No. 2134 W. 3.8.83
" ~~2127~~
" 2127 W. 2.8.83
" 1831 W. 29.6.83

Re 2302 Way 16 to Aug 8

Ordered to be forwarded with a copy of G.O. No. 2127 W dy 2. August 1883 for the early sanction of the Govt. of India to the additional Accounts estabt. applied for.

2. The proposal in para: 2 of the Exs. letter is sanctioned.

H.E. No 2303 W dy 16 Aug 83

Forwarded

Cy
10/8

Rect
11-8-83
send & send in with letter and ref. of 6 Nov 2127 W 2 Aug 83

17/8

Ex. P.W. Accts:

17/8

Cy
copy 10/8 No. 1618
2116

6-12-86

From,

The Examiner P.W. Accounts,

Madras.

To,

The Secretary to Government,

P.W. Department.

83 W.

Re 2302 / 2303 Way 16-8-83

8th August 1883.

Encore

Additional temporary Accounts Clerical Establishments in nection with the Tank Maintenance emes. Applies for------

Withdrawn

Exhibit Rect Nov

Statement showing changes in the Establishment of Accountants of the Madras P.W.D.
To accompany letter to the Government of India No of

Present scale			Proposed scale			Increase		Decrease		Grounds of proposition	Remarks.
Designation	Salary	No.	Designation	Salary	No.	Amount		No.	Amount		
Accountants											
Permanent (Madras)											
Accountants 1st Grade	800	2	Accountants 1st Grade	800		-	-	-	-		
do 2nd do	885	3	do 2nd do	885		-	-	-	-		
do 3rd do	1200	6	do 3rd do	1200		-	-	-	-		
do 4th do	1955	17	do 4th do	1955		-	-	-	-		
do 5th do	1725	30	do 5th do	1725		-	-	-	-		
(A) Accountants Cooking	6565	58	Accountants Cooking	6565							(A) Sanctioned by the Government of India in letter No. 221 A.E. of 29th December 1881.
Permanent (Coorg)											
(B) Accountants 1st Grade	230	2	Accountants 1st Grade	230		-	-	-	-		(B) Sanctioned by the Government of India in letter No. 711 G of 15th June 1883.
Total Permanent Accountants Establishment.	6795	60	Total Permanent Accountants Establishment	6795		-	-	-	-		(C) Sanctioned by the Government of India in letter No. 40 A.E. of 6th February 1883.
Temporary			Temporary								
(C) Accountants 1st Grade	460	1	Accountants 2nd Grade	295	1	295					
		1	do 3 do	200	1	200					
		4	do 4th do	460							
		6	(D) do Temporary	955	2	495					(D) No. of Accountants allowed for 3 temporary Divisions 3 Add do for Tank – 1 4 For Head Office 2 6
Total Accountants Permanent and temporary	7750	66	Total Accountants Permanent & Temporary	7750	2	495	-	-	-		Under para 41 of the Madras P.W. Code. 1/8 of 6 = 3/4 = 1 Second Grade 1/4 of 6 = 1 1/2 = 1 Third Grade 4 Fourth Grade Total 6

Madras
8th August 1883

D. C. Cumberlege

Examined P.W. Accounts.
Madras 8th Aug 1883

No.831W

From

THE EXAMINER,

PUBLIC WORKS ACCOUNTS,

MADRAS,

To

The Secretary to Government,

Public Works Department.

Madras, 8th August 1883.

Sir,

With reference to the orders of Government contained in G.O.No.2127 W. dated the 2nd. Instant, I have the honor to forward herewith for the sanction of the Government of India, a statement of the additional temporary Accounts Establishment required for work in connection with the Tank Maintenance Scheme.

2. To provide for the increased amount of clerical work that will necessarily follow, sanction of Government is solicited to the entertainment of a small Establishment of 2 clerks IV. Class 3rd. Grade at a total monthly cost of Rs.40 per mensem. This sanction if accorded will supersede that given in G.O.No.1831 W. dated 29th. June 1883 for one temporary clerk on Rs.40.

3. The favor of early orders is solicited.

I have the honor to be,

Sir,

Your Most Obedient Servant.

J. C. Cumming

Examiner P.W. Accounts.

No. 2134 W. 3.8.83
" ~~2127~~ 2127 W. 2.8.83
" 1831 W. 29.6.83

Re 2302 Wdg 16 Encls

Ordered to be forwarded with a copy of G.O. No. 2127 W d/2. August 1883 for the early sanction of the Govt. of India to the additional Accounts establt. applied for.

2. The proposal in para: 2 of the Exr's letter is sanctioned.

Re No 2303 Wdg 16 Encls 3

Forwarded

Ex Re

Additional temporary Accounts and Clerical Establishments in connection with the Tank Maintenance Scheme. Applies for------

From,

The Examiner P.W. Accounts,

Madras.

To,

The Secretary to Government,

P.W. Department.

6-12-86

No. 83 W.

Re 2302 Wdg 16-8-83
2303

Dated 8 August 1883.

Encl.

complete the Establishments to the sanctioned strength by the transfer or appointment of men of the classes falling within their powers of sanction under Code Rules.

5. As regards Upper Subordinates, the Chief Engineer will be prepared, on the application of Superintending Engineers to make temporary appointments to such extent as may be necessary to bring the total strength of the Department up to that required for the temporary Divisions plus the existing permanent Divisions.

6. Superintending Engineers are now requested to report any transfers they wish to have made, and the names of any men they may desire to recommend specially for the temporary appointments.

(By Order)

Major R.E.

Dy. Chief Engineer P.W.D.

To

Superintending Engineers

First, Second, & Sixth Circles.

Chief Engr. for Irrigation.

Examiner P.W.A.

P.W. D E P A R T M E N T.

No. 289 C, dated 29th. January 1883.

M E M O R A N D U M.

As Superintending Engineers are understood to be in doubt as to the exact arrangements which are admissible for providing the staff requisite for the Temporary Divisions recently sanctioned, information on the subject is now circulated for guidance.

2. The Establishment, Executive and Office, which has been sanctioned for the new Divisions is that given below:-

CENTRAL GODAVARI DIVISION.

1 Executive Engineer 2nd. grade.

1 Assistant Engineer Do.

1 Sub Engineer 3rd. grade.

* 4 Overseers

OFFICE ESTABLISHMENT.

1 Clerk 3rd. class 2nd. grade.

1 „ 4th. „ 1st. „

1 „ 4th. „ 2nd. „

1 „ 4th. 3rd. „

1 Draftsman 1st. Class.

1 do. 3rd.

1 Messenger at Rs. 7.

1 do. „ „ 6.

1 Accountant 4th. Grade.

* vide No. 110 G.D. dated 16th. November 1882 from the Chief Engr. for Irrigation.

IRRIGATION.
ACCOUNT.

Govt. of {1883} Madras.

PUBLIC WORKS.

Dated September, 3rd.

Read. *Encl.*

G.O., 3rd Sept. 1883, No. 714 I.

SEPTEMBER.

Barur Tank Project

The provisional sanction of the Government of India, in anticipation of the approval of the Secretary of State to the revised estimate for the —, communicated to officers concerned.

No. 21344 38 83 ... 866

* vide No.110 G.D.dated 16th. November 1882 from Chief Engr.for Irrigation.

2 SUB DIVISIONAL OFFICE ESTABLISHMENTS.

4 Clerks 4th. Class 3rd. grade.

4 Messengers at Rs. 6 each.

OVERSEERS CLERKS.

4 Clerks 5th. Class, 1st. grade.

PETTY ESTABLISHMENT.

1 Store keeper at Rs. 25-/

3 Lascars " 6-/ each

GUDIVADA DIVISION.

1 Executive Engineer 4th. Grade.

1 Assistant Engineer 1st. "

1 Sub Engineer 3rd. "

2 Overseers.

OFFICE ESTABLISHMENT.

1 Clerk 3rd. Class 2nd. grade.

1 " 4th. " 1st.

1 " 4th. " 2nd.

1 4th. 3rd.

1 Draftsman 1st. Class.

1 do. 3rd. "

1 Messenger at Rs. 7.

1 do. 6.

1 Accountant 4th. Grade.

SUB DIVISIONAL OFFICE ESTABLISHMENT.

2 Clerks, 4th. Class 3rd. grade.

2 Messengers at Rs. 6 each.

OVERSEERS CLERKS

2 Clerks, 5th. Class 1st. grade.

PETTY ESTABLISHMENT.

1 Storekeeper at Rs. 25-/

3 Lascars " 6-/ each.

CAUVERY and VENNAR REGULATOR DIVISION.

1 Executive Engineer 4th. Grade.

1 Sub Engineer 3rd. "

2 Overseers.

OFFICE ESTABLISHMENT.

1 Clerk 3rd. class 2nd. grade.

1 " 4th. " 2nd. "

2 " 4th. " 3rd. "

1 Draftsman 1st. Class.

1 do. 3rd. "

1 Messenger at Rs. 7.

1 do. " 6

1 Accountant, 4th. Grade.

3 Overseers Clerks.

PETTY ESTABLISHMENT.

1 Storekeeper at Rs. 25-/

3 Lascars " 6-/ each.

3. This Establishment can be provided for either by temporary appointments direct to the new Divisions, or by the transfer of men on the permanent Establishment, the places of the latter being filled up by temporary appointments.

4. Superintending Engineers are authorised to at once

complete

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Irrigation
Account.

Read—the following letter from Colonel H. A. BROWNLOW, R.E., Deputy Secretary to the Government of India, Public Works Department (Civil Works—Irrigation), to the Secretary to the Government of Madras, Public Works Department, dated Simla, 7th August 1883, No. 294 I.:—

In reply to your endorsement, No. 409 I., dated 19th May 1883, I am directed to communicate the provisional sanction of the Government of India, in anticipation of the approval of Her Majesty's Government, to the estimate amounting to Rs. 3,33,793, of which Rs. 3,20,000 represent the direct and Rs. 13,793 the indirect charges for the construction, as a Productive Public Work, of the Barur Tank Project in the district of Salem, in the Madras Presidency.

2. I am at the same time to request that care may be taken to have all masonry and earthwork on the supply channel leading from the anicut on the Ponniár river to the tank so executed as to admit of ready enlargement of the channel, should it be afterwards found necessary, to a capacity sufficient for easy discharge, under average conditions of flow in the river, of a monthly volume equal to the storage capacity of the Barur and minor tanks, *plus* the monthly volume required for the support of the growing rice crop dependent on the tanks.

3. The sanction accorded in paragraph 1 has been registered as No. I of 1883-84, and the plans and estimates received with your letter under reply are herewith returned.

4. A copy of the despatch which has been forwarded to the Secretary of State regarding this project, together with copies of the revised forecast statements prepared in the Accountant-General's Office, are herewith forwarded for information.

Enclosures.

From the Government of India, Public Works Department (Civil Works—Irrigation), to the Right Honorable the Secretary of State for India, dated Simla, 11th August 1883, No. 41 P.W.

We have the honor to report that we have accorded provisional sanction, in anticipation of the approval of your Lordship, to an estimate amounting to Rs. 3,33,793, of which Rs. 3,20,000 represent the direct and Rs. 13,793 the indirect charges, for the construction, as a Productive Public Work, of a scheme of tank irrigation in the district of Salem, in the Madras Presidency.

2. This scheme, which is called the Barur Tank Project, is intended to improve the water-supply of a number of existing tanks, of which one near the village of Barur is the largest, so as to bring under irrigation an area of 5,430 acres in addition to 1,457 acres already watered by the tanks. The supply will be obtained from the river Ponniár, which flows through the north of the Salem District. The proposed works mainly consist of an "anicut" across this river and a supply channel 7¼ miles in length leading from it to the Barur Tank. The tanks when completed will have a storage capacity of 16½ millions of cubic yards. The water-supply in the Ponniár has been ascertained to be amply sufficient for purposes of irrigation and storage.

3. The Salem District suffered severely from famine in 1877, and the project was undertaken as a famine relief-work in the month of August of the same year. The total expenditure on the work, excluding charges for Establishment and Tools and Plant, has up to the close of 1882-83 amounted to Rs. 80,357.

4. An estimate for the project was received in March 1881, but as it was not accompanied by any forecast of revenue and was imperfect in many other respects, we returned it to the Government of Madras for revision. A complete estimate has lately been received, which we now forward for your Lordship's approval.

5. The project will be finally completed in 1886-87, when the total area irrigable will amount to 6,887 acres. The net revenue expected to be obtained from the irrigation of this area will amount to Rs. 21,396 and will yield a return of 7·7 per cent. on Rs. 2,76,376,* the total sum that will be at charge for interest ten years after the probable date of the completion of the work.

* Estimated capital outlay—	Rs.
Direct	3,20,000
Indirect	13,793
	3,33,793
Add—Simple interest on direct capital up to ten years after the probable date of the completion of the project	1,65,374
	4,99,167
Deduct—Net revenue the project is expected to earn up to that date	2,22,791
Total sum at charge ..	2,76,376

6. The forecast of the growth of irrigation, revenue receipts and charges has been approved by the Revenue Officers of the Government of Madras.

7. The forecast statements sent forward by the Government of Madras not being quite correct, revised statements have been prepared by the Accountant-General, Public Works Department, and are forwarded herewith.

8. The project thus amply fulfils the conditions required for classing it as a Productive Public Work, and as it will also prove valuable as an efficient means of protection to a district which has already suffered from the worst effects of famine, we have no hesitation in recommending it to your Lordship for sanction as a charge against Loan Funds.

BARUR TANK PROJECT.

No. I.—Summary of the estimated Direct Charges to Capital Account.

Year.	Works.	Establishment.	Tools and Plant.	Total.
1	2	3	4	5
	Rs.	Rs.	Rs.	Rs.
Actuals to end of 1882-83	80,357	18,022	1,691	1,00,070
Estimated for 1883-84	60,765	13,816	2,401	76,982
,, 1884-85	57,526	13,231	1,863	72,620
,, 1885-86	56,352	12,961	1,015	70,328
Total ...	2,55,000	58,030	6,970	3,20,000

No. II.—Summary of the estimated Indirect Charges to Capital, excluding Interest.

Year.	Capitalisation of Land Revenue abated.	Loss by Exchange on Payments in England.	Charges for Leave and Pension Allowances.	Total.
1	2	3	4	5
	Rs.	Rs.	Rs.	Rs.
Actuals to end of 1882-83	6,829	...	2,163	8,992
Estimated for 1883-84	...	...	1,658	1,658
,, 1884-85	...	...	1,588	1,588
,, 1885-86	...	...	1,555	1,555
Total ...	6,829	...	6,964	13,793

The figures in Column 4 are calculated at 12 per cent. on the figures entered in Column 3 of Statement No. I.

No. III.—Estimate of Growth of Irrigation and Revenue Receipts and Charges.

Year.	Irrigated Area at end of Year.	Revenue Receipts and Charges.					
		Gross Revenue due to Works.			Charges both Direct and Indirect against Revenue Account.	Net Revenue due to Works.	
		Direct Receipts.	Enhanced Land Revenue or Indirect Receipts.	Total.		Including Enhanced Land Revenue.	Excluding Enhanced Land Revenue.
1	2	3	4	5	6	7	8
	Acres.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Estimated for 1885-86 ..	3,457	..	10,594	10,594	1,763	8,831	..
,, 1886-87 ..	6,887	..	26,039	26,039	4,643	21,396	..
,, 1887-88 ..	6,887	..	26,039	26,039	4,643	21,396	..
,, 1888-89 ..	6,887	..	26,039	26,039	4,643	21,396	..
,, 1889-90 ..	6,887	..	26,039	26,039	4,643	21,396	..
,, 1890-91 ..	6,887	..	26,039	26,039	4,643	21,396	..
,, 1891-92 ..	6,887	..	26,039	26,039	4,643	21,396	..
,, 1892-93 ..	6,887	..	26,039	26,039	4,643	21,396	..
,, 1893-94 ..	6,887	..	26,039	26,039	4,643	21,396	..
,, 1894-95 ..	6,887	..	26,039	26,039	4,643	21,396	..
,, 1895-96 ..	6,887	..	26,039	26,039	4,643	21,396	..

N.B.—1. The figures in Column 2 include 1,457 acres, the area of old irrigation. This has not, however, been taken into account in calculating the revenue figures entered in Column 4.

N.B.—2. The Columns 3 and 8 are blank, there being no Direct Revenue due this project. The water-rate, on which forms the principal item of Direct Revenue in the other provinces, is collected in the Madras Presidency by the Civil Department along with the Land Revenue, and is treated in the estimates and accounts of the Public Works Department as an item of Indirect Revenue.

No. IV.—Estimate of Net Financial Results of ten years after the probable date of completion of the work.

Year.	Direct Capital Outlay during the Year.	Direct Capital Outlay to end of Year.	Simple Interest at 4 per cent. on Capital Outlay to end of previous year, *plus* half outlay during Year.	Net Revenue, including Enhanced Land Revenue, Column 7 of Table III.	Simple Interest, less Net Revenue.	Net Revenue, less Simple Interest.
1	2	3	4	5	6	7
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Actuals to end of 1882-83 ..	1,00,070	1,00,070	11,905	..	11,905	..
Estimated for 1883-84 ..	76,982	1,77,052	6,542	..	5,542	..
,, 1884-85 ..	72,620	2,49,672	8,534	..	8,534	..
,, 1885-86 ..	70,328	3,20,000	11,393	8,831	2,562	..
,, 1886-87 ..	..	3,20,000	12,800	21,396	..	8,596
,, 1887-88 ..	..	3,20,000	12,800	21,396	..	8,596
,, 1888-89 ..	..	3,20,000	12,800	21,396	..	8,596
,, 1889-90 ..	..	3,20,000	12,800	21,396	..	8,596
,, 1890-91 ..	..	3,20,000	12,800	21,396	..	8,596
,, 1891-92 ..	..	3,20,000	12,800	21,396	..	8,596
,, 1892-93 ..	..	3,20,000	12,800	21,396	..	8,596
,, 1893-94 ..	..	3,20,000	12,800	21,396	..	8,596
,, 1894-95 ..	..	3,20,000	12,800	21,396	..	8,596
,, 1895-96 ..	..	3,20,000	12,800	21,396	..	8,596
	..	..	1,65,374	2,22,791	..	57,417

Order—dated 3rd September 1883, No. 714 I., Public Works.

Communicated to the officers concerned.

(True Extract.)

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

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

Exd. A. F. Goodall.
Spare Copies

IRRIGATION.
ACCOUNT.

Govt. of {1883} Madras.

PUBLIC WORKS.

Dated September, 3rd.

Recd. *Encl.*

G.O., 3rd Sept. 1883, No. 714 I.

SEPTEMBER.

Barur Tank Project

The provisional sanction of the Government of India, in anticipation of the approval of the Secretary of State to the revised estimate for the —, communicated to officers concerned.

IRRIGATION.
ACCOUNT.

Govt. of {1883} Madras.

PUBLIC WORKS.

Dated May, 19th.

Recd. *Encl.*

G.O., 19th May 1883, No. 409 I.

MAY.

Barur Project

FORWARDED to the Government of India the revised estimate for the —.

List of Papers connected with the Barur Project to go to the Government of India in original with Endorsement, No. 409 *I., dated* 19*th May* 1883.

1. Barur Project.—The Index Map of the — ... . Sheet No. 1.
2. Do. —Plan and sections of the proposed anicut and flood-banks on each side ... ... „ „ 3.
3. Do. —Plan and sections of Barur head-sluice ... ... „ „ 4.
4. Do. —Plan and sections of Agaram head-sluice ... ... „ „ 5.
5. Do. —Plan and sections of sand-sluice for anicut ... ... „ „ 7.
6. Do. —Barur Tank—The map of— ... ... „ „ 26.
7. Do. —Cross-sections of Barur tank bund ... ... „ „ 27.
8. Do. —Report containing the following :—

Appendix A.—Original report by Mr. Lowry, Executive Engineer, Hosúr, dated 15th January 1879.

Do. A-1.—Note by Major J. Pennycuick, R.E., No. 48, dated 5th December 1878.

Do. A-2.—Letter from Chief Engineer, Mysore, No. 100, dated 23rd January 1879.

Do. B.—Rainfall Register.

Do. C.—Letter from Collector of Salem, No. 150, dated 26th January 1881, estimating probable returns.

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

Do. E.—Note by the Chief Engineer for Irrigation, No. 18 I., dated 5th February 1881, reviewing the Project.

Do. F.—Note by the Chief Engineer for Irrigation, dated 18th October 1880, reviewing the Project.

9. Appendix G.—Tables I, II, III and IV—Ponniár Discharges.
10. Do. G*a*.—Register of water of Ponniár river at Nedungal for October 1881.
11. Do. G*b*.— Do. do. November 1881.
12. Do. G*c*.— Do. do. December 1881.
13. Do. H.—Statement of compensation for land taken up for the Project.
14. Tabular Statement to accompany Estimate for the Baroor Tank Project.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Irrigation.
Account.

Read—the following papers:—

Report by Superintending Engineer, Fourth Circle, dated 1st March 1882, enclosing report from Lieutenant Romilly, R.E., with Appendices.

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

No. 48 I.

Note by the Acting Chief Engineer for Irrigation.

The Barur Tank Project was undertaken as a Famine Relief Work under the authority given in G.O., Revenue Department, No. 735, dated 19th February 1877, in August 1877. It was intended to improve and enlarge the Barur tank in the Krishnagiri Taluk of the Salem District and provide it with a supply from the Ponniár, a river which rises near Nundidroog in the Mysore territory, passes through the Salem and South Arcot Districts, and falls into the sea near Cuddalore. The original estimate submitted in September 1877 amounted to Rs. 52,688.

2. The expenditure on the work amounted to Rs. 1,07,101, of which Rs. 67,185 is the normal value of the work, the balance having been charged to Famine. Since the famine, some work has been done to enable the old cultivation under the Barur tank to be resumed, and compensation for the land taken up has been paid. The expenditure thus incurred amounted to Rs. 13,172, making the total expenditure on the project Rs. 80,357.

3. As soon as the pressure from the famine admitted, the complete project was worked out by the late Mr. Lowry, Executive Engineer, and this was submitted to the Government of India with a Note by the Chief Engineer for Irrigation, reviewing the works in detail, and suggesting several modifications of design, which it was intended should be carried out during the execution of the works, as they were not expected to entail any additional expenditure, and it was considered desirable to avoid further delay. These estimates, which were submitted in February 1881, amounted to Rs. 2,35,500.

4. In April 1881, the estimates were returned by the Government of India for revision, and in order that they might be submitted in a complete form with information on the following points:—

(1.) The capacity of the Barur tank and minor tanks to be supplied.
(2.) The discharge of the river.
(3.) The area commanded and irrigable.
(4.) Forecasts of financial results.

5. The revision of the estimates was entrusted to Lieutenant Romilly, R.E., the officer in charge of the B. Project Division, who has submitted complete estimates revised in accordance with the instructions of the Chief Engineer for Irrigation, with a report on the work necessary to complete the project, and since then, the forecast statements have been revised, and the statement of revenue to be expected has been approved by the Collector.

6. The project provides for—

(1.) An anicut across the Ponniár river at Nedungal in the Krishnagiri Taluk of the Salem District.
(2.) Head-sluices to the Nedungal and Agaram channels on the right bank of the river.
(3.) A channel on the left bank on the river to the Barur tank, passing through three small tanks and commanding three other tanks.
(4.) The enlargement of the Barur tank.
(5.) Distributary channel from the Barur tank.
(6.) Increasing the supply to thirteen other tanks.

And the work already done is approximately—

Supply channel. Three-fourths of earthwork and two-thirds of rock blasting.

Barur tank. Puddle core of bank. Two-thirds of earthwork, three-fourths of revetment; western sluice three-fourths completed.

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

7. The area commanded by the project is 11,251 acres, and it is proposed to irrigate 6,887 acres, of which 1,457 acres are already irrigated under the tanks. Of the area to be newly irrigated, 3,300 acres are waste land, on which the enhanced land revenue is calculated at Rs. 1-4-9 per acre, being the average rate of dry assessment in the villages commanded. All newly-irrigated land will pay a water-rate of Rs. 4 an acre.

8. When the project was first submitted the supply available for irrigation was estimated from the quantity supposed to run off the catchment area. While Lieutenant Romilly was engaged in revising the estimates, he carefully gauged the river at the anicut site, and in his report has compared the actual discharge measured with the quantity supposed to run off the catchment area. This comparison showed that one-seventh and one-sixth of the rainfall drained off in the two recorded floods. From this it is considered safe to allow that one-tenth of the rainfall will always be available, and taking the average of thirteen years' rainfall (in which the famine years are included), it is shown that from May to November 36 millions of cubic yards per month would pass the anicut site. Allowing that 8,000 cubic yards per acre are required to bring one crop to maturity, 55 millions of cubic yards, or little more than 1½ months' supply in the river, are required.

The full supply in the channel is obtained when the gauge reads 3 feet, and the result of the observations taken in 1881 (a year in which, as noticed by the Superintending Engineer, the rainfall was unusual, early freshes having failed) shows that without any anicut the channel would have run full for 24 days in August, September, and October, discharging 24 millions of cubic yards, while for the rest of the time, and in fact until the end of December, there was from 6 to 8 inches of water in the river. In addition the local rainfall would also be available for storage, the Barur tank itself having a drainage basin of about 7 miles. There can therefore be no doubt that the supply of water is sufficient for the cultivation of the full acreage. Appendices to the Report, G, G-1, G-2, and G-3, show the observations recorded and calculations of discharge.

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

10. The estimates as now submitted amount to—

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

and can be worked out in three years; the increased cultivation is expected to be taken up as soon as water is available, and the gross revenue is estimated at ... Rs. 26,767
net revenue do. ... ,, 21,448

6·7 per cent. on direct charges, or 6·4 per cent. on direct and indirect charges.

The works are therefore of a remunerative character, and it is recommended that the project be classed as a Productive Public Work.

11. The Salem District suffered so severely in the late famine that it would be very desirable to undertake works which would irrigate 5,000 acres, even if the anticipated return from them was much less than it has been shown to be. The stoppage of the works has of course resulted in some loss, and to increased expenditure being necessary, otherwise the results would have appeared more favorable.

OOTACAMUND,
17th April 1883.

(Signed) J. O. HASTED, Colonel, R.E.,
Ag. Chief Engineer for Irrigation.

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

APPENDIX A.

TABULAR Statement showing the Dimensions of Channels of the Barur Tank Project.

Distance from Head.	Name of Work.	Channel.					Discharge.			Remarks.
		Bed Width.	Depth of Water, Full Supply.	Depth of Water, Maximum.	Side Slopes.	Bed Fall.	Mean Velocity.	Discharge calculated.	Discharge required.	
MILES. FEET.		FEET.	FEET.	FEET.	INCH.	FEET PER MILE.	FEET PER SECOND.	C. FEET PER SECOND.	C. FEET PER SECOND.	
...	Barur Tank Supply Channel ...	20	5	7	$1\frac{1}{4}$ to 1	1·97				
1 2,936	Do. do. ...	18	5	7	$1\frac{1}{2}$ to 1	1·71	2·76	379	105	Length of the channel from the anicut to the Barur Tank is 7 miles 1,550 feet.
...	East Sluice Channel from Barur tank.	11·5	4	...	$1\frac{1}{2}$ to 1	1·77				
5 1,100	Do. do. ...	5·5	4	...	$1\frac{1}{2}$ to 1	2	2·14	150	120	
6 2,870	Do. do. ...	4	Average 2·5	...	$1\frac{1}{2}$ to 1	2	1·74	80	65	Total length from Barur tank to the termination is 10 miles and 2,880 feet.
4 5,060	Branch No. 1 of East Sluice Channel.	2	2	...	$1\frac{1}{2}$ to 1	2	1·6	25	18	
5 880	Branch No. 2 of do. ...	2	2	...	$1\frac{1}{2}$ to 1	2	1·4	14·4	12	Length 1 mile and 2,508 feet.
6 2,860	Branch No. 3 of do. ...	6	3	...	$1\frac{1}{2}$ to 1	2	1·4	14·4	12	Do. 1 mile and 2,840 do.
6 3,160	Branch No. 4 of do. ...	2	3	...	$1\frac{1}{2}$ to 1	2	1·9	60	45	Do. 5 miles and 500 do.
...	West Sluice Channel of Barur tank.	4	3	...	$1\frac{1}{2}$ to 1	2	1·4	27	20	Do. 2 miles and 1,313 do.
1 900	Branch No. 1 of do. ...	2	2	...	$1\frac{1}{2}$ to 1	2	1·4	35	30	Do. 2 miles and 3,960 do.
							1·4	14·4	12	Do. 1 mile and 2,026 do.

(Signed) J. O. HASTED, Colonel, R.E.,
Ag. Chief Engineer for Irrigation.

APPENDIX B.

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

Sub-head.	Name of Work.	Amount of Individual Estimate.	Total of each Sub-head.
		RS.	RS.
	(1).—HEAD WORKS.		
B. Land ...	Compensation for land	*7,841	7,841
C. Works ...	Nedungal anicut across the Ponniár	18,035	
	Flood-banks	2,345	20,380
	Total ...	...	28,221
	(2).—MAIN CANALS AND BRANCHES.		
	Agaram Channel.		
D. Regulators.	Head sluice	9,600	9,600
L. Earthwork.	New head	1,055	1,055
	Nedungal Channel.		
D. Regulators.	Head sluice	860	860
	Barur Tank Supply Channel.		
D. Regulators.	Head sluice	5,210	5,210
F. (1) Other Cross Drainage Works.	Inlet No. 1		60
	Do. ,, 2		10
	Do. ,, 3		20
	Do. ,, 4		39
	Do. ,, 5		25
	Do. ,, 6		41
	Do. ,, 7		41
	Do. ,, 8		17
	Do. ,, 9		31
	Do. ,, 10		41
	Do. ,, 11		97
	Do. ,, 12		43
	Do. ,, 13		34
	Do. ,, 14		34
	Do. ,, 15		24
	Outlet ,, 1		165
	Do. ,, 2		14
	Do. ,, 3		285
	Do. ,, 4		53
	Do. ,, 5		740
	Do. ,, 6		167
	Do. ,, 7		130
	Do. ,, 8		56
	Do. ,, 9		72
	Do. ,, 10		381
	Do. ,, 11		62
	Do. ,, 12		296
	Do. ,, 13		70
	Do. ,, 14		92
	Do. ,, 15		375

* Includes compensation for land taken up for all works of the project generally.

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

Sub-head.	Name of Work.	Amount of Individual Estimate.	Total of each Sub-head.
	(2).—MAIN CANALS AND BRANCHES—*cont.*	RS.	RS.
	Barur Tank Supply Channel—cont.		
F. (1) Other Cross Drainage Works—*cont.*	Outlet No. 16	350	
	Do. „ 17	463	
			4,328
G. Bridges ...	One bridge	600	
	Two bridges	1,200	
	Four do.	1,740	
			3,540
L. Earthwork...	Barur tank supply channel	48,004	48,004
N. Tanks ...	Moorasamputty tank sluice	440	
	Velangamvady small tank sluice	680	
	Pungamputty tank sluice	784	
			1,904
O. Miscellaneous.	Syphon sluice	2,600	
	Fifteen distribution sluices	4,650	
			7,250
	Total (2), Main Canals and Branches ...	...	81,751
	(2A).—RESERVOIRS.		
L. Earthwork.	Barur tank bund	53,115	53,115
C. Works ...	Do. surplus weir	3,096	3,096
	Total (2A), Reservoirs ...	...	56,211
	(3).—DISTRIBUTARIES.		
N. Tanks ...	Keelcoopum tank sluice	414	414
C. Works ...	Do. eastern sluice	3,310	
	Do. western sluice	2,500	
	Do. aqueduct	2,900	
	Do. twenty-three inlets	2,024	
	Do. twenty outlets	8,540	
	Do. fifteen do.	5,580	
	Do. six terminals	516	
	Do. thirteen sluices	1,560	
	Do. forty-seven sluices	4,935	
	Three masonry falls of 2 feet	510	
	Six do. of 3 do.	1,260	
	Ten do. of 4 do.	2,800	
	Tunnels	1,230	
	Bridge	682	
			38,347
L. Earthwork.	Keelcoopum east channel	3,260	
	Do. do. branch channel	1,110	
	Do. west channel	22,500	
	Do. do. No. 1 branch channel ...	1,340	
	Do. do. „ 2 do. ...	1,460	

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

Sub-head.	Name of Work.	Amount of Individual Estimate.	Total of each Sub-head.
	(3).—DISTRIBUTARIES—*cont.*	RS.	RS.
L. Earthwork—*cont.*	Keelcoopum west No. 3 branch channel ...	10,950	
	Do. do. „ 4 do.	2,350	
			42,970
	Total (3), Distributaries ...	...	81,731
	Total, Works ...	...	2,47,914
	Lump sum provision for unforeseen works ...		7,086
			2,55,000
	Establishment	...	58,030
	Tools and Plant	...	6,970
	Total, Direct Charges ...	...	3,20,000
	Indirect Charges—		
	Capitalized abatement of Land Revenue ...	6,829	
	Leave and Pension Allowances	8,221	
			15,050
	Grand Total ...	...	3,35,050

(Signed) J. O. HASTED, Colonel, R.E.,
Ag. Chief Engineer for Irrigation.

APPENDIX C.

BARUR TANK PROJECT.

No. I.—Summary of the Actual and Estimated Direct Charges to Capital Account.

Year.	Works.	Establishment.	Tools and Plant.	Total.	Remarks.
1	2	3	4	5	6
	RS.	RS.	RS.	RS.	
Actual outlay to end of 1882-83 ...	80,357	18,022	1,691	1,00,070	
Do. 1883-84 ...	60,765	13,816	2,401	76,982	
Do. 1884-85 ...	57,526	13,231	1,863	72,620	
Do. 1885-86 ...	56,352	12,961	1,015	70,328	
Total ...	2,55,000	58,030	6,970	3,20,000	

No. II.—Summary of the Actual and Estimated Indirect Charges to Capital (including Interest).

Year.	Capitalization of Land Revenue abated.	Loss by Exchange on Payment in England.	Charges for Leave and Pension Allowances.	Total.	Remarks.
1	2	3	4	5	6
	RS.	RS.	RS.	RS.	
Actual to end of 1882-83	6,829	...	2,554	9,383	
Do. 1883-84	...	...	1,957	1,957	
Do. 1884-85	...	...	1,874	1,874	
Do. 1885-86	...	...	1,836	1,836	
Total ...	6,829	...	8,221	15,050	

N.B.—The figures in Column 4 are calculated at $14\frac{1}{6}$ per cent. on the corresponding figures in Column 3 of Table No. I.

No. III.—Estimate of Growth of Irrigation and Revenue Receipts and Charges.

Year.	Irrigated Area at end of Year.	Revenue Receipts and Charges.						Remarks.
		Gross Revenue due to Works.			Charges, both Direct and Indirect.	Net Revenue due to Works.		
		Direct Receipts.	Indirect Revenue.	Total.		Including Indirect Revenue.	Excluding Indirect Revenue.	
1	2	3	4	5	6	7	8	9
	ACRES.	RS.	RS.	RS.	RS.	RS.	RS.	
Estimated during 1885-86.	3,457	..	11,322	11,322	2,491	8,831	— 2,491	
Estimated during 1886-87.	6,887	..	26,767	26,767	5,319	21,448	— 5,319	Net revenue = 6·7 per cent. on Capital direct charges, or 6·4 per cent. on total Capital including indirect charges.

N.B.—1. The figures in Column 2 include 1,457 acres, the area of old irrigation.
2. The figures in Column 4 include Rs. 728, the approximate amount of old maintenance charges saved.
3. The figures in Column 6 have been arrived at by calculating charges in the Public Works Department at 8 annas per acre, and the collection charges in the Revenue Department 7·2 per cent. on Revenue.

(Signed) C. D. MACLEANE,
Collector of Salem.

No. IV.—Estimate of Net Financial Results for ten Years after probable date of completion of the Works.

Year.	Direct Capital Outlay during the Year.	Direct Capital Outlay to end of Year.	Simple Interest at 4 per cent. on Capital Outlay to end of previous Year *plus* half Outlay during Year.	Net Revenue including Indirect Revenue, Column 7 of Table III.	Simple Interest less Net Revenue.	Net Revenue less Simple Interest.	Remarks.
1	2	3	4	5	6	7	8
	RS.	RS.	RS.	RS.	RS.	RS.	
Actual to end of 1882-83 ..	..	1,00,070	11,905	..	11,905	..	
Do. of 1883-84 ..	76,982	1,77,052	5,542	..	5,542	..	
Do. of 1884-85 ..	72,620	2,49,672	8,534	8,831	..	297	
Do. of 1885-86 ..	70,328	3,20,000	11,393	21,448	..	10,055	
Do. of 1886-87 ..	..	3,20,000	12,800	21,448	..	8,648	
Do. of 1887-88 ..	..	3,20,000	12,800	21,448	..	8,648	
Do. of 1888-89 ..	..	3,20,000	12,800	21,448	..	8,648	
Do. of 1889-90 ..	..	3,20,000	12,800	21,448	..	8,648	
Do. of 1890-91 ..	..	3,20,000	12,800	21,448	..	8,648	
Do. of 1891-92 ..	..	3,20,000	12,800	21,448	..	8,648	
Do. of 1892-93 ..	..	3,20,000	12,800	21,448	..	8,648	
Do. of 1893-94 ..	..	3,20,000	12,800	21,448	..	8,648	
Do. of 1894-95 ..	..	3,20,000	12,800	21,448	..	8,648	
Do. of 1895-96 ..	..	3,20,000	12,800	21,448	..	8,648	
Total ..	..	..	1,65,374	2,44,759	17,447	96,832	
Net Surplus Revenue ..	..	..	..	..	..	79,385	

(Signed) J. O. HASTED, Colonel, R.E.,
Ag. Chief Engineer for Irrigation.

REPORT ON THE BARUR PROJECT.

This project has been for some years under consideration; it was forwarded to the Government of India (see G.O., No. 124 I., of 11th February 1881), who returned it requesting that more information might be afforded, and that certain modifications of many of the designs which

the Chief Engineer pointed out as advisable might be made. This has now been made by Lieutenant Romilly, the Executive Engineer of the B. Project Division, and his report, &c., are now forwarded; it is hoped that it will be considered satisfactory, and that the project, which will pay and prove most valuable to a poor tract of country, may be sanctioned and funds allotted at once for its execution.

It is much to be regretted that the river at the site of the proposed anicut has not been gauged for a longer period than six months, viz., from July to date, and that this year—1881—has been a very exceptional one, there having been no rain sufficient to throw a supply into the river until August; in fact, the south-west monsoon failed, and taking the rain registers at Hosúr for this year—1881—and comparing them with the average as shown in Appendix B, we have only 23·48 inches against an average of 32·62 inches for the year, the monthly distribution being as follows:—

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Average of ten years including famine years.	0·08	0·24	1·00	1·37	5·03	2·34	1·93	5·59	5·06	6·09	2·62	1·27	32·62
During 1881	..	..	..	..	..	·61	·42	5·85	11·15	·35	4·20	·90	23·48

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

From the above it is, it is considered, clearly shown by observation that the supply is more than ample, and probably hereafter the project may be extended on the south side of the river with great profit and advantage as shown in the Collector's letter, No. 150, dated 26th January 1881, paragraph 8, forwarded in Appendix C.

As the project has been revised according to the notes of the Chief Engineer for Irrigation, there is no necessity for this office to comment on them further than to state that it is considered that the works can be carried out for the estimated cost, and that the project is a good and paying one. It is thought, however, that as three years have elapsed since the work was stopped, that Rs. 5,000 should be added (making a total of Rs. 2,67,144) as contingencies to allow for deterioration of materials, &c. Some provision for this is necessary, as many of the banks partly thrown up and channel partly dug must have deteriorated.

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

(Signed) H. R. MEAD, Major, R.E.,
Superintending Engineer, Fourth Circle.

COIMBATORE,
1st March 1882.

REPORT ON REVISED BARUR PROJECT.

Previous references.

The plans and estimates for this project were originally prepared and forwarded by the late Mr. Lowry, Executive Engineer of the Salem Division, in March 1879, to the Superintending Engineer of the Fourth Circle, and submitted by that officer to the Chief Engineer for Irrigation in the same year. These papers were forwarded to the Government of India, accompanied by a note on the designs by the Chief Engineer for Irrigation, in G.O., No. 124 I., of 11th February 1881. This note by the Chief Engineer pointed out many particulars in which modifications of the various designs appeared to be necessary, and the project was returned by the Government of India with a request that it might be resubmitted after revision in accordance with these suggestions, and also that some additional data and information should be supplied to enable the project to be properly considered. The letter from the Assistant Secretary to the Government of India, Public Works Department (Civil Works—Irrigation), returning the project for revision, is dated 29th April 1881, No. 166 I., and is printed with G.O., No. 310 I., of 11th May of the same year. The project is now resubmitted, the various designs having been modified as directed in the note by the Chief Engineer for Irrigation, and additional information required by the Government of India supplied.

2. THE PROJECT.—The Barur Project has for its object the improvement and extension of irrigation in the vicinity of the village of Barur, situated about 2 miles north of the trunk road from Coimbatore to Jalárpet in the Krishnagiri Taluk of the Salem District, about 10 miles south-west of the cusbah of Krishnagiri.

Object and locality.

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

Area.

Conformation.

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

General aspect.

5. The Pennér forms the western boundary of this tract of country and receives its drainage. This river, called also the Penankeni, rises in Mysore, about 40 miles north-east of Bangalore near Nundidroog. The first 50 miles of its course lie within the Mysore territory, and its direction runs from north to south. It enters the Madras territory a little to the north-east of Hosúr in the Salem District, and, gradually altering in its course to one nearly west to east, enters the South Arcot District near the Javadi Hills, and, traversing this district under the name of the Pennér, falls into the Bay of Bengal near Cuddalore. The bed is rocky in many parts The fall of the river is rapid, being as much as 30 feet per mile near Barur. High rocky hills lie just beyond the limit of the tract on the north, and one or two isolated hills of the same formation lie within the area. On the east and south the limits are marked merely by a small watershed.

River.

6. Data of rainfall recorded at three stations in the catchment basin of the Pennér are attached. The physical conditions of these stations are very similar to those of Barur. No day maxima are recorded, but I consider that 5·75 inches in twenty-four hours is not likely to be exceeded. During the famine of 1877-78 this tract of country lay within the stricken area, and a part of the work of the project under report was carried out as a relief-work.

Rainfall—*Vide* Appendix B.

Famine.

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

Wells.

8. Near Nedungal, on the Pennér, about 4 miles north of Barur, a small channel is taken off from the river which feeds a few of the tanks and irrigates a few acres of land. Under each of the tanks within the area is a small patch of irrigation, the total area then irrigated being about *1,640* acres. The improvement of this system and conversion of the Barur tank into a storage reservoir is what the works proposed in the project will effect.

Present irrigation.

1,457 acres.—J. O. H.

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

Nature of ground.

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

Crops and seasons.

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

11. There are some twenty odd villages comprised in the tract of country under report, giving shelter to about 4,000 inhabitants. Barur, the largest, has a temple and a population of probably 500 or 600 souls. The majority of the villagers are occupied in cultivating the lands, but a small proportion find employment as laborers on the road and in the neighbourhood. In one village, about 1½ miles from Barur, are 50 "woddurs," by whom the repairs or construction of the rough masonry works to the tanks seem to be carried out. The locality is healthy. The trunk road divides the area into two nearly equal portions, connecting it with Tirupatúr and Dharmapuri, two cusbah stations, distant from Barur 23 and 15 miles respectively, and a branch road connects the village with Sámalpati, a station on the Madras Railway, about 14 miles to the south of Barur. There are several cart-tracks about the area itself, and the produce of the lands would therefore have easy access to at least three good markets.

Villages and population.

Occupations.

Communications.

Railway.

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

Land Assessment.

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

Ryots favorable to project.

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

Project details.

Original Report (O. R.), Appendix A.

The original arrangements of the project remain unaltered and consist of—

General arrangement.

(1) An anicut across the Pennér near Nedungal.
(2) A supply channel with head-sluice from the river to the Barur tank.
(3) The enlargement of the Barur tank and construction of two irrigating sluices in its embankment.

Vide paragraph 3, O. R.

(4) Two distribution channels from the tank.
(5) Sluices, masonry falls, weirs, outlets and inlets in the channels for the distribution of the water and maintenance of the channels in an efficient condition.

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

Paragraph 4, O. R.

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

Information called for by Government of India.

(*a*) The proper determination of the capacity of the Barur tank.
(*b*) The capacities of the minor tanks dependent on the proposed works.
(*c*) An estimate of the discharge of the Pennér at different seasons.
(*d*) A statement of the area commanded and that irrigable from the proposed work.
(*e*) A proper forecast of financial results according to the orders conveyed in Circular XVII of 21st April 1880.

Vide G.O., No. 310 I., dated 11th May 1881.

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

Index Map Sheet.

The total area of the ground shown on the map measures 11,000 odd acres, but only 10735·2 acres can be commanded by the channels. Of these *1,640* acres are already cultivated, leaving a balance of 9095·2 acres to be brought under cultivation by the proposed works.

Area commanded.

1,516 according to Revenue Accounts. Appendix E.

Statement given by Collector, which does not agree with this, has been adopted.—J. O. H.

16. Quantity of Water required.—In considering the amount of water required, it will be as well to assume that the net area that can be cultivated will be 10,000 acres, which leaves a balance of 735·2 acres for villages, pathways, and stony patches, and is well within the mark. A water-supply based on this assumption will err on the side of excess. Taking 8,000 cubic yards per acre as the quantity of water required for a five months' monsoon crop (*vide* Professional Circular No. 39 of the Chief Engineer for Irrigation), the quantity of water necessary for the prosperity of the lands affected by the project will be 10,000 × 8,000 = *80 millions* of cubic yards, and this must be forthcoming between May and December.

Assumption of demand.

It has been settled, in communication with the Revenue authorities, that 6,887 acs. only will be irrigated.—J. O. H.

Amount required.

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

Data for ascertaining the quantity available.

(1) The area of the catchment basin of the Pennér.
(2) Rainfall statistics for thirteen years recorded at three stations within this catchment about 20 and 30 miles apart.
(3) Gauge readings at the site of the proposed anicut which record the W.L. of the river since August 1881 and include the last two freshes of that year.

18. THE CATCHMENT BASIN.—The area of this catchment basin at the anicut site is 2,082 square miles. Of this area 461 square miles lie within the Mysore territory. Near the Madras frontier the main stream is bunded, and the whole of the drainage out of Madras territory is intercepted by chains of the Mysore tanks, and, except when the terminal tanks of these chains are discharging, there is little or no supply in the river north of the Madras frontier. This leaves 1,621 square miles between the latter and the Nedungal Anicut, and, as this portion of the basin includes numerous tanks, one-third of this area should be deducted on their account, leaving a free catchment of 1,080 square miles, the drainage from which will be available for the project. Using Dickens' formula with a co-efficient of 300 $\left(D = 300 \sqrt[3]{M^2} \right)$, the discharge from this area would be 58,926 cubic feet per 1 inch. The area is undulating, many parts being occupied by high, steep, rocky hills.

Total Area.

Vide Appendices A-1, A-2.

Net area affecting project.

Physical features.

19. Calculations made from longitudinal and cross sections of the river at $\frac{1}{4}$ mile intervals from the site of the proposed anicut to a point 2 miles above it give, with a M.F.L. of 140·07 at the anicut site, a discharge at this latter place of 58,866 cubic feet per 1 inch. These sections are shown on Sheets 2-A and 2-B, and the flood-levels recorded on them have been obtained from observations of the flood-marks on the banks combined with information obtained from the villagers in the vicinity of the river.

Discharge of Pennér.

See Tables I, II. Appendix G.

The gauge zero is 130·62, and the highest reading recorded in the late freshes was 8 feet 9 inches (on evening of 18th September), corresponding to a F.L. of 139·37 at the anicut site. The rainfall for the season was not above the average, and the circumstances of the river recorded by the gauge during the months of August to November last may safely be accepted as representing the normal condition of the river during the freshes of the north-east monsoon.

M.F.L. of 1881.

Paragraph 9, O. R.

20. The gauge readings from 6 inches and upward for August, September, and October with calculations (approximate of course) of the discharge at every $\frac{1}{2}$ foot difference of water-level are given in Appendix Table II. These calculations, which all err on the side of safety, show that during the first fresh—from 25th August to 8th September last—55$\frac{1}{3}$ millions of cubic yards passed the anicut site, and 143 million cubic yards during the second fresh from 17th September to 16th October, a total quantity of *198*$\frac{1}{3}$ million cubic yards in about six weeks. The river was not dry until the end of December, the gauge reading from 1 inch to 3 inches daily equivalent to about 6 inches or 8 inches of water in the river, but of this no account has been taken.

Freshes during August, September, and October 1881.

Total supply.

By paragraph 6 the supply for the season necessary for the satisfactory working of the project is *80* million cubic yards, so that the amount that passed down the river in August to October alone was 2·72, or very nearly three times the amount required for the whole season.

Demand.

Reduced area only requires 56 millions.—J. O. H.

21. During the period of the first fresh 3·67 inches and 4·69 inches of rainfall were registered at Matteghiri and Kistnagiri respectively. During the second fresh 11·79 inches and 8·60 inches were recorded at the same stations. In both periods the rainfall occurred in groups of consecutive days, and the absorption of the ground was probably small. The register of 11·79 inches at Matteghiri, however, must not be regarded when considering the general amount of the rainfall over the catchment, as the average there for that period was abnormally raised by a heavy fall of 5·62 inches, that occurred there on 17th September, and was evidently confined to a small portion of the drainage basin. Neglecting this, the mean of the first two, 4·18 inches, and 8·6 inches, the quantity gauged at Kistnagiri during the latter part of September and beginning of October, are taken to represent the falls over the catchment basin of, say, 1,000 square miles in these two periods and producing the freshes in the river.

Rainfall during freshes.

Extraordinary fall at Matteghiri.

22. A fall of 4·63 inches over 1,000 square miles would give 398 million cubic yards to drain off, and 9·60 inches over the same area 825 million cubic yards. The actual quantities passed down the river during these falls, and the proportions of rainfall drained off to that received, were $\frac{1}{7{\cdot}1}$ and $\frac{1}{5{\cdot}7}$, say one-seventh and one-sixth respectively. It is of course inaccurate to generalize from isolated data, more particularly in a case like the present where the data are so scanty compared to the conditions to which they refer. If, however, about half the above results are taken, and one-tenth assumed as the proportion of rainfall over the catchment that may be counted on, the approximation will, it is thought, be well within the mark, and, if the requirements of the project are found to be satisfied by it, it may safely be accepted.

Comparison of discharges with rainfall.

Approximate proportion of discharge rainfall.

23. From the averages of 13 years' rainfall, which include the famine years, and are therefore safe data to go upon in this case, the rainfall from May to November is 4·03 inches per month, and one-tenth inch of this would give a discharge of ·4 inch per month from the drainage area that may safely be counted on for the Barur irrigation. This is equivalent to *36* million cubic yards per month, and, as the 10,000 * acres of land at 8,000 cubic yards per acre per *season* would not require more than 13 million cubic yards per month, there will still be a surplus of nearly two-thirds for storage or other purposes available from what may certainly be counted on as the average monthly supply.

Minimum yield to be anticipated from catchment.

Vide Appendix B.

* Say 7,000.—J. O. H.

24. The F.S.L. of the supply channel for the project is 133·5, so that it will run full with the river in its present state whenever the reading or the gauge is 3 feet or over. In the months of August, September, and October last the guage read over 3 feet for 5$\frac{1}{2}$, 10$\frac{1}{2}$, and 8 days respectively. When the anicut is constructed its crest will be 1 foot above F.S.L., so that the channel may safely be expected to run full for quite half a month, and it will certainly not be less than $\frac{1}{4}$ full for the remainder of the month. The full discharge of the channel is 379 cubic feet per 1 inch, or 1 million cubic yards per day, so that, supposing it to run full for half a month and carry no water at all for the remaining fortnight, the amount conveyed will be 15 million cubic yards, or 2 millions more than the monthly quantity required. This assumption errs considerably on the side of safety, and it may be noted that, although 133·5 is taken as the F.S.L. of the channel, it is capable of carrying 2 feet more water with a M.S.L. of 135·5 when the discharge would be nearly double that at F.S.L. In fact during high freshes it would frequently be practicable to send as much as 600 cubic feet per 1 inch down the channel, or 1·9 million cubic yards in 24 hours.

Discharging power of supply channel.

Paragraph 12, O. R.

25. An error was made in Mr. Lowry's report in estimating the increased capacity of the Barur tank. When enlarged it will hold 11,605,540 (say 11$\frac{1}{2}$ million) cubic yards. The total capacity of the other tanks contained within the field of the project amounts to 5$\frac{1}{4}$ million cubic yards, so that the total storage capacity available is 16$\frac{3}{4}$ million cubic yards, rather more than one month's supply.

Capacity of Barur Tank.

Paragraph 15, O. R.

26. The facts and deductions given in paragraphs 16 to 25 may be briefly summed up as follows:—

Deduction from above.

	Million Cubic Yards.
Maximum quantity of water required from May to November for the prosperity of the project	* 13 per month.
Maximum quantity that may be counted on to drain off the catchment.	36 do.
Maximum quantity that the supply channel will carry during season.	15 do.
Maximum storage capacity of the Barur and other tanks connected with it	16$\frac{3}{4}$

27. It should be noted that no account is taken of the effect of local drainage and direct rainfall on the several tanks themselves. The drainage basin of the Barur tank is about 7 square miles, and proportion of water drained off to that received over this confined area would be much greater than in the case of the larger area of 1,000 square miles. Adhering, however, to the same assumption of one-tenth of the rainfall per month, the quantity received by the tank from its own gathering ground would not be less than $\frac{1}{4}$ million cubic yards, which would go far to meet losses from evaporation.

Local drainage not considered.

28. The above figures are sufficient to show that the prosperity of the project may be safely counted on so far as its requirements as regards water are concerned. It will now be as

Water-supply ample for project.

* Under 10 for 7,000 acres at 8,000 cubic yards per acre.

well to explain in more or less detail the various designs where modifications on the originals have been effected.

29. The Anicut.—The general design of the anicut remains unaltered, but modifications in the sand sluices have been introduced, as required in paragraph 7 of the note by the Chief Engineer for Irrigation. Instead of 2 sets of 2 vents each 3′ × 3′ as at first allowed, 2 sets of 4 vents each 4′ × 4′ are provided for, giving a total of 196 square feet against 36 square feet in the original design. It was not thought advisable to make them larger lest the body of the dam should be unduly weakened by the loss of so much weight to decrease its stability. At the suggestion of the Superintending Engineer, Fourth Circle, buttresses with a base equal to their height have also been added in rear of the piers and abutments of the sand sluice vents. Fixed spears to shutters are not advisable. They would catch anything coming down the river and be liable to damage. In the Godávari and Kistna movable spears are used. The screw-gearing rests on beams supported at the piers and abutments of the vents and counter sunk on the crest of the anicut, so that the tops of the beams are flush with the crest.

Paragraph 6, O. R.

See altered section of anicut where rock is not met with.—J. O. H.

Sand sluices revised.

Paragraph 7, O. R.

These modifications on the original design have altered the cost of the work from Rs. 14,600 to Rs. 18,305.

The crest of the anicut will be at 134·5 above datum. As stated in paragraph 19, the M.F.L. of the river here is 140·07 and the discharge at that level 58,860 cubic feet per 1 inch.

With charges on the proposed dam of 8·12 feet and 8·87 corresponding to water-levels of 142·82 and 143·07, the discharges will be respectively 57,748 cubic feet and 61,845 cubic feet, the heads in each case being 2·75 feet and 3·00 feet. These calculations neglect the effect of velocity of approach, which would increase the head about 0·80, so that 143·07 may safely be taken as the probable future M.F.L. in the river after the anicut is built. This agrees very closely with the conclusion arrived at by the Chief Engineer for Irrigation in paragraph 2 of his note on the designs, and with that given by Mr. Lowry in his original report, so that the levels of the different parts of the anicut and head-works remain unaltered.

Afflux caused by anicut.

Paragraph 9, O. R.

30. Barur Head Sluice.—With a few trifling exceptions, the original arrangements remain unaltered.

Paragraph 11, O. R.

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

Paragraph 12, O. R.

Inlets and Outlets.—Considerable modifications have been made on the original designs. The number of outlets has been reduced from 22 to 17, and in most cases their designs simplified by the substitution of rough stone revetments with a body wall carried into the banks in place of the masonry wings originally provided. These modifications are in accordance with the instructions given in paragraphs 11, 12, and 13 of the note by the Chief Engineer for Irrigation, and reduce the cost from Rs. 5,483 to Rs. 4,328. The head throughout is 2 feet.

Paragraphs 13 and 15, O. R.

Head.

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

Appendix F.

33. Foot Bridges.—At the points where these bridges are to be built there is no likelihood of cattle or carts ever requiring to cross the channel, and the width of the bridges has been reduced from 6 feet to 4½ feet. The beam stones in the original design have been replaced by brick arches as required by the Chief Engineer for Irrigation, but it is submitted that it is not understood why this modification is necessary in these small bridges.

The modifications in the original designs of these bridges alter their total cost from Rs. 2,809 to Rs. 3,540.

33 (*a*). Syphon Culvert.—In place of the culvert of two vents allowed in the original design, the plan now submitted provides for one vent of 8 feet span and 2 feet 6 inches to springing level, which with the arch gives a clear waterway of 34·73 square feet with a head of 2 feet. This culvert can discharge 333 cubic feet per 1 inch, about 2 per cent. more than the estimated discharge to be passed under the channel.

Paragraph 16, O. R.

At the centre of the culvert the masonry is liable to be subjected to an outward pressure due to a head of 7 feet, equal to 4 cwt. or 448 lb. per square foot, which, if the roof of the

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

Precaution against water pressure under head.

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

Paragraph 17, O. R.

Regulation by plugs.

The former designs for the tank sluices for the three tanks through which the supply channel passes have also been modified in a similar manner, and in one case a new sluice provided in lieu of additions to an old one. The general tenor of these modifications is in accordance with the instructions contained in paragraphs 8 and 15 of the note by the Chief Engineer for Irrigation, and increases the cost of the distribution arrangements in the supply channel from Rs. 2,964 to Rs. 6,554.

35. The Barur Tank.—It has already been stated that the actual capacity of the tank from the level of the sluice sills to F.T.L. will be 11½ million cubic yards. Provision is made in the estimates now submitted to carry the revetment 3 feet higher up the inner slope of the bund as suggested in paragraph 16 of the Note by the Chief Engineer for Irrigation. The precaution is certainly necessary, the tank is very exposed, and during the north-east monsoon, when the winds will act so as to set the water directly at the bund, the wash will affect the bank for several feet above the W.L.

Paragraph 18, O. R.

Additional height to revetment.

36. The Irrigation Sluices.—The west sluice has been already nearly completed. The actual acreage under it is 1,232 acres, but the sluice will supply, if necessary, about 1,500 acres with the W.L. in the tank about 1½ feet above the plug stone. The necessary data are recorded on the plan.

West sluice already built.

The design for the east sluice has been recast in conformity with the instructions given by the Chief Engineer in paragraph 16 of his note. The acreage under the sluice will be 7,456 acres, but the sluice is capable of supplying 9,000 acres with about 1½ feet of water on the plug stones. The cost of the present sluice will be Rs. 3,310; that of the former was Rs. 2,698.

East sluice.

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

Paragraph 22, O. R.

38. The Distribution Channels.—These appear in the first instance to have been made unnecessarily large. The acreage under the *East main* channel is 7,432 acres, for which a discharge of 120 cubic feet per 1 inch would suffice. In accordance, however, with the instructions of the Chief Engineer for Irrigation (paragraph 17 of his note) the channel has a bottom breadth at its head of 11½ feet, so that with 4 feet of water in the channel it will carry 150 cubic feet per 1 inch. The channel will vary in size as it progresses and the following dimensions are assigned to it, the fall per mile being 2 feet:—

Paragraph 23, O. R.

Dimensions of East Distribution Channel.

Limits.	Acreage.	Discharge.	Bottom Breadth.	Depth.
		CUB. FT.		
Section 1 to 38	8,000	150	11½	4
,, 38 to 46	4,320	80	5⅓	4
,, 46 to 48	1,230	35	4	2½
,, 48 to 70	500	15	4	2

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

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

Paragraph 26, O. R.

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

Former sections too large.

The acreage under the west channel is 1,234 acres, for which a discharge of 30 cubic feet per 1 inch would suffice, but a discharge of 35 cubic feet per 1 inch is allowed, which will be obtained with a bottom width of 4·00 feet in the channel and a depth of 3 feet. In the original design a bottom width of 6 feet was allowed.

Discharge.

39. THE BRANCH CHANNELS.—The branch M.N. from the west main, and branches Nos. 1 and 2 from the east main, command acreages of from 300 to 360 acres, for which a discharge of 12 cubic feet per 1 inch would suffice. They originally were designed with a head section of 3 feet bottom width and 3 feet depth of water, which would discharge 33·44 cubic feet of water per 1 inch. The channels are now designed with a bottom breadth of 2 feet, and will carry a discharge of *14·4* cubic feet per 1 inch with a depth of water of 2 feet, allowing a small margin for contingencies.

Discharge.

No. 3 *Branch Channel* commands 2,987 acres, and the section originally given to it, viz., 6 feet bottom breadth with 3 feet depth of water, would carry *60* cubic feet per 1 inch sufficient for the irrigation of 3,000 acres. It has not been thought necessary to alter this, and the section and estimates remain as originally cast.

Discharge.

No. 4 *Branch Channel* will have to distribute water to 784 acres, for which a discharge of 20 cubic feet per 1 inch would suffice. In the original estimate a bottom breadth of 4 feet was given to this branch. A breadth of 2 feet is now allowed, which with a depth of 3 feet will carry 27 cubic feet per 1 inch.

Discharge.

Paragraph 26, O. R.
Slopes and fall.

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

Terminals.

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

40. THE DISTRIBUTION SLUICES.—The original designs have been recast to the same general design as those for the supply channel. Plug regulation however has not been provided as it is thought that it is not suitable to sluices in channels where the depth of water at its maximum is not more than 2 or 3 feet. The water will be admitted by circular orifices suitable to the acreages at the mouth of the tunnels and closed by an ordinary shutter. The necessary data are recorded on the design. The difference of cost of the present sluices compared with those in the original estimate is Rs. 6,545 against Rs. 2,429.

Plug regulation not suitable.

I do not see the necessity for *circular* orifices.—J. O. H.

41. *The Masonry falls* for reducing the gradients in the channels have been entirely recast; the original designs were faulty in several points and allowed too great a waterway. Water cushions have been provided, their depths being calculated by the formula $d = 1{\cdot}5\sqrt[3]{h}\sqrt[3]{h_2}$, h and h_2, the depth on the weir sill. Details of the discharges over the falls and in the channels at the different points are given in the table of reference. In some places the discharge over the fall is slightly less than that in the channel at the same point. As, however, a very slight increase in the head on the falls will at once

Paragraph 24, O. R.
Water cushions.

Differences between discharges in channel and over-falls.

greatly increase their waterway, any trifling deficiency in the discharges here and there will be compensated for by an immaterial heading up in the channel. It is an advantage to have the different falls arranged with the lengths of their crests in simple dimensions, &c.

42. *The inlets and outlets* for the distribution channels have been retained as originally designed. Wing-walls are generally advisable as rock is not available for their foundation as was the case in those in the supply channel, and there being the margin in the minor channels between F.S.L. and M.W.L., it is better to pass the drainages off as they enter the channels, and not reduce the number of outlets by carrying surplus water along the channel.

Paragraph 26, O. R.

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

Paragraph 4, O. R.

* Their construction is chargeable to the project, as the Anicut will cut off the supply to these channels.—J. O. H.

44. MATERIALS AND LABOR IN THE LOCALITY.—Abundance of stone (gneiss) is available close to the sites of all the works. The bed of the river where the anicut is to be built is very rocky, and boulders crop up everywhere in the locality, and close to the Barur tank are two rocky hills where stone has been quarried by the Woddurs for years passed. Kunkur can be obtained easily over the area, and where the soil is gravelly, plenty of pebble or small stone can be procured for making concrete. Brick earth is found near the river, where there are a few native kilns.

Stone.

Lime.

Brick.

45. The labor procurable from the locality is small except for unskilled labor such as earthwork. For this, out of the cultivating season probably 2,000 laborers could be raised out of the villages comprised within the area of the project. Plenty of skilled labor in the way of masons, carpenters, &c., procurable from Kaveripatnam, Dharmapuri and Tirupatur, situated 10, 15 and 23 miles from Barur respectively.

Laborers.

Skilled labor to be got elsewhere.

46. COST OF THE PROJECT.—The project submitted in 1879, was estimated to cost Rs. 2,35,500. The cost of the project in its revised form is Rs. 2,40,073, or Rs. 2,47,914 including land compensation, showing an excess Rs. 12,414 due to the modifications in the various designs and to an increase of about Rs. 1,500 on the item for compensation. This latter increase is caused by the compensation for loss of crops, which at first was reckoned for one year's crop, being subsequently assessed in the Bill presented by the Revenue Authorities for three years' crops, raising the total amount claimed from Rs. 6,195-9-0 to Rs. 7,840-12-10.

Original.

Present.

Difference.

Compensation.

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

General nature of modifications.

47. The total cost of the project being Rs. 2,40,074 and the area commanded 10,735 acres, the cost per acre is Rs. 22·36.

Cost of terms of storage, acreage and capacity.

The Barur tank holds 313 million cubic yards, and the cost of the bund and weir amounts to Rs. 56·211, making the cost per 100 million cubic yards stored Rs. 179·5. If the cost of the head works and channel for the conveyance of the water to the reservoir is included, which altogether amount to Rs. 1,49,263, the cost of the storage will be Rs. 47·68 per million cubic feet. The tank only holds 0·14 of a year's supply. The cost of the distribution arrangements below the tank is Rs. 8,171, and the discharging capacity of the two main channels being 185 cubic feet per 1 inch, the cost of distribution is Rs. 444·3 per cubic foot of water conveyed to the lands.

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

Previous expenditure.

Famine excess.

The work done is as follows:—

Approximate quantity of work already done.

SUPPLY CHANNEL.—About three-fourths of the earthwork and two-thirds of the rock blasting.

BARUR TANK.—The puddle case of the bund, about two-thirds of the earthwork and about three-fourths of the revetment including gravelling backing. About three-fourths of the western sluice is also completed. In addition to this a good deal of rough stone has been collected from the blasting in the channel, and a good deal of stone has been dressed and is ready at the Anicut site. Altogether I roughly estimate the value of the work already done as follows:—

Approximate value of work.

	RS.
On supply channel	25,296
On Barur tank	38,450
On Barur sluice	1,800
Earthwork to Agaram head-sluice	353
Stone at site	2,702
	68,601

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

Establishment.

49. The establishment that is considered suitable for supervising the work is given in the column of remarks on Form No. 1, Appendix. Its cost would be about 6½ per cent. on the value of the work executed, and leaves a small margin for contingencies. The project is comprised within a limited area and the various component works are of so simple a nature that an elaborate establishment is uncalled for. The Executive Engineer of the Salem Division, in whose charge the work will be carried out, can reach the scene of operations in six hours, if necessary, should any unforeseen difficulty arise.

Large establishment not required.

Time required to complete.

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

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

Work.	Probable Expenditure.	Remarks.
First Year.		
	RS.	
Head works	12,545	About one-third of the Anicut, Barur Agaram head-sluices and complete flood-banks and Nedungal head-sluice.
Supply Channel.		
Earthwork	23,008	Complete the channel and syphon sluice.
Syphon sluice	2,500	
Barur Tank.		
Bund	14,365	Complete bund and west sluice. Build weir and about half of the east sluice.
Weir	3,096	
East sluice	1,500	
West sluice	580	
	57,594	Total for the first year.
Second Year.		
Head works	23,500	Complete head works.
Supply Channel.		
Masonry works and 3 Tank sluices ...	13,000	Complete outlets and inlets, bridges and sluices.
Barur Tank.		
East sluice	1,810	Complete sluice.

Work.	Probable Expenditure.	Remarks.
Distributaries.	RS.	
East and west channels and ...	14,216	Complete west distributary with its masonry works and carry out about half east distributary.
Masonry works	5,000	
	57,526	Total for second year.
Third Year.		
Distributaries	28,815	Complete eastern distributary and branches.
Masonry works	27,537	
	56,352	Total for third year.

First utilization of project.

At the end of the second year the project will be completed up to the Barur tank together with one of the distributaries (west one), so that the 2,045 acres under the supply channel and the 1,232 acres under the western distributary could come under the influence of the projected works.

Financial forecast.

51. In Appendices J 1, 2, 3 the necessary details are given of the grand cost of the work, including both direct and indirect charges, and the estimate of growth of irrigation consequent on the execution of the project with the return that may be expected. The acreages given in Form No. 3 are taken from the figures given in paragraphs 5 and 6 of the letter from the Collector of Salem, attached, and are thus deduced—

Appendix E.

Data on which expected revenue is based.

Area commanded	10,735
Deduct Mitta	3,087
Balance, assessed land	7,648
Deduct about ½ for unirrigable portions	2,206
Balance, probable cultivation under Project Works ...	5,442
Area at present irrigated	1,519
Net area on which returns are based	3,923

This has been revised. J.O.H.

and 1,483 acreage of 3,087 acres of mitta land on which a water-rate may be anticipated.

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

Return.

Prospects of project.

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

1. Water-supply ... ... Ample.
2. Utilization ... ... Fully guaranteed.
3. Returns ... ... Not less than 6 per cent.

The project the work of the late Mr. Lowry, Executive Engineer.

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

2nd February 1882. (Signed) F. J. ROMILLY, Lieutenant, R.E.

ORDER—dated 19th May 1883, No. 408 I., Public Works.

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

2. The amount of the estimates is—

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

and the return expected from the cultivation of 5,430 acres is, after deducting all charges, Rs. 21,448, that is, 6·7 per cent. on direct charges, or 6·4 per cent. on direct and indirect charges. The project may, therefore, in the opinion of the Right Honorable the Governor in Council, be classed as a Productive Public Work.

(Here enter No. 409 I., dated 19th May 1883.)

(True Extract.)

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

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

ENDORSEMENT—dated 19th May 1883, No. 409 I., Public Works.

Forwarded to the Government of India.

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

Exd. E. Fernandez.
Spare Copies

IRRIGATION.
ACCOUNT.

Gobt. of {1883} Madras.

PUBLIC WORKS.

Dated May, 19th.

Recd. *Encl.*

G.O., 19th May 1883, No. 409 I.

MAY.

Barur Project

FORWARDED to the Government of India the revised estimate for the —.

GENERAL.
ESTABLISHMENT.

Gobt. of {1883} Madras.

PUBLIC WORKS.

Dated June, 16th.

Recd. *Encl.*

G.O., 16th June 1883, No. 1699 W.

JUNE.

Rushikulya Project

Temporary establishment for the — of one Executive and two Assistant Engineers. — Letter from the Government of India sanctioning a —, communicated, with remarks, to officers concerned.

3. The question of the provision of the necessary Engineer Establishment for the project will be dealt with separately.

(True Extract.)

(Signed) R. H. SANKEY, Colonel, R.E.,
Secretary to Govt., P.W.D.

To the Superintending Engineer, First Circle.
„ Chief Engineer for Irrigation.
„ Examiner, Public Works Accounts.

Exd. C. Howarth,
Spare Copies

16TH JUNE 1883, No. 1699 W., PUBLIC WORKS.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

General.
Establishment.

READ—the following letter from G. H. W. WALKER, Esq., Officiating Under Secretary to the Government of India, Public Works Department (General), to the Secretary to the Government of Madras, Public Works Department, dated Simla, 21st May 1883, No. 742 G. :—

In reply to your letter, No. 1132 W., dated 16th April 1883, I am directed to communicate sanction to the temporary establishment marginally noted for a period of one year for the execution of the Rushikulya Project, and to request, should it be found necessary to retain the establishment for a longer period, that application for renewal of sanction may be submitted three months before the expiry of the present sanction.

		Rs.
1	Executive Engineer	650
1	Assistant do.	450
1	do. do.	350

2. As regards the request that the Government of India will obtain the services of qualified persons for the appointments now sanctioned, I am to state that the Governments of Bengal and the North-Western Provinces and Oudh have been asked if they can recommend any Engineers who would answer both for this and the tank systems, and if so to inform you direct, giving full particulars of their qualification; meanwhile, the Government of India will not object to the Madras Government engaging Royal Engineer Officers temporarily in the fourth grade of Executive Engineer from the Madras Sappers and Miners if they can be spared, but I am to say that it is considered the local Government might do more towards supplying the temporary Assistant Engineers required from amongst the passed students of its own Civil Engineering College.

3. The rest of the temporary appointments which do not exceed Rs. 250 a month can be sanctioned by the Madras Government under Public Works Code, I, 88.

4. I am to add that these sanctions are not to be taken as affecting the general question of the strength of the permanent establishment for Madras, which is being separately considered.

ORDER—dated 16th June 1883, No. 1699 W., Public Works.

Communicated to officers concerned.

2. The Superintending Engineer will at the proper time report on the subject of paragraph 1 of the foregoing letter.