M R O. 1—77,003—8-6-37.

(1) Number of pages 56

(2) Date of repair 30 10-42

(3) Initials of the Reference

# MADRAS RECORD OFFICE.

## Government of Madras.

Public Works DEPARTMENT.

G.O. No. 22×23 Press ~~Mis.~~

43-47

Dated 6- 1- 1865.

***Not to be folded or roughly handled***

## *Proceedings of the Madras Government, Public Works Department, 6th January 1865.*

Read the following letters:—

No. 13. From Lieutenant-Colonel O. W. S. CHAMBERS, R. E., Superintending Engineer, 1st Division, to Colonel C. A. ORR, R. E., Secretary to Government, Department Public Works, dated Waltair, 23rd June 1864, No. 444.

SIR,

1. In obedience with the order of Government as per margin, I do myself the honor of forwarding two plans* and three papers which will supply the Lieutenant Governor of the North Western Provinces with the information regarding the Godavery and its dam he is in need of

G O. No. 1,215 of 28th April 1864

* Sent by bunghy.

2. These three papers are—

I. Letter from Major Stoddard giving the maximum and minimum discharge of the river; information regarding the nature and quality of the stone and lime used on the work, as well as the means of transporting the same to the dam.

II. Extract from a report from Sir A. Cotton, giving the necessary information regarding the longitudinal section of the river's bed, as well as the levels of the country in the vicinity of the work.

III. Information from the Sub-Engineer in charge of the anicut, V. Viranna Garú Rai Bahadur, on the subject of the rates of the several kinds of work at the dam, on the time it was under construction, and on the means used to protect it from floods when incomplete.

3. In conclusion, I beg to recommend Major Stoddard's suggestion to Government, that a copy of the papers of the Madras Engineers treating of the Godavery works should be sent to his Honor the Lieutenant Governor, North Western Provinces.

Volume III

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From Major J. STODDARD, Executive Engineer, Godavery District, to Lieutenant-Colonel O. W. S. CHAMBERS, R. E, Superintending Engineer, 1st Division, dated Dowlaishweram, 17th June 1864, No. 79.

SIR,

With reference to your letter No. 65, dated 5th ultimo, I have the honor to forward the following documents connected with the Godavery river and anicut, which I hope will supply Lieutenant-Colonel Morton with all the information he requires. *Vide* his letter No. 1,238A, dated 29th March 1864, to the Secretary to Government, Department Public Works, Madras.

2 Plans.
1 Letter.
1 Extract of Report.

*First.*—A survey of the Godavery taken last year in the vicinity of anicut with *transverse* sections above and below, and shewing height of ordinary floods and of the extraordinary flood of 1861.

*Second.*—Plans and sections of each of the four branches of the anicut in their present state, that is three* of them raised two feet in the last two years.

* Rally, Muddoor, and Vizasweram.

*Third.*—Extract of a report on the Godavery Delta made to Government by Colonel Cotton in April 1845, descriptive of the course of the river, the fall in its bed, and the fall from its banks on either side in a direction perpendicular to its course. This extract will answer the purposes of the sections of the country in the vicinity of the anicut which I regret it is impossible to get done with our present establishments.

*Fourth.*—An original letter from the Sub-Engineer at present in charge of the anicut, and who has been intimately connected with the work from its very commencement, and who is therefore a good authority on the original cost of each kind of work, nature and cost of foundations, &c., &c.

*Fifth*.—The calculated discharge of the extraordinary flood of 1861 was 210 millions *cubic feet per minute*, and the discharge of the Godavery, during the driest season, is not less than 90,000 *cubic feet per minute*.

*Sixth*.—The distance from which the stone of which the anicut is built, was brought, was not more than four miles to the *farthest* point of the anicut. The stone used is a "sand stone," found in various stages of hardness. Some of it making excellent cut-stone covering. It is an excellent building stone, a cubic yard of it weighs 1¼ ton.

The stone was conveyed from the quarries to the edge of the river on wagons, running on iron rails, and from thence in barges to the site of the work. An excellent hydraulic-limestone* is found in immense quantities at Catair about eight miles from the anicut.

* Magnesian limestone found between two outflows of Basalt—it is full of fossils older than the nummulitic series.

*Seventh*.—In concluding this letter I would suggest that a copy of the 3rd Volume of the Madras Engineering Professional Papers be forwarded to Colonel Morton, as it contains full particulars of the construction of the Godavery anicut from its commencement till its completion, and which cannot be obtained from any other source.

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*Extract from the Second Report on the Delta of the Godavery*

1. The Godavery, rising near Bombay, passes for several hundred miles through an open country, watered chiefly by the south-west monsoon. About 200 miles from the sea, it enters the hilly tract that runs at the back of the Northern Circars, and at sixty miles from the sea it enters the alluvial country which it has itself formed. It seems very remarkable that in passing through the great barrier of hills (I find from information which seems to me conclusive) it has so effectually made its way, that there are no falls throughout the whole length of its channels, nor indeed any obstructions of consequence. Such is the statement of the boatmen who navigate the river, and it seems to be completely confirmed by the fact, that the timber rafts never come down from the Hyderabad country except when the river is almost at its lowest, and has not more than two or three feet of water at the fords in the low country. The alluvial land does not immediately expand to a great width from the point at which the river leaves the main range, there being still rising grounds and detached patches of hills at a distance of from half a mile to five miles from the river, for the distance of twenty-three miles further; at the end of which distance, two or three detached hills come close to it, the river divides into two streams, the alluvial country spreads out on both sides, and the Delta may properly be said to commence, extending on the west side till it meets that of the Kistna at the Colair lake, about forty miles, and in the east side about thirty-two miles to the shore of the Coringa bay, where the coast runs for some distance nearly north and south.

2 Within the line of the hills the river has, I conclude, from the abovementioned fact, a very moderate fall; and I saw that such was the case for some distance within. From the hills where the alluvial land immediately adjoining the river is eighty feet above the level of the sea at high-water, spring tides, it has a most regular slope, commencing with a foot and a half per mile, and gradually diminishing to one foot as it approaches the sea. The rise and fall of the river there is thirty-eight feet, and as the rise of the river is reduced to nothing at the sea, it follows that the summer surface of t[illegible]er must have a less fall than that of its banks to that extent, viz., thirty-eight feet, so that [illegible]olaveram, where it leaves the hills, the summer level is only forty-two feet above high-water, [illegible]the bed at the ford there only thirty-eight feet. But the fall of the bed, or even of the sur[illegible] surface of the river is by no means regular, like that of the surface of the floods and that [illegible] land. Between the fords there are deep hollows, one I measured thirty feet deep in sum[illegible] another twenty-six feet, and in one place I find a slope of nine feet in three miles in t[illegible]mmer surface of the water; in another only one and a half foot in four miles. The average [illegible] the hills to the sea is seven and a half inches per mile. At the head of the Delta, the bed at the ford is twenty-two feet above the sea, and the



distance being thirty-eight miles in a direct line, the average fall measured in that way is seven inches a mile; but if the actual length of the river, viz., fifty miles, is taken, it is only five and a quarter inches.

3. Besides the slope of the land towards sea in a Delta, it has another slope, viz., a fall from the river in a direction perpendicular to its course, and this fall is much more rapid than that towards the sea. In the present case it has been ascertained to be in one place, viz, soon after the river leaves the hills, eighteen feet in one and a half miles, to where it meets the adjacent hills on the east side. In another on the west side, about four miles from the hills, eight feet in three-quarters of a mile. Near the head of the Delta, sixteen feet in two miles on the west, and seven feet in two and a half miles on the east side. Thirteen miles further down, that is twenty-five miles from the sea, the fall is nine feet in two and a half miles on the west side of the Godavery. Thus the river banks form a ridge from eighteen to seven feet above the level of the land, at the distance of from three-quarters to two and a half miles distant on either side, providing most remarkably for the leading out of the water upon the lands. The slope of the country towards the sea, at the foot of the ridge, is uniformly one foot one inch per mile on the west side, all the way from near the hills. On the east side, the distance being shorter to the bay of Coringa, the fall is one and a quarter foot per mile, from near the head of the Delta where the Dowlaishweram hill closes in the bank of the river.

(True Extract.)

(Signed) J. STODDARD, *Major*,
*Executive Engineer, Godavery District*

DOWLAISHWERAM,
17*th June* 1864.

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From T. VIRANNA RAI BAHADUR, Sub-Engineer, Godavery District, to Major J. STODDARD, Executive Engineer, Godavery District, dated Dowlaishweram, 18th May 1864, No. 6

SIR,

I have the honor to forward the information requested in your letter No. 26 of 13th instant, as below specified:—

I Plan and cross section of the anicut (each branch) as it now stands. } Four Sections and plan forwarded.

II. Memorandum of rates for the several kinds of work executed on it, viz:—

(*a*) Cost of wells with size of the same at the time of construction of anicut. } Wells 6 feet by 4½ feet, cost of each Rs. 4-12 0.

| | | | | | | |
|---|---|---|---|---|---|---|
| (*b*.) | Rough stone in chunam ... ... ... | Per cubic yard | Rupees | 1 | 10 | 0 |
| (*c*.) | Do in apron ... ... ... .. ... | Do do | „ | 0 | 11 | 0 |
| (*d*.) | Cut stone covering ... .. ... ... | Do. do. | „ | 4 | 0 | 0 |
| (*e*.) | Cyclopean stone covering .. ... ... | Do. do. | „ | 2 | 8 | 0 |

III. The period in which the anicut was completed. If work done during rainy season, the mode adopted to protect the unfinished anicuts from floods:—

The Anicut was commenced in 1846 and completed in 1852.

No work had been executed during the monsoons.

The unfinished portion of the anicut was protected from floods by large quantities of rough stone thrown in such directions, as seemed necessary, during the freshes The work was commenced in the year 1846 with its head and under-sluices as well as locks. The rubble work of the Dowlaishweram branch was finished to the height of nine feet above the deep bed in the year 1847, and of the Muddoor and Vizasweram branches to the height of 10½ and 9 feet respectively in 1849. Rally branch partially closed by a rough stone dam. The rubble masonry of this anicut was completed in the year 1850 The covering with dressed stone of the Dowlaishweram, Rally, and Vizasweram anicuts was finished in 1851, and that of Muddoor anicut with Cyclopean stone in 1852.

No 44. From Lieutenant-Colonel J. C. ANDERSON, R E, Superintending Engineer, 2nd Division, to Colonel C. A. ORR, R. E., Secretary to Government, Department Public Works, dated Masulipatam, 3rd September 1864, No. 70.

Plans sent by banghy

SIR,

1. Referring to G. O No. 1,215, dated 28th April 1864, in which I am called upon to furnish certain information regarding the Kistna anicut, I have the honor to forward the following documents:—

(1) A longitudinal section of the bed of the Kistna in the vicinity of the anicut; also a survey of the river to correspond, shewing its condition at the driest period of the past season (May 1864).

(2.) Transverse sections of the river above and below the anicut.

(3.) Three lines of level along the principal channels on the south side of the river, and a line of level along the river bank, eight miles upwards from Bezoarah.

(4) Plan and section of the anicut.

(5) Memorandum of rates, &c.

(6) Do. of discharge.

(7) Do. regarding quarries.

2. The Kistna anicut was commenced in November 1852, and completed in May 1855. Full information regarding the mode of construction will be found on reference to Colonel Orr's reports which have been published in the 4th Volume of Professional Papers of the Madras Engineers.

3. A skeleton map of the Delta is also forwarded with the other plans.

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*Memorandum of rates at Bezoarah Anicut.*

| | | |
|---|---|---|
| Cut-stone coping, large blocks about 6'×3'×1½' | Rupees | 7 per square yard. |
| Smaller cut-stone 9" to 1" thick | " | 3 to 6, according to size. |
| Cut-stone, cut-waters of piers, large | " | 9 to 10 per cubic yard. |
| Rubble masonry and chunam | " | 2 to 3 do. |
| Hammer dressed | " | 3½ do. |
| Concrete | " | 1½ do. |
| Rough-stone packing | " | 1½ do. |
| Do. filling in | " | 1 do. |
| Pointing | " | 1 per 100 square feet. |
| Teak-wood wrought | " | 3 per cubic yard. |
| Rough-stone, delivered on boats | | 11 to 14 Annas do. |
| Chunam | | 6 Annas a para of 20"×20"×10" |
| Firewood | | 1¼ Rupee per bandy load = 2 cubic yards. |
| Masons | | 4 to 7 Annas a day. |
| Carpenters | | 5 to 8 " " |
| Smiths | | 11 to 12 " " |
| Coolies | | 2 to 3 " " |
| Boys and women | | 1 to 2 " " |
| Monthly quarrymen | | 5 to 6 Rupees a month. |

Rates are steadily rising.

MASULIPATAM,
*3rd September* 1864.

(Signed) J. C. ANDERSON, Lieut.-Colonel, R. E.,
*Superintending Engineer, 2nd Division.*

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*Quarries, Stone, &c.*

1. Quarries for the anicut are worked in the Bezoarah and Seetanagram hills, which are within a few yards of the flanks of the work.

2. The stone is of the gneiss species, generally soft, but interspersed with veins of quartz and other hard stone. The rocks are full of cracks and flaws, and though easily worked only here and there yield stone fit for dressing.

3. The largest stone is used for the coping of the main wall of the anicut. The blocks are in many instances six feet long by three feet wide and 1½' thick. The stone hardens by exposure,



4. One reason of the beds of the rivers in Southern India being less deranged by freshes than those which issue from the Himalayas, is that the sand in the former is of heavier and coarser quality. The weight of a cubic foot of sand from the Kistna is when dry 90½ lbs., when wetted the sand will occupy less space, and 7½ lbs have to be added to make a cubic foot, and 21 lbs. of water will be held in the interstices Finer sand from the sea beach weighs 94 lbs. per cubic foot dry, wet sand to a cubic foot 111½ lbs., and water additional 17½ lbs.

MASULIPATAM,
*3rd September* 1864

(Signed) J. C. ANDERSON, Lieut.-Colonel, R. E.,
*Superintending Engineer, 2nd Division.*

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No. 45. From Colonel A J M BOILEAU, R E., Superintending Engineer, 4th Division, to Colonel C. A. ORR, R. E, Secretary to Government, Public Works Department, dated Madras, 2nd December 1864, No 4,432.

SIR,

Proceedings of Government, No 1,215, dated 28th April 1864
Do. No 1,349, 10th May 1864
Do ,, 89, 30th November 1864
Memorandum No. 138, 31st August ,,
Do ,, 68, 21st October ,,
2 Plans

1. Adverting to the Proceedings of Government and Memoranda as per margin, I have the honor to forward the accompanying plans shewing what progress has been made towards carrying out the orders of Government

2 In my letter No 2,642, dated 5th September 1864, I pointed out that I had been unable to obtain the services of a competent Surveyor, although I had advertized for one in the "Fort Saint George Gazette," and I am sorry to say that still proving unsuccessful I have been obliged to content myself with making use chiefly of the services of one of the Apprentices for the purpose, whose work is very incomplete. No. 1 Plan gives a longitudinal section of the Palar river for one mile only above the anicut, and one mile below. As the former shews only the part of the river above the anicut where accumulations have occurred, I was about to return it to have the level carried up one or two miles still higher, and also for the correction of the flood level, which rose two days ago three feet above the anicut. The excessive fall shewn of twenty-five feet in one mile, seemed to me also to want checking. The Apprentice, however, has been engaged lately in studying for his examination and in appearing at the College for the purpose, so that his services have not been available. In the same plan are given two transverse sections, one taken above and the other below the anicut.

3 In Plan No 2, prepared by the Táluq Overseer, (whose services were availed of for a short period at very great inconvenience,) are also given transverse sections of the river above and below the anicut, and sections of the country, but the information given is not what was intended in my call for it, and I apprehend is quite inadequate for the purposes required by the Government of the North Western Provinces. The transverse sections should, I suppose, be carried on either side up to the ridge of the water shed of the Palar valley, and the sections of country are probably required for several miles to exhibit the general fall of the country as compared with that of the river. This will be a very troublesome job, as the whole country thereabouts is ordinarily one vast extent of wet cultivation, and the recent rains and floods render field operations there still more difficult.

4. The Range Officer's attention will once more be drawn to the necessity of furnishing the plans and sections, memoranda, calculations of discharge, and other information called for in the 4th, 5th, 6th, and 7th clauses of paragraph 2 of Colonel Morton's letter.

5 I hope to succeed in obtaining the services of an experienced Surveyor, Mr. Colquhoun, for one month, and I trust that a final report in connection with this subject with plans, &c, complete will be before Government by the 15th January.

6 The present is one of many instances, that continually come before me, of the urgent need of one of that good old useful class of Surveyor being attached permanently to each District of each Division

but the wear and tear from the action of the current is considerable, and every year many of the largest cut-stones are ripped off the crest of the anicut and rolled along for a distance of 20 or 30 yards.

4. The rough stone between the front and rear walls is packed on blocks about 2′ × 1½′ × 1′, some larger some smaller, and that for the apron beyond the rear wall is large and small intermixed; some very large blocks were thrown in there, when the anicut was built. They could then be conveyed by trucks, but now boats only are available, and as they can only pass along the front of the anicut, it would be expensive and would take more time and labor than are available to convey large stone across the anicut to the apron. Hence for any repairs, small stone of the size that a man can carry on his head is used.

5. Considerable damage is produced every year by the freshes. The coping of the front wall is here and there dislodged, and occasionally the rough stone packing is torn up in rear of it. The portion of the anicut most subjected to this action is between 400 and 500 yards from the Bezoarah under-sluice, when the stream after impinging on the Bezoarah quarry hill is thrown with accumulated force. In 1862, a hole 250′ long 50′ wide and with a maximum depth of 8′ or 9′ was thus formed. It has now become the practice to strengthen portions of the work, which are injured in this manner, by party-walls, longitudinal and transverse, which have the effect of holding the rough stone packing together.

MASULIPATAM,
*3rd September* 1864.

(Signed) J. C. ANDERSON, Lieut.-Colonel, R. E.,
*Superintending Engineer, 2nd Division.*

*Memorandum on discharge of Kistna.*

1. The distance from Bezoarah to the sea following the course of the Kistna is 60 miles. A fresh of 37′ on the register, or 17′ above crest of anicut, would have its surface 60 feet above ordinary high-water, and the fall of surface would then be one foot per mile.

2. From this and a cross section of the river taken before the anicut was constructed, I have calculated the discharge at the height specified at 537,000 cubic yards per hour. Average depth 25·4 feet, average mean velocity 6·33 feet per second, maximum (at deep bed) 8·5 per second. The highest fresh on record was 39 feet on register. Taking the average depth then at 27·4 and the mean velocity compared with the other as the square root of the depth, the discharge would be 3,600 × 27·4 × 6·5 = 641,160 cubic feet per second.

3. The following information may be found useful :—

Observed height of Kistna above and below anicut reduced to zero of register, which is 20 feet below crest of anicut.

| Depth on crest. | Depth below Anicut. |
|---|---|
| 20·6 | 9·9 |
| 21·0 | 10·3 |
| 22·0 | 12·9 |
| 23·0 | 14·11 |
| 24·0 | 17·0 |
| 25·0 | 19·0 |
| 26·0 | 20·11 |
| 27·0 | 22·9 |
| 28·0 | 24·4 |
| 29·0 | 25·10 |
| 30·0 | 27·2 |
| 31·0 | 28·3 |
| 32·0 | 29·4 |
| 33·0 | 30·4 |
| 34·0 | 31·4 |
| 35·0 | 32·3 |
| 35·6 | 32·11 |
| 35·8 | 33·1 |



No 46 From Captain J. BEAN, R. E, Officiating Superintending Engineer, 6th Division, to Major J. H. M. SHAW STEWART, R E., Deputy Secretary to Government, Public Works Department, dated Tanjore, 30th July 1864, No. 927.

SIR,

1. I have the honor to forward by banghy* agreeably to Government Order, No. 1,215, dated 28th April 1864, the following plans, with reference to the Upper Coleroon Anicut :—

* 2 Plans.

I. Longitudinal section of the Coleroon and Cauvery river beds above and below the Upper Anicut, for a distance of two miles and one mile respectively.

II. Transverse sections of the same rivers shewing the average and flood levels.

III Plan and section of the Upper Anicut with specification and memorandum of rates of different descriptions of work entered on the plan.

2. I beg also to report that the highest flood discharge of the Cauvery at the dam constructed across its head, as near as we can ascertain, is seven million cubic yards per hour, and in the dry season, about one million cubic yards per hour. The discharge over the Coleroon Upper Anicuts in the highest flood is 700,000 cubic yards per hour. The volume flowing through the anicut sluices in the dry season has not been accurately ascertained.

3 I have no levels of the country in the neighbourhood of the Upper Anicut, but the river passess through rice lands, the country being perfectly flat.

4 I find it difficult to get accurate information regarding the construction of the anicut, as it was built 28 years ago. The work was commenced very late in the season of 1835 and completed by June 1836 No special interruption occurred during this period, and whatever water flowed in the bed of the river was turned off the works by means of embankments thrown up in front. The anicut was breached in 1837, and it was found desirable to improve the section by extending the aprons and otherwise strengthening the work. The following statement of the cost for four years after construction may prove useful :—

*Upper Anicut.*

| | Rs. |
|---|---|
| Construction in 1836 ... ... ... ... ... ... | 85,389 |
| Repairing breach, &c., in 1837 ... ... ... ... | 25,473 |
| Repairs and improvements in 1838 ... ... ... ... | 10,475 |
| Do. do. in 1839 ... ... ... ... | 18,785 |
| Total .. | 1,40,122 |

5. The stone used in the construction of the Upper Anicut was granite, and was brought to the work spot on Wudder carts a distance of ten miles, and, occasionally, when sufficient water in the river bed allowed of it, on basket boats. The rough stone averaged from three to nine cubic feet, and the cut-stone six cubic feet in size.

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No. 47. ORDER THEREON, 6th January 1865, No. 22.

Ordered that the following letter be despatched :—

(Here enter No. 23, dated 6th January 1865.)

(True Extract.)

(Signed) CHARLES A ORR, Colonel, R E,
*Secretary to Government.*

Exd. S. T. Augustin

PUBLIC WORKS DEPARTMENT.
*Public.*
FORT SAINT GEORGE,
*6th January* 1865.

No. 48.

No. 23.

From

COLONEL C. A. ORR, R. E.,

*Secretary to the Government of Fort Saint George, P. W. D.,*

To

*The Secretary to Government, North Western Provinces,*
*Public Works Department.*

SIR,

1. I am directed by His Excellency the Governor in Council to forward, in compliance with the request made in your letter No. 1,238 A. dated 29th March 1864, copies of the correspondence marginally noted, with the plans and other papers therein referred to, containing the information required by the Honorable the Lieutenant-Governor, North Western Provinces, regarding the Godavery, Kistna, and Upper Coleroon Anicuts.

From the Superintending Engineer, 1st Division, No 444, dated 23rd June 1864, with three enclosures and two plans.
From the Superintending Engineer, 2nd Division, No 70, dated 3rd September 1864, with three enclosures and five plans
From the Superintending Engineer, 6th Division, No 927, dated 30th July 1864, with two plans.

2. His Excellency regrets that the information regarding the Palar Anicut is not yet available. The Superintending Engineer, 4th Division, has promised to submit, by the 15th proximo, a final report on the subject with the necessary plans, &c, which shall be forwarded to you immediately on receipt.

3. Fuller information than can be elsewhere obtained regarding the Godavery, Kistna, and Coleroon Anicuts will be found in the accompanying copies (Volumes I to IV) of the Professional Papers of the Madras Engineers.

I have the honor to be,
Sir,
Your most obedient servant,
(Signed) CHARLES A. ORR, Colonel, R. E.,
*Secretary to Government.*

Exd. S. T. Augustin.

No 4432- Superintending Engr Office 4th Dn
Madras, 2nd December 1864

From Colonel A. Pollean, R.E
Superintending Engineer 4th Dn

Public. To Colonel C. A. Orr, R.E.
Secretary to Government F.W.D.

Pro. Govt No 1215 of 28 April 64
D No 1349 - 10 May 1864.
D No 89. 30 Nov 64
Genl No 138. 31 Aug 64.
D 68. 21 Oct 64
2 Plans.

Sir,

Adverting to the Proceedings of Government, and Memoranda as per margin, I have the honor to forward the accompanying Plans shewing what progress has been made towards carrying out the orders of Government.

In my letter No 2642 dated 5th September 1864, I provided out that I had been unable to obtain the Services of a competent Surveyor although I had advertized for one in the Fort St George Gazette, and I am sorry to say that while proving unsuccessful I have been obliged to content myself with making use chiefly of the Services of one of the apprentices for the purpose, whose work is very incomplete. No 1. Plan gives a longitudinal section of the Palar River for one Mile only above the Anicut, and one Mile below. As the former above plans only

only the part of the River above the Anniceut where accumulations have occurred, I was about to petition it to have the level carried up one or two Miles still higher, and also for the correction of the flood level, which rose 2 days ago 3 feet above the Anniceut. The excessive fall shown of 25 feet in one mile, seemed to me also to want checking. The Apprentice, however, has been engaged lately in studying for his examination and in appearing at the College for the purpose, so that his services have not been available. In the same Plan are given 2 Transverse Sections one taken above, and the other below the Anniceut.

In Plan No 2 prepared by the Talook Overseer (whose services were availed of for a short period at very great inconvenience) are also given Transverse Sections of the River above and below the Anniceut, and Sections of the Country, but the information given is not what was intended in my call for it, and I apprehend is quite inadequate for the purposes required by the Government of the N. W. Provinces. The transverse Sections planed, I suppose, be carried on either side up to the ridge of the

watershed of the Palar Valley, and the Sections of Country are probably required for several miles to exhibit the general fall of the Country as compared with that of the River. This will be a very troublesome job as the whole Country thereabouts is ordinarily one vast extent of wet cultivation, and the present rains and floods render field operations there still more difficult.

The Ranges Officers attention will once more be drawn to the necessity of furnishing the plans and Sections, Memoranda, Calculations of discharge and other information called for in the 4th 5th 6th & 7th Clauses of Para 2 of Colonel Mahon's letter.

I hope to succeed in obtaining the services of an experienced Surveyor, Mr Colquhoun, for one month, and trust that a final report in connection with this subject with Plans &c. complete will be before Government by the 15th January.

The present, is one of many instances, that continually come before me of the urgent need of one of that good old useful class of Surveyor being attached permanently

to

to each District of each Division.

I have the honor to be
Sir,
Your most obt Servant

Madras
2d Dec 1864

H Pollock Colr R.E.
Supg Engr 4th Div

To
Colonel C. A. Orr, R.E.
Secretary to Government
P.W.D.

1864 Depart
Pol: 1st Coast for Jany/65
From No 5205
The Supg Engineer
4th Division
To
The Secy to Govt
P. W. Depth
Dated 2d } Dec 1864
Recd 3d }

E-2 No 4432.

Forwards two plans shewing what progress has been made towards carrying out the Orders of Government regarding the Pálar Annicut.

J: 45.

No 5224 29 - 6th Jany 1865.

C. 16th Dec 1864 (No. 2 Encl)

Means of rates at Bezwarah
Ancient.

| | | |
|---|---|---|
| Cut stone. Opening large blocks about 6'×3'×1¼ | 70 Rs. | per Cft. |
| Smaller Cut stone 9" to 1" thick | 3 to 6 Rs. | according to size |
| Cut stone. Cut waters of piers. large. | 9–10 Rs. | per Cft. |
| Rubble Masonry and Chunam | 2–3 Rs. | Do. |
| Hammer dressed. | 3½ Rs. | Do. |
| Concrete | 1½ Rs. | Do. |
| Rough stone packing | 1½ Rs. | Do. |
| Rough stone filling in | 1 Rupee | Do. |
| Pointing | 1 Rupee | per 100 Square feet. |
| Teakwood wrought. | 3 Rupees | per Cft. |
| Rough stone delivered in boats | 1 Rupee 614 As. | Do. |
| Chunam | 6 Annas a par a | 1 20"×20"×18" |
| Firewood | 1¼ Rupee | per boat load = 1 Cubic Ft. |
| Masons | 4 to 7 Annas | a day. |
| Carpenters | 5 to 8 " | Do. |
| Smiths. | 11 to 12 " | Do. |
| Coolies | 2 to 3 Annas | a day. |
| Boys and women | 1 to 2 Annas | " |
| Monthly Quarry hire | 5 to 6 Rupees | a month. |

Rates

Rates are steadily rising.

Sd Jackson
Lieut Colonel RE
Supt Engineer Dd Dy

Supt Engineers Office
Dd Dy Jerusalem
2 September 1864

Quarries. Stone &c.

1 Quarries for the Ancient are worked in the Bezoarah and Leetanagrew Hills which are within a few yards of the flanks of the work.-

2 The stone is of the Gneiss species generally soft, but interspersed with veins of quartz, and other hard stone. The rocks are of full of cracks and flaws and though easily worked, only here and there yield stone fit for dressing.

3 The largest stone is used for the coping of the main wall of the Ancient. The blocks are in many instances 6 feet long by 3 feet wide and 1½ thick. The stone hardens by exposure but the wear and tear from the action of the current is considerable and every year many of the largest cut stones are ripped off the crest of the Ancient and rolled along for a distance of 20 or 30 yards.

4. The roughstone between the front and rear walls is packed as blocks about 2'x1½'x1'. some larger some smaller. and that for the Apron beyond the rear wall is large and small intermixed. Some very large blocks were thrown in there, when the Aniout was built. they could then be conveyed by trucks, but now boats only are available, and as they can only pass along the front of the Aniout, it would be expensive and would take more time and labor than are available to convey large stone across the Aniout to the Apron. Hence for any repairs, small stone of the size that a Man can carry on his head is used.

5. Considerable damage is produced every year by the freshes. The coping of the front wall is here and there dislodged and occasionally the roughstone packing is torn up in rear of it. The portion of the Aniout most

Subjected to this action is between 400 and 500 yards from the Bezoarah Undersluice where the stream after impinging on the Bezoarah Quarry Hill is thrown with accumulated force. In 1862. a hole 250' long 50' wide and with a Maximum depth of 8 or 9' was thus formed. It has now become the practice to strengthen portions of the work which are injured in this manner, by parallel walls. longitudinal and transverse which have the effect of holding the roughstone packing together.

Supt Engineer's Office 3d Divn
Ahsalipatam
3d September 1864

J. Anderson Lieut Colonel
Supt Engineer 3d Division.

No 40
Sir

Sapper's Office 2nd Dpt
Mauritius
32 September 1864.

From

Lieut Col C. Shervinton R.E.
Supt Engineer 2nd Dpt

To

The Secretary to Government
&c &c &c

Plans
sent for
inspection.

Sir

Referring to G.O. No 12/15
dated 28th April 1864, in which I am
directed by Government to furnish
a statement regarding the Riviere Noire Bridge
now in course of construction,

I have the honor to forward the following
documents:-

1 A longitudinal section of the bridge
of the Riviere Noire in the direction of the stream;
also a survey of the Rivers Creek and
showing the Condition at the bridge
site of the Rivers Creek (May 1864)

2 Transverse sections of the River
above and below the bridge.

3 Three lines of level along the princi-
=cipal channels on the right bank of the
River, and a line of level along the
River bank, 8 miles upstream from
Pamplemousses.

I have &c &c &c

Lieut Col
Supt Engineer 2nd Dpt

Enclosure in a letter
from the Superintending
Engineer 2nd Dpt
to the Secretary to Govt
No 70 dated
32 September 1864.

No 4657/64
From 1st January 1844

Rivers du
Poudre d'Or

6 Memo of Discharge

7 Do Regarding Marine

8 2 The Victoria Aqueduct was Commenced in November 1853 and Completed in May 1855. Full information regarding the Mode of Construction will be found on reference to Colonel Ouseley's Reports which have been published in the 2nd Vol of Professional Papers of the Madras Engineers.

9 3 A Skeleton Map of the Delta is also forwarded with the other plans.

I have the honour to be
Sir
Your Most obedient Servt

J. Anderson Lieut
Offg Secretary to Govt

Extract from the Second Report on the Delta of the Godavery.

The Godavery, rising near Bombay, passes for several hundred Miles through an open Country, watered chiefly by the S.W. Monsoon. About 200 Miles from the sea, it enters the hilly tract that runs at the back of the Northern Circars, and at sixty Miles from the sea it enters the alluvial Country which it has itself formed. It seems very remarkable, that in passing through the great barrier of hills (I find from information which seems to me Conclusive) it has so effectually made its way, that there are no falls throughout the whole length of its Channels, nor indeed any obstructions of Consequence. Such is the statement

of

of the boatmen who navigate the river, and it seems to be completely confirmed by the fact, that the timber rafts never come down from the Hyderabad Country except when the river is almost at its lowest, and has not more than two or three feet of water at the fords in the low Country. The alluvial land does not immediately expand to a great width from the point at which the river leaves the main range, there being still rising grounds and detached patches of hills, at a distance of from half a mile to five miles from the river, for the distance of twenty-three miles further; at the ends of which distance, two or three detached hills came close to it, the river divides into two streams, the alluvial Country spreads out on both sides, and the Delta may properly be said to commence,

extending



extending in the West side till it meets that of the Kistna at the Colair Lake, about forty miles, and in the East side about thirty-two Miles to the shore of the Coringa bay, where this Coast runs for some distance nearly North and South.

Within the lines of the hills the river has, I conclude from the above-mentioned fact, a very moderate fall; and I saw that such was the case for some distance within. From the hills where the alluvial land immediately adjoining the river is eighty feet above the level of the sea at high water, spring tides, it has a most regular slope, commencing with a foot and a half per Mile and gradually diminishing to one foot, as it approaches the sea. The rise and fall of the river there is thirty-eight feet; and as the rise of the river is reduced to nothing at the sea,

it

it follows that the summer surface of the river must have a less fall than that of its banks to that extent, viz., thirty-eight feet, so that at Palaveram, where it leaves the hills, the summer level is only forty-two feet above high water, and the bed at the ford there only thirty-eight feet. But the fall of the bed, or even of the summer surface of the river is by no means regular, like that of the surface of the floods and that of the land: Between the fords there are deep hollows, one I measured thirty feet deep in summer, another twenty-six feet; and in one place I find a slope of nine feet in three miles in the summer surface of the water: in another only one and a half foot in four miles. The average from the hills to the sea is seven and a half inches per mile. At the head of the Delta, the



bed at the ford is twenty-two feet above the sea, and the distance being thirty-eight miles in a direct line, the average fall measured in that way is seven inches a mile; but if the actual length of the river, viz., fifty miles is taken, it is only five and a quarter inches.

Besides the slope of the bed towards the sea in a Delta, it has another slope, viz., a fall from the river in a direction perpendicular to its course, and this fall is much more rapid than that towards the sea. In the present case it has been ascertained to be in one place viz., soon after the river leaves the hills, eighteen feet in one and a half miles, to where it meets the adjacent hills on the East side. In another on the West side, about four miles from the Hills, eight feet in three quarters of a mile. Near the head of the Delta, sixteen feet in two miles on the West, and seven feet

feet in two and a half miles on
the East side. Thirteen miles further
down, that is, twenty-four miles
from the sea, the fall is nine feet
in two and a half a miles on
the West side of the Godavery.
Thus the river banks form a
ridge from eighteen to seven feet
above the level of the land, at
the distance of from three quarters
to two and a half miles distant
on either side, providing most
remarkably for the leading out
of the water upon the lands.
The slope of the country towards
the sea, at the foot of the ridge,
is uniformly one foot one inch per
mile on the West side, all the
way from near the hills. On the
East side the distance being shorter,
to the bay of Coringa, the fall
is one and a quarter foot per
mile, from near the head of
the Delta where the Dowlaiswaram

hill

hill closes in the bank of the
river.

17

9

/True Extract/

Major
Executive Engineer Godavery

Dowlaiswaram
17 June 1846

Executive Engineer's Office
Cocanada 17th June 1864

No 79

From Major H. Goldsmid (RE)
Executive Engineer Godavery

To Lieut Colonel C. Allen, Chief Engineer
Superintending Engineer
Circle

Sir

With reference to your letter
No 65 dated 5th ultimo I have
the honor to forward the following
documents connected with the
Godavery River and Colonel Morton's visit.

Enclosures 4
2 Plans
1 Letter
1 Extract from Report

In a letter No 79
dated 17 June 1864
from the Executive
Engineer Godavery
District to the Supg.
Engineer 1st Division

No W 3168/64

From 1st January 1865

Extract from the
2d Report on the
Delta of Godavery.

taken last year in the Vicinity of Amicut with transverse sections above and below and shewing height of Ordinary Floods and of the Extra-ordinary Flood of 1861.

2d. Plans and Sections of each of the 4 branches of the Amicut in their present State - that is 3 of them raised 2 feet in the last 2 years

× Rally Muddoor & Vijayawaram

3d. Extract of a Report on the Godavery Delta made to Government by Colonel Cotton in April 1845 - descriptive of the Course of the river, the fall in its bed and the fall from its banks on either side in a direction perpendicular to its Course - This Extract will answer the purposes of the sections of the Country in the Vicinity of the Amicut - but which I regret it is impossible

19

to get done with our present Establishments -

4th. An original letter from the Sub Engineer at present in charge of the Amicut and who has been intimately connected with the Work from its very Commencement and who is therefore a good authority on the original cost of each kind of Work, nature and cost of foundations &c &c -

5th. The calculated discharge of the extra-ordinary flood of 1861 was 210 Millions Cubic feet per minute and the discharge of the Godavery during the driest season is not less than 90000 Cubic feet per minute -

6th. The distance from which the Stone of which the Amicut is built, was brought, was not more than 4 Miles to the farthest point of the Amicut -

The

of the Amicut was procured from

The Stone used is a Sand Stone found in various Stages of hardness - Some of it making excellent Cut Stone Coping - It is an excellent building Stone a Cubic Yard of it weighs 1¼ Ton -

The Stone was conveyed from the Quarries to the edge of the River on Wagons, running on iron rails, and from thence in barges to the Site of the Work - An excellent hydraulic Lime Stone is found in immense quantities at Catair about 8 Miles from the Annicut -

In concluding this Letter I would suggest that a copy of the 3d Vol. of the Madras Engineering Professional Papers, be forwarded to Colonel Morton - as it contains full particulars of the Construction of

* magnesian limestone found between two outflows of basalt - it is full of fossils Echinus &c the Nummulitic series

of the Godavery Annicut from its Commencement till its Completion and which cannot be obtained from any other Source.

I have the honor to be
Sir
Your most obedient Servt
Lt Colonel & Major
Executive Engineer Godavt

Dowlaiswaram
17th June 1844

of the Annicut was protected from

No. 5 Range Office
Aberdeenshire
18th May 1854.

No. 6

Major A. Anderson
Executive Engineer

Sir,

I have the honor to forward the information required in your letter No. 26 of 13th inst. as below specified.

I. Plan & Profection of the Aniat Head branch of the Aberdeen Canal — 1 Section & Plan forwarded.

II. Mens. & rates for the several kinds of work executed on the Canal.

(a) Cost of bell mouth sluice of the Canal at the time of Commencement of Aniat. — Bells 6 feet by 4½ feet. Cost of each £ 4—12—

(b) Rough stone in Chisnies — Per Cubic yard £ 1—10—

(c) do in Arbroath — do — 1—4—

(d) Cut stone Coverings — do — 4—0—

(e) Cyclopean stone Coverings — do — 2—8—

The Aniat was Commenced in 1846 & Completed in 1852.

No work has been executed during the Winter

The unfinished portion of the Aniat was protected from

Dundee 8th/54
Aniat
Mr Executive Engineer
Aberdeen
Sir
I have the honor to
Your obedient Servant
Engineer
Received 12th Aug 1854
Recorded
No 26
Enclosures 4
Returned
Returned the
Sir
I have the honor to be
Your obedient Servant
Engineer & Surveyor

III. The period at which the Church was Completed. The Work done during each season, the Means adopted to protect the unfinished Church from floods.

from floods by large quantities of Rough Stone thrown in such directions, as seemed best calculated for the purpose. The work was Commenced in the year 1846 with the Semi-circular Arch. The Rubble Work of the Nave Branch was finished to the height of 9 ft above the Arch laid in the year 1847 & the Mullion & Square Branches to the height of 10½ and 9 ft respectively finished in 1849. Rubble Branch Parapet by Rough Stone Dam. The Rubble Work of the Church was Completed in the year 1850. The Groins with Dressed Stone of the Nave Arches Rubble and Quadrated. Church was finished in 1851 Mullion Mullion Church with Coping Stone in 1852.

I have the honorable
Lord
Your obedient humble
Servant
William Richardson
Civil Engineer & Architect

Superintending Engineer's
Office 1st Division /
Baltair 23rd June 1864.

No. 444

From

Lieutenant Colonel Chambers R.E.
Superintending Engineer
1st Division

To

Colonel C. A. Orr R. E.
Secretary to Government
P. W. Works.

Sir,

In obedience with the order of
Government as per margin, I do myself
the honor of forwarding 2 plans* and
three papers which will supply the
Lt Governor of the North Western
Provinces with the information regard
ing the Godavery and its dam he is
in need of.

2. These three papers are:

a. Letter from Major Woodward
giving the maximum and minimum
discharge

G.O. No 1215
of 28 April 64

*Sent by
Baughy.

---

From
Superintending Engineer
1st Division
To
Secretary to Government
P. W. Works
Subject
Plans and papers
connected with the
Godavery Project
Remitted
Dated 23rd June 1864
Received
Dated
Registered
Dated
Answered
Dated
Referred to
Dated
Returned
Dated
Memorandum
P. W. D. 88/64
Ten Thousand Nos.

discharge of the River, information, re-
garding the nature and quality of the
Stone and Lime used on the work, as
well as the means of transporting the
same to the Dam.

b. Extract from a Report from
Sir A. Cotton giving the necessary
information regarding the Longitudinal
Section of the River's bed, as well as
the levels of the Country in the vicinity
of the work.

c. Information from the Asst.
Engineer in charge of the Anicut, T.
Viramagaris R. Bs. on the subject of the
rates of the several kinds of work at
the dam, on the time it was under con-
-struction, and on the means used to
protect it from floods when incomplete.

3. In conclusion, I beg to recommend
Major Stoddard's suggestion to Govern-
-ment that a Copy of the Papers of the
Madras Engineers treating of the Goda-
-very works, should be sent to his as-

Vol VII

Honor the Lieutenant Governor North-
Western Provinces.-

21 2

I have the honor to be
Sir,
Your Most obedient Servant

R. Chambers Lieut.
Superintending Engineer 1st Dr.

Rec'd

Copy

Lieut. Col. Wise to Dr. Tayne 30th July 1864

Enclosure 1

Captain J. Dean R.E.
Office Lieut. Colonel & Dr.

Sir,

Major J. H. H. Elliot Adjutant R.E.
Deputy Secretary to Government P.W.D.

Sir,

I have the honor to forward by
[illegible] herewith, agreeably to Government Order
No 1215 dated 28th April 1864, the following
Plans with reference to the Lytton-Colquhoun
Military Road.

Viz:

I Topographical sketch of the Eleven
and Quarry Rivers above and below
the Lytton Crossing for a distance of two
Miles and a Mile respectively.

II Transverse Section of the same
rivers showing the average and flood levels.

III Plan and Section of the Lytton
Crossing with explanation and Memo:

Accompanied with specifications and
Memorandum of works executed on the Plan.

I would submit that the Plan also to replace that the
Ships also to replace that the Company at
Kinchelin flood discharge of the Company at
the Dam constructed, assures its [illegible]
and

[illegible] 1865 Date
No 30/8
From Govt for January
Telegraphically
Ref Enclosure

To The Secretary to Govt
Do

Rec'd 25th June 1864
Sent 26 — do —
Rec'd 9 July

No 464
Encls 5

Forwards 2 plans and
3 profiles which will
supply the Govt of
the North Western
Provinces with the infor-
mation regarding the Loss
and the dam he is in
hand of

No 403

No 22 & 23 - 6th January 1865.

Rec'd 16th Dec. 1864 On 22nd

as near as we can ascertain, is 7 Million Cubic yards per hour, and in the dry season, about 1 Million Cubic yards per hour. The discharge over the Coleroon Upper Anicuts in the highest flood is 700,000 Cubic yards per hour. The volume flowing through the Anicut Lines in the dry season has not been accurately ascertained.

3 I have no Levels of the Country in the Neighbourhood of the Upper Anicut, but the River passes through rice lands the Country being perfectly flat.

4 I find it difficult to get accurate information regarding the construction of the Anicut, as it was built 28 years ago. The work was commenced very late in the season of 1835 and completed by June 1836. No special interruption occurred during this period and whatever water flowed in the bed of the River was turned off the works by means of embankments thrown up in front. The Anicut was breached in 1837, and it was found desirable to improve the section by extending the Aprons and otherwise strengthening the work. The following Statement of the cost for 4 years after construction may prove useful

| Upper Anicut | | Rupees |
|---|---|---|
| Construction in | 1836 | 85,389 |
| Repairing breach &c. in | 1837 | 25,473 |
| Repairs and improvements in | 1838 | 10,475 |
| Do. Do. in | 1839 | 18,785 |
| Total Rupees | | 140,122 |

5 The stone used in the construction of the Upper Anicut was granite and was brought to the work spot on Trichinopoly Carts a distance of 10 Miles, and occasionally, when sufficient water in the river bed allowed of it, on basket boats. The rough stone averaged from 3 to 9 Cubic feet and the cut stone 6 Cubic feet in size.

I have the honor &c.
Sir,
Your most Obedient Servt
Lieut Capt RE
Offg Supt Engineer
So Dn

Proceedings of the Madras Government
Under date the 6th January 1865 No. 1

From the Secretary to Government
Public Works Department

Forwarding a Plan and a Report
which with the Plans Drawings
&c therein referred to has been
submitted for the information
-ning and disposal of the Govt

From the Secretary to Govt P.W.D.

Forwarding certain information
regarding the Cauvery Mettur
Project &c &c

From the Secretary to Govt P.W.D.

Forwarding Plans &c &c

From the Secretary to Govt P.W.D.

Dated 30th July 1864
Rec'd 2nd Aug. 1864
No. 927.

Forwarding Plans of the Upper Coleroon Anicut and offering certain remarks in connection with the work.

No. 46.

1864 Date
No. of Govt Letter
From
To
The Secretary to Govt P.W.D.

Dated 30th July 1864
Rec'd 2nd Aug.
No. 927.

Forwarding Plans of the Upper Coleroon Anicut and offering certain remarks in connection with the work.

No. 46.

No. 1 dated 6th January 1865.
No. 22 dated 23rd January 1865.

No. 22

Proceedings of the Madras Government
Under date the 6th January 1865 No. 1

From the Secretary to Government
Public Works Department

Forwarding a Plan and a Report
which with the Plans Drawings
&c therein referred to has been
submitted for the information
-ning and disposal of the Govt

From the Secretary to Govt P.W.D.

Forwarding certain information
regarding the Cauvery Mettur
Project &c &c

From the Secretary to Govt P.W.D.

Forwarding Plans &c &c

From the Secretary to Govt P.W.D.

Ordered that the
following letter be despatched.

No. 23

To
The Secretary to Government
Madras Public Works Department

Sir,

I am directed

Governor in Council to forward, in compliance with the request made in your letter No 1238. A dated 29th March 1864, Copies of the correspondence marginally noted with the Plans and other papers therein referred to, containing the information required by the Honorable the Lieutenant Governor North Western Provinces, regarding the Godavery, Kistna and Upper Coleroon Anicuts.

2. His Excellency requests that the information regarding the Palar Anicut is not yet available. The Superintending Engineer S.D. has promised to submit, by the 15th Proximo, a final report on the subject with the necessary plans, &c., which shall be forwarded to you immediately on receipt.

From the Supg Engr 1st Div No 46/64 dated 23rd June /64, with 3 Enclosures and 2 plans—

From the Supg Engr S. Div No 89/70 dated 3rd Septr /64. with 3 Enclosures & 5 plans

From the Supg Engr S.D. No 927 dated 30th Dec /64 - with 2 plans—

Ins

2872

3 Fullest information than can be elsewhere obtained regarding the Godavery, Kistna and Coleroon Anicuts will be found in the accompanying Copies (Nos 1 & 11) of the Professional papers of the Madras Engineers.

1st
2d

Chepauk
6th January 1865

Secy to Govt

Secrt 9th January 1865 - With all the Enclosures mentioned in the letter.

P. V. 1865 Depts
P. Co: of Goods for Chas.
P. 22 & 28
P. Co: of the Bilgood
2 f 6 Jany 65.

Letters from the Supt
Engineers 1st & 2d Divs submitting
Estimates &c. of the Gadsden, Fishburn
and Nelson Colorow Excavators
(Ordered to the Command'g Off.
the Gen'l. of the N. H. Companies

P. 40. @ 48