(1) Number of pages 138

(2) Date of repair 8-87

(3) Initials of the Referencer Bwn

TAMIL NADU ARCHIVES

GOVERNMENT OF TAMIL NADU

P W. DEPARTMENT

G.O. No. / ~~B.P. No.~~	1292 — W	Press. / ~~Misc.~~
Dated	2-5-1883	~~198~~ .

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GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

General.
Account.

READ— the following letter from G. T. WALCH, Esq., Officiating Superintending Engineer, First Circle, to the Chief Engineer, Public Works Department, dated Dowlaishweram, 16th April 1883, No. 191 G.D. :—

With reference to G.O., No. 818 W., dated 13th March 1883, I have the honor to point out that it does not definitely settle the question as to whether the Canal and Ferry Funds should pay the bill for repairs objected to, though it seems to me perfectly clear they should do so.

2. If the bill is not paid, the loss to the workshops will actually injuriously affect the revenue from Capital Productive Public Works, with which the steamer has nothing whatever to do.

See G.O., No. 1941, dated 2nd March 1883.

ORDER—dated 2nd May 1883, No. 1292 W., Public Works.

The Government consider that the Ferry Fund should pay the difference between the cost of repairs executed up to date of the sale of the steamer and the amount of rent paid to the same period.

(True Extract.)

Major, R.E.,
Under Secy. to Govt., P.W.D.

To the Superintending Engineer, First Circle.
" Examiner, Public Works Accounts.
" Revenue Department.

Exd, A. F. Goodall.
Spare Copies

GENERAL.
ACCOUNT.

Govt. of {1883} Madras

PUBLIC WORKS.

Dated May, 2nd.

Recd.

G.O., 2nd May 1883, No. 1292 W.

MAY.

Steamer "Godavari"

The Ferry Fund to pay the difference between the cost of repairs to the — up to the time of her sale and the amount of rent for the same period.

1292/2

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

25th August 1881, No. 543 I.

Irrigation.

No. 67. Proceedings of Government, dated 25th August 1881, No. 543 I.

It being of much importance that Revenue Officers should understand clearly to what points their attention should be directed in forming an opinion as to the merits of Irrigation Projects on which they may have to report, and also what are the nature and extent of the revenue information which they should furnish in support of such projects, the Honorable the Governor in Council directs that careful consideration be given to the following instructions.

2. The Public Works Officer's report on a project will in all cases be forwarded to the Collector for perusal. The instructions for the preparation of projects are laid down in Chapter XVII of the Madras Public Works Code, and on all non-technical points and matters noticed in the report, or requiring to be considered, the Collector will make such remarks as he may deem necessary.

Code, paragraph 970.

3. He will give special consideration to the following points:—

1*st*, whether the extent of land intended to be irrigated is available and suitable for irrigation;

2*nd*, whether the introduction of irrigation in unirrigated tracts, or the extension of irrigation in partially irrigated tracts, is desired by the people generally;

3*rd*, whether the population of the tract to be irrigated is sufficient to allow of a reasonably rapid spread of irrigated cultivation;

4*th*, what is the extent, within the limits of the intended field of irrigation, of—

(1) occupied land held direct from Government,
(2) Government waste,
(3) Zemindari land,
(4) Inam land, respectively;

5*th*, what extent (if any) of land, included in the area to be irrigated, will be entitled to water without payment of water-rate;

6*th*, what water-rates are intended, or recommended, to be levied. When the tract is already partially irrigated, the actual water-rates obtained from such irrigation should be stated, or deduced from the consolidated assessment, if the latter prevails. Otherwise the proposals should be compared with the irrigation revenue derived from some neighbouring and similarly circumstanced tract of country;

7*th*, whether irrigation is likely to spread concurrently with the progress of the works, *i.e.*, whether it is probable that the water will be taken as it becomes available, and what will be the probable rate of growth until the full or ultimate area provided for is attained.

There is a special form for exhibiting the estimated growth of area and revenue with the consequent financial results, and this will have, in the case of all projects requiring the sanction of the Government of India, to be prepared and signed by the Collector as well as by the PublicWorks Officers;

Government of India Circular XVII of 1880, Form 3.
G.O., No. 314 I., 17th May 1880.

8*th*, whether the land compensation provision is adequate, with reference to the selling price of land as shown by the registration returns.

4. In the case of large projects the estimated area of irrigation is usually a certain proportion of the area commanded by each canal, or in each section of the tract of country to be dealt with. What the proportion is in each case has to be stated in the report, and it will be for the Collector to express an opinion as to whether, having regard to the population, their habits and circumstances, the proportion adopted is reasonable. It is not necessary that the Collector should be informed, or that he should attempt to ascertain exactly what lands in individual villages will or may be irrigated. For every canal there will be a water distribution statement, showing not only the area intended to be irrigated thereby, but giving the names of all the primary distribution channels, and the area to be supplied by each. The Collector has then to satisfy himself that approximately and generally there are these areas of suitable land available and that the people are willing to irrigate.

The areas commanded will be shown on the surveys, and their general correctness may be accepted on the responsibility of the Public Works officers. The names of the villages and their boundaries will also be indicated. Then from the area commanded in each village the Revenue Officer will be able to deduct the portions unsuitable for irrigation or entitled to free irrigation, showing both the area of the latter and the grounds of its exemption. When, as in the case of the Godávari and Kistna Deltas, a large part of the assumed proportion of area commanded is already irrigated, it will be comparatively easy to decide whether the rest, intended to be provided for, is likely to be irrigated, or whether any reduction of the total would be desirable.

5. It is of course open to the Collector to express an opinion that it would be desirable to provide for the irrigation of a larger area than may have been contemplated in the project arrangements, though generally the latter are based upon water-supply available. Otherwise it is immaterial if the area available for irrigation be found to be greater than that which the Public Works Officers have proposed to irrigate.

(True Extract.)

Under Secy. to Govt., P.W.D.,
Irrigation Branch.

To the Revenue Department.
" Board of Revenue.
To all Superintending Engineers.
To Superintendents of Works.
To the Chief Engineer for Irrigation.

Exd. E. C. Shunker.
Spare Copies

1292/3

IRRIGATION.

Govt. of {1881} Madras

PUBLIC WORKS.

To

THE REVENUE DEPARTMENT,

&c., &c., &

Dated August, 25th.

Issued

Recd. Encl.

G. O., 25th August 1881, No. 543 I.

AUGUST.

No. 67.

Irrigation Project.—Instructions issued to Revenue Officers as to the nature and extent of the revenue information which they should furnish in support of —.

1292/H

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.)

(Signed) JOHN MULLINS, Colonel, R.E.,
Joint Secy. to Govt., P.W.D.,
Irrigation Branch.

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

Exd. A. F. Goodall.
Spare Copies

CHIEF ENGINEER
APR
1881
FOR IRRIGATION

IRRIGATION.

Kw 249

Govt. of {1881} Madras.

PUBLIC WORKS.

To

THE CHIEF ENGINEER FOR IRRIGATION,

&c., &c., &c.

Dated April, 7th.

Issued

Rect. *Encl.*

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

APRIL.

Nos. 18-19.

Bawoor Project.—Papers regarding the
not return from the —, recorded.

1292/5

Index to Inspection Notes of the Chief Engineer for Irrigation, Second Circle, Salem Division, November 1880.

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1292/6

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

18th January 1881, No. 47 I.

Irrigation.

Read the following paper :—

No. 61. Endorsement of the Chief Engineer for Irrigation, dated Camp, Upper Anicut, 27th November 1880, No. 249 I.

Notes of Inspection of the Chief Engineer for Irrigation, Second Circle, Salem Division, November 1880.

Jeegoor Tank.—This tank is one of a small group of which the Hosúr tank is the terminal. According to the atlas sheet there are ten tanks above it and five below it. The water-supply is used entirely for the irrigation of the land attached to the Remount Depôt and properly therefore it would seem to be a Military work. It cannot be classed as Minor, but it might, it is thought, be handed over to the Remount Agent, and be maintained hereafter under his supervision. The bund is in good order though a little below the normal level in some parts. A new surplus channel was cut from the surplus weir at the left flank some time ago, and a part of this channel has a very steep fall, much in excess of what the soil can stand. This part of the channel is however short, and some stone has been collected and mortar prepared for constructing a drop, but the changes in the Department have interfered with the execution of the work. If a drop be built it should be placed at the lower end of the rapid, and may consist of a wall with its crest at a suitable level and with raised ends to form wings, the overfall being either on to a masonry apron at the level of bed of lower reach, or on to dry stone packed in steps of about 18 inches in height. In either case the sides of the channel must be revetted with a good gravel backing, from the drop wall to the end of the horizontal apron. Near the lower end of the cut there is a half built bridge, the design of the wings of which is indifferent. The drainage from the lands alongside the channel has formed some gullies, and a small bank near the edge of the channel would remedy this provided the water were admitted to the channel at moderate intervals, say by shoots formed with double or treble layers of turf sods. The channel indicates that not much water has passed down it, and though this tank is full there is very little water in the lower tanks. If it be decided to hand over the tank to the Remount Agent, the channel work should be completed before the transfer.

2. *Marandahully Project.*—Though the supply-channel from the Sunadakumaranaddi to the Sungumbasavan tank is in an advanced state, and could be completed in a few months, the value of work done being ... ... Rs. 38,025
and of that remaining to be done .... „ 21,474

Total „ 59,499

the Sungumbasavan tank itself is so much behind-hand, the new part of the bund north of the rocky hill in the middle being only about 3·5 feet above the sill of the

old tank sluice, or at about 1,916·50, while the top of the bund will be at 1,967·50, that it is impracticable by any small immediate expenditure to bring into use the work done during the famine. While therefore, as already directed, the estimates for—

(1) the anicut,
(2) the supply channel and its head sluice,
(3) the Sungumbasavam tank,

should be first completed, and may, when complete, be reported showing the amount of each, the amount already spent (*i.e.*, normal value of work done,) and that required to complete these items, it is not probable that any further expenditure will be recommended for sanction until the Baroor project has been completed down to the Baroor tank inclusive, together with such parts of the distribution channels as may be immediately required.

3. *General scope of project.*—The information available has enabled the following details defining the general scope of the project to be approximately settled :—

4. *Rainfall.*—The rainfall over the basin probably approximates to that in the basin of the Pooniár or Panar. The Remount Depôt at Madagiri is on the borders of the upper part of the basin, and the average rainfall there for a period of thirteen years was shown in the accompaniments to the Baroor project to be 31·79 inches, and its distribution no doubt will be very similar to that* for the Pooniár basin, viz.

* *Three Stations.* Remount Depôt. Hosúr. Krishnagiri.

	INCHES.
January to April	2·10
May to September	19·37
October to December	9·54
Total ...	31·01

The rainfall from January to April may be left out of account. That in May, 4·37 inches, will perhaps not put much water into the river, but it will do much to prepare for the cultivation. The remaining 24·54 inches may be reckoned on to cause freshes from time to time in the river. About one-fifth of this rainfall may be taken as likely to be available, and taking into account the large size of the supply-channel, which when running full will carry 1,130 cubic feet a second, it may be assumed that one-third of the supply in the river, or one-fifteenth of the 24·54 inches will be conveyed to the tanks. This will be equivalent to the channel running full for $13\frac{1}{3}$ days and will give a total supply of $4{\cdot}068 \times 24 \times 13\frac{1}{3} = 1{,}301{\cdot}76$ millions of cubic feet. Storage for 1,000 millions of cubic feet may be provided. The area of the catchment basin is, in the above calculations, assumed to be 340 square miles.

5. *Capacity of reservoirs.*—It may be assumed that the tanks will, if large enough to hold two-thirds of 1,000 millions, fill one and a half times. Consequently the storage capacity to be provided will be 667 millions of cubic feet or thereabouts.

6. *Capacity of Sungumbasuvan and Jairy Talab reservoirs.*—The Sungumbasavan tank has been designed to hold about 317 millions and the work has been partly carried out. From the shortness of bund and the absence of much cultivated land within the proposed contour it is well suited to this extent of storage. Consequently the Jairy Talab, which is the other considerable reservoir, should be designed to hold from 360 to 400 millions as may be found convenient. The highest contour taken is at 30 feet above present F.T.L., and gives a capacity of 715·60 millions ; the next contour at 25 feet, or 5 feet lower, gives 537·37 millions, so probably the new will be at about 18 feet above the present F.T.L.

Area at contour 30, 39·26 Ms. of Sqr. feet.
25, 32·03 do.

7. *Water Tower, Sungumbasavan Tank.*—The sluice to be built at the Sungumbasavan tank will have to supply the area between it and the Jairy tank, and occasionally it will be used to send on water to the Jairy Talab, but the chief part of the supply of the latter will be passed over the surplus weir of the Sungumbasavan tank.

A maximum discharge of 120 cubic feet a second will suffice for all probable demands on the sluice ; and this maximum may be provided when the tank water is at or above 1,941, or with a head of 16 feet. The floor of the sluice to be at 1,918, and the plug stone upper surface will then be at about 1,925, which will be the limit below which water cannot be drawn off. The contents of the tank below this level will be about 14·00 millions of cubic feet. The water tower at the head of the sluice to be circular with an interior diameter of 6 feet. Its height will be from the floor of the sluice $(1859{\cdot}50 + 2{\cdot}50 + 3) = 1{,}965 - 1{,}918 = 47$ feet, the depth of water above the sill (floor) at F.T.L. being $41\frac{1}{2}$ feet, and on the plug stone $34\frac{1}{2}$ feet. The thickness of the tower walls from floor to top of plug stone to be 6 feet, above the plug stone there will be no water pressure, the water level inside and outside the tower being the same. The thickness of the wall here to be $4\frac{1}{2}$ feet with an outside or face batter of 1 in 20, which will make the thickness at top $2\frac{1}{2}$ feet. The tower walls up to plug stone level to be faced with ashlar inside and burnt-stone rubble masonry outside, the hearting being of concrete ; above the plug stone burnt-stone rubble masonry throughout will do very well. The culvert side walls to be 6 feet thick to a point one-third of the distance between the tower and the puddle wall in the bund ; thence for another third 5 feet thick ; thence to the centre of the puddle wall 4 feet thick and for the rest of the distance 3 feet thick. The culvert arch to be of nine half bricks, eight, and seven half bricks in thickness in the successive lengths up to the puddle wall, and behind this five half bricks thick. The culvert to be 5 feet wide and 4 feet high to springing, with a semi-circular arch. All the rubble masonry and the brick-work to be built with hydraulic mortar. The ashlar to be laid in Portland or Morgan's cement. The water will be admitted to the tower by three openings having their sills flush with the plug stone, or at 1,925 ; width 2 feet and height to springing 2 feet ; arches semi-circular, shutters sliding on angle irons to be provided for closing these vents when the tank is low, *i.e.*, at or about 1,935. The vent between the tower and culvert to be $3 \times 2\frac{1}{2}$, and to be closed when necessary by an iron shutter sliding in an iron frame provided with V grooves, the frame being secured by bolts* to the masonry.

* About $2\frac{1}{4}$ feet long.

The platform near the top of the tower to be of wood, the beams to rest on bed stones and to have air spaces round the ends.

The plug rods to be kept in position by a collar at $4\frac{1}{2}$ feet above the plug stone, and by other collars at about 10 feet intervals.

The sketch furnished in August 1878 to Major Pennycuick not being forthcoming, and nothing having apparently been done, since the issue of instructions then given, towards the preparation of a design, another rough design has now been prepared which should be taken as a guide in making complete drawings† of the sluice.

Vide paragraph 6 of memorandum No. 42 S.L. of 13th August 1878.

† Adapted to the actual section of the bund at the sluice site.

The gear platform will be reached by stone steps projecting from the outer face of the tower, the steps to project 18 inches and to be 1 foot wide and 1 foot apart vertically,‡ and a hand rail (say of gas pipe) to be fixed to the tower wall by hold fasts placed 4 or 5 feet apart. The upper end of the rail to be connected with a lightning conductor and the lower end to be in communication with the tank water by an iron rod running down to about floor level.

‡ *i.e.*, with a rise of one foot ; the steps to be arranged with the rear edge of one step vertically under the front edge of the next step.

8. *Present state of the project works.*—The present state of the several items of the project is tolerably clearly indicated by the subjoined abstract, showing the distribution of the expenditure incurred during the famine. The sum of Rs. 3,995, which was spent after the close of the famine to enable the Sungumbasavan tank to again hold water up to the former F.T.L., is excluded, as it not only did not advance

the project work, but will hereafter entail some further expenditure, *e.g.*, in removing the rebuilt revetment of the old bund :—

Items.	Outlay * Rs.
1. Anicut on Sunadakumaranaddi	...
2. Supply channel, Sungumbasavan Tank	38,025
3. Sungumbasavan Tank	21,704
4. Channel from do.	...
5. Jairy Talab	520
6. Channel from do.	1,634
Total ...	61,883

* Normal value of work done during the famine.

Nothing has been done to the anicut ; the supply-channel has been nearly completed for 2½ miles with the exception of the rock cutting, of which a good deal remains to be done ; at the Sungumbasavan tank the foundations of the puddle wall have been laid for all but a short length between the north and south bunds, and the south bund, which was new and on a comparatively high level, has made considerable progress, but the north bund widening was commenced only a short time before the work was stopped ; a few yards only of the channel from this tank have been cut ; at the Jairy Talab a good deal of earthwork was done in strengthening the bund, but as the future capacity and F.T.L. had not, and have not yet, been settled, the work done was not in direct connection with the future section of the bund ; about 4,035 feet of the channel from this tank had been partly cut in August 1878, since which time nothing has been done, and the alignment of part of the channel will have to be revised.

9. *Baroor Project.*—This made very much better progress during the famine, and the early resumption of work is very desirable not only in order that the expenditure already incurred may be turned to some account, but that the villages affected may be benefited. The estimate, which amounts to Rs. 2,35,500, has been examined and will be submitted to Government as soon as the Collector's opinion on the project has been received. It was not until the project papers were taken up for examination that it was found that this officer's opinion had not been asked for, or the essential information regarding existing cultivation obtained.

10. *Anicut and head works on Panar or Poonidr.*—Preparations were made for commencing the anicut by preparing the rock in the bed of the river and many coping stones were cut ; the flood bank on the right bank was completed beyond the Nedingul channel ; a lime kiln of rather remarkable design was built with lime mortar instead of mud, which latter is the proper material, and some materials were collected. There is also a thatched bungalow which should be kept in repair until the project is finished. There was a good supply of water in the river on the 14th November.

11. *Baroor Tank supply-channel.*—The earthworks are nearly complete, but there is a good deal of rock to be removed though the stone stacked alongside the channel shows that a great deal has been taken out. All the cross drainage works have yet to be built, and the tanks through which the channel passes have not yet been adapted to the new conditions. The rock-cutting will take time and will have to be pushed on with as soon as sanction for the resumption of work is received. The channel work was well carried out and has stood well. Attention should be given to the disposal of the small drainages which bring a good deal of silt into the channel. A low diversion bank on the left side of the channel is generally all that is needed to fix the point at which the drainage shall enter.

12. *Baroor Tank.*—The widening of the old bund to the full section required has been completed up to the old bund level ; the new bund is considerably more advanced and at the western end is nearly complete. The western sluice has been built up to 10 feet above sill. The earthwork is well done, but the revetment does not appear to have a gravel backing, though the rules require this in all cases, and it is necessary to stability. A temporary escape has been provided at the east end. The surplus weir for the enlarged tank will be at the west end, and the excavation

for it has been partly made showing decomposed rock, which will be excellent as a foundation for masonry, but too friable to stand an overfall.

At this tank also some work had to be done to enable water up to old F.T.L. to be retained. The amount thus spent was Rs. 4,644. There will not be much to be undone when the work of enlarging the tank is resumed.

13. *Present state of the project works.*—The present state of the works is indicated below :—

Items.	Amount of Estimate.	Expenditure			Balance of Estimate.
		During Famine.*	After Famine.	Total.	
	Rs.	Rs.	Rs.	Rs.	Rs.
1. Anicut	16,898	4,613	...	4,613	12,285
2. Flood banks	2,343	1,032	...	1,032	1,311
3. Head sluice, Agaram channel...	10,667	1,194	...	1,194	9,473
4. Do. Nedingul channel.	1,071	...	...	...	1,071
5. Baroor Tank, supply channel—					
Head sluice	5,174	1,463	...	1,463	3,711
Channel	62,070	32,247	...	32,247	29,823
6. Baroor Tank	58,115	26,561	4,644	31,205	26,910
7. Do. distributaries	72,966	...	...	...	72,966
8. Land compensation	6,196	...	...	....	6,196
Total ...	2,35,500	67,110	4,644	71,754	1,63,746

* Normal value of work done.

14. *Pennagoondapuram Tank, 17th November.*—Heavy rains during the current month had nearly filled the tank and would probably have quite filled it had the sluice been allowed to discharge only the quantity required for irrigation. The tank when full will have 18 feet of water on the sluice sill, and with the surplus weir at the present level 17 feet will be retained. The depth was 15·12 on the 17th and 15·56 on the 18th. The rainfall at the tank was 0·58 inches on the 16th and 0·80 inches on the 17th.

There is at present no table of capacities of the tank at various levels, and so the water received cannot be compared with the rainfall.

The bund is in good section throughout, and does not show any sign of irregular settlements. The drains are acting freely and the quantity of leakage water is considerable ; but the water at the head of the drains is clear, and they appear to be acting efficiently in preventing saturation of the lower part of the bund. Altogether this season's trial of the tank is satisfactory and there is some reason, therefore, to hope that with care it will be fairly safe. Two of the plug holes of the sluice had become partly choked by palmyra leaves, grass, &c., large quantities of which had been washed into the tank by the recent freshes in the streams which fall into it. This rubbish was being taken out. The shutter of the lower vent not being as yet fitted with lifting gear, water cannot be discharged by this vent except when the tank is low.

The surplus channel above and below the weir has been cut through decomposed rock, and as this is tolerably hard the apron of the weir has been laid down as yet only to a width of 10 feet. It will be extended when found necessary. Along the wings it should be however now extended so as to protect their foundations and those of the returns from scour. The road from Muttoor to Samulputty Railway station crosses the crest wall of the weir obliquely. It would be better to alter it to run altogether below the crest wall. The distribution channel from the sluice is in good form so far as it goes, *i.e.*, for about half a mile. About 80 acres of, for the most part, very poor porous soil are said to be under irrigation.

The revised measurements of the bund, which are taken from the weir right wing, instead of as originally from the south end of the bund, should be laid down on

the section, which should show also the old measurement with reference to which the estimate was made out.

CAMP, UPPER ANICUT,
27th Nov. 1880.

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

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

SUBMITTED for the information of Government.

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

No. 62. ORDER THEREON, 18th January 1881, No. 47 I.

COMMUNICATED to the Superintending Engineer, Second Circle, for information and guidance.

(True Extract.)

(Signed) JOHN MULLINS, Colonel, R.E.,
Joint Secy. to Govt., P.W.D.,
Irrigation Branch.

To the Superintending Engineer, Second Circle.
" Chief Engineer for Irrigation.

Exd S. T. Austin.
Spare Copies

CHIEF ENGINEER
1 FEB
188
FOR IRRIGATION

IRRIGATION.

Govt. of (1881) Madras.

PUBLIC WORKS.

To

THE SUPERINTENDING ENGINEER,
SECOND CIRCLE,
&c., &c., &c.

Dated January 18th

Issued

Recd. *Encl.*

G. O., 18th January 1881, No. 47 I.

JANUARY.

Nos. 61-62.

Notes of Inspection of the Chief Engineer for Irrigation, Second Circle, Salem Division.—The — communicated to the Superintending Engineer, Second Circle, for information and guidance.

1292/10

GOVERNMENT OF MADRAS.

REVENUE DEPARTMENT.

6th October 1877, F. R. No. 2,208.

Famine Relief.

Read the following papers:—

No. 249. Endorsement of the Joint Secretary to Government, Public Works Department, dated 29th September 1877, No. 2,983.

Read the following letter from Major P. MONTGOMERIE, R.E., District Engineer, Salem, to Colonel J. MULLINS, R.E., Chief Engineer for Irrigation, dated 16th September 1877, No. 48 S. L.

I HAVE the honor to submit the plans, estimates, and documents, as per margin, connected with the Baroor Project in the Kistnagherry Taluq. They have been prepared by Mr. Executive Engineer Lowry with great labor and in much detail, but the project is not in that complete state in which I should have desired to submit it.

1 Detailed Estimate.
1 Abstract do.
1 Specification.
2 Reports.
1 Tin case containing plans (by banghy).

2. The work has, however, already been put in hand as a famine relief-work in accordance with the orders of Government, and as it is of the utmost importance that the project should be reviewed by you at the earliest possible date, I trust I may be excused for sending the plans and estimates exactly as they have been received.

3. The project is unaccompanied by any properly-prepared revenue statement, and no survey of the land to be irrigated has been made. It is therefore difficult, if not impossible, to ascertain accurately the return that is likely to be received from the proposed outlay.

4. The Pooniar River, although it cannot exactly be called a perennial stream, drains an area of over 2,000 square miles, and may therefore be considered to be a good source of supply, and is quite capable of irrigating the 1,500 acres proposed by Mr. Lowry, provided the water can be stored and worked off expeditiously; and there is no doubt that plenty of land is available for extra irrigation. The estimate for the project, as now proposed, amounts to Rs. 52,688-8-0, and this will yield a return of about 15 per cent.

5. The project is, however, incomplete, as no allowance has been made for improving the irrigation along the right bank of the river below the anicut, where the land is apparently more fertile and valuable than on the left bank. The F.T.L. of the Baroor tank should, in my opinion, also be raised to the level of the lower end of the supply channel, or about 9 feet above the present F.T.L.; this would increase its storage capacity by over five millions of cubic yards. No valuable land would be submerged. And the project might be extended beyond the Baroor tank, probably as far as the large Pennagoondapurum tank now being restored.

6. In conclusion I must remark, with reference to the history of this project, that although it was proposed many years ago, nothing whatever had been done towards its investigation until it was taken up in March last, *vide* page 9 of Mr. Lowry's report. In their Order in the Revenue Department, No. 735, dated 19th February 1877, Government were pleased to authorize this work (the supposed cost of it being Rs. 9,000) to "be put in hand at once as a relief-work, if, in the District Engineer's opinion, it has been properly prepared. The accurate estimates of the cost of executing this work, referred to in paragraph 6 of Mr. Wilkinson's letter, should be submitted without delay." The accurate estimates now submitted for the first time amounts to Rs. 52,688-8-0, and the project when completed will not cost less than a lakh of rupees.

7. As the work is now being vigorously prosecuted, I trust you will be so good as to return the plans and estimates, &c., with your instructions at the earliest possible date.

No. 198-I.

Note by the Chief Engineer for Irrigation.

The Baroor Project, as submitted by the District Engineer, Salem, provides for improving* an existing channel running from the Pooniar to the Moorasamputty tank a distance of $1\frac{3}{4}$ miles, for enlarging the capacity of this tank from 0·047 to 0·181 millions of cubic yards, for cutting a channel from this tank to the Poongumputty tank, which will be entered in the 7th mile, for enlarging this tank from a capacity of 0·125 to 0·558 millions of cubic yards, for continuing the channel thence to the Baroor tank, which will be reached in the 8th mile, the capacity of this tank being increased from 1·221 to 3·372 millions of cubic yards.

* This is gathered from the plan marked sheet No. 2.

2. *Work has been commenced.*—The work has, under the orders of Government, been already commenced, and the papers indicate that much pains have been bestowed upon the project. The remarks of the undersigned will, therefore, be confined to those points which it will be desirable to modify.

3. *Baroor Tank.*—The Baroor tank itself it is proposed to alter by raising the F.T.L. 3 feet only. There appears to have been no definite reason for this particular degree of alteration, and Mr. Lowry himself says that a further raising of the F.T.L. to the extent of 6 feet would be feasible; and it was because it was feared that the preparation of the requisite plans would occupy too much time that the larger capacity was not estimated for. The District Engineer recommends the greater enlargement, and says that the land which would be submerged is not valuable. The report and the references on plan, sheet No. 4, do not agree as to the capacity at different levels, but apparently the capacity at 9 feet above present F.T.L. is considerably more than double that at 3 feet above present F.T.L.

4. *Successive enlargements not advisable.*—It would not, as Mr. Lowry intimates, be a difficult thing to raise the bund again at some future time were the mode of enlargement shown on sheet 4 proper; but as the only safe plan is to put the new work on the tank side of the old bund, it is evident that each alteration would involve the reconstruction of the revetment throughout.

5. *Addition to be made to Depth.*—The enlargement now to be undertaken should therefore be such as to obviate the necessity for any future increase of capacity, and though the evidence as to the way in which the water would be utilized is somewhat indefinite, it seems probable that it will be worth while to make the tank of the larger size at once. The part of the ridge west of the tank and south of the end of the supply channel is somewhat low, and will require some raising. The new bund should be carried on a curve to the ridge, and the narrow bay to the south-west should be left outside the tank.

6. *Depth of Water.*—Under this recommendation the F.T.L. would be ... ... 112·60
Apparently the deep bed of the tank is at about (the sill levels of the sluices are not given) ... ... 94·33

Difference ... 18·27

So the depth of water will not be great, and probably the sluices can be adapted to the enlarged section of the bund; and if so, the new heads should be designed for regulation by plugs. If there be any doubt about the sufficiency of the sluices mentioned in the report as having been constructed last year, it will be necessary to build new sluices for the enlarged tanks; and this can be done after the monsoon.

7. *General dimensions of Bund.*—The top width of the bund may be 12 feet as shown in the sections.

The top of the bund should be 4 feet above M.W.L., or 7 feet above F.T.L.

Th extereior slope may be 2 to 1 as proposed.

The interior slope will depend upon the description of stone available. If it be good, large, and capable of being closely packed, a slope of 1 or $1\frac{1}{4}$ to 1 will suffice, and the stone should be laid at right angles to the slope with a thickness of 2 feet, and a substantial backing of gravel concrete. If the stone be irregular, a slope not steeper than $1\frac{1}{2}$ to 1 will be more suitable.

8. *Puddle-work.*—The puddle-work will depend much upon the composition of the bund, and the nature of the surface soil and sub-soil. If the old bund be of water-tight material, and if it rests on water-tight soil, no puddle will be necessary where the bund will be only enlarged and on the inner side: otherwise, after the revetment has been stripped a trench for a regular puddle wall should be cut so as to make the centre line of this wall coincide with the front edge of the bund at top. In any case it will be advisable to provide a puddle wall for the new bund from the north-west corner of the old bund to the ridge, and the wall must run at least 9 feet into the old bund to ensure a safe junction.

9. *Site for Surplus Weir, Baroor Tank.*—A new site will have to be selected for the weir where the ground is at or near F.T.L., and manifestly the line of outfall must be investigated and its circumstances put on paper. The design for the weir shown on sheet No. 4 is not well suited to any circumstances. If a retaining wall be required at all, it would need the protection of a dry-stone apron. The section is altogether slight for a weir to discharge 3 feet of water. As to the soil, &c., there is no information.

10. *Supply Channel.*—The upper part of the channel is to be 20 feet wide, with side slopes of $1\frac{1}{2}$ to 1 where not in hard soil, and a depth of water of 3 feet ordinarily, and $4\frac{1}{2}$ feet as a maximum when receiving upland drainage. The fall is to be 2 feet a mile. The ordinary full discharge is estimated by Mr. Lowry at 216·09 cubic feet a second. The actual discharge will probably be about two-thirds of the quantity named. The acreage anticipated being 1,500, the smaller quantity will be likely to suffice; but before the details of the anicut are finally decided upon, it will be advisable to know what depth and quantity of water it will be desirable to make available, as a small increase in the height of the weir and of the crest levels of the surplus works of the channel would allow of a considerable increase in the quantity of water conveyed.

11. *Surplus Weirs of Channel.*—Separate surplus weirs will not be needed for each petty drainage of $\frac{1}{8}$ to $\frac{1}{4}$ of a square mile. A re-arrangement of the works of this class will therefore be desirable.

12. *Supply Channel Head Sluice.*—The design is not at all appropriate, neither is it complete. The shutter platform should be above future M.F.L., which may,

it is thought, if present M.F.L. be 140·07, be taken as not likely to exceed 142·50.* The shutters will then be much too long to be conveniently handled by lascars and they should be gate shutters worked by screws, the bearings for the slide being of angle iron. It will then not be desirable to make the width of the vents so small as 4 feet, and instead of five vents of 4 feet, four of 6 feet may be substituted.

* *i.e.*, with crest of weir at 132·57. About 14 feet.

13. *Anicut.*—The greater part of the anicut will be founded on rock, some of which, however, judging from plan, sheet No. 5, is not well adapted without preparatory excavation to carry masonry. The crest wall will not need bolting down as proposed. The coping, if of thin slabs, may require to be thus secured, and if so, the bolts and straps should be not far from the upstream edge of the coping. The bolts need not be screw bolts, but may be fastened with washers and cottars. The cross section of the anicut where not on rock is not suited to any circumstances, but in the absence of any information as to what the soil is, a proper section cannot be given; though it is probable that a horizontal apron below the retaining wall is essential, and that there will have to be a retaining wall with its top at about 125·00.

Under sluices may and probably will be desirable. They will not need a bridge to allow them to be reached, but may be worked from the crest of the anicut.

14. The designs for head sluices for the Agaram and Nedigal channels on the right bank require revision.

* The total Abstract for Baroor Project.

15. The items of the estimate are—

	Earthworks.	Masonry and other works.	Total.
	Rs.	Rs.	Rs.
Anicut	1,300	7,276	8,576
Head sluice	...	1,052	1,052
Channel	†25,635	1,200	26,835
Escapes	203	875	1,078
Baroor tank*	6,525	800	7,325
Sand sluice	...	2,169	2,169
Poongumputty tank	3,755	160	3,915
Moorsamputty do.	710	150	860
	38,128	13,682	51,810
Land compensation ...	...	...	878½
			52,688½

* Will probably be much increased.
† About 11,200 Rupees rock cutting.

16. *Size of Plans.*—In his report Mr. Lowry alludes to 5 feet extension paper on which he would have drawn his plans had he possessed a supply of that material. He should remember that the largest plans receivable in this office are 30 × 22 inches, and that huge plans cannot even be looked at. Several of the plans forwarded with this project are much too large, and the jumbling up of all sorts of details, as on sheet No. 2, is a great mistake. Kaleidoscopic effects are not desirable.

17. Mr. Lowry at the end of his report expresses a hope that the censure passed upon him may be withdrawn. He apparently refers to G.O., Revenue Department, No. 2,535, 18th August 1877, and perhaps to No. 228-I, 9th August

1877. The District Engineer's letter indicates that the ideas of the Revenue Officers were very vague as to the amount of work involved in the completion of the projects.

18. Probably with the enlargement of the Baroor tank, so as to make F.T.L. 9 feet higher than at present, the earthworks including revetments, turfing, &c., will amount to about 48,000 Rupees, and will afford employment to about 6,000 coolies for three months.

Fort St. George,
26th September 1877.

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

Transferred to the Additional Secretary, Revenue (Famine) Department, for disposal.

(Signed) JOHN MULLINS, Colonel, R.E.,
Joint Secretary to Government, P.W.D.

No. 250. From Major P. MONTGOMERIE, R.E., District Engineer, Salem, to Colonel J. MULLINS, R.E., Chief Engineer for Irrigation, dated 25th September 1877, No. 52 S. L.

2 Revenue Statements.
1 Statement of Compensation.

In continuation of my No. 48, dated 16th September 1877, I have the honor to forward the revenue, &c., statemenst of the Baroor Project.

ENCLOSURE No. 1.

STATEMENT showing the extent of Cultivation of Lands watered by the River Channel falling into the Baroor Tank and other Tanks supplied with water by the said Channel for Fasli 1286.

Name of Village.	Name of Construction.	Ayacut.				During Fasli 1286.								Dry land to be taken hereafter under wet.		Remarks.
						Cultivated.				Not cultivated.						
		Area.		Assesment.		Area.		Assessment.		Area.		Assessment.		Area.		
1	3	3		4		5		6		7		8		9		16
		ACS.	CTS.	Rs.	A. P.	ACS.	CTS.	Rs.	A. P.	ACS.	CTS.	Rs.	A. P.	ACS.	CTS.	
Baroor	Big Tank...	286	51	1,503	8 0	275	75	1,483	9 0	10	82	19	15 0	283	47	
Through the leakage of this	Tank... ...	52	43	360	1 0	42	52	236	11 0	9	91	33	6 0	...	...	
Puliyoor, by the support of the Pungumputty.	Jamalari Channel Tank.	21	93	107	6 0	13	93	97	2 0	2	95	10	4 0	9	13	
Morasaputty	Do. ...	59	43	364	6 0	59	43	364	6 0	...	...	...	...	...	...	
Poongumputty	Channel ...	...	...	...	...	...	...	...	...	...	...	...	...	66	6	
Chellakuttamputty ...	Do. ...	...	...	...	...	...	...	...	...	...	...	...	...	109	17	
Marcothari	Do. ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Chellumputty	Do. ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Velanga Moody	Do. ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Varpatty	Do. ...	133	22	749	8 0	133	22	749	8 0	...	...	...	...	...	...	
Kavoyputty	Do. ...	...	...	...	...	...	...	...	...	...	...	...	...	5	13	
	Total ...	553	53	2,984	13 0	529	95	2,941	13 0	23	68	53	9 0	471	95	

The land to be taken hereafter 471 acres.

Water-rate revenue Rupees 2,399-1-0.

SALEM,
16th May 1877.

(Signed) T. PRITCHARD,
Deputy Collector,
for Collector.

Statement showing the Ayacuts, &c., of the undermentioned Tanks prepared in accordance to the instructions contained in Sub-Collector's No. 335.

Names of Tanks.	The present extent of Cultivation and Assessment.			Expected extent of Cultivation and increased Assessment.		Remarks.
	ACRES.	CENTS.	Rs. A. P.	ACRES.	CENTS.	
1. Morasarahully Tank Channel.	52	76	325 3 0	...	...	
2. Maroothary Tank	60	20	432 11 0	...	...	
3. Velenga Moodey Tank	98	72	582 14 0	...	...	
4. Poongumputty Tank	12	22	73 5 0	...	...	
5. Baroor small tank	104	14	593 11 0	...	...	
6. Do. large do.	254	15	1,387 8 0	0	23	
7. Jamboo Tank	9	26	34 4 0	19	75	In case a channel were to be cut, more lands will come under cultivation.
8. Wodengai Tank	3	91	19 9 0	...	...	
9. Thippanoor do.	17	10	86 5 0	15	0	
10. Bantharahally Tank	65	18	362 1 0	20	0	

31st August 1877.

(Signed) A. PRABALANADUN,
Tahsildar.

(True Translation.)

(Signed) P. MONTGOMERIE, Major, R.E.,
District Engineer.

Statement of Lands requiring Compensation to be paid in the execution of Baroor Channel.

Number and Name of Village.	Numbers.	Alphabet.	Sort.	Extent.	Amount.	Puttadar's Name.	Remarks for the Compensation Amount.
				ACS. C.	RS. A. P.		
No. 46. Marcothary Tank.	56	...	...	0 5	.....	.....	Waste land. Pathway.
	6	...	8	0 40	0 5 0	Mottai *alias* Mooneyen	Rupees 15
	7	...	8	0 23	0 3 0	Do. do.	
	8	B	8	0 38	0 5 0	Venkataramien, Jattavullahar	,, 20
	9	A	8	0 20	0 3 0	Do. do.	
	10	...	7	0 55	0 9 0	Veerun and Cuddathoor Arconachellum.	,, 15
	11	...	8	0 25	0 3 0	Venkatachellum	,, 8
	15	...	8	0 55	0 7 0	Vadi Woodayan	,, 25
	16	...	8	0 35	0 4 0	Do.	
	47	...	8	1 20	0 15 0	Arconachellian 1, Vathachellian 2 ...	,, 15
	45	...	7	0 48	0 8 0	Poosawri Venkatachellum	,, 10
	44	...	12	0 30	0 1 0	.....	Uncultivated land or (Tharus.)
	29	...	12	0 33	0 1 0	.....	Do.
	30	...	8	0 15	0 2 0	Nagarasumpatty Thammatha Chetty ...	Rupees 3.
	33	...	12	0 43	0 2 0	.....	Uncultivated land or (Tharus.)
	34	...	12	0 45	0 2 0	.....	Do.
	...	...	...	6 30	4 6 0		Total Rupees 111
No. 53. Sollumpully.	5	...	12	0 35	0 1 0	Narasinga Row	Rupees 10
	6	A	7	0 40	0 6 0	Do.	
	14	...	...	0 48	.....	.....	Waste land.
	39	A	7	0 75	0 12 0	Kallithan Parasdorama Chetty	Rupees 15
	37	...	12	0 72	0 3 0	Marcothary Venkatachellum	,, 10
	36	...	8	0 82	0 10 0	Narcogounden	,, 5
	35	...	8	0 6	0 1 0	Moothi	,, 2
	24	...	7	0 17	0 3 0	Toti Ponnun	
	25	...	7	0 42	0 7 0	Do.	,, 15
	26	...	7	0 26	0 3 0	Moothi	
	32	...	8	0 65	0 8 0	Do.	,, 15
	31	...	7	0 62	0 10 0	Surondaraman 1, Thandroyan	,, 10
	33	...	7	0 47	0 8 0	Munien 1, Vadi 2	,, 7
	147	...	7	0 82	0 13 0	Colunthay	
	146	...	7	0 27	0 4 0	Do.	,, 15
	144	...	7	0 38	0 6 0	Do.	
	...	...	...	7 68	6 1 0		Total ... 84
	...	...	...	7 26	6 1 0		
	...	...	...	0 48	.....	.....	
Total ...	...	...	...	7 68	6 1 0		
No. 47. Kolavay Hully.	3	...	7	0 38	0 14 0	Puttalumman Inam	Rupees 25
	1	...	7	0 58	0 9 0	Peroomaloo Inam	,, 15
	12	A	7	0 50	0 8 0	Naranappan *alias* Unnien	,, 10
	2	...	8	0 55	0 7 0	Sashgari Iyen	,, 15
	...	...	...	2 51	2 6 0		Total ... 65
Inam ...	...	...	...	1 5	0 15 0		
	...	...	...	1 46	1 7 0		
Total ...	...	...	...	2 51	2 6 0		
No. 48. Morasur Hully.	10	...	...	2 25	.....	.....	Waste land. Tank.
	26	...	7	0 50	0 8 0	Sashagherry Iyen	
	25	...	7	0 53	0 9 0	Do.	Rupees 30
Cultivated ...	...	...	...	1 3	1 1 0		
Waste land ...	...	...	...	2 25	.....	.....	
Total ...	...	...	...	3 28	1 1 0		
No. 45. Valanga Moody.	117	...	12	0 50	0 2 0	Sheristadar Sawmien	
	115	...	12	0 25	0 5 0	Do.	Rupees 40
	114	...	6	0 90	1 2 0	Do.	
	111	...	...	0 8	.....	.....	Waste land
	106	...	8	0 59	0 6 0	Sashagherry Iyen	
	105	...	12	0 13	0 1 0	Do.	
	106	...	8	0 20	0 3 0	Do.	Rupees 60
	104	...	12	0 50	0 2 0	Do.	
	99	...	6	0 65	0 13 0	Do.	
	100	...	6	0 50	0 10 0	Parasooramun 1, Cooppun 2	,, 10
	91	...	6	0 35	0 7 0	Thandaven and others	
	92	...	6	0 67	0 13 0	Do. do.	,, 25
						Do. do.	

Statement of Lands requiring Compensation to be paid, &c.—(*Continued*).

Number and Name of Village.	Numbers.	Alphabet.	Sort.	Extent.	Amount.	Puttadar's Name.	Remarks for the Compensation Amount.
				ACS. C.	RS. A. P.		
No. 45. Valanga Mudy.—(*Continued*).	93	...	6	0 78	1 9 0	Iroosan and others	Rupees 10
	94	...	6	0 40	0 8 0	Do. do.	,, 2
	84	...	6	0 8	0 2 0	Nunjun	
	73	...	7	0 88	0 6 0	Govinthagounden	
	72	...	7	0 83	0 13 0	Do.	,, 35
	66	...	7	0 28	0 5 0	Do.	
	65	...	7	0 17	0 3 0	Do.	,, 16
	64	...	6	0 25	0 5 0	Sashagherry Iyen	Waste land.
	62	...	...	0 7	.....	.....	Rupees 8
	48	...	12	0 17	0 1 0	Soobroya Chetty	
	61	...	6	0 43	0 9 0	Chellen 1, Patton 2	,, 20
	59	...	6	0 60	0 12 0	Do. do.	
	60	B	6	0 18	0 4 0	Do. do.	,, 25
	57	B	8	0 53	0 6 0	Moothoor Kistnachar and others. Inam.	,, 20
	56	B	8	0 69	0 8 0	Sashagherry Iyen and others	Waste land. Pathway.
	135	...	...	0 37	.....	.....	
	142	...	7	0 68	0 11 0	Lokara Inam Chennacharry	Rupees 20
	136	A	12	0 10	0 1 0	Do. do.	Waste land.
	136	B	...	0 18	.....	.....	
	137	B	8	0 28	0 3 0	Toti Chinnappien	Rupees 20
	138	B	8	0 30	0 4 0	Do.	
	...	...	...	13 8	12 5 0		Total Rupees 311
Cultivated ...	...	...	...	10 38	10 11 0		
	...	...	...	0 70	.....	.....	
Inam ...	...	...	...	2 0	1 10 0		
Total ...	...	...	...	13 8	12 5 0		
No. 46. Baroor Hully.	2	...	14	0 9	0 4 0	Chenroyen and Ramasawmien	Rupees 8
	3	...	10	0 15	0 14 0	Do. do.	Channel.
	4	...	...	0 37	.....	.....	
	6	...	10	0 20	0 2 0	Poottooyarcoothagounden	Rupees 5
	7	...	8	0 1	0 1 0	Do. do.	,, 3
	8	...	7	0 16	0 2 0	Ramalinga Nainar	Channel.
	9	...	...	0 30	.....	.....	Rupees 3
	10	...	10	0 21	1 4 0	Ramalinga Nainar	Waste land.
	11	...	...	0 1	.....	.....	Do.
	1	...	...	0 19	.....	.....	Rupees 15
	223	A	8	0 20	1 1 0	Phir Sing	Channel.
	...	B	...	0 28	.....	.....	
	220	...	8	0 19	1 5 0	Ramalinga Nainar	Rupees 15
	221	...	8	0 10	0 11 0	Do.	,, 10
	219	A	8	0 8	0 9 0	Boothi Sing	Channel.
	..	B	...	0 29	.....	.....	
	28	...	7	0 5	0 1 0	Ellathoor Royeppan, &c. Inam	Rupees 15
	29	...	7	0 12	0 2 0	Do. do.	,, 5
	218	A	7	0 7	0 1 0	Buthi Sing	Channel.
	...	B	6	0 11	.....	.....	Rupees 5
	212	A	14	0 11	0 6 0	Seetharamien. Inam	
	213	A	8	0 12	0 13 0	Royappa and others. Inam	,, 35
	214	...	8	0 40	2 13 0	Do. do.	
	210	...	10	0 10	0 10 0	Vencata Row	,, 15
	215	A	10	0 42	2 8 0	Do.	
	239	A	13	0 10	0 6 0	Perumaloor Inam	,, 3
	...	B	...	0 19	.....	.....	Channel.
	195	...	14	0 15	0 8 0	Veeraboy	Rupees 3
	241	B	8	0 1	0 1 0	Kavariputtanum Ramasoobien	,, 1
	242	A	13	0 7	0 4 0	Kistnien 1, Soobba Row 2	,, 8
	...	B	...	0 18	.....	.....	Channel.
	194	...	7	0 20	0 3 0	Hira Boy	Rupees 2-8-0
	243	A	8	0 10	0 11 0	Peekattoo Ramun 1, Theerthagiri 2 ...	,, 4.
	...	B	...	0 18	.....	.....	Channel.
	194	...	7	0 20	0 3 0	Hira Boy	Rupees 3
	243	A	8	0 10	0 11 0	Peekattoo Ramun 1, Theerthagiri 2 ...	,, 4
	...	B	...	0 10	.....	.....	Channel.
	190	...	6	0 5	0 1 0	Hira Boy	Rupees 2-8-0
	244	A	13	0 2	0 1 0	Rasawmi Iyen	,, 2
	...	B	...	0 3	.....	.....	Channel.
	245	A	14	0 4	0 2 0	Hira Boy	Rupees 2
	...	B	...	0 30	.....	.....	Channel.
	246	...	8	0 40	2 13 0	Sashagherry Iyen	Rupees 20
	274	B	...	0 18	.....	.....	Channel.
	...	A	14	0 30	0 14 0	Hira Boy	Rupees 15
	276	A	10	0 19	1 2 0	Woomam and others. Inam	,, 25
	...	B	...	0 14	.....	.....	Channel.
	186	A	10	0 35	2 2 0	Woomam and others. Inam	Rupees 30
	183	...	6	0 8	0 2 0	Hira Boy	,, 3

Statement of Lands requiring Compensation to be paid, &c.—(*Continued.*)

Number and Name of Village.	Numbers.	Alphabet.	Sort.	Extent.	Amount.	Puttadar's Name.	Remarks for the Compensation Amount.
				ACS C.	RS. A. P.		
No. 49. Baroor Hully—(*Contd.*)	278	A	10	0 40	2 6 0	Puttalumman. Inam	Rupees 35
	273	A	10	0 12	0 11 0	Do. do	Channel.
	...	B	...	0 30	.....	.....	Rupee 1
	279	A	7	0 5	0 1 0	Morasan putty Mocnien	,, 8
	282	A	8	0 30	0 4 0	Annayer	Channel.
	...	B	...	0 30	.....	.....	Rupees 3
	...	C	8	0 14	0 2 0	Do.	
	...	...	...	9 42	27 15 0		Total Rs 277-8-0
Cultivated...	...	...	...	4 40	19 15 0		
	...	...	...	3 62	.....		
Inam	...	...	...	1 40	8 0 0		
Total ...	...	...	...	9 42	27 15 0		
Total for six Agraharums.							
Cultivated...	...	..	...	98 80	42 11 6		
Inam	...	...	...	4 86	11 1 0		
	...	...	...	8 61	0 6 0		
Total ..	...	...	...	42 27	54 2 0	Total Compensation ...	Rupees 878-8-0

4th August 1877.

(Signed) S. KRISTNA ROW,
Revenue Inspector and Range Officer.

(,,) A. PRABALANADUN,
Tahsildar.

(True Translation.)

(Signed) P. MONTGOMERIE, Major, R.E.,
District Engineer.

No. 200-I.

SUBMITTED to Government in continuation of Note No. 198-I of the 26th September 1877.

FORT ST. GEORGE,
28th September 1877.

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

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

No. 2,984.

TRANSFERRED to the Additional Secretary to Government, Revenue (Famine Department, in continuation of endorsement, dated 27th instant.

29th September 1877.

(Signed) J. MULLINS, Colonel, R.E.,
Joint Secy. to Govt., P. W. D.

No. 251. ORDER THEREON, 6th October 1877, F. R. No. 2,208.

Miscellaneous.

THE Note of the Chief Engineer for Irrigation will be communicated to the District Engineer of Salem for his information and guidance.

2. Care should be taken that the suggestion regarding the enlargement of the Baroor tank, by increasing its capacity so as to obviate the necessity for any subsequent increase, is acted on, by making the tank of the larger size recommended by the District Engineer.

(True Extract.)

(Signed) J. H. GARSTIN,
Additional Secretary to Government.

To the Chief Engineer for Irrigation, with ten enclosures.
,, the Public Works Department.
,, the District Engineer, Salem.
,, the Collector of Salem.
,, the Board of Revenue.

Exd. A. F. Goodall.

CHIEF ENGINEER FOR IRRIGATION

Govt. of (18-7) Madras.

REVENUE.

To

The CHIEF ENGINEER for IRRIGATION,

&c., &c., &c.,

Dated October 6th.

Printed 10th.

Read.

Endorsed.

G.O. 6th October 1877, F. R. No. 2,208.

OCTOBER.
Nos. 249—251.

Barur Project.—Communicating to the Director of Public Works the Chief Engineer of Salem Note by the Chief Engineer for Irrigation on the —, and stating that care should be taken that the suggestion regarding the enlargement of the Barur tank is not lost sight of by making the bund the largest size recommended by the District Engineer.

GOVERNMENT OF MADRAS.

REVENUE DEPARTMENT.

23rd July 1878, F.R. No. 1,600.

Famine Relief.

Read the following paper :—

No. 390. Endorsement of the Chief Engineer for Irrigation, dated 13th July 1878, No. 105-W.

Read the following letter from Major J. PENNYCUICK, R.E., District Engineer, Salem, to Lieutenant-Colonel J. MULLINS, R.E., Chief Engineer for Irrigation, dated 28th June 1878, No. 42-S.I. :—

I HAVE the honor to submit the following report regarding the Barur and Pennagondapuram works which I have just visited in company with Mr. Lowry.

2. BARUR—*Head Works.*—The excavation for the anicut and head sluices is in progress, and materials for the manufacture of concrete are being prepared; it is expected that the actual execution of the anicut will be begun about the middle of next month.

3. *Main Channel.*—Three-fourths of the earthwork is completed, and about one-fourth of the blasting; the latter will, however, not take long to complete. The masonry work is very backward, and I have urged the Executive Engineer to press them on. The plans for the latter are prepared, and materials in course of collection, so that it is hoped that when once fairly started their progress will be rapid.

4. *Barur Tank.*—The progress here is considerable, a great portion of the extension having been brought up nearly to the level of the old bund; the revetment of the latter has been stripped so that it is now ready for widening, and the principal portion of the available labor will be concentrated on this, as it is not desirable to proceed with the raising either of the old or new portion until the former has been widened out to its full extent.

5. All work is being done departmentally except the stone work of the Barur tank for which favorable arrangements have been made with a contractor. The quality of the work done is good, and the execution careful. Instructions have been given upon certain minor points of detail which require correction.

6. Considerable progress has been made with the preparation of plans, those for nearly the whole of the works as far as the Barur tank having been drawn up and corrected by myself so that they only require fair-copying and the preparation of the estimates; but there will be some delay before they can be sent in, owing to the difficulty of getting competent draftsmen at all, and of getting draftsmen of any sort, competent or otherwise, to remain for more than a short time; every man who has been employed yet has fallen sick or resigned his post.

7. The expenditure on this work amounted to Rs. 33,051 up to the 15th instant, and by the end of the current month will reach Rs. 43,000, the sanction granted in G.O., No. 2,208 (F.R.) of 6th October 1877 being only Rs. 52,688; the present expenditure is at the rate of about Rs. 5,000 weekly (there being upwards of 4,000 coolies on the work), and I request therefore that a further grant of Rs. 35,000 may be made to carry us on to the end of August.

8. It was of course a matter of certainty from the first that the estimate of Rs. 52,000 must be exceeded, as it never professed to be more than an approximation, and included no provision for the excess due to the employment of famine labor, feeding of children, &c.; moreover, the scope of the work has been considerably increased in accordance with your instructions, with great advantage. The Barur tank alone as at present designed will contain 24 millions of cubic yards, and as the water-supply will be ample to fill this three times over, it is obvious that this tank alone would give a good return on an expenditure of considerably over a lakh of Rupees. Moreover there is room for a considerable extension of irrigation on the right bank of the river which has not as yet been taken into consideration at all, though it has been kept in view in working out the details of the head works.

9. The financial question will of course be gone into thoroughly when the estimates are sent up; it is merely alluded to now to guard against its being supposed that the increase of cost over the original approximate estimate means a reduced return; on the contrary the extended scope of the work will be most advantageous and the extra expenditure (leaving out of course charges due to gratuitous relief, &c.,) will be thoroughly remunerative, and there is every reason to believe that the project as a whole will be a highly satisfactory one, more so I expect than any other in the district.

10. *Pennagondapuram.*—The progress here is good, more than three-fourths of the earthwork being completed, the sluice tunnels are under construction, and the excavation for the escape is in progress; the revetment is very backward.

11. The main distribution channel has been marked out, and it is found that land sufficient to cultivate the whole water-supply can be obtained on the right bank of the stream which feeds the tank. This is a great advantage as it will save the necessity of crossing the tank escape or the Muthoor river which would have to be done if land on the left bank were to be irrigated.

12. Some want of management has been displayed regarding the executive arrangements, but this has been caused mainly by the frequent changes rendered necessary by sickness amongst the subordinate staff; and will not, it is hoped, recur under the present arrangements.

13. The remarks made with regard to the plans and estimates of the Barur Project apply to this work also, though the actual progress in their preparation has not been as great as in the former case.

14. As you are aware the scope of this work has been increased by an addition to the height of the bund of five feet above that originally intended, and the cost of the work will be correspondingly increased, but the increase will be advantageous. As it is the tank is much too small for its water-supply.

15. Out of the original sanction of Rs. 29,060, it is stated that Rs. 23,000 had been expended up to the 9th instant, and the probable further expenditure to the end of August may be taken at Rs. 20,000. An additional grant of Rs. 14,000 will therefore be required. The number of coolies now on the work is about 1,600.

16. On the whole I consider the progress made on these two works, Barur especially, to be satisfactory and creditable to the Executive Engineer in charge of the Division. He has had great difficulties to contend against, and has moreover had peculiar personal reasons for discouragement.

SUBMITTED for orders.

2. It is to be regretted that plans and regular estimates for the Barur and Pennagondapuram Projects in Salem have not been completed, but the circumstances have been adverse.

3. The District Engineer asks for further credits for these projects as follows:—

	RS.
Barur Project	35,000
Pennagondapuram	14,000

and it is recommended that these should be granted.

(Signed) J. MULLINS, Lieut.-Colonel, R.E.,
Chief Engineer for Irrigation.

No. 391. ORDER THEREON, 23rd July 1878, F.R. No. 1,600.

Miscellaneous.

THE additional grants for the Barur and Pennagondapuram works recommended are sanctioned.

2. The Governor in Council is glad to learn that their progress has on the whole been so satisfactory and considers the result is creditable to the District Engineer and to the Executive Officer and staff employed on the works.

(True Extract.)

(Signed) J. H. GARSTIN,
Additional Secretary to Government.

To the Chief Engineer for Irrigation.
,, the Public Works Department.
,, the Financial Department.
,, the Board of Revenue.
,, the Collector of Salem.
,, the Examiner of Public Works Accounts.
,, the Accountant-General.

Exd. T. O'Connor.

Index to Memorandum by the Chief Engineer for Irrigation, No. 134 W, 16th August 1878.

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1292
18

Govt. of (1878) Madras.

REVENUE.

To

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

Dated July 23rd.

Printed 30th.

Read.

Extract

G.O., 23rd July 1878, P.P., No. 1,600.

JULY.

Nos. 390-391.

Baroor and Tenmangalapuram Projects in Salem District.—Sanctioning the additional grants recommended by the Chief Engineer for Irrigation for the—, and considering the progress made on these works creditable to the District Engineer and to the Executive Officer and staff employed thereon.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

4th October 1878, No. 779 I.

Irrigation.
Account.

Read the following paper :—

No. 134 W.

No. 39. IRRIGATION MEMORANDUM.

THE following notes on the Baroor and Marandahully projects, undertaken for Famine Relief purposes in the Salem District and inspected in August, are submitted for the information of Government.

2. BAROOR PROJECT.—The water-supply for this is to be taken from the Pooniar which is to be dammed by an anicut, for the construction of which the site chosen near the village of Nedangul is favorable, a rock foundation being obtainable except perhaps for a short length at the right flank, and the left flank terminating at a mass of rock with a nearly vertical face and of much greater height than maximum flood level. The area of the catchment basin of the Pooniar above this point was stated in the report on the project to be 2,267 square miles, but the District Engineer makes it 1,980 square miles. A large part of the basin in Mysore is occupied by tanks and the ordinary water-supply therefore will be that due to the free basin only, which has not yet been taken out. There was a considerable quantity of water in the river on the 6th—7th August. The project as at present undertaken consists of an anicut and head works, a channel on the left bank of the river about $7\frac{1}{4}$ miles long, which passes through two small tanks by the way and discharges into the Baroor tank, which was originally proposed to be enlarged from a capacity of 1·221 millions of cubic yards to 3·372 millions, but is now intended to hold $24\frac{1}{2}$ millions.

In the future it is proposed to extend the supply of river water to other tanks lower down and also to greatly extend the irrigation under a channel* on the right bank which has its head near the anicut site.

* Agaram Channel.

3. *Anicut.*—No constructive work at the anicut itself has been commenced. A considerable quantity of material especially for concrete has been prepared also coping stones, mill stones, &c., and the blasting out of rock for the foundations of the weir has made some progress, but it will be a considerable time before the foundations can be laid. It may be noticed that when the rock-blasting of boulders has been done, and the more solid rock has to be benched out to form a trench for the foundation, no deep holes or considerable charges of powder should be used, but the bores should be of small diameter, inclined at an angle of about 45 degrees, should have a line of least resistance of $4\frac{1}{2}$ to 6 inches, and should be about 9 inches apart. Then a sufficiently regular bed will be obtained and the rock will not be shaken or cracked. The detached rock which has to be entirely removed can be treated with charges suited to the circumstances, as their effect will not extend beyond the bed of the boulder.

The anicut below the coping stones will consist of a facing on either side of rubble (burnt) stone and a hearting of concrete.

Granitic rock or gneiss of many different qualities is abundant in the neighbourhood, and a mill stone 6 feet in diameter and of nearly 15 inches average thickness

has been prepared at a cost of Rupees 20-12-0, and the texture of the stone throughout is very regular.

Right Flank and Head Sluice.—No complete design for the right flank of the anicut and for a head sluice for the existing channel having been prepared, and it being necessary that this should be done at once to admit of the excavations being made for the foundations, &c., a design adapted to the circumstances and allowing for an increased water-supply* to the channel was drawn up, leaving the depth of foundations only to be settled when the nature of the sub-soil or depth of rock surface below ground-level has been ascertained.

Agaram Channel head.
* Sluice 2 vents 6 × 4.

The flood bank on the right side of the river has with the exception of revetment been completed as far as can be done until the masonry works are well advanced. The left flood bank has not been begun.

Flood levels.—The present maximum flood level with the river in its natural state is said to be 140·07. The crest of the anicut is to be 134·50; the maximum flood discharge is calculated at 86,000 cubic feet a second, and the afflux caused by the dam is expected to be not more than 3·25 feet. If the normal flood level has been under-estimated the afflux will be less, but the water level above the weir may be higher; the top of the wings, flood banks, &c., has been fixed at 149·00 which will leave a sufficient margin for safety. It would be an unnecessarily large margin could the normal maximum flood level be relied on, but experience has shown in so many instances that about maximum floods no trustworthy evidence is obtainable, and it is prudent, therefore, to provide amply for safety.

	140·07
	3·25
	143·32
	149·00
Margin ...	5·68

4. *Baroor Channel, Head Sluice.*—This the left bank channel will have its head sluice placed between two masses of rock, that on the right being much higher than its roadway. Some excavation for the sluice has been commenced, but the design has not yet been prepared. The arrangements will be simple as there will be rock foundations and the sluice should cost but little. It will have 3 vents of 6 feet by 5 feet, and, with the exception of the wings and height of vent, the masonry above sill level will be arranged as in the design for the head sluice on the other bank of the river.

The sill will be at	128·50
„ shutter platform	145·00
„ roadway	149·00

Channel.—The bottom width of the channel above the Moorsamputty tank at the lower end of the 2nd mile is to be 20 feet, and below that place 18 feet; side slopes generally $1\frac{1}{2}$ to 1. The soil is, with the exception of a few short lengths, either sound or more or less decomposed granitic rock, and it became necessary to fix the normal depth so as to avoid too high a velocity for the soil which is not very stable. A depth of 5 feet will give a velocity of about 2·76 feet a second, and this has been taken as the normal depth and the height of the crust of surplus weirs above bed level. The discharge where the section of the channel is normal will be ·379 cubic feet a second, and the tank would be filled by this in 20·15 days, so the capacity of the channel will be very ample. 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 of 2 feet on each side has been left. The waste weirs will be calculated to discharge the greatest quantity coming in from upland drainage with a depth of 2 feet going over, so the maximum depth of water in the channel may reach 7 feet. At 7 feet above bed level berms 7 feet wide have been given and the top of the banks is 10 feet above bed level or 3 feet above maximum water level. The arrangement with the upper berm of 7 feet is an expensive one where the cutting is insufficient for the banks, elsewhere it is unobjectionable. Provision will have to be made for the drainage of the 7 feet berms or they will lead to guttering of the channel slopes.

A large proportion of the total excavation has been completed, but much blasting and rock cutting has yet to be done and it will take a long time to complete this part of the work. The data for comparing the total quantity of rock blasted up to date with the cost were not available, but as much of the rock so removed has been stacked there will be, it is hoped, little difficulty in arriving at a conclusion, and for the future the cost of each month's work or the rate for work in each month should be ascertained. Without some such guide it is not practicable to secure due economy, while if the cost in various places be ascertained and compared the best mode of working will soon be deduced. To get a cubic yard of stone with the smallest number of shots, the shortest total depth of bore hole, and the least expenditure therefore of time and labor is the object to be kept steadily in view. Mr. Lowry, the Executive Engineer, states that the cost of boring a foot of $1\frac{1}{2}$ inches hole is $2\frac{1}{2}$ to 3 Annas, and this is pretty nearly the task rate at Sunganbasavan. This work requires more attention than can well be given to it, good superintendence being very scarce. Some large crowbars would be useful for getting the broken stone out of the channel, and the further reduction of the lumps after blasting either by burning or breaking with hammers should, as far as possible, be avoided.

Cross Drainage.—It is desirable that the details of inlets and outlets should be settled and the drawings for the latter prepared as soon as possible. Then the foundations of the latter should be put in and brought up to bed level, and the wings should be carried up to their full height and the earthworks to be connected with them completed. The drainage will then take the proper line of outfall, and after the tank and the channel have been completed the crest walls of the channel weirs can be built up to the proper level. All that is needed in the way of inlets at most places is a little dry stone pavement with revetment to the ends of the banks to allow of the small drainages flowing into the channel without cutting up the soil and carrying it into the channel.

The upper two miles or a little more were gone over specially with a view to the proper and adequate treatment of this important matter, and all the drainages whether field or upland should be attended to without any avoidable delay.

Sand or undersluices may be inserted in the crest walls of surplus weirs when these are built on rock or hard soil; otherwise, unless specially necessary, they should be omitted, as they much increase the cost of the works.

Weirs on rocky or hard soil may be of the type shown in design No. 5, circular No. 67, with or without rough stone aprons as may be necessary. Weirs on soft soil, when their crests are not more than a foot or so above ground level, may have dry stone aprons; otherwise masonry aprons of a width equal to twice the height of M.W.L. above their surface should be allowed with a retaining wall and an outer dry stone apron.

$$D = C\sqrt[3]{M^2}$$

The discharges from upland drainage are to be calculated with a co-efficient of 450 with Ryves' formula.

5. *Baroor Tank.*—The enlargement of this tank was commenced in earnest, Mr. Lowry states, about the beginning of July, and for the month or so of work the progress has been very good, but the work is for the time of the year very much behindhand and very energetic measures will be needed to enable the tank to hold water in the next North-east monsoon.

The old bund will, with the exception of a short piece at the west end which turned abruptly to the south, be retained. At the east end there will be a considerable and straight extension across another valley to the high ground beyond, and at the south-west end a curved extension to high ground will complete the alignment. This latter work has been well advanced and the eastern extension or left flank has just been begun. At the old bund the revetment has been stripped, the excavation of the puddle trench has been nearly completed, and part of the foundation of the puddle wall laid, while at the western end of this part of the bund a considerable width and depth of new earthwork has been done and with it the puddle wall. To

make the tank ready for the October rains, the whole of the earthwork and revetment need to be brought up to the level of the top of the old bund, and there seems to be very little chance of this being accomplished. There were about 2,500 people on the works and there is room to work effectively more than double this number. All labor employed on earthworks at the supply channel, as distinguished from rock cutting, should be transferred to the tank bund and to the old part, leaving the extensions to be completed afterwards, and every effort must be made to get the bund completed to full section.

The construction of the revetment has been contracted for on what are considered to be favorable terms, but the bund is hardly sufficiently advanced except for a short length to allow of the construction being commenced. The arrangement, as mentioned by Mr. Lowry, was understood to be a payment of Rupees 1,000 for clearing away the old revetment and Rupees 2,000 for rebuilding it, but the District Engineer says that 1 Rupee a cubic yard for demolition and rebuilding is the agreement, and this with present prices is perhaps reasonable enough, but it is not a normal rate and about one-third of the total is excess due to famine. The designs for the new heads for the sluices should be prepared at once and the work done. It seems to be very doubtful whether the retention of these sluices, though some of them are not old, is advisable. The data for coming to a conclusion were not however available, and the arrangements should be made efficient on the basis of circular No. 87.

6. *Tasking.*—Efforts have been made to carry out tasking regularly, but there is a good deal to be done to make the tasking fully effective. The earthwork of the south-west extension is said to have been properly tasked, but the pits are not sufficiently regular to have made this an easy matter. Some work just started for a surplus channel had not been laid out in tasks beforehand, which is, of course, essential, and at the extension at the left flank the arrangements were not sufficiently systematic to work satisfactorily. At the same time the constructive work had been carefully laid out, and there is reason therefore to believe that it will be satisfactorily stable. Mr. Lowry, the Executive Engineer of the Range, was left unassisted when the work was first started and he was left without aid when Mr. Wyatt, Assistant Engineer, was recently on leave. Altogether, considering how necessarily inefficient most of the temporary supervising establishment is, it is considered that Mr. Lowry has done very well, and Government have already in the Order as per margin recorded a similar opinion.

G.O. R.(F)D., No. 1,600, dated 23rd July 1878.

7. *Condition of the people employed.*—The condition of the work-people generally is fair and, as regards a large percentage, really good. Many of the otherwise well-conditioned coolies are suffering from ulcers. The more weakly coolies and emaciates are placed in separate gangs and employed on lighter work. Some among them appeared to be unfit to do anything at all, but it is generally thought that such people when only emaciated recover better on the work than in hospital and, as there appeared to be no risk of over-work, they were left among the work-people although but little more than skeletons.

8. *Hospital.*—The hospital is under a Native Hospital Assistant from Bengal. The patients did not exceed a dozen, and most of them were suffering from ulcers. About half the inmates were in very reduced condition. It was mentioned that as the patients in hospital are so few it would be well for the Medical Subordinate to visit and dress the ulcers of the coolies who are at work, and who do not generally take the trouble to come to hospital to be attended to until their sores become very bad. The Hospital Assistant besides hospital work attends to the sanitary state of the camps and their surroundings.

9. *Accounts and Estimates.*—A regular estimate, amounting to Rs. 52,688-8-0, was prepared and sanctioned for the Baroor project, but the scope of the scheme has since been much changed and enlarged and it is very necessary.

G.O. No. 2,208, dated 6th October 1877, Revenue (Famine) Department.

1*st*,—that the quantities of work of various kinds and the proper cost at normal rates of each particular work of the project should be made out.

2*nd*,—that the work done should be ascertained and its actual cost also as far as may be. Probably from the information recorded on the nominal rolls this could be done.

3*rdly*,—that at any rate the work of each kind done in each month from the beginning of August should be recorded with its actual cost, and the information thus obtained made use of.

4*thly*,—that the gangs should be looked over from time to time and the work-people classed according to their capabilities as ablebodied or in three or four grades of less efficient labor, the last grade being composed of emaciated and feeble folk who can do little or nothing, who as soon as improved would be moved into a higher grade, and whose wages can therefore be neglected in estimating the cost of work. The rest of the non-ablebodied would be reducible to an equivalent of ablebodied labor, and then it would easily be seen whether the outturn of work for a week or a month were good, indifferent or bad, and improvement would naturally follow.

Mr. Lowry had an abstract of the superseded estimate in an excellent form, and what is now wanted is a similar abstract for the project as it is being carried out, and if a complete abstract be not capable of immediate compilation each part of the work as ascertained can be posted up and used. Then for each individual work, such as the channel, tank, &c., there should be an abstract showing the—

1*st*,—descriptions, quantities and value at normal rates of the whole work;

2*nd*,—three columns for each month showing the quantity, cost and normal value of the work of each description done.

With such information available, the District Engineer would be able to exercise a much more beneficial supervision than is at present practicable.

10. *Labor desiring work.*—On the 5th August some 200 people without the requisite nominal rolls from civil or relief officers applied for work and were present early in the morning. They were informed that without nominal rolls they could not be taken on. Where the nearest relief officer was to be found was not known at Baroor, but there was a Camp Superintendent not more than a few miles distant, and he would probably grant rolls; otherwise Kistnagherri, 19 miles off, would be the place to which the coolies would have to go. A good many of the people were not at all fit to make a march of 38 miles and had already fallen so far out of condition that it would be a long time before they would be able to earn a living again.

11. MARANDAHULLY PROJECT.—The brief description given of this project in Proceedings, Madras Government, No. 345 I, of the 24th September 1877, states that it has for its object the diversion of water from the Sunadakumara river to supplement the somewhat precarious supply of the Sunganbasavan, Jairy talab, and other tanks. There is very little more definite information as to the precise extent of the tanks. There is very little more definite information as to the precise extent of the scheme now available than is contained in the Proceedings above referred to. The F.T.L. of the Sunganbasavan tank which was then not settled has been fixed at 1960·50, but it is not yet known how far the water-supply may be expected to extend, and a considerable part of the distribution arrangements has not yet been worked out on paper. This comparative absence of progress in completing the investigation and drawing up the project in detail is due to the frequent change of officers in charge owing to sickness. The country in which the work is situated is unhealthy alike for Europeans and Natives, and the demands on the attention of the staff which it has been possible with great difficulty to maintain have for the immediate supervision of the relief labor alone been more than could be effectually met. To get ready plans, revise estimates, and complete investigations has in the past been impracticable, but recently by the stoppage of relief works elsewhere and a decrease of the numbers on these works, some subordinate establishment has been set free and survey work is now going on, and there is indeed a pressing necessity for some information, arrangements

for obtaining which have been made. For instance the capacity of the Sunganbasavan tank at various levels below the former F.T.L. has not yet been determined, and this should be known in order to fix on proper data the level of the sluice sill.

12. *Comparison of Marandahully and Baroor Projects.*—This scheme presents some remarkable contrasts to the Baroor project, as will be noticeable from the following particulars:—

	Maranda-hally.	Baroor.
Area of catchment basin of river of supply, square miles.	340	*2,120
Sectional water-way of channel from rivers, square feet.	360	137½
Ordinary full discharge, cubic feet a second	1,200	379
Capacity of principal tanks connected, millions of cubic feet	†478	661
Capacity of all the tanks to be connected	Unknown.	Unknown.

The disadvantages which the Marandahully project labors under from the very limited area from which the water-supply is to be obtained will be in a measure obviated by the large capacity of the supply channel, but the scheme may be expected to cost more and return less than the Baroor scheme.

13. *Anicut Head Sluice.*—The anicut across the Sunadakumara river and the head sluice for the regulation of the supply to the channel have not yet been commenced, and the examination of the bed of the river necessary to fix the exact alignment of the weir has yet to be made. So far as can be gathered from inspection there is a probability of rock foundations throughout. The design for the head sluice has been prepared and has been carefully adapted to the site. The shutters should be worked from a platform separate from and on the river side of the roadway instead of rising through the roadway as shown. The gear as designed appears to be more elaborate than is required, and a screw with a collar nut and plates will suffice.

14. *Main Channel.*—The head of the channel has been nearly completed, and a bund to exclude river water is being formed a short distance below the site for the head sluice. This bund need not, in the absence of an anicut, be made so high as was at the time of inspection supposed to be necessary, and probably with its top 11½ feet above channel bed or at 1,977·50 would suffice. The anicut crest will be only 1·89 feet below normal flood level and the difference consequently of flood level or in other words the afflux it will produce will be great.

The rest of the channel down to the junction with the old channel, a distance of about 2½ miles, is well advanced and in parts is nearly complete including the sectioning of the banks, berms, &c., but there is still some hard conglomerate to be got out, and this does not blast well and is too hard for picks; probably crowbars which would act as wedges would be better tools for the purpose. At those places where the side slopes are steep and soft strata occur, the soft soil should be cut out to a depth of 18 inches or so and stone should be packed in as a revetment. It is intended to discharge the drainage of the berms into the channel at intervals by means of slab stone shoots so as to clear the slopes; unless the overfall is on to rock a little rough stone should be packed flush with bed of channel to prevent scour, and when the soil of the side slope is doubtful it will be best to revet the slope.

Nothing has as yet been done to the old channel which has a steep fall and has to be widened to 30 feet.

With the exception of small gangs for completing the nearly finished parts of the channel and preventing deterioration, and for removing rock and conglomerate all the labor is to be transferred to the Sunganbasavan tank, so but little further progress will be made with the channel work for some months to come.

15. *Sunganbasavan.*—Until the tank had been drained after the season for cultivation was over, the work for enlarging this tank could not be commenced. The work is for the season of the year much behindhand, and it is unlikely that it will make such progress before October next as to allow of the tank holding water this year.

* Mean of two calculations.
† Sunganbasavan with its raised water level has been taken as about 324 millions.

Puddle Trench and Puddle.—The revetment of the old bund has been stripped and stacked; the excavation of the puddle trench in front of the main bund has been completed, and this proved to be a very difficult work owing to the depth* of silt met with and the great quantity of water which came in from the tank bed; the puddle trench had been nearly filled with puddle throughout. No part of the earth-work of this part of the bund in front of the puddle trench had been commenced except that, near the north end, the spoil from the trench had been placed where it will form part of the bund base.

* As much as 13 feet at one part.

Alignment of Bund.—The main bund of the old tank ran from a high rocky hill at the left flank to a low rocky hill at the right flank, and south-west of the latter hill there was only a small bund and the escape &c.

The former F.T.L. was at	1932·92
,, future do is to be at	1960·50
,, highest point of the low hill is about	1945·00

and the rock here is not solid. At the time of inspection a puddle trench for a bund to be carried round and in front of the hill had been commenced, but as the direct line over the hill for the construction of a masonry wall had not been investigated in detail, it was thought best to have a section taken, and the result was that the two arrangements were found to be likely to cost much the same,† and as the wall would have involved a larger amount of blasting for the foundations and skilled labor for the superstructure, it was decided that the semi-circular bund would be preferable and this will now be proceeded with.

† Rupees 21,000 or 22,000.

South of the rocky hill or rather south of the sluice site which is at its edge the earth-work and puddle of a new bund to connect with the high ground have made good progress, and work there will now be discontinued for the present.

Cut through Bund.—The cut made to unwater the puddle trench, &c., can be filled in for 2 feet at bottom with small stone to act as a drain; over the stone there should be 6 or 8 inches of turf sods and then the rest of the cut can be filled in with well-rammed soil. A suitable outfall for any drainage water should be provided.

Sluice.—The excavation for the sluice has been taken down to about 1,914 or 14 to 16 feet below ground surface, but the sections of the tank-bed which are in progress not having been completed it was not practicable to fix finally the level of the sluice sill, as the contents of the tank at different levels is not yet known. However it appeared probable that 1,920 would be found to be a proper level, and that the limits will be between this and 1,925. It is not necessary to completely drain the tank, and the sill may be placed at a level which will leave 10 or 15 millions of cubic feet in the tank bed. This space will serve as a silt trap and of course the rate of silt deposit will be largely increased.

A design for a sluice was drawn up for an assumed sill level at 1,920 as a guide to the preparation of a complete plan. The intention is to regulate the discharge by means of a number of wooden plugs, which will be worked from a platform carried by a tower, inside which ordinarily the water level will be that of the tank. Major Pennycuick has suggested a wrought-iron staging in lieu of a masonry tower, and also the regulation of the plugs from the top of the bund without a tower or staging, and he can mature these ideas during the interval which will elapse before the construction of the sluice must be commenced. The arrangements should admit of the plugs being made accessible for repair or renewal when the tank is comparatively low, say with 12 to 15 feet on the sill. This officer has further proposed a sluice with equilibrium valves of a similar design to that worked out by Mr. Stoney for a head sluice, and the papers connected with this and with the other form of sluice now in temporary use at the Red Hills tank will be sent to him. It is essential in the case of sluices of deep tanks that the arrangements should be such as will be perfectly safe and durable.

Revetment.—No part of the revetment has been commenced, and it is said that difficulty has been experienced in obtaining wudders to undertake its construction.

However this may be the revetment work must be started at once and, in default of wudders, gangs of the stronger coolies should be made up to do it. Up to 20 feet below F.T.L., or to 1940·50 very large stone need not be used, as the force of the waves will be less down below than up above. Provided through stones or single stones for the thickness of the revetment be used here, the other dimensions may be small. It has been settled that the thickness of the revetment at ground level and up to 20 feet below F.T.L. is to be 2 feet. It will increase to 3 feet at F.T.L. and diminish gradually to 1½ feet at the top of the bund. There will be a backing of small stone and gravel 18 inches thick throughout up to M.W.L., above which the thickness may diminish to 9 inches at top of bund. The foundations and the revetment where not more than 2 feet thick can be executed under proper supervision by any strong coolies: they will make slow progress at first, but they will soon get accustomed to the work, and it will be a long time before the services of stone wudders will be indispensable, and very possibly the coolies ere then will have been so far trained as to be able to handle large stones. A few low two-wheeled trucks for the transport of stone will be useful and a few hundred feet of planking to be laid down as tramways. In no case should the wudders or would-be contractors be allowed to fix their own rates irrespective of what is fair, taking current prices of grain into consideration. Here and elsewhere the rates should be fixed on equitable data, and the Public Works Department should be able to control the cost of work to this extent, seeing that all but a very small fraction of the employment available is in the hands of this department. If wudders be employed they should be dealt with through the head men of the gangs rather than through contractors.

Concentration of Labor on the Tank.—The Sunganbasavan tank is the work which greatly needs to be pushed on and the bulk of the labor should be concentrated on it, and as much as can be employed on the main bund and on the short length round the hill, without crowding, should be allotted to the earthwork, puddle, and revetment in such proportions as will allow of fair relative progress. The revetment will perhaps lag behind for a time, but if so this drawback must be admitted: every yard built will be so much to the good.

Manner of Working.—On many of the details of the arrangements much care had evidently been bestowed, and those for securing a proper mixture of soil for puddle were noticeably good. The people engaged in treading in puddle in the trench are selected as ablebodied and free from ulcers on the legs: the work is hard and the only fault to be found with it was that the treading appeared to be much in excess of what was required, and consequently the progress slow and the cost great. This matter has already received attention and it is expected that there will be a marked improvement, especially when the cost of work already done has been deduced and that of work executed subsequently ascertained at short intervals, which should not exceed a month of four weeks. The length of trench to be trodden and the depth or height to which the work is to be raised daily, and in six days, can be proportioned to the number of coolies to be employed in treading. This amount of work will take so many cubic feet of puddle, and coolies to bring the materials can be allotted accordingly. So long as the lead remains unchanged the work can be fixed after a little trial and examination of results. It may be noticed that for short leads of over 100 feet and less than 300 feet the trips of the carriers should amount to about 8 miles a day: when the lead is over 100 yards about 10 miles will be suitable, and the basket loads for women should be 40 lbs. For short leads the time and work required in filling the baskets are in excess, but, as a rule, the filling should be done by men coolies told off for the purpose and tasked by allotting so many carriers to each filler. When the women fill their own baskets the loads are apt to be light.

Taskwork.—Taskwork has been generally introduced, but it is doubtful whether it is in most cases fully effective. To secure a full task without making it unduly severe a great amount of organization is required, and such organization with indifferent subordinate establishment it is difficult to secure.

Efficiency of Tools.—The suitability and efficiency of the tools is another important matter and difficult to secure. For instance, two men are expected to bore

with a jumper 36 inches of 1½ inches hole in granite or gneiss of somewhat close texture. It is not a difficult task if the jumpers are in good order and have a sufficient clearance, and as many as 54 inches have been accomplished, but the jumpers are soon blunted and unless the maistry sees that they are changed the work gets behindhand.

Tamping Earthwork.—The tamping of the new earthwork has not been effectively tasked, for the coolies had not been required to raise the rammers to a proper height, and consequently eight or ten blows did about the work which one blow should do. The new iron rammers appear to be excellent if properly used, but no rammer is of much use if lifted but 2 or 3 inches. Some of the coolies allotted to this work are not very strong and the great majority of them are women, but probably without hardship the actual task of the past may be increased fourfold, and to obtain this improvement it will be essential to divide the gangs into sets, to allot adequate space to each set, and to test the work constantly with a stick as it goes on. With relief labor there is no making up for slack work.

Cost of Blasting.—Again, in order to know what the blasting is costing, besides tasking the boring, which is only a detail and a security against idleness, all the stone removed should be stacked and measured and two-thirds the measurement of the stacks may be taken as the corresponding measurement of solid rock. Mr. Rogers, the Assistant Engineer, in immediate executive charge of the tank work is an energetic and hard-working officer, and improvement in the method of working, so as to make results apparent and to ensure the remedy of defects, is the chief requirement to secure success.

New Escape.—Nothing has been done towards preparation, in the way of levelling and removing soil between the rocks, for constructive work, and there is no immediate necessity for making a commencement. The old escape weir is no longer available and has been dismantled, as the new south bund rendered it useless. Surplus in small quantities can be discharged at the cut for the sluice and is diverted thereto by a bund across the bed of the tank. When the main bund has been completed up to about 1,934, surplus will be capable of being discharged temporarily over a mass of rock on the south side of the low hill, which for a length of 60 or 70 feet is at about 1,828.

16. *Channels from Sunganbasavan Tank.*—No work has been commenced as yet. The details should be worked out as soon as may be convenient.

17. *Jairy Talab.*—Some earthwork but of no great extent is said to have been done: this tank was not inspected.

18. *Channel from Jairy Talab.*—East of the new Palcode road no work has been done, but on the west, commencing close to the road, more than a mile of channel has been cut. The alignment has been changed to avoid running across rather low ground and through a small village. The alteration involves rather deep cutting and a good deal of rock has been met with, and but little of this has as yet been taken out. There is no work going on at present.

19. *Cost of work.*—At present there is no information in a shape admitting of examination as to the cost of any description of work so far carried out, and it is very doubtful whether the materials for compiling a statement exist. Such information is of great importance and its absence is due to several causes, the principal being—

1*st.*—When the works were first started, and almost ever since, the establishment available has been inadequate to the effective management of the labor engaged in doing the work.

2*nd.*—The changes in the supervising establishment have owing to sickness been very frequent.

Arrangements to be made.—It is the more necessary that an immediate commencement should be made in ascertaining from the present time what work is done, and what labor and materials are used in doing it. The District Engineer has been requested to arrange for this being done. A daily statement of the distribution of the labor is the first essential, with weekly abstracts showing the cost of the labor

employed on each description of work. Either weekly or, if this be impracticable, monthly (every four weeks) the quantity of each kind of work done should be ascertained, and the cost and quantity of each kind should be compared and the rates deduced. In the next place for each principal work as the supply channel, the Sunganbasavan tank, the distributaries of this tank, the Jairy Talab, its distributaries, an abstract of total quantities of each kind of work should be prepared, and the principal works which are in hand should be first taken up; the normal rates should then be fixed, and for each period for which measurements may be made the particulars ascertained should be tabulated. This should be done regularly and punctually and then information as to results will always be available. The following form will be found suitable:—

Name of Work.—Sunganbasavan Tank.

PARTICULARS FOR SUCCESSIVE PERIODS OF FOUR WEEKS OR OTHERWISE.

Description of Work.	Unit.	Total Quantity as per Abstract Estimate.	Normal Rate.	First Period.			Second Period.			And so on.		
				Quantities.	Cost.	Rate.	Quantities.	Cost.	Rate.			
1	2	3	4	5	6	7	8	9	10	11		
			Rs. A. P.		Rs. A. P.	Rs. A. P.		Rs. A. P.	Rs. A. P.			

N.B.—The work done in the periods up to the end of the first sheet should be totalled and brought forward in the next sheet and so on to the end.

2. If columns 2, 3, and 4 cannot, in any case, be filled up, the columns for the periodical measurements should nevertheless be regularly posted up.

Similar information should be compiled for every considerable Irrigation work which is being carried on under the supervision of Public Works officers.

It may here be mentioned that whenever it is found necessary to reduce the pay of a gang for short work, the head cooly or gangsman, the maistry if more than one gang turns out short work, and the Sub-Overseer if his gangs generally work badly, should be subjected to stoppages in the same proportion. The Executive Officer must look to the overlookers of the labor to obtain due attention to orders, and they must suffer from shortcomings of all kinds, and for all neglect to do proper quantities of work and in the way in which directed. Whatever description of work is concerned, the instructions as to the way of doing it should, as far as possible, be in writing, and should be read out and explained to the overlookers of all grades. Then, if a little practical instruction follow, there can be no excuse for inattention.

20. *Number of Work-people and their condition.*—The number of work-people and their distribution is given for the 10th August in the statement appended which was furnished by Lieutenant deVillamil, the Sub-divisional Officer. On that date there were—

806 men 2,578 women 906 children	on constructive work.
3 head sweepers 44 sweepers	on sanitary work.
26 women 304 children	at children's kitchen.
281 patients in hospital.	

This latter is said to be a very low average, and on the 12th the Apothecary, Mr. Toomey, stated that there were 299 patients.

A large proportion of the labor is in very good working condition. The selected labor employed on treading puddle is quite up to the standard of ordinary seasons. The less ablebodied are employed on lighter work and the convalescents are still more lightly tasked; many of these are old and never likely to do much, and their value on the works is little more than nominal. Of the patients in hospital not very many are in reasonably good condition. The more common diseases are—

Ulcers which are very prevalent and often very bad.
Fever of a mild type has been prevalent of late.
Famine dropsy.

Opthalmia resembling sore-eyes broke out a little while ago, but has abated. Some remarkable restorations of famished children have occurred.

About 10 per cent. of the patients are not people who belong to the works, but suffering people who could not be refused treatment.

When at Darampoori Mr. Armstrong, the Relief Officer, showed me many rolls of coolies who had been sent from Marandahully to the Camp Hospital, but whether because the works hospital could not take them in or because they were too bad to afford a chance of recovery within a reasonable time is not clear. The matter did not come under notice when the undersigned was at Sunganbasavan. There seems to be little doubt but that most of the cases were bad. At the Darampoori camp out of about 1,000 coolies 500 were in hospital.

21. *Hutting.*—The huts at the Marandahully project works are of a very simple and inexpensive kind. Betel, palm posts, and plaited palm leaves for the roofs and wall screens are the materials used. No fires should be allowed in the huts or within the camp limits, but just outside and to leeward of these, cooking places should be provided consisting of a wall about 3 feet high, with short returns, to protect the fires from the wind. Fires elsewhere should not be permitted and the dismissal of coolies disobeying the rule should be the punishment for a second offence. All the huts of a camp might be burnt down in five minutes were one to windward to catch fire.

Some trouble has been experienced from the tendency of the coolies to use hut materials for their cooking. The fact is that fuel is scarce and the coolies have hardly time to go to any distance for it: a moderate quantity might, it is considered, be provided by fatigue parties told off in rotation for the purpose; two or three coolies

out of every gang of 50 would suffice. The Sunday is a free day, but the gangs could hardly collect and store for a week, and besides the Sunday is and should be a day of rest and comparative enjoyment, and the coolies spend it in the bazaar and do enjoy it.

22. *Revised Estimate for the Project.*—The estimates have not made much progress owing in some measure to establishment for the surveying and levelling still required not being available. As, moreover, the District Engineer has already explained there have been many hindrances to getting these very necessary estimates ready. Lieutenant deVillamil has asked to be allowed to dispose of the separate works one by one, and he has been informed that it will be much better to do this than to wait perhaps for a considerable time for the complete estimate. Estimates for the anicut, the supply channel, and the Sunganbasavan tank, should, therefore, be got ready first and as soon as possible. Except, as mentioned, at the channel from the Jairy Talab, but little other work has been done below the Sunganbasavan tank, and no labor will be employed below that point for some months to come. The estimates should of course be framed at normal rates, and as much information as possible should in submitting them be given as to the actual cost of work.

23. *Intention of Remarks on Defective details.*—In conclusion it is necessary to add that while many remarks have been made in the foregoing paragraphs, which indicate that there is room for improvement in several directions, it has not been intended to reflect unfavorably upon either of the officers, Lieutenant deVillamil or Mr. Rogers, now in charge of the works. On the contrary they are deserving of much credit for what they have accomplished, and it is only by visiting works and going into details that the difficulties officers, having to manage large numbers of coolies on relief works, have to contend with can be understood. The labor is unaccustomed to any organization, also as regards a large part of it to any steady labor, coolies are constantly coming and going, the subordinate supervision is untrained, and the power of dismissal has to be sparingly exercised seeing that those who may be freshly entertained are not likely to be better and may be worse than those discharged; and lastly the officers are not acquainted with the language of the people. There is no need, therefore, to find fault because perfection has not been attained; defects have been noticed in order that attention may be given to the direction in which improvement may be attempted. Classification of labor has to a considerable extent been carried out; it may be carried still further so that the value of each class may be approximately fixed, and the equivalent of ablebodied labor known.

24. *Value of these Project works to the laboring class.*—After more than three weeks spent in the Salem District, the undersigned feels no doubt as to the need for and value of these relief works. The losses of the agricultural population have been very great: prices are still excessive; few ryots can afford to employ a proper amount of labor in their fields, and crops have been so disappointing since any crops, after the middle of 1877, again became possible that there must be a strong and natural inclination to restrict expenditure as much as possible. Weeding is much neglected as a consequence, and the result is that the crops suffer and many field-workers have nothing but relief works to save them. The labor and distance tests are, it is believed, adequate security against the abuse of State relief, and undoubtedly the distance test is with some classes so distasteful that they will do anything to avoid going away from their homes. The miserable creatures seen on every road picking up berries and fruit from the avenue trees, and really undergoing slow starvation, are a proof that very great privation is deemed by them preferable to adequate food on the conditions on which it is obtainable. Many parts of the district appear to be still infested with locusts, and an army of young ones not yet able to fly was seen crossing* the road to Morapore a few miles from Darampoori yesterday morning. At least a fairly good outturn from the young crops now on the ground will be needed to give the part of the district recently visited a start towards becoming selfsupporting.

*North to south.

FORT ST. GEORGE,
16th August 1878.

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

To the Additional Secretary to Government, Revenue (Famine) Department.

No. 40. ORDER THEREON, 4th October 1878, No. 779 I.

COMMUNICATED to the District Engineer, Salem, for his information.

(True Extract.)

(Signed) J. O. HASTED, Lt.-Col., R.E.,
Acting Joint Secy. to Govt., P.W.D.,
Irrigation Branch.

To the District Engineer, Salem.
" Chief Engineer for Irrigation.
" Revenue (Famine) Department.

Exd. E. C. Shunker.
Spare Copies

IRRIGATION.
ACCOUNT.

Govt. of {1878} Madras.

PUBLIC WORKS.

To

THE DISTRICT ENGINEER,
SALEM.

&c., &c., &c.

Dated October 4th.

Read. *Encl.*

G. O., 4th October 1878, No. 779 I.

OCTOBER.

Nos. 39-40.

Baroor and Marandahully Projects, Salem District.—Notes, after inspection, on the — undertaken for famine relief purposes, communicated to the District Engineer, Salem, for information.

GOVERNMENT OF MADRAS.

REVENUE DEPARTMENT.

22nd October 1878, F. R. No. 2,201.

Famine Relief.

Read the following paper:—

No. 354. Endorsement of the Acting Chief Engineer for Irrigation, dated Fort St. George, 11th October 1878, No. 175-W.

Read the following letter from Major J. PENNYCUICK, R.E., District Engineer, Salem, to the Chief Engineer for Irrigation, dated 7th October 1878, No. 67 S.L.:—

I HAVE the honor to request that additional grants of the following amounts may be made for the irrigation works named:—

	Rs.
Baroor	20,000
Marandahully	20,000
Pennagoordapuram	15,000

The grants already made and expenditure up to date of last return (28th September) are as follow:—

	Grant. Rs.	Expenditure. Rs.
Baroor	87,688	73,324
Marandahully	2,10,000	2,00,928
Pennagoondapuram	43,060	41,235

2. I have just inspected the Baroor and Pennagoondapuram works, which are making fair progress, though the numbers employed have fallen off considerably during the last few weeks. You have yourself so recently visited these works that it is not necessary to remark upon them in detail.

3. I calculate that a further sum of Rs. 35,000, or perhaps somewhat less, will suffice to complete the Pennagoondapuram Project. This will make the total expenditure about Rs. 75,000, of which probably Rs. 30,000 will be chargeable to famine and the remainder to the work. This (Rs. 45,000) is rather more than 50 per cent. in excess of the original estimate of Rs. 29,060, but as the capacity of the tank has been increased from the original proposal of 88,000,000 of cubic feet to 146,000,000, the returns will be increased in a larger proportion than the cost.

4. It will be within your recollection that the revised design for the Baroor tank includes the extension of the bund eastward across the Kilcoopum Valley, instead of terminating it, according to the original plan, at the ridge which divides this valley from the present waterspread of the tank. This extension gives an increase of capacity of 120,000,000 of cubic feet, the portion to the westward of the ridge containing 540,000,000. Its cost is, however, nearly as half of the total cost of the tank, being as nearly as I can calculate Rs. 55,000 out of Rs. 1,25,000. The storeage thus gained, being at the rate of Rs. 460 per million cubic feet, is not particularly economical in itself, and contrasts strongly with the western portion of the tank, which only costs about Rs. 130 per million.

5. I have never been very favorably disposed towards this extension, and consented to its inclusion in the scheme mainly because it commanded a quantity of valuable ground which it was supposed could not be reached from the western portion. Levels lately taken have, however, shown that this is not the case, and there appears no sufficient reason for going on with the extension at present; it can be carried out at any time if thought desirable, as the cost of the short piece of bund along the dividing ridge between the two valleys, which will be the only work sacrificed by such a proceeding, is very slight.

6. It is also considered that Government may desire to restrict the expenditure as far as possible after the close of the famine, and this portion of the project may be struck off, at all events for the time, without greatly impairing the usefulness of the whole.

7. Orders have therefore been given for the discontinuance of all work on the Kilcoopum extension and the concentration of the labor on the enlargement of the existing tank. The actual amount of work done to the extension is very slight, consisting only of the marking out of the line of bund and the excavation of a small portion of puddle trench; its whole value is not more than Rs. 500. As reduced the capacity of the tank will be about 540,000,000 of cubic feet.

8. Mr. Lowry hopes to be able to submit the estimates for this and the Pennagoondapuram Project within a month, but I am afraid he is over-sanguine. The total cost of the work will probably be about Rs. 2,00,000, out of which sum 60,000 will be chargeable to famine, leaving Rs. 1,40,000 to be charged against the project; the original estimate was only Rs. 52,000, but this did not profess to be more than partial, and the scope of the work has been increased much more than threefold, the original proposal being to store 91,000,000 of cubic feet only. The area irrigated will certainly not be less than 8,000 acres, an area for which the tank will hold fifty days' supply, and it is quite certain that the supply from the river will never run short for a longer period than this between May and December. The return will therefore be very good in proportion to the expenditure. I should mention that Mr. Lowry considers my estimate of the cost of the work too high, and that we may reckon on irrigating 10,000 acres.

9. I have not been able to visit Marandahully since your inspection in August last, and have therefore nothing to report in connection therewith.

TRANSFERRED to the Revenue (Famine) Department for provision of funds.

2. Under the circumstances brought to notice by the District Engineer, the undersigned recommends that the extension of the Baroor tank bank across the Kilcoopum Valley should not be carried out, unless it is found necessary, when the other portion of the work is approaching completion, to find further work for the coolies employed.

(Signed) J. O. HASTED, Lieut.-Colonel, R.E.,
Acting Chief Engineer for Irrigation.

No. 355. ORDER THEREON, 22nd October 1878, F.R. No. 2,201.

Miscellaneous.

THE Governor in Council concurs in the opinion of the Acting Chief Engineer for Irrigation in regard to extending the bund across the Kilcoopum Valley.

2. The additional grants asked for in paragraph 1 of the District Engineer's letter are sanctioned.

3. The submission of the estimates should be hastened.

(True Extract.)

(Signed) J. H. GARSTIN,
Additional Secretary to Government.

To the Chief Engineer for Irrigation.
" the Examiner of Public Works Accounts.
" the Public Works Department.
" the Financial Department.
" the Board of Revenue.
" the Accountant-General.
" the Collector of Salem.

Exd. A. F. Goodall.

Govt. of {1878} Madras.

REVENUE.

To

THE CHIEF ENGINEER FOR IRRIGATION,

&c., &c., &c.

Dated October 22nd.

Printed November 2nd.

Encl.

G.O., 22nd October 1878, Rd. No. 2,201.

OCTOBER.

Nos. 354-355.

Borrow Maramdahilly, and Pennagoondapuram Projects in the Salem District—Sanctioning the additional grants applied for by the District Engineer for the —, desiring that the submission of the estimates should be hastened; and concurring in the opinion of the Acting Chief Engineer for Irrigation in regard to the extension of the Periyar tank bank across the Kiliyoorum Valley.

29.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

11th February 1879, No. 92 I.

Irrigation.

Read the following paper:—

No. 38. No. 38 I.

THE following notes of inspection in Salem from 18th to 20th January 1879 are submitted for the information of Government:—

1. Inspection of the works lately under execution from Famine Relief Funds was undertaken with a view to ascertain the exact condition in which the works were left when expenditure from Famine Funds was stopped, and what further expenditure was absolutely necessary to prevent damage to the work already executed, also whether by the further expenditure of any reasonable amount the work done could be made profitable.

2. PENNAGOONDAPURAM TANK.—The first work visited was the *Pennagoondapuram tank*. The estimate for this tank has been completed and is now with the Superintending Engineer to whom instructions have been given regarding the additional information required when submitting his report with it. The amount is Rupees 66,713; up to the 31st December expenditure on the work had reached Rupees 53,448, and there is a sum of Rupees 4,526 still due to contractors for work done before that date which will be paid immediately, the total expenditure will then be ... ... Rs. 57,974

Deduct excess due to famine	,,	25,387
Value of work done	,,	32,587
Value of work to be done	,,	34,126
Total Estimate ...	,,	66,713

3. DESCRIPTION OF ESTIMATE.—The tank is an old native one, long since ruined, the bund being breached in three places; it has been so long abandoned that there is no tradition of there having been cultivation under it. The estimate provides for very considerably enlarging the old bund so as to enable the tank to hold nearly 5½ millions of cubic yards, constructing an irrigation sluice to irrigate 1,300 acres at present, but ultimately 2,200 acres, and a waste weir of sufficient size to discharge the drainage from a catchment basin of 52 square miles and excavating an irrigation channel 7½ miles in length. The top of the bund is intended to be 9 feet above full supply level and about 5½ feet above maximum level.

4. STATE OF WORK ON 31ST DECEMBER 1878.—The earthwork has been completed to a height of 5 feet above full supply level except at No. 1 breach where it is only 3 feet above F.S.L. The sluice has been completed with the exception of the plug and shutter raising gear, and the weir is partly built, that is, the body wall is completed with the exception of coping and about 50 feet of the end. South wing is nearly completed, north wing not commenced, but excavation completed. Surplus channel excavation nearly done.

5. TANK BUND.—The work done appears generally satisfactory, the soil is very fair and is stated to have been watered and consolidated as the bund was raised; the rough stone revetment was fairly good but rather uneven, but the gravel backing or

at least that portion that was visible was not so good as it ought to be. It was stated that a puddle wall had been constructed at each of the three breaches, and that in rear of these walls rough stone drains had been put in to carry water to the rear of the bund. The outfall of these drains had been blocked up however, and leakage was evidently finding its way under the bund in places, although the water level at present in the tank is 15 feet below full tank level. This leakage is said to be through the rocky soil below the bund and to have decreased since water rose to its present level, but in any case the drains must be opened out and left so as to discharge freely. Beyond the breach through which the river has lately discharged the leakage has soaked into low ground, apparently pits from which the soil for the bund was taken, at a few yards distance from the toe of the bund, and being unable to escape has formed a quagmire. This must be drained into the river bed, and a longitudinal stone drain parallel to the bund and discharging into the river should be put in on the tank side of these pits. The foot of the bund must everywhere be kept dry.

6. SLUICE.—The arrangements for raising the plugs of the sluice are not satisfactory and must be altered; the Superintending Engineer is giving attention to this subject. The plank shutter should have screw gearing; there will be a heavy head against it.

7. WORK CONSIDERED ABSOLUTELY NECESSARY.—The breaches in the bund having been closed, it is absolutely necessary that the bund should be raised to a safe height and the weir made efficient before heavy rain falls, and as it is quite possible that there may be sufficient rain as early as March to fill the tank, it is essential that the necessary work should be carried out immediately.

The necessary work is as follows:—

To raise the bund throughout to 5 feet above full supply level or to + 43;
To complete the revetment fully;
To complete the body wall of weir to + 37;
To complete wing walls of weir;
To construct a rough stone apron 9 feet in width to weir;
To put in drain mentioned above in rear of bund;

and cost is estimated at Rupees 1,845.

The Superintending Engineer has been instructed to put this work in hand at once, and if he is unable to provide the full amount required from savings on other works a grant will be made from the Reserve.

8. IRRIGATION CHANNEL.—The irrigation channel from the sluice is intended to be $7\frac{1}{2}$ miles in length; the area to be irrigated will be all on north side of the river, and it is stated that the channel will command more than the full acreage the tank is intended to supply; the channel has already been excavated more than half a mile, and there are about 50 acres of cultivation under it now; the ryots came to meet us and begged that it might be extended another mile and they would then take up about 200 acres more land. It seems certain that the land will readily be taken up as soon as the channel is extended, and it is hoped that if funds are not available for the completion of the work next year arrangements may be made at all events for some extension of the channel.

9. WORK YET TO BE DONE.—The principal part of the work remaining to be done is the excavation of the channel and provision of masonry works for passing cross drainage. The tank bund has to be raised 4 feet or to + 47, which will be 9 feet above F.T.L. and $5\frac{1}{2}$ feet above M.T.L., and the weir level has to be raised 1 foot and a suitable apron of rough stone provided. As the work will be left, the tank bund will be 6 feet above the existing weir level, and but $2\frac{1}{2}$ feet above M.F.L., so that it will be necessary to complete the bund to full height early next year, and this will cost about Rupees 1,400, which will have to be provided from next year's grant for irrigation. The weir may be allowed to remain at 1 foot below its ultimate level for the present, and the channel can only be completed when funds are available; but having been once started the ryots will no doubt extend their field channels, so that next year there will be some return for the expenditure incurred.

10. BAROOR PROJECT.—This project has been described in *Memorandum by the Chief Engineer for Irrigation* printed with G.O., No. 779 I, dated 4th October 1878. It may be divided into four parts—

1. The anicut across the Pooniair.
2. The irrigation channel as far as Baroor large tank.
3. Enlarging the Baroor tank.
4. Continuing the irrigation channel from the tank.

11. EXPENDITURE INCURRED.—Work to some extent has been done on the three first-named sections of the work, and so far as the accounts have yet been made up it appears that the total expenditure up to 31st December 1878 is Rupees 1,08,601, of which is due to Famine about Rupees 40,000, balance chargable to the work Rupees 68,601.

12. ESTIMATE.—The plans and estimates have been nearly completed in detail by Mr. Lowry, the Executive Engineer of the division; and considering the extent of his charge, which till lately included important relief works, it is creditable to him that they are so far advanced; there is no doubt that he has taken much pains and had had very heavy work. It is expected that the estimates will be completed by the end of February; but whether the compensation statement will be ready by that time cannot be said; the Tahsildar of Krishnagiri was at Baroor engaged on this work when we were there. Mr. Lowry has furnished the following figures which may be considered nearly accurate:—

	RS.
Amount of estimate	2,40,000
Deduct expenditure to 31st December 1878 chargeable to the work ...	68,600
Balance to complete	1,71,400

13. ANICUT.—On the anicut very little has been done since Colonel Mullins' Memorandum was written in October 1878; besides the work there mentioned the foundations of the head sluice for the Agaram channel on the right bank have been in great part taken out, and thus far money will have been wasted as the pit is sure to be filled in by floods; the revetment to the right flood bank has been nearly completed, and the work is very good, but the end of the bank must be protected with stone before floods come down. Limestone, broken stone for concrete, cutstone for coping, charcoal and firewood have to some extent been collected; a lime-kiln has been built and milestones put up. Delay to the work will only involve a trifling loss on firewood, but expenditure must be incurred in keeping watchers and in repairing the buildings from time to time. There is no work now absolutely necessary.

14. CHANNEL TO BAROOR TANK.—The channel from the river to Baroor tank may perhaps be about three-fourths completed. Most of the earthwork in execution is completed, and for a considerable distance the banks have been made up and turfed and the grass is growing well; a great deal of rock blasting has been done, but there is still much to be done; all the inlets and outlets and under-tunnels have to be built, but much of the rock blasted from the channel will be of use in their construction; there is no work absolutely necessary, but there will be some expenditure caused by the work being delayed as the channel will become silted up, there being no proper inlets and outlets, and the banks will be partially destroyed. As soon as funds are available the channel should be opened and made complete from the head downwards, and it could then be used for irrigation.

15. BAROOR TANK.—The bund of the Baroor tank has made some progress. The west side or horn has been completed (the top of the bank should slope more decidedly to the rear), the west sluice has been built up to floor level, a gap being left in the bund to drain the tank; beyond the sluice the new bund has been constructed up to level of old bund and a good deal of revetment has been done, and the old east sluice has been partially demolished. The completed work is good, and the incomplete part of the bund is good work; the new soil has been thrown in front of the old bund, and where the bund is more than 8 feet high a puddle wall has been inserted. There is now no possibility of the work being completed before next monsoon, but if it is left as it is the cultivation under the old tank will be lost. It is therefore essential that the following work should be done:— Complete the west

sluice, and make up the bund at the gap to full height of old bank; make a temporary head to the old east sluice, and on the high ridge beyond this sluice construct a temporary escape; the level of the escape should be about 5 feet below the top of the bank as left, and its length should be not less than 100 feet. The soil is rocky and the site favorable for an escape. The cost of doing this work has been estimated by the Superintending Engineer at 1,800 Rupees, and he has been instructed to carry it out. Besides this necessary expenditure the pay of the extra establishment employed under Mr. Lowry in preparing the plans and estimates for the project has to be provided for; this will amount, up to end of February, to Rupees 500; this sum, it is proposed, to provide from the Reserve.

16. The channel below the Baroor tank has not yet been commenced.

17. REMOVAL OF PUDDLE.—Before recommencing work on the tank it will be necessary to remove all the portions of the puddle wall which have been exposed to the air and are dried and cracked. It was seen only in its dry state, but it looked as if the clay was too pure and needed some admixture of sand; this point should be attended to when work is again commenced.

18. RECORD OF WORK DONE.—As the channel will have to be left in an incomplete state, all bench marks should at once be fixed permanently and their value distinctly recorded, and a plan and section should be prepared showing the exact state of the channel throughout and the work to be done in each furlong. Bench marks may conveniently be placed on milestones and quarter milestones and their value cut on the stone as well as recorded on the plan. The materials at site should be examined and stored so as to be easily watched, those perishable being disposed of if possible, and a careful account should be taken of them and all tools and stores on the work.

19. BLASTING ROCK.—It is probable that better arrangements may be made for blasting rock when the work is recommenced; the cost has been greater than it ought to be; the work requires skilled supervision, and if Sappers could be employed for the purpose it would probably be found that some saving would be made; as the work was carried out it was impossible to provide the necessary supervision.

20. BAROOR SMALL TANK.—The new weir to the enlarged tank will discharge into a drainage which at present supplies the Baroor small tank, and if this tank is to be kept up another large weir to discharge into the river will be necessary. It would seem to be the better arrangement to give up the small tank, and to carry the surplus from the large tank through it to the river by means of an embankment on the east side. The greater part of the small tank bed could then be cultivated and it will be commanded, as well as the land at present irrigated under it, by the large tank. Before the tank is completed this subject should receive consideration, otherwise the small tank will be destroyed the first time the new tank overflows. The drainage which falls into the small tank should be diverted into the large tank.

21. SUPPLY OF WATER AVAILABLE.—Since Colonel Mullins visited the work it does not seem that any additional information has been obtained regarding the supply of water available in the river, and it is to be regretted that while the work was in progress the river was not carefully gauged, a gauge rod was observed near the site of the proposed anicut, but the record was not forthcoming. It might be difficult at the site of the anicut to measure accurately the discharge of the river, but some point might have been selected where it could have been measured, and the record of the floods compared with the rainfall would have been some guide to what may be expected of the river. On the 22nd January Mr. Lowry said he had never observed the water in the river to be lower, and then two small irrigation channels, one on either side of the river, were discharging sufficient for the cultivation, so far as could be judged by rough measurement, of at least 300 acres each, and there were two separate streams of water passing down the river. The supply would be probably altogether sufficient for the cultivation of 1,500 acres. It seems, on the whole, that the anticipations with regard to the water-supply are likely to be realized, and that the project is one which is likely to be remunerative and of great benefit to the country. The Superintending Engineer will, when submitting the estimates, give all the information that is available on this subject, and it can then be more fully considered.

22. KILCOOPUM EXTENSION.—The original intention of the estimate was to continue the bund of the Baroor tank across a spur and another valley, called the Kilcoopum valley. It appears that this extension would be costly and would not add considerably to the storage, while it would destroy some extent of existing irrigation. It has therefore been thought advisable by the officers in charge of the work to give up the extension and to carry the bund up the spur, instead of across it, till the necessary level is reached. The abandonment of the Kilcoopum extension should, it is considered, be deemed settled.

23. PROPOSED KISTNAGHERRY RESERVOIR.—The site of the proposed dam on the Pooniaur and of the escape was visited. Little if any additional information beyond that recorded in G.O., F.R. No. 883, dated 9th April 1878, has been collected, and nothing useful can be done till an officer with a proper establishment can be detailed for the investigation.

24. SITE OF DAM.—The site for the bund appears a very favorable one, but a thorough examination of the bed of the river must be made before it can be said that it is possible to construct a dam. Rock will probably be found at no great distance below the sandy bed of river in which at places it crops up, but the rock must be sound and without fissures throughout. The soil in the neighbourhood is not suitable material of which to construct a high bund; in fact it could hardly be worse, and so far as it is known no clay is available except from a distance of upwards of a mile. Stone is available in any quantity on the spot, limestone close at hand, and there is an unlimited supply of fuel almost within the water-spread of the tank; it therefore would appear that a masonry dam would be suitable, and probably concrete faced with stone would be the best and cheapest material to make it of.

25. ESCAPE.—The site selected for an escape is a saddle about three miles north of the site of dam. Major Pennycuick states that levels have been taken up the course of every drainage to the south of the river to 150 feet above the bed of the river, but no other saddle has been approached and the selected site is the only one available. It is a very good one, rock crops out in several places, and there is a sufficient length to form a proper escape at about 110 feet above the bed of the river, with a moderate depth of water going over. The escape would be about two miles from the town of Kistnagherry, and the surplus would pass down the valley to the south of the town, returning to the Pooniaur some miles below the site of dam. In this valley however are three tanks and some considerable extent of cultivation most of which would have to be sacrificed. In his rough estimate of the cost of the works Major Pennycuick includes compensation for this irrigation, but it is a serious matter and if by any means the valley can be spared it should be.

26. ALTERNATIVE ESCAPE.—The weather was so wet when we visited the site of the dam the rocks on either side could not be examined. It may be possible however to provide an escape of some length at one end of the dam, and it certainly would be feasible if the dam were built of masonry to construct surplus sluices in it at such a level that water could be discharged with a velocity which would be harmless to the work. It is believed that if the general objections to discharging the river through the dam are waived, a scheme may be worked out which will enable the surplus to be discharged directly into the river at a not unreasonable cost. If this is done, the height of the saddle at which it is proposed to make the escape will not measure the high water level of the reservoir; a comparatively inexpensive bank there would enable the level to be raised by several feet.

27. IRRIGATION.—So far as can be learned there is on one if not on both sides of the river below the site of the dam a very considerable extent of land available for irrigation, and that the whole extent which ordinarily could be irrigated might be irrigated direct from the reservoir, the surplus water falling back into the Pooniaur, where it would be caught by the Nedingul anicut which will supply the Baroor tank.

28. IMPROVEMENT OF THE COUNTRY.—This part of the Salem district is, with the exception of a small strip alongside the river which is irrigated by small channels taken off the river, almost a barren waste, the contrast between the part under the influence of river water and the rest of the country being very striking. The improvement that would be effected by the storage of sufficient water to irrigate

4,000 acres would be of such inestimable value to the country, that the project should not be looked at as an investment of capital for the direct returns that it will pay. The work will, there is every reason to believe, give a sufficient direct return to pay interest on capital and leave a considerable margin of profit, and it will also protect a considerable extent of this thinly-populated country from famine, and act as a flood moderator and prevent damage now not infrequently caused by inundation. These advantages are, it is thought, sufficient to warrant the expenditure necessary for completely investigating the project and preparing the necessary plans and estimates.

29. MARANDAHALLI PROJECT.—This project also is described in Colonel Mullins' memorandum printed with G.O., No. 779 I., dated 4th October 1878. Nothing more is known of the river and the site for the anicut than when that memorandum was written, and it is understood that very little work has been done since that time. The place has been extremely unhealthy both for the coolies and the engineering staff employed, and the work has been frequently interrupted in consequence.

30. COMPONENT PARTS OF THE PROJECT.—The project may be divided into the following parts:—

1. Anicut.
2. Supply channel to Sangambasavan tank.
3. Enlarging Sangambasavan tank.
4. Channels from do.
5. Enlarging Jairy Talab tank.
6. Channels from Jairy Talab.

It was contemplated to supply other tanks below the Jairy Talab as far as Dharmapuri tank, but apparently no survey has been made beyond a short distance below the Jairy Talab.

31. ESTIMATE.—An approximate estimate amounting to Rupees 1,50,000 was sanctioned in G.O., No. 345 I., dated 24th September 1877, but detailed estimates have not yet been worked out. Lieutenant de Villamil, R.E., was understood to be preparing these estimates, but his time must have been almost entirely taken up in superintending the work, and his health suffered very considerably, so that comparatively little was done beyond levelling the supply channel and contouring the Sangambasavan tank, and the drawings forthcoming are so incomplete that it will be a most difficult matter to work out the estimates. It is quite impossible that the Divisional Officer, Mr. Lowry, should, however willing, do the work, and if it is to be done satisfactorily, a special officer with one or two surveyors will have to be employed for the purpose.

32. COST OF WORK.—The accounts have not been made up, and accurate figures to show the expenditure chargeable to the work cannot be ascertained. The approximate figures given are as follow:—

	RS.
Expenditure to 31st December 1878	2,06,000
Deduct excess due to famine not less than	1,23,000
Balance chargeable to the work	82,400

and it seems probable that to complete the project would entail a further expenditure of 1½ lakhs.

33. ANICUT.—No work has been done to the anicut, two rough lime kilns are built, a small quantity of firewood and limestone has been collected, and a few cut stones have been prepared.

34. SUPPLY CHANNEL TO SANGAMBASAVAN TANK.—A great deal of work has been done to the supply channel; up to the point at which it falls into the old supply channel, about three-fourths of the work has been done; there is still, however, a good deal of blasting rock to be done, and all inlet and outlet have to be built. The sides of the excavation have been left in many places vertical, and there is sure to be a good deal of soil washed into the channel during next rains, but this cannot be prevented except at a considerable expenditure.

35. SANGAMBASAVAN TANK.—The principal part of the work done is on the Sangambasavan tank, about 4 millions cubic feet. Excavation of all sorts has been done against estimate of about 5½ millions cubic feet, and 200,000 cubic feet puddle wall have been built, besides stone revetment to the height of the new bund across the greater part of the old tank. The revetment of the old tank bund has been removed, and the earth stands at a slope of less than ½ to 1, its height above top of new bund which is placed in front of it being about 8 feet, and the old sluice has been blocked up, so that the old tank has been rendered useless, and there is no possibility of completing the new one for a considerable time even if funds could be provided for it. The ayacut under the old tank is 339 acres, and the assessment Rupees 1,565. The Superintending Engineer has been requested to estimate the cost of re-opening the sluice, revetting the inside face of the old bund with stone collected for the new revetment, and opening a rough escape at the west end of the bund, to see if it will be possible to save the existing cultivation next season.

36. CHANNELS FROM SANGAMBASAVAN TANK.—No work has been done to these channels.

37. JAIRY TALAB TANK.—A very insignificant quantity of earthwork at the west end of this tank bund has been done.

38. CHANNELS FROM JAIRY TALAB TANK.—Excavation of the west channel for about a mile has been carried out in part; the alignment of this channel was referred to in Colonel Mullins' memorandum above quoted, and probably since he saw the work a little more earthwork has been done. It can now be seen that the rocky cutting will be so formidable an undertaking that it will probably be more economical to revert to the old alignment, or at all events to select a line where less excavation will be needed.

39. MATERIALS AT SITE.—There are materials, building stone, limestone, &c., both on the supply channel and at the Sangambasavan tank, and a variety of tools and stores, some of considerable value, two bungalows near the tank, and many sheds. To prevent loss complete lists must be at once made out, the material stored on the work, and the tools and stones sent to some locality where they can be used. One of the bungalows should be kept up as a rest-house, the other demolished, and all the huts which are falling to pieces and apparently valueless should be burnt. The extreme unhealthiness of the localities on which the huts were built should not be forgotten, and if the work is taken up again no huts should be allowed to the west of the tank bund. The remarks made in paragraph 18 on recording the work done and fixing bench marks should be attended to here.

40. WORK TO BE DONE.—There is no question here of providing a small sum for emergent work, but the Superintending Engineer's estimate of the cost of making the old Sangambasavan tank available for existing irrigation next season will be awaited and funds allotted then if possible. It seems that the work hitherto done might best be utilized, first, by fitting the Sangambasavan tank to hold its usual supply of water; second, by clearing to proper level a certain width say 15 feet of the supply channel from the site of anicut to the junction with old supply channel and fitting it to carry a depth of 2 feet of water; third, by making either a rough head sluice, or by building a portion of the head sluice which has been already designed, to be subsequently added to; fourth, by constructing a rough stone dam with the face stones only set in cement 2 feet in height across the river, the bed of which is understood to be rock near the surface. The supply to the Sangambasavan tank could thus be improved and the work done to form the new tank would not suffer much, and should the tank discharge surplus the water would find its way by a natural drainage to the Jairy Talab tank, one weir of which could, if necessary, be extended.

41. EXPECTED RESULTS FROM THE PROJECT.—There is no further information available on which to judge the merits of the project than when the approximate estimates were submitted. Nothing is known of the supply of water available in the river, and the insignificant size of the drainage basin does not warrant sanguine anticipations. Arrangements should be at once made for gauging the river, and the project may be found if not a remunerative an advantageous one if carried out

on a small scale. The work done on the supply channel and the Sangambasavan tank will be in great measure thrown away if these works are not completed, and their completion will entail the construction of the anicut, but there are some doubts as to the advisability of enlarging the Jairy Talab tank, the proposed addition of 10 feet to the height of the bund would cause submergence of some valuable bund, and the bund is already a high one, of black soil apparently, and the raising would be expensive. If the investigation is completed, it may be found advisable to complete the first three works named in the project and then allow whatever water may be available after supplying the Sangambasavan tank to find its way by the natural drainages from tank to tank providing only for them efficient escapes. The available storage might not suffice for the available supply in a wet year, but in ordinary years it is believed that none of the water which could be taken from the river would be allowed to run to waste.

FORT ST. GEORGE,
7th February 1879.

(Signed) J. O. HASTED, Lt.-Col., R.E.,
Ag. Chief Engineer for Irrigation.

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

No. 39. ORDER THEREON, 11th February 1879, No. 92 I.

UNTIL complete estimates for the Pennagoondapuram, Baroor and Marandahalli Projects are submitted, the Government cannot decide to what extent it will be advisable to prosecute the works. It is hoped that the Executive Engineer with the aid of the establishment placed at his disposal will be able shortly to submit the estimates for the two former projects, and the Chief Engineer, Department Public Works, will arrange, as soon as practicable, to place at the disposal of the Superintending Engineer, Fourth Circle, the services of an officer for the completion of the estimates for the Marandahalli Project. The good work hitherto done by Mr. Lowry, the Executive Engineer in charge of the Division, is noticed with satisfaction.

2. The instructions given by the Acting Chief Engineer for Irrigation as to the work immediately to be carried out are approved, and a sum of Rupees 3,000 will be at once placed at the disposal of the Superintending Engineer from the reserve for this work. The Superintending Engineer will prepare estimates for the work suggested in paragraph 40 of the memorandum under reference, and also for such work as will enable the Baroor channel to be utilized to some extent.

3. The remarks made by the Acting Chief Engineer for Irrigation regarding the careful measurement and record of work done will receive attention. All tools, furniture, &c., should be disposed of as directed in G.O., Revenue Department, No. 116, dated 17th January 1879.

4. The investigation of the Kistnagherry Reservoir Project will receive further attention when the services of a special officer can be made available.

(True Extract.)

(Signed) J. O. HASTED, Lt.-Col., R.E.,
Ag. Joint Secy. to Govt., P.W.D.,
Irrigation Branch.

To the Superintending Engineer, Fourth Circle.
" Chief Engineer, Public Works Department.
" Chief Engineer for Irrigation.
" Revenue Department.

Exd. C. Howarth and E. C. Shunker.
Spare Copies

33

IRRIGATION.

Govt. of (1879) Madras.

PUBLIC WORKS.

To

The SUPERINTENDING ENGINEER,
FOURTH CIRCLE,
&c., &c., &c.

Dated February 11th.

Rect.

Encl.

G. O., 11th February 1879, No. 92 I.

FEBRUARY.

Nos. 38-39.

Pennagoondapuram, Baroor and Marandahalli Projects, and Kistnagherry Reservoir Project, Salem District.—Orders on the —

Accompaniment to G.O., No. 124 I., dated 11th February 1881.

LIST OF APPENDICES TO THE NOTE BY THE CHIEF ENGINEER FOR IRRIGATION ON BAROOR PROJECT.

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APPENDIX No. 1.

SUPERINTENDING ENGINEER'S. OFEICE
Coimbatore, 18*th July* 1879.

FROM No. 69-25 S.L.

MAJOR P. MONTGOMERIE, R.E.,

To Superintending Engineer, Fourth Circle,

THE CHIEF ENGINEER FOR IRRIGATION.

SIR,

I have the honor to submit the Plans, Estimates, and documents as per accompanying lists, connected with the Baroor Project and the Pennagondapuram Tank Restoration Scheme in the Salem District, which have been prepared by Mr. Lowry, Executive Engineer of the Hosúr Division.

	RS.
Baroor Project Estimate	2,35,500
Pennagondapuram Tank Estimate...	69,000

2. These papers have been detained in this office in the hope that I would be able to thoroughly examine them and verify the calculations before submitting them to you; but owing to the very extended range of the present Superintending Engineer's Circle, I find it almost impossible to conduct the current duties of the office (which have for some time been in arrears) and at the same time dispose of the numerous Irrigation Estimates, most of which have to be sanctioned without reference to the Head Office, and I trust I may be excused for submitting these two projects as received from the Divisional Officer.

3 Both projects appear to have been very carefully prepared by Mr. Lowry, and I have much pleasure in recommending to your favorable consideration the request made in the 5th paragraph of his letter, No. 2,643, dated 17th March 1879, regarding his supersession in the Department, and which he refers to in the last paragraph of his Report on the Baroor Project. And if the remarks made by me in my letter as District Engineer of Salem and printed with G.O., No. 228 I., dated 9th August 1877, regarding Mr. Lowry's "backwardness in the preparation of estimates," had any influence in the supersession he complains of, but which were not made with that intent, I have all the greater pleasure in bringing to favorable notice Mr. Lowry's good work in the preparation of these projects under difficult circumstances.

APPENDIX No. 2.

From R. J. LOWRY, Esq., Executive Engineer, Hosúr Division, to the Superintending Engineer, Fourth Circle, Coimbatore, dated Hosúr, 17th March 1879, No. 2,643.

I HAVE the honor to forward, for the approval and sanction of Government, the plans and estimate of the Baroor Irrigation Project with the other documents noted in the margin connected therewith.

1 Specification.
1 Report.
1 List of Plans.
47 Sheets of Plans.*
11 (Sheets) Channel Estimates.*
1 Sheet of Abstract Estimate.*
1 Bundle, containing 22 Estimates of Baroor Project.*
1 Compensation statement, with two enclosures from the Tahsildars.
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* Despatched per banghy post.

2. The amount of the estimated cost of the project is as you will perceive Rs. 2,35,500, and the expected revenue Rs. 50,000, or 21 per cent. on the outlay.

3. You will observe by the Report that there is every probability of much more water being available than will be required for the area, 10,000 acres, now calculated on as to be irrigated by

the project, and as there is a large extent of land that is commanded by the left sluice channel, by the cultivation of which the returns might be increased very considerably, the revenue will probably be more, rather than less, than it is here put down.

4. I am informed by the Tahsildar and by several of the more influential and intelligent of the villagers of Baroor and the neighbourhood, that the lands will all be at once taken up the moment the work is resumed, and they are convinced that it is the intention of Government to complete the project.

5. Now that you will have the whole scheme before you and can see the amount of work that had to be done, I cannot believe you will consider any excuse necessary for my having failed to submit the project when promised. You are aware of the quantity of other work besides the preparation of this and the Pennagondapuram Project which devolved on me in the last few months, and can judge if there was any needless delay. No one could be more anxious than I have been to get this project placed before Government in a complete state as soon as possible. As I had hoped that with this and the other project named above before them, and when they had been told by my late District Engineer, Major Pennycuick, R.E., and yourself how hard I have worked in the last two years, that they would graciously reconsider my claims for promotion and re-instate me in the position in the Department I should have held and which I have never done anything to forfeit, but in which I have been superseded by four of my juniors since December 1877.

6. I request that you will be good enough in forwarding the project to Government to submit this letter with it.

APPENDIX No. 3.

THERE are forty-seven sheets of Plans accompanying the Baroor Project as follows:—

Sheet No. 1—Is an Index Map showing the position of the proposed anicut or dam to be placed across the Puniár or Pennar. The supply-channel thence to Baroor Tank, that tank with its catchment basin and the lands to be irrigated under it as well as the lands to be irrigated direct from the supply channel. This map also shows the Puniár and the country on both sides of that river to the extent of 84 square miles. It is drawn to a scale of 2 miles to an inch.

Sheet No. 2—Shows sections of the Pennar, the position of the sections, and the distance of each above and below the anicut is lettered on them.

Sheet No. 3.—On this are shown the anicut or dam in elevation plan and section with the position of the Agaram, Nedingal and Baroor head sluices and plans and sections of the flood banks on each side of the anicut.

Sheet No. 4.—On this sheet are drawn the plan elevation and sections of Baroor head sluice, showing the wings and how it is proposed to raise the walls on the rock on the left and connect it with the flood bank on that side.

Sheet No. 5—Shows the plan elevation and sections of Agaram head sluice and the head of the Agaram channel.

Sheet No. 6—Shows the plan elevation and sections of a head sluice proposed for the existing Nedingal channel.

Sheet No. 7—Shows plans and sections of the sand sluices proposed to be placed in the dam, one on each side.

Sheets 8 *to* 11 inclusive show survey, longitudinal and cross sections of the Baroor supply-channel with the three tanks through which it passes and the drainage streams crossing it.

Sheet No. 12.—On this is drawn the plans, &c., for three inlets and two outlets for passing drainage in the first mile over the channel.

Sheet No. 13.—On this sheet are shown the drawings for an under or syphon sluice to pass the surplus from the Veeroopully tank under the channel.

Sheet Nos. 14 *to* 22—Show the plans and sections of fourteen inlets and twenty-one outlets for passing the drainage which crosses the channel between the first mile and the Baroor Tank.

Sheet No. 23.—On this sheet are drawn the plans for accommodation bridges to be built across the channel, one of which is proposed to be placed across the channel near its head to carry the road from Cavariputnam to Pochempully, one in the third mile to carry a branch from the above road to the village of Muratheray, and a third near where the channel enters Baroor Tank.

Sheet No. 24—Shows the plans for a foot-bridge, of which there will be four built across the channel at places found convenient for giving the villagers access to their villages and fields.

Sheet No. 25—Shows plan of distribution sluices for the irrigation of the lands under the upply-channel.

Sheet No. 26—Is the Survey Plan of the Baroor Tank showing contours rising by 3 feet each from 103·60 to 115·60 above datum; this sheet also gives a longitudinal section of the tank bund as proposed, the position of the two proposed sluices and the commencement of the irrigation channels leading from them.

Sheet No. 27—Shows cross sections of Baroor Tank bund.

Sheet No. 28.—On this sheet are the drawings of the proposed sluice for the right or western sluice of Baroor Tank.

Sheet No. 29—Shows the plans, sections, &c., for the left or western sluice of Baroor Tank.

Sheet No. 30—Shows plans and sections, &c., of Baroor Tank surplus weir.

Sheets Nos. 31 *to* 38—Are Survey Plans of the irrigable lands under the tank showing the position of both irrigation channels; also the existing tanks and the lands under them within the area to be irrigated by the project, and also the longitudinal and cross sections of those channels and the position of some of the masonry falls for regulating the gradients of the channel.

Sheets Nos 39 *to* 43.—On these sheets are drawn plans of the masonry falls for regulating the gradients of the beds of the irrigation channels.

Sheet No. 44—Shows plans of the distribution sluices for giving water to the lands under the irrigation channel.

Sheet No. 45—Shows the plans of outlets and inlets for passing water into and out of the irrigation channel from upland drainage.

Sheet No. 46.—On this is drawn the plans and sections of an aqueduct for passing drainage over the distribution channels only, and also of an inlet and waste weir for discharging into and out of the channel water from upland drainage.

Sheet No. 47.—On this sheet are drawn two designs for accommodation bridges to be built over the distribution channels.

(Signed) R. J. LOWRY,
Executive Engineer

Hosúr,
15th March 1879.

APPENDIX No. 4.

REPORT TO ACCOMPANY THE PLAN AND ESTIMATE FOR THE BAROOR IRRIGATION PROJECT.

Index to Report.

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Value of project	27
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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 25½ 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 Engineer'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 $D = C A\sqrt[3]{M^2}$. 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 those 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 4½ inches at the lower end; when fully open these orifices will with a head of 8½ 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 17¼ inches at the upper and 6¾ inches at the lower end, with a length of 45 inches each; these orifices when fully open with an 8½ 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 3½ 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.

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.

State of bund.

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.

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.*

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

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

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. 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.

Discharge from Catchment Basin.

Length of Escape Weir.

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 25¼ miles and be of the dimensions shown on the sections.

Eastern Distribution Channels.

The bottom width of the left or eastern channel at the head will be 18 feet, with slopes of 1½ 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

38

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.

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.

Masonry falls for reducing gradient.

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.

Aqueduct.

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

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 1½ 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.

Western Distribution Channels.

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.

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.

Value of Project.

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 21¼ per cent.

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.

Cause of delay in submitting project.

The Pennugoondapoornm 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.

G.O., No. 779 I., of 4th October 1878.

HOSUR,
15th January 1879.

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

APPENDIX No. 5.

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 in 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.

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

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.

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

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.

APPENDIX No. 6.

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 Penamkony 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.

REGISTER of Rainfall to accomp any 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.
	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
Remount Depôt, Mathegherri.	1872	..	0·80	..	2·75	8·00	1·25	2·50	4·00	6·25	4·75	8·25	2·75	41·80
	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	413·33
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
	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
Hosúr ..	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.
	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
Krishnagiri ..	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
	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	..	..	..	..	2·00	..	5·00	0·00	1·00	1·00	..	..	23·70
	1870	0·10	..	0·10	..	2·00	0·70	2·75	2·75	4·80	7·80	0·30	..	21·30
Dharmapuri ..	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. 8.

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.	Amount of Compensation for Land.	Amount of Compensation for the loss of Crop.	Grand Total of Compensation.	Date of Transfer.
						RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	
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	
				Velangamoody ..	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	43·15	27 5 0	273 2 0	125 0 0	398 2 0	
				Nedingal	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 No. 9-A.

ABSTRACT Estimate of Nedingal Anicut.

Quantity.	Description of Work.	Per	Rate.	Amount.	Total.
			RS. A. P.	RS. A. P.	RS. A. P.
4,136·38	C. feet of benching rock	C. ft.	0 12 0	3,102 4 6	
532·75	C. yards of concrete	C. yd.	4 8 0	2,397 6 0	
441·72	Do. of coursed rubble with cement	Do.	6 0 0	2,650 5 4	
422·5	Do. of rough stone in chunam...	Do.	3 0 0	1,267 8 0	
3,138·75	C. feet of coping stone	C. ft.	0 12 0	2,354 1 0	
532	Number of dowel pins	No.	0 6 0	199 8 0	
1,690·5	C. yards of new rough stone work ...	C. yd.	1 0 0	1,690 8 0	
113·60	Squares of pointing with cement ...	Sq.r	2 0 0	227 3 2	
13,646·5	C. yards of earthwork excavation ...	C. yd.	0 2 0	1,705 13 0	
132	C. feet of burnt stone dressed ...	C. ft.	0 6 0	49 8 0	
12¼	Do. of teakwood	Do.	4 0 0	49 0 0	
4	Lifting gear	Each	100 0 0	400 0 0	
	Total ...	...	...	16,093 1 0	
	Sundries and Superintendence ...	...	...	804 15 0	
	Total Estimate ...	...	...	...	16,898 0 0

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

APPENDIX No. 9-B.

ABSTRACT Estimate of Flood Embankments.

Quantity.	Dercription of Work.	Per.	Rate.	Amount.	Total.
			RS. A. P.	RS. A. P.	RS. A. P.
2,460	C. yards of earthwork, soft soil ...	C. yd.	0 1 3	192 3 0	
6,702	Do. of do. gravel soil ...	Do.	0 1 6	628 5 0	
1,208	Do. of new rough stone work...	Do.	1 0 0	1,208 0 0	
257	Do. of gravel backing	Do.	0 4 0	64 4 0	
369·43	Squares of turfing	Sqr.	0 6 0	138 8 6	
	Total ...	...	...	2,231 4 6	
	Sundries and Superintendence ...	...	...	111 11 6	
	Total Estimate ...	...	...	...	2,343 0 0

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

APPENDIX No. 9-C.

ABSTRACT Estimate of Agaram Channel Head Sluice.

Quantity.	Description of Work.	Per	Rate.	Amount.	Total.
			RS. A. P.	RS. A. P.	RS. A. P.
304½	C. yards of concrete	C. yd.	4 8 0	1,370 4 0	
833	Do. of burnt stone with cement.	Do.	6 0 0	4,998 0 0	
767¾	C. feet of arch work	C. ft.	0 8 0	383 14 0	
345⅞	Do. of cut stone work... ...	Do.	1 0 0	345 14 0	
750⅞	Do. of burnt stone dressed ...	Do.	0 6 0	281 9 3	
58·40	Squares of pointing with cement ...	Sq.	2 0 0	116 12 9	
45¾	C. feet of teakwood	C. ft.	4 0 0	183 0 0	
3,515	C. yards of earthwork	C. yd.	0 1 6	329 9 5	
248⅝	Do. of rough stone in chunam...	Do.	3 0 0	745 8 0	
2	Lifting gear	Each	200 0 0	400 0 0	
	Total ...	...	...	9,154 7 5	
	Sundries and Superintendence ...	...	...	457 8 7	
	Total Estimate ...	...	...	...	9,612 0 0

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

APPENDIX No. 9-D.

Abstract Estimate of Agaram Channel New Head.

Quantity.	Description of Work.	Per	Rate.	Amount.	Total.
			Rs. A. P.	Rs. A. P.	Rs. A. P.
5,249 1/3	C. yards of earthwork	C. yd.	0 2 0	656 2 8	
310	Do. of stone revetment ...	Do.	1 0 0	310 0 0	
155	Do. of gravel backing ...	Do.	0 4 0	38 12 0	
	Total ...	...	...	1,004 14 8	
	Sundries and Superintendence ...	...	...	50 1 4	
	Total Estimate ...	...	...	...	1,055 0 0

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

APPENDIX No. 9-E.

Abstract Estimate of Nedingal Channel Head Sluice.

Quantity.	Description of Work.	Per	Rate.	Amount.	Total.
			Rs. A. P.	Rs. A. P.	Rs. A. P.
248	C. yards of earthwork	C. yd.	0 1 6	23 4 0	
92 3/5	Do. of concrete	Do.	4 8 0	416 11 2	
40	Do. of rough stone in chunam.	Do.	3 0 0	120 0 0	
52 7/16	Do. of burnt stone in soorkee.	Do.	3 8 0	184 7 2	
63 1/2	C. feet of cut stone	C. ft.	1 0 0	63 8 0	
27	Do. of burnt stone dressed ...	Do.	0 6 0	10 2 0	
6·77	Squares of pointing in soorkee ...	Sqr.	1 8 0	10 2 6	
18 1/12	C. feet of teakwood	C. ft.	4 0 0	72 5 4	
1	Lifting gear	Each	120 0 0	120 0 0	
	Total ...	...	...	1,020 8 2	
	Sundries and Superintendence ...	...	...	50 7 10	
	Total Estimate ...	...	...	...	1,071 0 0

Hosur,
15th March 1879.

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

APPENDIX No. 10-A.

Abstract Estimate of Baroor Tank Supply Channel Head Sluice.

Quantity.	Description of Work.	Per	Rate.	Amount.	Total.
			Rs. A. P.	Rs. A. P.	Rs. A. P.
486	C. feet of benching rock	C. ft.	0 12 0	364 8 0	
381·14	C. yards of burnt stone with cement.	C. yd.	6 0 0	2,286 13 5	
3·5	Do. of concrete	Do.	4 8 0	15 12 0	
662·96	C. feet of arch work	C. ft.	0 8 0	331 7 8	
231·75	Do. of burnt stone dressed ...	Do.	0 6 0	86 14 6	
576·75	Do. of cut stone work	Do.	1 0 0	576 12 0	
43·84	Squares of pointing with cement.	Sqr.	2 0 0	87 10 10	
74 3/4	C. feet of teakwood	C. ft.	4 0 0	299 0 0	
234	C. yards of earthwork	C. yd.	0 1 6	21 15 0	
128 1/2	Do. of blasting rock ...	Do.	2 0 0	257 0 0	
3	Lifting gear	Each	200 0 0	600 0 0	
	Total ...	...	...	4,927 13 5	
	Sundries and Superintendence ...			246 2 7	
	Total Estimate ...	...	...	...	5,174 0 0

Hosur,
15th March 1879.

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

APPENDIX No. 10-B.

Abstract Estimate of Channel Earthworks.

Item No.	Quantity.	Description of Work.	Per	Rate.	Cost.
				Rs. A. P.	Rs.
16	91,303	Earthwork, hard gravel	C. yd.	0 2 0	11,413
17	99,388	Do., gravel	Do.	0 1 6	9,318
18	18,320	Do., soft	Do.	0 1 3	1,431
19	3,567	Rock blasting	Do.	2 0 0	7,134
20	2,822	Do.	Do.	1 0 0	2,822
21	2,817	Rock cutting	Do.	0 8 0	1,408
22	6,600	Do.	Do.	0 4 0	1,650
25	2,900	Rough stone revetment	Do.	1 0 0	2,900
26	2,053	Do. do.	Do.	0 12 0	1,540
29	2,620	Gravel backing	Do.	0 4 0	655
28	4,025	Puddling	Do.	0 6 0	1,509
31	10,459	Turfing	Sqr.	0 6 0	3,922
		Total ...	...	...	45,702
		Sundries and Superintendence at 5 per cent.	...	...	2,302
		Grand Total ...	...	...	48,004

Hosur,
15th March 1879.

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

APPENDIX No. 10-C.

Abstract Estimate of Baroor Tank Supply Channel, Masonry Works.

Quantity.	Description of Work.	Per	Rate	Amount.	Total.
	Syphon Sluice for Supply Channel.		Rs. A. P.	Rs. A. P.	Rs. A. P.
1,283 3/8	C. yards of earthwork	C. yd.	0 1 3	100 3 10	
337	Do. of concrete	Do.	3 0 0	1,011 0 0	
168 3/8	Do. of rough stone in chunam...	Do.	3 0 0	505 2 0	
296	Do. of burnt stone in chunam...	Do.	3 8 0	1,036 0 0	
31 7/10	Squares of pointing	Sqr.	0 12 0	23 12 4	
	Total ...	...	...	2,676 2 2	
	Sundries and Superintendence ...	...	...	133 13 10	
	Total Estimate ...	...	...	...	2,810 0 0
	Inlet No. 1.				
52	C. yards of earthwork	C. yd.	0 1 3	4 1 0	
50	Do. of new stone work ...	Do.	0 12 0	37 8 0	
14	Do. of jelly	Do.	0 4 0	2 12 0	
	Total ...	...	...	44 5 0	
	Sundries and Superintendence ...	...	...	2 11 9	
	Total Estimate ...	...	...	...	47 0 0
	Inlet No. 2.				
2 3/5	C. yards of earthwork	C. yd.	0 1 3	0 2 9	
10 2/3	Do. of new stone work ...	Do.	0 12 0	7 12 9	
2 1/3	Do. of jelly backing	Do.	0 4 0	0 10 0	
	Total ...	...	...	8 9 6	
	Sundries and Superintendence ...	...	...	0 6 6	
	Total Estimate ...	...	...	...	9 0 0

Abstract Estimate of Baroor Tank Supply Channel, Masonry Works—*cont.*

Quantity.	Description of Work.	Per	Rate.	Amount.	Total.
			RS. A. P.	RS. A. P.	RS. A. P.
	Inlet No. 3.				
19	C. yards of earthwork	C. yd.	0 1 3	1 7 9	
21¼	Do. of new stone work ..	Do.	0 12 0	16 5 7	
4¾	Do. of jelly backing	Do.	0 4 0	1 3 0	
	Total ...	...	...	19 0 4	
	Sundries and Superintendence ...	...	...	0 15 8	
	Total Estimate ...	...	...	...	20 0 0
	Inlet No. 4.				
44⅖	C. yards of new stone work ...	C. yd.	0 12 0	33 4 9	
8	Do. of gravel backing ...	Do.	0 4 0	2 0 0	
1	Do. of blasting rock ...	Do.	2 0 0	2 0 0	
	Total ...	...	...	37 4 9	
	Sundries and Superintendence ...	...	...	1 11 3	
	Total Estimate ...	...	...	...	39 0 0
	Inlet No. 5.				
23⅖	C. yards of earthwork	C. yd.	0 1 3	1 13 6	
27⅔	Do. of new stone work ...	Do.	0 12 0	20 8 9	
5⅔	Do. of gravel backing ...	Do.	0 4 0	1 6 8	
	Total ...	...	...	23 12 11	
	Sundries and Superintendence ...	...	...	1 3 1	
	Total Estimate ...	...	...	...	25 0 0
	Inlets Nos. 6 *and* 16.				
38	C. yards of earthwork	C. yd.	0 1 3	2 15 6	
45	Do. of new stone work ...	Do.	0 12 0	33 12 0	
37½	Do. of gravel backing ...	Do.	0 4 0	9 6 0	
	Total ...	...	...	46 1 6	
	Sundries and Superintendence ...	...	...	2 14 6	
	Total Estimate ...	...	...	49 0 0	
	For two inlets ...	...	...	...	98 0 0
	Inlet No. 7.				
37½	C. yards of earthwork	C. yd.	0 1 3	2 14 10	
45	Do. of new stone work ...	Do.	0 12 0	33 12 0	
9 7/10	Do. of gravel backing ...	Do.	0 4 0	2 6 9	
	Total ...	...	...	39 1 7	
	Sundries and Superintendence ...	...	...	1 14 5	
	Total Estimate ...	...	...	...	41 0 0
	Inlet No. 8.				
10	C. yards of earthwork	C. yd.	0 1 3	0 12 6	
19	Do. of new stone work ...	Do.	0 12 0	14 4 0	
4 9/17	Do. of gravel backing ...	Do.	0 4 0	1 1 3	
	Total ...	..	...	16 1 9	
	Sundries and Superintendence	...	...	0 14 3	
	Total Estimate ...	...	...	...	17 0 0

Abstract Estimate of Baroor Tank Supply Channel, Masonry Works—*cont.*

Quantity.	Description of Work.	Per	Rate.	Amount.	Total.
			RS. A. P.	RS. A. P.	RS. A. P.
	Inlet No. 9.				
22·22	C. yards of earthwork	C. yd.	0 1 3	1 11 9	
34	Do. of new stone work ...	Do.	0 12 0	25 8 0	
7·44	Do. of gravel backing ...	Do.	0 4 0	1 13 9	
	Total ...	...	...	29 1 6	
	Sundries and Superintendence ...	...	...	1 14 6	
	Total Estimate ...	...	...	...	31 0 0
	Inlet No. 10.				
42	C. yards of earthwork	C. yd.	0 1 3	3 4 6	
45	Do. of new stone work ...	Do.	0 12 0	33 12 0	
7 7/9	Do. of gravel backing ...	Do.	0 4 0	1 15 1	
	Total ...	...	...	38 15 7	
	Sundries and Superintendence ...	...	...	2 0 5	
	Total Estimate ...	..	...	...	41 0 0
	Inlet No. 11.				
112	C. yards of earthwork	C. yd.	0 1 3	8 12 0	
104	Do. of new stone work ...	Do.	0 12 0	78 0 0	
22	Do. of gravel backing ...	Do.	0 4 0	5 8 0	
	Total ...	...	...	92 4 0	
	Sundries and Superintendence ...	...	...	4 12 0	
	Total Estimate ...	...	...	...	97 0 0
	Inlet No. 12.				
41⅔	C. yards of earthwork	C. yd.	0 1 3	3 4 1	
44⅔	Do. of new stone work ...	Do.	0 12 0	33 8 0	
14⅔	Do. of gravel backing ...	Do.	0 4 0	3 8 10	
	Total ...	...	...	40 4 11	
	Sundries and Superintendence ...	...	...	2 11 1	
	Total Estimate ...	...	...	...	43 0 0
	Inlet No. 13.				
29⅓	C. yards of earthwork	C. yd.	0 1 3	2 3 10	
38	Do. of new stone work ...	Do.	0 12 0	28 8 0	
8⅓	Do. of gravel backing ...	Do.	0 4 0	2 1 3	
	Total ...	...	...	32 13 11	
	Sundries and Superintendence ...	...	...	1 2 11	
	Total Estimate ...	...	...	...	34 0 0
	Inlets No. 14.				
34⅓	C. yards of earthwork	C. yd.	0 1 3	2 11 1	
37⅔	Do. of new stone work ...	Do.	0 12 0	28 4 0	
8 2/7	Do. of gravel backing ...	Do.	0 4 0	2 0 10	
	Total ...	...	...	32 15 11	
	Sundries and Superintendence ...	...	...	1 0 1	
	Total Estimate ...	...	...	...	34 0 0

Abstract Estimate of Baroor Tank Supply Channel, Masonry Works—*cont.*

Quantity.	Description of Work.	Per	Rate.	Amount.	Total.
			RS. A. P.	RS. A. P.	RS. A. P.
	Inlet No. 15.				
28	C. yards of new stone work ...	C. yd.	0 12 0	21 0 0	
7	Do. of gravel backing ...	Do.	0 4 0	1 12 0	
	Total ...	...	...	22 12 0	
	Sundries and Superintendence ...	...	...	1 4 0	
	Total Estimate ...	...	...	...	24 0 0
	Outlet No. 1.				
45⅔	C. yards of rock blasting	C. yd.	2 0 0	91 5 4	
102½	Sq. feet of benching	Sq. ft.	0 6 0	38 7 0	
10½	C. yards of rough stone in chunam...	C. yd.	2 8 0	26 4 0	
1½	Squares of pointing	Sqr.	0 12 0	1 2 0	
	Total ...	...	...	157 2 4	
	Sundries and Superintendence ...	...	...	7 13 8	
	Total Estimate ...	...	...	...	165 0 0
	Outlet No. 2.				
1½	C. yards of earthwork	C yd.	0 1 3	0 1 10	
1⅛	Do. of rough stone in chunam	Do.	2 8 0	2 12 5	
11¼	Do. of new stone work ...	Do.	0 12 0	8 11 2	
2⅛	Squares of pointing	Sq.r	0 12 0	1 14 0	
3	C. yards of backing jelly	C. yd.	0 4 0	0 12 0	
	Total ...	...	...	14 3 5	
	Sundries and Superintendence ...	...	...	0 12 7	
	Total Estimate ...	...	...	...	15 0 0
	Surplus Weir, Moorasamputty Tank.				
73	C. yards of earthwork	C. yd.	0 1 3	5 11 3	
59⅓	Do. of rough stone in chunam...	Do.	2 8 0	149 8 6	
6⅛	Squares of pointing	Sqr.	0 12 0	5 1 0	
52⅝	C. yards of new stone work ...	C. yd.	0 12 0	39 6 6	
179	Sq. feet of tabling rock	Sq. ft.	0 6 0	67 2 0	
12¼	C. yards of gravel backing	C. yd.	0 4 0	3 1 4	
	Total ...	...	...	269 14 7	
	Sundries and Superintendence ...	...	...	13 1 5	
	Total Estimate ...	...	...	...	283 0 0
	Outlet No. 4.				
53	C. yards of earthwork	C. yd.	0 1 3	4 2 3	
63⅜	Do. of rough stone in chunam...	Do.	2 8 0	159 2 8	
5⅜	Squares of pointing	Sqr.	0 12 0	4 5 0	
28⅝	C. yards of new stone work ...	C. yd.	0 12 0	21 4 6	
5¼	Do. of gravel backing	Do.	0 4 0	1 6 0	
	Total ...	...	...	190 4 5	
	Sundries and Superintendence ...	...	...	9 11 7	
	Total Estimate ...	...	...	...	200 0 0
	Outlet No. 5.				
8½	C. yards of earthwork	C. yd.	0 1 3	0 10 7	
24⅓	Do. of rough stone in chunam...	Do.	2 8 0	60 13 4	
14	Do. of new stone work... ...	Do.	0 12 0	10 8 0	
2⅞	Do. of gravel backing	Do.	0 4 0	0 11 0	

Abstract Estimate of Baroor Tank Supply Channel, Masonry Works—*cont.*

Quantity.	Description of Work.	Per	Rate.	Amount.	Total.
			RS. A. P.	RS. A. P.	RS. A. P.
	Outlet No. 5—cont.				
3¾	Squares of pointing	Sqr.	0 12 0	2 13 0	
125⅔	Sq. feet of tabling rock	Sq. ft.	0 6 0	47 1 9	
	Total	...	...	122 9 8	
	Sundries and Superintendence ...	...	...	6 6 4	
	Total Estimate ...	...	...	...	129 0 0
	Outlet No. 6.				
178⅓	C. yards of earthwork	C. yd.	0 1 3	13 14 11	
28¼	Do. of concrete	Do.	3 0 0	84 12 0	
121⅓	C. yards of rough stone in chunam ...	C. yd.	2 8 0	303 5 4	
11	Squares of pointing	Sqr.	0 12 0	8 4 0	
98⅓	C. yards of new stone	C. yd.	0 12 0	73 12 0	
29	Do. of gravel backing... ...	Do.	0 4 0	7 4 0	
	Total	...	...	491 4 3	
	Sundries and Superintendence ...	...	...	24 11 9	
	Total Estimate ...	...	...	...	516 0 0
	Outlet No. 7.				
25⅓	C. yards of rough stone in chunam ...	C. yd.	2 8 0	63 5 4	
6¼	Squares of pointing	Sqr.	0 12 0	4 11 0	
227	Sq. feet of tabling rock	Sq. ft.	0 6 0	85 2 0	
40½	C. yards of blasting rock	C. yd.	2 0 0	81 0 0	
18	Do. of new stone work ...	Do.	0 12 0	13 8 0	
3⅝	Do. of gravel backing	Do.	0 4 0	0 14 3	
	Total	...	...	248 8 7	
	Sundries and Superintendence ...	...	...	12 7 5	
	Total Estimate ...	...	...	...	261 0 0
	Outlets Nos. 8 *and* 23.				
45	C. yards of earthwork	C. yd.	0 1 3	3 8 3	
11	Do. of concrete	Do.	3 0 0	33 0 0	
44½	Do. of rough stone in chunam ...	Do.	2 8 0	111 4 0	
5¾	Squares of pointing	Sqr.	0 12 0	4 5 0	
22	C. yards of new stone work	C. yd.	0 12 0	16 8 0	
4	Do. of gravel backing	Do.	0 4 0	1 0 0	
	Total	...	...	169 9 3	
	Sundries and Superintendence ...	...	...	8 6 9	
	Total Estimate ...	...	...	178 0 0	
	For two outlets ...	...	...	...	356 0 0
	Outlet No. 9.				
22½	C. yards of earthwork	C. yd.	0 1 3	1 12 1	
41	Do. of rough stone in chunam ...	Do.	2 8 0	102 8 0	
2⅛	Squares of pointing	Sqr.	0 12 0	1 14 0	
12⅓	C. yards of new stone work ...	C yd.	0 12 0	9 6 0	
22⅕	Sq. feet of tabling rock	Sq. ft.	0 6 0	8 7 0	
	Total	...	...	123 15 1	
	Sundries and Superintendence ...	...	...	6 0 11	
	Total Estimate ...	...	...	...	130 0 0

Abstract Estimate of Baroor Tank Supply Channel, Masonry Works—*cont.*

Quantity.	Description of Work.	Per	Rate.	Amount.	Total.
			RS. A. P.	RS. A. P.	RS. A. P.
	Outlet No. 10.				
16½	C. yards of earthwork	C. yd.	0 1 3	1 5 7	
34	Do. of rough stone in chunam ...	Do.	2 8 0	85 0 0	
4½	Squares of pointing	Sqr.	0 12 0	3 6 0	
8½	C. yards of new stone work	C. yd.	0 12 0	6 4 0	
3½	Do. of gravel backing	Do.	0 4 0	0 14 0	
86¼	Sq. feet of tabling rock	Sq. ft.	0 6 0	32 5 6	
	Total ...	...	...	129 3 1	
	Sundries and Superintendence ...	...	...	6 12 11	
	Total Estimate ...	...	...	...	136 0 0
	Outlet No. 11.				
60½	C. yards of earthwork	C. yd.	0 1 3	4 11 7	
13	Do. of concrete	Do.	3 0 0	39 0 0	
58⅔	Do. of rough stone in chunam ...	Do.	2 8 0	146 10 8	
5	Squares of pointing	Sqr.	0 12 0	3 12 0	
20⅓	C. yards of new stone work ...	C. yd.	0 12 0	15 4 0	
3·97	Do. of gravel backing	Do.	0 4 0	0 15 10	
	Total ...	...	...	210 6 1	
	Sundries and Superintendence ...	...	...	10 9 11	
	Total Estimate ...	...	...	...	221 0 0
	Outlet No. 12.				
11¾	C. yards of earthwork	C yd.	0 1 3	0 14 7	
27⅓	Do. of rough stone in chunam ...	Do.	2 8 0	68 12 0	
2	Squares of pointing	Sqr.	0 12 0	2 0 0	
12	C. yards of new stone work	C. yd.	0 12 0	9 0 0	
2¼	Do. of gravel backing	Do.	0 4 0	0 9 0	
92¾	Sq. feet of tabling rock	Sq. ft.	0 6 0	34 12 6	
4	C. yards of blasting rock	C. yd.	2 0 0	8 0 0	
	Total ...	...	...	124 0 1	
	Sundries and Superintendence ...	...	...	6 15 11	
	Total Estimate ...	...	...	...	131 0 0
	Outlet No. 13.				
125	C. yards of earthwork	C. yd.	0 1 3	9 12 3	
27	Do. of concrete work	Do.	3 0 0	81 0 0	
95	Do. of rough stone in chunam ...	Do.	2 8 0	237 8 0	
8	Squares of pointing	Sqr.	0 12 0	6 0 0	
35½	C. yards of new stone	C. yd.	0 12 0	26 10 0	
6½	Do. of gravel	Do.	0 4 0	1 10 0	
	Total ...	...	...	362 8 3	
	Sundries and Superintendence ...	...	...	18 7 9	
	Total Estimate ...	...	...	...	381 0 0
	Outlet No. 14.				
68	C. yards of earthwork	C. yd.	0 1 3	5 5 0	
15	Do. of concrete	Do.	3 0 0	45 0 0	
49⅓	Do. of rough stone in chunam ...	Do.	2 8 0	123 5 4	
4½	Squares of pointing	Sqr.	0 12 0	3 2 0	
20⅕	C. yards of new stone work	C. yd.	0 12 0	15 4 0	
3⅖	Do. of gravel backing	Do.	0 4 0	0 14 8	
	Total ...	...	...	192 15 0	
	Sundries and Superintendence ...	...	...	9 1 0	
	Total Estimate ...	...	...	...	202 0 0

Abstract Estimate of Baroor Tank Supply Channel, Masonry Works—*cont.*

Quantity.	Description of Work.	Per	Rate.	Amount.	Total.
			RS. A. P	RS. A. P.	RS. A. P.
	Outlet No. 15.				
12½	C. yards of rough stone in chunam ..	C. yd	2 8 0	30 8 0	
3⅔	Squares of pointing	Sqr.	0 12 0	2 12 0	
14	C. yards of new stone work ...	C. yd.	0 12 0	10 8 0	
1·46	Do. of blasting rock	Do.	2 0 0	2 14 9	
140	Sq. feet of tabling rock	Sq. ft.	0 6 0	52 8 0	
	Total ...	...	...	99 2 9	
	Sundries and Superintendence ...	...	...	4 13 3	
	Total Estimate ...	...	...	...	104 0 0
	Outlet No. 16.				
56⅓	C. yards of rough stone in chunam...	C. yd.	2 8 0	140 13 4	
11	Squares of pointing	Sqr.	0 12 0	8 4 0	
57	C. yards of new stone	C. yd.	0 12 0	42 12 0	
349	Sq. feet of tabling rock	Sq. ft.	0 6 0	130 14 0	
10⅓	C. yards of gravel backing	C. yd.	0 4 0	2 9 4	
	Total ...	...	...	325 4 8	
	Sundries and Superintendence ...	...	...	16 11 4	
	Total Estimate ...	...	...	...	342 0 0
	Outlets Nos. 17 *and* 18.				
10⅞	C. yards of earthwork	C. yd	0 1 3	0 13 7	
48⅓	Do. of rough stone in chunam ..	Do.	2 8 0	120 13 4	
4½	Squares of pointing	Sqr.	0 12 0	3 6 0	
144	Sq. feet of tabling rock	Sq. ft.	0 6 0	54 0 0	
30⅓	C. yards of new stone work ...	C. yd.	0 12 0	22 12 0	
3	Do. of gravel backing	Do.	0 4 0	0 12 0	
	Total ...	...	...	202 8 11	
	Sundries and Superintendence ...	...	...	10 7 1	
	Total Estimate ...	...	...	...	213 0 0
	Outlet No. 19.				
4	C. yards of earthwork	C. yd.	0 1 3	0 5 0	
20	Do. of rough stone in chunam...	Do.	2 8 0	50 0 0	
12	Squares of pointing	Sqr.	0 12 0	9 0 0	
146	Sq. feet of tabling rock	Sq. ft.	0 6 0	54 12 0	
18⅓	C. yards of new stone work ..	C. yd.	0 12 0	13 12 0	
3⅓	Do. of gravel backing... ...	Do.	0 4 0	0 13 4	
	Total ...	...	...	128 10 4	
	Sundries and Superintendence ...	...	...	6 5 8	
	Total Estimate ...	...	...	...	135 0 0
	Outlet No. 20.				
75⅓	C. yards of rough stone in chunam...	C. yd.	2 8 0	188 5 3	
14	Squares of pointing	Sqr.	0 12 0	10 8 0	
180¾	Sq. feet of tabling rock	Sq. ft.	0 6 0	67 12 6	
38	C. yards of new stone work ..	C. yd.	0 12 0	28 8 0	
7	Do. of gravel backing... ...	Do.	0 4 0	1 12 0	
	Total ...	...	...	296 13 9	
	Sundries and Superintendence ...	...	...	14 2 3	
	Total Estimate ...	...	...	...	311 0 0

ABSTRACT Estimate of Baroor Tank Supply Channel, Masonry Works—*cont.*

Quantity.	Description of Work.	Per	Rate.			Amount.			Total.		
			RS.	A.	P.	RS.	A.	P.	RS.	A.	P.
	Outlet No. 21.										
83	C. yards of earthwork	C. yd.	0	1	3	6	7	9			
$18\frac{2}{9}$	Do. of concrete	Do.	3	0	0	54	10	8			
$78\frac{3}{4}$	Do. of rough stone in chunam...	Do.	2	8	0	196	14	0			
7	Squares of pointing	Sqr.	0	12	0	5	4	0			
$42\frac{1}{2}$	C. yards of new stone work ...	C. yd.	0	12	0	31	14	0			
10	Do. of gravel backing ...	Do.	0	4	0	2	8	0			
	Total ...	...		...		297	10	5			
	Sundries and Superintendence ...	...		...		14	5	7			
	Total Estimate ...	...		...		...			312	0	0
	Outlet No. 22.										
113	C. yards of earthwork	C. yd.	0	1	3	8	13	3			
$18\frac{1}{3}$	Do. of concrete...	Do.	3	0	0	55	0	0			
$94\frac{1}{2}$	Do. of rough stone in chunam...	Do.	2	8	0	236	4	0			
$7\frac{1}{4}$	Squares of pointing	Sqr.	0	12	0	5	7	0			
2	C. yards of gravel backing	C. yd.	0	4	0	0	8	0			
1	Covering stone	Each	0	6	0	0	6	0			
1	Shutter including lifting gear ...	Do.	20	0	0	20	0	0			
	Total ...	...		...		326	6	3			
	Sundries and Superintendence ...	...		...		13	9	9			
	Total Estimate ...	...		...		...			340	0	0
	Distribution Sluice.										
19	C. yards of earthwork	C. yd.	0	1	6	1	12	6			
$13\frac{1}{3}$	Do. of rough stone in chunam ..	Do.	3	0	0	40	0	0			
$8\frac{2}{3}$	Do. of burnt stone in chunam...	Do.	3	8	0	30	5	4			
$8\frac{1}{2}$	Do. of concrete	Do.	3	0	0	25	8	0			
$1\frac{1}{2}$	Squares of pointing	Sqr.	0	12	0	1	2	0			
$10\frac{5}{16}$	Cubic feet of cut stone	C. ft.	1	0	0	10	5	0			
1	Shutter with rod complete	Each	4	0	0	4	0	0			
	Total ...	...		...		113	0	10			
	Sundries and Superintendence ...	...		...		5	15	2			
	Total Estimate ...	...		...		119	0	0			
	For nine sluices ...	...		...		...			1,071	0	0
	Distribution Sluice.										
17	C. yards of earthwork	C. yd.	0	1	6	1	9	6			
$13\frac{1}{6}$	Do. of rough stone in chunam...	Do.	3	0	0	39	5	4			
$8\frac{1}{3}$	Do. of burnt stone in chunam...	Do.	3	8	0	29	2	8			
$5\frac{2}{4}$	Do. of concrete	Do.	3	0	0	17	4	0			
$12\frac{5}{16}$	C. feet of cut stone work	C. ft.	1	0	0	12	5	0			
$1\frac{1}{5}$	Squares of pointing	Sqr.	0	12	0	1	2	0			
1	Shutter with rod complete	Each	4	0	0	4	0	0			
	Total ...	...		...		104	12	6			
	Sundries and Superintendence ...	...		...		5	3	6			
	Total Estimate ...	...		...		110	0	0			
	For four sluices ...	...		...		...			440	0	0

Abstract Estimate of Baroor Tank Supply Channel, Masonry Works—*cont.*

Quantity.	Description of Work.	Per	Rate.			Amount.			Total.		
			RS.	A.	P.	RS.	A.	P.	RS.	A.	P.
	Distribution Sluice.										
19	C. yards of earthwork	C. yd.	0	1	6	1	12	6			
14	Do. of rough stone in chunam...	Do.	3	0	0	42	0	0			
9	Do. of burnt stone in surki mortar	Do.	3	8	0	31	8	0			
9	Do. of concrete	Do.	3	0	0	27	0	0			
$9\frac{5}{8}$	C. feet cut stone	C. ft.	1	0	0	9	10	0			
$1\frac{1}{2}$	Squares of pointing	Sqr.	0	12	0	1	2	0			
1	Shutter with rod complete	Each	4	0	0	4	0	0			
	Total ...	...		...		117	0	6			
	Sundries and Superintendence ...	...		...		5	15	6			
	Total Estimate ...	...		...		123	0	0			
	For two sluices ...	...		...		...			246	0	0
	Bridge of 4 *Vents of* 10 *Feet Span across Supply Channel.*										
191	C. yards of earthwork	C. yd.	0	1	6	17	14	0			
$34\frac{2}{3}$	Do. of rough stone in chunam...	Do.	3	0	0	104	0	0			
52	C. yards of burnt stone in chunam...	C. yd.	3	8	0	182	0	0			
14	Squares of pointing	Sqr.	0	12	0	10	8	0			
32	Number of covering stones... ...	Each	4	0	0	128	0	0			
$5\frac{3}{8}$	C. yards of gravelling	C. yd.	0	4	0	1	6	8			
14	Do. of metalling	C. yd.	0	8	0	7	0	0			
	Total ...	...		...		450	12	8			
	Sundries and Superintendence ..	...		...		22	3	4			
	Total Estimate ...	...		...		...			473	0	0
	Bridge of 4 *Vents* 9 *Feet Span across Supply Channel.*										
$103\frac{1}{9}$	C. yards of earthwork	C. yd.	0	1	6	9	11	0			
25	Do. of rough stone in chunam...	Do.	3	0	0	75	0	0			
$39\frac{7}{16}$	Do. of burnt stone in chunam...	Do.	3	8	0	138	15	2			
11·46	Squares of pointing	Sqr.	0	12	0	8	9	6			
24	Number of covering stones ...	Each	4	0	0	96	0	0			
$9\frac{1}{8}$	C. yards of metalling	C. yd.	0	8	0	4	10	8			
$3\frac{7}{9}$	Do. of gravelling	Do.	0	4	0	0	15	1			
	Total ...	...		...		333	13	5			
	Sundries and Superintendence ...	...		...		16	2	7			
	Total Estimate ...	...		...		350	0	0			
	For four bridges ...	...		...		...			1,400	0	0
	Bridge of 4 *Vents* 9 *Feet Span across Supply Channel.*										
200	C. yards of earthwork	C. yd.	0	1	6	18	12	0			
$34\frac{2}{3}$	Do. of rough stone in chunam...	Do.	3	0	0	104	0	0			
$51\frac{1}{6}$	Do. of burnt stone in chunam...	Do.	3	8	0	179	1	4			
$13\frac{7}{16}$	Squares of pointing	Sqr.	0	12	0	10	2	0			
32	Number of covering stones ...	Each	4	0	0	128	0	0			
4	C. yards of gravelling	C. yd.	0	4	0	1	0	0			
10	Do. of metalling	Do.	0	8	0	5	0	0			
	Total ...	...		...		445	15	4			
	Sundries and Superintendence ...	...		...		22	0	8			
	Total Estimate ...	...		...		468	0	0			
	Total for two bridges ...	...		...		...			936	0	0

Abstract Estimate of Baroor Tank Supply Channel, Masonry Works—*cont.*

Quantity.	Description of Work.	Per	Rate.	Amount.	Total.
			RS. A. P.	RS. A. P.	RS. A. P.
	New Head to Moorasamputty Tank Sluice.				
34	C. yards of earthwork	C yd.	0 1 6	3 3 0	
9	Do. of concrete	Do.	3 0 0	27 0 0	
41⅘	Do. of burnt stone in chunam...	Do.	3 8 0	146 4 9	
2½	Squares of pointing	Sqr.	0 12 0	1 12 0	
8	Number of covering stones ...	Each	0 6 0	3 0 0	
24⅖	C. feet of burnt stone dressed ...	C. ft.	0 6 0	9 3 8	
1	Shutter with rod complete	...	...	20 0 0	
	Total ...	...	...	210 7 5	
	Sundries and Superintendence ...	...	...	9 8 7	
	Total Estimate ...	...	...	...	220 0 0
	Sluice for Valungamvady Small Tank.				
249¾	C. yards of earthwork	C. yd.	0 1 6	23 6 7	
34	Do. of concrete	Do.	3 0 0	102 0 0	
112¼	Do. of burnt stone in soorkee mortar	Do.	3 8 0	393 2 0	
6½	Squares of pointing...	Sqr.	0 12 0	4 12 0	
34	Number of covering stones ...	Each	0 6 0	12 12 0	
38	C. feet of burnt stone dressed ...	C. ft.	0 6 0	14 4 0	
1	Shutter including lifting gear ...	...	...	20 0 0	
	Total ...	...	...	570 4 7	
	Sundries and Superintendence ...	...	...	28 11 5	
	Total Estimate ...	...	...	...	599 0
	New Head to Poongumputty Tank Sluice.				
76½	C. yards of earthwork	C. yd.	0 1 6	7 2 9	
31¼	Do. of concrete	Do.	3 0 0	93 6 10	
66¼	Do. of burnt stone in soorkee mortar	Do.	3 8 0	231 14 0	
3¼	Squares pointing	Sqr.	0 12 0	2 7 0	
14	Number of covering stones ...	Each	0 6 0	5 4 0	
24¾	C. feet of burnt stone dressed ...	C. ft.	0 6 0	9 4 6	
1	Shutter including lifting gear ...	...	...	20 0 0	
	Total ...	...	...	369 7 1	
	Sundries and Superintendence ...	...	...	18 8 11	
	Total Estimate ...	...	...	...	388 0 0
	Grand Total of Estimate for Masonry Works of Supply Channel...	...	...	...	14,066 0 0

APPENDIX No. 11.

Abstract Estimate of Baroor Tank Earthworks.

Quantity.	Description of Work.	Per	Rate.	Amount.	Total.
			RS. A. P.	RS. A. P.	RS. A. P.
533,15	C. yards of earthwork, gravel soil.	C. yd.	0 1 6	4,998 4 6	
83,603	Do. of do. soft soil ...	Do.	0 1 3	6,531 7 9	
62,125	Do. of do. hard gravel ...	Do.	0 2 0	7,765 10 0	
21,847·92	Do. of puddling	Do.	0 6 0	8,195 15 6	
14,393·21	Do. of new stone work for revetment.	Do.	1 0 0	14,393 3 4	

Abstract Estimate of Baroor Tank Earthworks—*cont.*

Quantity.	Description of Work.	Per	Rate.	Amount.	Total.
			RS. A. P.	RS. A. P.	RS. A. P.
6,000	Do. of old stone work for revetment.	Do.	0 8 0	3,000 0 0	
7,003·75	Do. of gravel backing ...	Do.	0 4 0	1,750 15 0	
4,603·21	Squares of turfing	Sqr.	0 6 0	1,726 3 5	
1,507	C. yards of gravelling	C. yd.	0 4 0	376 12 0	
	Total ...	...	...	48,738 7 4	
	Sundries and Superintendence ...	..	...	2,437 8 8	
	Total Estimate ...	...	...	...	51,176 0 0

Hosur,
15th March 1879.

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

Abstract Estimate of Baroor Tank West Sluice.

Quantity.	Description of Work.	Per	Rate.	Amount.	Total.
			RS. A. P.	RS. A. P.	RS. A. P.
402⅓	C. yards of earthwork	C. yd.	0 1 6	37 11 6	
217½	Do. of concrete	Do.	4 8 0	978 12 0	
155⅓	Do. of burnt stone in soorkee mortar.	Do.	3 8 0	544 4 0	
59⅗	C. feet of cut stone	C. ft.	1 0 0	59 10 0	
417⅗	Do of burnt stone dressed ...	Do.	0 6 0	156 11 0	
12½	Squares of pointing	Sqr.	1 8 0	18 6 0	
28⅔	C. yards of puddling	C. yd.	0 6 0	10 12 0	
20½	C. feet of teakwood	C. ft.	4 0 0	82 0 0	
7	Lifting gear	Each	70 0 0	490 0 0	
	Total ...	...	...	2,378 2 6	
	Sundries and Superintendence ...	...	...	120 13 6	
	Total Estimate ..	...	...	...	2,499 0 0

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

Abstract Estimate of Baroor Tank East Sluice.

Quantity.	Description of Work.	Per	Rate.	Amount.	Total.
			RS. A. P.	RS. A. P.	RS. A. P.
691⅗	C. yards of earthwork	C. yd	0 1 6	64 13 4	
239½	Do. of concrete	Do.	4 8 0	1,077 12 0	
157	Do. of burnt stone in soorkee ..	Do.	3 8 0	549 8 0	
82⅓	C. feet of cut stone	C. ft.	1 0 0	82 8 0	
451¼	Do. of burnt stone dressed ...	Do.	0 6 0	169 5 0	
12½	Squares of pointing	Sqr.	1 8 0	18 12 0	
24⅖	C. yards of puddling	C. yd.	0 6 0	9 2 4	
27	C. feet of teakwood	C. ft.	4 0 0	108 0 0	
7	Lifting gear	Each	70 0 0	490 0 0	
	Total ...	...	...	2,569 12 8	
	Sundries and Superintendence ...	...	...	128 3 4	
	Total Estimate ...	..	...	...	2,698 0 0

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

Hosur Divisional Office,
15th March 1879.

ABSTRACT Estimate of Baroor Tank Surplus Weir.

Quantity.	Description of Work.	Per.	Rate.		Amount.		Total.	
			Rs.	A. P.	Rs.	A. P.	Rs.	A. P.
3,012	C. yards of earthwork	C. yd.	0	2 0	376	8 0		
267½	Do. of rough stone in chunam ...	Do.	3	0 0	801	5 4		
64-7/8	Do. of burnt stone in chunam ...	Do.	3	8 0	225	8 6		
14¼	Squares of pointing	Sqr.	0	12 0	10	14 0		
245	C. yards of new rough stone ...	C. yd.	1	0 0	245	0 0		
	Total ...	...		...	1,659	3 10		
	Sundries and Superintendence ...	...		...	82	12 2		
	Total Estimate ...	...		...	...		1,742	0 0

HOSUR DIVISIONAL OFFICE,
15th March 1879.

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

APPENDIX No. 12 A.

ABSTRACT Estimate of East and West Channel Earthworks.

Description of Work.	Per	Rate.	Right Sluice. Main Channel.		Right Sluice. Branch Channel. M. N.		Left Sluice. Main Channel.		Left Sluice. Branch Channel. No. 1 B. C.		Left Sluice. Branch Channel. No. 2 E. C.		Left Sluice. Branch Channel. No. 3 F. G. H.		Left Sluice. Branch Channel. No. 4 J. G.		Total.	
			Quantity.	Cost.	Quantity.	Cost.	Quantity.	Cost.	Quantity.	Cost.	Quantity.	Cost.	Quantity.	Cost.	Quantity.	Cost.	Quantity.	Cost.
Excavation.	C. yard ..	Rs. A. P.		Rs.		Rs.		Rs.		Rs.		Rs.		Rs.		Rs.		Rs.
Earthwork, hard gravel ..	Do. ..	0 2 0	2,425	303	2,204	276	46,705	5,838	1,484	186	519	65	3,275	409	2,089	261	58,701	7,328
Do. gravel ..	Do. ..	0 1 6	1,204	113	2,169	203	57,969	5,435	4,381	411	3,505	328	39,127	3,668	3,265	306	111,620	10,464
Do. soft	Do. ..	0 1 3	7,127	557	2,874	225	31,770	2,482	1,205	94	1,093	85	1,226	96	..	..	45,295	3,539
Hard rocks	Do. ..	2 0 0	..	..	..	..	1,044	2,088	..	..	..	..	..	..	..	..	1,044	2,088
Soft do.	Do. ..	0 8 0	151	75	..	..	3,293	1,647	160	80	31	16	445	223	155	77	4,235	2,118
Old stone revetment ..	Do. ..	0 8 0	..	..	..	..	121	61	..	..	..	..	..	..	..	..	121	61
New stone do. ..	Do. ..	0 12 0	..	..	..	..	773	580	..	..	..	..	..	..	..	..	773	580
Gravel backing	Do. ..	0 4 0	..	..	..	..	350	88	..	..	..	..	..	..	..	..	350	88
Earthwork	Do. ..	0 1 3	14,813	1,157	1,529	120	38,624	3,017	3,903	305	6,265	489	46,322	3,619	12,106	946	123,562	9,653
Turfing	Square ..	0 6 0	2,629	986	864	324	10,698	4,012	1,002	376	1,185	444	6,542	2,453	1,912	717	24,832	9,312
Total ..	..	..	..	3,191	..	1,148	..	25,248	..	1,452	..	1,427	..	10,468	..	2,307	..	45,241
Sundries	Cent. ..	5 0 0	..	159	..	57	..	1,262	..	72	..	71	..	523	..	115	..	2,259
Grand Total ..	..	..	..	3,350	..	1,205	..	26,510	..	1,524	..	1,498	..	10,991	..	2,422	..	47,500

HOSUR,
—March 1879.

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

APPENDIX No. 12 B.

ABSTRACT Estimate of East and West Channel, Masonry Works.

Quantity.	Description of Work.	Per	Rate.	Amount.	Total.
			RS. A. P.	RS. A. P.	RS. A. P.
	Keelcooppum Tank Sluice.				
56⅔	C. yards of earthwork	C. yd.	0 1 6	5 5 0	
38	Do. of concrete	Do.	3 0 0	114 0 0	
60	Do. of burnt stone in soorkee mortar.	Do.	3 8 0	210 0 0	
3½	Squares of pointing	Sqr.	0 12 0	2 10 0	
26	Number of covering stones ...	No.	0 6 0	9 12 0	
24⅝	C. feet of burnt stone dressed ...	C. ft.	0 6 0	9 3 8	
1	Shutter with rod complete ...	...	...	20 0 0	
	Total ...	...	...	371 0 8	
	Sundries and Superintendence ...	..	...	18 15 4	
	Total Estimate ...	...	...	...	390 0 0
	Distribution Sluice				
6½	C. yards of earthwork	C. yd.	0 1 6	0 9 9	
4⅗	Do. of rough stone in chunam.	Do.	3 0 0	14 0 0	
3⅙	Do. of burnt stone in chunam ..	Do.	3 8 0	10 14 3	
2½	Do. of concrete	Do.	3 0 0	7 8 0	
7/100	Square of pointing	Sqr.	0 12 0	0 8 5	
3	C. feet of burnt stone dressed ...	C. ft.	0 6 0	1 2 0	
1	Shutter with plug rod	...	...	4 0 0	
	Total ...	...	...	38 10 5	
	Sundries and Superintendence ...	...	...	2 5 7	
	Total Estimate ...	...	...	41 0 0	
	Total Amount for 25 sluices ...	...	...	...	1,025 0 0
	Distribution Sluice				
5¾	C. yards of earthwork	C. yd.	0 1 6	0 8 7	
4¼	Do. of rough stone in chunam...	Do.	3 0 0	12 12 0	
3½	Do. of burnt stone in chunam...	Do.	3 8 0	12 4 0	
2⅓	Do. of concrete	Do.	3 0 0	6 12 0	
2/7	Square of pointing	Sqr.	0 12 0	0 2 0	
2⅝	C. feet of burnt stone dressed ...	C. ft.	0 6 0	0 15 9	
1	Shutter with plug rod	...	4 0 0	4 0 0	
	Total ...	...	...	37 13 4	
	Sundries and Superintendence ...	...	...	1 2 8	
	Total Estimate ...	...	...	39 0 0	
	Total Amount for 22 sluices ...	...	...	...	858 0 0
	Distribution Sluice				
6	C. yards of earthwork	C. yd.	0 1 6	0 9 0	
4½	Do. of rough stone in chunam ...	Do.	3 0 0	13 8 0	
4¼	Do. of burnt stone in chunam ...	Do.	3 8 0	14 14 0	
2	Do. of concrete	Do.	3 0 0	6 0 0	
¾	Square of pointing	Sqr.	0 12 0	0 9 0	
2⅜	C. feet of burnt stone dressed ...	C. ft.	0 6 0	0 14 3	
1	Shutter with plug rod	...	...	4 0 0	
	Total ...	...	...	40 6 3	
	Sundries and Superintendence ...	...	...	1 9 9	
	Total Estimate ...	...	...	42 0 0	
	Total Amount for 13 sluices ...	...	...	...	546 0 0

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

Quantity.	Description of Work.	Per	Rate.	Amount.	Total.
			RS. A. P.	RS. A. P.	RS. A. P.
	Tunnel across Irrigation Channel.				
44½	C. yards of earthwork	C. yd.	0 1 6	4 2 9	
32¾	Do. of rough stone in chunam...	Do.	3 0 0	98 4 0	
23	Do. of burnt stone in chunam...	Do.	3 8 0	80 8 0	
5¾	Squares of pointing	Sqr.	0 12 0	4 5 0	
6½	C. yards of new stone work ...	C. yd.	1 0 0	6 1 10	
16	Number of covering stones... ...	Each	2 8 0	40 0 0	
3	C. yards of metalling	C. yd.	0 8 0	1 8 0	
1	Do. of gravelling	Do.	0 4 0	0 4 0	
	Total ...	...	...	235 1 7	
	Sundries and Superintendence ...	...	...	10 14 5	
	Total Estimate ...	...	...	246 0 0	
	For five tunnels ...	...	...	...	1,230 0 0
	Bridge across Irrigation Channel.				
76⅔	C. yards of earthwork	C. yd.	0 1 6	7 3 1	
54⅓	Do. of rough stone in chunam...	Do.	3 0 0	163 0 0	
59 16/27	Do. of burnt stone in chunam...	Do.	3 8 0	208 9 2	
14½	Squares of pointing	Sqr.	0 12 0	10 14 0	
64	Number of covering stones ...	Each	4 0 0	254 0 0	
3⅔	C. yards of gravelling	C. yd.	0 4 0	0 14 8	
12⅔	Do. of metalling	Do.	0 8 0	6 5 4	
	Total ...	...	...	649 13 11	
	Sundries and Superintendence ...	...	...	32 2 1	
	Total Estimate ...	...	...	...	682 0 0
	Aqueduct for Irrigation Channel.				
367½	C. yards of earthwork	C. yd.	0 1 6	34 7 0	
350¾	Do. of rough stone in chunam...	Do.	3 0 0	1,052 4 0	
277	Do. of burnt stone in soorkee mortar.	Do.	3 8 0	969 8 0	
310¾	Do. of new rough stone ...	Do.	1 0 0	310 12 0	
38½	Squares of pointing	Sqr.	0 12 0	28 14 0	
84	Covering stones	Each	2 8 0	210 0 0	
14¾	C. yards of concrete	C. yd.	3 0 0	44 4 0	
45⅓	Do. of gravel backing	Do.	0 4 0	11 5 4	
	Total ...	...	...	2,661 6 4	
	Sundries and Superintendence ...	...	...	133 9 8	
	Total Estimate ...	...	...	...	2,795 0 0
	Four Masonry Falls of 4 feet.				
91	C. yards of earthwork	C. yd.	0 2 0	11 6 0	
103⅙	Do. of rough stone in chunam...	Do.	3 0 0	309 5 4	
5 67/100	Squares of pointing	Sqr.	0 12 0	4 4 0	
89	C. yards of new stone work ...	C. yd.	1 0 0	89 0 0	
23 4/27	Do. of gravel backing ...	Do.	0 4 0	5 12 7	
	Total ...	...	...	419 11 11	
	Sundries and Superintendence ...	...	...	20 4 1	
	Total Estimate ...	...	...	...	440 0 0

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

Quantity.	Description of Work	Per	Rate.			Amount.			Total.		
			RS.	A.	P.	RS.	A.	P.	RS.	A.	P.
	Three Masonry Falls of 3 feet.										
63	C. yards of earthwork	C. yd.	0	2	0	7	14	0			
62½	Do. of rough stone in chunam...	Do.	3	0	0	187	8	0			
3 7/16	Squares of pointing	Sqr.	0	12	0	2	14	7			
58 6/27	C. yards of new stone work ...	C. yd.	1	0	0	58	3	7			
14 1/24	Do. of gravel backing ...	Do.	0	4	0	3	10	3			
	Total ...	...		...		260	2	5			
	Sundries and Superintendence ...	...		...		13	13	7			
	Total Estimate ...	...		...		...			274	0	0
	Masonry Fall of 2 feet.										
18½	C. yards of earthwork	C. yd.	0	2	0	2	5	0			
17 4/27	Do. of rough stone in chunam ...	Do.	3	0	0	51	7	1			
1 9/20	Squares of pointing	Sqr.	0	12	0	1	1	4			
17 1/3	C. yards of new stone work ...	C. yd.	1	0	0	17	5	4			
4½	Do. of gravel backing	Do.	0	4	0	1	2	0			
	Total ...	...		...		73	4	9			
	Sundries and Superintendence ...	...		...		3	11	3			
	Total Estimate ...	...		...		...			77	0	0
	Six Masonry Falls of 4 feet										
228	C. yards of earthwork	C. yd.	0	2	0	28	8	0			
380	Do. of rough stone in chunam...	Do.	3	0	0	1,140	0	0			
23½	Squares of pointing	Sqr.	0	12	0	17	7	0			
28½	C. yards of new stone work ...	C. yd	1	0	0	28	8	0			
7	Do. of gravel backing	Do.	0	4	0	1	12	0			
	Total ...	...		...		1,216	3	0			
	Sundries and Superintendence...	...		...		60	13	0			
	Total Estimate ...	...		...		...			1,277	0	0
	Four Masonry Falls of 3 feet.										
145⅔	C. yards of earthwork	C. yd.	0	2	0	18	3	4			
236⅔	Do. of rough stone in chunam...	Do.	3	0	0	710	0	0			
22¼	Squares of pointing	Sqr.	1	0	0	22	4	0			
21	C. yards of new stone work ...	C. yd.	0	12	0	15	12	0			
5⅔	Do. of gravel backing	Do.	0	4	0	1	15	0			
	Total ...	...		...		768	2	4			
	Sundries and Superintendence ...	...		...		39	13	8			
	Total Estimate ...	...		...		...			808	0	0
	Two Masonry Falls of 2 feet.										
67	C. yards of earthwork	C. yd.	0	2	0	8	6	0			
112 5/27	Do. of rough stone in chunam...	Do.	3	0	0	336	8	11			
10	Squares of pointing	Sqr.	1	0	0	10	0	0			
13	C. yards of new stone work ...	C. yd.	0	12	0	9	12	0			
3¼	Do. of gravel backing	Do.	0	4	0	0	13	0			
	Total ...	...		...		365	7	11			
	Sundries and Superintendence ...	...		...		18	8	1			
	Total Estimate ...	...		...		...			384	0	0

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

Quantity.	Description of Work.	Per	Rate.			Amount.			Total.		
			RS.	A.	P.	RS.	A.	P.	RS.	A.	P.
	23 *Inlets.*										
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			
53¼	Squares of pointing	Sqr.	0	12	0	39	13	6			
998 2/3	C. yards of new rough stone work ..	C. yd.	1	0	0	998	10	8			
259 2/3	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			
671⅓	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

BAROOR PROJECT.

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

Plan, Sheet No. I.—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.

2. The information given is manifestly incomplete, the flood lines having been omitted from the longitudinal and cross Sections, and the areas of waterway on the latter up to F.L. not having been given for comparison with the area of waterway at the anicut up to the calculated F.L occasioned by the construction of the dam. As regards the cross section at anicut site, it has not been shown how the F.L. of 145·00 marked has been arrived at. It does not agree with the level 143·32 given in paragraph 9 of the report. The length of waterway on the present M.F.L. line is 1,157 feet, and the area of the waterway as taken out by the undersigned is 8,098 square feet, the mean depth being thus just 7 feet. The length of the anicut crest is 930 feet, and as the velocity will be certainly somewhat greater than at present, it is evident that the waterway required will not be greater than that of the section up to 140·07. That area would be obtained with a depth of 8·71 feet nearly, and the crest being at 134·50, the future M.F.L., if 140·07 could be accepted as the present M.F.L., would be 143·21 as a maximum, the afflux then being 3·14 feet. Now, supposing the maximum flood discharge to be 70,587 cubic feet a second, which seems to be reasonable taking the circumstances of the catchment basin and the effect of the tanks therein as flood moderators into account,

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

Basin 2,082 square miles.
$\sqrt[3]{M^2} = 163{\cdot}50$
$C = 431{\cdot}8$

the calculated afflux would be just 3 feet and the future M.F.L. 143·07. It would seem, therefore, that the previously supposed M.F.L. of 143·32 is not likely to be 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.

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

Sheet 3.—Plan and Sections of Anicut.

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

With regard to the part of the anicut not to be founded on rock, there is nothing in the papers to show that 123·50, or 11 feet below crest, is a proper level for the bottom of the foundations. It is not stated whether an examination of the soil was made by borings or otherwise. Whether the section on AB is suitable to the circumstances of the bed at this point is not evident, as there is no longitudinal section of the bed at this part. It seems probable, however, that the apron will have to be laid on a slope, and that the top of the retaining wall will have to be placed several feet below that of the crest wall. A retaining wall at right angles to the crest wall at the left end of 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 should 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.

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

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

The area of the vents is $3 \times 6 \times 5$	= 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 carry 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 $5\frac{1}{2}$ feet high instead of $1\frac{1}{2}$ 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.

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 $10\frac{1}{2}$ instead of $4\frac{1}{4}$ feet as shown as the arch.

Sheet 5.—Agaram Channel, Head Sluice.

The revetted slope of the bank in connection with the right rear wing of the anicut will have to be made 1 instead of $1\frac{1}{2}$ to 1, as in the design it projects $12\frac{1}{3}$ 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 $1\frac{1}{2}$ 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.

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 $1\frac{1}{4}$ 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.

Sheet 6.—Nedingal Channel, Head Sluice.

No data have been noted on the plan.

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 $3\frac{1}{2}$ 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.

Sheet 7.—Sand Sluices for the Anicut.

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

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

Sheets 8 to 11.—Baroor Tank Supply Channel.

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 × $2\frac{1}{2}$, 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 $15\frac{3}{4}$ 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 $35\frac{1}{2}$ instead of 25 feet. Similarly the length of inlet No. 1 should be about 30 instead of 20 feet.

10. The drainage area being half a square mile, the discharge to be provided for

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

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 $34\frac{2}{3}$ 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.

* Brick work not concrete.

11. *Moorsamputty Tank Weir.*—The level 30·50 (130·50) of the crest is not

Sheet 14.

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 $3\frac{1}{2}$ 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.

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.

12. *Outlet No.* 6.—The water level (and crest level) would be that for a distance of $2\frac{1}{4}$ miles from the head, whereas the

Sheet 15.

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.

14. It is not desirable to carry the roadways on beam stones for spans of 9 and

Sheet 23.—Accommodation Bridges.

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 $9\frac{1}{2}$ 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 $7\frac{2}{3}$ feet.

Foot bridges 6 feet wide will be used by carts and then the parapets will be

Sheet 24.—Foot Bridge.

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 $4\frac{1}{2}$ feet, and the approaches should be 1 in 6 or thereabouts. Two feet parapets would be dangerous for cattle. Beam stones are not advisable.

15. The designs are for circular tunnels of three sizes, viz., 6, 9, and 12 inches

Sheet 25.—Distribution Sluices of Supply Channel.

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 $2\frac{1}{2}$ 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.

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.

Sheets 26 to 30.—Baroor Tank.

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.

* Report, paragraph 20.

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

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

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.

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.

Sheet 30.

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.

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

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	$1\frac{1}{2}$ 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.

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 $\frac{1}{36}$ would have done much better.

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

CHIEF ENGINEER FOR IRRIGATION

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

Sheet 44.—Distribution Sluices.

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

Sheet 45.—Inlets and Outlets.

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 46.—Aqueduct at 1 mile 74 chains, 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.

Sheet 47.—Trunk Road Bridge, East Channel.

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.

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.

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

OOTACAMUND,
18th October 1880.

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

To the Superintending Engineer, Second Circle.

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 yo[illegible] 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.

STATEMENT showing the Average Cultivation and Remission, &c., under the Tanks fed by the Barúr Project.

—	Villages.	Group. Wet.	Group. Dry.	Wet. Source of Irrigation and Area of Bed of Tanks.	Wet. Wet Ayacut.	Wet. Assessment.	Wet. Ten years average "Kaiput" of Wet Lands. Extent.	Wet. Ten years average "Kaiput" of Wet Lands. Assessment.	Wet. Average Remission.	Dry. Extent.	Dry. Assessment.	Unclassified Waste.	Inams. Dry Area.	Inams. Wet Area.	Total Area.	—
42	Barúr	4	3	Periyóri .. .. Acres 268.	269 87	1,444 0	247 86	1,405 7	165 6	779 86	574 8	..	89 16	17 2	1,259 55	The nunjah ayacut of Periyóri includes lands in the villages Nos. 40 and 41, and that of Chinnóri includes lands in the village No. 21.
..	....	..	..	Chinnóri .. .. Acres 88.	103 64	590 9	96 48	563 10	21 1	217 31	166 1	..	1 35	17 64	297 40	
40	Marudéri	3	3	Tank .. .. Acres 38.	61 10	435 3	56 74	428 3	7 14	22 77	17 10	..	13 44	0 26	67 63	
47	Kaluvéhalli	3	3	Do. supplied by Pennar channel.	31 17	206 14	29 65	200 3	21 11	61 49	54 6	..	..	..	120 94	The nunjah ayacut includes lands in villages Nos. 47 and 49.
48	Mornsarahalli	3	3	Do. do. .. Acres 22.	59 45	364 8	56 31	343 14	21 10	479 99	368 10	..	144 70	40 61	730 6	The excess over the ayacut is due to the transfer of certain lands from punjah to punjah and *vice versa*.
49	Dóruhalli	3	3	Pennar channel ..	100 56	581 14	84 67 92 57	560 2 573 5	51 11	412 85	292 14	..	87 86	20 49	624 70	..
45	Valangámudi	3	3	Tank supplied by Pennar channel. Acres 71.	2 94	12 14	2 90	12 9	.. 7 5	617 26	361 6	..	3 78	0 38	632 5	The ten years average of the holdings is in excess of the ayacut, which is due to the fact that in the fasli before the settlement the holdings were greater.
..	....	..	..	Ambattan kuttai .. Acres 4.	10 63	89 15	10 70	42 12	19 6	492 62	269 5	..	2 81	..	515 3	..
38	Kóttaipatti ..	5	3	Tank .. .. .. Acres 25.	15 62	55 1	14 53	52 2	..							
36	Thirumaiúr ..	5	3	Sekkilikuttaiyéri .. Pennar Thulai ..	3 98	9 15	3 98	9 15	..	416 69	351 13	..	..	..	479 8	
..	....	..	..	Acres 5.	52 51	260 15	41 64	221 5	..							
40	Puliyúr	4	3	Jambóri .. .. Acres 33.	9 88	40 1	8 76	37 13	.. 0 3	394 86	361 8	..	..	2 3	445 84	
..	....	5		Odusaléri .. .. Acres 16.	41 74	308 2	37 34	291 12	2 5							
43	Sellakuttapatti ..	5	3	Pennar channel ..	7 21	22 2	7 21	22 2	7 5	506 43	438 1	..	32 65	17 60	627 90	
..	....	..	..	Kuttai Uthu Pachal ..	48 94	300 11	40 43	276 12								
44	Pungampatti	3	3	Pennar channel ..	12 22	73 6	11 64	70 2	3 13	309 1	582 1	..	52 90	3 88	990 40	
..	....	..	..	Nágakuttaiyéri .. Acres 21.	9 76	34 2	8 22	28 12	..							
..	....	..	..	Nagakuttai Uthur Pachal	24 61	103 11	23 8	106 9	2 8	267 50	227 14	..	38 19	4 78	336 72	
41	Kilkuppam	5	3	Illuppakuttai .. .. Acres 18.	26 25	117 5	24 29	113 11	2 15	712 93	524 2	..	68 56	8 45	837 96	The nunjah ayacut includes lands in villages Nos. 38 and 39.
39	Muthupámpampatti ..	5	3	Sirkáryéri .. .. Acres 13.	48 1	178 4	41 99	176 2	3 12	365 82	299 2	..	10 5	..	402 25	
62	Dantharapalli	5	3	Sirkáryéri .. .. Acres 43.	26 38	96 3	19 33	79 14	..	535 87	354 12	..	..	..	539 52	
63	Viruppampatti	5	3	Sirkáryéri .. .. Acres 23.	3 65	16 9	3 27	15 3	7 14	276 10	222 3	..	29 65	3 87	381 40	The nunjah ayacut includes lands in village No. 67.
64	Thíthampatti	5	3	Sirkáryéri .. .. Acres 7.	71 [illegible]	222 5	38 69	169 6	7 5	163 1	128 4	..	12 60	2 45	281 53	
66	Mávathúr	5	3	Sirkáryéri .. .. Acres 44.	48 46	276 5	43 52	247 13	6 11	284 99	215 5	..	..	..	329 90	
32	Arasampatti	3	3	Pennar channel ..	44 91	240 5	40 25	214 11	11 9							
33	Manjamédu	3	3	Do.	69 80	381 2	62 27	350 11								
34	Bendrahalli	3	3	Periyéri Pachal .. Acres 71.	21 66	109 3	20 58	96 6	10 5	851 60	592 10	..	20 28	4 75	968 96	
..	....	..	..	Tippanam kuttai .. Acres 47.	0 87	1 11	0 87	1 11	..	122 9	129 7	..	..	0 72	122 81	
..	....	..	..	Pennar Yerappu ..	..	..	..	..	..	291 25	105 13	..	..	..	291 25	
..	....	..	..	....	..	..	..	..	..	776 18	528 5	..	5 1	46	781 65	
31	Thirunáthampatti ..	3	3	....	..	..	..	..	..	348 99	243 8	..	3 67	..	352 65	
37	Kánathimmampatti ..	5	3	....	..	..	..	..	..							
38	Jinkékadarsnahalli ..	..	3	....	..	..	..	..	..							
65	Sengampatti	..	..	....	..	..	..	..	..							
	Total ..	..	..		1,312 36	7,044 2	1,169 77	6,712 13	414 11	10,312 47	7,399 8	..	616 66	145 39	12,386 88	

(Signed) H. E. STOKES,
Acting Collector.

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—				
Head sluice	RS.		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			
„ Velangamudi do. ...	599			
„ Pungumputty do. ...	388			
			62,070	
6 Barúr tank—				67,244
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 3 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

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

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

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

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. RS.	Estimates of 1879. 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 Ocscotta 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.

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

CHEPAUK,
5th February 1881.

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	9,612
L. Earthwork ...	New head	1,055	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	5,174
F. (1) Other cross drainage works.	Inlet No. 1	47	600
	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	
	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	

Classified Abstract Estimate of the Barúr Tank Project in Salem District—*cont.*

Sub-head.	Name of Work.	Amount of individual Estimates.	Total of each Sub-head.
	(2) MAIN CANALS AND BRANCHES—*cont.*	RS.	RS.
	Barúr Tank, Supply Channel—cont.		
F. (1) Other cross drainage works—*cont.*	Outlet No. 20	311	4,883
	Do. „ 21	312	
	Do. „ 22	340	
	Do. „ 23	178	
		473	
G. Bridges	One bridge	1,400	2,809
	Do.	936	
	Do.		
		48,004	48,004
L. Earthwork ...	Barúr tank, supply channel	220	
N. Tanks	Moorsamputty tank sluice	599	
	Valangumvady small tank sluice ...	388	
	Pungumputty tank sluice	51,176	
	Barúr tank bund	1,742	
	Do. surplus weir	2,698	
	Do. eastern sluice	2,499	
	Do. western do.		
	Barúr tank distribution, Keelcooppum tank sluice	390	
	Do. east channel	3,350	
	Do. do. branch do.	1,205	
	Do. do. No. 1, branch channel ...	26,510	
	Do. do. No. 2, do. ...	1,498	
	Do. do. No. 3	10,991	
	Do. do No. 4	2,422	
	Do. aqueduct	2,775	
	Do. twenty-three inlets	2,115	
	Do. twenty outlets	7,180	
	Do. fifteen do.	5,385	
	Do. twenty-five sluices	1,025	
	Do. twenty-two do.	858	
	Do. thirteen do.	546	
	Four masonry falls of 4 feet	440	
	Three do. of 3 „	274	
	One do. of 2 „	77	
	Six do. of 4 „	1,277	
	Four do. of 3 feet	808	
	Two do. of 2 „	384	
	Tunnel	1,230	
	Bridge	682	
		2,810	1,32,288
O. Miscellaneous ...	Syphon sluice	1,757	
	Three syphon sluices		4,567
			1,98,325
	Total, Barúr Tank, Supply Channel ...	...	
	Total, (2) Main Canals and Branches ...	...	2,10,063
	(4) DRAINAGE AND PROTECTIVE WORKS.		
L. Earthwork ...	Flood banks	2,343	2,343

Classified Abstract Estimate of the Barúr Tank Project in Salem District—*cont.*

Sub-head.	Name of Work.	Amount of individual Estimates.	Total of each Sub-head.
		Rs.	Rs.
	(5) GENERAL.		
B. Land	Compensation for land	6,196	6,196
	Total, Works ...	...	2,35,500
	Establishment	...	64,762
	Tools and plant	...	7,068
	Total, Direct Charges ...	...	3,07,330

CHEPAUK,
5th February 1881.

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

No. 46. ORDER THEREON, 11th February 1881, No. 124 I.

THE Right Honorable the Governor in Council is glad to find from the papers submitted with the estimate for the Barúr project that this scheme, which is one of those taken up for famine relief purposes in the Salem district in 1877, is likely to prove useful and fairly remunerative. About 28½ per cent. of the work was done during and shortly after the close of the famine. The Collector has made a personal investigation of the project from the revenue point of view, and has reported favorably on it.

2. The estimate which amounts to Rs. 2,35,500 under Works and under Direct Charges to Rs. 3,07,330 will be forwarded for the sanction of the Government of India.

(True Extract.)

(Signed) JOHN MULLINS, Colonel, R.E.,
Joint Secy. to Govt., P.W.D.,
Irrigation Branch.

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

Exd. E. C. Shunker.
Spare Copies

CHIEF ENGINEER FOR IRRIGATION

IRRIGATION.
ACCOUNT.

Govt. of [1881] Madras.

PUBLIC WORKS.

To

THE CHIEF ENGINEER FOR IRRIGATION,

&c., &c., &c.

Dated February, 11*th*.

Issued

Rec'd. *Encl.*

G. O., 11*th February* 1881, *No.* 124 I.

FEBRUARY.

Nos. 45-46.

Bavûr Project.—Considering that the scheme is likely to prove useful and remunerative, and ordering that the estimate for the same be forwarded to the Government of India for sanction.

GOVERNMENT OF MADRAS.

JUDICIAL DEPARTMENT.

READ—the following papers:—

From W. S. BETTS, Esq., Agent, South Indian Railway, to the Consulting Engineer for Railways, dated Negapatam, 29th December 1882, No. 1087.

I have the honor to request your attention to Section 320 of the Code of Criminal Procedure, Act No. X of 1882, which will come into operation on the 1st January 1883.

2. Sub-section (*k*) of Section 320 provides that "persons exempted by the Local Government" shall not be required to attend Courts in the capacity of Jurors or Assessors, and as it is open to doubt whether persons now exempt will be exempt next year when the Act comes into force, unless, with special reference to Section 320 of this particular Act, a Government Order be passed for their exemption, I shall feel obliged by your obtaining a ruling on the subject.

3. From G.O., No. 26, dated 4th November 1876, it appears that all Railway Engineers in charge of sections of Railway open for public traffic are at present exempt from liability to serve as Jurors or Assessors in Mofussil Courts, and I propose that this exemption be continued, and I think it would be advantageous to the public interests were the Heads of the several Railway Departments exempted, as also District Traffic Superintendents, Permanent-way Inspectors, Station Masters, Engine Drivers, and Telegraph Signallers.

4. You will see by Sub-section (*i*) of the Code of Criminal Procedure above referred to that persons employed in Government Telegraph Offices are exempt. Such being the case, I consider it only reasonable that officers should be exempted on whom depends the keeping open and working of an important Railway. Looking to the advantage to be derived by Government and the public from the avoidance of those risks which must arise when officers and servants of the class named are called away from their proper duties, it seems to me there is a strong case for the exemption applied for.

From A. M. SAUNDERS, Esq., Agent and Manager, Madras Railway Company, to the Consulting Engineer for Railways, dated Madras, 20th February 1883, No. 128.

I have the honor to acknowledge the receipt of your letter, No. 15, of the 9th ultimo, and to inform you that I concur with Mr. Betts in considering that there should be some definite ruling exempting certain employés of the Railway Department from liability to be called upon to serve as Jurors both in the High Court of Madras and other Courts in the Presidency and in the Mofussil.

2. After due discussion of this matter with the different Heads of Departments, I have the honor to request that the following list may be accepted by His Excellency the Governor in Council as those Railway employés who should be exempted:—

Heads of Departments.
Deputy Chief Engineer.
Superintendent of Watchmen.
Assistant Traffic Managers.
Engineers in charge of Divisions.
Permanent-way Inspectors.
Locomotive Foremen.

Station Masters.
Engine Drivers.
Telegraph Inspectors and Signallers.

3. With regard to the second paragraph of your letter, the officers of the Madras Railway hitherto exempted have been the Chief Engineer, Deputy Chief Engineer on Permanent-way, the Locomotive Superintendent, the Traffic Manager, and the Superintendent of Watchmen, the latter being only exempt from service in the High Court. This list was published in the *Fort St. George Gazette* amongst the Jury Rules, dated the 21st April 1882.

From A. M. SAUNDERS, Esq., Agent and Manager, Madras Railway Company, to the Consulting Engineer for Railways, dated Madras, 6th March 1883, No. 165.

In reply to your letter, No. 158, of the 28th ultimo, I have the honor to state that I added the name of the Deputy Chief Engineer to the list of officials whom I proposed should be exempted from service on Juries or as Assessors for the reason that this official has for many years been exempted from such service. I also consider that when the Chief Engineer is away from Madras on inspection duty, which frequently happens, that it would be most inconvenient, now that the supervising staff in the office is reduced, if the Deputy Chief Engineer was required to absent himself from office to attend the Court, and I trust therefore that you will allow the list as submitted to stand.

2. With regard to the Superintendent of Watchmen, I have the pleasure to forward you a copy of a letter (No. 137, dated the 10th January 1882,) which I addressed to the Sheriff of Madras asking for the exemption of Mr. Ross, and a letter, dated the 14th March 1882, from the Clerk of the Crown, also attached, will show you that the Judges of the High Court allowed the exemption and considered my objection to be valid. I trust therefore that the name of the Superintendent of Watchmen may also remain on the list.

No. 70.

Endorsement on the above three papers.

Submitted for the consideration of Government.

2. The Agent, South Indian Railway, asks that a ruling of Government may be obtained in order that certain Railway officials may be exempted from attendance at Courts in the capacity of Jurors or Assessors, and the Agent of the Madras Railway concurs in the desirableness of such orders being passed.

3. In Proceedings of Government, No. 1142, dated 21st August 1872, the following officers of the Madras Railway,

Chief Engineer,
Deputy Chief Engineer,
Locomotive Superintendent,
Traffic Manager,

were exempted from liability to serve as Jurors in the High Court; and in Proceedings, No. 507, dated 15th February 1873, the Agent and the Locomotive Superintendent of the South Indian Railway were exempted from serving as Assessors in the Sessions Court of Negapatam.

4. In Proceedings of Government, No. 579, dated 5th March 1877, Judicial Department, the following persons were exempted while pressure continued in connection with the conveyance of grain to districts threatened with famine:—

all Railway Engineers in charge of sections of Railway open to traffic;
all employés of the Locomotive and Traffic Departments;

but this exemption was only to hold good to the end of the year 1877.

5. In 1878, the Agent of the South Indian Railway again raised the question, and the following officers of the South Indian Railway,

Chief Engineer,
Deputy Chief Engineer,
Locomotive Superintendent,
Traffic Manager,

were exempted from liability to serve in Mofussil Courts as Jurors or Assessors.

6. The Agents of both Companies now submit a much more comprehensive list of employés whom they would wish exempted.

7. In his letter, No. 165, dated 6th March 1883, the Agent of the Madras Railway explains why he considers it necessary that the Deputy Chief Engineer and the Superintendent of Watchmen should be included in the list.

8. I am of opinion that, having regard to the safety of the travelling public, it is expedient that the following officers should be exempted from serving in the Courts of the Mofussil:—

1. Chief Engineer.
2. Locomotive Superintendent.
3. Traffic Manager.
4. Assistant Traffic Managers.
5. Engineers in charge of Divisions.
6. Permanent-way Inspectors.
7. Locomotive Foremen.
8. Station Masters.
9. Engine Drivers.
10. Telegraph Inspectors.
11. Telegraph Signallers.
12. Superintendent of Watchmen.

9. It will be necessary to move the Judges to make a rule of Court that the same officials may be exempted in respect of the Courts within the original jurisdiction of the High Court.

MADRAS, 8*th March* 1883.

(Signed) J. SHAW-STEWART, Colonel, R.E.,
Consulting Engineer for Railways.

No. 592 C.

Transferred to the Judicial Department for consideration and orders.

(By Order.)

(Signed) C. J. SMITH, Lieut.-Colonel, R.E.,
Under Secy. to Govt., P. W. D., Railway Branch.

12*th March* 1883.

To the Judicial Department.

ORDER—dated 9th April 1883, No. 987, Judicial.

The following Notification will be published in the Fort St. George and all District Gazettes:—

NOTIFICATION.

Under the provisions of Section 320 of the Code of Criminal Procedure, the Governor in Council is pleased to exempt the undermentioned officers of the South

Indian and Madras Railways from liability to serve as Jurors or Assessors in the Mofussil Courts:—

The Deputy Chief Engineers.
Assistant Traffic Managers.
Permanent-way Inspectors.
Locomotive Foremen.
Station Masters.
Engine Drivers.
Telegraph Inspectors.
Telegraph Signallers.

2. The exemptions already made under previous enactments continue in force.

3. Application will be made to the Honorable the Judges of the High Court to grant a similar concession to such of the officers aforesaid as are resident within the limits of their original jurisdiction.

(True Extract.)

C. G. MASTER,
Chief Secretary.

To all Sessions Judges,
„ all District Magistrates,
„ the Public Works Department.

Exd. T. O'Connor.

Govt. of {1883} Madras.

JUDICIAL.

Issued

Recd. *Encl.*

G.O., 9th April 1883, No. 987.

No. 394 Ref. 1st April 83.

APRIL.

Communicate to the C. E. for Rep.
S of C.J.
C. E. for Rep.

Jurors.

Ordering that a Notification be published in the Fort St. George and District Gazettes exempting certain officers of the South Indian and Madras Railways from liability to serve as — or Assessors in the Mofussil Courts, and requesting the Honorable the Judges of the High Court to grant a similar concession to such of the officers as are resident within the limits of their original jurisdiction.

GOVERNMENT OF MADRAS.

REVENUE DEPARTMENT.

READ—again the following G.O., dated 11th January 1883, Miscellaneous No. 117, Revenue :—

Read—the following Proceedings of the Board of Revenue, dated 8th January 1883, Mis. No. 118 :—

Read—the following letter from A. J. STUART, Esq., Collector of North Arcot, to the Secretary to the Board of Revenue, dated 4th December 1882, No. 501 :—

With reference to Board's Proceedings, No. 5910, dated 11th ultimo, I have the honor to forward herewith a rough list of the contents of the 25 dufters of famine records in the Chandragiri taluk.

Resolution—dated 8th January 1883, Mis. No. 118.

Submitted to Government for orders with reference to G.O., No. 361, dated 23rd March 1880, no further orders having been received by the Board sanctioning the destruction of famine accounts.

(A true Copy and Extract.)

(Signed) E. GIBSON,
Acting Secretary.

To the Secretary to Government, Revenue Department, with original enclosure to be returned, and copy of Board's Proceedings, dated 11th October 1882, No. 5910, Routine.

Copy to the Collector of North Arcot.

Order—dated 11th January 1883, Mis. No. 117.

Referred to the Accountant-General for his remarks.

(True Extract.)

(Signed) P. P. HUTCHINS,
Ag. Secretary to Government.

READ—again the following G.O., dated 3rd February 1883, Miscellaneous No. 492, Revenue :—

Read—the following letter from H. F. CLOGSTOUN, Esq., Accountant-General, to the Secretary to Government, Revenue Department, dated Fort St. George, 23rd January 1883, No. 196 :—

With reference to your endorsement, Mis. No. 117, dated the 11th January 1883, referring, for my remarks, Proceedings of the Board of Revenue, No. 118, dated 8th January 1883, on the subject of the destruction of famine records in the Chandragiri taluk of the North Arcot district, I have the honor to state that a

reference might be made to the Examiner of Public Works Accounts regarding the records connected with relief works, as general ledger books showing the accounts of the repair of tanks and channels may possibly be of some use to his office. As regards the remaining records, I am of opinion that they may be destroyed unless they relate in any way to famine advances outstanding under the different heads of famine loans, advances for seed-grain, and advances to weavers when it would be advisable that they should be retained for the present.

Order—dated 3rd February 1883, Mis. No. 492.

The foregoing letter, together with the list received with the Board's Proceedings, dated 8th January last, No. 118, Mis., will be forwarded for the remarks of the Examiner of Public Works Accounts.

(True Extract.)

(Signed) P. P. HUTCHINS,
Ag. Secretary to Government.

To the Examiner of Public Works Accounts,
with list to be returned.

READ—again the following G.O., dated 8th March 1883, Mis. No. 1052, Revenue:—

Read—again G.O., dated 3rd February 1883, Mis. No. 492, Revenue.

Read—also the following letter from R. G. MACDONALD, Esq., Acting Examiner, Public Works Accounts, to the Secretary to Government, Revenue Department, dated Madras, 26th February 1883, No. 805-X:—

With reference to the Proceedings of the Board of Revenue, No. 118, Mis., dated 8th January 1883, I have the honor to state that none of the records referred to by the Accountant-General, Madras, in his letter embodied in the Proceedings will be of any use in this Office; but I would suggest a reference being made on the subject to the Chief Engineer for Irrigation, as some of the papers may possibly be of use in the New Tank Divisions which it is proposed to constitute.

Order—dated 8th March 1883, Mis. No. 1052.

The foregoing papers, together with the list of famine records in the Chandragiri taluk, will be forwarded for the remarks of the Chief Engineer for Irrigation, as suggested by Examiner, Public Works Accounts.

(True Extract.)

(Signed) P. P. HUTCHINS,
Ag. Secretary to Government.

To the Chief Engineer for Irrigation, with
two enclosures.

READ—also the following G.O., dated 16th March 1883, No. 240-I, Public Works:—

Read—the following Proceedings, Revenue Department, dated 8th March 1883, No. 1052.

ABSTRACT.—Forwarding list of famine records in the Chandragiri taluk for remarks, as to whether they are required by this (Public Works) Department.

Order—dated 16th March 1883, No. 240-I.

None of the famine relief records, enumerated in the list, are of any professional interest, nor do they furnish any statistics which will be of use to the Tank Divisions.

(True Extract.)

(Signed) A. S. RUSSELL,
Under-Secy. to Govt., P. W. D.,
Irrigation Branch.

To the Revenue Department.
" Board of Revenue.
" Chief Engineer for Irrigation.
" Examiner, Public Works Accounts.

ORDER—dated 11th April 1883, No. 432, Revenue.

Miscellaneous.

All the records excepting those which in any way relate to Famine advances outstanding under the different heads indicated by the Accountant-General, may be destroyed.

(True Extract.)

(Signed) E. F. WEBSTER,
Secretary to Government.

To the Board of Revenue, with one enclosure.
" Public Works Department.
" Accountant-General.

Exd. W. H. French.

80 Copies.

Govt. of {1883} Madras.

REVENUE.

Issued

Recd.

Encl.

G.O., 11th April 1883, No. 432.

No. 367 Jan. 2nd May/83.

APRIL.

Recorded.

S/ C.B.

R.I.

C. E. for I.

& Asst. P.W. acct.

Famine Records

in the Chandragiri Taluk, North Arcot.—All —excepting those which in any way relate to famine advances outstanding under the different heads indicated by the Accountant-General, ordered to be destroyed.

65

GOVERNMENT OF MADRAS.

REVENUE DEPARTMENT.

READ—the following G.O., dated 13th March 1883, No. 818 W., Public Works :—

Read—the following letter from G. T. WALCH, Esq., Officiating Superintending Engineer, First Circle, to the Chief Engineer, Public Works Department, dated Dowlaishweram, 17th February 1883, No. 2783 G.D. :—

With reference to G.O., No. 3172 W., 2nd December 1882, I have the honor to ask a reference to paragraph 3 of G.O., Revenue Department, No. 921, 4th August 1880, in which it is distinctly said that, in addition to the rent, the Canal and Ferry Fund should provide for current repairs.

2. The steamer and her engines are old, and, if Government consents to keep her in repairs, the rent will probably be almost all swallowed up.

3. It would be better to sell the steamer to the ferry for a small sum, say Rs. 8,000, than to hire her out at the present rate and keep her in repair.

Order—dated 13th March 1883, No. 818 W., Public Works.

The Government are of opinion that it would be better to sell the steamer. She will accordingly be put up to auction, when she can be purchased for the ferry if considered desirable.

(True Extract.)

(Signed) J. PENNYCUICK, Major, R.E.,
Under Secy. to Govt., P.W.D.

To the Superintending Engineer, First Circle.
" Examiner of Public Works Accounts.
" Revenue Department.

ORDER—dated 24th March 1883, No. 403, Revenue.

Miscellaneous.

Communicated to the Board of Revenue, who will consider the desirability of purchasing the steamer for the Godávari ferry and instruct the Collector as to the action he should take in the matter.

(True Extract.)

(Signed) E. F. WEBSTER,
Secretary to Government.

To the Board of Revenue.
" Public Works Department.

Exd. A. Aubert.

80 Copies.

Govt. of (1883) Madras.

REVENUE.

1492 W

Issued

Recd.

G.O., 24th March 1883, No. 403.

1079 wof 11th April

MARCH.

Recorded
S/c P.W.D.

Steamer "Godavari."

Proceedings, Public Works Department, directing sale of —, communicated to Revenue Board with instructions.

No. 1916

FROM, THE SUPERINTENDING ENGINEER
FIRST CIRCLE.

TO, THE CHIEF ENGINEER
P. W. Department
~~FOR IRRIGATION.~~

DOWLAISHWERAM, 16th April 1883

SIR,

With reference to G.O.No. 818 W. 15/3/83, I have the honor to point out that it does not definitely settle the question as to whether the Canal & Ferry Funds should pay the bill for repairs objected to. though it seems to me perfectly clear they should do so.

2. If the bill is not paid the loss to the Workshops will actually injuriously affect the Revenue from Capital Productive Public Works with which the steamer has nothing whatever to do.

See G.O.No. 1941 2/3/83.

† Send a P.W. Rep. on Fund No. & date.

I have the honor to be,
Sir,
your most obedient Sv.
C. Rivett
Offg. Supt. Engr. 1st Circle.

L9

B no 1079 of 11.4.83.
A (original) no 818 of 13.3.83
B. no 3172 of 2.12.82
B - 2649 of 30.8.80

P.W. Clo. 3641

From

The Supt Engineer
1st Circle

To

The Chief Engineer
P.W. Department

Dated 16th
Desp'd 18th } April 83
Recd 24

No 191 G.W.

Enclosure
Steamer "Godavari"
Bill for the repairs objected to — Requests to know whether the Canal and ferry funds should pay the —

Rs. 1292-11

Genl Dept

PUBLIC WORKS DEPARTMENT.

PROCEEDINGS OF THE MADRAS GOVERNMENT.

UNDER date the 2 May 83

READ the following

From the Superintending Engineer First Circle } No. 191 G.D. dated 16th April 83

The Government consider that the Ferry Fund should pay the differences between the Cost of repairs executed upto date of the sale of the Steamer and the amount of rent paid to the same period

To the Supdg. Engr. First Circle
Exam. P.W. accts
Rev. Dept
(Rev. Secretariat)
Dept
Rev.

25/4

27/4

Govt. of [1883] Madras.

PUBLIC WORKS.

Dated 7/5

Read Rgd.

G. O. 20 May 1883. No. 1292

Nos. K —

Steamer Endavour

Ferry Fund to pay
Collector etc.
of repairs to the —
time of her sale,
t of rent for the da

65—
4

Recpt Rejd