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MADRAS RECORD OFFICE.

Government of Madras.

Public works DEPARTMENT.

G.O. No. 554, 555, 556 556	603	Press / Mis.
Dated	25-2-	1873.

Not to be folded or roughly handled

Proceedings of the Madras Government, Public Works Department, *25th February* 1873

Read the following papers —

No 554. From the Superintending Engineer, 1st Division
(Here enter No 2,832, dated 8th November 1872)

No 555. Proceedings of the Madras Government in the Marine Department
(Here enter No 16, dated 5th February 1872)

MEMORANDUM ON VIZAGAPATAM HARBOUR.

Propositions for the improvement of Vizagapatam Harbour have been, I believe, several times laid before Government, but hitherto without result, and also without attracting much attention

The late Governor, Lord Napier, I learned in conversation, had not even heard of it.

It has not been thought worthwhile to direct Mr Robertson even to visit it while examining the coasts.

Having been for some years employed in coast districts on both sides of the Peninsula, and had my attention particularly attracted to the state of the river mouths—harbours they cannot at present be called—I have naturally taken an interest in this important subject, and trust I may be excused if the interest still remains, although no longer in the department to which they may be thought to belong

Government is always slow to undertake harbour works for two good reasons among others, namely, that the *cost* is usually very great, and that the results of such works, depending so much more on the action of nature in the locality, on currents, tides, sands, and on the contour of the coast, than on engineering skill in actual construction, are after all so problematical that the *risk* is great

It is acknowledged by Engineers that much more is dependent on knowledge of local natural circumstances, than on the very best professional talent that can be devoted to it.

It is on these grounds that I venture, with regard to a port that lies daily visible beneath my drawing-room door, to endeavour to call attention to what appears to me a neglected opportunity, and to offer a few suggestions for professional consideration.

2. I submit that Vizagapatam is the most natural, *the most easily formed port on the East Coast of the Peninsula*

Here the mouth of a small tidal river, from 20 to 28 feet deep for half a mile inland from the bar that closes it, is perfectly land-locked and sheltered by hills; has native docks from time immemorial on its banks, and a population accustomed to both building and repairing ships

The projecting headland, called the Dolphin's Nose, forms a sheltered bay in front of the river mouth, so that but for the bar there would, for nine months in the year, be smooth water in what may be called the outer harbour of Vizagapatam, and the access to the inner harbour consequently easy, and permitting of the entrance to it being made as narrow as may be thought well.

The course of the river near the sea is so straight that vessels might warp in with a rope taken to them by a boat

In a small silted-up bay on the south side of the river docks on the European system might probably be excavated with ease, and the same might be done on an unlimited scale in the alluvial flat at the back of the town, or in the disintegrating gneiss of which the other parts of the bank of the river consist

On the present bar lives and goods have been lost, and great inconvenience and delay are at all times experienced *

If it was removed the depth of water within is such that large vessels might lie alongside the wharves, and ship cargo *over a plank*

The port would be made

3 All that it needs is to have the bar removed within it the depth and shelter are all that could be desired

Is the removal of this bar (not long continuous miles of surf as in Madras, but a bar across the narrow mouth of a river,) so great a difficulty as to be properly left untouched ?

It is, I believe, uncertain to what depth it is merely a sand bar, and what amount of rock there may be, but I believe Engineers will at once say that the object being not the clearing of a large anchorage area, but simply the opening of a narrow passage, they would care little whether the obstruction was sand or rock, provided only that natural circumstances were such as to aid in rendering permanent the opening they could with ease make.

Such naturally aiding circumstances, I believe, partially exist and may be partially artificially created

The bar at the mouth of the river is caused by the opposing action of the outgoing, in-coming, and marine currents

If a scour outwards, over-powering other currents, could be created, this bar would be swept away

The river is too small a one to effect this, at any rate with its present undefined sandy mouth

4 In addition to the action of the river and the tides there are the littoral currents to be considered

Usually these are very powerful, and are the greatest difficulty and danger Harbour Engineers have to contend with

Occasionally, however, the force and direction of these currents may be so taken into alliance, as it were, as to aid quite as much as they would otherwise obstruct the formation of a port

When there is no current whatever the silt from a river mouth must inevitably be continually deposited directly in front of it, and, even when the river is powerful enough to shoot it out to some distance, it is still but a question of time, and that comparatively little, within which the river must by this action close its own mouth, the most lengthy and costly series of sea walls only construct a canal

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* The day before the despatch of this letter the largest barque belonging to the port has been driven on shore and wrecked by the action of the surf at the entrance to the river, though there is smooth water both outside and in

The value of this single loss would have sufficed to make the port

in the sea, and at ever increasing expense artificially continues a contest with the forces of nature to which the financial side of the question cannot but put a comparatively early limit

But Vizagapatam is happily situated

It is not without a littoral current, and the current that exists is not an inimical one.

The chief current at Vizagapatam is one that flows northward, as may be daily noted from the colored water it carries past the port.

This current, if properly studied, and taken as it were into our service, will, I submit, do inestimable service.

It will prevent the necessity for a sea-wall at all on the south side of the port, taking, in fact, the place of and doing the work of such a wall.*

It will increase and act with the scour just outside the mouth, and, most important of all, it will carry away northward and seaward all the silt that would otherwise lie at the river mouth in a more complete and thorough way than could be done at enormous cost by a fleet of steam dredges

5 When other means fail to remove a bar or deepen a river recourse may be had to dredging, or to a simpler, much forgotten, far more economical, and powerful method, namely, assisting a river by means of sub-marine grubbers to scour its own bed deeper

This may be done in many ways, but I believe the simplest would here suffice.

6 What I beg to suggest is the following —

The river has already a rocky precipitous bank along the whole of the south side and along half the other.

The remaining portion of the northern side is a spit of sand

The northern bank should be continued as a straight stone wall along this spit of sand, parallel with the southern, for 300 yards, and at the termination should be so taken as to narrow the entrance to the river to such width as may, on consideration, be found best for obtaining a thorough scour, and yet leaving sufficient space for ships to enter by.

7. Whether the northern wall be then still further lengthened in a direction at an angle of 45, or less, with the littoral current, is a minor subsequent question, which should depend upon observation after the above-named portion had been constructed.

This might or might not be found necessary to shoot the silt of the river further out to sea instead of along the coast

8. This defining of the form of the river mouth and the contraction of it would probably do something towards removing the bar.

The chief thing, however, that is required is a continuous current of sufficient strength outwards, and this I would propose artificially to obtain by inserting, along half the length of the sea-wall to be constructed on the north side, tidal shutters to admit into the harbour the rising tide, and keep it enclosed when endeavouring to recede, thus I would admit at least twice as much more water as entered by the open mouth, and compelling the whole to return to the sea by the latter course, would thereby hope to create such a scour there as would certainly perform work that no returning tide could undo.

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* ——— in the Baltic is an interesting instance of a spot where the littoral current has been thus utilized.

9. If the confining wall (1), the above described treble ebb-tides (2), and the friendly current (3) do not suffice to keep the mouth open, I would aid the scouring action by the use of some form of "Turkish rake" (4),* or marine grubber, at the time of the ebb, so to assist river and tide as to decide the point

10 The question of *expense* still remains, but I venture to think the element of *risk* and doubt as to the result of the effect of these four allied forces cannot surely be great

In this scheme nature has done more than half the work, and nothing expensive nor temporary, no breakwater and no steam dredges are necessary, nothing but a sea-wall of moderate length with shutters (protected, if necessary, by wave screen of six rows of piles), and all this in a sheltered bay, and chiefly inside the river mouth

The only work requiring some care and skill would be towards the sea end of the wall, where the scour and the depth of water will be greater, I imagine no estimate of these simple works could rise above £ 10,000, and that they might well be completed within the year

From both banks of the river any amount of stone can be obtained.

The prisoners in the jail are with difficulty found occupation, and might with advantage be employed on this work.

On the very spot where they would be required to work there are buildings capable of housing 100.

Thus, *at the cost of about half the price of one of the steam vessels* calling weekly at the port, a safe harbour might be constructed in the middle of the Bay of Bengal, in which, *within half an hour of the open sea*, vessels of any size might be laid up and repaired.

With slight additional expenditure the European system of docks might be introduced

11 There is only one possible objection I have heard among those who are locally acquainted and satisfied with the entire feasibility of the easy formation of a port here, namely, that the communications with the interior are few and imperfect, and it is not therefore a natural emporium for trade

Vizagapatam has always been backward in communications

But there is no reason in thenatural features of the country why this should continue to be the case

There are now three roads into the interior, and the ranges of hills which come down to within fifteen miles of the coast offer remarkable advantages for the construction of a far better means of transport by the formation of ravine†

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* See Report on the works at the Sulina mouth of the Danube
† At Kashipore Gorge and elsewhere

reservoirs, which would supply water in all seasons for small navigation canals throughout the length of the district.

Canals at first of only small width and depth, mere ditches, with passing places every hundred yards of twice that width would permit the passage of boats which in Malabar convey six tons of cargo each,* and they might be constructed for about the same cost per mile as an ordinary road with its bridges.

The incomparable value of water carriage in taking bulky raw produce to a port is well known.

The opening of the port—*the only port of refuge between Point Pedro and Calcutta*—could not fail largely to increase a trade already not contemptible †

12. The accompanying rough sketches show the present aspect of the river and the alterations proposed.

The small sum required for this great public work might be found direct by the (1) Government, or by the (2) Municipality by loan, if placed in charge of their own harbour dues, or even by one of those (3) enterprizing private individuals not unknown in this district and elsewhere, who value the fame of conferring a public benefit more than wealth uselessly hoarded or childishly wasted

(Signed) E S THOMAS,
Madras Civil Service.

VIZAGAPATAM,
24th September 1872.

No 555A REPORT TO ACCOMPANY ESTIMATES FOR IMPROVING THE MOUTH OF THE VIZAGAPATAM RIVER

THE construction of a groyne at the mouth of the river appears to have been first suggested by the late Master Attendant of Vizagapatam, Captain Pascal, in his letter to the Collector, No 26, of 20th April 1864, and this scheme for improving the port has been revived by his successor, Captain Waters The present estimates have been framed at the request of the Collector, under instructions from the Superintending Engineer.

2. Captain Waters now proposes that "a good substantial groyne, to keep the mouth of the river open from the south-west monsoon, should be run out to 19 feet 7 inches on the south side of the river's mouth," this, he considers, "would break the heavy swell which rolls round the Dolphin's Nose, and causes a heavy surf on the bar. Vizagapatam port would" then "be a safe place all the year round, the water running out of the river in a straight line would be the means of deepening the bar and allow vessels of moderate draught to enter the river," and there would no longer be any "surf on the bar."

3 "A good substantial groyne," *according to the Master Attendant*, should be 40 feet broad at its base near the shore, and widen to 62 feet at 700 feet in length, with a top width of 25 feet, and be raised to 12 feet above high water spring tides The material to be used up to 350 feet is "the largest stones that can be put down in as solid a block as they can be laid," and the outer portion of the groyne to be of stone of all sizes, and his reason for this is the "surf being heavy towards the shore, and the groyne outside only having to encounter the swell" Such a groyne he estimated to cost Rupees 30,000, but states that the nature of his duties will not admit of his undertaking the work

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* Three feet wide and sixty feet long
† As I write fifty six native craft of the largest class lie docked or at anchor in the river for the monsoon

4. In regard to the best position for a single groyne at the mouth of the river, Captain Waters differs from his predecessor, Captain Pascal, who recommended a "loose stone groyne on the northern side of the entrance" This Captain Waters has "every reason to believe would not be of any use," as "the sand constantly being checked by the groyne would cause the place in time to be blocked up," and he considers the proper place for the groyne to be on the *south side* of the river from the Dutch Battery, and that it "should be run out into three and a half to four fathoms water."

5 Captain Waters states that he does "*not* consider that littoral currents have anything to do with blocking the bar." He would carry the groyne out to 19 feet 7 inches, because "the surf does not break so far, the extreme outer edge of the surf being from 300 to 350 feet" His reasons for making the groyne 12 feet above high water spring tides are, "first, there can be no doubt the groyne will sink, second, the surf will not break over it to displace the stones" "Twenty-five feet on the top would be a good support for a platform, and make the groyne of use for tracking ships or boats either in or out of the river, also for landing or shipping cargo"

6. The object of the proposed groyne, as *I* understand it, is that of aiding the natural forces now in operation to maintain the greatest depth of water on the bar that they are capable of producing; and in considering what will be the best means of attaining this end, the following particulars may be noticed —

(*a*) The embouchure of the river is probably more or less affected by the waves, the tides, the littoral currents, the land freshes, and the ebb and flow of tidal water from the extensive swamp to the west of the town.

(*b*) The catchment basin of the Mégahdri river, which flows into the sea at Vizagapatam, covers an area of 220 square miles, which gives a volume of about 3¼ millions of cubic yards of water per hour in the great freshes of the north-east monsoon (assuming that only four inches of rain-fall flow off) to be discharged into the sea through a sectional area of about 7,850 square feet; this gives a mean velocity of 3 105 feet per second, or a least velocity of the current close to the bed of 2 25 feet per second, sufficient, according to Du Buat, to sweep forward gravel of 1 inch in diameter. These heavy land freshes produce the most powerful scour at the embouchure, and would be much more efficacious in clearing a channel at the bar if they were controlled and prevented spreading laterally, which, by causing the flood waters to float on the salt water, enfeebles their action on the bottom.

(*c*) A continuance of land floods for some days, as is often the case in the north-east monsoon, scours the sand off the bar, and carries it far into the road way, from whence it is swept by the current round the point of the Dolphin's Nose. When a strong land fresh occurs at low water spring tides, the current in the river has the greatest fall towards the sea, the body of the bar is completely cleared of sand, and the river's mouth left in the best state.

(*d*) The freshes of the south-west monsoon are never considerable, and exercise very little influence on the bar, so that during the rest of the year the principal natural cause at work in keeping the bar open is the ebb and flow of tidal water from the salt swamp. I may here mention, as showing the extent of this swamp, that the principal salt cotaur of the district is in it at about four miles in a direct line from the river's mouth. According to Stevenson, the "sectional area of estuaries at *low water* bears a nearly constant proportion to the volume of water which runs in and out at each tide, being from 7½ to 10 square feet of area for each million cubic feet of tidal water." Estimated by this rule, the ebb and flow of tidal water over the Vizagapatam bar must be about 305 millions of cubic feet.

(*e*) The littoral currents which are, in my opinion, the principal cause of the bar, may be said to be unceasing, as soon as the current from the south ceases, a re-action sets in from the north. Captain Graves, the Master Attendant at Bimlipatam, who has had great experience both as a practical navigator and also in the service of the Marine Department, appears to think that these currents are as often southwards as northwards, and on any temporary cessation of the one current the other at once takes its place. Captain Graves also informs me that experienced divers at Madras state that the whole face of the beach below tide-water mark, down to a depth of about six fathoms, is in a constant state of transition from the action of the littoral currents

(*f*) Strong easterly winds during the five months, October to February, bringing the sand coastwise southward, puts also in agitation that which has been previously lodged on the left bank of the embouchure, and at the same time forces it into the entry This effect of the easterly winds is strikingly apparent at that period of the year on the beach between Bimlipatam and Vizagapatam, every projecting spur of rock having its northern face then heavily covered with sand, while the southern face is left quite bare The bar is still further disimproved on the setting in of the south-west monsoon by deposits from the southern current driven in by the tide, and it is then found in its worst state.

(*g*) The depth of water in the deep channel at the bar probably now varies *from a normal depth of* 3 *feet to an exceptional one of* 7 *feet*, at low water spring tides Captain Waters informs me that "the trade of the port has *never* been stopped by want of water. The least depth of water at any time on the bar is not sufficient to stop the working of boats drawing 2½ feet of water." *On the 4th December* 1869, *about six weeks after the heavy freshes of the north-east monsoon, he found* 11 *feet of water on the bar* Vessels drawing 6 to 7 feet of water now enter the Vizagapatam river to be laid up for repairs

(*h.*) As might be expected, the deep channel at the bar shifts with every change in the littoral current. When that current is from the south, the deepest part of the bar is on the north side of the embouchure, and when the current sets down the coast the deep channel moves towards the Dolphin's Nose; but there is a projecting spur of rock near the Dutch Battery which prevents it approaching very close to that side.

7. I now proceed to give one or two brief extracts from writers on Marine Engineering, confirmatory of my own views on this matter—

"Recent investigations," Professor Rankine states, "tend towards the conclusion that every wave is more or less a "wave of translation," setting down each particle of water, or of matter suspended in water, a little in advance of were it picked that particle up. This property of waves accounts for the fact that they heap up sand, gravel, shingle, or such materials as they are able to sweep along, upon every flat or sloping beach against which they directly roll; that they carry such materials into the bays and estuaries; and that when they advance obliquely along the coast they make the materials of the beach travel along the coast in the same direction."

"If," observes Burnell, "during the advance of immersed substances, and of detrital matters in suspension, along the shore, under the double impulsion of the waves and of the currents, these alluvions meet a bay, the still-water existing in it will allow the heavier particles to subside; while if, in addition to the comparative tranquility of the bay, there should exist any subsidiary currents, as in the embouchures of rivers, the remaining matter in suspension will be deposited. *Bars are thus formed*, by the deposition of the alluvions upon the line of junction of the littoral currents with that of the down stream, and the axis of the bar follows that of the resultant affected by the velocity, the volume, and the direction of the down stream"

Again, Rankine states that "the *tidal* currents sweep along with them silt, or mud, sand, gravel, and other materials; hence the ebbing tide tends to scour and deepen inlets, and the flowing tide to silt them up, and the prevailing tendency of the tides, like that of the waves, is to choke and fill up estuaries, river channels and other inlets A strong fresh water current" (or a reflow of back-water) "may maintain a deep channel against this action of the sea; but where that current escapes into the open sea, a *bar is formed* by the action of the waves and tides.' "One of the chief objects of harbour engineering is so to manage and modify the action of the tidal currents that the ebb shall become stronger than the flood, and shall *scour deep channels and remove bars*"

8. In accordance with the above quoted authorities, I am of opinion that the littoral currents are the chief cause of the Vizagapatam bar, as they sweep past the mouth of the river laden with detrital matters in suspension, and meet there with the powerful ebb and flow of tidal water caused by the salt swamp. On the other hand, the reflow of backwater is the principal agency now at work in keeping open a channel through the bar. The most important effect of making a deep, direct, and regular channel into the river would be that of increasing the extent of rise and fall of the tide in the swamp, and thus improving the scour on the bar

9. In the present state of the river whatever tends to cut off or diminish the reflow of tidal water from the swamp is a detriment to the scour at the river's mouth, and to the maintenance of a channel at the bar.

I am therefore decidedly of opinion that further reclamations in the swamp should not be encouraged, at least until the mouth of the river has been improved.

10 "*In order to increase the depth over a bar*," Rankine writes, "piers or breakwaters must be carried out so as to concentrate the current over it, and it is best, if possible, to make the space between those piers *widen inwards*, in order both to hold scourge water, and to serve as a 'wave trap' When there is only one pier, it should run from the *up-stream* corner of the entrance" In a case like that of Vizagapatam, where the current down the coast is almost, if not quite, as powerful and lasting as that up, both equally laden with silt or mud, sand, gravel and other materials, I consider two piers or groynes necessary in order to sweep the bar into deep water, and, if possible, remove it altogether.

11 To remedy the constant state of fluctuation that the bar is subject to, both with regard to the depth of water upon it and the position of the deep channel, I propose, first, a river embankment, 850 feet in length, to be constructed on the left bank of the river, from A to B (see plan), to confine its waters to one invariable direction, without contracting the section of channel beyond what nature has itself provided a few hundred yards higher up, preventing the lateral spread which now enfeebles its action on the bar, and admitting of an increased velocity being employed to deepen the passage at the mouth, second, a groyne in prolongation of the river embankment to be carried out into deep water at 1,200 feet from the shore, and to be eventually prolonged seawards, and, third, a groyne of 1,000* feet in length, to be carried out as shown on the plan from the rocks near the Dutch Battery.

12 These groynes being carried up to three feet above the highest floods, would assist in confining the river until it had reached deep water, prevent the deposit of sand, gravel, etc, in the channel by winds or currents, and at the same time destroy the surf and secure the safety of passengers and goods being conveyed to and from the landing place Native craft of considerable size would also then be able to unload in the river

13 I anticipate that the waves, which now break violently into surf on the steep declivity at the river's mouth, checked and broken by the groynes, would spread and expend themselves without a surf as they advance up the gradually* widening channel of approach to the river's mouth over a gently sloping beach

14 One of the many advantages that Vizagapatam possesses over most other places for the construction of such works consists in the abundance of good material in the rocky hills close to the site I would propose to open quarries, and by means of short tramways, convey the stone to the spot where it is to be deposited. The ordinary effect produced by throwing out a groyne is that sand is accumulated on the up side of it, that is in a direction meeting that of the current, until it has filled the angle, when it passes the point and accumulates in the still water behind the groyne, I would therefore carry out these groynes as far as possible into deep water, with a view to such sand as passes the point being swept past the entry, or out to sea by the reflow from the swamp, and I have therefore provided for a length of 1,000 feet * With regard to the height of the work, I understand that the best examples of breakwaters now existing only rise a few feet above the water, and as I propose that the faces of the work should, as far as practicable, be covered with hammer-dressed stone of large size, cramped and pinned with iron, and the crown laid with hydraulic cement, I consider a height of 3 feet above the highest floods would be amply sufficient.

The foundation of the groynes to be of stones thrown in promiscuously, and left to form their own natural slope till they appear above low water, above that level to be placed by hand as far as practicable and well packed I propose cramping and pinning, or using hydraulic mortar for the exposed surfaces, because the chief danger to the face of such a work is that air and water penetrate the joints, and by their pressure and elasticity cause the stones to jump after receiving the blow of a wave.

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* Altered by Colonel Fischer to 600

* Colonel Fischer altered the plan to parallel groynes

* According to the original plan.

15 My estimates show that a single groyne of the description proposed by the Master Attendant would cost Rupees 67,500, while works of the nature I consider necessary could not be constructed for less than Rupees 2,29,800.* I leave to the Collector, who called for these estimates and who is possessed of statistics of the general trade of the district, the task of explaining the probable effect of such improvements, and showing whether any possible future trade of the port is likely to warrant such an outlay. The present shipping trade of Vizagapatam would evidently furnish no criterion of the probable value of such works, as all the exports of the north and west of the district, which now find their way to Bimlipatam, would at once be diverted to Vizagapatam, and *it* would doubtless eventually become the chief port of the district

16 I am also of opinion that the construction of a single groyne, whether to the north or south of the embouchure, but especially the latter, would be a dangerous experiment, for though most useful during the south-west monsoon, when a groyne on the south side would protect boats entering or leaving the river from the great violence of the surf at that period of the year, it might possibly result in the complete blocking up of the river's mouth in the dry season, as the effect of the easterly winds, described above in paragraph 5 (*f*), thereby temporarily stopping the supply of salt water to the swamp, besides other evils which would no doubt prove most detrimental to the health of the people at Vizagapatam

17 In conclusion, I would suggest, in view of any outlay being incurred for the improvement of this port, that the Marine Department be directed to keep a register of the levels of high and low water, and of the depths of water in the deep channel at the bar during the months of October, November, December, and January, when the bar is in its best state, also of the velocities of the currents into and out of the backwater at half ebb and half flood This may be done by the present establishment at little, if any, cost, the currents being measured with a Massey's log, or other instrument, in which the rotations of a fan driven by the current are registered by wheel work.

18 The proposal to construct a groyne at the river's mouth has already been reported on by Lieutenant J. F Dorward, R. E, in his letter to the Superintending Engineer, No 570, of 31st October 1870 The Superintending Engineer has also lately personally inspected the site of the proposed groynes, and I believe my present plans and estimate to be in accordance with the suggestions he then made

19 This report is accompanied by—
1 Plan of the mouth of the Vizagapatam river
1 Plan showing sections of proposed groynes and river embankment
1 Cross sections of sand bank at the mouth of the river
1 Estimate of works proposed by the Executive Engineer

WALTAIR,
8th November 1871

(Signed) J. BEATTY, Captain, R E,
Executive Engineer

(Revised Copy.)

WALTAIR,
15*th January* 1873

(Signed) J BEATTY, Major, R E,
District Engineer, Vizagapatam

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* The original estimate was 2,44 000 Rupees, and was revised by Superintending Engineer to Rupees 2,29,800

ESTIMATE No 31 OF 1871-72

Revised Estimate of the probable Expense of constructing two Groynes and an Embankment at the mouth of the Vizagapatam River

Measurements			Cubic Contents	Particulars of Work	Rate	Per Item	Amount			Total
Length	Breadth	Depth					RS	A	P	
				I—River Embankment from the present landing place to mouth of the river near the Ice House						
850	Area 210¼	..	178,712½	Embankment on the line AB See plan		..				
850	Area 63		53,550	Deductions for hammer-dressed stone work						
			1,25,162½	or 4,635-17½ cubic yards of loose rubble	2	C yd	9,271	4	8	
Feet 850	Area 63		53,550	or 1,983⅓ cubic yards of hammer-dressed stone, cramped and pinned with iron or laid with hydraulic cement	7	,,	13,883	5	4	
							23,154	10	0	
				Contingencies and Superintendence	20	P N	4,625	6	0	
				Total for river embankment			..			27,780
				II—Groyne on the north bank of the river near the Ice House.						
1,200	Area 860½		1,032,300	Groyne on the line B C See plan		..				
	Area 1,881½	8¾	16,463⅞	Ends of do			..			
			1,048,763⅛							
1,200	Area 189		226,800	Deductions for hammer-dressed stone work						
			821,963⅜	or 30,443-2⅛ cubic yards of loose rubble	2	C yd	60,886	2	6	
1,200	Area 189		226,800	or 8,400 cubic yards of hammer-dressed stones, cramped and pinned with iron or laid with hydraulic cement	7	,,	58,800	0	0	
							1,19,686	2	6	
				Contingencies and Superintendence	20	P N	23,933	13	6	
				Total for North Groyne			..			1,43,620
				III—Groyne on the south bank of the river near the Dutch Battery						
600	Area 624		374,400	Groyne on the line D E. See plan						
	Area 1,320	6⅔	8,800	Ends of do	..		.. ..			

sections accompanying Major Beatty's report are inexact as to plan, and inconsistent as to soundings Mr Thomas remarks that in planning harbour works much more is dependent on knowledge of local natural circumstances than on the very best professional talent that can be devoted to it It would be more correct to say that no professional opinion can possibly be formed without a precise knowledge of local natural circumstances; and that when these are known real professional knowledge is shown by drawing correct conclusions from them.

7 I am led by the facts recorded in Major Beatty's thoughtful paper to arrive at a very different conclusion from his, and one agreeing with Sir A. Cotton's, in placing whatever works are to be carried out on the southern side. I agree with Major Beatty that, if two groynes are to be thrown out, the southern should overlap the northern considerably; Lieutenant-Colonel Fischer's argument in paragraph 4 of his letter No. 2,173 of 12th October 1871, having failed to take into consideration the difference between a southern groyne and an ordinary projecting rock, in that the former would have a current running along its northern face to sweep it clean I anticipate no other effect from a southern groyne than that of throwing out the bar as many hundred feet beyond the present bar as it is long, a position in which the depth over it would be greatly increased and the surf on it proportionably diminished But to guard against a proportionate advance of the northern sandy beach, and contracting of the space between it and the bar in its new position, it will be necessary not to connect the southern groyne solidly to the main land, but to leave an interval bridged over by a pier on piles through which there shall always be free action of tide and current. What shall be the extent and material of such open pier, what the extent of its solid prolongation, what their exact direction and position with reference to the main land, are all details that cannot be worked out without a good survey and soundings all along from the Dolphin's Nose to the northern extremity of the bar

8 I recommend that the collection of such materials for further reliable plans and estimates be undertaken by the special officer placed at the disposal of the Inspecting Engineer for Ports and Communications for ghaut work in Jeypore, in the intervals when such work cannot be prosecuted. It would appear from the commercial statistics supplied by the Collector that the value of exports at Vizagapatam has averaged over 8 lakhs for the last five years against 6 lakhs for the five years previous, and that of imports more than 10 lakhs against 7 lakhs per annum, while the average of exports at Bimlipatam for ten years past is 20 lakhs, and the last five years average of imports equal to that of Vizagapatam, the excess being due to the resort of European shipping to the former harbour to treble the tonnage of those frequenting Vizagapatam. The facilities for improvement of the latter harbour at a moderate cost, say within 1 lakh of Rupees, appear to me greatly to outweigh those offered at the former, and with a fair improvement to the communications between the two places, it is presumable that if Vizagapatam river were made easy of access to vessels of not more than 12 feet draught it would supersede the rival port almost entirely. It would consequently be desirable to concentrate operations at Vizagapatam, at all events in the first instance.

(Signed) G. W. WALKER, Colonel, R. E.

No 556

CIVIL WORKS, No. 34.

ORDER THEREON, 25th February 1873, No 603.

ORDERED that copies of these papers be printed and forwarded to the Inspecting Engineer for Ports and Communications, who will arrange for the preparation of the survey and soundings at Vizagapatam.

2 The Marine Department will be requested to provide Rupees 600 for the purpose from Port Funds for expenditure in 1873-74.

(True Extract)

Colonel, R E,
Secretary to Government.

To the Inspecting Engineer for Ports and Communications
,, District Engineer, Vizagapatam
,, Revenue Department
,, Marine ,,
,, Controller of Public Works Accounts
To E Thomas, Esq

Exd E C Shunker.

No 90

Executive Engineer's Office
Camp Aganampoody
26th September 1872

From The Executive Engineer
Vizianagram Range

To, The Superintending Engineer
1st Division
Dowlaiswaram

Sir;

As requested in your docket No 1379 of 11th July 1872, I have the honor to furnish the Estimate of Captain Graves' groin called for in para 2 of G.O. No 1350 of 27th June 1872, together with a Plan of Bimlipatam, and soundings on the coast near it.

2 — Captain Graves' proposal was thus stated in his letter to the Master Attendant of Madras dated 14th February 1872. "It requires a good groin to the Southward of the Backwater for which there is a good foundation of Rocks jutting into the Sea for about half the length of the Groin required, which it would be necessary to carry out to a depth of 3½ fathoms; this would prevent the silting up of the mouth of the Backwater by the sand which is brought along by the southerly currents." This Groin or pier appears to Captain Graves to be the only method of

improving the Port, and he estimates that it would be 800 yards long, contain 74,800 Cubic yards of stone, and Cost 1,30,000 Rupees.

3 This idea of a single Groin off Bimlipatam is no new thing, and years ago the late Major Agnes selected Cemetery Point as the best site for it. The soundings now taken show that a shorter and cheaper groin could be run out there and produce much the same effect as the longer one from Mackenzie's Tower, which is the site selected by Captain Graves.

4 As the object to be attained by the Groin is the protection of the River's mouth from deposits brought there by the southern current, I append a table framed from observations taken at the Vizagapatam Observatory, showing the direction of the winds which, judging by the general bearing of the Coast line may be supposed to influence the littoral Currents. From this it seems probable that during the past twelve months the current was from the South 231 days and from the North 135 days.

5 Again the site on which Bimlipatam stands may be regarded as the extremity of a great natural Groin, which there fixes the Coast line and protects it from the encroachments of the sea; and it will be observed by the soundings on the Plan that the head of the existing Groin has been swept quite clear of sand on its southern face.

10a

River? taken [illegible]

6 These soundings were, however taken in the months of August and September when southerly winds had prevailed for upwards of six months, and to thoroughly determine the effect of the Currents and sand deposits a further set of soundings should be taken about the beginning of February when the land freshes, sand drift, and northern current have completed their work, and the Current begins again to be from the south.

7 In addition to protecting the River's mouth from the deposits of the southern Current the Groin would no doubt greatly moderate the surf on the bar, which is often most violent during the South-west Monsoon. There is generally a heavy swell on the sea at that period rolling up from the south which causes a heavy surf on the bar, and this of course seriously interferes with shipping operations.

8 But the ordinary effect produced by throwing out a groin is that sand is accumulated on the up side of it, that is in a direction meeting that of the current until it has filled the angle, when it passes the point, and accumulates in the still water behind the groin. Hence the question arises how long will the proposed groin be a protection to the Port, for as soon as the sand has begun to pass the point & accumulate on the northern side of it, the mouth of the Backwater will soon be driven away from the Town towards the North, which the mercantile community would certainly regard as an injury to the Port.

9 Again it seems to me not impossible that the deposits on the northern face of such a groin, caused by the land freshes, sand drift, and northern current would be as great as, if not greater than, those caused on the other face by the southern current, and consequently that the line of beach on both sides of the groin would advance seawards, the Town be left far inland and the shipping have to anchor

at

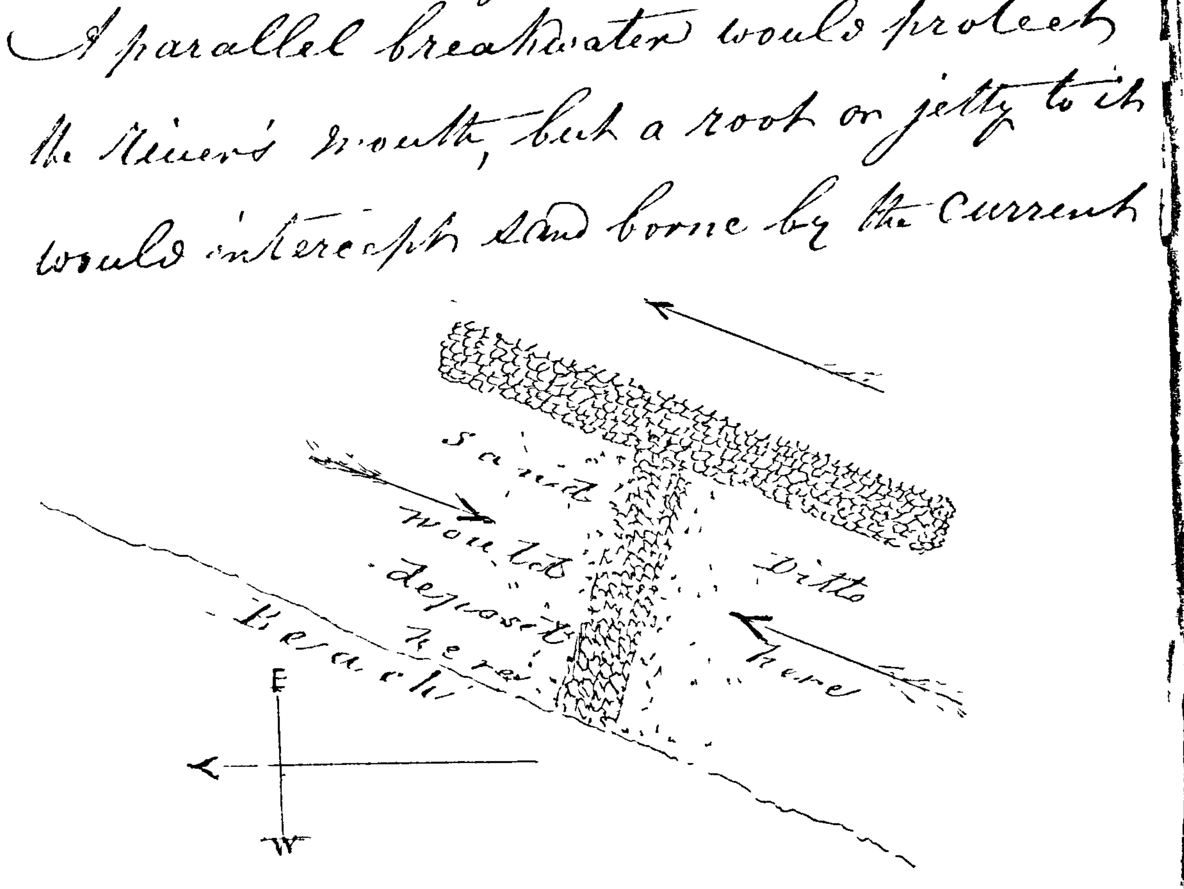
at a greater distance than they do now ~~[illegible]~~

Captain Graves, however, is of opinion that the deposits from the land freshes and northern current are very trifling and may be disregarded; also that the sand drift, which certainly has considerable effect at the mouth of the Vizagapatam River, is harmless at Bimlipatam.

10 The following Extract from a letter of the late Colonel Ouchterlony now on Record at Bimlipatam, will show you that I am not singular in my views of the possible consequences of constructing such a work:—

" I am afraid the Master Attendant's T Breakwater would form a nucleus for sand to collect against.

A parallel breakwater would protect the River's mouth, but a root or jetty to it would intercept sand borne by the current



But cut away the Stem and the Current would sweep away the sand fast enough".

11 "The present unfavorable condition of the Bimlipatam bar is not in my opinion solely or chiefly due to the southern current, but has been mainly caused by the failure of the north east monsoon last year. If we have the customary high floods in Octr. and November next the bar will doubtless be cleared and left in its normal state.

12 The drainage area of the Gostanuddy river which flows into the sea at Bimlipatam is supposed to be about 600 to 700 square miles. In the last few miles of its course it is about one hundred and fifty yards broad, and in the great freshes of 1870 it rose to a height of 22 feet on the floor of the Chittivalsa bridge. The freshes of the south west monsoon are seldom considerable, and have very little effect on the bar; but a continuance of land floods for some days as is often the case in the north east monsoon, produces "as powerful scour at the bar, which clears away the sand, carrying it far

far out into the roads, whence it is swept down the coast by the northern current the prevailing.

13 The easterly winds also from Octobe to February bring the sand coastwise to southward, put in motion that previously lodged on the left bank of the entrance and tend to choke it, and injure the bar, which is further disimproved on the setting in of the southwest monsoon by those deposits, from the southern current, which Captain Graves proposes to stop by means of a groin.

14 The usual annual clearance by the land freshes did not take place in Octobe and November 1871, owing to the failure of the monsoon; long continued dry weather came instead accompanied by easterly winds, producing sand drift, choking the river's mouth, and loading the bar with sand; this again being followed in the usual course by southerly winds and currents with their deposits.

Digging

15 Digging or dredging at the Bimlipatam bar would I consider be almost useless, because the River's mouth is continually shifting and never remains a fortnight in the same condition. The Master Attendant agrees with me in this; he suggests dredging as a partial remedy of doubtful effect. It seems to me more than doubtful and that it could only be resorted to with any advantage after the channel for boats had been fixed by training groins, such as were proposed by Colonels Moberly and Shaw Stewart.

16 I have estimated for making the base of Captain Graves' groin of large rubble brought by tramway from quarries to be opened in the southern face of the hill, the stones to be thrown in promiscuously to the level of low water, and I have assumed that they would take a slope of 5 to 1, the superstructure to be of the largest stones, say one to two tons in weight, and carefully laid from the level of ordinary low water, with side slopes of 3 to 1, the top to be 13 feet broad with a height of 4 feet above spring tides, so that though heavy waves would break over the work, it would afford considerable shelter in the southwest monsoon.

17 The Estimate amounts to Rs: 135,900, which is not much more than the Master Attendant calculated it would come to; and if his opinion be correct as to the insignificance of the deposits likely to form on the northern face of the groin, it is no doubt the most feasible method of improving the Port.

18 But before Government embarks in any large outlay for merely improving the open Roadstead at Bimlipatam, some consideration should I think be given to the scheme sub×mitted a few months since for improving the bar at Vizagapatam, which might possibly enable ships to enter the River there, and make it the Chief harbour of the Eastern Coast.

× Estimate Rs: 244,000

I have &c &c

(Signed) J. Beatty Major R.E.
Executive Engineer

(True Copy)

Lieut. Col. R.E.
Actg Supg Engineer 1st Dn

Statement shewing the course of the Winds from August 1871 to July 1872 inclusive prepared from the Records of the Vizagapatam Observatory.

Wind from	August 1871	September	October	November	December	January 1872	February	March	April	May	June	July	Total
NW	0	2	0	0	0	0	0	0	0	0	0	1	3
NW by W	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW	2	0	0	0	0	0	0	0	0	0	0	1	3
W by N	1	0	0	0	0	0	0	1	2	1	1	0	6
W	8	7	1	0	0	0	3	8	7	4	9	14	61
W by S	2	3	0	0	0	0	2	2	1	2	4	4	20
WSW	2	1	0	0	0	0	0	6	2	6	5	0	22
SW by W	1	0	0	0	0	0	0	0	0	0	1	2	4
SW	1	1	1	0	0	0	6	4	4	4	2	3	26
SW by S	1	0	0	0	0	0	0	1	0	0	0	0	2
SSW	0	1	0	0	0	1	0	0	0	1	1	1	5
S by W	1	0	1	0	0	0	1	0	1	0	0	0	4
S	5	7	2	0	1	0	2	4	7	4	3	3	38
S by E	2	2	1	2	1	1	0	3	0	2	1	1	16
SSE	0	0	1	1	0	1	4	1	2	0	1	0	11
SE by S	1	1	3	1	0	2	1	0	0	0	0	1	10
Total days of Current from the South	27	28	10	4	2	5	19	30	26	24	28	31	231

Wind from	August 1871	September	October	November	December	January 1872	February	March	April	May	June	July	Total
NW by N	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0	0	0	0	0	0	0
N by W	0	0	0	0	0	0	0	0	0	0	0	0	0
N	0	0	0	0	0	0	0	0	0	0	0	0	0
N by E	0	0	0	0	0	0	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0	0	0	0	0	0	0
NE by N	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	0	0	0	1	3	1	0	0	0	0	0	0	5
NE by E	0	0	0	1	1	0	0	0	0	0	0	0	2
ENE	1	0	3	13	10	6	0	0	0	0	0	0	33
E by N	0	0	2	7	2	3	0	0	1	0	0	0	15
E	2	1	4	4	6	8	2	0	0	1	0	0	28
E by S	0	0	1	0	2	0	0	0	0	0	0	0	3
ESE	0	0	2	0	3	3	0	0	0	0	0	0	8
SE by E	0	1	1	0	0	0	0	0	1	2	0	0	5
SE	1	3	8	0	2	5	8	1	2	4	2	0	36
Total days of Current from the North	4	5	21	26	29	26	10	1	4	7	2	0	135

Executive Engineer's Office
Waltair
September 1872

(Signed) J. Beatty Major R.E.
Executive Engr. Vizagapatam

(True Copy)

Lieut. Col. R.E.
Ag. Supg. Engineer 1st Dn

PW 5613/72

15a

Estimate No of 1872.73

Estimate of the probable expense of Captain Grace's Groin at Bimlipatam

Number	Length	Breadth	Depth	Cubical Contents	Particulars of Work	Rate	Per	Amount
					Groin commencing at Mackenzies Tower and extending due East to 3½ fathoms at High water of Spring Tides			
	480	216	"	103680	Portion of Groin from the Tower to ordinary low water			
	1680	309		519120	From low water to end of Groin			
	22½	40¾	3¾	3438	Sloping termination of groin			
				626238	C. ft. or 23194 C. yds of large stone of one to two tons weight carefully laid from low water level on a foundation of loose rubble	2 " "	C. yd	46388 " "

No. 18

1st Enclosure
in [illegible] letter No. [illegible]
26th October 1852

From
Captain [illegible] M. Grove
Master Attendant

To
Colonel J. Fischer R.E.
Chief Engineer [illegible]

Sir,

Replying to your letter of yesterday's date, I have the honor to forward you my opinion on the several Points therein called for.

1st I do not from actual observation consider that a Groin run out from Mackenzie's River would accumulate sand around it, the difference in the depth of water at the same distance from the shore is to be accounted for by the fact of the shoal part being off the mouth of the River and the silt brought down will naturally tend to shoal the sea opposite the River's mouth. I would here remark that my opinion has been altered as to the best spot to run the Groin out from, and I concur with Major [illegible]'s opinion that it should run out from the Cemetery Point.

176

2nd I am of opinion that it would be most advisable to do away with the Backwater entirely, which is very shallow and is not used [illegible] to leave [illegible] the River

which is required for [illegible]

[illegible]

[illegible]

[illegible]

[illegible] of the River [illegible] affording a large

[illegible] the River [illegible]

[illegible] that in calling

[illegible] N.E. and S.W. [illegible]

[illegible] the following would be the very best plan for

[illegible] or heaviest

shipping season being during the prevalence of the

N.E. and S.W. winds ships would be perfectly

sheltered [illegible] the Breakwater and Boats [illegible]

[illegible]

ship with ease in any state of weather, and one would be quite independent of the River for shipping purposes.

4 I have no register of rise and fall for a series of years but the rise and fall in spring tides is 3 feet 9 inches and at the Neaps 2 feet 8 inches.

I have &c yours

(Signed) [illegible] Graves

Master Attendant

(True Copy)

As. Superintendent [illegible]

184

P.W. 5613/72
in No. 556/24 Feby 73.
Enclosure in a letter
No 2832 dated 8th November
1872 from the Superinten-
ding Engineer 1st Division
to the Secretary to Govern-
ment D.P.W. [illegible]

No 2832

Superintending Engrs Office 1st Dn.
Dowlaiswarum 8th November /72
Despd 9th Do

19

From,
Lieutenant Col. B. R. Fischer R.E.
Ag Superintending Engineer 1st Dn.

To,
Colonel G. W. Walker R.E.
Secretary to Government D.P.W.
Madras

Sir,

Adverting to G.O. of the 27th June 1872 No 1550 I have the honor to forward Major Beatty's survey of Bimlipatam together with an Estimate amounting to Rupees 1,42,000 for constructing the groin at first proposed by the Master Attendant. On the 25th October last I met Major Beatty at Bimlipatam and with him consulted the Master Attendant who has been good enough to put his opinions in writing, and I herewith transmit a copy of his letter to me, and a Sketch Map showing the probable position

+ [illegible] Baughy

position of the backwater.

2. It will be observed Captain Graves now proposes to change the position of the groin from near Mackenzie's tower to Cemetary point the place formerly selected by the late Major Ryves for such a work, para 3 of Major Beatty's report; I regret to say I cannot undertake to recommend the construction of the groin at all, and agree altogether with the late Colo Ouchterlony in this matter whose objections are referred to in para 10 of Major Beatty's report, I would also beg to point out that the existing groin to which he refers in para 5, is a natural spur of the hill running out into the Sea near Mackenzies tower and from the survey it can be seen that the sand forms around this and shoals out so that 4 fathom water is found at

at

at a distance of 700 yards from the beach, immediately to the South of this natural obstruction 4 fathom water 200 is obtained within 250 yards distance from the beach, the opinions then formed by Colonel Ouchterlony regarding this matter and the conclusions arrived at by him appear to be quite correct and if we now increase this obstruction the probability is that the accumulation of sand will be increased in proportion.

3. The next point mentioned by Captain Graves is the adviseability of confining the current of the river and the tides to one branch instead of allowing these to dissipate their strength altogether in the swamp and backwater. This measure I had already advocated but the Government were not then pleased to approve of the suggestions; so far as

clearing the bar is concerned I am still of opinion this is quite correct in principle, for unless tidal Sluices are constructed to store the flood tide waters in the backwater and discharge them at half ebb to scour the bar there is in its natural state cannot effect the object; the rise and fall of the tide is so small that it is hardly worth while constructing such works which would moreover require similar embankments to be attached to them as the United I had proposed for confining the ordinary flood discharge of the river to one branch only, and providing for discharging all excessive ordinary floods to the North of Bimlipatam at a point at which the river now discharges itself in such seasons.

4. The next point on which Captain Graves writes is the feasibility of constructing a Breakwater at Bimlipatam; on the Sketch Map of the Port I have marked the site this would be likely to occupy in about 4½ - 6 7½ fathoms of water - its length would be about 2500 yards and mean height 36 feet to the level of ordinary tides, but if raised to the level of spring tides the height would have to be 42 feet so as to have the crest 2' above this level - if this is made 10 yards wide at top and the inner slope 1 to 1 and outer slope 5 to 1. the cubical contents will be nearly 2 Millions Cubic yards of stone - this can be obtained from an adjacent Hill and delivered at the site for 3 Rupees per Cubic yard so that the probable cost will not be less than

60

60 lacs of rupees.

5. The coast at Bimlipatam certainly affords many facilities for constructing a Breakwater at the line of this which at Vizagapatam is nearly East and West with a southern aspect much exposed to the violence of the South West Monsoon turns at Bimlipatam so as to be North and South facing the east almost, and is even now protected to some extent from the South West Monsoon, immediately to the North the line of coast runs North East nearly, so that either end of the Breakwater would be well protected under all circumstances, and as Captn. Graves anticipates all shipping and landing operations could be carried on direct from the beach at all seasons,

from

from the fact of so much deep water now existing near the coast line

at this site the marine currents must be able to keep the anchorage clear and to sweep away all deposits brought down by the river

6. No tide guages have been maintained at this port except for the short time the survey was preparing but Captain Graves has been good enough to give me the result of his own knowledge and observations and it appears that ordinary tides rise only 2'8" and spring tides 3'9" so that the strength of these after rising over the bar can be easily lost in an estuary of very small capacity; the day we were at Bimlipatam I was unable to go on the bar as the weather was

most unfavorable, a very heavy surf was running and the Master Attendant said it was impossible for boats to go out - there have been no heavy freshes in the river ~~this~~ season and I regret to report the bar is at present in a very unsatisfactory condition, [illegible] Effect of the Northern current is in clearing away the sand near McKenzie's bar deposited by the South West Monsoon - was distinctly visible and pointed out to us by Captain Graves, by constructing a groin at this point this natural action would be greatly interfered with and the Mouth of the river [illegible] 1/2 a mile away to the north of the Port in all probability.

7. The project referred to in the last para of Major Beatty's report for improving the entrance to the Vizagapatam back-water has I believe been disposed of by Government but no orders on the subject have been communicated to this Office, and I am therefore unable to give the Number and date, this backwater is probably the most valuable on the whole coast and has been used from time immemorial by the Native Ship-Owners for docking and repairing their Vessels; the bar at the Mouth is very dangerous during the South West Monsoon and all shipping and landing operations are carried on with the greatest difficulty, but once inside the bar there is sufficient depth of water for any ordinary Merchant Vessels or Steamers and the anchorage in the river is completely land-locked; the project provided for running out

two stone groins parallel to each other so as to keep a good scour on the bar and to extend these beyond the outer line of breakers to maintain smooth water at the entrance; even now there is always sufficient water on the bar for cargo boats and after any heavy freshes in the river this is considerably improved so that Vessels of considerable burden are able to come in, repair and go out to sea again, if the water in the bar were deepened to 15 or 18 feet, Vessels with their cargoes might be tugged into the Backwater discharge their freight take in cargo and be towed out to sea with every facility; the cost of the project 2½ lacs of rupees was not excessive

and

and the many advantages it held out were very encouraging; and as at Bimlipatam there is an abundance of good Materials at hand for such a work and during 8 Months of the year this would probably progress without any interruption

I have the honor to be
Sir
Your Most Obedt. Servt.
Lieutt. Col. R.E.
Ag Superintending Engineer 1st Divn

Pro 8th April /59 No 71-72
" 8th Aug — " 32-33-
" 5th Feby /72 - order of 16
Marine Depn
" 1st May — " 8 Nos
" 27 June — 386-387-
" 29 July — 221 Nos

1872 Department
From P.W. for Imp. Ry
No 5613
The Supy Engineer
1st Division

To
The Secretary to Govt
P.W.D.

Dated 8th
Despatched 9
Received 15 } November 1872

No 2032.
Enclosure Six

Forwards Major Beatty's Survey of Bimlipatam together with an Estimate amounting to Rs 14,200 for Constructing the groin at first proposed by the Master Attendant On the 25th October last.

R:C: 11 Feby/73 R. Br
C 8 Feb/73

No 603 - 25th Feby/73

1

354

Memorandum on Vizagapatam Harbour.

Propositions for the improvement of Vizagapatam Harbour have been I believe several times laid before Government, but hitherto without result, and also without attracting much attention.

The late Governor, Lord Napier, I learned in conversation, had not even heard of it.

It has not been thought worth while to direct Mr Robertson even to visit it while examining the coasts.

Having been for some years employed in coast districts on both sides of the Peninsula, and had my attention particularly attracted to the state of the river mouths - harbours they cannot at present be called - I have naturally taken an interest in this important subject, and trust I may be excused if the interest still remains although no longer in the department to which they may be thought to belong.

Government is always slow to undertake harbour works for two good reasons among others, viz. that the cost is usually very great, and that the results of such works, depending so much more on the action of nature in the locality, on currents, tides, sands, and on the contour of the coast, than on engineering skill in actual construction are after all so problematical, that the risk is great.

It is acknowledged by Engineers that much more is dependent on knowledge of local natural circumstances than on the very best professional talent that can be devoted to it.

It is on these grounds that I venture, with regard to a port that lies daily visible beneath my drawing room door, to endeavour to call attention to what appears to me a neglected opportunity, and to offer a few suggestions for professional consideration

I submit that Vizagapatam is the most natural, 2. the most easily formed port on the East coast of the Peninsula.

Here the mouth of a small tidal river from 20 to 28 feet deep for ½ a mile inland from the bar that closes it, is perfectly landlocked and sheltered by hills, has native docks from time immemorial on its banks, and a population accustomed to both building and repairing ships.

The projecting headland called the Dolphin's nose forms a sheltered bay in front of the river mouth, so that but for the bar there would for 9 months in the year be smooth water in what may be called the outer harbour of Vizagapatam, and the access to the inner harbour consequently easy and permitting of the entrance to it being made as narrow as may be thought well.

The course of the river near the sea is so straight that vessels might warp in with a rope taken to them by a boat.

In a small silted up bay on the south side of the river docks on the European system might probably be excavated with ease and the same might be done on an unlimited scale in the alluvial flat at the back of the town or in the disintegrating gneiss of which the other parts of the bank of the river consist.

On

*On the present bar lives and goods have been lost, and great inconvenience and delay are at all times experienced.

If it was removed the depth of water within is such that large vessels might lie alongside the wharves, and ship cargo over a plank.

The port would be made

3. All that it needs is to have the bar removed. within it, the depth and shelter are all that could be desired

Is the removal of this bar (not long continuous miles of surf as at Madras, but a bar across the narrow mouth of a river) so great a difficulty as to be properly left untouched?

It is I believe uncertain to what depth it is merely a sand bar, and what amount of rock there may be, but I believe Engineers will at once say that, the object being not the clearing of a large anchorage area, but simply the opening of a narrow passage, they would care little whether the obstruction was sand or rock provided only that natural circumstances were such as to aid in rendering permanent the opening they could with ease make.

Such naturally aiding circumstances I believe partially exist and may be partially artificially created.

The bar at the mouth of the river is caused by the opposing action of the outgoing, incoming and marine currents

If a scour outwards overpowering other currents could be created, this bar would be swept away

The river is too small a one to effect this at any scale

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* The day before the despatch of this letter the largest Barque belonging to the port has been driven on shore and wrecked by the action of the surf at the entrance to the river though there is smooth water both outside and in. The value of this single loss would have sufficed to make the port

rate with its present undefined sandy mouth.

In addition to the action of the river and the tides 4.
there are the littoral currents to be considered.

Usually these are very powerful, and are the greatest difficulty and danger harbour engineers have to contend with.

Occasionally however the force and direction of these currents may be so taken into alliance, as it were, as to aid quite as much as they would otherwise obstruct the formation of a port.

When there is no current whatever the silt from a river mouth must inevitably be continually deposited directly in front of it, and, even when the river is powerful enough to shoot it out to some distance, it is still but a question of time, and that comparatively little, within which the river must by this action close its own mouth - the most lengthy and costly series of sea walls only construct a canal in the sea, and at ever increasing expense artificially continues a contest with the forces of nature to which the financial side of the question cannot but put a comparatively early limit.

But Vizagapatam is happily situated

It is not without a littoral current, and the current that exists is not an inimical one.

The chief current at Vizagapatam is one that flows northward as may be daily noted from the colored water it carries past the port.

This current, if properly studied, and taken as it were into our service, will I submit do inestimable service.

It will prevent the necessity for a sea wall at all on the south side of the port - taking in fact the place of and doing the work of such a wall.*

It will increase and act with the scour just outside the mouth, and, most important of all, it will carry away northward and seaward all the silt that would otherwise lie at the river mouth in a more complete and thorough way than could be done at enormous cost by a fleet of steam dredges

5. When other means fail, to remove a bar or deepen a river, recourse may be had to dredging, or to a simpler, much forgotten, far more economical, and powerful method, viz assisting a river by means of submarine grubbers, to scour its own bed deeper

This may be done in many ways, but I believe the simplest would here suffice

6. What I beg to suggest is the following.

The river has already a rocky precipitous bank along the whole of the South side and along half the other.

The remaining portion of the northern side is a spit of sand.

The northern bank should be continued as a straight stone wall along this spit of sand parallel with the southern for 300 yards, and at the termination should be so taken as to narrow the entrance to the river to such width as may on consideration be found best for obtaining

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* in the Baltic is an interesting instance of a spot where the littoral current has been thus utilized.

a thorough scour, and yet leaving sufficient space for ships to enter by.

7 Whether the northern wall be then still further lengthened in a direction at an angle of 45° or less with the littoral current is a minor subsequent question which should depend upon observation after the above named portion had been constructed.

This might or might not be found necessary to shoot the silt of the river further out to sea instead of along the coast.

8 This defining of the form of the river mouth and the contraction of it would probably do something towards removing the bar.

The chief thing however that is required is a continuous current of sufficient strength outwards, and this I would propose artificially to obtain by inserting along half the length of the sea wall to be constructed on the north side tidal shutters to admit into the harbour the rising tide and keep it enclosed when endeavouring to recede — thus I would admit at least twice as much more water as entered by the open mouth, and compelling the whole to return to the sea by the latter course would thereby hope to create such a scour there as would certainly perform work that no returning tide could undo

9 If the confining(1) wall, the above described little ebb-tides(2), and the friendly current(3) do not suffice to keep the mouth open I would aid the scouring action by the use of some form of (4)Turkish rakes* or marine grubbers at the time of the ebb to

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* See report on the works at the Sulina mouth of the Danube

to assist river and tide as to decide the point.

10 The question of *expense* still remains; but I venture to think the element of *risk* and doubt as to the result of the effect of these 4 allied forces cannot surely be great.

In this scheme nature has done more than half the work, and nothing expensive nor temporary - no breakwater and no steam dredges are necessary, nothing but a sea wall of moderate length with shutters (protected if necessary by wave screen of six rows of piles) and all this in a sheltered bay and chiefly inside the river mouth

The only work requiring some care and skill would be towards the sea end of the wall where the scour and the depth of water will be greater; I imagine no estimate of these simple works could rise above £10,000, and that they might well be completed within the year

From both banks of the river any amount of stone can be obtained.

The prisoners in the Jail are with difficulty foun occupation and might with advantage be employed on this work

On the very spot where they would be required work, there are buildings capable of housing 100.

Thus *at the cost of about half the price of one* *the steam vessels* calling weekly at the port, a safe har might be constructed in the middle of the Bay of Beng in which *within ½ an hour of the open sea* vessels of an size might be laid up and repaired:

— Wit

With slight additional expenditure the European system of docks might be introduced.

11. There is only one possible objection I have heard among those who are locally acquainted and satisfied with the entire feasibility of the easy formation of a port here, viz, that the communications with the interior are few and imperfect, and it is not therefore a natural emporium for trade.

Vizagapatam has always been backward in communications.

But there is no reason in the natural features of the country why this should continue to be the case.

There are now 3 roads into the interior, and the ranges of hills which come down to within 15 miles of the coast offer remarkable advantages for the construction of a far better means of transport, by the formation of saving* reservoirs, which would supply water in all seasons for small navigation canals throughout the length of the District.

* [illegible] Gorge [illegible]

Canals at first of only small width and depth, mere ditches, with passing places every hundred yards of twice that width would permit* the passage of boats which in Malabar convey 6 tons of cargo each, and they might be constructed for about the same cost per mile as an ordinary road with its bridges.

The incomparable value of water carriage in taking bulky raw produce to a port is well known.

The

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*3 feet wide and 60 feet long

The opening of the port - the only port of refuge between Point Pedro and Calcutta could not fail largely to increase a trade already not contemptible*

12. The accompanying rough sketches show the present aspect of the river and the alterations proposed.

The small sum required for this great public work might be found direct by the Government,[1] or by the Municipality[2] by loan, if placed in charge of their own harbour dues, or even by one of those enterprising private individuals[3] not unknown in this District and elsewhere who value the fame of conferring a public benefit more than wealth uselessly hoarded or, childishly wasted.

E. S. Thomas

Madras Civil Service

Vizagapatam
24th Sep /72

With map & photographs_

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* As I write 56 native craft of the largest class lie docked or at anchor in the river for the monsoon

Report to accompany Estimates for improving the mouth of the Vizagapatam River.

should be run out to 19 f on the

the river's mouth;" this he considers would break the heavy swell which rolls round the Dolphin Nose, and causes a heavy surf on the bar. Vizagapatam port would" then be a safe place all the year round; the water running out

15.7.6 9½

in No 554 of 24th Feby/73

Report to accompany Estimates for improving the mouth of the Vizagapatam River.

The Construction of a groin at the mouth of the River appears to have been first suggested by the late Master Attendant of Vizagapatam, Captain Pascal, in his letter to the Collector No 26, of 20th April, 1864; and this scheme for improving the Port has been revived by his successor, Captain Waters. The present Estimates have been framed at the request of the Collector, under instructions from the Superintending Engineer.

2. Captain Waters now proposes that "a good substantial groin, to keep the mouth of the river open from the south-west monsoon should be run out to 19-7 on the south side of the river's mouth; this he considers would break the heavy swell which rolls round the Dolphins Nose, and causes a heavy surf on the bar. Vizagapatam port would then be a safe place all the year round; the water running

out of the river in a straight line would be the means of deepening the bar and allow vessels of moderate draught to enter the river"; and there would no longer be any "surf on the bar."

3. "A good substantial groin", according to the Master Attendant, should be 40 feet broad at its base near the shore, and widen to 62 feet at 700 feet in length, with a top width of 25 feet, and be raised to 12 feet above High Water Spring Tides. The material to be used up to 350 feet is "the largest stones that can be put down in as solid a block as they can be laid," and the outer portion of the groin to be of stone of all sizes; and his reason for this is the "surf being heavy towards the shore, and the groin outside only having to encounter the swell." Such a groin he estimated to Cost Rs 30,000; but states that the nature of his duties will not admit of his undertaking the work.

4. In regard to the best position for a single groin at the mouth of the river, Captain Waters differs from his predecessor, Capt. Pascal, who recommended a "loose stone groin on the

Northern

Northern side of the entrance". This Captain Waters has every reason to believe would not be of any use", as "the sand constantly being checked by the groin would cause the place in time to be blocked up"; and he considers "the proper place for the groin to be on the south side of the river from the Dutch Battery; and that it should be run out into 3½ to 4 fathoms water."

5. Captain Waters states that he does "not consider that littoral currents have any thing to do with blocking the bar." He would carry the groin out to 19-7", because "the surf does not break so far; the extreme outer edge of the surf being from 300 to 350 feet." His reasons for making the groin 12 feet above High Water Spring Tides are, 1st, there can be no doubt the groin will sink; 2nd, the surf will not break over it to displace the stones." "25 feet on the top would be a good support for a platform and make the groin of use for tracking ships or boats either in or out of the river; also for landing or shipping Cargo."

6. The object of the proposed groin, as I

understand it, is that of aiding the natural forces now in operation to maintain the greatest depth of water on the bar that they are capable of producing; and in considering what will be the best means of attaining this end, the following particulars may be noticed:-

(a) The embouchure of the river is probably more or less affected by the waves, the tides, the littoral currents, the land freshes, and the ebb and flow of tidal water from the extensive swamp to the west of the Town.

(b). The catchment basin of the Megahdri river, which flows into the sea at Vizagapatam, covers an area of 220 square miles, which gives a volume of about 3¼ millions of cubic yards of water per hour in the great freshes of the north east monsoon, (assuming that only 4 inches of rain-fall flow off) to be discharged into the sea through a sectional area of about 7850 square feet; this gives a mean velocity of 3.105 feet per second, or a least velocity of the current close to the bed of 2.25 feet per second, sufficient according to Du Buat to sweep

forward

forward gravel of 1 inch in diameter. These heavy land freshes produce the most powerful scour at the embouchure, and would be much more efficacious in clearing a channel at the bar if they were controlled and prevented spreading laterally, which, by causing the flood waters to float on the salt water, enfeebles their action on the bottom.

(c) A continuance of land floods for some days, as is often the case in the North east monsoon, scours the sand off the bar, and carries it far into the roadway, from whence it is swept by the current round the point of the Dolphin's Nose. When a strong land fresh occurs at low water spring tides, the current in the river has the greatest fall towards the sea, the body of the bar is completely cleared of sand, and the river's mouth left in the best state.

(d). The freshes of the South-West monsoon are never considerable and exercise very little influence on the bar; so that during the rest of the year the principal natural cause at work in keeping the bar open is the ebb and flow of tidal water from the salt swamp. I may here mention, as showing the extent of this swamp, that the principal salt Cotaur of the District is in it at about four miles in a direct line from the river's mouth. According to Stevenson, the "sectional area of estuaries at low water bears a nearly constant proportion to the volume of water which runs in and out at each tide, being from 7½ to 10 square feet of area for each million Cubic feet of tidal water." Estimated by this rule, the ebb and flow of tidal water over the Vizagapatam bar must be about 305 millions of Cubic feet.

(e) The littoral currents which are, in my opinion, the principal Cause of the bar may be said to be unceasing; as soon as the Current from the South ceases, a reaction sets in from the North. Capt. Graves, the Master Attendant at Bimlipatam, who has had great experience both as a practical navigator and also in the service of the Marine Department, appears to think that these Currents are as

Often

often southwards as northwards; and on any temporary cessation of the one current the other at once takes its place. Capt. Graves also informs me that experienced divers at Madras state that the whole face of the beach below tide water mark, down to a depth of about six fathoms, is in a constant state of transition from the action of the littoral currents.

(f) Strong easterly winds during the five months, October to February, bringing the sand coastwise southward, puts also in agitation that which has been previously lodged on the left bank of the embouchure; and at the same time forces it into the entry. This effect of the easterly winds is strikingly apparent at that period of the year on the beach between Bimlipatam and Vizagapatam; every projecting spur of rock having its northern face then heavily covered with sand, while the southern face is left quite bare. The bar is still further disimproved on the setting in of the south west monsoon by deposits from the Southern Current driven in by the tide, and it is then found in its worst state.

(g) The depth of water in the deep channel at the bar probably now varies from a normal depth of 3 feet to an exceptional one of 7 feet, at Low Water Spring Tides. Capt Waters informs me that "the trade of the Port has never been stopped by want of water. The least depth of water at any time on the bar is not sufficient to stop the working of boats drawing 2½ feet of water". On the 4th December, 1869, about six weeks after the heavy freshes of the North-East monsoon, he found 11 feet of water on the bar.

Vessels drawing 6 to 7 feet of water now enter the Vizagapatam river to be laid up for repairs.

(h). As might be expected, the deep channel at the bar shifts with every change in the littoral Current. When that Current is from the south, the deepest part of the bar is on the nort side of the embouchure, and when the current sets down the coast the deep channel moves towards the Dolphins Nose; but there is a projecting spur of rock near the Dutch Battery which prevents it approaching very close to that side.

7. I now proceed to give one or two brief extracts from writers on Marine Engineering confirmatory of my own views on this matter.

"Recent investigations", Professor Rankine states "tend towards the conclusion that every wave is more or less a 'wave of translation', setting down each particle of water, or of matter suspended in water, a little in advance of where it picked that particle up. This property of waves accounts for the fact, that they heap up sand, gravel, shingle, or such materials as they are able to sweep along, upon every flat or sloping beach against which they directly roll; that they carry such materials into the bays and estuaries; and that when they advance obliquely along the coast they make the materials of the beach travel along the coast in the same direction."

"If", observes Birnell, during the advance of immersed substances, and of detrital matter in suspension, along the shore, under the double impulsion of the waves and of the currents, these alluvions meet a bay, the still water existing in it will allow the heavier particles to subside; while if, in addition to the comparative tranquillity of the bay, there should exist any subsidiary Currents, as in the embouchures of rivers, the remaining matter in suspension will be deposited. *Bars are thus formed*, by the deposition of the alluvions upon the line of junction of the littoral currents with that of the down stream, and the axis of the bar follows that of the resultant affected by the velocity, the volume, and the direction of the down stream."

Again, Rankine states that the *tidal* currents sweep along with them silt, or mud, sand, gravel, and other materials; hence the ebbing tide tends to scour and deepen inlets, and the flowing tide to silt them up; and the prevailing tendency of the tides, like that of the waves, is to choke and fill up estuaries, river channels and other inlets. A strong fresh

water

water current" (or a reflow of back water) "may maintain a deep channel against this action of the sea; but where that current escapes into the open sea, a *bar is formed* by the action of the waves and tides." One of the chief objects of harbour engineering is so to manage and modify the action of the tidal currents that the ebb shall become stronger than the flood, and shall *scour deep channels and remove bars*".

8. In accordance with the above quoted authorities, I am of opinion that the littoral Currents are the Chief cause of the Vizagapatam bar as they sweep past the mouth of the river laden with detrital matters in suspension, and meet there with the powerful ebb and flow of tidal water caused by the salt swamp. *On the* other hand, the reflow of backwater is the principal agency now at work in keeping open a Channel through the bar. The most important effect of making a deep, direct, and regular Channel into the river would be that of increasing the extent of rise and fall of the tide in the swamp, and thus improving

the scour on the bar.

9. In the present state of the river whatever tends to cut off or diminish the reflow of tidal water from the swamp is a detriment to the scour at the river's mouth, and to the maintenance of a channel at the bar.

I am therefore decidedly of opinion that further reclamations in the swamp should not be encouraged; at least until the mouth of the river has been improved.

10. "*In order to increase the depth over a bar*" Rankine writes; "piers or break waters must be carried out so as to concentrate the current over it, and it is best, if possible, to make the space between those piers *widen inwards*; in order both to hold scourge water, and to serve as a 'wave trap'. When there is only one pier, it should run from the *up stream* corner of the entrance." In a case like that of Vizagapatam, where the current down the coast is almost, if not quite, as powerful and lasting as that up, both equally laden with silt or mud, sand, gravel and other materials, I

consider

consider two piers or groins necessary in order to sweep the bar into deep water, and, if possible, remove it altogether.

11. To remedy the constant state of fluctuation that the bar is subject to, both with regard to the depth of water upon it, and the position of the deep channel, I propose; 1st, a river embankment 850 feet in length, to be constructed on the left bank of the river from A to B (see plan) to confine its waters to one invariable direction, without contracting the section of channel beyond what nature has itself provided a few hundred yards higher up, preventing the lateral spread which now enfeebles its action on the bar, and admitting of an increased velocity being employed to deepen the passage at the mouth; 2nd, a groin in prolongation of the river embankment to be carried out into deep water at 1250 feet from the shore, and to be eventually prolonged seawards, and 3rdly, a groin of 1000× feet in length to be carried out as shewn on the plan from the rocks near the Dutch Battery.

× altered by Col. Fischer to 600 -

12. These groins being carried up to three feet above the highest floods, would assist in con-

-fining the river until it had reached deep water; prevent the deposit of sand, gravel, &c. in the channel by winds or currents, and at the same time destroy the surf, and secure the safety of passengers and goods being conveyed to and from the landing place. Native craft of considerable size would also then be able to unload in the river.

13. I anticipate that the waves, which now break violently into surf on the steep declivity at the river's mouth; checked and broken by the groins; would spread and expend themselves without a surf as they advance up the gradually* widening channel of approach to the rivers mouth, over a gently sloping beach.

14. One of the many advantages that Vizagapatam possesses over most other places for the construction of such works consists in the abundance of good material in the rocky hills close to the site. I would propose to open quarries, and by means of short tramways, convey the stone to the spot where it is to be deposited. The ordinary effect produced by throwing out a groin is that sand is accumulated on

* Col. Fischer altered the plan to parallel groins.

⊗ according to the original plan.

on the up side of it, that is in a direction meeting that of the current; until it has filled the angle; when it passes the point and accumulates in the still water behind the groin; I would therefore carry out these groins as far as possible into deep water, with a view to such sand as passes the point being swept past the entry; or out to sea by the reflow from the swamp, and I have therefore provided for a length of 1000 feet. ⊗ With regard to the height of the works, I understand that the best examples of break-water now existing only rises a few feet above the water; and as I propose that the faces of the works should, as far as practicable, be covered with hammer dressed stone of large size, cramped and pinned with iron, and the crown laid with hydraulic cement, I consider a height of 3 feet above the highest floods would be amply sufficient.

The foundation of the groins to be of stones thrown in promiscuously, and left to form their own natural slope till they appear above low water; above that level to be placed by hand as far as practicable and well packed. I propose cramping and pinning, or using hydraulic morter mortar for the exposed surfaces, because the chief danger to the face of such a work is that air and water penetrate the joints, and by their pressure and elasticity, cause the stones to jump after receiving the blow of a wave.

15. My estimates show that a single groin of the description proposed by the Master Attendant, would cost Rs. 67,500; while works of the nature I consider necessary could not be constructed for less than Rs. 2,29,800.× I leave to the Collector, who called for these estimates and who is possessed of statistics of the general trade of the District, the task of explaining the probable effect of such improvements and showing whether any possible future trade of the port is likely to warrant such an outlay. The present shipping trade of Vizagapatam would evidently furnish no criterion of the probable value of such works as all the exports of the North and West of the District, which now find their way to Bimlipatam, would at once be diverted to Vizagapatam, and it would doubtless eventually become the Chief port of the District.

× The original estimate was 2,44,000 Rs; and was revised by Supg. Engineer to Rs 2,29,800

16.

16. I am also of opinion that the constructio of a single groin, whether to the north or south of the embouchure, but especially the latter, would be a dangerous experiment, for though most useful during the South West monsoon, when a groin on the South side would protect boats entering or leaving the river from the great violence of the surf at that period of the year, it might possibly result in the complete blocking up of the river's mouth in the dry season as the effect of the easterly winds, described above in para 5(f), thereby temporarily stopping the supply of salt water to the swamp, besides other evils which would no doubt prove most detrimental to the health of the people at Vizagapatam.

17. In conclusion, I would suggest, in view of any outlay being incurred for the improvement of this port, that the Marine Department be directed to keep a Register of the Levels of High and Low water, and of the depths of water in the deep Channel at the bar during the months of October, November,

December and January, when the bar is in its best state, also of the velocities of the Currents into and out of the backwater at half ebb and half flood. This may be done by the present establishment at little if any cost; the currents being measured with a Massey's Log, or other instrument in which the rotations of a fan driven by the current are registered by wheel work.

18. The proposal to construct a groin at the river's mouth has already been reported on by Lieut. J. F. Darward R.E in his letter to the Superintending Engineer No 570 of 31st October 1870; ~~copy of which is herewith forwarded.~~ The Superintending Engineer has also lately personally inspected the site of the proposed groins, and I believe my present plans and estimate to be in accordance with the suggestions he then made.

19. This report is accompanied by,

1. Plan of the mouth of the Vizagapatam River.

1. Plan shewing sections of proposed groins and river embankment

1. Cross sections of sand bank at the mouth of the river.

1 Estimate of works proposed by the Executive Engineer.

Ex: Engineer's Office
Waltair
8th November 1871

(Signed) J. Beatty Captn RE
Executive Engineer

Revised Copy.

J. Beatty. Major RE
District Engineer
Vizagapatam

District Engrs Office
Waltair
15th January 1873

13-12-92

PWD No 576/13/7/72
In No 554 d/24 Feby 73

Estimate and Report
for improving the mouth
of the Vizagapatam River

Estimate No 31 of 1871-72

Revised Estimate of the probable expense of constructing two Groins and an Embankment at the mouth of the Vizagapatam River

Number	Measurements Length	Breadth	Depth	Cubic Contents	Particulars of Work	Rate	Per Item	Amount	Total
					I River Embankment from the present Landing place to mouth of the river near the Ice House				
	850	area 210/4		178712½	Embankment on the line AB See plan				
	850	area 63		53550	Deductions for hammer dressed stone work				
				125162½	or 4635-17½ Cyds of loose rubble	2	Cyd	9271 4 8	
	81 850	area 63	-	53550	or 1983⅓ Cyds of hammar dressed stone, cramped and pinned with iron or laid with Hydraulic Ciment	7	do	13883 5 4	
								23154 10 .	
					Contingencies and Superintendence.	20	Pct.	4625 6 .	
					Total for river embankment				27,780

			II Groin on the North bank of the river near the Ice House			
1200	area 860½	10,32,300	Groin on the line BC Sea plan			
	area 1881½ 8¾	16463⅞	Ends of — D°			
		1048763⅞				
1200	area 189	226800	Deductions for hammer dressed stone work			
		821963⅞	or 30443.2⅛ Cyds of loose rubble	2	Cyd	60886 2 6
1200	area 189	226800	or 8400 Cyds of hammer dressed Stones cramped and pinned with iron or laid with Hydraulic Cement	7	D°	58800
						119686 2 6
			Contingencces & Superintendence	20	Pct.	23933 13 6
			Total for North Groin			143,600
			III – Groin on the South bank of the river near the Dutch Battery			
600 ~~750~~	area 624	374,400 ~~468,000~~	Groin on the line DE See plan			
	area 1,320 6⅔	8.800	Ends of — D°			
600 ~~750~~	area 182	109,200 ~~130,500~~	Deductions for hammer dressed stone work			
		274,000 ~~340300~~				
		274,000 ~~340300~~	or 10148 1/6 ~~12603-19~~ Cyds of loose rubble	2	Cyd	20296 5 4 ~~25207 6 6~~
600 ~~750~~	area 182	109,200 ~~136500~~	or 4044 4/9 ~~5055 5/9~~ Cyds of hammer dressed stone cramped and pinned with iron or laid with hydraulic Cement	7	D°	28311 1 7 ~~35388 14 2~~
						48607 7 1 ~~60596 4 8~~
			Contingencces & Superentendence	20	Pct	9721 8 11 ~~12103 11 4~~
			Total for South Groin			58,400 ~~72,700~~
			Grand Total Rupees			229,800 ~~244,100~~

Ex: Engrs Office
Waltair
8th November 1871

(Signed) J Beatty Captain RE
Executive Engineer
Vizagapatam

(Signed) J. F. Fischer Major RE
Ag Superintending Engineer, 1st Divn

(True Copy)

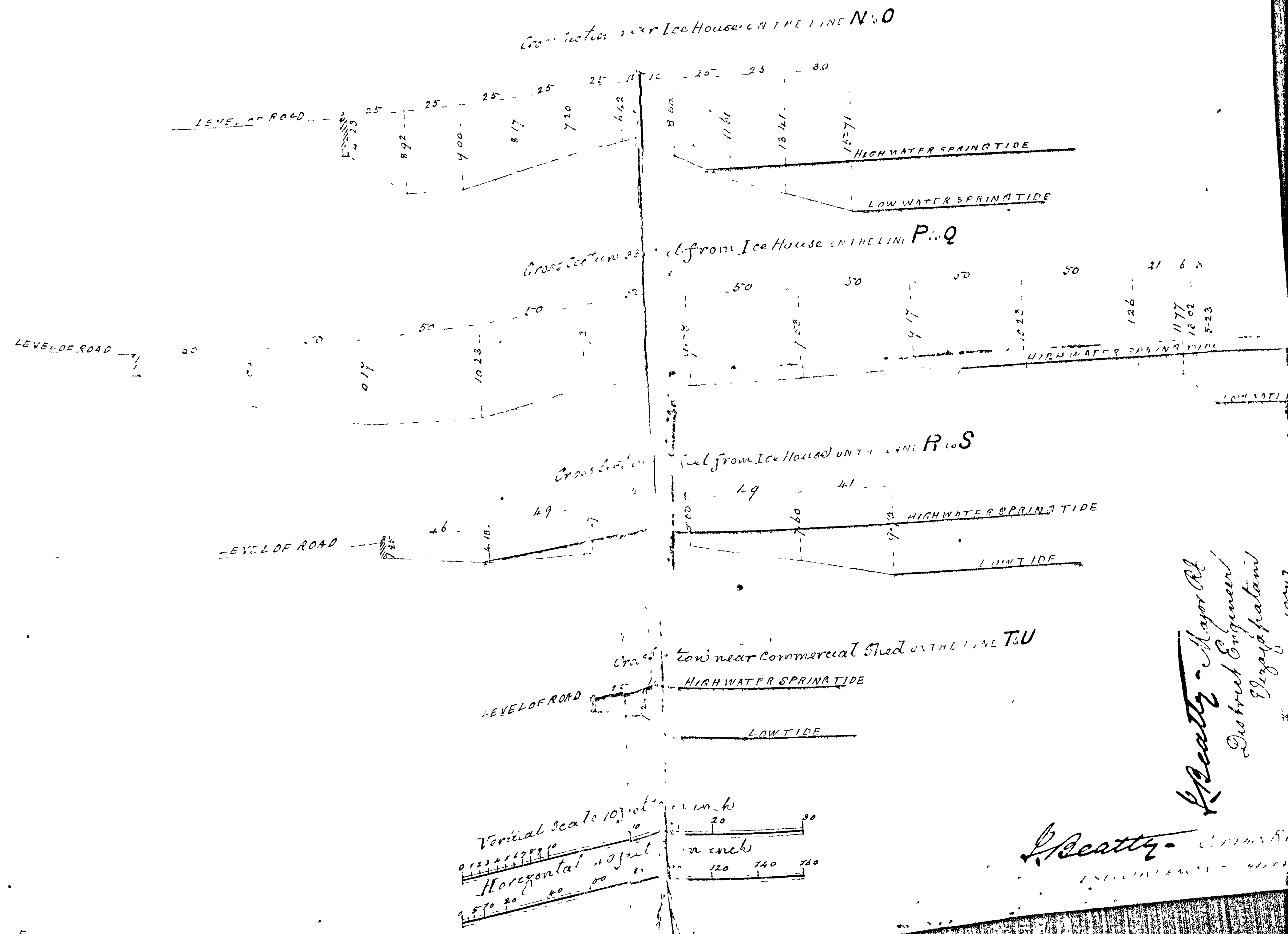
J Beatty Major RE
District Engineer
Vizagapatam

District Engineers Office
Waltair 15th January 1873

42a

R.No. 5613/2
dd 4-554 9/24 Feby/13

Cross Sections at the Mouth of Vizagapalam River on the left bank


Cross Section near Ice House on the line N to O
LEVEL OF ROAD
HIGH WATER SPRING TIDE
LOW WATER SPRING TIDE
Cross Section 33 ... from Ice House on the line P to Q
LEVEL OF ROAD
HIGH WATER SPRING TIDE
Cross Section ... from Ice House on the line R to S
LEVEL OF ROAD
HIGH WATER SPRING TIDE
LOW TIDE
Cross Section near Commercial Shed on the line T to U
LEVEL OF ROAD
HIGH WATER SPRING TIDE
LOW TIDE
Vertical Scale 10 feet to an inch
Horizontal 40 feet to an inch

G. Beatty - Major RE
District Engineer
Vizagapatam

G Beatty -

W. 5613/72

Dn. No: 534 d/ 24 Feby/73.

Cross sections
of sand bank at
the mouth of the
Vizagapatam
river, on the
left side -

G.O. W. 608 d/ 25-2-73

P.W. 5613/72

Dn. No: 554 d/ 24 Feby/73

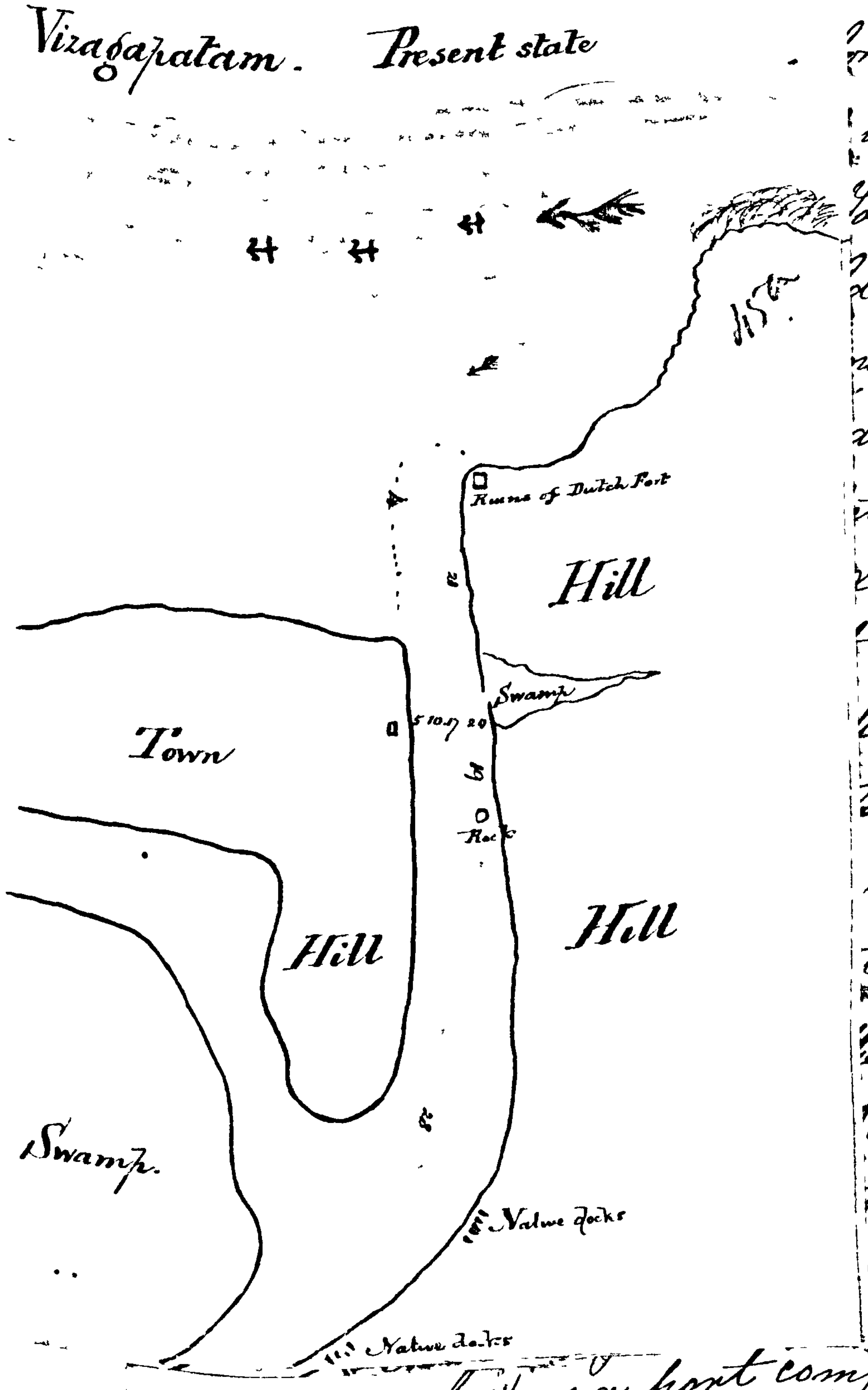
N

Memo. by the Chief Engineer

Bimliputam

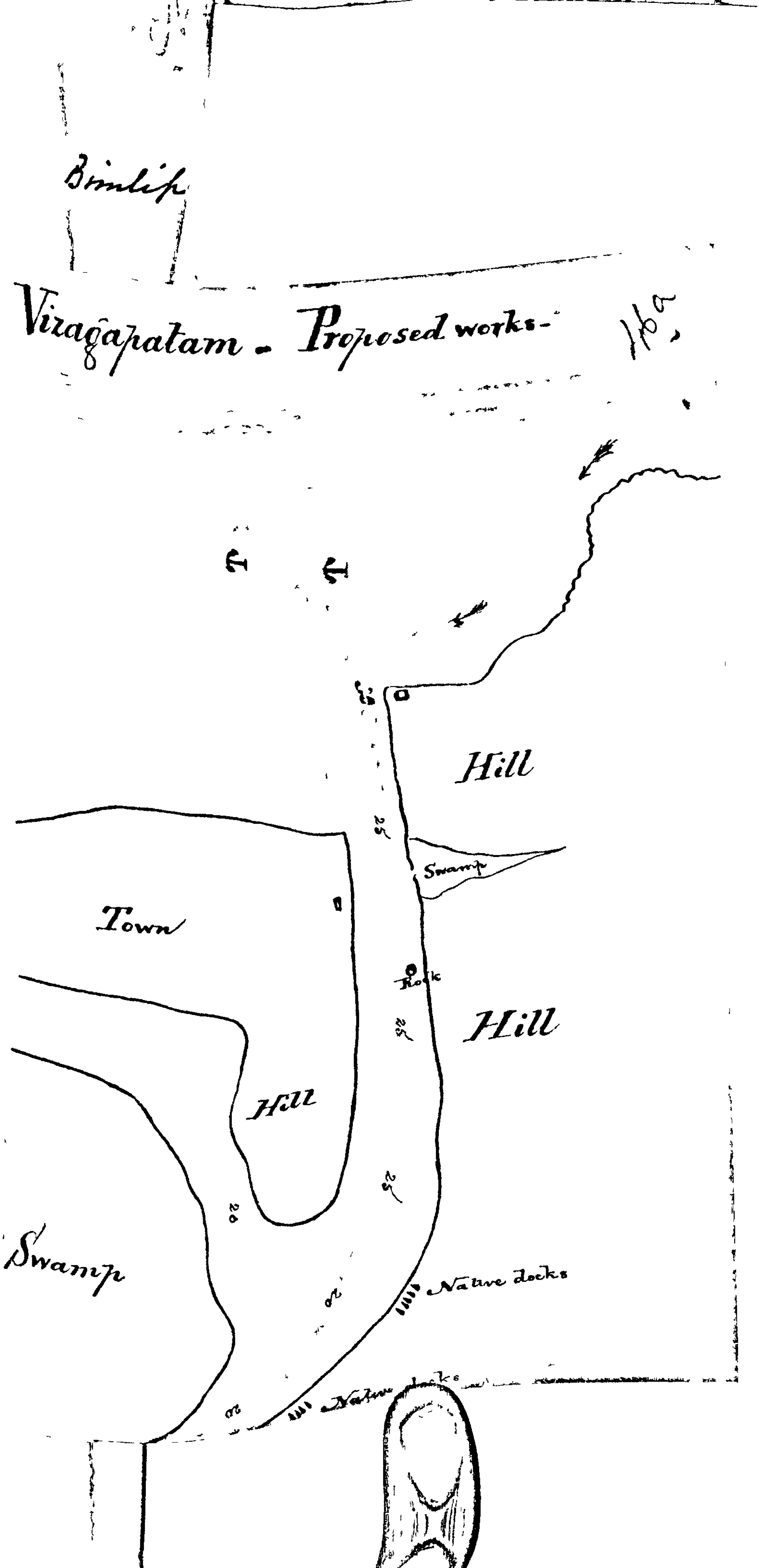
I have no doubt that theoretically
...d make the best
...r Bimlipatam would
... in length due east
...ower into 3 1/2 fathoms
...d be connected with a
...mile in length, running
...direction into 7 1/2
...tty should be of solid
...low water mark, as
...f the Breakwater, the
...hould be built up of
...s its outer side only
... long slope to seaward.
...ction to be similar
...e Portland Breakwater.
...such works would be
...uate to the claims of
...Bimlipatam, or to its
value as a port compared with other
Northern Ports such as Cocanada, or even
Vizagapatam. I certainly do believe that a
Pier partly open and partly solid

Vizagapatam. Present state



16a

Vizagapatam - Proposed works-



No.

Memo. by the Chief Engineer.

Bimlipatam

I have no doubt that theoretically the works which would make the best Harbour possible for Bimlipatam would be a Jetty of 2400 feet in length due east from Mackenzie's Tower into 3 1/2 fathom water, where it would be connected with a Breakwater of 1 1/2 mile in length, running in a North easterly direction into 7 1/2 fathom water. The Jetty should be of solid masonry ~~and~~ up to Low water mark, & thence of open piling to the Breakwater; the inner side of which should be built up of large squared blocks, its outer side only being shaped with a long slope to seaward. The method of construction to be similar to that adopted for the Portland Breakwater.

But the cost of such works would be altogether disproportionate to the claims of the existing trade of Bimlipatam, or to its value as a port compared with other Northern Ports such as Cocanada, or even Vizagapatam. I certainly do believe that a Pier partly open and partly solid carried out according to the Master Attendants original idea, but built up of large squared blocks on its northern side and costing with accessories say 1½ Lakhs would materially improve the Port by acting as a training wall for the river current, and by throwing the bar and surf upon it so many yards further seawards. But I should desire previous consideration of the comparative cost, and value to the trade, of a simple Pier of open Piling to be run out from the southern corner of the Town into 4 fathom water, which is there within 150 to 200 yards of Low water mark. The materials to be used might either be Iron or South Australian Timber said to be impervious to attacks of the **Teredo**. The main difficulty and expense likely to be experienced will be as to the means of fixing the foundations, as the rocky bottom which may be reckoned on will preclude the use of screw Piles.

It appears to me that the comparatively cheap expedient of a Pier which has been found useful at such exposed ports as those of Madras and Calicut, may realize as much as can be expected for Bimlipatam with reference to the nature and amount of its trade.

Vizagapatam..

The subject of improving the Harbour of Vizagapatam has been brought forward by Mr E. Thomas the Judge of that place in a Memorandum dated 24th September 1872, written apparently in ignorance of the propositions made by the Master Attendant of that Port and the present District Engineer which were summarily disposed of in the Marine Department as too expensive. See G.O. No 16 of 5th February 1872. And in neither of these schemes is any allusion made to the propositions of the Collector and District Engineer referred to Sir A. Cotton for Report in G.O. No 918 of 18th April 1859, and disposed of in his Report recorded with G.O. No 1900 of 8th August 1859.

The general conclusions arrived at in that paper were, that it was worth while spending about Rs 30,000 upon the Port and that this could be done to best advantage by running out a breakwater from the Dolphin's Nose; Captain Vertue's proposal having been to throw out a stone Groyne 440 feet in length, at an estimated cost of Rs 23,500, on the opposite or northern side of the River mouth. The propositions laid before Government a year ago consisted of a River embankment 850 feet long costing Rs 27,780, and its prolongation into deep water by a Groyne 1200 feet longer, estimated to cost Rs 1,43,620, on the north side; with a Groyne of 600 feet on the south side, run out from the Dutch Battery into to a depth of 16 feet at High water Spring Tides, to cost Rs 58,400. Mr Thomas's proposal is to spend about one Lakh in a River embankment and Groyne on the Northern side about 300 yards in length; differing from the first portion of the last mentioned scheme only by the addition of tidal shutters along half its length to admit the rising tide as freely as possible into the mouth of the Estuary. Thus it will be seen that all three schemes hitherto submitted to Government contemplate a Northern River wall and Groyne; one of them deprecates a single Groyne only, wherever placed, as likely to render the bar worse than at present (see Collector's letter No 957 of 26th December 1871 para 2), and adds a Groyne on the South side; while Sir A Cotton years ago condemned any scheme but one consisting of a breakwater of about 200 yards run out from the Salient point of the Dolphin's Nose, i.e. on the southern side of the harbour.

So far as can be judged from the facts brought forward I am decidedly of opinion that a work on the southern side of the River mouth is alone advisable; but there is not sufficient detailed information forthcoming to enable me to form a decided opinion as to its exact nature, position, or length. Major Vertue's chart, embracing an unnecessary extent of coast, is laid down on too small a scale to show accurately such soundings as have been taken, and none are given on the South side between the River Mouth and the Dolphin's Nose; while the Survey and Longitudinal sections accompanying Major Beatty's Report are inexact as to plan, and inconsistent as to soundings. Mr. Thomas remarks that in planning Harbour works much more is dependent on knowledge of local natural circumstances than on the very best professional talent that can be devoted to it. It would be more correct to say that no professional opinion can possibly be formed without a precise knowledge of local natural circumstances, and that when these are known real professional knowledge is shown by drawing correct conclusions from them.

I am led by the facts recorded in Major Beatty's thoughtful paper to arrive at a very different conclusion from his, and one agreeing with Sir A Cotton's, in placing whatever works are to be carried out on the southern side. I agree with Major Beatty that, if two Groynes are to be thrown out, the southern should overlap the northern considerably. Lieutenant Colonel Fischer's argument in para 4 of his letter No. 2173 of 12th October 1871 having failed to take into consideration the difference between a southern groyne and an ordinary projecting rock, in that the former would have a current running along its northern face to sweep it clean. I anticipate no other effect from a southern groyne than that of throwing out the bar as many hundred feet beyond the present bar as it is long, a position in which the depth over it would be greatly increased and the surf on it proportionably diminished. But to guard against a proportionate advance of the northern sandy beach, and contracting of the space between it and the bar in its new position, it will be necessary not to connect the Southern groyne solidly to the main land, but to leave an interval bridged over by a Pier on piles through which there shall always be free action of tide and current. What shall be the extent and material of such open Pier, what the extent of its solid prolongation, what their exact direction and position with reference to the main land, are all details that cannot be worked out, without a good survey and soundings all along from the Dolphin's Nose to the northern extremity of the Bar.

I recommend that the collection of such materials for further reliable Plans and estimates be undertaken by the Special officer placed at the disposal of the Inspecting Engineer for Ports and Communications for Ghaut work in Jeypore, in the intervals when such work cannot be prosecuted. It would appear from the Commercial Statistics supplied by the Collector that the value of exports at Vizagapatam has averaged over 8 Lakhs for the last 5 years against 6 Lakhs for the 5 years previous, and that of Imports more than 10 Lakhs per annum. While against 7 Lakhs per annum the average of Exports at Bimlipatam for 10 years past is 20 Lakhs, and the last 5 years average of imports equal to that of Vizagapatam; the excess being due to the resort of European Shipping to the former harbour to treble the tonnage of those frequenting Vizag. The facilities for improvement of the latter harbour at a moderate cost, say within one Lakh of Rupees, appear

7/72

twice those offered

at the former; and with a fair improvement to the communications between the two places, it is presumable that if Vizagapatam River were made easy of access to vessels of not more than 12 feet draught it would supersede the rival port almost entirely. It would consequently be desirable to concentrate operations at Vizagapatam, at all events in the first instance.

GWW

To the
Chief Secretary
to Government

Sir

I have the honour to forward a map and 3 photographs & request they may be placed with my memorandum on Vizagapatam harbour & returned
due when

no longer required

I have the honor to be

Sir

Yr obedt Servt

E. S. [illegible]

Vizagapatam
9th Octr /72

No 603 P.W.D.

Proceedings of the Madras Government

Read the following:-

From,
The Supg Engineer 1st Divn } (H. E. No 2832 of 8th Novr/72)
Do in the Marine Dept. — (—— 16 of 5th Feb/72)

Ordered that copies of these papers be printed and forwarded to the Inspecting Engineer for Ports and Communications, who will arrange for the preparation of the Survey and soundings at Vizagapatam.

The Marine Department will be requested to provide Rs 600 for the purpose from Port Funds, for expenditure in 1873-4.

*Inspecting Engr for Ports & Communications with enclosures
D.E. Vizagapatam D°
Rev Deptt D°
Marine Deptt
Controller

Extd

List of Enclosures forwarded to the Inspecting Engineer for Ports and Communications with G. O. no: 603 dated 25th Feby/73

1 – Sketch Map of the coast line near Bimlipatam

2 – Plan of the Town and Port of Bimlipatam ——

3 Revised Plan of the mouth of the Vizagapatam River

4 Revised sections of Groins

5 Sections of Captn Graves's Groin ——

6 – 1 copy of G O no: 1900 d/ 8th Augt/59

7 1 do —— do 918 d/ 18th Apl/59

8 1 do do 16 d/ 5 Feby/72 Marine Depto

The Insp. Engineer [illegible] with the [illegible] [illegible] for [illegible]
15/2/73

Rc 11th Feby/73 R 18.
C 8th Feby/73

List of Enclosures sent to Mr E.C.G. Thomas, Civil & Session Judge of Vizag:–

1 map
1 Photograph of the Harbour–

10 2-92
13-12-92 Recd
5-8-6

No. 5613

Govt. of [1873] Madras
PUBLIC WORKS.

The Inspecting Engr. for
Ports & Communicat.

Encl.

25th Feby. 1893.

No. 554 @ 556

Vizagapatam Harbour.

The Inspecting Engr. for
Ports and Communica-
tions to arrange for the
preparation of Survey
Soundings at Vizagapatam
and Marine Dept. to
provide Rs. 600 for the
purchase of ... Port Fund