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Revenue DEPARTMENT

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GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

3rd September 1877, No. 286 I.

Irrigation.

Read the following paper:—

No. 140 I.

KISTNA WESTERN DELTA—ROMPERU DRAINAGE.

Note by the Chief Engineer for Irrigation.

No. 13. THE way in which it is proposed to deal with the drainage of the country lying to the south of the Commamur canal is reported on in paragraphs 38 to 44 of the letter No. 104 of the 13th December 1876 from the Superintending Engineer, Kistna, and the particulars of areas drained and discharges to be provided for by the main drain and its affluents will be found in the table of Velocities and Discharges.

Appendix No. 1.

Appendix No. 2.

2. *General basis of arrangements.*—The general basis of the arrangements is that the main drain is to be capable of carrying off one-sixth of the maximum flood discharge of twenty-four hours, and of entirely relieving the country draining into it or that part of it which is now liable to submergence within six days, the total discharge of the six days being assumed to be equivalent to 12 inches of water from a standard area of 5 square miles, and a proportionate quantity from other areas. The affluents have been allowed a somewhat larger capacity, the dimensions being calculated to discharge one-fifth of the maximum drainage.

3. *Difficulty of making fully satisfactory arrangements.*—The intended arrangements will undoubtedly greatly improve the condition of the tract of country affected; but it is necessary to notice that they will not be fully satisfactory, and that to a considerable extent they must be carried out tentatively. At present all the drainage water with which it is proposed to deal finds its way to the low ground along which the main drain will run, submerges a great extent of ground which it renders unfit for cultivation, is partly carried away and very slowly to the estuary of the Romperu by a small natural drain, and partly absorbed or evaporated. By far the greater portion of the water comes from the uplands above the Commamur canal, and the scheme differs from that for entirely intra-deltaic rainage, inasmuch as the water from the uplands must come down into the low ground rapidly instead of gradually, whereas, on the other hand, the drainage from the rainfall over limited deltaic areas can be retained more or less completely and allowed to drain off gradually into the channels provided for its discharge. To make as effective provision for the discharge of upland drainage as for that belonging to the flat areas altogether within the delta would financially be impracticable. Consequently, the scheme is intended to materially augment the rapidity of discharge of drainage water into the estuary and through it into the sea, and this is to be effected by means of a cut or channel of considerable but at the same time very small dimensions compared with those which would be necessary to get rid of

the upland drainage as fast as it may come down, while the flood and spoil banks of the main drain are to be placed at such distances apart as to admit at times of heavy rainfall of very large bodies of water being carried down above ground level between the banks. Further, the bed fall of the drain will be in excess of the proposed or calculated surface fall, and the depth of water is expected to increase from 3·21 feet at the upper end, to 9·50 feet at the lower end. The banks enclosing the drain and the area liable to prolonged submergence on either side will as a minimum be 4 feet above calculated water level, and so there will be a considerable margin for contingencies. For the spoil bank next to the drain cutting there will be a great excess of soil, and the margin there consequently will be much greater. On the other side, however, the bank being at a distance of at one part as much as 2,766 feet from the other bank, must be made up from a separate cutting.

4. *Manner of carrying out the work.*—The affluents have to carry off the water crossing the Commamur canal, and they must be made of the full size estimated for. The main drain on the other hand it is proposed to cut in the first instance to about one-third of the intended ultimate width and to the full depth, the banks on either side being placed of course at the full distance apart. This work will, as will be seen from the longitudinal section, afford a free outfall on a limited scale, and such widening as may hereafter be proved to be desirable can afterwards be carried out.

5. *Area drained.*—The area drained appears from the Table Appendix, No. 2, to be—

	Sq. miles.	
Upland		465
South of Commamur canal—		
North of drain	74·72	
South of do.	30·09	
		104·81
Total		569·81

A large part of the area north of the drain is, or will be, irrigated. This area is 47,821 acres, of which the irrigated area* is expected to be 26,200. At present it is not anticipated that any considerable extent south of the drain will come under irrigation.

* *Vide* statement of water distribution of the Commamur canal, the portion west of Bapatla channel.

6. *Drainage of lands north of Main Drain.*—The lands north of the main drain will be bounded by the drain bank on the south, by the Commamur canal on the north, and east and west by the banks of the successive affluents. They will be protected from external inundation by these banks, and they will be relieved of rainfall drainage and surplus irrigation water by inlet sluices in the right bank of the main drain.

7. *Levels of Main Drain.*—The main drain has it head, according to the arrangement made in drawing up the scheme, at the point where the Sakicalwa drainage crosses the Commamur canal, where its bed level will be at ... ... 7·45
and its water surface at ... ... 10·66
At the lower end, distant 25 miles 8 chains, bed level will be at ... ... 6·50
and water surface at ... ... 3·00

Fall of surface 7·66 Bed 13·95

the bed fall will average therefore 0·556 feet and the surface fall 0·305 feet a mile. The surface fall is shown in the longitudinal section as regular throughout, but the bed fall is 0·456 down to 19½ miles, and 0·90 below that point. The Superintending Engineer has not explained what his reasons were for making this variation, and as no affluent reaches the drain at or near the point of change, while there is nothing apparent in the ground levels to require it, it would seem to be better to pre-

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serve a regular fall of bed from end to end instead of nearly doubling the fall in the last few miles, for then the increased depth of water will be carried back and the upper part of the drain will be more efficient. It may further be observed that it is not desirable to make the distance between the banks of the drain in the lower miles less than in higher parts of its course. These distances appear to have been based on calculations of discharge according to the ground level compared with water surface, but calculations of these small and varying depths cannot be very accurate, and it will be better to gradually increase the distance between the banks, and to make no subsequent contractions unless for the purpose of avoiding valuable land which is not likely to be met with anywhere. The bank away from the drain will cost as much in one position as another.

8. *Estimate.*—The following is a classified abstract of the estimate for the main drain and its affluents :—

KISTNA DISTRICT.

COMMAMUR CANAL—ROMPERU DRAIN.

Classified Abstract of the Estimate.

Position.		Particulars.	Amount.	Total of Sub-heads.
		KISTNA DELTA SYSTEM.	RS.	RS.
		Capital Extraordinary.		
		I. Works.		
		(4). Drainage and Protective Works—		
		Romperu Drain—		
		B. Land—		
		Compensation	1,000	
				1,000
MS.	CHS	C. Works—		
5	10	Inlet No. 1, Sakicalwa side drain.	1,480	
7	50	Inlet No. 2, for Parala do. ...	1,070	
7	50	Inlet No. 3, Karenchedu do. ...	1,070	
7	50	Bridge No. 4 on Parala road ...	8,760	
8	40	Inlet No. 5, 6 feet span ...	1,070	
10	20	„ „ 6, 6 „ „	1,070	
10	40	„ „ 7, 6 „ „	1,070	
12	60	„ „ 8, 6 „ „	1,060	
13	65	Bridge No. 9 on Vetapalem road across Romperu	8,700	
14	60	Inlet No. 10, left bank	1,060	
14	60	„ „ 11, right bank	1,060	
16	10	„ „ 12, R. B	1,020	
18	60	„ „ 13, L. B.	1,110	
19	20	„ „ 14, R. B.	1,090	
19	40	Improvements to Yadavakuduru Bridge, No. 15	7,510	
				38,200
		L. Earthwork—		
		Improvements to main drain ...	2,96,400	
				2,96,400
		O. Miscellaneous—		
		Ferry boat, Coconada road	500	
				500
		Total, Romperu Drain		3,36,100

Position.	Particulars.	Amount.	Total of Sub-heads.
		RS.	RS.
	Brought forward.—Total, Romperu Drain ...	...	3,36,100
	Bapatla Affluent—		
	B. Land—		
From head of affluent. MS CHS.	Compensation	...	
	C. Works—		
1 30	Inlet	1,140	
5 37	Do. right side	1,540	
3 0	Do. do.	1,540	
3 0	Do. left side	1,140	
			5,360
	L. Earthwork—		
	Improvements	14,800	
			14,800
	Total, Bapatla Affluent ...	...	20,160
	Karenchedu Affluent—		
	L. Earthwork—		
	Improvements	15,650	
			15,650
	Total, Karenchedu Affluent ...	...	15,650
	Parchur Vagu—		
	B. Land—		
	Compensation	500	
			500
	L. Earthwork—		
	Constructing	16,290	
			16,290
	Total, Parchur Vagu ...	...	16,790
	Swerna Affluent—		
	L. Earthwork—		
	Improvements	4,400	
			4,400
	Total, Swerna Affluent ...	...	4,400
	Allern Affluent—		
	L. Earthwork—		
	Improvements	10,870	
			10,870
	Total, Allern Affluent ...	...	10,870
	Total (4) Drainage and Protective Works ...	...	4,03,970
	Total (I) Works ...	...	4,03,970
	II. Establishment, 25 per cent.	...	1,00,992
	III. Tools and Plant, 2 per cent.	...	8,078
	Total, Direct Charges ...	...	5,13,040
	Leave and Pensions, 25 per cent. on Establishments ...	...	25,248
	Interest ...	...	...
	Total, Direct and Indirect Charges ...	...	5,38,288

The total for *works* is large, but until revised under the general instructions on which the delta drains generally have been revised, the amount was Rupees 1,85,560 in excess of the present total. Taking the area interested at 105 square miles or 67,200 acres, the rate per acre would be 7·63 Rupees. The estimate is divided into—

Main Drain.

	RS.	RS.
C. Works	38,200	
L. Earthworks	2,96,400	
O. Miscellaneous	500	
		3,35,100
Affluents		68,870

In the estimate for the main drain under C. Works provision has been made for the following bridges :—

	RS.
Parala Road	8,760
Vetapalem Road	8,700
Improvement to bridge on Kadavakuduru and Inkole Road ...	7,510

The last is, it is considered, the only work of the three properly chargeable to the drain. At the other roads there are no bridges at present, and the drain will not injure communication, but will improve it, by shortening the time during which the swamp is impassable. At most, the drain may be charged with the duty of making a good ford.

9. *Apportionment of charge to Delta System.*—The Delta system is interested in the drainage arrangements to the extent of the area expected ultimately to be irrigated, and this area is 26,200 acres out of a total of 104·81 square miles or 67,078 acres.

Were the charge to be proportioned directly as the area, the share of the system would therefore be Rupees 1,57,800. The Commamur Canal and the lands between it and the drain are, however, specially interested in the following portions of the drainage work to be carried out :—

MAIN DRAIN.

B. Land.

	RS.	RS.
Compensation	1,000	1,000

C. Works.

Position. MS. CHS.		RS.	RS.
5·4	Inlet No. 1 Sakicalwa side drain	1,480	
7·50	Do. „ 3 Karenchedu side drain	1,070	
8·40	Do. „ 5	1,070	
10·40	Do. „ 7	1,070	
12·60	Do. „ 8	1,060	
14·60	Do. „ 11	1,060	
16·10	Do. „ 12	1,020	
19·20	Do. „ 14	1,090	
19·40	Kadavakuduru bridge, improvements to	7,510	
			16,430

L. Earthworks.

One-third of the estimate		98,800
Total Main Drain ...		1,16,230
Affluents		68,870
Total...		1,85,100

It is recommended, therefore, that this amount should be charged to the Delta system, and that any further enlargement of the main drain which may be found requisite and that any further enlargement of the main drain which may be intended should be undertaken on its merits, and with reference to the objects it may be intended should be undertaken on its merits, and with reference to the objects it may be intended

to secure. If this arrangement be approved, the addition to the Commamur Canal estimate in considering its financial aspect will under direct charges be :—

	Rs.
Works	1,85,100
Establishment	46,275
Tools and Plant	3,705
	2,25,080

10. *Remarks on Design.*—(1.)—It is not apparent how the bottom widths of the cutting for the main drain have been in all cases determined. The intention is to carry, it would seem, $\frac{1}{30}$ of the maximum flood discharge in the cutting and the rest between the banks, but it is doubtful whether it has been sufficiently considered what the effect of the high ground level in the lower miles compared with drain water level will be. It is quite clear at any rate that in the lower miles when ground level is above supposed water level, all the water cannot be conveyed in a cut calculated to discharge only one-thirtieth of the drainage, and the water must therefore rise to a much higher level. Taking this into consideration, it is not desirable to diminish the bottom widths as the depth increases, proper as that course would have been were ground level to continue at the same distance above the bed of the drain. In carrying out, therefore, the tentative arrangements of cutting the drain to one-third of the ultimate probable dimensions, care should be taken to provide a drain which, taking the ground level into account, will discharge through the cut and above ground together about the same proportion of the total quantity of drainage throughout. This will secure the best results for any given outlay, and moreover will obviate the silting which would inevitably follow the provision of larger proportional water-way in the upper than in the lower miles.

(2.) The alteration to be made to the existing Kadavakuduru bridge of ten spans of 22 feet each is to construct a flooring with retaining walls at the intended bed level. It may be necessary hereafter to add considerably to the number of spans, but the proposed arrangements will suffice for the present, and water-levels should be registered above and below bridge whenever there may be heavy rainfall in order that proper data may be available.

(3.) It has already been noticed that the construction of bridges in the 8th and 14th miles should not be chargeable to the drain, and it will not be desirable to build any new bridges across it until the data which will be obtainable from the registration of flood levels after heavy rainfall are obtained. The designs must then be based upon the actual circumstances, and if, as will be most probable, the waterway at the bridges be necessarily much contracted to secure economy, the foundations must be protected by suitable floorings, and this protection cannot be secured unless the floorings be made to extend to a sufficient distance up and down stream beyond the cut-waters. The arrangements will, so far as this part of the work is concerned, be much the same as those which are considered necessary for head sluices. In the design prepared, this subject has not received the attention it requires.

(4.) Throughout the works, it must constantly be borne in mind that the flood levels have yet to be ascertained, and that consequently margins of banks and masonry works connected with them must be made ample. All that is certainly known is that the former maximum flood levels in the swamp will be reduced, and probably very materially; for though the passage of water from the uplands to the swamp is to be facilitated, such drainage does now, but in an irregular manner, find its way down with probably not much less rapidity than will occur in the future, and the chief difference will be that there will be no temporary retardation of its progress until the Commamur Canal has been extensively breached, while on reaching the main drain in the swamp it will find an out-fall which is now wanting.

COLLEGAL,
13th August 1877.

(Signed) JOHN MULLINS, Colonel, R.E.,
Chief Engineer for Irrigation.

To the Joint Secretary to Government, Public Works Department, Irrigation Branch.

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No. 14. ORDER THEREON, 3rd September 1877, No. 286 I.

THE Romperu drain in the Western Section of the Kistna Delta, for which estimates have been submitted by the Chief Engineer for Irrigation, provides for the conveyance to the sea of the large amount of upland drainage which crosses the Commamur Canal at and below the Sakicalwa in the 34th mile, and which now stagnates in the Romperu swamp, submerging a large area for a greater or less period according to the circumstances of the season's rain fall.

2. It appears that the drainage of 465 square miles of upland, and of nearly 105 square miles of land south of the Commamur Canal, has to be disposed of, and of the latter area 74·72 square miles lie between the Commamur Canal and the main drain. The canal is expected to irrigate about 26,200 acres out of this last named area, while it is probable that dry cultivation will follow the drainage of other parts of the ground.

3. The estimates, as prepared by the Superintending Engineer, Kistna, amount for *works* to Rupees 4,03,970, and the Chief Engineer for Irrigation explains in paragraph 9 of his note on them to what extent he considers the Delta system to be interested in this drainage scheme, and recommends that the part of the estimate as therein detailed should be sanctioned as appertaining to the Delta system, leaving further enlargement of the main drain to be considered hereafter on its merits, should the want of further relief with a view to extension of cultivation or otherwise be experienced. The amount recommended for sanction is for—

	Rs.
Works	1,85,100
Establishment	46,275
Tools and Plant	3,705
Total, direct charges ...	2,35,080

4. His Grace the Governor in Council approves of the proposals thus made, and the reduced estimate for the Romperu drainage will be submitted with that for the Commamur Canal, with which it is intimately connected, to the Government of India for sanction in due course.

5. The Chief Engineer's Note contains full information as to the scope of and the general arrangements of the scheme, and the work having been authorized to be undertaken as a Famine relief-work,

G.O., No. 197 I, dated 31st July 1877, paragraph 9.

Major Hasted's attention will at once be given to the remarks of the Chief Engineer, which indicate the way in which the project should be carried out.

(True Extract.)

Colonel, R.E.,
Joint Secy. to Govt., P.W.D.,
Irrigation Branch.

To the Chief Engineer for Irrigation.
" Superintending Engineer, Kistna.
" Collector of Kistna.
" Board of Revenue.
" Revenue Department (Famine).
" Examiner of Public Works Accounts.

Exd. A. Raitt.

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Communicated to the Board of Revenue

12 September/77

Rev 1877 Dept
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IRRIGATION.

Govt. of {1877} Madras.

PUBLIC WORKS.

To

The CHIEF ENGINEER for IRRIGATION,

&c., &c., &c.

Dated September 3rd,

Issued

Recd. 10th Sept. 77 Encl.

G. O., 3rd September 1877, No. 2864.

SEPTEMBER.

Nos. 13-14,

Min GO 12 September 1877 N 5418.

Rompern Drainage in the Western Section of the Kistna Delta.—Approves the proposal for submission to the Government of India in due course of the reduced estimate for the — with that for the Coompamur Canal.

To the Board of Revenue.