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M.R.O. 1—5,006—16-10-50.

(1) Number of pages 116

(2) Date of repair 24/4/70

(3) Initials of the Referencer

1533/82/[illegible]

25/[illegible]

MADRAS RECORD OFFICE

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Government of Madras

P.W. DEPARTMENT

G.O. No. 408 - 09

B.P. No.

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Index.

Appendix A. — Original Report by Mr. Lowry.
" A,1. — Note by Major Pennycuick R.E.
" A,2. — Letter from Chief Engineer Mysore.
" B. — Rain fall register.
" C. — Letter from Collector of Salem estimating probable returns.
" D. — Do. do. do.
" E. — Note by Chief Engineer for Irrigation reviewing Project.
" F. — Do. do. do.

APPENDIX ~~N. 4~~ A.

Report to Accompany the Plan and Estimate for the Baroor Irrigation Project.

Index to Report. By Mr. Lowry. Ex. Engr.

	PARAGRAPHS.
Cost and value of work done up to date	2
What the Project consists of	3
Agaram and Nedingal Head Sluices	4
Index Map	5
The Anicut	6
Sand Sluices	7
Area of catchment and supply	8
Flood line	9
Level of top of flood bank	10
Baroor Head Sluice	11
Baroor Supply-channel	12
,, Discharge	*Ibid*
,, Inlets and Outlets	13
,, Work already done to channel	14
,, Data for inlets and outlets	15
,, Under Sluice or culvert...	16
,, Distribution Sluices of supply-channel	17
Baroor Tank	18
,, Irrigation Sluices	19
,, State of bund	20
,, Work being so far completed as to fit the tank for irrigation of its former ayacut	21
,, Discharge from catchment basin and length of weir	22
,, Eastern distribution channels	23
,, Masonry falls for reducing gradient	24
,, Aqueduct	25
,, Western distribution channels	26
Value of project...	27
Cause of delay in submitting project	28

The estimated Cost of the Project	Rs. 2,35,500
Do. Revenue	,, 50,000

This work was undertaken for famine relief purposes in the month of August 1877 under G.O., No. 2,208, dated the 6th October 1877 (Revenue Famine Department).

Cost and value of work done up to date.

2. The expenditure on it up to date is	Rs. 1,08,601
Value of work done at normal rates	,, 68,601
Excess due to famine	,, 40,000

What the Project consists of.

3. The Project will consist of an anicut or dam built across the Puniár, near the village of Nedingal, about 10 miles south-east of the cusbah of Kistnagherry, a supply-channel 7¼ miles in length thence on the left or north bank of the river to the Baroor Tank, which will be increased in size from its present capacity of 1·221 millions of cubic yards to fit it to hold 20 millions of cubic yards. This tank with the three tanks, named Moorsamputty, Vellangauvady, and Poongamputty tanks, through which the supply-channel passes, and 13 other smaller tanks below the Baroor Tank, the supply-channel will fill. There will be two irrigation channels, aggregating with their branches a total length of 25¼ miles, one from the right or western sluice irrigating an area of 1,307 acres, the other from the left or eastern sluice to irrigate an area of 8,436 acres; the supply-channel will also have irrigation sluices on its lower bank and will irrigate an area of 2,256 acres.

Agaram and Nedingal Head Sluices.

4. It is also proposed to construct head sluices for the existing Nedingal and Agaram channels on the right bank, the former will have one opening 5 feet by 2 feet which will be more than sufficient to discharge the water required to irrigate the land under it; the Agaram head sluice will have two openings 6 feet by 4 feet and as the floor of this sluice will be placed at the same level (28·50) as that for the supply-channel of the Baroor Tank, it will discharge with a head of 3 feet, *i.e.*, with the water standing at the level of the anicut crest, 191·53 cubic feet per second sufficient for the irrigation of 8,165 acres. There is a large quantity of land on this bank of the river which could be cultivated from this sluice, if it hereafter be deemed desirable to take it up as a separate project; it is now only intended to build the head sluice.

Index Map.

5. An inspection of the Index map, Sheet No. 1, will make clear the position of the river, the dam and the supply-channel, as well as the Baroor Tank and the lands under it and under the supply-channel which are available for irrigation. On this is also shown the tanks and channels on the right bank.

The Anicut.

6. The anicut will have a clear length for overfall of 930 feet, of which 680 feet will be founded on surface rock, a gneiss reef which crosses the river at the site of anicut giving the necessary facilities for this. The footings of the remaining 250 feet will require to be put down to rock about 15 below the ground line. There will be a loose stone apron 47½ feet wide below this portion of the anicut, as shown in the drawing sheet No. 3.

Sand Sluices.

7. There will be two sand sluices, one near each end of the anicut, each having two openings of 3 feet by 3 feet. The position of these is shown in the longitudinal section of anicut sheet No. 3, and the plans of the sluices on sheet No. 7.

Area of catchment and supply.

8. The area of the catchment basin of the Puniár above the anicut is 2,000 square miles, of which 500 square miles form the drainage area of the Oosscuttu tank and the tanks of that group in Mysore, leaving a free drainage basin below of 1,500 square miles, the water from which is available for the purposes of this project.

Flood line.

Vide paragraph 3 of the Chief Enginneer's memorandum, No. 134 W., of the 4th October 1878.

9. The highest flood line with the river in its natural state is 140·07 as ascertained from the people living on the banks, this agrees very nearly with the level the calculated section gives, and it is calculated that with a discharge of 86,000 cubic feet per second this will be raised 3′·25 by the impediment offered by the dam raising the maximum flood line to 143·32.

Level of top of flood bank.

10. The top of the flood bank will be 149·00, and the parapets over the head sluices 151·50 or 5·68 and 8·18, respectively, above maximum flood line. Thus giving ample margin in case the discharge be greater than it is calculated to be.

Baroor Head Sluice.

11. The Baroor Head Sluice will be placed between two masses of rock, which to a great extent form a natural head for the channel, the mass on the right or river side is higher than it will be necessary to raise the roadway over the sluice. The plans and sections on sheet No. 4 show how it is proposed to construct the sluice so as to take advantage of this favorable situation.

It will have three vents of 6 feet by 5 feet and the floor will be placed at	128·50
Shutter platform at	145·50
The roadway at	149·00

It will be founded on rock as shown in drawing sheet No. 4.

Baroor Supply-channel.

12. The Baroor Channel.—The bottom width of the channel above the Moorsamputty tank in the second mile is 20 feet and below that tank 18 feet, the side slopes 1½ to 1. The fall per mile is 2 feet and the depth to be carried is 5 feet, giving a velocity 2·76 feet per second. The crest of the escape weirs will be placed 5 feet from the bed so as to make this the normal depth.

Discharge.

Vide Chief Engineer's memorandum No. 134 W., paragraph 4.

The discharge will be 379 cubic feet per second, and the Baroor Tank would be filled by this in 20·15 days, although the lower part of the channel has a smaller bottom width it is of equal or greater capacity in many parts, as at ground level a berm 2 feet in width on each side has been left.

Inlets and Outlets.

13. The inlets and outlets or waste weirs, of which there are 17 of the former and 23 of the latter, are shown on the sheets Nos. 12 and 14 to 21, are designed to pass into the channel and discharge the greatest quantity of water coming in from upland draniage, with a depth of 2 feet going over the crests of the weirs, so the maximum depth of water in the channel will not exceed 7 feet; at this level above bed berms 6 feet wide have been formed, the bank is raised 3 feet above the berms and the top will therefore be 10 feet above the bed, and 3 feet above maximum water level. The berms have been drained into the channel by slope drains with a gradient of 10 to 1-50 feet apart.

Work already done to channel.

14. Three-fourths of the earth-work for the excavation of the channel and forming the spoil banks has been executed, and nearly half the rock cutting done.

On Sheets Nos. 8 to 11 are shown survey plan, longitudinal and cross sections of the supply-channel, showing sections of the spoil banks, and the three tanks through which it passes and the drainage streams which cross it.

Data for Inlets and Outlets.

15. The plans of inlets and outlets or weirs for passing the upland drainage into and out of the channel, shown on sheets Nos. 12 and 15 to 22, are designed in accordance with the instructions of the Chief Engineer for Irrigation, the discharges being calculated with a co-efficient of 450 with Ryves' formulæ $D = C\sqrt[3]{M^2}$. This is figured on the sheets in each case.

Under Sluice or culvert.

16. An under sluice for passing the water from the lands irrigated by the Veeroopully small tank under the channel is shown on sheet No. 13. The discharge from the catchment of the tank and the other informations required is figured on this sheet.

Distribution Sluices of Supply-channel.

17. The distribution sluices shown on sheet No. 24 will be placed in the lower bank of the channel, at the sites marked on the longitudinal section; there will be 15 of these for the irrigation of the lands under the channel.

Baroor Tank.

18. Baroor Tank plan with the contours marked at every 3 feet above the old F.T.L. 103·60 up to 115·60 is shown on sheet No. 26, with longitudinal and cross sections of the old bund and also of the bund as it will be when enlarged are shown on sheet No. 26. It formerly held 1·221 millions of cubic yards, but will, when completed as is proposed, hold nearly 20 millions of cubic yards. It was before proposed to extend the bund eastward across the Keelcooppum Valley and increase the capacity of the tank to 24½ millions of cubic yards, but this extension was by G.O., (F.R.,) No. 2,201 of 22nd October 1878, ordered to be given up, and this end of the bund will turn north along the ridge, as shown on the plan, until the high ground is met, as the levels of the floors of the two sluices in the old bund are too low to command all the lands to be irrigated and the culverts are not of sufficient section for the discharge.

Irrigation Sluices.

19. Two new irrigation sluices will be required. Sheet No. 28 shows the irrigation sluice proposed to be constructed at the western end of the bund, and on sheet No. 29 are drawn the plans and sections for the left or eastern sluice, the former intended to discharge water for 1,500 acres and the latter 9,000 acres or more if required.

It will be seen by the drawing that the western sluice will have six plug-holes in its platform 12 inches in diameter, with plugs worked by screws from above 11¾ inches diameter at the upper end, and $4\frac{1}{2}$ inches at the lower end; when fully open these orifices will with a head of $8\frac{1}{2}$ feet each discharge 12·861 cubic feet per second, sufficient for the irrigation of 800 acres, and the whole six would give water for 4,800 acres, but there is less than 1,500 acres under the sluice, so that if the plugs be lifted 9 inches they will discharge more water than is required.

Vide Circular No. 87 from the Chief Engineer for Irrigation,

The sluices for the eastern or principal irrigation channel will have a platform with six holes 18 inches in diameter, and plugs fitted to them having a diameter of $17\frac{3}{4}$ inches at the upper and $6\frac{3}{4}$ inches at the lower end, with a length of 45 inches each; these orifices when fully open with an $8\frac{1}{2}$ feet head would discharge 29·11 cubic feet per second, sufficient for the irrigation of 1,941 acres each, or sufficient for 11,500 if all six were discharging, but as there is less than 9,000 acres under the sluice it will be sufficient to lift the plug 27 inches to get the necessary discharge.

Vide Circular No. 87 from the Chief Engineer for Irrigation.

It will also be observed, if the drawings on sheets Nos. 28 and 29 be examined, that there are additional openings below the plug platforms 3 feet by $3\frac{1}{2}$ feet in the former sluice and 4 feet by 4 feet in the latter, and those are closed by shutters regulated by screws from the screw platform above; if the water at any time gets low in the tank, or the discharge through the plug-holes be from any cause found insufficient, the shutters can be lifted and any supply desirable obtained as long as the water remains in the tank.

The table appended gives the calculation of discharges for these sluices with different heads, and with the plug and shutter for regulating the lower opening raised to different heights, and are in accordance with those given with the Chief Engineer for Irrigation's Circular No. 87, dated 1st March 1878.

State of bund.

20. It will be seen by the plan sheet No. 26 that the old bund, with the exception of a short length at the western end, which turned abruptly to the south, will be retained. The western extension has been completed to within 3 feet of the full height except for a length of 414 feet, where the temporary escape and the site of the western sluice is.

The cost of increasing the capacity of the Baroor Tank from 1·221 millions to 20 millions and placing irrigation sluices in it will be under Rs. 60,000, and there will therefore be upwards of 300 cubic yards stored per rupee.

The old bund has been completed of the full section up to its former level. The foundations and the floor of the western sluice have been built in and the revetment for the western extension has been completed, except for the length 414 feet mentioned above, and three-fourths of the height of revetment for the old bund has been built so that 104,600 cubic yards of the earthwork required to enlarge the bund of the tank has been done, the total quantity being 196,260 cubic yards, and 10,382 cubic yards of revetment has been built, the total quantity being 20,677 cubic yards, and nearly half the puddle wall in the centre of the bund is completed, so that rather more than half the work required to complete the Baroor Tank and about one-fourth of the whole quantity in the project has already been executed.

Work being so far completed as to fit the tank for irrigation of its former ayacut.

21. The western sluice is being so far completed as to make it capable of discharging the water required and the bund made over it, a new temporary escape cut at the eastern end and the revetment built up where low so as to make the tank safe and fit it to irrigate its former ayacut, thus saving the revenue amounting to Rs. 1,450-3-0 and preventing serious loss to the owners of the land under the tank. This work will cost Rs. 1,815 and is being done on the understanding that it will be paid in the month of April when funds will be available.*

Discharge from Catchment Basin.

22. The area of the catchment basin of the Baroor Tank is about 7 miles, from which with C = 450 the discharge would be 1,647 cubic feet per second, and if to this be added the discharge (379 cubic feet per second) from the supply-channel we get a total of 2,026 cubic feet per second.

Length of Escape Weir.

The escape for the tank which is shown on sheet No. 30, and is 200 feet in length, would discharge this quantity with 25 inches going over.

Eastern Distribution Channels.

23. The survey plans and longitudinal and cross sections of the distributions channels, sheets 31 to 38, will show what is proposed to be done in the case of those channels. They will aggregate a length of $25\frac{1}{4}$ miles and be of the dimensions shown on the sections.

The bottom width of the left or eastern channel at the head will be 18 feet, with slopes of $1\frac{1}{2}$ to 1 and fall 2 feet per mile with 4 feet depth of water, the discharge will be 300 cubic feet per second, sufficient for the irrigation of 12,789 acres.

The crest of the escape weirs or outlets shown on sheet No. 44 will be placed 4 feet above the bed of the channel at the head, so as to make the normal depth 4 feet, and this depth and

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* Funds have since been allotted for this work and it is nearly completed.

width will gradually decrease as the channel advances in the same proportion as the area to be irrigated decreases. The total area under this distributary and its branches is about 8,500 acres, but it will, if necessary, carry water for a much larger area.

Masonry falls for reducing gradient.

24. The masonry falls shown on sheets Nos. 39 to 43 will regulate the gradients of the distribution channels, and will be placed where they are marked on the longitudinal sections, so that the fall may nowhere, except at the extreme ends of the channels where they stoop to the river much, exceed 2 feet per mile; fourteen of those falls will be on No. 3 branch channel from the left sluice or main channel on the mile from its head, the position of those falls is shown on the longitudinal section.

Aqueduct.

25. There will be one aqueduct of the plan shown on sheet No. 45 in the second mile and two others in the eighth and ninth miles* of the main channel for passing upland drainage over it.

Western Distribution Channels.

26. The right or western channel, which will irrigate about 1,500 acres, will have a bottom width of 6 feet and a depth of 3 feet at the head gradually decreasing in depth and width as it advances and as the land to be irrigated gets less. The fall will be 2 feet per mile and slopes will be $1\frac{1}{2}$ to 1. This channel will also discharge more than double the quantity of water required to irrigate the lands under it in case more lands may be required to be taken up hereafter.

There will be six masonry falls of the plans shown on sheets Nos. 39 to 43 required to be built into the channel to reduce the gradient to 2 feet per mile; six inlets and four outlets of the designs shown on sheet No. 44 will be required to be constructed in the banks of this channel to pass upland drainage across it, the discharges, position in the channel, and all required information is given on the sheets named.

Value of Project.

27. Unfortunately there is no register in existence showing the quantity of water that has passed down the Puniár in previous years, but last year when the rainfall was under the average there was more water passing the anicut site from the 5th of June, when the first fresh came down, till the 15th of December, than would have sufficed to fill the channel during this period, and the people living on the banks are all agreed that in ordinary years there is more than sufficient water passing down the river to fill the channels during at least six months of each year. But if only half this be taken as the time during which the channel will run full, it will suffice to fill Baroor Tank holding 20 millions of cubic yards and the 16 smaller tanks commanded by it holding about 10 millions of cubic yards three times, giving a total quantity of 90 millions of cubic yards, sufficent for the irrigation of 12,800 acres, taking 7,000 cubic yards as enough water for the irrigation of one acre.

Again, there can scarcely be a doubt that there would be ample water in the river to allow of the channel carrying half its full supply for three months longer, thus giving a total of, say, 130 millions of cubic yards.

This being the state of the water-supply it may safely be calculated that there will be enough to irrigate 10,000 acres, and that over this area two crops may be reaped, and that therefore if the rate be taken as Rs. 5 per acre, it cannot be considered as too high. This would give a revenue of Rs. 50,000 on a normal expenditure of Rs. 2,35,500, or $21\frac{13}{47}$ per cent.

Cause of delay in submitting project.

28. In explanation of the delay in submitting this project, I would point out that this is the second Baroor scheme which I have prepared and submitted; the first, the estimate of which amounted to Rs. 52,688, was disposed of in G.O., No. 2,208, of 6th October 1877, the scope of the scheme now submitted having been changed and much enlarged, and that while preparing it I have had at the same time on my hands the preparation of the other projects detailed in the margin, which were submitted on the dates given after them, besides the preparation of 315 estimates for smaller irrigation works, roads, &c., and that for the greater part of the time with little or no assistance. I had to superintend and carry out as Famine Relief Works not only this and the other projects named, but some 300 other works which were in progress from Famine Funds, there having been in the last two years nine new sluices and 15 calingulas built, and 184 tanks and 525 miles of road repaired in the division as Famine Relief Works, on which 5,095,414 persons were employed.

The Pennugoondapooram Tank, on the 10th January 1879,
The Allalum Anicut and Channel, on the 22nd November 1878.

That the famine expenditure amounting to Rs. 6,65,275 has, with the exception of Rs. 6,228, been adjusted, and that all this extra work has been done without hitch of any kind.

Submitting this project and respectfully requesting the attention of Government to the above statement, which I have no doubt Major Pennycuick, R.E., the late District Engineer of this District, will verify, may I be allowed to ask why I have been passed over in promotion by no less than four of my juniors since the month of December 1877. I feel that I have been very hardly treated for no cause that I can imagine, Government having in G.O., No. 2,677 W., of 28th June 1878, rescinded the censure which through a mistake was passed on me in G.O., No. 228 I., of 9th August 1877, and since then in the Government Order No. as per margin it has been said I have done well, may I now hope that my case may be reconsidered.

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* Waste Weirs have been substituted for those two Aqueducts.—See Sheet No. 45.

GO., No. 779 I., of 4th October 1878.

Hosur,
15th January 1879.

(Signed) R. J. LOWRY,
Executive Engineer.

APPENDIX No. 5. A1

No. 48.

NOTE ON THE BAROOR PROJECT IN THE KRISHNAGIRI TALUK.

The history of the project and the objects aimed at will be found in the papers already forwarded.

2. The present condition of matters is as follows.

3. The greater part of the earthwork and about one half or more of the blasting for the main channel has been completed.

4. The bund of the Baroor Tank has probably by this time been brought up throughout to the level of the old bund, and to the full width required for the extra height to be hereafter added; the puddle wall has been carried on in due proportion to the earthwork, and the revetment is but little behindhand.

5. The masonry works of the channel are very much in arrear, and nothing has yet been done towards the construction of the head works, though a considerable quantity of materials has been collected.

6. Every endeavour should be made to push on the construction of these works, the former at once, and the latter as soon as the drying up of the river permits of work in its bed being carried on.

7. Among the papers will be found a detailed measurement of all the work done up to the 31st October, from which it will be seen that the famine excess is about 65 per cent. of the value at normal rates.

8. Mr. Lowry sometime ago promised that the detailed plans and estimates would be ready by the 20th instant, and it is hoped that this promise will be kept; it is highly desirable that the estimates should be got ready as soon as possible.

9. Judging from the data available I do not think that the whole cost of the work (allowing for the omission of the extension of the tank bund across the Kilcoopum valley) is likely to exceed Rs. 2,00,000 or Rs. 2,10,000, and out of this Rs. 50,000 or 60,000 will be chargeable to famine, so that the actual cost of the work will not be more than Rs. 1,60,000 at the most.

10. We have no records of the actual discharge of the river at the site of the anicut, and the quantity of water available for irrigation must therefore be estimated from the catchment basin.

11. The area of this basin at the site of the anicut is 2,082 square miles,* but out of this area 461 square miles are occupied by the Oorcotta tank [illegible] Mysore, leaving only 1,621 between the latter and the anicut. As the basin includes numerous tanks, one-third of the above area should be deducted on their account, leaving a free area of 1,080 square miles.

12. A depth of one inch run off from this area would give two thousand five hundred millions of cubic feet, and would suffice to fill the enlarged Baroor Tank (five hundred and forty millions of cubic feet) four and a half times over.

13. The maximum carrying capacity of the channel is about four hundred† cubic feet per second and its ordinary full discharge about three hundred,† and seeing that a depth from the catchment basin of one inch per month would give a discharge of nine hundred and sixty-eight cubic feet per second, it is probably a moderate estimate to reckon on the channel carrying an average supply during the nine months from May to January of two hundred cubic feet per second.

14. The tank holds thirty-one days' supply at this rate, and as it is highly improbable that the river will be absolutely dry for this time, or will carry less than one hundred cubic feet per second for sixty-two days together, we may fairly reckon on a constant supply of two hundred cubic feet, which would be sufficient for the irrigation of twelve thousand acres.

15. As nearly the whole area may be cropped twice, a net return of four and a half rupees per acre after deducting maintenance charges may fairly be reckoned on; this would give an annual return of fifty-four thousand rupees or thirty-three per cent. on the cost of the work; even if the latter were as high as two lacs and the area irrigated not more than eight thousand acres, the return would still be eighteen per cent.

16. It will be noted that I have taken no credit for any surplus from the thousand square miles occupied by existing tanks, nor for the storeage of the small tanks through which the channel passes; but in point of fact I consider that the Baroor Tank by itself is quite large enough to serve as an efficient regulator to the channel, holding as it does twenty-one days' full supply at three hundred cubic feet per second.

17. It is worthy of note that there is a considerable field for irrigation on the right bank of the river, which may be profitably taken in hand if it is found that any considerable supply remains unutilised; the head works being already constructed, this extension should be economical.

18. It is highly desirable that this work should be pushed on as rapidly as possible, and attention is invited to my suggestion that a section should be renewed for execution under famine rules, and the remainder carried out in the ordinary manner, as the supply of famine labor will be but small.

Salem,
5th December 1878.

(Signed) J. PENNYCUICK, Major, R.E.,
Executive Engineer, Salem Division.

To the Superintending Engineer, Fourth Circle.

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* This is a revised measurement just made by myself, and should be accepted in correction of former estimates.

† Written from memory; I have no note by me of the actual figures.

APPENDIX No. 6. A.2.

From Lieutenant-Colonel W. R. JOHNSON, Temporary Chief Engineer of Mysore, to the Superintending Engineer, Fourth Circle, Camp Baroor, dated Bangalore, 23rd January 1879, No. 100.

In reply to yours, without number, dated Baroor, 20th January 1879, requesting me to forward you a copy of register of the Penamkeny river if any have been kept in Mysore, I have the honor to inform you that we have no register of the supply in that river.

2. You will observe by a reference to the map that the main stream is bunded across at Hoskote about 15 miles from the Madras frontier, and that the side drainages, in the Mysore Province between the Hoskote tank and the frontier, are also stopped by chains of tanks, except when the terminal tanks of these chains are discharging; there is therefore little or no supply in the river within our boundary, except the tail water from the cultivation below the terminal tanks which is inconsiderable.

APPENDIX No. 7. B.

Register of Rainfall to accompany the Plans and Estimates of Baroor Project.

Stations.	Years.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
		IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN	IN.	IN.
Remount Depôt, Mathegherri.	1866	..	..	..	..	..	..	..	0·80	8·33	12·75	0·75	1·00	23·63
	1867	0·33	..	1·75	0·12	5·75	4·75	5·25	2·40	3·00	7·00	0·75	..	31·10
	1868	1·50	..	..	0·75	3·20	4·50	7·20	1·90	9·50	2·90	2·00	..	33·45
	1869	..	..	0·90	1·30	3·90	3·75	2·60	7·40	3·80	5·00	1·30	..	29·95
	1870	0·60	..	..	..	4·00	3·60	3·90	3·00	5·00	11·75	1·60	..	33·45
	1871	..	..	5·00	0·60	7·20	1·20	2·40	2·50	5·80	3·30	4·20	0·25	32·45
	1872	..	0·80	..	2·75	8·00	1·25	2·50	4·00	6·25	4·75	8·25	2·75	41·30
	1873	..	1·00	..	2·50	1·50	0·75	1·75	6·50	5·50	8·50	0·20	1·30	29·50
	1874	..	..	0·40	0·10	0·40	14·75	3·90	2·60	8·00	10·75	7·75	4·20	52·85
	1875	..	..	2·00	1·50	6·80	3·40	2·00	3·00	2·40	2·50	2·00	..	25·60
	1876	..	..	0·50	0·75	5·30	0·40	0·50	4·40	4·50	0·05	0·75	..	17·15
	1877	..	..	0·25	0·20	2·20	2·10	0·55	0·75	8·60	12·80	3·50	..	30·95
	1878	..	..	..	1·20	4·00	2·75	3·50	6·75	7·10	3·00	1·20	2·50	32·00
Total of 13 years ..	..	2·43	1·80	10·80	11·77	52·25	43·20	36·05	46·00	77·78	85·05	34·25	12·00	413·38
Average ..	..	0·19	0·14	0·83	0·91	4·02	3·32	2·77	3·54	5·98	6·54	2·63	0·92	31·79
Hosúr ..	1869	..	..	0·75	2·00	5·20	3·20	2·60	10·50	2·20	8·75	1·00	5·00	41·20
	1870	0·50	0·50	..	0·10	4·00	2·50	3·50	5·50	4·00	11·00	1·00	..	32·60
	1871	0·30	..	6·40	..	4·50	1·00	2·80	4·00	3·40	4·00	4·75	..	31·15
	1872	..	1·10	1·10	2·75	7·00	1·10	1·75	5·40	6·40	3·00	6·00	4·70	40·30
	1873	..	0·75	0·20	0·75	0·80	0·40	0 20	5·30	3·20	7·30	0·80	1·60	21·30
	1874	..	..	0·30	..	9·75	2·00	1·30	6·70	11·70	8·75	5·40	0·50	46·40
	1875	..	..	0·75	3·00	8·20	3·20	1·50	2·30	0·40	2·75	0·50	..	22·60
	1876	..	..	..	0·60	5·00	..	0·90	5·90	4·20	..	..	..	16·60
	1877	..	..	0·50	2·40	1·70	4·50	0·50	1·10	11·10	12·40	4·50	0 20	38·90
	1878	..	..	..	2·10	4·10	5·50	4·30	9·20	4·00	3·00	2·20	0·75	35·15
Total of 10 years ..	..	0·80	2·35	10·00	13·70	50·25	23·40	19·35	55·90	50·60	60·95	26·15	12·75	326·20
Average ..	..	0·08	0·24	1·00	1·37	5·03	2·34	1·93	5·59	5·06	6·09	2·62	1·27	32·62

Register of Rainfall to accompany the Plans and Estimates of Baroor Project—*cont.*

Stations.	Years.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
		IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
Krishnagiri ..	1859	..	..	..	..	..	..	4·50	4·50	3·50	0 25	3·50	..	16·25
	1860	..	..	..	..	5·50	1·25	0·50	3·00	0·50	11·25	0·25	0·75	23·00
	1861	..	..	6·00	1·00	2·50	2·00	7·50	4·50	5·75	2·75	4 25	..	36·25
	1862	..	..	..	1·00	6·75	1·75	..	3·50	12·00	8·50	..	..	33·50
	1863	..	..	3·00	1·00	5·75	2·50	0·50	3·50	3·25	5·25	0·25	1·75	26·75
	1864	..	..	..	1·00	2·75	4·00	0·50	5·50	3·00	6·00	9·00	..	31·75
	1865	..	0·25	..	1·75	4·25	3·75	7·75	2·25	2·25	0·50	7·16	..	29·91
	1866	..	..	..	1·00	2·50	..	2·75	4·00	5·25	6·75	1·25	1·25	24·75
	1867	..	..	..	1·00	5·75	..	3·00	1·50	1·75	7·75	0·25	..	21·00
	1868	1·50	..	..	..	1·75	5·00	8·50	1·50	4·75	5·00	1·50	..	29 50
	1869	..	..	0·75	..	3·25	4·00	4·25	7·50	1·75	6·75	0·50	0·50	29·25
	1870	..	..	0·75	..	3·00	10·50	2·75	6·00	9·50	6·25	1·50	0·50	40·75
	1871	..	..	4·50	..	7·00	..	0·50	3·50	9·25	3·75	1.75	..	30·25
	1872	..	..	..	..	8·00	1·25	4·75	3·00	7·25	4·00	4·00	0·75	33·00
	1873	..	1·25	..	1·75	0·50	1·75	0·75	5·75	2·75	7·75	..	..	22·25
	1874	..	..	..	..	12·75	2·50	3·00	2·00	14·75	10·75	3·25	0·50	49·50
	1875	..	..	0·75	1·75	2·25	4·25	..	2·50	2·50	5·75	0·25	..	20·00
	1876	..	..	..	..	..	..	..	..	..	..	..	..	..
	1877	..	..	0·25	0·25	2·25	2·75	..	0·50	11·75	9·50	5·50	1·50	34·25
	1878	..	..	..	0·75	4·75	2·75	7·75	0·75	4·50	6·50	2·75	1·50	32·00
Total of 20 years ..	..	1·50	1·50	16·00	12·25	81·25	50·00	59·25	65·25	106·00	115·00	46·91	9·00	563·91
Average ..	..	0·07	0·07	0·80	0·61	4·06	2·50	2·96	3·26	5·30	5·75	2·34	0·46	28·19
Dharmapuri ..	1866	..	..	..	..	..	..	..	3·10	5·10	9·00	..	0·10	17·30
	1867	..	..	..	0·10	..	0·40	0·25	0·10	2·00	0·10	5·10	..	8·05
	1868	3·00	..	..	..	1·00	1·00	3·00	..	3·00	7·10	..	..	18·10
	1869	..	..	..	..	3·00	..	5·00	6·00	5·10	5·50	2·10	..	26·70
	1870	0·10	..	0·10	..	2·00	0·70	2·75	2·75	4·80	7·80	0·30	..	21·30
	1871	..	0·30	1·60	0·10	0·30	0·10	..	0·10	0·40	1·40	0·50	0·20	5·00
	1872	..	..	..	0·40	6·50	2·75	1·60	2·50	8·10	6·90	6 25	1·50	36·50
	1873	..	2·30	..	2·20	..	0·25	1·00	5·90	3·40	9·50	0·40	1·00	25·95
	1874	..	..	..	..	10·40	1·70	3·10	3·75	6·90	9·50	0·75	0·25	36·35
	1875	..	..	1·70	1·50	5·80	1·80	1·30	2·50	2·50	5·10	0·50	..	22·70
	1876	..	..	0·20	0·50	4·50	1·00	0·75	1·20	2·80	..	..	..	10·95
	1877	..	..	1·10	..	2·20	1·40	0·10	1·50	9·60	6·25	3·50	0·40	26·05
	1878	..	..	0·20	2·20	4·00	3·00	5·30	2·00	4·60	1·50	3·50	..	26·30
Total of 13 years ..	..	3·10	2·60	4·90	7·00	39·70	14·10	24·15	31·40	58·30	69·65	22·90	3·45	281·25
Average ..	..	0·24	0·20	0·38	0·54	3·05	1·08	1·86	2·42	4·48	5·36	1·76	0·26	21·63

APPENDIX No. 3.

Statement showing the Amount of Compensation to be paid for Lands, &c., taken up for Baroor Project.

Name of Project.	Number and Date of Govt. Order.	Amount of Estimate.	Name of Work.	Situation of land. Villages.	Area of Land.	Assessment. RS. A. P.	Amount of Compensation for Land. RS. A. P.	Amount of Compensation for the loss of Crop. RS. A. P.	Grand Total of Compensation. RS. A. P.	Date of Transfer.
Baroor Project.	..	Rs. 2,35,500.	Baroor Project.	Baroohully	23·77	42 12 0	745 0 0	142 8 0	887 8 0	
				Morasahully	2·63	2 10 0	39 6 0	..	39 6 0	
				Kalvahully	7·05	6 11 0	103 12 0	..	103 12 0	
				Maroodoory ..	11·31	9 8 0	95 0 0	60 0 0	155 0 0	
				Chellamputty ..	22·81	17 9 0	250 10 0	5 0 0	255 10 0	
				Velangamoedy ..	26·29	27 11 0	335 10 0	40 0 0	375 10 0	
				Poongamputty ..	12·24	12 11 0	138 2 0	25 0 0	163 2 0	
				Baroor	202·62	132 5 0	2,444 6 0	57 8 0	2,501 14 0	
				Mottoopputty ..	2·66	2 0 0	20 0 0	..	20 0 0	
				Ammanayakumputty ..	23·38	38 3 0	511 9 0	..	511 9 0	
				Kilkooppam	43·18	27 5 0	273 2 0	125 0 0	398 2 0	
				Nedingul	1·27	7 5 4	350 0 0	374 0 0	724 0 0	
				Avathvody Mittah.						
				Jagany	..	..	..	60 0 0	60 0 0	
				Total ..	385·21	326 10 4	5,306 9 0	889 0 0	6,195 9 0	

Ossoor Division Office,
March 1879.

(Signed) R. J. LOWRY,
Executive Engineer.

Appendix C

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

11th February 1881, No. 124 I.

Irrigation.
Account.

Read the following papers :—

No. 45. From H. E. STOKES, Esq., Acting Collector of Salem, to the Joint Secretary to Government, Public Works Department, Irrigation Branch, dated Salem, 26th January 1881, No. 150.

With reference to your letter, 12th October 1880, I have the honor to furnish the following information regarding the Barúr project. The details given by you as regards irrigable area and as regards the possible extension of irrigation on the right bank of the river are not sufficiently definite to admit of a very exact calculation of the probable return.

2. The tract on the left bank of the river shown in the index map as commanded by the channels is partly in the Kristnageri and partly in the Uttankarai taluks. In the former it comprises Government villages only, but the portion of the latter included is entirely mitta land, and only water-rate at Rs. 4 or Rs. 5 per acre of new irrigation can be counted on.

3. A larger profit can be obtained on the Government lands in Kristnageri taluk which may come under irrigation. It includes twenty-four villages, in whole or part. In the settlement the wet lands of these villages were placed in the third group, the Cauvery channel irrigation forming the first, and the river channel irrigation under the Vasishtanadi and Pálár rivers forming the second. I think that in assessing the dry lands to be irrigated under the project they may fairly be placed with reference to the certainty and sufficiency of supply in the second group. I assume that the wet lands in the tract which are now in the third group cannot be re-assessed during the currency of the present settlement. The only profit which can be obtained from them is the saving of remissions, and this is a very small item averaging during the last ten years Rs. 412 only. The remissions were chiefly granted in the famine years and therefore the asset, small as it is, is doubtful.

4. In order to ascertain what will be payable per acre on dry land irrigated under the project, I have analyzed in detail the assessments of the dry lands in fifteen villages in the tract in question, and taking according to the usual tables the second group wet rates for soil and class, I find that 7,215·71 acres now assessed at Rs. 5,257-2-0 or an average of Re. 0-11-8 per acre would be assessed at the corresponding wet rates in the second group at Rs. 32,598-13-0. Adding the composition for second crop at one-third, the total wet assessment would be Rs. 43,465-1-0, or an average of Rs. 6-0-5 per acre. This may appear a low average, but the soil is poor. The difference is Rs. 5-4-9 per acre, and this may safely be assumed as the average return per acre under the project.

5. You give the total area commanded as shown in the index map as 11,251 acres. I have marked the taluk boundary on the map, and find the area of the Uttankarai portion to be by scale 3,087 acres. Deducting this the Kristnageri portion

is 8,164 acres. I consider that one-third is an ample deduction for unirrigable portions, and this leaves 5,442 acres, of which 1,519 acres are already assessed as irrigated.* The balance at 5-4-9 per acre will pay Rs. 20,776. You state that if Rs. 20,000 can be shown to be a probable return, the project will be a paying one.

* *Note.*—The ten years average occupation has been only 1,315·16 acres.

6. Besides the profit above-mentioned there will be the water-rate on the mitta lands newly irrigated. I have no doubt that the mitta ryots will gladly pay Rs. 5 per acre, but Rs. 4 may safely be counted on. I think the same proportion of gross area may be taken as in the Kristnageri villages. I have not exact information as to the extent already irrigated in the mitta tract, but believe it to be less than in the Kristnageri villages, and the land is more favorably situated with reference to the channels, so that the proposed assumption is safe. We have therefore 8,164 : 3,923 : : 3,087 : 1,483, and at Rs. 4 the return will be Rs. 5,932.

7. Including remissions saved the total return may therefore be estimated Rs. 27,120.

8. As to the prospects on the right bank, I can make no estimate, as your data are so indefinite. I may, however, state for your information that the land on this bank from Nedangal to a point nearly opposite Maraderi is mitta land, and I do not think that much new irrigation is possible so far. From this point to about three-quarters of a mile north of the trunk road crossing the land belongs to Government, and for so much of this as is newly irrigated a return similar to that on the left bank villages may be looked for. From the last named point to the southward as far as the map extends the land belongs to the Kamminellúr mittadar. If the channels on the left bank are further extended to the south-east, Government land will be available.

The project as prepared makes no provision for extension of irrigation on the right bank of the river.—J. M.

9. I am of opinion that there will be no delay in the extension of irrigation from the disinclination or inability of the ryots to use the water. I know as a fact that already land in Barúr and the neighbouring villages is scarcely to be bought owing to anticipation of the completion of the project, and that much land has been taken up and is being paid for though now uncultivable in the hope that irrigation will be made available for it.

10. You ask for statements showing the average cultivation and remissions under, and the area of the beds of the tanks numbered on the index map, and I enclose such a statement accordingly, though I do not see that it is of use in the calculation. I return the index map.

Appendix D.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

7th April 1881, No. 255 I.

Irrigation.

Read the following paper:—

No. 18. Endorsement of the Chief Engineer for Irrigation, dated Chepauk, 31st March 1881, No. 40 I.

From H. E. STOKES, Esq., Acting Collector of Salem, to the Chief Engineer for Irrigation, dated 25th March 1881, No. 764.

WITH reference to paragraph 6 of your Note on the Baroor Project recorded in G.O., Public Works Department, dated 11th February 1881, No. 124 I., I have the honor to state that the charge for second crop included in my estimate is, as stated in my letter, a composition which, according to the principles of the settlement, is to be paid whether a second crop is cultivated or not. An addition for possible second crop is made to the assessment of all wet lands in the district at varying rates according to the class of irrigation, and is paid in all years. There is no ground, therefore, for the deduction made by you from my estimates.

2. There is another item of profit which it is perhaps worthwhile to mention, viz., the increased rates which, at the close of the present settlement, twenty years hence, it will be possible to impose on lands now irrigated by raising them also to the second group. The increase would be about 3,000 rupees. If you think it worthwhile, I shall have the amount worked out exactly according to soils.

SUBMITTED for the information of Government with reference to G.O., No. 124 I., dated 11th February 1881.

2. The particulars given in this letter indicate that the net return from the Baroor Project may eventually be rather more than 8 per cent., instead of 7 per cent. as deduced in the Note reviewing the scheme.

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

~~No.~~ 19. ORDER THEREON, 7th April 1881, No. 255 I.

RECORDED.

2. A copy of these Proceedings will be forwarded for the information of the Government of India in continuation of docket No. 125 I., dated 11th February 1881.

(True Extract.)

Lieut Coll.
~~Captain,~~ R.E.,
Ag. ~~Under~~ Joint Secy. to Govt., P.W.D.,
Irrigation Branch.

To the Chief Engineer for Irrigation.
,, Superintending Engineer, Second Circle.
,, Revenue Department.

No. 205

Exd. A. F. Goodall.
8 Spare Copies

Communicated to the Executive Engineer Salem Division for information.

a/23d April/81

3 Spare copies

IRRIGATION.

Govt. of (1881) Madras.

PUBLIC WORKS.

To

THE CHIEF ENGINEER FOR IRRIGATION,
&c., &c., &c.

Dated April, 7th.

Issued

Recd. Encl.

G. O., 7th April 1881, *No.* 255 *I.*

APRIL.
Nos. 18-19.

21

Baroor Project.—Papers regarding the net return from the —, recorded.

[illegible]
No. 205
81

STATEMENT showing the Average Cultivation and Remission

—	Villages.	Group.		Wet.					
		Wet.	Dry.	Source of Irrigation and Area of Bed of Tanks.	Wet Ayacut. Acres	Assessment. Rs a	Ten years average "Kaiput" of Wet Lands. Extent.	Ten years average "Kaiput" of Wet Lands. Assessment.	Average Remission.
42	Barúr	4	3	Periyéri .. .. Acres 268.	269 87	1,444 0	247 86	1,405 7	165 6
..	....	..	..	Chinnéri .. .. Acres 88.	103 64	590 9	96 48	563 10	21 1
46	M[illegible]éri	3	3	Tank .. .. Acres 38.	61 10	435 3	56 74	428 3	19 2
47	Kaluvéhalli	3	3	Do. supplied by Pennar channel.	31 17	206 14	29 65	200 3	7 14
48	Morasarahalli	3	3	Do. do. .. Acres 22.	59 45	364 8	56 31	343 14	21 11
49	Béruhalli	3	3	Pennar channel ..	84 76	520 14	84 67	560 2	31 10
45	Valangámudi	3	3	Tank supplied by Pennar channel. Acres 71.	100 56	581 14	92 57	573 5	51 11
..	....	..	..	Ambattan kuttai .. Acres 4.	2 94	12 14	2 90	12 9	..
35	Kóttaipatti	5	3	Tank.. .. .. Acres 25.	10 63	39 15	10 70	42 12	7 5
36	Thimmanúr	5	3	Sekkilikuttaiyeri ..	15 62	55 1	14 53	52 2	19 6
..	....	..	..	Pennar Thulai .. Acres 5.	3 98	9 15	3 98	9 15	..
40	Puliyúr	4	3	Jambéri .. .. Acres 33.	52 51	260 15	41 64	221 5	..
..	....	5		Odusaléri .. .. Acres 16.	9 88	40 1	8 76	37 13	..
43	Sellakuttapatti.. ..	5	3	Pennar channel ..	41 74	308 2	37 34	291 12	0 3
..	....	..	..	Kuttai Utha Pachal ..	7 21	22 2	7 21	22 2	..
44	Pungampatti	3	3	Pennar channel ..	48 94	300 11	40 43	276 12	2 5
..	....	..	..	Nágakuttaiyéri .. Acres 21.	12 22	73 6	11 64	70 2	7 5
..	....	..	..	Nagakuttai Uthur Pachal	9 76	34 2	8 22	28 12	3 13
41	Kilkuppam	5	3	Illuppakuttai .. .. Acres 18.	24 61	103 11	23 8	106 9	..
39	Muthupápampatti ..	5	3	Sirkáryéri .. .. Acres 13.	26 25	117 5	24 29	113 11	2 8
62	Bantharapalli	5	3	Sirkáryéri .. .. Acres 43.	48 1	178 4	41 99	176 2	2 15
63	Viruppampatti.. ..	5	3	Sirkáryéri .. .. Acres 23.	26 38	96 3	19 33	79 14	3 12
64	Thâthampatti	5	3	Sirkáryéri .. .. Acres 7.	3 65	16 9	3 27	15 3	..
60	Mávathúr	5	3	Sirkáryéri .. .. Acres 44.	71 78	222 5	38 69	169 6	7 14
32	Arasampatti	3	3	Pennar channel ..	48 46	276 5	43 52	247 13	7 5
33	Manjamédu	3	3	Do.	44 91	240 5	40 25	214 11	6 11
34	Bendrahalli	3	3	Periyéri Pachal .. Acres 71.	69 80	381 3	62 27	350 11	11 9
..	....	..	..	Tippanam kuttai .. Acres 47.	21 66	109 3	20 58	96 6	10 5
..	....	..	..	Pennar Yeruppu ..	0 87	1 11	0 87	1 11	..
31	Thirunáthampatti ..	3	3	....	..	..	..	..	..
37	Kúnathimmampatti ..	..	3	....	..	..	..	..	..
38	Jinkékadaranahalli ..	5	3	....	..	..	..	..	..
65	Sengampatti	..	3	....	..	..	..	..	..
	Total ..	..	..	....	1,312 36	7,044 2	1,169 77	6,712 13	411 11

Appendix E.

No. 18 I.

BARUR PROJECT—SALEM DISTRICT.

Note by the Chief Engineer for Irrigation.

THE estimate for this project, as prepared by the late Mr. Lowry, amounts to Rs. 2,35,500, and includes the following items:—

			RS.
1. Anicut across the Ponniár ...			16,898
2. Flood banks at flanks of do. ...			2,343
3. Head sluice, Agaram channel ...			10,667
4. Do. Nedangal do. ...			1,071
5. Barúr tank supply channel—		RS.	
Head sluice ...	RS.	5,174	
Channel—Earthworks ...	48,004		
" Syphon sluice ...	2,810		
" Inlets ...	600		
" Outlets ...	4,883		
" Distribution sluices ...	1,757		
" Bridges ...	2,809		
" Moorsamputty tank sluice ...	220		
" Velangamudí do. ...	599		
" Pungumputty do. ...	388		
		62,070	
			67,244
6 Barúr tank—			
Bund... ...	51,176		
Surplus weir ...	1,742		
Western sluice ...	2,499		
Eastern do. ...	2,698		
		58,115	
Distributaries—			
Kulkuppam tank sluice ...	390		
Earthwork ...	47,500		
Aqueduct ...	2,795		
Inlets ...	2,115		
Outlets ...	12,565		
Distribution sluices ...	2,429		
Masonry falls ...	3,260		
Bridges and culverts ...	1,912		
		72,966	
			1,31,081
Land compensation ...			6,196
		Total ...	2,35,500

2. The project was undertaken as a famine relief work in August 1877, authority for starting it having been given in paragraph 8 of G.O., Revenue Department, No. 735, 19th February 1877, but at that time very little was known about it. In September 1877 the first definite project was submitted, and the estimate for this amounted to Rs. 52,688-8-0. It was reviewed and submitted to Government and a material enlargement of the Barúr tank with other modifications recommended.—*Vide* Proceedings of Madras Government, Revenue Department (F.R.) No. 2,208, 6th October 1877. On the general lines then laid down the project has been about one-fourth carried out. The total expenditure to the end of March 1879 amounted to ... ... Rs. 1,07,101

The normal value of work done was	"	67,185
Excess due to famine ...	"	39,916

Vide C.'s Office Note No. 744, of 6th November 1880.

In this case therefore the value of the work is 62·73 per cent. on the total expenditure; but as some work was done after the famine to enable the old cultivation under the Barúr tank to be resumed, it will be more correct to take the expenditure up to the end of December 1878 as a guide.

	RS.
This was	1,03,291
Excess due to famine ...	39,916
Normal value of work done ...	63,375

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and then the value of work becomes 61·35 per cent. nearly on the total famine outlay. It has to be noticed here that in the books of the Examiner of Public Works Accounts the whole outlay, Rs. 22,402, in 1877-78 was charged to famine, though the normal value of work done in that year was Rs. 14,051, consequently the recorded cost of the project to end of 1878-79 is only Rs. 53,134, whereas the real cost is, as above shown, Rs. 67,185.

3. The following comparison of the estimates of 1877 and 1879 so far as the former went, for they did not include distributaries, indicates the extent of the alteration of the scope of the project:—

Items.	Estimates of	
	1877.	1879.
	RS.	RS.
Anicut ...	10,745	16,898
Main channel ...	33,740	67,244
Barúr tank ...	7,325	58,115
	51,810	1,42,257

The width of the supply channel has not been altered, but the depth of water to be carried has been increased from 3 to 5 feet, and this made a considerable difference in the cost. The Barúr tank will under the later estimate be a considerable reservoir. In the report on the project its capacity is stated to be nearly 20 millions of cubic yards or 540 millions of cubic feet, but there are no particulars of the calculations, and those made in this office make the contents, at F.T.L., 297·27 millions of cubic feet, or just 11·10 millions of cubic yards, a very important difference.

Appendix 4.

4. *Area to be irrigated.*—In paragraph 27 of his report the late Mr. Lowry supposed that 10,000 acres will be irrigated. In paragraph 14 of a note on the project Major Pennycuick concludes that the water will suffice for 12,000 acres. The papers submitted by the Superintending Engineer, late Fourth Circle, contain no particulars of the extent and situation of the lands to be irrigated except that on the index map the field of irrigation is shown, and apparently the gross area commanded by the channels was not ascertained. No doubt there is land further to the eastward which could be supplied, but the project makes no provision for supplying water to any land outside the field of irrigation shown on the index map. The gross area so commanded measures 17·58 square miles or 11,251 acres, and this includes all the present irrigation, of which no account has been given in the papers received from the circle, as also high ground, tanks, roads, &c. It is not probable that more than 7,500 acres or two-thirds of the area will be irrigated at all and this inclusive of the present irrigated area which from information obtained from the Collector is acres 1,890. The present irrigation will require but little additional water. The new irrigation may be assumed to require 200,000 cubic feet per acre. The water-supply required will then be about as follows:—

Sheet 1.

Letter No. 150, 26th January 1881, paragraph 5.

One thousand five hundred and nineteen acres assessed as irrigated, 1,315 acres occupied in Kristnageri taluk. Paragraph 6 shows that the present irrigation in Uttankarai is about 575 acres, or altogether 1,890 acres.

	Millions of Cubic Feet.
1,890 acres of old irrigation at 25,000 cubic feet per acre ...	47·25
5,610 " of new " at 200,000 " " ...	1,122·00
Total ...	1,169·25

This would be for a single crop, and it amounts to just four times the storage capacity of the Barúr tank. There are twenty other tanks, none of them large, and the capacities of these have not been ascertained. Four of them are on the line of the channels and will therefore be directly supplied whenever there is water running.

Probably the total storage available will be about 400 millions of cubic feet, and, if so, the tanks will require to receive as much water as would fill them nearly three times.

5. *Water-supply.*—Major Pennycuick having specially taken out the area of the catchment basin of the river, his figures will be adopted in preference to Mr. Lowry's (report, paragraph 8). He states the circumstances thus :—

	SQ. M.	SQ. M.
Total area of the basin above site of anicut	...	2,082
Area above Ooscotta tank in Mysore...	461	
Do. of basins of numerous other tanks, say	541	
		1,002
Free basin		1,080

NOTE.—Paragraph 11, *vide* Appendix 13.

There is no record of the discharge of the river at the anicut site, and no reliable record can be made until the anicut is built. The data are therefore—

(1) the area of gathering ground or catchment basin ;

(2) the rainfall in the neighbourhood.

As regards the rainfall the statement submitted has been recast so as to show the average fall in each month for a series of years at all the stations in the neighbourhood at which registers have been kept. Taking the three stations within the basin, the average rainfall is in the non-irrigating season :—

Appendix 7.

	INCHES.
January	0·11
February	0·15
March	0·88
April	0·96
Total ...	2·10

no account need be taken of this. In the months which include the main and second crops the rainfall averages for —

	INCHES.		INCHES.
May	4·37	October	6·13
June	2·87	November	2·53
July	2·55	December	0·88
August	4·13		
September	5·45		
	19·37		9·54

These registers include the famine years, so they are less favorable than the normal average. The rainfall is conveniently distributed for the requirements of the project and confirms the local opinion as to the supply of water in the river being good.

In order to err, if at all, on the safe side, it is proposed to take 900 square miles as the free catchment basin above the anicut, and in that case the depth draining off this area, in a month, which would be necessary to keep the channel running full, would be 0·42 of an inch. From May to November, therefore, the channel will frequently be running full, and on the assumption that—

for 6 days in a month the channel is full,
6 do. do. is two-thirds full,
6 do. do. is half full,
12 do. do. is one-fourth full,

the quantity conveyed would average 176 cubic feet a second, while that essential to the prosperity of the crops would be, with reference to the areas of old and new irrigation given in paragraph 3 above,

1,890 acres at, say, 100 acres to the cubic feet a second	18·90
5,610 do. 66 do. do.	84·15
Total, cubic feet per second ...	103·05

The water-supply is likely therefore to be ample and it is probable that the storage will suffice to maintain a constant supply to the lands irrigated throughout the season.

6. The Collector (paragraph 7) estimates the returns at Rs. 27,120. These returns would seem to be based, however, on the supposition that the whole area will be double cropped, which perhaps may not be found feasible. The actual area of second crop would probably vary from year to year and would depend upon the distribution of the rainfall, the date of commencement of the first crop, which again depends upon the rainfall of the earlier part of the season, and the prospects as regards water-supply on the completion of the first crop. From the information given in paragraph 4 of the Collector's letter the calculation may be given in the following form :—

	Water-rates.	
	RS.	RS.
Assessment per acre for first crop...	4·52	
Deduct the land assessment	0·73	
		3·79
Water-rate on second crop		1·51

If, then, the returns be based on the 5,610 acres of new irrigation, and if it be assumed that 3,000 acres will be cultivated with two crops, the gross revenue would be—

	RS.
5,610 acres at Rs. 3·79	21,262
3,000 acres at Rs. 1·51	4,530
	25,792
Saving on remissions ...	412
Total ...	26,204

The increase of maintenance charges above those incurred on the up-keep of the existing works will be about 8 annas an acre on the new irrigation.

	RS.	RS.
5,610 acres at 8 annas	2,805	
Add one-third for establishment	935	
Assessment of land occupied	*327	
		4,067
Net revenue...		22,137

* Appendix 8.

7. The works estimate amounts to	Rs. 2,35,500
The establishment charges will be	„ 64,762
The tools and plant do.	„ 7,068
Total, Direct Charges ...	„ 3,07,330

and the return will amount, therefore, to about 7 per cent.

8. The Collector supports the opinion of the Public Works Officers that the project is one in which the people have shown considerable interest, and it is recommended that the estimate be sanctioned and the works carried on to completion ; care, of course, being taken that the distribution works are not advanced too much beyond immediate requirements, but extended as the demand for water may indicate to be necessary.

9. Careful registers of the water-supply at the anicut in the supply channel in the Barúr tank and the distributaries should be maintained and made use of by the officer in charge to determine what reserve should be kept in the Barúr tank and when water should be sent on to the minor tanks commanded thereby.

CHEPAUK, (Signed) JOHN MULLINS, Col., R.E.,
5th February 1881. Chief Engineer for Irrigation.

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

IRRIGATION AND NAVIGATION WORKS FOR WHICH NEITHER CAPITAL NOR REVENUE ACCOUNTS ARE KEPT.

CLASSIFIED ABSTRACT ESTIMATE of the Barúr Tank Project in Salem District.

Sub-head.	Name of Work.	Amount of individual Estimates.	Total of each Sub-head.
	(1) HEAD WORKS.	RS.	RS.
C. Works	Nedangal anicut across the Ponniár ...	16,898	
			16,898
	(2) MAIN CANALS AND BRANCHES.		
	Agaram Channel.		
D. Regulators ...	Head sluice	9,612	
L. Earthwork ...	New head	1,055	9,612
			1,055
	Total, Agaram Channel ...	...	10,667
	Nedangal Channel.		
D. Regulators ...	Head sluice	1,071	
			1,071
	Barúr Tank, Supply Channel...		
D. Regulators ...	Head sluice	5,174	
F. (1) Other cross drainage works.	Inlet No. 1	47	5,174
	Do. " 2	9	
	Do. " 3	20	
	Do. " 4	39	
	Do. " 5	25	
	Do. " 6	49	
	Do. " 7	41	
	Do. " 8	17	
	Do. " 9	31	
	Do. " 10	41	
	Do. " 11	97	
	Do. " 12	43	
	Do. " 13	34	
	Do. " 14	34	
	Do. " 15	24	
	Do. " 16	49	
			600
	Outlet No. 1	165	
	Do. " 2	15	
	Surplus weir, Moorasamputty tank ...	283	
	Outlet No. 4	200	
	Do. " 5	129	
	Do. " 6	516	
	Do. " 7	261	
	Do. " 8	178	
	Do. " 9	130	
	Do. " 10	136	
	Do. " 11	221	
	Do. " 12	131	
	Do. " 13	381	
	Do. " 14	202	
	Do. " 15	104	
	Do. " 16	342	
	Do. Nos. 17 and 18	213	
	Do. No. 19	135	

ABSTRACT Estimate of East and West Channel Masonry Works—*cont.*

Quantity.	Description of Work.	Per	Rate.			Amount.			Total.		
	23 Inlets.		RS.	A.	P.	RS.	A.	P.	RS.	A.	P.
1,405⅔	C. yards of earthwork	C. yd.	0	1	6	131	12	0			
1,720⅞	Do. of new rough stone ...	Do.	1	0	0	1,720	14	0			
430¼	Do. of gravel backing	Do.	0	6	0	161	6	3			
	Total ...	...	...			2,014	0	3			
	Sundries and Superintendence ...	...	...			100	15	9			
	Total Estimate ...	...	...			...			2,115	0	0
	20 Outlets.										
1,223	C. yards of earthwork	C. yd.	0	1	6	114	10	6			
1,873¾	Do. of rough stone in chunam...	Do.	3	0	0	5,621	4	0			
53⅛	Squares of pointing	Sqr.	0	12	0	39	13	6			
998⅔	C. yards of new rough stone work ..	C. yd.	1	0	0	998	10	8			
259⅔	Do. of gravel backing	Do.	0	4	0	64	14	8			
	Total ...	...	...			6,839	5	4			
	Sundries and Superintendence...	...	...			340	10	8			
	Total Estimate ...	...	...			...			7,180	0	0
	15 Outlets.										
887	C. yards of earthwork	C. yd.	0	1	6	83	2	6			
1,426	Do. of rough stone in chunam...	Do.	3	0	0	4,278	0	0			
74	Squares of pointing	Sqr.	0	12	0	55	8	0			
671½	C. yards of new rough stone ...	C. yd.	1	0	0	671	8	0			
160	Do. of gravel backing	Do.	0	4	0	40	0	0			
	Total ...	...	...			5,128	2	6			
	Sundries and Superintendence ...	...	...			256	13	6			
	Total Estimate ...	...	...			...			5,385	0	0
	Grand Total, East and West channel Masonry Works.	...	...			...			25,466	0	0

Appendix F.

BAROOR PROJECT.

Note by the Chief Engineer for Irrigation on the designs of the Works.

Plan, Sheet No. 1.—Index Map.

ON this should have been noted the area commanded by the project works; the ayacut, and average cultivated area of the wet lands under the several existing tanks within the limits of the field of irrigation of the project. The late Mr. Lowry, in paragraph 27 of his report, bases the area of irrigation on the water-supply, and supposes that 10,000 acres will be the area irrigated; but the total area commanded is not more than 11,251 acres as taken out from this Index Map, and it is improbable that more than two-thirds of this area, or 7,500 acres, will be irrigated, including existing irrigation. Major Pennycuick, in paragraph 14 of his Note, refers to 12,000 acres as the area which can be irrigated, and he bases his estimate of returns in the following paragraph on this area. It was clearly necessary to ascertain whether so large an area was available, and to show where it was. Again, the boundaries of the areas to be irrigated from the supply channel, the right and left channels from the tank, and the principal branches of these latter should have been laid down, the areas calculated, and the extent of irrigation in each case compared therewith. With such data erroneous assumptions would have been avoided.

Sheet 2.—Longitudinal and Cross Sections of the Pennár (or Pooniár).

2. The information given is manifestly incomplete, the flood lines having bee omitted from the longitudinal and cro: Sections, and the areas of waterway on th latter up to F.L. not having been give for comparison with the area of waterway at the anicut up to the calculated F. occasioned by the construction of the dam. As regards the cross section at anicu site, it has not been shown how the F.L. of 145·00 marked has been arrived at. I does not agree with the level 143·32 given in paragraph 9 of the report. The lengt of waterway on the present M.F.L. line is 1,157 feet, and the area of the waterwa as taken out by the undersigned is 8,098 square feet, the mean depth being thus jus 7 feet. The length of the anicut crest is 930 feet, and as the velocity will be certain somewhat greater than at present, it is evident that the waterway required will n be greater than that of the section up to 140·07. That area would be obtained with depth of 8·71 feet nearly, and the crest being at 134·50, the future M.F.L., if 140·0 could be accepted as the present M.F.L., would be 143·21 as a maximum, the afflu then being 3·14 feet. Now, supposing the maximum flood discharge to be 70,58 cubic feet a second, which seems to l reasonable taking the circumstances of t catchment basin and the effect of the tan therein as flood moderators into accoun the calculated afflux would be just 3 feet and the future M.F.L. 143·07. It wou seem, therefore, that the previously supposed M.F.L. of 143·32 is not likely to b exceeded, and that there are no data for the M.F.L. of 145·00 marked on this section which level is inconsistent with the normal F.L. of 140·07.

Basin 2,082 square miles.

$\sqrt[3]{M^2} = 163{\cdot}50$

$C = 431{\cdot}8$

Sheet 3.—Plan and Sections of Anicut.

3. On this sheet the normal M.F.L. is marked, and the future M.F.L. is give as 143·32, the previously suppose maximum.

Proceedings of Madras Government, No. 779 I., dated 4th October 1878. Memorandum, paragraph 3.

With regard to the part of the anicu not to be founded on rock, there is nothing in the papers to show that 123·50, or 11 fee below crest, is a proper level for the bottom of the foundations. It is not stated whethe an examination of the soil was made by borings or otherwise. Whether the section o AB is suitable to the circumstances of the bed at this point is not evident, as there is n longitudinal section of the bed at this part. It seems probable, however, that th apron will have to be laid on a slope, and that the top of the retaining wall will ha to be placed several feet below that of th crest wall. A retaining wall at rig angles to the crest wall at the left end the apron will also be required.

On Sheet 5 the top of this retaining wall would seem to be at 128·50, or 6 feet below the crest.

Where founded on rock the bottom course of the rear face of the crest wall shoul be fitted to the rock so as to receive the overfall on stone, not concrete. It is supposed that the vertical is intended to be the downstream face.

Agaram Channel New Head.—The widths as shown on the plan and on the sections do not agree.

Sheet 4.—Head Sluice, Baroor Tank Supply Channel.

4. The data for the waterway are not recorded on the plan, nor is the actual waterway noted.

The area of the vents is 3 × 6 × 5 ... ... = 90 square feet.
„ velocity with water flush with crest of anicut will be 6·42 feet a second.
„ discharge do. ... ... 577·80 do.
„ discharge of channel at normal F.S.L. will be ... 377·00 do.

The sluice will therefore admit on emergency of perhaps a somewhat greater discharge down the channel when the supply is sufficient to keep the water level up to crest of anicut, but of course to allow of a greater depth in the supply channel the crests of the surplus works will have to be temporarily bunded.

A horizontal seat, whether in steps or otherwise, must be cut in the rock to carr the walls. The sloping benches shown in several places in the design are inadmissible.

The rear wings at the outer end should be at any rate 6 inches above water level, or 5½ feet high instead of 1½ feet high as shown. If the connected earthwork be revetted at 1 to 1, the 6 feet returns shown will do.

The M.F.L. is incorrectly marked at 145·00.

Sheet 5.—Agaram Channel, Head Sluice.

5. No data are recorded on the plan, but the dimensions of the waterway of the sluice being those settled in 1878 with a view to future extension of irrigation on this side are approved. The abutment may be made 3 feet thick for a length of 10½ instead of 4¼ feet as shown as the arch.

The revetted slope of the bank in connection with the right rear wing of the anicut will have to be made 1 instead of 1½ to 1, as in the design it projects 12⅓ feet beyond the face of the wing, and would be liable to cause eddies.

In the section on GG, if a second or upper arch be deemed desirable, it must be differently arranged, for as drawn it would not do. As sketched in pencil it would do, and 1 foot will be a sufficient thickness.

A rough stone apron will be required in support of the rear retaining wall of the sluice. It may be 15 feet wide, 2 feet deep at the wall, and 1½ feet at the outer edge.

It is not clear how much of the work shown on this plan is included in the head sluice estimate. BB would be the proper line of division. The retaining wall of the anicut apron is on this plan 4·50 feet lower than as shown on Sheet 3. Some of the walls are thicker than they need be, *e.g.*, section on BB—

The height is ... ... 14·50
Mean thickness is nearly ... ... 5·00

The section shown in pencil would be strong enough. It is generally advisable to have an offset at the foot of a batter, so as to allow for slight deviations in the lower work. Probably a rough stone apron 9 feet wide and 2 feet deep will be required in front of this wall.

Sheet 6.—Nedingal Channel, Head Sluice.

6. This design will need recasting. As bricks are to be made for other works, the arches should be of brickwork, not concrete. A concrete arch with a span of 7 feet and a rise of 1¼ feet would not be safe. The abutments are weak; the floors, 3 feet in thickness, are very unnecessarily thick; the foundations of the abutments are in part 3 feet and in part 6 feet deep; in places the walls are rather weak and elsewhere much more massive than is necessary. Altogether there is much room for, and much need of, improvement.

No data have been noted on the plan.

Sheet 7.—Sand Sluices for the Anicut.

7. The vents as shown are 3 feet by 3 feet, and from Sheet 3 it would appear that there are to be two sets of two vents each. They would have but little effect. One set is a long way from the right flank; the other is fairly near the left flank. Under sluices where the anicut is founded on rock will cost but little, and it will be desirable to allow five vents of 6 feet in each set, making the vents as high, up to 5 feet, as the arrangements for working the shutters will allow. If screws are used 3½ feet will be as much as can be obtained, and then the area of vent will be 210 square feet against 36 square feet in the design. If baulk shutters be supplied 300 square feet will be obtainable, and the sills may be placed somewhat higher than 126·25, say as high as 127·50, to suit the rock level. The chief objection to baulk or needle shutters is the amount of leakage they involve.

It will be seen that the lifting gear in the design is placed on the masonry, which is not practicable.

Sheets 8 to 11.—Baroor Tank Supply Channel.

8. The general arrangements have been long since settled and partly carried out.

It will be necessary to make the right bank of the channel at the head higher than 138·50, as normal M.F.L. in river is 140·07. The fall of the river is rapid, but the flood level should be marked on the L.S. of the channel until it falls to 3 feet below normal top of bank or 7 feet above bed, and down to this point the right bank should be at least 3 feet above the flood level.

An outlet is shown at 31 chains. To allow of one being placed here, M.F.L. in river must not be higher than 132·73. From the L.S. of the river the bed would seem hereabouts to be at about 117·00, and the water surface may not be higher than 125·00, but until the flood line is plotted it must be uncertain what the circumstances are.

The place at which the sluice shown on Sheet 8 is to be built is not noted, but from the level of the sill, which is that of the channel bed at 4 miles, it is supposed that it is to be placed in the Moorsamputty tank. The tunnel is 1 × 1 foot: it must be 2 × 2½, and should be arched in. The shutter as shown would not close the vent. The size of the vent itself will depend upon the acreage, which is not noted.

Similar remarks apply to the sluice, the design of which is shown on Sheet 10, and to that on Sheet 11, which should not be an addition to the present sluice, but entirely new, as the depth of water will be 15¾ feet.

Sheet No. 12.—Inlets Nos. 1 to 3. Outlets Nos. 1 and 2.

9. Where there is rock, and therefore no crest wall to outlets, there is no need of masonry wings. Revetments to the end of the banks will suffice.

It will be seen that Mr. Lowry has taken the drainage of one-fourth of a square mile as one-fourth that from a square mile, which is incorrect. Also for outlet No. 1 the discharge per foot with 2 feet going over as 11·34 cubic feet a second, the proper quantity being 9·17 with a clear overfall which is not obtainable here. About 8 cubic feet per foot would be the probable discharge, making the length 35½ instead of 25 feet. Similarly the length of inlet No. 1 should be about 30 instead of 20 feet.

Sheet 13.—Syphon Sluice (culvert) at 0 mile 49 chains.

10. The drainage area being half a square mile, the discharge to be provided for is 283 cubic feet a second. The head available would seem to be not less than 2 feet, and it could be made more by connecting the face walls with the higher part of the channel banks. The velocity may be taken at 9 feet a second, and the waterway needed will be 32 square feet. A culvert 8 × 3 would do if the rise of the arch be made 2 feet, the area of the waterway being then about 34⅔ square feet; the *arch to be 18 inches thick with 6 inches of concrete over it. The floor will then be at 7 feet below bed, or 1 foot higher than in the design. The nature of the soil has not been stated, but if good an allover bed of concrete 2 feet thick will suffice for the foundations, instead of part of the foundations being 6 and part 4 feet below floor. The abutments to be carried up at the rear faces to bed level to act as a retaining wall to the concrete. With these modifications probably 1,500 instead of 2,810 rupees will suffice.

Sheet 14.

11. *Moorsamputty Tank Weir.*—The level 30·50 (130·50) of the crest is not right for the distance, 1 mile 2,904 feet, from the head sluice, the fall due to that distance being 3·10 feet, making the F.S.L. 133·50 — 3·10 = 130·40. The length, 70 feet, will do, though 72 would be the correct length. Some of the details will depend upon the nature of the soil where rock is absent. Possibly wings as designed will not be necessary, but a prolongation of the crest wall, stepped up to level of top of banks, into the banks a sufficient distance to allow of revetted slopes.

Outlet and Inlet No. 4.—The water level at the distance stated would be 128·97, and not 129·75. The apron below the crest wall of outlet is not substantial enough for a 3½ feet overfall, and the retaining wall will need the protection of a rough stone apron.

It is thought that this very small drainage might be carried by the channel to the next outlet No. 5 and there discharged. The difference between the discharge of the channel at F.S.L. and M.W.L. is over 300 cubic feet a second, so that 71 cubic feet, the calculated discharge of this drainage, can easily be carried the short distance of 990 feet.

---

* Brick work not concrete.

Outlet and Inlet No. 5.—The discharge being shown as 112·5 cubic feet, adding 71 to this will make the total 183·5, for which a length of 20 feet for the outlet will be proper. The crest wall is on rock, so the extra 9 feet will cost very little. The water level at the distance named would be 128·57, not 129·37, or 129·34, both are shown.

The section of the channel as shown is not appropriate where the cutting is in rock.

Sheet 15.

12. *Outlet No.* 6.—The water level (and crest level) would be that for a distance of 2¼ miles from the head, whereas the distance noted is 2·652 miles. The discharge from the drainage area is wrongly stated, but the length of the weir crest is nearly right. The apron is altogether unsuited to a 5 feet overfall.

Outlet No. 7.—The W.L. is 0·80 feet above that due to the fall of 2 feet a mile.

13. *Sheets* 16 *to* 22 contain designs for other inlets and outlets. Regarding these it may be noted—

1*st.*—That the longitudinal section indicates that several of these may be combined with others, and, as far as possible, the outlets to be retained and made to serve for two or more drainages should be those for which there is rock available.

2*nd.*—It will but seldom be necessary to construct masonry wings where the discharge is over rock, and if any masonry be thought desirable a stepped wall run into the bank at either end with revetted slopes would suffice.

3*rd.*—Where masonry wings are allowed the rear wings should splay a little. The curves in the designs will do pretty well if the centre be placed on the line of the ends of the wings instead of about half way between this line and the crest wall. Altogether some saving on outlets may be effected, it is thought, though where an overfall apron has to be provided the cost of the designs will be materially increased. Some of the outlets so circumstanced will, however, be superseded.

Sheet 23.—Accommodation Bridges.

14. It is not desirable to carry the roadways on beam stones for spans of 9 and 10 feet, neither would it probably be cheaper to substitute such stones for arches. With the roadway at the same level arches can be used, as the springing may be at 6 inches above normal W.L. or F.S.L. The abutments as shown would not retain the roadway slopes. Twelve feet as proposed from face to face will more than suffice, but the roadway should be 9 feet wide instead of 9½ feet, *vide* Professional Circular 3; the parapets should be 3 feet high, and the lower part should have an offset 8 inches wide and 1 foot above the road to act as a wheel guard, so at road surface the width would be 7⅔ feet.

Sheet 24.—Foot Bridge.

Foot bridges 6 feet wide will be used by carts and then the parapets will be damaged. Probably it is not desirable to prevent carts using them, and if so 9 feet as above should be allowed. If, however in any case carts are to be excluded, the width of roadway should be 4½ feet, and the approaches should be 1 in 6 or thereabouts. Two feet parapets would be dangerous for cattle. Beam stones are not advisable.

Sheet 25.—Distribution Sluices of Supply Channel.

15. The designs are for circular tunnels of three sizes, viz., 6, 9, and 12 inches diameter, and the estimates are Rs. 110, 119, and 123, respectively. If concrete tunnels can be easily constructed there is no objection to their use, but it is thought that brickwork for the walls and arches would be more easily executed. It will be better to have only one size of tunnel, and as the length is 30 feet, it is thought that 2 feet by 2½ feet the usual minimum should be allowed. There are fifteen sluices estimated to cost Rs. 1,757; if the cost be increased to Rs. 150 a sluice, or 2,250, the additional expense will be only Rs. 500, and the sluices can be kept in good order without opening the bank. The regulation should be by plugs as in tank sluices, the diameter of the plug

holes being adapted to supply the lands with about $2\frac{1}{2}$ feet of water in the channel. The usual lower vent closed by a plank may of course be provided in addition; the width of such vent may be 1 foot, and the height will be regulated by the plug stone, the under side of which may, it is thought, be about 8 inches above the sill.

Sheets 26 to 30.—Baroor Tank.

16. *Tank.*—The full tank level of 115·60 is apparently as high as would be admissible without swamping three villages. It has been elsewhere noticed that the capacity of the tank is only 11·10 millions of cubic yards, instead of nearly 20 millions as supposed by Mr. Lowry. It is hoped that the actual level at which the puddle core wall has been laid has been duly recorded. At the deeper parts of the tank the base as shown on the cross sections is not as low as would seem to be desirable. All or nearly all the work up to the height of the old bund has been carried out. It is probable that the revetment will have to be carried up about 3 feet higher, for on 2 to 1 slopes the water will wash up a considerable distance.

West Sluice.—The foundations and floor have been laid.* The acreage is said to be less than 1,500, and the maximum discharge required is not likely to exceed 33·75 cubic feet a second, or 5·625 cubic feet at each plug hole, which will be secured when the level of the water in the tank is a little more than $1\frac{1}{2}$ feet above the surface of the plug stone. The plug stone may with advantage be placed 1 foot lower, or with the surface at 3 instead of 4 feet above sill. The supply to the irrigation through the plug holes will then be continued much longer. The lower vent will then be $3\frac{1}{2} \times 2$ or 7 square feet and the irrigation can be fully supplied with about 0·58 feet head above the F.S.L. in channels. The lower vent shutter is shown in the longitudinal section as worked by a screw and in the details as being composed of separate planks with hooks. As the tank water may rapidly rise, it will be best to use a screw, and the spear must be much larger than that for a plug, and it must be supported at 3 feet† intervals by cross bars with collars to prevent the spear bending. The gear beam will require to be held down at the ends by bolts and plates, the former 5 feet long and the beam should be 8 inches × 6 inches. One inch spears will do for the plugs, and for each there should be one collar bar 42 inches above the plug stone so as to keep the plug vertically over the hole. The gear beams for the plugs may be just wide enough to carry the plate on which the nut will revolve; and their thickness need not exceed 3 inches; they are marked 12 inches on the drawing, but they scale 9 inches.

East Sluice.—Paragraph 19 of the Report names 9,000 acres as the area to be supplied. This is probably much in excess of the area which will be irrigated, paragraph 1 above; but supposing that the channel will ultimately be extended eastward, there will be no objection to the sluice being capable of supplying this extent of land. The plug stone may be placed 9 inches lower, or with its top at $4\frac{1}{4}$ instead of 5 feet above sill. The lower vent shutter should be worked by a screw, as above described, for the west sluice. The maximum discharge required will be 135 cubic feet a second, and as the lower vent will be $4 \times 3\frac{1}{4} = 13$ square feet, the velocity would be over 10 feet a second, and the head needed $2\frac{1}{2}$ feet. If, therefore, this acreage is to be provided for, the sluice is not large enough, and it will be better to insert a short pier $2\frac{1}{2}$ feet thick and to make the span of the culvert or tunnel $2 \times 4 + 2\frac{1}{2} = 10\frac{1}{2}$ feet. The velocity of the water on leaving the rear floor will then be moderate, and the head required will be only 0·625 of a foot. The pier will carry the plug stones and also the arches for the gear platform. The cost of this sluice will be about Rs. 4,500 instead of Rs. 2,698. As regards the plug holes, the 6 of 18 inches diameter shown in the plan would give the required discharge with $5\frac{1}{2}$ feet of water nearly on the plug stone, and this would not be at all convenient. With the double vent and second bay for plugs twelve plug holes can be provided, and the discharge through each will be 11·25 feet. Retaining the same size of hole the depth of water on the plug stone will be 1·5 feet or rather less, and the conditions will then approximate to those at the western sluice. The maximum depth of water on the plug stone will be $16·70 - 4·25 = 12·45$ feet, and taking the head

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* Report, paragraph 20.

† $3\frac{1}{2}$ feet from top of shutter when down for the lower collar.

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of the plug to be 2 feet in diameter, the pressure thereon may be as much as 2,357 lbs., so the spears may be $1\frac{1}{4}$ inches diameter with one collar 63 inches above the plug stone.

It may be noticed that it is easier to cut the holes in the plug stones if the junction of these be on the centre line of the plug hole. Rough stone aprons should be given in rear of both sluices, 9 feet wide and 2 deep.

Sheet 30.

Surplus Weir.—The length is suitable, but the design will need modification. The form of the rear wings is not good, and should be altered to that shown in pencil. The front wings may with advantage be placed a little more to the front. The apron will not do as shown, and the rear retaining wall must be protected by an apron 15 feet wide and not less than $1\frac{1}{2}$ feet thick.

Sheets 31 to 38.—Left (East) and Right (West) Channels from Baroor Tank.

17. The way in which the longitudinal and cross sections of these channels and their branches have been mixed upon these plans is very inconvenient and confusing.

East Channel.—From paragraph 23 of the Report it appears that the arrangements provide for in the upper part a—

Bed width of	18 feet
Side slopes	1½ to 1 ,,
Depth of water	4 ,,
Fall per mile	2 ,,

and Mr. Lowry goes on to say that the discharge will be 300 cubic feet a second, or enough for the irrigation of 12,789 acres.

This allows 1 cubic foot a second for about 44 acres apparently, which is more than is required. Were it necessary, the sluice even when altered as mentioned in the preceding paragraph of this Note would suffice for only 5,940 acres. The channel should be constructed to carry not more than 150 cubic feet a second, which will allow a margin of 11 per cent. for contingencies. It may be noticed that Mr. Lowry's channel would not carry 300 cubic feet a second, but about 215 cubic feet, and for 150 cubic feet a second a bed width of 11·25 feet will suffice with 4 feet depth of water. This reduction of width will effect a saving of between 5,000 and 6,000 Rupees.

West Channel.—Paragraph 26 of the Report states that this channel is to commence with a bottom width of 6 feet and a depth of 3 feet, and both width and depth are to decrease gradually. The sections show that hardly any two are alike, and as designed the widths require to be laid out to two places of decimals which is impracticable. The widths should decrease by quarter or half feet, and the depth of water should be altered only at reasonable intervals. It will suffice if the channel carries 35 cubic feet a second. The channel as designed would carry 45·36 cubic feet. It is hardly worthwhile to reduce its size, but the depth of water required will be about $2\frac{2}{3}$ feet.

Nothing can be said about the branch channels until the position and extent of the several plots of land to be irrigated are known. These details will have to be settled in due course by the Superintending Engineer.

Plans Nos. 39 to 43.—Falls on Distribution Channels.

18. The designs have no data recorded on them, and they will need modification. If a water cushion be provided, it must be of the form shown in pencil on sheet 39, and the top of the retaining wall must not be above the bed of the lower reach. The length of the crest of the fall appears to be much too great, and it is flush also with the bed of the upper reach, which is not usually a good arrangement. The foundations are on three different levels, which is a bad arrangement, and those of the rear retaining wall are not only above those of the wings on either side, but they are only 2 feet deep. The rough stone apron as designed is altogether inadequate both in width and thickness. The scale, 3 feet to an inch, is an inconvenient one, and $\frac{1}{50}$ would have done much better.

Sheet 44.—Distribution Sluices.

19. The remarks made on the similar sluices for the supply channel, *vide* paragraph 15 above, are applicable to those on this sheet.

Sheet 45.—Inlets and Outlets.

20. The general remarks in paragraphs 9 to 13 above will apply, and the aprons will need to be much more substantial.

Sheet 46.—Aqueduct at 1 mile 74 chains, East Channel.

21. The abutments should not have any projection on the upstream side. Curved water wings would be unobjectionable. The side walls of the aqueduct between the abutment faces need not be higher than F.S.L. The retaining wall on the lower side must be protected by a rough stone apron. The floor under the aqueduct should be cemented. Water levels in the drainage stream have not been noted, and the data as regards soil and subsoil have not been recorded.

Sheet 47.—Trunk Road Bridge, East Channel.

22. The remarks on the bridges across the supply channel apply. The bed of the channel is represented as being at ground level, and the site is therefore not a good one for a bridge. The data for the design are not recorded.

23. Altogether the undersigned thinks that the revision of the details of the project will not add to the total of the estimate, as on some items there will be reductions which will be likely to compensate for excess on others. As each part of the project may be taken up for execution, the details must be completely reconsidered so far as is necessary and the estimate revised.

Executive Engineer's No. 2,662, 21st March 1879.

24. There is a tracing No. 36, dated Public Works Workshops, 15th March 1879, of the shutters and gear. Angle irons are required in the grooves, and are better and cheaper than finely dressed ashlar. No cast-iron standards to carry the gear are needed; they lengthen the spears, which is undesirable. The gear should be placed on the gear beams, and the spanner, which need not be hinged, should have the handles curved up to $2\frac{1}{2}$ feet above the socket. The height of the vent being 5 feet, the height of the shutter to be $5\frac{1}{4}$ feet, not $5\frac{1}{2}$ feet, and the sill groove to be $1\frac{1}{2}$ inches deep.

OOTACAMUND,
18th October 1880.

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

To the Superintending Engineer, Second Circle.

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Report
Appendices

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Report

Appendicies A.B.C.D.E.F.

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Table I.

Baroor Project.

Calculations of discharges in the Punniar

Number of section	Distance in feet	Bed Level	Bed Fall S	Ordinary flood WL	Ordinary flood Fall S	Ordinary flood area A	Maximum flood WL	Maximum flood Fall S	Maximum flood area A	Discharge at OFL	Discharge at MFL	Remarks
I	0	154·00		161·45	·0020	4110	165·03	·0020	5620	31,657	53,390.	Discharges are calculated by the formula
II	1320	150·75	·0024	159·50	·0020	3720	162·33	·0022	4994	30,162	52,936	V = C × 100 $\sqrt{RS}$ D = A.V when V = mean vel.^y in ft per second
III	1320	148·00	·0020	156·60	·0022	3704	158·50	·0030	4971	29156	[illegible]	S = fall per 1000 R = hyd mean depth in feet
IV	1320	146·02	·0012	154·50	·0022	3447	156·50	·0015	5278	27,152	[illegible]	A = area in Sq ft.
V	1660	140·60	·0032	148·00	[illegible]	3500	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	If R = 5, 6, 7, 8 or 9 C = ·65, ·68, ·70, ·71 or ·73.
VI	960	139·20	·0014	146·50	·0016	4144	150·60	·0029	5819	29,173	55,862	
VII	1320	133·33	·0044	143·00	·0026	4145	145·59	·0026	6359	32745	57231	
VIII	1320	130·00	·0025	138·66	·0030	3987	141·25	·0030	5966	33889	58466	
IX	1320	126·58	·0025	137·06	·0012	5577	140·07	·0012	8400	32,914	58,800.	Section at proposed anicut site.

B. Project Division Office
Baroor 2d February 1882.

F. J. Romilly
L.R.2
Executive Engineer

Table II. Discharges at anicut site at ½ ft vertical inter with equivalent guage readings

R32dL

Height on guage	Corresponding W. L.	Discharge In Cft per second	Discharge In round numbers	Remarks
9' 6"	140·	58,800	59,000	
9·0"	139·5	52,161	52,000	Zero of guage 130·62
8' 6"	139·	45,532	45500	The guage is situated about
8' 0"	138·5	42,625	43,000	100 ft North of the Site of the
7' 6"	138.	39,718	40,000	Anicut.
7' 0"	137·5	36311	36,000	
6' 6"	137·	32914	33000	1 Cft per 1" = 13·3 Cyds per hour.
6' 0"	136·5	29043	30,000	
5' 6"	136.	25173	25,000	
5' 0"	135·5	22914	23,000	
4·6"	135·	20655	21000	
4·0"	134·5	18,320	18,000	
3' 6"	134	15988	16,000	
3' 0"	133·5	13708	14,000	
2' 6"	133·	11528	12,000	
2' 0"	132·5	10,166	10,000	
1·6"	132·	8804	8,500	
1' 0"	131·5	5514	5500	
0' 6"	131·	2325	2300	
0' 0"	130·5	1719	1700	
	130·	1113	1100	

Barorr 2d February 1882.

F. J. Rowe[illegible]

Executive Engineer.

Table III

Main readings on guage at Nedungal.
from 20th August to 8th September 1881.

Month	Date	Rainfall Matheghere	Rainfall Kristnaghiri	Mean readings on guage A.M. TO P.M. 12 hours	Mean readings on guage P.M. TO A.M. 12 hours	Date
August	20					
	21				1"	
	22	1·35			1"	
	23		1·00	5"	4"	
	24	·17		4"	4"	
	25	·08		4"	1' 4"	26
	26	·70	1·00	1' 5"	5' 3"	27
	27	·40	1·85	8' 6"	6' 6"	28
	28	·50	0·15	3' 9"	3' 1"	29
	29		·69	3' 9"	4' 2"	30
	30	·47		3' 9"	3' 1"	31
	31			2' 7"	2' 6"	1.
		3·67	4·69			
September	1			2' 4"	2' 3"	2
	2			2' 3"	2' 2½"	3
	3			2' 2"	2' 1"	4
	4			2' 0"	1' 11"	5
	5	·80	·20	1' 9"	1' 6"	6
	6			1' 3"	1·2"	7
	7			1' 1"	10"	8
	8			7"	6"	9
		4·47	4·89	39·1	39 2 39 1	

Remarks.

There were some showers registered at Mathigerri between 1st to 12th which did not however affect the river and are therefore not taken into account.

$$\frac{4·47 + 4·89}{2} = \frac{9·36}{2} = 4·63"$$

4·63" over 1000 Sq. miles = 398,351,222. Cyds

Readings recorded daily at 6. a.m. & 6. p.m.

Duration of fresh 29×12 = 348 hours or 12½ days

Average height on guage for the period 2' 7"

Corresponding water level 3' 1" say 133 feet.

Discharge at 3 ft. = 12000 Cft per 1"

= 12000 × 13·3 Cyds per hour.

= 12000 × 13·3 × 29×12 Cyds from 25th Augt. to 8th Septr.

= 55,540,800 Cyds discharged during fresh.

= 55½ Million Cyds

B. Project Division Office
Barorr 2d February 1882.

F. J. Rowndly
Lt R.E.
Executive Engineer

Table IV. Mean readings on guage at Nedungal from 16th September to 16th October 1881.

Month	Date	Rain fall Mutta ghiri	Rain fall Kristna ghiri	Mean reading on guage A.M. TO P.M 12 hours	Mean reading on guage P.M. TO A.M. 12 hours	Date
September	16	·80 ·40	·20 ·50	3"	3"	17
	17	5·66	·60	6' 9"	3' 3"	18
	18	1·25	2·00	7' 1"	7' 1"	19
	19	·20	·10	5' 3"	4' 9"	20
	20	·31		4' 4"	3' 10"	21
	21		1·20	3' 5"	3' 3"	22
	22	—	—	3' 0"	3' 0	23
	23	—	—	2' 9"	2' 6"	24
	24	—	—	2' 4"	2' 3"	25
	25	—		2' 2"	2' 0"	26
	26			1' 9"	1' 8"	27
	27	1·03		1' 6"	1' 4"	28
	28	·10	·60	4' 3"	6' 5"	29
	29			5' 6"	6' 6"	30
	30	2·30	·65	6' 8"	7' 2"	1
		12·05	4·85			
October	1	·60		7' 6"	7' 1"	2
	2		·60	6' 8"	6' 5"	3
	3		·40	6' 4"	5' 11"	4
	4			5' 6"	5' 4"	5
	5			5' 3"	5' 2"	6
	6			5' 0"	4' 2"	7
	7			3' 5"	3' 4"	8
	8		·30	2' 9"	2' 5"	9
	9		·65	2' 3"	1' 7"	10
	10			1' 6"	1' 5"	11
	11			1' 4"	1' 3"	12
	12		2·00	1' 2"	1' 1"	13
	13			1' 0"	1' 0"	14
		0·60	3·95			
	14			6"	6"	15
	15			5"	5"	16
	16			3"	3"	
		11·85	9·60			

Remarks.

Showers between 8th - 14th of the month are not taken into account.

9'-6" over 1000 Square miles catchment
= 825, 955, 555. C. yards.

Readings recorded daily at 6. a.m. & 6. p.m.

Duration of fresh 56×12 = 672 hours = 28. days.
Average height on the guage for the period = 3'.6"
Corresponding W. L. in river 134'

Discharge at 4' = 16,000 C feet per 1"
= 16000 × 13·3 C. yds per hour
= 16000 × 13·3 × 56 × 12 from 17th Septr to 15th Octr
= 143,001,600 C yds during fresh.
= 143 Million C yds. say

B. Project Division Office
Barovr 2nd February 1882.

F. J. Romilly
Lt Col
Executive Engineer.

CHIEF ENGINEER
6 MAR
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Baroor Project.

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Report.

Appendix. G

Tables I.
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Punniar Discharge

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(18)

Baroor Project.

Register of water of Punniar River at Nedungal for December 1881.

Date	A.M.		P.M.		Remarks.
	Feet.	Inches	Feet.	Inches.	
1	"	4	"	4	
2	"	3	"	3	
3	"	3	"	2	
4	"	3	"	2	
5	"	2	"	2	
6	"	3	"	2	
7	"	2	"	1	
8	"	2	"	1	
9	"	2	"	1	
10	"	1	"	1	
11	"	1	"	1	
12	"	1	"	1	
13	"	2	"	3	
14	"	3	"	3	
15	"	3	"	3	
16	"	3	"	3	
17	"	2	"	2	
18	"	2	"	2	
19	"	3	"	3	
20	"	2	"	2	
21	"	3	"	3	
22	"	3	"	2	
23	"	2	"	2	
24	"	3	"	2	
25	"	2	"	2	
26	"	2	"	2	
27	"	2	"	2	
28	"	2	"	2	
29	"	3	"	3	
30	"	3	"	2	
31	"	2	"	2	

Signed/ Ragava Iyengar
Taluq Overseer

4th January 1882

B. Project Dn. office
12 February 1882

F. J. Romilly Lieutt. R. E.
Executive Engineer.

CHIEF ENGINEER
6 MAR
1882
FOR IRRIGATION

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Register of water of Pennar River at Nedungal for the Month of November 1881

Date	Morning		Evening		Remarks
	Feet	Inches	Feet	Inches	
1	..	1	..	1	
2	..	2	..	2	
3	..	3	..	2	
4	..	6	..	5	
5	..	4	..	4	
6	..	4	..	4	
7	..	4	..	4	
8	..	3	..	3	
9	..	6	..	6	
10	..	5	..	5	
11	..	4	..	3	
12	..	3	..	5	
13	..	7	..	8	
14	..	4	..	4	
15	..	3	..	3	
16	..	3	..	2	
17	..	2	..	2	
18	..	2	..	2	
19	..	3	..	3	
20	..	3	..	7	
21	..	6	..	5	
22	..	5	..	5	
23	..	4	..	3	
24	..	2	..	2	
25	..	1	..	1	
26	..	8	..	7	
27	..	8	..	7	
28	..	6	..	6	
29	..	6	..	5	
30	..	5	..	4	

3rd December 1881 }
Munthoor }

(Signed) S. Raghava Iyengar
Taluq Overseer D. P.

Salem Division
Kistnaghery Taluq
Baroor Project

CHIEF ENGINEER
9 MAR
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FOR IRRIGATION

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Appendix G b

Register of Water
of Pennar river
at Nedungul for
the month of
November 1881

Register water of Pennar River at Nedungal for the month of October 1881.

Date.	Morning Feet.	Morning Inches.	Evening Feet.	Evening Inches.	Remarks.
1	7	7	7	5	
2	6	9	6	5	
3	6	5	6	4	
4	5	7	5	5	
5	5	3	5	3	
6	5	"	5	"	
7	3	5	"	"	
8	3	1	2	5	
9	2	4	2	2	
10	1	7	1	5	
11	1	4	1	3	
12	1	2	1	2	
13	1	"	1	"	
14	"	7	"	7	
15	"	5	"	5	
16	"	3	"	3	
17	"	2	"	2	
18	"	2	"	2	
19	"	2	"	2	
20	"	1	"	1	
21	"	2	"	2	
22	"	2	"	2	
23	"	2	"	2	
24	"	2	"	2	
25	"	2	"	2	
26	"	1	"	1	
27	"	1	"	1	
28	"	1	"	1	
29	"	1	"	1	
30	"	1	"	1	
31	"	1	"	1	

4th November 1881.

Signed/ S. Ragava Iyengar
Overseer

13 Project Dn. office
Camp Venkatasamoodram
12 February 1882

F. J. Romilly
Lieut. R.E.
Executive Engineer.

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B. Project Division. IV Circle. Kristnaghery Taluq D. Pr. D.

Comparative Statement showing the amount of compensation to be paid for lands &c. taken up for Baroor Project.

Name of Project	No. and date of Govt. order.	Amount of Estimate	Name of work.	Names of Village to which the lands belong to.	Proposed to be paid: Acres of land	Assessment	Amount of compensation for land.	Amount of do for loss of crops	Total amount of compensation	Date of Transfer	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12
oject	/11th February 1881		pply channel	Barvohully —	21·51	44-3--	632-4--	570---	1202-4--		
				Morasahully —	2·59	2-10--	26-4--	----	26-4--		
				Habichuhully —	2·93	2-11--	26-14--	--	26-14--		
				Marvodary —	11·12	9-2--	91---	240---	331---		
				Chellampully —	15·74	13-4--	192-8--	5---	197-8		
				Velangamoody —	22·77	22-9--	270-10--	160---	430-10--		

Barvor

G. O. No. 124.

Anicut and

Poongamputty	4·04	5--	35--	100--	135--
Barvor	166·87	114-10--	2017-8--	230--	2247-8--
Mattorpatty	2·70	2--	20--	•	20--
Amanackamputty	9·28	22-13--	196-12--	•	196-12--
Kilcooppum	33·65	26-15--	240--	500--	740--
Nedungal	1·27	7-5-4	350--	1663--10	2013--10
Chellagootty putty	"	•	•	15--	15--
Jagany (Awathavadyputty)	"	•	•	240--	240--
				19--	19--
	294·47	273-2-4	4098-12--	3742--10	7840-12-10

Compensation for loss of crops from fasly 1287 to 1290 inclusive.

B. Project Dn. office
Barvor 2d. Feb: /82

/Sd/ A. J. Romilly
Lieut. RE
Exe. Engineer

Appendix A

Tabular statement showing the dimensions of channels of the Barur Tank Project

Distance from Head		Name of work	Channel					Discharge			Remarks
			Bed width	Depth of water full supply	Depth of water maximum	Side slopes	Bed fall	Mean velocity	Discharge calculated	Discharge required	
mile	feet		feet	feet	feet	inch	feet per mile	feet per sec.	C. ft per second	C. ft per second	
0	0	Barur Tank Supply Channel	20	5	7	$1\frac{1}{2}$ to 1	1.97	2.76	379	105	Length of the channel from the Anicut to the Barur Tank is 7 miles 155
1	2936	do	18	5	7	$1\frac{1}{2}$ to 1	1.71				
0	0	East Sluice channel from Barur Tank	11.5	4	"	$1\frac{1}{2}$ to 1	1.77	2.14	150	120	Total length from Barur Tank to the termination is 10 miles and 2880 feet.
5	1100	do	5.5	4	"	$1\frac{1}{2}$ to 1	2	1.74	80	65	
6	2870	do	4	average 2.5	"	$1\frac{1}{2}$ to 1	2	1.6	25	18	
4	5060	Branch No. 1 of East Sluice Channel	2	2	"	$1\frac{1}{2}$ to 1	2	1.4	14.4	12	Length 1 mile + 2508 feet
5	880	Branch No. 2 of – do	2	2	"	$1\frac{1}{2}$ to 1	2	1.4	14.4	12	do 1 mile + 2840 feet
6	2860	Branch No. 3 of – do –	6	3	"	$1\frac{1}{2}$ to 1	2	1.9	60	45	do 5 miles + 500 feet
6	3160	Branch No 4 of – do –	2	3	"	$1\frac{1}{2}$ to 1	2	1.4	27	20	do 2 miles + 1313 feet

0	0	West Sluice channel of Barur Tank	4	3	"	1½ 61	2	1.4	35	30	do 2 miles & 3960 feet
1	900	Branch No. 1 of do	2	2	"	½ 61	2	1.4	1¼	12	do 1 mile & 2020 feet

Colonel R.E.

Ag: Chief Engineer for Irrigation

Appendix B.

Classified Abstract Estimate of the Barur Tank Project, Salem District.

Subhead	Name of Work	Amount of individual Estimate	Total of Each Subhead
	(1) Head Works.		
B. Land	Compensation for land	×7841	7,841
C. Works	Nedungal Anicut across the Ponniar	18,035	
C. Works	Flood banks.	2,345	20,380
	Total		28,221
	(2) Main Canals & Branches.		
	Agaram channel		
D. Regulators	Head Sluice	9,600	9,600
L. Earthwork	New head	1,055	1,055
	Nedungal Channel		
D. Regulators	Head Sluice	860	860
	Barur Tank Supply Channel.		
D. Regulators	Head Sluice	5,210	5,210
F(1) Other Cross drainage Works.	Inlet No. 1	60	
	do " 2	10	
"	do " 3	20	
"	do " 4	39	
"	do " 5	25	
"	do " 6	41	
"	do " 7	41	
"	do " 8	17	
"	do " 9	31	
"	do " 10	41	
"	do " 11	97	
"	do " 12	43	
"	do " 13	34	
"	do " 14	34	
"	do " 15	24	
"	Outlet " 1	165	
	do " 2	14	
	Carried forward	736	16,725

× Includes Compensation for land taken up for all works of the project generally

Subhead	Name of work	Amount of individual Estimates	Total of each Subhead
		736	16,725
F. (1) Other Cross	Outlet No 3	285	
drainage works.	— do — 4	53	
"	— do — 5	740	
"	— do — 6	167	
"	— do — 7	130	
"	— do — 8	56	
"	— do — 9	72	
"	— do — 10	381	
"	— do — 11	62	
"	— do — 12	296	
"	— do — 13	70	
"	— do — 14	92	
"	— do — 15	375	
"	— do — 16	350	
"	— do — 17	463	4,328
G. Bridges.	One Bridge	600	
	Two — do	1,200	
	Four — do	1,740	3,540
L. Earthwork	Barur Tank Supply Channel	48,004	48,004
N. Tanks.	Moorasamputty Tank sluice	440	
	Velangamvady small tank sluice	680	
	Oungamputty tank sluice	784	1,904
O. Miscellaneous	Syphon sluice	2,600	
	Fifteen distribution sluices	4,650	7,250
	Total (2) Main Canals & Branches		81,751

(2A) Reservoirs

Subhead	Name of work	Amount of individual Estimates	Total of each Subhead
L. Earthwork	Barur Tank bund	53115	53,115
C. Works.	do Surplus Weir	3,096	3,096
	Total (2A) Reservoirs		56,211

Subhead	Name of work	Amount of individual Estimates	Total of each Subhead

(3) Distributaries

Subhead	Name of work	Amount of individual Estimates	Total of each Subhead
N. Tanks -	Keelcoopum tank sluice	414	414
C. Works.	do Eastern Sluice	3,310	
	do Western Sluice	2,500	
	do Aqueduct	2,900	
	do twenty three inlets	2,024	
	do Twenty outlets	8,540	
	do Fifteen do	5,580	
	do Six terminals	516	
	do thirteen sluices	1,560	
	do Forty seven do	4,935	
	Three masonry falls of 2 feet	510	
	Six — do — of 3 do	1,260	
	Ten — do — of 4 do	2,800	
	Tunnels	1,230	
	Bridge	682	38,347
L. Earthwork	Keelcoopum East Channel	3,260	
	— do — do branch Channel	1,110	
	— do — West Channel	22,500	
	— do — do No 1 branch Channel	1,340	
	— do — do " 2 — do	1,460	
	— do — do " 3 — do	10,950	
	— do — do " 4 do	2,350	42,970
	Total (3) Distributaries		81,731
	Total Works		247,914
	Lump sum provision for unforeseen works		7,086
			2,55,000
	Establishment		58,030
	Tools and Plant		6,970
	Total Direct charges		3,20,000

Subhead	Name of Work	Amount of individual Estimates	Total of Each Subhead
	Indirect Charges.		3,20,000
	Capitalized abatement of land revenue	6,829	
	Leave and Pension allowances	8,221	15,050
	Grand Total		3,35,050

Colonel R.E.

Ag. Chief Engineer for Irrigation

P.W. E-2 / 3857/18

Appendix C

Baroor Tank Project

No. I

Summary of the Actual & Estimated Direct Charges to Capital Account

Year	Works	Establishment	Tools and plant	Total	Remarks
1	2	3	4	5	6
Actual outlay to end of 1882-83	80,357	18,022	1691	100,070	
Do 1883-84	60,766	13,816	2401	76,982	
Do 1884-85	57,526	13,231	1,863	72,620	
Do 1885-86	56,352	12,961	1,015	70,328	
Total	2,55,000	58,030	6,970	3,20,000	

No. II

Summary of the actual & estimated Indirect Charges to Capital (including interest)

Year	Capitalization of land Revenue abated	Loss by exchange on payments in England	Charges for leave and pension allowances	Total	Remarks
1	2	3	4	5	6
	Rs	Rs	Rs	Rs	
Actual to end of 1882-83	6,829	"	2,554	9,383	
Do 1883-84	"	"	1,957	1,957	
Do 1884-85	"	"	1,874	1,874	
Do 1885-86	"	"	1,836	1,836	
Total	6,829	"	8,221	15,050	

N.B. The figures in Column 4 are calculated at 14 1/6 per cent on the corresponding figures in Column 3 of Table No. I.

No. III

Estimate of growth of Irrigation and Revenue receipts & Charges.

Year	Irrigated area at end of year	Revenue receipts & Charges: Gross revenue due to Works: Direct receipts	Indirect Reve.	Total	Charges both Direct and Indirect	Net revenue due to works: Including indirect Revenue	Excluding indirect revenue	Remarks
1	2	3	4	5	6	7	8	9
	acres	Rs	Rs	Rs	Rs	Rs	Rs	
Estimated during 1885-86	3457	..	11,322	11,322	2491	8831	-2491	
do 1886.87	6887	..	26,767	26,767	5319	21,448	-5319	Net Rev = 6.7 per cent on capital direct charges or 6.4 per cent on total capi including ind charges.

N.B. 1 The figures in Column 2 include 1457 acres the area of old irrigation -

2. The figures in Column 5 include Rs 728 the approximate amount of old maintenance charges saved.

3 The figures in column 6 have been arrived at by calculating charges in the P. W. D. at 8 annas per acre and the Collection charges in the Reve Department 7.2 per cent on revenue.

(Signed) C. D. Macleane.

Collector of Salem

No. IV

Estimate of Nat Financial results for ten years after probable date of completion of the works

Year	Direct Capital outlay during the year	Direct Capital outlay to end of year	Simple interest at 4 per cent on Capital outlay to end of previous year plus half outlay during year	Nat Revenue includ-ing in-direct Revenue Col 7 of Table III	Simple interest less net revenue	Nat Revenue less simple interest	Remarks
1	2	3	4	5	6	7	8
Actual to end of 1882-83	..	100,070	11,905	..	11,905	..	
— do — 1883-84	76,982	177,052	5542	..	5542	..	
— do — 1884-85	72,620	249,672	8534	8831	..	297	
— do — 1885-86	70,328	320,000	11,393	21,448	..	10,055	
— do — 1886.87	..	320,000	12,800	21,448	..	8648	
— do — 1887-88	..	320,000	12,800	21,448	..	8648	
— do — 1888-89	..	320,000	12,800	21,448	..	8648	
— do — 1889-90	..	320,000	12,800	21,448	..	8648	
— do — 1890-91	..	320,000	12,800	21,448	..	8648	
— do — 1891-92	..	320,000	12,800	21,448	..	8648	
— do — 1892-93	..	320,000	12,800	21,448	..	8648	
— do — 1893-94	..	320,000	12,800	21,448	..	8648	
— do — 1894-95	..	320,000	12,800	21,448	..	8648	
— do — 1895-96	..	320,000	12,800	21,448	..	8648	
Total —	..	..	165,374	244,759	17,447	96,832	
Net Surplus Reve						79,385	

[illegible] Col R.E.

Ag: Chief Engineer for Irrg.

P.W.D. 1 / 3852/83

Print

Report on the Baroor Project.

This Project has been for some years under consideration it was forwarded to the Government of India (see G. O. No. 124 I of 11th Feb: 1881) who returned it requesting that more information might be afforded and that certain modifications of many of the designs which the Chief Engineer pointed out as advisable might be made. This has now been made by Lieut. Romilly the Executive Engineer of the B. Project Division and his report &c. are now forwarded it is hoped that it will be considered satisfactory and that the

Project which will pay and prove most valuable to a poor tract of Country may be sanctioned and funds allotted at once for its execution.

It is much to be regretted that the river at the site of the proposed Anicut has not been guaged for a longer period than 6 months namely from July to Date and that this year 1881 has been a very exceptional one there having been no rain sufficient to throw a supply into the river until Agust in fact the South West Monsoon failed, and taking the rain registers at Oossoor for this year - 1881 - and Comparing them with the average as shewn in

Appendix

Appendix B we have only 23·48 inches against an average of 32·62 inches for the year the monthly distribution being as follows -

	January	February	March	April	May	June	July	August	September	October	November	December	Total.
Average of 10 years including famine years	0·08	0·24	1·00	1·37	5·03	2·34	1·93	5·59	5·06	6·09	2·62	1·27	32·62.
During 1881 —	-	-	-	-	-	·61	·42	5·55	11·15	·35	4·20	·90	23·48.

Appendix G. shows that with this deficient rainfall there was an ample supply in the river from the 23rd August to the 31st December.

From the above it is, it is considered, clearly shewn by observation that the supply is more than ample and probably hereafter the project may be extended on the south side of the River with great profit and advantage as shown in the Collector's letter No. 150 dated 26th January 82 para 8 forwarded in Appendix C.

As the Project has been revised according to the Notes of the Chief Engineer for Irrigation there is no necessity for this Office to comment on them further than to state that it is considered that the works can be carried out for the Estimated Cost and that the project is a good and paying one. It is thought however that as 3 years have elapsed since the work was stopped that Rs 5,000 should be added (making a total of Rs 2,67,144) as Contingencies to allow for deterioration of materials

materials &c. some provision for this is necessary as many of the banks partly thrown up and Channel partly dug must have deteriorated.

As Form M I No. 83 has not been circulated it is not forwarded.

vide P.W. Code Vol II para 236b

a statement to show dimensions of channels and works on each main channel

lcs

Signed H. R. Mead
Maj R.E.
Supt. Engr. 4th Circle

Coimbatore
1st ~~February~~ March 1882

C. A. Fraser Major R.E.
for Supg. Engineer, 4th Circle

CHIEF ENGINEER
6 MAR
1882
FOR IRRIGATION

Encl. No. 1

R. 220/82

In No. 36 of 1st March 1882 from the Offg. Supt. Engr. 4th Circle.

Report on the Baroor Project by Major Mead R.E. Supt. Engineer 4th Circle.

Print

Report on Revised Baroor Project.

Previous references.

1. The Plans and Estimates for this project were originally prepared and forwarded by the late Mr. Lowry Executive Engineer of the Salem Division in March 1879 to the Superintending Engineer of the IVth Circle, and submitted by that Officer to the Chief Engineer for Irrigation in the same year. These papers were forwarded to the Government of India accompanied by a note on the designs by the Chief Engineer for Irrigation in G.O. No. 124 I of 11th February 1881. This note by the Chief Engineer pointed out many particulars in which modifications of the various designs appeared to be necessary and the Project was returned by the Government of India with a request that it might be resubmitted after revision in accordance with these suggestions, and also that some additional data and information should be supplied to enable the Project to be properly considered. The letter from the Assistt. Secretary to the Government of India P.W.D. (Civil Works – Irrigation) returning the Project for revision is dated 29th April 1881 No. 166 I, and is printed with

x Letter No 166.I of 29th April 81 embodied in P.W.G. No 310 I of [illegible] May 81

with G. O. No. 310. I. of 11th May of the same year.
The Project is now resubmitted, the various designs having been modified as directed in the note by the Chief Engineer for Irrigation, and additional information required by the Government of India supplied.

The Project

Object and locality

2. The Baroor Project has for its object the improvement and extension of irrigation in the vicinity of the village of Baroor, situated about 2 miles North of the Trunk road from Coimbatore to Jolarpet in the Kistnaghiry Taluq of the Salem District, about 10 miles South West of the cusbah of Kistnaghiry.

General description of Country

Area

Conformation

3 The tract of country to be brought under the influence of the proposed works is about 17½ Square miles in extent. The surface is undulating the contours varying between 100 feet and 230 feet above datum, and the different valleys form sites for numerous small tanks. There are altogether 21 of these reservoirs and the largest of them is close to the village of Baroor and called by the same name.

General aspect.

4. The general aspect of the area is barren, there being few trees and little vegetation except

in

in the immediate vicinity of the tanks.

River.

5. The Pennar forms the Western boundary of this tract of country and receives its drainage. This river, called also the Penankini, rises in Mysore, about 40 miles North East of Bangalore near Nandidroog. The first 50 miles of its course lie within the Mysore territory, and its direction runs from North to South. It enters the Madras territory a little to the North-East of Oosoor in the Salem district and gradually altering in its course to one nearly West to East enters the South Arcot district near the Javadi Hills and traversing this district under the name of the Pennar, falls into the Bay of Bengal near Cuddalore. The bed is rocky in many parts.
The fall of the river is rapid, being as much as 31 ft per mile near Baroor. High rocky hills lie just beyond the limit of the tract on the North and one or two isolated hills of the same formation lie within the area. On the East and South the limits are marked merely by a small watershed.

Rainfall
Vide Appendix: B

Famine.

6. Data of rainfall recorded at three stations in the catchment basin of the Pennar, are attached. The physical conditions of these stations are very similar to those of Baroor. No day maxima are recorded but I consider that 5.75" in 24 hours is not likely to be exceeded. During the famine of 1877/78 this tract of country lay within the stricken area and a part of the work of the

Project under report was carried out as a relief work.

Wells.

7. There are plenty of wells of good water. In the dry season the water in them stands about 12 feet below the surface of the ground.

Present irrigation

8. Near Nedingal on the Pennar about 4 miles North of Baroor a small channel is taken off from the river which feeds a few of the tanks and irrigates a few acres of land. Under each of the tanks within the area is a small patch of irrigation, the total area then irrigated being about 1640 acres. The improvement of this system, and conversion of the Baroor Tank into a storage reservoir is what the works proposed in the project will effect.

1457 acres &c

Nature of ground.

9. The surface of the ground is stony and where not cultivated with wet or dry crops covered with short grass. The soil itself is rich and would and promises to repay labour bestowed upon it. The sub soils are gravel, clay, black soil or rock. The slopes are gentle, and drainage off them would be rapid owing to the impervious nature of the surface of the ground.

Crops and seasons.

10. Where wet crops are grown the seed is sown in July and the harvest reaped in December and January. In favourable seasons two wet crops are obtained off the land.

The dry crops reared are oil-seed, gram, ragi, cumboo, samai, & mocha-cotai. They are reaped in the month of January.

Villages and population

11. There are some 20 odd villages comprised in the tract of country under report, giving shelter to about 4000 inhabitants. Baroor the largest has a temple and a population of probably 500 or 600 souls.

Occupations

The majority of the villagers are occupied in cultivating the lands, but a small proportion find employment as labourers on the road and in the neighbourhood. In one village about 1½ mile from Baroor are 50 "wodders" by whom the repairs or construction of the rough masonry works to the tanks seem to be carried out. The locality is healthy.

Communications

The trunk road divides the area into two nearly equal portions connecting it with Tripatore and Dharampuri two cusbah stations distant from Baroor 23 and 15 miles respectively, and a branch road connects the village with Samalpatty

Railway.

a station on the Madras Railway about 14 miles to the South of Baroor. There are several cart tracks about the area itself, and the produce of the lands would therefore have easy access to at least three good markets.

12. Full information regarding the water rates obtaining in the Baroor limits are given in the letter of the Collector of Salem, attached to this report. The rates vary from Rs 5 to Rs 7 per acre for wet land and from 8 Annas to 2 Rs per acre for dry. A portion of the land which will come under the influence of the project is Mitta land.

Land assessment

There seems to be every reason to expect that land owners will cooperate heartily in the extension of irrigation. Already in anticipation of the scheme being worked out the land about Baroor which will be influenced by it has been eagerly bought up. The view is fully supported by the Revenue Authorities. According to the testimony of the Baroor ryots a good many people from other villages are prepared to come and settle at and round about Baroor when the proposed Project is completed.

Ryots favourable to Project.

13 Having thus briefly described the tract of the country where the proposed works are to be constructed the Project itself may now be considered in detail. Reference is suggested to Mr. Lowry's original report attached.

Project details

The original arrangements of the Project remain unaltered and consist of

General arrangement.

I. An anicut across the Pennar near Nedungal.

II. A

38

II. A Supply channel with head Sluice from the river to the Baroor tank.

III. The enlargement of the Baroor tank and construction of two irrigating sluices in its embankment.

IV Two distribution channels from the Tank.

V. Sluices, masonry falls, weirs, outlets and inlets in the channels for the distribution of the water & maintenance of the channels in an efficient condition.

Provision is also made for the construction of two Hd. Sluices on the further bank of the river with a view to future extension of irrigation, but these are beyond the present scope of the Project.

Information called for by Govt. of India.

14. The points on which additional or more satisfactory informations were required by the Government of India are as follows:—

Vide G.O. No. 310. I. dated 11.5.81.

(a). The proper determination of the capacity of the Baroor tank.

(b). The capacities of the minor tanks dependent on the proposed works.

(c). An Estimate of the discharge of the Pennar at different seasons.

(d). A statement of the area commanded, & that irrigable from the proposed works.

(e) A proper forecast of financial results according to the orders conveyed in Circular XVII of 21st April 1880.

Index Map Sheet.

15. The general scheme is clearly shown on the Index Map Sheet No 1 which has now been contoured at 10 feet intervals and the areas commanded by the channel and capacities of the several tanks contained within the field of the Project are also shown upon it.

Area commanded

1516 according to Revenue accounts. Appendix E.

The total area of the ground shown on the Map measures 11000 odd acres, but only 10,735.2 acres can be commanded by the channels. Of these 1640 acres are already cultivated leaving a balance of 9095.2 acres to be brought under cultivation by the proposed works.

Statement furnished by the Collector which does not agree with this has been adopted
Jon

Quantity of water required

Assumption of demand.

16. In considering the amount of water required, it will be as well to assume that the net area that can be cultivated will be 10,000 acres which leaves a balance of 735.2 acres for villages, pathways and stony patches and is well within the mark. A water supply based on this assumption will err on the side of excess. Taking 8000 Cubic Yards per acre as the quantity of water required for a 5 months monsoon crop (Vide Circular No 82, Chief Engineer for Irrigation) the quantity of water necessary for the prosperity of the lands affected by the

project.

It has been settled in communication with the Rev: authorities that only 6887 acres will be irrigated
Jon

Amount required.

project will be 10,000 x 8,000 = 80 Millions of Cubic yds, and this must be forthcoming between May and December.

Data for ascertaining the quantity available.

17. To admit of an approximate estimate being formed of the quantity of water available for the Project we are in possession of the following data.

I The area of the catchment basin of the Pennar.

II Rainfall Statistics for 13 years recorded at three stations within this catchment about 20 & 30 miles apart.

III Guage readings at the site of the proposed anicut which record the **W.L** of the river since August 1881 and include the last two freshes of that year.

The Catchment Basin

Total area

Vide Appendices A1 A2

18. The area of this catchment basin at the anicut site is 2,082 Square Miles. Of this area 461 Square Miles lie within the Mysore territory. Near the Madras frontier the main stream is bunded, and the whole of the drainage out of Madras territory is intercepted by chains of the Mysore tanks, and except when the terminal tanks of these chains are discharging there is little or no supply in the river North of the Madras frontier.

This leaves 1621 Square miles between the latter and the Nedigal anicut, and as this portion of the basin includes numerous tanks, one third of this area should be deducted on their account leaving a free catchment of 1,080 Square Miles the drainage from which will be available for the Project.

Net area affecting Project.

Using Dickens' formula with a coefficient of 300 ($\underline{D} = 300\sqrt[3]{M^2}$) the discharge from this area would be 58,926 Cubic feet per 1". The area is undulating, many parts being occupied by high, steep, rocky hills.

Physical features.

Discharge of Pennar.

19. Calculations made from longitudinal and cross sections of the river at ¼ mile intervals from the site of the proposed anicut to a point 2 miles above it give with a M.F.L of 140.07 at the anicut site, a discharge at this latter place of 58,866 Cub feet per 1". These sections are shewn on sheets 2A and 2B., and the flood levels recorded on them have been obtained from observations of the flood marks on the banks combined with information obtained from the villagers in the vicinity of the river.

See table I, II. Appendix G

The guage zero is 130.62 and the highest reading recorded in the late freshes was 8' 9" (on evening of 18th Septr.) corresponding to a F.L. of 139.37 at the anicut site. The rainfall for the season was not above the average and the circumstances of the river recorded by the guage during the

MFL of 1881.

months

months of August to November last may safely be accepted as representing the normal condition of the river during the freshes of the North East monsoon.

Freshes during August, Septr & October 1881.

20. The guage readings from 6" and upward for August, September and October with calculations (approximate of course) of the discharge at every ½ ft difference of water level are given in appendix table II. These calculations which all err on the side of safety, shew that during the first fresh from 25th August to 8th September last 55½ millions of cub. yards passed the anicut site, and 143 million Cub. yards during the second fresh from 17th Septr to 16th October, a total quantity of 198½ million Cub. yards in about six weeks. The river was not dry until the end of December, the guage reading from 1" to 3" daily equivalent to about 6" or 8" of water in the river, but of this no account has been taken.

Total Supply

Demand.

Reduced area only requires 56 mill yds

By para 6., the supply for the season necessary for the satisfactory working of the project is 80 million Cub yards so that the amount that passed down the river in August to October alone was 2.72 or very nearly three times the amount required for the whole season.

Rainfall during

21. During the period of the first fresh 3.67" and 4.69" of rainfall were registered at Matteghirri

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Freshes.

-ghirri and Kistnaghirri respectively. During the second fresh 11.79" and 8.60" were recorded at the same stations. In both periods the rainfall occurred in groups of consecutive days, and the absorption of the ground was probably small. The register of 11.79" at Mattighirri however must not be regarded when considering the general amount of the rainfall over the catchment as the average there for that period was abnormally raised by a heavy fall of 5.62" that occurred there on 17th September and was evidently confined to a small portion of the drainage basin. Neglecting this, the mean of the first two 4.18", and 8.6" the quantity guaged at Kistnaghirri during the latter part of September & beginning of October are taken to represent the falls over the catchment basin of say 1,000 square miles in these two periods and producing the freshes in the river.

Extra ordinary fall at Mattighirri

22. A fall of 4.63" over 1000 square miles would give 398 Million Cub yards to drain off and 9.60" over the same area, 825 million Cub yards. The actual quantities passed down the river during these falls, the proportions of rainfall drained off to that received were $\frac{1}{7.1}$ and $\frac{1}{5.7}$ say $\frac{1}{7}$th and $\frac{1}{6}$th respectively. It is of course inaccurate to generalize from isolated data, more particularly in a case like the present where the

Comparison of discharges with rain fall.

data are so scanty compared to the conditions to which they refer. If however about half the above results are taken, and $\frac{1}{10}$th assumed as the proportion of rain fall over the catchment that may be counted on, the approximation will it is thought be well within the mark, and if the requirements of the Project are found to be satisfied by it, it may safely be accepted.

Approximate proportion of discharge rain fall.

23. From the averages of 13 years rain-fall, which include the famine years and are therefore safe data to go upon in this case, the rainfall from May to November is 4.03" per month, and 1/10th of this would give a discharge of .4" per month from the drainage area that may safely be counted on for the Barr irrigation. This is equivalent to 36 million Cub. yards per month, and as the 10,000× acres of land at 8,000 Cub. yards per acre per season would not require more than 13 million Cub yards per month, there will still be a surplus of nearly $\frac{2}{3}$rds for storeage or other purposes, available from what may certainly be counted on as the average monthly supply.

Minimum yield to be anticipated from Catchment.

Vide Appendix B.

× say 7000

Do.

24. The **F.S.L.** of the Supply Channel for the project is 133.5 so that it will run full with the river in its present state whenever the reading or the guage is 3 feet or over. In the months of August

Discharging power of Supply Channel.

August, September and October last the gauge read over 3 feet for 5½, 10½ and 8 days respectively. When the ascent is constructed its crest will be 1 ft above F.S.L. so that the channel may safely be expected to run full for quite half a month, and it will certainly not be less than ¼ full for the remainder of the month. The full discharge of the channel is 379 Cub ft per 1" or 1 Million Cub Yards per day so that supposing it to run full for half a month and carry no water at all for the remaining fortnight, the amount conveyed will be 15 Million Cub Yards or 2 Million more than the monthly quantity required. This assumption errs considerably on the side of safety, and it may be noted that although 133.5 is taken as the F.S.L. of the channel it is capable of carrying 2 feet more water with a M.S.L. of 135.5 when the discharge would be nearly double that at F.S.L. In fact during high freshes it would frequently be practicable to send as much as 600 Cub feet per 1" down the channel or 1.9 Million Cub Yards in 24 hours.

Capacity of Baroor tank.

25. An error was made in Mr Lowry's report in estimating the increased capacity of the Baroor tank. When enlarged it will hold 11.605,540 (say 11½ million) cub yards. The total capacity of the other tanks contained within the field of the Project amounts to 5¼ million Cub yards so that the total storeage capacity available is 16¾ million Cub yards, rather more than one month's supply.

Deduction from above

26. The facts and deductions given in paras 16 to 25 may be briefly summed up as follows,

Maximum quantity of water required from May to November for the prosperity of the Project	million C. yds * 13 per Month.
Maximum quantity that may be counted on to draw off the catchment	36 per Month
Maximum quantity that the Supply Channel will carry during Season	15 per Month.
Maximum storeage capacity of the Baroor and other tanks connected with it	16¾ C.yds.

* under 10 Rs
7000 acres at 5000 C.yds
per acre

Local drainage not considered

27. It should be noted that no account is taken of the effect of local drainage and direct rainfall on the several tanks themselves. The drainage basin of the Baroor tank is about 7 Square miles, and proportion of water drained off to that received over this confined area would be much greater than in the case of the larger area of 1000 Square Miles. Adhering however to the same assumption of $\frac{1}{10}$th of the rain fall

per month, the quantity received by the Tank from its own gathering ground would not be less than 3/4 million cub yards which would go far to meet losses from evaporation.

28. The above figures are sufficient to shew that the prosperity of the Project may be safely counted on so far as its requirements as regards water are concerned. It will now be as well to explain in more or less detail the various designs where modifications on the originals have been effected.

Water supply ample for Project.

29. The Anicut. The general design of the anicut remains unaltered, but modifications in the Sand Sluices have been introduced as required in para 7 of the note by the Chief Engineer for Irrigation. Instead of 2 sets of 2 vents each 3' × 3' as at first allowed, 2 sets of 4 vents each 4' × 4' are provided for giving a total of 196 square feet against 36 Sqr ft in the original design. It was not thought advisable to make them larger, lest the body of the dam should be unduly weakened by the loss of so much weight to the decrease its stability. At the suggestion of the Superintending Engineer, 4° Circle, buttresses with a base equal to their height have also been added in rear of the piers and abutments of the sand Sluice vents. The screw gearing rests on beams

See attached section of anicut where this is not yet into

Jn.

Sand Sluices revised.

Fixed spears to shutters are not advisable. They would catch any thing coming down the river & be liable to damage. In the Godavari & Kistna movable spears are used.

Jn.

beams supported at the piers and abutments of the vents and counter sunk on the crest of the anicut so that the tops of the beams are flush with the crest.

These modifications on the original design have altered the cost of the work from Rs 14600 to Rs 18,305

The crest of the anicut will be at 134.5 above datum. As stated in para 19, the M.F.L. of the river here is 140.07 and the discharge at that level 58860 cub ft per 1".

With charges on the proposed dam of 8.12' and 8.87 corresponding to water levels of 142.82 and 143.07, the discharges will be respectively 57748 Cft and 61845 Cft the heads in each case being 2.75' and 3.00'. These calculations neglect the effect of velocity of approach which would increase the head about 0.80, so that 143.07 may safely be taken as the probable future M.F.L in the river after the anicut is built. This agrees very closely with the conclusion arrived at by the Chief Engineer for Irrigation in para 2 of his note on the designs, and with that given by Mr Lowry in his original report so that the levels of the different parts of the anicut and head works remain unaltered.

Afflux caused by Anicut.

30. Baroor Head Sluice. With a few trifling exceptions the original arrangements remain unaltered.

31. Baroor Supply Channel. The remarks

in the original report under this head call for no comment.

The M.F.L. of the river has been shewn on the longitudinal section of the head of the channel as required by the Chief Engineer in para 8 of his note, and the right banks altered accordingly.

Inlets and Outlets. Considerable modifications have been made on the original designs. The number of Outlets has been reduced from 22 to 17 and in most cases their designs simplified by the substitution of rough stone revetments with a body wall carried into the banks in place of the masonry wings originally provided. These modifications are in accordance with the instructions given in paras 11, 12, & 13 of the note by the Chief Engineer for Irrigation and reduce the cost from Rs 5483 to Rs 4328. The head throughout is 2 ft. Head.

32. Accommodation Bridges.

The original designs have been altered by the substitution of brick arches for beam stones, and the width of the roadway reduced from 9½ to 9 ft as directed by the Chief Engineer in para 14 of his note.

Appendix F

33. Foot Bridges.

At the points where these bridges are to be built, there is no likelihood of cattle or carts ever requiring to cross the channel and the

width

width of the bridges has been reduced from 6 ft to 4½ ft. The beam stones in the original designs have been replaced by brick arches as required by the Chief Engineer for Irrigation, but it is submitted that it is not understood why this modification is necessary in these small bridges.

It is a question of cost - if beam stones are cheaper than brick arches they can be used for foot bridges -

The modifications in the original designs of these bridges alter their total cost from Rs 2,809 to Rs 3540.

NP 26

NP 23

33 (a). Syphon Culvert.

In place of the culvert of two vents allowed in the original design, the plan now submitted provides for one vent of 8 feet span and 2' 6" to springing level, which with the arch gives a clear waterway of 34.73 square feet with a head of 2 feet. This culvert can discharge 333 cub ft per 1" about 2% more than the estimated discharge to be passed under the Channel.

At the centre of the culvert the masonry is liable to be subjected to an outward pressure due to a head of 7 feet,

equal

through which the supply Channel passes have also been modified in a similar manner, and in one case a new sluice provided in lieu of additions to an old one. The general tenour of these modifications is in accordance with the instructions contained in paras 8 and 15 of the note

by

in the original report under this head call for no comment. The M.F.L. of the river has been shown on the longitudinal section of the head of the channel as required by the Chief Engineer in para 8 of his note, and the right banks altered accordingly.

Inlets and Outlets. Considerable modifications have been made in the original designs. The

equal to 4 Cwt. or 448 lbs per Square foot, which if the roof of the culvert at this point were an ordinary brick arch would cause it to blow up supposing the Supply channel to be empty at the time that drainage was passing through the culvert. To meet this the roof of the culvert for the centre 28 feet of its length is to be constructed of slab stones 2 feet thick covered with 1 foot of stone concrete which will altogether weigh 450 lbs per Sqr. foot.

Precaution against water pressure under head.

33. **Foot Bridges.** At the points where these bridges are to be built, there is no likelihood of cattle or carts ever requiring to cross the channel and the

width

width of the bridges has been reduced from 6 fts to 4½ ft. The beam stones in the original designs have been replaced by brick arches as required by the Chief Engineer for Irrigation, but it is submitted that it is not understood why this modification is necessary in these small bridges.

Tis a question of cost if beam stones are cheaper than brick arches they can be used for foot bridges –

The modifications in the original designs of these bridges alter their total cost from Rs 2,809 to Rs 3540.

P. 26

34. Distribution Sluices of the Supply Channel.

The original designs for these sluices have been considerably altered. In place of circular concrete pipes of 6" 9" & 12" diameter as at first provided, the Sluices are constructed on an uniform design with a brick tunnel 2' × 2½' on an allover bed of concrete, and the admission of water into them regulated by plugs, by which the maximum supply can be obtained when there is about 2½ feet of water in the channel. Particulars of their discharge and duty will be found in the tables lettered on the plans.

Regulation by plugs.

The former designs for the tank sluices for the three tanks through which the supply Channel passes have also been modified in a similar manner, and in one case a new sluice provided in lieu of additions to an old one. The general tenour of these modifications is in accordance with the instructions contained in paras 8 and 15 of the note by the Chief Engineer for Irrigation, and increases the costs of the distribution arrangements in the Supply Channel from Rs 2964 to Rs 6554.

35. The Baroor Tank. It has already been stated that actual capacity of the tank from the level of the sluice sills to F.T.L. will be 12¼ million cubic yards. Provision is made in the Estimates now submitted to carry the revetment 3 feet higher up the inner slope of the bund as suggested in para 16 of the note by the Chief Engineer for Irrigation. The precaution is certainly necessary, the Tank is very exposed and during the North East monsoon when the winds will act so as to set the water directly at the bund, the wash will affect the bank for several feet above the W.L.

Additional height to revett.

36. The Irrigation Sluices. The West Sluice has been already nearly completed. The actual acreage under it is 1232 acres, but the Sluice will supply if necessary about 1500 with the W.L. in the tank about 1½ feet above the plug stone. The necessary data are recorded on the plan.

West Sluice already built

The design for the East Sluice has been recast in conformity with the instructions given by the Chief Engineer in para 16 of his note. The acreage under the sluice will be 7,456 acres, but the Sluice is capable of supplying 9,000 acres with about 1½ ft of water on the plug stone. The cost of the present sluice will be Rs 3310, that of the former was Rs 2698.

37. The Surplus Weir. This has been revised according to para 16 of the note by the Chief Engineer. The modifications are trifling, the design simple and call for no comment. The length required is 236 ft not 200 ft.

38 The distribution Channels. These appear in the first instance to have been made unnecessarily large. The acreage under the East Main Channel is 7,432 acres, for which a discharge of 120 Cub ft per 1" would suffice. In accordance however with the instructions of the Chief Engineer for Irrigation (para 17 of his note) the channel has a bottom breadth at its head of 11¼ feet so that with 4 feet of water in the channel it will carry 150 cub ft per 1". The channel will vary in size as it progresses and the following dimensions are assigned to it, the fall per mile being 2 feet.

11½

Dimension of East Distribution Channel.

Limits	Acreage.	Discharge	Bottom breadth	Depth.
Section 1 to 38	8000	150 C.ft.	11½	4
" 38 to 46	4320	80 "	5½	4
" 46 to 48	1230	35 "	4	2½
" 48 to 70	500	15 "	4	2

The cost of the Channel in its present form as compared with its original section is Rs 42,970 against Rs 47,500 a saving of Rs 4,530 on the former Estimate.

In commenting on the original design of the West main channel (para 17 of his note) which was arranged so as to show a gradually decreasing depth and width as the channel advanced, the Chief Engineer for Irrigation seems to object to this arrangement on the grounds that at the various sections the widths would have to be laid out on the ground to two places of decimals and that this would be "impracticable". It is however submitted that it would be perfectly practicable to lay these sections out to the nearest inch represented by the decimals, and that calculations of channel discharges cannot be expected to be so rigidly accurate that such deviations from the computed sections would be of the smallest practical consequence.

Former Sections too large.

The channel as designed by Mr Lowry was certainly too large for the duty it had to perform, but by reducing the widths by even feet and retaining the fractional parts shown on the original sections, the original sections and Estimate can with trifling alterations be adapted to the new section required. This saves a large amount of fresh estimating, and the same plan has it may be noted been adopted in revising the branch channels.

The acreage under the West channel is 1234 acres for which

Discharge.

which a discharge of 30 cub ft per 1" would suffice, but a discharge of 35 cub ft per 1" is allowed which will be obtained with a bottom width of 4.00' in the channel and a depth of 3 ft. In the original design a bottom width of 6 feet was allowed.

39. The branch Channels. The branch M.N., from the West main, and branches No 1 and 2 from the East main command acreages of from 300 to 360 acres for which a discharge of 12 cub ft per 1" would suffice. They originally were designed with a head section of 3 ft bottom width and 3 feet depth of water whi would discharge 33.44 Cub ft of water per 1". The chann are now designed with a bottom breadth of 2 feet and wi

Discharge.

carry a discharge of 14.4 Cub ft per 1" with a depth of water of 2 feet, allowing a small margin for contingencies.

No 3 Branch channel, commands 2987 acres, & the section originally given to it viz 6 feet bottom breadt

Discharge.

with 3 ft depth of water would carry 60 c ft per 1" sufficien for the irrigation of 3,000 acres. It has not been thought necessary to alter this and the section & Estimates remain as originally cast.

No 4 Branch Channel will have to distribute wate

Discharge.

to 784 acres for which a discharge of 20 c ft. per 1" woul suffice. In the original estimate a bottom breadth of 4 feet was given to this branch. A breadth of 2 feet is now allowed which with a depth of 3 feet will carry 27 Cub feet per 1":

Discharge.

Slopes & Falls.

The West main channel and all the branches diminish gradually in depth and breadth from head to tail have a slope of 2 feet per mile and interior slopes of 1½ to 1.

Terminals.

The channels are to terminate in small masonry weirs provided with shutters so that water may be held up in them at any time if desired and none allowed to run to waste until the lands and tanks have been properly supplied. These were not provided in the original estimate. Masonry walls across the beds of channels at every ¼ mile are also included in the present estimates, their crests to be at bed level to serve as a standard reference to the proper level of the channel sills at these points for future guidance.

Plug regulation not suitable

I do not see the necessity for circular orifices.
Jm

40. The distribution Sluices. The original designs have been recast to the same general design as those for the Supply Channel. Plug regulation however has not been provided as it is thought that it is not suitable to sluices in channels where the depth of water at its maximum is not more than 2 or 3 feet. The water will be admitted by circular orifices suitable to the areas at the mouth of the tunnels and closed by an ordinary shutter. The necessary data are recorded on the design. The difference of cost of the present sluices compared with those in the original estimate is Rs. 6545 against Rs. 2429.

Water cushions.

Differences between discharges in channel and over falls.

41. The masonry falls for reducing the gradient in the channels have been entirely recast, the original designs were faulty in several points and allowed too great a waterway. Water cushions have been provided, their depths being calculated by the formula $d = 1.5\sqrt{h}\ \sqrt[3]{h_2}$, h and h_2 the depth on the weir sill. Details of the discharges over the falls and in the channels at the different points are given in the table of reference. In some places the discharge over the fall is slightly less than that in the channel at the same point. As however a very slight increase in the head on the falls will at once greatly increase their waterway, any trifling deficiency in the discharges here and there will be compensated for by an immaterial heading up in the channel. It is an advantage to have the different falls arranged with the lengths of their crests in simple dimensions &c.

42. The inlets and outlets for the distribution channels have been retained as originally

designed. Wing walls are generally advisable as rock is not available for their foundation as was the case in those in the Supply Channel, and there being the margin in the minor channels between F.S.L. and M.W.L. it is better to pass the drainages off as they enter the channels and not reduce the number of outlets by carrying surplus water along the channel.

43. The designs for Agraram and Nedungil Hd. Sluices appear to call for no remarks. Their general details were settled some years ago and they have* nothing to do with the Barroor Project. The design for the Nedungal Head has been recast as was directed by the Chief Engineer in his note. Data are recorded on the plans.

* Their construction is chargeable to the Project, as the anicut will cut off the supply to these channels.
Jn

Materials and Labor in the locality.

Stone

44. Abundance of stone (gneiss) is available close to the sites of all the works. The bed of the river where the Anicut is to be built is very rocky, and boulders crop up every where in the locality, and close to the Barroor tank are two rocky hills where stone has been quarried by the wodders for years passed. Kunker can be obtained easily over the area and where the soil is gravelly plenty of

Lime

of pebble or small stone can be procured for making concrete. Brick earth is found near the River where there are a few native kilns.

Brick

Labourers.

45. The labour procurable from the locality is small except for unskilled labour such as earth work. For this, out of the cultivating season probably 2,000 labourers could be raised out of the villages comprised within the area of the Project. Plenty of skilled labor in the way of masons, carpenters &c procurable from Kaveripatnam, Dharmapoori & Tripatore situated 10, 15 & 23 miles from Barroor respectively.

Skilled labour to be got elsewhere.

Cost of the Project.

2,47,914
2,35,500
12,414

46. The Project submitted in 1879 was estimated to cost Rs 2,35,500. The cost of the Project in its revised form is Rs 240,073* showing an excess Rs 4573 (12414) due to the modifications in the various designs and to an increase of about Rs 1500 on the item for compensation. This latter increase is caused by the compensation for loss of crops which at first was reckoned for one years crop, being subsequently assessed in the bill presented by the Revenue Authorities for three years' crops, raising the total amount claimed from Rs 6195-9-0 to Rs

Original.

Present

difference.

* 247914 including land compn

Compensation.

Rs 7840. 12. 10.

General nature of modifications.

The general tenour of the modifications on the original designs has been to increase the cost of the masonry works. The rough stone aprons have been made more substantial, and additional aprons have been added in rear of the Sluices and weirs while in one or two cases new works have been substituted for additions to old ones. The saving anticipated by the reduction in width of some of the distributaries has not however been realized as in going over the original earth work estimate some serious clerical errors were detected in some of the large items which resulted in the work being originally under estimated.

Cost of terms of Storage, acreage and capacity.

47. The total cost of the Project being 2,40,074 and the area commanded 10735 acres, the cost per acre is Rs 22.36.

The Baroor Tank holds 313 million Cub yards and the cost of the bund and weir amount to Rs 56,211 — making the cost per 100 million Cub yards stored — Rs 179.5. If the cost of the head works and channel for the conveyance of the water to the reservoir is included which altogether amount to Rs 1,49,263 the cost of the storage will be Rs 476.8 per Million Cub feet. The

(48) No 29

The tank only holds 0.14 of a year's supply. The cost of the distribution arrangements below the tank is Rs 8171 and the discharging capacity of the two main channels being 185 C/ft. per 1", the cost of distribution is Rs 444.3 per C/ft of water conveyed to the lands.

Previous Expenditure.

48. As already stated a portion of the work has been carried out as famine relief work and an expenditure of Rs 1,08,601 has been incurred. The actual value of the work done at normal rates is Rs 68,601 shewing an excess of Rs 40,000 due to famine and with which the Project cannot correctly be debited.

Famine excess.

Approximate quantity of work already done.

The work done is as follows

Supply Channel. About 3/4th of the earth work and 2/3rd of the rock blasting.

Baroor Tank. The puddle core of the bund, about 2/3rd of the earth work, and about 3/4th of the revetment including gravelling backing. About 3/4th of the Western Sluice is also completed. In addition to this a good deal of rough stone has been collected from the blasting in the channel and a good deal of stone has been dressed and is ready at the anicut site. Altogether I roughly estimate the value of the work already done as follows:—

Approximate value of work.

On Supply Channel	Rs. 25,296.
" Barror Tank	" 38,450.
" Do. Sluice.	" 1,800.
Earthwork to Agaram Hd. Sluice	" 353.
Stone at Site.	" 2,702.
Total Rupees.	68,601

and deductions in these proportions have been made in estimating the time and expenditure necessary for completing the project.

Establishment.

49. The Establishment that is considered suitable for supervising the work as given in the columns of Remarks on Form No. 1 Appendix. Its cost would be about 6½ per cent on the value of the work executed and leave a small margin for contingencies.

[illegible] 2½ p.c. [illegible] of work

Large establishment not required.

The project is comprised within a limited area and the various component works are of so simple a nature that an elaborate establishment is uncalled for. The Executive Engineer of the Salem Division in whose charge the work will be carried out can reach

the

(60)

31

the scene of operations in 6 hours if necessary should any unforeseen difficulty arise.

Time required to complete.

50. The work can be completed in three years supposing a yearly allotment of 60,000 Rs to be granted for the purpose. The various portions of the Project should be carried out & completed in the following order:—

Order of carrying out the items of the Project and probable expenditure.

Work.	Probable expenditure.	Remarks.
	First year.	
Head Works.	12,545.	About ⅓ of the anicut, Barror Agaram Head Sluices and complete flood banks & Nediyal Head Sluice.
Earthwork	23,008	Complete the Channel and Syphon Sluice.
Syphon Sluice	2,500	
Bund	14,365	Complete bund and West Sluice. Build weir & about half of the East Sluice.
Weir	3,096	
East Sluice	1,500	
West Sluice	580	
	57,594	Total for the First year.
	Second year.	
Head Works	23,500	Complete Head works.
Masonry works & 3 Tank Sluices	13,000	Complete Outlets and Inlets, Bridges and Sluices.
East Sluice	1,810	Complete Sluice.
East & West Channels and	14,216	Complete West Distributary with its masonry works and carry out about half East Distributary.
Masonry works	5,000	
	57 526	Total for Second year.
	Third year.	
Distributaries	28.815	Complete Eastern Distributary and branches.
Masonry works	27,537	
	56,352	Total for Third year.

At

First utilization of Project.

At the end of the Second year the Project will be completed up to the Baror Tank together with one of the Distributaries western one, so that the 2045 acres under the Supply Channel and the 1232 acres under the Western Distributary could come under the influence of the Projected works.

Financial forecast.

51. In Appendices I.1.2.3, the necessary details are given of the grand cost of the work including both direct & indirect charges, and the Estimate of growth of irrigation consequent on the execution of the Project with the return that may be expected. The acreages given in Form No 3 are taken from the figures given in paras 5 & 6 of the letter from the Collector of Salem attached and are thus deduced.

Appendix I.

Data on which expected revenue is based.

This has been revised.

Jn

Area commanded ————	10,735
Deduct Mitta ————	3,087
Balance assessed land ————	7,648
Deduct about ½ for unirrigable portion.	2,206
Balance, probable cultivation under Project works ————	5,442
Area at present irrigated ————	1,519
Net area on which Returns are based.	3923.

and

1,483 acreage of 3087 acres of Mitta land on which a water rate may be anticipated.

These figures assume that about $\frac{2}{3}$rd of the area commanded by the project will be cultivated. This assumption I consider to be a very safe one and the returns based upon it may be unhesitatingly accepted. From what I have seen of the land myself, I see nothing to prevent nearly the whole of the area affected by the Project being profitably cultivated. The figures in Appendix I Form No 3 show that on a modest estimate of the working of the Project a return of Rs 8¾ per cent may possibly be obtained and a return of Rs 6¾ per cent may safely be counted on equivalent to a probable or certain return of 8¾ % and 6¾ % respectively of the entire outlay of Rs 2,70,911 which includes all charges direct and indirect.

Return

Prospects of Project.

52. To conclude the prospects of the Scheme may be summed up as follows:—

1. Water Supply ———— ample.
2. Utilization ———— fully guaranteed.
3. Returns ———— not less than 6 percent.

The Project the work of the late Mr Lowry Ex: Eng:

53. In closing this report I should to notice that beyond carrying out modifications in some of the designs directed by the Chief Engineer for Irrigation & adding a some extra details. I have had nothing whatever to do with the preparation of the Project. The plans now submitted are practically those that were prepared by the late Mr Lowry, Executive Engineer, when in charge of the Osoor Range Salem District and who evidently bestowed much care and thought in drawing up the plans, estimates & report at a time when his duties were of a peculiarly arduous nature.

F. J. Romilly
L'R.E.
2. Feby 1822

CHIEF ENGINEER
6. MAR
1882
FOR IRRIGATION

R. No 956
4/82

P.W. 5
3858/8

M. Expenditure on Productive Public Works Capital Acct
5. Irrigation and Navigation

~~Irrigation and Navigation Works for which neither Capital not~~
~~Revenue accounts are kept~~

lassified Abstract Estimate of the Baruv Tank Project Salem Dt.

Subhead	Name of work	Amount of individual Estimates	Total of each Subhead
	(1) Head Works.		
C. Works.	Aidangal anicut across the Ponniar	18035	18035
	(2) Main Canals & Branches		
	Baroor Tank Supply channel		
D Regulators	Head Sluice	5,210	5210 ✓
F (1) Other cross drainage works	Inlet No. 1	60	
	Do. " 2	10	
	Do. " 3	20	
	Do. " 4	39	
	Do. " 5	25	
	Do. " 6	41	
	Do. " 7	41	
	Do. " 8	17	
	Do. " 9	31	
	Do. " 10	41	
	Do. " 11	97	
	Do. " 12	43	
	Do. " 13	34	
	Do. " 14	34	
	Do. " 15	24	557
	Outlet No. 1	165	
	Do. 2	14	
	Do. 3	285	
	Do. 4	53	

Sub head	Name of work	Amount of individual Estimate	Total of each Sub head
	(2) Main canal and Branches contd.		
	Baroor Tank supply channel contd.		
F (1) Other cross drainage works contd.	Outlet No. 5	740	
	Do " 6	167	
	Do " 7	130	
	Do " 8	56	
	Do " 9	72	
	Do " 10	381	
	Do " 11	62	
	Do " 12	296	
	Do " 13	70	
	Do " 14	92	
	Do " 15	375	
	Do " 16	350	
	Do " 17	463	
			3,771
G Bridges	One Bridge	600	
	2 Bridges	1,200	
	4 Do	1,740	
			3,540
L Earth work	Baroor Tank supply channel	48,004	
			48,004
N Tanks	Moorasamputty tank sluice	440	
	Velangamvady small tank sluice	680	
	Pungamputty Tank sluice	784	
	Barur tank bund	53,115	
	Do Surplus weir	3,096	
	Do Eastern sluice	3,310	
	Do Western do	2,500	

Sub head	Name of work	Amount of individual Estimate	Total of each Sub head
	2 Main canal and Branches contd.		
	Baroor tank supply channel contd.		
N Tanks	Baroor tank distribution, Keelcoopum Tank sluice	414	
	Do East channel	3,260	
	Do do Branch do	1,110	
	Do West channel	22,500	
	Do do No. 1 branch channel	1,340	
	Do do " 2 do	1,460	
	Do do " 3 do	10,950	
	Do do " 4 do	2,350	
	Do Aqueduct	2,900	
	Do Twenty three inlets	2,024	
	Do Twenty outlets	8,540	
	Do Fifteen do	5,580	
	Do Six terminals	516	
	Do Thirteen sluices	1,560	
	Do Forty seven do	4,935	
	Three Masonry falls of 2 feet	510	
	Six do of 3 "	1,260	
	Ten do of 4 "	2,800	
	Tunnels	1,230	
	Bridge	682	
			139,846
Miscellaneous	Syphon Sluice	2,600	
	Fifteen Distribution Sluices	4,650	
			7,250
	Total Barur tank supply Channel		226,213
	Agaram channel		
D Regulators	Head Sluice	9,600	
			9,600

Sub head	Name of work	Amount of individual Estimates	Total of each Sub head
	(2) Main canal & Branches Contd.		
	Agaram channel continued.		
L Earth works	New head	1055 ✓	1055
	Total Agaram channel		10,655
	Nedungal channel		
D Regulators	Head Sluice	860	860
	Total (2) Main canals & Banches		237,728
	(4) Drainage and Protective Works.		
L Earthwork	Flood banks	2,345	2,345
	(5) General.		
B Land	Compensation for land	7,841	7,841
	Total works		247,914
	Lump sum provision for unforeseen works		7086
			255000
	Establishment		~~11520~~ 58030
	Tools and Plant		~~2710~~ 6770
	Total Direct charges		~~262144~~ 320000
	Capitalized indirect charges		
	Capitalization of abatement of Land Rev:	6829	
	Leave & pension allowances	8221	15050
	Grand total		335,050

B. Project Division Office
Baroor 2d February 1882.

F. J. Romilly Lieut. R.E.
Executive Engineer.

Camp Ootacamund
1st March 1882

A. T. Fraser

4th Circle

Salem District

Bároor Project

R 956 / Ird / 5/82

CHIEF ENGINEER
6 MAR
1882
FOR IRRIGATION

P.W. 33 / 385 T/78

Classified Abstract Estimate

Amount of Estimate 262144

Recd - the following papers:- (51) No 1

Report by Supg: Engr, 4th Circle, d/ 1st March 1882. Enclosing report from Lt Romilly R.E. with appendices.

G.O. No 124 - I dated 11th February 1881.

No 48. I.

Exa. 42

Note by the Ag: Chief Engineer for Irrign

. The Barur Tank Project was undertaken as a Famine Relief work, under the authority given in G.O. R.D. No 735 dated 19th February, 1877, in August 1877. It was intended to improve and enlarge the Barur Tank in the Kistnagherry Taluq of the Salem District and provide it with a supply from the Poniar, a river which rises near Nundidroog in the Mysore territory, passes through the Salem and South Arcot Districts and falls into the sea near Cuddalore. The original Estimate submitted in September 1877 amounted to Rupees 52,688.

2. The Expenditure on the work amounted to Rs 1,07,101 of which Rs 67,185 is the normal value of the work, the balance having been charged to Famine. Since

channels on the right bank of the river.

3. a channel on the L.B. on the river to the Barur tank, passing through 3 small tanks and commanding 3 other tanks

4. The enlargement of the Barur tank

5. Distributary channel from the Barur tank

6. Increasing the supply to 13 other tanks.

And the work already done is, approximately,

Supply channel - $\frac{3}{4}$ of Earthwork and $\frac{2}{3}$ of rock blasting

Barur Tank - Puddle core of bank - $\frac{2}{3}$ of earthwork, $\frac{3}{4}$ of revetment
Western sluice $\frac{3}{4}$ completed

Anicut - Rough stone collected to some extent, and a good deal of dressed stone ready.

7. The area commanded by the Project is 11,251 acres and it is proposed to irrigate 6887 acres, of which 1457 acres are already irrigated under the Tanks. Of the area to be newly irrigated 3300 acres are waste land on which the enhanced land revenue is calculated at Rs 1.4.9 per acre, being the average rate of dry assessment in the villages commanded.

All

All newly irrigated land will pay a water rate of 4 Rs an acre.

8. When the Project was first submitted the supply available for irrigation was estimated from the quantity supposed to run off the catchment area. While Lieut. Romilly was engaged in revising the estimates he carefully guaged the river at the Anicut site, and in his report has compared the actual discharge & measured with the quantity supposed to run off the catchment area. This comparison showed that $\frac{1}{4}$ and $\frac{1}{6}$ of the rainfall drained off in the two recorded floods. From this it is considered safe to allow that $\frac{1}{10}$ of the rainfall will always be available and taking the average of 13 years rainfall (in which the famine years are included) it is shown that from May to November 36 millions of cubic yards per month would pass the Anicut site. Allowing that 800 cubic yards per acre are required to bring one crop to maturity 55 millions

of cubic yards or little more than ½ mnths' supply in the river are required.

The full supply in the channel is obtained when the guage reads 3 feet, and the result of the observations taken in 1881 (a year in which, as noticed by the Supg: Engineer the rainfall was unusual, early freshes having failed) shows that without any Anicut the channel would have run full for 24 days in August, September and October discharging 24 millions of cubic yards while for the rest of the time and in fact until the end of December there was from 6 to 8 inches of water in the river. In addition the local rainfall would also be available for storage, the Barur Tank itself having a drainage basin of about 7 miles. There can therefore be no doubt that the supply of water is sufficient for the cultivation of the full acreage. Appendices to the Report, G, G1 G2 and G3 show the observations recorded and calculations of discharge.

9. The capacities of the Tanks have been accurately determined and it is shown that the Barur Tank will, when its enlargement is completed, store 11½ millions of cubic yards and the smaller Tanks about 5 millions - total 16½ millions of cubic yards. A statement showing the capacity of each individual Tank is given on the index map. If the Tanks are once filled there would be sufficient water for ⅓ of the whole crop.

10. The estimates as now submitted amount to

Direct charges.

	Rs.
Works	2,55,000
Establishment	58,030
Tools and Plant	6,970
	3,20,000
Indirect charges.	
Capitalization of land revenue	6,829
Charges for leave and pension allowances.	8,221
	3,35,050

and can be worked out in 3 years, the

P.W.C. No. 3856

the increased cultivation is expected to be taken up as soon as water is available, and the gross revenue is estimated at Rs 26,767

net revenue " " 21,448

6.7 per cent on Direct charges or 6.4 per cent on Direct and indirect charges. The works are therefore of a remunerative character and it is recommended that the Project be classed as a Productive Public Work.

Recd 8-5-83

11. The Salem District suffered so severely in the late famine that it would be very desirable to undertake works which would irrigate 5000 acres, even if the anticipated return from them was much less than it has been shown to be. The stoppage of the works has of course resulted in some loss, and to increased expenditure being necessary, otherwise the results would have appeared more favorable.

Ootacamund }
17th April 1883 }

Sd. [illegible] Colonel R.E.

Ag. Chief Engineer for Irrign.

Cur 23/4 R 28/4

To

O.L.S. 27-4. The Joint Secy: to Govt P.W.D. [illegible]

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(55)

List of papers connected with the Baroor Project to go to the Government of India in original with Endorsement No. I of May 1883:

1 Baroor Project — The Index map of the — Sheet No. 1

2 — do — Plan & sections of the proposed Anicut and flood banks on each side — Sheet No. 3

3 — do — Plan & sections of Baroor Head sluice — Sheet No. 4

4 — do — Plan & sections of Agaroon Head Sluice — Sheet No. 5

5 — do — Plan & sections of Sand sluice for Anicut — Sheet No. 7

6 — do — Baroor Tank — The map of — Sheet No. 26

7. — do — Cross sections of Baroor Tank bund — Sheet No. 27

8 — do — Report containing the following:—

Appendix A — Original report by Mr Lowry Ex: Engr: Hosur, No. — of 15th January 1879

— do — A1 — Note by Major J. Pennycuick R.E. No. 48 of 5th Decr. 1878.

— do — A2 — Letter from Chief Engr: Mysore No. 100 of 23rd January 1879.

— do — B — Rainfall Register —

— do — C — Letter from Collector of Salem No. 150 of 26th Jany 1881 estimating probable returns.

— do — D — Letter from Collector of Salem No. 764 of 25th March 1881 estimating probable returns.

— do — E — Note by the Chief Engineer for Irrigation No. 183 of 5th February 1881 reviewing the Project.

— do — F — Note by the Chief Engineer for Irrign of 18th October 1880 reviewing the Project.

9. Appendix G - Tables I, II, III & IV - Pennaiar discharge

10. — do — G^a — Register of water of Pennaiar
river at Nedungal for October 1881

11 - — do — G^b — do — do — November 1881

12. — do — G^c - do — do — December 1881

13. — do — H - Statement of Compensation for
land taken up for the Project.

14 - Tabulate statement to accompany Estimate
for the Barour Project

No. 1,08 I

PUBLIC WORKS DEPARTMENT.

PROCEEDINGS OF THE MADRAS GOVERNMENT.

UNDER date the 19th May 1883

Read the following :—

Note by the Ag. Chief Engr. for Irrg. {N.E. No. 48. I. dated 17th April 1883}

The revised Estimates for the Barur Project which have been submitted with the information required by the Government of India in their letter No. 166 I dated 29th April 1881 will be forwarded for the approval of the Govt of India.

2. The amount of the Estimates is

	Rs.
Direct charges	3,20,000
Indirect charges	15,050
Total	3,35,050

and the return expected from the cultivation of 5430 acres is, after deducting all charges, Rs. 21,448, that is 6.7 per cent on Direct charges or 6.4 per cent on Direct and

Indirect charges. The project may therefore, in the opinion of the Right Hon'ble the Governor in Council, be classed as a Productive Public Work.

21/4/83

G.O. 124 I of 11-2-81
" 310 I of 11-5-81

W.S. No. 409 I d/19th May/83

Forwarded to the Govt of India.

D.G.W.
23/5

7C
a 577 I 19.6.84

[illegible] to Technical section [illegible]
G.O. No 7/143
3-4-83 — 6/4/83

O.L.S. 27-4
Cir 23/4 R 28/4

D.G.W.
23/5

Supg. Engr Fourth Circle 1
C.E. for Irrigation 1
Exr P.W. Accts 1
Rev Depts 2
Bd of Rev 2

For C. No. 4048/91

To be sent direct to [illegible] office

MEMORANDUM.

Requested for reference the undermentioned papers :—

The appendices to Lieutenant Romilly's Report read in G.O. No 408 I dated 19-5-83.

+ General Records — 23-7-91

Government Office,
Revenue Department,
23rd July 1891.

Reeeam
AS Under Secretary to Government.

To
The Undersecretary to Govt. P.W.D.

C# 22/7

Endorsement

Returned with thanks

R. Ellis
Ag. Under Secy.

Ooty
27 Aug 1891

To
the Under Secy. to Govt.
Public Works Dept.

1-9-91

Returned to the
Genl. Record Dept.
D.P.
1-9-91-

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22 AUG 91

No. 25 W.

Herewith Appendices A to H. called for. Please return them as soon as done with.

27/8/91

Under Secy. to Govt.
P.W.D., Irrign.
17 Aug 91

To
The Under Secy. to Govt.
Revenue Dept.
Ootacamund.

P.T.O.

[illegible]

Govt. of (1883) Madras

PUBLIC WORKS.

Dated [illegible] 8/5.
4 [illegible]

Recd. Encl.

G. O. 19th May 1883, Nos 408 – 409

Nos.

Barur Project

Revised Estimate for the – ordered to be fordd to the Govt of India –

Fwd. to the Govt of India the Revised Estimate for the Barur Project.

100
8
48