

Questions as to exact lines, Mode of Construction, and Cost of Proposed Works.

With respect to the exact lines for the breakwaters, the precise character of construction, and the cost of the works hereinbefore described and shown on the drawings, the information at present available in this country is not sufficient to enable me to determine these points with the confidence which is requisite before finally recommending the adoption of works of such magnitude. Not being able, for the reason stated, to decide at this stage upon the mode of construction which should be adopted, it is, of course, not possible for me now to give an approximate estimate of cost. Before I could definitely determine the character and cost of the works, it will be requisite that I should be furnished with the information referred to in the accompanying memorandum, which sets out in detail the exact nature and scope of the further data requisite for supplying a decided opinion of the points named.

Improvement of the Channel within the Estuary.

In conclusion, I should remark that there is indicated, by red dots on both of the accompanying drawings, a line which I consider it would be very desirable to establish, as that of the navigable channel or sailing course for vessels through that part of the estuary lying between Taiaroa Head and Dowling Bay, always supposing the nature of the bottom would admit of such a channel being readily formed either by scourage alone or by scourage aided by dredging, and, perhaps, to a partial extent, by some training work.

I am strongly inclined to the opinion that one indirect effect of the two breakwaters would be to enable the tidal currents alone to scour the eastern margin of the large sand flat to a very considerable extent, and thus to promote, if not actually to bring about, the transference of the deep-water channel so far to the westward as to cause it to approximate to, if not actually to attain, the line I have indicated on the drawings.

The Secretary, Otago Harbour Board, Dunedin.

I have, &c.,

JNO. COODE.

MEMORANDUM of further information required for the purpose of determining the exact lines, the character of construction, and the cost of the works described in Sir John Coode's report to the Otago Harbour Board, dated 31st March, 1880, and shown upon the drawings accompanying the same.

A.—Borings, Currents, &c.

1. *Problings or Borings.*—At or as nearly as practicable to each of the 36 points indicated by red circles on Drawing No 2, and numbered 1 to 36 respectively, it is desirable to ascertain by probing or boring what is the general character of the materials underlying the surface, down to a depth of at least 30 feet below a datum line corresponding with low water of ordinary spring tides, and more especially as to their being such as would be capable of being dredged with greater or less facility, and, so far as can be estimated, the actual and relative facility with which such materials could probably be moved by dredging, and also (if feasible) by scourage; the fullest information practicable to be given in the notes containing the results of this investigation. It may be mentioned that, if (as is not improbable) sand should be found to exist at the greater number, if not all, of these spots, the probings may be greatly facilitated by using wrought-iron gas-pipes of $\frac{3}{8}$ or $\frac{1}{2}$ bore, and injecting water through them with a small hand force-pump. A similar series of probings or borings should be made at the several spots indicated by the red circles, numbered 37 to 44 inclusive, on Drawing No. 2; these also should be carried down to a depth, say, of 30 feet below the low water datum before described, and the results, as to the depths of water and the respective strata, to be in all cases figured below the datum of low water of ordinary spring tides at the Pilot Beach.

2. *Currents.*—At each of the four points marked thus \times in red, on Drawing No. 2, observations should be made upon the set or direction and the velocity of the tidal currents, when the weather is free from any material disturbance: these to be taken at the first, second, and third quarters, both of flood and of ebb tides, and on the occurrence of spring and of neap tides.

3. *Surf at Entrance.*—From time to time during these investigations, when the surf is moderate or heavy, observations should be made and recorded of the direction and approximate height, more especially the former, of the swell or surf on the outer edge and on the crest of the bar, the direction and strength of the wind being also noted, and, as far as can be ascertained, the depth of water (below the datum) over the crest of the bar at the time. The persistency of surf, and relatively the prevalence of such from any particular quarter or quarters, to be noted, as also the frequency and duration of the periods when there is but little or no swell at the entrance.

B.—Materials suitable for Works.

4. *Character of Stone procurable.*—It is desirable to have full particulars of the character of such stone (if any) as may be procurable in the locality suitable for marine works. The points to be chiefly attended to are: hardness; durability when exposed to the action of the sea or otherwise; specific gravity; shape, as raised from the quarry; largest sizes; and relative proportions of largest medium and smallest sizes that will apparently be yielded by the rock in the locality; nature and depth of surface soil or baring necessary to be removed to reach the stone, ascertained by trial pits; direction and angle of the "dip" and "strike" of the rock; facility and cost of quarrying, also of dressing for masonry purposes, if required; positions of quarry sites with respect to the entrance, and approximate level of quarry floors above datum. Samples of the stone to be furnished. Sections should be taken over such ground as may appear to be most suitable for quarry sites, and full notes to be made, descriptive of any exposed faces of rock which may exist near Taiaroa Head on the east side, and the mainland near the estuary entrance on the west; and of lines most suitable for temporary railways for conveyance of stone from probable quarry sites to the starting-point or root of each of the breakwaters, and probable cost of same. Information should also be sent as to the mode and cost of obtaining possession of land, either for quarries or as sites for work-yards and buildings, &c., near the shore end of each of the suggested works.

5. *Shingle, Gravel, and Sand.*—It will also be important to know whether clean shingle and gravel,