

increase the value of real estate in Onset, while relieving the property owners from the necessity of paying for the work themselves, it appears to me that such an improvement would be so local in its interests, and so little a matter of general interest to the country at large, that, if made, it should be paid for by those locally interested, and not by the United States as a whole.

I have, therefore, to state my opinion, as requested by Congress, that for the reasons above given Onset Harbor, Massachusetts, is not at present worthy of improvement by the General Government.

Respectfully submitted.

W. H. BIXBY,
Captain, Corps of Engineers.

Brig. Gen. WM. P. CRAIGHILL,
Chief of Engineers, U. S. A.

(Through Col. Henry L. Abbot, Corps of Engineers, Division Engineer, Northeast Division.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, June 7, 1895.

Respectfully forwarded to the Chief of Engineers. For the reasons stated by Captain Bixby I do not regard Onset Harbor as at present worthy of improvement by the General Government.

HENRY L. ABBOT,
*Colonel of Engineers, Bot. Brig. Gen., U. S. A.,
Division Engineer.*

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PRELIMINARY EXAMINATION OF BASS RIVER, MASSACHUSETTS.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., May 31, 1895.

GENERAL: In accordance with the river and harbor act of August 17, 1894, and orders from your office dated August 20, 1894, I have the honor to submit the following report upon a preliminary examination of Bass River, Massachusetts.

My opinions, as below stated, are based upon my own knowledge and special study of this locality, which was visited by me in person during the past year. This personal visit was used as a check upon such information as has been received by me from various sources during the past year, and also as a check upon the hydrography and topography of the locality as given on the latest Coast Survey charts and local maps.

Bass River is one of the small rivers on the south shore of Cape Cod Bay, between Hyannis and Chatham, and empties into Nantucket Sound about 5 miles east of Hyannis.

Cape Cod at this neighborhood is only about 6 miles wide, with Cape Cod Bay on the north and Nantucket Sound on the south, and its surface consists mainly of sand hills and sand flats with occasional ponds and marshes, the inland ponds being mostly of fresh water, while the other ponds and marshes near the bays and sounds are of salt water. The soil of this region is not well adapted to cultivation except to that of cranberries, very little ordinary farming being done. Most of its corn,

wheat, hay, and other similar supplies have to be brought from a distance. Consequently this section of the country has a very small and scattered population, and at the present time depends largely for its support upon the cranberry culture in the fall, and the hotels, boarding houses, and summer cottages during the rest of the year. There are but few manufacturing establishments anywhere in the neighborhood, and these few are small in size. Almost all the cottage towns and settlements along the adjoining shore fronts are supplied with small wharves directly on the bay or sound, suitable for use by light-draft vessels during the summer season. The cold weather and the ice prevent the use of these wharves along this part of the coast during the winter season. The main supplies of this section of the coast are therefore carried to it by the Cape Cod branch of the Old Colony Railroad, which at this point runs along the center ridge of the cape almost half way between Cape Cod Bay on the north and Nantucket Sound on the south. Naturally with such a small permanent population, with but little in the way of farming interests and manufacturing interests and with a summer population mainly composed of visitors, the commercial interests of the neighborhood are exceedingly small and local, and it is apparent that the United States Government improvements must be limited to the improvement only of the largest and most important harbors. Hyannis Harbor, which is only 5 miles west of Bass River, has naturally a fairly good anchorage for vessels of 15 feet draft, and has a large bay adjoining it suitable for vessels of smaller draft. Hyannis Harbor has therefore received a good deal of assistance from the General Government, the cost of such assistance up to the present time being about \$150,000, by which it has been provided with a breakwater of over 1,000 feet length, and with a well-protected anchorage ground, in rear of this breakwater and in front of Hyannis Wharf, covering over 150 acres and having a draft of 15 feet. Because of the existence of this natural harbor at Hyannis (and its improvement by the General Government), the Cape Cod Railroad has constructed a branch line to its harbor and wharves, allowing the easy landing of all heavy supplies such as iron, coal, grain, etc., for general distribution to the adjacent section of Cape Cod.

About sixty years ago, before the construction of the existing railroad line through this region, Bass River was a place of considerable importance to this neighborhood, and was the center of a large amount of shipping, principally composed of whaling vessels. In those days as many as 150 vessels are reported as having been laid up in the river every winter. In consequence of the commercial importance of this place at that time, the United States, under river and harbor appropriations, expended about \$20,000 between 1837 and 1840 outside the mouth of this river in the construction of a breakwater of about 250 feet length, to serve as a shelter to vessels of from 6 to 12 feet draft; and later on, in 1854-55, the Light-House Department constructed a light-house on the breakwater at a further expense of \$4,000. Since that date the whaling interests have almost entirely died out, and the adjoining better harbor of Hyannis, combined with the construction of the Hyannis branch of the Old Colony Railroad, has diminished the local importance of Bass River so that its commerce is at present very small. Further than this, the shifting sand of this neighborhood have built up shoals in rear of the breakwater and around its harbor so that it is now possible at low water for a man to wade without difficulty from the breakwater to the shore on either side of the entrance to the

river. Boats at present lying in what is left of the anchorage behind the breakwater can not go directly into the mouth of the river, except by passing over a shoal of about 0.75 mile length with an average depth of only 0.5 foot at low water. In order to get from the breakwater harbor to the mouth of the river by the best boat channel, boats must now first sail 1.5 miles westward from the breakwater and then enter the river by a narrow and winding entrance, having at its shoalest point (its outer bar) hardly 2 feet depth at low tide. Owing to the marked decrease of the commerce of this river, and of its usefulness to navigation, the Light-House Department in about 1881 removed its light from the breakwater to the adjacent shore, retaining the breakwater itself as a front range to the shore light for the use of vessels approaching the river entrance and the breakwater harbor. At present, however, the main utility of this breakwater is as a popular fishing place for summer visitors.

Bass River itself, from its source to its mouth, is only about 7 miles long, the upper 3 miles consisting mainly of large ponds, and the lower 4 miles having a reasonably good channel of 40 to 50 feet width and of 5 to 7 feet depth at low water down to the apparent mouth of the river, that is, to the general line of the shore front of Nantucket Sound. Outside of this shore line lies a shoal of from 2,000 to 8,000 feet length, the shallowest portion of which constitutes the outer bar of the river mouth, and lies about 1.5 miles in front of the general shore line.

The Old Colony Railroad crosses Bass River just below the upper ponds and about 3 miles from the head of the river, by a bridge about 50 feet wide, leaving a waterway under it of about 40 feet clear width and 12 feet clear height. From the railroad downstream, a distance of about 0.75 mile to the South Dennis Highway Bridge, the river varies from 50 to 600 feet in width, with a boating channel of perhaps 40 feet width and 5 or 6 feet depth at low water. The South Dennis Bridge is about 180 feet long, and is without any draw, but has a boating span of about 20 feet width and 10 to 12 feet height at low water. From the South Dennis Bridge down a farther distance of about 2 miles to the South Yarmouth and West Dennis Bridge the river varies from 200 feet to 3,000 feet in width, with a boating channel of about 50 feet width and 6 to 7 feet depth at low water. The South Yarmouth and West Dennis Bridge is about 600 feet long, with a good draw of 30 feet width. From the South Yarmouth Bridge 1.5 miles farther to the apparent mouth of the river the river varies from 300 to 800 feet in width, with a good boating channel of about 50 to 60 feet width and about 6 to 7 feet depth at low water. From the apparent mouth of the river to its outer bar in Nantucket Sound, i. e., to the deep water of Nantucket Sound, the distance is about 1.5 miles, measured along the boating channel, this channel, as marked by stakes (cut down by the ice each winter and replaced every spring) being from about 60 to 600 feet in width; the depth on the outer bar (a few hundred feet from deep water of the sound) being a little less than 2 feet; the distance from 3 feet depth outside of the bar to 3 feet depth inside the bar at low water being about 2,000 feet; and the distance from 6 feet depth outside the bar to 6 feet depth inside the bar at low water being from 5,000 to 6,000 feet. The bottom is everywhere of shifting sand, and the boat channel is continually changing its position from year to year. The local conditions cause a difference of about an hour between the times of low tide and of slack water; and the movement of the tidal currents are so slow that there is an interval of nearly three hours between the times

of low tide on the outer bar and of low tide at the South Yarmouth bridge, the distance between the two places being only about 3.5 miles.

There are very few settlements around the upper part of Bass River, north of the Old Colony Railroad, the nearest village being that of Yarmouth, about a mile from the head of the river. Yarmouth, however, is less than a mile distant from Yarmouth Port, on Barnstable Harbor, Cape Cod Bay, and consequently Yarmouth commerce naturally seeks an outlet to the ocean through Cape Cod Bay and not through Bass River. South of the Old Colony Railroad, on the east side of Bass River and close to it, lie the villages of South Dennis and West Dennis. South Dennis is a place of only about 700 population, its center lying about 0.25 mile distant from the railway station, and also about 0.25 mile distant from the river. West Dennis is a place of about 800 population, its center being about 2 miles southwest of South Dennis, about a half mile from the nearest point of the river, and about 2 miles from the mouth of the river. The half township of Dennis south of the railroad contains another settlement called Dennisport, a place of about 900 population, lying directly on the shore front of Nantucket Sound and having wharves that run directly out into 6 feet depth of water in this sound. As Dennisport is only about 2.5 miles from South Dennis and the same distance from West Dennis, it might easily serve as a port of entry for all three places, as it undoubtedly used to do fifty years ago; but Dennisport is at present mainly a seaside resort for summer residents, and its wharves are used mainly by the small boats of such summer residents. On the west side of Bass River and between the Old Colony Railroad and Nantucket Sound, the only settlement of any size is South Yarmouth. South Yarmouth is a village of about 900 population, lying directly on the bank of the river about 1.5 miles from its mouth, about 2 miles from the South Yarmouth Station, on the Old Colony Railroad, and directly opposite West Dennis. The river channel at this point lies on the South Yarmouth side of the river, and the draw in this South Yarmouth and West Dennis Bridge is consequently close to South Yarmouth. South Yarmouth and South Dennis each possess one wharf, used by two-masted sailing packets of from 5 to 6 feet draft and of from 20 to 30 tons cargo. During about nine months of the year one of these boats leaves each wharf for New York about once every ten days, i. e., each boat makes about twenty-five trips during each year. The cargo of these boats is mainly coal, grain, hay, and other similar supplies, and the two boats seem to easily carry all the commerce of the neighborhood. Either of these boats could easily go through the ship draw and up the river 2 miles farther to South Dennis, but neither of them appear to ever make any such trips, evidently because there is no demand for such service. As these boats draw from 5 to 6 feet of water—more than there is on the sound bar at low water—they, of course, arrange their trips so as to pass over the bar at high tide; but as the delays on the bar only occur once in ten days, and then for only a few hours at a time, it is naturally not a very serious detriment to the commerce. However, these boats would, of course, like a better channel over the bar; but the main demand for such improvement comes from the summer cottage population, who desire free passage for their pleasure boats across the bar at all stages of the water. Any improvement to be of decided benefit to even the pleasure boats would require the dredging of a channel of about 2,000 feet length and of 3 feet depth at low water, while to be of decided benefit to the sailing packets the channel should be dredged to about

5,000 feet length and 6 feet depth at low water. Both channels would require their banks to be protected by revetments of either piling or of stone. The extensive sand shoals of the neighborhood, and the continual shifting to which the channel has always been subject, would render useless any dredging unless the channel was protected by side revetments; and there would be no reasonable hope of keeping the channel permanently within these revetments unless the latter were made quite solid and were carried well up upon the shore at the shore end, and also well out into deep water outside of the outer bar. The cost of any such work appears to be entirely out of proportion to the commerce of this river, either present, or prospective.

The desired improvement would undoubtedly be of great benefit to the immediate neighborhood and of moderate benefit to the few adjoining settlements, but it appears to me from the reasons above given that such an improvement would be so extremely local in its interests and so little a matter of general interest to the country at large that if made it should be paid for by those locally interested and not by the United States as a whole.

Moreover, it is now quite probable (the bill already having gone to its third reading) that the State of Massachusetts will soon authorize the construction by private parties of a canal across Cape Cod from Nantucket Sound to Cape Cod Bay via Bass River. In such case, the route selected for this canal will in all probability leave Nantucket Sound near the deep water in rear of the Bass River Breakwater, and will therefore not only pass at least a mile east of the present entrance to Bass River, but will also serve as an entirely new entrance to this river. Under such circumstances, even large annual expenditures for dredging will be insufficient to keep open any improved channel at the present entrance to this river; so that any work which may be done at the present time at the present entrance to Bass River for its improvement will necessarily soon become of small local value, and even then will give no permanent results.

I have, therefore, to state my opinion that for the reasons above given Bass River, Massachusetts, is not at present worthy of improvement by the General Government.

Respectfully submitted.

W. H. BIXBY,
Captain, Corps of Engineers.

Brig. Gen. WM. P. CRAIGHILL,
Chief of Engineers, U. S. A.

(Through Col. Henry L. Abbot, Corps of Engineers, Division Engineer, Northeast Division.)

[First indorsement.]

NORTHEAST DIVISION ENGINEER OFFICE,
New York, June 7, 1895.

Respectfully forwarded to the Chief of Engineers.

For the reasons stated by him I concur with Captain Bixby in regarding the improvement of Bass River as unworthy to be undertaken by the General Government.

HENRY L. ABBOT,
Colonel of Engineers, Bvt. Brig. Gen., U. S. A.,
Division Engineer.