 3, 1875, appropriated	10,000 00
Total	56,300 00

In 1866, under the allotment of $8,300 for Plymouth Harbor, a wooden breakwater was built, by contract, in that year, for the protection of Long Beach, under the charge of Maj. Jared A. Smith, Corps of Engineers. In the annual report for the fiscal year ending June 30, 1867, it is stated that—

One thousand three hundred linear feet of that breakwater had been built. It consists of triangular frames placed at intervals of 4 feet, covered with 2-inch plank, set in a trench 12 feet wide and 3 feet deep, the trench and frame being filled to the level of the ground. It is situated on the crest of a ridge of sand, of about 3 miles in extent, and of an average width of 800 feet. At intervals along this ridge there are depressions, through which the sea breaks with great violence. It is in these intervals that the breakwater is placed.

In 1867 other work was added by the State of Massachusetts, at an expense of about $2,000.

These works were then deemed sufficient to resist any action of the sea; but a storm in the autumn of 1867 carried away some of the more exposed portions, and a second occurring the subsequent winter, when tides were highest, carried away about 1,000 linear feet of the strongest portion of the work, besides doing other damage, leaving the northern portion of the beach, adjacent to the main entrance of the harbor, entirely unprotected from the open sea, save by some remaining portions of a work completed in 1832, and the beach itself so much reduced as to be entirely submerged, at extreme high tides, for a length of 1,500 feet. The sand was such that, while a slight action of the sea would raise the beach, the prevailing winds and heavier seas would drive the sand into the channel, and it was evident that a severe storm would not only seriously injure the beach thus unprotected, but also the main channel, and leave it entirely exposed to further encroachments.

Under an additional allotment of $7,500 made in August, 1868, out of the appropriation of July 25, 1868, 200 linear feet of substantial cribwork of timber covered with plank, and 175 linear feet of triangular work (similar to that built in 1866) were built by contract in the autumn of 1868, for the further protection of Long Beach where injured by the storms of the previous autumn, Major Smith having been in charge of the work.

Under the appropriation of $10,000 made by act of July 11, 1870, a contract was made by the late Lieut. Col. J. G. Foster, Corps of Engineers, then in charge of the work, for the construction near the outer end of Long Beach of about 1,700 linear feet of bulk-head and jetties, built of frame-work and filled with brush and ballasted with stone. This work was commenced in September, 1870, and completed before the close of that season.

In May, 1871, the charge of Plymouth Harbor improvement was transferred to Lieut. Col. George Thom, Corps of Engineers, by whom contracts were made under the appropriation of March 3, 1871, for completing the projected bulk-head and jetties on the extremity of Long Beach, at $3.86 per linear foot, and for furnishing and placing granite grout upon the stone bulk-head to connect the outer end of the beach with the beacon, at $2.25 per ton. Work was commenced under both contracts in June, 1871; that on the brush bulk-head and jetties was finished in August, 1871, 641½ linear feet having been built under the contract; and the contract for the stone was completed in September, 1871, 2,028 tons having been furnished. The balance of the appropriation of 1871 was applied to the repairs of the bulk-head and jetties previously built upon Long Beach, in places where they had been damaged by storms, and to the planting of beach grass on the beach where most necessary for its preservation.

Under the appropriation of June 10, 1872, ($2,500,) the following repairs were made in July and August of that year, viz:

1. In making about 200 linear feet of brush bulk-head and jetties, to replace that damaged by the storm in November, 1871;
2. In strengthening the outer part of the bulk-head with 613 tons of stone, purchased for that purpose;
3. In making 300 linear feet of single brush jetties, and 250 linear feet of small stone jetties; and,
4. In planting 10,800 hills of beach-grass.

This work was done by hired labor and with materials purchased in open market, as authorized so to do.

The appropriation of $3,000 made by act of March 3, 1873, was applied to continued repairs upon all the works previously built, to the building of stone and brush groins outside and inside the bulk-head at the outer end of Long Beach, and to planting over 10,000 hills of beach-grass on the newly-formed beach, and in other places where most necessary.

The appropriation of $5,000 made by act of June 3, 1874, was applied to the completion of all the stone and brush groins on the outer end of Long Beach; to increasing in height and strength the stone bulk-head connecting the beacon with the outer end of the beach; to building a small bulk-head of frame-work, brush, and stone, 290 feet in length, for protecting the beach about one mile from its inner end; to planting beach-grass, and making repairs where most necessary for the protection and preservation of Long Beach. This work was done by hired labor and with materials purchased in open market, and was completed in August, 1875.

From the foregoing it is seen that the several amounts that have been allotted to and appropriated for the improvement of Plymouth Harbor since 1866 have been applied to the construction of bulk-heads, jetties, and groins, and the planting of beach-grass where most necessary for protecting and strengthening Long Beach throughout its whole extent of about 2¾ miles.

These bulk-heads consist of triangular frames, (built in 1866 and 1868,)

or of crib-work of timber covered with plank, (built in 1868,) and those built in 1870 and 1871 of a frame-work well secured in the ground, filled with brush, and ballasted with stone; that connecting the outer end of the beach with the beacon being built entirely of rubble-stone.

The jetties consist of a frame-work filled with brush and ballasted with stone, and the groins of small stones intermixed with brush, and sometimes of brush alone. These groins, 33 in number, are built out perpendicularly from the main bulk-head, on the seaward side, varying in length from 75 to 265 feet, and aggregating 5,250 feet in length, and from 50 to 150 feet apart. Others have been built inside the bulk-head, in places where most necessary. They were made by placing brush upon the surface of the beach and piling upon it beach-bowlders to a height of about 2 feet and for a width of 5 feet. The brush groins were made by digging a trench 2 feet by 2 feet, and placing brush in it upright and as close as practicable, the brush being held by sand being thrown into the trench and well rammed down, and sometimes further protected by small bowlders placed in a row along the sides of the groin. The brush rises about 2 or 3 feet above the surface of the beach.

The bulk-heads and jetties had already accumulated a large quantity of sand, forming a ridge throughout its whole extent; but with a view to increasing its strength and efficiency, the several groins have been built, and have fully answered the purpose for which they were intended. Beach-grass has been planted, and covers nearly all this newly-formed beach, which is now in an efficient condition. Repairs will, however, continue to be necessary from time to time, as they now are, along this beach, exposed as it is to injury by violent storms. Something more should also be done for increasing the efficiency of the stone bulk-head at the outer end, and its connection with the beach, the estimated cost of which is as follows, viz:

1. 1,000 tons rubble-stone, at $2	$2,000 00
2. Repairs of bulk-head near inner end of beach, (partially burnt of late)	250 00
3. Repairs of bulk-head and jetties	750 00
Adding for contingencies, say	500 00
Total	3 500 00

A survey was made of this harbor in February, 1874, by Mr. Sophus Haagensen, assistant engineer, in compliance with a resolution of the House of Representatives dated December 10, 1873, "with a view to dredging and improving the same, so as to afford greater protection and facilities to commerce."

To make this portion of the harbor practicable for "beating up" with sailing-vessels would require a width of not less than 500 feet, which would necessitate the excavation of about 80,000 cubic yards of hard sand on the "Middle Ground" and "Splitting Knife" Bars, which obstruct the present channel, and about 320,000 cubic yards of mud and clay between the "Middle Ground" and "Long Wharf," at a probable cost of not less than $176,000, and with a likelihood that the improvement would be but temporary, as the same causes which have already produced the existing shoals would, it is more than probable, reproduce them. Should it be decided to improve this harbor by dredging, it is recommended that it should be applied to the opening of a channel 100 feet in width and 6 feet in depth at mean low-water, from the end of Long Wharf outward in continuation of the present main channel above the Middle Ground. A channel of this width would enable vessels to be towed up to the vicinity of the wharves of the town, and would probably be kept open by the scour of the ebb-tide deflected into it from "Town Brook."

The estimated cost of this channel was as follows, viz:

64,000 cubic yards dredging, at 40 cents per cubic yard	$25,600 00
Add for contingencies, say	2,400 00
Total	28,000 00

Under the appropriation of $10,000, made by act of March 3, 1875, for improving this channel as above projected, a contract was made May 13, 1875, with Mr. Augustus R. Wright, of Geneva, N. Y., the lowest bidder, at 23 cents per cubic yard, as measured in the scows, for 35,000 cubic yards, more or less, of dredging, to be applied to the partial excavation of the projected channel. Dredging was commenced under this contract on the 19th of April, 1876, and was completed on the 21st of June, 1876, resulting in 34,985 cubic yards of dredging, whereby a channel was opened up to wharves of Plymouth for a width of 50 feet and to a depth of 6 feet at mean low-water.

After further considering the wants of commerce and the facilities required, it is recommended that a basin be excavated at the upper end of the channel in front of the wharves, where vessels may lie secure and be able to pass each other at any stage of the tide. Here it now averages 1 foot bare at mean low-water, and it is recommended that the basin be excavated to a depth of 8 feet at mean low-water for an area of 12,500 square yards, which would require about 45,000 cubic yards of dredging in addition to that called for in the estimate submitted in February, 1874. With this modification in the project, the following estimate is submitted for completing the improvement of this harbor, viz:

1. 30,000 cubic yards dredging for completing channel, as per original estimate, at 30 cents per cubic yard	$9,000 00
2. 45,000 cubic yards additional, for basin, at 30 cents per cubic yard	13,500 00
Adding for contingencies, say	4,327 42
Total	26,827 42
Adding to this the above estimate for continuing the works for the protection and preservation of Long Beach	3,500 00
Total	30,327 42
Amount available July 1, 1876	327 42
Additional amount required for the fiscal year ending June 30, 1878	30,000 00

Money statement.

Amount available July 1, 1875	$11,075 67
Amount expended during fiscal year ending June 30, 1876	10,748 25
Amount available July 1, 1876	327 42
Amount (estimated) required for completion of existing project	30,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1878	30,000 00

13. *Plymouth Harbor, Massachusetts.*—The several appropriations heretofore made for this harbor have been applied to the construction of bulkheads, jetties, and groins for the preservation and strengthening of Long Beach, upon which the harbor depends for its existence. During the past year these works have been repaired and strengthened where most necessary, being now in a very good and effective condition. Repairs will, however, be required hereafter upon these works from year to year as heretofore, for which Congress will continue to be called upon for suitable appropriations.

By act of March 3, 1875, the sum of $10,000 was appropriated for this harbor, and has been applied in part to improving the harbor itself. The project adopted consists in opening, by dredging, a channel leading from the Middle Ground up to the wharves of Plymouth, to a depth of 6 feet at mean low-water, or 16 feet at mean high-water, and for a towing width of 100 feet.

Under a contract made May 13, 1875, dredging operations were commenced in April and finished in June, 1876, resulting in 34,985 cubic yards in completion of the contract, by which the projected channel was opened for a width of 50 feet and to the depth required. For completing this channel as now recommended by the engineer officer in charge, and for the annual repairs of the works built for the preservation and protection of Long Beach, an additional appropriation of $30,000 will be required.

July 1, 1876, amount available	$327 42
July 1, 1877, amount expended during fiscal year	233 50
July 1, 1877, amount available	93 92
Amount (estimated) required for completion of existing project	30,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1879	30,000 00

(See Appendix A 13.)

A 13.

IMPROVEMENT OF PLYMOUTH HARBOR, MASSACHUSETTS.

The existence of this harbor depends entirely upon the protection and preservation of Long Beach, which is a narrow strip of land that extends 2¾ miles out from the main land in a northwesterly direction, nearly parallel to the shore of the town of Plymouth, and distant from it about 1 mile. It affords to the harbor its only shelter from easterly storms. In late years it has been washed away in some places, and much weakened in others, to an extent seriously threatening the ruin of the harbor. For the protection and preservation of this beach, various works have been built from time to time, until finally they have proved efficient and successful.

The total amount that has been appropriated by Congress for the preservation and improvement of this harbor, from 1824 up to and including 1875, as shown by statement furnished under date of February

1, 1876, by the Chief of Engineers for the information of the Committee on Commerce of the House of Representatives, is $97,766.

Of this amount there has been allotted to and appropriated for this harbor, since the resumption of works on rivers and harbors in 1866, the sums as follows, viz:

Amount allotted in 1866 from appropriations made for harbors on the Atlantic coast	$8,300 00
Amount allotted under act of July 25, 1868	7,500 00
Appropriated by act approved July 11, 1870	10,000 00
Appropriated by act approved March 3, 1871	10,000 00
Appropriated by act approved June 10, 1872	2,500 00
Appropriated by act approved March 3, 1873	3,000 00
Appropriated by act approved June 23, 1874	5,000 00
Appropriated by act approved March 3, 1875	10,000 00
Total	56,300 00

In 1866, under the allotment of $8,300 for Plymouth Harbor, a wooden breakwater was built by contract for the protection of Long Beach, under charge of Maj. Jared A. Smith, Corps of Engineers. In the annual report for the fiscal year ending June 30, 1867, it is stated that—

One thousand three hundred linear feet of that breakwater had been built. It consists of triangular frames placed at intervals of 4 feet, covered with 2-inch plank, set in a trench 12 feet wide and 3 feet deep, the trench and frame being filled to the level of the ground. It is situated on the crest of a ridge of sand, of about 3 miles in extent, and of an average width of 800 feet. At intervals along this ridge there are depressions, through which the sea breaks with great violence. It is in these intervals that the breakwater is placed.

In 1867 other work was added by the State of Massachusetts, at an expense of about $2,000.

These works were then deemed sufficient to resist any action of the sea, but a storm in the autumn of 1867 carried away some of the more exposed portions, and a second, occurring the subsequent winter, when tides were highest, carried away about 1,000 linear feet of the strongest portion of the work, besides doing other damage, leaving the northern portion of the beach, adjacent to the main entrance of the harbor, entirely unprotected from the open sea, save by some remaining portions of a work completed in 1832, and the beach itself so much reduced as to be entirely submerged, at extreme high tides, for a length of 1,500 feet. The sand was such that while a slight action of the sea would raise the beach, the prevailing winds and heavier seas would drive the sand into the channel, and it was evident that a severe storm would not only seriously injure the beach thus unprotected, but also the main channel, and leave it entirely exposed to further encroachments.

Under an additional allotment of $7,500, made in August, 1868, out of the appropriation of July 25, 1868, 200 linear feet of substantial cribwork of timber, covered with plank, and 175 linear feet of triangular work (similar to that built in 1866) were built by contract in the autumn of 1868, for the further protection of Long Beach, where injured by storms of the previous autumn, Major Smith having been in charge of the work.

Under the appropriation of $10,000, made by act of July 11, 1870, a contract was made by the late Lieut. Col. J. G. Foster, Corps of Engineers, then in charge of the work for the construction near the outer end of Long Beach of about 1,700 linear feet of bulkhead and jetties, built of frame-work and filled with brush and ballasted with stone. This work was commenced September, 1870, and completed before the close of that season.

In May, 1871, the charge of Plymouth Harbor improvement was transferred to Lieut. Col. George Thom, Corps of Engineers, by whom contracts were made under the appropriation of March 3, 1871, for completing the projected bulkhead and jetties on the extremity of Long

Beach, at $3.86 per linear foot, and for furnishing and placing granite grout upon the stone bulkhead, to connect the outer end of the beach with the beacon, at $2.25 per ton. Work was commenced under both contracts in June, 1871; that on the brush bulkhead and jetties was finished in August, 1871, 641½ linear feet having been built under the contract, and the contract for the stone was completed in September, 1871, 2,028 tons having been furnished. The balance of the appropriation of 1871 was applied to the repairs of the bulkhead and jetties previously built upon Long Beach, in places where they had been damaged by storms, and to the planting of beach-grass on the beach, where most necessary for its preservation.

Under the appropriation of June 10, 1872, ($2,500,) the following repairs were made in July and August of that year, viz:

1. In making about 200 linear feet of brush bulkhead and jetties, to replace that damaged by the storm in November, 1871;
2. In strengthening the outer part of the bulkhead with 613 tons of stone, purchased for that purpose;
3. In making 300 linear feet of single brush jetties, and 250 linear feet of small stone jetties; and
4. In planting 10,800 hills of beach-grass.

This work was done by hired labor, and with materials purchased in open market, as authorized so to do.

The appropriation of $3,000, made by act of March 3, 1873, was applied to continued repairs upon all the works previously built; to the building of stone and brush groins outside and inside the bulkhead at the outer end of Long Beach, and to planting over 10,000 hills of beach-grass on the newly-formed beach and in other places where most necessary.

The appropriation of $5,000, made by act of June 23, 1874, was applied to the completion of all the stone and brush groins on the outer end of Long Beach; to increasing in height and strength the stone bulkhead connecting the beacon with the outer end of the beach; to building a small bulkhead of frame-work, brush, and stone, 290 feet in length, for protecting the beach about 1 mile from its inner end; to planting beach-grass and making repairs where most necessary for the protection and preservation of Long Beach. This work was done by hired labor and with materials purchased in open market, and was completed in August, 1875.

From the foregoing it is seen that the several amounts that have been allotted to and appropriated for the improvement of Plymouth Harbor since 1866 have been applied to the construction of bulkheads, jetties, and groins, and the planting of beach-grass where most necessary for protecting and strengthening Long Beach throughout its whole extent of about 2¾ miles.

These bulkheads consist of triangular frames, (built in 1866 and 1868,) or of crib-work of timber covered with plank, (built in 1868,) and those built in 1870 and 1871 of a frame-work well secured in the ground, filled with brush and ballasted with stone, that connecting the outer end of the beach with the beacon being built entirely of rubble-stone.

The jetties consist of a frame-work filled with brush and ballasted with stone, and the groins of small stones intermixed with brush, and sometimes of brush alone. These groins, 33 in number, are built out perpendicularly from the main bulkhead on the seaward side, varying in length from 75 to 265 feet, and aggregating 5,250 feet in length, and from 50 to 150 feet apart. Others have been built inside the bulkhead in places where most necessary. They were made by placing brush

upon the surface of the beach and piling upon it beach-bowlders to a height of about 2 feet and for a width of 5 feet. The brush-groins were made by digging a trench 2 feet by 2 feet, and placing brush in it upright and as close as practicable, the brush being held by sand being thrown into the trench and well rammed down, and sometimes further protected by small bowlders placed in a row along the sides of the groin. The brush rises about 2 or 3 feet above the surface of the beach.

The bulkheads and jetties had already accumulated a large quantity of sand, forming a ridge throughout its whole extent, but with a view to increasing its strength and efficiency, the several groins have been built, and have fully answered the purpose for which they were intended. Beach-grass has been planted, and covers nearly all this newly-formed beach, which is now in an efficient condition. Repairs will, however, continue to be necessary from time to time, as they now are, along this beach, exposed as it is to injury by violent storms. Something more should also be done for increasing the efficiency of the stone bulkhead at the outer end, and its connection with the beach, the estimated cost of which is as follows, viz:

1. 1,000 tons rubble-stone, at $2	$2,000 00
2. Repairs of bulkhead near inner end of beach, (partially burned of late)	250 00
3. Repairs of bulkhead and jetties	750 00
Adding for contingencies, say	500 00
Total	3,500 00

A survey was made of this harbor in February, 1874, under my direction, in compliance with a resolution of the House of Representatives dated December 10, 1873, "with a view to dredging and improving the same, so as to afford greater protection and facilities to commerce."

To make this portion of the harbor practicable for "beating up" with sailing-vessels would require a width of not less than 500 feet, which would necessitate the excavation of about 80,000 cubic yards of hard sand on the Middle Ground and Spilting Knife Bars, which obstruct the present channel, and about 320,000 cubic yards of mud and clay between the Middle Ground and Long Wharf, at a probable cost of not less than $176,000, and with a likelihood that the improvement would be but temporary, as the same causes which have already produced the existing shoals would, it is more than probable, reproduce them. Should it be decided to improve this harbor by dredging, it is recommended that it should be applied to the opening of a channel 100 feet in width and 6 feet in depth at mean low-water, from the end of Long Wharf outward in continuation of the present main channel above the Middle Ground. A channel of this width would enable vessels to be towed up to the vicinity of the wharves of the town, and would probably be kept open by the scour of the ebb-tide deflected into it from Town Brook.

The estimated cost of this channel was as follows, viz:

Sixty-four thousand cubic yards, at 40 cents per cubic yard	$25,600 00
Add for contingencies, say	2,400 00
Total	28,000 00

Under the appropriation of $10,000, made by act of March 3, 1875, for improving this channel as above projected, a contract was made May 13, 1875, with Mr. Augustus R. Wright, of Geneva, N. Y., the lowest bidder, at 23 cents per cubic yard, as measured in the scows, for 35,000 cubic yards, more or less, of dredging, to be applied to the partial excavation of the projected channel. Dredging was commenced under this contract

on the 19th of April, 1876, and was completed on the 21st of June, 1876, resulting in 34,985 cubic yards of dredging, whereby a channel was opened up to the wharves of Plymouth for a width of 50 feet, and to a depth of 6 feet at mean low-water.

After further considering the wants of commerce and the facilities required, it is recommended that a basin be excavated at the upper end of the channel in front of the wharves where vessels may lie secure and be able to pass each other at any stage of the tide. Here it now averages 1 foot bare at mean low-water, and it is recommended that the basin be excavated to a depth of 8 feet at mean low-water, for an area of 12,500 square yards, which would require about 45,000 cubic yards of dredging in addition to that called for in the estimate submitted in February, 1874. With this modification in the project, the following estimate is submitted for completing the improvement of this harbor, viz:

1. 30,000 cubic yards of dredging for completing channel as per original estimate, at 30 cents per cubic yard	$9,000 00
2. 45,000 cubic yards additional for basin, at 30 cents per cubic yard	13,500 00
3. For continuing the works for the protection and preservation of Long Beach	3,500 00
Adding for contingencies, say	4,000 00
Total	30,000 00

The amount of revenue, commerce, and navigation for this port is shown in the accompanying letter of the United States collector of customs.

Money statement.

July 1, 1876, amount available	$327 42
July 1, 1877, amount expended during fiscal year	233 50
July 1, 1877, amount available	93 92
Amount (estimated) required for completion of existing project	30,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1879	30,000 00

COMMERCIAL STATISTICS.

CUSTOM-HOUSE, PLYMOUTH, MASS.,
Collector's Office, July 10, 1877.

SIR: I have the honor to acknowledge the receipt of your letter of the 11th ultimo, and in answer beg leave to inform you that during the year ending December 31, 1876, the amount of revenue collected at the port of Plymouth was $16,478.83.

Amount of domestic merchandise exported to foreign ports	$14,750 00
And during the same period the entrances and clearances, foreign, were	6 vessels.

The number of arrivals, coastwise, at this port consisted of—

47 cargoes of coal, amounting to	10,152 tons.
23 cargoes of iron, amounting to	2,103 tons.
1 cargo of sand, amounting to	175 tons.
16 cargoes of lumber, amounting to	2,225,000 feet.
13 cargoes of salt, amounting to	560,900 pounds
22 vessels from the Grand Bank fisheries with 14,342 quintals codfish, value	$71,710 00
22 vessels from the Grand Bank fisheries with 4,441 gallons fish-oil, value	2,665 00
7 vessels from the Bay fisheries with 4,980 barrels mackerel, value	39,470 00
4 vessels from the lobster-fisheries with 129,000 lobsters, value	7,740 00
Total value of fisheries	121,585 00

Besides the above, there were sundry cargoes of nails, hollow ware, hoops, staves, barrels, hay, and other commodities to and from Plymouth, coastwise, in our regular packets, not enumerated therein.

I am, with respect, your obedient servant,

THOMAS LORING,
Collector.

Bvt. Brig. Gen. GEORGE THOM,
Lieut. Col. of Engineers, U. S. A.

12. *Improvement of Plymouth Harbor, Massachusetts.*—The several appropriations heretofore made for this harbor have been applied to the construction of bulkheads, jetties, and groins for the preservation and strengthening of Long Beach, upon which the harbor depends for its existence; also to the partial opening of a channel leading from the Middle Ground up to the wharves of Plymouth. This channel is projected to have a width of 100 to 125 feet for a depth of 6 to 8 feet at mean low-water, or 16 to 18 feet at mean high-water. In 1870 it was opened to a width of about 50 feet up to Long Wharf, and to a depth of 6 feet at mean low-water. For completing this channel as now estimated by the engineer officer in charge, and for the annual repairs of the works built for the preservation and protection of Long Beach, an additional appropriation of $25,000 will be required.

July 1, 1877, amount available	$93 92	
Amount appropriated by act approved June 18, 1878	5, 000 00	
		$5, 093 92
July 1, 1878, amount expended during fiscal year		5 85
July 1, 1878, amount available		5, 088 07
Amount (estimated) required for completion of existing project		25, 000 00
Amount that can be profitably expended in fiscal year ending June 30, 1880		25, 000 00

(See Appendix A 12.)

A 12.

IMPROVEMENT OF PLYMOUTH HARBOR, MASSACHUSETTS.

The existence of this harbor depends entirely upon the protection and preservation of Long Beach, which is a narrow strip of land that extends 2¾ miles out from the mainland in a northwesterly direction, nearly parallel to the shore of the town of Plymouth, and distant from it about one mile. It affords to the harbor its only shelter from easterly storms. In late years it has been washed away in some places, and much weakened in others, to an extent seriously threatening the ruin of the harbor. For the protection and preservation of this beach various works have been built from time to time, until finally they have proved efficient and successful.

The total amount that has been appropriated by Congress for the preservation and improvement of this harbor, from 1824 up to and including June 18, 1878, is $118,567.

Of this amount there has been allotted to and appropriated for this

harbor, since the resumption of work on rivers and harbors in 1866, the sums as follows, viz:

Amount allotted in 1866, from appropriations made July 2, 1864, for harbors on the Atlantic coast	$8,300 00
Amount allotted under act of July 25, 1868	7,500 00
Appropriated by act approved July 11, 1870	10,000 00
Appropriated by act approved March 3, 1871	10,000 00
Appropriated by act approved June 10, 1872	2,500 00
Appropriated by act approved March 3, 1873	3,000 00
Appropriated by act approved June 23, 1874	5,000 00
Appropriated by act approved March 3, 1875	10,000 00
Appropriated by act approved June 18, 1878	5,000 00
Total	61,300 00

A history and description of the several works built for the protection and preservation of Long Beach will be found in the annual report for the fiscal year ending June 30, 1877, from which it is seen that the several amounts that have been allotted to and appropriated for the improvement of Plymouth Harbor since 1866 have been applied to the construction of bulkheads, jetties, and groins, and the planting of beach-grass where most necessary for protecting and strengthening Long Beach throughout its whole extent of about 2¾ miles.

The bulkheads and jetties have accumulated a large quantity of sand, forming a ridge throughout its whole extent, and the beach-grass covers nearly all this newly formed beach, which is now in efficient condition. Repairs, however, are now necessary, as they doubtless will continue to be from time to time along this beach, exposed, as it is, to injury by violent storms. Something more should also be done for increasing the efficiency of the stone bulkhead at the outer end, and its connection with the beach.

The estimated cost of this work is as follows, viz:

1. 1,000 tons rubble-stone, at $2	$2,000 00
2. Repairs of bulkhead near inner end of beach (partially burned of late)	250 00
3. Repairs of bulkhead and jetties	750 00
Adding for contingencies, say	500 00
Total	3,500 00

A survey was made of this harbor in February, 1874, in compliance with a resolution of the House of Representatives dated December 10, 1873, "with a view to dredging and improving the same so as to afford greater protection and facilities to commerce."

The plan that has been projected for the improvement of this harbor is to open a channel by dredging through the sand, mud, and clay, from the Middle Ground up to Long Wharf, a distance of about 2,500 feet, the channel to have a width of 100 feet, and a depth of 6 feet at mean low-water, or 16 feet at mean high-water; this channel to be extended southward, in front of the wharves above Long Wharf, for a distance of about 900 feet to the mouth of Town Brook, so as to form a basin 125 feet in width and 8 feet in depth at mean low-water. The total quantity of dredging required for this improvement was estimated at about 110,000 cubic yards.

Under the appropriation of $10,000, made by act of March 3, 1875, for improving this channel as above projected, a contract was made May 13, 1875, with Mr. Augustus R. Wright, of Geneva, N. Y., the lowest bidder, at 23 cents per cubic yard, as measured in the scows, for 35,000 cubic yards, more or less, of dredging, to be applied to the partial excavation of the projected channel. Dredging was commenced under this contract on the 19th of April, 1876, and was completed on the 21st of June, 1876,

resulting in 34,985 cubic yards of dredging, whereby a channel was opened up to the wharves of Plymouth for a width of 50 feet, and to a depth of 6 feet at mean low-water.

To complete this channel and basin will therefore require about—

Seventy-five thousand cubic yards more of dredging, the estimated cost of which, at 30 cents per cubic yard, is		$22,500 00
Adding for contingencies, say		3,000 00
Total		25,500 00
The estimated cost of works and repairs now necessary for the protection and preservation of Long Beach, as above, is, including contingencies	$3,500 00	
For probable repairs to be provided for for the fiscal year ending June 30, 1880	1,000 00	4,500 00
		30,000 00
Amount appropriated by act of June 18, 1878		5,000 00
Additional amount required for completing the improvement as projected is		25,000 00

Application has been made to the collector of customs at Plymouth for information as to the revenue and commerce of that port, but no reply has been received.

Money statement.

July 1, 1877, amount available	$93 92	
Amount appropriated by act approved June 18, 1878	5,000 00	
		5,093 92
July 1, 1878, amount expended during fiscal year		5 85
July 1, 1878, amount available		5,088 07
Amount (estimated) required for completion of existing project		25,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1880		25,000 00

13. *Improvement of Plymouth Harbor, Massachusetts.*—The several appropriations heretofore made for this harbor have been applied to the construction of bulkheads, jetties, and groins for the preservation and strengthening of Long Beach, upon which the harbor depends for its existence; also to the partial opening of a channel leading from the Middle Ground up to the wharves of Plymouth. This channel is projected to have a width of 100 to 125 feet for a depth of 6 to 8 feet at mean low-water, or 16 to 18 feet at mean high-water. In 1875 it was opened to a width of about 50 feet up to Long Wharf, and to a depth of 6 feet at mean low-water.

Under the appropriation of $5,000, made by the act of June 18, 1878, the work for the extension of the stone bulkhead, and for the repairs of the other works on Long Beach, where necessary, was carried on from the 20th of August to the end of November last, when it was suspended for the winter, the work having been done by hired labor and with materials purchased in open market.

The work projected for the improvement and preservation of Long Beach has been completed with the exception of the stone bulkhead at its outer end, which will probably be completed before the close of the present season.

By the act of March 3, 1879, the sum of $3,500 was appropriated for the further improvement of this harbor, leaving still required for its completion the additional sum of $21,500.

July 1, 1878, amount available	$5,088 07	
Amount appropriated by act approved March 3, 1879	3,500 00	
		$8,588 07
July 1, 1879, amount expended during fiscal year		2,992 60
July 1, 1879, amount available		5,595 47
Amount (estimated) required for the completion of existing project		21,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1881		21,500 00

(See Appendix A 13.)

A 13.

IMPROVEMENT OF PLYMOUTH HARBOR, MASSACHUSETTS.

The existence of this harbor depends entirely upon the protection and preservation of Long Beach, which is a narrow strip of land that extends 2¾ miles out from the main land, in a northwesterly direction, nearly parallel to the shore of the town of Plymouth, and distant from it about 1 mile. It affords to the harbor its only shelter from easterly storms. In late years it has been washed away in some places and much weakened in others, to an extent seriously threatening the ruin of the harbor. For the protection and preservation of this beach various works have been built, from time to time, until finally they have proved efficient and successful.

These works consist of bulkheads, jetties, and groins built for the accumulation of sand, and the planting of beach-grass, also to accumulate sand and give permanency to the beach thus formed, whereby a ridge has been formed throughout the whole extent of the beach, which is for the most part covered with beach-grass, and is now in an efficient condition.

The total amount that has been appropriated by Congress for the preservation and improvement of this harbor, from 1824 up to and including March 3, 1879, is $122,067.

Of this amount there has been allotted to and appropriated for this

harbor, since the resumption of work on rivers and harbors in 1866, the sum of $64,800, as follows, viz:

Amount allotted in 1866 from appropriations made July 2, 1864, for harbors on the Atlantic coast	$8,300
Amount allotted under act of July 25, 1868	7,500
Appropriated by act approved July 11, 1870	10,000
Appropriated by act approved March 3, 1871	10,000
Appropriated by act approved June 10, 1872	2,500
Appropriated by act approved March 3, 1873	3,000
Appropriated by act approved June 23, 1874	5,000
Appropriated by act approved March 3, 1875	10,000
Appropriated by act approved June 18, 1878	5,000
Appropriated by act approved March 3, 1879	3,500
Total	64,800

A history and description of the several works built for the protection and preservation of Long Beach will be found in the annual report for the fiscal year ending June 30, 1877.

For the permanent preservation of the extreme outer end of the beach, near the beacon, a rubble-stone bulkhead has been built. But, owing to its exposed position, the beach has not grown to the extent desired; so that it has been found necessary to extend this bulkhead further round the end of the beach.

Under the appropriation of $5,000 made for this harbor by the river and harbor act of June 18, 1878, the work for the extension of the stone bulkhead, and the repairs of the other works where necessary, was carried on from the 20th of August to the end of November last, the work having been done by hired labor, with stone and other materials purchased in open market. During that period 1,435 tons of large and small stone were purchased and placed in the works (viz: the stone and wooden bulkheads and jetties); also about 35 tons of brush in the repairs of the wooden bulkhead and jetties. Work was resumed about the middle of June, 1879, since which time 213 tons of granite grout has been purchased and placed upon the stone bulkhead, in extension of the same, making a total of 1,648 tons of stone during the year.

The works projected for the improvement and preservation of Long Beach are now all completed with the exception of the extension of the stone bulkhead on its outer end, which will probably be completed about the 1st of September next.

In a recent inspection of these works, they were all found in good condition. But, exposed as they are to violent easterly storms, they necessarily will require occasional repairs. The unexpended balance of the appropriation of June 18, 1878, will probably be sufficient for the completion of the stone bulkhead and all the repairs that may be necessary during the year ending June 30, 1880.

Under an appropriation of $10,000 by the river and harbor act of March 3, 1875, for the improvement of this harbor, a channel was opened by dredging from the Middle Ground up to Long Wharf, a distance of about 2,500 feet, to a depth of 6 feet at mean low-water (or 16 feet at mean high-water), and for a width of 50 feet. The project originally provided for a channel 100 feet in width, to be extended southward to the mouth of Town Brook, a distance of about 900 feet above Long Wharf, so as to form a basin in front of the wharves of the city 125 feet in width, with a depth of 8 feet at mean low-water. For the completion of this project the additional sum of $25,000 was asked in my last annual report to the Chief of Engineers, since published by Congress, of which amount $3,500 was appropriated by the river and harbor act of March 3, 1879, leaving still required for completion $21,500.

The following information as to the revenue and commerce of the port of Plymouth, Mass., for the year ending December 31, 1878, has been furnished by the collector of customs at that port, viz:

Amount of revenue collected	$29,572,04
Value of exports	$3,540 00
Vessels cleared for foreign ports	2
Tonnage	134.78
Vessels cleared for the cod-fishery	25
Tonnage	1,355.69
Product	$62,000 00
Arrivals, coastwise	111
Clearances, coastwise	25

Money statement.

July 1, 1878, amount available	$5,088 07	
Amount appropriated by act approved March 3, 1879	3,500 00	
		$8,588 07
July 1, 1879, amount expended during fiscal year		2,992 60
July 1, 1879, amount available		5,595 47
Amount (estimated) required for completion of existing project		21,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1881		21,500 00

17. *Plymouth Harbor, Massachusetts.*—The present project for the improvement of this harbor was adopted in 1866 and modified in 1875, the object being—

1. The protection and preservation of Long Beach, upon the existence of which the harbor depends for its only shelter from easterly storms; and

2. Opening a channel of navigable width and of not less than 6 feet in depth at mean low-water (or 16 feet at mean high-water) from the Middle Ground up to Long Wharf, and thence to the mouth of Town Brook, with a depth of 8 feet at mean low-water. The natural channel was very narrow and crooked, with not more than ½ foot in depth at mean low-water in its shoalest part.

The total amount expended from 1866 to the 30th of June, 1880, on the project being executed is $61,271.15, and has resulted in the completion of the works projected for the protection and preservation of Long Beach and in a channel 50 feet in width from the middle up to Long Wharf.

The appropriation of $11,500 asked for, with that now available, is to be applied to the *completion* of the projected channel, and to such *repairs* as may be necessary on Long Beach.

July 1, 1879, amount available	$5,595 47	
Amount appropriated by act approved June 14, 1880	10,000 00	
		$15,595 47
July 1, 1880, amount expended during fiscal year		2,066 62
July 1, 1880, amount available		13,528 85
Amount (estimated) required for completion of existing project		11,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1882		11,500 00

(See Appendix A 17.)

A 17.

IMPROVEMENT OF PLYMOUTH HARBOR, MASSACHUSETTS.

The existence of this harbor depends entirely upon the protection and preservation of Long Beach, which is a narrow strip of land that extends 2¾ miles out from the mainland, in a northwesterly direction, nearly parallel to the shore of the town of Plymouth and distant from

it about 1 mile. It affords to the harbor its only shelter from easterly storms. In late years it has been washed away in some places and much weakened in others, to an extent seriously threatening the ruin of the harbor. For the protection and preservation of this beach various works have been built from time to time, until they have finally proved to be efficient and successful. These works consist of bulk-heads, jetties, and groins built for the accumulation of sand, and the planting of beach-grass also to accumulate sand and give permanency to the beach they formed; whereby a ridge has been formed throughout the whole extent of the beach, which is, for the most part, covered with beach grass, and is now in an efficient condition.

A history and description of the several works built on Long Beach will be found in the annual report for the fiscal year ending June 30, 1877.

The following sums have been appropriated by Congress and allotted for the preservation and improvement of this harbor, from 1864 up to and including June 14, 1880, viz:

Amount allotted in 1866 from appropriations made July 2, 1864, for harbors on the Atlantic coast	$8,300
Amount allotted under act of July 25, 1868	7,500
Amount appropriated by act approved July 11, 1870	10,000
Amount appropriated by act approved March 3, 1871	10,000
Amount appropriated by act approved June 10, 1872	2,500
Amount appropriated by act approved March 3, 1873	3,000
Amount appropriated by act approved June 23, 1874	5,000
Amount appropriated by act approved March 3, 1875	10,000
Amount appropriated by act approved June 18, 1878	5,000
Amount appropriated by act approved March 3, 1879	3,500
Amount appropriated by act approved June 14, 1880	10,000
Total	74,800

Owing to the exposed position of the rubble stone bulk-head built for the preservation of the beach, at its outer end near the beacon, the beach has not increased to the extent desired; so that it has been found necessary to extend this bulk-head farther around the end of the beach.

Under the appropriation of $5,000 made for this harbor by the act of June 18, 1878, the work for the extension of the stone bulk-head, and for the repairs of the other works where necessary (which was completed, in part, during the last fiscal year), was resumed in June, 1879, and continued up to November 3, 1879; during which period 1,693 tons of rubble stone was purchased in open market and placed in the work in completion of the same to the extent projected; whereby the bulk-head has been extended for a total length of about 700 feet along and outside of the crib-work bulk-heads, now much impaired by age and storms. During the past year all the other works on Long Beach have been repaired, where necessary; but, exposed as they are to injury from violent easterly storms, they will necessarily continue to require occasional repairs.

Under the appropriation of $10,000 made by the act of March 3, 1875, for the improvement of this harbor, a channel was opened by dredging from the "middle ground," up to Long Wharf, a distance of about 2,500 feet, for a width of 50 feet and to a depth of 6 feet at mean low-water, or 16 feet at mean high-water. The project for the improvement of this harbor provides for a channel 100 feet in width up to Long Wharf, to be extended southward to the mouth of Town Brook—a distance of about 900 feet above Long Wharf—so as to form a basin in front of the wharves of the city 125 feet in width, with a depth of 8 feet at mean low-water. The completion of this project it is estimated will cost

$25,000 as stated in the last annual report; of which amount there is now available the sum of $13,500, which it is proposed to apply to the completion in part of the projected channel and basin; but for its total completion an additional appropriation of $11,500 will be required.

Plymouth Harbor is in the collection district of Plymouth, of which Plymouth is the port of entry. The nearest light-houses are the Gurnet lights, about 5 miles distant from the town of Plymouth.

The following information in regard to the revenue and commerce of the port of Plymouth, for the year ending December 31, 1879, has been furnished by the United States collector of customs of that port:

Amount of revenue collected $18,342.58; imports, foreign, 1 cargo; exports, foreign, none; arrivals, coastwise, 132 cargoes; clearances, coastwise, 32 cargoes.

With the above, a regular steamer runs twice a week to and from Boston, averaging 100 tons freight per trip. About 15 sail of vessels (not included in the above) are engaged in mackerel, lobster, and other fisheries. The number of vessels arriving and sailing each day will average about 5 sail. Excursion steamers arriving and sailing during the summer season average from 1 to 2 per week carrying about 4,000 passengers.

Money statement.

July 1, 1879, amount available	$5,595 47	
Amount appropriated by act approved June 14, 1880	10,000 00	
		$15,595 47
July 1, 1880, amount expended during fiscal year		2,066 62
July 1, 1880, amount available		13,528 85
Amount (estimated) required for completion of existing project		11,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1882		11,500 00

20. *Plymouth Harbor, Massachusetts.*—The present project for the improvement of this harbor was adopted in 1866 and modified in 1875, the object being—

1. The protection and preservation of Long Beach, upon the existence of which the harbor depends for its only shelter from easterly storms; and,

2. Opening a channel 100 feet in width and of not less than 6 feet in depth at mean low-water (or 16 feet at mean high-water) from the Middle Ground up to Long Wharf, and thence to the mouth of Town Brook, 150 feet in width with a depth of 8 feet at mean low-water. The natural channel was very narrow and crooked with not more than ½ foot in depth at mean low-water in its shoalest part.

The total amount expended from 1866 to the 30th of June, 1880, on the project being executed was $61,271.15, and resulted in the completion of the works projected for the protection and preservation of Long Beach, and in a channel 50 feet in width from the Middle Ground up to Long Wharf.

The amount expended thereon during the fiscal year ending June 30, 1881, including outstanding liabilities, is $8,609.15, which has resulted in the completion of the main channel leading from the Middle Ground up to the wharves of Plymouth, to its full width of 100 feet, and in the commencement of the 8-foot channel in front of the wharves.

Under the appropriation of $10,000 made by the river and harbor act of March 3, 1881, a contract has been made for completing on the 31st of January, 1882, all the work projected for the improvement of this harbor.

The sum of $1,000 asked for for the fiscal year ending June 30, 1883, it is proposed to apply, if appropriated, to such repairs as may be required on the several works built for the protection and preservation of Long Beach.

July 1, 1880, amount available	$13,528 85	
Amount appropriated by act approved March 3, 1881	10,000 00	
		$23,528 85
July 1, 1881, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1880	7,114 83	
July 1, 1881, outstanding liabilities	1,494 32	
		8,609 15
July 1, 1881, amount available		14,919 70
Amount (estimated) required for completion of existing project		1,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1883		1,000 00

(See Appendix A 20.)

A 20.

IMPROVEMENT OF PLYMOUTH HARBOR, MASSACHUSETTS.

The existence of this harbor depends entirely upon the protection and preservation of Long Beach, which is a narrow strip of land that extends 2¾ miles out from the mainland, in a northwesterly direction, nearly parallel to the shore of the town of Plymouth, and distant from it about 1 mile. It affords to the harbor its only shelter from easterly storms.

In late years it has been washed away in some places, and much weakened in others, to an extent seriously threatening the ruin of the harbor.

For the protection and preservation of this beach various works have been built, from time to time, until they have finally proved to be efficient and successful.

These works consist of bulkheads, jetties, and groins built for the accumulation of sand, and the planting of beach grass, also to accumulate sand and give permanency to the beach thus formed; whereby a ridge has been formed throughout the whole extent of the beach, which is, for the most part, covered with beach grass, and is now in an efficient condition.

A history and description of the several works built on Long Beach will be found in the annual report for the fiscal year ending June 30, 1877.

The following sums have been appropriated by Congress, and allotted for the preservation and improvement of this harbor, from 1864 up to and including March 3, 1881, viz:

Amount allotted in 1866 from appropriations made July 2, 1864, for harbors on the Atlantic coast	$8,300
Amount allotted under act of July 25, 1868	7,500
By river and harbor act of July 11, 1870	10,000
By river and harbor act of March 3, 1871	10,000
By river and harbor act of June 10, 1872	2,500
By river and harbor act of March 3, 1873	3,000
By river and harbor act of June 23, 1874	5,000
By river and harbor act of March 3, 1875	10,000
By river and harbor act of June 18, 1878	5,000
By river and harbor act of March 3, 1879	3,500
By river and harbor act of June 14, 1880	10,000
By river and harbor act of March 3, 1881	10,000
Total	84,800

Under the appropriation of $10,000, made by the act of March 3, 1875, for the improvement of this harbor, a channel was opened by dredging from the "Middle Ground," up to Long Wharf, a distance of about 2,500 feet, for a width of 50 feet, and to a depth of 6 feet at mean low-water, or 16 feet at mean high-water. The project for the improvement of this harbor provides for a channel 100 feet in width, up to Long Wharf, to be extended southward to the mouth of Town Brook, a distance of about 900 feet above Long Wharf, so as to form a basin in front of the wharves of the city, 150 feet in width, with a depth of 8 feet at mean low-water.

Under the appropriation of $10,000 made by the river and harbor act of June 14, 1880, for this harbor, a contract was made August 24, 1880, with Messrs. Robert Hamilton, jr., of Chebeague Island, and Solomon Sawyer, of Yarmouth, Me., the lowest of four bidders, for 60,000 cubic yards, more or less, of dredging, at 17 cents per cubic yard, measured *in scows.*

Under this contract 43,950 cubic yards of dredging has been done up to the end of the fiscal year, whereby the *main channel* has been com-

pleted to its full projected width (viz, 100 feet), and to a depth of 6 feet at mean low-water, or 16 feet at mean high-water, from deep water near the Middle Ground up to the wharves of Plymouth; and a portion of the projected basin in front of the wharves has been dredged to a depth of 8 feet at mean low-water.

The remainder of the dredging under this contract is to be applied to deepening the basin.

Under the appropriation of $10,000 made by the river and harbor act of March 3, 1881, for this harbor, a contract was made June 14, 1881, with the Eastern Dredging Company, of Portland, Me., the only bidder, for 40,000 cubic yards, more or less, of dredging, at 23 cents per cubic yard, measured *in scows*, the same to be completed on or before January 31, 1882. This dredging is to be applied to the *completion* of the projected basin.

All the works projected for the protection and preservation of Long Beach (which gives to this harbor its only shelter from easterly storms) were completed in 1879; but, exposed as they are to injury from those violent storms, they will necessarily require occasional repairs.

For this purpose an appropriation of $1,000 is asked.

Plymouth Harbor is in the collection district of Plymouth, of which Plymouth is the port of entry.

The nearest light-houses are the Gurnet lights, about 5 miles distant from the city of Plymouth.

The following information in regard to the revenue and commerce of the port of Plymouth for the year ending December 31, 1880, has been furnished by the United States collector of customs of that port:

REVENUE.

Collections for 1880	$28,208 66
Expenses collecting revenue	2,574 62
Net amount paid the government	25,634 04

FOREIGN IMPORTS.

Hemp	tons..	1,162
Burlaps	yards..	119,197
Coal	tons..	729
Potatoes	bushels..	1,094

Value, $132,660.

FOREIGN EXPORTS.

Cordage	coils..	956
Swedes jack-plates		6,600

Value, $5,768.

REMAINING IN BOND.

Hemp	tons..	664
Burlaps	yards..	63,623

Value, $108,618.

DOMESTIC IMPORTS.

	Cargoes.	Tons.	
Cotton	3	125	
Coal	60	16,400	
Iron	37	3,800	
Fish, dry	4	200	= 2,000 quintals.
Fish, pickled	8	600	= 6,000 quintals
Salt	6	270	
Granite	2	200	
Lumber	16	1,800	= 2,000,000 feet
Tar	2	370	= 2,500 tierces.
Hay	11	758	
	149	24,523	

Miscellaneous, by packets and steamers, estimated at 15,000 tons.

Estimated value, $1,044,000.

DOMESTIC EXPORTS.

	Cargoes.	
Fish, dry	6	6,000 quintals.
Nails	10	800 tons.
Barrels, empty	12	6,000
Wood	10	400 cords.
Value, $99,400.	38	

There are some twenty to twenty-five sail of vessels that are not included, engaged in the mackerel, lobster, and fisheries. There are also, not included, the regular steamers and packets plying between this port and other domestic ports, or excursion steamers. Most of the vessels arriving with cargoes, sail from here light.

There were no vessels built in this district in 1880.

The following-named papers are hereto appended, to-wit:

Two abstracts of proposals received.
Abstracts of contracts made.
Sketch of Plymouth Harbor, showing all the improvements made and projected.

Money statement.

July 1, 1880, amount available	$13,528 85	
Amount appropriated by act approved March 3, 1881	10,000 00	
		$23,528 85
July 1, 1881, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1880	7,114 83	
July 1, 1881, outstanding liabilities	1,494 32	
		8,609 15
July 1, 1881, amount available		14,919 70
Amount (estimated) required for completion of existing project		1,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1883		1,000 00

Abstract of proposals received August 17, 1880, for dredging Plymouth Harbor, Massachusetts.

Number for reference.	Bidders.	Residence.	Dredging 40,000 cubic yards, more or less.
1	Robert Hamilton, jr., and Solomon Sawyer	Cheheague Island, Me. Yarmouth, Me.	17 cents per cubic yard, measured in scows.
2	William W. Wright	Geneva, N. Y	*26 cents per cubic yard, measured in scows.
3	Edgar M. Payn	Albany, N. Y	33 cents per cubic yard, measured in scows.
4	Augustus B. Martin	Boston, Mass	50 cents per cubic yard, measured in scows.

* If time of completion be extended to June 30, 1881, bids 20 cents.

Abstract of proposals received June 6, 1881, for dredging in Plymouth Harbor, Massachusetts.

Number for reference.	Bidders.	Residence.	Dredging 45,000 cubic yards, more or less.
1	Eastern Dredging Company, by William W. Wright, president.	Portland, Me	23 cents per cubic yard, measured in scows.

Abstract of contracts made during the fiscal year ending June 30, 1881, for the improvement of Plymouth Harbor, Massachusetts.

Date of contract.	Contractors.	Nature of work.	Price per cubic yard.
1880.			
Aug. 24	Robert Hamilton, jr., of Cheheague Island, Me., and Solomon Sawyer, of Yarmouth, Me.	Dredging from the Middle Ground up to Long Wharf and above, 60,000 cubic yards, more or less.	$0 17
1881.			
June 14	Eastern Dredging Company, by William W. Wright, president.	Dredging, in completion of the "Inner Basin," near Long Wharf and above, 40,000 yards, more or less.	23

20. *Plymouth Harbor, Massachusetts.*—The present project for the improvement of this harbor was adopted in 1866 and modified in 1875 and 1882, the object being—

1. The protection and preservation of Long Beach, upon the existence of which the harbor depends for its only shelter from easterly storms; and

2. Opening a channel 100 feet in width and of not less than 6 feet in depth at mean low-water (or 16 feet at mean high-water) from the Middle Ground up to Long Wharf, and thence to near the mouth of Town Brook, not less than 150 feet in width, with a depth of 8 feet at mean low-water. The natural channel was very narrow and crooked, with not more than half a foot in depth at mean low-water in its shoalest part.

The total amount expended from 1866 to the 30th of June, 1881, on the project being executed was $69,880.30, and resulted in the completion of the works projected for the protection and preservation of Long Beach, with the exception of the stone bulkhead at its outer extremity, and a channel 100 feet in width from the Middle Ground up to Long Wharf, and the commencement of the 8-foot channel in front of the wharves.

The amount expended during the fiscal year ending June 30, 1882, including outstanding liabilities, is $14,830.03, which has resulted in the completion of the main channel leading from the Middle Ground up to the wharves of Plymouth to its full width of 100 feet, and in the completion of the 8-foot channel in front of the wharves, and in repairing works on Long Beach.

The only work that now remains to be done for the preservation and improvement of this harbor consists of the completion of the stone bulkhead near the outer extremity of Long Beach, the estimated cost of which is $14,000, for which an appropriation has been made by the river and harbor act of August 2, 1882.

The officer in charge asks that $1,000 be appropriated for the fiscal year ending June 30, 1884, for such repairs as may be required on the several works built for the protection and preservation of Long Beach.

July 1, 1881, amount available	$14,919 70	
July 1, 1882, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1881	14,830 03	
July 1, 1882, amount available		89 67
Amount appropriated by act passed August 2, 1882		14,000 00
Amount available for fiscal year ending June 30, 1883		14,089 67
Amount (estimated) required for completion of existing project		1,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1884		1,000 00

(See Appendix A 20.)

A 20.

IMPROVEMENT OF PLYMOUTH HARBOR, MASSACHUSETTS.

The existence of this harbor depends entirely upon the protection and preservation of Long Beach, which is a narrow strip of land that extends 2¾ miles out from the mainland, in a northwesterly direction, nearly parallel to the shore of the town of Plymouth, and distant from it about 1 mile. It affords to the harbor its only shelter from easterly storms.

In late years it has been washed away in some places, and much weakened in others, to an extent seriously threatening the ruin of the harbor.

For the protection and preservation of this beach various works have been built from time to time, until they have finally proved to be efficient and successful. These works consist of bulkheads, jetties, and groins, built for the accumulation of sand and the planting of beach grass; also to accumulate sand and give permanency to the beach thus formed, whereby a ridge has been formed throughout the whole extent of the beach, which is, for the most part, covered with beach grass, and is now generally in an efficient condition.

A history and description of the several works built on Long Beach will be found in the Annual Report for the fiscal year ending June 30, 1877.

The following sums have been appropriated by Congress, and allotted for the preservation and improvement of this harbor from 1864 up to the close of the fiscal year ending June 30, 1882, viz:

Amount allotted in 1866 from appropriations made July 2, 1864, for harbors on the Atlantic coast	$8,300
Amount allotted under act of July 25, 1868	7,500
By river and harbor act of July 11, 1870	10,000
By river and harbor act of March 3, 1871	10,000
By river and harbor act of June 10, 1872	2,500
By river and harbor act of March 3, 1873	3,000
By river and harbor act of June 23, 1874	5,000
By river and harbor act of March 3, 1875	10,000
By river and harbor act of June 18, 1878	5,000
By river and harbor act of March 3, 1879	3,500
By river and harbor act of June 14, 1880	10,000
By river and harbor act of March 3, 1881	10,000
By river and harbor act of August 2, 1882	14,000
Total	98,800

The project for the improvement of this harbor provided for a channel of 100 feet in width up to Long Wharf, to be extended southward to the mouth of Town Brook, a distance of about 90 feet above Long Wharf, so as to form a basin in front of the wharves of the city not less than 150 feet in width, with a depth of 8 feet at mean low-water.

Under the appropriation of $10,000 made by the act of March 3, 1875, for the improvement of this harbor, the channel was opened by dredging from the "Middle Ground" up to Long Wharf, a distance of about 2,500 feet, for a width of 50 feet, and to a depth of 6 feet at mean low-water, or 16 feet at mean high-water.

Under the appropriation of $10,000 made by the act of June 14, 1880, for this harbor, a contract was made August 24, 1880, with Messrs. Robert Hamilton, jr., of Cheteague Island, and Solomon Sawyer, of Yarmouth, Me., the lowest of four bidders, for 60,000 cubic yards, more or less, of dredging, at 17 cents per cubic yard, measured *in scows*. Under this contract 43,950 cubic yards of dredging was done up to the end of that fiscal year, whereby the *main channel* was completed to its full projected width (viz, 100 feet), and to a depth of 6 feet at mean low-water, or 16 feet at mean high-water, from deep water near the Middle Ground up to the wharves of Plymouth, and a portion of the projected basin in front of the wharves was dredged to a depth of 8 feet at mean low-water.

Operations were continued under this contract up to the 1st of September, 1881, resulting in an aggregate of 58,998½ cubic yards of dredging in completion of the same, by which the basin was nearly completed for a distance of about 50 feet above Weston & Harlow's Wharf.

Under the appropriation made by the river and harbor act of March 3, 1881, for this harbor, proposals have been invited (see abstract herewith) and contracts made as follows, viz:

1. With Mr. Cummings M. Holden, of Tremont, Me., August 10, 1881, for 200 tons, more or less, of small bowlders, at $1.55 per ton of 2,240 pounds, for repairing works on Long Beach.

2. With the Eastern Dredging Company, of Portland, Me., June 14, 1881, for 40,000 cubic yards, more or less, of dredging, at 23 cents per cubic yard, as measured *in scows*, for completing the basin in front of the Plymouth wharves.

Under the contract with Mr. Holden 186$\frac{1360}{2240}$ tons of small bowlders were furnished up to the 6th of March, 1882, in completion of his contract.

Under the contract with the Eastern Dredging Company, operations were commenced on the 28th of October and completed on the 23d of December, 1881, resulting in 44,969 cubic yards of dredging in completion of said contract, and in completion of the projected channel and basin.

All the works projected for the protection and preservation of Long Beach were completed in 1879. Some of these works (bulkheads and jetties) were built of crib-work about fifteen years ago, but owing to their exposed position at the outer end of the beach, and *particularly* to the unusually severe storms that occurred in February and March last, they have become much decayed and broken up, so much so that the beach has been much abraded, and weakened to such an extent as to render it liable to immediate destruction. The attention of the department was called to this matter in a special report, dated March 30, 1882, with a recommendation that Congress be requested to make an appropriation of $14,000 for the purpose of extending the stone bulkhead along the western shore of the beach for an additional distance of

1,000 feet, so as to protect in a more permanent manner this the weakest part of the beach.

With the unexpended funds available $219\frac{1440}{2240}$ tons of rubble-stone have been placed in the bulkhead during May and June, 1882; and it is proposed to apply the appropriation for the fiscal year ending June 30, 1883, to the continuation of this work.

Plymouth Harbor is in the collection district of Plymouth, of which Plymouth is the port of entry.

The nearest light-houses are the Gurnet lights, about 5 miles from the city of Plymouth.

The accompanying letter from the United States collector of customs at Plymouth furnishes a statement of the amount of commerce and navigation for that port during the year ending December 31, 1881; also, the benefits to the same by the improvements made and projected; and the tables give a list of proposals received, and the contracts made during the fiscal year ending June 30, 1882.

Money statement.

July 1, 1881, amount available	$14,919 70
July 1, 1882, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1881	14,830 03
July 1, 1882, amount available	89 67
Amount appropriated by act passed August 2, 1882	14,000 00
Amount available for fiscal year ending June 30, 1883	14,089 67
Amount (estimated) required for completion of existing project	1,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1884	1,000 00

Abstract of proposals received August 8, 1881, for furnishing about 600 tons of rubble-stone for the bulkhead on Long Beach, Plymouth Harbor, Massachusetts.

Number for reference.	Bidder.	Residence.	About 600 tons rubble-stone.	
			400 tons granite quarry grout.*	200 tons small rounded bowlders.*
1	Cummings M. Holden	Tremont, Me.	No bid received	$1.55

*Per ton of 2,240 pounds.

Abstract of contracts made during the fiscal year ending June 30, 1882, for the improvement of Plymouth Harbor, Massachusetts.

Date of contract.	Contractor.	Nature of work.	Price per ton of 2,240 pounds.
1881 Aug. 10	Cummings M. Holden, Tremont, Me.	Furnishing and delivering 200 tons, more or less, of small rounded bowlders on the bulkhead on Long Beach.	$1.55

COMMERCIAL STATISTICS.

CUSTOM-HOUSE, PLYMOUTH, MASS.,
Collector's Office, June 12, 1882.

SIR: I have the honor to present to you the following report of the amount of receipts and disbursements of the United States revenue, the amount of merchandise in bond, the amount of foreign and domestic imports and exports, the number of cargoes received, and the number of vessels arriving and sailing into and from the port of Plymouth for the year ending December 31, 1881, as follows:

REVENUE.

Collections from imports, hospital, and tonnage dues	$47,343 34
Expenses collecting the revenue	2,295 00
Net amount paid government	45,048 34

FOREIGN IMPORTS.

	Value.
Hemp, 1,767 tons	$309,225 00
Burlaps, 117,336 yards	2,866 00
Coal, 2,183 tons	7,740 00
Potatoes, 190 bushels	190 00
	320,021 00

FOREIGN EXPORTS.

Cordage, 115,392 pounds	$12,713 00

MERCHANDISE IN BOND.

Hemp, 648 tons	$89,790 00
Burlaps, 86,691 yards	1,723 00
	91,513 00

DOMESTIC IMPORTS.

	Cargoes.	Tons.
Coal	97	18,084
Hay	11	771
Tar	2	366 = 2,445 barrels.
Hemp	5	544
Iron	7	916
Fish	13	442 = 7,950 quintals.
Lumber	24	3,500 = 4,881,000 feet.
Salt	6	220 = 440,232 pounds.
Granite	43	4,403
Moulding sand	1	150
Miscellaneous, by steamers and packets, estimated	150	15,000
Total	359	44,396

EXPORTS.

	Cargoes.	Tons.
Nails	8	700
Wood	12	700 = 500 cords.
Barrels	12	50 = 4,500 barrels.
Fish	13	400 = 7,000 quintals.
Total	45	1,850

SUMMARY.

Value of foreign imports by water	$320,021	
Value of foreign exports by water	12,713	
		$332,734
Value of domestic imports by water	987,672	
Value of domestic exports by water	118,900	
		1,106,572
Total value of imports and exports		1,439,306

Number of cargoes, foreign and domestic	404
Weight of cargoes—tons	44,246
Arrivals and departures of all vessels	2,732
Passengers arriving and departing by water	11,484

There have been no vessels built in this district during the year 1881.

It is a very difficult question to answer as to "what amount of commerce and navigation will be benefited by the improvements in Plymouth Harbor." I can only answer, what is well known to you, that it is perfectly apparent to all that all the commerce and navigation, as well as all the property, consisting of wharves, stores, goods in store, lumber and coal yards, and, in fact, all the property on the inner shore of our inner harbor is entirely dependent on "Long Beach" and its preservation, without which Plymouth (inner) Harbor would be but an open roadstead. What has been accomplished towards its protection by government under your judicious management has been very beneficial, and we know that under your supervision our inner harbor has been greatly improved, and by the deepening of the water at the wharves a benefit has been conferred on all our commerce and navigation that dollars and cents could hardly estimate.

Of course there remains much to be done; judicious repairs are a continual necessity to maintain the works accomplished and now in progress. To that end we trust that through your advice government will keep an open, liberal hand to provide means at your disposal.

Very respectfully, your obedient servant,

SAMUEL H. DOTEN,
Collector of Customs.

General GEO. THOM,
Colonel of Engineers.

5. *Plymouth Harbor, Massachusetts.* (In charge of Maj. F. Harwood, Corps of Engineers, from January 18 to March 26, 1883, and of Lieut. Col. G. H. Elliot, Corps of Engineers, to April 4, 1883.)—The project for the improvement of this harbor was adopted in 1866, and modified in 1875, and 1882 the object being—

1. To protect and preserve Long Beach, on which the harbor depends wholly for its shelter from easterly storms; and

2. To open a channel of navigable width, with not less than 16 feet depth at mean low water.

The natural channel was very narrow and crooked, and not more than half a foot in depth at mean low water in its shoalest part.

Since 1866 there has been allotted and appropriated for the improvement of this harbor $98,800; of this amount, $84,710.33 had been expended at the close of the fiscal year ending June 30, 1882, and the projects of 1866 and 1875 were then reported as completed.

In furtherance of the modification of 1882, during the fiscal year ending June 30, 1883, $12,968.53 have been expended, resulting in the prolongation of the bulkhead along the western shore of the beach, an additional 830 feet, backing the old portion of this bulkhead with cedar trees and small stone, so as to render it sand-tight for a length of 640 feet, building a catch-sand fence of cedar trees and stone parallel to and 15 feet east of the old triangular bulkhead for a length of 730 feet, and stopping a leak north of the old crib-work by backing 60 feet of the stone bulkhead with trees and small stone.

For the further necessary protection and preservation of this beach it is estimated that $19,000 will be required, all of which could be profitably expended during the fiscal year ending June 30, 1885.

July 1, 1882, amount available	$89 67
Amount appropriated by act passed August 2, 1882	14,000 00
	14,089 67
July 1, 1883, amount expended during the fiscal year, exclusive of outstanding liabilities July 1, 1882	12,968 53
July 1, 1883, amount available	1,121 14
Amount (estimated) required for completion of existing project	19,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	19,000 00

(See Appendix B 5.)

B 5.

IMPROVEMENT OF PLYMOUTH HARBOR, MASSACHUSETTS.

The charge of this work was transferred to me by Lieut. Col. George H. Elliot, Corps of Engineers, April 6, 1883, in compliance with directions of the Chief of Engineers, dated April 4, 1883.

The present project for the improvement of this harbor was adopted in 1866, and modified in 1875 and 1882, the object being:

1. The protection and preservation of Long Beach (this harbor's only protection from easterly storms), which of late years has been washed away in places, seriously threatening the ruin of the harbor.

2. The opening a channel of navigable width, with a depth of not less than 16 feet at mean high water, from the natural channel to the dredged basin in front of the wharves at Plymouth.

For the protection and preservation of Long Beach various works have been built, consisting of bulkheads, jetties, crib-piers, and groins, resulting in its restoration in part by the accumulation of sand and growth of beach-grass. A full history of these works will be found in the annual report of the Chief of Engineers of June 30, 1877.

From 1866 to 1883 there has been allotted and appropriated by Congress $98,800, as follows:

Amount allotted in 1866 from appropriations made July 2, 1864, for harbors on the Atlantic coast	$8,300
Amount allotted under act of July 25, 1868	7,500
By river and harbor act of July 11, 1870	10,000
By river and harbor act of March 3, 1871	10,000
By river and harbor act of June 10, 1872	2,500
By river and harbor act of March 3, 1873	3,000
By river and harbor act of June 23, 1874	5,000
By river and harbor act of March 3, 1875	5,000
By river and harbor act of June 18, 1878	3,500
By river and harbor act of March 3, 1879	10,000
By river and harbor act of June 14, 1880	10,000
By river and harbor act of March 3, 1881	10,000
By river and harbor act of August 2, 1882	14,000
Total	98,800

By aid of these appropriations the projects of 1866 and 1875 were reported as completed June 30, 1882, during which year $14,830.03 were expended.

In furtherance of the modified project of 1882, the following work has been done during the fiscal year ending June 30, 1883, to wit:

Contract was entered into September 20, 1882, with Mr. Charles H. Edwards, of Quincy, Mass., for furnishing and putting in place rubble-stone in extension of the bulkhead along the western shore of the beach, this being its weakest part. Under this contract 5,006 tons of stone have been placed, extending the bulkhead for a length of 830 feet, making a total length of 1,700 feet.

In addition to this, by hired labor and purchased material, the old part of this bulkhead has been backed with cedar trees and small stone, to render it sand-tight, for a length of 640 feet. A catch-sand fence of cedar trees and stone has been built parallel to and 15 feet east of the old triangular bulkhead which forms the backbone of the old works for a length of 730 feet. A leak north of the old crib-work has also been stopped by backing 60 feet of the stone bulkhead with trees and small stone.

The work of protecting Long Beach has, since 1870, been mainly confined to the restoration of its northern extremity, within 2,000 feet of the

beacon, and has resulted in the reformation along this stretch of beach of about 171,000 cubic yards of sand, at an estimated cost of about $54,000, the growth being wholly due to this work.

The remaining 2½ miles of beach, which previous to 1870 had been protected by triangular plank bulkheads, have since then suffered greatly from wind and wave action, notably in the gale of January 10, 1883, rendering necessary the rebuilding of about 5,000 linear feet of the crest. It is proposed to accomplish this by the construction of a plank sand-barrier, faced with brush and stone, the estimated cost of which is as follows:

I. For protection of lower (southerly) end of Long Beach, 5,000 linear feet of plank sand-barrier faced wi h brush and stone, at $3.60 per linear foot, including contingencies	$18,000
II. For probable repairs to work on northern extremity of the beach	1,000
Total	19,000

This amount, if appropriated, can be profitably expended during the fiscal year ending June 30, 1885.

This work is located in the collection district of Plymouth, Mass., of which Plymouth is the port of entry. The nearest light-houses are the Plymouth (Gurnet) lights, about 5 miles from the city of Plymouth, and Duxbury pier light, distant about 2 miles.

Money statement.

July 1, 1882, amount available	$89 67
Amount appropriated by act passed August 2, 1882	14,000 00
	14,089 67
July 1, 1883, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1882	12,968 53
July 1, 1883, amount available	1,121 14
Amount (estimated) required for completion of existing project	19,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1885	19,000 00

Abstract of proposals received and opened September 15, 1882, by Col. George Thom, Corps of Engineers, for improving harbor at Plymouth, Mass.

No.	Names of bidders.	Residence.	About 6,000 tons of rubble-stone.	
			5,000 tons of large stone, per ton of 2,240 pounds.	1,000 tons of small stone, per ton of 2,240 pounds.
1	Charles H. Edwards	Quincy, Mass	$1 97	*$1 70
2	Joseph H. White	Hyde Park, Mass	2 19	2 19
3	Mount Waldo Granite Works, John T. Rowe, president.	Frankfort, Me	2 50	2 50

* Or $1.50 if landed on the beach.

ABSTRACT OF CONTRACT FOR IMPROVING HARBOR AT PLYMOUTH, MASSACHUSETTS, DURING THE FISCAL YEAR ENDING JUNE 30, 1883, BY COLONEL GEORGE THOM, CORPS OF ENGINEERS.

Contract with Charles H. Edwards, of Quincy, Mass., dated September 20, 1882, and expiring December 31, 1882, for furnishing and putting in place rubble-stone in bulkhead on Long Beach, as follows:

1. Granite quarry grout (large stone), for $1.97 per ton of 2,240 pounds.
2. Rounded bowlders and small quarry fragments, for $1.70 per ton of 2,240 pounds.
3. Small stone, if landed on the beach, for $1.50 per ton of 2,240 pounds.

COMMERCIAL STATISTICS OF PLYMOUTH HARBOR, MASSACHUSETTS, FOR THE FISCAL YEAR ENDING JUNE 30, 1883, FURNISHED BY THE COLLECTOR OF CUSTOMS.

Amount of revenue collected $70,549 33

FOREIGN ENTRANCES AND CLEARANCES.

Number	50
Tonnage	32,981

FOREIGN IMPORTS AND EXPORTS.

			Value.
Imports:			
Hemp	tons	1,635	$302,795
Iron rivet-rods	do	909	35,935
Coal			2,866
Fish (800 quintals)	tons	40	1,575
Total imports			343,171
Exports:			
Cordage	pounds	92,524	9,094
Merchandise now in bond:			
Iron rivet-rods	tons	833	33,158
Total value of imports and exports			385,423

DOMESTIC IMPORTS AND EXPORTS.

			Cargoes.
Imports:			
Coal	tons	18,150	83
Hay	do	265	4
Fish (2,430 quintals)	do	150	3
Iron	do	2,102	18
Lumber (4,338,845 feet)	do	2,000	21
Granite	do	200	2
Tar (2,400 barrels)	do	240	2
Salt	do	225	7
Miscellaneous, by steamers and packets (estimated)	do	1,200	..
Total imports	do	35,332	140
Exports:			
Nails	tons	250	5
Wood	do	1,200	20
Barrels	do	224	28
Miscellaneous, by steamer and packet (estimated)	do	1,000	..
Total exports	do	2,674	53
Total imports and exports	do	38,006	193

Value, imports and exports, $993,362.

RECAPITULATION.

Value of foreign imports and exports	$352,265
Value of domestic imports and exports	993,362
Total	1,345,627
Number of cargoes, foreign and domestic	243
Number of tons merchandise	38,006
Number of arrivals and departure of vessels	2,643
Number of passengers arriving and departing by water	28,184

5. *Plymouth Harbor, Massachusetts.*—The object of the improvement of this harbor is to protect it by the preservation of Long Beach, and to deepen and widen the channels of approach to the city wharves.

The preservation of Long Beach is essential to the existence of the harbor, and the natural channels of approach to the wharves were narrow and crooked, with about 6 inches depth of water at mean low tide.

In the preservation of Long Beach, from 1824 to 1883, inclusive, $111,846.84 were spent; in the improvement of the channels, $28,419.16 have been spent since the adoption of the project for their improvement, in 1875.

During the fiscal year ending June 30, 1884, the balance available July 1, 1883 ($1,121.14), was mainly expended in preserving Long Beach, and in making surveys of the works of improvement.

Future appropriations will be expended in repairing Long Beach and in continuing and extending the dredged area.

July 1, 1883, amount available	$1,121 14
July 1, 1884, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1883	1,070 05
July 1, 1884, amount available	51 09
Amount appropriated by act approved July 5, 1884	10,000 00
Amount available for fiscal year ending June 30, 1885	10,051 09
Amount (estimated) required for completion of existing project	18,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1886	18,000 00

(See Appendix B 5.)

B 5.

IMPROVEMENT OF PLYMOUTH HARBOR, MASSACHUSETTS.

The object of this improvement is to protect the harbor by the preservation of Long Beach, and to deepen and widen the channels of approach to the wharves of Plymouth.

Previous to the year 1875 the work done in this harbor was for the preservation and strengthening of Long Beach. An account of the various devices employed for this purpose is given in the Annual Report

of the Chief of Engineers for 1877. This work, from its nature, cannot be considered completed and permanent, small annual expenditures being necessary to keep it in repair. Such expenditures have been made for many years, amounting, from 1824 to 1883, to $111,846.84.

Before improvement, the channel to the wharves was about 6 inches deep at mean low water.

The project of the improvement of the main channel was adopted in 1875. It provided for straightening the channel, and giving it a width of 100 feet, and a depth of 6 feet at mean low water. This project was modified in 1877 so as to include the excavation of a basin 150 feet wide and 8 feet deep in front of the city wharves.

The original estimate of cost of the modified project of 1877 was $41,500.

From 1866 to the present time there has been allotted and appropriated by Congress $98,800, as follows:

Amount allotted in 1866 from appropriations made July 2, 1864, for harbors on the Atlantic coast	$8,300
Amount allotted under act of July 25, 1868	7,500
By river and harbor act of July 11, 1870	10,000
By river and harbor act of March 3, 1871	10,000
By river and harbor act of June 10, 1872	2,500
By river and harbor act of March 3, 1873	3,000
By river and harbor act of June 23, 1874	5,000
By river and harbor act of March 3, 1875	10,000
By river and harbor act of June 18, 1878	5,000
By river and harbor act of March 3, 1879	3,500
By river and harbor act of June 14, 1880	10,000
By river and harbor act of March 3, 1881	10,000
By river and harbor act of August 2, 1882	14,000
By river and harbor act of July 5, 1884	10,000
Total	108,800

EXPENDED TO JUNE 30, 1883.

For beach protection and superintendence	$69,259 70
For dredging	28,419 16
Total	97,678 86

During the fiscal year ending June 30, 1884, immediately necessary repairs have been made at Long Beach, and the dredged channel and basin have been surveyed.

The work of protecting Long Beach has, since 1870, been mainly confined to the restoration of its northern extremity, within 2,000 feet of the beacon, and has resulted in the re-formation of about 200,000 cubic yards of sand, the growth being wholly due to this work.

In my annual report of last year I remarked as follows:

> The remaining 2½ miles of beach, which previous to 1870 had been protected by triangular plank bulkheads, have suffered greatly from wind and wave action, rendering necessary the reconstruction of about 5,000 linear feet of the crest.

Along this line it was proposed to build a sand barrier of plank, faced with brush and stone, the cost of which was estimated at $18,000. I have recently inspected this shore and find its condition greatly improved. I am now of the opinion that the protection recommended will not be immediately required, there being no present danger of serious or permanent injury.

The works at the northern extremity of the beach are in very good condition; those recently constructed have produced very favorable

results. Three additional groins are needed and two breaks require repairs. This work will cost about $500, to which $500 should be added to provide for the immediate repair of unforeseen damage caused by storms.

The dredged channel and basin were completed in 1881, in accordance with the modified project of 1877.

The resurvey of this channel and basin was made under the authority of the Chief of Engineers, in order to determine the desirability of further dredging. As the result of this survey, it was found that the dredged channel has not deteriorated, but has been deepened by scour. It seems, therefore, desirable that the channel be further improved to meet the increased demands of commerce. The project proposed in my letter of January 30, 1884, to the Engineer Department, contemplates dredging to a depth of 9 feet at mean low water, widening the channel to 150 feet, and rounding off the junctions with the main ship-channel and basin. It requires the excavation of 81,000 cubic yards, and is estimated to cost $27,000.

I therefore recommend the following appropriations, which can be profitably expended during the fiscal year ending June 30, 1886:

I. For the repair of Long Beach	$500 00
II. For contingencies	500 00
III. For widening and deepening channel	27,000 00
Total	28,000 00

The sum of $10,000 having been appropriated by the act approved July 5, 1884, the total amount recommended for appropriation is $18,000.

This work is located in the collection district of Plymouth, Mass., of which Plymouth is the port of entry. The nearest light-houses are the Plymouth (Gurnet) Lights, about 5 miles from the city of Plymouth, and Duxbury Pier Light, distant about 2 miles.

The accompanying commercial statistics for the fiscal year ending June 30, 1884, have been furnished by the collector of customs for the port of Plymouth, Mass.

Money statement.

July 1, 1883, amount available	$1,121 14
July 1, 1884, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1883	1,070 05
July 1, 1884, amount available	51 09
Amount appropriated by act approved July 5, 1884	10,000 00
Amount available for fiscal year ending June 30, 1885	10,051 09
Amount (estimated) required for completion of existing project	18,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1886	18,000 00

COMMERCIAL STATISTICS.

CUSTOM-HOUSE, PLYMOUTH, MASS.,
Collector's Office, June 30, 1884.

SIR: I have the honor herewith to forward to you my annual report (as per request) of receipts and disbursements for the collection of the revenue of the United States at this port, the amount of foreign imports and exports, the amount of merchandise now in bond, foreign entrances and clearances, domestic arrivals and contents of cargoes, the number of vessels arriving and sailing for harbor and otherwise; also the amount of navigation benefited by the Government works completed and now in progress for the protection of the harbor and the commercial interests of the port.

United States revenue:		
Import, hospital, and tonnage dues		$23,830 13
Expenses for collection		2,267 79
		21,562 34
Foreign imports by water:		
Sisal hemp	336 tons	29,059 00
Iron rivet-rods	2,474,976 pounds	47,388 00
Coal	3,588 tons	3,167 00
		79,614 00
Foreign exports:		
Cordage	102,593 pounds	11,872 00
Merchandise in bond:		
Iron rivet-rods	1,924,879 pounds	34,848 00
Secured duties		11,549 28

Foreign entrances and clearances: Number of vessels, 57; tonnage, 5,425.21.

Domestic imports and exports by water.

IMPORTS.

No. of cargoes.	Articles.	No. of tons.
79	Coal	20,351
27	Lumber (6,000,000 feet)	4,050
2	Lime (400 casks)	40
4	Salt	400
1	Oil	115
2	Tar (2,800 barrels)	280
1	Molding sand	150
7	Fish (3,600 quintals)	242
9	Hay	710
6	Granite	705
100	Miscellaneous, by steamers and packets	13,000
238		40,103

EXPORTS.

10	Wood (580 cords)	1,160
12	Nails	855
4	Barrels	75
4	Fish	200
10	Miscellaneous	1,000
40		3,290

SUMMARY.

Number of cargoes, foreign and domestic	278
Tons of merchandise	43,293
Arrivals and departures of all vessels for harbor and otherwise	2,328
Number of passengers arriving and departing by water	48,300

GOVERNMENT PROPERTY AT PLYMOUTH.

One double light-house at Gurnet Head.
One single light-house at Duxbury Pier.
Two first-class life-saving stations.
Fort Andrew, at Gurnet Head.
Fort Standish, at Saguish.
One *rented* custom-house and furniture, with records dating from 1873 to this day.
One *rented* post-office, the receipts of which are rising $6,000 above expenses.
There are also six Government warehouses, three of which are now full.

MANUFACTURING INDUSTRY.

Aggregate capital of twenty-two of the principal manufactories is $2,017,000, manufacturing cordage, cottons, woolens, duck, iron, nails, tacks, rivets, zinc, castings, and other staple goods; value, $3,372,000.

BANKING CAPITAL.

Old Colony National Bank, capital and surplus	$350,000
Plymouth National Bank, capital and surplus	192,000
Plymouth Savings Bank	2,223,380
Plymouth Five-cent Savings	589,997
Total	3,355,377

In answer to your question of "what amount of commerce and navigation is benefited by the completion of each particular Government work at this port," I answer that it can hardly be estimated, as the benefit to our *inner harbor* by the Government work at Long Beach has secured to us a large part of the commerce herewith presented, and the further work of widening, deepening, and cutting new channels to the wharves has not only been of great benefit to this port, but also to all other ports, by giving us and them good water communication at all times of tide by steamers, as will be seen by reference to the number of passengers landed here by water, and which is yearly on the increase. The work of deepening and cutting new channels has accomplished this much-desired result.

To the large amount of navigation that frequents Massachusetts Bay, Plymouth Harbor and its roadsteads are of great importance, and having now become well known for its capacious and safe anchorage and its good shelter from storms and adverse winds, as well as for its good lights and beacons for safe guidance, large fleets of vessels, often to the number of two or three hundred at a time, are safely anchored in its harbor and ample roadsteads; and for the protection of the harbor and roadsteads we are indebted to the good engineering and fostering care of Government.

I have added to my returns the amount of Government property at this port and also the statistics of business, merely that you may see that the industry of the place is well worthy of Governmental care and protection.

Very respectfully, your obedient servant,

SAMUEL H. DOTEN,
Collector of Customs.

CHARLES W. RAYMOND,
Major of Engineers.

5. *Plymouth Harbor, Massachusetts.*—The object of the improvement of this harbor is to protect it by the preservation of Long Beach and to deepen and widen the channels of approach to the city wharves.

The preservation of Long Beach is essential to the existence of the harbor, and the natural channels of approach to the wharves were narrow and crooked, with about 6 inches depth of water at mean low tide.

In the preservation of Long Beach from 1824 to 1884, inclusive, $112,916.89 were expended. In the improvement of the channels $28,419.16 have been expended since the adoption of the project for their improvement in 1875.

During the fiscal year ending June 30, 1885, 36,426 cubic yards (scow measurement) were removed by dredging, resulting in deepening the channel, 100 feet wide and 6 feet deep, to 9 feet at mean low water for a least width of 90 feet, with an increased width at its junction with the main ship-channel and the basin in front of the wharves.

The balance available for the fiscal year ending June 30, 1886, is $3,317.50, which it is proposed to apply to the preservation of Long Beach, or so much thereof as may be necessary.

During the fiscal year ending June 30, 1887, $20,000 can be expended to advantage in widening and deepening the channel and in deepening the basin, by dredging, and in repairs to Long Beach, in accordance with the approved project.

July 1, 1884, amount available	$51 09
Amount appropriated by act approved July 5, 1884	10,000 00
	10,051 09
July 1, 1885, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1884	6,733 59
July 1, 1885, amount available	3,317 50
Amount (estimated) required for completion of existing project	20,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1887. Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.	20,000 00

(See Appendix B 5.)

B 5.

IMPROVEMENT OF PLYMOUTH HARBOR, MASSACHUSETTS.

The object of this improvement is to protect the harbor by the preservation of Long Beach, and to deepen and widen the channels of approach to the wharves of Plymouth.

Previous to the year 1875 the work done in this harbor was for the preservation and strengthening of Long Beach. An account of the various devices employed for this purpose is given in the Annual Report of the Chief of Engineers for 1877. This work, from its nature, cannot be considered completed and permanent, small annual expenditures being necessary to keep it in repair. Such expenditures have been made for many years, amounting, from 1824 to 1884, to $112,916.89.

Before improvement, the channel to the wharves was about 6 inches deep at mean low water.

The project for the improvement of the main channel was adopted in 1875. It provided for straightening the channel, and giving it a width of 100 feet and a depth of 6 feet at mean low water. This project was modified in 1877 so as to include the excavation of a basin 150 feet wide and 8 feet deep in front of the city wharves.

The original estimate of cost of the modified project of 1877 was $41,500.

The existing project for improvement was adopted in 1884. It contemplates dredging the channel to a depth of 9 feet at mean low water, widening it to 150 feet, and rounding off its junctions with the main ship-

channel and basin. It requires the excavation of 81,000 cubic yards (scow measurement), and was estimated to cost $27,000. Owing to the unusually low price of the dredging already executed, the total cost of the improvement, under the existing project, is now estimated at $22,500.

From 1866 to the present time there has been allotted and appropriated by Congress $108,800, as follows:

Amount allotted in 1866 from appropriations made July 2, 1864, for harbors on the Atlantic coast	$8,300
Amount allotted under act of July 25, 1868	7,500
By river and harbor act of July 11, 1870	10,000
By river and harbor act of March 3, 1871	10,000
By river and harbor act of June 10, 1872	2,500
By river and harbor act of March 3, 1873	3,000
By river and harbor act of June 23, 1874	5,000
By river and harbor act of March 3, 1875	10,000
By river and harbor act of June 18, 1878	5,000
By river and harbor act of March 3, 1879	3,500
By river and harbor act of June 14, 1880	10,000
By river and harbor act of March 3, 1881	10,000
By river and harbor act of August 2, 1882	14,000
By river and harbor act of July 5, 1884	10,000
Total	108,800

EXPENDED TO JUNE 30, 1884.

For beach protection and superintendence	$70,329 75
For dredging	28,419 16
Total	98,748 91

During the fiscal year ending June 30, 1885, the following work has been done:

Under contract of September 27, 1884, with Mr. George E. Runyan, of Boston, Mass., 36,426 cubic yards, scow measurement, were removed by dredging. The channel formerly dredged to a width of 100 feet and a depth of 6 feet at mean low water has thereby been deepened to 9 feet for a least width of 90 feet, with increased width at its junctions with the main ship-channel and the basin in front of the wharves.

The work of protecting Long Beach has, since 1870, been mainly confined to the restoration of its northern extremity, within 2,000 feet of the beacon, and has resulted in the re formation of about 200,000 cubic yards of sand, the growth being wholly due to this work.

The works at Long Beach are in good condition and continue to produce very favorable results. The slight repairs and additions needed are already provided for, and will be made during the present season with funds now on hand. The cost will not exceed $1,000.

No shoaling has been observed in the channel dredged during the past year. Should funds be provided, it is proposed to continue the dredging so as to complete the improvement in conformity with the project proposed in my letter of January 30, 1884. This will require the excavation of 44,574 cubic yards, measured in scows, and is estimated to cost $13,500.

The dredging of the basin in which the channel terminates to a depth equal to that of the channel is much desired. This basin was dredged to a depth of 8 feet at mean low water in 1881, but has since shoaled so that it has now an average depth of only about 7 feet.

As I have explained in my letter to the Department of January 30, 1884, this shoaling was principally if not wholly due to the lowering of Town Brook, and as the brook has now found its natural bed, no further shoaling from this cause need be anticipated. The excavation of this

basin to a depth of 9 feet at mean low water will require the removal of 20,000 cubic yards, measured in scows, and is estimated to cost $6,000.

In furtherance of the project above mentioned, I recommend the following appropriations, which can be expended to advantage during the fiscal year ending June 30, 1887:

1. For the repair of damage by storms at Long Beach	$500
2. For widening and deepening channel	13,500
3. For deepening basin	6,000
Total	20,000

This work is located in the collection district of Plymouth, Mass., of which Plymouth is the port of entry. The nearest light-houses are the Plymouth (Gurnet) Lights, about 5 miles from the city of Plymouth, and Duxbury Pier Light, distant about 2 miles.

The accompanying commercial statistics for the fiscal year ending June 30, 1885, have been furnished by the collector of customs for the port of Plymouth, Mass.

Money statement.

July 1, 1884, amount available	$851 09
Amount appropriated by act approved July 5, 1884	10,000 00
	10,051 09
July 1, 1885, amount expended during fiscal year, exclusive of outstanding liabilities July 1, 1884	6,733 59
July 1, 1885, amount available	3,317 50
Amount (estimated) required for completion of existing project	20,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1887	20,000 00

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

CUSTOM-HOUSE, PLYMOUTH, MASS.,
Collector's Office, June 30, 1885.

SIR: I have the honor herewith to forward to you a report of receipts and disbursements of revenue at this port, also the amount of merchandise in bond, entrances and clearances, domestic arrivals, composition of cargoes, number of arrivals and departures for harbor and otherwise, passengers by water, and property benefited by Government works at this port.

Revenue:	
Collections from all sources	$18,929 10
Disbursements	2,015 00
	16,914 10
Foreign imports:	
Rivet-rods, 1,747,723 pounds	$33,071 00
Bar-iron, 676 tons	28,671 00
Bassie steel, 186 tons	4,046 00
Culm coal, 517 tons	468 00
	66,256 00
Amount in bond:	
Rivet-rods, 634,318 pounds; Bar-iron, 624 tons — value	$43,574 00
Foreign exports:	
Cordage, 65,661 pounds	5,377 00

DOMESTIC IMPORTS.

Articles.	No. of cargoes.	Tons.
Coal	66	18,088
Scrap-iron	18	2,096
Lumber	26	4,000
Lime	2	150
Brick	10	800
Fish	9	300
Mackerel	4	200
Salt	3	300
Molding sand	2	200
Hay	7	460
Granite	6	670
Tar	1	150
Miscellaneous	90	14,000
Total	244	41,414

DOMESTIC EXPORTS.

Wood	8	600
Nails	10	700
Fish	2	150
Barrels	6	80
Gravel	50	4,000
Miscellaneous	10	1,500
Total	86	7,030

SUMMARY.

Number of cargoes, foreign and domestic	330
Merchandise, import and export, tons	48,444
Arrivals and sailing of all vessels for harbor and other purposes	2,208
Number of passengers by steamers, packets, and otherwise by water arrival and departure	44,000

GOVERNMENT PROPERTY.

The same as per last report except the abandoning of Forts Andrew and Standish.

There is gain in the manufacturing industry, its standing now being close onto $3,500,000, with the capital at the same figures as last report, and an increase of banking capital to $3,400,000. All the above commercial interests and capital receives direct benefit from the improvements and protection of this harbor by Government.

Skillful engineering has nowhere been more successful or given greater returns for money and labor expended than at this port, and should the future prove as successful as the past, no port in Massachusetts Bay (Boston only excepted) will be better protected or show better facilities for commerce and all its attendant interests than the port of Plymouth.

Through the fostering care of Government and the improvement of deepening the channels it has already become a noted seaside resort, and the steadily-increasing number of passengers by steamer from Boston and elsewhere that are daily landed here gives sure evidence that what has thus far been accomplished is well appreciated by the traveling and pleasure-seeking public.

Very respectfully, your obedient servant,

SAMUEL H. DOTEN,
Collector of Customs.

Maj. C. W. RAYMOND,
United States Engineers.

1885

48th Congress, 2d Session) HOUSE OF REPRESENTATIVES. (Ex.Doc. No.71.

PRELIMINARY EXAMINATION OF CHANNEL FROM GOOSE POINT, IN PLYMOUTH HARBOR, MASSACHUSETTS, TO THE WHARF OF THE CORDAGE COMPANY.

Boston, Mass., September 4, 1884.

General: In compliance with instructions contained in your letter of July 31, 1884, I have the honor to submit the following report of a preliminary examination of the proposed "channel from Goose Point, in Plymouth Harbor, to the wharf of the Cordage Company," provided for by the river and harbor act of July 5, 1884.

Goose Point Channel is a branch of the Main Ship Channel of Plymouth Harbor, extending in a southwesterly direction for a distance of about 1,980 yards. Its general location is shown in the sketch map of Plymouth Harbor, accompanying my letter to the Department, dated March 17, 1884.

The average width of this channel is 180 feet, and its average depth 12 feet at mean low water. The proposed improvement consists in the extension of this channel by dredging from the point where it now terminates to the wharf of the Plymouth Cordage Company.

A survey of the channels in Plymouth Harbor was made during the months of December, 1883, and January, 1884, by authority of Depart-

ment letter, dated November 10, 1883. My report, dated January 30, 1884, was submitted to the Department, and the proposed extension of the Goose Point Channel was discussed therein. The details of the project considered are shown on Tracing No. 2, accompanying that report. The line of the proposed excavation is taken through the flats of sand and mud along the line of deepest water. There is at present along that line an average depth of 1½ feet at mean low water; so that no low-water channel now exists. The length of the proposed excavation is 5,940 feet. It is 100 feet wide and 5 feet deep at mean low water. These dimensions have been adopted in order to permit vessels drawing 12 feet to work up through the channel at high water. The project requires the excavation of 103,000 cubic yards, and is estimated to cost about $42,000.

I am of the opinion that a channel thus constructed would be permanent, since the outflowing tide moves in the direction of its axis, and since the material is the same as that already dredged in the extension of the main ship channel, in which the cut has remained open.

Shorter lines were considered, but none were found which would not, in all probability, rapidly deteriorate.

In my report of January 30, 1884, I remarked as follows:

> It does not appear that such a channel is required by any vessels other than those going to the wharf of the Plymouth Cordage Company.

Subsequently I received letters from other parties claiming to be more or less interested in the proposed improvement.

These letters were transmitted to the Department, and my accompanying letter, dated March 17, 1884, considers in detail the character and amount of the interests supposed to be involved. A copy of a letter from the collector of the port of Plymouth, more recently received, is herewith respectfully transmitted.

In connection with this subject I need here only remark that the opinion expressed in my report, to the effect that the proposed improvement is required only for the convenience of the Plymouth Cordage Company, still appears to me to be substantially correct.

Plymouth is a port of entry, and it appears from the letter of the collector that the Plymouth Cordage Company pays about three-fourths of the total revenue there received. While, therefore, there seems to be few or none who are directly interested in the proposed improvement, there are doubtless many who desire the encouragement of an establishment without which the collection district would greatly diminish in importance or possibly even cease to exist.

It appears that the Plymouth Cordage Company was established in 1824, since which time it has managed to transact its business without any low-water channel. During the three years ending June 30, 1883, 51 vessels with cargoes from foreign ports arrived at this company's wharf, being an average of 17 vessels per year.

There are many points along the shore of Plymouth Harbor which are now in accessible at low water, but to which channels might be dredged at less expense than that required for the one under consideration. Such property can, of course, be cheaply obtained. Should a company locate itself at one of these points, and pay sufficient revenue and transact sufficient business to interest the people of Plymouth, it might with considerable reason demand that the United States construct a channel to *its* wharf, should the channel now proposed be executed for the benefit of the Plymouth Cordage Company.

It is now my duty to give my judgment, based upon the above facts, as to whether or not the harbor is worthy of improvement.

1885

I understand the question to be whether the particular improvement proposed is of such a character, and promises such benefit to commerce as to justify the necessary expenditure by the United States.

I am of the opinion that "the harbor is not worthy of improvement."

Very respectfully, your obedient servant,

CHAS. W. RAYMOND,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

LETTER OF THE COLLECTOR OF CUSTOMS AT PLYMOUTH, MASSACHUSETTS.

CUSTOM-HOUSE, PLYMOUTH, MASS.,
Collector's Office, February 19, 1884.

SIR: As the Corps of Engineers under your orders have this winter been making surveys for the improvement of the harbor, and you have been pleased to recommend an appropriation therefor, and have later made additional surveys with the view of excavating a channel from Goose Point Channel (so called) to the wharf of Plymouth Cordage Company, I deem it merely an act of justice to that company for me to say that about three-fourths of the revenue received at this port is received from them.

In furtherance of the wishes of that company, *but not from any request on their part,* I think I now state to you the sentiment and wish of the large majority of the disinterested of this community when I say, that if an appropriation should be granted, no part thereof should be otherwise expended till the aforesaid channel was completed, always excepting the repairs on Long Beach, the which, but for the skillful engineering and plans executed by that department, would have been long since partially destroyed and Plymouth Harbor left but little better than an open roadstead.

Very respectfully, your obedient servant,

SAMUEL H. DOTEN,
Collector.

CHARLES W. RAYMOND,
Major of Engineers.

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5. *Plymouth Harbor, Massachusetts.*— The original condition of this harbor was that Long Beach was rapidly being worn away by storms, and the main ship-channel to the town wharves had but 6 inches of water at mean low tide.

The object of the improvement is to protect and preserve Long Beach and to deepen and widen the channels of approach to the town wharves.

The preservation of Long Beach has been carefully attended to for many years, as the existence of the harbor depends on it. From the nature of the work it can at no time be considered completed.

The project for the improvement of the channel was originally adopted in 1875. It proposed to straighten, deepen, and widen the channel, so that it would be 2,286 feet long, 100 feet wide, and 6 feet deep at mean low water. This was estimated to cost $28,000. This project was modified in 1877 so as to include the dredging of a basin 866 feet long, 150 feet wide, and 8 feet deep at mean low water in front of the town wharves. This modified project was estimated to cost $41,500. The project was again modified in 1884, when it was proposed to dredge the channel to 9 feet, widen it to 150 feet, and round off its junctions with the main channel and basin. In 1885 it was proposed to deepen the basin to 9 feet. The project of 1884 was estimated to cost $27,000, and that of 1885 $22,500.

The tides rise and fall a mean distance of 9.3 feet.

The amount expended to June 30, 1885, was, for beach protection	$70,329 75
For dredging	35,152 75
Total	105,482 50

By the expenditure of which the beach was in good order; the channel was 90 feet wide and 9 feet deep, with rounded junctions with the basin and main channel, and the basin was 7 feet deep. During the fiscal year Long Beach was repaired at its southern end. Brush and stone bulkheads were built, which filled breaches made in the beach during the winter of 1885–'86. They aggregated 476 feet long, with 22 jetties each 15 feet long. The beach is now in good order, as is the dredged channel and basin.

Twenty-three hundred vessels sought this port during the fiscal year, carrying about 43,000 tons; and some 45,000 passengers were landed from steamers, packets, &c.

The benefit to be expected from the completion of this improvement is a more convenient navigation of the improved channel and greater facilities in docking vessels.

July 1, 1885, amount available		$3,317 50
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$1,900 63	
July 1, 1886, outstanding liabilities	357 18	
		2,257 81
July 1, 1886, amount available		1,059 69
Amount appropriated by act approved August 5, 1886		6,000 00
Amount available for fiscal year ending June 30, 1887		7,059 69
Amount (estimated) required for completion of existing project		15,500 00
Amount that can be profitaby expended in fiscal year ending June 30, 1888		10,000 00

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

(See Appendix B 5.)

B 5.

IMPROVEMENTS OF PLYMOUTH HARBOR, MASSACHUSETTS.

I relieved Maj. C. W. Raymond, Corps of Engineers, U. S. A., of the charge of this work February 4, 1886, in accordance with Special Orders No. 16, Adjutant-General's Office, dated January 20, 1886.

The object of this improvement is to protect the harbor by the preservation of Long Beach and to deepen and widen the channels of approach to the wharves at Plymouth.

The preservation of Long Beach has been carefully attended to for many years, as the existence of the harbor depends on it, and from the nature of the work it can at no time be considered completed and permanent; small annual appropriations are necessary to immediately repair any damage caused by storms.

The various devices employed for this purpose are described in the Annual Report of the Chief of Engineers for 1877.

The project for the improvement of the main channel was originally adopted in 1875. It provided for straightening the channel so that its total length would be 2,286 feet, gave it a width of 100 feet and a depth of 6 feet at mean low water. This project was modified in 1877 so as to include the dredging of a basin 866 feet long, 150 feet wide and 8 feet deep in front of the city wharves. This modified project was estimated to cost $41,500. The project was again modified in 1884. It was then proposed to dredge the channel to a depth of 9 feet at mean low water, widen it to 150 feet, and round off its junctions with the main ship-channel and the basin. In 1885 it was proposed to deepen the basin to 9 feet at mean low water.

This modified project required the excavation of 81,000 cubic yards (scow measurement), and was originally estimated to cost $27,000.

This amount was revised in 1885, in accordance with the low prices for dredging then current, and the cost of the work was then estimated to be $22,500.

Before improvement the channel to the town wharves was about 6 inches deep at mean low water.

From 1866 to 1884, inclusive, the following allotments or appropriations were made for this improvement:

Amount allotted in 1866 from appropriations made July 2, 1864, for harbors on the Atlantic coast	$8,300
Amount allotted, act of July 25, 1868	7,500
By river and harbor act of July 11, 1870	10,000
March 3, 1871	10,000
June 10, 1872	2,500
March 3, 1873	3,000
June 23, 1874	5,000
March 3, 1875	10,000
June 18, 1878	5,000
March 3, 1879	3,500
June 14, 1880	10,000
March 3, 1881	10,000
August 2, 1882	14,000
July 5, 1884	10,000
Total	108,800
Of which amount there had been expended to June 30, 1885:	
For beach protection	70,329 75
For dredging	35,152 75
Total	105,482 50

The condition of the improvement June 30, 1885, was as follows:

Long Beach was essentially in good order.

The dredged channel was 90 feet wide and 9 feet deep, with rounded junctions at the basin and main channels.

The basin originally dredged to 8 feet depth had shoaled to an average depth of 7 feet. This shoaling was caused by the lowering of Town Brook immediately after the basin was excavated, and no increase of shoaling has been discovered since that time.

During the fiscal year ending June 30, 1886, operations have been confined to repairing Long Beach. The storm of December 26, 1885, caused extensive damage to the southerly part of the beach. At nine different points, from Eel River Bridge to a point 4,000 feet north of it, large breaches were made in the beach. The sand and gravel thus cut out by the sea was thrown into Eel River, damming it up, and threatening to give it an outlet directly into the sea to the consequent injury of the harbor. Private parties removed those dams and re established the original course of the stream. The gaps in the beach were filled with brush and stone bulkheads (under direction of this office), aggregating 476 feet in length, with 22 jetties, each 15 feet long.

These bulkheads consist of a triple row of 7 by 7-inch posts, 9 feet long, set generally 4 feet into the sand and 5 feet apart. They are braced, top and bottom, in both horizontal directions, by 2 by 3 inch strips spiked on.

Spurs or jetties 15 feet long, and the same distance apart, similarly built, project from the front and rear. The bulkheads and spurs are filled with brush, which is loaded with bowlders taken from the beach. An apron of bowlders about 5 feet wide is placed at the outer end of the spurs, extending the whole length of the bulkhead.

A survey of the beach covering that portion repaired during the year, and connecting with previous surveys of the northern end of the beach, was made during the latter part of June, 1886. The resultant chart accompanies this report.

The whole length of beach is now in good order.

The balance available July 1, 1886 ($1,059.69) it is proposed to reserve for any urgent necessary repairs of Long Beach that may occur.

To complete the modified project will require the appropriation of $21,500, all of which could be profitably expended during the fiscal year ending June 30, 1888, in the following manner:

Widening the channel to 150 feet and deepening it to 9 feet, 44,574 cubic yards	$13,500
Deepening the basin to 9 feet, 20,000 cubic yards	6,000
Contingencies	2,000
Total	21,500

This work is located in the collection district of Plymouth, Mass., of which Plymouth is the port of entry. The nearest light-houses are the Plymouth (Gurnet) lights, about 5 miles from Plymouth, and Duxbury Pier Light, distant about 2 miles.

The accompanying commercial statistics for the fiscal year ending June 30, 1886, have been furnished by the collector of customs for the port of Plymouth, Mass.

Money statement.

July 1, 1885, amount available		$3,317 50
July 1, 1886, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1885	$1,900 63	
July 1, 1886, outstanding liabilities	357 18	
		2,257 81
July 1, 1886, amount available		1,059 69
Amount appropriated by act approved August 5, 1886		6,000 00
Amount available for fiscal year ending June 30, 1887		7,059 69

PLYMOUTH HARBOR, MASS.

Plan showing location of
works of preservation and improvement at
LONG BEACH

SCALE OF PLAN (1:12,000)

At a,b,c,d,e & f. Framework bulkheads built previous to 1870 (partly [illegible])

Between g & h, Bulkhead of 3 rows of 3-cornered piles with brush and stone, built in 1870-71 (now [illegible])

" i.k. Stone wall with [illegible] complete [illegible] in 1871

l.k. Stone and brush groins built [illegible]

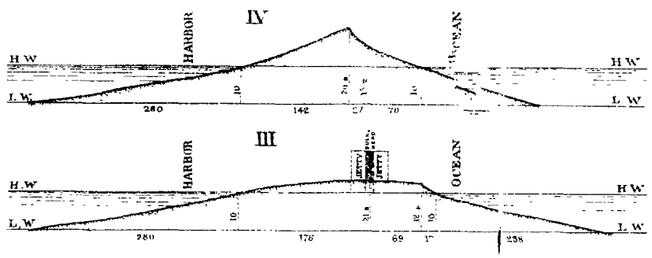
" m n. Stone breakwater built in 1872 - 1873

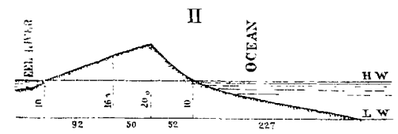
" o.p Sandcatch [illegible] and stone built in 1883

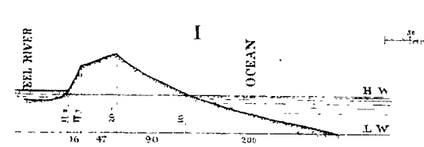
" q. Two large trow[illegible] built previous to 1870 (One now 2 runs [illegible])

At AB ...K Bulkheads and [illegible] of framework filled with brush [illegible] in 1886

North or seaward [illegible] compiled from surveys prior to 1881 [illegible] special survey made in June 1886





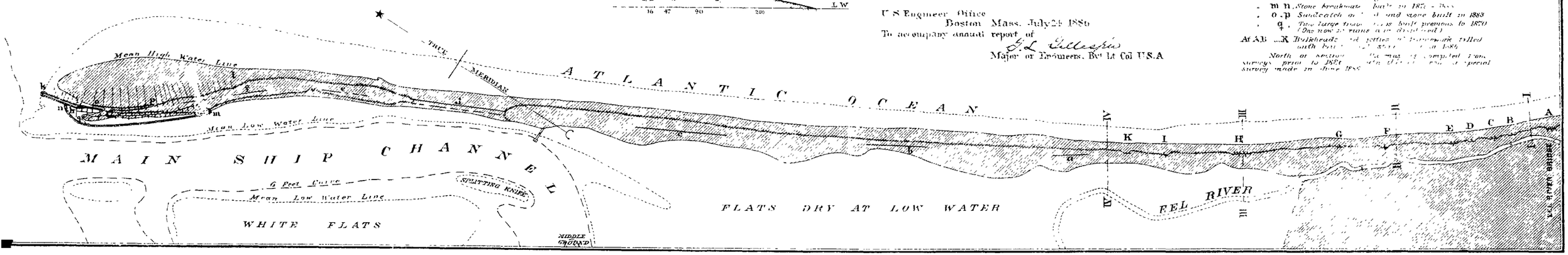


SCALE OF PROFILES

HORIZONTAL (1" 2400)

VERTICAL (1" 450)

U S Engineer Office
Boston Mass. July 24 1886
To accompany annual report of
G L Gillespie
Major of Engineers, Bvt Lt Col U.S.A



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THE AMERICAN GRAPHIC CO, N.Y.

Amount (estimated) required for completion of existing project	$15,500 00
Amount that can be profitably expended in fiscal year ending June 30, 1888	15,500 00

Submitted in compliance with requirements of section 2 of river and harbor acts of 1866 and 1867.

COMMERCIAL STATISTICS.

CUSTOM-HOUSE, PLYMOUTH, MASS.,
Collector's Office, June 30, 1886.

SIR: I have the honor to forward to you a report of receipts and disbursements of revenue at this port, the amount of merchandise in bond, domestic arrivals and clearances, composition of cargoes, arrival and departure of all vessels for a harbor and otherwise, estimated number of passengers by steamers, &c., estimate amount of annual business of the port, and Government property here located, and other statistics that may be of possible value to you in your official estimates.

Revenue:	
Official collections from all sources	$30,901 25
Disbursements	2,442 43
Net amount	28,458 82

	Pounds.
Foreign imports:	
Rivet rods	2,130,302
Basic steel	1,874,205
Salt	22,400
Wool	2,778
Total	4,039,685
Foreign exports:	
Cordage	76,848
Remaining in bond:	
Rivet rods	1,344,228

Articles.	No. of cargoes.	Tons.
DOMESTIC IMPORTS.		
Coal	65	17,680
Scrap-iron	12	2,091
Lumber	24	4,000
Fish	9	300
Hay	9	670
Molding sand	1	200
Granite	2	200
Tar	1	150
Miscellaneous (by packets, steamers, &c.)	90	12,000
Total	213	37,291
DOMESTIC EXPORTS.		
Wood	10	700
Nails	9	650
Fish	2	175
Barrels	4	70
Gravel	43	3,800
Total	68	5,395

SUMMARY.

Number of cargoes: imports and exports	281
Tons of merchandise: imports and exports	42,686
Arriving and sailing of all vessels for harbor and other purposes, estimated number	2,300
Number of passengers arriving and departing by steamers, packets, &c., estimated	45,000

BONDED WAREHOUSES.

There are seven bonded warehouses, in which are stored foreign goods now in bond, all in charge of Government.

GOVERNMENT PROPERTY AT THIS PORT.

One double light-house at Gurnet Head.
One single light-house at Duxbury Pier.
One first-class life-saving station at the Gurnet.
One first-class life-saving station at Manomet Point.
One rented custom-house, with furniture, records and files dating from 1773 to date.
One rented post-office and contents.

All thus far enumerated is property in Government hands at this port, all of which is directly benefited by Government surveys and appropriations.

As this is the first and probably the only statement we shall have the honor to forward to you, we have taken the liberty to add to it the business statistics of the port, by which you will see that it is largely dependent on its harbor facilities, and that appropriations and surveys by Government have been turned to good account, and that there is still room for further improvement.

MANUFACTURING INDUSTRY.

The aggregate capital of twenty-two of the principal manufactories amounts to $2,017,000, manufacturing cordage, cottons, woolens, duck, iron, nails, tacks and rivets, zinc, castings, and other staple goods, valued annually, $3,372,000.

The aggregate banking capital is $3,335,377. All this capital receives a direct benefit from the improvements and protection of this harbor by the General Government.

Through the fostering care of the Government and the deepening and widening of its channel it has already become a noted sea side resort, and the steadily increasing number of visitors for business and pleasure by steamers from Boston and elsewhere that are daily landed here gives the best evidence that what has thus far been accomplished by Government is, as it should be, well appreciated in all its parts, and of great benefit not only to the town, but to the community at large.

As the Department calls for "suggestions," we would respectfully suggest that Long Beach, that forms the protection of Plymouth Inner Harbor, was severely injured in the storms of the last winter; and whatever is done for the benefit of this harbor, Long Beach should be the first object of attention, as without it our harbor would be but an open "sea-way," and thus become useless to navigation and an injury to the town almost beyond estimation. We would suggest that if the appropriation of $6,000 now before the House should be granted, that so far as is wanted it should be used for this especial object.

The channel cut by the Government requires more width and depth to make it the more useful, but Long Beach is of the most importance. We only make the above suggestions from the fact they are called for, as we believe that Government engineers are the best and only sure evidence in all cases where needed.

Very respectfully, your obedient servant,

SAMUEL H. DOTEN,
Collector of Customs.

G. L. GILLESPIE,
Major of Engineers, Bvt. Lieut. Col., U. S. A.

11. *Plymouth Harbor, Massachusetts.*—The object of this improvement is to protect the harbor by the preservation of Long Beach, which covers it, and to deepen and widen the channels of approach to an enlarged basin for anchorage opposite the town wharves.

The various devices employed for the purpose of preserving Long Beach are described in the Annual Report of the Chief of Engineers for the year 1877.

The original project for the improvement of the harbor was adopted in 1875. It was modified in 1877 and again in 1884. The modified project proposed an improved channel, 2,286 feet long, 150 feet wide, and 9 feet deep at mean low water, and an anchorage basin 866 feet long, 150 feet wide, and 9 feet deep at mean low water. In 1885 it was estimated that $22,500 would complete the project.

Before improvement there was about 6 inches of water in the channel at mean low water.

From 1866 to date $114,800 have been appropriated for this harbor.

The expenditures to June 30, 1886, were:

For beach protection	$72,587.56
For dredging	35,152.75
Total	107,740.31

During the fiscal year ending June 30, 1887, 14,812 cubic yards of material were dredged from the channel and basin. The channel is 115 feet wide and 9 feet deep at mean low water; one-half the basin has 9 feet depth, and the balance from 7 feet to 3 feet depth.

Dredging operations in the basin are still in progress.

The balance available July 1, 1887, $2,957.39, will be expended in completing the existing contract.

To complete the modified project will require the appropriation of $15,500, all of which, in the opinion of the officer in charge, could be expended during the fiscal year ending June 30, 1889.

July 1, 1886, amount available		$1,059.69
Amount appropriated by act approved August 5, 1886		6,000.00
		7,059.69
July 1, 1887, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1886	$1,125.22	
July 1, 1887, outstanding liabilities	2,977.08	
		4,102.30
July 1, 1887, amount available		2,957.39
Amount (estimated) required for completion of existing project		15,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1889		10,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.

(See Appendix B 11.)

B 11.

IMPROVEMENT OF HARBOR AT PLYMOUTH, MASSACHUSETTS.

The object of this improvement is to protect the harbor by the preservation of Long Beach which covers it, and to deepen and widen the channels of approach to an enlarged basin for anchorage, opposite the wharves at Plymouth.

The preservation of Long Beach has been carefully attended to for many years, as the existence of the harbor depends on it, and from the nature of the work it can at no time be considered completed and permanent; small annual appropriations are necessary to immediately repair any damage caused by storms.

The various devices employed for this purpose are described in the Annual Report of the Chief of Engineers for 1877.

The project for the improvement of the main channel was originally adopted in 1875. It provided for straightening the channel so that its length would be 2,286 feet, gave it a width of 100 feet and a depth of 6 feet at mean low water. This project was modified in 1877, so as to include the dredging of a basin 866 feet long, 150 feet wide, and 8 feet deep in front of the city wharves. This modified project was estimated to cost $41,500. The project was again modified in 1884. It was then proposed to dredge the channel to a depth of 9 feet at mean low water, widen it to 150 feet, and round off its junctions with the main ship channel and the basin. In 1885 it was proposed to deepen the basin to 9 feet at mean low water.

The modified project required the excavation of 81,000 cubic yards (scow measurement), and was originally estimated to cost $27,000. This amount was revised in 1885, in accordance with the low prices for dredging then current, and the cost of the work was then estimated to be $22,500.

Before improvement the channel to the town wharves was about 6 inches deep at mean low water.

From 1866 to date the amount appropriated for this improvement was $114,800, of which amount there had been expended to June 30, 1886:

For beach protection	$72,587.56
For dredging	35,152.75
Total	107,740.31

The condition of the improvement June 30, 1886, was as follows:

The beach was essentially in good order. The improvements applied to the closing of the breaches made through the beach in 1885 and 1886 have had the result of causing sand and gravel to accumulate at the weak points, and to make them comparatively secure against future damages.

The dredged channel leading from the main channel to the inner basin was 90 feet wide and 9 feet deep at mean low water, and could be easily entered and left.

The inner basin had less than 7 feet depth at mean low water.

The river and harbor act of August 5, 1886, appropriated $6,000 for continuing the improvement.

Sealed proposals were opened October 12, 1886, after public advertisement, according to law, for dredging 18,000 cubic yards, more or less, of material from the channel leading to the basin, and the contract was awarded to the New England Dredging Company, the lowest bidder, at 24 cents per cubic yard, scow measurement.

Work under the contract was begun May 26, 1887, and at the close of the fiscal year 14,812 cubic yards had been removed. The contract is still in progress.

The improved channel is now 115 feet wide and 9 feet deep at mean low water, and extends with full width and depth from the main ship-channel through the north side of the basin to the wharves at Plymouth.

To complete the modified project will require the appropriation of $15,500, all of which could be profitably expended during the fiscal year ending June 30, 1889, in deepening the basin to 9 feet at mean low water and in enlarging its approaches.

The river and harbor act of July 5, 1884, provided for the examination of "Goose Point Channel in Plymouth Harbor, to the wharf of the Cordage Company." The examination was made and a report submitted

by the local engineer, dated September 4, 1884. (Annual Report, Chief of Engineers, 1885, Part I, page 538.) It is stated in that report that the Goose Point is not a low-water channel, and that the cost of excavating a channel 5,940 feet long, 100 feet wide, and 5 feet deep at mean low water will be $42,000.

No appropriation has been made for this improvement.

During the fiscal year $4,102.30 were expended.

The balance available July 1, 1887, will be expended in completing the existing contract and in making such repairs to Long Beach as may become necessary from storm action.

Plymouth Harbor is located in the collection district of Plymouth, Mass., of which Plymouth is the port of entry. The nearest light-houses are the Plymouth (Gurnet) Lights, about 5 miles from Plymouth, and Duxbury Pier Light, about 2 miles distant.

The accompanying commercial statistics for the fiscal year ending June 30, 1887, have been furnished by the collector of customs at Plymouth, Mass.

Money statement.

July 1, 1886, amount available		$1,059.69
Amount appropriated by act approved August 5, 1886		6,000.00
		7,059.69
July 1, 1887, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1886	$1,125.22	
July 1, 1887, outstanding liabilities	2,977.08	
		4,102.30
July 1, 1887, amount available		2,957.39
Amount (estimated) required for completion of existing project		15,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1889		15,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.		

Abstract of proposals for dredging in Plymouth Harbor, Massachusetts, opened October 12, 1886, by Major G. L. Gillespie, Corps of Engineers.

No.	Name of bidder.	Price bid per cubic yard measured in scows.
		Cents.
1	New England Dredging Company, per C. H. Souther, president*	24
2	Bay State Dredging Company, per A. B. Martin, proprietor	26
3	Augustus R. Wright	30
4	Robert Hamilton, jr	30

*Lowest bid.

Contract for dredging was awarded to the New England Dredging Company, with the approval of the Chief of Engineers.

COMMERCIAL STATISTICS FOR THE FISCAL YEAR ENDING JUNE 30, 1887.

Revenue collected	$77,698.14
Foreign arrivals and clearances (tonnage, 1,688)	4
Domestic arrivals and clearances (tonnage, 14,312)	109
Vessels registered in port (tonnage, 536)	8
Passengers landed by steamers, about	25,000

14. *Plymouth Harbor, Massachusetts.*—Plymouth Harbor is 30 miles south of Boston. The object of its improvement is to perpetuate the harbor by the preservation of Long Beach, which forms it, and to deepen and widen the channels of approach to an enlarged anchorage basin in in front of the town wharves.

The various devices employed for the preservation of Long Beach are described in the Annual Report of the Chief of Engineers for the year 1877.

The original project for improvement was adopted in 1875, and modified in 1877 and 1884. The modified project proposed an improved channel 2,286 feet long, 150 feet wide, and 9 feet deep at mean low water; leading to an anchorage basin 866 feet long, 150 feet wide, and 9 feet deep, at mean low water.

From 1866 to date $114,800 have been appropriated for this harbor. The expenditures to June 30, 1888, were:

For beach protection	$72,587.56
For dredging, etc	42,212.44
Total	114,800.00

During the fiscal year 8,312 cubic yards were dredged from the improved channel and basin. The channel is 115 feet wide and 9 feet deep at mean low water; the basin is 800 feet long, 9 feet deep for 90 feet of its width, nearest the town wharves, with an average of 5 feet deep for the remainder.

A survey of the improvement made in June, 1888, showed no deterioration since operations were suspended in July, 1887.

Long Beach is in good order throughout.

No balance is available July 1, 1888.

To complete the present project will cost $9,500.

The prospective benefits to commerce are increased facilities and safety to navigation.

July 1, 1887, amount available	$2,957.39
July 1, 1888, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1887	2,957.39
Amount appropriated by act of August 11, 1888	6,000.00
Amount (estimated) required for completion of existing project	9,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1890	9,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.

(See Appendix B 11.)

B 11.

IMPROVEMENT OF PLYMOUTH HARBOR, MASSACHUSETTS.

Plymouth Harbor is situated 30 miles south of Boston. Its outer anchorage, the "Cow-Yard," is common to Plymouth, Kingston, and Duxbury, and is the only refuge for sea-going vessels from northeasterly gales when caught between Boston and Provincetown, a distance of about 75 miles, following the coast-line. The entrance to this outer anchorage is direct, unobstructed, of ample width, and sufficiently deep for the wants of commerce. The anchorage is capacious, and has good "holding ground," but the extensive tidal basins inside of it give rise to strong variable currents across it.

The inner or harbor proper is formed by Long Beach, a narrow low sand-spit 3 miles long, which runs generally parallel to the mainland and about a mile from it.

The harbor contains 2,000 acres, almost all of which is dry at low tide. A few narrow, crooked, shallow channels traverse these flats. These

channels join about the center of the harbor, opposite the town wharves, and form the main ship-channel, 150 feet wide approximately and 10 feet deep at mean low water, which runs directly behind the northern half of Long Beach to the outer anchorage.

The maintenance of this inner harbor and channel depends on the preservation of Long Beach.

Before improvement about 6 inches depth only of water could be carried to the town wharves at low tide.

Previous to 1875 the project was a general one, and had for its object the *preservation* only of Long Beach. From the nature of the work it can at no time be considered completed, and small annual appropriations are necessary to repair any damage done by storms. The various devices employed for this purpose are described in the Annual Report of the Chief of Engineers for 1877, all of which have been remarkably successful.

The project for the *improvement* of the harbor was first adopted in 1875. It provided for dredging a channel from the town wharves to the main ship-channel, 2,286 feet long, 100 feet wide, and 6 feet deep at mean low water. This project was modified in 1877 so as to include the dredging of a basin 866 feet long, 150 feet wide, and 8 feet deep, directly in front of the town wharves.

In 1884 and 1885 it was proposed to deepen the improved channel and basin to 9 feet at mean low water, and to make their approaches more easy.

The modified project of 1884 required the excavation of 81,000 cubic yards (scow measurement), and was originally estimated to cost $27,000.

This estimate was revised in 1885, in accordance with the low prices then current for dredging, and the cost was then estimated to be $22,500. From 1866 to date the amount appropriated for this improvement was $114,800, of which there had been expended to June 30, 1888:

For beach protection	$72,587.56
For dredging, etc	42,212.44

During the fiscal year ending June 30, 1888, 8,312 cubic yards of material were removed from the improved channel and basin under a contract with the New England Dredging Company, dated October 22, 1886. This contract was satisfactorily completed in July, 1887, and a total of 23,124 cubic yards were dredged at a contract price of 24 cents per yard. A small bowlder developed by the dredging was removed by hired labor in August, 1887.

During the latter part of the fiscal year a survey of the dredged basin and channel was made, and lines of soundings were also run over the main ship-channel to its junction with the outer anchorage. This survey shows that the basin and improved channel have not deteriorated since dredging was suspended in July, 1887, though it is noticed that extensive changes have taken place in the shoals surrounding the main ship-channel, especially between Plymouth Beacon and Duxbury Pier Light, since the survey of 1870. The channel is, however, essentially uninjured, and at least 9 feet depth at low water can be carried to the town wharves. A chart showing the results of the survey accompanies this report.

The condition of the improvement on June 30, 1888, is as follows: The improved channel was 115 feet in width, 9 feet in depth for 90 feet of its width nearest the town wharves, and the remainder averaged 5 feet depth. Long Beach was in good order throughout and the works of preservation on it required no repairs or extensions.

PLYMOUTH HARBOR, MASS.

PLAN SHOWING CONDITION OF THE CHANNEL FROM THE "COW YARD" TO THE WHARVES

TO ACCOMPANY ANNUAL REPORT OF

LT. COL. GEO. L. GILLESPIE, CORPS OF ENGRS. U.S.A.

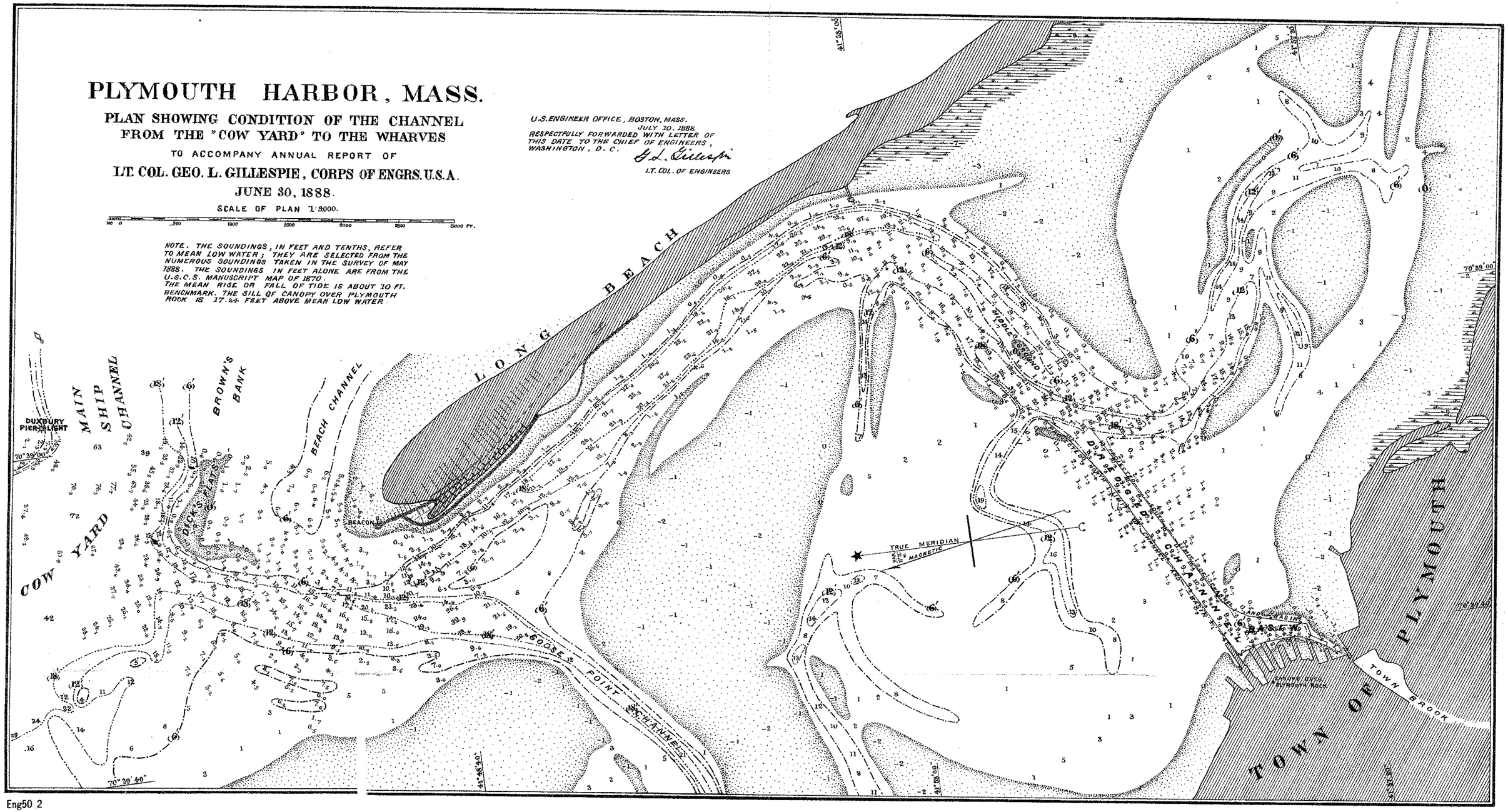
JUNE 30, 1888.

SCALE OF PLAN 1:2000.

U.S. ENGINEER OFFICE, BOSTON, MASS.
JULY 20. 1888
RESPECTFULLY FORWARDED WITH LETTER OF THIS DATE TO THE CHIEF OF ENGINEERS, WASHINGTON, D. C.

G. L. Gillespie
LT. COL. OF ENGINEERS

NOTE. THE SOUNDINGS, IN FEET AND TENTHS, REFER TO MEAN LOW WATER; THEY ARE SELECTED FROM THE NUMEROUS SOUNDINGS TAKEN IN THE SURVEY OF MAY 1888. THE SOUNDINGS IN FEET ALONE ARE FROM THE U.S.C.S. MANUSCRIPT MAP OF 1870. THE MEAN RISE OR FALL OF TIDE IS ABOUT 10 FT. BENCHMARK. THE SILL OF CANOPY OVER PLYMOUTH ROCK IS 17.24 FEET ABOVE MEAN LOW WATER.



Eng50.2

No appropriation was made for the fiscal year ending June 30, 1888. The river and harbor bill (not yet passed) for the fiscal year ending June 30, 1889, contains an item of $3,000 for continuing the improvement, and if this sum should be appropriated it will be applied towards completing the project by widening and deepening the basin. This work done, there will still be required the sum of $9,500 to complete the project. An appropriation of $9,500 is recommended for continuing the improvement for the fiscal year ending June 30, 1890.

The prospective benefits to commerce are increased facilities and safety in navigating the improved channel.

Plymouth Harbor is located in the collection district of Plymouth, Mass., of which Plymouth is the port of entry. The nearest light-houses are the Plymouth (Gurnet) lights, about 5 miles from Plymouth, and Duxbury Pier Light, about 2 miles distant.

The accompanying commercial statistics for the fiscal year ending June 30, 1888, have been furnished by the collector of customs at Plymouth, Mass.

Money statement.

July 1, 1887, amount available	$2,957.39
July 1, 1888, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1887	2,957.39
Amount appropriated by act of August 11, 1888	6,000.00
Amount (estimated) required for completion of existing project	9,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1890	9,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

COMMERCIAL STATISTICS.

Commercial statistics for the fiscal year ending June 30, 1888.

Revenue collected during the fiscal year ending June 30, 1888	$91,919.97
Derived from the following sources, namely:	
Duties on imports from hemp	42,205.42
Duties on imports from sisal-grass	13,504.50
Duties on imports from rivet-wire rods	18,711.86
Duties on imports from wool	10,710.80
Duties on imports from bar iron	7,745.84
Duties on imports from steel bars	3,944.70
Duties on imports from salt and lumber	96.85
Total	91,919.97

Shipping.	No. of vessels.	Tonnage.
Foreign entrances	3	1,327
Foreign clearances	5	1,648

Coastwise entrances were 114 in number, namely:

78 cargoes of coal	tons	27,300
25 cargoes of lumber	feet	2,700,000
3 cargoes of granite	tons	300
3 cargoes of cement and lime	do	600
2 cargoes of brick	do	240
2 cargoes of hay	do	120
1 cargo of tar	bbls	1,775

The above items do not include ordinary packet running, and in addition thereto a steamer runs regularly during the summer months.

13. *Plymouth Harbor, Massachusetts.*—Plymouth Harbor is 30 miles south of Boston. The object of its improvement is to perpetuate the harbor by the preservation of Long Beach, which forms it; and to deepen and widen the channels of approach to an enlarged anchorage basin in front of the town wharves.

The various devices employed for the preservation of Long Beach are described in the Annual Report of the Chief of Engineers for the year 1877.

The original project for improvement was adopted in 1875, and modified in 1877 and 1884. The modified project proposed an improved channel 2,286 feet long, 150 feet wide, and 9 feet deep at mean low water.

From 1866 to date, $120,800 have been appropriated for this harbor.

The expenditures to June 30, 1888, were, for beach protection, $72,587.56; for dredging, etc., $42,212.44; total, $114,800.

The channel was 115 feet wide, 9 feet deep at mean low water; the basin was 800 feet long, 9 feet deep for 90 feet of its width nearest the town wharves, and averaged 5 feet deep for the remainder of its width.

During the fiscal year a contract was entered into to dredge 13,000 cubic yards from the basin; the contract expires December 31, 1889. No operations under it have been in progress during the fiscal year.

Four breaches in Long Beach, aggregating 370 feet in length, were closed with bulkheads of plank by hired labor, at a cost of $444.17.

The condition of the improvement on June 30, 1889, is essentially the same as at the close of the last year.

To complete the present project, and to provide funds for necessary and probable repairs to Long Beach, will require an appropriation of $17,500.

The prospective benefits to commerce are increased facilities and safety to navigation.

Amount appropriated by act of August 11, 1888		$6,000.00
July 1, 1889, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1888	$502.75	
July 1, 1889, amount covered by existing contracts	3,883.75	
		4,386.50
July 1, 1889, balance available		1,613.50

Amount (estimated) required for completion of existing project	17,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1891	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

(See Appendix B 13.)

B 13.

IMPROVEMENT OF HARBOR AT PLYMOUTH, MASSACHUSETTS.

Plymouth Harbor is situated 30 miles south of Boston. Its outer anchorage, the "Cow Yard," is common to Plymouth, Kingston, and Duxbury, and is the only refuge for sea-going vessels from northeasterly gales when caught between Boston and Provincetown, a distance of about 75 miles, following the coast line. The entrance to this outer anchorage is direct, unobstructed, and of ample width, and sufficiently deep for the wants of commerce. The anchorage is capacious, and has good "holding-ground," but the extensive tidal basins inside of it give rise to strong variable currents across it.

The inner or harbor proper is formed by Long Beach, a narrow, low sand-spit 3 miles long, which runs generally parallel to the mainland and about a mile from it.

The harbor contains 2,000 acres, almost all of which is dry at low tide. A few narrow, crooked, shallow channels traverse these flats. These channels join about the center of the harbor, opposite the town wharves, and form the main ship-channel, 150 feet wide, approximately, and 10 feet deep at mean low water, which runs directly behind the northern half of Long Beach to the outer anchorage.

The maintenance of this inner harbor and channel depends on the preservation of Long Beach.

Before improvement about 6 inches depth of water could be carried to the town wharves at low tide.

A chart of the harbor was published in the Annual Report of the Chief of Engineers for the year 1888, Part I, page 460.

Previous to 1875 the project was a general one, and had for its object the *preservation* only of Long Beach. From the nature of the work it can at no time be considered completed, and small annual appropriations are necessary to repair any damage done by storms. The various devices employed for this purpose are described in the Annual Report of the Chief of Engineers for 1877, all of which have been remarkably successful.

The project for the *improvement* of the harbor was first adopted in 1875. It provided for dredging a channel from the town wharves to the main ship-channel, 2,286 feet long, 100 feet wide, and 6 feet deep at mean low water. This project was modified in 1877 so as to include the dredging of a basin 866 feet long, 150 feet wide, and 8 feet deep, directly in front of the town wharves.

In 1884 and 1885 it was proposed to deepen the improved channel and basin to 9 feet at mean low water, and to make the approaches more easy.

The modified project of 1884 required the excavation of 81,000 cubic yards (scow measurement), and was originally estimated to cost $27,000. This estimate was revised in 1885, in accordance with the low prices then current for dredging, and the cost was then estimated to be $22,500.

From 1866 to date the amount appropriated for this improvement was $120,800, of which there had been expended to June 30, 1888,

For beach protection	$72,587.56
For dredging etc	42,212.44
Total	114,800.00

The condition of the improvement on June 30, 1888 was as follows: The improved channel was 115 feet in width, 9 feet in depth at mean low water; the basin was 800 feet in length, 9 feet in depth for 90 feet of its width nearest the town wharves, and the remainder averaged 5 feet in depth; Long Beach was in good order throughout, and the works of preservation on it required no repairs or extension.

On August 24, 1888, a project was submitted for the expenditure of the sum of $6,000 made available for this improvement by the river and harbor act of August 11, 1888.

This project proposed to reserve $1,000 for probable necessary repairs to Long Beach, and to expend $5,000 in enlarging "the basin" to its full projected dimensions.

This project was approved September 14, 1888. Specifications and advertisement for the proposed work were prepared and issued, and bids received were opened November 1, 1888. A copy of the proposals received will be found in the annexed table.

A contract was entered into with Mr. Augustus R. Wright on November 26, 1888, to dredge 13,000 cubic yards, more or less, from "the basin" at 29⅞ cents per yard, scow measurement. This contract expires December 31, 1889, and no operations have been in progress under it during the fiscal year.

In November, 1888, an easterly storm caused four serious breaches in the northern part of Long Beach; they were at once closed with plank bulkheads aggregating 370 feet in length. This work was done by hired labor and cost $444.17.

On June 30, 1889, the improved channel and basin are in the same condition essentially as at the close of the last fiscal year. Some repairs and extensions to the existing bulkheads on Long Beach are required, which it is estimated will cost $1,500.

To complete the project will require, at present rates for dredging, an appropriation of $14,500.

A small sum should always be available for the harbor, to immediately repair any damage made by storms to Long Beach. These necessary repairs have in the last twenty years averaged $1,500.

During the fiscal year ending June 30, 1891, an appropriation of $17,500 could be expended to advantage for dredging, for necessary repairs and extensions of the present bulkheads on Long Beach, and for the repair of probable storm damages.

The prospective benefits to commerce are increased facilities and safety in navigating the improved channel.

Plymouth Harbor is located in the collection district of Plymouth, Mass., of which Plymouth is the port of entry.

The nearest light-houses are the Plymouth (Gurnet) lights about 5 miles from Plymouth, and Duxbury Pier Light, about 2 miles distant.

The accompanying commercial statistics for the fiscal year ending June 30, 1889, have been furnished by the collector of customs at Plymouth, Mass.

Money statement.

Amount appropriated by act of August 11, 1888		$6,000.00
July 1, 1889, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1888	$502.75	
July 1, 1889, amount covered by existing contracts	3,883.75	
		4,386.50
July 1, 1889, balance available		1,613.50
Amount (estimated) required for completion of existing project		17,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1891		17,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.

Abstract of proposals for dredging in Plymouth Harbor, Mass., opened November 1, 1888, by Lieut. Col. G. L. Gillespie, Corps of Engineers.

No.	Name of bidder.	Price bid for— Dredging per cubic yard, measured in scows.	Price bid for— The removal of bowlders weighing over 3 tons, per cubic yard.
		Cents.	
*1	Augustus R. Wright	20¾	$10
2	National Dredging Company, by George G. Barker, vice-president	30	.....
3	Bay State Dredging Company, by A. B. Martin, proprietor	35	.....
†4	Boynton Bros	32	12

* Lowest bid. † Bid informal.

Contract awarded to Augustus R. Wright, with the approval of the Chief of Engineers.

COMMERCIAL STATISTICS.

Shipping.	Foreign. Number.	Foreign. Tonnage.	Foreign. Value.	Domestic. Number.	Domestic. Tonnage.	Domestic. Value.
Entrances	4	1,329	$67,663	117	17,012	$185,585
Clearances	5	1,523	5,790	119	17,165	.....

Amount of revenue collected	$100,562.58	Merchandise ... tons	463
Coal imported ... tons	20,897	Miscellaneous imports ... do	650
Iron imported ... do	450	Lumber imported ... feet	4,055,000
Cordage exported (value $45,900) tons	320	Value of machinery exported	$5,790

The vessels frequenting the port are principally schooners from 8 to 12 feet draught

13. *Plymouth Harbor, Massachusetts.*—Plymouth Harbor is 30 miles south of Boston.

The object of its improvement is to perpetuate the harbor by the preservation of Long Beach, which forms it; and to deepen and widen the channels of approach to an enlarged anchorage basin in front of the town wharves.

The various devices employed for the preservation of Long Beach are described in the Annual Report of the Chief of Engineers for the year 1877.

The original project for improvement was adopted in 1875 and modified in 1877 and 1884. The modified project proposed an improved channel 2,286 feet long, 150 feet wide, and 9 feet deep at mean low water.

The expenditures to June 30, 1889, were, for beach protection, $73,031.73; for dredging, $42,271.02; total, $115,302.75.

At that date the channel was 115 feet wide, 9 feet deep at mean low water; the basin was 800 feet long, 9 feet deep for 90 feet of its width nearest the town wharves, and averaged 5 feet deep for the remainder of its width.

On June 30, 1889, a contract was in force to dredge 13,000 cubic yards from the basin. During the year 13,000 cubic yards were dredged under this contract, at a cost of $5,169.57, from the basin, and at the date of this report the basin is 800 feet long, averages 150 feet wide, 9 feet deep at mean low water.

The improved channel and the condition of Long Beach are the same as at the date of the last report.

The prospective benefits to commerce are increased facilities and safety to navigation.

July 1, 1889, amount available	$1,613.50
July 1, 1890, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1889	285.82
July 1, 1890, balance available	1,327.68
Amount appropriated by act of September 19, 1890	8,000.00
Amount available for fiscal year ending June 30, 1891	9,327.68
Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	9,500.00

(See Appendix B 13.)

B 13.

IMPROVEMENT OF HARBOR AT PLYMOUTH, MASSACHUSETTS.

Plymouth Harbor is situated 30 miles south of Boston. Its outer anchorage, the "Cow Yard," is common to Plymouth, Kingston, and Duxbury, and is the only refuge for sea-going vessels from northeasterly gales when caught between Boston and Provincetown, a distance of about 75 miles, following the coast-line. The entrance to this outer anchorage is direct, unobstructed, and of ample width, and sufficiently deep for the wants of commerce. The anchorage is capacious and has good "holding ground," but the extensive tidal basins inside of it give rise to strong variable currents across it.

The inner or harbor proper is formed by Long Beach, a narrow, low sand-spit 3 miles long, which runs generally parallel to the mainland and about a mile from it.

The harbor contains 2,000 acres, almost all of which is dry at low tide. A few narrow, crooked, shallow channels traverse these flats. These channels join about the center of the harbor, opposite the town wharves, and form the main ship-channel, 150 feet wide, approximately, and 10 feet deep at mean low water, which runs directly behind the northern half of Long Beach to the outer anchorage.

The maintenance of this inner harbor and channel depends on the preservation of Long Beach.

Before improvement about 6 inches depth of water could be carried to the town wharves at low tide.

A chart of the harbor was published in the Annual Report of the Chief of Engineers for the year 1888, Part 1 page 460.

Previous to 1875 the project was a general one and had for its object the *preservation* only of Long Beach. From the nature of the work it can at no time be considered completed, and small annual appropriations are necessary to repair any damage done by storms. The various devices employed for this purpose are described in the Annual Report of the Chief of Engineers for 1877, all of which have been remarkably successful.

The project for the *improvement* of the harbor was first adopted in 1875. It provided for dredging a channel from the town wharves to the main ship-channel 2,286 feet long, 100 feet wide, and 6 feet deep at mean low water. This project was modified in 1877 so as to include the dredging of a basin 866 feet long, 150 feet wide, and 8 feet deep, directly in front of the town wharves.

In 1884 and 1885 it was proposed to deepen the improved channel and basin to 9 feet at mean low water, and to make the channel 150 feet wide.

The modified project of 1884 required the excavation of 81,000 cubic yards (scow measurement), and was originally estimated to cost $27,000. This estimate was revised in 1885, in accordance with the low prices then current for dredging, and the cost was then estimated to be $22,500.

From 1866 to date the amount appropriated for this improvement was $120,800, of which there had been expended to June 30, 1889—

For beach protection	$73,031.73
For dredging, etc	42,271.02
Total	115,302.75

The condition of the improvement on June 30, 1889, was as follows:

The improved channel was 115 feet in width, 9 feet in depth at mean low water; the basin was 800 feet in length, 9 feet in depth for 90 feet

of its width nearest the town wharves, and the remainder averaged 5 feet in depth; some repairs and extensions to the existing bulkheads on Long Beach were required.

At the beginning of the year a contract was in force with Mr. Augustus R. Wright to dredge 13,000 cubic yards, more or less, from the basin at 29⅞ cents per yard, scow measurement. Operations under this contract were commenced in October, 1889, and completed in November, 1889; 13,000 cubic yards were dredged from the basin, leaving it 800 feet long, with an average width of 150 feet, 9 feet deep at mean low water.

To complete the project will require, at present rates for dredging, an appropriation of $14,500.

A small sum should always be available for the harbor, to immediately repair any damage made by storms to Long Beach. These necessary repairs have in the last twenty years averaged $1,500.

During the fiscal year ending June 30, 1892, an appropriation of $17,500 could be expended to advantage for dredging, for necessary repairs and extensions of the present bulkheads on Long Beach, and for the repair of probable storm damages.

The prospective benefits to commerce are increased facilities and safety in navigating the improved channel.

Plymouth Harbor is located in the collection district of Plymouth, Mass., of which Plymouth is the port of entry.

The nearest light-houses are the Plymouth (Gurnet) lights, about 5 miles from Plymouth, and Duxbury Pier Light, about 2 miles distant.

The accompanying commercial statistics for the fiscal year ending June 30, 1890, have been furnished by the collector of customs at Plymouth, Mass.

Money statement.

July 1, 1889, amount available	$1,613.50
July 1, 1890, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1889	285.82
July 1, 1890, balance available	1,327.68
Amount appropriated by act of September 19, 1890	8,000.00
Amount available for fiscal year ending June 30, 1891	9,327.68
Amount (estimated) required for completion of existing project	9,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1892. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	9,500.00

COMMERCIAL STATISTICS.

Amount of revenue collected, $108,174.31.

Shipping.	Foreign.		Domestic.	
	No.	*Tons.*	*No.*	*Tons.*
Entrances	2	1,864	124	18,104
Clearances	10	1,443	120	17,148

Imported:	*Tons.*	Imported:	*Tons.*
Coal	23,500	Lumber	9,800
Iron	1,325	Miscellaneous	975

Vessels of all kinds from 8 to 14 feet draught frequent the harbor.

No increase in the tonnage of the harbor is apparent since the improvement was commenced, and no new lines of water transportation have been established.

15. *Plymouth Harbor, Massachusetts.*—Plymouth Harbor is 30 miles south of Boston.

The object of its improvement is to perpetuate the harbor by the preservation of Long Beach which forms it, and to deepen and widen the channels of approach to an enlarged anchorage basin in front of the town wharves.

The various devices employed for the preservation of Long Beach are described in the Annual Report of the Chief of Engineers for the year 1877.

The original project for improvement was adopted in 1875 and modified in 1877 and 1884. The modified project proposed an improved channel 2,286 feet long, 150 feet wide, and 9 feet deep at mean low water, leading to an anchorage basin 866 feet long, 150 feet wide, and 9 feet deep at mean low water.

From 1866 to date, $128,800 has been appropriated for this harbor. The expenditures to June 30, 1890, were:

For beach protection	$76,915.48
Dredging	42,556.84
Total	119,472.32

At that date the entrance channel was 115 feet wide and 9 feet deep at mean low water. The basin was 800 feet long, averaged 150 feet wide and 9 feet deep at mean low water. The works protecting Long Beach were in fair order.

During the fiscal year a contract, which expires December 31, 1891, was entered into, to dredge 18,000 cubic yards from the channel and basin. Operations under this contract were commenced during the latter part of June, 1891, and during the fiscal year 6,918 cubic yards was removed. At the date of this report the improved channel is 130 feet wide, and the basin is essentially the same as on June 30, 1890.

The prospective benefits to commerce are increased facilities and safety to navigation.

July 1, 1890, balance unexpended		$1,327.68
Amount appropriated by act approved September 19, 1890		8,000.00
		9,327.68
June 30, 1891, amount expended during fiscal year		156.29
July 1, 1891, balance unexpended		9,171.39
July 1, 1891, outstanding liabilities	$1,867.86	
July 1, 1891, amount covered by uncomplet d contracts	2,992.14	
		4,860.00
July 1, 1891, balance available		4,311.39
Amount (estimated) required for completion of existing project		9,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1893		9,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.

(See Appendix B 15.)

B 15.

IMPROVEMENT OF PLYMOUTH HARBOR, MASSACHUSETTS.

Plymouth Harbor is situated 30 miles south of Boston. Its outer anchorage, the "Cow Yard," is common to Plymouth, Kingston, and Duxbury, and is the only refuge for seagoing vessels from northeasterly gales when caught between Boston and Provincetown, a distance of about 75 miles, following the coast line. The entrance to this outer anchorage is direct, unobstructed, and of ample width, and sufficiently deep for the wants of commerce. The anchorage is capacious and has good "holding ground," but the extensive tidal basins inside of it give rise to strong variable currents across it.

The inner or harbor proper is formed by Long Beach, a narrow, low sand spit 3 miles long, which runs generally parallel to the mainland and about a mile from it.

The harbor contains 2,000 acres, almost all of which is dry at low tide. A few narrow, crooked, shallow channels traverse these flats. These channels join about the center of the harbor, opposite the town wharves,

and form the main ship channel, 150 feet wide, approximately, and 10 feet deep at mean low water, which runs directly behind the northern half of Long Beach to the outer anchorage.

The maintenance of this inner harbor and channel depends on the preservation of Long Beach.

Before improvement about 6 inches depth of water could be carried to the town wharves at low tide.

A chart of the harbor was published in the Annual Report of the Chief of Engineers for the year 1888, Part I, page 460.

Previous to 1875 the project was a general one and had for its object the *preservation* only of Long Beach. From the nature of the work it can at no time be considered completed, and small annual appropriations are necessary to repair any damages done by storms. The various devices employed for this purpose are described in the Annual Report of the Chief of Engineers for 1877, all of which have been remarkably successful.

The project for the *improvement* of the harbor was first adopted in 1885. It provided for dredging a channel from the town wharves to the main ship channel 2,286 feet long, 100 feet wide, and 6 feet deep at mean low water. This project was modified in 1877 so as to include the dredging of a basin 866 feet long, 150 feet wide, and 8 feet deep directly in front of the town wharves.

In 1884 and 1885 it was proposed to deepen the proposed channel and basin to 9 feet at mean low water, and to make the channel 150 feet wide.

The modified project of 1884 required the excavation of 81,000 cubic yards (scow measurement) and was originally estimated to cost $27,000.

This estimate was revised in 1885, in accordance with the low prices then current for dredging, and the cost was then estimated to be $22,500.

From 1866 to date the amount appropriated for this improvement was $128,000, of which there had been expended to June 30, 1890—

For beach protection	$76,915.48
Dredging	42,556.84
Total	119,472.32

The condition of the improvement on June 30, 1890, was as follows:

The improved channel was 115 feet wide, 9 feet deep at mean low water; the basin was 800 feet long, with an average width of 150 feet, 9 feet deep at mean low water.

The river and harbor act of September 19, 1890, appropriated for this improvement $8,000. This sum it was proposed to expend as follows: $1,500 to be reserved for probable necessary repairs to the works of preservation; $1,500 to be expended on necessary extensions and repairs of the works protecting Long Beach; and the balance, $5,000, to be expended in enlarging the basin to its full projected dimensions, and in enlarging the improved channel so that it would be 130 feet wide. This project was approved October 6, 1890.

An advertisement was issued under date of October 15, 1890, inviting bids for the proposed work.

An abstract of the proposals received will be found in the annexed table.

On December 6, 1890, a contract was entered into with the National Dredging Company to dredge 18,000 cubic yards, at 27 cents per yard. This contract expires December 31, 1891.

Operations under this contract were commenced during the latter part of June, 1891, and at the close of the fiscal year 6,918 cubic yards had been dredged. The condition of the improvement remains essentially the same as on June 30, 1890.

To complete the project will require an appropriation of $9,500, all of which could be expended during the fiscal year ending June 30, 1893.

A small sum should always be available for the harbor, to immediately repair any damage made by storms to Long Beach. These necessary repairs have in the last 20 years averaged $1,500.

The prospective benefits to commerce are increased facilities and safety in navigating the improved channel.

Plymouth Harbor is located in the collection district of Plymouth, Mass., of which Plymouth is the port of entry.

The nearest light-houses are the Plymouth (Gurnet) lights, about 5 miles from Plymouth, and Duxbury Pier Light, about 2 miles distant.

The accompanying commercial statistics for the fiscal year ending June 30, 1891, have been furnished by the collector of customs at Plymouth, Mass.

Money statement.

July 1, 1890, balance unexpended		$1,327.68
Amount appropriated by act approved September 19, 1890		8,000.00
		9,327.68
June 30, 1891, amount expended during fiscal year		156.29
July 1, 1891, balance unexpended		9,171.39
July 1, 1891, outstanding liabilities	$1,867.86	
July 1, 1891, amount covered by uncompleted contracts	2,992.14	
		4,860.00
July 1, 1891, balance available		4,311.39
Amount (estimated) required for completion of existing project		9,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1893		9,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.

Abstract of proposals for dredging in Plymouth Harbor, Massachusetts, opened November 22, 1890, by Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Name and address of bidders.	Price bid for dredging per cubic yard, measured in scows.	Price bid for removal of bowlders weighing over 3 tons each.	Remarks.
1	Metropolitan Dredging Company, Lynn, Mass.	$0.33	$6.00	
2	Augustus R. Wright, Portland, Me	.29½	5.00	
3	National Dredging Company, Wilmington, Del.	.27	10.00	Lowest bid.

Contract awarded to the National Dredging Company with the approval of the Chief of Engineers.

COMMERCIAL STATISTICS.

Amount of revenue collected 1890, $108,174.31; 1891, $73,536.29.

Shipping.	1890.	
	No.	*Tons.*
Entrances:		
Foreign	2	1,864
Domestic	124	18,104
Clearances:		
Foreign	10	1,443
Domestic	120	17,148

Imported.	1890.	1891.
	Tons.	*Tons.*
Coal	23,500	18,065
Iron	1,325	1,973
Lumber	9,800	6,100
Miscellaneous	975	330

The vessels frequenting the port are coasting schooners drawing from 8 to 14 feet.

15. Plymouth Harbor, Massachusetts.—Plymouth Harbor is 30 miles south of Boston.

The object of its improvement is to perpetuate the harbor by the preservation of Long Beach, which forms it, and to deepen and widen the channels of approach to an enlarged anchorage basin in front of the town wharves.

The various devices employed for the preservation of Long Beach are described in the Annual Report of the Chief of Engineers for the year 1877.

The original project for improvement was adopted in 1875 and modified in 1877 and 1884. The modified project proposed an improved channel 2,286 feet long, 150 feet wide, and 9 feet deep at mean low water, leading to an anchorage basin 866 feet long, 150 feet wide, and 9 feet deep.

The expenditures to June 30, 1891, were:

For beach protection	$127,553.77
For dredging	42,713.13
Total	170,266.90

The condition of the improvement on June 30, 1891, was as follows: The improved channel was 130 feet wide; the basin was 800 feet long and averaged 150 feet wide; both were 9 feet deep at mean low water. Some repairs were needed on Long Beach.

During the fiscal year 11,676 cubic yards were dredged from the basin, thus completing it. One thousand three hundred feet of the bulkheads protecting Long Beach were repaired.

At the date of this report the basin is completed, the improved channel is 130 feet wide, and Long Beach is in fair repair, but needs additional works of protection at its southern end.

July 1, 1891, balance unexpended	$9,171.39
June 30, 1892, amount expended during fiscal year	6,878.74
July 1, 1892, balance unexpended	2,292.65
July 1, 1892, outstanding liabilities	299.35
July 1, 1892, balance available	1,993.30
Amount appropriated by act approved July 13, 1892	9,500.00
Amount available for fiscal year ending June 30, 1893	11,493.30

(See Appendix B 15.)

B 15.

IMPROVEMENT OF HARBOR AT PLYMOUTH, MASSACHUSETTS.

Plymouth Harbor is situated 30 miles south of Boston. Its outer anchorage, the "Cow Yard," is common to Plymouth, Kingston, and Duxbury and is the only refuge for seagoing vessels from northeasterly gales when caught between Boston and Provincetown, a distance of about 75 miles, following the coast line. The entrance to this outer anchorage

is direct, unobstructed, and of ample width, and sufficiently deep for the wants of commerce. The anchorage is capacious and has good "holding ground," but the extensive tidal basins inside of it give rise to strong variable currents across it.

The inner or harbor proper is formed by Long Beach, a narrow, low sand spit 3 miles long, which runs generally parallel to the mainland and about a mile from it.

The harbor contains 2,000 acres, almost all of which is dry at low tide. A few narrow, crooked shallow channels traverse these flats. These channels join about the center of the harbor, opposite the town wharves, and form the main ship channel, 150 feet wide, approximately, and 10 feet deep at mean low water, which runs directly behind the northern half of Long Beach to the outer anchorage.

The maintenance of this inner harbor and channel depends on the preservation of Long Beach.

Before improvement about 6 inches depth of water could be carried to the town wharves at low tide.

A chart of the harbor was published in the Annual Report of the Chief of Engineers for the year 1888, Part I, page 460.

Previous to 1875 the project was a general one and had for its object the preservation only of Long Beach. From the nature of the work it can at no time be considered completed and small annual appropriations are necessary to repair any damages done by storms. The various devices employed for this purpose are described in the Annual Report of the Chief of Engineers for 1877, all of which have been remarkably successful.

The project for the improvement of the harbor was first adopted in 1875. It provided for dredging a channel from the town wharves to the main ship channel, 2,286 feet long, 100 feet wide, and 6 feet deep at mean low water. This project was modified in 1877 so as to include the dredging of a basin 866 feet long, 150 feet wide, and 8 feet deep, directly in front of the town wharves.

In 1884 and 1885 it was proposed to deepen the proposed channel and basin to 9 feet at mean low water and to make the channel 150 feet wide.

The modified project of 1884 required the excavation of 81,000 cubic yards (scow measurement) and was originally estimated to cost $27,000. This estimate was revised in 1885 in accordance with the low prices then current for dredging, and the cost was then estimated to be $22,500.

From 1824 to date the amount appropriated for this improvement is $170,266.90, of which there had been expended to June 30, 1891—

For beach protection	$127,553.77
For dredging	42,713.13
Total	170,266.90

On June 30, 1891, the improved channel was in good order, 115 feet wide, 9 feet deep at mean low water. The basin was 800 feet long, with an average width of 150 feet, 9 feet deep at mean low water. Some repairs were needed to the bulkheads protecting Long Beach and dredging operations were in progress under a contract with the National Dredging Company to dredge 18,000 cubic yards from the channel and basin.

The contract for dredging was completed in July, 1891; 18,504 cubic yards were removed, and the channel was widened to 130 feet, 9 feet deep at mean low water, and the basin completed as proposed.

During the year about 1,300 feet of the bulkheads protecting Long Beach were repaired.

At the date of this report the improved channel and basin are in good order; the channel is 2,286 feet long and 130 feet wide; the basin, 866 feet long, 150 feet wide, both 9 feet deep at mean low water. The existing bulkheads protecting Long Beach are in fair order, but the southern part of the beach, for a distance of 5,000 feet, has for some years been growing lower and narrower, and this part of it will soon require additional protection.

To complete the project will require an appropriation of $9,500, all of which could be expended during the fiscal year ending June 30, 1894.

A small sum should always be available for the harbor to immediately repair any damages made by storms to Long Beach. These necessary repairs have in the last twenty years averaged $1,500.

The prospective benefits to commerce are increased facilities and safety in navigating the improved channel.

Plymouth Harbor is in the collection district of Plymouth, Mass., of which Plymouth is the port of entry.

The nearest light-houses are the Plymouth (Gurnet) lights, about 5 miles from Plymouth, and Duxbury Pier Light, about 2 miles distant.

The accompanying commercial statistics for the fiscal year ending June 30, 1892, have been furnished by the collector of customs at Plymouth, Mass.

The dates and amounts of appropriations for this work are as follows:

Act of—		Act of—	
May 26, 1824	$20,000.00	March 3, 1873	$3,000.00
March 3, 1825	5,712.00	June 23, 1874	5,000.00
March 25, 1826	13,184.90	March 3, 1875	10,000.00
April 23, 1830	1,850.00	June 18, 1878	5,000.00
March 2, 1831	2,820.00	March 3, 1879	3,500.00
July 3, 1832	2,500.00	June 14, 1880	10,000.00
March 2, 1833	600.00	March 3, 1881	10,000.00
June 28, 1834	2,000.00	August 2, 1882	14,000.00
March 3, 1835	700.00	July 5, 1884	10,000.00
July 2, 1836	500.00	August 5, 1886	6,000.00
July 7, 1838	2,400.00	August 11, 1888	6,000.00
August 31, 1852	5,000.00	September 19, 1890	8,000.00
July 11, 1870	10,000.00		
March 3, 1871	10,000.00	Total	170,266.90
June 10, 1872	2,500.00		

Money statement.

July 1, 1891, balance unexpended	$9,171.39
June 30, 1892, amount expended during fiscal year	6,878.74
July 1, 1892, balance unexpended	2,292.65
July 1, 1892, outstanding liabilities	299.35
July 1, 1892, balance available	1,993.30
Amount appropriated by act approved July 13, 1892	9,500.00
Amount available for fiscal year ending June 30, 1893	11,493.30

COMMERCIAL STATISTICS.

Amount of revenue collected, 1890, $108,174.31; 1891, $73,536.29; 1892, $73,808.36.

Shipping.	1890.		1892.	
	No.	*Tons.*	*No.*	*Tons.*
Entrances:				
Foreign	2	1,864	2	196
Domestic	124	18,104	103	.....
Clearances:				
Foreign	10	1,443	9	1,817
Domestic	120	17,148	.....	.....

Imported.	1890.	1891.	1892.
Coal ..... tons	23,500	18,065	16,861
Iron ..... do	1,325	1,073	1,143
Lumber ..... feet	9,800	6,160	3,303,463
Sand ..... tons	.....	.....	295
Miscellaneous ..... do	*975	*330	†1,145

* Miscellaneous. † Steel.

The vessels frequenting the harbor are coasting schooners drawing from 7 to 15 feet.

17. Plymouth Harbor, Massachusetts.—Plymouth Harbor is 30 miles south of Boston. The object of its improvement is to perpetuate the harbor by the preservation of Long Beach, which forms it, and to deepen and widen the channels of approach to an enlarged anchorage basin in front of the town wharves.

The various devices employed for the preservation of Long Beach are described in the Annual Report of the Chief of Engineers for the year 1877.

The original project for improvement was adopted in 1875 and modified in 1877 and 1884. The modified project proposed an improved

channel 2,286 feet long, 150 feet wide, and 9 feet deep at mean low water, leading to an anchorage basin 866 feet long, 150 feet wide, and 9 feet deep.

The total appropriations to date have been $179,766.90.

The expenditures to June 30, 1892, were:

For beach protection	$122,553.77
For dredging	45,719.83
Total	168,273.60

On June 30, 1892, the improved channel was 2,286 feet long, 130 feet wide; the basin was 866 feet long, 150 feet wide; both were 9 feet deep at mean low water. Long Beach was in fair condition, but additional bulkheads were needed at its southern end.

On September 16, 1892, a contract was entered into to widen the improved channel to 150 feet. Operations under this contract were commenced in December, 1892, and were satisfactorily completed in April, 1893. No other operations were in progress during the fiscal year.

At the date of this report the proposed improvement by dredging is completed. Some repairs and extensions of the works protecting Long Beach are necessary.

July 1, 1892, balance unexpended	$2,292.65
Amount appropriated by act approved July 13, 1892	9,500.00
	11,792.65
June 30, 1893, amount expended during fiscal year	5,094.41
July 1, 1893, balance unexpended	6,698.24
Amount (estimated) required for repairs	1,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	1,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix B 17.)

B 17.

IMPROVEMENT OF HARBOR AT PLYMOUTH, MASS.

Plymouth Harbor is situated 30 miles south of Boston. Its outer anchorage, the "Cow Yard," is common to Plymouth, Kingston, and Duxbury, and is the only refuge for sea-going vessels from northeasterly gales when caught between Boston and Provincetown, a distance of about 75 miles, following the coast line. The entrance to this outer anchorage is direct, unobstructed, and of ample width, and sufficiently deep for the wants of commerce. The anchorage is capacious and has good "holding ground," but the extensive tidal basins inside of it give rise to strong variable currents across it.

The inner or harbor proper is formed by Long Beach, a narrow, low sand spit 3 miles long, which runs generally parallel to the mainland and about 1 mile from it.

The harbor contains 2,000 acres, almost all of which is dry at low tide. A few narrow, crooked channels traverse these flats. They join

about the center of the harbor opposite the town wharves, and form the main ship channel, 150 feet wide, approximately, and 10 feet deep at mean low water, which runs directly behind the northern half of Long Beach to the outer anchorage.

The maintenance of this inner harbor and channel depends on the preservation of Long Beach.

Before improvement about 6 inches depth of water could be carried to the town wharves at low tide.

A chart of the harbor was published in the Annual Report of the Chief of Engineers for the year 1888, Part I, page 460.

Previous to 1875 the project was a general one, and had for its object the preservation of Long Beach. From the nature of the work it can at no time be considered completed, and small annual appropriations are necessary to repair any damages done by storms. The various devices employed for this purpose are described in the Annual Report of the Chief of Engineers for 1877.

The project for the improvement of the harbor was first adopted in 1875. It provided for dredging a channel from the town wharves to the main ship channel, 2,286 feet long, 100 feet wide, and 6 feet deep at mean low water. This project was modified in 1877 so as to include the dredging of a basin 866 feet long, 150 feet wide, and 8 feet deep, directly in front of the town wharves.

In 1884 and 1885 it was proposed to deepen the channel and basin to 9 feet at mean low water, and to make the channel 150 feet wide.

The modified project of 1884 required the excavation of 81,000 cubic yards (scow measurement), and was originally estimated to cost $27,000. This estimate was revised in 1885 in accordance with the low prices then current for dredging, and the cost was then estimated to be $22,500.

From 1824 to date the amount appropriated for this harbor is $179,766.90, of which there has been expended to June 30, 1892:

For beach protection	$122,553.77
For dredging	45,719.83
Total	168,273.60

On June 30, 1892 the improved channel was 2,286 feet long, 130 feet wide; the basin was 866 feet long, 150 feet wide; both were 9 feet deep at mean low water. Long Beach was in fair condition, but additional bulkheads were needed on its southern end.

On July 18, 1892, it was recommended that of the available funds $2,000 be reserved for necessary repairs to the works protecting Long Beach; that $2,500 be expended in making repairs and extensions to the works on the southern part of the beach, and that the balance of the funds be expended in widening the improved channel to 150 feet, thus completing the proposed dredging. This was approved July 22, 1892.

On August 6, 1892, an advertisement was issued calling for proposals for the dredging. The bids received were opened September 6, 1892, and an abstract of them will be found in the annexed table.

On September 16, 1892, a contract was entered into with the National Dredging Company, of Wilmington, Del., to dredge 12,000 cubic yards from the improved channel.

Operations under this contract were commenced in December, 1892; were suspended January, February, and March, 1893; resumed and satisfactorily completed in April, 1893. A total of 14,998 cubic yards were dredged under this contract.

No other operations were in progress during the fiscal year.

At the date of this report all of the dredging for the improvement of the harbor which has been proposed is completed.

Some repairs and extensions of the existing works protecting Long Beach are necessary.

A small sum should always be available for the harbor to immediately repair any damages made by storms to Long Beach. These necessary repairs have, in the last twenty years, averaged $1,500.

The prospective benefits to commerce are increased facilities and safety in navigating the improved channel.

Plymouth Harbor is in the collection district of Plymouth, Mass., of which Plymouth is the port of entry. The nearest light-houses are the Plymouth (Gurnet) Lights, about 5 miles from Plymouth, and Duxbury Pier Light, about 2 miles distant.

The accompanying commercial statistics for the fiscal year ending June 30, 1893, have been furnished by the collector of customs at Plymouth, Mass.

The dates and amounts of appropriations for this harbor are as follows:

Act of—		Act of—	
May 26, 1824	$20,000.00	March 3, 1873	$3,000.00
March 3, 1825	5,712.00	June 23, 1874	5,000.00
March 25, 1826	13,181.90	March 3, 1875	10,000.00
April 23, 1830	1,850.00	June 18, 1878	5,000.00
March 2, 1831	2,820.00	March 3, 1879	3,500.00
July 3, 1832	2,500.00	June 14, 1880	10,000.00
March 2, 1833	600.00	March 3, 1881	10,000.00
June 28, 1834	2,000.00	August 2, 1882	14,000.00
March 3, 1835	700.00	July 5, 1884	10,000.00
July 2, 1836	500.00	August 5, 1886	6,000.00
July 7, 1838	2,400.00	August 11, 1888	6,000.00
August 31, 1852	5,000.00	September 19, 1890	8,000.00
July 11, 1870	10,000.00	July 13, 1892	9,500.00
March 3, 1871	10,000.00		
June 10, 1872	2,500.00	Total	179,766.90

Money statement.

July 1, 1892, balance unexpended	$2,292.65
Amount appropriated by act approved July 13, 1892	9,500.00
	11,792.65
June 30, 1893, amount expended during fiscal year	5,094.41
July 1, 1893, balance unexpended	6,698.24
Amount (estimated) required for completion of existing project	1,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1895	1,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

Abstract of proposals for dredging from Plymouth Harbor, Massachusetts, opened September 6, 1892, by Lieut. Col. S. M. Mansfield, Corps of Engineers.

No.	Bidders.	Price bid for— Dredging per cubic yard.	Price bid for— Removal of bowlders over 3 tons.	Total.	Remarks.
		Cents.			
1	National Dredging Co., Wilmington, Del	29	$15	$3,480	Lowest bid.
2	Augustus R. Wright, Portland, Me	38	3	4,560	
3	Augustus B. Martin, Boston, Mass	40	10	4,800	
4	Charles H. Souther, Boston, Mass	36½	5	4,380	

The contract was awarded to the National Dredging Company, with the approval of the Chief of Engineers.

53D CONGRESS, 3d Session. } HOUSE OF REPRESENTATIVES. { Ex. Doc. No. 50.

The Board of Engineers.
RECEIVED DEC 2 1894

PRELIMINARY EXAMINATION OF PLYMOUTH HARBOR, MASSACHUSETTS.

LETTER

FROM

THE SECRETARY OF WAR,

TRANSMITTING,

With letter of the Chief of Engineers, report of a preliminary examination of Plymouth Harbor, Massachusetts.

DECEMBER 6, 1894.—Referred to the Committee on Rivers and Harbors and ordered to be printed.

WAR DEPARTMENT,
Washington, December 4, 1894.

SIR: I have the honor to inclose herewith a letter from the Chief of Engineers, dated December 1, 1894, together with a copy of a report from Lieut. Col. S. M. Mansfield, Corps of Engineers, dated October 29, 1894, of a preliminary examination made by him in compliance with the provisions of the river and harbor act of August 17, 1894, of Plymouth Harbor, Massachusetts.

Very respectfully,

DANIEL S. LAMONT,
Secretary of War.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 1, 1894.

SIR: I have the honor to submit the accompanying copy of report of October 29, 1894, by Lieut. Col. S. M. Mansfield, Corps of Engineers, giving results of preliminary examination of Plymouth Harbor, Massachusetts, "with a view to the removal of the obstructions known as 'Splitting Knife' and 'Middle Ground,' and the north and south sides of the excavated channel in said harbor with a view to deepening and improving the same," as required by river and harbor act of August 17, 1894.

Work at Plymouth has been carried on for a number of years under appropriations by Congress, but, for the reasons stated, it is the opinion

of Colonel Mansfield, in which I concur, that the harbor is worthy of additional improvement by the General Government to the extent of removing the "Middle Ground" obstructions and of the easterly end of "Splitting Knife" to ease the entrance to the dredged channel.

The survey necessary for the preparation of project and estimates may be made for $300.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

PRELIMINARY EXAMINATION OF PLYMOUTH HARBOR, MASSACHUSETTS, WITH A VIEW TO THE REMOVAL OF THE OBSTRUCTIONS KNOWN AS "SPLITTING KNIFE" AND "MIDDLE GROUND," AND THE NORTH AND SOUTH SIDES OF THE EXCAVATED CHANNEL IN SAID HARBOR, WITH A VIEW TO DEEPENING AND IMPROVING THE SAME.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., October 29, 1894.

GENERAL: In accordance with the requirements of letter from your office of August 20, 1894, I have the honor to submit the following report upon the examination of Plymouth Harbor, with a view to the removal of the obstructions known as "Splitting Knife" and "Middle Ground," and the north and south sides of the excavated channel in said harbor with a view to deepening and improving the same.

The present condition of the harbor and dredged channel is only fairly satisfactory. The removal of the Middle Ground, which is a serious obstruction, and a portion of the Splitting Knife shoals to ease the sharp bend from the main channel at the entrance to the dredged channel will result in a great improvement.

The dredged channel to the wharves is at present 150 feet wide and 9 feet deep, and the history of the work shows that it is maintained only by repeated dredging of the silt and sewage brought down by Town Brook, emptying directly into it, causing shoaling more especially of the enlarged inner end or basin.

A great many passengers are carried annually between Boston and Plymouth on small steamers, and the present facilities slightly improved are ample for the accommodation.

Commercial statistics for the fiscal year ending June 30, 1894, have been furnished by the collector of customs, as follows:

Amount of revenue collected, 1892, $73,808.36; 1893, $47,330.06; 1894, $24,073.13.

Shipping.	1892.		1893.		1894.	
	No.	*Tons.*	*No.*	*Tons.*	*No.*	*Tons.*
Entrances:						
Foreign	2	196	3	286	1	159
Domestic	103	.....	108	.....	95	.....
Clearances:						
Foreign	9	1,817	8	1,721	5	1,074
Domestic	.....	.....	.....	.....	.....	.....

Imported.	1892.	1893.	1894.
Coal ..... tons	16,861	19 094	24,285
Iron ..... do	1,443	650	1,512
Lumber ..... feet	3,303,463	2,085,000	2,260,000
Sand ..... tons	295	140	.....
Miscellaneous ..... do	1,145	2,173	.....

Coasting vessels drawing from 7 to 13 feet frequent the harbor.

In my opinion, and for the reasons stated, the harbor is worthy of additional improvement by the General Government to the extent of removing the "Middle Ground" obstructions and of the easterly end of "Splitting Knife" to ease the entrance to the dredged channel.

The harbor was surveyed in 1888, but a survey in the vicinity of the Middle Ground and Splitting Knife shoals will be necessary for a project and estimate of cost, and may be made for $300.

Very respectfully, your obedient servant,

S. M. MANSFIELD,
Lieutenant-Colonel, Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

○

also printed in House Ex. Doc. 50, (3d Cong 3d Sess) attached

COMMERCIAL STATISTICS.

Amount of revenue collected, 1891, $73,536.29; 1892, $73,808.36; 1893, $47,330.06.

Shipping.	1892.		1893.	
	No.	*Tons.*	*No.*	*Tons.*
Entrances:				
Foreign	2	196	3	286
Domestic	103	.....	108	.....
Clearances:				
Foreign	9	1,817	8	1,721
Domestic	.....	.....	.....	.....

Imported.		1891.	1892.	1893.
Coal	tons	18,065	16,861	19,094
Iron	do	1,973	1,443	650
Lumber	feet	6,169	3,303,463	2,085,000
Sand	tons	.....	295	140
Miscellaneous	do	330	1,145	2,173

Coasting vessels drawing from 7 to 13 feet frequent the harbor.

17. Plymouth Harbor, Massachusetts.—Plymouth Harbor is 30 miles south of Boston. The object of its improvement is to perpetuate the harbor by the preservation of Long Beach, which forms it, and to deepen and widen the channels of approach to an enlarged anchorage basin in front of the town wharves.

The various devices employed for the preservation of Long Beach are described in the Annual Report of the Chief of Engineers for the year 1877.

The original project for improvement was adopted in 1875 and modified in 1877 and 1884. The modified project proposed an improved channel 2,286 feet long, 150 feet wide, and 9 feet deep at mean low water, leading to an anchorage basin 866 feet long, 150 feet wide, and 9 feet deep.

The total appropriations to date have been $179,766.90.

The total expenditures to June 30, 1893, were—

For beach protection	$122,553.77
For dredging	50,514.89
Total	173,068.66

At that date the project for improvement had been completed. Long Beach was in good order, but additional bulkheads were needed at its southern end.

During the fiscal year a small force of hired labor was employed in building these bulkheads and repairing existing ones, and at the date of this report Long Beach is in good order.

July 1, 1893, balance unexpended	$6,698.24
June 30, 1894, amount expended during fiscal year	4,680.65
July 1, 1894, balance unexpended	2,017.59
Amount appropriated by act of August 17, 1894	1,500.00
Amount available for fiscal year ending June 30, 1895	3,517.59
Amount that can be profitably expended in fiscal year ending June 30, 1896 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.	1,500.00

(See Appendix B 17.)

B 17.

IMPROVEMENT OF HARBOR AT PLYMOUTH, MASSACHUSETTS.

Plymouth Harbor is situated 30 miles south of Boston. Its outer anchorage, the "Cow Yard," is common to Plymouth, Kingston and Duxbury, and is the only refuge for seagoing vessels from northeasterly gales, when caught between Boston and Provincetown, a distance of about 75 miles, following the coast line. The entrance to this outer anchorage is direct, unobstructed, of ample width, and sufficiently deep for the wants of commerce. The anchorage is capacious, and has good "holding ground," but the extensive tidal basins inside of it give strong variable currents across it.

The inner or harbor proper is formed by Long Beach, a narrow, low sand spit 3 miles long, which extends generally parallel to the mainland, and about 1 mile from it.

The harbor contains about 2,000 acres, almost all of which is dry at low tide. A few narrow, crooked channels traverse these flats. They join about the center of the harbor, opposite the town wharves, and form the main ship channel (150 feet wide, approximately, and 10 feet deep at mean low water), which runs directly behind the northern half of Long Beach to the outer anchorage.

The maintenance of this inner harbor and channel depends on the preservation of Long Beach.

A chart of the harbor was published in the Annual Report of the Chief of Engineers for the year 1888, Part I, p. 460.

Before improvement about 6 inches depth of water could be carried to the town wharves at low tide.

Previous to 1875 the project was a general one, and had for its object the preservation of Long Beach. From the nature of the work it can at no time be considered completed, and small annual appropriations are necessary to repair any damages done by storms. The various

devices employed for this purpose are described in the Annual Report of the Chief of Engineers for 1877.

The project for the improvement of the harbor was first adopted in 1875. It provided for dredging a channel from the town wharves to the main ship channel, 2,286 feet long, 100 feet wide, and 6 feet deep at mean low water. This project was modified in 1877, so as to include the dredging of a basin, 866 feet long, 150 feet wide, and 8 feet deep, directly in front of the town wharves.

In 1884 and 1885 it was proposed to deepen the channel and basin to 9 feet at mean low water, and to make the channel 150 feet wide.

The modified project of 1884 required the excavation of 81,000 cubic yards (scow measurement), and was originally estimated to cost $27,000. This estimate was revised in 1885, in accordance with the low prices then current for dredging, and the cost was then estimated to be $22,500.

From 1824 to date the amount appropriated for this harbor is $179,766.90, of which there had been expended to June 30, 1893:

For beach protection	$122,553.77
For dredging	50,514.89
Total	173,068.66

On June 30, 1893, the improved channel was 2,286 feet long, 150 feet wide; the basin was 866 feet long, 150 feet wide; both were 9 feet deep at mean low water. Long Beach was in fair order, but additional bulkheads were needed on its southern end.

During the fiscal year a small force of hired labor was employed in repairing and extending the bulkheads protecting the south end of Long Beach. Three thousand running feet of bulkheads were built or rebuilt.

At the date of this report Long Beach is in good order, and the project for the improvement of the harbor is completed.

A small sum should always be available for the harbor to immediately repair any damage made to Long Beach by storms. These necessary repairs have averaged, in the last twenty years, $1,500.

Plymouth Harbor is in the collection district of Plymouth, Mass., of which Plymouth is the port of entry. The nearest light-houses are the Plymouth (Gurnet) Lights, about 5 miles from Plymouth, and Duxbury Pier Light, about 2 miles distant.

The accompanying commercial statistics for the fiscal year ending June 30, 1894, have been furnished by the collector of customs at Plymouth, Mass.

The dates and amounts of appropriations for this harbor are as follows:

Act of—		Act of—	
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July 3, 1832	2,500.00	June 14, 1880	10,000.00
March 2, 1833	600.00	March 3, 1881	10,000.00
June 28, 1834	2,000.00	August 2, 1882	14,000.00
March 3, 1835	700.00	July 5, 1884	10,000.00
July 2, 1836	500.00	August 5, 1886	6,000.00
July 7, 1838	2,400.00	August 11, 1888	6,000.00
August 31, 1852	5,000.00	September 19, 1890	8,000.00
July 11, 1870	10,000.00	July 13, 1892	9,500.00
March 3, 1871	10,000.00		
June 10, 1872	2,500.00	Total	179,766.90

Money statement.

July 1, 1893, balance unexpended	$6,698.24
June 30, 1894, amount expended during fiscal year	4,680.65
July 1, 1894, balance unexpended	2,017.59
Amount (estimated) required for completion of existing project	1,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1896	1,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Amount of revenue collected, 1892, $73,808.36; 1893, $47,330.06; 1894, $24,073.13.

Shipping.	1892.		1893.		1894.	
	No.	*Tons.*	*No.*	*Tons.*	*No.*	*Tons*
Entrances:						
Foreign	2	196	3	286	1	[illegible]
Domestic	103	.....	108	.....	95	..
Clearances:						
Foreign	9	1,817	8	1,721	5	[illegible]
Domestic	.....	.....	.....	.....	.....	.....

Imported.	1892.	1893.	1894.
Coal ..... tons	16,861	19,094	24,285
Iron ..... do	1,443	650	1,512
Lumber ..... feet	3,303,463	2,085,000	2,269,000
Sand ..... tons	295	140	.....
Miscellaneous ..... do	1,145	2,173	.....

Coasting vessels drawing from 7 to 13 feet frequent the harbor.

17. Plymouth Harbor, Massachusetts.—Plymouth Harbor is 30 miles south of Boston. The object of its improvement is to perpetuate the harbor by the preservation of Long Beach, which forms it, and to deepen and widen the channels of approach to an enlarged anchorage basin in front of the town wharves.

The various devices employed for the preservation of Long Beach are described in the Annual Report of the Chief of Engineers for the year 1877.

The original project for improvement was adopted in 1875 and modified in 1877 and 1884. The modified project proposed an improved channel 2,286 feet long, 150 feet wide, and 9 feet deep at mean low water, leading to an anchorage basin 866 feet long, 150 feet wide, and 9 feet deep.

The total appropriations to date have been $181,266.90.

The expenditures to June 30, 1894, were:

For beach protection	$127,245.34
For dredging	50,514.89
Total	177,760.23

At that date the project for improvement had been completed and the works for the protection of Long Beach were in good order.

No operations were in progress during the fiscal year, and at the date of this report the works of protection and improvement are in good condition.

July 1, 1894, balance unexpended	$2,017.59
Amount appropriated by act of August 17, 1894	1,500.00
	3,517.59
June 30, 1895, amount expended during fiscal year	10.92
July 1, 1895, balance unexpended	3,506.67
Amount (estimated) required for completion of existing project	1,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	1,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

(See Appendix B 17.)

B 17.

IMPROVEMENT OF HARBOR AT PLYMOUTH, MASSACHUSETTS.

Plymouth Harbor is situated 30 miles south of Boston. Its outer anchorage, the "Cow Yard," is common to Plymouth, Kingston, and Duxbury, and is the only refuge for seagoing vessels from northeasterly gales when caught between Boston and Provincetown, a distance of about 75 miles, following the coast line. The entrance to this outer anchorage is direct, unobstructed, of ample width, and sufficiently deep for the wants of commerce. The anchorage is capacious, and has good "holding ground," but the extensive tidal basins inside of it give strong variable currents across it.

The inner or harbor proper is formed by Long Beach, a narrow, low sand spit 3 miles long, which extends generally parallel to the mainland and about 1 mile from it.

The harbor contains about 2,000 acres, almost all of which is dry at low tide. A few narrow, crooked channels traverse these flats. They join about the center of the harbor, opposite the town wharves, and form the main ship channel (150 feet wide, approximately, and 10 feet deep at mean low water), which runs directly behind the northern half of Long Beach to the outer anchorage.

The maintenance of this inner harbor and channel depends on the preservation of Long Beach.

A chart of the harbor was published in the Annual Report of the Chief of Engineers for the year 1888, Part I, page 460.

Before improvement about 6 inches depth of water could be carried to the town wharves at low tide.

Previous to 1875 the project was a general one, and had for its object the preservation of Long Beach. From the nature of the work it can at no time be considered completed, and small annual appropriations are necessary to repair any damages done by storms. The various devices employed for this purpose are described in the Annual Report of the Chief of Engineers for 1877.

The project for the improvement of the harbor was first adopted in 1875. It provided for dredging a channel from the town wharves to the main ship channel, 2,286 feet long, 100 feet wide, and 6 feet deep at mean low water. This project was modified in 1877 so as to include the dredging of a basin 866 feet long, 150 feet wide, and 8 feet deep directly in front of the town wharves.

In 1884 and 1885 it was proposed to deepen the channel and basin to 9 feet at mean low water and to make the channel 150 feet wide.

The modified project of 1884 required the excavation of 81,000 cubic yards (scow measurement), and was originally estimated to cost $27,000. This estimate was revised in 1885, in accordance with the low prices then current for dredging, and the cost was then estimated to be $22,500.

From 1824 to date the amount appropriated for this harbor is $181,266.90, of which there had been expended to June 30, 1894:

For beach protection	$127,245.34
For dredging	50,514.89
Total	177,760.23

On June 30, 1894, the improved channel was 2,286 feet long, the basin was 866 feet long; both were 150 feet wide, 9 feet deep at mean low water. Long Beach was in good order.

No operations were in progress during the year.

At the date of this report Long Beach is in good order and the project for the improvement of the harbor is completed.

A small sum should always be available for the harbor to immediately repair any damage made to Long Beach by storms. These necessary repairs have averaged in the last twenty years $1,500.

Plymouth Harbor is in the collection district of Plymouth, Mass., of which Plymouth is the port of entry. The nearest light-houses are the Plymouth (Gurnet) Lights, about 5 miles from Plymouth, and Duxbury Pier Light, about 2 miles distant.

The accompanying commercial statistics for the fiscal year ending June 30, 1895, have been furnished by the collector of customs at Plymouth, Mass.

The dates and amounts of appropriations for this harbor are as follows:

Act of—		Act of—	
May 26, 1824	$20,000.00	March 3, 1873	$3,000.00
March 3, 1825	5,712.00	June 23, 1874	5,000.00
March 25, 1826	13,184.90	March 3, 1875	10,000.00
April 23, 1830	1,850.00	June 18, 1878	5,000.00
March 2, 1831	2,820.00	March 3, 1879	3,500.00
July 3, 1832	2,500.00	June 14, 1880	10,000.00
March 2, 1833	600.00	March 3, 1881	10,000.00
June 28, 1834	2,000.00	August 2, 1882	14,000.00
March 3, 1835	700.00	July 5, 1884	10,000.00
July 2, 1836	500.00	August 5, 1886	6,000.00
July 7, 1838	2,400.00	August 11, 1888	6,000.00
August 31, 1852	5,000.00	September 19, 1890	8,000.00
July 11, 1870	10,000.00	July 13, 1892	9,500.00
March 3, 1871	10,000.00	August 17, 1894	1,500.00
June 10, 1872	2,500.00	Total	181,266.90

Money statement.

July 1, 1894, balance unexpended	$2,017.59
Amount appropriated by act of August 17, 1894	1,500.00
	3,517.59
June 30, 1895, amount expended during fiscal year	10.92
July 1, 1895, balance unexpended	3,506.67
Amount (estimated) required for completion of existing project	1,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1897	1,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Amount of revenue collected, 1893, $47,330.06; 1894, $24,073.13; 1895, $6,947.39.

Shipping.	1893.		1894.		1895.	
	No.	Tons.	No.	Tons.	No.	Tons.
Entrances:						
Foreign	3	286	1	195	4	.....
Domestic	108	.....	95	.....	83	.....
Clearances:						
Foreign	8	1,721	5	1,074	5	.....

Imported.	1893.	1894.	1895.
	Tons.	*Tons.*	*Tons.*
Coal	19,094	24,285	22,603
Iron	650	1,512	1,598
Lumber	*2,085,000	*2,260,000	*2,600,000
Sand	140	.....	165
Miscellaneous	2,173	.....	.....

*Feet.

Coasting schooners of an average draft of 13 feet frequent the harbor.

B 24.

PRELIMINARY EXAMINATION OF PLYMOUTH HARBOR, MASSACHUSETTS, WITH A VIEW TO THE REMOVAL OF THE OBSTRUCTIONS KNOWN AS "SPLITTING KNIFE" AND "MIDDLE GROUND," AND THE NORTH AND SOUTH SIDES OF THE EXCAVATED CHANNEL IN SAID HARBOR, WITH A VIEW TO DEEPENING AND IMPROVING THE SAME.

[Printed in House Ex. Doc. No. 50, Fifty-third Congress, third session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 1, 1894.

SIR: I have the honor to submit the accompanying copy of report of October 29, 1894, by Lieut. Col. S. M. Mansfield, Corps of Engineers, giving results of preliminary examination of Plymouth Harbor, Massachusetts, "with a view to the removal of the obstructions known as 'Splitting Knife' and 'Middle Ground,' and the north and south sides of the excavated channel in said harbor with a view to deepening and improving the same," as required by river and harbor act of August 17, 1894.

Work at Plymouth has been carried on for a number of years under appropriations by Congress, but, for the reasons stated, it is the opinion of Colonel Mansfield, in which I concur, that the harbor is worthy of additional improvement by the General Government to the extent of removing the "Middle Ground" obstructions and of the easterly end of "Splitting Knife" to ease the entrance to the dredged channel.

The survey necessary for the preparation of project and estimates may be made for $300.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,
Brig. Gen., Chief of Engineers.

Hon. D. S. LAMONT,
Secretary of War.

REPORT OF LIEUT. COL. S. M. MANSFIELD, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., October 29, 1894.

GENERAL: In accordance with the requirements of letter from your office of August 20, 1894, I have the honor to submit the following report upon the examination of Plymouth Harbor, with a view to the removal of the obstructions known as "Splitting Knife" and "Middle Ground," and the north and south sides of the excavated channel in said harbor with a view to deepening and improving the same.

The present condition of the harbor and dredged channel is only fairly satisfactory. The removal of the Middle Ground, which is a serious obstruction, and a portion of the Splitting Knife shoals to ease the sharp bend from the main channel at the entrance to the dredged channel will result in a great improvement.

The dredged channel to the wharves is at present 150 feet wide and 9 feet deep, and the history of the work shows that it is maintained only by repeated dredging of the silt and sewage brought down by Town Brook, emptying directly into it, causing shoaling more especially of the enlarged inner end or basin.

A great many passengers are carried annually between Boston and Plymouth on small steamers, and the present facilities slightly improved are ample for the accommodation.

Commercial statistics for the fiscal year ending June 30, 1894, have been furnished by the collector of customs, as follows:

Amount of revenue collected, 1892, $73,808.36; 1893, $47,330.06; 1894, $24,073.13.

Shipping.	1892.		1893.		1894.	
	No.	Tons.	No.	Tons.	No.	Tons.
Entrances:						
Foreign	2	196	3	286	1	159
Domestic	103	.....	108	.....	95	.....
Clearances:						
Foreign	9	1,817	8	1,721	5	1,074

Imported.	1892.	1893.	1894.
Coal ... tons	16,861	19,094	24,285
Iron ... do	1,443	650	1,512
Lumber ... feet	3,303,463	2,085,000	2,269,000
Sand ... tons	295	140	.....
Miscellaneous ... do	1,145	2,173	.....

Coasting vessels drawing from 7 to 13 feet frequent the harbor.

In my opinion, and for the reasons stated, the harbor is worthy of additional improvement by the General Government to the extent of removing the "Middle Ground" obstructions and of the easterly end of "Splitting Knife" to ease the entrance to the dredged channel.

The harbor was surveyed in 1888, but a survey in the vicinity of the Middle Ground and Splitting Knife shoals will be necessary for a project and estimate of cost, and may be made for $300.

Very respectfully, your obedient servant,

S. M. MANSFIELD,
Lieut. Col., Corps of Engineers.

Brig. Gen. THOMAS L. CASEY,
Chief of Engineers, U. S. A.

14. Harbor at Plymouth, Mass.—Plymouth Harbor is 30 miles south of Boston. The object of its improvement is to perpetuate the harbor by the preservation of Long Beach, which forms it, and to deepen and widen the channels of approach to an enlarged anchorage basin in front of the town wharves.

The various devices employed for the preservation of Long Beach are described in the Annual Report of the Chief of Engineers for the year 1877.

The original project for improvement was adopted in 1875 and modified in 1877 and 1884. The modified project proposed an improved channel 2,286 feet long, 150 feet wide and 9 feet deep at mean low water, leading to an anchorage basin 806 feet long, 150 feet wide, and 9 feet deep.

The total appropriations to date have been $182,766.90.

The expenditures to June 30, 1895, were:

For beach protection	$127,245.34
For dredging	50,514.89
Total	177,760.23

At that date the project for improvement had been completed and the works for the protection of Long Beach were in good order.

No operations were in progress during the fiscal year, and at the date of this report the works of protection and improvement are in good condition.

The commerce involved in this improvement consists of supplies of coal, lumber, etc., for local consumption. The deepening of the channel has enabled larger vessels to be employed in the transportation of these supplies, resulting in reduction of freight cost.

The value of the freight commerce is approximately $161,000 annually. The project for improvement is completed, but the maintenance of works of preservation will approximate $1,500 annually.

July 1, 1895, balance unexpended	$3,506.67
Amount appropriated by act of June 3, 1896	1,500.00
	5,006.67
June 30, 1896, amount expended during fiscal year	18.00
July 1, 1896, balance unexpended	4,988.67

(See Appendix B 14.)

B 14.

IMPROVEMENT OF HARBOR AT PLYMOUTH, MASSACHUSETTS.

Plymouth Harbor is situated 30 miles south of Boston. Its outer anchorage, the "Cow Yard," is common to Plymouth, Kingston, and Duxbury, and is the only refuge for seagoing vessels from northeasterly gales when caught between Boston and Provincetown, a distance of about

75 miles, following the coast line. The entrance to this outer anchorage is direct, unobstructed, of ample width, and sufficiently deep for the wants of commerce. The anchorage is capacious, and has good "holding ground," but the extensive tidal basins inside of it give strong variable currents across it.

The inner or harbor proper is formed by Long Beach, a narrow low sand spit 3 miles long, which extends generally parallel to the mainland and about 1 mile from it.

The harbor contains about 2,000 acres, almost all of which is dry at low tide. A few narrow crooked channels traverse these flats. They join about the center of the harbor, opposite the town wharves, and form the main ship channel (150 feet wide, approximately, and 10 feet deep at mean low water), which runs directly behind the northern half of Long Beach to the outer anchorage.

The maintenance of this inner harbor and channel depends on the preservation of Long Beach.

A chart of the harbor was published in the Annual Report of the Chief of Engineers for the year 1888, Part I, page 460.

Before improvement about 6 inches depth of water could be carried to the town wharves at low tide.

Previous to 1875 the project was a general one, and had for its object the preservation of Long Beach. From the nature of the work it can at no time be considered completed, and small annual appropriations are necessary to repair any damages done by storms. The various devices employed for this purpose are described in the Annual Report of the Chief of Engineers for 1877.

The project for the improvement of the harbor was first adopted in 1875. It provided for dredging a channel from the town wharves to the main ship channel, 2,286 feet long, 100 feet wide, and 6 feet deep at mean low water. This project was modified in 1877 so as to include the dredging of a basin 866 feet long, 150 feet wide, and 8 feet deep directly in front of the town wharves.

In 1884 and 1885 it was proposed to deepen the channel and basin to 9 feet at mean low water, and to make the channel 150 feet wide.

The modified project of 1884 required the excavation of 81,000 cubic yards (scow measurement), and was originally estimated to cost $27,000. This estimate was revised in 1885, in accordance with the low prices then current for dredging, and the cost was then estimated to be $22,500.

From 1824 to date the amount appropriated for this harbor is $182,-766.90, of which there had been expended to June 30, 1895:

For beach protection	$127,245.34
For dredging	50,514.89
Total	177,760.23

On June 30, 1895, the improved channel was 2,286 feet long, the basin was 866 feet long; both were 150 feet wide and 9 feet deep at mean low water. Long Beach was in good order.

No operations were in progress during the year.

At the date of this report Long Beach is in good order and the project for the improvement of the harbor is completed.

A small sum should always be available for the harbor to immediately repair any damage made to Long Beach by storms. These necessary repairs have averaged in the last twenty years $1,500.

Plymouth Harbor is in the collection district of Plymouth, Mass., of which Plymouth is the port of entry. The nearest light-houses are the Plymouth (Gurnet) Lights, about 5 miles from Plymouth, and Duxbury Pier Light, about 2 miles distant.

The accompanying commercial statistics for the fiscal year ending June 30, 1896, have been furnished by the collector of customs at Plymouth, Mass.

The dates and amounts of appropriations for this harbor are as follows:

Act of—		Act of—	
May 26, 1824	$20,000.00	June 23, 1871	$5,000.00
March 3, 1825	5,712.00	March 3, 1875	10,000.00
March 25, 1826	13,181.90	June 18, 1878	5,000.00
April 23, 1830	1,850.00	March 3, 1879	3,500.00
March 2, 1831	2,820.00	June 11, 1880	10,000.00
July 3, 1832	2,500.00	March 3, 1881	10,000.00
March 2, 1833	600.00	August 2, 1882	11,000.00
June 28, 1834	2,000.00	July 5, 1884	10,000.00
March 3, 1835	700.00	August 5, 1886	6,000.00
July 2, 1836	500.00	August 11, 1888	6,000.00
July 7, 1838	2,400.00	September 19, 1890	8,000.00
August 31, 1852	5,000.00	July 13, 1892	9,500.00
July 11, 1870	10,000.00	August 17, 1894	1,500.00
March 3, 1871	10,000.00	June 3, 1896	1,500.00
June 10, 1872	2,500.00		
March 3, 1873	3,000.00	Total	182,766.90

Money statement.

July 1, 1895, balance unexpended	$3,506.67
Amount appropriated by act of June 3, 1896	1,500.00
	5,006.67
June 30, 1896, amount expended during fiscal year	18.00
July 1, 1896, balance unexpended	4,988.67
Amount (estimated) required for completion of existing project	1,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1898	1,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of March 3, 1893.

COMMERCIAL STATISTICS.

Amount of revenue collected, 1894, $24,073.13; 1895, $6,947.39; 1896, $3,780.13.

Shipping.	1894		1895		1896	
	No.	Tons	No.	Tons	No.	Tons
Entrances:						
Foreign	1	195	4	...	6	...
Domestic	95	...	83	...	90	...
Clearances:						
Foreign	5	1,074	5	...	13	...
Domestic	...	...	...	...	3	...

Imported	1894	1895	1896
	Tons	*Tons*	*Tons*
Coal	24,285	22,663	24,832
Iron	1,512	1,598	791
Lumber	2,260,000	*2,600,000	1,400,000
Sand	...	165	160
Miscellaneous	...	...	†3,486

* Feet. † Stone.

Coasting schooners of an average draft of 13 feet frequent the harbor.

14. Harbor at Plymouth, Mass.—Plymouth Harbor is situated 30 miles south of Boston. Its outer anchorage, the "Cow Yard," is common to Plymouth, Kingston, and Duxbury, and is the only refuge for seagoing vessels from northeasterly gales when caught between Boston and Provincetown, a distance of about 75 miles, following the coast line. The entrance to this outer anchorage is direct, unobstructed, of ample width, and sufficiently deep for the wants of commerce. The anchorage is capacious, and has good "holding ground," but the extensive tidal basins inside of it give strong variable currents across it.

The inner or harbor proper is formed by Long Beach, a narrow low sand spit 3 miles long, which extends generally parallel to the mainland and about 1 mile from it.

The harbor contains about 2,000 acres, almost all of which is dry at low tide. A few narrow crooked channels traverse these flats. They join about the center of the harbor, opposite the town wharves, and form the main ship channel (150 feet wide, approximately, and 10 feet deep at mean low water), which runs directly behind the northern half of Long Beach to the outer anchorage.

The maintenance of this inner harbor and channel depends on the preservation of Long Beach.

A chart of the harbor was published in the Annual Report of the Chief of Engineers for the year 1888, part 1, page 460.

Before improvement about 6 inches depth of water could be carried to the town wharves at low tide.

Previous to 1875 the project was a general one, and had for its object the preservation of Long Beach. From the nature of the work it can at no time be considered completed, and small annual appropriations are necessary to repair any damages by storms. The various devices employed for this purpose are described in the Annual Report of the Chief of Engineers for 1877.

The project for the improvement of the harbor was first adopted in 1875. It provided for dredging a channel from the town wharves to the main ship channel 2,286 feet long, 100 feet wide, and 6 feet deep at mean low water. This project was modified in 1877 so as to include the dredging of a basin 866 feet long, 150 feet wide, and 8 feet deep directly in front of the town wharves.

In 1884 and 1885 it was proposed to deepen the channel and basin to 9 feet at mean low water and to make the channel 150 feet wide.

The modified project of 1884 required the excavation of 81,000 cubic yards (scow measurement), and was originally estimated to cost $27,000. This estimate was revised in 1885, in accordance with the low prices then current for dredging, and the cost was then estimated to be $22,500.

From 1824 to date the amount appropriated for this harbor is $182,766.90, of which there had been expended to June 30, 1896—

For beach protection	$127,263.34
For dredging	50,514.89
Total	177,778.23

On June 30, 1896, the project for improvement had been completed. Long Beach was in good order.

On April 3, 1897, a plan and project for further improvement of the harbor were submitted, in accordance with the river and harbor act of June 3, 1896. This report and project were published as House Doc. No. 39, Fifty-fifth Congress, first session. They are also printed as Appendix B 29 of this report.

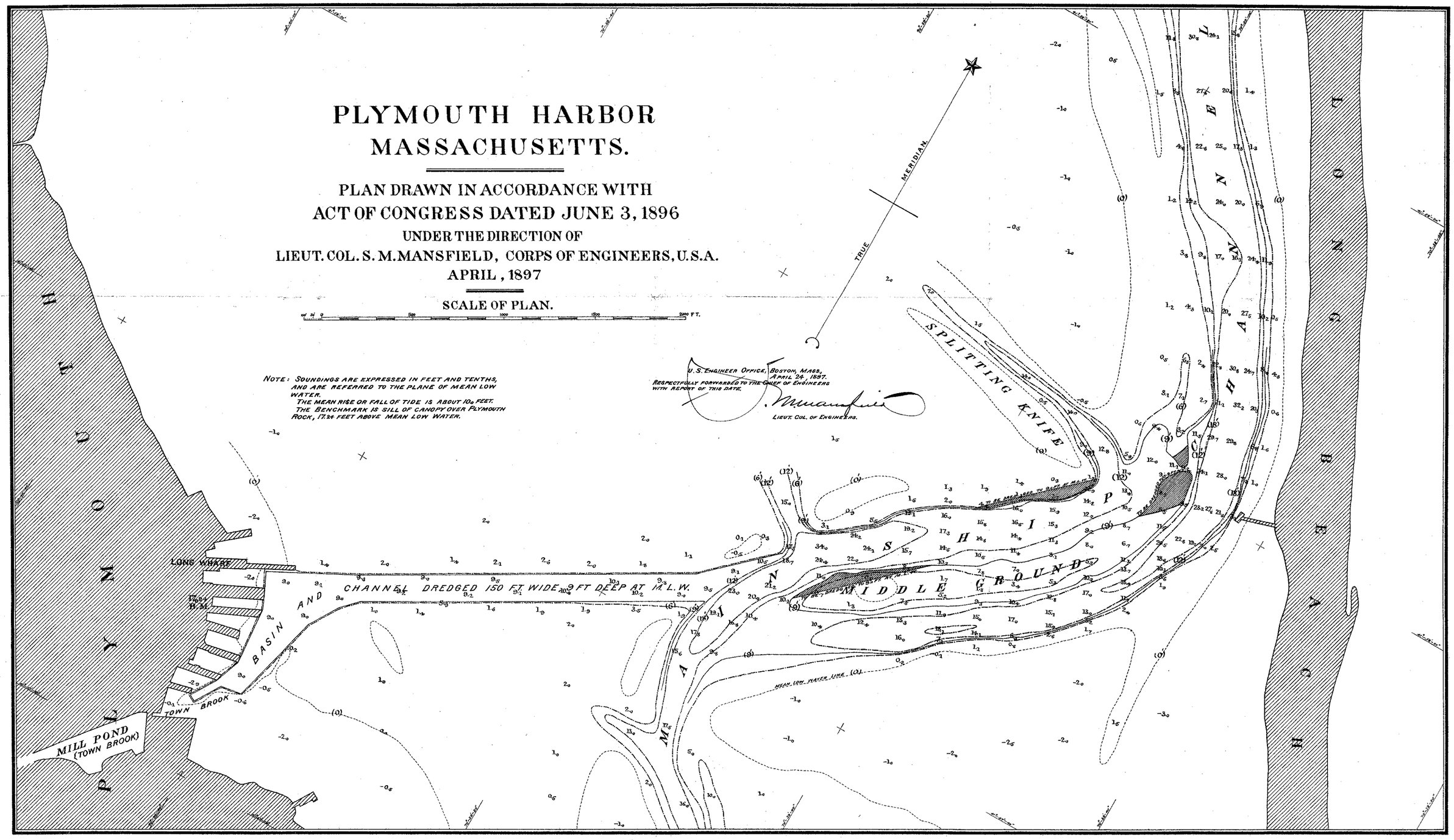
PLYMOUTH HARBOR
MASSACHUSETTS.

PLAN DRAWN IN ACCORDANCE WITH
ACT OF CONGRESS DATED JUNE 3, 1896
UNDER THE DIRECTION OF
LIEUT. COL. S. M. MANSFIELD, CORPS OF ENGINEERS, U.S.A.
APRIL, 1897

SCALE OF PLAN.

NOTE: SOUNDINGS ARE EXPRESSED IN FEET AND TENTHS, AND ARE REFERRED TO THE PLANE OF MEAN LOW WATER.
THE MEAN RISE OR FALL OF TIDE IS ABOUT 10_0 FEET.
THE BENCHMARK IS SILL OF CANOPY OVER PLYMOUTH ROCK, 17.24 FEET ABOVE MEAN LOW WATER.

U.S. ENGINEER OFFICE, BOSTON, MASS., APRIL 24, 1897.
RESPECTFULLY FORWARDED TO THE CHIEF OF ENGINEERS WITH REPORT OF THIS DATE.
S. M. MANSFIELD
LIEUT. COL. OF ENGINEERS.



H Doc. 39 — 55 1

ANDREW B. GRAHAM, PHOTO-LITHO, WASHINGTON, D.C.

In April, 1897, operations were commenced in the repair of breaches in Long Beach made by the storms of the winter of 1896–97. During the fiscal year 1,216.5 feet of bulkheads was built, and at the date of this report the beach is in good order.

July 1, 1896, balance unexpended	$4,988.67
June 30, 1897, amount expended during fiscal year	1,090.39
July 1, 1897, balance unexpended	3,898.28
July 1, 1897, outstanding liabilities	890.84
July 1, 1897, balance available	3,007.44

(See Appendix B 14.)

B 14.

IMPROVEMENT OF HARBOR AT PLYMOUTH, MASSACHUSETTS.

Plymouth Harbor is situated 30 miles south of Boston. Its outer anchorage, the "Cow Yard," is common to Plymouth, Kingston, and Duxbury, and is the only refuge for seagoing vessels from northeasterly gales when caught between Boston and Provincetown, a distance of about 75 miles, following the coast line. The entrance to this outer anchorage is direct, unobstructed, of ample width, and sufficiently deep for the wants of commerce. The anchorage is capacious, and has good "holding ground," but the extensive tidal basins inside of it give strong variable currents across it.

The inner or harbor proper is formed by Long Beach, a narrow, low sand spit 3 miles long, which extends generally parallel to the mainland and about 1 mile from it.

The harbor contains about 2,000 acres, almost all of which is dry at low tide. A few narrow, crooked channels traverse these flats. They join about the center of the harbor, opposite the town wharves, and form the main ship channel (150 feet wide, approximately, and 10 feet deep at mean low water), which runs directly behind the northern half of Long Beach to the outer anchorage.

The maintenance of this inner harbor or channel depends on the preservation of Long Beach.

A chart of the harbor was published in the Annual Report of the Chief of Engineers for the year 1888, part 1, page 460.

Before improvement about 6 inches depth of water could be carried to the town wharves at low tide.

Previous to 1875 the project was a general one, and had for its object the preservation of Long Beach. From the nature of the work it can at no time be considered completed, and small annual appropriations are necessary to repair any damages done by storms. The various devices employed for this purpose are described in the Annual Report of the Chief of Engineers for 1877.

The project for the improvement of the harbor was first adopted in 1875. It provided for dredging a channel from the town wharves to the main ship channel 2,286 feet long, 100 feet wide, and 6 feet deep at mean low water. This project was modified in 1877 so as to include the dredging of a basin 866 feet long, 150 feet wide, and 8 feet deep directly in front of the town wharves.

In 1884 and 1885 it was proposed to deepen the channel and basin to 9 feet at mean low water, and to make the channel 150 feet wide.

The modified project of 1884 required the excavation of 81,000 cubic yards (scow measurement), and was originally estimated to cost $27,000. This estimate was revised in 1885 in accordance with the low prices then current for dredging, and the cost was then estimated to be $22,500.

From 1824 to date the amount appropriated for this harbor is $182,766.90, of which there had been expended to June 30, 1896:

For beach protection	$127,263.34
For dredging	50,514.89
Total	177,778.23

On June 30, 1896, the project for improvement had been completed. Long Beach was in good order.

The river and harbor act of June 3, 1896, ordered a survey to be made and project submitted for further improvement of the harbor, and on April 24, 1897, a plan and project for improvement were submitted, the estimated cost of which was $8,716.95.

This report and project were published as House Doc. No. 39, Fifty-fifth Congress, first session.

The storms of the winter of 1896–97 created breaches in the beach protection of Long Beach at points about midway of its length, which necessitated extensions of the protecting bulkheads.

On March 31, 1897, an agreement was entered into with Messrs. Burgess & Marks, of Plymouth, Mass., for the construction of 600 feet, more or less, of bulkhead, at $1.44½ per running foot.

Operations under this agreement were commenced April 27, 1897, and during the fiscal year 1,216.5 feet of bulkhead was constructed.

At the date of this report the condition of the beach is satisfactory.

A small sum should always be available for the harbor to immediately repair any damage made to Long Beach by storms. These necessary repairs have averaged in the last twenty years $1,500.

Plymouth Harbor is in the collection district of Plymouth, Mass., of which Plymouth is the port of entry. The nearest light-houses are the Plymouth (Gurnet) lights, about 5 miles from Plymouth, and Duxbury Pier Light, about 2 miles distant.

Money statement.

July 1, 1896, balance unexpended	$4,988.67
June 30, 1897, amount expended during fiscal year	1,090.39
July 1, 1897, balance unexpended	3,898.28
July 1, 1897, outstanding liabilities	890.84
July 1, 1897, balance available	3,007.44

The dates and amounts of appropriations for this harbor are as follows:

Act of—		Act of—	
May 26, 1824	$20,000.00	June 23, 1874	$5,000.00
March 3, 1825	5,712.00	March 3, 1875	10,000.00
March 25, 1826	13,184.90	June 18, 1878	5,000.00
April 23, 1830	1,850.00	March 3, 1879	3,500.00
March 2, 1831	2,820.00	June 14, 1880	10,000.00
July 3, 1832	2,500.00	March 3, 1881	10,000.00
March 2, 1833	600.00	August 2, 1882	14,000.00
June 28, 1834	2,000.00	July 5, 1884	10,000.00
March 3, 1835	700.00	August 5, 1886	6,000.00
July 2, 1836	500.00	August 11, 1888	6,000.00
July 7, 1838	2,400.00	September 19, 1890	8,000.00
August 31, 1852	5,000.00	July 13, 1892	9,500.00
July 11, 1870	10,000.00	August 17, 1894	1,500.00
March 3, 1871	10,000.00	June 3, 1896	1,500.00
June 10, 1872	2,500.00		
March 3, 1873	3,000.00	Total	182,766.90

The accompanying commercial statistics have been furnished by the collector of customs at Plymouth, Mass.

COMMERCIAL STATISTICS.

Amount of revenue collected, 1895, $6,947.39; 1896, $3,780.43; 1897, $1,750.26.

Shipping.	1895.		1896.		1897.	
	No.	Tons.	No.	Tons.	No.	Tons.
Entrances:						
Foreign	4		6		8	766
Domestic	83		90			
Clearances:						
Foreign	5		13		9	1,071
Domestic			3			

Imported.	1895.	1896.	1897.
	Tons.	*Tons.*	*Tons.*
Coal	22,663	24,832	22,566
Iron	1,598	791	725
Lumber	*a* 2,600,000	*a* 1,400,000	*a* 3,400,000
Sand	165	160	320
Miscellaneous		*b* 3,486	

a Feet. *b* Stone.

Barges and schooners of an average draft of 13 feet frequent the harbor.

B 20.

PRELIMINARY EXAMINATION OF GURNET ROCK AND OTHER ROCKS AT MOUTH OF PLYMOUTH HARBOR, MASSACHUSETTS.

[Printed in House Doc. No. 314, Fifty-fourth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., February 18, 1897.

SIR: I have the honor to submit the accompanying copy of report, dated February 15, 1897, by Lieut. Col. S. M. Mansfield, Corps of Engineers, upon the results of a preliminary examination of Gurnet Rock and other rocks at mouth of Plymouth Harbor, Massachusetts, made to comply with the provisions of the river and harbor act of June 3, 1896.

For the reasons given Colonel Mansfield is of the opinion, which is concurred in by me, that work necessary to afford additional facilities to navigation at this locality is not worthy of being undertaken by the General Government.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers, U. S. Army.

Hon. DANIEL S. LAMONT,
Secretary of War.

REPORT OF LIEUT. COL. S. M. MANSFIELD, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., February 15, 1897.

GENERAL: In accordance with directions contained in letter from your office dated June 16, 1896, I have the honor to submit the following report upon a preliminary examination of Gurnet Rock and other rocks at the mouth of Plymouth Harbor, Massachusetts.

An excellent opportunity was afforded me to examine this locality by accompanying the light-house inspector in his tender upon his visit to the Gurnet Lights on the 29th and 30th of September, 1896. I extract the following description of Gurnet and other rocks at the entrance to Plymouth Harbor from the Atlantic Coast Pilot:

Gurnet Rock is a detached ledge with 4 feet at mean low water, lying a quarter of a mile southeast by east three-fourths east from Gurnet Point, and on the northern side of the channel. It is marked with a buoy placed in 18 feet of water on the eastern side, and between them is another rock with 9 feet at low water.

On the northern side of the channel, about 800 yards southwest by west one-half west from Gurnet Rock buoy, is a red spar buoy marking Bass Rock, upon which is 4 feet at low water and bears from Gurnet Point light-houses south one-half west, distant a little over 500 yards. The buoy is in 15 feet of water on the southern side of the rock.

There is no record of disasters on these rocks, and from all I am able to learn they offer no serious danger to navigation. I am therefore of opinion that they are not worthy of improvement by the General Government.

Very respectfully, your obedient servant,

S. M. MANSFIELD,
Lieut. Col., Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers U. S. A.

B 29.

SURVEY OF HARBOR AT PLYMOUTH, MASSACHUSETTS.

[Printed in House Doc. No. 39, Fifty-fifth Congress, first session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., April 29, 1897.

SIR: I have the honor to submit the accompanying report of April 24, 1897, with map,* by Lieut. Col. S. M. Mansfield, Corps of Engineers, of the results of a survey of harbor at Plymouth, Mass., made to comply with the requirements of the river and harbor act of June 3, 1896.

Plymouth Harbor has heretofore been improved to the extent of providing a channel from the outer anchorage (Cow Yard), 150 feet wide and 9 feet deep, mean low water, with a turning basin in front of the town wharves 866 feet long and 150 feet wide.

The further improvement proposed by Colonel Mansfield is to provide, in the vicinity of the Middle Ground or Splitting Knife Shoals, where a sharp turn occurs, a channel 250 feet wide and 9 feet deep at mean low water to facilitate navigation, and to redredge the basin, all at an estimated cost, including contingencies, of $8,716.95.

In transmitting this report Colonel Mansfield states that in his opinion the harbor is worthy of improvement, and the expense is justified by the interests of commerce involved.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers, U. S. Army.

Hon. R. A. ALGER,
Secretary of War.

REPORT OF LIEUT. COL. S. M. MANSFIELD, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., April 24, 1897.

GENERAL: In accordance with instructions of September 5, 1896, I have the honor to submit the following report (with a plan) upon the survey of Plymouth Harbor, Massachusetts, as provided for in the river and harbor act of June 3, 1896.

Plymouth Harbor has heretofore been improved to the extent of pro-

* Not reprinted. Printed in House Doc. No. 39, Fifty-fifth Congress, first session.

viding a channel from the outer anchorage (Cow Yard), which is a common anchorage ground for Plymouth, Kingston, and Duxbury, 150 feet wide and 9 feet deep, mean low water, with a turning basin in front of the town wharves 866 feet long and 150 feet wide.

In my preliminary examination report, submitted October 29, 1894, and which is published in the Annual Report of the Chief of Engineers for the year 1895, page 646, it is stated that the then condition of the harbor and dredged channel is only fairly satisfactory. The removal of the Middle Ground, which is a serious obstruction, and a portion of the Splitting Knife Shoals to ease the sharp bend from the main channel at the entrance to the dredged channel will result in a great improvement. It has been found that the silt and sewage brought down by Town Creek empties directly into the dredged basin and has caused some shoaling, and this deposit must be periodically removed, if the depth of 9 feet is to be maintained. Such a shoaling has once been removed since the basin was dredged, and further dredging is now required.

No change is apparent in the position and dimension of the Middle Ground or Splitting Knife Shoals, or of the bar at the east end of the Middle Ground, and it is proposed to provide in this vicinity, where a sharp turn occurs, a channel 250 feet wide and 9 feet deep at mean low water to facilitate navigation, and this will necessitate the removal from a portion of each of the shoals and of the bar at the east end of the Middle Ground of—

19,082 cubic yards, at 30 cents per cubic yard	$5,724.60
For redredging the basin, 7,333 cubic yards, at 30 cents per cubic yard	2,199.90
	7,924.50
Engineering expenses and contingencies, 10 per cent	792.45
Total	8,716.95

Respectfully submitted.

S. M. MANSFIELD,
Lieut. Col., Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

14. Plymouth Harbor, Massachusetts.—Plymouth Harbor is situated 30 miles south of Boston. Its outer anchorage, the "Cow Yard," is common to Plymouth, Kingston, and Duxbury, and is the only refuge for sea-going vessels from northeasterly gales when caught beween Boston and Provincetown, a distance of about 75 miles, following the coast line. The entrance to this outer anchorage is direct, unobstructed, of ample width, and sufficiently deep. The anchorage is capacious and has good "holding ground," but the extensive tidal basins inside of it give strong, variable currents across it.

The inner or harbor proper is formed by Long Beach, a narrow, low sand spit 3 miles long, which extends generally parallel to the mainland and about 1 mile from it.

The harbor contains about 2,000 acres, almost all of which is dry at low tide. A few narrow, crooked channels traverse these flats. They

join about the center of the harbor, opposite the town wharves, and form the main ship channel (150 feet wide, approximately, and 10 feet deep at mean low water), which runs directly behind the northern half of Long Beach to the outer anchorage.

The maintenance of this inner harbor and channel depends on the preservation of Long Beach.

A chart of the harbor was published in the Annual Report of the Chief of Engineers for the year 1888, Part I, page 460.

Before improvement about 6 inches depth of water could be carried to the town wharves at low tide.

Preivous to 1875 the project was a general one, and had for its object the preservation of Long Beach.

From the nature of the work it can at no time be considered completed, and small annual appropriations are necessary to repair any damages by storms. The various devices employed for this purpose are described in the Annual Report of the Chief of Engineers for 1877.

The project for the improvement of the harbor was first adopted in 1875. It provided for dredging a channel from the town wharves to the main ship channel 2,286 feet long, 100 feet wide, and 6 feet deep at mean low water. This project was modified in 1877 so as to include the dredging of a basin 866 feet long, 150 feet wide, and 8 feet deep directly in front of the town wharves.

In 1884 and 1885 it was proposed to deepen the channel and basin to 9 feet at mean low water and to make the channel 150 feet wide, at an estimated cost of $27,000, reduced in 1885 to $22,500.

On April 3, 1897, a plan and project for further improvement of the harbor were submitted, in accordance with the river and harbor act of June 3, 1896. This report and project were published as House Doc. No. 39, Fifty-fifth Congress, first session, also in Annual Report, Chief of Engineers, 1897, page 877.

From 1824 to date the amount appropriated for this harbor is $182,766.90, of which there had been expended to June 30, 1897—

For beach protection	$128,353.73
For dredging	50,514.89
Total	178,868.62

On June 30, 1897, the project of 1884–85 for improvement had been completed. Long Beach was in good order.

An examination of the dredged channel and basin was made in January, 1898.

No other operations were in progress during the fiscal year, and at the date of this report the dredged channel is in good order; but the basin has shoaled by deposit from the mud flats and Town Brook, so that there is but 2 feet depth at mean low water at its upper end. Provision for the redredging of this basin is included in the project of April 3, 1897.

Long Beach is generally in good order, but several weak places were developed by last winter's storms and may require protection by bulkheads during this summer's season.

July 1, 1897, balance unexpended	$3,898.28
June 30, 1898, amount expended during fiscal year	949.34
July 1, 1898, balance unexpended	2,948.94

(See Appendix B 14.)

B 14.

IMPROVEMENT OF THE HARBOR AT PLYMOUTH, MASSACHUSETTS.

Plymouth Harbor is situated 30 miles south of Boston. Its outer anchorage, the "Cow Yard," is common to Plymouth, Kingston, and Duxbury, and is the only refuge for seagoing vessels from northeasterly gales when caught between Boston and Provincetown, a distance of about 75 miles, following the coast line. The entrance to this outer anchorage is direct, unobstructed, of ample width, and sufficiently deep for the wants of commerce. The anchorage is capacious and has good "holding ground," but the extensive tidal basins inside of it give strong variable currents across it.

The inner or harbor proper is formed by Long Beach, a narrow, low sand spit 3 miles long, which extends generally parallel to the mainland and about 1 mile from it.

The harbor contains about 2,000 acres, almost all of which is dry at low tide. A few narrow, crooked channels traverse these flats. They join about the center of the harbor, opposite the town wharves, and form the main ship channel (150 feet wide, approximately, and 10 feet deep at mean low water), which runs directly behind the northern half of Long Beach to the outer anchorage.

The maintenance of this inner harbor or channel depends on the preservation of Long Beach.

A chart of the harbor was published in the Annual Report of the Chief of Engineers for the year 1888, Part I, page 460.

Before improvement about 6 inches depth of water could be carried to the town wharves at low tide.

Previous to 1875 the project was a general one, and had for its object the preservation of Long Beach. From the nature of the work it can at no time be considered completed, and small annual appropriations are necessary to repair any damages done by storms. The various devices employed for this purpose are described in the Annual Report of the Chief of Engineers for 1877.

The project for the improvement of the harbor was first adopted in 1875. It provided for dredging a channel from the town wharves to the main ship channel, 2,286 feet long, 100 feet wide, and 6 feet deep at mean low water. This project was modified in 1877 so as to include the dredging of a basin 866 feet long, 150 feet wide, and 8 feet deep directly in front of the town wharves.

In 1884 and 1885 it was proposed to deepen the channel and basin to 9 feet at mean low water, and to make the channel 150 feet wide.

The modified project of 1884 required the excavation of 81,000 cubic yards (scow measurement), and was originally estimated to cost $27,000. This estimate was revised in 1885 in accordance with the low prices then current for dredging, and the cost was then estimated to be $22,500.

The river and harbor act of June 3, 1896, ordered a survey to be made and project submitted for further improvement of the harbor, and on April 24, 1897, a plan and project for improvement were submitted, the estimated cost of which was $8,716.95.

This report and project were published as House Doc. No. 39, Fifty-fifth Congress, first session; also Annual Report, Chief of Engineers, 1897, page 877.

From 1824 to date the amount appropriated for this harbor is $182,766.90, of which there has been expended to June 30, 1897—

For beach protection	$128,353.73
For dredging	50,514.89
Total	178,868.62

On June 30, 1897, the project of 1884–1885 for improvement had been completed. Long Beach was in good order.

An examination of the dredged channel and basin was made in January, 1898.

No other operations were in progress during the fiscal year.

At the date of this report the condition of the improved channel is good, but the anchorage basin has shoaled so that its upper end has but 2 feet of water at mean low water, and requires redredging, which is provided for in the project submitted April 24, 1897.

The condition of the beach generally is satisfactory, but the winter storms of 1897–98 weakened it in places, which may require protection during the present summer.

A small sum should always be available for the harbor to immediately repair any damage made to Long Beach by storms. These necessary repairs have averaged in the last twenty years $1,500.

Plymouth Harbor is in the collection district of Plymouth, Mass., of which Plymouth is the port of entry. The nearest light-houses are the Plymouth (Gurnet) Lights, about 5 miles from Plymouth, and Duxbury Pier Light, about 2 miles distant.

Money statement.

July 1, 1897, balance unexpended	$3,898.28
June 30, 1898, amount expended during fiscal year	949.34
July 1, 1898, balance unexpended	2,918.94

The dates and amounts of appropriations for this harbor are as follows:

Act of—		Act of—	
May 26, 1824	$20,000.00	June 23, 1874	$5,000.00
March 3, 1825	5,712.00	March 3, 1875	10,000.00
March 25, 1826	13,184.90	June 18, 1878	5,000.00
April 23, 1830	1,850.00	March 3, 1879	3,500.00
March 2, 1831	2,826.00	June 14, 1880	10,000.00
July 3, 1832	2,500.00	March 3, 1881	10,000.00
March 2, 1833	600.00	August 2, 1882	14,000.00
June 28, 1834	2,000.00	July 5, 1884	10,000.00
March 3, 1835	700.00	August 5, 1886	6,000.00
July 2, 1836	500.00	August 11, 1888	6,000.00
July 7, 1838	2,400.00	September 19, 1890	8,000.00
August 31, 1852	5,000.00	July 13, 1892	9,500.00
July 11, 1870	10,000.00	August 18, 1894	1,500.00
March 3, 1871	10,000.00	June 3, 1896	1,500.00
June 10, 1872	2,500.00		
March 3, 1873	3,000.00	Total	182,766.90

COMMERCIAL STATISTICS.

The accompanying commercial statistics have been furnished by the collector of customs at Plymouth, Mass.

Amount of revenue collected, 1896, $3,780.43; 1897, $1,750.26; 1898, $2,887.21.

Shipping.	1896.		1897.		1898.	
	No.	Tons.	No.	Tons.	No.	Tons.
Entrances:						
Foreign	6		8	766	a 1	
Domestic	99				a 73	
Clearances:						
Foreign	13		9	1,071	3	
Domestic	3				71	

Imports.	1896.	1897.	1898.
	Tons.	*Tons.*	*Tons.*
Coal	24,832	22,566	23,521
Iron	791	725	
Lumber	b 1,400,000	b 3,400,000	b 2,400,000
Sand	160	320	
Miscellaneous	c 3,486		130

a Value, $104,000. b Feet. c Stone.

Barges and schooners of an average draft of 13 feet frequent the harbor.

17. *Harbor at Plymouth, Mass.*—Plymouth Harbor is situated 30 miles south of Boston. Its outer anchorage, the "Cow Yard," is common to Plymouth, Kingston, and Duxbury, and is the only refuge for seagoing vessels from northeasterly gales when caught between Boston and Provincetown, a distance of about 75 miles, following the coast line. The entrance to this outer anchorage is direct, unobstructed, of ample width, and sufficiently deep. The anchorage is capacious and has good holding ground, but the extensive tidal basins inside of it give strong variable currents across it.

The inner or harbor proper is formed by Long Beach, a narrow, low sand spit 3 miles long, which extends generally parallel to the mainland and about 1 mile from it.

The harbor contains about 2,000 acres, almost all of which is dry at low tide. A few narrow, crooked channels traverse these flats. They join about the center of the harbor, opposite the town wharves, and form the main ship channel (150 feet wide, approximately, and 10 feet deep at mean low water), which runs directly behind the northern half of Long Beach to the outer anchorage.

The maintenance of this inner harbor and channel depends on the preservation of Long Beach.

A chart of the harbor was published in the Annual Report of the Chief of Engineers for the year 1888, Part I, page 460.

Before improvement about 6 inches depth of water could be carried to the town wharves at low tide.

Previous to 1875 the project was a general one, and had for its object the preservation of Long Beach.

From the nature of the work it can at no time be considered completed, and small annual appropriations are necessary to repair any damages by storms. The various devices employed for this purpose are described in the Annual Report of the Chief of Engineers for 1877.

The project for the improvement of the harbor was first adopted in 1875. It provided for dredging a channel from the town wharves to the main ship channel 2,286 feet long, 100 feet wide, and 6 feet deep at mean low water. This project was modified in 1877 so as to include the dredging of a basin 866 feet long, 150 feet wide, and 8 feet deep directly in front of the town wharves.

In 1884 and 1885 it was proposed to deepen the channel and basin to 9 feet at mean low water and to make the channel 150 feet wide, at an estimated cost of $27,000, reduced in 1885 to $22,500.

On April 24, 1897, a plan and project for further improvement of the harbor were submitted, in accordance with the river and harbor act of June 3, 1896. This report and project were published as House Doc. No. 39, Fifty-fifth Congress, first session; also in Annual Report Chief of Engineers, 1897, page 877.

From 1824 to date the amount appropriated for this harbor is $267,766.90, of which there had been expended to June 30, 1898—

For beach protection	$129,303.07
For dredging	50,514.89
Total	179,817.96

On June 30, 1898, the project of 1884–85 for improvement had been completed. Long Beach was in good order.

The severe storms of the winter of 1898–99 seriously damaged the protective works on Long Beach. The river and harbor act of March 3, 1899, appropriated $75,000 for repair of the storm damages in accordance with plans and estimate submitted January 20, 1899, and $10,000 for maintenance.

On June 5, 1899, the Secretary of War approved a project for expenditure of the $75,000 in building a rubblestone riprap on Long Beach; and on May 27, 1899, a project for expenditure of the $10,000 in redredging the improved channel and basin was approved.

Advertisement was issued, under date of June 27, 1899, calling for proposals for constructing the rubblestone riprap; and under date of June 20, 1899, for dredging the channel and basin.

During the present season the channel and basin will be restored to their former depth; and so far as is practicable the beach will be strengthened.

The estimate of cost of this work submitted January 20, 1899, was $95,700, and this full amount will be required to restore the beach to its former condition.

July 1, 1898, balance unexpended	$2,948.94
Amount appropriated by river and harbor act approved March 3, 1899	85,000.00
	87,948.94
June 30, 1899, amount expended during fiscal year	446.43
July 1, 1899, balance unexpended	87,502.51
July 1, 1899, outstanding liabilities	50.00
July 1, 1899, balance available	87,452.51
Amount (estimated) required for completion of existing project	20,700.00
Amount that can be profitably expended in fiscal year ending June 30, 1901. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	20,700.00

(See Appendix B 17.)

B 17.

IMPROVEMENT OF HARBOR AT PLYMOUTH, MASSACHUSETTS.

Plymouth Harbor is situated 30 miles south of Boston. Its outer anchorage, the "cow yard," is common to Plymouth, Kingston, and Duxbury, and is the only refuge for seagoing vessels from northeasterly gales when caught between Boston and Provincetown, a distance of about 75 miles, following the coast line. The entrance to this outer anchorage is direct, unobstructed, of ample width, and sufficiently deep for the wants of commerce. The anchorage is capacious and has good "holding ground," but the extensive tidal basins inside of it give strong variable currents across it.

The inner or harbor proper is formed by Long Beach, a narrow, low sand spit 3 miles long, which extends generally parallel to the mainland and about 1 mile from it.

The harbor contains about 2,000 acres, almost all of which is dry at low tide. A few narrow, crooked channels traverse these flats. They join about the center of the harbor, opposite the town wharves, and form the main ship channel (150 wide, approximately, and 10 feet deep at mean low water), which runs directly behind the northern half of Long Beach to the outer anchorage.

[1] Expended in improvement of Miles or South Channel under project of December 1, 1871.

The maintenance of this inner harbor or channel depends on the preservation of Long Beach.

A chart of the harbor was published in the Annual Report of the Chief of Engineers for the year 1888, Part 1, page 460.

Before improvement about 6 inches depth of water could be carried to the town wharves at low tide.

Previous to 1875 the project was a general one, and had for its object the preservation of Long Beach. From the nature of the work it can at no time be considered completed, and small annual appropriations are necessary to repair any damage done by storms. The various devices employed for this purpose are described in the Annual Report of the Chief of Engineers for 1877.

The project for the improvement of the harbor was first adopted in 1875. It provided for dredging a channel from the town wharves to the main ship channel 2,286 feet long, 100 feet wide, and 6 feet deep at mean low water. This project was modified in 1877 so as to include the dredging of a basin 866 feet long, 150 feet wide, and 8 feet deep directly in front of the town wharves.

In 1884 and 1885 it was proposed to deepen the channel and basin to 9 feet at mean low water and to make the channel 150 feet wide.

The modified project of 1884 required the excavation of 81,000 cubic yards (scow measurement), and was originally estimated to cost $27,000. This estimate was revised in 1885 in accordance with the low prices then current for dredging, and the cost was then estimated to be $22,500.

The river and harbor act of June 3, 1896, ordered a survey to be made and project submitted for further improvement of the harbor, and on April 24, 1897, a plan and project for improvement were submitted, the estimated cost of which was $8,716.95.

This report and project were published as House Doc. No. 39, Fifty-fifth Congress, first session; also Annual Report, Chief of Engineers, 1897, page 877.

From 1824 to date the amount appropriated for this harbor is $267,766.90, of which there has been expended to June 30, 1898—

For beach protection	$129,303.07
For dredging	50,514.89
Total	179,817.96

On June 30, 1898, the project of 1884-85 for improvement had been completed. Long Beach was in good order. No appropriation had been made for work under the project of improvement dated April 24, 1897.

The severe storms of the winter of 1898-99 seriously damaged the beach, sweeping all protective works from it for a length of about 12,000 feet and cutting down the crest to a level of about 2 feet above mean high water. Eel River was also turned from its former course in the inner harbor and made to discharge directly into the sea through the beach at the southern end.

On January 20, 1899, a report on the condition of the beach was submitted in accordance with Department letter of January 14, 1899, in which it was estimated that the cost of the necessary repairs would be $95,700.

The river and harbor act of March 3, 1899, appropriated $75,000 for repair of storm damages to the beach, in accordance with this report, and on May 20, 1899, a project for the expenditure of this appropriation was submitted, proposing to protect the beach with a rubblestone riprap for as great a length as the funds available would purchase.

This project was approved by the Secretary of War on June 5, 1899, and on June 27, 1899, advertisement was issued calling for proposals for construction of the riprap.

A survey of the dredged channel and basin was made in May, 1899, and showed that both channel and basin had shoaled so as to seriously impair the utility of the improvement.

The river and harbor act of March 3, 1899, appropriated $10,000 for maintenance, and on May 25, 1899, it was recommended that this appropriation be expended in redredging the channel and basin. This recommendation was approved on May 27, 1899, and on June 20, 1899, advertisement was issued calling for bids for the proposed dredging.

No other operations were in progress during the fiscal year.

The dredged channel and basin will be redredged to their former depth during the ensuing year. Repairs will be made to Long Beach so far as the available funds will admit, but the full amount of the estimate of January 20, 1899, will be required to fully repair the storm damages.

Plymouth Harbor is in the collection district of Plymouth, Mass., of which Plymouth is the port of entry. The nearest light-houses are the Plymouth (Gurnet) Lights, about 5 miles from Plymouth, and Duxbury Pier Light, about 2 miles distant.

Money statement.

July 1, 1898, balance unexpended	$2,948.94
Amount appropriated by river and harbor act approved March 3, 1899	85,000.00
	87,948.94
June 30, 1899, amount expended during fiscal year	446.43
July 1, 1899, balance unexpended	87,502.51
July 1, 1899, outstanding liabilities	50.00
July 1, 1899, balance available	87,452.51
Amount (estimated) required for completion of existing project	20,700.00
Amount that can be profitably expended in fiscal year ending June 30, 1901. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	20,700.00

The dates and amounts of appropriations for this harbor are as follows:

Act of—		Act of—	
May 26, 1824	$20,000.00	March 3, 1875	$10,000.00
March 3, 1825	5,712.00	June 18, 1878	5,000.00
March 25, 1826	13,184.90	March 3, 1879	3,500.00
April 23, 1830	1,850.00	June 14, 1880	10,000.00
March 2, 1831	2,820.00	March 3, 1881	10,000.00
July 3, 1832	2,500.00	August 2, 1882	14,000.00
March 2, 1833	600.00	July 5, 1884	10,000.00
June 28, 1834	2,000.00	August 5, 1886	6,000.00
March 3, 1835	700.00	August 11, 1888	6,000.00
July 2, 1836	500.00	September 19, 1890	8,000.00
July 7, 1838	2,400.00	July 13, 1892	9,500.00
August 31, 1852	5,000.00	August 18, 1894	1,500.00
July 11, 1870	10,000.00	June 3, 1896	1,500.00
March 3, 1871	10,000.00	March 3, 1899	10,000.00
June 10, 1872	2,500.00		75,000.00
March 3, 1873	3,000.00		
June 23, 1874	5,000.00	Total	267,766.90

COMMERCIAL STATISTICS.

The accompanying commercial statistics have been furnished by the collector of customs at Plymouth, Mass.

122.2/4 69

Amount of revenue collected:

1897	$1,750.26
1898	2,887.21
1899	10,678.00

Shipping.	1897.		1898.		1899.	
	Number.	Tons.	Number.	Tons.	Number.	Tons.
Entrances:						
Foreign	8	766	1	Value, $104,000	5	
Domestic			73		61	
Clearances:						
Foreign	9	1,071	3		7	
Domestic			71		61	

Imported.		1897.	1898.	1899.
Coal	tons	22,566	23,521	20,001
Lumber	feet	3,400,000	2,400,000	3,080,000
Miscellaneous	tons		130	

Barges and schooners of an average draft of 13 feet frequent the harbor.

REPORT ON CONDITION OF PLYMOUTH BEACH, AND WORK NECESSARY FOR PROTECTION OF PLYMOUTH HARBOR, MASSACHUSETTS.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., January 20, 1899.

GENERAL: In accordance with your letter of January 14, 1899, I have the honor to submit the following report upon the condition of Plymouth Beach, together with an estimate of cost of work necessary for protection of Plymouth Harbor.

An examination of the beach was made subsequent to the severe storm of November 27, 1898. It was found that Eel River, which formerly emptied into Plymouth Harbor, had been diverted from its former channel into the sea through a gap formed in the beach at the extreme southern end of the harbor.

Sections of the beach aggregating 9,000 feet in length had been cut down to from 4 to 5 feet above mean high water.

All protective works which had been built in former years upon these damaged sections of the beach were totally demolished by the sea.

About 2,500 feet of the main ship channel lying behind a damaged section of the beach is endangered by the weak condition of this barrier, which separates it from the sea.

The balance available for this work is $2,940.34, which is barely sufficient to build the lightest form of bulkhead for protection of the main ship channel at the most critical points, and this expenditure will probably result in but temporary relief.

On high tides during very heavy storms the seas may be expected to sweep several feet in depth over these low sections of the beach, and any structure placed upon the crest should be of sufficient strength to resist the force of these seas.

The bulkheads which have been built for the protection of this beach have cost from $20 down to $1.50 per linear foot.

They have been constructed principally of timber, filled with brush or gravel, and vary in form from substantial structures acting as breakwaters down to the lightest form designed only to control the shifting of the beach sand under influence of high winds.

In considering the necessary repairs to the beach, the work may be divided into three parts:

1. To insure the safety of the main ship channel by protecting that portion of the beach behind which it lies. This involves the construction of about 2,500 linear feet of substantial bulkhead.

2. To strengthen the remaining weak sections of the beach, about 6,500 feet in length.

3. To return Eel River into its former course, emptying into Plymouth Harbor.

The following estimate for this work should be considered approximate only, for the reason that further changes are likely to occur before the work can be accomplished, which changes may materially increase or diminish the amount of work necessary to restore the beach to a safe condition.

Estimates.

To strengthen the section of beach between the main ship channel and the sea, 2,500 feet of bulkhead, at $12 per foot		$30,000.00
To strengthen remaining weak sections of the beach, 6,500 feet of bulkhead, at $8 per foot		52,000.00
To return Eel River to its former course:		
Excavating 5,000 cubic yards of sand and gravel from the old bed of river at 60 cents per yard	$3,000.00	
Bulkhead to close gap	2,000.00	
		5,000.00
		87,000.00
Contingencies 10 per cent		8,700.00
Total		95,700.00

A sketch[1] showing location of the weak sections of the beach is inclosed herewith.

Very respectfully, your obedient servant,

CHAS. R. SUTER,
Colonel, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

9. Harbor at Plymouth, Mass.—Plymouth Harbor is situated 30 miles south of Boston. Its outer anchorage, the "Cow Yard," is common to Plymouth, Kingston, and Duxbury, and is the only refuge for seagoing vessels from northeasterly gales when caught between Boston and Provincetown, a distance of about 75 miles, following the coast line. The entrance to this outer anchorage is direct, unobstructed, of ample width, and sufficiently deep. The anchorage is capacious and has good holding ground, but the extensive tidal basins inside of it give strong variable currents across it.

The inner or harbor proper is formed by Long Beach, a narrow, low sand spit 3 miles long, which extends generally parallel to the mainland and about 1 mile from it.

The harbor contains about 2,000 acres, almost all of which is dry at low tide. A few narrow, crooked channels traverse these flats. They join about the center of the harbor, opposite the town wharves, and form the main ship channel (150 feet wide, approximately, and 10 feet deep at mean low water), which runs directly behind the northern half of Long Beach to the outer anchorage.

The maintenance of this inner harbor and channel depends on the preservation of Long Beach.

A chart of the harbor was published in the Annual Report of the Chief of Engineers for 1888, page 460.

Before improvement about 6 inches depth of water could be carried to the town wharves at low tide.

Previous to 1875 the project was a general one, and had for its object the preservation of Long Beach.

From the nature of the work it can at no time be considered completed, and small annual appropriations are necessary to repair any damages by storms. The various devices employed for this purpose are described in the Annual Report of the Chief of Engineers for 1877.

The project for the improvement of the harbor was first adopted in 1875. It provided for dredging a channel from the town wharves to the main ship channel 2,286 feet long, 100 feet wide, and 6 feet deep at mean low water. This project was modified in 1877 so as to include the dredging of a basin 866 feet long, 150 feet wide, and 8 feet deep directly in front of the town wharves.

In 1884 and 1885 it was proposed to deepen the channel and basin to 9 feet at mean low water and to make the channel 150 feet wide, at an estimated cost of $27,000, reduced in 1885 to $22,500.

On April 24, 1897, a plan and project for further improvement of the harbor were submitted, in accordance with the river and harbor act of June 3, 1896. This report and project were published in House

Doc. No. 39, Fifty-fifth Congress, first session; also in the Annual Report of the Chief of Engineers for 1897, page 877.

From 1824 to date the amount appropriated for this harbor is $267,766.90, of which there had been expended to June 30, 1899—

For beach protection	$129,526.29
For dredging	50,738.10
Total	180,264.39

On June 30, 1899, the project of 1884–85 for improvement had been completed.

The severe storms of the winter of 1898–99 seriously damaged the protective works on Long Beach. The river and harbor act of March 3, 1899, appropriated $75,000 for repair of the storm damages in accordance with plans and estimate submitted January 20, 1899, and $10,000 for maintenance.

On June 5, 1899, the Secretary of War approved a project for expenditure of the $75,000 in building a rubblestone riprap on Long Beach, and on May 27, 1899, a project for expenditure of the $10,000 in redredging the improved channel and basin was approved.

On August 15, 1899, a contract was entered into for dredging 45,000 cubic yards of material from the improved channel and basin.

Work under this contract was completed in February, 1900, and at the date of this report the channel and basin are at least 150 feet wide and 9 feet deep at mean low water.

On August 18, 1899, a contract was entered into for depositing 45,000 tons of rubblestone in a riprap for the protection of Long Beach. At the date of this report about 550 running feet of riprap have been built and construction of the riprap is in progress.

The estimate of cost of this work submitted January 20, 1899, was $95,700, and this full amount will be required to restore the beach to its former condition.

The commerce of Plymouth Harbor consists of coal, lumber, etc., for local consumption, and approximates an annual value of $175,000. It is also a port of entry, and the annual revenue collected in 1900 was $1,224.88.

July 1, 1899, balance unexpended		$87,502.51
June 30, 1900, amount expended during fiscal year		16,212.33
July 1, 1900, balance unexpended		71,290.18
July 1, 1900, outstanding liabilities	$886.52	
July 1, 1900, amount covered by uncompleted contracts	56,371.39	
		57,257.91
July 1, 1900, balance available		14,032.27
Amount (estimated) required for completion of existing project		20,700.00
Amount that can be profitably expended in fiscal year ending June 30, 1902, in addition to the balance available July 1, 1900		20,700.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

(See Appendix C 9.)

C 9.

IMPROVEMENT OF HARBOR AT PLYMOUTH, MASSACHUSETTS.

Plymouth Harbor is situated 30 miles south of Boston. Its outer anchorage, the "cow yard," is common to Plymouth, Kingston, and Duxbury, and is the only refuge for seagoing vessels from northeasterly gales when caught between Boston and Provincetown, a distance of

[1] Expended in 1872–1874 in improving the Miles or South Channel.

about 75 miles, following the coast line. The entrance to this outer anchorage is direct, unobstructed, of ample width, and sufficiently deep for the wants of commerce. The anchorage is capacious and has good "holding ground," but the extensive tidal basins inside of it give strong variable currents across it.

The inner or harbor proper is formed by Long Beach, a narrow, low sand spit 3 miles long, which extends generally parallel to the mainland and about 1 mile from it.

The harbor contains about 2,000 acres, almost all of which is dry at low tide. A few narrow, crooked channels traverse these flats. They join about the center of the harbor, opposite the town wharves, and form the main ship channel (150 feet wide, approximately, and 10 feet deep at mean low water), which runs directly behind the northern half of Long Beach to the outer anchorage.

The maintenance of this inner harbor or channel depends on the preservation of Long Beach.

A chart of the harbor was published in the Annual Report of the Chief of Engineers for the year 1888, Part I, page 460.

Before improvement about 6 inches depth of water could be carried to the town wharves at low tide.

Previous to 1875 the project was a general one, and had for its object the preservation of Long Beach. From the nature of the work it can at no time be considered completed, and small annual appropriations are necessary to repair any damage done by storms. The various devices employed for this purpose are described in the Annual Report of the Chief of Engineers for 1877.

The project for the improvement of the harbor was first adopted in 1875. It provided for dredging a channel from the town wharves to the main ship channel 2,286 feet long, 100 feet wide, and 6 feet deep at mean low water. This project was modified in 1877 so as to include the dredging of a basin 866 feet long, 150 feet wide, and 8 feet deep directly in front of the town wharves.

In 1884 and 1885 it was proposed to deepen the channel and basin to 9 feet at mean low water and to make the channel 150 feet wide.

The modified project of 1884 required the excavation of 81,000 cubic yards (scow measurement), and was originally estimated to cost $27,000. This estimate was revised in 1885 in accordance with the low prices then current for dredging, and the cost was then estimated to be $22,500.

The river and harbor act of June 3, 1896, ordered a survey to be made and project submitted for further improvement of the harbor, and on April 24, 1897, a plan and project for improvement were submitted, the estimated cost of which was $8,716.95.

This report and project were published as House Doc. No. 39, Fifty-fifth Congress, first session; also Annual Report, Chief of Engineers, 1897, page 877.

From 1824 to date the amount appropriated for this harbor is $267,766.90, of which there has been expended to June 30, 1899—

For beach protection	$129,526.29
For dredging	50,738.10
Total	180,264.39

On June 30, 1899, the project of 1884–85 for improvement had been completed. No appropriation had been made for work under the project of improvement dated April 24, 1897.

The severe storms of the winter of 1898–99 seriously damaged the beach, sweeping all protective works from it for a length of about 12,000 feet and cutting down the crest to a level of about 2 feet above mean high water. Eel River was also turned from its former course in the inner harbor and made to discharge directly into the sea through the beach at the southern end.

On January 20, 1899, a report on the condition of the beach was submitted in accordance with Department letter of January 14, 1899, in which it was estimated that the cost of the necessary repairs would be $95,700.

The river and harbor act of March 3, 1899, appropriated $75,000 for repair of storm damages to the beach, in accordance with this report, and on May 20, 1899, a project for the expenditure of this appropriation was submitted, proposing to protect the beach with a rubblestone riprap for as great a length as the funds available would purchase.

This project was approved by the Secretary of War on June 5, 1899. On June 27, 1899, advertisement was issued calling for proposals for construction of the riprap, and on July 29, 1899, bids were received and opened. An abstract of the bids will be found annexed.

On August 18, 1899, a contract was entered into with Bell & Co., of Boston, Mass., to deposit 45,000 tons of stone in the riprap on Long Beach.

This contract was approved September 15, 1899, and under it work was to be commenced on or before October 1, 1899, and was to be completed by October 31, 1900.

During the fiscal year about 550 feet of riprap was constructed under this contract.

A survey of the dredged channel and basin, made in May, 1899, showed that both channel and basin had shoaled so as to seriously impair the utility of the improvement.

The river and harbor act of March 3, 1899, appropriated $10,000 for maintenance, and on May 25, 1899, it was recommended that this appropriation be expended in redredging the channel and basin. This recommendation was approved on May 27, 1899. On June 20, 1899, advertisement was issued calling for bids for the proposed dredging, and on July 21, 1899, five bids were received and opened. An abstract of these bids will be found annexed.

On August 15, 1899, a contract was entered into with the Hartford Dredging Company, of Hartford, Conn., to dredge 45,000 cubic yards, more or less, of mud from the channel and basin.

This contract was approved October 7, 1899, and under it work was to be commenced on or before October 25, 1899, and was to be completed by January 9, 1900.

Work under this contract was commenced November 10, 1899, and was completed February 8, 1900. A total of 44,232 cubic yards of material was dredged, and the channel and basin were restored to full projected depth of 9 feet and a least width of 150 feet.

At the date of this report Long Beach is in poor condition, and construction of protective works will be continued during the ensuing year, so far as the available funds will admit, but the full amount of the estimate of January 20, 1899, will be required to fully repair the storm damages, and could be expended to advantage during the fiscal year ending June 30, 1902.

Plymouth Harbor is in the collection district of Plymouth, Mass., of which Plymouth is the port of entry. The nearest light-houses are the Plymouth (Gurnet) Lights, about 5 miles from Plymouth, and Duxbury Pier Light, about 2 miles distant.

Money statement.

July 1, 1899, balance unexpended		$87,502.51
June 30, 1900, amount expended during fiscal year		16,212.33
July 1, 1900, balance unexpended		71,290.18
July 1, 1900, outstanding liabilities	$886.52	
July 1, 1900, amount covered by uncompleted contracts	56,371.39	
		57,257.91
July 1, 1900, balance available		14,032.27
Amount (estimated) required for completion of existing project		20,700.00
Amount that can be profitably expended in fiscal year ending June 30, 1902, in addition to the balance available July 1, 1900		20,700.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

The dates and amounts of appropriations for this harbor are as follows:

Act of—		Act of—	
May 26, 1824	$20,000.00	March 3, 1875	$10,000.00
March 3, 1825	5,712.00	June 18, 1878	5,000.00
March 25, 1826	13,184.90	March 3, 1879	3,500.00
April 23, 1830	1,850.00	June 14, 1880	10,000.00
March 2, 1831	2,820.00	March 3, 1881	10,000.00
July 3, 1832	2,500.00	August 2, 1882	14,000.00
March 2, 1833	600.00	July 5, 1884	10,000.00
June 28, 1834	2,000.00	August 5, 1886	6,000.00
March 3, 1835	700.00	August 11, 1888	6,000.00
July 2, 1836	500.00	September 19, 1890	8,000.00
July 7, 1838	2,400.00	July 13, 1892	9,500.00
August 31, 1852	5,000.00	August 18, 1894	1,500.00
July 11, 1870	10,000.00	June 3, 1896	1,500.00
March 3, 1871	10,000.00	March 3, 1899	10,000.00
June 10, 1872	2,500.00		75,000.00
March 3, 1873	3,000.00		
June 23, 1874	5,000.00	Total	267,766.90

Abstract of proposals for dredging in Plymouth Harbor, Massachusetts, opened July 21, 1899, by Col. Chas. R. Suter, Corps of Engineers.

No.	Name and address of bidder.	Price bid per cubic yard— For dredging.	Price bid per cubic yard— For removal of bowlders over 3 tons each.	Total that can be dredged.
		Cents.		*Yards.*
1	Alonzo E. Smith, New York, N. Y.	24½	$15.00	36,734
2	The Hartford Dredging Co., Hartford, Conn. *a*	20	.....	45,000
3	Chas. H. Souther, Boston, Mass.	25	5.00	36,000
4	Augustus B. Martin, Boston, Mass.	32½	5.00	27,692
5	Eastern Dredging Co., Boston, Mass	28¾	5.00	31,806

a Lowest bid.

The contract was awarded to The Hartford Dredging Company, with the approval of the Chief of Engineers.

Abstract of proposals for construction of rubblestone riprap on Long Beach, Plymouth Harbor, Massachusetts, opened July 29, 1899, by Col. Chas. R. Suter, Corps of Engineers.

No.	Name and address of bidder.	Price per ton of 2,000 pounds.	Total.
			Tons.
1	Dexter H. Craig, Plymouth, Mass	$1.47	41,326
		1.75	34,714
2	John P. Conkling, New York, N. Y	2.10	28,928
3	Pigeon Hill Granite Co., Rockport, Mass	1.73	35,115
4	Rockport Granite Co., Rockport, Mass	1.93	31,476
5	Saml. F. Randolph, New York, N. Y	1.419	41,925
6	Bell & Co., Boston, Mass. *a*	1.33	45,676

a Lowest bid.

The contract was awarded to Bell & Co., with the approval of the Chief of Engineers.

ABSTRACT OF CONTRACT IN FORCE JUNE 30, 1900.

Contract dated August 18, 1899; Bell & Co., Boston, Mass., contractors; to deposit 45,000 tons, more or less, of rubblestone in the riprap at $1.33 per ton; approved September 15, 1899; to be commenced October 1, 1899; to be completed October 31, 1900.

COMMERCIAL STATISTICS.

The accompanying commercial statistics have been furnished by the collector of customs at Plymouth, Mass.

Amount of revenue collected:

1898	$2,887.21
1899	10,678.00
1900	603.91

Shipping.	1898.	1899.	1900.
Entrances:			
Foreign	1	5	4
Domestic	73	61	73
Clearances:			
Foreign	3	7	6
Domestic	71	61	71

Imported.	1898.	1899.	1900
Coal ... tons	23,521	20,001	23,649
Lumber ... feet	2,400,000	3,080,000	3,015,000
Miscellaneous ... tons	130	.....	.....
Brick ... number	.....	.....	600,000

Barges and schooners up to 18 feet draft frequent the harbor.

9. *Harbor at Plymouth, Mass.*—Before improvement a depth of only about 6 inches of water could be carried to the wharves at low tide.

The existing project, approved by the act of March 3, 1899, is to restore, at an estimated cost of $95,700, the works constructed under former projects (and destroyed by the storms of 1898–99) for the preservation of Long Beach, upon which depends the preservation of the basin along the wharves and of the channel to it, both dredged under the completed project of 1884–85.

The amount expended to June 30, 1900, was $196,476.72, of which $60,727.52 was applied to maintenance.

With the amount expended during the fiscal year ending June 30, 1901, 3,391.5 linear feet of dike of riprap was built on Long Beach.

On June 30, 1901, the maximum draft that could be carried over the shoalest part of the improvement at mean low water—in the channel to the wharves and in the basin along them, dredged under the completed project of 1884–85—was 9 feet in the channel and 9 feet in the basin.

Chart of harbor, showing location of works, is in Annual Report of the Chief of Engineers for 1888, page 460.

The commerce of the harbor consists of supplies of coal, lumber, etc., for local consumption, and approximates an annual value of $220,000.

July 1, 1900, balance unexpended	$71,290.18
June 30, 1901, amount expended during fiscal year	20,136.62
July 1, 1901, balance unexpended	51,153.56
July 1, 1901, outstanding liabilities	4,446.35
July 1, 1901, balance available	46,707.21
July 1, 1901, amount covered by uncompleted contracts	39,283.65
Amount (estimated) required for completion of existing project	20,700.00
Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance available July 1, 1901	20,700.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix C 9.)

C 9.

IMPROVEMENT OF HARBOR AT PLYMOUTH, MASSACHUSETTS.

The amount expended during the fiscal year has been applied wholly to the construction of a dike of riprap on Long Beach, under the design approved by the Secretary of War June 5, 1899, for the application of $75,000 appropriated by the act of March 3, 1899.

July 1, 1900, to October 25, 729 linear feet of the dike, containing 3,861.75 tons of stone, were built under the contract of August 18, 1899, with Bell & Co., of Boston, Mass.

October 25, 1900, that contract was annulled because of unsatisfactory progress, and on November 20, 1900, an emergency contract was entered into with the Rockport Granite Company to insure the speedy advance of the dike along the lowest and most exposed parts of the beach, and prevent disaster that severe storms could hardly fail to cause to the beach and harbor.

By the Rockport Granite Company there have been built: November 24, 1900, to May 10, 1901, under the emergency contract, 1,823 linear feet of dike, containing 6,180 tons of stone, at $2.13 per ton; and May 11 to June 30, 1901, under formal contract of May 16, 1901 (abstracts of bids and contracts herewith), 839.5 linear feet of dike, containing 2,215 tons of stone.

The total length of dike constructed during the fiscal year is thus 3,391.5 linear feet, containing 12,256.75 tons of stone.

The entire length of dike constructed on Long Beach to June 30, 1901, under the appropriation of March 3, 1899, and design approved by the Secretary of War June 5, 1899, is 3,941.5 linear feet, containing 14,872.25 tons of stone.

Bell & Co. built (under their contract of August 18, 1899, annulled October 25, 1900), 1,279 linear feet of the dike, containing 6,477.25 tons of stone.

Plymouth Harbor is in the collection district of Plymouth, Mass., of which Plymouth is the port of entry. The nearest light-houses are the Plymouth (Gurnet) lights, about 5 miles from Plymouth, and Duxbury Pier light, about 2 miles distant.

Money statement.

July 1, 1900, balance unexpended	$71,290.18
June 30, 1901, amount expended during fiscal year	20,136.62
July 1, 1901, balance unexpended	51,153.56
July 1, 1901, outstanding liabilities	4,446.35
July 1, 1901, balance available	46,707.21
July 1, 1901, amount covered by uncompleted contracts	39,283.65
Amount (estimated) required for completion of existing project	20,700.00
Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1901	20,700.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

The dates and amounts of appropriations for this harbor are as follows:

Act of—		Act of—	
May 26, 1824	$20,000.00	March 3, 1875	$10,000.00
March 3, 1825	5,712.00	June 18, 1878	5,000.00
March 25, 1826	13,184.90	March 3, 1879	3,500.00
April 23, 1830	1,850.00	June 14, 1880	10,000.00
March 2, 1831	2,820.00	March 3, 1881	10,000.00
July 3, 1832	2,500.00	August 2, 1882	14,000.00
March 2, 1833	600.00	July 5, 1884	10,000.00
June 28, 1834	2,000.00	August 5, 1886	6,000.00
March 3, 1835	700.00	August 11, 1888	6,000.00
July 2, 1836	500.00	September 19, 1890	8,000.00
July 7, 1838	2,400.00	July 13, 1892	9,500.00
August 31, 1852	5,000.00	August 18, 1894	1,500.00
July 11, 1870	10,000.00	June 3, 1896	1,500.00
March 3, 1871	10,000.00	March 3, 1899	10,000.00
June 10, 1872	2,500.00		75,000.00
March 3, 1873	3,000.00		
June 23, 1874	5,000.00	Total	267,766.90

ABSTRACT OF CONTRACT IN FORCE JUNE 30, 1901.

Contract dated May 16, 1901: Rockport Granite Company, contractors; to deposit 23,000 tons, more or less, of rubblestone in the riprap on Long Beach, at $1.89 per ton of 2,000 pounds; approved June 12, 1901; to be commenced June 29, 1901; to be completed February 28, 1902.

COMMERCIAL STATISTICS.

The accompanying commercial statistics have been furnished by the collector of customs at Plymouth, Mass.

Amount of revenue collected	
1899	$10,678.00
1900	603.91
1901	757.95

Entrances and clearances.

	1899.	1900.	1901
Entrances:			
Foreign	5	4	5
Domestic	61	73	58
Clearances.			
Foreign	7	6	5
Domestic	61	71	58

Imports.

		1899.	1900	1901
Coal	tons	20,001	23,649	28,928
Lumber	feet	3,080,000	3,015,000	2,600,000
Brick	number	.....	600,000	.....

Barges and schooners up to 18 feet draft frequent the harbor.

8. Harbors at Plymouth and Provincetown, Mass. (*a*) *Plymouth Harbor.* In the original condition of the harbor the channel and low-water line were about 2,500 feet from the wharf at Plymouth. Long Beach, between the harbor and the ocean, was, for the most part, low and narrow, and liable to inroads by the sea that would injure or destroy the harbor.

All projects and expenditures prior to 1875 appear to have been for the construction of works for the preservation of the beach.

The original project for the improvement of the channel, adopted by the act of March 3, 1875, was to dredge a channel, 100 feet wide and 6 feet deep at mean low water, through the flats from the channel in the inner harbor to Long Wharf in Plymouth, at an estimated cost of $28,000.

Prior to operations under the existing project $190,634.38 had been expended in preserving Long Beach and in dredging under the project of March 3, 1875, as modified, which resulted in obtaining a channel 150 feet wide and 9 feet deep and a basin directly in front of the town wharves 866 feet long, 150 feet wide, and 9 feet deep. Of this amount $60,727.52 was expended for maintenance.

The existing project for the protection of the beach, adopted by the act of March 3, 1899, is to strengthen the sections of beach damaged by the great storm of November, 1898, and to restore Eel River to its former course, discharging into the head of the harbor from its present course into the sea, to which it was changed by the storm, at an estimated cost of $95,700. The local officer has reported the project to be unworthy of prosecution so far as it relates to Eel River, and so far only.

The amount expended on the work of the existing project to the close of the fiscal year ending June 30, 1902, is $58,332.69, with which 10,468 linear feet of rubblestone dike was built on Long Beach, which has resulted in strengthening the beach by the accretion of a large volume of sand and beach shingle.

The maximum draft that can be carried June 30, 1902, at mean low water over the shoalest part of the improved channel is 7.5 feet, and of the basin 7 feet. The mean range of tides is 10.1 feet.

The commerce benefited by this improvement consists of coal and lumber, of which 29,000 tons and 3,000,000 feet, respectively, were carried into the harbor during the fiscal year.

The original project for dredging is published in the Annual Report of the Chief of Engineers for 1874, Part II, page 348. A map of the dredged channel and basin is printed in the Annual Report of the Chief of Engineers for 1888, page 460.

C 10.

IMPROVEMENT OF HARBOR AT PLYMOUTH, MASSACHUSETTS.

During the fiscal year ended June 30, 1902, under the contract of May 16, 1901, with the Rockport Granite Company, 6,526.5 linear feet of rubblestone dike, containing 13,728 tons of stone, were built, completing a dike 10,468 feet in length, containing 28,600 tons of stone, on Long Beach, Plymouth Harbor, which has resulted in strengthening the beach by the accretion of a large volume of sand and beach shingle.

It is proposed to apply the available balance and the amount recommended to be appropriated to maintenance in redredging the channel and basin to and at the wharf dredged under the project of March 3, 1875, as modified.

Money statement.

July 1, 1901, balance unexpended	$51,153.56
Amount appropriated by river and harbor act approved June 13, 1902	4,000.00
	55,153.56
June 30, 1902, amount expended during fiscal year	32,353.73
July 1, 1902, balance unexpended	22,799.83
Amount (estimated) required for completion of existing project	20,700.00
Amount that can be profitably expended in fiscal year ending June 30, 1904, in addition to the balance unexpended July 1, 1902, for maintenance of improvement	5,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

The dates and amounts of appropriations for this harbor are as follows:

Act of—		Act of—	
May 26, 1824	$20,000.00	June 18, 1878	$5,000.00
March 3, 1825	5,712.00	March 3, 1879	3,500.00
March 25, 1826	13,184.90	June 14, 1880	10,000.00
April 23, 1830	1,850.00	March 3, 1881	10,000.00
March 2, 1831	2,820.00	August 2, 1882	14,000.00
July 3, 1832	2,500.00	July 5, 1884	10,000.00
March 2, 1833	600.00	August 5, 1886	6,000.00
June 28, 1834	2,000.00	August 11, 1888	6,000.00
March 3, 1835	700.00	September 19, 1890	8,000.00
July 2, 1836	500.00	July 13, 1892	9,500.00
July 7, 1838	2,400.00	August 18, 1894	1,500.00
August 31, 1852	5,000.00	June 3, 1896	1,500.00
July 11, 1870	10,000.00	March 3, 1899	{10,000.00 {75,000.00
March 3, 1871	10,000.00	June 13, 1902	4,000.00
June 10, 1872	2,500.00		
March 3, 1873	3,000.00		
June 23, 1874	5,000.00	Total	271,766.90
March 3, 1875	10,000.00		

COMMERCIAL STATISTICS FOR THE FISCAL YEAR 1902.

[Through the courtesy of the collector of customs at Plymouth, Mass.]

Amount of revenue collected 1902	$947.67

Entrances and clearances, 1902.

Entrances:	
Foreign	5
Domestic	67
Clearances:	
Foreign	7
Domestic	67

Freight.

Coal	tons	29,023
Lumber	feet	3,080,000

[a] Allotment requested from appropriation of $15,000 for "Improving Harbors at Plymouth and Provincetown, Massachusetts."

8. Harbors at Plymouth and Provincetown, Mass.—(*a*) *Harbor at Plymouth.*—In the original condition of the harbor the channel and low-water line were about 2,500 feet from the wharf at Plymouth. Long Beach, between the harbor and the ocean, was, for the most part, low and narrow, and liable to inroads by the sea that would injure or destroy the harbor.

All projects and expenditures prior to 1875 appear to have been for the construction of works for the preservation of the beach.

The original project for the improvement of the channel, adopted by the act of March 3, 1875, was to dredge a channel, 100 feet wide and 6 feet deep at mean low water, through the flats from the channel in the inner harbor to Long Wharf in Plymouth, at an estimated cost of $28,000.

Prior to operations under the existing project $190,634.38 had been expended in preserving Long Beach and in dredging under the project of March 3, 1875, as modified, which resulted in obtaining a channel 150 feet wide and 9 feet deep and a basin directly in front of the town wharves 866 feet long, 150 feet wide, and 9 feet deep. Of this amount $60,727.52 was expended for maintenance.

The existing project for the protection of the beach, adopted by the act of March 3, 1899, is to strengthen the sections of beach damaged by the great storm of November, 1898, and to restore Eel River to its former course, discharging into the head of the harbor from its present course into the sea, to which it was changed by the storm. The estimated cost was $95,700.

The amount expended on the work of the existing project to the close of the fiscal year ending June 30, 1903, is $58,629.76, with which 10,468 linear feet of rubblestone dike was built on Long Beach, which has resulted in strengthening the beach by the accretion of a large volume of sand and beach shingle, and emergency contracts have been made for returning Eel River to its former course.

In addition to the aforesaid amount expended under the present project $3,954.42 has been expended from the appropriation made by the act of June 13, 1902, for maintenance in redredging the turning basin which had been dredged at the wharves under the project of March 3, 1875.

The maximum draft that can be carried, June 30, 1903, at mean low water over the shoalest part of the locality under improvement is 9 feet. The mean range of tides is 10.1 feet.

The commerce of the harbor amounted, in the fiscal year 1902, to 32,873 tons, and in 1903 to 29,326 tons, of which about 93 per cent was coal.

The original project for dredging is published in the Annual Report of the Chief of Engineers for 1874, Part II, page 348. A map of the dredged channel and basin is printed in the Annual Report of the Chief of Engineers for 1888, page 460.

C 8.

IMPROVEMENT OF PLYMOUTH AND PROVINCETOWN HARBORS, MASSACHUSETTS.

(A) PLYMOUTH HARBOR.

May 9 to 22, under the contract of February 18, 1903, with the Bay State Dredging Company, there were dredged 12,200 cubic yards of mud and sludge, at 29.75 cents per cubic yard, from the turning basin at the wharves.

The dredging restored to the depth of 9 feet at mean low water an area of about 3 acres which had been before redredged to that depth in 1899.

It is proposed to apply the available balance to returning the Eel River to its former course and to such extension as may be necessary of the dike of riprap stones on Long Beach.

Money statement.

July 1, 1902, balance unexpended	$22,799.83
June 30, 1903, amount expended during fiscal year	4,251.49
July 1, 1903, balance unexpended	18,548.34
July 1, 1903, outstanding liabilities	1.25
July 1, 1893, balance available	18,547.09
July 1, 1903, amount covered by uncompleted contracts	3,276.21
Amount (estimated) required for completion of existing project	20,700.00

The dates and amounts of appropriations for this harbor are as follows:

Act of—		Act of—	
May 26, 1824	$20,000.00	June 18, 1878	$5,000.00
March 3, 1825	5,712.00	March 3, 1879	3,500.00
March 25, 1826	13,184.90	June 14, 1880	10,000.00
April 23, 1830	1,850.00	March 3, 1881	10,000.00
March 2, 1831	2,820.00	August 2, 1882	14,000.00
July 3, 1832	2,500.00	July 5, 1884	10,000.00
March 2, 1833	600.00	August 5, 1886	6,000.00
June 28, 1834	2,000.00	August 11, 1888	6,000.00
March 3, 1835	700.00	September 19, 1890	8,000.00
July 2, 1836	500.00	July 13, 1892	9,500.00
July 7, 1838	2,400.00	August 18, 1894	1,500.00
August 31, 1852	5,000.00	June 3, 1896	1,500.00
July 11, 1870	10,000.00	March 3, 1899	10,000.00
March 3, 1871	10,000.00		75,000.00
June 10, 1872	2,500.00	June 13, 1902	4,000.00
March 3, 1873	3,000.00		
June 23, 1874	5,000.00	Total	271,766.90
March 3, 1875	10,000.00		

ABSTRACT OF CONTRACTS IN FORCE JUNE 30, 1903.

Emergency contract dated June 22, 1903: Clark Finney, of Plymouth, Mass., contractor, to excavate 1,829 cubic yards, more or less, of material from the former bed of Eel River, Plymouth, Mass., at 49 cents per cubic yard; to be commenced July 6, 1903, and to be completed by August 22, 1903.

Emergency contract dated June 30, 1903: Wonson & Latimer, of Gloucester and Boston, Mass., contractors; to furnish 1,000 tons, more or less, of riprap stone, and to build thereof a riprap dike on the beach near Eel River, Plymouth, Mass., at $2.38 per ton put in place; to be commenced July 30, 1903, and to be completed September 30, 1903.

COMMERCIAL STATISTICS FOR THE FISCAL YEAR 1903.

[Through the courtesy of the collector of customs at Plymouth, Mass.]

Amount of revenue collected $216.13

Entrances and clearances.

Entrances—		Clearances—	
Foreign	2	Foreign	3
Domestic	57	Domestic	56

FREIGHT.

	Tons.
Coal	27,326
Lumber	2,000
	29,326

1904

23. Harbors at Plymouth and Provincetown, Mass. (*a*) *Harbor at Plymouth.* In the original condition of the harbor the channel and low-water line were about 2,500 feet from the wharf at Plymouth. Long Beach, between the harbor and the ocean, was, for the most part, low and narrow, and liable to inroads by the sea that would injure or destroy the harbor.

All projects and expenditures prior to 1875 appear to have been for the construction of works for the preservation of the beach.

The original project for the improvement of the channel, adopted by the act of March 3, 1875, was to dredge a channel, 100 feet wide and 6 feet deep at mean low water, through the flats from the channel in the inner harbor to Long Warf in Plymouth, at an estimated cost of $28,000.

Prior to operations under the existing project, $198,859.22 had been expended in preserving Long Beach and in dredging under the project of March 3, 1875, as modified, which resulted in obtaining a channel 150 feet wide and 9 feet deep and a basin directly in front of the town wharves 866 feet long, 150 feet wide, and 9 feet deep. Of this amount $60,727.52 was expended for maintenance.

The existing project for the protection of the beach, adopted by the act of March 3, 1899, is to strengthen the sections of beach damaged by the great storm of November, 1898, and to restore Eel River to its former course, discharging into the head of the harbor from its present course into the sea, to which it was changed by the storm. The estimated cost was $95,700.

The amount expended on the work of improvement under the existing project to the close of the fiscal year ending June 30, 1904, is $63,015.99, with which 10,468 linear feet of rubblestone dike was built on Long Beach, which has resulted in strengthening the beach by the accretion of a large volume of sand and beach shingle; Eel River was restored to its former course, and 536 linear feet of stone dike was built to prevent the river from being again turned into the sea. In addition to the aforesaid amount expended under the present project, $3,954.42 has been expended for maintenance in redredging the turning basin which had been dredged at the wharves under the project of March 3, 1875.

In the report of January 20, 1899, submitting the project with estimate of cost it was said:

> The following estimate for this work should be considered approximate only, for the reason that further changes are likely to occur before the work can be accomplished, which changes may materially increase or diminish the amount of work necessary to restore the beach to a safe condition.

The accretion of the beach before the stone dike was built materially diminished the cross section of a considerable part of it, and permitted its extension to protect other places where further erosion has occurred. With the balance available June 30, 1904, all further extension of the dike which is necessary to protect the remaining weak sections of the beach can be completed.

The maximum draft that can be carried, June 30, 1904, at mean low water, over the shoalest part of the locality under improvement is 7.5 feet. The mean range of tides is 10.1 feet.

The commerce of the harbor consists of coal and lumber, of which 29,326 tons was received in 1902 and 34,142 tons in 1903.

The original project for dredging is published in the Annual Report of the Chief of Engineers for 1874, Part 2, page 348. A map of the dredged channel and basin is printed in the Annual Report of the Chief of Engineers for 1888, page 460.

B 21.

IMPROVEMENT OF PLYMOUTH AND PROVINCETOWN HARBORS, MASSACHUSETTS.

(A) PLYMOUTH HARBOR.

In returning Eel River to its former course, 2,085 cubic yards of earth were excavated from its original bed under emergency contract with Clark Finney, at a cost of $1,081.65; a dam of earth and sand bags was built across its new bed and extended across the lower part of the beach by 355 feet of light stone dike, by hired labor at a cost of $243.29; the return of the river to its original bed by which it flowed into the harbor was accomplished August 17, 1903.

To prevent it from being again turned into the sea, 536 linear feet of stone dike were built along it on Long Beach, under emergency contract with Wonson & Latimer, at a cost of $2,055.97. The total cost of turning the river and of protecting it from being again turned into the sea was $4,380.91.

To June 30, 1904, the project for the protection of the beach and the return of Eel River, had been 84 per cent accomplished.

It is proposed to apply the available balance for beach protection ($11,984.01) to completing the extension of dike necessary to protect the remaining weak sections of beach, and the available balance for dredging ($2,178.10) to the maintenance of the channel in the harbor.

Money statement.

July 1, 1903, balance unexpended	$18,548.34
June 30, 1904, amount expended during fiscal year, for works of improvement	4,386.23
July 1, 1904, balance unexpended	14,162.11
July 1, 1904, outstanding liabilities	20.00
July 1, 1904, balance available	14,142.11
Amount (estimated) required for completion of existing project	20,700.00

APPROPRIATIONS.

Act of—		Act of—	
May 26, 1824	$20,000.00	March 3, 1875	$10,000.00
March 3, 1825	5,712.00	June 18, 1878	5,000.00
March 25, 1826	13,184.90	March 3, 1879	3,500.00
April 23, 1830	1,850.00	June 14, 1880	10,000.00
March 2, 1831	2,820.00	March 3, 1881	10,000.00
July 3, 1832	2,500.00	August 2, 1882	14,000.00
March 2, 1833	600.00	July 5, 1884	10,000.00
June 28, 1834	2,000.00	August 5, 1886	6,000.00
March 3, 1835	700.00	August 11, 1888	6,000.00
July 2, 1836	500.00	September 19, 1890	8,000.00
July 7, 1838	2,400.00	July 13, 1892	9,500.00
August 31, 1852	5,000.00	August 18, 1894	1,500.00
June 23, 1866 (allotment)	8,315.00	June 3, 1896	1,500.00
July 11, 1870	10,000.00	March 3, 1899	10,000.00
March 3, 1871	10,000.00		75,000.00
June 10, 1872	2,500.00	June 13, 1902	4,000.00
March 3, 1873	3,000.00		
June 23, 1874	5,000.00	Total	280,081.90

NOTE.—From 1842 to 1859, inclusive, $90.16 were carried to surplus fund.

CONTRACTS IN FORCE.

Emergency contract dated June 22, 1903: Clark Finney, of Plymouth, Mass., contractor, to excavate 1,829 cubic yards, more or less, of material from the former bed of Eel River, Plymouth, Mass., at 49 cents per cubic yard; to be commenced July 6, 1903, and to be completed by August 22, 1903.

Emergency contract dated June 30, 1903: Wonson & Latimer, of Gloucester and Boston, Mass., contractors, to furnish 1,000 tons, more or less, of riprap stone, and to build thereof a riprap dike on the beach near Eel River, Plymouth, Mass., at $2.38 per ton put in place; to be commenced July 30, 1903, and to be completed September 30, 1903.

COMMERCIAL STATISTICS.

[Through the courtesy of the collector of customs at Plymouth, Mass.]

Amount of revenue collected $313.72

Entrances and clearances.

Entrances—		Clearances—	
Foreign	2	Foreign	7
Domestic	69	Domestic	64

FREIGHT.

	Tons.
Coal	29,642
Lumber	4,500
	34,142

18. Harbors at Plymouth and Provincetown, Mass.—(*a*) *Harbor at Plymouth.*—In the original condition of the harbor the channel and low-water line were about 2,500 feet from the wharf at Plymouth. Long Beach, between the harbor and the ocean, was, for the most part, low and narrow, and liable to inroads by the sea that would injure or destroy the harbor.

All projects and expenditures prior to 1875 appear to have been for the construction of works for the preservation of the beach.

The original project for the improvement of the channel, adopted by the act of March 3, 1875, was to dredge a channel, 100 feet wide and 6 feet deep at mean low water, through the flats from the channel in the inner harbor to Long Wharf in Plymouth, at an estimated cost of $28,000.

Prior to operations under the existing project, $198,859.22 had been expended in preserving Long Beach and in dredging under the project of March 3, 1875, as modified, which resulted in obtaining a channel 150 feet wide and 9 feet deep and a basin directly in front of the town wharves 866 feet long, 150 feet wide, and 9 feet deep. Of this amount $60,727.52 was expended for maintenance.

The existing project for the protection of the beach, adopted by the act of March 3, 1899, is to strengthen the sections of beach damaged by the great storm of November, 1898, and to restore Eel River to its former course, discharging into the head of the harbor from its course into the sea, to which it was changed by the storm. The estimated cost was $95,700.

The amount expended on the work of improvement under the existing project to the close of the fiscal year ending June 30, 1905, is $72,431.18, with which 11,843 linear feet of rubblestone dike was built on Long Beach, which has resulted in strengthening the beach by the accretion of a large volume of sand and beach shingle; Eel River was restored to its former course, and 536 linear feet of stone dike was built to prevent the river from being again turned into the sea. In addition to the aforesaid amount expended under the present project, $3,951.42 has been expended for maintenance in redredging the turning basin which had been dredged at the wharves under the project of March 3, 1875.

In the report of January 20, 1899, submitting the project with estimate of cost it was said:

> The following estimate for this work should be considered approximate only, for the reason that further changes are likely to occur before the work can be accomplished, which changes may materially increase or diminish the amount of work necessary to restore the beach to a safe condition.

The accretion of the beach before the stone dike was built materially diminished the cross section of a considerable part of it, and permitted its extension to protect other places where further erosion has occurred.

The balance available June 30, 1905, is sufficient for contingencies for the preservation of the beach.

It is reported by the harbor master at Plymouth that the improvement of this locality by the United States has effected a saving of 50 cents per ton in freight rates.

The commerce of the harbor consists of coal and lumber, of which 24,765 tons was received in 1899 and 49,386 in 1904, an increase of about 100 per cent in five years.

The maximum draft that can be carried, June 30, 1905, at mean low water, over the shoalest part of the locality under improvement is 7.5 feet. The mean range of tides is 10.1 feet.

The original project for dredging is published in the Annual Report of the Chief of Engineers for 1874, Part 2, page 318. A map of the dredged channel and basin is printed in the Annual Report of the Chief of Engineers for 1888, page 460.

B 18.

IMPROVEMENT OF PLYMOUTH AND PROVINCETOWN HARBORS, MASSACHUSETTS.

(A) PLYMOUTH HARBOR.

In protecting the weak sections of Long Beach 4,256 tons of riprap stone were deposited, under a contract with Smith & Robinson, extending the stone dike previously built for a distance of 1,375 feet.

On June 30, 1905, the project for the protection of the beach and the return of Eel River to its former course had been substantially completed.

It is proposed to apply the available balance for beach protection ($2,565.82) to repairing the riprap dike on the beach, and the available balance for dredging ($2,178.10) to the maintenance of the channel in the harbor.

Money statement.

July 1, 1904, balance unexpended	$14,162.11
June 30, 1905, amount expended during fiscal year, for works of improvement	9,418.19
July 1, 1905, balance unexpended	4,743.92
July 1, 1905, outstanding liabilities	110.00
July 1, 1905, balance available	4,633.92
Amount (estimated) required for completion of existing project	20,700.00

APPROPRIATIONS.

May 26, 1824	$20,000.00	March 3, 1875	$10,000.00
March 3, 1825	5,712.00	June 18, 1878	5,000.00
March 25, 1826	13,184.90	March 3, 1879	3,500.00
April 23, 1830	1,850.00	June 14, 1880	10,000.00
March 2, 1831	2,820.00	March 3, 1881	10,000.00
July 3, 1832	2,500.00	August 2, 1882	14,000.00
March 2, 1833	600.00	July 5, 1884	10,000.00
June 28, 1834	2,000.00	August 5, 1886	6,000.00
March 3, 1835	700.00	August 11, 1888	6,000.00
July 2, 1836	500.00	September 19, 1890	8,000.00
July 7, 1838	2,400.00	July 13, 1892	9,500.00
August 31, 1852	5,000.00	August 18, 1894	1,500.00
June 23, 1866 (allotment)	8,315.00	June 3, 1896	1,500.00
July 11, 1870	10,000.00	March 3, 1899	10,000.00 75,000.00
March 3, 1871	10,000.00	June 13, 1902	4,000.00
June 10, 1872	2,500.00		
March 3, 1873	3,000.00		
June 23, 1874	5,000.00	Total	280,081.90

NOTE.—From 1842 to 1859, inclusive, $90.16 were carried to surplus fund.

CONTRACT IN FORCE.

Contractor: Smith & Robinson, New York, N. Y.
Date of contract: August 10, 1904.
Date of approval: August 23, 1904
Date of commencement: August 15, 1904.
Date of completion: December 31, 1904. (Time of completion waived. Contract completed April 29, 1905.)

For 1,350 feet of riprap dike (estimated at 3,150 tons of stone) on Long Beach, Plymouth Harbor, at $2.09 per ton of 2,000 pounds.

COMMERCIAL STATISTICS.

Entrances and clearances.

Vessels	Entrances.	Clearances.
Foreign		2
Domestic	73	71

Freight.

Articles	1903.	1904
	Tons.	*Tons.*
Coal	29,642	38,086
Lumber	4,500	5,700
Stone		5,000
Fish		400
Miscellaneous		200
Total	34,142	49,386

Passengers carried in 1904, 49,335.

15. Harbors at Plymouth and Provincetown, Mass. —(*a*) *Harbor at Plymouth.*—In the original condition of the harbor the channel and low-water line were about 2,500 feet from the wharf at Plymouth. Long Beach, between the harbor and the ocean, was, for the most part, low and narrow, and liable to inroads by the sea that would injure or destroy the harbor.

All projects and expenditures prior to 1875 appear to have been for the construction of works for the preservation of the beach.

The original project for the improvement of the channel, adopted by the act of March 3, 1875, was to dredge a channel, 100 feet wide and 6 feet deep at mean low water, thru the flats from the channel in the inner harbor to Long Wharf in Plymouth, at an estimated cost of $28,000.

Prior to operations under the existing project, $198,859.22 had been expended in preserving Long Beach and in dredging under the project of March 3, 1875, as modified, which resulted in obtaining a channel 150 feet wide and 9 feet deep and a basin directly in front of the town wharves 866 feet long, 150 feet wide, and 9 feet deep. Of this amount $60,727.52 was expended for maintenance.

The existing project for the protection of the beach, adopted by the act of March 3, 1899, is to strengthen the sections of beach damaged by the great storm of November, 1898, and to restore Eel River to its former course, discharging into the head of the harbor, from its course into the sea, to which it was changed by the storm. The estimated cost was $95,700.

The amount expended on the work of improvement under the existing project to the close of the fiscal year ending June 30, 1906, is $73,375.57, with which 11,843 linear feet of rubblestone dike was built on Long Beach, which has resulted in strengthening the beach by the accretion of a large volume of sand and beach shingle; Eel River was restored to its former course, and 536 linear feet of stone dike was built to prevent the river from being again turned into the sea. In addition to the aforesaid amount expended under the present project, $3,954.42 has been expended for maintenance in redredging the turning basin which had been dredged at the wharves under the project of March 3, 1875.

In the report of January 20, 1899, submitting the project with estimate of cost it was said:

> The following estimate for this work should be considered approximate only, for the reason that further changes are likely to occur before the work can be accomplished, which changes may materially increase or diminish the amount of work necessary to restore the beach to a safe condition.

The accretion of the beach before the stone dike was built materially diminished the cross section of a considerable part of it, and permitted its extension to protect other places where further erosion has occurred.

It is proposed to apply the available balance to repairing the riprap dike on the beach.

The commerce consists of coal, lumber, and stone, of which 24,765 tons were received in 1899 and 57,400 tons in 1905, an increase of 132 per cent in 6 years.

It is reported by the harbor master at Plymouth that the improvement of this locality by the United States has effected a saving of 50 cents per ton in freight rates.

The maximum draft that can be carried, June 30, 1906, at mean low water, over the shoalest part of the locality under improvement is 7.5 feet. The mean range of tides is 10.1 feet.

The original project for dredging is published in the Annual Report of the Chief of Engineers for 1874, Part 2, page 348. The project of 1899 is printed in the report for that year, page 1089. A map of the dredged channel and basin is printed in the Annual Report of the Chief of Engineers for 1888, page 460.

July 1, 1905, balance unexpended	84,743.92
June 30, 1906, amount expended during fiscal year, for works of improvement	941.39
July 1, 1906, balance unexpended	3,802.53
July 1, 1906, outstanding liabilities	4.00
July 1, 1906, balance available	3,798.53
Amount (estimated) required for completion of existing project	20,700.00

B 14.

IMPROVEMENT OF PLYMOUTH AND PROVINCETOWN HARBORS, MASSACHUSETTS.

(A) PLYMOUTH HARBOR.

From October to December, 1905, 775 linear feet of riprap dike on Long Beach, Plymouth Harbor, were repaired by hired labor, closing breaches made in the dike at six localities and resetting the upper stones which had been displaced by the severe storms and high tides of the preceding winter.

APPROPRIATIONS.

May 26, 1824	$20,000.00	March 3, 1875	$10,000.00
March 3, 1825	5,712.00	June 18, 1878	5,000.00
March 25, 1826	13,184.90	March 3, 1879	3,500.00
April 23, 1830	1,850.00	June 14, 1880	10,000.00
March 2, 1831	2,820.00	March 3, 1881	10,000.00
July 3, 1832	2,500.00	August 2, 1882	14,000.00
March 2, 1833	600.00	July 5, 1884	10,000.00
June 28, 1834	2,000.00	August 5, 1886	6,000.00
March 3, 1835	700.00	August 11, 1888	6,000.00
July 2, 1836	500.00	September 19, 1890	8,000.00
July 7, 1838	2,400.00	July 13, 1892	9,500.00
August 31, 1852	5,000.00	August 18, 1894	1,500.00
June 23, 1866 (allotment)	8,315.00	June 3, 1896	1,500.00
July 11, 1870	10,000.00	March 3, 1899	10,000.00
March 3, 1871	10,000.00		75,000.00
June 10, 1872	2,500.00	June 13, 1902	4,000.00
March 3, 1873	3,000.00		
June 23, 1874	5,000.00	Total	280,081.90

NOTE.—From 1842 to 1859, inclusive, $90.16 were carried to surplus fund.

COMMERCIAL STATISTICS.

Articles.	1903.	1904.	1095.
	Tons.	*Tons.*	*Tons.*
Coal	29,642	38,086	50,000
Lumber	4,500	5,700	2,000
Stone	.....	5,000	5,000
Fish	.....	400	400
Miscellaneous	.....	200	.....
Total	34,142	49,386	57,400
Number of passengers carried	....	49,335	58,000

16. Harbors of Plymouth and Provincetown, Mass.—(a) Harbor at Plymouth.—In the original condition of the harbor the channel and low-water line were about 2,500 feet from the wharf at Plymouth. Long Beach, between the harbor and the ocean, was, for the most part, low and narrow, and liable to inroads by the sea that would injure or destroy the harbor.

All projects and expenditures prior to 1875 appear to have been for the construction of works for the preservation of the beach.

The original project for the improvement of the channel, adopted by the act of March 3, 1875, was to dredge a channel, 100 feet wide and 6 feet deep at mean low water, through the flats from the channel in the inner harbor to Long Wharf in Plymouth, at an estimated cost of $28,000.

Prior to operations under the existing project, $198,859.22 had been expended in preserving Long Beach and in dredging under the project of March 3, 1875, as modified, which resulted in obtaining a channel 150 feet wide and 9 feet deep and a basin directly in front of the town wharves 866 feet long, 150 feet wide, and 9 feet deep. Of this amount $60,727.52 was expended for maintenance.

The existing project for the protection of the beach, adopted by the act of March 3, 1899, is to strengthen the sections of beach damaged by the great storm of November, 1898, and to restore Eel River to its former course, discharging into the head of the harbor, from its course into the sea, to which it was changed by the storm. The estimated cost was $95,700.

The amount expended on the work of improvement under the existing project to the close of the fiscal year ending June 30, 1907, is $73,437.28, with which 11,843 linear feet of rubblestone dike was built on Long Beach, which has resulted in strengthening the beach by the accretion of a large volume of sand and beach shingle; Eel River was restored to its former course, and 536 linear feet of stone dike was built to prevent the river from being again turned into the sea. In addition to the aforesaid amount expended under the present project, $3,954.42 has been expended for maintenance in redredging the turning basin, which had been dredged at the wharves under the project of March 3, 1875.

By way of refundment, $4,530.12 was collected as damages from the surety of a failing contractor.

In the report of January 20, 1899, submitting the project with estimate of cost, it was said:

> The following estimate for this work should be considered approximate only, for the reason that further changes are likely to occur before the work can be accomplished, which changes may materially increase or diminish the amount of work necessary to restore the beach to a safe condition.

The accretion of the beach before the stone dike was built materially diminished the cross section of a considerable part of it, and permitted its extension to protect other places where further erosion has occurred.

It is proposed to apply the available balance to repairing the riprap dike on the beach.

The commerce consists of coal, lumber, and stone, of which 24,765 tons was received in 1899 and 33,354 tons in 1906.

It is reported by the harbor master at Plymouth that the improvement of this locality by the United States has effected a saving of 50 cents per ton in freight rates.

The maximum draft that can be carried, June 30, 1907, at mean low water, over the shoalest part of the locality under improvement is 7.5 feet. The mean range of tides is 10.1 feet.

The original project for dredging is published in the Annual Report of the Chief of Engineers for 1874, Part 2, page 348. The project of 1899 is printed in the report for that year, page 1089. A map of the dredged channel and basin is printed in the Annual Report of the Chief of Engineers for 1888, page 460.

July 1, 1906, balance unexpended	$3,802.53
Damages from surety of failing contractor	4,530.12
	8,332.65
June 30, 1907, amount expended during fiscal year, for works of improvement	61.71
July 1, 1907, balance unexpended	8,270.94
Amount (estimated) required for completion of existing project	20,700.00

B 16.

IMPROVEMENT OF PLYMOUTH AND PROVINCETOWN HARBORS, MASSACHUSETTS.

(A) PLYMOUTH HARBOR.

No work was done and none required in the maintenance of the rip-rap dike on Long Beach.

Money statement.

July 1, 1906, balance unexpended	$3,802.53
Damages from surety of failing contractor	4,530.12
	8,332.65
June 30, 1907, amount expended during fiscal year, for works of improvement	61.71
July 1, 1907, balance unexpended	8,270.94
Amount (estimated) required for completion of existing project	20,700.00

APPROPRIATIONS.

May 26, 1824	$20,000.00	June 18, 1878	$5,000.00
March 3, 1825	5,712.00	March 3, 1879	3,500.00
March 25, 1826	13,184.90	June 14, 1880	10,000.00
April 23, 1830	1,850.00	March 3, 1881	10,000.00
March 2, 1831	2,820.00	August 2, 1882	14,000.00
July 3, 1832	2,500.00	July 5, 1884	10,000.00
March 2, 1833	600.00	August 5, 1886	6,000.00
June 28, 1834	2,000.00	August 11, 1888	6,000.00
March 3, 1835	700.00	September 19, 1890	8,000.00
July 2, 1836	500.00	July 13, 1892	9,500.00
July 7, 1838	2,400.00	August 18, 1894	1,500.00
August 31, 1852	5,000.00	June 3, 1896	1,500.00
June 23, 1866 (allotment)	8,315.00	March 3, 1899	10,000.00
July 11, 1870	10,000.00		75,000.00
March 3, 1871	10,000.00	June 13, 1902	4,000.00
June 10, 1872	2,500.00	Damages from surety of failing contractor	4,530.12
March 3, 1873	3,000.00		
June 23, 1874	5,000.00		
March 3, 1875	10,000.00	Total	284,612.02

NOTE.—From 1842 to 1859, inclusive, $90.16 were carried to surplus fund.

COMMERCIAL STATISTICS.

Articles.	1904	1905.	1906.
	Tons	*Tons*	*Tons*
Coal	38,086	50,000	31,314
Lumber	5,700	2,000	2,000
Stone	5,000	5,000	....
Fish	400	400	.....
Miscellaneous	200	....	40
Total	49,386	57,400	33,354
Number of passengers carried	49,335	58,000	49,795

16. Harbors of Plymouth and Provincetown, Mass.—(a) Harbor at Plymouth.—In the original condition of the harbor the channel and low-water line were about 2,500 feet from the wharf at Plymouth. Long Beach, between the harbor and the ocean, was, for the most part, low and narrow, and liable to inroads by the sea that would injure or destroy the harbor.

All projects and expenditures prior to 1875 appear to have been for the construction of works for the preservation of the beach.

The original project for the improvement of the channel, adopted by the act of March 3, 1875, was to dredge a channel, 100 feet wide and 6 feet deep at mean low water, through the flats from the channel in the inner harbor to Long Wharf in Plymouth, at an estimated cost of $28,000.

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The accretion of the beach before the stone dike was built materially diminished the cross section of a considerable part of it, and permitted its extension to protect other places where further erosion has occurred.

It is proposed to apply the available balance to repairing the riprap dike on the beach.

The commerce consists chiefly of coal and lumber, of which 33,354 tons was received in 1906 and 40,615 in 1907.

It is reported by the harbor master at Plymouth that the improvement of this locality by the United States has effected a saving of 50 cents per ton in freight rates.

The maximum draft that can be carried, June 30, 1908, at mean low water, over the shoalest part of the locality under improvement is 7.5 feet. The mean range of tides is 10.1 feet.

The original project for dredging is published in the Annual Report of the Chief of Engineers for 1874, Part 2, page 348. The project of 1899 is printed in the report for that year, page 1089. A map of the dredged channel and basin is printed in the Annual Report of the Chief of Engineers for 1888, page 460.

July 1, 1907, balance unexpended	$8,270.94
July 1, 1908, balance unexpended	8,270.94
Amount (estimated) required for completion of existing project	20,700.00

B 16.

IMPROVEMENT OF PLYMOUTH AND PROVINCETOWN HARBORS, MASSACHUSETTS.

(A) PLYMOUTH HARBOR.

No work was done and none required in the maintenance of the riprap dike on Long Beach.

Money statement.

July 1, 1907, balance unexpended	$8,270.94
July 1, 1908, balance unexpended	8,270.94
Amount (estimated) required for completion of existing project	20,700.00

APPROPRIATIONS.

May 26, 1824	$20,000.00	March 3, 1835	$700.00
March 3, 1825	5,712.00	July 2, 1836	500.00
March 25, 1826	13,184.90	July 7, 1838	2,400.00
April 23, 1830	1,850.00	August 31, 1852	5,000.00
March 2, 1831	2,820.00	June 23, 1866 (allotment[a])	8,315.00
July 3, 1832	2,500.00	July 11, 1870	10,000.00
March 2, 1833	600.00	March 3, 1871	10,000.00
June 28, 1834	2,000.00	June 10, 1872	2,500.00

[a] The date of allotment shown above is unknown.

March 3, 1873	$3,000.00	September 19, 1890	$8,000.00
June 23, 1874	5,000.00	July 13, 1892	9,500.00
March 3, 1875	10,000.00	August 18, 1894	1,500.00
June 18, 1878	5,000.00	June 3, 1896	1,500.00
March 3, 1879	3,500.00	March 3, 1899	10,000.00
June 14, 1880	10,000.00		75,000.00
March 3, 1881	10,000.00	June 13, 1902	4,000.00
August 2, 1882	14,000.00	Damages from surety of failing contractor	4,530.12
July 5, 1884	10,000.00		
August 5, 1886	6,000.00		
August 11, 1888	6,000.00	Total	284,612.02

NOTE.—From 1842 to 1859, inclusive, $90.16 were carried to surplus fund.

COMMERCIAL STATISTICS.

Articles	1904.	1906.	1907.
	Tons.	*Tons.*	*Tons*
Coal	38,086	31,314	37,155
Lumber	5,700	2,000	2,960
Stone	5,000	.....	.....
Miscellaneous	600	40	500
Total	49,386	33,354	40,615
Number of passengers carried	49,335	49,795	52,525

	Customs collected.	Entrances and clearances.
1905	.....	50
1906	$574.32	58
1907	.....	72

60TH CONGRESS, 2d Session. } HOUSE OF REPRESENTATIVES. { DOCUMENT No. 1168.

PLYMOUTH HARBOR, MASSACHUSETTS.

LETTER

FROM

THE SECRETARY OF WAR,

TRANSMITTING,

WITH A LETTER FROM THE CHIEF OF ENGINEERS, REPORTS OF PRELIMINARY EXAMINATION AND SURVEY OF PLYMOUTH HARBOR, MASSACHUSETTS, WITH A VIEW TO THE CONSTRUCTION OF A BREAKWATER.

DECEMBER 10, 1908. Referred to the Committee on Rivers and Harbors and ordered to be printed with illustration.

WAR DEPARTMENT,
Washington, December 9, 1908.

SIR: I have the honor to transmit herewith a letter from the Chief of Engineers, U. S. Army, dated 5th instant, together with copies of reports from Lieut. Col. Edward Burr, Corps of Engineers, dated November 20, 1907, and September 8, 1908 (with map), upon a preliminary examination and survey, respectively, of Plymouth Harbor, Massachusetts, made by him in compliance with the provisions of the river and harbor act of March 2, 1907.

Very respectfully, LUKE E. WRIGHT,
Secretary of War.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 5, 1908.

SIR: I have the honor to submit herewith for transmission to Congress reports of November 20, 1907, and September 8, 1908 (with map), by Lieut. Col. Edward Burr, Corps of Engineers, on preliminary examination and survey, respectively, authorized by the

river and harbor act approved March 2, 1907, of Plymouth Harbor, Massachusetts, with a view to the construction of a rubblestone breakwater, extending from Long Beach easterly along the crest of Browns Island.

In the survey report of September 8, 1908, Lieutenant-Colonel Burr submits a plan for a breakwater 6,000 feet long at the location named in the act at an estimated cost of $405,000, the construction of which by the United States is recommended by him, subject to certain conditions specified in his report and with the understanding that an extension of the breakwater to a length of 8,000 feet, or even 10,000 feet, at a corresponding increase in cost, may ultimately be demanded to provide the maximum benefits.

From the facts and for the reasons given in their respective reports of September 19, 1908, and November 2, 1908 (herewith), the division engineer, Col. John G. D. Knight, Corps of Engineers, and the Board of Engineers for Rivers and Harbors express the opinion that it is not at present advisable for the United States to undertake the construction of a breakwater at the locality under consideration, and in this adverse opinion I concur.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

PRELIMINARY EXAMINATION OF PLYMOUTH HARBOR, MASSACHUSETTS.

WAR DEPARTMENT,
UNITED STATES ENGINEER OFFICE,
Boston, Mass., November 20, 1907.

SIR: In accordance with instructions contained in Department letter of March 14, 1907, I have the honor to submit the following report upon a preliminary examination of Plymouth Harbor, Massachusetts, made under the following provision of the river and harbor act of March 2, 1907, viz: "Plymouth Harbor, with a view to the construction of a rubblestone breakwater, extending from Long Beach easterly along the crest of Browns Island."

This item refers by name to Plymouth Harbor only. The effect of the improvement, if undertaken by the United States, would include all of the bay of which a part only is called Plymouth Harbor or Plymouth inner harbor, the other important sections of the bay being Kingston and Duxbury bays.

Plymouth Harbor is the southerly portion of the bay lying between Gurnet Point on the north and Rocky Point on the south, distant from each other about 3½ miles. From Gurnet Point to the southern entrance to Boston Harbor is 28 miles. Both of these points are permanent in character. From the shore about 2 miles westerly from Rocky Point, Long Beach extends north-northwesterly 2½ miles to Pier Head, and from Gurnet Point Saquish Neck extends westerly 2 miles to Saquish Head, and Duxbury Beach extends north-northwesterly 4 miles and more. Inclosed by these beaches is an area of water that includes Plymouth Harbor, Kingston Bay, and Duxbury Bay. The first occupies the southern, the second the western, and the third the northern portions of this inclosed area. Plymouth

Harbor lies directly in rear of Long Beach, upon whose maintenance the security of the harbor depends. This beach is but a narrow sand spit, subject to attack by the sea, and since 1824 the United States has been concerned in holding it intact.

From the northerly end of Long Beach there extends easterly to a distance of 2½ miles, measured to the 6-foot contour, an area of shoals known as "Browns Bank" or "Browns Island," parts of which are bare at low water along its northerly edge. From Gurnet Point a shoal foreshore extends westerly 1 mile beyond Saquish Head to Duxbury pier. Between these shoals lies the entrance to the bay, or outer channel, through which there exists in general a good depth of water to and just beyond Duxbury pier. The controlling depth in the outer channel is, however, 24 feet at mean low water and at one point this depth has a minimum width of approximately 500 feet. At Duxbury pier the channel forks into three branches. The largest of these is known as the "Cow Yard," extending north into Duxbury Bay and carrying for a mile a depth of 24 feet or more. The other two channels extend into Plymouth and Kingston bays. All three channels gradually disappear in wide areas of tide flats bare at low water, and none of them carries a depth of 3 fathoms to nearer than three-fourths of a mile of the main shores. The locality is shown on United States Coast and Geodetic Survey Chart No. 338.

All three sections of the main bay have been the subject of examinations, surveys, and improvements by the United States. The original project for Duxbury Harbor was authorized by the act of July 4, 1836, and appears to have been for the protection of Duxbury Beach against breaching by the sea. The second project of June 10, 1872, provided for dredging a channel 200 feet wide and 8 feet deep at mean low water for a distance of 2,300 feet to the wharf at Duxbury in Kingston Bay, and was completed in May, 1874. The expenditures on these two projects were $24,911. The existing project of August 12, 1899, is to dredge a channel 6 feet deep at mean low water and 60 feet wide, increasing to 100 on the curve, from the southerly wharf at Duxbury, in Duxbury Bay, 3,600 feet to the same depth in the natural channel. The estimated cost of this project in 1899 was $17,820. To date there has been expended on this project $12,000, with which the channel was excavated to its full depth and length, but not to the full projected width. No funds for the improvement have been appropriated since 1899, and the channel has shoaled in its upper end to less than the projected depth.

The town of Kingston lies about 1 mile from Kingston Bay, its only harbor. The harbor of Kingston has been the subject of several examinations or surveys in accordance with law. All of these examinations have developed that the improvement desired is the dredging of a channel leading to the wharf of the Plymouth Cordage Company, which has had since 1821 an extensive plant on the shore of Kingston Bay, but in the northern part of the town of Plymouth. As a result of the third examination, a survey was made in 1891, followed by a project for dredging a channel 6 feet deep at mean low water and 100 feet wide to the wharf of the cordage company at a cost estimated at $10,000. This sum was appropriated for the improvement of Kingston Harbor by the act of July 13, 1892, and the dredging was completed in June, 1893. Under authority of the act of March 3, 1905, Kingston Harbor was again the subject of an examination, the

improvement desired being the dredging of a channel 100 feet wide and 10 feet deep at mean low water to the wharf of the Plymouth Cordage Company. The report upon this examination was unfavorable.

Plymouth Harbor has been under improvement by the United States since the appropriation in the act of May 26, 1824, of $20,000 for this purpose. All projects and expenditures prior to 1875 appear to have been for the construction of works for the preservation of Long Beach, which lies between Plymouth Harbor and the ocean, and is for the most part a low and narrow sandy point liable to inroads from the sea that would injure or destroy the harbor. The original project for the deepening of the channel in Plymouth Harbor was adopted by the act of March 3, 1875, and provided for dredging a channel 100 feet wide and 6 feet deep at mean low water from Long wharf in Plymouth through the flats to the natural channel in the inner harbor, at an estimated cost of $28,000. This project was modified in 1877 to include the dredging, directly in front of the wharves, of a basin 866 feet by 150 feet and 8 feet deep at mean low water, and was completed in December, 1881. A survey of the channel in 1883 showed no deterioration in the dredged channel but a deepening by scour and resulted in a project in 1884 and 1885 to deepen the channel and basin to 9 feet at mean low water and to widen the channel to 150 feet. The dredging was completed in 1893. A survey in 1899 showed serious shoaling in both the channel and basin and in the same year they were redredged to the projected dimensions, since which time no work has been done upon the channel, but the basin was again redredged to 9 feet depth in 1903.

For the maintenance of Long Beach the works originally undertaken were temporary structures of light design, acting merely as sand catches. Subsequently these structures were accompanied or succeeded by more substantial constructions variously called bulkheads, dikes, groins, or breakwaters, of timber filled with sand, brush, or stone, in different combinations, or of brush and stone without the inclosing timber frame. None of these structures was permanent in character or able to resist the force of the sea when it reached them through the erosion of the beach. The best and most permanent results were obtained at the north end of the beach where use was made of dikes or groins of brush and stone or of stone alone.

The unusually severe storms of the winter of 1898–99 swept away all protective works and cut down the beach for an aggregate length of 9,000 feet to a level of but 4 or 5 feet above mean high water, or below extreme storm-tide height, endangering a part of the main ship channel lying directly in its rear. Eel River, which enters the harbor from the south, was diverted directly into the sea through a break in the beach at its extreme southern end. Beginning in 1899 the beach has been protected by a substantial rubblestone dike extending southerly 11,843 feet from a point 2,000 feet from the north end, and the new mouth of Eel River has been closed and protected by 536 feet of dike. These works have fully served their purpose and continue in good order to the present time.

The sums appropriated directly for the improvement of Plymouth Harbor, or allotted from joint appropriations, since 1824 amount to $280,081.90, and the expenditures to June 30, 1907, have been $276,250.92. Approximately $64,500 has been applied to dredging the

channel and basin, of which about $15,000 has been for maintenance. The expenditures upon the protection of Long Beach amount to about $212,000, of which $73,437.28 was expended under the existing project of 1899 and has provided a beach projection that is practically permanent in character. The remainder, nearly $139,000, was expended in relatively small sums in the seventy-five years between 1824 and 1899 in the construction of expedients that were mainly of a temporary nature, subject to destruction by storms and requiring frequent renewal or replacement.

From interested parties it is ascertained that the improvement now desired to be undertaken by the United States is the construction of a rubblestone breakwater beginning above storm high-water mark on Long Beach and extending across the slue, so called, and along the crest of Browns Bank, or Browns Island shoal, for a distance of 5,000 feet or more, as may be found to be desirable.

The objects sought to be gained by this improvement are stated to be:

First. Generally to safeguard and convenience a large volume of domestic and foreign commerce, which it is intended to establish at the port.

Second. To make safer the deep-water anchorage at the Cow Yard for ships engaged in the before-mentioned commerce; likewise for smaller vessels using the port for shelter, including the fishing fleet from which in the winter season the General Government daily collects spawn for the propagation of codfish at the Woods Hole hatchery.

Third. By confining and directing the strongly outflowing current from the great interior basin to cause it materially to deepen the main ship channel, thus allowing vessels of the largest class to make safe, direct, and convenient use of the lower harbor and its anchorages. Erosion of Dicks flat and the projecting point of Long Beach, which are now obstructions at entrance of the inner harbor, it is hoped may also beneficially ensue.

Fourth. Incidentally, to protect the Duxbury pier light-house, now exposed to the full force of seas arising in easterly and southeasterly gales.

Fifth. To prevent the drift of sand from Browns Island shoal and the outside of Long Beach into the harbor, so narrowing and obstructing the mouths of the channels from deep water to the wharves, as to make their entrance for navigation difficult and uncertain, by reason of liability to changing conditions.

The facts and reasons for advocating the construction of the breakwater are stated as follows:

The State legislature at its session in 1906, with improvement of interior waterways in Plymouth Harbor in view, directed the board of harbor and land commissioners to make a survey of the same. When completed it very conclusively showed the deterioration of the harbor which the unchecked inward drift of the sand from Browns Island shoal has caused by formation of flats and obstruction of channel mouths.

All the channels of Plymouth, Kingston, and Duxbury harbors (the towns being on the same water basin) unite in the main ship channel at Beach Point and Duxbury pier light-house, where protection afforded by a breakwater would be comprehensive and effective in all the respects enumerated in the numbered memoranda and benefit the navigation and commercial interests of the three towns.

The imports for Plymouth amount annually to $7,000,000, and extensive enlargements now being made of hemp and wool manufacturing plants will, in the near future, greatly add to the same. The demand for coal to be used both for fuel and manufacturing purposes will also be an important factor in coastwise traffic.

A part of the fishing fleet supplying the Boston market in the winter season each night makes harbor at Plymouth, thus enabling the United States Fish Commission, which keeps a steamer at Plymouth for the purpose, to procure daily from the vessels, under the most favorable circumstances, its supply of spawn for the fish hatchery at Woods Hole. This work of the commission in

propagating and stocking adjacent waters with food fish is in the highest degree beneficial and important, and the safety of the fishing fleet at Plymouth is therefore worthy of the especial care and consideration of the Government in behalf of one of its most beneficent departments. Two hundred million eggs were collected from these vessels during the past winter.

As a harbor of refuge Plymouth is the only port south of Boston, on Massachusetts Bay, which may be safely approached by vessels for shelter, if caught in storms and unable to reach Boston. With the opening of the Cape Cod Canal, the building of which is now thought to be assured, the lines of navigation will be directly by the mouth of the harbor, and vessels going in either direction, meeting with adverse winds, must necessarily use the port for anchorage while waiting favoring circumstances.

The Cow Yard anchorage, where vessels seek refuge from storms or, if bound to the port, often lie temporarily is exposed to winds from the south to east quadrant, the gales from the southeast, though usually short, being extremely violent. Construction of a breakwater as proposed will almost landlock the harbor and particularly shelter this now open roadstead by breaking the force of the seas driven from the bay by winds from the direction mentioned. The Duxbury pier light-house will incidentally be placed in a very close lee, and its safety thereby enhanced.

The main ship channel from the open sea is but 4 miles long, deep, wide, and almost perfectly straight, so that the largest ships afloat can now at mean high water come to a point hardly more than a mile from shore. Straightening and deepening of interior channels now existing for distances of 5,000 or 6,000 feet would place any class of vessels at wharves with cargoes for local manufacturing supply, and also in direct rail connection with New York and the West. The access to the harbor is the easiest, shortest, and safest of any on the coast north of the capes of Delaware.

The Massachusetts legislature, at its present session, has taken action favoring liberal expenditure by the State for improvement of the inner harbor at Plymouth, and by a special act authorized the town to join with the State in the work, which is to be done under the charge of the harbor and land commission. The aggregate sum so provided by the State and town will be $160,000, to which will be added an even larger amount by manufacturing interests for shipping and commercial purposes.

Plymouth is making one of the most phenomenal growths in the State, both in population and manufactures, and with protection of her coastwise and ocean business, at comparatively small cost to the General Government, and with such assistance, will become quite an important commercial port. Three large concerns using wool and fiber are making great additions to their plants, and two of them are to build wharves to extend their harbor facilities.

For the future prosperity of Plymouth it is earnestly hoped that the proposed breakwater will be found practicable and receive the approval of the Engineer Department.

The outer or main ship channel leading to Plymouth Harbor has been briefly described above. It is straight and of good depth to the vicinity of Duxbury pier and its northern extension, the Cow Yard, has the same characteristics. The only anchorage in the bay is found in the vicinity and inside of Duxbury pier, but is open to the sea in the easterly and southeasterly storms common on this coast. The construction of a breakwater extending from the northern end of Long Beach easterly along the shoal crest of Browns Bank will protect this anchorage in southeasterly storms and the Cow Yard furnishes a safe anchorage in easterly storms, which ordinarily have not the duration and great severity of northeasters and southeasters. Such a breakwater would be of value also in deepening or widening the outer main channel by closing the swash channel or the slough around the northern end of Long Beach, and by confining the tidal flow, particularly the ebb tide, to the main channel. The general tendency of the ebb tide is to set toward the southeast, and the result of the escape across Browns Bank of a part of the ebb flow is evident in

the diminished depths of the outer portion of the main channel. That a breakwater on Browns Bank would, if given a sufficient extension, increase the minimum depths now found in the channel does not appear to admit of doubt.

The coast as a whole is rocky in this vicinity. The sand movement is relatively small in amount, and beaches are confined largely to the indentations of the coast. From the configuration of Plymouth outer bay and its beaches and spits between Rocky Point and Gurnet Point it is evident that the general sand movement is toward the north; due to the preponderating influences of southeasterly storms, with their resulting beach or surf currents, during periods of maximum agitation of beach sands. Storms from the southeast produce also the highest tides, with maximum flood tide currents, and have in the past broken through Long Beach. During such storms there has been a movement of sand into the inner bay across Long Beach and around its northern end. There are no streams of any consequence entering the bay, and the mass of material forming its shoals is the result of a beach movement. With the permanent protection of Long Beach now accomplished, the construction of a breakwater on Browns Bank will to a very large extent prevent the movement of sand into the southern portion of the inner bay and render more easy of maintenance the inner channels dredged or to be dredged to the wharves.

The commerce to be benefited by the proposed improvement includes that of the harbors of Plymouth, Kingston, and Duxbury, each of which has been separately under improvement by the United States. The tonnage and estimated value of this commerce for the calendar year of 1906, and the tonnage for various years from 1876 to 1906, are given in the accompanying tabulations. For 1906 the tonnage was 47,303, of which 42,900 tons was coal, and the estimated value was $287,805. There is in addition a considerable passenger traffic during the summer months. The principal industries are manufactures of wool and fiber located in Plymouth. Of these, the most important is the plant of the Plymouth Cordage Company, whose wharf is reached through the channel dredged by the United States for the improvement of Kingston Harbor. The commerce of the bay shows no growth of consequence in the past twenty-five years. On the contrary, it has diminished in value, due to the discontinuance of direct imports of raw materials for local industries as a result of the increased size and draft of ships in the foreign trade, such imports now being made through the port of Boston with local delivery by rail. The population of Plymouth in 1905 was 11,119, an increase of nearly 16 per cent since 1900, but the other towns on the bay show no changes of mark.

The present commerce of this locality does not in itself appear sufficient to warrant the expenditure by the United States of the sum necessary for its improvement in the manner specified in the item quoted in the beginning of this report. The harbor is, however, of some general value as a port of refuge to fishing and other vessels. Under present conditions this value is lessened by the exposure in easterly and southeasterly storms and by its relative remoteness from the customary course of vessels bound around Cape Cod in either direction. The first-named drawback would be removed by the construction of the proposed breakwater, and the emergency value of

the harbor may in the future become greatly more important through the construction of the so-called Cape Cod Canal. The opening of such a canal to give direct connection between Buzzards Bay and Cape Cod Bay and to avoid the long and hazardous route around Cape Cod and the numerous shoals off its southeastern shore has been investigated by many authorities over a period of one hundred years and more. Recently a company has been organized by parties of high financial standing to construct a canal, and the company's location and plans have received the approval of the harbor and land commission of the State. In accordance with these plans the eastern terminus of the canal is proposed to be at Scusset Beach, 16 miles south of Gurnet Point. The course of vessels bound between Boston or northern ports and the canal entrance will lie as close to Manomet and Gurnet points as safe navigation will permit, and, as the only harbor south of Boston, Plymouth will, after the opening of such a canal, have an increased emergency value, particularly in view of the class of shipping which may be expected to make the greatest use of it.

While the commerce of the locality is relatively unimportant at the present time, no great increase can be expected until the inner channels are improved to meet modern conditions. Local interests have initiated steps toward commencing such improvements at the expense of the State and the town of Plymouth. By an act approved June 19, 1907, the State of Massachusetts authorized the improvement of Plymouth Harbor by the dredging of a channel from the Cow Yard to the wharf of the Plymouth Cordage Company, in Plymouth. The plans for this channel provide for a depth of 18 to 20 feet at mean low water and a width of 200 to 250 feet, with a turning basin at its inner end. Under the terms of the above-named act the State is to pay one half the cost of the improvement and the town of Plymouth the other half, provided the cost does not exceed $160,000. Any excess of the cost of the work above $160,000 is to be paid by the town of Plymouth. By this act and by an act approved May 6, 1907, the town of Plymouth was given the necessary authority for raising funds for the improvement of channels in the harbor. The submission of this report has been delayed pending action by the town, under authority of the above act, but this action has not yet been taken. Information has, however, been received informally to the effect that the town will probably accept the terms of the act in the near future.

Having in view the above-stated facts and conditions and the favorable location of Browns Bank for the construction of a breakwater, I am of the opinion that it is advisable for the United States to undertake the improvement of Plymouth Harbor in the manner specified in the item quoted above, provided that the cost of the work as determined by a survey shall not be found to be incommensurate with the benefits to be expected from improvement. The improvement should in any case be conditioned upon the acceptance by the town of Plymouth of the terms of the act of the legislature of Massachusetts approved June 19, 1907, and further conditioned upon the assumption by the State of Massachusetts or other local authority of the improvement and maintenance of all channels in Plymouth Harbor, Kingston Bay, and Duxbury Bay.

It is therefore recommended that a survey be made of the locality defined in the item first above quoted, and that there be allotted $500 to cover the cost thereof.

Very respectfully, your obedient servant,

EDW. BURR,
Major, Corps of Engineers.

The CHIEF OF ENGINEERS, U. S. ARMY.
(Through the Division Engineer.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, November 23, 1907.

Respectfully forwarded to the Chief of Engineers, U. S. Army.

I do not deem Plymouth Harbor worthy of improvement by the General Government to the extent of constructing a breakwater along the crest of Browns Island.

The outer channel to this and, in common, to Duxbury and Kingston harbors has a controlling depth of 24 feet at mean low water. It forks into three branches, of which the one extending into Duxbury Bay carries a depth of 21 feet for a mile or more.

Projects for improving the channels in these harbors by the General Government have so far been limited to dredging them to depths of from 6 to 9 feet, and when Kingston Harbor was examined with a view to a channel of 10 feet the report was unfavorable.

Shoaling in the basin of Plymouth Harbor is to some extent due to silt and sewerage brought down by Town Creek, and the 1899 contract for dredging in this harbor was for removing "mud."

It is the upper end of Duxbury Bay which is reported as having shoaled to less than the projected depth.

It is very doubtful whether the proposed breakwater would diminish the shoaling of channels in the three harbors.

When the expenditure of $160,000 by the State of Massachusetts and town of Plymouth, now in contemplation, shall have resulted in a development of that harbor capable of utilizing the existing controlling depth of 24 feet of the outer channel, it will be time to consider the advisability of constructing a breakwater.

JOHN G. D. KNIGHT,
Colonel, Corps of Engineers,
Division Engineer.

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., January 31, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

In the within report the district officer gives a comprehensive description of the physical features of Plymouth Harbor, Duxbury Bay, and Kingston Bay and a history of examinations, surveys, and improvements heretofore made by the United States at these localities.

The question now under consideration, as designated by the act of March 2, 1907, is the construction of a rubblestone breakwater extending from Long Beach easterly along the crest of Browns Island. The objects sought to be attained by this improvement, as stated by interested parties, are specified in the district officer's report. These objects include the protection of the Cow Yard anchorage from south-

easterly storms, the prevention of the inward drift of sand into the harbor, and the control of the ebb flow from the interior basin in order to produce a scour in the main ship channel, which will so deepen the channel as to provide a safe and direct entrance for the deepest draft vessels. The other objects specified are incidental to these considerations.

The commerce to be benefited by the proposed improvement includes that of the harbors of Plymouth, Kingston, and Duxbury. The aggregate commerce of these places during 1906 is reported at 47,303 tons, valued at $287,805. While this commerce would not of itself justify an improvement of the magnitude now proposed, the locality serves as a rendezvous for an important fishing fleet supplying the Boston and New York markets. It is the first harbor of refuge on the Massachusetts coast south of Boston Harbor, and its value as such will probably continue to increase in the future, particularly if the proposed Cape Cod Canal becomes a reality. It appears from the information contained within that under the terms of an act of the legislature of Massachusetts the State and town of Plymouth are to expend $160,000 on the improvement of the inner harbor, with the expectation that the provision of a channel suitable for ocean vessels will enable the port to receive direct from foreign countries the large and valuable importations of raw materials which are now received at Boston and thence carried by rail to the manufactories at Plymouth. In a communication recently received from the board of selectmen of the town of Plymouth it is stated that the details and necessary legal formalities are now being carried out which will enable contracts for dredging to be made early in the spring of the present year.

It is the opinion of the Board that the facts and circumstances briefly mentioned above justify a fuller investigation of the merits of the proposed improvement than could be made in connection with the preliminary examination. It recommends that the district officer be authorized to make the survey which he proposes, at a cost of $500, for the purpose of determining the cost of a breakwater on the lines specified in the act, and the efficiency of such a breakwater for the purposes set forth by interested parties as reasons for its construction, including a thorough investigation of the present and prospective benefits which it will confer, and a further expression of opinion as to the advisability of undertaking the work, in the light of the information thus obtained.

For the Board:

H. F. HODGES,
Lieut. Col., Corps of Engineers,
Senior Member Present.

[Fourth indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, February 6, 1908.

Respectfully submitted to the Secretary of War.

This is a report on preliminary examination of Plymouth Harbor, Massachusetts, authorized by the river and harbor act of March 2, 1907.

Inviting attention to the report of the Board of Engineers for Rivers and Harbors in the preceding indorsement, I recommend that a survey of the locality, as proposed, be authorized.

A. MACKENZIE,
Brig. Gen., Chief of Engineers, U. S. Army.

[Fifth indorsement.]

WAR DEPARTMENT,
February 8, 1908.

Approved as recommended by the Chief of Engineers.

F. C. AINSWORTH,
The Adjutant-General,
Acting Secretary of War.

WATER-BORNE FREIGHT IN PLYMOUTH BAY, MASSACHUSETTS, INCLUDING HARBORS AT PLYMOUTH, KINGSTON, AND DUXBURY.

[Accompanying Major Burr's report of examination.]

[Tons of 2,000 pounds each.]

Articles.	1876.[a]	1881.[a]	1885.[b]	1890.[b]	1895.[b]	1900.[b]	1903.[a]	1904.[a]	1905.[a]	1906.[a]
Coal	10,152	20,267	18,605	23,500	22,663	23,649	29,898	39,028	51,660	42,900
Iron	2,103	916	4,771	1,325	1,598					
Hemp		3,019								
Sand	175		4,200		165					
Lumber	5,562	3,500	4,000	9,800	6,500	7,538	5,046	6,252	3,165	3,563
Fish	1,600		650					400	440	45
Stone		4,403	820					5,000	5,000	
Brick			800			1,500				
Miscellaneous	485	18,899	17,823	975				200	83	795
Total	20,077	51,004	51,669	35,600	30,926	32,687	34,944	50,880	60,348	47,303
Value		[d]$1,439,306								287,805
Revenue collected	$16,478.83	$47,343.34	$18,929 10	$108,174.31	$6,947.39	$603.91	$313 72	[b]$299.57	([c])	[b]$574.32
Cargoes	139	404	330							
Entrances				129	87	77	71	73	50	58
Clearances				130	5	77	71	73	50	58

[a] Calendar year.
[b] Fiscal year.
[c] Unknown.
[d] Ann. Rep. C. of E., 1882, p. 524.

Value (estimated) of water-borne freight in Plymouth Bay, Massachusetts.

[For the calendar year 1906.]

Articles.	Tons of 2,000 pounds.	Estimated value per ton.	Estimated value
Coal	42,900	$4.00	$171,600
Lumber	3,563	30.00	106,890
Fish	45	80.00	3,600
Ice	640	2.50	1,600
Lime	45	15.00	675
Cement	70	8.00	560
Miscellaneous	40	72.00	2,880
Total	47,303		287,805

SURVEY OF PLYMOUTH HARBOR, MASSACHUSETTS.

WAR DEPARTMENT,
UNITED STATES ENGINEER OFFICE,
Boston, Mass., September 8, 1908.

SIR: I have the honor to submit the following report upon a survey of Plymouth Harbor, Massachusetts, made under the authority of letter of the Chief of Engineers dated February 11, 1908, and in accordance with the following item of the river and harbor act of March 2, 1907, viz: "Plymouth Harbor, with a view to the construction of a rubblestone breakwater extending from Long Beach easterly along the crest of Browns Island."

The report upon the preliminary examination in this case was submitted to the Chief of Engineers under date of November 20, 1907, and contains such information as was then available regarding physical conditions, prior improvements, and present and past commerce of Plymouth. It should be considered in connection with this report, although some necessary repetitions will be found as a result of the instructions under which this report is made.

There is transmitted herewith a tracing of the map of the survey that is the subject of this report. This map shows that in the locality surveyed the conditions remain essentially the same as found by surveys in 1870, or earlier, and shown on United States Coast and Geodetic Survey Chart No. 338. The slough or swash channel close under the end of Long Beach remains practically unchanged. Browns Island or bank toward its inner end appears to have lost slightly in elevation along its crest, although the loss is so slight as to be due possibly to a difference in elevation of tide gauges, and its width between 6-foot contours has decreased, due to the northward movement of the outside contour. Toward the outer or eastern end of Browns Island the changes are more marked. The extreme end of the island remains apparently unchanged, but at a point 12,000 feet from the end of Long Beach a minor channel is developing across the bank with about 1,000 feet between the 12-foot contours. Between 6,000 and 10,000 feet from Long Beach the northern or channel face of the island has receded, and at 10,000 feet the crest has lost in height. These changes as a whole indicate a loss of material in the island, particularly toward its outer or eastern end.

The item calling for this survey locates the proposed breakwater upon the crest of Browns Island (or Browns Bank, United States Coast and Geodetic Survey Chart No. 338), extending easterly from Long Beach. No discretion is therefore permitted excepting as to minor adjustments of the location with reference to the crest of Browns Island. Moreover, there appears to me no other suitable location for a breakwater to accomplish the objects desired by the parties interested. These objects, as quoted in the report upon the preliminary examination, are:

First. Generally to safeguard and convenience a large volume of domestic and foreign commerce, which it is intended to establish at the port.

Second. To make safer the deep-water anchorage at the Cow Yard for ships engaged in the before-mentioned commerce; likewise for smaller vessels using the port for shelter, including the fishing fleet from which in the winter season the General Government daily collects spawn for the propagation of codfish at the Woods Hole hatchery.

Third. By confining and directing the strongly outflowing current from the great interior basin, to cause it materially to deepen the main ship channel, thus allowing vessels of the largest class to make safe, direct, and convenient use of the lower harbor and its anchorages. Erosion of Dicks flat and the projecting point of Long Beach, which are now obstructions at entrance of the inner harbor, it is hoped may also beneficially ensue.

Fourth. Incidentally to protect the Duxbury pier light-house, now exposed to the full force of seas arising in easterly and southeasterly gales.

Fifth. To prevent the drift of sand from Browns Island shoal and the outside of Long Beach into the harbor, so narrowing and obstructing the mouths of the channels from deep water to the wharves, as to make their entrance for navigation difficult and uncertain, by reason of liability to changing conditions.

The first and second of these objects will be secured to a large extent by the construction in the proposed location of a breakwater of sufficient length. The prevailing severe storms on this coast blow in the quadrant from northeast to southeast. Easterly storms are of shorter duration and less severity than northeasters or southeasters, the latter as a rule having the greatest duration and violence. The anchorage below Duxbury pier light in the channel is open to the sea in easterly and southeasterly storms, particularly in southeasterly. It is also exposed in easterly and northeasterly storms to seas that curve inshore along the line of shoal water and break across Browns Island. The anchorage above Duxbury pier light, known as the Cow Yard, is protected by Duxbury Beach and Saquish Neck against seas, excepting such as come in across Browns Island from the southeast. A breakwater built on Browns Island from Long Beach to a point opposite the end of Saquish Neck will protect the Cow Yard anchorage from the southeasterly seas that now run into it and should reduce somewhat the effect of easterly seas running up the lower or channel anchorage. A further extension of the structure would increase the protection to the Cow Yard. It does not seem probable that any practicable length would make the channel below Duxbury pier light a secure anchorage in severe easterly weather, but with the Cow Yard protected it is not necessary nor desirable to consider this lower channel as an anchorage.

The third object will in its main aspects be secured by the proposed structure serving as a jetty to prevent the escape of that part of the tidal discharge that now flows southeastward across Browns Island and to confine the entire discharge to the channel. In this vicinity the coast is generally bold with projecting points either of ledge or gravel hardpan. The sand movement is relatively small in amount, and sand beaches are confined largely to the indentations of the coast. Plymouth Bay occupies such an indentation, extending from Rocky Point to and beyond the northern end of Duxbury Beach. Gurnet Point is formed of hardpan, and its beaches are composed of bowlders and shingle, as are also the beaches of Saquish Neck, this group forming a natural, permanent jetty on the north side of the channel. From the general configuration of Plymouth outer bay and the beaches and spits north of Rocky Point it is clear that the resultant sand movement is northerly as a result of the preponderating influence of southeasterly storms with their northerly beach or surf currents during periods of maximum agitation of beach sands. Storms from the southeast produce also the highest tides with maximum flood-tide currents and have in the past broken through Long Beach and Duxbury Beach. During such storms there is undoubtedly a movement of sand into the inner bay across Long Beach,

around its northern end and across Browns Island. There are no streams of any consequence entering the bay, and the mass of the materials forming its shoals must, like that in the inclosing beaches, be the result of the beach sand movement.

The general tendency of the ebb tide is to set toward the southeast, and the result of the escape across Browns Island of a part of the ebb flow is evident in the diminished depths in the outer portion of the main channel. This opinion is reenforced by the changes noted above, as shown by this survey to have occurred since the survey of 1870. The changes in question are most marked opposite or immediately inside of the section where the minimum channel depth has existed and perhaps forecast the opening of a second entrance, with the consequent loss in channel depth that invariably follows such developments. That a breakwater or jetty on Browns Island would, if given sufficient length, increase the minimum depths now found in the channel and prevent the development of a second channel at the entrance does not appear to admit of doubt, and such a structure may later be found necessary to prevent or correct the deterioration of this channel, the only deep-water entrance between Cape Cod and Boston.

The fourth object stated above carries no material weight in deciding upon the advisability of this improvement. Duxbury pier lighthouse was designed and built to meet present conditions and has met them fully.

In reference to the fifth object of the above quotation, attention is invited to the statements above and in the report of November 20, 1907, regarding sand movements. The resultant sand movement is undoubtedly to the northward. The proposed breakwater in connection with the riprap protection of Long Beach will, until these structures are overtopped by it, restrain the movement of sand into the channels and harbor across Long Beach, around its northern end and over Browns Island, excepting such as is blown by the winds. As the sand movement is relatively small in quantity, the overtopping of the breakwater may not be expected for a number of years. Holding back this sand should render more easy and less expensive the maintenance of present or future channels.

The above paragraphs relate to the physical benefits that may be reasonably expected to result from the proposed improvement. They are sufficient to justify the improvement considered only from that standpoint. Local commercial conditions were discussed in the report of November 20, 1907, and the following extracts from that report are repeated here for convenience of reference in connection with what follows:

The commerce to be benefited by the proposed improvement includes that of the harbors of Plymouth, Kingston, and Duxbury, each of which has been separately under improvement by the United States. The tonnage and estimated value of this commerce for the calendar year of 1906 and the tonnage for various years from 1876 to 1906 are given in the accompanying tabulations. For 1906 the tonnage was 47,303, of which 42,900 tons was coal, and the estimated value was $287,805. There is in addition a considerable passenger traffic during the summer months. The principal industries are manufactures of wool and fiber located in Plymouth. Of these the most important is the plant of the Plymouth Cordage Company, whose wharf is reached through the channel dredged by the United States for the improvement of Kingston Harbor. The commerce of the bay shows no growth of consequence in the past twenty-five years. On the contrary it has diminished in value, due to the discontinuance

of direct imports of raw materials for local industries as a result of the increased size and draft of ships in the foreign trade, such imports now being made through the port of Boston with local delivery by rail. The population of Plymouth in 1905 was 11,119, an increase of nearly 16 per cent since 1900, but the other towns on the bay show no changes of mark.

The present commerce of this locality does not in itself appear sufficient to warrant the expenditure by the United States of the sum necessary for its improvement in the manner specified in the item quoted in the beginning of this report. The harbor is, however, of some general value as a port of refuge to fishing and other vessels. Under present conditions this value is lessened by the exposure in easterly and southeasterly storms and by its relative remoteness from the customary course of vessels bound around Cape Cod in either direction. The first-named drawback would be removed by the construction of the proposed breakwater and the emergency value of the harbor may in the future become greatly more important through the construction of the so-called Cape Cod Canal. The opening of such a canal to give direct connection between Buzzards Bay and Cape Cod Bay and to avoid the long and hazardous route around Cape Cod and the numerous shoals off its southeastern shore has been investigated by many authorities over a period of one hundred years and more. Recently a company has been organized by parties of high financial standing to construct a canal, and the company's location and plans have received the approval of the harbor and land commission of the State. In accordance with these plans the eastern terminus of the canal is proposed to be at Scusset Beach, 16 miles south of Gurnet Point. The course of vessels bound between Boston or northern ports and the canal entrance will lie as close to Manomet and Gurnet points as safe navigation will permit and, as the only harbor south of Boston, Plymouth will, after the opening of such a canal, have an increased emergency value, particularly in view of the class of shipping which may be expected to make the greatest use of it.

While the commerce of the locality is relatively unimportant at the present time, no great increase can be expected until the inner channels are improved to meet modern conditions. Local interests have initiated steps toward commencing such improvements at the expense of the State and town of Plymouth. By an act approved June 19, 1907, the State of Massachusetts authorized the improvement of Plymouth Harbor by the dredging of a channel from the Cow Yard to the wharf of the Plymouth Cordage Company in Plymouth. The plans for this channel provide for a depth of 18 to 20 feet at mean low water and a width of 200 to 250 feet, with a turning basin at its inner end. Under the terms of the above-named act the State is to pay one-half the cost of the improvement and the town of Plymouth the other half, provided the cost does not exceed $160,000. Any excess of the cost of the work above $160,000 is to be paid by the town of Plymouth. By this act and by an act approved May 6, 1907, the town of Plymouth was given the necessary authority for raising funds for the improvement of channels in the harbor. The submission of this report has been delayed pending action by the town under authority of the above act, but this action has not yet been taken. Information has, however, been received informally to the effect that the town will probably accept the terms of the act in the near future.

Commercial conditions remain practically unchanged since the writing of the 1907 report. In the meantime the town of Plymouth has accepted the terms of the State act of June 19, 1907, for improving the harbor by dredging a channel 18 feet to 20 feet deep at mean low water at an estimated cost of $160,000, to be borne equally by the State and the town. This action of a town of 11,000 population in assessing itself $80,000 for channel improvement is the best evidence of good faith on its part in its endeavors to advance its commercial and transportation interests, being equivalent to a tax on the city of Boston of $4,000,000 on the basis of population or $10,000,000 based on assessed valuation. With deeper water in the interior channels, local interests expect that much of the raw material used by local industries will be imported direct instead of through the port of Boston with railroad transshipment to Plymouth and that domestic commerce will receive corresponding benefits, a return to the condi-

tions existing before the increase in size of shipping forced it from this harbor. One local industry, the Plymouth Cordage Company, states that in the calendar year 1907 it received through the port of Boston 40,032 tons of fiber valued at $6,434,314, including 21,335 tons of sisal hemp of the value of $2,800,000 from Mexico in the cargoes of 18 steamers; that they hope to receive the Mexican fiber direct at Plymouth and, possibly, to make arrangements for receiving direct their imports of manila hemp from the Philippines. Other local interests will no doubt take similar advantage of the increased facilities for water transportation furnished by deeper channels and a protected anchorage. The avoidance of the increased cost and delays in railroad transfers from the nearest deep-water port, Boston, particularly under congested traffic conditions such as existed in 1906–7, will suffice to bring about this result.

The location of the proposed breakwater is shown on the accompanying map. The sea face of Long Beach is protected by a substantial rubblestone dike 11,843 feet long. It extends to a point 2,000 feet south of the northern end of the beach and has a general height of 18 feet above mean low water. Beginning at the end of this dike the breakwater should extend across the deeper water of the slue on the shortest line to the crest of Browns Island, the top sloping down to a height of 15 feet in the first 820 feet; thence along the crest of the island, following the most economical location. Bearing in mind the tendency of the channel face of the island to wear away toward its eastern end, the structure should not be located too close to that face and the constructing officer should be authorized to adjust the details of location to meet conditions as they exist at the time of building. The minimum length of structure necessary to accomplish the desired objects can be determined only by experience, but a length of 5,000 feet as suggested by interested parties is not deemed sufficient. It is believed that a length of 10,000 feet, measured along the axis of the structure from the end of the Long Beach dike, will serve the desired ends as fully as can be expected of such a structure both as a breakwater and as a jetty. A shorter and less costly structure may, however, be found by experience to give results sufficient to meet the needs of the near future. A wise policy in this respect would lead to the initiation of the work with the least length that possibly will suffice, and this is believed to be 6,000 feet. Considering all the circumstances of the location there appears no great probability of scour in advance of the work for a length of 8,000 feet and after the relatively deep water of the slue is crossed. Local conditions and the character of the work seem to be entirely favorable to the adoption of a project limited at first to a 6,000-foot length of breakwater. At the same time it seems quite probable that an extension to 8,000 feet may be found desirable and that a length of 10,000 feet may be ultimately demanded to provide the maximum benefits.

The type of structure recommended for the proposed breakwater is a mound of rubblestone having a general width across the top of 15 feet and side slopes on the channel and sea faces of 1 on 1 and 1 on 2, respectively. The top of the mound is 18 feet above mean low water where it connects with the Long Beach dike at the same height, slopes down to 15 feet in 820 feet, and carries the height of 15 feet for the remainder of its length. In the first 820 feet the width proposed is 15 feet at elevation 15 feet above mean low water.

One half the stone should be in pieces weighing at least 3 tons each and the other half should average at least 2 tons per piece.

The estimated cost of a breakwater 6,000 feet long is as follows, estimating 1 ton (2,000 pounds) of stone for 20 cubic feet of theoretical section and allowing 10 per cent for settlement:

262,955 tons of rubblestone, at $1.40 per ton	$368,137
Engineering and contingencies, 10 per cent, say	36,863
Total	405,000

Based upon the results of the survey and upon the facts and reasons set forth above and in the report upon the preliminary examination in this case, I am of the opinion that the commercial and other interests involved—present and prospective—justify the improvement of Plymouth Harbor, Massachusetts, by the United States to the extent of constructing a rubblestone breakwater extending from Long Beach easterly 6,000 feet along the crest of Browns Island, at an estimated cost of $405,000.

The improvement should be conditioned upon the assumption by the State of Massachusetts or by other local authority of the improvement and maintenance of all channels and anchorage grounds in Plymouth Harbor, Kingston Bay, and Duxbury Bay, being all the interior waters served by the channel to be benefited by this improvement. The State of Massachusetts has provided an organization and the means for protecting and improving its navigable tidal waters, and is one of the few States, if not the only one, that systematically provides for such improvements at local expense. Local action of this character would seem to warrant special consideration for proposed general improvements in waters where the State or other local authority is engaged upon works at its own charges.

Very respectfully, your obedient servant,

EDW. BURR,
Lieut. Col., Corps of Engineers.

The CHIEF OF ENGINEERS, U. S. Army.
(Through the Division Engineer.)

[First indorsement.]

NORTHEAST DIVISION, ENGINEER OFFICE,
New York, September 19, 1908.

Respectfully forwarded to the Chief of Engineers, U. S. Army.

The proposed structure is to serve both as breakwater and as jetty. In either capacity a length of 6,000 feet seems to me insufficient. With this length an opening of 4,500 feet remains between the end of the breakwater and Saquish Neck. As a jetty it falls short by about 3,000 feet of reaching abreast of the location of shoaling in the channel; by 6,000 feet of reaching the vicinity where a second entrance is threatened, and by at least 9,000 feet of extending abreast of Gurnet Point, and of thus favoring the northerly movement of sand across the channel, instead of into it.

The ultimate expenditure which will be demanded by extensions, as above, will probably be from about twice to possibly three and five times the estimated cost of the breakwater 6,000 feet long, or from $800,000 to $1,200,000 or $2,000,000.

I fear that a structure of the length proposed, while affording moderate protection as a breakwater, will have a deleterious effect on the channel.

I do not deem Plymouth Harbor worthy of improvement by the General Government to the extent of constructing a breakwater along the crest of Browns Island of such a length as physical features of the vicinity, in my opinion, justify.

JOHN G. D. KNIGHT,
Colonel, Corps of Engineers,
Division Engineer.

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., November 2, 1908.

Respectfully returned to the Chief of Engineers, U. S. Army.

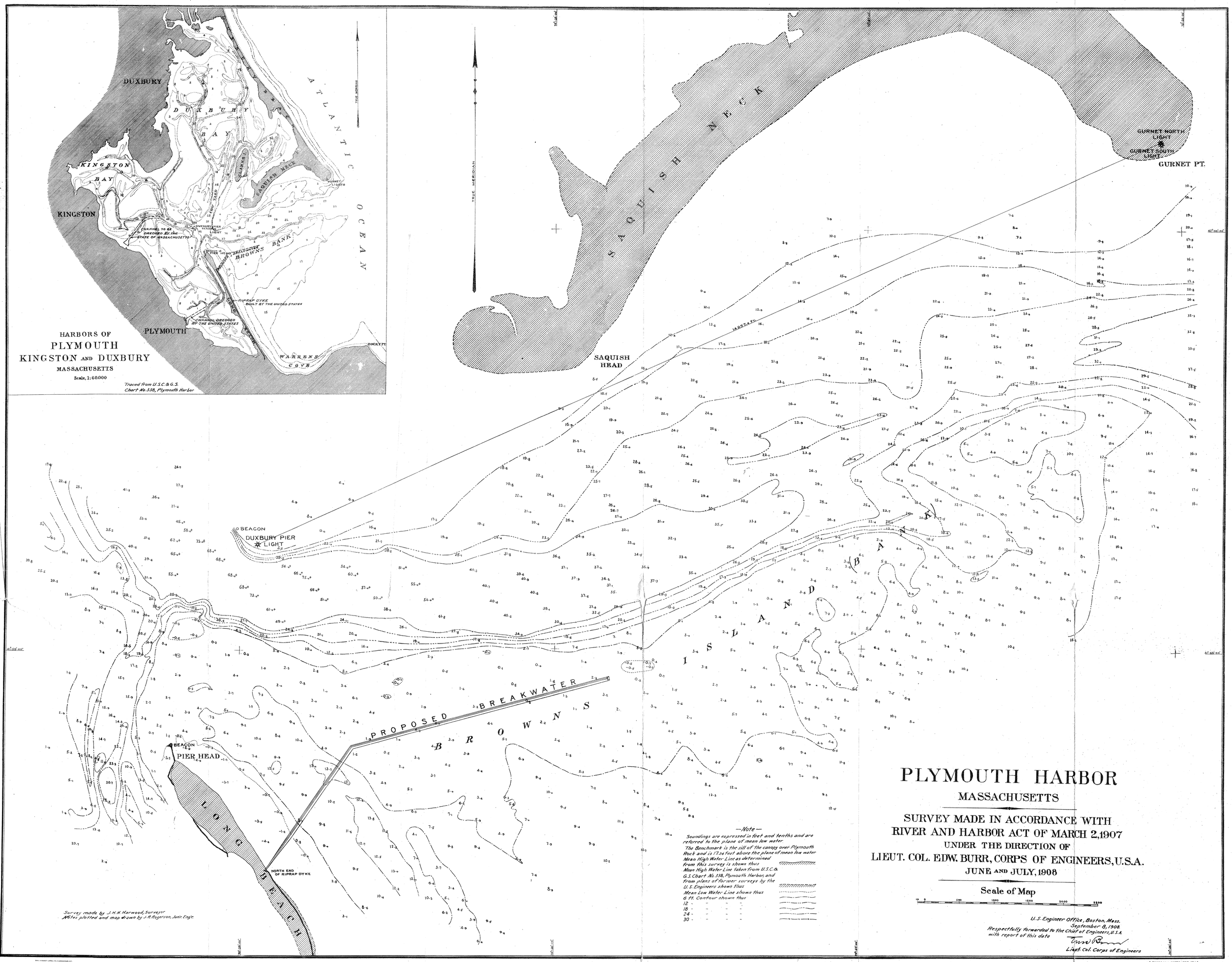
The district officer presents a plan for the improvement of Plymouth Harbor along the lines designated in the act calling for the preliminary examination. It provides for a breakwater 6,000 feet in length extending from the north end of the riprap on Long Beach easterly along the crest of Browns Island, estimated to cost $405,000. He states that an extension to 8,000 feet may be desirable, and that a length of 10,000 feet may be ultimately demanded to provide the maximum benefits. He recommends the improvement as worthy of being undertaken by the United States. For reasons given hereon, the division engineer does not concur in the views of the district officer.

In order that it might have before it all information obtainable bearing upon the merits of the proposed improvement, the Board, through a committee of its members, made a personal examination of the locality and held a duly advertised public hearing on October 16, 1908, in the town of Plymouth. A number of persons presented both written and oral arguments in favor of the improvement.

The principal objects desired by interested parties to be secured by the construction of the proposed breakwater are, first, to prevent the movement of sand into the inner harbor, and second, to protect the Cow Yard anchorage. An incidental object to be attained, mentioned by the district engineer, is the increased depth in the entrance channel to be secured by the jetty effect of the proposed breakwater. Taking these objects in the inverse order, it appears to the Board that the present entrance channel affords sufficient depth, and that as it has maintained itself in practically the present condition for many years there is little likelihood of deterioration, and that there is no present necessity for increased depth.

The necessity for protection of the Cow Yard anchorage does not at present appear to justify the expense of the construction of a breakwater, nor is it certain that such a structure is the best or most economical means of securing the desired protection.

The breakwater would undoubtedly prevent the entrance of sand into the inner harbor and to that extent lessen the cost of maintenance of the channels now under improvement by the Government, and of the channel to the Plymouth Cordage Works to be constructed by the town of Plymouth and the State of Massachusetts. The amount of this decreased cost of maintenance is, however, not possible of exact determination. The cost of maintaining the channels now



HARBORS OF
PLYMOUTH
KINGSTON AND DUXBURY
MASSACHUSETTS
Scale, 1:60.000
Traced from U.S.C.&G.S. Chart No. 338, Plymouth Harbor
DUXBURY
DUXBURY BAY
KINGSTON BAY
KINGSTON
PLYMOUTH
ATLANTIC OCEAN
SAQUISH NECK
BROWNS BANK
WARRENS COVE
CHANNEL TO BE DREDGED BY THE STATE OF MASSACHUSETTS
CHANNEL DREDGED BY THE UNITED STATES
RIPRAP DYKE BUILT BY THE UNITED STATES
TRUE MERIDIAN
GURNET NORTH LIGHT
GURNET SOUTH LIGHT
GURNET PT.
SAQUISH HEAD
BEACON
DUXBURY PIER LIGHT
PROPOSED BREAKWATER
BROWNS ISLAND BANK
BEACON
PIER HEAD
LONG BEACH
NORTH END OF RIPRAP DYKE
PLYMOUTH HARBOR
MASSACHUSETTS
SURVEY MADE IN ACCORDANCE WITH
RIVER AND HARBOR ACT OF MARCH 2,1907
UNDER THE DIRECTION OF
LIEUT. COL. EDW. BURR, CORPS OF ENGINEERS, U.S.A.
JUNE AND JULY, 1908
Scale of Map
Survey made by J.H.H. Harwood, Surveyor
Notes plotted and map drawn by J.R. Rogerson, Junr. Engr.
—Note—
Soundings are expressed in feet and tenths and are referred to the plane of mean low water.
The Benchmark is the sill of the canopy over Plymouth Rock and is 17.24 feet above the plane of mean low water
Mean High Water Line as determined from this survey is shown thus
Mean High Water Line taken from U.S.C.& G.S. Chart No. 338, Plymouth Harbor, and from plans of former surveys by the U.S. Engineers shown thus
Mean Low Water Line shown thus
6 ft. Contour shown thus
12 " " " "
18 " " " "
24 " " " "
30 " " " "
U.S. Engineer Office, Boston, Mass.
September 8, 1908.
Respectfully forwarded to the Chief of Engineers, U.S.A. with report of this date
Lieut. Col. Corps of Engineers
J.R. ROGERSON, SEPTEMBER, 1908

under improvement by the Government has been small, and should it be decided by Congress that the maintenance of the new channel should be undertaken by the Government it is believed that it would be preferable to wait until the cost of its maintenance can be determined before undertaking the expense of constructing the breakwater. It is possible that the cost of maintaining both this new channel and the present channels by dredging will be considerably less than the interest cost on the construction of the breakwater, or that some other means of taking care of this sand movement would be more economical.

The Board is therefore of opinion, agreeing with the division engineer, that it is not at present advisable for the United States to undertake the construction of a breakwater extending from Long Beach easterly along the crest of Browns Island.

For the Board:

D. W. Lockwood,
Colonel, Corps of Engineers,
Senior Member of the Board.

O

13. Harbors of Plymouth and Provincetown, Mass.—(a) Harbor at Plymouth.—In the original condition of the harbor the channel and low-water line were about 2,500 feet from the wharf at Plymouth. Long Beach, between the harbor and the ocean, was, for the most part, low and narrow, and liable to inroads by the sea that would injure or destroy the harbor.

All projects and expenditures prior to 1875 appear to have been for the construction of works for the preservation of the beach.

The original project for the improvement of the channel, adopted by the act of March 3, 1875, was to dredge a channel, 100 feet wide and 6 feet deep at mean low water, through the flats from the channel in the inner harbor to Long Wharf in Plymouth, at an estimated cost of $28,000.

Prior to operations under the existing project, $198,859.22 had been expended in preserving Long Beach and in dredging under the project of March 3, 1875, as modified, which resulted in obtaining a channel 150 feet wide and 9 feet deep and a basin directly in front of the town wharves 866 feet long, 150 feet wide, and 9 feet deep. Of this amount $60,727.52 was expended for maintenance.

The existing project for the protection of the beach, adopted by the act of March 3, 1899, is to strengthen the sections of beach damaged by the great storm of November, 1898, and to restore Eel River to its former course, discharging into the head of the harbor, from its course into the sea, to which it was changed by the storm. The estimated cost was $95,700.

The amount expended on the work of improvement under the existing project to the close of the fiscal year ending June 30, 1909, is $73,437.28, with which 11,843 linear feet of rubblestone dike was built on Long Beach, which has resulted in strengthening the beach by the accretion of a large volume of sand and beach shingle; Eel River was restored to its former course, and 536 linear feet of stone dike was built to prevent the river from being again turned into the sea. In addition to the aforesaid amount expended under the present project, $3,954.42 has been expended for maintenance in redredging the turning basin, which had been dredged at the wharves under the project of March 3, 1875.

By way of refundment, $4,530.12 was collected as damages from the surety of a failing contractor.

In the report of January 20, 1899, submitting the project with estimate of cost, it was said:

> The following estimate for this work should be considered approximate only, for the reason that further changes are likely to occur before the work can be accomplished, which changes may materially increase or diminish the amount of work necessary to restore the beach to a safe condition.

The accretion of the beach before the stone dike was built materially diminished the cross section of a considerable part of it, and permitted its extension to protect other places where further erosion has occurred.

It is proposed to apply the appropriation recommended to maintenance of improvement.

The commerce consists chiefly of coal and lumber, of which 33,354 tons was received in 1906 and 39,860 in 1908.

It is reported by the harbor master at Plymouth that the improvement of this locality by the United States has effected a saving of 50 cents per ton in freight rates.

The maximum draft that can be carried, June 30, 1909, at mean low water, over the shoalest part of the locality under improvement is 7.5 feet.

The town of Plymouth at its own expense has undertaken to restore and deepen to 10 feet at mean low water the channel and basin completed by the Government.

The mean range of tides is 10.1 feet.

The original project for dredging is published in the Annual Report of the Chief of Engineers for 1874, Part 2, page 348. The project of 1899 is printed in the report for that year, page 1089. A map of the dredged channel and basin is printed in the Annual Report of the Chief of Engineers for 1888, page 460.

Reports of examination and survey, with a view to the construction of a rubblestone breakwater from Long Beach along the crest of Browns Island, are printed, with map, in House Document No. 1168, Sixtieth Congress, second session.

July 1, 1908, balance unexpended	$8,270.94
July 1, 1909, balance unexpended	8,270.94
Amount (estimated) required for completion of existing project	20,700.00
Amount that can be profitably expended in fiscal year ending June 30, 1911, for maintenance of improvement, exclusive of the balance unexpended July 1, 1909	10,000.00

Submitted in compliance with requirements of sundry civil act of June [illegible] of 1900.

B 13.

IMPROVEMENT OF HARBORS AT PLYMOUTH AND PROVINCETOWN, MASSACHUSETTS.

(A) PLYMOUTH HARBOR.

No work was done during the fiscal year.

Estimate of additional funds required.

Amount that can be profitably expended in fiscal year ending June 30, 1911, exclusive of the balance unexpended July 1, 1909, for maintenance of improvement	$10,000

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

APPROPRIATIONS.

1824–1896 [a]	$191,081.90
March 3, 1899	85,000.00
June 13, 1902	4,000.00
Damages from surety of failing contractor	4,530.12
Total	284,612.02

NOTE.—From 1842 to 1859, inclusive, $90.16 were carried to surplus fund.

COMMERCIAL STATISTICS.

Articles.	1904.	1906.	1907.	1908.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Coal	38,086	31,314	37,155	37,860
Lumber	5,700	2,000	2,960	2,000
Stone	5,000	.....	.....	.....
Miscellaneous	600	40	500	.....
Total	49,386	33,354	40,615	39,860
Number of passengers carried	49,335	49,795	52,525	53,987

	Customs collected.	Entrances and clearances.
1905	.....	50
1906	$574.32	58
1907	.....	72
1908	.....	47

Passenger steamers from Boston land at Plymouth daily between June 15 and September 15 of each year.

[a] For itemized statement, see House Document No. 421, Fifty-seventh Congress, second session, page 269.

13. Harbors of Plymouth ~~and~~ Provincetown, Mass.—(a) Harbor at Plymouth.- In the original condition of the harbor the channel and low-water line were about 2,500 feet from the wharf at Plymouth. Long Beach, between the harbor and the ocean, was, for the most part, low and narrow, and liable to inroads by the sea that would injure or destroy the harbor.

All projects and expenditures prior to 1875 appear to have been for the construction of works for the preservation of the beach.

The original project for the improvement of the channel, adopted by the act of March 3, 1875, was to dredge a channel about one-half mile long, 100 feet wide, and 6 feet deep at mean low water, through the flats from the channel in the inner harbor to Long Wharf in Plymouth, at an estimated cost of $28,000.

Prior to operations under the existing project, $198,859.22 had been expended in preserving Long Beach and in dredging under the project of March 3, 1875, as modified, which resulted in obtaining a channel about one-half mile long, 150 feet wide, and 9 feet deep and a basin directly in front of the town wharves 866 feet long, 150 feet wide, and 9 feet deep. Of this amount $60,727.52 was expended for maintenance.

The existing project for the protection of the beach, adopted by the act of March 3, 1899, is to strengthen the sections of beach damaged by the great storm of November, 1898, and to restore Eel River to its former course, discharging into the head of the harbor, from its course into the sea, to which it was changed by the storm. The estimated cost was $95,700.

The amount expended on the work of improvement under the existing project to the close of the fiscal year ending June 30, 1910, is $81,396.25, with which 12,459 linear feet of rubblestone dike was built on Long Beach, which has resulted in strengthening the beach by the accretion of a large volume of sand and beach shingle; Eel River was restored to its former course, and 536 linear feet of stone dike was built to prevent the river from being again turned into the sea. At the date of this report work is being undertaken, under contract, in repair of two sections of the riprap dike extending along the seaward face of Long Beach, in expenditure of an allotment of $19,500 from appropriation for "Emergencies in River and Harbor Works." During the year the rubblestone dike on Long Beach was extended 616 feet.

In addition to the aforesaid amount expended under the present project, $3,954.42 has been expended for maintenance in redredging the turning basin, which had been dredged at the wharves under the project of March 3, 1875.

By way of refundment, $4,530.12 was collected as damages from the surety of a failing contractor.

In the report of January 20, 1899, submitting the project with estimate of cost, it was said:

> The following estimate for this work should be considered approximate only, for the reason that further changes are likely to occur before the work can be accomplished, which changes may materially increase or diminish the amount of work necessary to restore the beach to a safe condition.

The accretion of the beach before the stone dike was built materially diminished the cross section of a considerable part of it, and permitted its extension to protect other places where further erosion has occurred.

It is proposed to apply the available funds to repair and extension of beach protection.

The commerce consists chiefly of coal and lumber, of which 33,354 short tons was received in 1906, 39,860 in 1908, and 37,840 in 1909.

It is reported by the harbor master at Plymouth that the improvement of this locality by the United States has effected a saving of 50 cents per ton in freight rates.

The maximum draft that can be carried, June 30, 1910, at mean low water, over the shoalest part of the locality under improvement is 7.5 feet.

The town of Plymouth at its own expense has restored and deepened to 10 feet at mean low water the channel and basin completed by the Government.

The mean range of tide is 10.1 feet.

The original project for dredging is published in the Annual Report of the Chief of Engineers for 1874, Part 2, page 348. The project of 1899 is printed in the report for that year, page 1089. A

map of the dredged channel and basin is printed in the Annual Report of the Chief of Engineers for 1888, page 460.

Reports of examination and survey, with a view to the construction of a rubblestone breakwater from Long Beach along the crest of Browns Island, are printed, with map, in House Document No. 1168, Sixtieth Congress, second session.

July 1, 1909, balance unexpended		$8,270.94
Amount appropriated by river and harbor act approved June 25, 1910		10,000.00
Amount allotted from emergency appropriation by river and harbor act approved March 3, 1909		19,500.00
		37,770.94
June 30, 1910, amount expended during fiscal year:		
For works of improvement	$7,939.00	
For maintenance of improvement	19.97	
		7,958.97
July 1, 1910, balance unexpended		29,811.97
July 1, 1910, amount covered by uncompleted contracts		18,000.00
Amount (estimated) required for completion of existing project		[a]20,700.00

[a] Exclusive of the balance unexpended July 1, 1910.

B 13.

IMPROVEMENT OF HARBORS AT PLYMOUTH AND PROVINCETOWN, MASSACHUSETTS.

(A) PLYMOUTH HARBOR.

Under contract with Rowe Brothers Company, dated September 17, 1909, the riprap dike was extended northerly 616 linear feet, by the deposit of 2,499 tons of rubblestone, and the contract was completed on December 17, 1909, at an expenditure of $7,939.

Under the contract with The Breakwater Company, dated June 14, 1910, repairs to one section of the dike commencing about 1,950 feet south of the old pile wharf on the harbor side and extending 900 feet south from that point, and to another section commencing about 3,900 feet south of the wharf and extending for about 1,825 feet south from that point was commenced. The expenditure, $19.97, was for engineering expenses in connection with contract.

1910

APPROPRIATIONS.

1824–1896 [a]	$191,081.90	Damages from surety of failing contractor	$4,530.12
March 3, 1899	85,000.00		
June 13, 1902	4,000.00		
March 3, 1909 [b]	19,500.00	Total	314,112.02
June 25, 1910	10,000.00		

NOTE.—From 1842 to 1859, inclusive, $90.16 were carried to surplus fund.

COMMERCIAL STATISTICS.

Articles.	1906.	1907.	1908.	1909.
	Short tons.	*Short tons.*	*Short tons*	*Short tons.*
Coal	31,314	37,155	37,860	35,240
Lumber	2,000	2,960	2,000	2,250
Miscellaneous	40	500	.....	350
Total	33,354	40,615	39,860	37,840
Number of passengers carried	49,795	52,525	53,987	58,246

Passenger steamers from Boston land at Plymouth daily between June 15 and September 15 of each year.

[a] For itemized statement, see House Document No. 421, Fifty-seventh Congress, second session, p. 269.

[b] Allotment August 26, 1909, from appropriation for "Emergencies in River and Harbor Works."

CONTRACTS IN FORCE.

Contractor: Rowe Brothers Company, Richmond, Me.
Date of contract: September 17, 1909.
Date of commencement: Within two weeks after signature.
Date of completion: On or before December 31, 1909.
For such length of riprap dike on Long Beach, Plymouth Harbor, as can be built for $7,500: Price, $2.97 per ton of 2,000 pounds.
Contractor: The Breakwater Company, Philadelphia, Pa.
Date of contract: June 14, 1910.
Date of approval: July 19, 1910.
Date of commencement: June 15, 1910.
Date of completion: On or before December 31, 1910.
For repair of dike on Long Beach, Plymouth Harbor. Price, $2.43 per ton of 2,000 pounds.

13. Harbors of Plymouth and Provincetown, Mass.—(a) Harbor at Plymouth.—In the original condition of the harbor the channel and low-water line were about 2,500 feet from the wharf at Plymouth. Long Beach, between the harbor and the ocean, was, for the most part, low and narrow, and liable to inroads by the sea that would injure or destroy the harbor.

All projects and expenditures prior to 1875 appear to have been for the construction of works for the preservation of the beach.

The original project for the improvement of the channel, adopted by the act of March 3, 1875, was to dredge a channel about one-half mile long, 100 feet wide, and 6 feet deep at mean low water, through the flats from the channel in the inner harbor to Long Wharf in Plymouth, at an estimated cost of $28,000.

Prior to operations under the existing project, $198,859.22 had been expended in preserving Long Beach and in dredging under the project of March 3, 1875, as modified, which resulted in obtaining a channel about one-half mile long, 150 feet wide, and 9 feet deep; and a basin directly in front of the town wharves 866 feet long, 150 feet wide, and 9 feet deep. Of this amount $60,727.52 wes expended for maintenance.

The existing project for the protection of the beach, adopted by the act of March 3, 1899 (printed in the Annual Report of the Chief of Engineers for 1899, p. 1089) is to strengthen the sections of beach damaged by the great storm of November, 1898, and to restore Eel River to its former course, discharging into the head of the harbor, from its course into the sea to which it was changed by the storm. The estimated cost was $95,700.

The amount expended on the existing project to June 30, 1911, is $88,685.64, including $7,309.36 for maintenance. With this expenditure, 12,459 linear feet of rubblestone dike have been built on Long Beach, which has resulted in strengthening the beach by the accretion of a large volume of sand and beach shingle; Eel River has been restored to its former course; 536 feet of stone dike have been built to prevent the river from being again turned into the sea; and 2,133 feet of the riprap dike (in two sections) extending along the seaward face of Long Beach have been repaired.

During the year two sections of the riprap dike extending along the seaward face of Long Beach were repaired for a total length of 2,133 feet.

In addition to the aforesaid amount expended under the present project, $3,954.42 has been expended for maintenance in redredging the turning basin, which had been dredged at the wharves under the project of March 3, 1875.

By way of refundment, $4,530.12 was collected in 1906 as damages from the surety of a failing contractor.

In the report of January 20, 1899, submitting the project with estimate of cost, it was said:

> The following estimate for this work should be considered approximate only, for the reason that further changes are likely to occur before the work can be accomplished, which changes may materially increase or diminish the amount of work necessary to restore the beach to a safe condition.

The accretion of the beach before the stone dike was built materially diminished the cross section of a considerable part of it and permitted its extension to protect other places where further erosion has occurred.

It is proposed to apply the available funds to completing repair of beach protection.

The commerce consists chiefly of coal and lumber, of which 33,354 short tons was received in 1906, 39,860 in 1908, 37,840 in 1909, and 39,848 in 1910, valued at $192,797.50.

It is reported by the harbor master at Plymouth that the improvement of this locality by the United States has effected a saving of 50 cents per ton in freight rates.

The maximum draft that can be carried, June 30, 1911, at mean low water, over the shoalest part of the locality under improvement is 10 feet.

The town of Plymouth at its own expense has restored and deepened to 10 feet at mean low water the channel and basin completed by the Government.

The mean range of tide is 10.1 feet.

The original project for dredging (with report of survey made in 1874) is published in the Annual Report of the Chief of Engineers for that year, part 2, page 348. The project of 1899, with report of January 20, 1899, on condition of the beach and work necessary for protection, is printed in the report for that year, page 1089. A map of the dredged channel and basin is printed in the Annual Report of the Chief of Engineers for 1888, page 460.

// Report of a preliminary examination of channel from Goose Point, in Plymouth Harbor, to wharf of the Cordage Co., made in 1884, is printed in Annual Report of the Chief of Engineers for 1885, page 538; of a preliminary examination of Goose Point Channel, Plymouth Harbor, to public wharf at Kingston, made in 1888, in Annual Report for 1889, page 596; and of preliminary examination of Gurnet Rock and other rocks at mouth of Plymouth Harbor, made in 1897, in Annual Report for 1897, page 863 (House Doc. No. 314, 54th Cong., 2d sess.).

Report of preliminary examination of the harbor (made in 1894) with a view to the removal of the obstructions known as "Splitting Knife" and "Middle Ground" and the north and south sides of the excavated channel, with a view to deepening and improving the same, is printed on page 646 of the Annual Report of the Chief of Engineers for 1895 (House Ex. Doc. No. 50, 53d Cong., 3d sess.); and report of survey of these localities, made in 1897, in the Annual Report of the Chief of Engineers for 1897, page 877 (House Doc. No. 39, 55th Cong., 1st sess.).

Reports of preliminary examination and survey, with a view to the construction of a rubblestone breakwater from Long Beach along the crest of Browns Island (required by river and harbor act of Mar. 2, 1907), are printed, with map, in House Document No. 1168, Sixtieth Congress, second session.

July 1, 1910, balance unexpended	829,811.97
June 30, 1911, amount expended during fiscal year, for maintenance of improvement	7,289.39
July 1, 1911, balance unexpended	22,522.58
July 1, 1911, outstanding liabilities	3,110.62
July 1, 1911, balance available	19,411.96
July 1, 1911, amount covered by uncompleted contracts	8,304.30
Amount (estimated) required to be appropriated for completion of existing project	[1] 20,700.00

[1] Exclusive of the balance unexpended July 1, 1911.

B 13.

IMPROVEMENT OF HARBORS AT PLYMOUTH AND PROVINCETOWN, MASS.

(A) PLYMOUTH HARBOR.

Under the contract with The Breakwater Co., 2,133 feet of the riprap dike were repaired by the deposit of 3,990 tons of stone.

APPROPRIATIONS.

1824–1896 [1]	$191,081.90	Damages from surety of failing contractor	$4,530.12
Mar. 3, 1899	85,000.00		
June 13, 1902	4,000.00		
Mar. 3, 1909 [2]	19,500.00	Total	314,112.02
June 25, 1910	10,000.00		

NOTE.—From 1842 to 1859, inclusive, $90.16 were carried to surplus fund.

[1] For itemized statement, see H. Doc. No. 421, 57th Cong., 2d sess., p. 269.
[2] Allotment Aug. 26, 1909, from appropriation for "Emergencies in river and harbor works."

CONTRACT IN FORCE.

Contractor: The Breakwater Co., Philadelphia, Pa.
Date of contract: June 15, 1910.
Date of approval: July 19, 1910.
Date of commencement: June 15, 1910.
Date of completion: On or before December 31, 1910. (Time limit waived Dec. 29, 1910, for a reasonable period.)
For repair of dike on Long Beach, Plymouth Harbor. Price, $2.43 per ton of 2,000 pounds.

COMMERCIAL STATISTICS.

Articles.	1906	1907	1908	1909
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*
Coal	31,314	37,155	37,860	35,240
Lumber	2,000	2,960	2,000	2,250
Miscellaneous	40	500	.....	350
Total	33,354	40,615	39,860	37,840
Number of passengers carried	49,795	52,525	53,987	58,246

Vessel classification, 1910.

Class.	American.	Foreign.	Total.	Net registered tonnage.	Passengers.
Registered:					
Steamers	[1] 184	.....	184	[1] 82,248	58,985
Sailing	16	.....	16	1,854	.....
Barges	24	.....	24	18,895	.....
Total	224	.....	224	102,997	58,985

[1] One steamer of 447 tons, 184 trips.

Freight traffic.

Articles.	Amount (customary units).	Amount in short tons.	Valuation.
Coal	36,798 tons	36,798	$152,597.50
Lumber	1,950,000 feet	2,650	39,000.00
Miscellaneous	400 tons	400	1,200.00
Total	.....	39,848	192,797.50

Passenger steamers from Boston land at Plymouth daily between June 15 and September 15 of each year.

13. Harbors of Plymouth ~~and Provincetown~~, Mass.—~~(a) Harbor at Plymouth.~~—Plymouth Harbor is situated 45 miles by water south of Boston. Its outer anchorage, the "Cow Yard," is common to Plymouth, Duxbury, and Kingston. The harbor contains 2,000 acres, almost all of which, except the channels, is dry at low tide.

In the original condition of the harbor the channel and low-water line were about 2,500 feet from the wharf at Plymouth. Long Beach, between the harbor and the ocean, was, for the most part, low and narrow, and liable to inroads by the sea that would injure or destroy the harbor.

All projects and expenditures prior to 1875 appear to have been for the construction of works for the preservation of the beach.

The original project for the improvement of the channel, adopted by the act of March 3, 1875, was to dredge a channel about one-half mile long, 100 feet wide, and 6 feet deep at mean low water, through the flats from the channel in the inner harbor to Long Wharf in Plymouth, at an estimated cost of $28,000.

Prior to operations under the existing project, $198,859.22 had been expended in preserving Long Beach and in dredging under the project of March 3, 1875, as modified, which resulted in obtaining a channel about one-half mile long, 150 feet wide, and 9 feet deep; and a basin directly in front of the town wharves 866 feet long, 150 feet wide, and 9 feet deep. Of this amount $60,727.52 was expended for maintenance.

The existing project for the protection of the beach, adopted by the act of March 3, 1899 (printed in the Annual Report of the Chief of Engineers for 1899, p. 1089) is to strengthen the sections of beach damaged by the great storm of November, 1898, and to restore Eel River to its former course, discharging into the head of the harbor, from its course into the sea to which it was changed by the storm. The estimated cost was $95,700.

No modification has been made in the existing project since its adoption.

In the report of January 20, 1899, submitting the project with estimate of cost, it was said:

> The following estimate for this work should be considered approximate only, for the reason that further changes are likely to occur before the work can be accomplished, which changes may materially increase or diminish the amount of work necessary to restore the beach to a safe condition.

The accretion of the beach before the stone dike was built materially diminished the cross section of a considerable part of it and permitted its extension to protect other places where further erosion has occurred.

References to examination or survey reports and maps or plans not in project documents.

Section covered.	Congressional documents.				Annual reports of Chief of Engineers.	
	House or Senate.	No.	Congress.	Session.	Year.	Page.
Report upon protection and improvement of Plymouth Harbor, 1869.	House	[1] Ex. 18	Forty-first	Second		
Plymouth Harbor, 1871 (for dredging).[2]	do	[1] Ex. 161	Forty-third	First	1871 (Pt. 2)	348
Map showing works completed and projected up to 1881.					1881 [3]	528
Map of dredged channel and basin, 1888.					1888 [3]	460
Plymouth Harbor, report on condition of beach and work necessary for protection, 1899.[4]	House	[1] 230	Fifty-sixth	First	1899 [1]	1089

[1] No maps.
[2] Original project, Mar 3, 1875.
[3] Contains maps.
[4] Existing project, Mar. 3, 1899.

References to examination or survey reports and maps or plans not in project documents—Continued.

Section covered.	Congressional documents.				Annual reports of Chief of Engineers.	
	House or Senate.	No.	Congress.	Session.	Year.	Page.
Goose Point to wharf of Plymouth Cordage Co., 1884.	House	[1] Ex. 71	Forty-eighth	Second	1885 [1]	538
Goose Point Channel, to public wharf at Kingston, 1888.					1889 [1]	596
Gurnet Rock and other rocks at mouth of harbor, 1897.	House	[1] 314	Fifty-fourth	Second	1897 [1]	863
Plymouth Harbor, with view to removal "Splitting Knife" and "Middle Ground" and north and south sides excavated channel, 1894, 1897.	do	Ex. 50	Fifty third	Third	1895 [1]	645
		[2] 39	Fifty-fifth	First	1897 [1]	877
Rubblestone breakwater from Long Beach along crest of Browns Island, 1907, 1908.	do	[2] 1168	Sixtieth	Second		
Plymouth Harbor, dredging, 1910-11 [3]						

[1] No maps. [2] Contains maps. [3] Not yet printed.

During the year 1,301 linear feet of the riprap dike (in two sections) extending along the seaward face of Long Beach were repaired at an expenditure of $11,190.64, all for maintenance.

The amount expended on the existing project to June 30, 1912, was $100,176.28, including $18,800 for maintenance.

In addition to the aforesaid amount expended under the present project, $3,954.12 has been expended for maintenance in redredging the turning basin, which had been dredged at the wharves under the project of March 3, 1875.

By way of refundment, $4,530.12 was collected in 1906 as damages from the surety of a failing contractor.

Under the existing project 12,459 linear feet of rubblestone dike have been built on Long Beach, which has resulted in strengthening the beach by the accretion of a large volume of sand and beach shingle; Eel River has been restored to its former course; 536 feet of stone dike have been built to prevent the river from being again turned into the sea; and 3,434 feet of the riprap dike (in two sections) extending along the seaward face of Long Beach have been repaired.

The town of Plymouth at its own expense has restored and deepened to 10 feet at mean low water the channel and basin completed by the Government.

The maximum draft that can be carried, June 30, 1912, at mean low water, over the shoalest part of the locality under improvement is 10 feet.

The mean range of tide is 10.1 feet.

The commerce consists chiefly of coal and lumber, of which 39,860 short tons were received in 1908, 37,840 in 1909, 39,848 in 1910, and 48,657 in 1911, valued at about $250,000.

It is reported by the harbor master at Plymouth that the improvement of this locality by the United States has effected a saving of 50 cents per ton in freight rates.

July 1, 1911, balance unexpended	$22,522.58
Balance returned to the emergency appropriation	700.00
	21,822.58
June 30, 1912, amount expended during fiscal year, for maintenance of improvement	11,490.64
July 1, 1912, balance unexpended	10,331.94
Amount (estimated) required to be appropriated for completion of existing project	[1] 20,700.00

[1] Exclusive of the balance unexpended July 1, 1912.

(See Appendix B 13)

B 13.

IMPROVEMENT OF HARBORS AT PLYMOUTH ~~AND~~ PROVINCETOWN, MASS.

~~(A)~~ PLYMOUTH HARBOR.

Under the contract with The Breakwater Co., 1,301 feet of the riprap dike were repaired by the deposit of 3,230 tons of stone.

APPROPRIATIONS.

1824–1896 [1]	$191,081.90	Damages from surety of failing contractor	$4,530.12
Mar. 3, 1899	85,000.00		
June 13, 1902	4,000.00		
Mar. 3, 1909 [2]	19,500.00		314,112.02
June 25, 1910	10,000.00		
Total	309,581.90		

NOTE.—From 1842 to 1859, inclusive, $90.16 was carried to surplus fund.

CONTRACT IN FORCE.

Contractor: The Breakwater Co., Philadelphia, Pa.
Date of contract: June 15, 1910.
Date of approval: July 19, 1910.
Date of commencement: June 15, 1910.
Date of completion: On or before December 31, 1910. (Time limit waived.) (Completed Sept. 14, 1911.)
For repair of dike on Long Beach, Plymouth Harbor. Price, $2.43 per ton of 2,000 pounds.

COMMERCIAL STATISTICS.

Articles.	1907	1908	1909	1910
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*
Coal	37,155	37,860	35,240	36,798
Lumber	2,960	2,000	2,250	2,650
Miscellaneous	500	----------	350	400
Total	40,615	39,860	37,840	39,848
Number of passengers carried	52,525	53,987	58,246	58,985

[1] For itemized statement, see H. Doc. No. 421, 57th Cong., 2d sess., p. 269.
[2] Allotment Aug. 26, 1909, from appropriation for "Emergencies in river and harbor works," to which appropriation $700 was restored on Oct. 30, 1911.

Vessel classification, 1911.

Class.	American.	Total net registered tonnage.	Passengers.
Registered:			
Steamers	185	[1] 82,699	53,893
Sailing vessels	19	8,226	----------
Barges	17	9,042	----------
Unregistered sailing vessels	3	----------	----------
Total	224	99,967	53,893

Freight traffic.

Articles.	Amount (customary units).	Short tons.	Valuation.
Coal	46,257 short tons	46,257	$215,771.65
Lumber	1,100,000 feet	2,000	30,000.00
Total	----------	48,257	245,771.65
Miscellaneous	----------	400	(2)
		48,657	----------

[1] Includes 1 steamer of 447 tons, 184 trips.
[2] Not ascertainable.

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62D CONGRESS, 3d Session. } HOUSE OF REPRESENTATIVES. { DOCUMENT No. 1194.

PLYMOUTH HARBOR, MASS.

LETTER

FROM

THE SECRETARY OF WAR,

TRANSMITTING,

WITH A LETTER FROM THE CHIEF OF ENGINEERS, REPORTS ON EXAMINATION AND SURVEY OF PLYMOUTH HARBOR, MASS.

JANUARY 2, 1913.—Referred to the Committee on Rivers and Harbors and ordered to be printed, with illustration.

WAR DEPARTMENT,
Washington, December 30, 1912.

SIR: I have the honor to transmit herewith a letter from the Chief of Engineers, United States Army, of this date, together with copies of reports from Col. Frederic V. Abbot, Corps of Engineers, dated October 10, 1910, and February 17, 1911, with map, on preliminary examination and survey, respectively, of Plymouth Harbor, Mass., made by him in compliance with the provisions of the river and harbor act approved June 25, 1910.

Very respectfully,

HENRY L. STIMSON,
Secretary of War.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, December 30, 1912.

From: The Chief of Engineers.
To: The Secretary of War.
Subject: Preliminary examination and survey of Plymouth Harbor, Mass.

1. There are submitted herewith, for transmission to Congress, reports dated October 10, 1910, and February 17, 1911, with map, by Col. Frederic V. Abbot, Corps of Engineers, on preliminary examination and survey, respectively, of Plymouth Harbor, Mass., called for by the river and harbor act approved June 25, 1910.

2. The present project for this harbor provides for a channel 9 feet deep and 150 feet wide leading to the town wharves. The improvement desired is an 18-foot channel, and estimates are submitted by

the district officer for such a channel via three routes. The route deemed preferable utilizes the natural deep pocket lying under the lee of Long Beach so far as it extends, and beyond that point consists of a dredged channel 18 feet deep and 200 feet wide up to the wharf front. The estimated cost is $167,000. The cost of a similar channel 150 feet wide is estimated at $125,000. The district officer analyzes the commerce which would make use of the proposed channel, and reaches the conclusion that either channel would be too costly when compared with the present water-borne commerce of the locality. The division engineer concurs in this opinion.

3. These reports were referred, as required by law, to the Board of Engineers for Rivers and Harbors, and attention is invited to its report herewith, dated December 6, 1912. The board gave a hearing on April 17, 1911, to Hon. R. O. Harris, M. C., and has since received a letter from the Board of Harbor and Land Commissioners of the State of Massachusetts, expressing the opinion that the State should cooperate with the Federal Government by defraying a portion of the cost of the improvement. This paper having been referred to the district officer, he expresses the opinion in his supplemental report of November 23, 1912, herewith, that the locality is worthy of improvement by the United States to the extent of creating a channel 18 feet deep and 200 feet wide, at a total estimated cost of $167,000, provided one-half of this cost be contributed by the State. In this opinion the division engineer and the Board of Engineers for Rivers and Harbors concur.

4. After due consideration of the above-mentioned reports, I concur in general with the views of the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors, and therefore, in carrying out the instructions of Congress, I report as follows: That on condition that the State or other local agency contribute one-half of the cost of construction, the improvement by the United States of Plymouth Harbor, Mass., is deemed advisable so far as to secure a channel depth of 18 feet and a channel width of 200 feet increased at entrances and on curves, at an estimated cost of $167,000 for first construction and approximately $5,000 annually for maintenance, these estimates being based on the supposition that the construction work will, as now seems desirable and advantageous, be prosecuted under a first appropriation of $83,500, being the full share of the cost of the improvement to be borne by the United States under the plan of cooperation recommended.

W. H. Bixby,
Chief of Engineers, U. S. Army.

REPORT OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS, ON SURVEY.

[Third indorsement.]

Board of Engineers for Rivers and Harbors,
December 6, 1912.

To the Chief of Engineers, United States Army.

1. From the report of the district officer on survey of Plymouth Harbor, it appears that through the cooperation of the town of Plymouth and the State of Massachusetts, a channel 150 feet wide and

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18 feet deep has been dredged from the entrance to Plymouth Harbor to the wharves of the Plymouth Cordage Co., at a cost of about $145,000. The Plymouth Cordage Co. is located about 2 miles from the town of Plymouth in a northwesterly direction therefrom, and this channel is available only for the uses of the cordage company.

2. The existing project provides for a channel in the harbor 9 feet deep and 150 feet wide with a turning basin at the town wharves. The work now desired by the people of Plymouth is a dredged channel 18 feet deep, so that vessels of greater draft may reach the town wharves. In his study of this subject, the district officer has prepared several plans and estimates for such a channel. The route which appears best adapted for the purpose intended is shown on the map as channel No. 1, and this is the only route receiving serious consideration. With dimensions of 18 feet in depth by 200 feet in width, the estimated cost is $167,000, while with similar depth and a width of 150 feet, the estimate is $125,000. The district officer did not consider it advisable for the United States to undertake this improvement.

3. Interested parties were notified of the unfavorable report of the district officer and given an opportunity of presenting their views to the board. On April 17, 1911, Hon. R. O. Harris, M. C., appeared before the board in behalf of the improvement and presented a number of communications (not printed) from citizens of the locality bearing upon this subject. The matter has since been held under advisement to afford the interests concerned further opportunity to submit data regarding the necessity for the proposed improvement. Among other papers received by the board is a letter of August 16, 1912, from the Board of Harbor and Land Commissioners of the State of Massachusetts, in which the commission expresses the opinion that the State should cooperate with the Federal Government by defraying a portion of the cost of the improvement. This paper having been referred to the district officer, with request for supplemental estimates of cost of channels 12 and 15 feet deep, he reports adversely on providing either of these lesser depths, but expresses the opinion that the locality is worthy of improvement by the United States to the extent of creating a channel 18 feet deep, 200 feet wide, suitably widened at the bends, at a total estimated cost of $167,000, provided one-half of this cost be contributed by the State. The division engineer concurs in the views of the district officer.

4. After mature consideration of all the information now available, the board concurs with the district officer in believing that it is advisable for the United States to enlarge its project for improvement of Plymouth Harbor to the extent of creating a channel 18 feet deep and 200 feet wide, via route 1, as indicated on the accompanying tracing, at a total estimated cost of $167,000, contingent upon cooperation by the State of Massachusetts or other interests to the extent of defraying one-half of the cost of the improvement. The estimate for maintenance of a channel 150 feet wide is given as $5,000 and it is believed that approximately that amount will serve for the channel now recommended. The full amount of the share to be paid by the United States, $83,500, should be provided in one appropriation.

5. In compliance with law, the board reports that except as contemplated by the above recommendations, there are no questions of terminal facilities, water power, or other subjects so related to the

project proposed that they may be coordinated therewith to lessen the cost and compensate the Government for expenditures made in the interests of navigation.

For the board:

WM. T. ROSSELL,
Colonel, Corps of Engineers,
Senior Member of the Board.

PRELIMINARY EXAMINATION OF PLYMOUTH HARBOR, MASS.

WAR DEPARTMENT,
UNITED STATES ENGINEER OFFICE,
Boston, Mass., October 10, 1910.

SIR: 1. In accordance with instructions contained in department letter of August 4, 1910, I have the honor to submit the following report upon a preliminary examination of Plymouth Harbor, Mass., made in conformity with the river and harbor act of June 25, 1910.

2. Conference with interested parties develops the fact that the work especially desired at this time is identical with that covered by a similar clause contained in the river and harbor act of March 2, 1907, under which full reports of an examination and survey and an accurate map (printed as H. R. Doc. 1168, 60th Cong., 2d sess.) were submitted to Congress under date of December 9, 1908.

3. If a breakwater is not considered worthy of being undertaken by the United States, the investigation of the subject of interior dredging to afford access to the wharves or to naturally sheltered anchorage is desired.

4. Summarized and condensed, the reports above cited show that the movement of sand at the part of the coast involved is from south to north; that three towns have subharbors on the one bay defined on the ocean side by Gurnet Point and Rocky Point; that the entrance to the bay proper is between Long Beach and Saquish Head, two comparatively narrow sand spits, which together form a pair of sand jetties converging toward the inner bay and forcing the flood tide to enter through a comparatively narrow throat; inside of the throat the flood wave expands and fills the comparatively large and shallow inner bay, cutting deep, crooked channels near the throat, but rapidly losing erosive power as its concentrated flow is lost by expansion; that the flood tide enters the bay from the southward, passing over Browns Bank, forming the usual blind flood tide channel nearly through that bar near Long Beach.

5. Inside of the narrow throat above described there are three distinct basins, each having its own crooked and complicated system of channels, probably formed by the concentration of ebb flow. The only large deep natural inner channel is that known as the "Cow Yard," which affords a comparatively small but deep anchorage; one not well sheltered from the heaviest storms which come from the southeast.

6. The history of the bay is shown by its form; Long Beach, Duxbury Beach, and its prolongation inward, known as Saquish Head, are composed almost exclusively of easily moved sand and are simply the physical indications of the resultants of the many forces in action. A tidal rise of 10 feet, a position sheltered in part

by the outer end of Cape Cod, so that the tidal waves as well as storm waves are operating not entirely under free conditions, and an unlimited supply of finely comminuted material with which to record the points where action is the least, have automatically marked out the positions where the forces of tide, wind, and wave have mutually overcome each other.

7. The known history of this locality confirms the above; the records show that in severe storms Long Beach and Duxbury Beach have more than once been broken through, with resulting fear of permanent breaches on the part of local residents, but that up to this time such breaches have always been closed with sand by natural agencies. Long Beach has of late years been subject to more or less continuous erosion, however, and has therefore been protected by heavy riprap extending 12,459 feet.

8. The construction of a breakwater on Browns Bank appears to be the only economically possible solution of the problem of securing a properly sheltered anchorage in the present harbor in times of southeast storms; its crest would have to be 15 or more feet above low-water level, and its length should be not less than 10,000 feet, more probably 15,000 feet. A structure shorter than 10,000 feet might easily modify the conditions of tidal flow and wave action enough to endanger the maintenance of present conditions, without affording sufficient shelter, and local cutting around its outer end might throw large quantities of sand into the outer ship channel, producing shoaling there and perhaps other results far different from those desired. A breakwater of 15,000 feet length would, if properly located, probably increase the channel depths at the entrance, but would so materially modify the direction in which the flood tide enters the interior basin as to seriously affect the channels inside of the present throat. These inner channels are partly formed and maintained by the concentrated flood current which now enters the bay through the funnel-shaped entrance formed by Long Beach and Saquish Point. The ebb currents depend only on the conformation of the inner bay, and would be but little affected; a change in the flood current would change the existing balances of forces and should therefore be expected to produce changed channels, whose depths and positions it would be extremely hazardous to predict.

9. To make it safe to undertake such a radical modification of natural conditions at the entrance of this sand-inclosed harbor, it would be essential to have in hand enough money to do interior dredging, or to construct interior training walls or jetties to guide and control changes in the sandy bottom of the interior bay; the cost of such supplementary works should be covered by the project and should appear in the estimates.

10. It is reported in the appended letter (not printed) of the board of selectmen of Plymouth that the State of Massachusetts and town of Plymouth have completed wharf and harbor betterments costing nearly $250,000, of which dredging alone amounted to $160,000; they have provided sufficient depth to permit vessels drawing about 26 feet to reach the wharf of the cordage company and to lie there in safety. On general principles it is believed to be wise for the United States to come to the assistance of communities which have shown sufficient public spirit to undertake and carry through to successful issue extensive improvements of their natural waterways, if the cost to the General Government bears a reasonable ratio to the sums

expended by the State and local authorities, and this should be considered as well as the absolute amount of existing and prospective commerce.

11. The commercial claims of the locality for recognition by the General Government are well stated in the appended letter; it covers fully the reasons why the breakwater is desired by the citizens of Plymouth, states that the value of the annual manufactures in the town approximates $14,000,000; that raw material from Mexico and the Philippine Islands, and valued at $7,000,000 annually, has up to this time reached the Plymouth Cordage works by rail, but that the new channel provided jointly by the State of Massachusetts and the town of Plymouth will result in its delivery at the cordage company's wharf in the original bottoms, as vessels of 3,500 tons can now reach the wharf; in addition to this $7,000,000 annual foreign imports, a domestic annual commerce of 50,000 tons of coal and lumber valued at about $200,000 and foreign exports amounting to $2,000,000 is claimed, and a passenger business of 30,000 persons; that each winter the United States Fish Commission keeps a steamer at Plymouth collecting codfish spawn; that there are 4,000 vessels per annum seeking anchorage in the harbor; the claim is made that Plymouth actually stands twelfth in the United States in the order of harbors arranged according to the aggregate of imports and exports; that it stands third in the list of such ports in New England, and second in the State of Massachusetts; that Plymouth harbor is the only deep-water inlet between the mouth of the Cape Cod Canal and Boston, about 56 miles apart, the water in Massachusetts Bay being proverbially rough; that the completion of the Cape Cod Canal will bring Plymouth inlet close to the routes of 50,000 vessels passing between New York and Boston; that its entrance is straight and free from outlying shoals and rocks; that there is also a possibility that Plymouth may be the terminus of an intracoastal canal from Taunton River to Boston; that the cordage company, the largest plant making rope and binder twine in the world, distributes its products over the entire United States via a railroad line independent of Boston; that Plymouth is thus a distributing point of distinctive importance; that the harbor is landlocked, 3½ miles in area, with shores not over 2½ miles from deep-water anchorage, with easily deepened interior channels; that between Plymouth and Kingston for 4 miles the railroad track is between 300 and 2,000 feet only from the shores, and that three more miles of railroad to South Duxbury are not far from the shore; that the inlet is 24 feet deep at low tide, is straight and leads to a deep inner anchorage ground; that the town, with only 12,000 inhabitants, has paid out $90,000 for railroad facilities and has contributed largely to the State in paying for deepening its channels of approach; that it is the only port of refuge on Massachusetts Bay south of Boston in reach of $263,000,000 worth of annual commerce passing by sea through Massachusetts Bay, and that 500,000 passengers will make the trip between Boston and New York annually by the Cape Cod Canal; that its commerce exceeds somewhat that of Charleston, S. C., which port has been improved by the United States at a cost of $4,675,000, while the breakwater asked for Plymouth would probably cost not over $1,000,000, one-quarter as much; that the breakwater is outside the harbor proper and can not be built by the State or private parties, being plainly in the province of the General Government; that a prospective commerce of $75,000,000 and 500,000

passengers passing through the Cape Cod Canal will pass directly in front of Plymouth Harbor, or will enter thereat; that the town itself in 1909 voluntarily paid $12,000 to redredge the channel previously dredged to the town wharves by the United States.

12. A map based on the New York, New Haven & Hartford Railroad printed folder, and showing the commercial routes and amount of commerce on each, accompanied the above letter, and a copy is appended to this report.[1]

13. The water frontage of Plymouth Harbor is owned by individuals, local corporations and the town of Plymouth, and wharves of sufficient capacity are available or can be made available to meet the present and prospective demands of the commerce of the locality. None of the wharves is owned by the railroad but the latter is in easy reach of the shore for about seven miles. (For details as to available wharf and terminal facilities see accompanying statement[1] by the chairman of the board of selectmen of the town of Plymouth, Mass., received January 25, 1910.)

14. Uncertainty as to the exact effects of building the proposed breakwater and supplementary works, and their evidently great cost, makes it apparent that the disproportion in the present case between work proposed and that already completed by the State and town is so great that the United States can not be expected to undertake the work alone. Without direct contributions from private or State interests covering fully three-quarters of the cost and all of the maintenance charges, the locality is not worthy of improvement by the United States by the building of a breakwater.

15. The commercial showing made by the selectmen of Plymouth, summarized in paragraph 11, and the creation of a convenient harbor of refuge close to the traffic through the new Cape Cod Canal, justify, however, serious consideration of the alternative plan suggested, that of providing sheltered anchorage space by dredging inside of the throat, so that vessels can get into the lee of Long Beach. The available maps indicate that such an area may be provided, for a not exorbitant sum, and that it can be connected with the water front of the town also. It is believed that the matter is worthy of further study based on an actual survey, which can be made for the sum of $1,000, and the allotment of that sum is recommended.

Very respectfully, your obedient servant,

FREDERIC V. ABBOT,
Colonel, Corps of Engineers.

The CHIEF OF ENGINEERS, United States Army
(Through the Division Engineer).

[First indorsement.]

NORTHEAST DIVISION, ENGINEER OFFICE,
New York, October 18, 1910.

Respectfully forwarded to the Chief of Engineers, United States Army, concurring in the recommendation of Col. Abbot, district engineer officer, that an allotment be made for a survey of Plymouth Harbor.

W. M. BLACK,
Colonel, Corps of Engineers,
Division Engineer.

[1] Not printed.

[Third indorsement.]

THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, October 31, 1910.

Respectfully returned to the Chief of Engineers, United States Army.

1. Under authority of the act of March 2, 1907, a report on preliminary examination and survey of Plymouth Harbor with a view to the construction of a rubblestone breakwater, extending from Long Beach easterly along the crest of Browns Island, was submitted and may be found printed in House Document No. 1168, Sixtieth Congress, second session. For reasons given in that report, the board deemed it inadvisable for the United States to undertake the improvement of the harbor by the construction of a breakwater.

2. The act under which the present examination is made does not specify the character of work contemplated, and the district officer suggests the possibility of a satisfactory improvement to be effected by means of dredging within the harbor, and he recommends further study based upon an actual survey, which he estimates will cost $1,000.

3. In the opinion of the board the importance of the locality as a commercial port and as a harbor of refuge is sufficient to warrant the expenditure necessary to determine the cost of the alternative method of improvement now suggested, and it therefore joins with the division engineer in recommending that the survey be authorized.

For the board:

WM. T. ROSSELL,
Colonel, Corps of Engineers,
Senior Member of the Board.

[Fourth indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, November 5, 1910.

1. Respectfully submitted to the Secretary of War.

2. This is a report on preliminary examination of Plymouth Harbor, Mass., authorized by the river and harbor act of June 25, 1910.

3. Inviting attention to the report of the Board of Engineers for Rivers and Harbors in the preceding indorsement, I recommend that a survey of the locality as proposed be authorized.

W. H. BIXBY,
Chief of Engineers, U. S. Army.

[Fifth indorsement.]

WAR DEPARTMENT, *November 7, 1910.*

Approved.

ROBERT SHAW OLIVER,
Acting Secretary of War.

SURVEY OF PLYMOUTH HARBOR, MASS.

WAR DEPARTMENT,
UNITED STATES ENGINEER OFFICE,
Boston, Mass., February 17, 1911.

SIR: 1. In accordance with instructions from your office, dated November 8, 1910, I have the honor to submit the following report upon a survey made in conformity with the provisions of section 3, act of Congress approved June 25, 1910, for survey of Plymouth Harbor, Mass.

2. The State authorities have completed a channel 150 feet wide and 18 feet deep at low water to the water front of the Plymouth Cordage Co., where a suitable permanent wharf is under construction, at which vessels of 3,500 tons burden can lie in safety. As this provides for the commerce of that part of the town of Plymouth, the survey was limited to the portion of the bay between Long Beach and the existing wharves, covering also the shore line as far west as the inner end of Goose Point Channel. The question of dredging an anchorage area under the lee of Long Beach was also investigated.

3. In a preliminary report from this office, dated October 10, 1910, it was shown that the desire of the local authorities was the building of a breakwater on Browns Bank to give a sheltered anchorage; that the building of such a breakwater might endanger the present channels, and that the cost would be so great that it should not be undertaken by the United States unless three-quarters of the original cost and all maintenance charges were guaranteed by the State or by private interests. An approximate location of such a breakwater is shown on the index chart at the upper left-hand corner of the map accompanying this report. Upon further study nothing has been found to throw doubt upon the soundness of the above views.

4. If a breakwater was not recommended the local authorities asked an investigation of the subject of dredging inside of Long Beach. During the survey and the subsequent study of the matter the local authorities have been constantly consulted, and any suggestions they have made have been carefully considered.

5. The local authorities state that the natural channel leading southward toward Plymouth from the deep entrance at the throat of the bay has a fairly constant depth, which depth, as far as the end of Long Beach, the survey shows to be about 15 feet when a width of 300 feet is considered. If this were dredged to 18 feet deep, a vessel entering under stress of weather would have to make a right-angled turn to enter the comparatively narrow channel, and with any easterly winds would have to run fully 3,000 feet close along a very shoal lee shore before the shelter of Long Beach is reached. The maintenance of this 18-foot channel without frequent dredging is questionable. This entrance channel is common to all the three plans subsequently described in this report for the outer 2,000 feet of its length.

6. In continuation of this entrance channel three routes to the wharf front of Plymouth are possible. The first utilizes the natural deep pocket lying under the lee of Long Beach so far as it extends, and beyond that point consists of a dredged channel 18 feet deep and 200 feet wide up to the wharf front of the town. About 762,000 cubic yards of dredging is involved, at a cost of about $167,000.

7. For tugboats running to Boston with tows from the Cape Cod Canal the entrance channel and a safe anchorage area 18 feet deep, 1,000 feet wide, and 3,000 feet long in rear of Long Beach can be provided by dredging 1,802,000 cubic yards, at a cost of $396,000; and the channel described in paragraph 5, from the inner end of this anchorage basin to the wharf front of the town, can be provided by dredging 595,000 cubic yards at an added cost of $130,000. The depth of 18 feet would not permit anchorage of any large steamers or of deep-draft sailing vessels, but it is unlikely that such craft would try to run into Plymouth for safety when a short 30 miles more navigation in deep water would carry them into the safe waters of Boston Harbor; 18 feet will be sufficient for all ordinary tugs and their tows, especially as part of the sheltered area is naturally 24 feet deep and would thus, even at low tide, accommodate a few exceptionally deep-draft barges. After the anchorage area is once dredged it is probable that it will remain reasonably permanent as it is not exposed to heavy waves, being protected to the northwestward by a large area distant some hundreds of feet, bare at low water, and to the northeastward by Long Beach. Experience has shown that the channel formerly dredged in rear of Long Beach and thence to the town wharves has suffered only reasonable deterioration since its original excavation by dredging.

8. A second solution of the problem, suggested by the local authorities, consists of widening and straightening the natural channel known as Goose Point Channel, leading for about 3,000 feet to the southwestward from near the point of Long Beach, and extending the same by dredging to near the shore line opposite Nelson Street, and thence along parallel to the shore as far as the present basin in front of the town wharves. In favor of this plan is the fact that it would create a long, deep water frontage for the business part of the town, which would permit an extensive development of wharf facilities. The yardage is about 1,756,000 and is estimated to cost about $386,000. The permanence of such a dredged channel lying close under the lee of a sand bar which is dry at extreme low water of spring tides, appears problematical unless some protecting breakwater were erected, but the cost of such a structure would be prohibitive.

9. For purely comparative purposes the yardage along the straight route No. 3, shown on the map, has been computed. It is about 1,364,000 cubic yards, and with the exception of its straightness, offers few advantages and its serious consideration is not recommended.

10. All the estimates given above are for scow measurement at 20 cents per cubic yard, with customary allowance of about 10 per cent for engineering and contingencies. Each estimate includes the section of entrance channel common to all routes. There appeared so little probability of finding ledge rock in the way of any of the proposed dredging that expenditure of either time or money to make borings was deemed unnecessary.

11. A salient feature of Plymouth Harbor is the fact that the bay contains so large a proportion of shoal water that at low tide the water area is not much more than three-fifths as great as at high tide. This has been indicated on the map by dotting all areas dry at mean low tide. The courage and energy of the people

WAR DEPARTMENT

CORPS OF ENGINEERS, U.S. ARMY

HARBORS OF
PLYMOUTH
KINGSTON AND DUXBURY
MASSACHUSETTS

SCALE 1000' 0 1 2 3 4 5 6 7 8000 FEET

TRACED FROM U.S.C.&G.S. CHART
PLYMOUTH HARBOR No. 538

DUXBURY BAY
KINGSTON BAY
KINGSTON
ATLANTIC OCEAN
GURNET LIGHTS
COWS YARD
CHANNEL DREDGED BY THE STATE OF MASSACHUSETTS 18 FT. DEEP AT M.L.W. 150 FT. WIDE IN 1910.
DUXBURY PIER LIGHT
BREAKWATER
SUGGESTED
BROWNS BANK
PIER HEAD
PLYMOUTH
CHANNEL DREDGED BY THE UNITED STATES IN 1893. 9 FT. DEEP AT M.L.W. 150 FT. WIDE.
ROCKY PT.
WARRENS COVE
TRUE NORTH

DUXBURY PIER LIGHT
BEACON
PIER HEAD
FORGE RIVER
ANCHORAGE BASIN
CHANNEL
GOOSE
BASE LINE
ROUTE No 3
ROUTE No 2
ROUTE No 1
N.Y.N.H.&H.R.R.
RAILROAD YARDS
RAILROAD STATION
SOUTH ST.
COURT HOUSE ST.
SAWMILL ST.
MONUMENT ST.
BRIDGE ST.
NORTH ST.
BENCHMARK
LINDEN ST.
TOWN BROOK
Court House
Plymouth National Monument
41°58'00"
70°40'00"

LATITUDES AND LONGITUDES

STATION	LATITUDE	LONGITUDE	AUTHORITY
Plymouth National Monument	41° 57' 36.70"	70° 40' 34.94"	U.S.C.&G.S.
Duxbury Pier Light	41 59 14.94	70 38 56.57	"
Plymouth Court House	41 57 26.37	70 40 02.23	"

NOTE

The soundings north of the northerly end of Long Beach were taken from plan of a survey made in 1908.

Soundings are expressed in feet and tenths and are referred to the plane of Mean Low Water.

The Benchmark is the sill of the canopy over Plymouth Rock and is 17.24 feet above the plane of Mean Low Water.

Mean High Water Line is shown thus
" Low " " " " "
6 Ft. Contour is shown thus
12 " " " " "
18 " " " " "
24 " " " " "
30 " " " " "
Flats exposed at low water shown thus

U.S. Engineer Office, Boston, Mass.
February 17, 1911.
Respectfully forwarded to the Chief of Engineers with report of this date.

Frederic V. Abbot
Col. Corps of Engineers.

PLYMOUTH HARBOR

MASSACHUSETTS

SURVEY MADE IN ACCORDANCE WITH

RIVER AND HARBOR ACT OF JUNE 25, 1910.

UNDER THE DIRECTION OF

Col. Frederic V. Abbot, Corps of Engineers, U.S.A.

NOVEMBER AND DECEMBER, 1910.

ASSISTANTS

T.T.H. HARWOOD, ASS'T. ENG'R.

FIELD WORK AND PLOTTING BY
F.O. STEVENS, JUN'R. ENG'R.

DRAFTING BY
J.R. ROGERSON, JUN'R. ENG'R.

SCALE OF MAP 100 0 500 1000 1500 2000 FEET

House Doc. No. 1194 ; 62d Cong., 3d Sess.

who, in spite of such enormous natural difficulties, have invested their own money freely in efforts to make their town a practical and convenient seaport is apparent. If the General Government, for a reasonable sum, could supplement their work and bring it to a successful issue, it seems that such a community can be trusted to make every effort to utilize the facilities afforded them, which is not always the case where all the work is done at the cost of the United States.

12. A careful analysis of the statistics of commerce submitted by the selectmen of the town of Plymouth, accompanying the report of the preliminary examination, however, throws considerable doubt upon the actual utility of any of the projects above considered: (*a*) It is apparent that the $14,000,000 worth of articles manufactured in the town is largely the product of the cordage works; these works are not accessible from wharves lying upon the proposed basin or channels, but lie on the deep channel already provided by the State and town. (*b*) The foreign imports, reported as $7,000,000 by the selectmen of Plymouth, are expressly stated to be for the cordage works, and if they came by sea they would go to the wharf of that company lying at the inner end of the same State channel. (*c*) The coal and lumber, valued at $200,000, would probably come largely through the proposed United States channel. (*d*) How much of the $2,000,000 "foreign exports" would come from the town wharves, supplied by the woolen mills, etc., and how much from the cordage works is not stated in a form permitting its division between the two, but apparently a large proportion would come from the latter, and would not use the proposed United States channel. (*e*) Passenger traffic, stated at 30,000 per annum, would undoubtedly use the latter channel. (*f*) The Fish Commission would probably lay its vessels at the town wharves, but would conduct its business as at present in the main bay, so as to avoid towage charges on the vessels supplying the spawn. (*g*) That Plymouth is near the route of 50,000 vessels annually passing through the Cape Cod Canal does not necessarily indicate that many would stop to enter the harbor for business or for refuge. The entrance is less than 40 miles from Boston; there is only a comparatively narrow channel, 24 feet deep at low tide, and there is a right-angled turn to be made in rough water before reaching the quiet, inner basin under the shelter of Long Beach. If this turn is avoided it would be necessary to anchor in the rough, deep water of the Cow Yard. Properly equipped steam vessels might, except in extreme cases, run for Boston in spite of adverse weather conditions, while tugs going north with barges in tow would certainly have sufficient warning through the Weather Bureau signals to remain in the sheltered waters of Buzzards Bay or to lie under the lee of the breakwater which will eventually have to be built at the Massachusetts Bay end of the Cape Cod Canal. Tows and sailing vessels from Cape Ann or beyond, bound through the canal, might find a safe harbor at Plymouth a great advantage in case of sudden storms from the northward, at least till a breakwater is built to shelter the entrance to the Cape Cod Canal from waves created by such storms, but even under present conditions the Cow Yard is quiet, with winds from that quarter, so the basin inside of Long Beach would not then be needed.

1913

The total water-borne commerce of Plymouth Harbor during the calendar year 1910 amounted to about 60,500 short tons, of which 21,600 short tons were carried to the wharves of the Plymouth Cordage Co.

13. The proximity of Boston Harbor, already improved at large cost by the United States, raises the question of the propriety of recommending the creation at national expense of an artificial deep harbor only 30 miles distant, but the present time is perhaps not well suited for a fair determination of the worthiness or unworthiness of Plymouth Harbor for further development by the United States. If the completion of the Cape Cod Canal actually results in largely increased use of Plymouth Harbor for imports and exports, or for refuge, further consideration may well be given to the question. At the present time dredging the channel 200 feet wide and 18 feet deep to Plymouth wharves, at a cost of $167,000, is believed to be too costly. The local interests state that a channel 150 feet wide and 18 feet deep at mean low water would put the commerce of the town proper, and of that part of the town occupied by the Plymouth Cordage Works, "upon equality, to which it would seem that the port as a whole, in its commercial importance, is entitled." The original cost of such a channel 150 feet wide is estimated as $125,000, and the annual cost of maintenance at $5,000. Either improvement is believed to be too costly when compared with the present water-borne commerce of this locality, and I am, therefore, constrained to report that Plymouth Harbor is not now worthy of further improvement by the United States, but that it is not impossible that the work already done by local authorities and the completion of the Cape Cod Canal may result in future commercial growth such as to make the harbor worthy of the construction of the 200 foot channel 18 feet deep at mean low water, at a cost of $167,000.

Very respectfully, your obedient servant,

FREDERIC V. ABBOT,
Colonel, Corps of Engineers.

The CHIEF OF ENGINEERS, United States Army
(Through the Division Engineer).

[First indorsement.]

NORTHEAST DIVISION, ENGINEER OFFICE,
New York, February 21, 1911.

Respectfully forwarded to the Chief of Engineers, concurring in the opinion of the district engineer officer that Plymouth Harbor is not worthy of further improvement by the General Government at the present time.

W. M. BLACK,
Colonel, Corps of Engineers,
Division Engineer.

[For report of the Board of Engineers for Rivers and Harbors see p. 2.]

1913

SUPPLEMENTARY REPORT ON PRELIMINARY EXAMINATION AND SURVEY OF PLYMOUTH HARBOR, MASS.

WAR DEPARTMENT,
UNITED STATES ENGINEER OFFICE,
Boston, Mass., November 23, 1912.

SIR: (1) For a 12-foot channel, 150 feet wide, beginning 200 feet off the end of Long Wharf, where the present anchorage basin begins, and extending to 12 feet depth at the outer end, with side slopes 1 on 7, and allowing 1 foot for overdepth dredging, the yardage measured in scows would be 104,500. For a 15-foot channel, 150 feet wide, beginning 200 feet off the end of Long Wharf, where the present anchorage basin begins, and extending to 15 feet depth at the outer end, with side slopes 1 on 7, and allowing 1 foot for overdepth dredging, the yardage measured in scows would be 275,000. These estimates cover for both depths a width of 250 feet at the right-angled turn near Long Beach, and of 200 feet at the turn near the end of Long Beach.

Estimate.

12-foot channel, 104,500 cubic yards	$28,800
15-foot channel, 275,000 cubic yards	66,500

(2) In the presentation of their case the local interests have consistently laid much stress on the approaching completion of the Cape Cod Canal, which will provide 25 feet depth at low water. If the Plymouth channel is made 18 feet deep this will permit anything that can go through the Cape Cod Canal at high water to enter Plymouth at high water, due to the fact that the range of tide at Plymouth is greater than in Buzzards Bay; with less than 18 feet this would not be true.

The size of coal-carrying craft has been steadily increasing of late years, and the depth of 18 feet and width of 200 feet in the original report were selected after very careful study of the type of craft that will probably pass through the Cape Cod Canal, and thus follow a route close to Plymouth Harbor entrance. It is not to be anticipated that small coal-carrying craft will be specially chartered to run to Plymouth; their exposure to ocean storms in the part of their route from Fishers Island Sound to Buzzards Bay would make such a charter party costly. It is now hard to get barges of sufficiently light draft to enter Newburyport, where 15 feet is guaranteed on the charter parties, and so 17-foot barges are often entered there at considerable risk, because smaller ones are not available. The history of improvements on the New England coast illustrates the excessive cost of providing slight increases in depth, to be followed by subsequent slight betterments. Shallow dredging is costly, because of the frequent moving of dredges and scows with small output of dredges per day, and because the bottom must be cleared of lumps for each successive projected depth, and deductions must be made for successive overdepths, which lead to increased prices every time a contract is let to redredge previous work. The contractor's increase of price to cover only one clearing up and one probable deduction for overdepth is all the United States has to pay when the really desirable depth is given a channel at the beginning. Reasoning along these lines, I report adversely as to the advisability of dredging

any channel at Plymouth 12 feet deep. I report adversely as to the advisability of dredging any channel at Plymouth 15 feet deep. In this view I am supported by the following clause of a letter from the Board of Harbor and Land Commissioners of the State of Massachusetts, dated November 21, 1912:

The board is of the opinion that if the channel leading to the wharves in Plymouth Harbor is to be improved, a depth of not less than 18 feet at mean low water should be provided

(3) In reporting on the amount of cooperation that should be asked of the State as a condition precedent to the initiation of work by the United States, the above plainly indicates that for a 12-foot or a 15-foot channel no cooperation should be asked of the State. Without cooperation the work should not be undertaken by the United States. For an 18-foot channel the Harbor and Land Commissioners offer the following cooperation:

The board, considering the limited amount at its disposal for harbor improvement, is unwilling to make any allotment from the appropriation which it is authorized to expend under the provisions of chapter 481 of the acts of 1909, and chapter 642 of the acts of 1912, for the purpose of defraying a portion of the cost of improving Plymouth Harbor by the General Government in accordance with a project, the cost of which is estimated at $167,000; but it will, either in its next annual report to the legislature, in January, 1913, or before any legislative committee before which this matter would come, recommend or advocate a special appropriation by the legislature for the further improvement of this harbor, in accordance with such project as may be adopted by the General Government, the same to be used in connection with such appropriation as may be made by Congress, and as a contribution by the State of Massachusetts, towards defraying a portion of the cost of carrying such project into effect.

In my judgment one-half would be a fair proportion for the State to pay. If a clause be inserted in the next river and harbor act of Congress making the expenditure of any funds for the proposed Plymouth channel conditional upon the pledging of State funds to the extent of one-half the cost of the 18-foot channel (estimated in the preceding report at $167,000), I regard the locality as worthy of improvement to the amount of the balance (estimated at $83,500), to be applied to creating a channel 18 feet deep, 200 feet wide, suitably widened at the bends, as shown on the map accompanying the original report from this office dated February 17, 1911.

FREDERIC V. ABBOT,
Colonel, Corps of Engineers.

The CHIEF OF ENGINEERS, UNITED STATES ARMY.

LETTER OF THE BOARD OF HARBOR AND LAND COMMISSIONERS OF THE COMMONWEALTH OF MASSACHUSETTS.

COMMONWEALTH OF MASSACHUSETTS,
BOARD OF HARBOR AND LAND COMMISSIONERS,
Boston, August 16, 1912.

GENTLEMEN: The Board of Harbor and Land Commissioners of Massachusetts begs to inform you that a communication under date of July 29, 1912, signed by the members of the board of selectmen of the town of Plymouth and by Charles C. Doten, harbor engineer for said town, in relation to a survey and report on the improvement of Plymouth Harbor made by the United States District Engineer officer at Boston under authority of a recent act of Congress, has been received and that at a conference with representatives of the town of Plymouth and the town's harbor engineer on August 14, 1912, it was stated that a report of the Engineer officer, Col. Abbot, on the subject

of this harbor is now before the United States Board of Engineers for Rivers and Harbors for action.

It was requested that the harbor and land commissioners consider this matter and acquaint the United States board with its attitude toward the desired improvement.

After consideration, this commission is of the opinion that this harbor is worthy of further improvement and that the State should cooperate with the Federal Government, either by making an allotment from the appropriation for 1913, under authority of chapter 642 of the acts of 1912, available for river and harbor improvements, or by recommending a special appropriation by the legislature for the purpose of defraying a portion of the cost of the improvement of this harbor, which the board is informed is estimated to be $167,000.

Respectfully, for the board.

WM. S. MCNARY,
Chairman.

To the BOARD OF ENGINEERS FOR RIVERS AND HARBORS.

○

1913

13. Harbor of Plymouth ~~and Provincetown~~ Mass. ~~*(a) Harbor at Plymouth.*~~—Plymouth Harbor is situated 45 miles by water south of Boston. Its outer anchorage, the "Cow Yard," is common to Plymouth, Duxbury, and Kingston. The harbor contains 2,000 acres, almost all of which, except the channels, is dry at low tide.

In the original condition of the harbor the channel and low-water line were about 2,500 feet from the wharf at Plymouth. Long Beach, between the harbor and the ocean, was, for the most part, low and narrow, and liable to inroads by the sea that would injure or destroy the harbor.

All projects and expenditures prior to 1875 appear to have been for the construction of works for the preservation of the beach.

The original project for the improvement of the channel, adopted by the act of March 3, 1875, was to dredge a channel about one-half mile long, 100 feet wide, and 6 feet deep at mean low water, through the flats from the channel in the inner harbor to Long Wharf in Plymouth, at an estimated cost of $28,000.

Prior to operations under the existing projects, $198,859.22 had been expended in preserving Long Beach and in dredging under the project of March 3, 1875, as modified, which resulted in obtaining a channel about one-half mile long, 150 feet wide, and 9 feet deep; and a basin directly in front of the town wharves 866 feet long, 150 feet wide, and 9 feet deep. Of this amount $60,727.52 was expended for maintenance.

The existing project for the protection of the beach, adopted by the act of March 3, 1899 (printed in the Annual Report of the Chief of Engineers for 1899, p. 1089, no map), is to strengthen the sections of beach damaged by the great storm of November, 1898, and to restore Eel River to its former course, discharging into the head of the harbor, from its course into the sea to which it was changed by the storm. The estimated cost was $95,700.

No modification has been made in this project since its adoption.

In the report of January 20, 1899, submitting the project with estimate of cost, it was said:

> The following estimate for this work should be considered approximate only, for the reason that further changes are likely to occur before the work can be accomplished, which changes may materially increase or diminish the amount of work necessary to restore the beach to a safe condition.

The accretion of the beach before the stone dike was built materially diminished the cross section of a considerable part of it and permitted its extension to protect other places where further erosion has occurred.

The existing project for dredging was adopted by the act of March 4, 1913 (H. Doc. No. 1194, 62d Cong., 3d sess., with map), and is to dredge a channel 18 feet deep at mean low water from that depth in the bay to the town wharves, 200 feet wide, increased at the entrance and on curves, at a total estimated cost of $167,000. By that act one-half of the amount ($83,500) was appropriated, the adoption of the project and the expenditure of the appropriation being conditional upon the Commonwealth of Massachusetts or other interests defraying the remaining half of the expense, which condition was accepted by the State on June 16, 1913, when an appropriation of $83,500 was made, but the amount has not yet been placed to the credit of the United States.

References to examination or survey reports and maps or plans (including project documents).

Section covered.	Congressional documents.				Annual reports of Chief of Engineers.	
	House or Senate.	No.	Congress.	Session.	Year.	Page.
Report upon protection and improvement of Plymouth Harbor, 1869.	House...	[1] Ex. 18	Forty-first....	Second....	.....	.....
Plymouth Harbor, 1874 (for dredging).[2]	..do.....	[1] Ex. 161	Forty-third...	First.....	1874 [1] (Pt. 2)	348
Map showing works completed and projected up to 1881.	.....	.....	.....	.....	1881 [3]	528
Map of dredged channel and basin, 1888.	.....	.....	.....	.....	1888 [3]	460
Plymouth Harbor, report on condition of beach and work necessary for protection, 1899 [4]	House...	[1] 240	Fifty-sixth....	First.....	1899 [1]	1089
Goose Point to wharf of Plymouth Cordage Co., 1884.	House...	[1] Ex. 71	Forty-eighth..	Second....	1885 [1]	538
Goose Point Channel, to public wharf at Kingston, 1888.	.....	.....	.....	.....	1889 [1]	596
Gurnet Rock and other rocks at mouth of harbor, 1897.	House...	[1] 314	Fifty-fourth...	Second....	1897 [1]	863
Plymouth Harbor, with view to removal "Splitting Knife" and "Middle Ground" and north and south sides excavated channel, 1894, 1897.	..do.....	Ex. 50 [3] 39	Fifty-third.... Fifty-fifth.....	Third..... First.....	1895 [1] 1897 [1]	645 877
Rubblestone breakwater from Long Beach along crest of Browns Island, 1907, 1908.	..do...	[3] 1168	Sixtieth.....	Second..	.....	.....
Plymouth Harbor, dredging, 1910-11.[5]	...do.....	[3] 1194	Sixty-second..	Third.....	.....	.....

[1] No maps.
[2] Basis of original project adopted by Congress Mar. 3, 1875.
[3] Contains maps.
[4] Basis of existing project for protection of beach adopted by Congress Mar. 3, 1899.
[5] Basis of existing project for dredging adopted by Congress Mar. 4, 1913.

No expenditures were made and no work was done during the fiscal year on either the project for beach protection or on the project for dredging.

The amount expended on the existing project for beach protection to June 30, 1913, was $100,176.28, including $18,800 for maintenance.

In addition to the aforesaid amount expended under the present project, $3,954.42 has been expended for maintenance in redredging the turning basin, which had been dredged at the wharves under the project of March 3, 1875.

By way of refundment, $4,530.12 was collected in 1906 as damages from the surety of a failing contractor.

No expenditure has been made under the existing project of March 4, 1913, for dredging.

Under the existing project for beach protection 12,459 linear feet of rubblestone dike have been built on Long Beach, which has resulted in strengthening the beach by the accretion of a large volume of sand and beach shingle; Eel River has been restored to its former course; 536 feet of stone dike have been built to prevent the river from being again turned into the sea; and 3,434 feet of the riprap dike (in two sections) extending along the seaward face of Long Beach have been repaired.

No work has been done under the existing project of March 4, 1913, for dredging.

The town of Plymouth at its own expense has restored and deepened to 10 feet at mean low water the channel and basin completed by the Government.

The maximum draft that can be carried, June 30, 1913, at mean low water, over the shoalest part of the locality under improvement is 10 feet.

The mean range of tide is 10.1 feet.

The commerce consists chiefly of coal and lumber, of which 39,860 short tons were received in 1908; 37,840 in 1909; 39,848 in 1910; 48,657 in 1911; and 37,620 in 1912, valued at about $200,000.

It is reported by the harbor master at Plymouth that the improvement of this locality by the United States has effected a saving of 50 cents per ton in freight rates.

No estimate of additional funds required is submitted, for the reason that the available funds in hand are sufficient.

July 1, 1912, balance unexpended	[1] $10,000
Amount appropriated by river and harbor act approved Mar. 4, 1913	83,500
July 1, 1913, balance unexpended	93,500
Amount (estimated) required to be appropriated for completion of existing project for beach protection	[2] 20,700

[1] $331.94 carried to surplus fund June 30, 1912.
[2] Exclusive of the balance unexpended July 1, 1913.

B 13.

IMPROVEMENT OF HARBOR$ AT PLYMOUTH ~~AND PROVINCETOWN~~, MASS.

~~(A)~~ PLYMOUTH HARBOR.

No expenditures were made during the fiscal year and no work was done on either the project for beach protection or on the project for dredging.

During the next fiscal year it is expected to issue specifications and enter into contract for all the dredging required to complete the approved project.

APPROPRIATIONS.

1824–1896 [1]	$191,081.90	Damages from surety of failing contractor	$4,530.12
Mar. 3, 1899	85,000.00		
June 13, 1902	4,000.00		
Mar. 3, 1909 [2]	19,500.00		397,612.02
June 25, 1910	10,000.00		
Mar. 4, 1913	83,500.00		
Total	393,081.90		

NOTE.—From 1842 to 1859, inclusive, $90.16 was carried to surplus fund, to which account $331.94 was also carried June 30, 1912.

[1] For itemized statement, see H. Doc. No. 421, 57th Cong., 2d sess., p. 269.
[2] Allotment Aug. 26, 1909, from appropriation for "Emergencies in river and harbor works," to which appropriation $700 was restored on Oct. 30, 1911.

COMMERCIAL STATISTICS.

Articles.	1908	1909	1910	1911
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*
Coal	37,860	35,240	36,798	46,257
Lumber	2,000	2,250	2,650	2,000
Miscellaneous	.....	350	400	400
Total	39,860	37,840	39,848	48,657
Number of passengers carried	53,987	58,246	58,985	53,893

Vessel classification, 1912.

Class.	American.	Foreign.	Total.	Total net registered tonnage.	Passengers carried.
Registered:					
Steamers	185	.....	185	[3] 82,625	52,009
Sailing vessels	16	(4)	17	4,171	.....
Barges	20	.....	20	14,893	.....
Unregistered:					
Unrigged	(4)	.....	(4)	.....	.....
Total	222	(4)	223	101,689	52,009

~~[1] For itemized statement, see H. Doc. No. 491, 61st Cong., 2d sess., p. 289.~~
~~[2] Allotment Aug. 26, 1909, from appropriation for "Emergencies in river and harbor works," to which appropriation $700 was restored on Oct. 20, 1911.~~
[3] Includes one steamer of 447 tons, 184 trips.
[4] Not ascertainable.

Freight traffic.

Articles.	Amount (customary units).	Amount in short tons.	Valuation.
Coal	35,320 short tons	35,320	$157,170.79
Lumber	2,000,000 feet	2,200	40,000.00
Total	.....	37,520	197,170.79
Miscellaneous	.....	100	(1)
		37,620	.....

[1] Not ascertainable.

1914

12. Harbors of Plymouth and Provincetown, Mass.—(a) Harbor at Plymouth.—Plymouth Harbor is situated 45 miles by water south of Boston. Its outer anchorage, the "Cow Yard," is common to Plymouth, Duxbury, and Kingston. The harbor contains 2,000 acres, almost all of which, except the channels, is dry at low tide.

In the original condition of the harbor the channel and low-water line were about 2,500 feet from the wharves at Plymouth, to which access could be had only at high water. Long Beach, a narrow, low sand spit 3 miles long, between the harbor and the ocean, was liable to inroads by the sea that would injure or destroy the harbor.

All projects and expenditures prior to 1875 appear to have been for the construction of works for the preservation of the beach.

The original project for the improvement of the channel, adopted by the act of March 3, 1875, was to dredge a channel about one-half mile long, 100 feet wide, and 6 feet deep at mean low water, through the flats from the channel in the inner harbor to Long Wharf in Plymouth, at an estimated cost of $28,000.

Prior to operations under the existing projects, $198,859.22 had been expended in preserving Long Beach and in dredging under the project of March 3, 1875, as modified, which resulted in obtaining a channel about one-half mile long, 150 feet wide, and 9 feet deep, and a basin directly in front of the town wharves 866 feet long, 150 feet wide, and 9 feet deep. Of this amount $60,727.52 was expended for maintenance.

The existing project for the protection of the beach, adopted by the act of March 3, 1899 (printed in the Annual Report of the Chief of Engineers for 1899, p. 1089, no map), is to strengthen the sections of beach damaged by the great storm of November, 1898, and to restore Eel River to its former course, discharging into the head of the harbor, from its course into the sea to which it was changed by the storm. The estimated cost was $95,700. No estimate of cost of maintenance was stated.

No modification has been made in this project since its adoption.

In the report of January 20, 1899, submitting the project with estimate of cost, it was said:

> The following estimate for this work should be considered approximate only, for the reason that further changes are likely to occur before the work can be accomplished, which changes may materially increase or diminish the amount of work necessary to restore the beach to a safe condition.

The accretion of the beach before the stone dike was built materially diminished the cross section of a considerable part of it and permitted its extension to protect other places where further erosion has occurred.

1914

The existing project for dredging was adopted by the act of March 4, 1913 (H. Doc. No. 1194, 62d Cong., 3d sess., with map), and is to dredge a channel 18 feet deep at mean low water from that depth in the bay to the town wharves, 200 feet wide, increased at the entrance and on curves, at a total estimated cost of $167,000 for first construction and approximately $5,000 annually for maintenance. By that act one-half of the amount ($83,500) was appropriated, the adoption of the project and the expenditure of the appropriation being conditional upon the Commonwealth of Massachusetts or other interests defraying the remaining half of the expense, which condition was accepted by the State on June 16, 1913, when an appropriation of $83,500 was made. The amount was placed to the credit of the United States August 25, 1913. No modification has been made in this project since its adoption.

References to examination or survey reports and maps or plans (including project documents).

Section covered.	Congressional documents.				Annual Reports of Chief of Engineers.	
	House or Senate.	No.	Congress.	Session.	Year.	Page.
Report upon protection and improvement of Plymouth Harbor, 1869.	House...	[1] Ex. 18	Forty-first....	Second....	.....	.....
Plymouth Harbor, 1874 (for dredging).[2]	..do.....	[1] Ex. 161	Forty-third...	First.....	[1] 1874 (Pt. 2)	348
Map showing works completed and projected up to 1881.	.....	.....	.....	.....	[2] 1881	528
Map of dredged channel and basin, 1888.	.....	.....	.....	.....	[3] 1888	460
Plymouth Harbor, report on condition of beach and work necessary for protection, 1899.[4]	House...	[1] 230	Fifty-sixth....	First.....	[1] 1899	1089
Goose Point to wharf of Plymouth Cordage Co., 1884.	... do....	[1] Ex. 71	Forty-eighth..	Second....	[1] 1885	538
Goose Point Channel, to public wharf at Kingston, 1888.	.....	.....	.....	.....	[1] 1889	596
Gurnet Rock and other rocks at mouth of harbor, 1897.	House...	[1] 314	Fifty-fourth...	Second....	[1] 1897	863
Plymouth Harbor, with view to removal "Splitting Knife" and "Middle Ground" and north and south sides excavated channel, 1894, 1897.	..do.....	[1] Ex. 50 [3] 39	Fifty-third.... Fifty-fifth.....	Third..... First.....	[1] 1895 [1] 1897	645 877
Rubblestone breakwater from Long Beach along crest of Browns Island, 1907, 1908.	...do.....	[3] 1168	Sixtieth.....	Second....	.....	.....
Plymouth Harbor, dredging, 1910–11.[5]	...do.....	[3] 1194	Sixty-second..	Third.....	.....	.....

[1] No maps.
[2] Basis of original project adopted by Congress Mar. 3, 1875.
[3] Contains maps.
[4] Basis of existing project for protection of beach adopted by Congress Mar. 3, 1899
[5] Basis of existing project for dredging adopted by Congress Mar. 4, 1913.

No work was done during the fiscal year on the project for beach protection.

During the last half of the fiscal year, under the approved project for dredging, specifications were issued, contract was made, and 148,544 cubic yards of material were dredged under the contract. Expenditure, $9,291.41, all for improvement.

The amount expended on the existing projects for beach protection and dredging to June 30, 1914, was $109,467.69, of which $100,176.28, including $18,800 for maintenance, was expended for beach protection and $9,291.41 for dredging.

This expenditure includes $4,530.12, collected in 1906 as damages from the surety of a failing contractor.

In addition to the aforesaid amount expended under the present projects, $3,954.42 has been expended for maintenance in redredging the turning basin, which had been dredged at the wharves under the project of March 3, 1875.

The total amount expended on all projects to June 30, 1914, is $312,281.33.

Under the existing project for beach protection 12,459 linear feet of rubblestone dike have been built on Long Beach, which has resulted in strengthening the beach by the accretion of a large volume of sand and beach shingle; Eel River has been restored to its former course; 536 feet of stone dike have been built to prevent the river from being again turned into the sea; and 3,434 feet of the riprap dike (in two sections) extending along the seaward face of Long Beach have been repaired.

The existing project for dredging is about 20 per cent completed.

The town of Plymouth at its own expense in 1909 restored and deepened to 10 feet at mean low water the channel and a portion of the basin completed by the Government.

The maximum draft that can be carried, June 30, 1914, at mean low water, over the shoalest part of the locality under improvement is 10 feet.

The mean range of tide is 10.1 feet.

The commerce consists chiefly of coal and lumber, of which 37,840 short tons were received in 1909; 39,848 in 1910; 48,657 in 1911; 37,620 in 1912, and 38,612 in 1913, valued at over $200,000.

It is reported by the harbor master at Plymouth that the improvement of this locality by the United States has effected a saving of 50 cents per ton in freight rates.

No estimate of additional funds required is submitted, for the reason that the available funds in hand are sufficient.

July 1, 1913, balance unexpended		$93,500.00
Amount contributed by State of Massachusetts		83,500.00
		177,000.00
June 30, 1914, amount expended during fiscal year for works of improvement:		
Government funds	$4,645.53	
State funds	4,645.88	
		9,291.41
July 1, 1914, balance unexpended		167,708.59
July 1, 1914, outstanding liabilities		10,707.13
July 1, 1914, balance available		157,001.46
July 1, 1914, amount covered by uncompleted contracts		62,152.45
Amount (estimated) required to be appropriated for completion of existing project for beach protection		[1] 20,700.00

[1] Exclusive of the balance unexpended July 1, 1914.

See Appendix B 12.

1914

B 12.

IMPROVEMENT OF HARBORS AT PLYMOUTH AND PROVINCETOWN, MASS.

(A) PLYMOUTH HARBOR.

No expenditures were made during the fiscal year and no work was done on the project for beach protection.

Under the project for dredging, work was commenced May 1, 1914, under the contract with Eugene Breymann, dated February 28, 1914, and 148,544 cubic yards of sand and mud were removed.

During the next fiscal year it is expected that all dredging embraced in the project will be completed.

APPROPRIATIONS.

1824–1896[1]	$191,081.90	Damages from surety of failing contractor	$4,530.12
Mar. 3, 1899	85,000.00	Contributed by the Commonwealth of Massachusetts, 1913	83,500.00
June 13, 1902	4,000.00		88,030.12
Mar. 3, 1909[2]	19,500.00		
June 25, 1910	10,000.00		
Mar. 4, 1913	83,500.00		
Total of appropriations by the United States	393,081.90	Grand total	481,112.02

NOTE.—From 1842 to 1859, inclusive, $90.16 was carried to surpus fund, to which account $331.94 was also carried June 30, 1912.

CONTRACT IN FORCE.

Contractor: Eugene Breymann, Toledo, Ohio.
Date of contract: February 28, 1914.
Date of approval: March 18, 1914.
Date of commencement: Within 30 days after date of receipt of notification of approval.
Date of completion: Approximate date August 22, 1915, if one month allowed in winter; otherwise, July 22, 1915.
For dredging about 689,000 cubic yards, at 11½ cents per cubic yard.

COMMERCIAL STATISTICS.

Articles.	1909	1910	1911	1912
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*
Coal	35,240	36,798	46,257	35,320
Lumber	2,250	2,650	2,000	2,200
Miscellaneous	350	400	400	100
Total	37,840	39,848	48,657	37,620
Number of passengers carried	58,246	58,985	53,893	52,009

[1] For itemized statement, see H. Doc. No. 421, 57th Cong., 2d sess., p. 269.
[2] Allotment Aug. 26, 1909, from appropriation for "Emergencies in river and harbor works," to which appropriation $700 was restored on Oct. 30, 1911.

Vessel classification, 1913.

Classes.	American.	Total net registered tonnage.	Passengers carried.
Registered:			
Steamers	88	[1] 39,336	70,876
Sailing vessels	10	968	.....
Barges	23	17,300	.....
Unregistered, unrigged	4	.....	.....
Total	125	57,604	70,876

[1] One steamer of 417 tons, 88 round trips from Boston.

Freight traffic.

Articles.	Amount (customary units).	Amount in short tons.	Valuation.
Coal	36,287 short tons	36,287	$168,805.50
Lumber	1,200,000 feet	1,800	35,000.00
Total		38,087	203,805.50
Miscellaneous		525	(1)
		38,612	.....

[1] Not ascertainable.

1915

12. PLYMOUTH AND PROVINCETOWN HARBORS, MASS.

(A) PLYMOUTH HARBOR.

Location.—Plymouth Harbor is situated 45 miles by water south of Boston. Its outer anchorage, the "Cow Yard," is common to Plymouth, Duxbury, and Kingston. The harbor contains 2,000 acres, much of which, outside the channels, is dry at low tide. (See U. S. Coast and Geodetic Survey chart No. 1208.)

Original condition.—In the original condition of the harbor the channel and low-water line were about 2,500 feet from the wharves at Plymouth, to which access could be had only at high water. Long Beach, a narrow, low sand spit, 3 miles long, between the harbor and the ocean, was liable to inroads by the sea that would injure or destroy the harbor.

Previous projects.—The original project was adopted by act of May 26, 1824, and was for the preservation of the beach. A project for dredging was adopted by the river and harbor act of March 3, 1875, modified in 1877, 1884, and 1885. The total expenditures were $202,813.64. For scope of previous projects, see Appendix, page 1746.

Present projects.—The present project for beach protection is for strengthening the sections of Long Beach damaged by the great storm of November, 1898, and for restoring Eel River to its former course. The estimated cost was $95,700. No estimate of cost of maintenance was stated. (Annual Report for 1899, p. 1089; no

map.) The project was adopted by the river and harbor act of March 3, 1899.

The present project for dredging is to obtain a channel 18 feet deep at mean low water from that depth in the bay to the town wharves, a distance of about 2 miles, 200 feet wide, increased at the entrance and on curves, with a suitable turning basin at the inner end of the channel, at a total estimated cost of $167,000 for first construction and approximately $5,000 annually for maintenance (H. Doc. No. 1194, 62d Cong., 3d sess., with map). The project was adopted by the river and harbor act of March 4, 1913.

The mean range of tide is 10.1 feet.

Operations and results prior to the fiscal year.—Under the beach protection projects various sand-catching devices of timber had been built but have long since washed away; several miles of rubblestone dike had been built, which resulted in strengthening the beach by the accretion of a large volume of sand and shingle; Eel River had been restored to its former course, and the place where it had cut through to the sea was also protected with a stone dike. By dredging, a channel 150 feet wide and 9 feet deep at mean low water had been obtained to the town wharves, including a turning basin; and a new channel, 18 feet deep, which is located on the site of the old one and supersedes it, had been 20 per cent completed. The expenditures under the present project for beach protection were $81,376.28 for new work and $18,800 for maintenance. The expenditures under the present project for dredging were $9,291.41 for new work, making the total expenditures $109,467.69, of which $90,667.69 was for new work and $18,800 for maintenance.

Operations and results during the fiscal year.—No operations were in progress and no expenditures made, except for dredging the 18-foot channel, which was practically completed, and in the turning basin. The expenditures were $86,758.25, all for new work, under contract.

Condition at the end of fiscal year.—The condition of the work under the present project for beach protection is as stated under *Operations and results prior to the fiscal year.* The protection as at present constructed is sufficient, but from the nature of the work it can at no time be considered completed. The expenditures were $81,376.28 for new work and $18,800 for maintenance. The 18-foot channel project is 96 per cent completed, which gives a channel of that depth up into the turning basin at Plymouth. The expenditures were $96,049.66 for new work, making a total on the existing project of $196,225.94, of which $177,425.94 was for new work and $18,800 for maintenance.

Local cooperation.—The act of March 4, 1913, adopting the project for the 18-foot channel appropriated one-half ($83,500) of its total estimated cost, subject to the condition that the Commonwealth of Massachusetts or other local agency contribute a like amount. This condition was accepted by the Commonwealth on June 16, 1913, when an appropriation of $83,500 was made, and this amount was deposited in the Treasury of the United States by the Secretary of War August 25, 1913. The town of Plymouth, in 1909, at an expense of $12,000, restored and deepened to 10 feet at mean low water the channel and

a portion of the basin completed by the Government under the project of 1875. In 1911, with funds provided by the Commonwealth of Massachusetts and the town of Plymouth, the Commonwealth dredged a channel to the wharf of the Plymouth Cordage Co., for a length of about 1,100 feet to the width of 250 feet and depth of 20 feet at mean low water and for a length of about 5,000 feet to the width of 150 feet and depth of 18 feet at mean low water, at a total cost of $142,339.09.

Effect of improvement.—It is reported by the harbor master at Plymouth that the old 9-foot channel effected a saving of 50 cents per ton in freight rates. No data are yet available as to the effect of the deeper channel.

Proposed operations.—No estimate of additional funds required is submitted for the reason that the available funds are sufficient.

Commercial statistics.—The commerce during the current year consisted chiefly of coal.

Comparative statement.

Calendar year.	Amount in short tons.	Value.
1912	37,620	[1] $200,000
1913	38,612	[2] 200,000
1914	45,127	243,780

[1] About. [2] Over.

Financial summary.

GOVERNMENT FUNDS.

Amount expended on all projects to June 30, 1915:	
New work	$318,047.70
Maintenance	32,967.05
Total	351,014.75

Amount expended during fiscal year ending June 30.	1913	1914	1915
New work		$4,645.53	$43,379.30
Maintenance			

APPROPRIATIONS.

[For last five fiscal years only.]

Mar. 4, 1913		$83,500.00
July 1, 1914, balance unexpended		88,854.47
June 30, 1915, amount expended during fiscal year for works of improvement		43,379.30
July 1, 1915, balance unexpended		45,475.17
July 1, 1915, outstanding liabilities	$12,316.14	
July 1, 1915, amount covered by uncompleted contracts	4,510.35	
		16,826.49
July 1, 1915, balance available		28,648.68
Amount (estimated) required to be appropriated for completion of existing project for beach protection		[1] 20,700.00

[1] Exclusive of the balance unexpended July 1, 1915.

CONTRIBUTED FUNDS.

Amount expended on all projects to June 30, 1915, new work		$48,024.83
Amount expended during fiscal year ending June 30, new work:		
1914		4,645.88
1915		43,378.95

APPROPRIATIONS.

[For last five fiscal years only.]

Acts of Massachusetts, 1913, chapter 132		83,500.00
July 1, 1914, balance unexpended		78,854.12
June 30, 1915, amount expended during fiscal year for works of improvement		43,378.95
July 1, 1915, balance unexpended		35,475.17
July 1, 1915, outstanding liabilities	$6,681.13	
July 1, 1915, amount covered by uncompleted contracts	4,510.34	
		11,191.47
July 1, 1915, balance available		24,283.70

CONSOLIDATED.

Amount expended on all projects to June 30, 1915:	
New work	366,072.53
Maintenance	32,967.05
Total	399,039.58

Amount expended during fiscal year ending June 30.	1913	1914	1915
New work		$9,291.41	$86,758.25
Maintenance			

APPROPRIATIONS.

[For last five fiscal years only.]

Mar. 4, 1913		$83,500.00
Acts of Massachusetts, 1913, chapter 132		83,500.00
July 1, 1914, balance unexpended		167,708.59
June 30, 1915, amount expended during fiscal year for works of improvement		86,758.25
July 1, 1915, balance unexpended		80,950.34
July 1, 1915, outstanding liabilities	$18,997.27	
July 1, 1915, amount covered by uncompleted contracts	9,020.69	
		28,017.96
July 1, 1915, balance available		52,932.38
Amount (estimated) required to be appropriated for completion of existing project for beach protection		[1] 20,700.00

[1] Exclusive of the balance unexpended July 1, 1915.

12. PLYMOUTH AND PROVINCETOWN HARBORS, MASS.

(A) PLYMOUTH HARBOR.

Under contract with Eugene Breymann, 675,123 cubic yards of mud and sand were removed, which completed the 18-foot channel, excepting the removal of a few small shoals, and about 65 per cent of the 18-foot turning basin at the inner end.

APPROPRIATIONS.

1824–1896 (as given in H. Doc. No. 421, 57th Cong., 2d sess., p. 269)		$191,081.90
Mar. 3, 1899		85,000.00
June 13, 1902		4,000.00
Mar. 3, 1909 (allotment Aug. 26, 1909)		19,500.00
June 25, 1910		10,000.00
Mar. 4, 1913		83,500.00
Total		393,081.90
Contributed by the Commonwealth of Massachusetts, 1913	$83,500.00	
Damages from surety of failing contractor	4,530.12	
		88,030.12
		481,112.02
Carried to surplus fund from 1842–1859 and 1912	422.10	
Returned to appropriation from allotment of Aug. 26, 1909	700.00	
		1,122.10
		479,989.92

CONTRACT IN FORCE.

Contractor: Eugene Breymann, Toledo, Ohio.
Character and amount: For dredging about 853,900 cubic yards.
Unit price: 11½ cents per cubic yard.
Date of contract: February 28, 1914.
Date of approval: March 18, 1914.
Date fixed for commencement: Within 30 days after date of receipt of notification of approval.
Date fixed for completion: No definite date fixed; 20,000 cubic yards per month first two months, and 50,000 cubic yards per month thereafter.
Percentage of completion at end of fiscal year: 96.

COMMERCIAL STATISTICS.

Articles.	1910	1911	1912	1913
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*
Coal	36,798	46,257	35,320	36,287
Lumber	2,650	2,000	2,200	1,800
Miscellaneous	400	400	100	525
Total	39,848	48,657	37,620	38,612
Number of passengers carried	58,985	53,893	52,009	70,876

Vessel classification, 1914.

Classes.	American.	Foreign.	Total.	Total net registered tonnage.	Passengers carried.
Registered:					
Steamers	86	.....	86	[1] 38,442	61,805
Sailing vessels	13	.....	13	2,271	.....
Sailing vessel	.....	1	1	Unknown.	.....
Barges	27	.....	27	21,751	.....
Total	126	1	127	[2] 62,464	61,805

[1] One steamer of 447 tons, 86 round trips from Boston.
[2] Incomplete.

Freight traffic.

Articles.	Amount (customary units).	Amount in short tons.	Valuation.
Coal	43,827 short tons	43,827	$191,780
Lumber	1,228,380 feet	1,000	37,000
Miscellaneous	300 short tons	300	15,000
Total	.....	45,127	243,780

1916

12. PLYMOUTH AND PROVINCETOWN HARBORS, MASS.

(A) PLYMOUTH HARBOR.

Location and description.—Plymouth Harbor is situated 45 miles by water south of Boston. Its outer anchorage, the "Cow Yard," is common to Plymouth, Duxbury, and Kingston. From this anchorage a channel about 2 miles long leads through extensive flats to a turning basin at the inner end opposite the wharves of the town. The channel and harbor are protected on the sea side by Long Beach, a narrow, low sand spit extending generally parallel to the mainland and about 1 mile from it. The harbor contains 2,000 acres, much of which, outside the channels, is dry at low tide. (See U. S. Coast and Geodetic Survey chart No. 1208.)

Original condition.—In the original condition of the harbor the channel and low-water line were about 2,500 feet from the wharves at Plymouth, to which access could be had only at high water. Long Beach was liable to inroads by the sea that would injure or destroy the harbor. The range of tide was 9.2 feet.

Previous projects.—The original project was adopted by act of May 26, 1824, and was for the preservation of the beach. A project for dredging was adopted by the river and harbor act of March 3, 1875, modified in 1877, 1884, and 1885. The expenditures were $188,646.59 for new work and $22,969.81 for maintenance, a total of $211,616.40. For scope of previous projects, see page 1746 of Annual Report for 1915.

Existing projects.—The existing project for beach protection is for strengthening with rubblestone riprap the sections of Long Beach damaged by the great storm of November, 1898, and for restoring Eel River to its former course. The estimated cost was $95,700. No estimate of cost of maintenance was stated. (Annual Report for 1899, p. 1089; no map.) The project was adopted by the river and harbor act of March 3, 1899. The existing project for dredging is to obtain a channel 18 feet deep at mean low water from that depth in the bay to the town wharves, a distance of about 2 miles, 200 feet wide, increased at the entrance and on curves, with a suitable turning basin at the inner end of the channel, at a total estimated cost of $167,000 for first construction and approximately $5,000 annually for maintenance (H. Doc. No. 1194, 62d Cong., 3d sess.). The project was adopted by the river and harbor act of March 4, 1913. The mean tidal variation is 9.2 feet. The latest published map

showing the 18-foot channel (route No. 1), which map also shows in part the location of the beach protection on Long Beach, will be found in House Document No. 1194, Sixty-second Congress, third session.

Operations and results during the fiscal year.—No operations were in progress and no expenditures made under the project for beach protection.

Under contract, 30,959 cubic yards of material were dredged from the 18-foot channel and turning basin, completing the project on September 18, 1915; expenditure, $17,950.34, all for improvement. Under written order and acceptance, 60,598 cubic yards of clay, mud, and sand, and 11.3125 cubic yards of bowlders, were removed from the old 9-foot turning basin in deepening it to 15 feet and 3,024 cubic yards from a strip 60 feet wide along the outer edge in deepening it to 18 feet; expenditure, $8,802.76, all for maintenance. The total expenditures were $26,753.10.

Condition at the end of fiscal year.—Under the previous projects various sand-catching devices of timber were built but these have long since washed away; by dredging, completed by 1893, a channel was obtained 2,286 feet long, 150 feet wide, and 9 feet deep at mean low water, with a basin in front of the town wharves 866 feet long, 150 feet wide, and 9 feet deep at mean low water, and thereafter maintenance work was done in 1899–1900 and 1903. The 9-foot channel has been superseded by the 18-foot channel under the existing project and the 9-foot turning basin in part by the 18-foot turning basin. In fiscal year 1916 the greater portion of the 9-foot basin not included in the 18-foot project was deepened to 15 feet at mean low water, with a cut 60 feet wide and 18 feet deep along the outer edge, the latter being for the convenience and at the expense of private interests.

Under the existing project for beach protection, several miles of rubblestone dike have been built on Long Beach, which has resulted in strengthening the beach by the accretion of a large volume of sand and shingle; Eel River has been restored to its former course, and the place where it had cut through to the sea protected with a stone dike. The dikes are in good condition and are serving the purpose for which they were built. The protection as at present constructed is sufficient, but from the nature of the work it can at no time be considered completed. The expenditures under the existing project for beach protection were $81,376.28 for new work and $18,800 for maintenance, a total of $100,176.28.

Under the existing project for dredging, completed September 18, 1915, there has been obtained a channel 18 feet deep at mean low water, from that depth in the bay to the town wharves, a distance of 2 miles, 200 feet wide, increased at the entrance and on curves, with a turning basin of the same depth at the inner end of the channel. The expenditures under the existing project for dredging were $114,000 for new work (which completed the project at a saving of $53,000).

The total expenditures under both the existing projects were $214,176.28, of which $195,376.28 was for new work and $18,800 for maintenance.

The net total of results accomplished under the previous and existing projects is the building on Long Beach of several miles of rubble-stone dike, which has strengthened the beach by the accretion of a large volume of sand and shingle, the restoring of Eel River to its former course, the dredging of a channel 18 feet deep at mean low water, 200 feet wide, widened at the entrance and on curves, with a turning basin at the inner end, about two-thirds of which has a depth of 18 feet and about one-third a depth of 15 feet.

Local cooperation.—The act of March 4, 1913, adopting the project for the 18-foot channel appropriated one-half ($83,500) of its total estimated cost, subject to the condition that the Commonwealth of Massachusetts or other local agency contribute a like amount. This condition was accepted by the Commonwealth on June 16, 1913, when an appropriation of $83,500 was made, and this amount was deposited in the Treasury of the United States by the Secretary of War August 25, 1913. The cost of the completed work being less than the estimated cost by $53,000, one-half of the saving, or $26,500, was returned to the Commonwealth of Massachusetts on March 10, 1916, under provisions of section 4 of the river and harbor act of March 4, 1915.

The town of Plymouth, in 1909, at an expense of $12,000, restored and deepened to 10 feet at mean low water the channel and a portion of the basin completed by the Government under the project of 1875. In 1911, with funds provided by the Commonwealth of Massachusetts and the town of Plymouth, the Commonwealth dredged a channel to the wharf of the Plymouth Cordage Co., for a length of about 1,100 feet to the width of 250 feet and depth of 20 feet at mean low water and for a length of about 5,000 feet to the width of 150 feet and depth of 18 feet at mean low water, at a total cost of $142,339.09.

In 1915 the Commonwealth dredged an anchorage basin, about 94,000 square feet in area, extending northerly from the Government channel and easterly of Long North, and Craig Wharves, to the depth of 12 feet at mean low water, at a cost of $7,000.

A contribution of $400 by the Plymouth Electric Light Co., received on July 17, 1915, was expended in deepening to 18 feet at mean low water a strip 60 feet wide along the outer edge of the old 9-foot turning basin, the work being done in conjunction with redredging the remainder of the basin to 15-foot depth.

Effect of improvement.—It is reported by the harbor master at Plymouth that the old 9-foot channel effected a saving of 50 cents per ton in freight rates. Owing to abnormal conditions in water freight rates at the present time the completion of the 18-foot channel has effected no reduction in water rates, but it has made possible the use of vessels of larger capacity.

Proposed operations.—The funds available will be held for maintenance of the existing channels and for repair of the beach protection on Long Beach, and being sufficient for any probable work that will be needed in the near future no estimate of additional funds required is submitted.

Recommended modifications of project.—None.

Commercial statistics.—The commerce during the current year consisted chiefly of coal.

Comparative statement.

Calendar year	Amount in short tons.	Value.
1913	38,612	[1] $200,000
1914	15,127	213,780
1915	36,828 275	214,992.56 (2)

[1] Over. [2] Not ascertainable.

Financial summary.

GOVERNMENT FUNDS.

Amount expended on all projects to June 30, 1916:

New work	$327,022.87
Maintenance	41,369.81
Total	368,392.68

Amount expended during fiscal year ending June 30.	1914	1915	1916
New work	$4,645.53	$43,379.30	$8,975.17
Maintenance			8,402.76
Total	4,645.53	43,379.30	17,377.93

APPROPRIATIONS.

[For last five fiscal years only.]

Mar. 4, 1913		$83,500.00
July 1, 1915, balance unexpended		45,475.17
June 30, 1916, amount expended during fiscal year:		
For works of improvement	$8,975.17	
For maintenance of improvement	8,402.76	
		17,377.93
July 1, 1916, balance unexpended		28,097.24
Amount (estimated) required to be appropriated for completion of existing project for beach protection		[1] 20,700.00

CONTRIBUTED FUNDS.

Amount expended on all projects to June 30, 1916:

New work	$57,000.00
Maintenance	400.00
Total	57,400.00

Amount expended during fiscal year ending June 30.	1914	1915	1916
New work	$4,645.88	$43,378.95	$8,975.17
Maintenance			400.00
Total	4,645.88	43,378.95	9,375.17

[1] Exclusive of the balance unexpended July 1, 1916.

APPROPRIATIONS.

[For last five fiscal years only.]

Acts of Massachusetts 1913, chapter 132		$83,500.00
Plymouth Electric Light Co., 1915		400.00
July 1, 1915, balance unexpended		35,475.17
Receipts from Plymouth Electric Light Co		400.00
		35,875.17
Deduction on account of refund to Commonwealth of Massachusetts		26,500.00
		9,375.17
June 30, 1916, amount expended during fiscal year:		
For works of improvement	$8,975.17	
For maintenance of improvement	400.00	
		9,375.17

CONSOLIDATED.

Amount expended on all projects to June 30, 1916:	
New work	$384,022.87
Maintenance	41,769.81
Total	425,792.68

Amount expended during fiscal year ending June 30.	1914	1915	1916
New work	$9,291.41	$86,758.25	$17,950.34
Maintenance			8,802.76
Total	9,291.41	86,758.25	26,753.10

APPROPRIATIONS.

[For last five fiscal years only.]

Mar. 4, 1913		$83,500.00
Acts of Massachusetts, 1913, chapter 132		83,500.00
Plymouth Electric Light Co., 1915		400.00
July 1, 1915, balance unexpended		80,950.34
Receipts from Plymouth Electric Light Co		400.00
		81,350.34
Deduction on account of refund to Commonwealth of Massachusetts		26,500.00
		54,850.34
June 30, 1916, amount expended during fiscal year:		
For works of improvement	$17,950.34	
For maintenance of improvement	8,802.76	
		26,753.10
July 1, 1916, balance unexpended		28,097.24
Amount (estimated) required to be appropriated for completion of existing project for beach protection		[1] 20,700.00

[1] Exclusive of the balance unexpended July 1, 1916.

12. PLYMOUTH AND PROVINCETOWN HARBORS, MASS.

(A) PLYMOUTH HARBOR.

During the fiscal year, under contract with Eugene Breymann, 30,959 cubic yards of mud and sand were removed from the 18-foot channel and basin, completing the improvement; expenditure, $17,950.34. Under written order and acceptance Eugene Breymann dredged 60,598 cubic yards of clay, mud, and sand, and 11.3125 cubic yards of bowlders from the old 9-foot turning basin in deepening it to 15 feet, and 3,024 cubic yards from a strip 60 feet wide along the outer edge in deepening it to 18 feet; expenditure, $8,802.76. Unit price, 11½ cents per cubic yard. The total expenditures were $26,753.10.

APPROPRIATIONS.

	Previous projects.	Existing projects.		Total.
		Beach protection.	18-foot channel.	
Act of—				
1824-1892 (see H. Doc. No. 1491, 63d Cong., 3d sess., p. 527)	$188,081.90			$188,081.90
Aug. 18, 1894	950.00	$550.00		1,500.00
June 3, 1896		1,500.00		1,500.00
Mar. 3, 1899	10,000.00	75,000.00		85,000.00
June 13, 1902 (allotment Aug. 28, 1902)	3,871.90	128.10		4,000.00
Mar. 3, 1909 (allotment Aug. 26, 1909)		[1] 18,800.00		[1] 18,800.00
June 25, 1910	8,402.76	1,597.24		10,000.00
Mar. 4, 1913			$83,500.00	83,500.00
	211,306.56	97,575.34	83,500.00	392,381.90
Carried to surplus fund from 1842 to 1859, inclusive, and June 30, 1912	90.16	331.94		422.10
	211,216.40	97,243.40	83,500.00	391,959.80
Contributed funds:				
By Commonwealth of Massachusetts, 1915 $83,500				
Returned to Commonwealth, 1916 26,500				
57,000				
By Plymouth Electric Light Co. 400				
57,400	400.00		57,000.00	57,400.00
Damages from surety of failing contractor		4,530.12		4,530.12
Total	211,616.40	101,773.52	140,500.00	453,889.92

[1] $19,500 allotted from appropriation for "Emergencies in river and harbor works," to which appropriation $700 was restored on Oct. 30, 1911.

CONTRACT IN FORCE.

Contractor: Eugene Breymann, Toledo, Ohio.
Character and amount: For dredging about 853,900 cubic yards.
Unit price: 11½ cents per cubic yard.
Date of contract: February 28, 1914.
Date of approval: March 18, 1914.
Date fixed for commencement: Within 30 days after date of receipt of notification of approval.
Date fixed for completion: No definite date fixed; 20,000 cubic yards per month first two months, and 50,000 cubic yards per month thereafter.
Completed September 18, 1915.

COMMERCIAL STATISTICS.

Articles.	1911	1912	1913	1914
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*
Coal	46,257	35,320	36,287	43,827
Lumber	2,000	2,200	1,800	1,000
Miscellaneous	400	100	525	300
Total	48,657	37,620	38,612	45,127
Number of passengers carried	53,893	52,009	70,876	61,805

Vessel classification, 1915.

Classes.	American.	Total.	Total net registered tonnage.	Passenger carried.
Registered:				
Steamers	79	79	[1] 35,313	50,493
Sailing vessels	26	26	10,490	.....
Barges	8	8	6,861	.....
Unregistered sailing vessels	1	1	.....	.....
Total	114	114	52,664	50,493

[1] One steamer of 447 net tons, 79 round trips from Boston.

Freight traffic.

Articles.	Amount in customary units.	Amount in short tons.	Value.
Coal	34,878 short tons	34,878	$177,992.56
Lumber	1,300,000 feet	1,950	37,000.00
		36,828	214,992.56
Fruit and provisions		275	(1)
Total		37,103	(1)

[1] Not ascertainable.

1917

14. PLYMOUTH HARBOR, MASS. (A10).

Location and description.—Plymouth Harbor is situated 45 miles by water south of Boston. Its outer anchorage, the "Cow Yard," is common to Plymouth, Duxbury, and Kingston. From this anchorage a channel about 2 miles long leads through extensive flats to a turning basin at the inner end opposite the wharves of the town. The channel and harbor are protected on the sea side by Long Beach, a narrow, low sand spit extending generally parallel to the mainland and about 1 mile from it. The harbor contains 2,000 acres, much of which, outside the channels, is dry at low tide. (See U. S. Coast and Geodetic Survey chart No. 1208.)

Original condition.—In the original condition of the harbor the channel and low-water line were about 2,500 feet from the wharves at Plymouth, to which access could be had only at high water. Long Beach was liable to inroads by the sea that would injure or destroy the harbor. The range of tide was 9.6 feet.

Previous projects.—The original project was adopted by act of May 26, 1824, and was for the preservation of the beach. A project for dredging was adopted by the river and harbor act of March 3, 1875, modified in 1877, 1884, and 1885. The expenditures were $188,616.59 for new work and $22,969.81 for maintenance, a total of $211,616.40. For scope of previous projects, see page 1746 of Annual Report for 1915.

Existing project.—The existing project is as follows:

(*a*) For beach protection, by strengthening with rubblestone riprap the sections of Long Beach damaged by the great storm of November, 1898, and for restoring Eel River to its former course.

(*b*) For dredging a channel 18 feet deep at mean low water from that depth in the bay to the town wharves, a distance of about 2 miles, 200 feet wide, increased at the entrance and on curves, with a suitable turning basin at the inner end of the channel.

Under ordinary conditions the mean range of tide is 9.6 feet. The low water varies from 2.1 feet below to 1.7 feet above mean low water.

and the high water varies from 2.0 feet below to 2.0 feet above mean high water. As a rule, fluctuations due to wind or other causes do not materially affect navigation interests.

The estimates of cost of the project for new work, exclusive of amounts expended on previous projects, were as follows: (*a*) For beach protection, $95,700. (*b*) For dredging, $167,000. For beach protection there is no approved estimate of cost of annual maintenance. The estimate of cost of annual maintenance for dredging was $5,000.

The existing project was authorized by the following river and harbor acts: (*a*) The act of March 3, 1899, provided for the beach protection in accordance with the report published in Annual Report for 1899, page 1089. (*b*) The act of March 4, 1913, provided for dredging the 18-foot channel in accordance with the report published in House Document No. 1194, Sixty-second Congress, third session.

The latest published map showing the 18-foot channel (route No. 1), which map also shows in part the location of the beach protection on Long Beach, will be found in House Document No. 1194, Sixty-second Congress, third session.

Operations and results during the fiscal year.—No operations were in progress. The expenditure of $6.13 was for inspection expenses, chargeable to maintenance under the project for beach protection.

Conditions at the end of fiscal year.—Under the previous projects various sand-catching devices of timber were built, but these have long since washed away; by dredging, completed by 1893, a channel was obtained 2,286 feet long, 150 feet wide, and 9 feet deep at mean low water, with a basin in front of the town wharves 866 feet long, 150 feet wide, and 9 feet deep at mean low water, and thereafter maintenance work was done in 1899–1900 and 1903. The 9-foot channel has been superseded by the 18-foot channel under the existing project and the 9-foot turning basin in part by the 18-foot turning basin. In fiscal year 1916 the greater portion of the 9-foot basin not included in the 18-foot project was deepened to 15 feet at mean low water, with a cut 60 feet wide and 18 feet deep along the outer edge, the latter being for the convenience and at the expense of private interests.

Under the existing project, several miles of rubblestone dike have been built on Long Beach, which has resulted in strengthening the beach by the accretion of a large volume of sand and shingle; Eel River has been restored to its former course, and the place where it had cut through to the sea protected with a stone dike. The dikes are in good condition and are serving the purpose for which they were built. The protection as at present constructed is sufficient, but from the nature of the work it can at no time be considered completed. The expenditures for beach protection were $76,846.16 for new work and $18,806.13 for maintenance, a total of $95,652.29.

By dredging, completed September 18, 1915, there has been obtained a channel 18 feet deep at mean low water, from that depth in the bay to the town wharves, a distance of 2 miles, 200 feet wide, increased at the entrance and on curves, with a turning basin of the same depth at the inner end of the channel. The expenditures for the dredging were $114,000 for new work (which completed the project at a saving of $53,000).

The total expenditures under the existing project were $209,652.29, not including receipts from sales, etc., amounting to $1,530.12, of which $190,846.16 was for new work and $18,806.13 for maintenance.

The net total of results accomplished under the previous and existing projects is the building on Long Beach of several miles of rubble-stone dike, which has strengthened the beach by the accretion of a large volume of sand and shingle, the restoring of Eel River to its former course, the dredging of a channel 18 feet deep at mean low water, 200 feet wide, widened at the entrance and on curves, with a turning basin at the inner end, about two-thirds of which has a depth of 18 feet and about one-third a depth of 15 feet.

Local cooperation.—The act of March 4, 1913, adopting the project for the 18-foot channel appropriated one-half ($83,500) of its total estimated cost, subject to the condition that the Commonwealth of Massachusetts or other local agency contribute a like amount. This condition was accepted by the Commonwealth on June 16, 1913, when an appropriation of $83,500 was made, and this amount was deposited in the Treasury of the United States by the Secretary of War August 25, 1913. The cost of the completed work being less than the estimated cost by $53,000, one-half of the saving, or $26,500, was returned to the Commonwealth of Massachusetts on March 10, 1916, under provisions of section 4 of the river and harbor act of March 4, 1915.

The town of Plymouth, in 1909, at an expense of $12,000, restored and deepened to 10 feet at mean low water the channel and a portion of the basin completed by the Government under the project of 1875. In 1911, with funds provided by the Commonwealth of Massachusetts and the town of Plymouth, the Commonwealth dredged a channel to the wharf of the Plymouth Cordage Co., for a length of about 1,100 feet to the width of 250 feet and depth of 20 feet at mean low water and for a length of about 5,000 feet to the width of 150 feet and depth of 18 feet at mean low water, at a total cost of $142,339.09.

In 1915 the Commonwealth dredged an anchorage basin, about 94,000 square feet in area, extending northerly from the Government channel and easterly of Long, North, and Craig Wharves, to the depth of 12 feet at mean low water, at a cost of $7,000, and is now dredging an extension to the Goose Point Channel 60 feet wide and 12 feet deep at mean low water.

A contribution of $100 by the Plymouth Electric Light Co., received on July 17, 1915, was expended in deepening to 18 feet at mean low water a strip 60 feet wide along the outer edge of the old 9-foot turning basin, the work being done in conjunction with redredging the remainder of the basin to 15-foot depth.

Effect of improvement.—It is reported by the harbor master at Plymouth that the old 9-foot channel effected a saving of 50 cents per ton in freight rates. Owing to abnormal conditions in water freight rates at the present time the completion of the 18-foot channel has effected no reduction in water rates, but it has made possible the use of vessels of larger capacity.

Proposed operations.—The funds available will be held for maintenance of the existing channels and for repair of the beach protection on Long Beach, and being sufficient for any probable work that

will be needed in the near future no estimate of additional funds required is submitted.

Recommended modifications of project.—None.

References to published articles.—None.

Commercial statistics.—The usual limits of draft in the 18-foot channel for loaded boats carrying coal, comprising about 95 per cent of the commerce for the current year and valued at $234,229.25, are 16 to 17 feet.

Comparative statement.

Calendar year.	Short tons.	Value.	Calendar year.	Short tons.	Value.
1912	37,620	[1] $200,000.00	1915	36,828	$214,992.56
1913	38,612	[2] 200,000.00		275	(3)
1914	45,127	243,780.00	1916	39,848	259,229.25
				100	(3)

[1] About. [2] Over. [3] Not ascertainable.

Financial summary.

Amount expended on all projects to June 30, 1917, exclusive of receipts from sales, etc., formerly included, amounting to $4,530.12:

New work—		
Government funds	$322,492.75	
Contributed funds	57,000.00	
		$379,492.75
Maintenance—		
Government funds	41,375.94	
Contributed funds	400.00	
		41,775.94
Total expended—		
Government funds	363,868.69	
Contributed funds	57,400.00	
		421,268.69
Total appropriations to June 30, 1917:		
Government	391,959.80	
Contributed	57,400.00	
		449,359.80

Fiscal year ending June 30.	1913	1914	1915	1916	1917
Expended for new work:					
Government funds	.....	$4,645.53	$13,379.30	$8,975.17	.....
Contributed funds	.....	4,645.88	13,378.95	8,975.17	.....
	.....	9,291.41	86,758.25	17,950.34	.....
Expended for maintenance:					
Government funds	.....	.....	.....	8,402.76	$6.13
Contributed funds	.....	.....	.....	400.00	.....
	.....	.....	.....	8,802.76	6.13
Total expended	.....	9,291.41	86,758.25	26,753.10	6.13
Contributed	$57,000.00	.....	400.00	.....	.....
Appropriated or allotted	83,500.00	.....	.....	.....	.....

July 1, 1916, balance unexpended	$28,097.24
June 30, 1917, amount expended during fiscal year, for maintenance	6.13
July 1, 1917, balance unexpended	28,091.11
Amount (estimated) required to be appropriated for completion of existing project for beach protection	[1] 20,700.00

[1] Exclusive of the balance unexpended July 1, 1917.

14. PLYMOUTH HARBOR, MASS. (A10).

No work was in progress during the fiscal year. For inspection expenses, $6.13 was spent.

APPROPRIATIONS.

	Previous projects	Existing projects. Beach protection.	Existing projects. 18-foot channel.	Total
Acts of—				
1821-1892 (see H. Doc. No. 1491, 63d Cong., 3d sess., p. 527)	$188,081.90	...	...	$188,081.90
Aug. 18, 1894	950.00	$550.00	...	1,500.00
June 3, 1896	...	1,500.00	...	1,500.00
Mar. 3, 1899	10,000.00	75,000.00	...	85,000.00
June 13, 1902 (allotment Aug. 28, 1902)	3,871.90	128.10	...	4,000.00
Mar. 3, 1909 (allotment Aug. 26, 1909)	...	[1] 18,800.00	...	[1] 18,800.00
June 25, 1910	8,102.76	1,597.24	...	10,000.00
Mar. 4, 1913	...	...	$83,500.00	83,500.00
	211,306.56	97,575.34	83,500.00	392,381.90
Carried to surplus fund from 1842 to 1859, inclusive, and June 30, 1912	90.16	331.94	...	422.10
	211,216.40	97,243.40	83,500.00	391,959.80
Contributed funds:				
By Commonwealth of Massachusetts, 1915 — $33,500				
Returned to Commonwealth, 1916 — 26,500				
57,000				
By Plymouth Electric Light Co. — 400				
57,400	400.00	...	57,000.00	57,400.00
Total	211,616.40	97,243.40	140,503.00	449,359.80
Receipts from sales, etc.	...	...	...	4,530.12

[1] $19,500 allotted from appropriation for "Emergencies in river and harbor works," to which appropriation $700 was restored on Oct. 30, 1911.

COMMERCIAL STATISTICS.

Articles.	1912	1913	1914	1915
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*
Coal	35,320	36,287	43,827	34,878
Lumber	2,200	1,800	1,000	1,950
Fruit and provisions	...	...	...	275
Miscellaneous	100	525	300	...
Total	37,620	38,612	45,127	37,103
Number of passengers carried	52,009	70,876	61,805	50,493

Vessel classification, 1916.

Classes.	American.	Total net registered tonnage.	Passengers.
Registered:			
Steamers	1	186	
	[1] 91	46,956	76,179
Sailing vessels	25	13,196	
	10		
Barges	6	2,441	
Total	133	62,779	

[1] One steamer of 516 net tons, 91 round trips from Boston.

Freight traffic.

Articles	Amount in customary units.	Amount in short tons.	Value.
Coal	38,746 short tons	38,746	$234,229 25
Lumber	740,000 feet	1,100	25,000 00
Total		39,846	259,229 25
Miscellaneous	400 short tons	400	(1)
Total tonnage		40,246	(2)

[1] Unknown. [2] Not ascertainable.

1918

14. PLYMOUTH HARBOR, MASS. (A10).

Location and description.—Plymouth Harbor is 45 miles by water south of Boston. Its outer anchorage, the "Cow Yard," is common to Plymouth, Duxbury, and Kingston. From this anchorage a channel about 2 miles long leads through extensive flats to a turning basin at the inner end opposite the wharves of the town. The channel and harbor are protected on the sea side by Long Beach, a narrow, low sand spit extending generally parallel to the mainland and about 1 mile from it. The harbor contains 2,000 acres, much of which, outside the channels, is dry at low tide. See United States Coast and Geodetic Survey chart No. 1208.

Original condition.—The channel and low-water line were about 2,500 feet from the wharves at Plymouth, to which access could be had only at high water. Long Beach was liable to inroads by the sea that would injure or destroy the harbor.

Previous projects.—The original project was adopted by act of May 26, 1824, and was for the preservation of the beach. A project for dredging was adopted by the river and harbor act of March 3, 1875, and modified in 1877, 1884, and 1885. The amount expended prior to the adoption of the existing project (expenditures on which began in 1899) was $188,646.59 for new work, and $2,013.21 for maintenance, a total of $190,659.80, from United States funds. For further details of previous projects, see page 1746 of Annual Report for 1915.

Existing project.—This provides for (*a*) protecting by riprap the sections of Long Beach damaged by the storm of November, 1898, and for restoring Eel River to its former course; (*b*) dredging a channel 18 feet deep at mean low water and 200 feet wide, increased at the entrance and on curves from the bay to the town wharves, a distance of about 2 miles, with a suitable turning basin at the inner end. The mean range of tide is 9.6 feet. The extreme range is 13.7

feet. As a rule, fluctuations due to wind or other causes do not materially affect navigation.

The estimates of cost for new work, exclusive of amounts expended under previous projects, are as follows: (*a*) for beach protection, $95,700, made in 1899; (*b*) for dredging, $167,000, made in 1911. For beach protection the latest (1917) approved estimate for annual cost of maintenance is $500. For dredging the latest (1917) approved estimate for annual cost of maintenance is $5,000.

The existing project was authorized by the following river and harbor acts: (*a*) The act of March 3, 1899, provided for the beach protection (Annual Report for 1899, p. 1089); (*b*) the act of March 4, 1913, provided for dredging the 18-foot channel (H. Doc. No. 1194, 62d Cong., 3d sess.). The latest published map showing the 18-foot channel (route No. 1), which map also shows in part the location of the beach protection on Long Beach, is in House Document No. 1194, Sixty-second Congress, third session.

Operations and results during fiscal year.—None. The expenditure of $0.18 represents the proceeds from sale of blue prints received during the previous fiscal year, chargeable to maintenance and applied to office expense.

Condition at end of fiscal year.—The existing project was completed in 1915. The 9-foot channel of the previous project has been superseded by the 18-foot channel under the existing project and the 9-foot turning basin in part by the 18-foot turning basin. In the fiscal year 1916 the greater portion of the 9-foot basin, not included in the 18-foot project, was deepened to 15 feet at mean low water, with a cut 60 feet wide and 18 feet deep along the outer edge, the latter being for the convenience and at the expense of private interests. The net total of results accomplished under the previous and existing projects is the building on Long Beach of several miles of rubblestone dike, which has strengthened the beach by the accretion of a large volume of sand and shingle, the restoring of Eel River to its former course, and the dredging of a channel 18 feet deep at mean low water, 200 feet wide, widened at the entrance and on curves, and with a turning basin at the inner end, about two-thirds of which has a depth of 18 feet and about one-third a depth of 15 feet. The controlling depth, as ascertained in 1915, is 18 feet at mean low water. The expenditures under the existing project were as follows:

	United States funds.	Contributed funds.	Total.
New work	$133,846.16	$57,000.00	$190,846.16
Maintenance	39,362.73	400.00	39,762.73
Total	173,208.89	57,400.00	230,608.89

Local cooperation.—The act of March 4, 1913, required that the Commonwealth of Massachusetts or other local agency contribute one-half the estimated cost of the channel. This condition was accepted by the Commonwealth on June 16, 1913, when an appropriation of $83,500 was made, and this amount was deposited by the Sec-

retary of War August 25, 1913. The cost of the completed work being less than the estimated cost by $53,000, one-half of the saving, or $26,500, was returned to the Commonwealth of Massachusetts on March 10, 1916, under provisions of section 4 of the river and harbor act of March 4, 1915.

The town of Plymouth, in 1909, at an expense of $12,000, restored and deepened to 10 feet at mean low water the channel and a portion of the basin completed by the Government under the project of 1875. In 1911, with funds provided by the Commonwealth of Massachusetts and the town of Plymouth, the Commonwealth dredged a channel to the wharf of the Plymouth Cordage Co. for a length of about 1,100 feet to the width of 250 feet and depth of 20 feet at mean low water and for a length of about 5,000 feet to the width of 150 feet and depth of 18 feet at mean low water, at a total cost of $142,339.09.

In 1915 the Commonwealth dredged an anchorage basin, about 94,000 square feet in area, extending northerly from the Government channel and easterly of Long, North, and Craig wharves, to the depth of 12 feet at mean low water, at a cost of $7,000; and is now dredging an extension to the Goose Point Channel 60 feet wide and 12 feet deep at mean low water, which, to December 1, 1917, has been carried for about 1,600 feet to within a short distance of the originally selected terminal point, at a cost of $12,278.86.

A contribution of $400 by the Plymouth Electric Light Co., received on July 17, 1915, was expended in deepening to 18 feet at mean low water a strip 60 feet wide along the outer edge of the old 9-foot turning basin, the work being done in conjunction with redreging the remainder of the basin to a 15-foot depth.

Terminal facilities.—At the head of the dredged channel there are nine wharves, all of which are used for commercial purposes and consist almost wholly of wooden bulkheads filled solid, but in some cases faced by pile platforms or extensions. One of these wharves has a frontage of about 650 feet, is publicly owned, and is open to general public use; the other wharves have an aggregate frontage of about 3,000 feet, are privately owned, and are not open to general public use.

The terminal facilities are considered adequate for existing commerce.

Effect of improvement.—It is reported that the old 9-foot channel effected a saving of 50 cents per ton in freight rates. Owing to abnormal conditions the completion of the 18-foot channel has effected no reduction in water rates, but it has made possible the use of vessels of larger capacity.

Proposed operations.—The funds available will be held for maintenance of the existing channels and for repair of the beach protection on Long Beach, and being sufficient for any probable work that will be needed in the near future no estimate of additional funds required is submitted.

Recommended modifications of project.—None.

References to published articles not previously reported.—None.

Commercial statistics.—The usual drafts in the 18-foot channel for loaded boats carrying coal, comprising about 93 per cent of the commerce for the current year, and valued at $209,973.75, are 16 to 17 feet.

Comparative statement.

Calendar year.	Short tons.	Value.	Passengers.	Calendar year.	Short tons.	Value.	Passengers.
1913	38,612	[1] $200,000.00	70,876	1916	39,816	$259,229.25	76,179
1914	45,127	243,780.00	61,805		400	(2)	
1915	30,828	214,992.56	50,493	1917	28,604	243,973.75	None.
	275	(2)					

[1] Over. [2] Not ascertainable.

The passenger line of the Nantasket Beach Steamboat Co. between Boston and Plymouth was discontinued during the calendar year 1917.

A considerable decrease in receipts of coal also occurred, attributable to war conditions as affecting fuel production and transportation.

Financial summary.

Amount expended on all projects to June 30, 1918, after deducting receipts from sales, etc., amounting to $4,530.12:	
New work	$322,492.75
Maintenance	41,375.94
Net total expended	363,868.69
Total appropriations to date of this report	391,959.80

Fiscal year ending June 30.	1914	1915	1916	1917	1918
Expended for new work [1]	$4,645.53	$43,379.30	$8,975.17		
Expended for maintenance [1]			8,402.76	$6.13	$0.18
Total expended [1]	9,291.41	86,758.25	26,753.10	6.13	.18
Appropriated or allotted					

July 1, 1917, balance unexpended	[2] $28,091.29
June 30, 1918, amount expended during fiscal year, for maintenance [1]	.18
July 1, 1918, balance unexpended	28,091.11
Amount (estimated) required to be appropriated for completion of existing project for beach protection	[3] 20,700.00

[1] Not deducting receipts from sales, etc.
[2] Includes $0.18 receipts from sales not included in 1917 report.
[3] Exclusive of available funds.

14. PLYMOUTH HARBOR, MASS. (A10).

OPERATIONS DURING THE FISCAL YEAR.

No work was in progress. The expenditure of $0.18 represents the proceeds from sale of blue prints received during the previous fiscal year.

CONTRACTS IN FORCE.

None.

COMMERCIAL STATISTICS.

[Year-round navigation season.]

Articles.	1913	1914	1915	1916
	Short tons.	*Short tons.*	*Short tons.*	*Short tons.*
Coal	36,287	43,827	31,878	38,746
Lumber	1,800	1,000	1,950	1,100
Fruit and provisions	.....	.....	275	.....
Miscellaneous	525	300	.....	400
Total	38,612	45,127	37,103	40,246
Number of passengers carried	70,876	61,805	50,193	76,179

Vessel classification, 1917.

Classes.	American.	Total net registered tonnage.
Registered sailing vessels and barges	27	13,264
Unregistered lighters	9	.....
Total	36	13,264

There has been no passenger traffic for 1917. The Plymouth line of the Nantasket Beach Steamboat Co. was discontinued for that year.

Freight traffic.

Articles.	Amount in customary units.	Amount in short tons.	Value.
Coal	27,101 short tons	27,101	$209,973.75
Lumber	1,000,000 feet	1,500	34,000.00
Total		28,601	243,973.75

APPROPRIATIONS.

	Previous projects.	Existing project.			Total
		Beach protection.	18-foot channel.	16-foot channel.	
Acts of—					
1824-1896 (see H. Doc. No. 1491, 63d Cong., 3d sess., p. 527)	$191,081.90	.....	.....	.....	$191,081.90
Mar. 3, 1899	.....	$75,000.00	.....	$10,000.00	85,000.00
June 13, 1902 (allotment Aug. 28, 1902)	.....	128.10	.....	3,871.90	4,000.00
Mar. 3, 1909 (allotment Aug. 26, 1909)	.....	[1] 18,800.00	.....	.....	[1] 18,800.00
June 25, 1910	.....	1,597.24	.....	8,402.76	10,000.00
Mar. 4, 1913	.....	.....	$83,500.00	.....	83,500.00
	191,081.90	95,525.34	83,500.00	22,274.66	392,381.90
Carried to surplus fund from 1842 to 1859, inclusive, and June 30, 1912	422.10	.....	.....	.....	422.10
	190,659.80	95,525.34	83,500.00	22,274.66	391,959.80
Contributed funds:					
By Commonwealth of Massachusetts, 1915 ..... $83,500					
Returned to Commonwealth, 1916 26,500					
57,000	.....	.....	57,000.00	.....	57,000.00
By Plymouth Electric Light Co.	.....	.....	.....	400.00	400.00
Total	190,659.80	95,525.34	140,500.00	22,674.66	449,359.80

Receipts from sales, etc., $4,530.12.

[1] $19,500 allotted from appropriation for "Emergencies in river and harbor works," to which appropriation $700 was restored on Oct. 30, 1911.

14. PLYMOUTH HARBOR, MASS. (A10.)

Location and description.—Plymouth Harbor is 45 miles by water south of Boston. Its outer anchorage, the "Cow Yard," is common to Plymouth, Duxbury, and Kingston. From this anchorage a channel about 2 miles long leads through extensive flats to a turning basin at the inner end opposite the wharves of the town. The channel and harbor are protected on the sea side by Long Beach, a narrow, low sand spit extending generally parallel to the mainland and about 1 mile from it. The harbor contains 2,000 acres, much of which, outside the channels, is dry at low tide. See U. S. Coast and Geodetic Survey charts Nos. 338 and 1208.

Original condition.—The channel and low-water line were about 2,500 feet from the wharves at Plymouth, to which access could be had only at high water. Long Beach was liable to inroads by the sea that would injure or destroy the harbor.

Previous projects.—The original project was adopted by act of May 26, 1824, and was for the preservation of the beach. A project for dredging was adopted by the river and harbor act of March 3, 1875, and modified in 1877, 1884, and 1885. The amount expended prior to the adoption of the existing project (expenditures on which began in 1899) was $188,646.59 for new work, and $2,013.21 for maintenance, a total of $190,659.80, from United States funds. For further details of previous projects, see page 1746 of Annual Report for 1915.

Existing project.—This provides for (*a*) protecting by riprap the sections of Long Beach damaged by the storm of November, 1898, and for restoring Eel River to its former course; (*b*) dredging a channel 18 feet deep at mean low water and 200 feet wide, increased at the entrance and on curves from the bay to the town wharves, a distance of about 2 miles, with a suitable turning basin at the inner end. The mean range of tide is 9.6 feet. The extreme range is 13.7 feet. As a rule, fluctuations due to wind or other causes do not materially affect navigation.

The estimates of cost for new work, exclusive of amounts expended under previous projects, are as follows: (*a*) for beach protection, $95,700, made in 1899; (*b*) for dredging, $167,000, made in 1911. For beach protection the latest (1917) approved estimate for annual cost of maintenance is $500. For dredging the latest (1917) approved estimate for annual cost of maintenance is $5,000.

The existing project was authorized by the following river and harbor acts: (*a*) The act of March 3, 1899, provided for the beach protection (Annual Report for 1899, p. 1089); (*b*) the act of March 4, 1913, provided for dredging the 18-foot channel (H. Doc. No. 1194, 62d Cong., 3 sess.). The latest published map showing the 18-foot channel (route No. 1), which map also shows in part the location of the beach protection on Long Beach, is in House Document No. 1194, Sixty-second Congress, third session.

Operations and results during fiscal year.—No operations were in progress and no expenditures made.

Condition at end of fiscal year.—The existing project was completed in 1915. The 9-foot channel of the previous project has been superseded by the 18-foot channel under the existing project and the 9-foot turning basin in part by the 18-foot turning basin. In the fiscal year 1916 the greater portion of the 9-foot basin, not included in the 18-foot project, was deepened to 15 feet at mean low water, with a cut 60 feet wide and 18 feet deep along the outer edge, the latter being for the convenience and at the expense of private interests. The net total of results accomplished under the previous and existing projects is the building on Long Beach of several miles of rubblestone dike, which has strengthened the beach by the accretion of a large volume of sand and shingle, the restoring of Eel River to its former course, and the dredging of a channel 18 feet deep at mean low water, 200 feet wide, widened at the entrance and on curves, and with a turning basin at the inner end, about two-thirds of which has a depth of 18 feet and about one-third a depth of 15 feet. The controlling depth, as ascertained in 1915, is 18 feet at mean low water. The expenditures under the existing project were as follows:

	United States funds.	Contributed funds.	Total.
New work	$133,816 16	$57,000.00	$190,816 16
Maintenance	39,362.73	400 00	39,762 73
Total	173,208.89	57,400.00	230,608.89

Local cooperation.—The act of March 4, 1913, required that the Commonwealth of Massachusetts or other local agency contribute one-half the estimated cost of the channel. This condition was accepted by the Commonwealth on June 16, 1913, when an appropriation of $83,500 was made, and this amount was deposited by the Secretary of War August 25, 1913. The cost of the completed work being less than the estimated cost by $53,000, one-half of the saving, or $26,500, was returned to the Commonwealth of Massachusetts on March 10, 1916, under provisions of section 4 of the river and harbor act of March 4, 1915.

The town of Plymouth, in 1909, at an expense of $12,000, restored and deepened to 10 feet at mean low water the channel and a portion of the basin completed by the Government under the project of 1875. In 1911, with funds provided by the Commonwealth of Massachusetts and the town of Plymouth, the Commonwealth dredged a channel to the wharf of the Plymouth Cordage Co. for a length of about 1,100 feet to the width of 250 feet and depth of 20 feet at mean low water, and for a length of about 5,000 feet to the width of 150 feet and depth of 18 feet at mean low water, at a total cost of $142,339.09.

In 1915 the Commonwealth dredged an anchorage basin, about 94,000 square feet in area, extending northerly from the Government channel and easterly of Long, North, and Craig wharves, to the depth of 12 feet at mean low water, at a cost of $7,000; and completed on December 7, 1917, at a cost of $9,846.24, the dredging of an extension to the Goose Point Channel 60 feet wide and 12 feet deep at mean low water, for about 1,600 feet to within a short distance of the originally selected terminal point.

A contribution of $400 by the Plymouth Electric Light Co., received on July 17, 1915, was expended in deepening to 18 feet at mean low water a strip 60 feet wide along the outer edge of the old 9-foot turning basin; the work being done in conjunction with redredging the remainder of the basin to a 15-foot depth.

To December 1, 1918, the Commonwealth had expended on Plymouth Harbor a total of $220,074.37.

Terminal facilities.—At and near the head of the dredged channel there are eight wharves, and about 1 mile north one wharf, all of which are used for commercial purposes and available for waterborne freight. They consist almost wholly of wooden bulkheads filled solid, but in some cases faced by pile platforms or extensions. One of these wharves has a frontage of about 650 feet, is leased by the town of Plymouth, and open to general public use; the others have an aggregate frontage of about 2,600 feet, are privately owned, and are not open to general public use. One is a landing for passenger excursion steamers, with total dockage of 310 feet.

These facilities are considered adequate for existing commerce. For a full description of terminal facilities see House Document No. 226, Sixty-third Congress, first session.

Effect of improvement.—It is reported that the old 9-foot channel effected a saving of 50 cents per ton in freight rates. Owing to abnormal conditions the completion of the 18-foot channel has effected no reduction in water rates, but it has made possible the use of vessels of larger capacity.

Proposed operations.—The funds available will be held for maintenance of the existing channels and for repair of the beach protection on Long Beach; and being sufficient for any probable work that will be needed in the near future, no estimate of additional funds required is submitted.

Recommended modifications of project.—None.

References to published articles not previously reported.—None.

Commercial statistics.—The usual drafts in the 18-foot channel for loaded boats carrying coal, comprising 95 per cent of the commerce for the calendar year 1918, and valued at $107,491, are 16 to 17 feet.

Comparative statement.

Calendar year.	Short tons.	Value.	Passengers.	Calendar year.	Short tons.	Value.	Passenger
1914	15,127	$243,780.00	61,805	1917	28,604	$243,973.75	...
1915	37,103	[1] 214,992.56	50,493	1918	13,516	125,491.00	...
1916	40,246	[1] 259,229.25	76,179				

[1] Incomplete.

The passenger steamboat line between Boston and Plymouth, discontinued during 1917, was not resumed during 1918.

Financial summary.

Amount expended on all projects to June 30, 1919, after deducting receipts from sales, etc., amounting to $4,530.12:	
New work	$322,492.75
Maintenance	41,375.94
Net total expended	[1] 363,868.69
Total appropriations to date of this report	391,959.80

Fiscal year ending June 30.	1915	1916	1917	1918	1919
Expended for new work [1]	$13,379.30	$8,975.17	...	...	...
Expended for maintenance [1]	...	8,402.76	$6.13	$0.18	...
Total expended	13,379.30	17,377.93	6.13	.18	...
Appropriated or allotted	...	...	...	...	...

[1] Not deducting receipts from sales, etc.

July 1, 1918, balance unexpended	$28,091.11
July 1, 1919, balance unexpended	28,091.11

[1] In addition to this amount, $57,400 was expended from contributed funds, $57,000 for new work, and $400 for maintenance.

14. PLYMOUTH HARBOR, MASS. (A 10.)

OPERATIONS DURING THE FISCAL YEAR.

None were in progress and no expenditures made.

CONTRACTS IN FORCE.

None.

COMMERCIAL STATISTICS.

[Year-round navigation season.]

Vessel classification, 1918.

Classes.	American.	Total net registered tonnage.
Registered sailing vessels and barges	17	9,090
Unregistered lighters	3	...
Total	20	9,090

These were all freight vessels. There was no passenger traffic during 1918, as no excursion steamers ran between Boston and Plymouth during that year.

Freight traffic.

Articles.	Amount in customary units.	Amount in short tons.	Value.
INBOUND TRAFFIC.			
Coastwise:			
Coal	12,841 short tons	12,841	$107,491
Lumber	450,000 feet	675	18,000
Total		13,516	125,491

A sharp decrease (over 50 per cent) in receipts of coal and lumber occurred during 1918, attributable to the difficulty in securing water transportation, and the consequent traffic by rail.

APPROPRIATIONS.

		Existing project			
	Previous projects.	Beach protection.	18-foot channel.	16-foot channel.	Total
Acts of—					
1824-1896 (see H. Doc. No. 1491, 63d Cong., 3d sess., p. 527)	$191,081.90				$191,081.90
Mar. 3, 1899		$75,000.00		$10,000.00	85,000.00
June 13, 1902 (allotment Aug. 28, 1902)		128.10		3,871.90	4,000.00
Mar. 3, 1909 (allotment Aug. 26, 1909)		[1] 18,800.00			[1] 18,800.00
June 25, 1910		1,597.24		8,402.76	10,000.00
Mar. 4, 1913			$83,500.00		83,500.00
	191,081.90	95,525.34	83,500.00	22,274.66	392,381.90
Carried to surplus fund from 1842 to 1859, inclusive, and June 30, 1912	422.10				422.10
	190,659.80	95,525.34	83,500.00	22,274.66	391,959.80
Contributed funds:					
By Commonwealth of Massachusetts, 1915 $83,500					
Returned to Commonwealth, 1916 26,500					
57,000			57,000.00		57,000.00
By Plymouth Electric Light Co.				400.00	400.00
Total	190,659.80	95,525.34	140,500.00	22,674.66	449,359.80

[1] $19,500 allotted from appropriation for "Emergencies in river and harbor works," to which appropriation $700 was restored on Oct. 30, 1911.
Receipts from sales, etc., $4,530.12.

PLYMOUTH HARBOR.

PHYSICAL CHARACTERISTICS.

Description,----------	A.R.67,p.46
	" 69,p.411
	" 70,pp.455,456
	" 71,p.893
Description of part of harbor embracing main channel, and of works of protection,	Pages 5-9

PROJECTS.

By Maj.Mendell,1866,breakwater and jetties,	A.R.66,ii,28
By Capt.Smith,1868,stronger work,consisting of cribs,----------	" 68,p.804,
	" 69," 411,
	" 70," 456.
By Maj.Houston,1869,bulkhead,with jetties in front and rear,----------	" 70," 457
Note: Prior to 1875 appropriations were applied to the protection and preservation of Long Beach; the aggregate of appropriations from 1824 to 1874, inclusive, was $103,566.90.	
By Lt.Col.Thom,bulkheads and jetties,1873,	Page 2
By Lt.Col.Thom,1874,dredging a channel 100 f.wide and 6 f.deep from the "Middle Ground" to "Long Wharf" at Plymouth,----	5-9
Modified in 1876,to provide for dredging a basin 866 f.long,150 f.wide,and 8 f. deep in front of town wharves,---------	14,19-31
In 1884-85 it was proposed to widen the channel to 150 f.and deepen to 9 f.,---	44,45,48
The amount appropriated from 1875 to 1886,inclusive,was $68,500,when it was estimated that $15,500 would be required to complete existing project,---	55,58,63
Increased to $17,500 in 1889,----------	68
By Lt.Col.Mansfield, 1892,repairing protecting works of Long Beach,estimate $2,000; repairing and extending the works on the southern part of the beach, estimate,$2,500;the balance of available funds to be used in widening the improved channel to 150 f.to complete proposed dredging,----------	80

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Examination with a view to removing obstructing shoals in the harbor, and to deepening excavated channel, ordered by act of Aug.17,1894, made by Lt.Col.Mansfield, 1894, report favorable for limited improvement,---------- 88,89

Lt.Col.Mansfield estimated, 1897, that it would cost $8,716.95 for further improvement of the harbor in the vicinity of Middle Ground,---------- 95

Examination of Gurnet and other rocks at the harbor mouth ordered by act of June 3, 1896, made by Lt.Col.Mansfield, 1897, report unfavorable,---------- 96

Survey ordered by act of Jun.3,1896, made by Lt.Col.Mansfield, 1897, report favorable,---------- 97,98

By Col. Suter, 1899, repairing beach, estimate $95,700. Congress appropriated $75,000,---------- 104

By Col. Suter, 1899, redredging channel and basin with $10,000 appropriated by Congress,---------- 105

Minor survey by Col.Suter, 1899,---------- 106,107

Examination and survey, November, 1907, and September, 1908 (with map), respectively, under direction of Lt.Col.Burr, authorized by river and harbor act of Mar.2,1907, with a view to the construction of a rubblestone breakwater, extending from Long Beach easterly along the crest of Browns Island, Plymouth Harbor (report unfavorable), 1909,---------- 133,151

Examination (Oct.1910) and survey (Feb.1911, with map) by Col. F.V.Abbot, called for by river and harbor act of Jun.25,1910, for dredging a channel 18 feet deep at mean low water and 200 ft. wide, increased at entrances and on curves (designated as "Route No.1"), estimated cost $167,000, conditional upon pledging of State funds to the extent of 1/2 the cost (favorable),------ 165-180

Project adopted by the act of Mar.4,1913; $83,500 appropriated by State of Mass. placed to credit U.S. Aug.14,1913.

PLYMOUTH HARBOR.

MAPS.

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Plymouth Beach, 1836,	15
Plymouth Harbor, 1881,	31
Plymouth Harbor (Long Beach)	58
Plymouth Harbor, 1888,	65
Plymouth Harbor, 1897,	97
Plymouth, Kingston & Duxbury Harbors, 1908,	151
Plymouth, Kingston & Duxbury Harbors, 1910,	175

ENGINEER OFFICERS IN CHARGE.

Col.J.D.Graham,	1865
Maj.G.H.Mendell,	1866
Capt.J.A.Smith,	1867-69
Maj.D.C.Houston,	1869-70
Lt.Col.J.G.Foster,	1870-71
Lt.Col.G.Thom,	1871-83
Maj.C.W.Raymond,	1883-86
Lt.Col.G.L.Gillespie,	1886-89
Lt.Col.S.M.Mansfield,	1889-98
Col.C.R.Suter,	1899-1901
Col.W.S.Stanton,	1901-06
Maj.Edw.Burr,	1906-1910
Col.F.V.Abbot,	1910-13
Col. John Millis,	1913-