

Number of pages 106

(2) Date of repair 20-4-44

(3) Initials of the Referencee

MADRAS RECORD OFFICE.

Government of Madras.

Public Works DEPARTMENT.

G.O. No. 2335	Press- Mis.
Dated 28. 9. 1940.	

Not to be folded or roughly handled

10/11/44

** 16 Encls Supplied*

12-11-71

MEMORANDUM.

REQUESTED for reference the under-mentioned papers

Enclosure B.S.O. No 22335 - 28th Sep: 70

OFFICE OF THE CHIEF
ENGR. FOR IRRIGATION,
P. W. Department,

13 Nov. 1871.

To

The Registrar of the

H.R.

J. H. Hastings

Head Clerk.

Wm. Seal

List of Enclosures given to the Chief Engineer for Irrigation
in the 13th Nov 71

General Abstract Estimate

- 1- Abstract Estimate for the completion and improvement
of the Canal in the Eastern Section of the Godavary
Delta—
- 1- Statement showing the outlay incurred on the Delta
works from the year 1847 up to 1869-1870—
- 1- Statement of Amunirative works in the Godavary Dist.
for the year 1868-69—
- 1- Statement showing the number of Boats licensed and
the amount of Collections during the year 1869-70—
- 1- Statement showing the number of Boats passed through
different Locks— No 1 Range Godavary—
- 1- Appendix to Statement No 1 & 2. Eastern Delta—
- 1- Statement showing the area of Land now irrigated as well
as the area comprised under each Canal
in the Eastern Delta Godavary District—
- 1- Statement of Cultivation in 1878/1868-69/ and
probable ultimate area of Irrigation Eastern
Delta Godavary—
- 1- Statement showing the outlay incurred on the
year from 1847 up to 1869-70 No 2—
- 1- Detailed Estimate for the value of land to be
occupied by the proposed improvement to
Canals &c in the Eastern Delta Range
Godavary District—
- 1- Abstract Estimate No 3 of 1870-71. Godavary Eastern
Delta for the value of land to be occupied
by the proposed improvements to Canals &c—
- 1- Statement of Water distribution of the Eastern Delta of
the Godavary—

1 Statement showing additional land which might be cultivated and under what channel for

July 12/78

1 Letter from the Officer in charge of Range No 70

1 Letter from the Superintendent of Range No 875. 21 June 70

Mr. Hankins.

Major Mullens is not
in spare the time to go through these
now. He has asked me to do so. They
do not be all right, but I would
just your asking the Examiner on the
top to go through the statements again.
Kindly see also that the arrangement of
the papers corresponds with that ordered
by Major M in the Memo. which
was sent to Fredrick.

Yrs. truly
D. D. Val
13/9/70

P.S. Major M. evidently
wishes that the breadth in
the year 889 and the
width in the first line
of his list. You had better
have ascertained.

or attached.

- ✓ 1 letter in which the German abstract
papers were to be printed
- ✓ 2 Major Friedman's letter (see 8/15 - (18/15/15))
- ✓ 3 English abstract
- ✓ 4 General abstract estimate

4 General Westcott's statement
 Vol 5 - Statement of cultivation in 1275 (1864)
 & probable ultimate cause of irrigation
 do 6 - Statement of land irrigated & the
 irrigated under each canal
 do 7 - Statement of water in Aqueduct 1847 to 1869-70
 do 8 - do of do in other works.
 do 9 - do of boats licensed for 1869-70
 do 10 - Traffic statement at the several locks
 do 11 - Communication statement 1868-69
 do 12 - Captain Thyer's communication
 pages 1 to 12 (with the statement on p 13)
 & pages 61 to 107 - This must not be
 printed but the pages original can
 be attached -

No 3271

to the

Secretary

Paper to the

Note by the Acting Chief Engineer for Irrigation

In 1869 Captain Ryves, the then superintending Engineer of the 1st Division, when on the eve of starting for England on furlough, transmitted to this office estimates for the improvement and completion of the system of irrigation in the Eastern portion of the Godavary Delta. These estimates amounted to Rupees 7,01,300, and were accompanied by a memorandum explaining the results anticipated from the execution of the various works provided for. The state of Captain Ryves' health obliged him to leave India before the whole of the estimates could be worked out in detail, and some of them were consequently only the best approximations which that officer, with an intimate knowledge of the country aided by some levels, was able to make.

2. After going through the estimates I considered that the information furnished was

was not sufficiently complete to allow of their submission to the Government of India, with a view to their being carried out from Loan Funds, and they were therefore sent to the Acting Superintending Engineer of the Division, with instructions as to the course to be followed in revising and retransmitting them for the consideration of Government.

The revised estimates transmitted by the Actg. Superintending Engineer amount to Rupees 12,16,300. Subjoined is a comparative abstract of the two sets of estimates.

Items	Captain Ryles' estimates	Major Fischer's revised estimates	
		Works	Compensation for land
1 Improvements to Head sluice	18,000	17,890	
2 Main Duet		28,060	
3 Cocanada Canal	208,000	1,86,000	6,545
4 Mundapett Canal	66,000	74,100	3,273
5 Bant Canal	1,81,510	2,14,900	6,218
6 Coringa Canal	44,000	76,000	6,545
7 Imperaw do	21,800	78,600	3,273
8 Biccarole drain	40,000	65,000	6,300
9 Torhabaga do	82,000	1,38,100	12,866
10 Taker main do	40,000	2,66,300	18,000
11 Overseers' sheds or Rest houses	"	7,530	"
	7,01,310	11,53,280	63,020

12,16,300

I have placed the compensation for land apart from works, because, as far as I remember, Captain Ryles made no provision on this account, and the comparison between the cost of works in the several estimates can thus be the more easily made. All Captain Ryles' papers were sent to the Division and have not been returned, so that the notes made when examining them are all that I have now to refer to. With some few exceptions these notes will be sufficient to explain all considerable differences between the estimates.

4. Before offering remarks on the several items of the estimates, a few words may be said regarding the present and expected ultimate area of irrigation in the Eastern Delta, the intended capacity of the main Canal, and the water supply afforded by the Godavery. The several authorities who have ^{expressed} an opinion on the subject differ somewhat as to the present, and probable ultimate area of irrigation in this part of the Delta, and

There

their statements are shown below:

	Revenue Officers	Captain Ryder	Executive Engineers
Area at present irrigated	105093	147000	123007
expected to be irrigated ul- timately.	163795	190000	188170

The Executive Engineer's area of present irri-
gation is said to include "Mamoo Pallam", *vide Appendix*
or land paying no water tax, and this *Ch 2*
may account for the difference between his
estimate and that of the Collector. In sup-
port of the difference of 65,163 acres between
the present and anticipated areas, there is
a statement showing, for the 207 villages
concerned, the additional lands whether go-
vernment, Inam, or Zemindari which may
be irrigated. It is not stated how this in-
formation was obtained, but it may be no-
ticed that the difference between this ad-
ditional area and that, acres 58,702, re-
ported by the Revenue officers as available
is not nearly so great as in the case of
the present area of irrigation. It seems

surprising

surprising that there should be any diffi-
culty in finding out what acreage now ob-
tains and pays for water, but I have never yet
been able to ascertain, either from the Annual
land Revenue reports, or from the local officers
of the P. W. D., the exact area. The difficulty
appears to arise partly from the fact that,
while the Government lands have been sur-
veyed, those which are Zemindari have not
been measured: nevertheless this circumstance
does not account for the absence of any com-
plete and reliable record of, for each year,
1st The area of Govt land 1st crop & amount of water rate.

2nd do & do

2ndly The area of other lands paying water rates for do

3rdly The area of lands entitled to water without
payment.

Appendix N^o 1

and undoubtedly the officers in charge of the
channels should have this information in
their hands. The Executive Engineer has
also furnished a statement showing the ul-
timate area 1st crop, & the cultivated area

for

These statements are shown below:

	Revenue Officers	Deputy Engineers	Executive Engineers
Area at present irrigated	105093	147000	123007
expected to be irrigated ultimately.	163795	190000	188170

The Executive Engineers area of present irrigation is said to include "Mamoor Pallum", or land paying no water tax, and this may account for the difference between his estimate and that of the Collector. In support of the difference of 65,163 acres between the present and anticipated areas, there is a statement showing, for the 207 villages concerned, the additional lands whether Government, Qanun, or Zemindari which may be irrigated. It is not stated how this information was obtained, but it may be noticed that the difference between this additional area and that, acres 58,702, reported by the Revenue officers as available is not nearly so great as in the case of the present area of irrigation. It seems surprising

surprising that there should be any difficulty in finding out what acreage now obtains and pays for water, but I have never yet been able to ascertain, either from the annual land Revenue reports, or from the local officers of the P. W. D., the exact area. The difficulty appears to arise partly from the fact that, while the Government lands have been surveyed, those which are Zemindari have not been measured: nevertheless this circumstance does not account for the absence of any complete and reliable record of, for each year, the area of Govt. land 1st crop & amount of water rate.

- 2ndly The area of other lands paying water rates for
- 3rdly The area of lands entitled to water without payment.

Appendix A/1

and undoubtedly the officers in charge of the channels should have this information in their hands. The Executive Engineer has also furnished a statement showing the ultimate area 1st crop, & the cultivated area for

for July 1278 (1868-69) for each canal and for the several reaches of each canal, but I do not know how far this, or any of the information on this subject is to be deemed reliable. The estimates have been prepared on the data thus collected by the Executive Engineer, and, while I would recommend that orders be issued requiring full particulars to be furnished, with information showing on what data the areas of the Zemindars and other unsurveyed lands have been estimated, there seems to be no better course open than to deal with the project now upon the information on this point which has been sent up with the estimates. In July 1869 the necessity for exact information was pointed out, and it was remarked that it would be of advantage to show what the actual cultivation in this Delta has been for a series of years, in order that it may be seen what the tendency towards increase has been, and whether the variations have been great or otherwise. There ought consequently to have been no great difficulty in preparing in communication with

Memo #221 para 5.

* The Western Delta was referred to but the general instructions were specially made applicable to the Eastern section also.

also also Supd
Engr's letters of
1288 & 1431 of the 19th
July & 2nd Aug 1870
respectively, which re-
present the particu-
lars required to be
unobtainable.

with the collector, during the many months that have since elapsed, such returns as would have satisfied Government of the real condition and prospects of the Delta. On referring to para 18. of the Superintending Engr's letter the following passage will be found - "As regards the Revenue past & present of the Taluqs forming this Delta, I regret to say I am unable to give any particular information, but I have not considered it advisable to keep back the project on this account, as all the details can be readily obtained from the Revenue Board Office in Madras." I believe the Board of Revenue has not the means of furnishing such details, but, however this may be, it was clearly the duty of the Superintending Engineer to obtain the information required from the collector of the district.

5. The main canal has been designed to carry 376,340 cubic yards an hour (2822.55 cubic feet a second) being at the rate of 2 cubic yards per acre per hour for the whole ultimate area of 188,170 acres to be irrigated, as estimated by the Executive Engineer. The crest of the

ancient

ancient is at 34 feet above datum, and the
 sill of the sluice placed at 28, and in the ar-
 rangements, as revised by Major Fischer, the
 bed of the channel is flush with the sill
 of the sluice. The depth of water in the
 channel, when carrying a full supply, must
 be 8.21 feet. The area of the sluice vents is
 $(13 \times 6 \times 0) 624$ square feet, consequently the
 velocity must be 4.52 feet a second and, tak-
 ing the coefficient of discharge at .666, the
 head required will be 8 5/8 inches, or .72 feet. There-
 fore for a full supply in the canal the river
 must be at 36.93 or at 2.93 feet above the
 crest of the ancient. Paras 9, 10 & 12 of Captain's Appendix 8
 Rypes' memorandum show that the principal
 or 1st crop of rice is cultivated between the mid-
 dle of June and the end of November, and
 that, during the 16 years preceding, the go-
 davers was on the average above 37 for 85
 days, between 36 & 37 for 55 days, between 35
 & 36 for 19 days, and less than 1 foot above
 the ancient crest for 9 days, making altogether
 the

the 168 days between the dates named. It
 will be seen therefore that the revised arrangements
 of the canal ensure a full supply for only
 85 days, and probably a nearly full supply
 for 55 days more. For the remaining 28
 days of the season perhaps the level of the
 river might be taken at 1 foot above crest
 and, in that case, the discharge of the
 main canal would be about 260,000
 cubic yards an hour. I should estimate
 the probable actual supply at
 2 cubic yards per acre per hour for 85 days = 170

1.7	"	"	"	55	"	=	96.5
1.4	"	"	"	28	"	=	39.2
							305.7

Total supply per acre for the season 7336.8
 and this will more than suffice, for 6000 cubic
 yards are usually considered enough for direct
 irrigation from canals, and 8000 cubic yards
 per acre where the water is stored in Tanks.
 It will be noticed that Captain Rypes is of opinion
 that

that, except when the rainfall of the South West monsoon has been below the average, & the North East monsoon has failed altogether, the supply will prove sufficient even in the last month of the season to mature the whole of the first crop, not only in the Eastern but in the other two sections of the Delta, and that such an adverse season may be expected once in 12 or 15 years and would result in the loss of a part of the crop.

6. Taking the several items of the head sluice alteration estimate as they have been given in para 3 above, it will be observed that the present Acting Superintending Engineer is of opinion that it is not necessary to provide a double set of shutters for the head sluice. The subject is alluded to at the end of para 22 of his letter transmitting the estimates, but he does not there give his reasons. In para 3 of the letter printed in P.W. Ls of the 3rd March last, N^o 687, however, he states that, as the river rises only an inch an hour, double shutters are not required

required. Captain Ryves has not left his views, regarding the alteration proposed by him, on record, but I imagine that he intended by the use of double shutters to divide the head of water, and thus to diminish the risk of the shutters being forced in. The maximum head would be 22 feet, less the depth of water in the canal, which probably would not be less than 5 or 6 feet. I propose to retain the estimate, leaving it to Captain Ryves on his return from England to show whether it will be advisable to alter the sluice so as to carry the double shutters. I have in para 4 of a memorandum, N^o 234, dated 24th July 1869 suggested an arrangement for carrying out the alteration which appeared to me preferable to that shown in the plans, and at the same time considerably less expensive.

The

7. The length of what is termed the main canal main canal is $6\frac{1}{2}$ miles: it will carry the estimate Rupees 20,060 full discharge of 376,340 cubic yards per hour for the first $\frac{3}{4}$ of a mile, where the Bank canal will take off 179,186 cubic yards for itself and the Loringa canal: at $4\frac{1}{4}$ miles the Samulcotta canal receives cubic yards 55,459, and at the lower end the balance is divided between the Mundapetta canal, which requires 64,238 cubic yards, and the Kocanadu canal, which takes cubic yards 77,594. I find that the dimensions allowed for the several parts are about right, except just below the head of the Samulcotta canal, where (cross section N 36) the calculated discharge is about 18,000 cubic yards less than that estimated as necessary: the actual cross section here is however somewhat larger than the design, and as the calculated discharge lower down is correct, it does not appear necessary to make any

vide Kocanadu canal sections in which those of the main canal are included.

any alteration. The surface fall of this canal will be 0.4 feet a mile and bed fall 0.26 to 0.27 feet: the velocity is estimated at from 1.75 to 1.60 feet per second. A tabulated statement, in which all the principal features of the arrangements are shown accompanies this estimate, and similar statements have been furnished for each canal. The whole of the estimate is for earthworks.

Kocanadu canal 8 The work provided for in the estimate for this canal is earthworks - Rupees 38,120
estimate Rupees 186,800

Madapadi Lock $9\frac{1}{2}$ miles - 28,050

do " weir " 7,360

Thopapudi Lock 16 " 23,820

do " weir " " 5,060

Ghintapilly Lock 27 " 26,160

do " weir " " 3,070

Kooror Lock " 26,160

20 miles minor channels " 8,000

30 Head sluices " 21,000

In Captain Ropes scheme for this canal a waste weir was provided at $7\frac{3}{8}$ miles. The estimate for this

This work has been transferred to the Poonjab
drain at the head of which it is intended to
be placed. As mentioned in the preceding para-
graph the full discharge of this canal will
be 77,594 cubic yards an hour, or more correct-
ly 77,522 cubic yards for the estimated total
area, acres 38,761 of irrigation. The velocity in
the canal will vary from 1.52 feet per second
at the head to 1.36 at the 20 1/2 miles. Below
that point the current will be hardly per-
ceptible, as the quantity of water to be car-
ried for irrigation is extremely small com-
pared with the present cross section of the
channel, to which but little is intended to
be done and that, either for the regulation
of the depth for navigation, or for bringing
the embankments to a proper level. One of
the smaller of the cross sections (No. 143) has
29 square yards of waterway and the full
discharge of this reach being 14,168 cubic yards
an hour, the velocity would be about 0.41
feet a second. This being the case the surface
fall

Meins No. 234
para 11

fall per mile, 1.68 inches allowed in the lon-
gitudinal section should be reduced to 3/4 of an
inch, and the upper gate and side walls of
the lower lock at the 29 1/4 mile should
be adjusted accordingly, otherwise they will
be dangerously near the water surface. In
this reach the full depth is allowed for a
width of 30 feet. It will be observed that
no longitudinal or cross sections of the canal
below the lower lock have been furnished,
though the Superintending Engineer's attention
was called to the omission in July 1869.
The books of cross sections and the tabulated
statement of sectional areas, depths & show
clearly the nature of the improvements as
respects earthworks which are contemplated,
and the arrangements provided for allow suf-
ficiently closely for the required discharge
at the several points. The construction of the
locks and weirs included in the estimate for
this canal has already sanctioned by the Go-
vernment of India.

The

9. The items composing the estimate for Mundapett Canal
this Canal are. Estimate Rs- 74,100

Earthworks. Rupees 12,700

Lock at Thapewaraw. " 22,370

Weir at do. " 3,070

Lock at Papalaphudi. " 21,960

Weir at do. " 3,000

Minor channels & masonry works. 11,000

This Canal, as will be seen from the sketch map, leaves the Bocanada Canal in the 7th mile, and joins the Boringa Canal in the 25th mile. The area of irrigation under it is acres 32,155, and the intended full discharge is cubic yards 64,310 per hour. Were the actual bed of the Canal in the first reach to correspond with the normal bed, the discharge would be about 10 per cent too little, but as the former, except at the lower end of the reach, is below the latter, the capacity of the canal will be sufficient. The tables by which discharges have been generally calculated in this

Presidency

5. Presidency are those prepared by Captain (now Lieut Colonel) Stoddard from Du Buat's formulae and; as far as I am aware, the quantities thus derived have not been found to be too great. Major Fischer appears to prefer Eytelwein's formula, which gives, with the same data, a velocity & discharge of 10 per cent more; and, in para 4 of his letter of the 8th January last N^o 3539, he mentions that he has directed this latter formula to be used all over the Delta for all other estimates. I am of opinion that no change of the kind should be made until clear evidence of the incorrectness of the tables hitherto in use shall have been adduced, and then only upon the regular sanction of this office. It would be extremely embarrassing were it to be found that, owing to the main & Bocanada Canal in this Delta having been designed upon one formula and other canals on a different formula the distribution of the water had been effected to an extent requiring the subsequent execution of additional works. Moreover the calculations of discharge, wherefrom it has been customary to

to

to ascertain the quantity of water actually consumed in irrigation, have been based upon Dr. Buato's formula, and ^{as} it would be manifestly extremely inconvenient to change the standard, this should not be done unless upon very clear necessity.

10 The dimensions of the locks of this ^{Dimensions of} and other 2nd class canals do not correspond ^{locks} with those laid down in the instructions sent to the Superintending Engineer for the revision of the Delta estimates. Major Fischer says "I have adopted dimensions for 2nd class locks somewhat different to those recently ordered - viz. 110 x 18 instead of 105 x 15. I had arranged for the former size before I received the order regarding the latter." The order to which the Superintending Engineer apparently refers is that issued by the Government under date the 8th February 1870 N^o 441, but he seems to have thought it unnecessary to pay attention to the instructions furnished from this office in July 1869 for his guidance. As regards the dimensions of the locks those instructions were definite, and they should have been acted upon at once. It was open to the Superintending Engineer to submit any

any objections he might have to offer for consideration, but only an order of Government overruling such instructions could relieve him from the obligation of carrying them out. Delay and waste of time and labour on the part of all concerned must be the inevitable result of a wilful disregard of orders. The width of 2nd class locks having been fixed at 105 x 15 all the locks of this class should be so built. Major Fischer states that the reason for his considering a width of 15 feet too small is that paddle steamers with having could not enter such locks. It is extremely improbable that steamers with side paddles will ever be generally used on these canals, or that steamers will be used at all on the 2nd class lines of traffic. ~~Furthermore~~ A length of 100 feet and a beam of 14 feet would be very ample for twin screw steamers, and it is not likely that on the first class canal steamers of greater beam will be introduced, though the locks there are 150 x 20 in order to allow of several boats being locked through at one time. To fix the dimensions of locks on canals of this kind to suit side paddle steamers, a class

clap of rapids which has almost ceased to be built, and which is extremely ill adapted to canal navigation, would be far from wise. The dimensions of the locks of both claps, as determined last year, were arranged rather with reference to the space it was desirable to afford for passing several boats at one time than in order to accommodate large single vessels; and, at the same time, the sizes of locks, which had recently been constructed in other parts of the country were duly taken into account, while it was not forgotten that it may be expected that the first clap canals of the Kistna and Godavari Deltas will ultimately, & perhaps at no distant date, be in connection with the East Coast Canal, and so with Madras; and that consequently there were reasons of some weight for giving to these lines a considerably larger clap of lock than was necessary for the minor navigable canals of the Deltas.

11. The levels at the lower end of this canal do not agree with those of the Loringa Canal

Canal with which it communicates,

Mundapett. Canal water surface + 16.19

Loringa do do + 15.95

Mundapett. do Bed level + 10.29

Loringa do do + 9.88

in carrying out the works these differences should receive attention and be adjusted.

12. The designs for the weirs in connection with the Thapieswarium & Pasalapudi locks are not as good as they might be. The rear wall of the water cushions is extremely weak, and of a cross section ill adapted to allow the water to pass freely out. When the original estimates were returned for revision the defects in the designs of similar weirs were pointed out, and the alterations required for their improvement noticed. Major Fischer says of the arrangements suggested "it requires no demonstration to prove that materials could not be more arranged to resist the impact of falling water for such a place. (Plan?) can only hold together as long as the

adhesive"

"adhesive power of the cement lasts. Should
 this fail whatever material is used must
 inevitably be washed out. The letter contain-
 ing these words was not addressed to me, and
 I did not think it necessary to take any
 official notice of the summary manner in
 which he had put aside, without seeking
 for explanation, the instructions which he had
 received, but after satisfying myself that Ma-
 jor Fischer's objections were without any real
 foundation, I wrote to this officer semi-offi-
 cially pointing out that the course he had
 followed was not very proper or courteous and
 explaining that he was in error in condemn-
 ing the arrangements upon the grounds
 he had stated. I hoped that this commu-
 nication would have had the desired effect,
 but as such has not been the case, I am
 obliged to show how it has happened that
 designs, in which much of the experience
 which has been gained of the proper form

of

of works of this kind has been ignored,
 have been sent up for sanction. Before the
 weirs are constructed fresh designs should
 be sent to this office for approval and
 the depth of water cushion should be fixed
 agreeably to the formulae in use in the
 N. W. Provinces, that being based on ar-
 rangements which have been proved to be
 suitable.

Banks Canal
 Estimate Rs. 24,900.

13. The items composing this estimate
 are

Earthworks	Rupees	1,17,790
Lock at 9 th mile	"	20,640
Head sluice - do -	"	9,160
Lock at Kotalashwaraw 16 mile -	"	20,520
Weir do	"	4,620
Lock at Kotala 22 nd mile	"	23,690
Weir at do	"	4,360
Weir at head of Jungarow drain	"	2,260
do at 30 th mile of canal	"	2,260
15 miles of minor channels	"	6,600
6 distribution sluices	"	3,000

The

The water statement transmitted with these estimates gives the discharge at the head of this canal as cubic yards 191,155 an hour, but the statement for the main canal allows only cubic yards 179,186. From the statement of present and ultimate cultivation it would appear that the ultimate

Storage under the Bank canal will be

40,399

Under the Loringa canal, which

takes off from it

32,257

Under the Injeraw canal, a branch

of the Loringa canal,

16,897

89,553

Consequently the proper discharge at 2 cubic yards per acre per hour would be 179,186, which closely approximates with that allowed from the main canal; and, as the latter carries no excess of water, it is evident that the discharge of the Bank canal must be confined to its proper share of the total supply

Letter 4875 para 11-

supply of this part of the Delta. I imagine the difference of about 12,000 cubic yards between the two quantities to be the supply for 6,000 acres of land as Loringa Island, under what has been termed the Yanam extension, but Major Fischer has left out this extension altogether, so that probably the inclusion of the water supply is a mistake. Captain Ryes' estimates for this canal, including a provision of 66,200 Rupees for the Yanam extension, amounted to Rupees 1,81,510, and in returning them it was mentioned that the arrangements were generally approved, but that some of the details had not been quite clearly explained. The revised estimates provide for radically different arrangements, and I regret that I am unable, upon the information furnished, to recommend their sanction. Captain Ryes' estimate, exclusive of the Yanam extension consisted of the following items,

Earthwork	84,000	84,000
New drop weir at $4\frac{1}{2}$ miles	1,800	
do	27	2,400
		<u>4,200</u>
		84,000

4,200 84,000

Lock (Kutchal) at 27 mile — 8,340

Correcting levels of crests of caliw.

Quilaks at 16, 17, 21 & 38 1/4 miles — 1,200

New surplus weir at 28th mile — 1,750

18 sluices — 4,320

Total masonry — 19,810 19,810

Improving & extending branches

into minor masonry works — 11,500

Total 115,310

This officer proposed to improve, as far as was deemed necessary by him, the 38 miles of the Banto Canal down to Yanam. He intended to retain the 3 existing locks, to add a fourth, and to make the whole 38 miles navigable.

Major Fischer on the other hand proposes to do away with the first of the present locks,

that in the 5th mile, to abandon the present

line of navigation in part of the 2nd, the

whole of the 3 & 4th & part of the 5th miles, to

build a new lock at the 9th mile, to rebuild

the two lower of the existing locks on revised

levels, and to do nothing below the 30th mile.

The revised arrangements down to this last named

point.

vide sketch & para
6 of Supp. Engr's letter
No 15.

Appendix 8.

point may be preferable or more complete than those proposed by Captain Ryves, but they are far more costly, and it is necessary that it should be clearly explained why it was thought advisable to supersede Captain Ryves scheme, as also to show that the advantages are such as to compensate for the greatly increased expense. He also leaves the lower 8 miles of the canal unregulated, although Captain Ryves has stated, in paras. 84 & 87 of his memorandum, that the water level at the lower end of this canal needs regulation. In short this latter officer provided for what he at least thought to be a sufficient improvement of the canal at a cost of Rupees 3,035 a mile, while the revised estimates take up the first 30 miles only, and they amount to Rupees 7,160 per mile. No doubt the original estimates would have required to be considerably increased, for it is not advisable to construct what are called Kutchal locks, and the allowances for weirs were small; but, whatever might have been found requisite in this direction, it was incumbent

incumbent on the Superintending Engineer,
in transmitting estimates which had been
largely increased owing to a radical change
of arrangements, to submit such full ex-
planations as would suffice to show that
the alterations made were either necessary
or highly desirable. In support of the pro-
posed change of the present navigable channel
in the 2nd to 5th miles from its present line to
the surplus channel to the eastward, the Execu-
tive Engineer, says that in high freshes "the
river percolates through to an alarming extent."
The difference of level between the river and the
canal water at such times is not however men-
tioned, and the cross sections give no indication
of any such difference as would occasion se-
rious percolation for, referring to cross sections
at the 3rd mile, both banks are designed
to be 3 feet above full canal level, whence it
may be supposed that the river water cannot
be expected ever to rise much above that in the
canal.

15
canal.
14. In July 1869 the Superintending Engineer was
instructed to have detailed estimates prepared for the
irrigation of 5000 to 6000 acres on Boringa island.
He has omitted this part of the project, and,
as a reason for so doing, quotes the order of
Government of the 10th March last N^o 755, which
had nothing to do with the Delta irrigation,
but referred to measures which Major Fischer
had recommended for the improvement of the
Locanada harbour. Whether Captain Rye's plan
of throwing a bund across the Boringa river or
creek, for the purpose of carrying irrigation
water in a channel on the top of it, was fea-
sible or not I do not know, and much would
depend perhaps upon the quantity of water
which passes down this creek when the river
is in fresh; but it was but very indirectly
connected with Major Fischer's proposal to bund
this river in order to prevent silt laden water
from shoaling the Locanada harbour. I think
that the Yanam extension may be left to a future
time.

time, as there will be as much to be done elsewhere in the Delta, as will fully occupy the time of the executive engineer & his establishment for several years, so that the postponement need not be prejudicial.

15 The following are the works included in the Boringa Canal revised estimate Estimate. Rs. 76,000

Earthworks	Rupess 41,180
Altering Alamoor locks	1,700
New weir at do	7,120
20 miles of minor channels	8,000
30 distribution head sluices	18,000
Captain Rypes estimate was	
Earthworks	20,800
Raising Alamoor weir	1,750
Branch channels & maining works	21,450

It will be seen that the earthworks have ^{been} nearly doubled in the revised estimate. It has not been clearly explained on what account this has been found necessary, but the discharge of the canal has been raised from 75,000 to 90,308 cubic yards an hour, which latter however would be under 90,000 if calculated by the same formula as the former. Some saving in earthworks might be effected by placing the bed & water levels between the Alamoor and Vellah locks somewhat higher, and this would

be

be an advantage as regards the navigation at the upper end of the reach. As there will be 6.11 feet of water on the upper sill of the Alamoor lock as it stands at present, it does not appear to be necessary to lower the sill 0.89 feet as estimated for, & the 1,700 Rupees provided for this purpose may be omitted. The water surface as shown in the longitudinal section at the head of this canal is 29.11, but at the corresponding point on the Banks Canal 29.69 is entered: if the latter be correct there will be still less need to lower the upper sill of the Alamoor lock. As it not probable that any material alterations of this canal below the Alamoor locks will be necessitated by any changes that may be made in the Banks Canal, the estimate, reduced to Rupees 74,300 may be sanctioned, leaving it to the Superintending Engineer to take care that the proper bed & water surface levels above that lock are determined correctly as soon as possible. The discharge of the canal would, from the use of a different formula, be less than is required were the surface kept exactly as designed from the Alamoor weir downwards; but, as the proper discharge can be given at that weir, & the additional quantity will not raise the water level below to an injurious extent, I am unwilling to delay the estimates any further for an adjustment of the cross section

section of the canal.

16. This is a branch of the Boringa canal, and Chigraw Canal it tails into the Taku main drain, in tide water. Estimate Rs. 78,600 is expected that the ultimate area of cultivation under it will be 16,897 acres, the present area being 18,787 acres.

The items of the estimate are

Earthworks	Rupees 12,850
New Lock at 30 miles	19,420
Weir at do	2,620
Tidal Locks	27,140
Weir at do	3,360
Leaps near Ventoor	2,210
Minor channels & sluices	11,000

Captain Ryes' estimate for this canal amounted to Rupees 21,000 & provided for

Earthworks	Rupees 11,200
Raising Ventoor weirs 2.90 ft	200
New weir at 30 miles	3,800
Minor channels & sluices	6,600

Now it will be seen no great difference in the entries for earthworks. The canal at present does not possess through navigation & while boats can go from end to end & via the Boringa Canal to the coast ports, the communication is not as convenient as it would be were a tidal lock constructed at the lower end. Captain

... of ... it will be noticed, Captain Ryes, it will be noticed, that not considering it requisite to go to the expense of this additional lock, but, in returning the estimates last year, the following remarks were made by me. "Blind Canals of navigation are usually inconvenient, and, if a good reason can be shown for giving a tidal lock, one may be included in the estimate. It is observed that a single lock would give a through navigation 20 miles in length, and connect all this tract of country directly with Coringa, Co. ... and Wyanon. The Superintendent Engineer has not taken any special notice of the considerations of which it would have been convenient to have had a clear expression. In para 3 of his letter the Canal and its intended arrangements are mentioned, and that is all from the traffic statement. For various locks it will be seen that the existing lock at Yerra Notheram the

Traffic on this Canal was as follows.

	Salmon	Boats	Supplies
	No.	Tonnage	No.
May to December 1866.	29	366	52
Jan to Dec 1867	39	785	25
Jan to Dec 1868	27	418	25
Jan to Dec 1869	11	196	13

These particulars appear to me to support Captain Rye's view that a tidal lock is not required, and I do not therefore recommend its construction.

Again in support of the proposal to build a new lock and weir at the 50th mile, all that is to be found in the papers received are the following brief remarks in the Secretary's letter No 537 of the 1st February last.

"I have allowed for 2 new locks as the one at Gerrapollanam is 'Kutcha'.

"4th I have allowed for 2 new Calm Guls, as I do not know what the foundations of the present one at Gerrapollanam are." & c.

of this kind are very insufficient to warrant the sanction of an outlay of some 22,000 Rs. On the escape weir at Ventoor Captain Rye's proposal to spend 200 Rs. the revised estimates include Rs. 210 for a new weir and the following is the explanation given:

"6th The surplus 'Kalungalah' shown in longitudinal section at 2nd mile is of 2 bays of 7 feet each the crest position is below the bed of the channel. I have therefore allowed for a new escape of one bay of 10 feet span which with 2.99 feet going over will discharge 24,000 cu ft per hour. This explanation appears to me to be altogether insufficient. The level of the crest at present is 10.25, and were it raised 2.90 feet, as intended by Captain Rye, the revised level would be 13.15, against 13.00 the proposed level of the new weir. What evidence there is therefore is in favor of the 'sustainability' of the arrangements of the original

estimates. The sanction for this for
 Canal should under these circumstances be confined to the
 following items -

Earth work.	Rs. 12,850
Wear at 55% mile.	3800
Raising end of escape near Vindoor, including allowance for any minor improvements that may be necessary.	100
Minor. Dhondhols and Sincio	11,000
Total Rs.	28,050

It may be noted that had been necessary to build a new lock at Jerrapothigam it would have been advisable to place its lower sill at 3.25 or 3.00, instead of 4.25, for the depth allowed at the head of the Canal is 5.82 above the lock 30 miles 5.50 below 4.00 above total lock 6.50.

and it would not be a good plan

to build a new lock with such a different and insignificant depth on its lower sill, as that here shown. The discharge of this Canal should in the upper reach be 33,794 cubic yards an hour. The regular cross sections, having been calculated on the altered formula would give only 31,057, but the Canal is actually so much wider, than is necessary, that it will be requisite to reduce the surface fall in order to prevent too great a discharge, and I think the level of the water at the 30 mile weir should be about 1 foot higher than that shown in the longitudinal section, or at 14.75 instead of 13.75. The lock wall is high enough to allow of this adjustment, and generally the soil from the excavation required for deepening the Canal, will admit of the banks at the lower end being brought to a proper level. For the tail weir I have allowed the amount of Captain Rives' estimate rather

than the lower sum of the revised
 estimates, because the design of the
 work provided for in the latter requires
 modification. The level of the water below
 is marked +1.00, i.e. 1 foot above high
 water level, which is the datum referred
 to in these levels, though a year ago
 it was requested that mean sea level
 might be substituted as the universal
 datum for all the Delta works, and
 this substitution need have occasioned
 but very little trouble, as it would
 have sufficed to introduce it ab-
 solutely only on new plans and
 sections, and to give the requisite
 information in a note on all those
 which did not require revision. Cap-
 tain Tyne states the rise and
 fall of the spring tides to be 4.50
 feet, and the water level to be taken
 for a weir circumstanced as this is

supposing the H.W.L. used to be
 that of spring tides and this is
 doubtful, be $5\frac{1}{2}$ feet below the line
 shown below the fall on the plan.
 At such times then the drop would
 be 12 feet, and the depth of water
 cushion required would be 5 feet.
 The floor of the cushion ^{should} be placed
 2 feet lower than it is shown in
 the design. The batter on the
 base of the main wall of the weir
 should not exceed 1 in 6. The cushion
 wall is too high and too weak - an
 improved cross section for the work
 has been sketched in pen and ink
 on the design.

Drainage Works.

17 The principal drainage works re-
 quired for this section of the Delta
 are -

The Biscavole drain &c.	Rs. 65000
" Dookhabaya —	" 138100
" Lake —	" 266300

Add compensation for land — 469400
 37168

Total Rs. 506566

This

1 This is undoubtedly a large amount.
2 Captain Tyler estimates amount
3 to £152,500 only, but they were
4 confessedly only rough estimates,
5 and the great increase is not due
6 to any radical change in the capacity
7 of the drains but almost entirely
8 to the difference in the quantity
9 of work found necessary when
10 the estimates came to be regularly
11 worked out. The drainage is made
12 up of two items: first, the river water
13 discharged by surplus works on
14 the Canals, and secondly, rain water
15 to the extent of 1 inch draining off
16 in the 24 hours. Paragraph 13 to
17 16 of the Superintending Engineer's letter
18 refers to these drainage works, and it
19 will be seen that he considers that the
20 data on which the capacity of the
21 drains has been based, allows of
22 the drainage of the lands in a
23 much shorter time than is necessary.

21
and he thinks that at any rate
in the first instance, these works
should not be carried out on the
scale upon which they have been
designed. He says no drainage
works have ever yet been carried
out, and consequently no observations
have been recorded. The Secretary
in his memorandum on the
drainage, which is the ^{most} correct
of the time, gives in full detail
the area to be drained by each
portion, and it will be observed that
it is only from irrigated lands,
which may be supposed to be
saturated, that 1 inch of rain fall
drainage in the day is taken into
account, while only $\frac{1}{2}$ inch is
allowed for the dry lands drain-
ing into the channel. In order
to see what saving would be effected
were the drain to be cut in the
first instance for a drainage of
half an inch only from all the
lands, I have calculated what

diminution of the cross section
such an alteration would admit
of, and I feel that above cross
section 70 no decrease of section
of any consequence could be made;
that from section 70 to 73 the bottom
width may be reduced
from 73 to 105. 15 feet.
105 to 137. 20 ..
30 ..

and that the consequent saving
in the estimate would be about
\$40,000. This amount is but
a little more than one seventh
of the estimated total cost of the
drain, and I am of opinion
therefore that it is not advisable
to make any reduction in the
estimate; but that, as the ex-
ecution of these works must ne-
cessarily occupy some years,
it will be advisable in the first
instance to cut the drains of

51 22
sufficient width to discharge a rain
fall drainage of one third of an
inch, to watch the results, and to go
on widening the drains, if found
necessary, as fast as the labor
available will allow. The embank-
ments should of course be placed
at the distances apart required for
the full capacity estimated for,
and the bed level should be cut
as designed. It may further be
remarked that the calculations of
discharge have been made with the
formula which adds 10 per cent.
to the velocities, and this is of
considerable importance where
the discharge is expected to be
upwards of 300,000 cubic yards
an hour. The total area to be
drained by the Lake drain is
110 square miles, and 48,000 cubic
yards an hour of river water
available to be thrown in by the
surplus weir which is to relieve
the Cornish and Dorset Canal.

when necessary -

18. Turning to the details of the drainage estimates, the items of the Biceavole drain are -

(Biceavole drain Est.
Rs. 65,000.)

Earth works. Rs. 60,730

Drain at head - Rs. 2,220

Do 1 1/2 " " 2,050

The papers submitted with the previous estimates do not give any account of the objects which this drain is intended to serve but, as far as I remember, the drainage coming down from the Samulcollah Canal near Biceavole now finds its way into the Cocanada Canal, which occupies here a part of the old natural drainage river of this tract of the country, and this has been found to be extremely inconvenient. The area of country to be drained is 29 square miles. With the water in the drain at the normal level of 5 feet above bed the upper part will

discharge about the maximum quantity of water which may be received from both the Samulcollah Canal and the rain fall, and with 7 feet of water the discharge will still be a little under the maximum. I do not think the provision made will ultimately prove to be excessive. The Samulcollah contains an item, Rs. 2,200, for drain in a part of the bed of the old Samulcollah, which it is thought may be thought unnecessary. It will be observed from the sketch map that the Biceavole drain is to follow the whole of the tract of country between the Samulcollah and Cocanada Canals and to carry the drainage water into the Galora a tidal creek.

Tookabaga 19 The items comprising the drain - Est. Rs. 138,100. estimates are - Earthworks. Rs. 131,710. Trade weir at head. " 5,580. Aqueduct. Independent. " 100. Sluice at new head of Samarasalam Channel. 160.

This drain is for the benefit of the country lying between the Cocanada and Coringa Canals. It has to provide for carrying off as a maximum, 70,000 Cubic yards of water from the Cocanada Canal and the drainage of 28 square miles of country. The length of the main drain is 33½ miles, and of the branch drain (F.C.) 4½ miles. At present a large portion of this tract of country has no proper drainage. The Cocanada Canal occupies a part of the old Tookabaga and the loop of this river from A to B, a length of some 8 miles, is left without any outfall. Where further to the westward there is a drainage channel, it is altogether too small, and the cross sections

59th 24

needs enlargement. The quantity of earthwork to be executed is very great, but the proposed outfall of the river does not appear to me to be a serious one, and I believe that a very great benefit will be conferred upon the country interested by the carrying out of this part of the general scheme. Nevertheless in this, and in every case, the necessity of the drain should be made in the soil insuring throughout sufficient to provide for one third of an inch of drainage added to the probable quantity of surface water to be carried.

Takka drain 20' The component items of the Estimate for the drain are:

236,500	Estimate for the drain are:
	Excavation 1,42,500
	Improvements to small drains 7,000
	Escape and aqueduct at head 3,700
	Provisional, which have

made so large an item for earth
works necessary, have been noticed
at length in para 12 above, and
the detail of the work is not now
described.

21. The rate allowed per rod
is to be applied to all of the
land to be, and tends to be
submerged for longer or shorter
periods, it is not improbable that
the provision under this head
will be enough. It would have
been much more high than
however had some information
as to the way in which this rate
is to be applied.

22. These are the designs (Rest house
and Stables) called for by the Estimate R.
but this is manifestly

Compensation
for
land R.
65000.

not an appropriate name.

The plan for the room
is to be a good deal of
sufficient but not excessive. The
y-shin in the plan for the
could be considered for the
amount of the estimate, and
that also the work to be done
times for a moderate annual
outlay. I should not hesitate
to recommend their sanction.
I feel sure however that it is not
possible to construct consider-
ably more than half of the
plan for the room, and
and I would therefore recom-
mend that the following modi-
fications be introduced.

1. All the foundations and base
of the principal buildings
the windows fill in, a feet of
the walls above floor level, and
the upper 2 feet of the walls to

be of brick in chimney; the rest
of these walls except the sittings
of the door and window frames
to be of burnt brick in mud -

2nd The parts of all brick in
mud walls which are exposed
to the weather to show the joints
raked out half an inch deep, and
to be pointed and channeled -

3^d The height of the walls of
the main room does not exceed 14
feet. I think provision to the
extent of £10,000 may be made
for next winter, leaving it to the
Board hereafter, when the present
designs & estimates are received
how many shall be sanctioned.

The Superintending Engineer has
not stated when they are to be built,
and this point will require con-
sideration -

23. Some points and subjects
on which instructions have been
to the Surveyor General in July
1849 have not received attention -
1st As mentioned in a previous part
of this note, the level has not
not been taken for the datum to
which all levels are referred. Consequently
it is not known whether the lower
ends of the tidal locks will be
in a position to be raised, and I have
had to make reference to Major
Pemberton for his opinion on this
subject -

2nd It is a matter of very
considerable importance that
means may be taken which have
to retain a considerable body
of water should be
protected by a bank of mud.
The body wall of the locks

weirs & the other works
have this protection
al. & the same
for the same
in each
valle and of percolation
the same, the cement
being material is all
the same
added to water the
same
is much less liable to
The resolution is

This point should be attended to all masonry
works connected with irrigation, and freedom from
leakage should be secured by such means as have
been indicated, whenever necessary is brought into
contact with water under pressure.
The total area of land covered by such
canal and attached to it the water which has
not been given the general statement of water
distribution for the whole section of the Delta
the main command is shown as the same as
that for which water has been provided this is
a mistake for nearly the area available for
command has been taken as the area command
ed. According to the sketch map the area
commanded is about 240 square miles, or 236,000
acres & the ultimate area to be irrigated is
just over $\frac{1}{4}$ of this area, while the present ir-
rigation is rather more than one half of the
same area.
The beds of training paths require to be
regulated, and they should be given $\frac{3}{4}$ to 3
feet above the surface of the water when the
canals are carrying a full supply. The drain-
age of the lands between a canal and its
embankments should also be carefully ar-
ranged. It appears from the map that the instructions on these points have
been received

received attention.

24. The items of the revised estimates which I am able to recommend for present sanction, are the following:

The outlay proposed under the results anticipated from it

1	Improvements to the canal	Rupies 17,896
2	" " " "	22,010
3	" " " "	156,800
4	" " " "	72,100
5	" " " "	74,200
6	" " " "	58,050
7	Biscuit house	65,000
8	Toolshed	13,100
9	Toolshed	266,000
10	Rest houses	10,000
11	Compensation for land	* 56,800

Total Rupies 945,400

* i.e. 63,020
less Rupies 6,220
for the land required for the Banks

The anticipated increase of cultivation, which is the principal source whence a direct return for the proposed outlay must be expected is

Under the proposed canal	acres 2,425
" " " "	7,090
" " " "	10,811
" " " "	4,110

Total acres 24,436

The order proposed to estimate the returns from the Eastern section of the S. as a whole,

it will be necessary to include The S. canal, the improvement of which has been nearly completed on an estimate of Rs. 1,31,200, as also the Banks canal, which for the present purpose may be supposed to cost, say, 2,25,000, when all its requirements have been fully provided for. The total of the estimates will then be

as above	Rupies 945,400
Chamkottah canal	1,31,200
Banks canal	2,25,000

Total for Eastern section Rupies 13,01,600

and the extension of cultivation will be

as above	acres 24,436
Chamkottah canal	7,210
Banks	3,517

Total acres 35,163

The Biscuit house will benefit the lands under the Chamkottah canal, and the Toolshed as much requires for the lands under the Banks canal, as for those under the Beringa canal and the S. canal. The description of the general results which may be expected from the whole of the expenditure already incurred or contemplated, thus provided for the case now contemplated.

attempted to estimate separately the returns from the works and recommended for sanction.

25. Were it probable that the whole of the additional area, for which water will be made available, would be brought under irrigation within the next 5 or 6 years, the outlay proposed would bring in ample returns in the shape of increases. Revenue from water rates, for the sanctioned rate is Rupees 4 per acre for each crop, and that on the first crop alone would amount to Rupees 2,60,652 or 20 per cent on the total outlay, and some addition to this would be made for the 2^d crop.

It is however the opinion of the Executive Engineer in charge of the Range that no large proportion of the 60,163 acres will be taken up at once, and that a gradual increase only must be expected; he considers that very much will depend on the drainage being effectually carried out; and, as regards the trunk canal, under which the land available for the extension of wet cultivation is more than half of the ultimate increase anticipated, this officer very much doubts whether for a great many years the ryots will change their cultivation from

dry and garden to wet because the whole of the land is even now well under cultivation. 26. It would not be practicable to ascertain before hand exactly what effect will be produced by the radical improvements to this tract of country, which are contemplated and provided for in these estimates. At present the lands are either all drained or not drained at all, the water supply is defective from the absence of a proper regulation of the levee, and for want of works of distribution, and the communication between the villages and the coast is difficult. It is proposed to make the drainage thoroughly efficient, to provide an ample supply of water, giving at the same time all requisite facilities of distribution, and to make the communication complete & easy. It can hardly be doubted, I think, but that such a great change of circumstances will be productive of marked results. This section of the Delta is very favourably situated, and every part of it will be connected with the port of Cocanada by canals which will be navigable without the difficulties which are now experienced. Notwithstanding the present unfavourable circumstances 120,000 acres are

are now irrigated, and it may fairly be assumed that, when the lands can be more profitably cultivated than can now be done, there will be a desire to bring a larger area under irrigation.

27. The reported ultimate extension of cultivation under the Government, Mundafett, Beringa & Chyiraw Kanals is 24,436 acres, the present area of irrigation being 95,631 acres, so that the increase is but little more than 25 per cent, and this extension alone would give a return of more than 10 per cent. It must be noticed moreover that the Delta has a very strong claim to the sanction of the expenditure for the improvement of its works of irrigation and communication. These works have added largely to the Revenue, but the absence of drainage has produced a marked effect of late years on the health of the people, and fever has become very prevalent. I had hoped to have been able to show clearly what increase of Revenue has been derived from the Eastern section of the Delta during the past 23 years, in consequence of the construction of these canals, but the Superintending Engineer has not been able to furnish the details called for, and,

in

*by telegram
see also letter of 24.31
12th August 1870.

Letter of 8/5 para
19

Appendix 7
Rs 193,73,750

in reply to a telegram, which I sent to him, within the last few days, he states that he has not yet obtained an answer from the Collector's requisition on this subject made in March last. Major Fischer however points out that the balance of income on the whole Delta is shown, by the statement of remunerative works for 1868-69, to have been nearly 19 1/2 lacs, and that the share of the Eastern section of the Delta of this amount would be about 60 lacs. On the other hand the total outlay up to the same date, exclusive of repairs which have been deducted from income is as follows:

Share of the expenditure on
the amount, Rupees 15,66,574, Rupees 1,84,500
works in this section of the Delta 7,65,468
Total Rupees 12,49,968

An outlay therefore of 12 1/2 lacs has, after paying 4 per cent interest on capital and all expenses for maintenance, returned to the Treasury during some 21 years about 60 lacs of Rupees, and it is now desired at a nearly equal expenditure, upon which there are good reasons for expecting a moderate direct return of perhaps 10 per cent, to make

The

the works efficient and convenient. This further outlay will amount to a little more than one-fifth of the ^{* inclusive, of the} sum contributed by the people who are in ^{Samuelcott's Canal} interested in the carrying out of the desired improvements, and this claim to consideration is therefore a very strong one.

28. I would recommend that the Government of India be asked to sanction the execution of these improvements from Loan Funds. Provisional sanction has already been accorded to the greater part of the estimate for the Buchanan Canal, ^{Rs 1,19,600} and the reformation of the Samuelcott's Canal has been similarly provided for. The importance of not burdening the State with Loan interest as the cost of unremunerative works cannot be very great, but in the face of the difficulty which must always to some extent attach to the demonstration of the results of expenditure, if I might be permitted to make a suggestion, I would say that a possible solution of the difficulty might be found in providing each year, out of the amount available

for expenditure from Revenue, the sum charged for the interest not recovered from works executed from Loan Funds. Such an arrangement would not only show the Government annually the results of the outlay on works expected to be remunerative, and lead to the remedy, where possible, of defects of whatever kind, which might have tended to mar their success, but, while protecting the current resources of the Government from undue pressure, it would prevent new works or improvements, in support of which good prima facie evidence was adducible, from being unduly postponed owing to the difficulties, which must ever be experienced, of predicting accurately the effect of any given works upon the Revenue.

29. The Superintending Engineer states that he has not attempted to make any separation of the cost of the navigation and irrigation, and he thinks that, with the exception of the cost of the locks, no large portion of the estimates is due to the requirements

of the navigation. I think something might have been done towards obtaining an approximate valuation of the outlay attributable to making the canals efficient as communications, but I cannot myself spare the time which would be necessary for making the investigation; and I will therefore here only give a short account of the present state of the traffic on the canals. The statements of boats which passed through the several locks shows that in the years 1867-68 & 1869 the average traffic on the Cocanada Canal was as follows.

		Number	Tonnage	Boats empty
Madapad Lock	Up	1016	24,195	1981
	Down	3,133	81,693	408
Chintapilly do	Up	1045	24,425	2786
	Down	3600	83,317	376
Govt do	Up	953	22,038	3,305
	Down	4,166	93,648	347
			329,316	
Average			54,886	

On the average therefore 54,886 tons were carried,

if not throughout the length of the canal, but 25 miles eachway, for the Madapad lock is in the 11th mile, or altogether 2,743,300 were carried one mile. The value of this line of navigation may to some extent be estimated from the difference between the cost of land water carriage, though were land carriage obligatory only a fraction of the traffic would be possible. The cost of land carriage would not be less than 2 annas a ton a mile.

2,743,300 Tons at 2 annas = Rupees 34,2913

cost of carriage by boats

2,743,300 Tons at 1/2 anna = " 85,728

Differenced Rupees 257,184

* This is rather a high rate vide paras 13 & 14 of Colonel Anderson's Memorandum printed in P.O. No 3652-21st Nov 1868

Up to 1869-70 Rs 1,26,317
Present estimate - " 1,06,800
3,13,117

* Gold locks pay 45,000
Land do 1,04,590
Lanthorns pay 25,810
1,75,000

The total cost of the Canal will be a little over 3 lacs, and probably the outlay of all kinds due to navigation will not exceed 1 3/4 lacs, so that the annual benefit to the District of this line of navigable canal must be very great compared with its cost, and indirectly, if not directly, the prosperity resulting therefrom cannot fail to be of advantage to the Revenue.

Similarly

a Similarly for the Samulcotta Canal

		Number	Boats	Tonnage	Empty
1 Samulcotta Locks	Up	188		4,225	1,268
	Down	1376		24,212	85
2 Venkata Krishna Rao	Up	207		4,573	1,157
	Down	1100		23,057	93
3 Kocanada	Up	193		4,504	862
	Down	886		17,420	104
Average				77,991	12,998

On this case the locks being all near the lower end of the canal it is less easy to estimate the average distance passed over by the traffic. The whole length of the canal is 39 miles, and taking 30 miles for the distance traversed each way the tonnage carried one mile would be 779,880. The cost of land carriage would be Rupees 97,485 and of water carriage is about " 24,371.

Difference Rupees 73,114.

The third important navigation canal in this part of the Delta is the Boringa.

		Number	Boats	Tonnage	Empty
Radipalunka Locks	Up	353		7,363	433
	Down	494		11,674	246
Mamoot	Up	260		5,330	241
	Down	264		6,091	178
Vello	Up	129		2,486	501
	Down	388		8,518	136
Munja	Up	81		1,575	632
	Down	518		10,821	90

This lock takes Bank Canal Traffic as well as its own. Therefore excluded from the total.

The Mamoot Lock is just at the head of the Boringa Canal, and therefore the average traffic may be taken as passing over the 24 miles to Boringa each way. The tonnage carried one mile would therefore be 278,736, and the difference of cost of carriage by land and water would be Rupees 26,131.

On these three principal canals of the eastern section of the Delta therefore the ton mileage is 3,801,916; the economy, as against land carriage represented by the facilities afforded by these canals is Rupees 3,56,429 annually, and, as far as I can judge, that sum would about represent the whole cost of the navigation.

as above	1,75,000
Samulcotta Canal 1 double	
2 single locks	60,000
Boringa Canal	
4 locks	65,000
Other works	50,000
	3,50,000

A statement forming one of the accompaniments of the estimates shows that for the year 1869-70 the boats licensed in this part of the Delta and the fees collected were as follow.

Largo Boats	631	Rupees 13,646-8-
Peeping boats	34	" 2,178-14-
Thames boats	3	" 28--"
Rafte		1215-1-9.
Chundries		226-2-1.

Total Rupees 17,293. 15. 10.

It also appears from the statement of remuneration

Appendix of Income 41,337 Rupees. Management 14,000

works

works for 1868-69 that the management of the navigation of the whole Delta costs about $\frac{1}{3}^{rd}$ of the whole income, so that the net navigation revenue of this part of the Delta is somewhat over 3 per cent on the cost of providing complete navigation on the 3 main lines. From the improvements now estimated for an increase of returns under this head may be expected, & I hope this result will be brought about by increase of produce, and consequently of the number of boats needed for its transport. I would rather see the number of licenses increased than the fees on boats raised; but should the latter be found requisite, it seems probable that were these fees increased, on the completion of the improvements, 25 to 30 per cent. all round, the cost of carriage would not be augmented beyond the present standard, because with good locks & a greatly diminished current, as also with the levels regulated, whereby the time that the Canal will be navigable without difficulty will be extended, the work which can be done by a boat will be greater & the cost of doing it less.

Ootacamund 3 Whimundins Major R.R.
6th August 1870 Acting Chief Engr. for Irrigation
To
The Secretary to Government P.W. Dept.

Practical Book for the Situation

The Atg Chief Engineer
for Irrigation

To the Secretary to Govt. of India.

Dated 6th
 Decr 13th
 Recd 22

August 1870.

Enclosures 10

Note on the estimated
Rs. for the improvement &
completion of the system
of Irrigation in the Eastern
section of the Godavari
Taluk.

No 481

№ 2325-28-Sept 27/27

W. No. 1, or Eastern Delta Range - Godavari Dist.
Cross Section of Beasole Drain -

- (a) Statement of Expenditure in several items
- (b) " " " " " " " " " " " "
- (c) Memorandum transmitted with " " " " " "
- (d) Detailed Estimate
- (e) Specification
- (f) Abstract Estimate
- (g) Plans & sections of Escapes at the head of " "
- (h) Survey of " " " " " " " " " "
- (i) Letter of Mr. Tag to Tag

(2) No. 1 or Eastern to No. 2 cross section of
Cocaine Canal.

- (a) 1. Long statement
(b) 1. provides abstract Estimate
(c) 1. specification
(d) 1. revised detailed Estimate
(e) 1. detailed Estimate
(f) 1. ——— or ———
(g) 1. ——— or ———
(h) 1. ——— or ———
(i) 1. ——— or ———
(j) 1. ——— or ———
(k) 1. ——— or ———

- (1) 1 detailed Estimate.
- (2) do do
- (3) do do
- (4) 1 revised plan, section & elevation of a lock to be constructed in connection with the canal.
- (5) 1 plan of Calingulak.
- (6) 1 drawing of gates for locks.
- (7) 1 plan showing arrangement of anchor irons for lower & upper gates for locks.
- (8) 1 revised plan, section & elevation of a lock.
- (9) 1 plan of shutters for the lock.
- (10) 1 Longitudinal section of Pucasa Canal.
- (11) Cross section of Lohabaga Drain.
- (a) 1 Longitudinal section of do.
- (b) 1 Sketch showing the proposed site for the new Calingulak.
- (c) 1 Survey of the drain.
- (d) 1 Enlarged Elevation & section of an aqueduct over the drain and another of the same kind (both sketched together).
- (e) 1 Plan, section & Elevation of a sluice at the head of the Comapalem Channel.
- (f) 1 do do do of a shutter for the Calingulak.
- (g) 1 letter from Mr. Sapp No 610.
- (h) 3 detailed Estimates.
- (i) 1 abstract Estimate & a specification.
- (j) 1 Memo to accompany the project.
- (k) 1 statement of expenditure.
- (l) 1 large statement (sketched into the above statement).

- (12) (1) Transverse section of Dowlaishwar Head Sluice.
- (a) 1 plan and elevations of Head Sluice.
- (b) 1 plan of a wooden shutter in rear.
- (c) 1 statement.
- (d) 3 detailed & two abstract Estimates.
- (13) (1) Map of the Eastern Delta Range.
- (2) Map of the Eastern Delta Range.
- (3) (1) Cross section of Pongu Canal.
- (a) 1 Longitudinal section of do.
- (b) 1 plan & section of front bay of Mamoor Lock.
- (c) 1 plan of gates for front bay of do.
- (d) 1 plan of shutter for Calingulak of do.
- (e) 1 plan showing arrangement of anchor irons for upper gates.
- (f) 1 plan, section & elevation of a Calingulak.
- (g) 1 Letter of Mr. Sapp No 554.
- (h) 1 Abstract Estimate of Mamoor Lock.
- (i) 1 specification of do.
- (j) 3 detailed Estimates (sketched together).
- (k) 1 do do.
- (l) 1 statement of expenditure & a large statement sketched together.
- (14) (1) Sketch Map showing system of alluvial Canals in the E. Delta.

4
(8) (1) Cross sections of Bank Canal from Dargah
- ~~ward head sluice to Yamun~~ -

(a) 1 Plan, Section & Elevation of a lock near How
- ~~laishwan on Bank Canal~~ -

(b) 1 plans showing arrangement of anchor rods for
lower & upper gates for lock

(c) 1 plan, Section & Elevation of head sluice

(d) 1 ~~do do do~~ of a lock at Koolia

(e) 1 plan of shutter

(f) 1 plan, Section & Elevation of eachingulaks

(g) 1 plan, Section & Elevation of a lock

(h) 1 Sketch of a portion of Bank Canal, ~~see~~

(i) Longitudinal section of ~~do~~

(j) 1 letter of Mr. Sapp no 56

(k) 1 specification

(l) 1 Abstract Estimate

(m) 11 detailed Estimates

2 (h) Statement of expenditure & another large sketch
- ment (sketches together) -

(9) (1) Cross sections of Mundapetta Canal

(a) 1 Longitudinal section of ~~do do~~

(b) 1 plan of shutter for inlet & outlet ~~do~~ of the lock
at the paishwan

(c) 1 plans of gates for the lock at ~~do~~

(d) 1 plans, Sections & Elevation of salingulaks

(e) 1 ~~do do do~~ of a lock

(f) 1 ~~do do do~~ of a lock at Pandapudiy

(g) 1 letter of Mr. Sapp no 503

5
(h) 1 large statement -

(i) 2 detailed Estimates -

(j) 1 specification

(k) 1 Abstract Estimate

(l) 6 detailed Estimates -

(10) (1) Longitudinal cross section of Angerim Canal

(a) 1 plans showing arrangement of anchor rods for
lower & upper gates for lock

(b) 1 plan of shutter for the inlet & outlet ~~do~~ of the lock

(c) 1 plan of gates for tidal lock

(d) 1 ~~do do~~ for the lock on the Canal

(e) 1 plan, Section & Elevation of a lock on ~~do~~

(f) 1 ~~do do do~~ of tidal lock

(g) 1 ~~do do do~~ of salingulaks

(h) 1 letter of Mr. Sapp no 537

(i) 2 statements of expenditure (sketches together)

(j) 8 detailed Estimates -

(k) 1 specification -

(l) 1 abstract Estimate -

(11) (1) Cross Section of Lake main drain.

(a) 1 Longitudinal Section of do.

(b) 1 plan, Section & elevation of a Calingula and an Aqueduct at the head of do.

(c) 1 sketch map showing the area drained by do.

(d) 1 Letter of Mr. Sayer to 35.

(e) 1 Memo. on the subject of the do.

(f) 2 detailed Estimates, 1 abstract Estimate and 1 specification (all sketches to be put in)

(g) 1 abstract Estimate.

(h) 1 statement of expenditure sketches into a large statement.

28th Sept 1870. No. 2335
Proceedings of the Madras Com. 105

Read the following

From the Acting Engr., 1st Div. (Mr. Sayer) 14 June 70/
Note by the Acting Chief Engr. - dated 5th Aug 70/
for Engr.

With the note by the Acting Chief Engr. for Irrigation recorded above, the revised estimates for the improvement of the irrigation of the eastern section of the Godavari have been submitted for the consideration of the Government.

2. It appears that Captain Ryles in the middle of 1869 transmitted to the Chief Engineer estimates and

amounting to Rs. 701,310. but the information furnished with them, and some of the estimates themselves, being incomplete, instructions for their revision and completion were sent to Captain Ryves' successor, as that Officer had been obliged to proceed to Europe on sick leave. The revised estimates forwarded by Major Fisher amount to Rs. 11,53,280 for works, and Rs. 63,020 for land compensation, or together to Rs. 12,16,300.

The Acting Chief Engineer recommends for sanction some of the estimates as

received others with modifications, and the bank canals, ~~the~~ ^{the} things, for the reasons given in para 13 of this note, should be reconsidered. The subjoined statement exhibits the differences

Items.	Revised Estimates	Recom. modified for sanction
	Rs.	Rs.
1 Improvements to Head Race	17,890	17,890
2 Do Main Duct	28,060	28,060
3 Do Canada Canal	1,86,890	1,86,800
4 Do Munderpett	74,100	74,100
5 Do Bank Canal	2,14,900	—
6 Coringa Do	76,000	74,300
7 Do Chigeram Do	78,600	28,050
8 Biechrook drain	65,900	65,000
9 Pooiabaga Do	1,38,100	1,38,100
10 Lake Do	2,66,300	2,66,300
11 Rest houses	7,530	10,000
12 Compensation for land	56,302	56,800
Totals. Rs.	12,16,300	9,45,400

The Government of India have already sanctioned the construction of the new locks and lock weirs on the Coomra Canal, and the present estimate includes these works, as also the earth distribution works required for its completion.

Letter No. 152. I of 2nd April 1870.

4. The present area of irrigated lands in this section of the Delta is shown to be about 125,007 acres, while the ultimate area is estimated at 188,170 acres. These areas include the irrigation under the Samuleotta Canal, the improvement of

G.O. No. 2854 of 28 Nov 1862.
Letter No. 152 A. I. 19th Apr 1868

of which ^{from Government} nearly completed under the sanction given by the Government of India to an estimate of Rs. 1,31,200, as also that, under the Canal (Cargil) Subproject No. 10 the particulars for the several Canals.

	Cultivation of July 1278 (1868-69)	Estimated ultimate area	Difference
Samuleotta Canal	20,491	27,701	7,210
Coomra "	36,356	38,761	2,405
Mundapelt "	25,065	32,155	7,090
Bank "	6,882	40,399	33,517
Coringa "	21,446	32,257	10,811
Injetann "	12,787	16,897	4,110
Acres	125,007	188,170	63,163

The information given by the Revenue and

and Public Work

Officers respectively
regarding the present
and probable area of
irrigation in this part
of the Delta, varies
considerably, but it
is observed that while
the difference is nearly
18,000 acres for the
existing area, upon
which conclusive evidence
should be obtainable,
that for the increase
of irrigation which may
be expected is only
6,461 acres. The

Government concern
with the Acting Chief
Engineer for Irrigation
in considering that it

2250 2/1 1911
2251 2/1 1911
2252 2/1 1911

is desirable that
total information re-
garding the area and
assessment of both
first and second
crop lands, whether
belonging to the Gov-
ernment or to Zemine-
dars, should be record-
ed for each year and
as it would appear
that at present such
details are not known
to be found in the
Revenue Returns,
this subject will be
referred to the Revenue
Department, with a
view to its being as-
certained for how
many years such
particulars can be given

in a reliable form
and to the preparation
of a statement in detail
of each village, and in
abstract, for each Taluk,
showing the cultivated
area, and a statement
for many years
may be practicable.
Such information will
be absolutely requisite
in order to show the
results of the improve-
ments contemplated
and for the compilation
of the returns which
will have to be sub-
mitted to the Govt.
of India for the
several Canals, the
completion of which

911 73
has been, or may be,
sanctioned from Loan
funds.
It is to be regretted
that reliable information
regarding the revenues
derived from the villages
and lands now under
the several Canals of
the Eastern Delta, for
a period prior to the
construction of the
Godavari Canal, is
not forthcoming, in
order that a comparison
might be made
between former, present,
and estimated future
collections. As however
the submission of these
Estimates to the Govt.
of India would be

delayed for an indefinite time were the receipt of further reports from the Revenue Officers awaited, and as moreover it appears to be very doubtful whether any better information than that which has been embodied in the statement of remunerative works can now be obtained, the Government consider that it will be best to accept such particulars as are available as a basis for judging of the returns which may be expected from carrying out the improvements provided for in these Estimates.

The Acting Chief Engineer for Irrigation shows that, including the Samuleotta Canal and the probable amount which will be required for the Bank Canal, the expenditure upon this part of the Delta will amount altogether to Rs. 13,01,300. Were the whole of the expected increase of area of 65,163 acres likely to be brought rapidly under irrigation, the returns from the water sale of Rs. 400 on the first crop, would alone amount to 20 per cent on the total outlay. The evidence however is indicative that exclusion of

irrigation is likely
to be gradual, though
it may be anticipated
that, when the circum-
stances of the country
are so much improved,
as they will be by
the carrying out of the
contemplated works,
in respect of water
supply, thorough
drainage, and facility
of transport for produce,
an impetus will be
given to agricultural
operations which will
hasten the spread
of irrigation, and lead
to the utilization of

of all the water ^{95%} ^{likely}
available within a
reasonable period. It
may be remembered
that there will, in the
case of these works,
be but little difference
between the gross and
the net returns arising
from any extension
of irrigation, for the
expenses of mainte-
nance will cer-
tainly not be any
materially,
and they may pos-
sibly be rather di-
minished. To yield a
return of 10 per cent
on the total outlay
about 32500. additional
acres of irrigation will
be

needed or one half
of the whole increase
ultimately expected;
while, to cover the bare
interest on the cost
of the improvements,
only 16,000, or 17,000
acres would be needed.
Such being the case
His Excellency the
Governor in Council
is of opinion, that
without taking into
account the large amount
of revenues in excess
of their first cost which
these irrigation works
have been the means
of securing, the further
outlay proposed may

978
be submitted to, has
sufficiently remained
true to the estimate of the
submission of the
estimate, as per
intended for sanction
by the Acting Chief
Engineer for Irrigation,
to the Government of
India for approval
with a view to the
being carried out from
some time back.
The Superintending
Engineer should also
have no
time in modifying
the Bank Canal
estimate to such ex-
tent as may be re-
quired, and consider-
ing the large area which

is expected to be
regulated by this Canal,
any should be taken
that the arrangements
are such as to ensure
it being made as
roughly efficient for
and fairly convenient for irrigation
throughout.
On suspending the revised
estimate, the remarks
of the Chief Engineer
should receive attention,
and full explanation
should be a finding
in support of all pro-
positions for outlay
upon the removal and
reconstruction of ex-
isting works, the re-
vision of which was

991
intended by Captain
Thyres. The extension
of irrigation to the Island
of Coinga may be
postponed until the
time for preparing the
designs and estimates
can be conveniently
spared.
It is to be un-
derstood that although
to save delay, estimates
for locks of larger
dimensions than have
been approved for 2nd
Class Canals, have
been passed, such
locks are to be con-
structed in accordance
with the sanctioned
scale. The Government

of the Godavary Delta.

2. These estimates provide for all the improvements still requiring to be carried out in this part of the Delta, with the one exception of the Bank Canal, the estimate for which has been found to require re-consideration and revision. The Sinnatollah Canal, the only other channel not provided for in these estimates, has already been nearly completed on an estimate of Rs. 131,200 ^{the estimate} ^{from San Funds} which was sanctioned by the

133A
Government of India on the 1st September 1878. No 132 A.I. 1878

3. His Excellency the Governor in Council I am to state, hopes that the information regarding these estimates contained in the Proceedings of this Govt. dated the 21st of

Nov. will be deemed sufficiently complete and satisfactory to allow of the works being executed from San Funds, and I am to solicit their sanction.

Accordingly
It will be ob-
served that the estimate
of Rs. 186,800 for the
Cocanada Canal,
which forms an item
of the above amount
of Rs. 945,100, includes
the locks and lock
gates which were sanc-
tioned by the Govt.
of India for im-
mediate execution
in your letter No. 1521
dated 2nd April 1870,
and that sanction will
accordingly be super-
seded by the present
estimate, should the
latter receive the assent

of the Governor General
in Council.
5. I am also to
point out that items
79 to 81 of the Current
year's budget, against
which Rs. 95,000
altogether are entered
for expenditure, all
refer to works in-
cluded in the es-
timate now sub-
mitted, and, should
these be sanctioned,
that amount will be
available for car-
rying on the works.
J

(5)
I am to request
that the plans and
estimates may be
returned when no longer
required, as the im-
portance of avoiding
delay has prevented
copies being retained
in the office -

W. 10/8/70

21

Desp^d 4/10/70 with 26th Dec.
of Gen^l 23.35 of 1870.

G.O. 2335
of 1870

Plans, Estimates &c. accord-
ing to the List attached hereto.
Desp^d on the 13th Dec^r 70 in a box