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MADRAS RECORD OFFICE.

Government of Madras.

Public works DEPARTMENT.

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162-163		
Dated	9. 21	1870.

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*Proceedings of the Madras Government, Public Works Department,
9th April 1870*

No 162 Read the following letter from the Acting Consulting Engineer for Irrigation and Canal Company, to the Secretary to Government, Public Works Department, dated Madras, 24th February 1870, No. 138 —

I HAVE the honour to submit the correspondence as per margin, accompanied by revised estimates, for the earthwork of the 6th Section Main Canal, that is from the 73rd to the 91st mile, including revetments and catch-water drains, and amounting to Rupees 3,88,550, giving an increase of Rupees 1,81,500.

From Agent, No 375, dated 16th November 1869, with Chief Engineer's No 957, dated 6th November 1869
To do No 219, dated 30th November 1869
do „ 297, „ 25th January 1870
From do „ 68, „ 11th February 1870, with Chief Engineer's No 117, 24th January 1870, and Mr Dodson's No 453, dated 18th December 1869, and his No 459, dated 20th Dec 1869
From do No 72, dated 17th February 1870, with Chief Engineer's No 174, dated 3rd February 1870.
One Detailed Estimate
One Abstract do
One Comparative Statement

2 The amounts formerly sanctioned for this work were as follow. —

	RS
By G O, No 1,555, dated 3rd July 1862	3,02,000
By do do do	2,930
Total	3,04,930
Deduct for masonry works	1,55,390
Balance for earthwork	1,49,540
Of this sum the earthwork of the first six miles required	45,400
And for the remaining 12½ miles there was	1,04,140
Then there was an additional sanction on account of the earthwork in the first six miles by G. O, No 3,624, of 14th November 1866	57,510
Bringing the total sanction for the section exclusive of masonry works up to	2,07,050

There was also a further provisional sanction of Rupees 6,015 on account of the earthwork in the upper six miles given in Government Order, No. 537, dated 17th February 1868, with instructions to prepare revised estimates without delay, which has only now after a lapse of two years been attended to

3 The estimate now submitted amounts to Rupees 3,88,550, so the increase is Rupees 1,81,500, and is made up of the following items —

	RS	A	P.
Earthwork first six miles	35,144	11	11
Earthwork for remaining 12½ miles	38,006	8	6
Catch-water drains	2,612	0	11
Stop bank 82nd and 83rd miles	1,198	8	0
Revetments	4,578	13	0
Surplus water channel at the Mettacondal cut	13,196	10	8
Contingencies	36,762	11	0
Depreciation of plant, stores, and store charges	50,000	0	0
Total	1,81,500	0	0

4. In his letter No. 84, dated 31st October 1866, the Consulting Engineer submitted a revised estimate for the earthwork of the first six miles which amounted to Rupees 1,43,520 against the former sanction of Rupees 45,400, being an increase of Rupees 98,120 or 216 per cent., and which was stated to be owing to the necessity for increasing the top width of the banks and flattening the slopes, also to the omission in the original estimate of catch-water drains, revetments in the 73rd mile, and to the insufficiency of rates. In laying the estimate before Government the Consulting Engineer recommended that the top width should be only six instead of nine feet, and the inside slopes two to one, and the outside slopes one-and-a-half to one instead of two to one on both sides as proposed, this modification reduced the estimate considerably, and the Government approving of the recommendation sanctioned for these six miles Rupees 1,02,910 in Government Order, No. 3,624, dated 14th November 1866, in lieu of Rupees 1,43,520.

5. In the correspondence on that occasion it was shown that there was considerable ambiguity in regard to what had been intended to be the width of the banks at top and what the slopes of the banks should be, and that there had been a great want of exactness and correctness in the preparation of the former estimates, and it would now appear that the revised ones were scarcely more reliable, for it will be seen by the Executive Engineer's letter in which he details the condition of the earthwork in each mile when he began to work upon the revised estimate, that the amounts provided were very insufficient to complete the work then remaining to be done at average rates, and it was on the Executive Engineer's representation to this effect in January 1868 that the additional provisional sanction on account of earthwork in the first six miles was given, and he, Mr. Dodson, now explains that besides the inaccuracy of quantities in the estimate, the cost of executing the work was enhanced by the scarcity of soil, whereby the ordinary method of forming the banks could not be adopted, the soil being only nine inches deep, in consequence of which it became necessary to procure puddle clay for cones to the banks from a distance.

6. With respect to the earthwork of the remaining $12\frac{1}{2}$ miles the Executive Engineer observes that the position of many of the locks were changed in order to get better foundations, and to lessen the height of banks, as it cost less to take out a foot more cutting than to raise double banks a foot, but that these alterations make it impossible to compare the sanctioned with the revised estimates mile by mile, the proportion of banks to cuttings having been so much altered; and I very much doubt that there was any reduction in the quantity of earthwork by reason of the changes.

7. The Chief Engineer in his No 957, 6th November 1869, referring to the increase of sanction asked for, on account of the last $12\frac{1}{2}$ miles of the section, observes that they have been much modified by the changes sanctioned in the site of locks in order to save earthwork and to improve the foundations, and that the slopes of the banks instead of being one and-a-half to one at which the earth would not permanently stand, outer slopes of one and three quarter to one and inner slopes of two to one are proposed. "Besides," he adds, "the top breadth of banks has been increased to six and eight feet."

8. In his No. 174, 3rd February 1870, he denies that by this expression he accounted for a large part of the increase in the earthwork estimate, but I cannot discover any other meaning in the remark.

9. I feel, and greatly regret, that I am laying these revised estimates before Government with a much less clear explanation of the causes of increase than I should do, but the whole question is so confused, and there has already been so much delay in getting the estimates and any explanation at all about them, while the working season is fast slipping away, that I think it is better to submit them as they are.

10. The item on account of catch water drains is because no provision had been made for turning the drainage water through the culverts, which it would consequently have passed and flowed down above the canal.

11. The next item requiring explanation is the surplus channel to take off the water from the natural calingulah in 72nd mile for which the only sanction existing was Rupees 2,930.

12. The total estimated cost, including rock-cutting to form the calingulah, is Rupees 16,098-12-0, of which the large sum of Rupees 13,169 is required to cover the amount that has been spent to date, but the Executive Engineer says "he can find no record of how or where it was spent, all excepting Rupees 210 having been spent before he was in charge." He adds "he is unable to give any satisfactory explanation of this large expenditure beyond the fact that the yards actually executed will, at the rates given in the abstract, account for such a sum being spent on the works." It is this abstract that the Chief Engineer refers to as being incorrect in his letter No. 174, 3rd February 1870, and he remarks that the quantity of work done is 65,250 cubic yards of excavation, earth and rock, which would give an average of about four cubic yards to the rupee.

13. The increase to the estimate under the head of Contingencies is Rupees 36,762-11-0 which the Executive Engineer explains to be an addition of ten per cent. to the total estimate to cover the expenditure on Contingencies already increased, as shown in Form II 11 and for Contingencies on work still to be done. In other words the item of Contingencies as sanctioned is over Rupees $7\frac{1}{2}$ per cent. and that now included in the estimate is more than Rupees $17\frac{3}{4}$ per cent.

From the Agent and Manager of the Madras Irrigation and Canal Company, to the Consulting Engineer of the Madras Irrigation and Canal Company, dated Madras, 16th November 1869, No 375

I HAVE the honour to forward for sanction revised estimates of earthwork in the 6th Section, with explanatory letters from the Chief Engineer and Mr. Dodson as to the necessity for an additional sanction

Nos 957 and 257

2. The cross-sections referred to in paragraph 1 of Mr. Dodson's letter I have not yet received, but I shall lose no time in transmitting them to you as soon as they reach me

3. The communication referred to in the 4th paragraph of Mr. Dodson's letter was embodied in the Chief Engineer's No 345, of 16th June 1869, copy of which accompanied my No 167 of the 29th June to your address

4. I enclose one revised estimate, one abstract estimate, and one comparative statement.

*Proceedings of the Madras Government, Public Works Department,
9th April 1870.*

From Mr. J H COX, for Chief Engineer, absent in camp, to the Agent and Manager of the
Madras Irrigation and Canal Company, dated Kurnool, 6th November 1869, No 957

I HAVE the honour to enclose, for submission to Government, revised estimate of the earth-
work of 6th Section

2 On the first six miles (73 to 78 of present sanction) more money would have been saved
had not the selection of material for the banks required so much care, and much of the
bank previously thrown required opening up for the insertion of a core of rammed earth, which
even in many cuttings had to be collected from a distance

3 The remaining 12½ miles have been much modified by the changes sanctioned in the
site of locks in order to save earthwork and improve foundations The decrease of quantity
thus effected is 1,07,442 cubic yards* showing
a saving of about 6 per cent The average rate
at present sanctioned is 96 yards per rupee
which has proved insufficient, and is now raised
to 64 yards The total amount of the estimate
for these 12½ miles is thus increased by Rupees
27,966-10-4† or, say, 26 per cent The saving
in quantity would have been greater had not
more secure slopes been proposed Instead of
slopes of 1½ to 1, at which the earth would not

	C Yds
* Former quantities	17,86,280
Revised do	16,78,838
Saving	1,07,442

	RS	A	P
† Present sanction, (1862)	1,06,095	5	6
Revised estimate	1,31,061	15	10
Addition	27,966	10	4

permanently stand, slopes of 2 to 1 inside the
canal and 1½ to 1 outside are proposed, and
included in this estimate ‡ Besides this the top
breadth of banks has been increased to 6 and
8 feet *Revetment*—Kunkur revetment is pro-
posed in all cases, where inside the canal and
the use of red shale is abandoned In the case
of some culverts, especially those under the
upper platforms of locks, where the canal takes
very nearly the average direction of the steepest slope of the country, I found no provision for
turning the drainage water through the culvert, and it would have passed the culvert, and flowed
down above the canal Banks are now included for turning this water through the culverts

4 The canal is 60 feet at full water-level as originally sanctioned between sloped banks
When the banks are vertical the same average width is estimated for

From the Acting Consulting Engineer for Irrigation and Canal Company, to the Agent and Manager
of the Madras Irrigation and Canal Company, dated Madras, 30th November 1869, No 249

With reference to the revised estimates for earthwork of the 6th Section received with your
letter No 375, of the 16th instant, I have the honour to observe as follow —

2 In paragraph 3 of his letter § Mr Dodson states that, by comparing the actual amount
§ No 257 without date attached, to the Agent's No 375
spent on the first six miles of the section
with the sanctioned amount, his abstract will
show a saving of Rupees 11,454 in the first
four miles and an excess of Rupees 4,146 in the next two miles, whereas neither the abstract
estimate nor the comparative statement signed by the Chief Engineer and received with your letter
shows this result On the contrary they show an excess over the sanctioned amount in every one
of the first six miles, amounting in the aggregate to Rupees 35,144, exclusive of the excess in the
item "Contingencies" which comes to Rupees 9,576, or both giving a total excess of Rupees 44,720
over the sanctioned amount for the six miles as shown in the following statement —

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Miles	GOVERNMENT SANCTION		AS NOW REVISED		DIFFERENCE.		
	Quantity.	Amount	Quantity	Amount.	Increase		Decrease.
					RS. A. P.	RS. A. P.	
From 73rd to 76th mile inclusive.	4,37,415½	69,339 7 9	4,68,662 ch 77	94,396 12 3	57,151½ ch 77.	25,057 4 6	25,905
From 77th and 78th mile ...	1,46,810½	20,440 12 6	1,77,062 ch 20	30,528 3 11	30,251½ ch 20	10,087 7 5	
Total earthworks ..	5,84,226	89,780 4 3	6,45,724 ch 97.	1,24,925 0 2	87,403 ch 97	35,144 11 11	25,905
Contingencies ..	...	9,354 0 0		* 18,930 0 0	...	9,576 0 0	...
Grand Total . . .	5,84,226	99,134 4 3	6,45,724 ch 97.	1,43,855 0 2	87,403 ch 97	44,720 11 11	25,905

* The total amount for Contingencies is Rupees 51,299-13-4, and proportion on the cost of the first six miles comes to Rs 18,930.

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I, therefore, request to be informed how Mr Dodson's statement and paragraph 1 of Mr. Latham's letter, which also states that more money would have been saved in this portion of the section had it not been for the reasons assigned, are to be reconciled with the revised estimates, and, if the result shown by these documents be correct, full explanation of the excess, which comes to 45 per cent on the supplemental sanction for the first six miles given in November 1866 will be necessary, as both Messrs. Latham and Dodson say nothing about it

G O, No 3,624, dated 14th November 1866

3 The total quantity of earth-work sanctioned, as shown in the Progress Reports, is 17,93,205* cubic yards, but it is entered as 17,86,280† cubic yards in the revised estimate similarly the amount sanctioned in 1866 for the earth-work of the first six miles is Rupees 89,780-4-3 Deducting this sum from the total of earth-work in the column headed "Sanctioned Amount," in the revised estimate, the difference, Rs 96,055-7-4, comprise the amount for the other twelve-and-a-half miles of the section, but this is taken, as Rupees 1,06,095-5-6 in the margin of the Chief Engineer's letter explanation of these variations is also requested

	C Yds
* 73rd to 78th mile	5,84,226
79th to 91st do	12,08,979
	17,93,205
† 73rd to 78th mile	5,84,226
79th to 91st do	12,02,054
	17,86,280

From Colonel J CARPENDALE, R E, Acting Consulting Engineer for the Madras Irrigation and Canal Company, to the Agent and Manager, dated Madras, 25th January 1870, No 297

In the latter part of paragraph 22 of Mr Dodson's letter, which accompanied your's of the 16th November last, No. 375, it is stated "that the yards actually executed will, at the rates given in the abstract, account for such a sum as being spent on the works," but your letter not having been accompanied with such abstract, or the quantity and rates of work not being given with estimates received with your letter, I have the honour to request that Mr Dodson's abstract may be furnished to me at your earliest convenience

2 I also request an explanation of the Chief Engineer's statement that the top breadth of the banks in the last twelve-and-a-half miles of the 6th Section having been increased to 6 and 8 feet, accounts for a large part of the increase in the earth-work estimate, the fact being that a greater top width, namely, 9 feet, was formerly provided, the alleged alteration in the slopes of the banks would also appear to be an error It is said that, instead of one-and-a-half to one, the inner slopes are now proposed to be two to one, and the outer one-and-three-quarter to one, but I find that for many miles, certainly fourteen out of the whole length, the cross sections belonging to the former estimate show both the inner and the outer slopes as much as two to one

3 I further beg to be informed what is the meaning of the 53,145 cubic yards of something mentioned in the margin of paragraph 3, Chief Engineer's letter, No. 957, dated 6th November 1869, attached to your No. 375 of 16th idem

From J H LATHAM, Esq, Chief Engineer, to the Agent and Manager of the Madras Irrigation and Canal Company, dated Kurnool, 21st January 1870, No 117.

In reply to the Consulting Engineer, No 249, of 30th November, sent with your foot note 730 of 9th ultimo, I have the honour to say that I regret that I was not made aware, after my letter was drafted, that so important a mistake had been discovered, made by the Divisional Engineer in his statement of the amount sanctioned for the first six miles of the 6th Section

2 His letter, No. 453, copy enclosed, shows that he took the total amount sanctioned for those miles as the amount sanctioned to finish them with, and these most nearly agreed with the actual quantities and sanctioned rates. In drafting my letter I took his statement of total sanctions as correct, since, with the Agent's monthly progress reports before him, it seemed almost

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impossible for him to make an error It was, of course, detected in my office, but I was not informed of it. The estimates I signed are correct. It seems that the quantities of works actually requiring to be done to complete the banks, for which the excavations from the cuttings was rarely suitable, were so large that, if divided by the sanctioned money remaining unexpended in 1867, the remainder giving the number of cubic yards to be executed for a rupee was respectively 7 9, 10 8, 11 1, 12 3, 17 and 4 5, whereas the number of cubic yards actually obtained for each rupee has been 5 3, 5 1, 4 3, 5 1, 4 3, and from 4 to 5 yards, and that sanctioned* was 7, 6, 5 1, 6, 5, and 5 on the six miles from the 73 to 78 inclusive

G O, No. 537, of 17th February 1863

3 In addition to the complication due to the quantity of work actually required exceeding that sanctioned was that due to the fact that the latest sanctioned amounts, and rates did not fit on to the latest sanctioned quantities The amounts and rates last sanctioned (G O, No. 537, of 1863) were taken in my office as defining the sanctioned work, and the quantities deduced from them entered in my estimates as the sanctioned quantities. This explains Colonel Carpendale's paragraph 3

From A J DODSON, Esq, Executive Engineer, to the Chief Engineer, dated Bhowanassy Division, Velapanoor, 18th December 1869, No 453

Your's of the 15th, No 449.

2. I much regret the mistake I have been led into by not taking the proper meaning of G O, No 3,624, of 14th November 1866

3 I received from your office a statement showing in the first column sanctioned estimates and in the last column total amount requiring sanction with a mark X against the first six miles, referring to a footnote as under —

"Those marked X were sanctioned in G O, etc," I then took those amounts and added them to the sums in the first column headed "Original Estimate," and in that way got the amounts given in the first six lines of the abstract sent to you in my last I now see that the original estimate should not be added

4 I am preparing, and hope to forward you on the 20th, an amended abstract none of the other columns will need altering than those affected by this unfortunate error of mine. The amount of work to be done remains the same, and the only amount requiring sanction will be altered I shall also forward you an amended letter of explanation to cancel the one sent with the erroneous estimate

(True Copy)

(Signed) J. H COX,
Assistant to Chief Engineer.

From A J DODSON, Esq, Executive Engineer, to the Chief Engineer, dated Bhowanassy Division, Velapanoor, 20th December 1869, No 459.

I HAVE the honour to forward you herewith my revised estimates of the earth-works in the 6th Section of the Main Canal, consisting of nine sheets of detail estimates, one sheet of abstract, and — sheets of cross sections.

2 The first six miles of this section were estimated by Mr H C Cotton in 1866, and that estimate was by Captain Mullins considerably cut down in quantity and in rates, from an average of five yards as recommended by yourself to seven yards, and with those deductions it was sanctioned in G O, No 3,624, of 14th November 1866 In January 1868 you applied for sanction for the rates to be raised in some miles to six yards and in others to five yards, and this was sanctioned in G O, No 537, of 17th February 1868

3 It was not until early in 1868 that I was able to re-commence these miles with an Assistant Engineer, Mr J H Cox, in residence at Lockinsula I soon found, however, that, owing to the scarcity of soil in most of these miles, that the ordinary method of forming them could not be adopted. The soil in some miles was not more than nine inches deep, and below was nothing but shale

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You then instructed me to form these banks with cores of the best earth procurable within a reasonable distance and to throw the shale and stone on the slopes only. This has been done throughout great part of the 73rd, 74th, 75th, 77th, and 78th miles. The core was well rammed down, and, when water could be had, it was mixed with the soil. This process was, however, an expensive one.

4 For the 73rd mile I found a total sanction of Rupees 27,283, (I always omit annas and pies,) but by Form H-II of April 1868 I found that Rupees 20,909 was already spent, leaving me a balance of only Rupees 6,374 to complete the mile with. On taking out all the quantities I found that there was still 3,356 cubic yards of cutting and 47,302 of banks to complete, which, at the rate of 6 annas per yard for the cutting and an average rate of five yards for the embankments, raised the amount now required for sanction to Rupees 5,050. In fact, the former estimate must have been very deficient in quantity.

5 In the 74th mile the balance of the former estimate at my disposal was Rupees 6,417, but I had 69,375 cubic yards of embankment to complete, which, at an average rate of 5½ yards to the rupee, required an additional sanction of Rupees 6,894.

6 In the 75th mile I had Rupees 7,437 to spend and 86,044 cubic yards to complete, and on that mile I require an additional sanction of Rupees 10,473.

7 For the whole of the 76th mile I had a sanctioned estimate of only Rupees 71,821, and in Form H-II I found Rupees 10,272, leaving only Rupees 1,549 of the sanction; and, as I had yet 19,152 yards to complete the mile, even at the lowest possible rates it required an additional sanction of Rupees 2,640.

8 In the 77th mile I had a balance of Rupees 1,672 to spend and 28,149 cubic yards to complete, which, at an average of five yards to the rupee, obliges me to ask for an extra sanction of Rupees 4,732.

9 In the 78th mile I had an available balance of Rupees 1,978 and 2,854 yards of banks and 6,070 yards of rock cutting to complete, the former averaging at five yards and the latter at four yards the rupee, requires an extra sanction of Rupees 5,145. The total extra sanction required for the earth-works of these six miles is Rupees 35,144-11-11, caused chiefly by extra rates, necessitated by the scarcity of soil and increased value of labour, and also due to the deficiency of the quantity of work allowed for as to be done in Mr Cotton's estimate of 1866.

10 As the estimate I now send in for the miles from the 73rd to the 91st (the end of the section) has been prepared in a similar manner to that fully explained in my report on the revised estimate for the 5th Section, (see my letter, No 40, 28th April 1869,) I need not here enter into any description of the manner in which I have obtained the amounts shown in column 6 of the abstract, but will proceed to comment on the causes of excess in some of the miles.

11 From Lock No 3 to Lock No 8 the position of the principal masonry works have not been altered in any way to affect the amount of earth-work, but below Lock No 8 I have altered, as you are aware, the position of nearly all the locks, in some cases to obtain better foundation but in others to lessen the heights of banks above the locks, as it is nearly always cheaper to take out a foot more cutting than to raise double banks a foot higher. These alterations, however, make it impossible to compare the sanctioned with revised estimates mile by mile, the proportions of banks and cuttings having been so much altered.

12 The 79th mile requires Rupees 3,922 more than the sanctioned amount to complete it, although the amount of rock-cutting was considerably lessened by the introduction of Lock No 2-A, but as the rock proved to be very hard and had to be carried out over a high spoil bank, I could not do this for less than 10 annas a cubic yard, but the amount in the sanctioned estimate 1½ to 1, they are now calculated for 1½ to one outside and 2 to 1 inside. This difference causes a considerable increase in high banks, and in those of the 79th mile it adds 2,417 cubic yards. The rate is also raised from 1 anna and 2 pies to 2 annas a cubic yard. The above will account for the extra amount required for completion.

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13 Mile 80th requires Rupees 5,700 more than the sanction to complete it, but in the estimate of 1862 it is evident that the quantities allowed for the high banks above Lock No 4 have been greatly under-estimated, and the rate, 1 anna and 2 pies, is now too low. The alteration in the slopes adds 6,230 cubic yards, and the cutting, which had about six inches of slabs and kunkur, to be necessitated a higher rate.

14 Mile 81st requires Rupees 2,648 more to the banks above Lock No 5, adds 7,075 cubic yards to the total amount at a rate of 7 annas, and the rates for the completion of the cutting are to be increased considerably.

15 The 82nd mile has Rupees 3,702 added to its list chiefly due to the cutting which is entirely through hard slabs and yet harder kunkur, requiring an increase to the rate also, an addition of 4,979 cubic yards to the slopes.

16 The 83rd mile requires Rupees 12,132 more than the amount sanctioned. Most of this is owing to the increase of rates required for the high banks from the 10th to the 65th chains.

17 The cross sections show that in many chains the soil not being more than six or eight inches deep overshale we have been obliged to form the banks with a core made of the best earth procurable, and throw the shale and stony soil on the slopes. This method of forming the banks, and the great distance (often as much as six chains) from which the soil has to be gathered, obliged me to allow a rate of six-and-a-half yards to a rupee.

18 The rate allowed in the estimate of 1862 is 13 yards to the rupee. This difference of rate will account for about Rupees 10,000 of the extra amount required, and the additions to the slopes requiring 734 cubic yards at six-and-a-half yards adds Rupees 1,129, leaving Rupees 923, which is required to cover the increased rate given to complete the cutting.

19 On the 84th mile I expect a small saving on the sanctioned amount, and for the 85th mile only Rupees 924 will be required extra to complete it, due to the accumulations of silt during the five seasons it has been exposed to rain and floods.

20 The 86th mile needs Rupees 8,578 extra to complete it, and the 87th Rupees 3,645, in both cases the excess is due to the extra slopes and slight increase of rates required.

21 On the sanctioned estimate for the 88th mile there will be a saving of Rupees 2,378, due to the alterations in the position of locks.

22 The 89th mile requires Rupees 6,777 above the sanctioned amount, but it is nearly all in embankment, and the extra amount in the slopes and increase of rate due to long leads and scarcity of soil in some parts fully account for the requirement on the 90th and 54th chains of the 91st mile, there is a considerable saving on the sanctioned amount.

Revetment.

23 The only revetment provided for in the estimate sanctioned in 1866 was in the 73rd mile, and the rate was 4 annas to the cubic yard for its completion. I have allowed from 12 annas to a rupee 4 annas per yard, according to the distance it had to be brought. I have also provided for the protection of the slopes of the upper bank whenever flood or streams diverted under our culverts are likely to injure them, all these points are fully shown in sheet No 7 showing the detail of work yet to be done.

Catch-water Drains

24 The additional sanction required for is Rupees 2,612, chiefly due to the heavy drains needed to divert a large nullah through the three-arch bridge under Lock No 9-A and to a large drain required to divert the nullah in the 90th mile (where a culvert was formerly proposed) along the upper bank down into the Cawlee.

25 The stop-banks are new works required to divert flood waters under the three-arch culvert at Lock No 6 and the twelve-feet arch under Lock No 7. They are fully shown in the plans and sections accompanying the estimate.

26 The only item now requiring any comment is the surplus channel to take off the water from the natural calingulah in the 72nd mile and from the under-slucies in the 73rd mile down into the Cawlee.

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27 In the sanctioned estimate of 1866 no sum has been allowed for this work, but in Form II-II for December 1862, I find a sum of Rupees 2,930 allowed, I believe, for the escape channel only. The present sum includes the cost of the calingulah also, which is so entirely insufficient for a work requiring the large amount of 15,730 cubic yards of rock-cutting and 46,600 cubic yards of embankment, etc., that it appears to me that the plans must have originally been very different from the one now executed.

28 I have a plan, dated 15th February 1862, which nearly agreed with the work as executed, and from it I have taken the quantities shown in sheet No 9 and put them at what I consider a fair rate, adding the revetment as executed and the repairs I have made lately.

29 The large sum of Rupees 13,169 is required to cover the total amount shown in Form II-II as spent up to date, but as all but Rupees 210 spent by me was incurred long before I was in charge of the division, and as I can find no records of how or when it was spent, I am unfortunately unable to give you any satisfactory explanation of this large expenditure beyond the fact that the yards actually executed will, at the rates given in the abstract, account for such a sum being spent on the work.

30 I have added 10 per cent to the total of my estimates to cover the amount of contingencies shown in Form II-II of December 1866, and the amount required for the part done or remaining to be done since I have been in charge.

(True Copy.)

(Signed) J. H. COX,
Assistant to Chief Engineer

No. 68

Copy forwarded to the Consulting Engineer with reference to his No 249, dated 30th November 1869.

MADRAS,
11th February 1870

(Signed) C. A. BADHAM,
Acting Agent and Manager

From J. H. LATHAM, Esq. Chief Engineer, to the Agent and Manager of the Madras Irrigation and Canal Company, dated Kunnool, 3rd February 1870, No. 174.

6th Section Revised Estimates Colonel Carpendale's 297 of 25th January 1870

MR. DODSON'S abstract was not furnished with the copy of his letter, as it was incorrect and would have been misleading. The quantity of work in the 73rd mile surplus channel was by mistake omitted in my estimate. It is 65,250 cubic yards of "earth-work," (rock and earth,) which, with a total expenditure of Rupees 16,098-12-0, would give an average rate of about four yards a rupee. This quantity should have been entered in column 5 of my comparative statement and column 2 of my detailed estimate.

2. Colonel Carpendale in his paragraph 2 has quoted me as writing that "the top breadth of the banks in the first 12½ miles of 6th Section having been increased to 6 and 8 feet, accounts for a large part of the increase in the earth-work estimate." I can find no such statement in my letter. After stating what the increase of slope added to the earth-work, I add "besides the top breadth of the banks has been increased to 6 and 8 feet." By reference to Major Mullins' letter accompanying G. O., No 3,624, of 14th November 1866, paragraph 5, it will be seen that there was some obscurity about the original top breadth, which was perhaps 9 feet. But I have that breadth shown only on a sheet of sections signed by Mr. Harry Cotton (only), dated Yellagode, 29th April 1862, in which the depth of water is 5 feet only. The G. O. above quoted fixed the width for the future at 6 feet at most, according to paragraph 6 of Major Mullins' letter. As Major Mullins' remarks in paragraph 5 of that letter that the quantities in the original estimate cannot be reconciled with the section he refers to, the estimate indicating in the 74th mile 30 per cent less bank in the first 1,000 feet and the same percentage for the next 700 yards less than the sections he refers to would require with the banks 9 feet broad at top.

*Proceedings of the Madras Government, Public Works Department,
9th April 1870.*

3 I can find no cross sections of the 6th Section of a date previous to the original sanction which give slopes flatter than 1½ to 1. I never heard of any, nor do I see that Major Mullins has mentioned any. This deceived me, and I thought that 1½ to 1 was the slope adopted in the original estimates from Soonkasala to Rajoli.

4 In my letter I omitted to mention that the depth of water now allowed for in the 6th Section above first drop-lock is six feet, while the original depth was possibly five only.

5 The context shows that the 53,145 cubic yards shown in the margin of my letter refer to the increase due to the extra slopes required for the security of the banks. Mr. Dodson's No 257 states this clearly for miles 79 to 83. I received the information concerning miles 87 to 89 in a subsequent letter (No 282 of 14th October 1869) from Mr. Dodson.

No 72.

Copy forwarded to the Consulting Engineer with reference to his No. 297 of 25th January 1870.

MADRAS,
17th February 1870

(Signed) C. A. BADHAM,
Acting Agent and Manager.

No. 163 ORDER THEREON, 9th April 1870, No. 1,000.

IRRIGATION, No. 18

3rd July 1862	...	...	...	RS 1,49,540
14th November 1866	...	...	...	57,510
Total ..				2,07,050

In the Proceedings of Government, Nos. 1,555 and 3,624, of the 3rd July 1862 and 14th November 1866 respectively, sanction was accorded to estimates, amounting in the aggregate to Rupees 2,07,050, for the earth-works in the 6th Section of the Madras Irrigation and Canal Company's Main Canal.

2. With his letter above recorded the Consulting Engineer submits a further revised estimate of Rupees 3,88,550,* exhibiting an excess of Rupees 1,81,500, or about 88 per cent. upon the total of the sanctioned amounts.

3 The Government are disappointed to find from the papers submitted that the revised estimates which were sanctioned in G. O., dated 14th November 1866, No 3,624, were prepared so loosely as to be quite as unreliable as those which they superseded. His Excellency in Council has no guarantee that the estimate now under consideration is complete or sufficient; but, considering the stipulations as to time under which the Company are carrying on their operations, and that there is no probability of satisfactory explanations regarding the causes of the very large excess now reported being forthcoming, His Excellency in Council sees no alternative but to sanction the revised estimate as it is at present laid before the Government.

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

To the Consulting Engineer for the Madras Irrigation and Canal Company.
do Agent and Manager for do.

Exd A. S. Rodgers.

Govt. of 1870 Madras.

PUBLIC WORKS.

To

THE CONSULTING ENGINEER FOR
THE MADRAS IRRIGATION AND
CANAL COMPANY.
do. do. do.

Dated April, 9th

For

Encl

G. O., 9th April 1870, No 1,000

APRIL

No. 102-103

Earth works (Madras Irrigation and
Canal Company).—Revised estimate of
Rs. 3,58,550 for the earth works in the
6th Section of the Madras Irrigation and
Canal Company's Main Canal sanctioned
with remarks

P. W. Department

Proceedings of the Madras Government

Under date the 9th April 1870

Read the following

From The Consulting Engineer
for S. B. Company } H. E. No 138 of 24 February 1870

In the Progs of Govern-

ment Nos 1555 and 3624

3rd July 1862 — Rs 149,540
14th Nov 1866 — " 57,510
Totals Rs 2,07,050

of the 3rd July 1862 and

14th November 1866 res-

pectively. Sanction

was accorded to

estimates amounting

in the aggregate to

Rs 3,07,050 for the earth-

works in the 6th Section

of the Madras Irrigation

and Canal Company's
Main Canal.

With his letter above
recorded the Consulting
Engr. submits a further
revised estimate of

Rs. 3,88,550 exhibiting
an excess of Rs. 1,81,500 on

* Includes Rs. 50,000 for
depreciation of the value
of plant, tools &c.

about 8.8 per cent upon
the total of the sanctioned
amounts.

The Govt. are
disappointed to find
from the papers sub-

mitted that the revised
estimates which were
sanctioned in 1894

dated 11th November 1894 No 3624

were prepared so loosely
as to be quite as unre-
liable as those which
they superseded. His
Excellency in Council
has no guarantee that
the estimate now under
consideration is com-
plete or sufficient,
but considering the
stipulations as to time
under which the Company
are carrying on their
operations, and that
there is no probability
of satisfactory expla-
nations regarding
the causes of the very

large excess now reported
being forthcoming, His
Excellency in Council
sees no alternative
but to sanction the
revised estimate
as it is at present
laid before the Govt

(5)

W. B.

20
70

The Congl. Imp. & L. Compy. Ltd.
Agent and Manager of the
Congl. Imp. & L. Compy. Ltd.

C. 85 March 1870 R. 25

Decr 12/4/70

P W L to Engd 723rd
June No 22 of 1870.

Aug 29
Sect. of 1870. 31111111

PUBLIC WORKS.

To
The Consulting Engineer
for the Hudson River
Canal Co. &c.

Dated

Read

G O. 9 April 1870 No 1000

Nos. 162 - 163

Earth works (see 10660) Plans
Estimate of \$388,500 for the earth
works in the 6th section of the main
L. & C. Company's main Canal, and
with remarks.

C. 85 March 1870 A. 25th

1870