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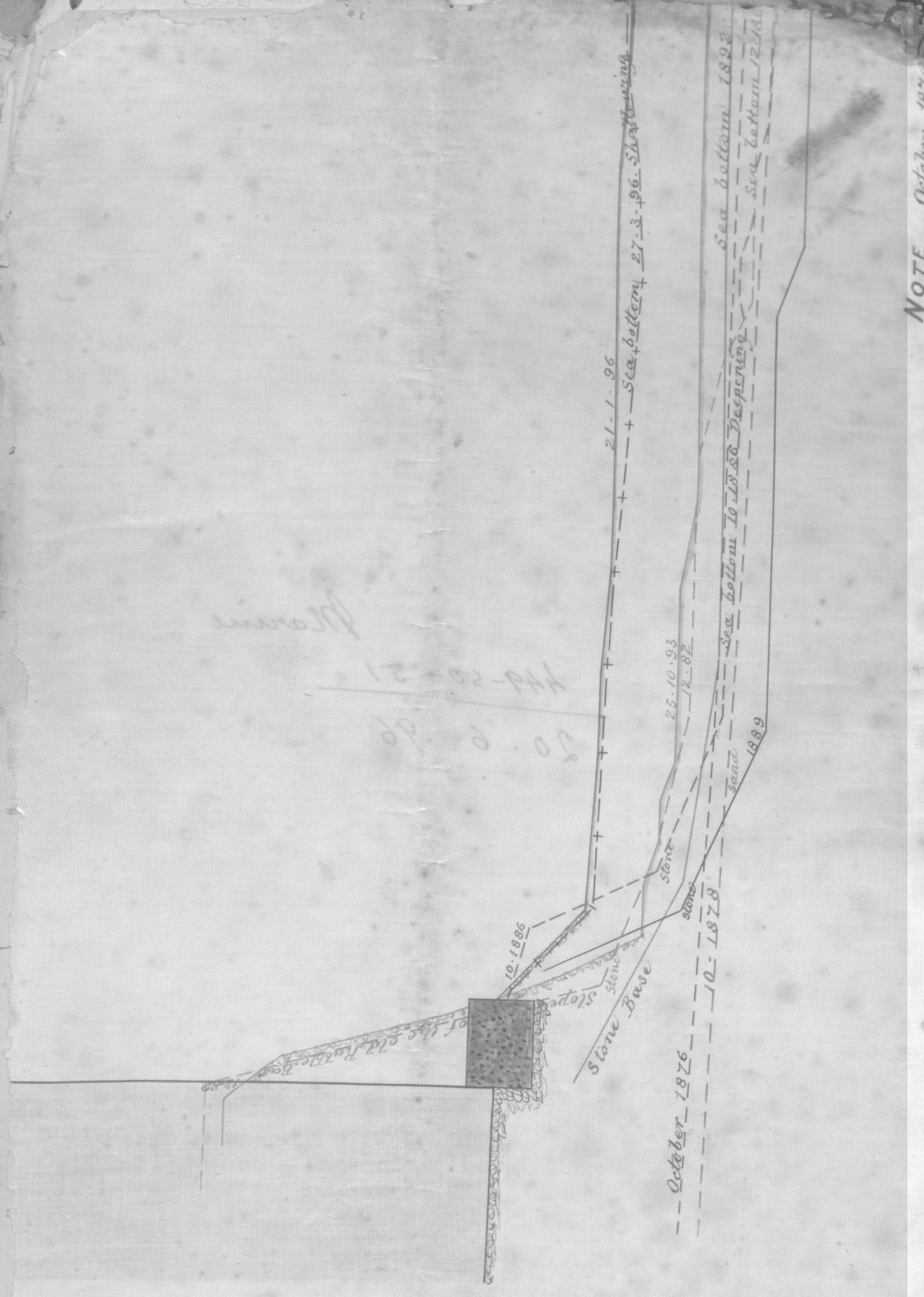

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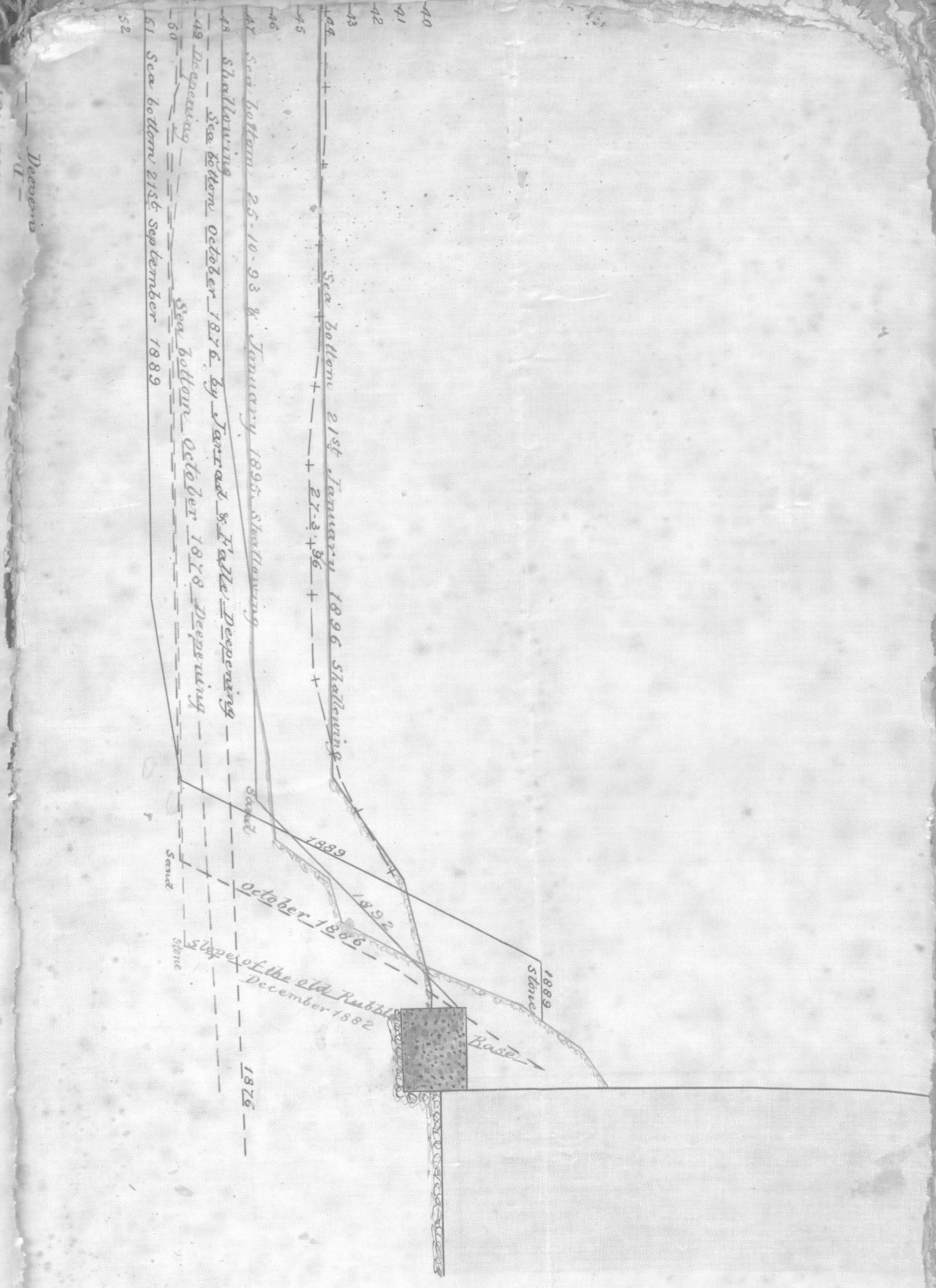
NOTE.— October 187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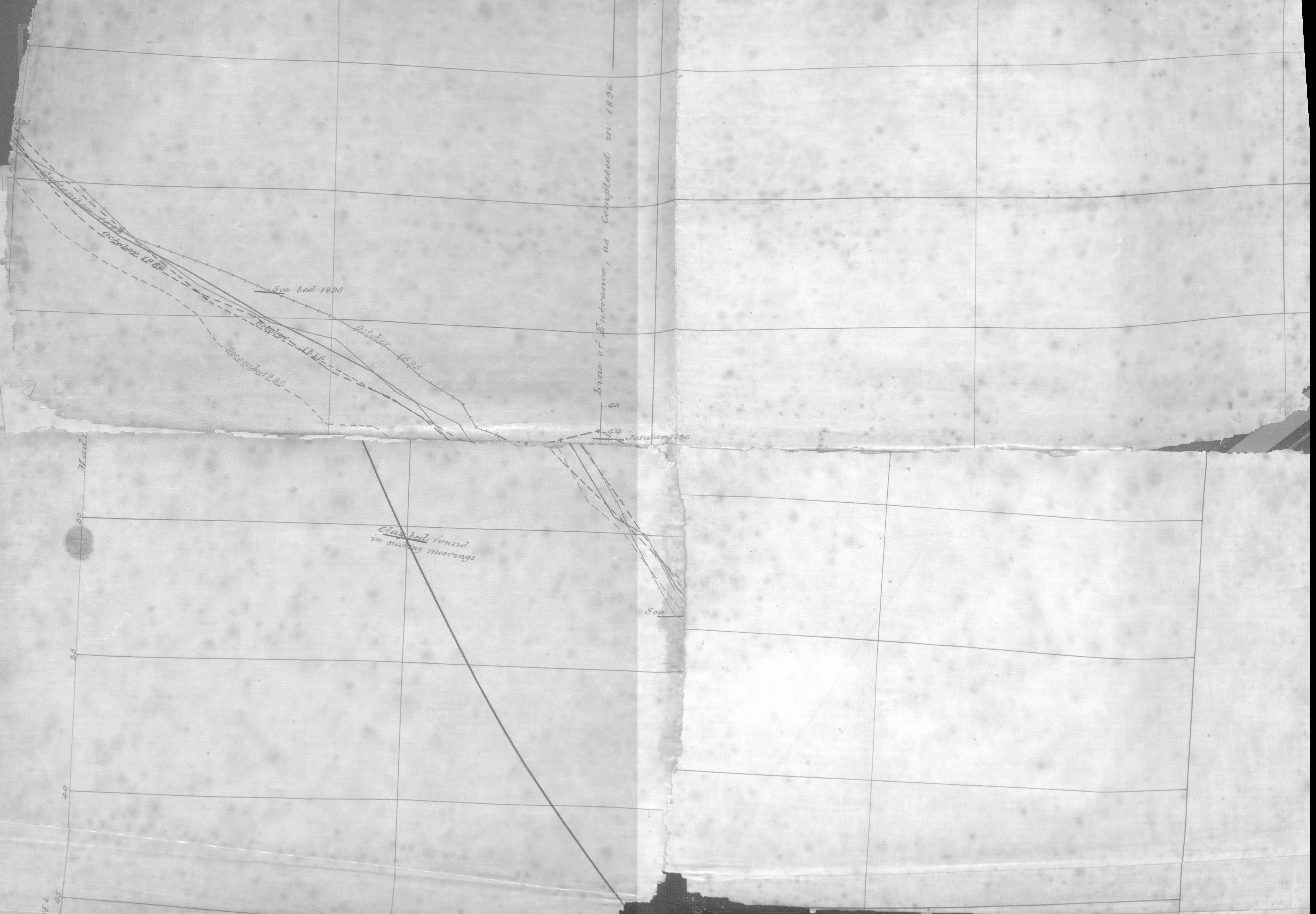
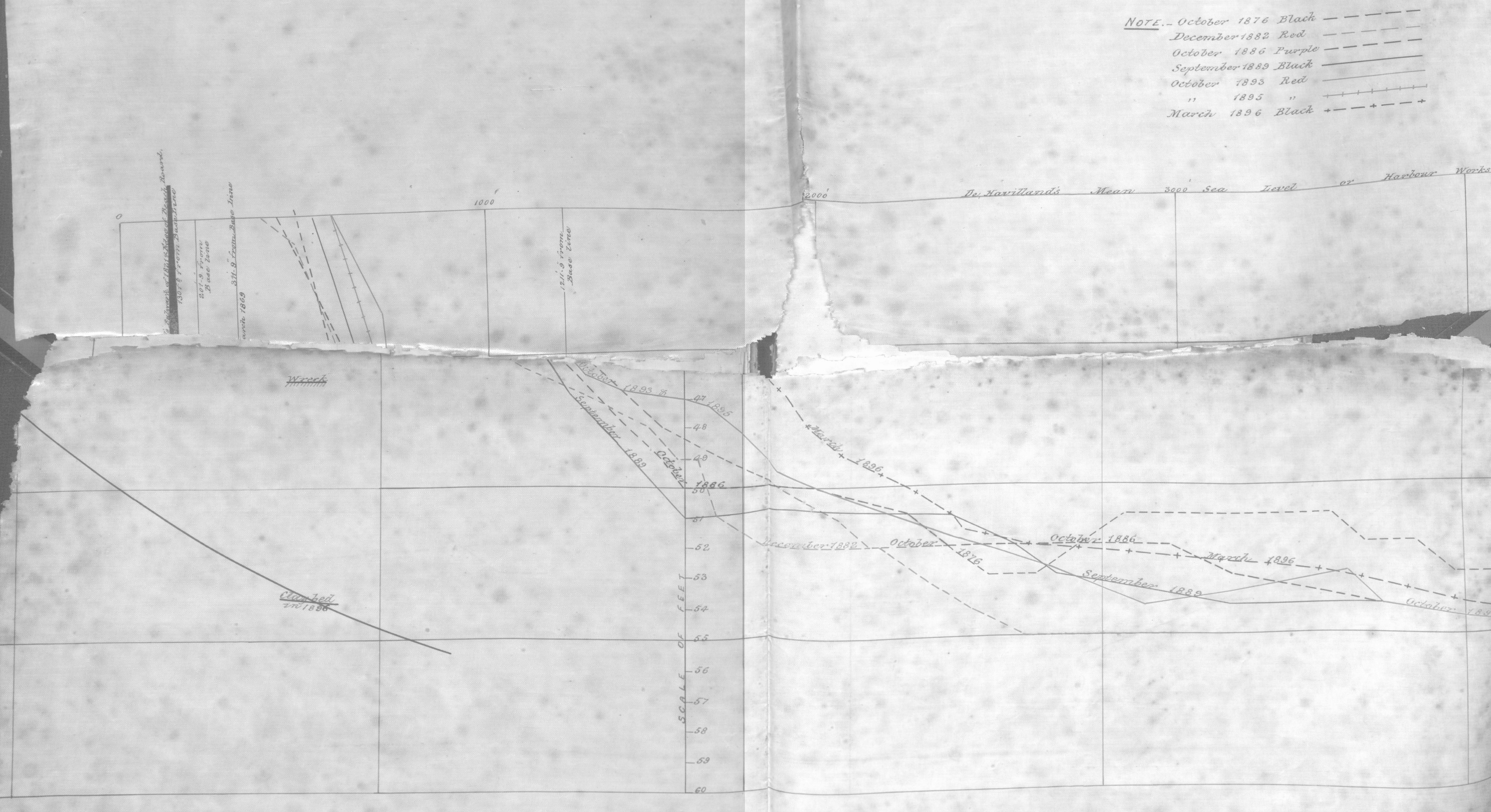
Sea bottom 21st January 1896 Shallowing
27.3.96
Sea bottom 25.10.93 & January 1895 Shallowing
Shallowing
Sea bottom October 1876 by Jarrad & Falle Deepening
Deepening
Sea bottom October 1878 Deepening
Sea bottom 21st September 1889
Sand
Stone
1889
1892
October 1886
1876
Slope of the old Rubble Base December 1882


1895
September 1883
October 1886
Sea bed 1896
October 1876
October 1895
December 1882
Line of Entrance, as Completed in 1896.
43
44
January 1896.
Clay bed found
in sinking moorings
Sea
Madr
30
35
40
45
EL

Section along survey line No. 6 running

acco



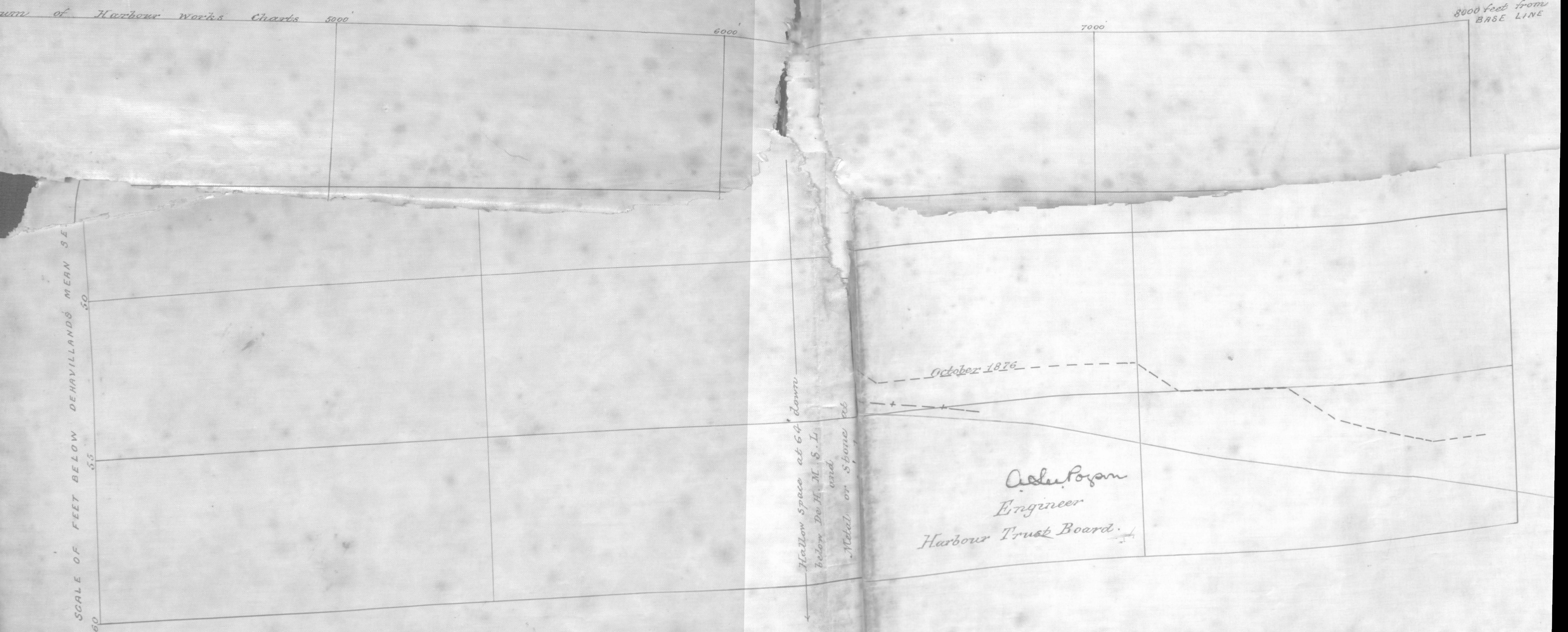
M.H.W

Iron Pier through centre of Entrance out to Sea, East South East.

ng Engineer's letter No. 68A dated 25th April 1896.

Scale.

Horizontal 2000 feet = One foot
Vertical 25 " = One foot


um of Harbour Works Charts
5000
6000
7000
8000 feet from BASE LINE
SCALE OF FEET BELOW DEHAVILLANDS MEAN SE
50
55
60
October 1876
Hallow space at 64' down below De H. M. S. L. and Metal or Stone at

Engineer
Harbour Trust Board.

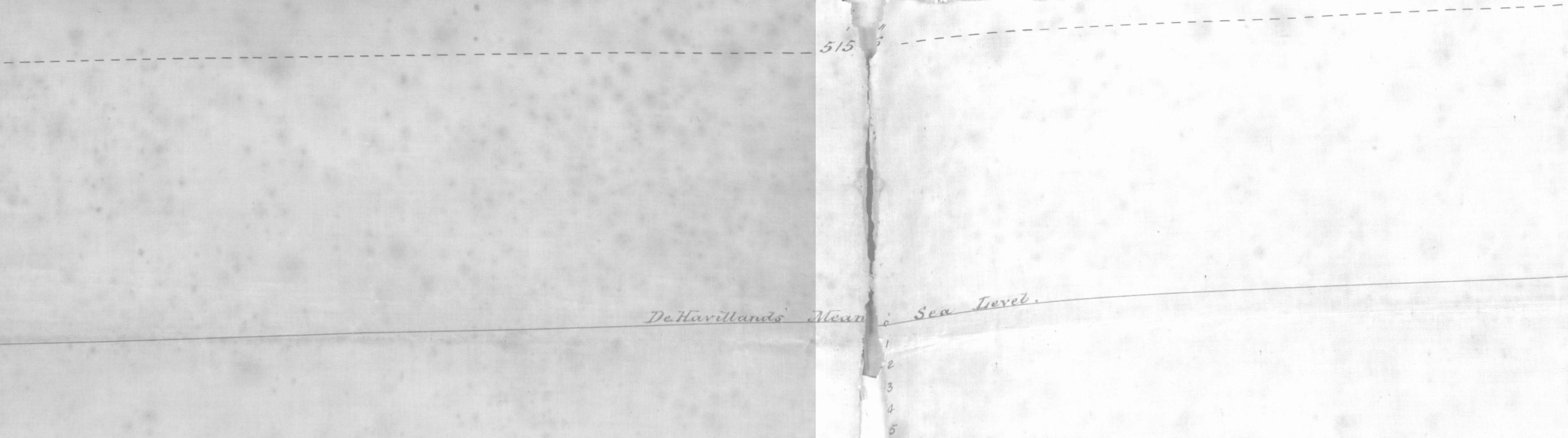
85.04

Madras Harbour.

Sections acc ss Entrance.

accompanying Engineer's letter No 68 ss 25th April 1896.
S

Horizont one foot.



harbour and compare them with the earliest soundings available before the construction of the harbour. It had been shown above that Lieut. Sweny's soundings of 1859 are identical with those taken in 1869, showing that during this period of 10 years before the construction of the harbour walls there was no variation of depth. What is wanted is a comparative statement of depths at varying distances from the Ir end of the Pier.

(Signed) G. McNeil Campbell Col. R.E.
Secretary to Government
Marine Department

(True Copy)

Ag Secretary
Harbour Trust Board

S.a.d.

---

end of the Pier" [illegible] yards

shallowing is due to the harbour works. This conclusion must be maintained until some other reasonable cause can be found, and it is for Mr Pogson to adduce this before he can venture to assume that "the shallowing of the roadstead cannot be said to be due to the harbour."

11 The fact that in 1882,* 8 fathoms was the depth throughout, and within the entrance, and was inshore of the 7 fathom line of 1868 proves nothing more than that a greater depth occurred in this position *after* the partial construction of the walls; and was most likely the primary effect of these groynes. The increased depth was only temporary. It had now been reduced, and more probably has since been lost than was previously gained. The present* 8 fathom line is 2760 feet from the Ir end of the pier. It had thus receded 230 feet between 1882 and 1895. If any conclusion can be drawn from these facts, it is that the harbour walls alone are responsible for the variations of depth; and not the contrary as assumed by Mr Pogson.

* 2530 feet from the Ir end of the pier. Vide – Chart prepared in this Office.

* Vide Chart.

Incorrectly copied? – [illegible]

12. The action of the harbour walls will be made plainer if Mr Pogson will plot the soundings for a series of years after the construction of the harbour

harbour

the published Chart by Lieut. Sweeny of the late Indian Navy in 1859 there is very strong ground for believing that beyond the 6 fathom line there is no sensible variation in the depth of the sea."

8. In his report recorded with G. O. No. 529 W. dated 11 February 1896 Mr Pogson* says "soundings outside the harbour show that at a distance of 220 feet east of the entrance where there was a depth of 48' 4" in 1893, (and 51 feet in 1869) there is now 45' 4", or 3 feet less water. This change together with what has taken place in deeper water would tend to show that the roadstead is shallowing as it has been known to have done in years past × × ×. The shallowing of the roadstead cannot be said to be due to the harbour where deep water is concerned."

* Paras 37 to 40.

9. The conclusion arrived at by Mr Pogson is opposed to the facts mentioned by the Harbour Committee of 1869, in whose report it is distinctly stated, on the evidence adduced, that "there is very strong ground for believing that beyond the 6 fathom line there is no sensible variation in the bed of the sea", i.e. before the construction of the Harbour walls.

10. If the bed of the sea was uniform before the construction of the harbour walls and is now found to be "shallowing", the inference seems to be that the

Shallowing

---

end of the pier". This would make the pier 300 yards, or 900 feet long.

5. In para 28 I of the report the pier head is said to be "1010 feet from the shore"; a discrepancy of 110 feet.

6. In the same para it is stated that "there is a wide bed of loose sand in constant motion, and the depth of which varied as much as 8 feet at the pier head, which is 1010 feet from the shore, as evidenced by soundings taken along the side of the pier periodically for a series of years."

7. It is also said that "the European diver who had walked all along the bed of the sea from opposite the Fort up to opposite the Railway terminus, and as far out as 11 fathoms depth informs us that the loose sand extends as far as 6 fathoms only, beyond which the bed of the sea is stiff blue clay, with a small depth of firm sand over it; and he adduced as evidence in support of his statement the circumstance that while within the 6 fathom line the height of the sand with reference to fixed articles, such as anchors, is variable, he had never found any variation at a greater depth, and as soundings taken under the orders of the Master Attendant, while our Committee was sitting give the same results as

the

No. 766.

Government of Madras

Marine Department.

Memorandum

Dated Madras 18th February 1896.

Write separate
26/2

+ In para 10 of their letter recorded with G.O. No. 529 W. dated 11th February 1896 the Harbour Trust Board say they "would be glad to receive any information on record which Government may be able to furnish with regard to the variations in the depth of the roadstead, as in paras 40 to 44 of his report Mr Dogson Contends that the shoaling now shown by the latest survey to have taken place, between 1893 and 1895, is not due to the construction of the harbour, as in 1882 + after the construction of the walls, 8 fathoms was the depth throughout, and within the entrance, that position being inshore of the 7 fathom line of 1868."

+ Since then the walls have had time to produce the effects now existing?
R.S.
10 Mar 96

2. The following information had been collected:-

3. In para 15 of his Memorandum, Appendix B of G.O. No 866 dated 17th March 1869, Colonel Orr says, "7 fathoms will be found at a distance of about 1200 yards from the Shore and directly parallel with it."

4. Para 23 of the committee's report printed with this G.O. mentions the 7 fathom line at the same distance from the Shore, viz., 1200 yards, or 900 yards from the ent

end

issue of the G.O. is due to the copies not having ~~been~~ returned signed.

The despatch to the Secy of State was signed by H.E. and the Honorable Members and sent down to Madras on the 10th July 1896.

Maj
17/7/96

~~SAW~~

Forwarded in continuation of ~~para telegram~~ note of this day.

A.S.
17 July 96.

SAW

Sr. note below date of despatch of Order & letter to admiralty of the originals being marked.

A.S.
18 June 96

CAW

Order and lett
despatched this d

C
20

HG

~~HD~~ Note on the origina

R.
22

No. 449, Marine, 20th June 1896.

GOVERNMENT OF MADRAS.

MARINE DEPARTMENT.

Read—the following papers:—

From W. AUSTIN, Esq., I.C.S., Chairman, Harbour Trust Board, Madras, to the Joint Secretary to Government, Marine Department, dated 27th May 1896, No. 786.

I have the honour to forward for the information and orders of Government copy of Resolution No. 3 passed by the Board at its meeting of the 22nd instant, and also to enclose a copy of the Board's Engineer's report with four tracings of plans which accompany the report.

2. After perusal of Mr. Pogson's report the Board is of opinion that it is inexpedient to undertake any protective work until the statements made by Mr. Pogson in paragraphs 18, 42, 43, 44, 45, 46 and 49 have been placed before an expert in harbour construction and an opinion on the same obtained.

3. The Board further considers that a survey of the harbour and roadstead should be made by an officer of the Marine Survey of India and beg the Government of India may be addressed in view of this work being undertaken as soon as the state of the weather permits.

Enclosure.

Extract of Proceedings of the Trustees of the Harbour of Madras at a meeting held at the offices of the Board on Friday the 22nd day of May 1896.

* * * * *

From the Engineer, Harbour Trust Board, Madras, to the Chairman, Harbour Trust Board, dated Madras, 25th April 1896, No. 68 A.

I have the honour to acknowledge the receipt of G.O., No. 76 E, Marine, dated 18th February 1896, forwarded under your Endorsement No. 720 E, dated 2nd March 1896, for remarks.

Enclosures four tracings.

2. The above Government Order relates to my report upon the soundings of the Madras roadstead and harbour made in 1895, and contends to show that the Harbour works alone has been the cause of the change in the depth of the roadstead and variations in the coast line.

3. To show that the Harbour is not directly the cause of the roadstead shallowing, reference must be made to records relating to the Madras Coast years before the harbour was thought of; and as changes in the roadstead can be proved to have taken place then, I presume it will be accepted that similar changes may take place again, as there is nothing I am aware of to show that the natural currents or the Bay of Bengal is not now acting in the same manner as it has done for generations past, or why the changes which took place by nature before the Harbour was built should not continue for ever.

4. From the earliest records, referring to the Madras coast line between the River Cooum and Ráyapuram, the following has been collected.

5. In 1639 Fort St. George was built, and it must be assumed that the fort was built at some safe distance from the coast line at that date, this foreshore a few years later disappeared, when we read of the first "Great bulwark being built to save Madras."

6. The coast line then advanced for years, and we read of it *returning again to the original bulwark* in 1682 as follows :—

"Tuesday, 11th July 1682." The sea having for about ten days past *encroached upon this town*, and we, hoping, as it is usual, that it would retreat again of itself, forbore any remedies to keep it off; but now that instead of its losing it mightily gains ground upon us, and that without a speedy course be taken, the town will run an apparent hazard of being swallowed up, for it has undermined even to the very walls, and so deep that it has eaten away below the very foundation of the town and the great bulwark next to the sea side, without a speedy and timely prevention, will certainly, in a day or two more, yield to its violence; it is therefore ordered forthwith that the drum be beat to call all coolies, carpenters, smiths, peons and all the workmen, and that sufficient materials be provided, that they may work day and night to endeavour to put a stop to its fury, for without effectual means be used in such an eminent danger and exigency, the town, garrison, and our own lives, considering all the foregoing circumstances, must needs be very hazardous and insecure."

7. From the above it will be seen that the first bulwark, built after the construction of the fort, saved Madras from erosion; the shore line therefore must have advanced, for it to have returned again in 1682 to threaten and undermine the *original bulwark*, and so serious was this second attack of the sea on Madras, that a further reference is made to it on the 31st May 1683, and an extract given from a general letter from England to the authorities here, says :—

"We take notice of the great inundation that endangered our town and fort, and we would have you endeavour to prevent such future accidents by laying such a deep and strong foundation with chunam, as you mention, that may be sufficient in all human probability to prevent damage by any such accident hereafter."

8. From 1683 the shore line advanced again for about four years and there was no harbour or Cotton's breakwater in those days to cause it do so; but later on and during a storm on—

"Sunday, 9th October 1687, or four years later, it is recorded—During the fierceness of this storm, the winds continued between east and north-east, which brought the sea very near the bulwark and wall; but this morning the wind and sea abating, we hope the danger is past."

9. The coast line advanced, and again returned and threatened the *bulwark* for a third time on record up to 1687 and in 1696 it is again reported that "fresh encroachments of the sea took place."

10. From this date no further mention is made of the coast line giving trouble until about 125 years later, but during this period, it would appear that the coast line advanced some three miles from the bulwark to a point which was called "Cocoanut Island," referred to in paragraph 16 of the committee's report of 1868, which reads :—

"We may, however, remark that if there is any truth in the tradition that the shore at Madras was formerly two or three miles in advance of the present line, it must follow that the sea which has shown its power to abrade and carry away so vast an amount of material *must have equally the power of re-conveying alike amount of material* and of depositing it in the former position."

And in the same report, paragraph 32, Appendix H, referring to *the natural changes in the roadstead*, it is written: "This appears particularly the case at Madras, for people are now living (1868), whose forefathers have assured them that they used to walk out on a Sunday some two or three miles to Cocoanut Island to enjoy themselves, *but every trace of it has long since disappeared.*"

11. Regarding the existence of Cocoanut Island and there having been some three miles of foreshore in front of the present coast line sometime about 1750, sets aside any doubt as to whether the *present* roadstead has ever changed in depth. There are still signs of this extensive foreshore or island, and if every trace of it had disappeared in 1868, as above, the present bank, three miles out, must be a re-formation of it again in 1896.

12. There are records to show that in 1810, there was a large stretch of foreshore in front of Fort St. George and upon which troops were camped out.

13. In 1811 the 9 fathom line was said to have been at a distance of four miles from shore, and in 1813 it is recorded "the walk from the landing place opposite the Custom House to that emporium was over a loose *sand for half a mile.*"

14. At this time, erosion of foreshore and deepening of the roadstead was taking place, and in 1815, opposite the Abercrombie's battery (new site for the Madras bank) "logs of wood, heaps of fishing nets, masulah boats, and catamarans extended to where the surf now breaks (in 1864)."

15. Between 1815 and 1821 rapid erosion continued, and all this foreshore disappeared; and for the fourth time, the fort and town were so seriously threatened that in 1821 it became necessary to build another "or third extensive bulwark, which was 1¾ miles long and 6 yards high, supported by a retaining wall of brick masonry also 6 yards high; this work cost about 8 lacs"—*vide* report by Captain Cotton, to the Secretary, *Breakwater Committee, 11th November* 1837.

16. From the foregoing it is clear that the position of the shore line changed several times before the harbour was commenced, and there is no doubt that the shore line advanced and returned from half a mile east of the Custom House, while there is no reason for doubting the records that it even reached three miles east of the Custom House about 1750. It is well known that the bottom of the sea retains a natural slope, and therefore each change in the position of the coast line must have changed the depth of the roadstead in retaining that slope, and as the roadstead varied in depth in the past, it must be admitted that either action would take place again with or without a harbour.

17. The harbour might tend to hasten the *natural* advance of foreshore and consequent shallowing of the roadstead or, on the other hand, prolong the action of erosion or washing away of the foreshore which has repeatedly taken place; but with the foregoing facts before us, it cannot be said to be the sole cause of the shallowing of the roadstead in 1896, when deepening of the roadstead is proved to have taken place for the first eight years after its construction. This change from deepening to shallowing was, I maintain, the commencement of a natural change in the depth of the roadstead or only a repetition of what has taken place for centuries past.

18. The soundings in deep water show a steady shallowing at a distance from the harbour where it can have no effect upon the sea bottom, and therefore, unless the sand is prevented from reaching the harbour entrance, it may be left high and dry in a few years hence.

19. It may happen that the present period of shallowing of the roadstead may be a short one, in which case the necessary protective works for the entrance need not extend very far to sea; but if nothing is done until further shallowing has taken place, it will be too late, and a considerable depth of water at the entrance will have been permanently lost.

20. It has been said that the harbour is the cause of the roadstead shallowing, grant for sake of argument that this is so in 1896, but what caused the foreshore to advance *beyond* the position of the present harbour in former days when there was no harbour, the answer can only be nature, and as the natural currents, which still exist, caused this change, why should they not continue to be the cause of re-forming the foreshore and shallowing the roadstead.

21. Because the foreshore has been advancing since the construction of the harbour, it is not necessarily the cause of it, and this theory is completely upset by the fact that in 1835 Sir A. Cotton projected a breakwater, extending out to the 4½ fathom line, which should have accreted foreshore to the south of it in the same manner as the south pier has done; but the *reverse* action took place as the roadstead was at that time deepening. The foreshore between the bulwark and the breakwater disappeared and left the breakwater detached from the shore (which wrecked it), and erosion continued so rapidly that Madras was again, and for the fourth time on record, in danger of being washed away.

22. Colonel DeHavilland was then directed to extend the bulwark to Ráyapuram, and did so, which work is known as DeHavilland's sea wall, and can be seen intact to this day.

23. From 1854 foreshore accreted in front of this wall to some distance, but in 1865 it had all disappeared again; and there are persons now in Madras who can remember the waves washing over the above wall and upon the beach road in front of Messrs. Arbuthnot & Co.'s permises.

24. The shore line then steadily advanced previous to and up to the date of the commencement of the harbour; deepening of the roadstead then commenced and continued till 1889 (see sections at entrance of harbour); but since 1889 shallowing has taken place everywhere, out to sea, and in the deep *water to the north of the harbour.*

25. At a point 5 *miles* south of the harbour and at a distance where the harbour cannot in any way act upon the foreshore or roadstead, the high water line has advanced exactly 317 feet between March 1892 and March 1896, which is nearly as rapid an advance of the shore line as there has been near the south pier.

26. Paragraph 21 of the Committee's report of 1868 gives the following information which shows that similar changes took place before the harbour was commenced: "Every one who remembers Madras ten years ago (1858 to 1868) will recollect very well that only a very narrow strip of sand was then found lying *alongside the breakwater* at the beach road, and that the surf in many places and often came on to the bulwark by the roadside over the narrow strip of sand; and further that often the sand was swept away and the groynes and bulwark left bare; all of which shows that the surf broke close to the beach road at that time; all this is now changed (1868); the groynes and bulwark are at this time entirely covered with sand and in many places the *sand-banks* extend far beyond the ends of the groynes."

27. The information collected from the above records, and the finding of clay and wrecks, &c. (hereafter referred to), at over 2 fathoms below the present bed of the sea, at points where the depth of water has remained the same within a few *inches* since 1876, or immediately before the harbour was commenced, proves that the roadstead does and has changed in depth; and that the present shallowing of the roadstead is only a repetition of what has taken place in the past, or vessels would not be found at 12 and 15 feet below the present bed of the sea *inside*

the harbour, and lying on the *bed of clay* on which the diver of 1868 is reported to have walked upon. Where there was a depth of 51 feet and a clay bottom in 1868, there is now, and was in 1876, 39 feet, and a sandy bottom, so that between the period of the Committee's report of 1868 and the commencement of the harbour in 1876, or in *eight years*, the roadstead shallowed 12 to 15 feet, viz., the 8½ fathom line of 1868 became 6½ fathoms in 1876; and to further support the fact that the roadstead did change without a harbour; and that the sea-bed was not always uniform, I refer to the Committee's report, G.O., No. 857, dated 17th March 1868, paragraph 6, of appendix C, wherein it is clearly stated that Lieutenant Sweney's Survey—

> "On examination it would be observed from the *steady and regular increase* in the distances between the contour lines that there is some action of the water in the bottom, as far as the chart extends (*nine and a half fathoms*), and it would be well to keep *this fact in mind*."

28. No statement could be clearer, and instead of the Committee's report being opposed to my views (*vide* G.O., No. 76 E, under reply), they are therein most strongly supported.

29. The remark that there was to be found a varying depth of *8 feet* of sand at the iron pier head can hardly be credited, as it is known that the iron pier piles were only screwed down to 13 feet below the sea-bed, and therefore if 8 feet of this depth was known to be *variable*, no Engineers would have been satisfied, with at times there being only 5 feet of the piles below the sea-bed. Recent experience of the action of storms at Madras makes it impossible that the piles with so little hold in the ground as 5 feet at times, could have withstood an ordinary rough sea, much less the *cyclones which it has done*.

Paragraphs 1 to 6, G.O., No. 76 E.

30. The points therein referred to have already been dealt with, but paragraph 5 points out what is supposed to be a discrepancy of 110 feet in the Committee's report. This is easily explained, as the reference to the "shore" does not mean the length of the pier, which is longer than either dimensions given in the report.

31. The "shore" means the *high water mark* which was 900 feet from the pier head in 1868, but the "1,010 feet to shore" is the "high water line" as evidenced by soundings taken periodically "for a series of years" which means the *average* position of the shore line from the pier head "*over a series of years*," while the 900 feet was the position of the "shore" at a fixed date, viz., September 1868.

32. The length of the iron pier remained constant, and was 1,091¾ feet in length from the day it was completed.

Paragraph 7, G.O., No. 76 E.

33. It will be seen from the Committee's report that the remarks upon the changes in the roadstead relating to harbour were wholly based upon the report and evidence of a single diver a Mr. Shilleto, and as this diver's evidence can, from a better and longer knowledge of the coast and roadstead (extending over 21 years' experience from regular *diving and surveys*), be proved to be wrong in two of the three points put forward, I based my arguments upon facts and recorded soundings, and did not refer to the diver's statements, although in statement A he was correct, and his evidence supports my statement, that the roadstead shallowed before the harbour was built. Mr. Shilleto reported to the Committee—

A.—That the sea-bed was of hard clay from 6 fathoms outwards, &c. (in 1868);
B.—That the roadstead was without any current from 7 fathoms outwards; and
C.—That no movement of sand took place between a depth of 6 and 11 fathoms.

34. *Statement A.*—If the diver found the sea-bed to be one of clay, beyond a depth of 6 fathoms in 1868 (and there is no reason for doubting what he could actually see) this fact proves that the roadstead "varied in depth before the construction of a harbour" as at a depth of 6 and 6½ fathoms in 1876, 1881 and 1896 the sea-bed was, and has ever since been, one of sand for a depth of 12 feet, and not of clay.

35. When screwing down moorings in 1881 in 4½ fathoms of water, and again in 1896 the sea-bed was found to be one of *sand*, and this formation continued varying from a depth of 12 to even 15 down, and it was below this depth of sand that the original clay bottom of 1868 was met with at 6½ fathoms down, and this shows a shallowing of the roadstead by 12 feet between 1868 and 1876.

36. At one of the moorings in August 1881, a wreck was struck at 7½ feet below the bed of the sea, and its deck and hull were passed through at 12½ feet down, and the original clay bottom of 1868, upon which the wreck was resting was then entered; therefore, it is here again proved that there was a bed of clay at 6 fathoms in 1868 or earlier, for a wreck to be found upon it, and which was subsequently buried in 12½ feet of sand, before the harbour was commenced.

37. At another point a mooring screw was put down (in 1896) in 6½ fathoms of water where the sea-bed inside the harbour was of sand. After the screw had been sunk 7½ feet below bed level, it struck upon a buried wreck, and by the force of the water pumped down, several logs of

red-wood were washed up; and a log 5 feet long was brought up by the divers, which is in my possession. Several logs of timber were in this way moved, and on the screw being shifted west a little it slipped off the wreck and struck the clay which was met with at a depth of 15 feet below the sea-bed, when it was penetrated to the required depth.

38. At this point, when the clay formed the bed of the sea in 1868, there must have been 9 fathoms of water over it or 54 feet; and as there is in 1896, and was also in 1876 (before the harbour was built), only 6½ fathoms of water = 39 feet over the same spot, 15 feet of sand must have accumulated in the 8 years, 1868—76, previous to the construction of the harbour. Therefore the above shows that the 9-fathom line of 1868 varied without a harbour; and that the clay bottom, was once the bed of the sea, cannot be disputed, since vessels and timber have been found lying upon it.

39. On the 16th March 1896, when putting down the 46th screw inside the harbour in deep water, where the depth has not changed more than a few *inches* since the harbour was commenced. I struck the bed of clay (samples of which I have) at 12 feet below the present sea bottom, the borer then penetrated hard clay for a depth of 15 feet, and at *27 feet* below the present bed level, the borer rested upon something hard, like iron, which cut into the brass rose, I was working with. There was therefore metal or something hard at a depth of 60 feet below water level, viz., 33 feet of water to present sea bottom; through 12 feet of sand and shells, and then through 15 feet of hard clay, when this obstacle was met with. I have repeatedly bored through sand and clay to a depth of *64 feet* inside the harbour and never before met with anything harder than clay, after entering that formation. I therefore do not believe it was rock, but if it was a wreck, the clay must be a formation from silt before the harbour was commenced.

40. On the following day another screw was being put down at about 500 feet nearer shore and the same stratum of clay was struck at 11 feet below the present sea-bed, and clay continued for a depth of 16 feet, when suddenly space or a sort of a pulp was met with, and the borer simply dropped 3 feet, which was the limit to which it could be lowered, as unfortunately the other lengths of piping were on shore.

41. Four days later another screw was being sunk 200 feet south of the last position, and after passing through a depth of 12 feet of sand and shells, the clay was met with, which was pierced for a depth of 10 feet, when the borer again dropped into something so soft that it dropped 7 feet without any resistance. From the softness of the material, or space entered, it appeared to me to be a wreck buried in silt, like clay, and that the vessel had since rotted away leaving space. Had the formation above it been sand, the space would have filled in, but in clay, I believe, the form of a vessel would remain as space after the timber had rotted away, and mango wood would in a very short time rot into a pulp such as met with; but how or when a vessel got below the clay to a depth of *60* feet below the sea level, where there is now, and was in 1876, only 33 feet of water must remain a mystery, but the fact remains, and I can at any time find the spot again.

42. In putting down the moorings both inside and *outside* the harbour, I have never found the clay nearer the present sea-bed than 10 feet, and in most cases 15 feet; I therefore think it conclusively proved, with the discovery of wrecks and timber at that depth, that the roadstead has varied in depth as far as in 10 fathoms of water previous to the construction of the harbour. The Committee's report of 1868 contains the following: "it must follow that the sea, which has shown its power to abrade and carry away so vast an amount of material, must have equally the power of re-conveying alike amount of material, and of depositing it in the former position" which is now taking place.

43. *Statement B.*—It was reported in 1868 that "there was no current beyond on a depth of 7 and 8 fathoms." I have at different dates made current observations at each fathom of depth as far out as 9 fathoms, and not only found strong currents but sand travelling with them, as proved by an arrangement I made for bringing up water at various depths, where and when a diver could not be conveniently sent down. With the water caught near the sea bottom, fine sand was also caught, which was in suspension with it and moving with the current.

44. In 9½ fathoms the current was found to be so strong that the divers could not keep their footing unless they knelt down, and I can at any time prove that the currents extend down to the bottom of the sea. Mr. Shilleto, the diver, was therefore mistaken in his evidence, which misled the Committee.

45. On the 7th March 1896, while sounding in *10* fathoms of water, I observed a strong current passing over the spot where "Cocoanut Island" must have existed, from the distance and bearings given of it, referred to in paragraph 10 of this report, taken from the Committee's report of 1868.

46. It was stated that *no trace* of this land, or advance of 3 miles of foreshore, remained in 1868, but now, in 1896, I find a shallowing of a fathom at 2½ miles east of the harbour entrance with deeper water east and west of it. The bank is in 10 fathoms of water, and appears to extend south, where less water or a higher bank is found. Opposite the entrance to the harbour the bank is about 600 feet wide and from the soundings and material brought up, the bed of the sea is found to be of coarse sand and shells, much worn by movement.

47. The surveys on record do not extend so far to sea; and therefore it is difficult to say whether this bank is the remains of "Cocoanut Island," or the commencement of its reformation again, but there is no doubt that a bank now exists with deeper water east and west of it.

48. A survey of this shallowing is being made, and the soundings will be repeated whenever the weather will permit of accurate work being done.

49. *Statement C.*—Movement of sand was said not to exist beyond a depth of 6 fathoms in 1868.

Further experience from 1883 to date proves that any vessel placed upon the sea-bed in 8 or 9 fathoms will collect sand when there is an ordinary current running, and I have brought up sand caught in this way.

50. Some years back the "Kingdom of Sweden" (anchored a little north of the harbour) dropped a large case about 6 feet in depth, overboard into 9½ fathoms of water; its position was noted, but, due to rough weather, it could not be recovered for some time later. When the divers went down to recover the case, it could not be found, but it was eventually discovered almost buried level with the sea bottom; not that it had sunk, because it was a light pine case and the contents did not weigh much.

51. This case had obstructed the sand from passing up the coast in 9½ fathoms (where the Committee say the sand is at rest) and had collected sand around it, forming a bank; I therefore consider this fact proof enough that sand does move even in 9½ fathoms of water.

52. The case could not be dug out of the sand, so as to permit a sling being passed beneath it; it was therefore opened under water, and then it was found that the sand had not only collected around the case, but had got into it through the open joints and filled it with sand. The divers dug the machinery out and left the case below, but were sent back again, as it was said to contain small materials also. The case was then emptied of sand, and the bolts, &c., were recovered and sent up in baskets. One of the divers is now on the works, and I was in the boat at the time.

53. Lieutenant Sweney's survey of 1859 is referred to in paragraph 7 of G.O., No. 76 E., wherein it is said "that there is no sensible variation in the depth of the sea *beyond* 6 fathoms." It is difficult to understand this statement unless Lieutenant Sweney's and all former surveys are ignored, and the statement of the diver of 1868 accepted, who is now proved to be wrong.

54. Paragraph 6 of appendix, page 13 of G.O., No. 857, of 17th March 1869, states that variations did take place in the roadstead, and the following is quoted therefrom:—

"The map, drawing No. 1, has, however, been carefully contoured from a chart of the roads surveyed in the year 1859 by Lieutenant M. A. Sweney. On examination it would be observed, from the steady and regular increase in the distance between the contour lines, *that there is* some action of the water in the bottom as far as the chart extends (*nine and a half fathoms*); and it would be well to keep this fact in mind."

55. With the above on record, taken from former surveys, and with regular and reliable surveys since, proving similar changes to have taken place, together with the banking up of sand against the case in deep water, there can be no doubt that the 9½ fathoms line does alter, and therefore the diver's evidence was unreliable for want of observations extending over a longer period.

Paragraph 8, G.O., No. 76 E.

56. In paragraph 8 there is an error. My report referred to therein, stated the depth east of the entrance to have been 51 feet in 1889 and not 1869 as quoted.

Paragraph 9, G.O., No. 76 E.

57. The facts now put forward regarding the shallowing of the roadstead previous to the construction of the harbour are indisputable, and therefore the Committee was wrong in its decision in 1868, as shallowing took place eight years later, which covered the bed of clay, and wrecks with it.

Paragraph 10, G.O., No. 76 E.

58. States "If the *bed* of the sea was uniform before the construction of the harbour, &c."

The bed of the sea was never uniform, but if it is meant that the roadstead did not change in depth, I can only refer to the Committee's report (already quoted in paragraph 27 of this report), wherein it is clearly stated that variations in the depth of the roadstead did take place, and the soundings collected from these old reports, also show great changes to have taken place in depth from time to time.

The concluding portion of this paragraph has been already answered, and sufficient evidence adduced to prove that the depth of the roadstead changed previous to the construction of the harbour.

Paragraph 11, G.O., 76 E.

59. There are no grounds whatever for assuming that the roadstead deepened to 1882, and again until 1889 due to the "partial construction of the harbour," as in 1882 the harbour walls *below low water* had been completed for over eighteen months, and therefore, if the harbour was responsible for the deepening of the roadstead from 1876—82 and until 1889, that action would certainly have continued to this day as the walls could not act in two different ways; but the deepening being temporary as remarked, proves that some other stronger agent commenced its work about 1889, which has continued since, viz., the natural shallowing of the roadstead; and as the roadstead is known to have shallowed, and the *foreshore advanced* and returned before the construction of the harbour, there can be no reason why it should not do so again.

60. The plan from which the measurements referred to in paragraph 11, G.O., 76 E., have been made to the 8-fathom line, and inferences drawn, is incorrect, as the year of 1895 has been mistaken for 1893, and 1889 for 1886.

61. From the original surveys, it will be seen that the 8-fathom line steadily came back towards shore, showing a deepening of the roadstead until 1889 as follows:—

Distance from T end of iron pier to 8-fathom line	in 1876	was	2,568 feet.
" " " "	in 1882	"	2,528 "
" " " "	in 1886	"	2,468 "
" " " "	in 1889	"	2,398 "
" " " "	in 1893	"	2,768 "
" " " "	in 1896	"	2,973 "

It is therefore clear that, whether due to the deepening of the roadstead to 1889, or any deepening effects the harbour might have had, that a change to shallowing took place from 1889, and my contention is that if the harbour was the cause of this deepening, it would have continued; but since 1889, the roadstead having shallowed again as it has done before, has overpowered any deepening action the harbour walls may have had, and therefore the roadstead is responsible for the present shallowing, and not the harbour.

62. The soundings across the entrance also show an increasing depth to 1889, but a rapid shallowing since as follows:—

		De. H. M. S. L.
Depth at position of entrance previous to commencement of harbour in	... ...	1876 = 48′ 6″
Depth at position of entrance during construction of harbour	... ...	1878 = 49′ 7″
Depth in centre of entrance after completion	... ...	1882 = 49′ 0″
Do.	do.	1886 = 49′ 6″
Do.	do.	1889 = 51′ 0″
Do.	do.	1892 = 48′ 0″
Do.	after 25th October	1893 = 47′ 0″
Do.	after January	1895 = 47′ 0″
Do.	after 21st January	1896 = 44′ 5″
Do.	after 27th March	1896 = 44′ 0″

63. The 8-fathom contour line has moved east by 205 feet between 1893 and 1896; or shallowed by 3 feet in three years, and being so near the harbour walls, may or may not be influenced by them, but the shallowing of the 9 and 9½ fathom lines to nearly ¾ of a mile east of the harbour entrance, cannot be said to be due to the harbour.

64. It is certain that the harbour entrance is rapidly shallowing, and if measures are not taken to prevent it from doing so, in less than eight years (at the present rate of shallowing) vessels will not be able to enter the harbour, unless the roadstead ceases to shallow; but until such a change takes place, nothing but a groyne as proposed can save any form of entrance to the harbour from closing.

Paragraph 12, G.O., 76 E.

65. All soundings available in this office have been plotted in the form of sections, which show more readily the variations in the roadstead previous to, and since the construction of the harbour. A few soundings were no doubt taken for the Committee in 1868, and it is quite likely there had not been much change in the roadstead since 1859, but as there appears to have been no record made of them in the form of a chart, they are useless for comparison and must be ignored. The Committee refer to them as follows:—

"Soundings taken under the orders of the *Master Attendant*, while our Committee was sitting, give the same results as the published chart by Lieutenant Sweney in 1859; there is very strong ground for believing that beyond the 6-fathom line there is no sensible variation in the bed of the sea, and if this is the case now, there can be no cause for apprehending any variations after the construction of a breakwater." The above was not the case, as a considerable shallowing took place after the Committee submitted its report.

66. The next reliable survey was made in 1876 or just before the harbour was commenced, and this survey shows a considerable shallowing of the roadstead between 1859 and 1876; but this change no doubt took place between 1868 (the Committee's soundings) and those of Messrs. Jerrard and Falle in 1876, or eight years later. The finding of clay at this date with so great a depth of sand above it, proves that rapid shallowing occurred about that time or previous to the construction of the harbour.

67. From 1876 to 1889 there was a period of deepening, but since 1889 the roadstead has been shallowing; and as the harbour could not act upon the roadstead in two different ways, I maintain that the deepening and shallowing of the roadstead in deep water was, and is from natural causes, and is not due to the construction of the harbour.

Read minutes by Trustees.

Resolved that a copy of the Engineer's report be submitted to Government with the request that the Government will, if they see fit, address the Government of India with a view to the ordering of a survey of the harbour and roadstead, as soon as the weather permits, by the Marine Survey of India. The Chairman is further invited to address Government regarding the necessity at all of harbour protective works.

* * * * *

(True Extract.)

(Signed) S. HUTCHENCE,
Ag. Secretary, Harbour Trust Board.

ORDER—No. 449, Marine, dated 20th June 1896.

His Excellency the Governor in Council desires that Mr. Pogson be instructed to discuss with the Consulting Engineer in London the subject of this communication. Meanwhile, the Government of India will be requested to arrange, if possible, for a survey of the harbour and roadstead being made by an officer of the Marine Survey of India.

[Here enter No. 450, Marine, dated 20th June 1896.]

(True Extract.)

(Signed) D. McNEIL CAMPBELL, Colonel, R.E.,
Joint Secretary to Government.

To the Chairman, Harbour Trust Board.

Exd. T. K. Narayana Aiyangar.
Spare Copies

Govt. of {1896} Madras.

MARINE.

Dated *June, 20th.*

Recd. *Encl.*

G.O. No. 449, 20th June 1896.

JUNE.

Madras Harbour and Roadstead

Orders directing, with remark, that the Government of India be requested to arrange, if possible, for a survey of the — being made by an officer of the Marine Survey of India.

No. 450, Marine, 20th June 1896.

MARINE DEPARTMENT.

Letter—from

The Hon'ble Colonel D. McNEIL CAMPBELL, R.E.,
Joint Secretary to the Government of Madras,
Marine Department,

To

The SECRETARY to the GOVERNMENT of INDIA,
Marine Department.

Sir,

I am directed to request that arrangements may, if possible, be made at an early date for a careful survey, by an officer of the Marine Survey of India, of the harbour and roadstead of Madras, the gradual shoaling of which within recent years has been brought to the notice of His Excellency the Governor in Council.

I have the honour to be,
Sir,
Your most obedient servant,

(Signed) D. McNEIL CAMPBELL, Colonel, R.E.,
Joint Secretary to Government.

Ootacamund,
20th June 1896.

Exd. T. K. Narayana Aiyangar.
Spare Copies

Govt. of {1896} Madras.

MARINE.

Dated June, 20th.

Recd. *Encl.*

No. 450, 20th June 1896.

JUNE.

Madras Harbour and Roadstead

Requesting to arrange, if possible, for a careful survey of the — by an officer of the Marine Survey of India.

No. 9, Marine, 20th June 1896.

MARINE DEPARTMENT.

Letter—to

The Right Honourable the SECRETARY of STATE for INDIA,
London.

My Lord,

In continuation of our despatch No. $\frac{12}{1220}$ W., dated 7th April 1896, we have the honour to forward, herewith, a further communication from the Engineer of the Harbour Trust Board on the question of the shoaling of the harbour and roadstead of Madras, and to request that the matter may be placed before the Consulting Engineer in England for consideration, and discussion with Mr. Pogson. We have meanwhile asked the Government of India to arrange, if possible, for a careful survey of the harbour and roadstead being made by an officer of the Marine Survey Department.

We have the honour to be,
My Lord,
Your Lordship's most obedient, humble servants,

(Signed) A. E. HAVELOCK.
(„) H. W. BLISS.
(„) J. GROSE.

Ootacamund,
20th June 1896.

Exd. T. K. Narayana Aiyangar.

GOVT. OF FORT ST. GEORGE.

MARINE (1896) *DEPARTMENT.*

(Copy.)

Letter to the Right Honourable
the Secretary of State for
India.

Dated 20th June,

No. 9 of 1896.

Forwarding a further communication from the Engineer of the Harbour Trust Board on the question of the shoaling of the Madras harbour and roadstead, and requesting that the matter may be placed before the Consulting Engineer in England for consideration and discussion with Mr. Pogson.

Print

Harbour Trust Office,
MADRAS, 27th May 1896

No. 786

10

From
Ware Austin Esq. I. C. S.
Chairman, Harbour Trust Board,
MADRAS.

To
The Hon'ble Col. D. McNeil Campbell R. E.
Joint Secretary to Government,
Marine Department.

Sir,

I have the honour to forward for the information and orders of Government copy of Resolution No. 3 passed by the Board at its meeting of the 22nd Instant, and also to enclose a copy of the Board's Engineer's report with four tracings* of plans which accompan the report.

By Bookpost

2. After perusal of Mr. Pogson report the Board is of opinion that it is inexpedient to undertake any protective work until the statement made by Mr. Pogson in paras 18, 42, 43, 44, 45, 46 and 49 have been placed before an expert

in

and

in Harbour Construction and an opinion on the same obtained.

3. The Board further considers that a Survey of the Harbour and Roadstead should be made by an officer of the Marine Survey of India and beg the Government of India may be addressed in view of this work being undertaken as soon as the state of the weather permits.

I have the honour to be
Sir
Your obedient Servant

W. Austin
Ag. Secy. Chairman
Harbour Trust Board

Print

EXTRACT of Proceedings of the TRUSTEES OF THE HARBOUR OF MADRAS, at a Meeting held at the Offices of the Board on Friday the 22nd day of May 1896

3. Read letter No. 69 A, dated 25th April 1896, from the Board's Engineer, replying to memo No. 768, dated 18th February, from the Joint Secretary to Government, Marine Department regarding recorded variations in the depths of the roadstead.

Read minutes by Trustees.

1858

Resolved that a copy of the Engineer's report be submitted to Government with the request that the Government will, if they see fit, address the Government of India with a view to the ordering of a Survey of the Harbour

and

and Roadstead, as soon as the weather permits, by the Marine Survey of India. The Chairman is further invited to address Government regarding the necessity at all of Harbour protective works.

True Extract

Whitehouse
Offg. Secretary
Harbour Trust Board

No. 68 A. MADRAS, *25th April 1896.*

From

The ENGINEER,
Harbour Trust Board,
MADRAS.

To

The CHAIRMAN,
Harbour Trust Board,
Madras.

Sir,

I have the honor to acknowledge the receipt of G. O., No. 76 E, Marine, dated 18th February 1896, forwarded under your Endorsement No. 720 E, dated 2nd March 1896, for remarks.

Enclosures 4 Tracings.

2. The above G. O., relates to my report upon the soundings of the Madras Roadstead and Harbour made in 1895, and contends to show that the Harbour Works alone has been the cause of the change in the depth of the Roadstead and variations in the Coast line.

3. To show that the Harbour is not directly the cause of the Roadstead shallowing, reference must be made to records, relating to the Madras Coast, years before the Harbour was thought of, and as changes in the Roadstead can be proved to have taken place then, I presume it will be accepted that similar changes may take place again, as there is nothing I am aware of, to show that the natural currents, or the Bay of Bengal is not now acting in the same manner as it has done for generations past, or why the changes which took place by nature, before the Harbour was built, should not continue for ever.

4. From the earliest records, referring to the Madras Coast line between the River Cooum and Royapuram, the following has been collected.

5. In 1639, Fort St. George was built, and it must be assumed that the Fort was built at some safe distance from the Coast line at that date, this foreshore a few years later disappeared, when we read of the first "Great Bulwark being built to save Madras."

6. The Coast line then advanced for years, and we read of it *returning again to the Original Bulwark* in 1682, as follows:—

"Tuesday, 11th July 1682." The sea having for about 10 days past "
" *encroached upon this town,* and we, hoping, as it is usual, that it would "

> "retreat again of itself, forbore any remedies to keep it off; but now"
> "that instead of its losing it mightily gains ground upon us, and that"
> "without a speedy course be taken, the town will run an apparent"
> "hazard of being swallowed up for it has undermined even to the"
> "very walls, and so deep that it has eaten away below the very found-"
> "ation of the town and the Great Bulwark next to the sea side, without"
> "a speedy and timely prevention, will certainly, in a day or two more,"
> "yield to its violence; it is therefore ordered forthwith that the drum be"
> "beat to call all coolies, carpenters, smiths, peons and all the workmen,"
> "and that sufficient materials be provided, that they may work day and"
> "night to endeavour to put a stop to its fury, for without effectual"
> "means be used in such an eminent danger and exigency, the town,"
> "garrison, and our own lives, considering all the foregoing circum-"
> "stances, must needs be very hazardous and insecure."

7. From the above it will be seen that the first bulwark, built after the construction of the Fort, saved Madras from erosion; the shore line therefore must have advanced, for it to have returned again in 1682 to threaten and undermine the *original bulwark*, and so serious was this second attack of the sea on Madras, that a further reference is made to it on the 31st May 1683, and an extract given from a general letter from England to the Authorities here, says :—

> "We take notice of the great inundation that endangered our Town"
> "and Fort, and we would have you endeavour to prevent such future"
> "accidents by laying such a deep and strong foundation with chunam,"
> "as you mention, that may be sufficient in all human probability to"
> "prevent damage by any such accident hereafter."

8. From 1683 the shore line advanced again for about 4 years and there was no Harbour or Cotton's Breakwater in those days to cause it to do so; but later on and during a storm on

> "Sunday, 9th October 1687," or four years later, it is recorded—"
> "During the fierceness of this storm, the winds continued between east"
> "and north-east, which brought the sea very near the bulwark and wall;"
> "but this morning the wind and sea abating, we hope the danger is"
> "past."

9. The Coast line advanced, and again returned and threatened the *bulwark* for a third time on record up to 1687 and in 1696 it is again reported that "Fresh "encroachments of the sea took place."

10. From this date no further mention is made of the Coast line giving trouble until about 125 years later, but during this period, it would appear that the Coast line advanced some three miles from the bulwark, to a point which was called "Cocoanut Island," referred to, in para. 16 of the Committee's report of 1868, which reads :—

> "We may, however, remark that if there is any truth in the tradition"
> "that the shore at Madras was formerly two or three miles"
> "in advance of the present line, it must follow that the sea"

> "which has shown its power to abrade and carry away so vast an"
> "amount of material, *must have equally the power of re-conveying alike*"
> "*amount of material*, and of depositing it in the former position."

And in the same report, para. 32, Appendix H, referring to *the natural changes in the Roadstead*, it is written.—" This appears particularly the case

> "at Madras, for people are now living, (1868), whose forefathers have"
> "assured them that they used to walk out on a Sunday, some two or"
> "three miles to Cocoanut Island, to enjoy themselves, *but every trace of*"
> "*it has long since disappeared*".

11. Regarding the existence of Cocoanut Island and there having been some three miles of foreshore in front of the present Coast line sometime about 1750, sets aside any doubt as to whether the *present* Roadstead has ever changed in depth. There are still signs of this extensive foreshore or Island, and if every trace of it had disappeared in 1868, as above; the present bank, three miles out, must be a reformation of it again in 1896.

12. There are records to show that in 1810, there was a large stretch of foreshore in front of Fort St. George and upon which troops were camped out.

13. In 1811 the 9 fathom line was said to have been at a distance of four miles from shore, and in 1813 it is recorded "the walk from the landing place opposite" "the Custom House to that emporium, was over a loose *sand for half a mile*".

14. At this time, erosion of foreshore and deepening of the Roadstead was taking place, and in 1815, opposite the Abercrombie's Battery (new site for the Madras Bank) "logs of wood, heaps of fishing nets, masulah boats, and catamarans" "extended to where the surf now breaks (in 1864)".

15. Between 1815 and 1821, rapid erosion continued, and all this foreshore disappeared; and for the fourth time, the Fort and Town were so seriously threatened, that in 1821, it became necessary to build another, "or third extensive bulwark," "which was 1$\frac{3}{4}$ miles long, and 6 yards high, supported by a retaining wall of brick" "masonry also 6 yards high; this work cost about 8 lacs." *Vide* Report by Captain Cotton. To the Secretary" *Breakwater Committee, 11th November* 1837.

16. From the foregoing it is clear that the position of the shore line changed several times, before the Harbour was commenced, and there is no doubt that the shore line advanced, and returned from half a mile East of the Custom House; while there is no reason for doubting the records, that it even reached 3 miles East of the Custom House about 1750. It is well known that the bottom of the sea retains a natural slope, and therefore each change in the position of the Coast line, must have changed the depth of the Roadstead, in retaining that slope, and as the Roadstead varied in depth in the past, it must be admitted that either action would take place again, with or without a Harbour.

17. The Harbour might tend to hasten the *natural* advance of foreshore, and consequent shallowing of the Roadstead, or, on the other hand, prolong the action of erosion or washing away of the foreshore, which has repeatedly taken place, but with

the foregoing facts before us, it cannot be said to be the sole cause of the shallowing of the Roadstead in 1896, when deepening of the Roadstead is proved to have taken place for the first 8 years, after its construction. This change from deepening to shallowing, was, I maintain, the commencement of a natural change in the depth of the Roadstead, or only a repetition of what has taken place for centuries past.

18. The soundings in deep water, show a steady shallowing at a distance from the Harbour, where it can have no effect upon the sea bottom, and therefore, unless the sand is prevented from reaching the Harbour Entrance, it may be left high and dry in a few years hence.

19. It may happen that the present period of shallowing of the Roadstead, may be a short one, in which case the necessary protective works for the Entrance, need not extend very far to sea, but if nothing is done until further shallowing has taken place, it will be too late; and a considerable depth of water at the Entrance will have been permanently lost.

20. It has been said that the Harbour is the cause of the Roadstead shallowing, grant for sake of argument that this is so in 1896, but what caused the foreshore to advance *beyond* the position of the present Harbour in former days when there was no Harbour, the answer can only be nature, and as the natural currents, which still exist, caused this change, why should they not continue to be the cause of reforming the foreshore, and shallowing the Roadstead.

21. Because the foreshore has been advancing since the construction of the Harbour, it is not necessarily the cause of it, and this theory is completely upset by the fact that in 1835 Sir A. Cotton projected a Breakwater, extending out to the 4½ fathom line, which should have accreted foreshore to the south of it, in the same manner as the South Pier has done; but the *reverse* action took place, as the Roadstead was at that time deepening. The foreshore between the Bulwark and the Breakwater disappeared and left the Breakwater detached from the shore (which wrecked it), and erosion continued so rapidly that Madras was again, and for the fourth time on record, in danger of being washed away.

22. Col. DeHavilland was then directed to extend the Bulwark to Royapuram, and did so, which work is known as DeHavilland's Sea Wall, and can be seen intact to this day.

23. From 1854 foreshore accreted in front of this wall to some distance, but in 1865 it had all disappeared again, and there are persons now in Madras, who can remember the waves washing over the above wall and upon the Beach Road in front of Messrs. Arbuthnot & Co's premises.

24. The shore line then steadily advanced, previous to, and up to the date of the commencement of the Harbour; deepening of the Roadstead then commenced and continued till (1889) (see sections at Entrance of Harbour), but since (1889) shallowing has taken place everywhere, out to sea, and in the deep *water to the North of the Harbour.*

25. At a point *5 miles* south of the Harbour and at a distance where the Harbour cannot in any way act upon the foreshore or Roadstead, the High Water Line has advanced exactly 317 feet, between March 1892, and March 1896, which is nearly as rapid an advance of the shore line as there has been near the South Pier.

26. Para. 21 of the Committee's report of 1868 gives the following information, which shows that similar changes took place, before the Harbour was commenced. "Every one who remembers Madras ten years ago, (1858 to 1868) will recollect" "very well that only a very narrow strip of sand was then found lying *alongside the*" "*Breakwater* at the beach road, and that the surf in many places, and often, came on" "to the bulwark by the roadside, over the narrow strip of sand; and further, that" "often the sand was swept away and the groynes and bulwark left bare; all of which" "shows that the surf broke close to the Beach Road at that time, all this is now" "changed (1868); the groynes and bulwark are at this time entirely covered with" "sand, and in many places the *sand-banks* extend far beyond the ends of the groynes."

27. The information collected from the above records, and the finding of clay and wrecks &c., (hereafter referred to) at over 2 fathoms below the present bed of the sea, at points where the depth of water has remained the same within a few *inches* since 1876; or immediately before the Harbour was commenced, proves that the Roadstead does and has changed in depth; and that the present shallowing of the Roadstead is only a repetition of what has taken place in the past, or vessels would not be 7 found at 12 and 15 feet below the present bed of the sea *inside the Harbour*, and lying on the *bed of clay* on which the diver of 1868 is reported to have walked upon. Where there was a depth of 51 feet and a clay bottom in 1868, there is now and was in 1876, 39 feet, and a sandy bottom, so that between the period of the Committee's report of 1868, and the commencement of the Harbour in 1876, or in *8 years* the Roadstead shallowed 12 to 15 feet, *viz.*, the 8½ fathom line of 1868, became 6½ fathoms in 1876; and to further support the fact that the Roadstead did change, without a Harbour; and that the sea-bed was not always uniform, I refer to the Committee's Report, G. O., No. 857, dated 17th March 1868, para. 6, of Appendix C, wherein it is clearly stated that Lieutenant Sweney's Survey.

"On examination it would be observed from the *steady and regular increase*" "in the distances between the contour lines, that there is some action of the water in" "the bottom, as far as the chart extends (*nine and a half fathoms*); and it would be" "well to keep *this fact in mind*."

28. No statement could be clearer, and instead of the Committee's report being opposed to my views; *vide* G. O., No. 76 E, under reply, they are therein most strongly supported.

29. The remark that there was to be found a varying depth of *8 feet* of sand at the Iron Pier Head can hardly be credited, as it is known that the Iron Pier Piles were only screwed down to 13 feet below the sea-bed, and therefore if 8 feet of this depth, was known to be *variable*, no Engineers would have been satisfied, with at times there being only 5 feet of the piles below the sea-bed. Recent experience of the action of storms at Madras, makes it impossible that the piles with so little hold in the ground as 5 feet at times, could have withstood an ordinary rough sea, much less the *Cyclones which it has done.*

30. The points therein referred to have already been dealt with, but para. 5 points out what is supposed to be a discrepancy of 110 feet in the Committee's report. This is easily explained, as the reference to the "shore" does not mean the length of the Pier, which is longer than either dimensions given in the report. Paras. 1 to 6, G. O. 76 E.

31. The "shore" means the *High Water Mark* which was 900 feet from the Pier Head in 1868, but the "1,010 feet to shore" is the "High Water Line" as evidenced by soundings taken periodically "for a series of years" which means the *average* position of the shore line from the Pier Head "*over a series of years*" while the 900 feet, was the position of the "shore" at a fixed date *viz.*, September 1868.

32. The length of the Iron Pier remained constant, and was 1,091¾ feet in length from the day it was completed.

33. It will be seen from the Committee's report that the remarks upon the changes in the Roadstead, relating to a Harbour, were wholly based upon the report and evidence of a single diver a Mr. Shilleto, and as this diver's evidence can, from a better and longer knowledge of the Coast and Roadstead [extending over 21 years' experience from regular *diving and surveys*], be proved to be wrong in two of the three points put forward, I based my arguments upon facts and recorded soundings, and did not refer to the diver's statements, although in Statement A, he was correct, and his evidence supports my statement that the Roadstead shallowed before the Harbour was built. Mr. Shilleto reported to the Committee. Para. 7, G. O. 76 E.

A. That the sea-bed was of hard clay from 6 fathoms outwards &c. (in 1868);

B. That the Roadstead was without any current from 7 fathoms outwards, and

C. That no movement of sand took place between a depth of 6 and 11 fathoms.

Statement A.—34. If the diver found the sea-bed to be one of clay, beyond a depth of 6 fathoms, in 1868 (and there is no reason for doubting what he could actually see) this fact proves that the Roadstead "varied in depth before the construction of a Harbour" as at a depth of 6 and 6½ fathoms in 1876, 81 and 96 the sea-bed was, and has ever since been, one of sand for a depth of 12 feet, and not of clay.

35. When screwing down Moorings in 1881 in 4½ fathoms of water, and again in 1896, the sea-bed was found to be one of *sand*, and this formation continued, varying from a depth of 12 to even 15 down, and it was below this depth of sand that the original clay bottom of 1868 was met with, at 6½ fathoms down, and this shows a shallowing of the Roadstead, by 12 feet between 1868 and 1876.

36. At one of the Moorings in August 1881, a wreck was struck at 7½ feet below the bed of the sea, and its deck and hull were passed through at 12½ feet down, and the original clay bottom of 1868, upon which the wreck was resting was then entered; therefore, it is here again proved that there was a bed of clay at 6 fathoms in 1868 or earlier, for a wreck to be found upon it, and which was subsequently buried in 12½ feet of sand, before the Harbour was commenced.

37. At another point, a Mooring screw was put down (in 1896) in 6½ fathoms of water where the sea-bed inside the Harbour was of sand. After the screw had been sunk 7½ feet below bed level, it struck upon a buried wreck, and by the force of the water pumped down, several logs of red-wood were washed up; and a log 5 feet long was brought up by the divers, which is in my possession. Several logs of timber were in this way moved, and on the screw being shifted west a little, it slipped off the wreck, and struck the clay which was met with at a depth of 15 feet below the sea-bed, when it was penetrated to the required depth.

38. At this point, when the clay formed the bed of the sea in 1868, there must have been 9 fathoms of water over it, or 54 feet; and as there is in 1896, and was also in 1876, (before the Harbour was built) only 6½ fathoms of water,=39 feet over the same spot, 15 feet of sand must have accumulated in the 8 years, 1868–76, previous to the construction of the Harbour. Therefore, the above shows that the 9 fathom line of 1868 varied without a Harbour; and that the clay bottom, was once the bed of the sea, cannot be disputed, since vessels and timber have been found lying upon it.

39. On the 16th March 1896, when putting down the 46th screw inside the Harbour in deep water, where the depth has not changed more than a few *inches* since the Harbour was commenced. I struck the bed of clay (samples of which I have) at 12 feet below the present sea bottom, the borer then penetrated hard clay for a depth of 15 feet, and at *27 feet* below the present bed level, the borer rested upon something hard, like iron, which cut into the brass rose, I was working with. There was therefore metal or something hard at a depth of 60 feet below water level, *viz.*, 33 feet of water to present sea bottom; through 12 feet of sand and shells, and then through 15 feet of hard clay, when this obstacle was met with. I have repeatedly bored through sand and clay to a depth of *64 feet* inside the Harbour and never before met with anything harder than clay, after entering that formation. I therefore do not believe it was rock, but if it was a wreck, the clay must be a formation from silt, before the Harbour was commenced.

40. On the following day another screw was being put down, at about 500 feet nearer shore and the same stratum of clay was struck at 11 feet below the present sea-bed, and clay continued for a depth of 16 feet, when suddenly space, or a sort of a pulp was met with, and the borer simply dropped 3 feet, which was the limit to which it could be lowered, as unfortunately the other lengths of piping were on shore.

41. Four days later, another screw was being sunk 200 feet south of the last position, and after passing through a depth of 12 feet of sand and shells, the clay was met with, which was pierced for a depth of 10 feet, when the borer again dropped into something so soft that it dropped 7 feet without any resistance. From the softness of the material, or space entered, it appeared to me to be a wreck buried in silt, like clay, and that the vessel had since rotted away leaving space. Had the formation above it been sand, the space would have filled in, but in clay, I believe, the form of a vessel would remain as space, after the timber had rotted away, and mango wood, would in a very short time, rot into a pulp such as met with; but how or when a vessel got below the clay, to a depth of *60* feet below the sea level, where there is now, and was in 1876, only 33 feet of water must remain a mystery, but the fact remains, and I can at any time find the spot again.

42. In putting down the Moorings both inside and *outside* the Harbour, I have never found the clay nearer the present sea-bed, than 10 feet, and in most cases 15 feet; I therefore think it conclusively proved, with the discovery of wrecks, and timber at that depth, that the Roadstead has varied in depth as far as in 10 fathoms of water, previous to the construction of the Harbour. The Committee's report of 1868 contains the following "it must follow that the sea which has shown its power to abrade and" "carry away so vast an amount of material, must have equally the power of re-convey-" "ing alike amount of material, and of depositing it in the former position" which is now taking place.

Statement B.—43. It was reported in 1868 that "there was no current beyond on" "a depth of 7 and 8 fathoms." I have at different dates made current observations at each fathom of depth, as far out as 9 fathoms, and not only found strong currents, but sand travelling with them, as proved by an arrangement I made for bringing up water at various depths, where and when a diver could not be conveniently sent down. With the water caught near the sea bottom, fine sand was also caught, which was in suspension with it, and moving with the current.

44. In 9½ fathoms the current was found to be so strong that the divers could not keep their footing unless they knelt down; and I can at any time prove that the currents extend down to the bottom of the sea. Mr. Shilleto, the diver, was therefore mistaken in his evidence, which misled the Committee.

45. On the 7th March 1896, while sounding in *10* fathoms of water I observed a strong current passing over the spot where "Cocoanut Island" must have existed, from the distance and bearings given of it, referred to in para. 10 of this report, taken from the Committee's report of 1868.

46. It was stated that *no trace* of this land, or advance of 3 miles of foreshore, remained in 1868, but now in 1896, I find a shallowing of a fathom at 2½ miles East of the Harbour Entrance with deeper water East and West of it. The bank is in 10 fathoms of water, and appears to extend South, where less water, or a higher bank is found. Opposite the Entrance to the Harbour, the bank is about 600 feet wide and from the soundings and material brought up, the bed of the sea is found to be of coarse sand and shells, much worn by movement.

47. The Surveys on record do not extend so far to sea; and therefore it is difficult to say whether this bank is the remains of "Cocoanut Island," or the commencement of its reformation again, but there is no doubt that a bank now exists, with deeper water East and West of it.

48. A Survey of this shallowing is being made, and the soundings will be repeated whenever the weather will permit of accurate work being done.

Statement C.—49. Movement of sand was said not to exist beyond a depth of 6 fathoms in 1868.

Further experience from 1883 to date, proves that, any vessel placed upon the sea-bed in 8 or 9 fathoms, will collect sand, when there is an ordinary current running, and I have brought up sand, caught in this way.

50. Some years back the "Kingdom of Sweden" (anchored a little North of the Harbour) dropped a large case about 6 feet in depth, overboard into 9½ fathoms of water; its position was noted, but due to rough weather it could not be recovered for some time later. When the divers went down to recover the case, it could not be found, but it was eventually discovered almost buried level with the sea bottom; not that it had sunk, because it was a light pine case and the contents did not weigh much.

51. This case had obstructed the sand from passing up the coast in 9½ fathoms (where the Committee say the sand is at rest) and had collected sand around it, forming a bank; I therefore consider this fact proof enough, that sand does move, even in 9½ fathoms of water.

52. The case could not be dug out of the sand, so as to permit a sling being passed beneath it; it was therefore opened under water, and then it was found that the sand had not only collected around the case, but had got into it through the open joints and filled it with sand. The divers dug the machinery out, and left the case below, but were sent back again, as it was said to contain small materials also. The case was then emptied of sand, and the bolts &c., were recovered, and sent up in baskets. One of the divers is now on the works, and I was in the boat at the time.

53. Lieutenant Sweney's Survey of 1859 is referred to in para. 7 of G. O., No. 76 E, wherein it is said, "that there is no sensible variation in the depth of the sea *beyond* 6" fathoms." It is difficult to understand this statement, unless Lieutenant Sweney's, and all former surveys, are ignored, and the statement of the diver of 1868 accepted; who is now proved to be wrong.

54. Para. 6 of Appendix, page 13 of G. O., 857 of 17th March 1869, states that variations did take place in the Roadstead, and the following is quoted therefrom.

"The Map, Drawing No. 1 has, however, been carefully contoured from a chart of" "the Roads, surveyed in the year 1859 by Lieutenant M. A. Sweney. On examination" "it would be observed from the steady and regular increase in the distance between the" "contour lines, *that there is* some action of the water in the bottom as far as the chart" "extends (*nine and a half fathoms*); and it would be well to keep this fact in mind."

55. With the above on record, taken from former surveys, and with regular and reliable surveys since, proving similar changes to have taken place, together with the banking up of sand against the case in deep water, there can be no doubt that the nine and a half fathoms line does alter, and therefore the diver's evidence was unreliable for want of observations extending over a longer period.

Para. 8, G. O., 76 E. 56. In para. 8, there is an error.

My report referred to therein, stated the depth East of the Entrance to have been 51 feet in 1889, and not 1869 as quoted.

Para. 9, G. O., 76 E. 57. The facts now put forward, regarding the shallowing of the Roadstead previous to the construction of the Harbour are indisputable, and therefore the Committee was wrong in its decision in 1868, as shallowing took place 8 years later, which covered the bed of clay, and wrecks with it.

Para. 10, G. O., 76 E. 58. States "If the *bed* of the sea was uniform before the construction of the Harbour &c."

The bed of the sea was never uniform, but if it is meant that the Roadstead did not change in depth, I can only refer to the Committee's report (already quoted in para. 27 of this report), wherein it is clearly stated that variations in the depth of the Roadstead did take place, and the soundings collected from these old reports, also show great changes to have taken place in depth from time to time.

The concluding portion of this para. has been already answered, and sufficient evidence adduced to prove that the depth of the Roadstead changed, previous to the construction of the Harbour.

59. There are no grounds whatever for assuming that the Roadstead deepened to 1882, and again until 1889 due to the "partial contruction" of the Harbour," as in 1882 the Harbour Walls *below low water* had been completed for over 18 months, and therefore, if the Harbour was responsible for the deepening of the Roadstead from 1876–82 and until *1889*, that action would certainly have continued to this day as the walls could not act in two different ways, but the deepening being temporary as remarked, proves that some other stronger agent commenced its work about 1889, which has continued since, *viz.*, the natural shallowing of the Roadstead, and as the Roadstead is known to have shallowed, and the *foreshore advanced* and returned before the construction of the Harbour, there can be no reason why it should not do so again. Para. 11, G. O., 76 E.

60. The plan from which the measurements referred to in para. 11, G. O., 76 E, have been made to the 8 fathom line, and inferences drawn, is incorrect; as the year of 1895 has been mistaken for 1893, and 1889 for 1886.

61. From the original surveys, it will be seen that the 8 fathom line steadily came back towards shore, showing a deepening of the Roadstead until 1889 as follows:—

Distance from T end of Iron Pier to 8 fathom line in	1876	was	2568'
,, ,, ,, ,, ,,	1882	,,	2528'
,, ,, ,, ,, ,,	1886	,,	2468'
,, ,, ,, ,, ,,	1889	,,	2398'
,, ,, ,, ,, ,,	1893	,,	2768'
,, ,, ,, ,, ,,	1896	,,	2973.

It is therefore clear that, whether due to the deepening of the Roadstead to 1889, or any deepening effects, the Harbour might have had, that a change to shallowing took place from 1889, and my contention is that if the Harbour was the cause of this deepening, it would have continued; but since 1889 the Roadstead, having shallowed again, as it has done before, has overpowered any deepening action the Harbour walls may have had, and therefore the Roadstead is responsible for the present shallowing, and not the Harbour.

62. The soundings across the Entrance, also show an increasing depth to 1889, but a rapid shallowing since as follows:—

	De. H. M. S. L.
Depth at position of Entrance previous to commencement of Harbour in	1876=48'-6"
Depth at position of Entrance during construction of Harbour ...	1878=49'-7"
Depth in centre of Entrance after completion	1882=49'-0"
,, ,, ,, ,, ...	1886=49'-6"
,, ,, ,, ,, ...	1889=51'-0"
,, ,, ,, ,, ...	1892=48'-0"
,, ,, ,, 25th October	1893=47'-0"
,, ,, ,, January	1895=47'-0"
,, ,, ,, 21st January	1896=44'-5"
,, ,, ,, 27th March	1896=44'-0"

63. The 8 fathom contour line has moved East by 205 feet between 1893 and 96; or shallowed by 3 feet in three years, and being so near the Harbour walls, may or may not be influenced by them, but the shallowing of the 9 and 9½ fathom lines to nearly ¾ of a mile East of the Harbour Entrance, cannot be said to be due to the Harbour.

64. It is certain that the Harbour Entrance is rapidly shallowing and if measures are not taken to prevent it from doing so, in less than 8 years (at the present rate of shallowing) vessels will not be able to enter the Harbour, unless the Roadstead ceases to shallow, but until such a change takes place, nothing but a groyne as proposed can save any form of Entrance to the Harbour, from closing.

65. All soundings available in this office have been plotted in the form of sections, which show more readily the variations in the Roadstead previous to, and since the construction of the Harbour. A few soundings were no doubt taken for the Committee in 1868, and it is quite likely there had not been much change in the Roadstead since 1859, but as there appears to have been no record made of them in the form of a chart, they are useless for comparison and must be ignored. The Committee refer to them as follows:— Para. 12, G. O., 76 E.

"Soundings taken under the orders of the *Master Attendant*, while our Committe," "was sitting give the same results as the published chart by Lieutenant Sweney" "in 1859, there is very strong ground for believing that beyond the six fathom line" "there is no sensible variation in the bed of the sea, and if this is the case now there" "can be no cause for apprehending any variations after the construction of a Break-" "water". The above was not the case, as a considerable shallowing took place after the Committee submitted its report.

66. The next reliable survey was made in 1876 or just before the Harbour was commenced, and this survey shows a considerable shallowing of the Roadstead between 1859 and 1876, but this change no doubt took place between 1868 (the Committee's

1480.

soundings) and those of Messrs. Jerrard and Falle in 1876, or 8 years later. The finding of clay at this date with so great a depth of sand above it, proves that rapid shallowing occurred about that time or previous to the construction of the Harbour.

67. From 1876 to 1889, there was a period of deepening, but since 1889, the Roadstead has been shallowing, and as the Harbour could not act upon the Roadstead in two different ways, I maintain that the deepening and shallowing of the Roadstead in deep water was, and is from natural causes, and is not due to the construction of the Harbour.

I have the honor to be,
Sir,
Your most obedient servant,
A. LEE POGSON, M. INST. C. E., M. I. M. E., &c.,
Engineer,
Harbour Trust Board.

Encl
6/12/56.

PRINTED BY GRAVES, COOKSON AND CO., SCOTTISH PRESS, MADRAS.

C. No: 612 Marine

MARINE C. No 612

Recd 1-8-96

Encls. 4
(2 Plans in duplicate)

MARINE DEPARTMENT.

FROM

THE CHAIRMAN,
HARBOUR TRUST BOARD,
MADRAS.

TO

THE SECRETARY TO GOVERNMENT,
Marine Department.

DATED 27th May 96

DESPATCHED 29th do

RECEIVED

ENCLOSURES 4 (Two tracings in duplicate)
(By Bookpost)

No. 786.

28.8.68. 2773.
7.9.68. 2849.
8.9.68. 2869 W
11.2.96. 529.30 W
18.2.96. 76 E.
7.4.96. 1220.21 W.
7.4.96. 12/1220 W.
18.2.96. 76 E

SUBJECT.

Submitting copy of the Board's Engineer's letter No. 68 A dated 25th April 96 regarding recorded variations in the depth of the roadstead

[illegible] PRESS.

Pr 1/8/96 Urgent

[illegible] 1/6/96

Memo: No: 76 E. d/18th February 1896 cannot be traced among the Marine Records here and there is nothing in the Record Register to show that the Memo: was received into the Records. The attender says that Mr. D. Parsons was aware of the non-receipt of the Memo in the Records and that the latter promised to send it up as soon as it was found. It has not yet been received.

Please have the memo searched for and send it up. If it cannot be traced, please obtain a copy from the Chairman H. T. B. and send it.

Maj
1/8/96

× Memo: to the Chairman, H. T. B. regarding variations in the depth of the Madras Roadstead.

SAW

I fear the Memo itself will be unintelligible without the Charts, and these I think were sent [illegible] Harbour Trust Board?

S.

Note for H. E. the Governor:-

The undersigned has made an attempt to answer Mr. Pogson's arguments, but finds that he cannot go fully into the matter without the old records which are quoted in Mr. Pogson's report. These are not available in Ootacamund, and they will, it is expected, take some time to collect in Madras. Meanwhile it seems desirable that the orders already drafted should issue as soon as possible.

2. The question of the Marine survey of the Harbour roadstead has to be referred to the Government of India, and it is desirable that Mr. Pogson should receive distinct orders to discuss the question of shoaling with the Consulting Engineer in London.

18/6/96

W.

~~H.E.~~

Urgent

Madras Harbour & Roadstead
Shoaling of –

Print emergently

~~Note~~ Back papers
on the Current

449-505

Print and issue
as soon as possible –
File the then submit
for further disposal

20/6/96

C.S.
20 June 96

Marine
~~PUBLIC WORKS~~ DEPARTMENT.

PROCEEDINGS OF THE MADRAS GOVERNMENT.

READ the following

Letter from the Chairman H.I. Board (H.E. No. 786 d/27 May 1896)
(Print with enclos.)

16 P

No. 449 Marine, 20 June 1896

His Excellency the Governor in Council desires that Mr. Pogson be instructed to discuss with the Consulting Engineer in London the subject of this communication. Meanwhile, the Government of India will be requested to arrange, if possible, for a survey of the harbour and roadstead being made by an officer of the Marine Survey of India.

(H.E.

A.S.H.
19.6.96

20/6/96

20/6/96

The Chairman H.I.B. S

Despd. from Madras on 20/7/96

40—300—6-3-96.

(H.E. No. 450 Marine, of 20.6.96)

To,

The Secretary to the
Government of India,
Marine Dept.

Sir,

I am directed to request that arrangements may, if possible, be made at an early date for a careful survey, by an officer of the Marine Survey of India, of the harbour and roadstead of Madras, the gradual hoaling of which within ecent years has been rought to the notice of His cellency the Governor in ouncil.

I have &c.

of Dy/S. from Madras office 20/7/96 11/6/96

A.S.H. 19.6.96

H.D. 20/6/96

J.G.

Note. It does not seem desirable that this discussion should be continued in the Secretariat. It is a matter for consideration by the Consulting Engineer in London.

Marine Dept.

No. 451 Mar. of 20th June 1896

J.P.

Letter - to

10

The Right Honourable
The Secretary of State
for India, London.

My Lord,

A.S.H. 19.6.96

H.D. 20/6/96

J.G. 20/6/96

In continuation of our despatch No. 12/1220 W, ~~dated~~ dated 7th April 1896, we have the honour to forward herewith a further communication from the Engineer of the Harbour Trust Board on the question of the shoaling of the harbour and roadstead of Madras, and to request that the matter may be placed fore the Consulting Engineer gland for considera

Copy

[illegible] discussion with
[illegible] Mr Pogson. We have
meanwhile asked the
Government of India to
arrange, if possible for a
careful survey of the harbour & roadstead being
made by an officer of
the Marine Survey Dept.

We have &ca,

L
11/6/96

Madras Harbour & Roadstead
Shoaling of –

~~The Hon Mr Bliss CIE~~
~~The Hon Mr [illegible] CIE~~

Enclosures. Proceedings of
Government and two
plans. also a copy of Memo No 76E
d/ 18 Feb 96.

D[illegible]D
15 JUL. 96

Marine

449-50-51
20.6.96