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Government of Madras.

Public works DEPARTMENT.

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Proceedings of the Madras Government, Public Works Department.
2nd March 1866.

No. 52. Read the following letter from the Officiating Superintending Engineer, 8th Division, to the Secretary to Government, Department Public Works, dated Paumben, 9th February 1866, No. 2,216 :—

1 Letter.
2 Abstract Estimates.

1. With reference to G. O. No. 2,058, of the 18th July 1865, I have the honor to

submit again the two estimates therewith returned, viz. :—

For deepening Paumben channel from 12 feet to 14 feet at	rs.
low-water... ..	33,760
For maintaining do. at a depth of 14 feet at low-water	7,000

2. The first point on which Government require explanation is, that Lieutenant Coningham states in paragraph 10 of his report, that the sum of Rupees 43,340, sanctioned for removing 12 feet of the inner angle of the Reef Channel, will cover the cost of removing 14 feet; while barely a year before, a supplemental estimate of Rupees 19,460, for the former work alone, was laid before the Government. The principal cause of this is, that the estimate of Rupees 43,340 includes the large item of Rupees 17,298 under the heads of Convicts and gunpowder; up to the year 1864-65 the labor of the Convicts, and the cost of powder, were charged to the work, but after May 1864 these charges were discontinued. The expenditure up to May 1864 was Rupees 23,469, and during the following year the outlay was Rupees 4,866, now the charge for Convicts and powder is about $\frac{1}{4}$ of the estimate, Rupees 43,342; so that the remaining charge for work is $\frac{3}{4}$ of that sum.

If the amount of the supplemental estimate, Rupees 19,460, be added to the original, the total becomes Rupees 62,902; now the expenditure in 1864-65 would have been proportionately $(\frac{4,866}{6})=8,110$ Rupees if Convicts and powder had been charged, or adding the previous expenditure, Rupees 23,469, the total is Rupees 31,579, which is just about one-half of the total quoted above.

3. I think, therefore, that Lieutenant Coningham was correct in assuming that by the saving in powder and Convicts, the deepening to 14 feet can be effected out of the sanctioned amount; considering that more than half of the work is already done, at the time of his writing, viz., in May 1865. But there are also other causes from which the work is being carried out at a less cost than was anticipated, which I have been able to look into during my visit here; as the work has progressed the quantity of hard rock has been found to be less than was expected; the upper portion of the rock has also been found to be much harder than that below, and in fact generally at a depth of 13 feet mud is found instead of stone; as then the upper rock was blasted, and the hand-dredge worked in clearing away the broken stone, shingle, &c., the scour in the channel itself has helped to clear it out, and the hand-dredge has thus been deepening the channel, in parts, to the full depth of 14 feet. When blasting was commenced the stone being found to be hard, blasting was generally practised, but as the lower stone is much softer, blasting to the same extent became unnecessary, and the hand-dredge did the work: so that as the blasting is the more expensive operation, the work became cheaper. Up to the year 1864-65 the proportion of stone raised by the hand-dredge to that raised by divers after blasting, was as 2.1 to 1; in the present year the proportion has been as 8 to 1. The hand-dredge has been employed in working, where it could,

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round the rock, and the rock being then exposed, the charges are placed so as to have good effect in removing it. When the holes were previously bored more at random, the charge would perhaps be placed near the edge of a hard block and the explosion would therefore lose much of its force.

4. The Government have already marked their approval of the new method of laying the charges, by the substitution of baskets and cylindrical boxes of aloe, for the former leather bags, from which there results a saving in the cost of the charges; and I have no doubt more effect has been produced by the present system of tamping with fragments of the sand stone, instead of with pure sand, as was the former practice: when the tamping was only sand the charge could be removed by pulling it up by the bamboo attached, but with the present system of tamping the charge is more firmly fixed, and cannot be pulled up. I learn further that, formerly, when common hose was used to fire the charges many of them missed fire, whereas by the use of the Bickford's fuse, that very seldom happens.

5. Secondly, Lieutenant Coningham has treated the work in the reef channel as consisting of rock to the extent of only one-sixth of the excavation, whereas in the previous estimates the whole was assumed to be solid rock. In the first estimate of 1862, Rupees 68,000, the whole of the excavation is treated as solid rock, to be blasted with powder, and the total cubical content of rock is to be raised by divers and boat-men, without the use of the steam dredge.

In the second estimate of 1863, Rupees 36,000 (which differs from the former one in striking out the pay of a Mechanical Engineer and crew for the steam dredge for two years), the whole bed of the channel again is treated as rock to be blasted; but one-ninth only of the cubical content is supposed to be raised as stone by divers, and the remaining eight-ninths to be taken up by the steam dredge.

In the last estimate of 1865, Rupees 33,760, only one-sixth of the bed of the channel is assumed to be rock to be blasted, and the whole is intended to be raised by the hand-dredge; it being calculated that the amount of hard stone that would require to be raised by divers is so small that the difference of cost in removing by that means will be met from the charge for sundries.

It will be observed, that the second and third estimates do not differ much in amount; in the former a much greater quantity of blasting is provided, but nine-tenths of the debris is to be removed by the steam dredge; whereas, in the latter, the hand-dredge is intended to remove the whole of the debris, while the proportion of blasting is only one-sixth.

6. The latest estimate has been drawn up from a better knowledge of the existing state of the channel; the bed of the channel is also altered from the condition it was in three years ago, and especially experience has been gained from the work of the inner angle in judging of the state of the channel itself.

I have seen soundings taken in the channel which, at parts, gave 14 and 15 feet of water, and allowing for the state of the tide at the time, it is evident that there is now as much as 13 and 14 feet of water at low-water. The scour in the channel is very considerable, in the monsoon time the current runs through at a rate that reaches seven miles an hour, and the width of the channel at bottom being only 80 feet it follows that the loose sand and light fragments of stone have been

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carried away by the force of the water alone; again, as in the inner angle mud was arrived at thirteen feet below the surface under the stone, and the lower part of the stone was uniformly found to be softer than the upper crust, we may reasonably expect that the same condition of stone and bed may be found in the main channel; at present the divers are unwilling to come to the work at the inner angle, as they say it is not worth their while to do so, they are paid by the cubic content of stone they raise, as measured on the shore afterwards, and they find that the stone blasted at the greater depths is so soft, and breaks up into such scattered fragments, that they cannot get hold at the bottom of any large blocks, so that it does not pay them to bring up repeatedly nothing but small pieces of stone. As the divers' work thus comes to an end, the hand-dredge is able to do the whole work of clearing, and as the hand-dredge has been employed in the inner angle, clearing away the broken and soft stone, mud, &c., thereby laying bare the solid stone, so it will also be used in the main channel. While then it is impossible that an estimate can be made beforehand with any accuracy as to the quantity of rock that will be found, it is now a matter of certainty, as shown by the soundings, that one and two feet below what is supposed to be the depth of the channel, viz., 12 feet at low-water, there is at parts no rock at all; there is every probability of the hand-dredge being able to remove a great portion of the bed at other parts where blasting will not be required, and I am of opinion that the estimated proportion of the bed of the channel that will have to be blasted, viz., one-sixth, is reasonable, and as near to accuracy as we can attain. After the hand-dredge has been working for some time, the quantity of rock will become more clearly defined; but this estimate cannot be drawn, up as the legitimate cost of a certain amount of work, for the amount is an unknown quantity, and I can find no cause for taking any other proportion than that which is assumed by Lieutenant Coningham, from his general experience of the works.

7. In Order No. 3,142 of the 1st November 1864, the Government require estimates for deepening the Paumben Channel to 12 and 14 feet respectively, and to know the cost of maintenance at both levels. As the channel has already a depth of 12 feet at low-water, the former estimate is not needed. Lieutenant Coningham states in paragraphs 2 and 3 of his report that he has not estimated for maintenance at the depth of 12 feet, because the expenditure on maintenance depends on the number of dredges, and that the amount of work for maintaining the channel at 12 feet, being nearly one-third of the work required for 14 feet depth, the expenditure will be about one-third, hence it is inferred that the cost of maintenance at 12 feet will be one-third of Rupees 7,000 (the estimate for maintenance at 14 feet) or Rupees 2,333.

8. Now, the maintenance allowance is principally required for the clearance of what is called the sand bank channel, about $1\frac{1}{2}$ miles to the south of the reef; the reef channel is subject to not much silting, and that chiefly at the extremities, at the change of the monsoons. To maintain the passage at 12 feet through the sand bank involves the removal of 1,80,000* cubic feet of sand in the year, while to keep the passage open to a depth of 14 feet requires the clearance of 4,50,000* cubic feet of sand. To maintain the greater

* In round numbers.

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depth, dredging is necessary to a distance of 1,350 feet at the north end of the sand bank channel, and to a length of 3,000 feet from the south end, in addition to the length of the sand bank channel itself, 2,100 feet. The proportion of cost of maintenance at the two levels is thus nearly as 2 to 5, rather than as 1, 2, 3, or, if the maintenance charge for 14 feet costs Rupees 7,000 per annum, that for 12 feet will cost Rupees 2,800. The accumulation of silt has been found, from observations in past years, to be only seven-eighths of a foot and half a foot in the year. A separate estimate is thus not made for the maintenance at the lower level of 12 feet, because it does not appear to be required, for if the reef channel is deepened throughout to 14 feet, it is necessary that the sand bank channel should have a corresponding depth.

9. In paragraphs 4, 6, and 7 of his report, Lieutenant Coningham adverts to the charges used in blasting; the proposition to use large charges resting on the rock is, I think, not applicable to the present circumstances; for though the labor of boring would be dispensed with, the current is so strong that divers would be required to fix the charge in position, and from there being comparatively so little hard stone to be dealt with, the powder would be thrown away in acting on an under surface of broken stone, sand, and mud. As noticed above, pains are now taken to isolate the blocks of hard stone, and small charges are found to be the most economical.

10. I think I have now referred to the different points in Lieutenant Coningham's report; the provision for a Maistry, that he refers to in paragraph 11, is struck out of the estimate, as that charge will come under the head Petty Establishment.

11. But while the estimates for deepening the Paumben Channel to 14 feet, and for maintenance at that level, have been framed to the amounts of Rs. 33,760 and Rupees 7,000, respectively, by the present system of treating the charges for Convict labor and gunpowder the actual sums to be provided in the Public Works Budget become much reduced.

Thus the sub-divisions of the estimates are:—

	For deepening Paumben Channel to 14 feet.	For maintenance at 14 feet.
1. Actual charge to estimate	10,060	1,080
2. Petty Establishment	*	504
3. Tools and Stores	13,500	3,360
4. Convicts and Gunpowder	10,200	2,056
Total Rupees	33,760	7,000

* Rupees 1,440 for Petty Establishment already struck out.

The addition of items Nos. 1 and 3 will then give the reduced sums of Rupees 23,560 and Rupees 4,440. In dealing with estimates of an ordinary nature, item No. 3 should also be struck out, as tools and stores now form a main head of the Budget allotment; but as in the operations here these charges form such a large portion of the work, and no separate provision is made for them, I think they ought properly to be included in the estimates.

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12. While then I submit the estimates again, in the same form as they were previously submitted in last June, I would recommend for the approval of Government

Estimate for deepening Paumben Channel to 14 feet... Rs. 23,560
Maintenance do. at do... „ 4,440

13. Referring to paragraph 8 of the Government Order under reply, the amount of estimate Rupees 1,450 for two hand dredges is provided from the sum of Rupees 2,750, allotted in G. O. No. 2,815 of the 22nd September 1865, or rather I propose an expenditure of Rupees 725 for one dredge during the current official year; the machinery is being made at Madras, and if one dredge is fitted up now, the other can be put in hand at the beginning of the coming official year so as to be ready by August, when the working season again begins.

No. 53.

ORDER THEREON, 2nd March 1866, No. 721.

CIVIL WORKS, No. 9.

6th November 1862, No. 2,668.
1st do. 1864, „ 3,142.

1. In his letter of the 24th June 1865, No. 432, the Superintending Engineer of the 8th Division, in pursuance of the Orders as per margin, submitted two estimates of Rupees 33,760 and

Rupees 7,000, respectively, for deepening the Paumben Channel from 12 to 14 feet at low-water, and for annually maintaining it at that depth. As, however, these estimates were unaccompanied by any expression of the Superintending Engineer's opinion of their suitability or sufficiency, and were, moreover, submitted in a very incomplete form, the Government were under the necessity of returning them, and in doing so they noticed the following discrepancies in Lieutenant Coningham's report which gave cover to the estimates:—

(1.) The sum of Rupees 43,340, which was sanctioned for the removal of the inner angle of the reef channel to 12 feet in depth was alleged to be sufficient to cover the cost of deepening it to 14 feet, although a supplemental estimate of Rupees 19,460 had been submitted sometime previously for the former work alone.

(2.) The work in the reef channel was treated as consisting of rock to the extent of only one-sixth of the excavation, whereas in former estimates the whole was assumed to be solid rock.

2. In his letter above recorded Captain Prendergast re-submits the estimates under notice with the required explanations. He states that the estimate of Rupees 43,340 includes no less a sum than Rupees 17,298 for Convict labor and gunpowder; but that as, since the year 1864-65, the charges under these heads do not involve an actual money outlay, the amount of the estimate will suffice to meet the cost of securing the required depth of 14 feet. Captain Prendergast further explains that as the work has progressed it has been found that the quantity of hard rock requiring removal is less than was anticipated, and the expensive operation of blasting has been in consequence, in a great measure, dispensed with.

3. The experience which has been gained on the work in progress at the inner angle has afforded some data upon which the estimate of Rupees 33,760 for deepening the main channel has been prepared; and as the result of the soundings taken in the channel (which in certain parts is believed to be as much as 13 and

after May 1864, these charges were discontinued.

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14 feet deep at low-water) shows that one and two feet below the supposed depth of 12 feet at low-water there is no rock at all in parts, and that in others the hand-dredges, which have been employed at the inner angle with great advantage, can be used in removing a great portion of the bed, Captain Prendergast is of opinion that one-sixth may reasonably be supposed to be the proportion of the channel bed that will have to be blasted.

4. With regard to the estimate of Rupees 7,000 for maintaining the channel at a depth of 14 feet, Captain Prendergast explains that that allowance is principally required for the clearance of what is called the sand bank channel, which is about a mile and a half to the south of the reef, and that to maintain the required depth a clearance of 4,50,000 cubic feet of sand will be necessary.

5. The Government consider these explanations to be satisfactory.

6. His Excellency in Council cannot, however, approve of the manner in which the Officiating Superintending Engineer proposes in paragraph 11 to deal with the charges in the estimates. He has no objection to such portion of the provision under "Tools and Stores," as relates to repairs, &c., to boats and canoes being allowed to stand in the estimates; but the balance must be omitted, and the charges met in the usual manner from the specific allotment under "Tools and Stores." These alterations will reduce the estimate for deepening the channel to Rupees 22,810, and that for maintaining it to Rupees 1,800, exclusive of the cost of Convict labor and gunpowder, for which no cash payments are necessary. These estimates are sanctioned, and the question of providing funds for the works, in addition to the grant of Rupees 7,000 in the Budget for 1866-67 for cutting the inner angle of the reef channel, will be considered after 1st May next.

(True Extract.)

(Signed) CHARLES A. ORR, Colonel, R. E.,
Secretary to Government.

To the Superintending Engineer, 8th Division.
.. Controller of Public Works Accounts.
.. Accountant General.

Exd. S. T. Augustin.

N^o 2216 Sup^t Engrs Office 8 Division
Paunder 9th February 1866.

From
Captain H. L. Prendergast R.E.
Officiating Superintending Engr 8th Division
Colonel C. A. Orr R.E.
Secretary to Government
P. W. D.

Sir,
With reference to G.O. N^o 2058 of the 18th July 1865, I have the honor to submit again the 2 estimates herewith returned viz:
1 For deepening Paunder channel from 12 feet to 14 feet at low water Rs 33,760.
2 For maintaining it at a depth of 14 feet at low water Rs 7,000.

Incls: 3

1 Letter.

2 Abstract estimates.

2 The first point on which Government require explanation is, that Lieutenant Coningham states in para 10 of his report, that the sum of Rs 43,340 sanctioned for removing 12 feet of the inner angle of the Reef channel, will cover the cost of removing 14 feet; while barely a year before, a supplemental estimate of Rs 19,400, for the former work alone was laid before the Government. The principal cause of this is, that the estimate of Rs 43,340 includes the large item of Rs 17,298 under the heads of Convicts and gunpowder up to the year 1864-65, the labour of the Convicts, and the cost of powder, were charged to the work, but after May 1864, these charges were discontinued.

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The expenditure up to May 1864, was Rs 23,169, and during the following year the outlay was Rs 1866, now the charge for Concretes & powder is about 1/6 of the estimate. Rs 13,312; so that the remaining charge for work is 6 of that sum.

If the amount of the supplemented estimate Rs 19,460 be added to the Original; the total becomes Rs 62,902; now the expenditure in 1864/65 would have been proportionately $\frac{1866}{23169} \times 62902 = 8110$ Rs if Concretes & powder had been charged; or adding the previous expenditure Rs 23,169; the total is Rs 31,579; which is just about one half of the total quoted, above.

3 I think therefore, that Lieutenant Coningham was correct, in assuming, that by the saving in powder, and Concretes, the deepening to 14 feet can be effected out of the sanctioned amount; considering that more than half of the work is already done, at the time of his writing, viz, in May 1865. But there are also, other causes, from which the work is being carried out at a less cost than was anticipated; which I have been able to look into during my visit here; as the work has progressed, the quantity of hard rock has been found to be less than was expected; the upper portion of the rock, has also been found to be much harder than that below; and in fact generally, at a depth of 13 feet, mud is found instead of stone; as then the upper rock was blasted, and the hand

hand-dredge worked, in clearing away broken stone, shingle &c; the scour in the channel itself has helped to clear it out, and the dredge has thus been deepening the channel in parts, to the full depth of 14 feet. When blasting was commenced, the stone being found to be hard, blasting was generally practised; but, as the lower stone is much softer, blasting to the same extent, became unnecessary; and the hand dredge did the work; so that, as the blasting is the more expensive operation, the work became cheaper. Up to the year 1864/65, the proportion of stone raised by the hand dredge to that raised by divers after blasting, was, 2.1 to 1; in the present year, the proportion has been, as 8 to 1. The hand-dredge has been employed in working, where it could, round the rock; and the rock being then exposed, the charges are placed so as to have good effect in removing it. When the holes were previously bored, more at random; the charge would perhaps be placed near the edge of a hard block, and the explosion would therefore lose much of its force.

4 The Government have already marked their approval, of the new method of laying the charges, by the substitution of baskets, and cylindrical boxes of aloe, for the former leather bags, from which there results, a saving in the cost of the charges; and I have no doubt more.

more effect has been produced, by the present system of tamping, with fragments of the sand stone, instead of with pure sand, as was the former practice: when the tamping was only sand, the charge could be removed by pulling it up, by the bamboo, attached; but with the present system of tamping, the charge is more firmly fixed, and cannot be pulled up. I learn further, that formerly, when Common hose was used to fire the charges, many of them missed fire; whereas by the use of the Wickford's fuse, that very seldom happens.

5 Secondly, Lieutenant Coningham has treated the work in the reef channel, as consisting of rock to the extent of only one-sixth of the excavation, whereas in the previous estimates, the whole was assumed to be solid rock.

In the first estimate of 1862, Rs 68,000; the whole of the excavation is treated, as solid rock, to be blasted with powder; and the total Cubical Content of rock, is to be raised by divers, and boat-men, without the use of the steam dredge.

In the second estimate, of 1863 Rs 36,000 — which differs from the former one, in striking out the pay of, a Mechanical Engineer, and Crew for the steam Dredge for 2 years; the whole bed of the channel again, is treated, as rock to be blasted; but $\frac{1}{6}$ only of the Cubical Content.

is supposed to be raised, as stone by divers; and the remaining $\frac{5}{9}$ to be taken up by the steam dredge.

In the last estimate, of 1865, Rs 33,760 only $\frac{1}{6}$ of the bed of the channel, is assumed to be rock to be blasted; and the whole is intended to be raised by the hand dredge; it being calculated, that the amount of hard stone that would require to be raised by divers, is so small, that the difference of cost in removing by that means, will be met from the charge for sundries.

It will be observed, that the 2^d & 3^d estimates do not differ much in amount; in the former, a much greater quantity of blasting is provided, but $\frac{7}{10}$ of the debris, is to be removed by the steam dredge; whereas, in the latter, the hand-dredge is intended to remove the whole of the debris; while the proportion of blasting, is only $\frac{1}{6}$.

6 The latest estimate has been drawn up, from a better knowledge of the existing state of the channel; the bed of the channel is also altered from the condition it was in, 3 years ago; and especially, experience has been gained, from the work of the inner angle, in judging of the state of the channel itself.

I have seen soundings taken in the channel, which, at parts, gave 14 and 15 feet of water, and

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and, allowing for the state of the tide at the time, it is evident, that there is now as much as 13, and 14 feet of water, at low water. The scour in the channel is very considerable; in the monsoon time, the current runs ~~there~~ at a rate that reaches 7 miles an hour, and the width of the channel, at bottom being only 80 feet; it follows that the loose sand and light fragments of stone, have been carried away by the force of the water alone - again, as in the inner angle, mud was, arrived at, 13 feet below the surface, under the stone, and the lower part of the stone was uniformly found to be softer than the upper crust; we may reasonably expect that the same condition of stone and bed, may be found, in the main channel - at present, the divers are unwilling to come to the work at the inner angle, as they say it is not worth their while to do so - they are paid by the cubic content of stone they raise, as measured on the shore afterwards; and they find, that the stone blasted at the greater depths, is so soft, and breaks up into such scattered fragments, that they cannot get hold, at the bottom, of any large blocks, so that it does not pay them to bring up, repeatedly, nothing but small pieces of stone - as the divers' work thus comes to an end, the hand dredge is able to do the whole work of clearing; and, as the hand dredge has

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been employed in the inner angle, clearing away the broken, and soft stone, mind you, thereby leaving bare the solid stone; so it will also be used in the main channel. while then it is impossible, that an estimate can be made before hand with any accuracy, as to the quantity of rock that will be found; it is now a matter of certainty, as shown by the sounding, that 142 feet below what is supposed to be the depth of the channel, viz. 12 feet at low water, there is at parts no rock at all; there is every probability of the hand dredge being able to remove a great portion of the bed at other parts, where blasting will not be required; and I am of opinion that the estimated proportion of the bed of the channel that will have to be blasted, viz. 6th is reasonable, and as near to accuracy as we can attain. After the hand dredge has been working for some time, the quantity of rock will become more clearly defined; but this estimate cannot be drawn up, as the legitimate cost of a certain amount of work; for the amount is an unknown quantity; and I can find no cause for taking any other proportion than that which is givened by Lieutenant Cunningham, from his general experience of the works.

7 In order No 3142 of the 1st November 1864. the Government require estimates for deepening the Paumben Channel to 12 and 14 feet respectively.

and to know the cost of maintenance, at both levels. As the channel has already a depth of 12 feet, at low water: the former estimate is not needed. Lieutenant C Cunningham states in paras 2 & 3 of his report, that he has not estimated for maintenance, at the depth of 12 feet; because the expenditure on maintenance, depends on the number of dredges; and that the amount of work for maintaining the channel at 12 feet, being nearly $\frac{2}{3}$ of the work, required for 14 feet, depth; the expenditure will be, about $\frac{2}{3}$; hence, it is inferred that the cost of maintenance, at 12 feet will be $\frac{2}{3}$ of Rs 7000 (the estimate for maintenance at 14 feet) or Rs 2333.

8 Now, the maintenance allowance, is principally required for the clearance of what is called, the sand bank channel, about $\frac{1}{2}$ mile to the south of the reef; the reef channel is subject to not much silting, and that chiefly, at the extremities, at the change of the monsoons. To maintain the passage, at 12 feet this sand bank, involves the removal of 180,000 cubic feet of sand in the year; while to keep the passage open to a depth of 14 feet, requires the clearance of 145,000 cubic feet of sand. - So - to maintain the greater depth, dredging is necessary to a distance of 1350 feet, at the north end of the sand bank channel, and to a length of 3000 feet from the south end; in addition to the length of the sand bank channel itself, 2100 feet. The proportion

proportion of cost of maintenance, at the 2 levels is thus nearly as 2 to 5, rather than as 2.3: or, if the maintenance charge for 14 feet costs Rs 7000 per annum, that for 12 feet, will cost Rs 2800. The accumulation of silt has been found from observations in past years, to be only $\frac{1}{8}$ foot, and $\frac{1}{2}$ ft. in the year - A separate estimate is thus not made for the maintenance at the lower level of 12 feet; because it does not appear to be required; for if the reef channel is deepened through out to 14 feet, it is necessary that the sand bank channel should have a corresponding depth.

9 In paras 4. 6 & 7 of his report, Lieutenant Cunningham adverts to the charges used in blasting; the proposition to use large charges, resting on the rock, is, I think, not applicable to the present circumstances; for the labour of boring would be dispensed with, the current is so strong, that shivers would be required to fix the charge in position, and from there being comparatively so little hard stone to be dealt with; the powder would be thrown away, in acting on the under surface of broken stone, sand & mud. - As noticed above, pains are now taken, to isolate the blocks of hard stone; and small charges, are found to be the most economical.

10 I think I have now referred to the different points

points in Lieutenant Cunningham's report; the provision for a main body that he refers to in para 11, is struck out of the estimate, as that in charge will come under the head, petty establishment.

fo. 11 But, while the estimates for deepening the Paumotu Channel to 14 feet, and for maintenance, at that level, have been framed to the amounts of Rs 33,760, and Rs 7000, respectively; by the present system of treating the charges for convict labour and gun powder, the actual sums, to be provided in the Public Works Budget, will become much reduced.

Thus the subdivisions of the estimates are—

For deepening Paumotu Channel to 14 feet. For maintenance at 14 feet.

1 Actual charge to estimate	10,060	1080
2 Petty establishment	"	504
3 Tools and Stores	15,500	3360
4 Convicts & gun powder	10,200	2056
Total	33760	7000

Rs 11440 for Petty establishment already struck out.

The addition of items to 1 & 3: will then give the reduced sums of Rs 23,560, and Rs 4440. In dealing with estimates of an ordinary nature; items to 3 should also be struck out, as tools and stores now form a main head of the Budget, allotment; but, as,

in the operations here, these charges form such a large portion of the work, and no separate provision is made for them, I think they ought properly to be included in the estimates.

12 While then I submit the estimates, again, in the same form as they were previously submitted in last June: I would recommend for the approval of Government.

Estimate for deepening Paumotu Channel to 14 feet — Rs 23,560

" Maintenance D at D Rs 4440

13 Referring to para 8 of the Government Order under reply; the amount of estimate Rs 11,500 for 2 hand dredges, is provided, from the sum of Rs 2750, allotted in G.O. to 2815 of the 22nd September 1867 or rather, I propose an expenditure of Rs 725 for 1 dredge during the current official year; the machinery is being made at Madras, and if one dredge is fitted up now; the other can be put in hand at the beginning of the coming official year, so as to be ready by August, when the working season again begins.

I have &c
Hew Lundquist. Captain R.E.
Offg. Supd. Engrs & Dns

220 Kelly 1866 Q. 265

1852

18721 - 2nd March 1866

the following plan the
estimate returned with
y. D. N. 2058 of the 18th Aug 65
report on the first report in
the Commission also regarding
the deepening & maintaining the
Caumben Channel & recommend
for the approval of Government
certain arrangements, keeping
it in a better condition

17-5-19

1852 July 18 44 61 61 63

the following plan the
estimate returned with
y. D. N. 2058 of the 18th Aug 65
report on the first report in
the Commission also regarding
the deepening & maintaining the
Caumben Channel & recommend
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it in a better condition

Miscellaneous Public Improvements
New Work
Abstract Estimate No 146 of 1865/66

Work—Deepening Caumben Channel from 12 feet to 14 feet depth
at low water

Quantities	Description of Work	Rate	Amount	Amount of each part
<u>Deepening Channel</u>				
1	Hand Dredge for removing 448200 Cft of Shingle in 32 months / per mensem /	@ 54	1728	
2000	Charges for blasting 70000 Cft of Rock per 16. Charges—	@ 22	2750	
6	Divers for 12 months / per mensem /	@ 5	360	
1	Hand Dredge for removing 410760 Cft of Rock & Shingle in 41 months / per mensem /	@ 54	2214	
1	Hand Dredge for removing 1290000 Cft of Sand in 46 months / per mensem /	@ 54	2484	
			524	10060
<u>Sundries</u>				
<u>Repairing Tools and Stores</u>				
	Repairing Boats &c for 3 1/2 years / per year /	@ 3600	12600	
	Jumpers for 12 months / per mensem /	@ 15	180	
	Lengthening Boat Columbo into Mud Boat		150	
	Tools Stores and Sundries		570	13500
<u>Corvict Labor</u>				
92250	Corvicts to be employed in 3 hand Dredges for 3 1/4 years / per Corvict /	@	14	7687 8
5760	do do in 3 Rafts for 12 months / per mensem /	@	14	480
	Sundry work by Corvicts &c		157 8	8325
5000	Gun Powder 1/2 lbs of Gun Powder - / per lb /	@	3	1875
	Total of Estimate Rupees			33760

Caumben
18th May 1865

Signed W. Cunningham Lieut. R. E.
Subt. of Operations Caumben

J. Huber
Lieut. Colonel R. E.
Superintending Engineer 8th Division

Miscellaneous Public Improvement. Main Finance.
Abstract Estimate No. 14 } of 1865/66.
District Madras

Abstract Estimate No. 17 of 1865/66.

Work Maintaining Pamblico Channel at a depth of 14 feet
at low water

Quantities	Description of work	Rate	Amount	Amount of cash paid
	<u>Maintaining Channel.</u>			
3	Hand Dredges for removing 4,570 7/5 cu ft of Sand in 9 months / per manum / — at	120	1080	
3	Springs for 1 year / per manum / — at	14	504	1504
	<u>Repairing Tools and Boats</u>			
	Repairing 3 Dredges / per year / —		1500	
	do 6 Mud Boats —		600	
	do 3 Canoes —		30	
	Current repair of 3 Dredges for 9 months per manum — at	40	1000	
	<u>Sundries</u>		150	3360
22140	Convict labor not paid for in money consists to be employed in 3 Dredges for 9 months / per Convict / — at	1 1/2	1045	
	Sundry work by Convicts, Rope &c..		211	2050
	<u>Total of Estimate Proper</u>			7000

Number
154 May 1865 }

Signed / H. Cunningham Esq. R. C.
Supt of Operations Denmark

J. H. Gandy
Superintending Engineer & Division

No 721

Proceedings of the Madras Government
Under date the 2nd March 1866
Read the following

From The Offg Supg Engrs & Co

In submitting again the
Estimates returned with G.O. No 2058
of the 18th July/65 reports on
the points referred to in Lt Cuninghame's
letter regarding the deepening and
maintaining the Pambour Channel
& recommends for the approval of Govt
certain arrangements for keeping it in
a better condition.

H. E. 9th February 1866
No 2216

In his letter of the 25 June
1865, No 422, the Supg Engrs of the
S. E. in pursuance of the orders as
per margin, submitted two es-
timates of Rs 33,760 & Rs 7000
respectively for deepening the
Pambour Channel from 12 to
14 feet at low water, & for
annually maintaining it at
that depth. As these estimates
however were unaccompanied by
any expression of the S. Engrs
opinion of their suitability or
sufficiency, & were moreover

6 Nov 62 - 2668
1 Nov 62 - 3142

Handwritten initials and signatures.

Enclosure in a letter
from the Offg Supg Engrs
of the 18th July 1865
No 2058
H. E. 9th February 1866
No 2216
In submitting again the
Estimates returned with G.O. No 2058
of the 18th July/65 reports on
the points referred to in Lt Cuninghame's
letter regarding the deepening and
maintaining the Pambour Channel
& recommends for the approval of Govt
certain arrangements for keeping it in
a better condition.

has been prepared; & as the result of the soundings taken in the Channel (which in certain parts is believed to be as much as 13 & 14 feet deep at low water) shows that one & two feet below the supposed depth of 12 feet at low water there is no rock at all in parts, and that in others the hand dredges, which have been employed at the inner angle with great advantage, can be used in removing a great portion of the bed, Capt. Prendergast is of opinion that one-sixth may reasonably be supposed to be the proportion of the channel bed that will have to be blasted.

With regard to the estimate of Rs 7000 for maintaining the Channel at a depth of 14 feet, Capt. Prendergast explains that that allowance is principally required for the clearance of what is called

31
the sand bank Channel, ^{which is} about a mile & a half to the south of the gulf, & that to maintain the required depth a clearance of 4,50,000 C. feet of sand will be necessary.

The Government consider these explanations to be satisfactory.

MR. and Council cannot however approve of the manner in which the Dy. Supt. Engineer proposes in P. 11 to deal with the charges in the estimates. He has no objection to such portion of the provision under "Tools & Stores" as relates to repairs to boats & canoes being allowed to stand in the estimates; but the balance must be omitted, & the charges not in the usual manner from the specific allotments under "Tools & Stores". This alteration will reduce the estimate for deepening the Channel to

Rs 22,010 & that for main-
taining it to A. 1860, exclusive
of the cost of Conrick labor
& gunpowder, for which no
cash payments are necessary.

These estimates are sanctioned,
and the question of providing
funds for the work, in addition
to the grant of Rs 7,000 in the
Budget for 1860/7 for cutting
the inner angle of the Reef
Channel, will be considered
after 1 May next.

W.B.

23
The Secy to Govt.

Controller

Act General

4.7.06.
31-7-07 ✓

P. H. M. S. D. 1875
Pro. of Govt for March
No. 721.
Pro. of the Madras Govt.
Of 2^d March/87

Pambam Channel
Madras District Estimates
for the deepening and
maintaining of - same
with certain remarks