

Report on Christchurch Harbour and Highcliffe Cliffs

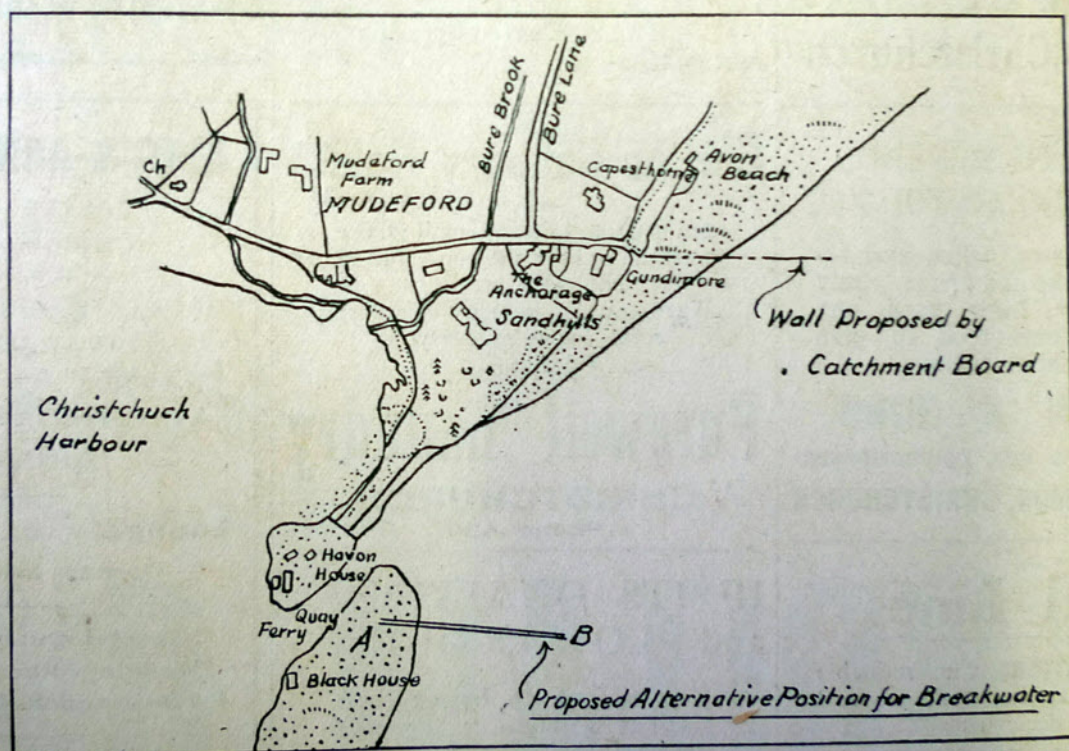
Dr. J. S. Owens Suggestions

Sheet Piling for Highcliffe and Breakwater Entrance to Harbour

C.T. March 21, 1936

We are privileged to print excerpts from the report of Dr. J. S. Owens made at the request of the Council the points he makes are here summarized :—

Dr. J. S. Owens' Report on Christchurch Harbour and Highcliffe Cliffs



A chart prepared by Dr. J. S. Owens, illustrating his proposed alternative to the Catchment Board's suggestion. Dr. Owens' report is detailed on another page.

The cliff material is easily eroded and leaves little residue for forming a protective beach. There has been, for many years, continuous erosion of Hengistbury Head and the cliffs to the east. There is a long history of the growth of sandspits at the Harbour mouth, and of breaches through their bases, both spits and breaches are formed at approximately the same sites respectively. Travel of beach material here is due more to wave than tidal action, but the long continued high water gives a better opportunity for moving material than a single high water would. The drift of beach forming material is chiefly from the west. Groynes in Bournemouth Bay or at Hengistbury Head would react unfavourably on Christchurch Bay, tending to rob it of material which would otherwise be brought in by the drift from the west. The Avon and Stour Catchment Board's training wall, if erected, should penetrate deeper near seaward end. It would not act as a groyne to protect the coast between it and the Harbour. It would have no effect on the sand dunes, but would prevent the 'Run' from forming so close to the cliffs as in the past. The proposed training wall at Harbour mouth would:-

Direct "Run" from forming close to the toe of the cliffs. Give some protection to the shore just east of Harbour. Build up sand dunes now being eroded. Tend to maintain a deep water channel to Harbour. The cost would be little, if any, more than for the wall proposed by the Avon and Stour Catchment Board. The erosion at Highcliffe is best dealt with for the present by:-
Reinforced concrete sheet piling along the toe where urgently required. Diverting land water from the cliffs.

THE REPORT.

Dr. Owens, in company with the Borough surveyor (Mr. H.J. Farmer) made observations and tests on October 29th and 30th, and also benefited by discussions with Councillor Derham, "whose local knowledge," says the doctor, "of the harbour and adjoining foreshores is very extensive." After dealing with the formation of the coast and its bearing upon the erosion problem, and some explanatory remarks upon the sea borne materials forming foreshores, the report continues : —
There appears to be little difference in the times of H.W. at Mudeford and Christchurch Quay, but a more marked difference between the times of L.W. During both Spring and Neap tides, low water was about 45 minutes earlier at Mudeford than at the Quay. The Spring tide curve of a graph made brings out clearly the extended period of H.W., which is of some importance as bearing upon the erosion of the foreshore.

PATH OF CURRENTS.

With regard to the currents, Mr. Farmer's observations on the path of a float made on December 5th at L.W. neap tides show that this path, starting from the Harbour entrance, is first almost due N.E., i.e., in the direction of the current from the harbour, then bending gradually through S.E., it became finally almost due south, in a little under an hour from L.W.
The velocity of the tidal currents is so low as to be negligible as a means of moving anything but fine sand or mud, except round Hengistbury Head.
They also show clearly the effect of winds in causing surface drift, as all the experiments referred to deal with surface drift. For example, it was found that with an onshore wind, there was a surface drift towards the shore; such a drift is necessarily accompanied by escape currents, usually near the bottom and hence the well-known experience that on-shore winds tend to pull down the shore and flatten the gradient, i.e., to drift the finer material seaward with the undertow.
The tidal currents are not of great importance except where they are accelerated by the flow in and out of the Harbour, and I think that the general drift of material along the shore of the bay is governed mainly by the winds rather than by the tidal currents. The tidal currents at this part of the coast are weak, except of course in the immediate neighbourhood of the Harbour. The long duration of H.W. gives the flood currents a longer time for action upon the upper part of the foreshore than where there is only a single H.W. This is of importance in connection with the breaching of the sandspit, as it may well be that the tide is high for two or three hours and, during rough weather, this long time available for action gives it a greater opportunity for breaching.
The current from and to the Harbour reaches a high velocity, as much as 8 knots, I was informed by Mr. Derham, who made this observation by finding that his launch, which is capable of 8 knots, is sometimes only barely able to maintain her position against the current. This localised current from the Harbour cannot have any appreciable effect much beyond the outfall into the sea, but where it is forced against the cliffs, by the growth of the sandspit forming a long run, it has a very pronounced effect, as is evident from the condition of the cliffs at the entrance to the old run. Thus, if the run be diverted from the toe of the cliffs, it would help to minimise erosion there.

HENGISTBURY HEAD BREAKWATER

Speaking of the probable effect of the proposed breakwater at Hengistbury Head, the report continues :
By building a breakwater seaward from the Head, would tend to restore previous conditions and undoubtedly would restrict the flow of material eastward, more particularly that of coarse shingle and flints derived from the cliffs; these, travelling as they do along the bottom, would be held up by such an obstruction. I do not think, however, it would have any great effect upon the movement of the finer sand

which moves in suspension in the water, although, of course, if carried sufficiently far seaward, it would tend to divert this drift past the Harbour.

There is no doubt that the recession of Hengistbury Head has exposed the Harbour to dangers which did not exist previously, since the sand dunes have narrowed down as the Head receded and there is a definite danger of the sea breaking through these sand dunes near the Head. I think it probable therefore that the first effect of such a breakwater, built out from the Head, would be to reduce the flow of shingle and probably slightly reduce also that of sand, so that it may be a source of immediate danger to the sand dunes.

MUDEFORD BEACH WOULD SUFFER

I am of the opinion that, as a result of the proposed breakwater at the Head, you would have accentuated erosion of the sandspit forming the southern boundary of the Harbour, now used as a beach for huts. Further east, I think that the effect would be very slight and that the drift would be restored.

The erection of groynes in the Bay west of the Head, in so far as they are successful in building up the foreshore, will certainly react unfavourably upon the foreshore to the east of the Head, since the main supply of shore forming material comes from the west. This is an inevitable result of all coast protection works which have for their object the checking of the littoral drift in order to protect the shore in the immediate neighbourhood.

CATCHMENT BOARD'S "TRAINING WALL."

Dr. Owens says: I have not received any statement indicating the line of reasoning which determined this design, or what its chief purpose is intended to be.

Regarded as a training wall, its effect will be to divert the water from the Harbour on the ebb tide and cause it to flow somewhat further from the base of the cliffs than the old "Run," i.e., on the N.E. side of the training wall. On the S.W. side, the flow of water from the Harbour will continue along the present line until diverted by the training wall, and this diversion will probably cause an eddy in the S.W. angle and some accumulation of sand there, but I do not think such accumulation will extend very far westward. The other effect will be to concentrate the ebb current from the Harbour round the eastward end of the breakwater at which point erosion will certainly be accentuated. I observe that in the design an openwork structure is used to terminate the training wall at the seaward end doubtless with the intention of correcting the tendency to concentrate the current round the end. This is to the good, so far as it goes, but will not, in my opinion, prevent erosion from going on there and indeed along the S.W. face of the wall where the current impinges upon it.

For this reason, I am of opinion that the piles at the seaward end for about the outer third of the wall should be driven deeper. The sheet piling at the seaward end is at present shown 7ft. 6in. into the bottom and the lateral piles 10ft. I think all these piles should be driven to at least 12ft. into the bottom. The structure at the seaward end, formed of open spaced piles, shows these piles driven 9ft. into the sea bed. I do not think this is nearly enough as the first effect of the diverted current and the waves during southerly and south-westerly winds would be to scour a hole round the end of this structure. I should like to see these piles driven at least 15ft. into the bottom to provide for this contingency.

The design of the training wall will minimise to some extent the effect of scour, but it must be remembered that if effective as a training wall, it will unavoidably have a concentrated current near its seaward end.

Apart from these suggestions, I think the design is quite satisfactory.

EFFECT ON "THE RUN."

Referring to its probable effect upon the "Run" from the Harbour, this will, I think, continue in its present direction for some distance towards the training wall. The drift of material from the west will not be able to cross the "Run." Hence, we must expect a building up of a sandspit on the seaward or S.W. side.

With the training wall in position, the "Run" will thus be moved bodily seaward where it passes the training wall. It will then, I think, again tend to turn towards the land. It is probable that if the training wall be erected soon, the new "Run" would form outside the position of the old "Run" as marked on the 6in. maps of 1932 and would thus be, to some extent, diverted from the sandy cliffs which have been suffering from erosion.

I do not think the effect would be important much beyond Highcliffe Castle, but that it would be to the advantage of Christchurch that such a training wall should be erected. The entrance to the Harbour would be to a great extent stabilised. This is not to be taken as expressing the view that such a training wall is the best means of obtaining the desired result; indeed, I would propose an alternative which in my view has many advantages.

PROPOSED ALTERNATIVE.

Broadly speaking, we have two factors which cause the growth of the sandspit : — (1) the littoral drift along the shore from the S.W. and (2) the sudden checking of this drift. The effect of the sudden checking of the drift is to deposit the material in the neighbourhood of the place where the check occurs and this results in a gradual growth of the point of the sandspit towards the N.E., the direction being determined by the conditions of equilibrium set up between the current in the " Run " on the one hand and the quantity or supply of deposited sand on the other. I propose to utilise this state of affairs to serve the purpose of getting a more stabilised harbour entrance and better protection for the cliff's to the N.E. The method suggested is to erect a breakwater or training wall to form the south side of the entrance to the Harbour and on a line substantially west to east as indicated by the line AB on the 6in. plan herewith. The effect of such a structure would, I anticipate, be as follows : -

EFFECT ON SAND DUNES.

The drift of material coming from the S.W. will be cut off by the breakwater and instead of passing north will accumulate at first on the south of the breakwater, which will thus act as a groyne and tend to build up the foreshore between there and Hengistbury Head, i.e., will tend to restore the sand dunes at that part where they are now suffering from erosion. This is an effect which would not result from the training wall proposed by the Avon and Stour Catchment Board.

EFFECT ON THE "RUN."

It is well-known that the action of such a groyne would normally be to produce scour or erosion on the leeward side, i.e., upon the side facing away from the direction of the main littoral drift. In ordinary circumstances, such erosion would be a serious matter and such a groyne might do more harm than good, but, in this particular case, it happens that we want erosion on the leeward side to keep the channel open and the effect would doubtless be to remove the now projecting nose of the sandspit and gradually to draw the current and channel at the Harbour outlet to the leeward or northern side of the breakwater AB. The drift of sand from the S.W. would continue until the breakwater AB had been filled on the southern side and would then pass round the end of the breakwater at B where the process which has been in operation during the past to form a long sandspit would doubtless commence again. The "Run" would thus pass along on the north side of the line AB and, at some future date, would tend to turn towards the N.E. beyond the seaward end at B and in the direction of the "Run" as shown upon the 6in. map, but this new position would be much further removed from the cliffs than the old " Run " was. Thus, so far as the " Run " is concerned, I anticipate the effect upon it of such a breakwater would be somewhat similar to that of the training wall proposed by the Avon and Stour Catchment Board, except that the " Run " would tend to be formed further from the present shore, and the position of the Harbour entrance would, I think, be more definitely stabilised, while the approach from deep water would be improved.

SHELTER.

The proposed breakwater AB would also give a definite shelter from southerly winds to a part of the shore near Sandhills, while, at the same time, tending to restore the sand dunes now used for summer huts. Owing to the interruption to the drift of material due to the " Run " from the Harbour, I do not see much hope of a breakwater in the position chosen by the Catchment Board being effective as a "Groyne."

THE POSSIBLE WORKS TO COMBAT EROSION AT HIGHCLIFFE.

There is general erosion of the cliffs along the whole of this Bay, a very narrow foreshore, i.e., a short distance between high and low water marks and a comparatively small drift of material along the coast. The cliffs themselves are very easily broken down and offer no great resistance to the sea, while the sand is so fine as to be very easily removed by sea action. Keeping these points in mind, I am of the opinion that the best course to adopt would be to erect at the toe of the cliff an inexpensive protection in the form of sheet-piling, at such parts as are suffering from attack. The shore is not a very promising one for the erection of groynes on account of the small amount of material and the probable injurious effect to the leeward side of such structures. In particular, I would suggest delaying action, except at points where protection becomes urgent, until the effect of the training wall is proved.

The form of protection which I have in mind is of reinforced concrete sheet-piling and this would probably be the least costly form which would be of much value. A point of considerable importance is the effect of land water. It was evident to me on inspection that a large part of the trouble was due to land water, softening the material of the cliffs. This is also shown by the sections sent to me by your Engineer, Mr. Farmer. In these the slope of the cliff face is very much flatter than would be the case if the material had not been, to a great extent, water-logged. This action would not of itself cause continual recession, but, combined with sea erosion of the foot, would accelerate it, owing to the softening of the material. Care should, therefore, be taken to prevent, as far as possible, the water-logging of the cliff material by providing such other drainage as will direct the land water from the cliff.