

a rule, soon fly round to the S.W., and expend their force from that quarter. From the configuration of the coast it is evident that Point Elizabeth affords protection to the northward of N.W., which is certainly an advantage to the Grey entrance.

Works Previously Proposed.—As hereinbefore stated, the works proposed by Mr. Moriarty, C.E., and by Mr. Carruthers, C.E., are shown upon the accompanying drawing No. 2; the former are tinted brown, and the latter green. By reference to this drawing it will be seen that Mr. Moriarty proposed an internal training wall, commencing at a point opposite to the north end of Johnstone Street and curving around towards the N.W. for a length of 3,300 feet; he also proposed a breakwater, extending thence outwards for a further distance of 2,100 feet in the same line, bringing the head of the breakwater into 12 feet at low water; this head, he suggested, should be turned outwards in a more westerly direction than the body of the work, “so as to present less resistance to the breaking waves, which will roll in on its end, and thus diminish the danger of its being washed down across the channel.” The cost of these works was estimated by Mr. Moriarty at £94,998, say £95,000. He considered that after they had been in operation some few years an available depth for navigation of about 15 or 16 feet at high water neaps on the bar, and in the channel leading to the wharves, might be confidently looked for. Mr. Moriarty did not propose in the first instance to carry out any works on the north side either of the river channel or of the entrance, as he considered they might not be required at all; but if they were, that it would be better to defer them until the effect of those on the south side had been seen, and the river allowed to establish its régime under the altered conditions resulting from the construction of the southern breakwater.

The foregoing particulars have been obtained from Mr. Moriarty’s lucid and comprehensive report of 1874, and the plan which accompanied it. I have not seen any report by Mr. Carruthers on the subject, but, from a plan furnished to me when in the colony, I gather that, as shown on drawing No. 2, the works that he proposed on the south side of the Grey were intended to follow practically the same line as that laid down by Mr. Moriarty; the essential difference in the two proposals being that Mr. Carruthers adopted, as an integral part of his scheme, a northern training-wall all the way down from Cobden Gorge nearly to the line of high water on the sea margin.

Works Recommended for Present Execution.

Having described the physical features of the river, more especially of its tidal compartment, and of the entrance, together with the proposals which have been made for their improvement, I now come to the works which, after a careful consideration of all the circumstances of the case, I have to recommend for execution:—

South Training Bank.—When at Greymouth I placed in the hands of Mr. Blakett a memorandum, intimating my opinion that the lower end of the training bank below Johnstone Street (at that time opposite Arney Street, *E* on the drawing No. 1) should be joined to the other end, *F*, of the spur bank then in progress just above the lagoon entrance, upon a line which I then indicated; I presume, therefore, that the training bank eastward of the lagoon entrance will have been completed before this report reaches the colony.

South Breakwater.—As will be seen by reference to Drawing No. 1 (as also No. 2), I propose that a training mound, 1,800 feet long, should be formed of heavy rubble stone. This work would commence near the west end of the timber bridge over the lagoon entrance, *A* on the Drawing No. 1, and run out in a west-north-westerly direction to the middle of the long tongue of shingle and sand which existed on the south side of the entrance at the time the special survey was made. Thus far the materials would be deposited by means of “end-tip” and “side-tip” wagons, in the ordinary manner, as shown in Figure 9 and Drawing No. 3; but seaward of this point the works would partake of the character of a *pierre-purdue* breakwater, running in the same direction for a length of 1,200 feet. The materials for this work would consist, for the most part, of the largest and heaviest of the blocks which can be procured from the limestone quarries eastward of the town, on the south side of the river, the stone being conveyed along the existing railway to the lagoon entrance, over which it would be carried by a temporary timber viaduct, for which provision has been made in the estimate. The whole of the stone should be deposited from a timber staging, as shown on Figure 11 (details of this staging are given in Figures 12 and 13), and so regulated that the large blocks shall be intermixed with not more than a sufficient proportion of stone of smaller sizes, thus attaining the greatest amount of solidity by having as few interstices as possible. Care should be taken that the largest blocks are deposited, as a rule, from the southern line of railway. The slopes on the outer extremity of this work would be protected by concrete blocks as indicated on the drawing, and a light would be placed there for the guidance of mariners at night.

North Breakwater.—Commencing on the beach above the high-water line, at the point *C* on Drawing No. 1, there would be a northern breakwater, the inner portion of which would run out in a west-by-south direction for a length of 900 feet, 650 feet of which would be formed as a rubble end-tip—see Figure 6, Drawing No. 3. The remainder of this breakwater (630 feet) would be rubble deposited from a staging, as on Figure 7, and in the same manner as the outermost part of the corresponding work on the south side, excepting that, in this, as in the case of the north training bank, the top should terminate at the level of high water of neap tides.

North Training Bank.—The works on the north side within the entrance would consist of a training bank 1,670 feet in length (*G* to *H*, Drawing No. 1), formed in the same manner as, and generally similar in character to, that on the south side eastward of the lagoon entrance, excepting that the materials in this northern training bank should be somewhat heavier, and the top of the bank should terminate at high-water of neap tides, as shown in Figures 3 and 4, Drawing No. 3.

The stone for the north breakwater and the training bank will be obtained from the quarry at Cobden Gorge, and conveyed therefrom to the site of each of these works over a temporary line of railway laid along the shingle-banks on the north side of the river. The best and largest of the material should be appropriated to the breakwater. Due allowance has also been made in the estimate for this temporary railway.