

further up the river and diminishing the current-velocity for some distance above the wharves, in order that the rush of water in the channel, due to the confined waterway and fall of the river above the town, would not be so increased as to interfere with the shipping. With regard to the levels and gradients, Sir John Coode in his report remarks, "There cannot be a doubt that the execution of the external and internal works previously described will have the effect, by scour alone, of materially improving the depth in the channel opposite the town and seaward thereof. It is more than probable that this scour would have to be supplemented by dredging. In any case it is advisable that the permanent bed of the channel should be formed at the level and to the gradients shown on the longitudinal section, drawing No. 1." From the wharves seaward Sir John Coode shows the west wall to run in a straight line, terminating about 1,100ft. below the existing half-tide wall on the east side, leaving a break for the influx and reflux of the lagoon waters, the width between the walls being 500ft., as at the wharves. By carrying the west wall straight out advantage would be taken of the existing half-tide wall on the east side for its entire length.

*Proposed Amended Line of Training-walls.*—I have shown upon the accompanying tracing the direction and extent of the training-walls which I have to recommend, to be executed on amended lines to those laid down by Sir John Coode. I propose that the wall should be commenced on the west bank of the river, at a point 1,000ft. above the Buller Bridge, and trend towards the east bank by easy curves as far as the section marked FF on the plan, where it would join with the line of wall as proposed by Sir John Coode. From section GG, for a length of 2,000ft. seaward, it would continue in a straight line thence, as shown, curve gently toward the west breakwater, thus including a great portion of the deep-water channel in the fairway. The line shown in green colour would pass under the Buller Bridge east of the first pier, and, as will be seen from the plan, would for a considerable length run practically parallel to the line of wall recommended by Sir John Coode.

I may here remark that Mr Wilson (the Board's Engineer) had staked out the wall above the town upon somewhat similar lines to those which I have adopted. Mr Wilson contemplated commencing immediately below the bridge, thus giving a sharper run to the bank than I have shown.

By keeping the training-wall further to the west than Sir John Coode advises, without having recourse to sharp bends, such as to cause the upper currents during the early stages of ebb-tide to overtop the wall, the channel would include a much greater area of the present waterway, and during freshes the river would not be so liable to scour away the top of the shingle-spit which now protects the gridiron. The line of wall indicated by green colour is as far to the westward as I would care to recommend with a view to obtaining the best results from the wall. This line will necessitate the removal of about 500,000 cubic yards of material, to bring the river to suitable gradients and levels after confining the channel. It is impossible to estimate with any degree of accuracy what portion of this amount would be carried off by scour—probably, one-half. This would leave, say, 250,000 cubic yards to be dredged, and the cost would be about £12,500.

If the Board is not prepared to undertake this amount of dredging above the wharves I would recommend that the wall be commenced on the west bank of the river, between the sections marked CC and DD on the plan, as shown by red line. This would not seriously interfere with modifications of the line of wall should it be found advisable in the future to alter it. For instance, should the wall be constructed, commencing between the sections CC and DD, as indicated on the plan, and it were afterwards decided to carry out the wall commencing above the bridge, it might be brought down the river on the line shown by green colour and stopped at a point a little below section DD, thus forming an overlap. The break between the walls would not, I consider, materially affect the general flow or sweep of the current, and would admit of logs getting clear should they overtop the wall higher up the stream.

With regard to the training-walls opposite the proposed floating-basin, it will be seen that I recommend, instead of their being run out straight, they should be curved to the westward. In recommending curved in preference to straight walls, I have been guided not so much by the saving in dredging by including a large portion of the deep water on the line of fairway as by the natural trend of the currents, rebounding from the east bank of the river near the staiths.

If the wall above the wharves were constructed as proposed to the west of the line suggested by Sir John Coode, thus giving a sharper inset to the current toward the east side of the river, it is extremely probable that it would impinge against the staiths, and make over toward the west with more force than at present. Were the walls run out straight the surface-currents during the first stages of ebb-tide would tend to overtop them, and proceed onward toward the west breakwater.

I have duly considered this point, and have decided to recommend that the walls be curved, so that the whole of the filaments of the current would be brought into a series of gentle curves harmonizing with the general direction of the walls, and, instead of being stopped and thrown off, thus impairing the combined effect, they would glide gently by with the least interruption possible. By curving the walls abreast of the lagoon a very much less quantity of material will require removing by scour and dredging from the channel and shingle-spit. I am informed by the Harbour-master, Captain Leech, that, as a rule, the seas entering between the breakwaters hug the east mole, in which case it would be an advantage to keep the channel to the west.

I have shown the knuckle or bend of the detached wall on the west side extending to the shore in order that the discharge from the lagoon might be brought into the main channel.

I would suggest that the training-wall on the west side, above the lagoon, be constructed and maintained at the level of 4ft. above low-water spring-tides, and, below the lagoon, at full half-tide. The walls complete, from 1,000ft. above the Buller Bridge to the seaward end shown on the plan, would contain, apparently, about 160,000 cubic yards of rubble. The alternate line, shown in red, commencing between sections CC and DD together with the east wall, will contain about 135,000 cubic yards. The cost of each respectively, apart from railway approaches, may be taken at, approximately, £48,000 and £40,000.