

The Width.—The question as to the proper width between the ends of the breakwaters is best determined by experience of the effects, as it is very easy to narrow the entrance by a groin, but it can never be widened again.

Average Depth.—It is found that the average depth opposite the present end of the west breakwater, the width being 700ft., is 12ft. 9in. at low water, and 22ft. 6in. at high water, being a little more at low water and a little less at high water than Sir John Coode anticipated. As it is objectionable for navigation to have the walls at the entrance parallel, on account of the roll of the waves which is kept up between them, it is just as well that the walls are at present 700ft. apart, as in the contemplated extension they can be converged to 600ft. and leave the entrance splayed, which is more roomy and better for navigation inside.

Supply of Stone.—For the extension here recommended I believe there is sufficient stone to be got at Cape Foulwind, but I would recommend that all the heavy rock now lying along the sides of both breakwaters where there is now no longer any danger from the sea, be lifted and placed in the extensions, and smaller stone be put in their places.

Shoaling of Bar.—In your instructions reference is made to the recent shoaling of the bar. The sections and soundings I have taken show that there is over 22ft. at high-water spring-tide in the line of the end of the west breakwater, and the water deepens rapidly outside that line. On the line of the end of the east breakwater there is a general depth of 25ft., the deepest water being on the east side of the line. This shows that if the walls were opposite there would be deeper water in the line between the ends. It also shows that the current out of the river escapes more towards the east than straight out.

Want of Floods.—It has been noticed that for a long time there have been no floods of any consequence. Under these circumstances it is to be expected that shoaler water would be found on the bar, and I think it is satisfactory to find that, after nearly eighteen months without the necessary floods, there is still over 22ft. of water. It is not to be expected that the depth can be maintained in the absence of floods, and it is only under the normal conditions of weather that a correct idea can be obtained as to the permanence or otherwise of the depth of water that the works are capable of maintaining. I am glad to have this opportunity of acknowledging the valuable assistance given me by Mr J. A. Wilson, your Engineer, whose local knowledge and intelligent observation have been of great service to me in the investigations embodied in this report.

I have, &c.,

The Chairman, Harbour Board, Westport.

C. NAPIER BELL, M.INST.C.E.

[A plan and sections accompany this report showing changes in low-water mark and depth of water.]

No. 21.

Report on Training-walls, by Mr. C. Napier Bell.

SIR,—

16th June, 1892.

Acting under your instructions, I have carefully considered the subject of the position of the training-walls proposed to be erected inside the river, and I beg to submit to you the following report, accompanied with a plan of the river, on which all proposed works are laid down.

In my report of October, 1891, I mentioned the objections which now exist to placing the walls on the lines originally laid down by Sir John Coode, the most serious of which was the great quantity of dredging and scouring which they would entail to restore the waterway cut off by them in the position intended, and this I did not consider necessary or advisable. Accordingly I have now shown the walls to commence at the left abutment of the Buller Bridge, from which it curves round so as to enclose as much as possible of the deep channel of the river, and not interfering with the great shingle-bank opposite Wakefield Street.

The curve will train the current so as to throw it against the lower part of Riley's wharf, and keep it on the right bank of the river, as far as the wharf and staiths extend. An opening in the wall is left opposite Martin's Island, which is required to give access to the island and the left bank of the river.

This line excludes as little as possible of the existing waterway, and, terminating at the bridge, prevents any danger by contraction of the channel under it, it also trains the current to scour the navigable part of the river.

In dealing with the position for the training-wall below the lagoon I had to take into consideration the existing bank of shingle and sand which occupies the widest part between the breakwaters on the right side of the river. This bank has grown since Sir John Coode's plan was made, and extensive dredging would be necessary to cut a channel through it in the original intended line. The chief objection to making the channel, and the training-walls to guide the current, on the original lines, is that the west training-wall would cross the present navigable fairway, and, if the training-wall were omitted until the channel were cut, it is feared it would silt up as fast as it was dredged.

On the other hand, I do not think it advisable to keep the present navigable fairway, which follows the track of an old, deep channel which existed in 1879, and leads the current in a round-about course to the signal-station, and from there in a direct line to the end of the east breakwater. This skew direction of the current is not that which would have the best effect on the bar.

After careful consideration I have adopted the plan of placing the west training-wall in such a position that it will leave open the present fairway, but at the same time it will divert the current so as to assist in scouring the new channel which is to be cut through the above-mentioned shingle-bank. The channel also is shifted more to the west, directing the current through the ends of the breakwaters more to the west than to the east side. This is an advantage, because the outflow of the river has always a tendency to run towards the east side of the entrance, which is caused by