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MADRAS RECORD OFFICE.

Government of Madras.

Public works DEPARTMENT.

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Proceedings of the Madras Government, Public Works Department.

2nd July 1867.

No. 30. Read the following letter from the Consulting Engineer for Irrigation and Canal Company, to the Secretary to Government, Department Public Works, dated Madras, 10th June 1867, No. 27 :—

1. Revised Earth-work estimates for the 7th Section Main Canal were received in this Office on the 1st March 1866, and their submission to Government has been delayed since that time, pending the receipt of explanation regarding the excessive

* Abstract Supplemental Estimate.

23 Detailed Estimates.

Comparative Statement.

From Agent, No. 589, 28th February 1866.

To " " 59¹/₂, 2nd March "

From " " 392, 7th " "

To " " 210, 31st August "

From " " 211, 3rd September "

To " " 13¹/₂, 12th " "

1 Sheet Progress longitudinal Section.

6 " " cross "

1 " average " "

quantities of work entered for many of the miles. As, however, the Government have in their order of the 25th ultimo, No. 1,582, desired the early submission of all estimates which will need sanction, and as the Chief Engineer has recently appointed an officer to the section, I beg now to forward these estimates,* with such information regarding them as has as yet reached me, for the consideration of Government.

2. The amount of the revised estimate is Rupees 4,00,830-6-0 ; but as this includes Rupees 50,000, a temporary charge for Tools and Plant which is not required to be provided in the estimates, the proper total becomes 3,50,830-6-0. The sanctions already given for this section are as follow :—

Proceedings Madras Government, No. 134, 17th	RS.	A.	P.
January 1863, Earth-works...	62,265	0	7
Superintendence ...	4,795	5	5
Do. do. No. 1,232, 15th May 1863, Earth-work ..	43,786	10	9
Superintendence ...	3,113	5	3
Total...	1,13,960	6	0

the supplemental sanction required is, therefore, Rupees 2,36,870.

3. The accompaniments of the Agent's first letter show that the Chief Engineer attributes the necessity for supplemental sanction :—

Paragraph 2 of Chief Engineer's No. 1,335.

1st. *To the insufficiency of the rates originally allowed.*—These rates appear to

have been Anna 1 Pice 2 a cubic yard throughout ; and there can be little doubt that this being, as it was, an average rate for the whole twenty-three miles, was fixed without ascertaining what the nature of the sub-soil was. The average cost of the work done would have been, had all the work paid for existed, Anna 1 Pice 5¹/₂ nearly. The average rate for the work remaining to be done is entered at Annas 2 Pice 6. The special rates range from 2 to 7 cubic yards for the rupee, and the minimum rate is 8 yards for the rupee. This latter rate is higher than that, 10 cubic yards, allowed in the revised estimate of the next lower section, and what is perhaps of more importance, it is considerably higher not only than the minimum, but than the average rate for the work already done. It is perhaps not necessary to object to the minimum thus adopted, but it should not be forgotten that, where the quantities of work are so large, even a small increase of the rate per cubic yard has a considerable influence on the total cost of the earth-works.

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Paragraph 3.

*2nd. To alterations in the cross
section of the canal by the increase of the*

cutting and embankment slopes from 1½ to 2 to 1.—Appended to the Agent's letter, No. 210, is a tabulated Statement showing the additional quantities of work due to the alterations there enumerated, viz. :—

Slopes of cuttings	...	...	...	Cubic yards	45,332
„ of banks	...	...	...	„	1,51,997
					1,97,329

Deduct decrease due to reduction of bottom width from	
53 to 50 feet...	19,118

Net increase .. 1,78,211

The Chief Engineer has omitted one cause of excess of a similar kind, which is, the increase of the top width of the embankments to 10 feet, whereas originally 9 feet

† Paragraph 6 of my letter No. 133. were allowed† where bed level was above ground, and 6 feet elsewhere. The increase

to the slopes of cutting, where the soil is light, is an advantage; there are, however, some miles in which the change is quite unnecessary; similarly, the interior slopes of the embankments may be properly flattened where exposed to the wash of the water, but where the cutting is in depth equal to the depth of water, there is no need of the flatter slopes; lastly, the top width of 10 feet to the banks throughout adds to the cost of the works considerably, without increasing their efficiency, and this plan of adopting uniform cross-sections under differing circumstances is not a satisfactory or economical way of designing the works.

4. The tabulated Statement above referred to gives information regarding the quantities of earth-work included in the revised estimate, which cannot be shown to be necessary for the execution of the work according to the arrangements proposed; as, however, the entries in column 4 for the revised estimate do not agree with the Abstract Supplemental Estimate, I have taken the entries shown in column 2 of the subjoined Statement from the latter, and the differences due to alteration of design (columns 8, 9, 10) from the former; the quantities of the sanctioned estimate (column 3) I have taken from paragraph 1 of my letter No. 392, as I find that the supposed mistake, pointed out in paragraph 2 of the Chief Engineer's letter, No. 382, does not exist, and that, therefore, the quantities shown are probably the most accurate obtainable; and their adoption is unobjectionable, as they reduce the deficiencies by nearly 37,000 cubic yards more than would be the case were the quantities, column 5, of the Chief Engineer's tabulated Statement, taken.

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2nd July 1867.*

These deficiencies are very different to the quantities unaccounted for in these miles, as shown in the preceding paragraph.

2nd. *To silt washed into the canal and soil washed down from the banks.*—The Chief Engineer appears to think that very much of the difference may be accounted for in this way. As I have already pointed out, in paragraphs 3 and 4 of my letter No. 133 to the Agent, general considerations, as well as the special examinations of the 103rd mile made by Mr. Knorpp and Mr. Smart, go to discountenance the supposition that generally any large amount of extra work will be necessitated by such causes. Mr. Smart's measurements to the 31st May 1865 show—

Work done	...	...	...	...	28,155
Do. to be done	...	...	...	...	19,531
					47,686

Mr. Knorpp's measurements taken in August 1866, when one whole monsoon and the greater part of another had intervened, give—

Work done including cubic yards 2,803 done and paid for after Mr. Smart's measurements	30,251
Work to be done	18,579
	48,830

Difference ... 1,144

Second measurement	...	RS.	30,251
Deduct additional work	...		2,803

First measurement	...	27,448
	...	28,155
		* 707

The difference as to work done is only 707* cubic yards, and is very moderate, and may be attributed to either the impossibility of identical measurements or to silting. The quantity of work paid for at the latter date was, however, 40,958 cubic yards against 30,251 found on measurement.

3rd. *To over-payments.*—This cause is alluded to in the last paragraph of the Chief Engineer's letter, and it is mentioned that the apparent excess averaged 25 per cent. for the whole section, but that, probably, after making proper allowances for silting, the actual excess would be but small. It is, however, noticeable that early in 1864 considerable over-payments had been found out, viz., cubic yards 11,373 in the 92nd mile, 16,000 in the 93rd, 3,000 in the 102nd, 5,000 in the 103rd mile, while it would seem that, in other miles, Mr. Smart had found less work than had been paid for, though the Engineer previously in charge thought he must be mistaken. It is evident that the very great discrepancies which exist between the original and revised estimates of certain miles go very far to show that the admitted over-payments in some miles are typical of the other miles in which similar discrepancies are found; the Chief Engineer has accepted the only escape from this conclusion, viz., the supposition that silt and washing down of banks would reduce the differences to quantities which would not be unreasonable. It would have been very far from satisfactory had it been clearly shown that the canal had suffered so much as the Chief Engineer's supposition requires to be admitted, but, perhaps, he is right in desiring this expla-

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condition that arrangements for the effective irrigation of the higher lands of the village were made. These lands cannot be watered direct from the canal unless there be $4\frac{1}{2}$ feet of water in the latter, and probably, therefore, the tank will be left as it is. No complete arrangements in connection with the Nundial tank have hitherto been matured.

10. The additional works provided for in the revised estimates are:—

	RS.	A.	P.
Trimming canal banks and clearing foot-paths	3,639	8	7
Revetments or pitching	22,847	0	0
Allowance for maintenance and siltage ...	2,658	5	4
	29,144	13	11
Contingencies 10 per cent.	2,914	3	9
Depreciation of tools, &c.	50,000	0	0
	82,059	1	8
To this sum may be added the value of the additional earth-work accounted for, viz., cubic yards 1,78,211, at $2\frac{1}{2}$ Annas a cubic yard			
	27,845	7	0
Sundries on the above	2,785	7	4
	1,12,690	0	0

11. The amount entered for revetments or pitching or, as entered in the estimate, "kunkur and stone benching," allows an average rate of 3 Annas the cubic yard, and from paragraphs 2 and 5 of the Chief Engineer's letter, Agent's No. 589.

No. 1,335, it appears that the above rate is additional to the general rate Annas 2 and Pice 6 for all the earth-work remaining to complete, and that the kunkur and other rocky materials obtained from the cuttings are to be used to protect the slopes where the soil is soft. It is clear, however, that if the cuttings have their slopes faced with 18 inches in thickness of hard material, they must, in the first place, be made so much wider, and I do not see any provision on this account. In the 105th, 108th, 109th, and 110th miles the allowances are equal in amount: in some parts the

cutting will yield, I think, nothing suitable for pitching, and were cartage* from elsewhere attempted it would result in expense not at all provided for in this estimate. No one can doubt that advantage would be derived from the protection of the slopes where submerged, wherever the soil is soft and readily soluble; but the same conclusion would be applicable to a very large proportion of the whole length of the canal, and before being undertaken in any particular locality the probable expense should be carefully ascertained and weighed against the advantages. In the present case it appears to me to have been supposed that the materials intended to be used will be found just where they are most wanted, and it will not be advisable that the Executive Engineer should think himself at liberty to execute pitching except where the cutting provides the necessary stone. It should be understood, therefore, that before the provision in the

* If stone has to be brought from a distance, the best plan will be to postpone pitching until the canal has been opened one season, and the required material can then be brought by boat.

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2nd July 1867.

15. Should the Government, under the circumstances in which the Co are placed, wish to sanction the estimate, I would recommend that the sanct made conditional, and that it be stated that the expenditure incurred up section will not be passed until, after the completion of the earth-works, the work done has been measured or otherwise reliably ascertained, and the resul before Government for their orders.

No. 31. ORDER THEREON, 2nd July 1867, No. 1,954.

IRRIGATION, No. 3.

17th January 1863,	...	Rupees 67,060
15th May	"	46,900
		* 1,13,960

1. In the Orders of Govern Nos. 134 and 1,232 of the 17th Ja and 15th May 1863, respectively, tion was accorded to estimates am ing in the aggregate to Rupees 1,13 for the earth-works in the seventh sc

of the Madras Irrigation Company's Main Canal.

2. The Consulting Engineer now submits a further revised estima Rupees 3,50,830,† exhibiting an e of Rupees 2,36,870, or about 203 cent. upon the last sanctioned am and raising the cost of the work‡

† Less Rupees 50,000 for tools and plant not required to be provided for in the estimate.

‡ 23 miles from the 92nd to the 114th mile.

Rupees 4,954 to Rupees 15,253 per mile for the earth-work alone.

3. Captain Mullins explains that of this excess, Rupees 1,90,870 have more or less satisfactorily accounted for, but that no sufficient explanation has given by the Company's Officers of the causes of the excess expenditure of Ru 46,000, and he recommends that, if the Government be disposed to sanction revised estimate, such sanction should be accorded on the understanding that expenditure incurred on the section will not be passed until the earth-work been completed, and a reliable statement furnished of the whole work. Subjec this condition, His Excellency in Council sanctions the revised estimate.

4. The Chief Engineer's attention will be directed to the remarks contain in paragraphs 8 and 11 to 13 of Captain Mullins' letter.

(True Extract.)

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

To the Consulting Engineer for Irrigation and Canal Company, with thirty-nine Enclosures.
" Manager for do. do.

Exd. S. T. Augustin.

P.M. No. 134-17th January 1863 Earthworks Rs-228
 Superintendence 4795-5-5
 P.M. No. 1332-15th May 1863 Earthworks 43786-10-9
 Superintendence 3113-5-3
 Total Rupees 113960-6-

The supplemental sanction required is therefore Rupees 236870-

3. The accompaniments of the Agent's first letter show that the Chief Engineer attributes the necessity for supplemental sanction,

1st, to the insufficiency of the rates originally allowed. para. 2 of Ch. Reg. 1335
 These rates appear to have been ^{a p} 1-2 a cubic yard through-
 out; and there can be little doubt that this being, as it
 was, an average rate for the whole 23 miles, was fixed
 without ascertaining what the nature of the subsoil
 was. The average cost of the work done would have been,
 had all the work paid for existed, ^{a p} 1-5⁵ nearly. The aver-
 -age rate for the work remaining to be done is entered
 at 2-6. The special rates range from 2 to 7 cubic yards
 for the rupee, and the minimum rate is 8 yards for the
 rupee. This latter rate is higher than that 10 cubic yards
 allowed in the revised estimate of the next lower Section,
 and what is perhaps of more importance it is considera-
 -bly higher not only than the minimum, but than the aver-
 -age rate for the work already done. It is perhaps not
 necessary to object to the minimum thus adopted, but it
 should not be forgotten that, where the quantities of work are
 so large, even a small increase of the rate per cubic yard has a
 considerable influence on the total cost of the earthworks.

2^d To alterations in the Cross Section of the Canal by the increase of the
 cutting and embankment slopes from 1 1/2 to 2 1/2. Appended to the Agent's letter
 No. 210 is a tabulated Statement showing the additional quantities of work
 due to the alterations therein enumerated viz:

Slopes of cuttings - cubic yards	15302
do of banks	45199
Reduct decrease due to reduction	197329
of bottom width from 53 to 50 feet	19118
Net increase	178211

Differences due to alteration of design (Columns 8, 9, 10) from the former; the quantities of the variations Estimate (Column 3) I have taken from para: 1 of my letter N^o 392, as I find that the supposed mistake pointed out in para: 2 of the Chief Engineer's letter N^o 382 does not exist, and that therefore the quantities shown are probably the most accurate obtainable; and their adoption is unobjectionable, as they reduce the deficiencies by nearly 37,000 cubic yards more than would be the case were the quantities, column 5, of the Chief Engineer's tabulated statement taken.

5.
expla
Ch. Eng. N^o 382 para: 6.
This
for
extra
para: 3 & 4 of my letter N^o 392.
jud
app
rea
to

Miles.	Quantities River & Estimate.	Quantities variations Estimate.	Quantities variations Estimate.	Quantities variations Estimate.	Quantities variations Estimate.	Quantities variations Estimate.	Quantities variations Estimate.	Quantities variations Estimate.	Quantities variations Estimate.	Quantities variations Estimate.
1	2	3	4	5	6	7	8	9	10	11
92	147827	104079	43748	2760	530	9290	4510	1780	22168	
93	111974	72517	39457	4239	2655	6394	2750	1136	35321	
94	64877	45825	19052	2269	2133	4402	1170	2232	15820	
95	102502	109284	782	1316	6617	8433	873	7560	83112	
96	31642	51834	29808	946	9728	10674		10674	19134	
97	120711	103686	17025	934	11223	12377	880	11497	5528	
98	902472	49173	410742	1649	3583	5232	1733	3499	375752	
99	79003	69289	9714	1398	6327	8325	560	7357	2457	
100	76173	70476	5697	2285	5353	7638	1452	6106	489	
101	110723	74783	35940	361	14917	15278		15278	20662	
102	80971	66264	14707	832	9995	10828		10828	3879	
103	47686	33253	14433		6636	6636		6636	7777	
104	60912	50106	10806		8388	8388		8388	2420	
105	71506	52249	17257	1743	3803	5046	1613	3431	13824	
106	90973	74530	24443	2478	2151	5629	2153	3476	31967	
107	90161	79012	11150	1149	4734	8873		8873	2277	
108	75640	51751	23889	1807	7657	9466		9466	14433	
109	70035	52373	17662	1168	7728	8896		8896	8766	
110	649062	48667	163395	1168	7728	8896		8896	73431	
111	73071	49577	23494	1404	9954	11358		11358	12136	
112	59633	47882	11751	1455	6785	8240		8240	3511	
113	59655	48420	11235	1438	7079	8567		8567	2660	
114	53450	43807	9643	1471	6501	8055		8055	1508	
	1098204	145177	447339	45332	15177	177329	17118	174211	87777	

50. Decrease
(red figures)

I pointed out, in paras. 3 and 4 of my letter N^o 133 to the Agent, general considerations, as well as the special examinations of the 103rd mile made by Mr. Knorpp and Mr. Smart go to discomfit the supposition that generally any large amount of extra work will be necessitated by such causes.

Mr. Smart's measurements to the 31st May 1865 when,

Work done _____ 28153
 To be done _____ 19531 47606

Mr. Knorpp's measurements taken in August 1866, when one whole division and the greater part of another had intervened, gave,

Work done including Suby 2803
 Done and paid for after Mr. Smart's measurements _____ 30251
 Work to be done _____ 12577 40830
 Difference - 1266

The difference as to work done is only 707 cubic yards and is very moderate, and may be attributed to either the impossibility of identical measurements or to silting. The quantity of work paid for at the latter date was however 40,958 cubic yards against 30251 found on measurement.

2nd measurement 30251
 & additional work 2803
 1st measurement 28153
 207

3rd As to over payments - This cause is alluded to in the last para. of the Chief Engineer's letter, and it is mentioned that the apparent excess averaged 25 per cent for the whole Section, but that probably, after making proper allowances for silting, the actual excess would be but small. It is however noticeable that early in 1866, considerable over payments had been found owing for cubic yards 11,373 in the 92nd mile; 16,000 in the 93rd, 3,000 in

See this Engr's letter N^o 45 - also last Engr's N^o 589 -

117.4. 13474-31

Tabulated Statement given above shows that some of the miles, which, on the Chief Engineer's supposition, should have suffered much, have hardly suffered at all; thus, two of the large drainages are crossed in the 95th and 97th miles; in the former there is a saving on the quantity of the original estimate, in the latter the excess unaccounted for is a little over 5 per cent. In the 104th mile also, which would be liable to inundation from the Mundial Cante, main supply channel, the excess is under 5 per cent.

26. The information gathered from the papers connected with the estimates showed that it was at least very desirable that the miles in which the differences were the greatest should be examined. It appeared that measurements of the 92nd and 93rd miles had been taken, and I requested that the cal. N^o 133. calculations from these measurements might be worked out that the results might be compared with the work paid for. I have not as yet received any additional report, either on the 2 miles referred to, or on the other miles which seemed equally in need of better evidence that the payments had been properly made.

7. There is another cause of excess to which the Chief Engineer has not alluded, but which has been made evident from the sheets of cross sections of the 103rd mile, and this is that outside cuttings were made to furnish earth for the banks

Government acceded to the absorption of the former Sank into the Canal on the condition that arrangements for the effective irrigation of the higher lands of the village were made. - These lands cannot be watered direct from the Canal unless there be $1\frac{1}{2}$ feet of water in the latter, and probably therefore the Sank will be left as it is. No complete arrangements in connection with the Mundial Sank have hitherto been matured. -

10. The additional works provided for in the revised estimates are:

Trimming Canal banks and clearing footpaths	Rs. 3639-8-7 ✓
Revetments or pitching	22847-11-11
Allowance for maintenance and village	2658-5-4 ✓
	29164-13-11
Contingencies 10 per cent	2914-8-9
Depreciation of tools &c	50000-11-11 ✓
	22059-1-8

To this sum may be added the value of the additional earthwork accounts for the 58211 at 3 1/4 annas a cub. yard - - - 17845-7-11
 Sundries on the above - - - - - 3795-7-11
 112690-11-11

11. The amount entered for Revetments or pitching, or, as entered in the estimate, "timber and stone benching", allows an average rate of 3 annas, the cutting, and from paras. 2 and 5 of the Chief Engineer's letter, No. 1335, it appears that the above rate is additional to the general rate 2 1/2 for all the earthwork remaining to complete, and that the timber and other rocky materials obtained from the cuttings are to be used to protect the slopes where the soil is soft. It is clear however that if the

the Government may be committed to the necessity of sanctioning estimates for expensive work of which they would not, under the circumstances, approve. -

12. The allowance for depreciation of tools and general plant is large, being nearly 17 per cent on the estimated cost of the work. - I imagine the item to have no special reference to the probable actual expenditure likely to be incurred on this account, but to the necessity for providing for the debit to works of the general charge on this account. Very accurate accounting is not necessary in distributing such charges but the Chief Engineer should not allow any Section to be unduly burdened in order to relieve some other Section for which otherwise supplemental sanction would be found necessary. -

13. I have put down the extra work for slopes and banks as additional work, but I do not admit the accuracy of the ^{Chief Engineer's} calculations. - Para: 3 of letter Agmts N° 210. N° 382 shows how the allowance for slopes of cuttings was arrived at, but the better way is to compare cross sections at average depths. - Thus in the 92nd mile the average depth is approximately 9½ feet, and the difference of sectional area due to change of section is a little over 1% yards which, multiplied by the length, gives 2.622 cubic yards instead of 8.768 cubic yards in the revised estimate. - ^{*1430 yards.}
Again

in which the Company are placed, with the sanction
of the estimate, I would recommend that the sanction
be made conditional, and that it be stated that the
expenditure incurred upon the Section will not be
passed until, after the completion of the earth-
works, the whole work done has been measured
or otherwise reliably ascertained, and the results
laid before Government for their orders.

I have the honor to be

Sir,

Yours most obedient servant,

Wm. Lunt

Captain R.E.

Commanding for S.M. Company.

a further revised esti-
mate of $\$3,508,850$, in-
cluding an excess of
 $\$2,368,570$, or about 208
per cent upon the last
mentioned amount,
and raising the cost of
the work from $\$4,951$
to $\$15,253$ per mile for
the earthwork alone.

Captain Mullins
explains that of this
excess, $\$1,908,870$ have
been more or less satis-
factorily accounted for,
but that no sufficiently
explanation has been
given by the Company's
officers of the causes of
the excess expenditure
of $\$46,000$, and he

* Less $\$500,000$ for contingents
not required to be provided
in the Estimate.

* 23 Miles from the 92nd to
the 115th Mile.

Copy in a Letter to England
of 12th August. 1867

P. W. 1867. Department.
Proc. of Govt. for July
No. 1954

PROCEEDINGS OF GOVERNMENT

Dated 2^d July 1867

The following, containing
the revised estimate
amounting to Rs. 25,000 for
the year 1867-68 as the
proposed action of the
Madras Irrigation and
Canal Company in the
Canal.

L. 30-31