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*Proceedings of the Madras Government, Public Works Department,
19th April 1875.*

No. 483. Read the following letter from Major J. O. HASTED, R.E., Superintending Engineer, Kistna, to Lieutenant-Colonel JOHN MULLINS, R.E., Chief Engineer for Irrigation, dated Camp at Inampudy Tunnel, 5th March 1875, No. 153:—

With reference to your memorandum, No. 581-D, dated 11th August 1874, I

- 1 Original letter from the Officer in charge of Cumbum Range, to the District Engineer, Kurnool, No. 407 of 17th Sept. 1874.
- 1 Sketch of the rocks and gap at Oomadavaram.
- 1 Plan and section of the sluices proposed for Oomadavaram Project.
- 1 Atlas sheet No. 76, (tracing).
- 1 Longitudinal section of the gap.
- 1 Atlas sheet No. 76, complete.

have the honor to submit the following report on the reservoir proposed by Captain Taylor at Momadianarem in the Kurnool District.

2. I spent between two and three days examining the site of the proposed bund, waste weir, &c., and have been in communication with Captain Taylor, who has kindly furnished me with all the information at his disposal regarding the proposed work. The register and sections of the Gundlacumma, referred to in Captain Taylor's letter to you of the 21st October 1874, have unfortunately not been found, and I learnt that the Brahmin living at Vellumpally who gauged the river was absent from his village.

3. The following account of the proposed reservoir, I have gathered from Captain Taylor's communications and from Mr. Bell's report, No. 407, dated 17th September 1874.

A little below the village of Momadianarem, the Gundlacumma immediately after receiving the waters of a drainage stream called the Kundlair passes through a gap in a line of low hills called the Yerramleys, lying partly in the Kistna and partly in the Kurnool District. A dam is proposed to be constructed across this gap, about 120 feet high, to form a large reservoir. A waste weir is proposed over a saddle in the hills 4 or 5 miles to the north of the gap, a single irrigation channel taken off immediately to the north of the river to be excavated, which may be made navigable and connected with the Kistna channels at or near Bezorah.

The width of the gap or space between the foot of hills on either side is about 3,000 feet, length of the top of the bund would be about 5,000 feet. The breadth of deep channel of the river is 600 feet, water-spread in floods 2,300 feet. The level of the gap (whether ground level or river bed level is unknown) is stated to be 340 feet above mean sea level. The minimum flow of the river is 800 cubic feet per second, the fall of the bed of river above gap from 3 to 4 feet per mile, the fall of the country towards sea about 4 feet per mile.

Several saddles in the range are said to be available for escapes, but the one fixed upon by Mr. Bell is 4 or 5 miles north of the gap, and is said to be 80 feet above the gap.

The drainage area of the river basin is above 2,000 square miles, rainfall assumed to be 27 inches in the year, but probably higher. Area of reservoir when full 100 square miles, mean depth 7 to 9 yards. Irrigation expected 300 square miles which, at Rupees 6 per acre for two crops, would yield a return of 11½ lakhs of Rupees.

Dam* to be of earth, with a concrete core and puddle wall in front, revetted with stone, scouring sluices to be built in bed of river under the dam. Irrigation sluice to be built through dam and supplied by openings in a masonry tower. Mr. Bell proposes to take advantage of a rock (20 feet high) in the gap to build the dam over it.

* Section enclosed.

The water-spread of the tank would submerge only five villages. A great part of the land submerged is waste of no value.

4. The basin is certainly a very fine one, and I have little doubt of the correctness of the water-spread as laid down by Captain Taylor, supposing that such a dam as he proposes were constructed, and the reservoirs were full. The lake would be a magnificent one, and in the midst of this dry and sterile country would undoubtedly prove of great benefit.

5. Agreeing with Captain Taylor as to the immense benefit that such a reservoir would be to the country, I have considered four points to which I will now direct attention as shortly as possible, first the feasibility of constructing such a dam, second the quantity of water it will be possible to store, third the probable cost of the works, and fourth the revenue that may be expected in consequence of this outlay.

6. I must premise that, in the absence of any levels, except a section of the gap and escape saddle, prepared apparently by an Overseer of the Kurnool District, and other definite information, all that I put forward now is the result of careful examination of the ground at the site of the proposed dam and in the neighbourhood and of many miles of exploration on and below the hills on either side of the gap, with readings of an aneroid barometer. The figures I give, though the result of careful consideration and calculation, must not be regarded as absolutely accurate, but as the best approximations I am able, with the information at my disposal, to make.

7. *The feasibility of constructing the dam.*—The section accompanying shows as before-mentioned that the width of the gap between foot of hills is about 3,000 feet, and at level of top of proposed bund about 5,000 feet. The deep bed of the river runs at the foot of the southern range of hills, and I may mention that the slope of the northern hills seemed to me to be considerably less above the water mark than shown on the section, but I could not be certain where the section was taken exactly. The hills on the north run up gradually from the gap till about one mile north of it I made the summit to be about 200 above river bed. Going on to the north I have noted first saddle to be about 170 feet above river bed, next high point about 190 feet, second saddle 140 feet, third saddle 140 feet, fifth saddle 200 feet, the two last are above Koopaconda tank. I was unable to find any saddle so low as that mentioned by Mr. Bell; even supposing he means that the height of the escape saddle is 80 feet above the general level of the gap, and not the deep bed of river. On the south the hills run up to a much greater height than 200 feet though gradually and the saddles all appear to be much higher.

8. The difficulty of finding a saddle of about the requisite height is, therefore, a serious question, any considerable cutting down of the ridge being a very expen-

sive matter; it is possible, however, that one of the saddles may turn out to be lower than I made it, the situation would then be suitable, the surplus water would fall again into the natural bed of the river below the dam, and the only difficulty would be that the Irrigation channel Captain Taylor proposes would have to be carried over the escape channel. The other point requiring notice in connection with the escape channel is that, if the weir is above the Koopaconda tank, the tank and cultivation below will probably have to be taken up.

9. The hills are very stony with rock continually cropping up and thinly covered with small bushes. The rocks appeared to me to be clay shale and quartzite with masses of quartz. Pieces of lime kunkur were occasionally found, and remains of a very small native kiln showed that it had been burnt here. The soil in the basin above the gap is very light red soil. Mr. Bell has mentioned that the soil for the bund may be brought from the high ground quarter of a mile in front of it. I therefore carefully examined this ground and the river banks both of the Gundlacumma and Kondlair for some distance up; I find the soil the same throughout, and it was only in the hollows in the river bed that I found anything like clay, and that in very small quantities. I can hardly imagine worse soil of which to construct a large bund, and I do not know where clay for the puddle bank, which would be an absolute necessity, is to come from, though it is possible it might be found by excavation in old courses of the river. Unless further examination should disclose better material, I would not recommend the construction of an earthen dam.

10. I think, therefore, that the dam would have to be constructed of masonry, the best rubble masonry. The stone that I met with is not good building stone; but Mr. Bell mentions that a fair quality of stone, a sort of slate, easily quarried and that hardens with exposure, is procurable. I conclude he refers to a clay shale, and some qualities of this might be suitable. The lime kunkur I met with I take to be similar to that found in many parts of this district, and which yields a very fair lime I believe slightly hydraulic; fuel is not procurable near at hand, but within ten miles distance it appears to be plentiful. It may be a question, I think, if the dam could not be built with concrete, the front slope protected with stone revetment from the wash of the water. Captain Taylor, it will be observed, proposed a concrete core to his dam, with a puddle wall in front, but he also allows an earthen bank over all.

11. Mr. Bell has advised that advantage should be taken of a rock in the gap (20 feet high) to build the bank over it. This rock I make out to be about 50 feet high. The dam, I think, should be wall in front of it, and certainly not over it, whatever materials the dam were constructed of there must be uneven settlement if it is over the rock. Advantage, however, might, it occurred to me, be taken of it in building the dam to turn the river by a bank abutting on it.

12. Captain Taylor has proposed scouring sluices in the bed of the river under the dam for the purpose of keeping the reservoir clear of silt. He has found from experiment that the Gundlacumma in flood contains 5 per cent. (in bulk) of silt in suspension, and he states that it has been ascertained from cross sections of the Cumbum tank that the bed has been raised by silt 45 feet in about 300

years. I am doubtful of the effect of such scouring sluices, they would probably affect the deep portion of the river bed only for a short distance, and I do not think it advisable to construct such sluices under the highest part of the dam.

13. *The quantity of water it will be possible to store.*—In the drainage area shown on Captain Taylor's map, the whole of the drainage basin of the Gundlacumma embracing that portion which supplies the Cumbum tank is included. I am not acquainted with the circumstances of this tank, but I think we should only calculate our supply from the drainage area of the basin exclusive of that portion which supplies Cumbum tank, adding to it the discharge over the Cumbum surplus weir and the surplus from irrigation under the tank. The last two items I have been obliged to omit from my calculations.

14. Rainfall has been assumed by Captain Taylor to be 27 inches a year, but he believes that it is generally more than that. The following figures are from the register of rain kept at Vinuconda about 10 miles from the site of the proposed dam :—

	INCHES.
Average fall of past eight years	24.89
Highest do.	34.75
Lowest do.	16.65

It is probable, however, that more rain falls in the hilly basin than below, and I, therefore, have accepted 27 inches as the yearly rainfall.

15. The area of the tank taken from the map I find to be 90 square miles; assuming Captain Taylor to be right and the average depth to be 9 yards, the contents would be 2,509,056,000 cubic yards.

The drainage basin taken as above-mentioned I find to be 1,630 square miles, rainfall being 27 inches in the year, the yearly fall in the basin would be 3,786,810,000 cubic yards, say that of this $\frac{1}{3}$ would run off and could not be stored, which seems probable, as the basin is generally rocky and hard soil; the quantity available for storage would be 2,272,089,600 cubic yards which, it will be observed, would not fill the tank.

The quantity available for irrigation will depend to some extent on the level at which water is drawn off, but I will assume that two-thirds of the quantity stored will be available or 1,514,726,000 cubic yards, allowing that 10,000 cubic yards stored will irrigate one acre, this will suffice for the irrigation, in round numbers, of 150,000 acres.

16. We must now assure that in a very wet year such as is experienced usually about once in every ten years the tank has filled and there is a heavy fall of rain, the discharge from the drainage basin and which must be passed over the waste weir I calculate from the formula $D = 657 M^{\frac{2}{3}}$ to be 93,150 cubic feet a second.

With a depth of 3 feet going over, the waste weir to pass this quantity must be 1,779 yards long with a depth of 5 feet 827 yards.

17. *The probable cost of the works.*—The works that would have to be carried out are, first the dam, second the waste weir, third the irrigation sluices, and fourth the Irrigation channels.

Captain Taylor has proposed that there shall only be one channel on the north of the river, and that the irrigation should be carried on between the 5th and 35th

miles of this channel, and then the channel should be continued simply as a navigable canal to near Bezorah. It seems to me, after having seen a good deal of the country, that it will be desirable to distribute the water more widely and therefore to have two Irrigation channels, one to the north of the river which would irrigate land lying exclusively in the Kistna District, the other passing through part of the Kistna into the Nellore District. I leave the question of a navigable canal for the present.

18. The dimensions of the dam I have calculated for the different sections which will have to be given to it according to its height as shown on the cross section of the gap, and I find that it will contain 489,614 cubic yards of masonry. Captain Taylor states the rubble masonry would cost from 3 to 4 Rupees a cubic yard. Taking it at four, the cost of the dam would amount to Rupees 19,58,456 or we will say nineteen and a half lakhs. I have, though taking the highest rate allowed by Captain Taylor, made no allowances for clearing foundations until solid rock is met with, and therefore I consider the rate allowed extremely moderate.

19. The outlet works will consist of masonry tunnels, though the shoulders of the hills on which the dam will abut, supplied by masonry towers; these works will necessarily be very expensive, and I do not think I have over-estimated their cost at one lakh of Rupees each.

20. The waste weir must also be a very expensive work, but without accurate levels it is impossible to estimate its cost accurately. I have, therefore, allowed a sum of one lakh of Rupees for it.

21. The Irrigation channels will have to be of considerable dimensions to pass the supply required. Here also, without accurate levels, it is impossible to frame a trustworthy estimate. Supposing that the irrigation were equally divided between the two sides of the river, each channel would have to supply 75,000 acres, and with a fall of 1 foot per mile depth of 6 feet, side slopes one and a half to one would have to be 60 feet wide at sill, the velocity would then be 2.67 feet per second. Were this channel within soil, the excavation required would cost, at 2 Annas per cubic yard, 10,000 Rupees a mile, and this allows nothing for embankments which would be heavy in places. The dimensions of the channels will, of course, decrease as water for irrigation is taken off, but I believe my estimate will be moderate if I calculate that to the end the excavation the Irrigation channels will cost Rupees 5,000 a mile; each channel being 35 miles long, the total cost of the two will be three and a half lakhs of Rupees.

22. The masonry works on the channels will be very heavy. One of the channels must have a super-passage over the surplus of the reservoir, and it will be seen from the map that both channels must cross the drainage of the country. The soil is bad, and the works must consequently be very solid. I estimate their cost at Rupees 5,00,000, which would be rather over 7,000 Rupees a mile of channel.

23. The distributing channels may be estimated to cost two lakhs of Rupees. Compensation will be a small item though I believe that more than five villages, as mentioned by Captain Taylor, will be submerged. I have allowed half a lakh of Rupees for this purpose.

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24. The rough estimate of cost then stands as follows :—

	RS.
Cost of dam	19,50,000
Two outlet works with towers	2,00,000
Waste weir	1,00,000
Two channels, each 35 miles long, at 5,000 Rupees a mile ...	3,50,000
Masonry works at about 7,000 Rupees a mile	5,00,000
Distributing channels	2,00,000
Compensation	50,000
Add for contingencies, &c.	3,50,000
Total...	37,00,000

25. Captain Taylor has proposed that in continuation of the Irrigation channel a navigation channel should be excavated passing by Guntur to meet the Kistna canals somewhere near Bezorah; as above-mentioned he gives the level of the ground at site of proposed dam as 340 feet above mean sea level. My own observations led me to suppose that it is not more than 200 feet above mean sea level, but the fall to be overcome is still considerable, and the difficulties in the way of excavating a channel to near Bezorah across the whole drainage of the country are great. It seems to me that the channel might be more easily connected with the Kistna channel by a cut running in a parallel direction to the great Nallamada drainage without crossing it, and joining the Commamore channel to the south of the Nallamada escape. The length of such a line would be not much in excess of 20 miles, whereas a channel passing Guntur would be 50 miles in length, the width at sill might be 25 feet, and second-class locks provided to overcome the fall of the country. The shorter and easier line would not probably be constructed under 20,000 Rupees a mile, considering the fall to be overcome; the longer would probably cost 25,000 Rupees a mile. The shorter line would, therefore, add four lakhs to the estimate, and make it 41,00,000 Rupees; the longer 12½ lakhs, and make it 49,50,000 Rupees.

26. *The revenue that may be expected.*—As stated above it is estimated that sufficient water can be stored ordinarily to cultivate 150,000 acres. This would return at 4 Rupees an acre 6 lakhs or 16·2 per. cent. on an outlay of 37 lakhs. If a navigable canal were constructed, the percentage of return would be with the shorter line mentioned above 14·6, with the longer 12·1, as the direct returns from navigation which rightly or wrongly are all that are taken into account in the Kistna delta would amount to a very trifling sum.

27. The return supposes that the full extent of land to which, in ordinary seasons, a full supply could be given is taken up, and while on the one hand it is possible that a further extent of land might be supplied in a good year, a year of scanty rainfall must lead to a reduction of cultivation. There is another question which very seriously affects the returns that must now be taken into consideration, supposing that after completion of the work we are in a position to supply water to 150,000 acres yearly.

28. The population of the country is scanty, and though there are traces of considerable Irrigation works existing in former years, wet cultivation does not

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appear to be now much sought after. Steps have been taken towards restoring some of the old reservoirs in the Vinuconda taluq, and a project (among others) for restoring the Dondapadu tank was investigated. The officer who made the investigation reported that it was improbable; the full extent of land that could be cultivated would be taken up for some time, and that the returns must be expected gradually. The Pedakancherla tank which has lately been restored and which it was estimated would irrigate about 2,000 acres gave a supply the first year to only 50 acres.

The Koopaconda tank, an old existing reservoir *favorably situated with a bund between two high hills, with a drainage area of about 20 square miles*, the bund being 30 feet in height above sluice floor and nearly 50 feet in the highest point, supplies only 77 acres, the average revenue, including land assessment, being 490 Rupees.

29. It appears from the returns of the last census that the total male population above ten years of age of the Vinuconda taluq is 21,784, or about thirty-nine to the square mile, comparing this with some of the Delta taluqs.

In Gudmadah it is 33,503 or about	63	to the square mile.
„ Repally „	67,089	„ 192 „ „
„ Bapatla „	48,435	„ 69 „ „
„ Gudmadah there are	76,532	acres under wet cultivation.
„ Repally „	37,302	„ „ „
„ Bapatla „	30,382	„ „ „

It therefore follows that the population cannot, under favorable circumstances, be expected to take up one-half of the land for which water is available, and that there must be a very considerable increase of population before the project can be remunerative. Captain Taylor has mentioned that villagers offered before him to cultivate 13,800 acres if the reservoir was made; but, in my opinion, it is very improbable that the cultivation within ten years would reach 50,000 acres, or a return of 5 per cent. on the expenditure be made.

30. Although, under the circumstances, the project cannot be considered a remunerative one, there can be no doubt that the country would benefit greatly by the construction of reservoir, and the indirect returns would be considerable. A great portion of the Vinuconda taluq might from a base parched up country devoid of trees and thinly populated and cultivated as the season permits only with dry crops, be turned into a garden, and with a population as dense as in the delta provide a supply of food for the dry districts adjoining, where a year of scanty rainfall causes scarcity of food and wide-spread distress.

From J. M. BELL, Esq., Officer in charge of Cumbum Range, to W. A. GOODCHAP, Esq., District Engineer, Kurnool, dated Cumbum, 17th September 1874, No. 407.

Report on Captain Taylor's Oomadavaram Project.

As verbally instructed by Captain Taylor, late Acting District Engineer, to report on the formation of a tank* situated near the village of Oomadavaram in the Markapoor taluq by embanking across a gap between two hills

* Plans, sections, &c., &c., will follow.

through which the Gundlacumma river flows, I have the honor to submit the following :—

2. The hills referred to, locally called the Yerramaleys, are a range extending from the Nullamaleys along the eastern boundary of the Markapoor taluq dividing the Kurnool and Nellore Districts.

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3. The supply to the proposed tank is the Gundlacumma river which has its affluents the Kundlair, Doovalairu, Tiggallairu and other large streams, making in all a drainage area, according to Captain Taylor's calculation, over 2,000 square miles. Captain Taylor informs me that he has already submitted to the Chief Engineer for Irrigation the District map, on which he has drawn the size of tank which will be formed, and the drainage area it commands; it will therefore be only necessary to give a brief outline of the work necessary to form the reservoir and its channels, and the sources of return such an irrigation work is likely to yield. From the accompanying plan will be seen the section of the gap, its greatest length (of bund) at top will be about 500 yards, and height varying from 40 yards over the bed of stream and running out to nothing on each side of the hill.

4. About five miles north of the gap a convenient saddle occurs which would form a good site for a calingulah, the height of this ridge is about 80 feet above level of ground at gap, and assuming this to be the level of calingulah, a bund of about 100 feet in height would be required.

5. The Gundlacumma river has a perennial flow, the normal flood level rises 6 feet, while a full fresh is sometimes 32 feet, the hot weather stream is never less than 3 feet in depth.

6. Captain Taylor, while Range Officer at Cumbum, in the year 1869, visited this site and, in fact, is the projector of the scheme. He evidently bestowed a great deal of attention to this discovery, and the pains he appears to have taken to fully investigate it deserve great praise. He had the stream gauged for nearly two years, and it is a matter for regret that the valuable information he had collected regarding the discharge of this river and other statistics in connection with the project have been lost from the office.

7. The figures he arrived at were that a tank could be formed to enclose a superficial area of 200 square miles with a drainage area over 2,000 square miles; the section of bund he proposed I believe was top breadth = depth of water at front of bund, with slopes of $1\frac{1}{2}$ to 1 at front, and 2 to 1 at rear. A concrete wall was to be raised to top of bund and run through it from hill to hill, its foundation sunk (about 6 feet) to the rock underlying the surface of ground. The revetment to have a backing of gravel and with rough stone laid at right angles to the slope.

8. Three sluices were to be provided, one on either side of river for irrigation purposes, and one built in bed of river for discharging silt and passing water if required along the old course of the river.

9. As the main channels will require to be made of considerable size to supply the great demand for water for cultivation purposes, it would be with little extra expense to make them available for navigation, so that direct communication could be effected on the north as far as the Kistna river, and on the south with the East Coast Canal. A considerable traffic is carried on at present by conveying salt, grain, &c., to Hyderabad and other inland districts which the channels would then monopolize.

10. The water-spread of the tank it is expected will reach within five miles of Doopand, a village lately the Cusba town of the Markapoor taluq, and the exports from this district would be chiefly the valuable timber such as teak, ebony, yeggy, &c., which grow in large quantities on the Nullamalay hills.

11. In comparing the longitudinal section (plan No. 1) and the sketch of the gap (plan No. 2) it will be seen that advantage has been taken of a rock (20 feet high) about midway, which will greatly strengthen the bund.

12. The depression on the north I am informed by the villagers is a natural outlet for the flood water of the Kundlair river when the Gundlacumma river is in fresh, and in forming a bund here it appears to me that this depression could be turned into some account by opening a channel to it so as to pass the water of the Gundlacumma through it, while the embankment connecting the rock and the main hill to the south is under construction.

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13. The greatest length and depth the embankment over the river is to be carried warrants that the greatest possible care and consolidation should be effected in forming it. I am of opinion that nothing simpler could be done than raising it so as to allow water to stand to the depth of 14 feet (level of depression) for a season or so, and permitting a monsoon to act on the earth embankment before the whole work is raised to its proper height and the full tank supply brought to bear on it. The construction of the second bund would not be very difficult, as opportunity could be taken of a dry month to let out the stream through all the sluices.

14. The soil for the bund may be brought from the rising ground, situated about quarter of a mile in front of it (within the tank), and I should recommend for economy as well for speed that a light tramway should be formed to this for transporting the earth.

15. Rock of fair quality can be obtained from the adjacent hills; it is a species of slate easily quarried and becomes hard by exposure to the atmosphere. The land which will be brought under wet cultivation will be entirely in the Nellore District, and as the country has one continuous fall (at about 4 feet per mile) to the sea, the extent of this (irrigated land) will depend on the supply from the tank.

16. The tank, although of such a large superficial area, submerges very few villages (five) which lie at present in its basin; it is owing probably to the scarce population arising from the poorness of the soil, as the villagers depend chiefly on cultivation for their means of support.

17. The ground is throughout rocky and chiefly waste, slight patches of cultivation may be met with during the rainy weather in the hollows where the soil of the uplands has been washed down, forming a thin layer over the rocky formation. The compensation on the whole is, therefore, not expected to amount to very much, considering the large volume of water which will be collected.

18. The short time at my disposal prevented my carrying out the investigation as far as I wished. It will be seen, however, the general outline of the project, and I have no doubt it has every likelihood, if carried out, to prove a remunerative work and of incalculable benefit to the country it will irrigate.

No. 310.

Note by the Chief Engineer for Irrigation.

CAPTAIN F. TAYLOR, when Acting District Engineer of Kurnool, having brought

No. 14, dated 24th July 1874.

to notice that he had discovered a very favorable site for a large reservoir

where the Gundlacumma passes through the hills dividing the Kurnool from the Kistna District the Superintending

No. 581 D, 11th August 1874.

Engineer, Kistna, was requested to

take an opportunity, when near Vinuconda, of examining the site and reporting on its capabilities, and the letter now submitted contains the results of his inspection.

2. It will be seen that in some respects the site is favorable, while in other and not unimportant respects it presents difficulties which would tend to make the reservoir costly. The gap in the hills through which the river passes is 3,000 feet wide at ground level, and a bund 120 feet high would be about 5,000 feet long at the top. There are two saddles to the northward at about 140 feet above bed of river, and surplus would have to be discharged at one or both of these. The drainage basin is above 2,000 square miles, of which about 1,630 square miles are available for the ordinary supply of the tank, which would cover an area of 90 square miles, and hold 2,509 millions of cubic yards, while in ordinary seasons

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the supply at $\frac{1}{2}$ of 27 inches over the whole area drained would amount to 2,272 millions of cubic yards. The country which would be submerged contains but few villages, and is poor and barren.

3. There is no soil in the neighbourhood suited for the construction of an earthen bund, and the dam would have to be made of rubble masonry or concrete.

4. Major Hasted has given in paragraph 24 of his report a rough computation of the probable cost of the reservoir and distributaries, which amounts to 37 lakhs of Rupees. Adding to this establishment charges the approximate estimate would become 50 lakhs.

5. The tank would be capable of irrigating 150,000 acres, and it will be safer to assume that the average water-rate would be 4 rather than 6 Rupees an acre exclusive of land assessment, so that 6 lakhs would then be the gross return or 12 per cent. on the outlay.

6. The Superintending Engineer notices, however, that the population of the country which would be capable of irrigation is very small; that under some existing tanks in the neighbourhood the cultivation is extremely limited, *e.g.* :—

Koopaconda tank—	20 Square miles.
Drainage basin	77 Acres.
* Area irrigated	490 Rupees.
Revenue (land assessment and water)	

Here then a square mile of drainage basin irrigates less than 4 acres, but it is not said whether the whole water-supply is utilized.

Again only 50 acres were cultivated the first year* under the lately restored Pedakancherla tank which it was supposed would irrigate 2,000 acres.

7. Were the whole area of 150,000 acres to be brought under cultivation within five years the reservoir would probably only just pay the interest on cost and provide for maintenance, and as it is unlikely that fifty years would see the whole of the land irrigated, it may be concluded that the scheme would not pay.

8. The formation of a reservoir would no doubt confer very considerable benefits on the country commanded by it, but half a million sterling would be too high a price to pay for these benefits when the people to enjoy them are so few.

9. Moreover, for a great many years to come, the Kistna Delta Works, which will benefit a large population in a neighbouring part of the country, will afford full occupation to all the establishment likely to be available, and will at the same time absorb a very large sum of money.

10. Captain Taylor deserves credit for his investigations, and some day they may not be without their value.

CAMP AT ENNORE, (Signed) JOHN MULLINS, Lieut.-Colonel, R.E.,
19th March 1875. Chief Engineer for Irrigation.

No. 484. ORDER THEREON, 19th April 1875, No. 1,095.

IRRIGATION, No. 56.

The papers submitted in connection with a proposed reservoir on the Gundlacumma near Momadianarem are of considerable interest, and the report of the Superintending Engineer, Kistna, shows

*Proceedings of the Madras Government, Public Works Department,
19th April 1875.*

that possibly such a reservoir might be constructed so as, under more favorable circumstances, to be not unremunerative. With, however, the scanty population of the country commanded, it is not at all likely that the water-supply would be made full use of until after the lapse of many years; and, as the Chief Engineer for Irrigation has pointed out in the neighbouring delta of the Kistna, it is in contemplation to expend large sums within the next 20 or 25 years, which will fully occupy the Public Works establishments and prove of much greater benefit than any single reservoir, however large, could be, taking the population of the two localities into account.

2. Such being the case, His Excellency the Governor in Council, while fully appreciating the service which Captain F. Taylor has done in looking into the capabilities of the Kurnool District in which he was recently employed, is of opinion that further investigation of the proposed reservoir may well be postponed.

(True Extract.)

(Signed) G. W. WALKER, Colonel, R.E.,
Secretary to Government.

To the Superintending Engineer, Kistna.
" " " Chingleput.
" District Engineer, Kurnool.
" Chief Engineer for Irrigation.

Exd. H. C. Shruker.
Spare Copies

Govt. of 1875, Madras.
PUBLIC WORKS.

To
THE SUPERINTENDING ENGINEER.

RISINA.

Ac. 20. 30.

Dated April 1943.

Issued.

Recd.

Ind.

G. O., 19th April 1875, No. 1,035.

APRIL

Nos. 483-484

Proposed Reservoir on the Gandiocum
near Memadianurem, Risina District.
Directing the further investigation of the
to be postponed.

ERNMENT (S.
ENUE DE IENT.

Famine Relief

Findings of Government, 29th September 1877, No. 3,027.

Irrigation Relief Works.

Nos. 6, 7, 8, 10, 13, 14, 28, 29, and 41 in the accompanying
have been already sanctioned and are in progress, or about to be

Works Nos. 1, 2, 9, 11, 12, 22, 26, 33, and 42 are provisionally sanc-
the Chief Engineer for Irrigation should direct their commencement

Works Nos. 20, 27, 30, 34, 35, 46 are not to be commenced pending

4. As soon as a work has been sanctioned to Government by the Chief Engineer, who should at the same time submit a statement showing the date at which the orders to begin the work reached the Executive Officer, and of any delay that may occur in commencing.

5. Works Nos. 3, 4, 5, 16, 17, 18, 21, 24, 25, 31, 32, 36, 37, 38, 39, 40, 43, 44, 45, 47, and 48 require further investigation, and the Chief Engineer for Irrigation should at once issue the orders necessary to enable him to submit full information to Government at the earliest possible date. This information should be submitted separately for each work as soon as ready.

6. Collectors and District Engineers should arrange, in conference, the time of commencement of each work, and when the work has been begun; the District Engineer or Officer in special charge of each work should keep the Collector at intervals, not exceeding one week, informed of the number of persons that can still be accommodated on it.

7. The works should be carried out in accordance with the provisions of G.O., dated 24th September 1877, No.

8. The Chief Engineer for Irrigation should issue all necessary subsidiary instructions, and should utilise to the extent the establishments now available in commencing the works sanctioned, either for superintendence of works or for conducting investigations, he should at once report in detail what aid will be

Revenue Department, 29th September 1877, No. 3,027.

Detailed plans and estimates should be submitted as soon as possible for those works on the sanctioned programme which are now without them.

(True Extract.)

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

To the Board of Revenue.
,, the Financial Department.
,, the Public Works Department.
,, the Chief Engineer for Irrigation.
,, the Collector of Tinnevely.
,, the " of Madura.
,, the " of Tanjore.
,, the " of Trichinopoly.
,, the " of Coimbatore.
,, the " of Salem.
,, the " of South Arcot.
,, the " of Chingleput.
,, the " of North Arcot.
,, the " of Nellore.
,, the " of Cuddapah.
,, the " of Bellary.
,, the " of Kurnool.

Ed. F. R. Bantleman.

Revenue Department, 29th September 1877, No. 3,027.

Works to be undertaken in the
Department.

Sanctioned Districts by the Irrigation

Collectorate.	No. of Work	Name of Work.	Amount of Expenditure	Number of people the work will employ.	For how long.	Remarks.
			RS.		MONTHS	
Tinnevely ...	1	Strivaikuntham anicut (south - main channel) ...	11,500	2,500	2	
	2	Improvements to Maradur Keelakal (east channel) ...	20,000	3,500	3	
	3	Shunmuganuddy reservoir project ...	1,20,000	10,000	4	
Madura ...	4	Gullapuram reservoir ...	7,50,000	30,000	9	
	5	Pulay reservoir ...	...	...	...	
Tanjore ...	6	River embankments ...	2,50,000	16,000	6	
	7	Cauvery embankments ...	1,60,000	10,000	6	
Trichinopoly ...	8	Coleroon embankments ...	1,60,000	10,000	6	
	9	Drainage of Adapompallam ...	10,000	1,250	3	
	10	Cauvery embankments ...	...	...	...	Already in progress.
Coimbatore ...	11	Pogalur channel improvement and extension of ...	52,000	5,000	4	
	12	Andatala project ...	67,905	5,000	5	Do.
	13	Pennakonda dam project ...	30,000	2,000	5	Do.
	14	Marandahur project ...	1,00,000	9,000	4	Do.
Salem ...	15	Baroor channel ...	9,000	1,500	2	
	16	Malapady Tank restoring ...	67,000	5,000	5	
	17	Dharampuri tank sites ...	...	...	...	
	18	Proposed tank on Vaniar near Venkatasamudrum ...	...	10,000	4	
	19	Guddelam-Attur project ...	...	3,000	3	
South Arcot ...	20	Pooniar embankments ...	...	6,000	3	Before commencement reference must be made to the Railway and Revenue Departments regarding any probable injury to land.
	21	Colroyan hills reservoir project ...	...	...	...	
	22	Vyalore project (channel) ...	28,888	8,500	3	
	23	Utramthur tank channel improvements ...	...	5,000	3	
Chingleput ...	24	Cortelair embankments east of Nellore road ...	38,000	4,500	3	
	25	Narayanavaram river irrigation ...	2,20,000	10,000	8	
North Arcot ...	26	Falar anicut channels, improvements north section ...	82,000	7,500	4	
Nellore ...	27	Sungum Project ...	16,00,000	50,000	12	Not to be commenced without the special orders of Government.
	28	Channels from Kendukur to P. T. & R. tanks ...	4,00,000	10,000	15	Believed to have been commenced last week.
Cuddapah ...	29	Cheyair embankments ...	1,20,000	10,000	4	In progress.
	30	Chintakoota tank restoring ...	38,000	4,000	3	Reference must be made to the Railway Department before this work is commenced.
	31	Papugny embankments ...	...	...	...	
	32	Restoring Talaricheruvu Dayala tank ...	...	...	...	
	33	Potalakunta Tank project ...	12,000	2,250	2	
	34	Chitravati-Parnapally Reservoir ...	8,00,000	20,000	15	Not to be commenced without the special orders of Government.
Bellary ...	35	Huggry-Maylapur Reservoir project ...	16,00,000	40,000	15	Do. do. do.
	36	Bookacherla project ...	18,98,560	30,000	24	
	37	Hindupoor project ...	1,10,200	10,000	4	
	38	Roddum project ...	43,280	4,500	4	
	39	Huggry-Raidroog project ...	...	5,000	3	
	40	Kalavatala Tank project ...	...	...	...	
	41	Cumbum Tank Channels improvements ...	...	...	...	Already commenced.
	42	Venkatareddipalliam Tank restoring ...	42,000	5,000	4	
	43	Arveed Tank restoring ...	18,000	2,000	4	
Kurnool ...	44	Proposed Tank south of Arveed ...	...	5,000	4	
	45	Other tank projects in Markapoor ...	...	10,000	8	
	46	Hindry-Dewanapally Reservoir ...	9,00,000	30,000	12	Not to be commenced without the special orders of Government.
	47	Hindry-Taikoor Reservoir ...	4,50,000	20,000	8	
	48	Mamidiaram Reservoir ...	...	20,000	96	Immediate report from Major Basted, should be called for regarding this work.

GOVERNMENT OF MADRAS.
PUBLIC WORKS DEPARTMENT.

19th October 1877, No. 429 I.

Irrigation.

Read the following paper:—

No. 79. Proceedings of Government in the Revenue (Famine) Department, dated 29th September 1877, No. 3,027.

No. 80. ORDER THEREON, 19th October 1877, No. 429 I.

COMMUNICATED to the Chief Engineer for Irrigation, and to all District Engineers, for information and guidance.

2. There is one work in the list regarding which His Grace the Governor desires to have the opinion of the departments mentioned. It is South Arcot, No. 20, Pooniar Embankments. The Chief Engineer for Irrigation is of opinion that although the scheme for the effective treatment of the Pooniar from Trikalore to the sea is not yet ready for sanction, useful work may be made available for the employment of famine labor by at once taking up for improvement that part of the river between the Trikalore anicut and the rejunction of the Koratar and Pooniar. This part of the work includes—

- (1.)—The embanking* of the Pooniar from the Trikalore anicut to the head of the Koratar.
- (2.)—The widening of the gorge in the Pooniar just opposite to (north of) the head of the Koratar.
- (3.)—The division of the flood waters between the Pooniar, the Koratar, and the Mullatar by means of embankments, regulating widths of channels and masonry regulators.

3. The Chief Engineer says of the Pooniar that "it is one of those rivers which dispose of their flood waters by several effluents, and the problem to be solved is the proper division of flood waters among the several out-fall channels available, and the prevention of inundation generally." Further particulars are to be found in Proceedings, Madras Government, No. 577, of the 21st February 1877.

4. Before approving of the commencement of any part of the improvements suggested by the Chief Engineer for Irrigation as desirable for relief-works, His Grace the Governor wishes to know whether the Railway Department are satisfied that such treatment of the river will be beneficial or not to the line of the South Indian Railway which comes within the influence of the Pooniar and its effluents, including the Guddelum; and he desires also to have the opinion of the Revenue Department whether the exclusion of uncontrolled spill from the lands now within the influence of the Pooniar floods will be advantageous or the reverse looking to the

* Right bank.

GOVT. OF MADRAS.
REVENUE.

THE BOARD OF REVENUE.

Secy. Secy. Secy.

Dated September 23rd.

Printed 29th.

Encl.

G.O., 29th September 1877, No. 3,027.

SEPTEMBER
No. 851.

FAMINE RELIEF, No. 2,023.

Relief-works to be undertaken in districts affected by the Irrigation Department—Forwarding with instructions, a statement of—

fertilizing influence of the water on the one hand, and to the injury which floods occasion by washing away soil, depositing sand, destroying crops, &c., on the other hand.

5. The Revenue Department will be requested to report what additional acreage will be irrigated and what revenue derived by the restoration of the Chintacoonta tank.

6. The sanctions accorded in the Revenue Department have been registered as follows:—

Work Nos. 1 and 2	...	...	Register No. 236 I of 1877-78
" No. 9	...	...	" " 237 I of "
" " 11	...	...	" " 238 I of "
" " 12	...	...	" " 239 I of "
" Nos. 22 and 23	...	...	" " 240 I of "
" No. 26	...	...	" " 241 I of "
" " 33	...	...	" " 242 I of "
" " 42	...	...	" " 243 I of "

(True Extract.)

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

To the Revenue Department.
To the Chief Engineer for Irrigation.
" Consulting Engineer for Railways.
" District Engineer, Madura.
" " " " Tinnevely.
" " " " Tanjore.
" " " " Trichinopoly.
" " " " Coimbatore.
" " " " Salem.
" " " " South Arcot.
" " " " Chingleput.
" " " " North Arcot.
" " " " Nellore.
" " " " Cuddapah.
" " " " Bellary.
" " " " Kurnool.

Ed. E. C. Shunker.

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IRRIGATION.

Gobt. of 1877 India
PUBLIC WORKS.

THE REVENUE DEPARTMENT,
&c., &c., &c.

Dated 19th October.

Issued

Recd.

Encl.

G. O., 19th October 1877, No. 429 I.

ORDER

Nos. 79-80.

Relief-works to be undertaken in distressed districts by the Irrigation Department.—
Proceedings in the Revenue Department forwarding with instructions a statement of —, communicated with remarks to the Chief Engineer for Irrigation, and to all Districts Engineers, for information and guidance.

GOVERNMENT OF MADRAS.

REVENUE DEPARTMENT.

3rd December 1877, F.R. No. 3,004.

Famine Relief.

Read the following paper:—

No. 67-K.S.

No. 31.

MEMORANDUM.

With reference to Proceedings of Madras Government, No. 1,095, of the 19th April 1875, and to the order as per margin, the undersigned has the honor to request the Superintending Engineer, Kistna, to be good enough to report, as early as possible, upon those points which, on the occasion of his former visit to the Mamidevaram Reservoir site, were left undecided.

These are chiefly—

- (1st.) Can sites for waste weirs at a suitable level and affording an adequate length of weir be found, and will the cost of the weirs, including any works required for the safe conduct of the surplus back to the channel of the river, be likely to be reasonable?
- (2nd.) Can material for puddle be obtained within a distance of a few miles? Taking the height of puddle wall at $100+6 = 106$ feet. Probably some 170,000 cubic yards would be required.
- (3rd.) Supposing a suitable puddle wall can be constructed; will the soil available in the neighbourhood do for the rest of the bund? It is considered that on the tank side of the puddle wall there must be 15 or 20 feet at least of good soil; that the rest of the bund on this side may be of any soil which will be stable and shale gravel, &c., will do; that in rear of the puddle wall there must be a sufficient thickness of earth to maintain the puddle in proper condition, i.e., prevent desiccation, and that 10 or 12 feet of any soil which can be well consolidated will do. Outside this shale gravel, small stone, and indeed anything will do, weight being all that is needed.

2. Major Hasted considered that it would be best to form a masonry dam, but in connection with famine relief-work, which is now the point in question, the dam, if constructed at all, must be of earth.

The security of the earth-dam will depend upon the puddle wall and about that therefore there must be no doubt.

FORT ST. GEORGE,
29th September 1877.

To the Superintending Engineer, Kistna.

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

From Major J. O. HASTED, R.E., Superintending Engineer, Kistna District, to Colonel J. MULLINS, R.E., Chief Engineer for Irrigation, dated Guntur, 4th November 1877, Extra No. C-II.

IN reply to your Memorandum, No. 67-K.S., dated 29th September 1877, I have the honor to report further on the proposed reservoir at Mamidivaram.

2. I have again examined the ground in the neighbourhood of the site of proposed bund, and have sunk pits in those places where it seemed to be probable clay or firm soil could be found. The river both above and below the gap has evidently worked from side to side, and its present course between high scarpd banks reveals the state of the soil down to the rock level; no better section of the ground can be obtained.

3. I found a bed of clay which I thought might be suitable for puddle immediately below the gap at the foot of the Northern Hill. This bed is about 250 yards long and of varying width, below 40 yards, and the pits showed depths of 1, 1½, and 1¾ yards; below this the soil became sandy, or rock was reached. I estimated the contents of this bed at about 10,000 cubic yards. Below this place I found another small deposit in a sort of island of high ground left by the river. I could not trace the outline of this bed, but it must be very small. I could find no clay in other places.

4. I made inquiries at all the neighbouring villages and obtained specimens of the clay used by the potters. I found that black clay was obtained from the bed whose measurement I have given, and a mixture of clay and sand from a hill pit about 1½ miles below the gap and ½ a mile from the river on the south side which I examined. The potters of Mamidivaram itself, which is above the gap, obtained clay from a spot about 3 miles distant.

5. I therefore consider this fact to be ascertained, viz., that clay in sufficient quantity to form a puddle wall of the dimensions required is not obtainable within a reasonable distance.

6. As regards the soil available for the bund, with the exception of strip wing along the foot of the hills to the north of gap, in which the clay above mentioned is found, there is nothing but light red sandy soil, quite unsuitable, in my opinion, for the formation of a high bank. The strip is darker soil mid with very small nodules of lime kunkur, and might be used, but there is very little of it. The hills are covered with stone-shale, quartzite, quartz, and limestone, and are bare of soil. As stated in my former report, I can hardly imagine any soil of which to construct a large bund than that available.

7. I consider that, under these circumstances, the idea of constructing a large earthen bank as a famine relief-work cannot be entertained.

8. While I was encamped near Mamidivaram I had a line of levels run across the gap and along the hills to the north by Supervisor Serjit Taylor, sketch* of which I enclose. The levels

* Will follow.

do not altogether agree with those given by the Aneroid Barometer, the saddles appearing lower than I anticipated; but they show the position very well, and prove that an escape of sufficient length can be provided at a level about 100 feet above the bed of the river, without much difficulty. The draze would pass into a large natural hollow which supplies two small tanks at runs past the village of Kottapalem into the river. The tanks and cultivation would have to be purchased, but the villagers would not suffer much loss as the irrigation channel from the tank must pass close by the village; and a saddle about 2 miles further north beyond the first high hill in the ridge. Aneroid Barometer showed to be on the same level as this saddle, and available length appeared to me to be ample; a weir here would discharge the large nullah below the Kooppaconda tank, and I think the surplus would pass off without doing any damage. Having assured myself of the feasibility of constructing a weir of sufficient length at a suitable level, I did not consider worth-

while to delay this report while further levels were being taken, and at this particular time can ill afford the services of the establishment required to do the work.

No. 235-W.

SUBMITTED for the information of Public Works Department, No. 429-I, dated 19th October 1877. Government with reference to G.O., Revenue (Famine) Department, No. 3,027, of the 29th September 1877.

2. Major Hasted's further report on Mamidivaram Reservoir site on the Gundlacumma indicates that the circumstances are altogether unfavorable for the formation of a reservoir with an earthen bund, there being nowhere in the neighbourhood sufficient soil suitable for a puddle wall or a sufficiency of good soil for the part of the bund which would need to be formed of such material.

3. At the same time, the site appears to be exceptionally favorable for the construction of a great reservoir with a masonry dam; and it will, it is thought, be desirable to depute a competent officer to complete the investigations when one can be spared for the purpose. It is seldom that a site for a reservoir, possessing adequate facilities for the disposal of surplus, great capacity, ample catchment basin, a narrow gap to be closed by a dam, and ground of little value within the water-spread can be found; and as this site would seem to possess these advantages in a marked degree, while there is much land between the hills and the sea which could be irrigated, the *prima facie* evidence in favor of a full investigation is strong.

SIRVAIL,
19th November 1877.

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

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

No. 35. ORDER THEREON, 3rd December 1877, F.R. No. 3,004.

Miscellaneous.

It is to be hoped that this work or any other large new work in this locality will not now be needed for relief purposes; but this site appears to be so favorable in many respects that it is a matter for consideration whether the investigation should not be completed on general grounds.

(True Extract.)

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

To the Public Works Department,
,, the Chief Engineer for Irrigation.
,, the Board of Revenue.
,, the Financial Department.
,, the Collector of Kistna.

Exd. F. R. Bantleman.

13TH JUNE 1882, No. 465 I., PUBLIC WORKS.

GOVERNMENT OF MADRAS.
PUBLIC WORKS DEPARTMENT.

Irrigation.

No. 48.

READ—the following letter from Colonel W. S. TREVOR, R.E., Secretary to the Government of India, Public Works Department (Civil Works—Miscellaneous), to the Secretary to the Government of Madras, Public Works Department, dated Simla, 6th May 1882, No. 163 M.:—

In reply to paragraph 9 of your No. 3198 W., dated 31st December 1881, and in continuation of this office letter No. 437 I., dated 12th November 1881, I am directed to state that the Government of India is desirous of confining the attention of the establishment, sanctioned against the "Protective Works Fund", entirely to the preparation of projects for works most suited to the purpose of protection from famine, as distinct from projects for works for affording relief during famine. It is thought that by confining the attention of this establishment entirely to its legitimate duties, and to the preparation of projects manifestly well adapted to protective purposes, the investigation of the schemes, for Steam Tramways, and Light Railways, alluded to in your letter, could, without much difficulty, be conducted by it. More than one of the schemes, mentioned in your No. 1697, dated 9th July 1881, are confessedly of doubtful value; and it seems very undesirable to employ establishment on the examination of such projects, when others of obviously greater importance await inquiry.

No. 48-A.

READ—the following Note by Colonel J. O. HASTED, R.E., Acting Chief Engineer for Irrigation, dated Ootacamund, 18th May 1882, No. 52 I.:—

The accompanying statements have been prepared from the lists submitted with this office No. 55 I., dated 21st February 1879, which were forwarded to the Famine Commission, and are printed in Appendix V of the Report of Famine Commission, showing under three different heads the projects proposed in the Madras Presidency for the extension of irrigation.

Statement No. I shows the projects which have been either sanctioned or submitted for sanction, and which are therefore disposed of.

Statement No. II shows the projects which, it is now considered, may be indefinitely postponed; the reasons for adopting this course are given in the remark column. It might be said that they may now be altogether set aside, but there are some which, when the large systems have been worked out and the population has increased, it may be possibly advisable to investigate.

GOVT. OF INDIA (1877) 3110000

REVENUE.

PUBLIC WORKS DEPARTMENT.

13th June 1882, No. 465 I.,

13th June 1882, No. 465 I.,

13th June 1882, No. 465 I.,

13th June 1882, No. 465 I.,

G.O. 3rd December 1877, F.P. No. 3001.

DECEMBER.

NO. 3185.

Memorandum Received, 13th June 1882.
Keeping that the formation of the proposed
or any other large new work in the locality will
not now be needed for relief purposes; and
observing that, for the reasons assigned, it is
a matter for consideration whether the invest-
ment should not be completed at present
circumstances.

Statement No. III shows the projects which it is proposed to take up and thoroughly investigate, and the agency by which it is suggested the work shall be done. It includes the projects now being investigated in the project and other divisions, and every work entered in the lists above referred to not named in Statements Nos. I and II, except those affecting existing irrigation, and which are not capable of any considerable extension.

Statement No. IV shows all these projects in the order in which it is proposed to take them up, the 13 works not allotted being reserved until further progress has been made in the project divisions.

2. It is possible that some of the projects which it is now proposed to work out may prove so remunerative that the works may be classed as Productive Public Works, but this can only be ascertained after they have been worked out. They are all Protective Works, and as such the establishment provided for from funds allotted or the prevention of famine may properly be employed on them.

3. A recent order of the Government of India makes a distinction between works intended for the prevention of famine, and works intended for execution during famine, and apparently contemplates the complete investigation of projects which answer the first condition only. Now, although, as stated above, all the works referred to may be classed as Protective Works, many of them would be suitable for the employment of famine labor, but until they are investigated it is impossible to ascertain to what extent they will be useful as famine works. Generally speaking, all those projects which contemplate the construction or improvements of reservoirs would, to a greater or less extent, provide employment for famine labor, but to class these works as famine works, and therefore only partially to investigate the projects and prepare rough estimates would, it is considered, lead to a waste of time and money. Allowing that they are Protective Works, the projects should thoroughly be worked out and submitted in such a complete state that the work can be commenced forthwith if necessary. They cannot be commenced for some time to come, and therefore many of them will, in all human probability, remain available for the employment of labor when failure of the monsoon rains has again induced scarcity or famine. To show how far these works will be available as famine works, it might be well to append to the estimates, when submitted, a statement showing the number of skilled and unskilled laborers that could be employed on them for, say, six months.

4. In Statement No. IV it will be seen that a very long list of projects has been allotted to the C. Project Division. This division is working and will work in the Third Circle, which comprises the districts of Cuddapah, Kurnool and Bellary, a part of the country which is most liable to suffer from failure of the rains. The projects proposed contemplate the diversion and storage of the flood water of the rivers which traverse these districts, and many of them have been worked out in connection with the Madras Irrigation and Canal Company's works, the plans, &c., prepared by the officers of that Company having been handed over to Government. There is therefore a great deal of work already done, and it is now proposed to take up the rivers systematically, examining the projects already investigated in turn, and to work out such schemes as may promise most effectually to utilize the water-supply.

5. In Statement No. II the Nilgiri reservoirs are included as projects to be indefinitely postponed, and in Statement III, in the remark opposite the Neringipett Anicut, reference is made to the Bhavani reservoir which was not included in the original lists. This reservoir was proposed to be constructed somewhere near the junction of the Bhavani and Moyar river, which together fall into the Cauvery. It was partially investigated and reported on by Major Montgomerie, R.E., in May 1880, Delta, and also to supply local cultivation. It is considered very important that the subject of flood regulators on one of the rivers supplied by the south-west monsoon should be taken up, and it is now thought, after the investigations that have been made, that such reservoirs can more probably be provided at reasonable cost at the foot of the hills rather than in the hills.

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

ENCLOSURES.

I.

STATEMENT of Irrigation Projects referred to in List accompanying this office No. 55 I., dated 21st February 1879, which have been disposed of.

	REFERENCE TO LISTS.		District.	System or Source of Supply.	Name of Project.	Remarks.
	List.	Number.				
	A	A	Godavari	Godavari Delta System.	Eastern Delta Completion.	Estimates have been submitted to the Government of India.
	..	B	..	..	Central Delta Completion.	
	..	C	..	..	Western Delta Completion.	
	..	E	Kistna	Kistna Delta System.	Eastern Delta Completion.	Estimates have been sanctioned by the Secretary of State.
	..	F	..	..	Western Delta Completion.	
	..	M	Nellore	Pennér River.	Sangam Project	
	..	N	Tanjore	Cauvery Delta System.	Upper Anicut—Regulation of the Cauvery at Grand Anicut.	Do. do.
	..	W	Tinnevely	Támbraparni.	Srivaikuntham Anicut.	Estimates have been submitted to the Government of India.
	B	I	Ganjam	Rushikulya	Rushikulya Project.	Do. do.

II.

STATEMENT of Irrigation Projects referred to in Lists accompanying this office No. 55 I., dated 21st February 1879, to be indefinitely postponed.

	REFERENCE TO LISTS.		District.	System or Source of Supply.	Name of Project.	Remarks.
	List.	Number.				
	A	D	Godavari	Godavari River.	Polavaram Anicut	It is only necessary to quote the late Colonel Anderson's remark: "It cannot seriously be thought of until the Delta System has been fully completed."
	B	3	Ganjam	Vamsadhara River.	Vamsadhara or Chica-cole Project.	
	..	4	Vizagapatam.	Surada	Kristnamraz Channel.	
	..	5	Do.	Do.	Kondakirla Ava Project.	These projects have been to some extent investigated; they are not recommended, as scantiness of population prevents extension of irrigation. Moreover, the Delta Works in the district will be in progress for many years to come, and irrigation is steadily increasing under these works.
	..	6	Do.	Nangoolia River.	Nangoolia River Project.	
	..	7	Kistna	..	Dondapad Tank	
	..	8	Do.	..	Bolapilly Tank	This was examined and set aside some years ago.
	B	9	Do.	..	Vippurli Tank	
	..	10	Do.	Muneyar	Muneyar Anicut	
	..	11	Do.	Nagaleru	Bunding Nagaleru	
	..	12	Do.	Peddavagu	Bunding Peddavagu and Yeddavagu.	
	B	38	North Arcot.	Cheyar	Mambaukum Project.	These reservoirs were proposed with the Rushikulya Project which has just been submitted, but were not considered necessary.
	..	42	Salem	Kurambapilly.	Badatalao Project	
	..	46	Do.	Ponnir	Malapady Tank Restoration.	
	C	III	Ganjam	Mahanadi	Kollada Reservoir	
	..	IV	..	Do.	Booliagutah do.	
	..	V	..	Goodaholo	do.	
	..	VI	..	Do.	Mutchycotta do.	

Statement of Irrigation Projects referred to in Lists accompanying this office, &c.—cont.

Division or Circle to which Project is allotted.	REFERENCE TO LISTS.		District.	System or Source of Supply.	Name of Project.	Remarks.
	List.	Number.				
C. Project Division.	VIII	22	Vizagapatam.	Surada	Kondakirala Aya	Referred to above. B 5. See remarks. B 7 to 12.
	XII	23	Kurnool	Goundlacuma.	Momadataram Reservoir.	
	XIV	24	Bellary	Chitravati River.	Parnapally Reservoir.	
	XV	25	Bellary	Chitravati River.	Parnapally Reservoir.	
	XVI	26	Mysore	Budra River.	Luckavally River	This has been given up, as borings in the bed of the river have shown that a safe foundation for the dam cannot be obtained. These projects were partially investigated in connection with the Madras Irrigation and Canal Company's works, but have been given up. The right of the Madras Government to store and make use of the water of rivers in foreign territory cannot be established.
	XVII	27	Do.	Tunga River.	Moodaba Reservoir.	
	XVIII	28	Do.	Choardya River.	Masoor Reservoir.	
	XIX	29	Do.	Choardya River.	Masoor Reservoir.	
	XXII	30	Malabar and Coimbatore.	Bhavani	Palavoor Reservoir.	Some of these projects have been investigated, and an attempt (which failed) was made to construct the bund of one of the reservoirs by the silting process. It is now considered that sites for the construction of reservoirs to regulate the flood waters of the Cauvery should not be looked for in the hills.
	XXIII	31	Do.	Do.	Kottamula Reservoir.	
	XXIV	32	Nilgiris	Pykara River.	Pykara Reservoir.	
	XXV	33	Do.	Drainage into Moyar.	Nunjanad Reservoir.	
	XXVI	34	Do.	Poorthy	Lake Victoria	
	XXVII	35	Do.	Do.	Lake St. Lawrence.	
	XXVIII	36	Do.	Sandy Nullah.	Sandy Nullah.	

III.

STATEMENT of Irrigation Projects referred to in Lists accompanying this office No. 55 I., dated 21st February 1879, showing the Agency by which it is proposed they should be investigated.

Division or Circle to which Project is allotted.	REFERENCE TO LISTS.		District.	System or Source of Supply.	Name of Project.	Remarks.
	List.	Number.				
D. Project Division.	A	H	Bellary	Tungabhadra River.	Upper Bellary Project.	Estimated for by the Madras Irrigation and Canal Company's Canal officers.
Second Circle.	L		Nellore	Pennar Anicut System.	Survapally Project.	The estimates are under preparation.
D. Project Division.	O		South Arcot, Tanjore.	Coleroon River.	Lower Coleroon Anicut.	It is intended to improve and extend the irrigation under the existing anicut.
B. Project Division.	U		Coimbatore and Salem.	Cauvery	Neringipett Anicut.	This will be considered when the Bhavani river is investigated.
C. Project Division.	V		Madura	Vaigai	Perryaur Project.	Estimates are expected to be ready in three or four months.
D. Project Division.	B	2	Ganjam	Korkey River.	Mullada Tampara Project.	Revised plans and estimates are being put into shape.
Not allotted	13		Nellore		Restoring Adurapillai Tank of Griddalore.	Ruined tanks which may be worth restoring.
Do.	14		Do.		Restoring Tirumalapady Tank.	
Do.	15		Do.		Restoring Gandipalem Large Tank.	These projects are for the utilization of the water of rivers in Cuddapah, Kurnool, and Bellary. Some of these have been investigated by the officers of the Madras Irrigation and Canal Company. It is proposed to take up each river separately and conclusively to deal with each project in turn.
Do.	16		Cuddapah	Suggalair	Suggalair Project.	
Do.	17		Do.	Talarcheruvu Dyalla	Talarcheruvu Dyalla Tank Restoration.	
Do.	18		Do.	Papadry	Anicut or Papadry.	
Do.	19		Do.	Peddapasula	Peddapasula Channel Irrigation.	
Do.	20		Kurnool	Restoring Venkatarreddipalem Tank.	Restoring Venkatarreddipalem Tank.	
Do.	21		Do.	Arveed Tank	Arveed Tank Restoration.	

Statement of Irrigation Projects referred to in Lists accompanying this office, &c.—cont.

Division or Circle to which Project is allotted.	REFERENCE TO LISTS.		District.	System or Source of Supply.	Name of Project.	Remarks.
	List.	Number.				
C. Project Division.	B.	22	Kurnool	Do.	Kalayatala Tank Project.	These projects are for the utilization of the water of rivers in Cuddapah, Kurnool, and Bellary. Some of these have been investigated by the officers of the Madras Irrigation and Canal Company. It is proposed to take up each river separately and conclusively to deal with each project in turn.
	23		Do.	Duvulair	Duvulair Project.	
	24		Do.	Hindri	Taikur Reservoir.	
	25		Do.		Dewanapilly Reservoir.	
	26		Do.		New Tank, south of Arveed Tank.	
	27		Do.		Garladinna Tank.	
	28		Do.		Tank sites in Markapur Taluk.	
	29		Bellary	Penner	Bookacherla Project.	
	30		Do.		Potalacoonta Tank Project.	
	31		Do.	Hagari	Mylapore Reservoir at Hagari.	
Do.	32		Do.	Penner	Hindupur Project.	These projects are expected to be submitted shortly.
Do.	33		Do.	Do.	Roddam Project.	
Do.	34		Do.	Hagari	Hagari Raidrug.	See remarks, B 15 to 31.
Not allotted	35		Chingleput	Narnaveram River.	Improving irrigation under Narnaveram River.	
Do.	36		Do.	Cortilair River	Channel from Anicut at Tamrapakum.	These projects have been partially investigated.
D. Project Division.	37		North Arcot.	Palar	Improving Palar River Channels, N. Section.	
Fourth Circle.	39		Do.	Cheyar	Cheyar River.	This as well as the improvement of irrigation in the S. Section is now under consideration with a view to the submission of a complete estimate system, as required by the Government of India.
Fifth Circle	40		South Arcot.	Do.	Arthur Project.	
Do.	41		Do.	Trimaneemoo-tanaddy.	Pullagacherry Channel Project.	There is no information regarding these projects. Partly investigated.
B. Project Division.	B	43	Salem		Pennacondapuram Tank Project.	
Do.	44		Do.	Sunnath Co-mara River.	Marandakully Project.	These were commenced as famine relief works. Projects are expected to be submitted shortly.
Do.	45		Do.	Ponniar River.	Baroor Project.	
Fourth Circle.	47		Coimbatore	Cauvery	Improvement and extension of Pugalore Channel.	Commenced as famine relief work.
Do.	48		Do.	Bhavani River	Channel from Bhavani to the Noyil.	
D. Project Division.	49		Trichinopoly.	Cauvery	Vengur Channel Project.	Estimates have been prepared, but require revision.
Do.	50		Do.	Do.	Kodunkoray Tank Project.	
Sixth Circle	51		Tinnevely	Tambraparni.	Maradur Channel improvement.	See remarks above, B 2.
D. Project Division.	C	VII	Ganjam	Korkey River.	Mallada Tampara	
Not allotted	IX		Godavari	Yerracalva	Annamalunka Reservoir.	Project has been investigated, but may require revision.
Do.	X		Do.	Penner	Gondicotta Reservoir.	
Do.	XI		Nellore	Do.	Do.	Proposed, but not investigated.
Do.	XIII		Kurnool	Kistna	Great Kistna Reservoir.	
B. Project Division.	XVIII		Salem	Ponniar River	Krishnagiri Reservoir.	Proposed by Sir A. Cotton.
Do.	XIX		Do.	Stream from Shevaroy Hills.	Vaniar Reservoir.	
Do.	XX		Do.	Swatanaddy.	Goodanully Reservoir.	Partly investigated.
Do.	XXI		Coimbatore	Cauvery	Allambody Reservoir.	
Do.	XXIX		Madura	Pitchlaur	Tank in Thaliooth Manoor Valley.	Not investigated.
Not allotted	XXX		Do.	Palar	Palni Reservoir.	
Do.	XXXI		Do.	Vaigai	Gallapuram Reservoir.	Partly investigated. Will not be taken up if Perryaur Project is sanctioned.
Do.	XXXII		Do.	Do.	Reservoir near Batagondoo.	
D. Project Division.	XXXIII		Tinnevely	Tambraparni.	Papanasam Reservoir.	Not investigated.

IV.

STATEMENT showing Irrigation Projects in progress, or to be taken up, in order of importance.

Division or Circle to which Work is allotted.	REFERENCE TO APPENDIX V, REPORT OF FAMINE COMMISSION.		District.	System or Source of Supply.	Name of Project.	Remarks.
	List.	Number.				
B. Project Division.	B	43	Salem		Pennacondapuram Tank.	These are nearly completed.
		44	Do.	Sunnath Comara River.	Marandahully Project.	
		45	Do.	Ponniar River.	Baroor Channel	
	C	XIX	Do.		Vaniar Reservoir	
		XVIII	Do.	Ponniar River.	Krishnagiri do.	
C. Project Division.	A	V	Do.	Cauvery	Narinjapett Anicut.	In progress. It is possible that very little work will be needed here. The work is entered in the list referred to in column 2, but will probably be superseded by the Bhavani Reservoir near Satyamangalam, reported on by Major Montgomerie, which it is proposed now to investigate.
	C	XX	Salem	Swatanadi	Goodanully Reservoir	
		XXI	Do.	Cauvery	Allambady do.	
	B	32	Bellary	Penner	Hindupur do.	
		33	Do.	Do.	Roddam do.	
	A	V	Madura	Vaigai	Perryaur Project	
	B	16 to 31 and 34	Cuddapah	Penner		
			Kurnool	Hindry,		
			Bellary	Hagari and minor rivers.		
D. Project Division.	B	2	Ganjam	Korkay River.	Mullada Tampara Project.	These are nearly completed. This is about to be taken up by Major Pennycuik. It is intended that the rivers should be taken up successively and thoroughly investigated. All projects hitherto proposed, including those investigated by the Madras Irrigation and Canal Company, the surveys and plans of which were made over to Government being taken into consideration.
	C	VII				
	A	H	Bellary	Tungabhadra River.	Upper Bellary Project.	
	B	37	North Arcot.	Palar	Improving River Channels, North Section.	
	C	XXXIII	Tinnevely	Tambraparni.	Papanasam Reservoir	
Fourth Circle.	B	49	Trichinopoly.	Cauvery	Vengur Channel Project.	The North Section only is mentioned, but the South Section has to be taken up also. Much of the work has been done.
		50		Do.	Kodunthoray Tank Project.	
	A	O	South Arcot.	Coleroon River.	Lower Coleroon Anicut.	
	B	47	Tanjore	Cauvery	Pugalur Channel.	
		48	Coimbatore	Do.	Channel from Bhavani to Noyil.	
Fifth Circle	B	40	South Arcot.	Cheyar	Athur Project.	Will not be taken up if the Perryaur Project is sanctioned.
		39	North Arcot.	Do.	Cheyar River.	
		41	South Arcot.	Trimaneemootonadi.	Pullagacherry Channel Project.	
Not allotted	B	13	Nellore		Restoring Adurapillai Tank of Griddalore.	
Do.		14	Do.		Restoring Timmalapady Tank.	
Do.	B	15	Do.		Restoring Gandipalam Large Tank.	
Do.	B	35	Chingleput	Narnaveram River.	Improving irrigation under Narnaveram River.	
Do.		36		Cortiliar River.	Channel from Anicut at Tamrapakam.	
Do.	C	IX	Godavari	Yerracalva	Annamalunka Reservoir.	
Do.		X		Pennar	Gandicotta Reservoir.	
Do.		XI	Nellore	Do.	Do.	
Do.		XIII	Kurnool	Kistna	Great Kistna do.	
Do.		XXIX	Madura	Pitchiar	Tank in Thalianooth Mamoor Valley.	
Do.		XXX		Palar	Palni Reservoir.	
Do.		XXXI		Vaigai	Gullapuram do.	
Do.		XXXII		Do.	Reservoir near Battagondoo.	

No. 49.

ORDER—dated 13th June 1882, No. 465 I., Public Works.

Ordered that the following letter be sent to the Government of India:—

(Here enter No. 465 I., dated 13th June 1882.)

(True Extract.)

(Signed)

R. H. SANKEY, Colonel, R.E.,
Secretary to Govt., P.W.D.To the Chief Engineer for Irrigation,
Consulting Engineer for Railways, } with copy of letter.Superintending Engineer
S.E. Tank Maintenance SchemeExd. C. Howarth.
Spare Copies.

IRRIGATION.

Govt. of (1882) Madras.
PUBLIC WORKS.

Dated June, 13th.

Recd.

Encl.

G.O., 13th June 1882, No. 465 I.

JUNE
Nos. 48-49.

Irrigation Projects suitable for
Famine Relief.

Statements of —, forwarded to the
Government of India.

13TH JUNE 1882, No. 466 I., PUBLIC WORKS.

PUBLIC WORKS DEPARTMENT.

Irrigation.

No. 50.

LETTER—from

COLONEL R. H. SANKEY, C.B., R.E.,

Secretary to Government, Public Works Department,

To

THE SECRETARY TO THE GOVERNMENT OF INDIA,

PUBLIC WORKS DEPARTMENT.

SIR,

With reference to your letter No. 163, dated 6th ultimo, I am desired by the Right Honorable the Governor in Council to forward the four statements of irrigation projects, as per margin, with a Note by the Chief Engineer for Irrigation, dated 18th ultimo.

- I. Statement of irrigation projects which have been disposed of.
- II. Statement of irrigation projects to be indefinitely postponed.
- III. Statement of irrigation projects showing the agency by which it is proposed they should be investigated.
- IV. Statement showing irrigation projects in progress, or to be taken up, in order of importance.

2. Of these statements, No. I enumerates practically ten works which have either been sanctioned or the projects for which have been framed or submitted. Though classed technically

as "Productive," they are each and all necessarily "Protective," and would moreover be very suitable for famine works, should such a calamity occur while they are in course of ordinary execution.

3. Statement II contains 31 works, which, though previously proposed and many of them in great degree investigated, are now proposed to be indefinitely postponed for the reasons assigned opposite each. In order to save time and prevent misapprehension it is thought best by this Government to place these on a prohibited list. To this list will also be transferred all other projects which, on sufficient investigation, are proved to the satisfaction of Government, to be capable of classification neither as Productive nor Protective.

For the reasons assigned in another letter of this date, No. ¹²⁷⁵_B W. His Excellency in Council is wholly averse to the commencement of large works during famine which cannot be classed either as Productive or Protective, or which would not from their nature be undertaken in ordinary years were funds available, or again any works however classified, which have not undergone all the needful scrutiny and been sanctioned by Government in ordinary course.

4. Statement III contains 56 works which it is proposed to investigate, and Statement IV shows the order of importance in which such investigations are to be taken up, and the project divisions or other agency to be employed with this object.

5. As the Government of India is unprepared to sanction any increase to the permanent establishment, for undertaking

- * 1. Kistna Completion Works.
- 2. Cauvery and Vennar Regulations.
- 3. Godavari Completion Works.

these investigations, and as the immediate necessity for creating two* new divisions for the execution of lately sanctioned

irrigation projects, and another immediately anticipated, will certainly absorb all the suitable agency of a temporary character available in South India, this Government is of opinion that the scheme now sent up is all that can, under existing circumstances, be attempted.

6. In the letter under reply the Government of India express an opinion that, the attention of the establishment should be confined entirely to its legitimate duties, and to the preparation of projects manifestly well adapted to protective purposes, but as with regard particularly to irrigation works it is quite impossible, prior to exhaustive investigation, to say whether a project can be classed as Productive or merely as Protective, His Excellency in Council has no other course open than to deal with the matter as above suggested, leaving, if necessary, the charge for establishment to be distributed in the best feasible manner, after the close of each year's operations.

7. In reference to Tramways or Light Railways to be employed as Protective Works, the inquiries are as yet, I am to say, incomplete, but the subject will be dealt with at the earliest opportunity.

I have the honor to be,

Sir,

Your most obedient servant,

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

OOTACAMUND,
13th June 1882.

that the project may be sent forward in sections as ready, in order that the sanction of the Secretary of State may be obtained to the commencement of construction.

5. The Government of India accepts the conclusion of the Government of Madras in favor of Vizagapatam as the sea terminus of the line, and I am to suggest that the project for the section from Vizagapatam to Párvatipur might be first completed and sent on for sanction.

6. In conclusion I am to request that an expression of the high satisfaction of the Government of India may be communicated to Mr. Nordmann and his Assistant Mr. Cormac for the very careful and complete way in which the duties entrusted to them have been carried out.

No. 118-B.

From Major F. FIREBRACE, R.E., Under Secretary to the Government of India, Public Works Department (Railway Establishments), to the Secretary to the Government of Madras, Public Works Department, dated Simla, 1st November 1882, No. 732 R.E.

In continuation of Public Works Department No. 943 R.C., of the 27th October 1882, I am directed to state that the services of Mr. E. H. Stone, Executive Engineer, Third Grade, are also placed at the disposal of the Government of Madras for employment on the surveys to be undertaken this season in that Presidency.

2. I am to request that the dates on which the officers on the Government of India list join the surveys may be reported on an early date.

No. 118-C.

Telegram to Government of India, dated 6th November 1882.

No. 118-D.

Telegram from the Secretary to the Government of India, Public Works Department, Simla, to the Secretary to the Government of Madras, Public Works Department, dated 10th November 1882.

Your telegram sixth. All officers available ordered to Madras. More will be posted as soon as practicable.

No. 119.

ORDER—dated 18th November 1882, No. 3058 W., Public Works.

Ordered that the following letter be sent, and that paragraph 6 of the letter from the Government of India, No. 943 R.C., dated 27th October 1882, be communicated to Messrs. Nordmann and Cormac.

(Here enter No. $\frac{3058}{A}$ W., dated 18th November 1882.)

(True Extract.)

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

To the Superintending Engineer, First Circle.
" " " Second "
" " " Third "
" Examiner, Public Works Accounts.
" Consulting Engineer for Railways.

Exd. C. Howarth.
Spare Copies

21-1-92


GENERAL
ESTABLISHMENT

Govt. of (1882) Madras
PUBLIC WORKS.

Dated November, 18th.

Recd.

Encl.

G.O., 18th Nov. 1882, No. 3058 W.

NOVEMBER.
Nos 118-119.

**Vizagapatam-Raipur
Railway.**

Ordering that the Government of India be addressed on the subject of the Staff of Officers required in connection with the surveys for the —, and communicating to Messrs. Nordmann and Cormac the satisfaction expressed by the Government of India with reference to the reconnaissance carried out by them.

30TH APRIL 1883, No. 386 R., PUBLIC WORKS.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Railway.

Read the following papers :—

From Major F. FIREBRACE, R.E., Under Secretary to the Government of India, Public Works Department (Railway Construction), to the Secretary to the Government of Madras, Public Works Department, dated Simla, 2nd November 1882, No. 965 R.C.

In continuation of Public Works Department letter, No. 943 R.C., of the 27th October 1882, I am directed to request that the Government of India may be furnished with as full and detailed estimates of probable traffic, description of the resources of the districts traversed, information as to the probable famine protective influence, &c., of the projected Vizagapatam-Raipur Railway as it is in the power of the Government of Madras to furnish.

No. 2159 C.

Copy of the above, with papers quoted in the margin, forwarded to the Collector of Vizagapatam with a request that he will be good enough to supply all the information he can collect from merchants and others. It would be particularly useful to show how the line of railway could have helped during the famine of 1866-67. The prices of grain above and below the ghâts should also be quoted.

24th November 1882.

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

To the Collector of Vizagapatam,
with papers marginally quoted as above.

Read again—

G.O., dated 18th January 1883, No. 65 R.
" " 8th February " " 123 R.

ORDER—dated 30th April 1883, No. 386 R., Public Works.

In view of the probable early submission of estimates for lines of railway connecting Vizagapatam with Raipur, Bezvâda with Tadpatri and possibly with Banga-

lore *via* the Nandikanama Pass, and Nellore with Tirupati, His Excellency the Governor in Council resolves to call upon the Collectors of the several districts * likely to

* Ganjam.	Cuddapah.
Vizagapatam.	Kurnool.
Godavari.	Bellary.
Kistna.	Anantapur.
Nellore.	North Arcot.

be served by the proposed lines for a comprehensive report upon the prospects severally of each undertaking.

2. Estimates of the probable traffic, both in passengers and goods, should be framed, supported, as far as practicable,

by statements showing the fairs and feasts in the several districts that would be likely to promote passenger traffic; the existing traffic on the Northern Trunk Road and on other principal roads; the principal commodities which would in all probability be moved by rail, together with comparative schedules of the prices ruling ordinarily in different localities. It should be shown in what respects the administration of the districts would be facilitated by the lines, and generally what advantages may be looked for from them.

3. The reports above called for will be submitted through the Board of Revenue, who, in laying them before the Government, will express their views on the subject, especially as to the probable effect of the proposed railways upon the export and import trade of the littoral districts, supported as far as possible by figures showing the produce now grown in those districts, the estimated annual local consumption, and the probable tonnage likely in ordinary years to be available for inland and foreign markets, with any other statistics that may be available in order to ascertain what return may be looked for in ordinary years from the outlay proposed.

4. The Commissioner of Salt Revenue will report what effect the construction of these lines of railway will, in his opinion, have upon the salt trade in the several districts, illustrating his views, as far as practicable, by statements showing the prices ruling in different localities, and the tonnage now carried along the several routes proposed, with any other statistics that may appear to him to bear upon the subject.

5. The Chambers of Commerce, Madras and Cocanada, will be requested to favor the Government with their views as to the development of trade generally that may be looked for from the construction of these railways. His Excellency in Council will gladly receive, through the Chambers, the views of any leading firms who may be specially interested in the trade of the districts concerned, and whose views the Chambers would recommend for consideration.

6. The Postmaster-General will be asked to report to what extent the public interests will be served and the revenue benefited by the proposed lines.

7. The Director of Revenue Settlement and Agriculture will be asked to report upon the subject generally, and especially with reference to the effect of the proposed railways upon the irrigated deltas, for which he has lately compiled revenue statistics.

8. The Inspector-General of Police will be requested to report to what extent in his opinion these railways would in each case facilitate the working of his department, both as regards the detection of crime and the general administration of the force.

9. The opinion of His Excellency the Commander-in-Chief will be obtained, in the Military Department, respecting the increased facilities for military administration in the districts concerned, which would result from the construction of the proposed railways.

10. His Excellency in Council trusts that the authorities now consulted will not confine their investigations to the several points indicated in the foregoing remarks; but that they will endeavour, so far as possible, to furnish for the information of the Secretary of State an exhaustive estimate of the advantages, direct and indirect, that may fairly be expected to accrue to the State from the construction of the proposed lines of railway.

11. It is hoped that the replies to this reference will be forwarded at as early a date as possible.

(True Extract.)

(Signed) J. SILAW-STEWART, Colonel, R.E.,
Joint Secy. to Govt., P.W.D.,
Railway Branch.

To the Consulting Engineer for Railways.
" Superintending Engineer, Bellary State Railway.
" Engineer-in-Chief, Vizagapatam State Railway.
" Collector of Ganjam.
" do. of Vizagapatam.
" do. of Godavari.
" do. of Kistna.
" do. of Nellore.
" do. of Cuddapah.
" do. of Kurnool.
" do. of Bellary.
" do. of Anantapur.
" do. of North Arcot.
" Public Department.
" Revenue Department.
" Board of Revenue.
" Commissioner of Salt Revenue.
" Chamber of Commerce, Madras.
" do. do. Cocanada.
" Military Department.
" Postmaster-General.
" Director of Revenue Settlement and Agriculture.
" Inspector-General of Police.

Exd. C. Howarth.
Spare Copies

RAILWAY.

Govt. of (1883) Madras.
PUBLIC WORKS.

Dated April, 30th.

Recd.

Encl.

G.O., 30th April 1883, No. 386 R.

APRIL.
407

Proposed Railways between
Vizagapatam and Raipur,
Bezvada and Tadpatri, &c.

Certain Collectors and other officials to
report on the prospects of —.

28TH NOVEMBER 1883, No. 3394 W., PUBLIC WORKS.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

READ—the following papers :—

- Telegram from Superintending Engineer, First Circle, dated 13th November 1883.
- Telegrams from Superintending Engineer, Second Circle, dated 12th and 17th November 1883.
- Letter from Superintending Engineer, Second Circle, dated 17th November 1883, No. 313.
- Letter from J. H. GARSTIN, Esq., c.s.i., Acting Second Member, Board of Revenue, dated 13th November 1883.
- Letter from W. WILSON, Esq., Director of Revenue Settlement and Agriculture, dated 13th November 1883, No. 2911/83.
- Letter from H. Sr. A. GOODRICH, Esq., Collector of Bellary, dated 16th November 1883, No. 4160.
- From the Chief Engineer for Irrigation, dated 24th November 1883, No 34 W.

ORDER—dated 28th November 1883, No. 3394 W., Public Works.

Ordered that the Government of India be addressed.

(Here enter No. 3395 W., dated 28th November 1883.)

(True Extract.)

(Signed) J. SHAW-STEWART, Colonel, R.E.,
Secretary to Govt., P.W.D.

To the Consulting Engineer for Railways, with copy of letter.

Exd. A. Aubert.
Spare Copies.

Govt. of (1883) Madras.
PUBLIC WORKS.

Dated November, 28th.

Recd.

Encl.

G.O., 28th Nov. 1883, No. 3394 W.

NOVEMBER.

Metre-gauge Railway

Regarding the proposed construction of a
— from Vizagapatam to Cocanada with an
extension to Madras and a line from Vizaga-
patam through Ganjam to Cuttack in Orissa.

28TH NOVEMBER 1883, No. 3395 W., PUBLIC WORKS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

LETTER—from

COLONEL J. SHAW-STEWART, R.E.,

Secretary to the Government of Madras,

Public Works Department,

To

THE SECRETARY TO THE GOVERNMENT OF INDIA,

PUBLIC WORKS DEPARTMENT.

SIR,

I am directed to acknowledge the receipt of your letter, No. 985 R.C., dated 2nd November 1883, requesting the views of the Madras Government on proposals from certain English promoters for the construction of a metre-gauge railway from Vizagapatam to Cocanada with an extension towards Madras; and also for a line from Vizagapatam through Ganjam to Cuttack in Orissa.

In reply I am to state that this Government see no present necessity for the proposed line of railway, and are of opinion that there is no prospect of such necessity arising in the immediate future.

The cost of the line, owing to the character of the country to be traversed would, I am to point out, be far in excess of the average cost of ordinary metre-gauge lines, as the line would have to be carried across the entire drainage of that part of the peninsula, including the Godavari and Kistna rivers, the anicuts on which could not possibly carry a line of railway.

The Government are of opinion that there is no prospect whatever of such a line yielding a return in any degree commensurate with the large outlay involved.

I have the honor to be,

Sir,

Your most obedient servant,

(Signed) J. SHAW-STEWART, Colonel, R.E.,
Secretary to Govt., P.W.D.

FORT ST. GEORGE,
28th November 1883.

Exd. A. Aubert.
Spare Copies

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of (1883) Madras
PUBLIC WORKS.

Dated November, 28th.

Recd.

Encl.

28th Nov. 1883, No. 3395 W.

NOVEMBER.

Metre-gauge Railway

REGARDING the proposed construction of a
— from Vizagapatam to Cocanada with an
extension to Madras and a line from Viza-
gapatam through Ganjam to Cuttack in
Orissa.

18TH APRIL 1884, No. 401 I., PUBLIC WORKS.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Irrigation.

READ—the following papers:—

From W. WILSON, Esq., Director of Revenue Settlement and Agriculture, to
the Joint Secretary to Government, Public Works Department, Railway
Branch, dated Madras, 8th December 1883, No. 3195/756.

I have the honor, in reference to G.O., No. 386 R., dated 30th April 1883, and
official memorandum, dated 30th July 1883, No. 1405 C., Public Works Department, to
point out that the lines from Guntur to Guntakal and from Nellore to Tirupati having
already received the sanction of the Secretary of State and being, it is believed, in process
of construction, the reports called for regarding them seem to be now unnecessary, while
the reports asked for in respect of the Vizagapatam-to-Raipur line and the line from
Tirupati to Madanapalle, through Chandragiri, Pchelair and Vayalpad, would be prema-
ture now, in view of the statistics of traffic which, in G.O., No. 2440 C., dated 6th
December 1883, it has been determined to collect regarding them in the first instance.

2. I have had a large number of figures collected regarding all the lines referred
to in the orders quoted at the head of this letter, but have not yet, I regret to say, had
leisure to throw them into shape for submission to Government.

3. In reference to the line from Guntur to Guntakal, I beg to invite the attention
of Government to the question of the construction of the Mamdivaram anicut across
the Gundlakamma at the point where it leaves the Markapur taluk of Kurnool and
enters the Vinukonda taluk of the Kistna.

4. This work was most favorably commented on in G.O., No. 3004 F.R., dated
3rd December 1877; but there were then difficulties connected with its construction
which this railway that will cross the Gundlakamma hard by its site will tend
largely to remove. The difficulty of getting locally proper material for making the
dam could be overcome by the transport of better from elsewhere, while the labor
that is altogether wanting and might be difficult to gather under the former conditions
could easily be brought to the spot by means of a railway which, too, by making
migration easy, would create the population that is now wanting to till the 150,000
acres that the work would irrigate. We should thus have a famine railway creating
a new famine-protecting delta.

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

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

18TH APRIL 1884, No. 401 I., PUBLIC WORKS.

No. 79 I.

Note by the Acting Chief Engineer for Irrigation.

The Mamidivaram reservoir, on the Gundlakamma river, Kurnool district, is shown in list No. II of the Note by the Chief Engineer for Irrigation printed with proceedings of Madras Government, No. 465 I., of 13th March 1882, as one of the projects to be indefinitely postponed. The construction of the Bellary-Kistna Railway will no doubt, as pointed out by Mr. Wilson, alter the state of affairs as regards "scantiness of population," which is one of the reasons which has hitherto barred the further investigation of the scheme, but it must be noticed that the irrigation channels from the reservoir will have to be carried under the railway, which will add considerably to the cost of the project. It is, however, recommended that the project be taken up when the necessary means are available; but as the Government of India have lately declined to sanction the entertainment, during the next official year, of two of the project divisions, there does not seem to be any likelihood of the necessary establishment being forthcoming at present.

CHEPÁK,

10th April 1884.

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

(Signed) A. S. RUSSELL,
for Chief Engineer for Irrigation.

ORDER—dated 18th April 1884, No. 401 I., Public Works.

The Government agree with the conclusions of the Chief Engineer for Irrigation, and the investigation of the Mamidivaram reservoir must therefore lie over for the present.

(True Extract.)

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

To the Chief Engineer for Irrigation.
" Consulting Engineer for Railways.
" Revenue Department.

Exd. E. Fernandez.
Spare Copies

IRRIGATION.

Govt. of (1884) Madras.
PUBLIC WORKS.

Dated April, 18th.

Recd.

Encl.

G.O., 18th April 1884, No. 401 I.

APRIL.

Mamidivaram Reservoir

Considering that the investigation of the
— on the Gundlakamma river, Kurnool
district, must lie over for the present.

No. 401

No. 3 or Kumtum Range Office
Kumtum 17th September 1884

From, The Officer in Charge of
Kumtum Range

To, The District Engineer
Kurnool

Subject: Report on Captain Taylor's
Amadavarum Project.

Sir,
As verbally instructed by
Captain Taylor late Acting District
Engineer, to report on the formation
of a tank situated near the village
of Amadavarum in the Maskapur
Taluk, by embanking across a gap
between two hills, through which the
Gundlacumma River flows, I have
the honor to submit the following
She

ans, sections
it will follow

The hills referred to, locally called the Yerramullays, are a Range extending from the Kullamalays along the eastern boundary of the Marcapoor Taluq, - dividing the Gurnool and Bellare Districts..

The supply to the proposed tank is the Gundlacumamah River which has its affluents the ~~Kundla~~ ^{Kundla} ~~Doodalapur~~ ^{Doodalapur} Siggala and other large streams, making in all a drainage area, according to Captain Saylor's calculation, over 2,000 sq. miles. Captain Saylor informs me, that he has already submitted to the Chief Engineer for Irrigation, the District map, on which he has drawn the size of tank which will be formed, and the drainage area it commands, it will therefore be only necessary to give a brief outline of the work necessary to form the reservoir and its channels, and the sources of return such

an

5516
an irrigation work is likely to yield. From the accompanying plan will be seen the section of the gap, its greatest length ^(of bund) at top will be about 700 yards and height varying from 40 yards over the bed of stream and running out to nothing on each side of the hill..

About five miles north of the gap a convenient saddle occurs which would form a good site for a Calingulah the height of this ridge is ^{about} 80 feet above level of ground at gap, and assuming this to be the level of Calingulah, a bund of about 100 feet in height would be required.

The Gundlacumamah River has a perennial flow, the normal flood level rises 6 feet while a full fresh is 32 feet, the hot weather stream is never less than three feet in depth.

Captain Saylor, while Deane Officer

at Bunnium in ^{the} year 1869, visited
this site and in fact is the projector
of the scheme. He evidently bestowed
a great deal of attention to this discovery,
and the pains he appears to have taken
to fully investigate it, deserve
great praise. He had the stream
gauged for nearly two years and it
is a matter for regret, that the valuable
information he had collected regarding
the discharge of this River and other
statistics in connection with the
Project, have been lost from the Office.

The figures he arrived at were, that
a Lake could be formed to enclose a
superficial area of 200 sq. miles with
a drainage area over 2000 sq. miles -
the section of bund he proposed I
believe was top breadth - depth of
waters at front of bund, with slopes
of $1\frac{1}{2}$ to 1 at front, and 2 to 1 at rear.
A



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A concrete wall was to be raised
to top of bund and run through it
from hill to hill, its foundation sunk
(about 6 feet) to the rock underlying
the surface of ground. The riverbed
to have a backing of gravel and
with rough stone laid at right angles
to the slope.

Three sluices were to be provided, one
on either side of river for irrigation
purposes, and one built in bed of
River for discharging silt and passing
waters if required along the old course
of the River.

As the main channels will
require to be made of considerable size
to supply the great demand for water
for cultivation purposes, it would be
with little extra expense to make them
available for navigation, so that direct
communication could be effected on the
North as far as the Krishna River, and
on

on the south with the East Coast Canal. A considerable traffic is carried on at present by conveying Salt grain &c. to Hyderabad and other inland Districts which the channels would then monopolize.

The water spread of the tank it is expected will reach within five miles of Doodpand a village lately the Cushtown of the Markapur Salug and the exports from this District would be chiefly the valuable timbers such as teak ebony Yeggy &c. which grow in large quantities on the Nallamala hills.

In comparing the Longitudinal section (plan No 1) and the ^{Sketch} ~~Survey~~ of the gap (plan No 2) it will be seen, that advantage has been taken of a rock (20 feet high) about midway, which will greatly strengthen the mound.

The depression on the North River is formed

59 18
informed by the villagers is a natural outlet for the flood water of the Kundla River when the Gundlacumma River is in fresh, and in forming a mound here it appears to me, that this depression could be turned ^{into} ~~out~~ some account, by opening a channel to it, so as to pass the water of the Gundlacumma through it while the embankment connecting the Rock and the main hill to the ^{South} ~~North~~ is under construction.

The greatest length and depth the embankment over the River is to be carried ^{warrant} ~~so that~~ the greatest possible care and consolidation should be effected in forming it. I am of opinion that nothing simpler could be done than raising it so as to allow water to stand to the depth of 14 feet (level of depression) for a season or so, and permitting a monsoon to act on the earth embankment before the whole work

work is raised to its proper height and the full tank supply brought to bear on it. The construction of the 2nd bund would not be very difficult as opportunity could be taken of a dry month to let out the stream through all the sluices.

The soil for the bund may be brought from the rising ground, situated about 1/4 of a mile in front of it (within ^{the} tank) and I should recommend for economy as well for speed, that a light tramway should be formed to this, for transporting the earth.

Rock of fair quality can be obtained from the adjacent hills, it is a species of Slate - easily quarried and becomes hard by exposure to the atmosphere. The land which will be brought under wet cultivation will be entirely in the Nellore District, and as the country has one continuous fall (at about four feet

61 19
per mile) to the sea, the extent of this (irrigated land) will depend on the supply from the tank.

The tank although of such a large superficial area submerges very few villages (five) ^{which} lie at present in its basin, it is owing probably to the scarce population arising from the pooriness of the soil, as the villagers depend chiefly on cultivation for their means of ^{support} subsistence.

The ground is throughout rocky and chiefly waste. Slight patches of cultivation may be met with during the rainy weather in the hollows where the soil of the uplands has been washed down, forming a thin layer over the rocky formation. The compensation on the whole is therefore not expected to amount to very much, considering the large volume of

water which will be collected.

The short time at my disposal pre-

sented my carrying out the investiga-

tion as far as I wished. It will be

seen however from the general outline

of the project, and I have no doubt

it has every likelihood, if carried

out, to prove a remunerative work

of and of incalculable benefit to the

country it will irrigate.

I have the honor to be,

Sir,

Your most obedient servant

In free

Assistant Engineer

Cumbeem Range.



Office of the Superintendent of
Engineer Station Camp Iru
Puducherry, Madras 1875

From, Major J. O. Hasted R.E.
Superintendent Engineer Station

To, Lieut. Col. John Mullins R.E.
Chief Engineer for Irrigation

Sir, With reference to your letter

Enclosures
1 Original letter from the officer in charge of Kurnool Range to the District Engineer Kurnool No. 407 of 17th Sept 74. I have the honor to submit the following report on the reservoir proposed by Captain Taylor at Komadianare in Kurnool District.
1 Sketch of the rocks & gap at Comadavaram
2 Plan and section of the sluices proposed for Comadavaram project. I spent between 2 and 3 days, examining the site of the proposed waste weir, and have been in communication with Captain Taylor, who has kindly furnished me with all the information at his disposal regarding the proposed work. The register and sections of the Gundlacumma, referred to in Captain Taylor's letter to you of the 21st October 1874.

- 1 Atlas sheet No 76 (tracing)
- 1 Longitudinal section of the gap
- 1 Atlas sheet No 76 Complete

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 3/11/75-

have unfortunately not been found, and I learnt that the Brahmin living at Vellumpally who grazed the river, was absent from his village.

3. The following account of the proposed reservoir I have gathered from Captain Taylor's communications, and from Mr Bell's report no 407 dated 17 September 1876.

A little below the village of Mowadianarem, the Gundlaccunna immediately after receiving the waters of a drainage stream, called the Kundlaur, passes through a gap in a line of low hills called the Yerramaleys lying partly in the Krishna and partly in the Kurnool District. A Dam is proposed to be constructed across this gap, about 120 feet high, to form a large reservoir. A waste weir is proposed over a saddle in the hills 4 or 5 miles to the north of the gap, a single irrigation channel

channel, taken off immediately to the north of the river, to be excavated, which may be made navigable and connected with the Krishna Channel at or near Biggarah.

The width of the gap or space between the foot of hills on either length of the top of the bund will be about 500 feet. The side is about 3000 feet. The breadth of deep channel of the river is 600 feet, water spread in floods 2300 feet. The level of the gap (whether ground level or riverbed level is unknown) is stated to be 340 feet above mean sea level. The minimum flow of the river is 800 cubic feet per second, the fall of the bed of river above gap from 3 to 4 feet per mile, the fall of the country towards sea about 4 feet per mile.

Several saddles in the Range are said to be available for escapes, but the one fixed upon by Mr Bell is 4 or 5 miles north of the gap, and is said to be 80 feet above the

the gap.

The drainage area of the river basin is about 2000 square miles, rainfall assumed to be 27 inches in the year, but probably higher.

Area of reservoir, when full, 100 square miles, mean depth 7 to 9 yards. Irrigation expected 300

square miles which at Rs 6 per acre for two crops would yield a return of 11½ lacs of Rupees.

Dam to be of earth with a concrete core and puddle wall in front, revetted with stone, scouring sluices to be built in bed of river under the dam. Irrigation sluice to be built through dam and supplied by openings in a masonry tower.

Mr. Bell proposes to take advantage of a rock (20 feet high) in the gap, to build the dam over it.

The water spread of the tank would submerge only 5 villages.

A great part of the land submerged is

is waste, of no value. 69 3
4. The basin is certainly a very fine one, and I have little doubt of the correctness of the water spread as laid down by Captain Taylor, supposing that such a dam as he proposes were constructed, and the reservoir were full. The lake would be a magnificent one, and in the midst of this dry and sterile country would undoubtedly prove of great benefit.

5. Agreeing with Captain Taylor as to the immense benefit that such a reservoir would be to the country, I have considered 4 points to which I will now direct attention as shortly as possible, 1st the feasibility of constructing such a dam, 2nd the quantity of water it will be possible to store, 3rd the probable cost of the works, and 4th the revenue that may be expected in consequence of this outlay.

6. I must premise that, in the absence of any levels, except a section of the gap and escape saddle, prepared apparently by an Overseer of the Murreel District, and other definite information, all that I put forward now is the result of careful examination of the ground at the site of the proposed dam, and in the neighbourhood, and of many miles of exploration on and below the hills on either side of the gap, with readings of an aneroid barometer. The figures I give, though the result of careful consideration and calculation, must not be regarded as absolutely accurate, but as the best approximations I am able, with the information at my disposal, to make.

7. The feasibility of constructing the dam. The section accompanying shows as before mentioned, that the width of the gap between foot of hills is about 3000 feet, and at level of top of

of proposed bund about 5000 feet. The deep bed of the river runs at the foot of the southern Range of hills and I may mention that the slope of the northern hills seemed to me to be considerably less above the water mark than shown on the section but I could not be certain where the section was taken exactly. The hills on the north run up gradually from the gap, till about 1 mile north of it I made the summit to be about 200 above river bed. Going on to the north, I have noted 1st saddle to be about 170 feet above river bed, next high point about 190. 2nd saddle 140, 3rd saddle 140. 5th saddle 200 feet, the two last are above Hoopakunda Tank. I was unable to find any saddle so low as that mentioned by Mr. Bell. Even supposing this, however, means that the height of the escape saddle is 80 feet above the general level of the gap, and well above the bed

bed of river. On the south, the hills run up to a much greater height than 200 feet, though gradually, and the saddles all appear to be much higher.

8. The difficulty of finding a saddle of about the requisite height, is therefore a serious question; any considerable cutting down of the ridge being a very expensive matter, it is possible however, that one of the saddles may turn out to be lower than I made it, the situation would then be suitable, the surplus water would fall again into the natural bed of the river below the dam, and the only difficulty would be, that the Irrigation Channel Captain Taylor proposes would have to be carried over the escape channel. The other point requiring notice in connection with the escape channel is that, if the weir is above the Koppookunda tank, the tank and cultivation

cultivation below will probably have to be taken up.

9. The hills are very stony, with rock continually cropping up and thinly covered with small bushes. The rocks appeared to me, to be clay shale, and quartzite with masses of quartz. Pieces of lime kunkur were occasionally found, and remains of a very small native kiln shewed that it had been burnt here. The soil in the basin, above the gap is very light red soil. Mrs. Bell has mentioned that the soil for the bund may be brought from the high ground $\frac{1}{4}$ of a mile in front of it. I therefore carefully examined this ground, and the river banks both of the Gundlucamma and Kondein for some distance up. I found the soil the same throughout and it was only in the hollows in the river bed that I found anything like clay and that in very small quantities. I can hardly imagine worse soil of which

to Construct a large bund and I
do not know where clay for the
puddle bank, which would be an
absolute necessity is to come from,
though it is possible it might be
found by excavation, in old courses
of the river. Unless further exa-

mination should disclose better
material, I would not recommend
the construction of an earthen dam.

10. I think, therefore, that the Dam
would have to be constructed of
the best rubble masonry.

The stone that I met
with is not good building stone,

but Mr. Bell mentions that a fair
quality of stone, a sort of slate,

easily quarried and that hardens
with exposure, is procurable. I

conclude he refers to a clay shale and
some qualities of this might be suitable.

The lime banks I met with I take

to be similar to that found in many
parts of the District and which yields

a very fair lime. The lime slightly
hydraulic.

hydraulic, fuel is not procurable
near at hand, but within 10 miles
distance it appears to be plentiful.
It may be a question, I think, if
the Dam could not be built with
concrete, the front slope protected
with stone revetment from the wash
of the waters. Captain Taylor, it
will be observed, proposed a concrete
core to his Dam, with a puddle wall
in front, but he also allowed an earthen
bank over all.

11. Mr. Bell has advised that advantage
should be taken of a rock in the gap
(20 feet high) to build the bank over
it. This rock, I make out to be about
50 feet high. The Dam, I think, should
be well in front of it, and certainly not
over it, whatever materials the Dam
were constructed of, there must be
unavoidable settlement if it is over the
rock. Advantage, however, might
it occurred to me, be taken of it, in
building the dam to turn the river
by

by a bank abutting on it.

12. Captain Taylor has proposed scouring sluices in the bed of the river under the dam for the purpose of keeping the reservoir clear of silt. He has found from experiment that the Gundlacamma in flood contains 5 per cent (in bulk) of silt in suspension, and he states that it has been ascertained from cross sections of the Cumbum tank that the bed has been raised by silt 45 feet in about 300 years. I am doubtful of the effect of such scouring sluices, they would probably affect the deep portion of the river bed only for a short distance, and I do not think it advisable to construct such sluices under the highest part of the dam.

13. The quantity of water it will be possible to store In the drainage area shown on Captain Taylor's map, the whole of the drainage basin of the Gundlacamma, embracing that portion which

which supplies the Cumbum tank is included. I am not acquainted with the circumstances of the tank, but I think we should only calculate our supply from the drainage area of the basin exclusive of that portion which supplies Cumbum tank, adding to it, the discharge over the Cumbum surplus weir and the surplus from irrigation under the tank. The last 2 items I have been obliged to omit from my calculations.

14. Rainfall has been assumed by Captain Taylor to be 27 inches a year, but he believes that it is generally more than that. The following figures are from the Register of rain kept at Vinconda about 10 miles from the site of the proposed

Dam	in
Average fall of past 8 years	24.89
Highest	34.75
Lowest	16.65

It is probable however that more rain falls in the hilly basin, than below

below, and I therefore have accepted
27 inches as the yearly rainfall.

15. The area of the Tank taken from
the map, I find to be 90 Sq. miles.

assuming Captain Taylor to be right
and the average depth to be 9 yards.

the contents would be 2,509,056,000 C. yards.

The Drainage basin taken as
above mentioned, I find to be 1630

Square miles; rainfall being 27
inches in the year, the yearly fall

in the basin would be 3,786,916,000 C. yds.

say that of this $\frac{1}{10}$ would run off
and could be stored, which seems

probable, as the basin is generally
rocky and hard soil, the quantity
available for storage would be

2,272,089,600 Cubic yards, which, it will
be observed, would not fill the tank.

The quantity available for Irrigation
will depend to some extent on the
level, at which water is drawn off
but I will assume that $\frac{2}{3}$ of the

quantity stored will be available
or

or 1,514,726,000 Cubic yards, allowing
that 10000 C. yards stored will irrigate
one acre, this will suffice for the
irrigation in round numbers, of
150,000 acres.

16. We must now assume, that in
a very wet year such as is experienced
usually about once in every
10 years, the tank has filled, and
there is a heavy fall of rain, the
discharge from the drainage basin, and
which must be passed over the
waste weir, I calculate from the
formula $D = 675 M^{\frac{2}{3}}$ to be 93,150 Cubic
feet a second.

With a depth of 3 feet going over
the waste weir, to pass this quantity
must be 1779 yards long, with a depth
of 5 feet - 827 yards.

17. The probable cost of the works. The
works that would have to be carried
out are 1. The Dam, 2. The waste
weir, 3. The Irrigation sluices, and
4. Irrigation channels.

Captain

Captain Taylor has proposed that there shall only be one channel on the north of the river and that the Irrigation should be carried on between the 5th and 35th miles of this Channel, and then the Channel should be continued simply as a navigable canal to near Bezgarah. It seems to me, after having seen a good deal of the country, that it will be desirable to distribute the water more widely and therefore to have 2

Irrigation Channels, one to the north of the river which would irrigate land lying exclusively in the Kistia District, the other passing through part of the Kistia into the Melloe district. I leave the question of a navigable Canal for the present.

18. The dimensions of the dam I have calculated for the different sections which will have to be given to it according to its height, as shown on

in the cross section of the gap and I find that it will contain 489,614 Cubic yards of masonry. Captain Taylor states the rubble masonry would cost from 3 to 4 Rupees a Cubic yard. Taking ^{at} the cost of the Dam would amount to Rs 19,58,456 or we will say 19½ Laes. I have though taking the highest rate allowed by Captain Taylor, made no allowance for clearing foundations until solid rock is met with, and therefore I consider the rate allowed extremely moderate.

19. The outlet works will consist of masonry tunnels, though the shoulders of the hills on which the dam will abut, supplied by masonry towers, these works will necessarily be very expensive and I do not think I have overestimated their cost at 1 Lae of Rupees each.

20. The waste weir must also be a very expensive work, but without accurate levels, it is impos-

its cost accurately. I have therefore allowed a sum of one Lacs of Rupees for it.

21. The Irrigation Channels will have to be of considerable dimensions to pass the supply required. Here also, without accurate levels, it is impossible to frame a trustworthy estimate.

Supposing that the irrigation were equally divided between the two sides of the river, each channel would have to supply 75,000 acres, and with a fall of 1 foot per mile, depth of 6 feet, side slopes $1\frac{1}{2}$ to 1, would have to be 60 feet wide at sill, the velocity would then be 2.67 feet per second. Here the channel within soil, the excavation required would cost at 2 annas per cubic yard, 10,000 Rupees a mile, and this allows nothing for embankments, which would be heavy in places. The dimensions of the channels will of course decrease, as water for irrigation is taken off, but I believe my estimate will be moderate if I calculate that to the

the end of the excavations, the Irrigation Channel will cost Rs 5,000 a mile. Each channel being 35 miles long, the total cost of the 2 will be $3\frac{1}{2}$ Lacs of Rupees. 83

22. The masonry works on the channels will be very heavy. One of the channels must have a super passage over the surplus of the reservoir, and it will be seen from the map that both channels must cross the drainage of the country. The soil is bad, and the works must consequently be very solid. I estimate their cost at Rs 5,00,000, which would be rather over 7,000 Rupees a mile of channel.

23. The distributing channels may be estimated to cost 2 Lacs of Rupees. Compensation will be a small item though I believe that more than 5 villages, as mentioned by Captain Taylor, will be submerged. I have allowed $\frac{1}{2}$ a Lac of Rupees for this purpose.

24. The rough estimate of cost then stands as follows. Cost

Cost of Dam	Ruppes. 19,50,000
2 Outlet Works with towers	2,00,000
Waste Weir	1,00,000
2 Channels each 35 miles long at 5000 Rs a mile.	3,50,000
Masonry Works at about 7000 Rs a mile.	5,00,000
Distributing Channels	2,00,000
Compensation	50,000
Add for Contingencies	3,50,000
Total	37,00,000

25. Captain Taylor has proposed that in continuation of Irrigation channel, a navigation channel should be excavated, passing by Gunter to meet the Krishna Canals somewhere near Bezbarah, as above mentioned. He gives the level of the ground at site of proposed dam, as 340 feet above mean Sea Level. My own observations led me to suppose that it is not more than 200 feet above mean Sea Level, but the fall to be overcome is still considerable and the difficulties in the way of excavating a channel to near Bezbarah, across the whole drainage of the country are great. It ...

to me that the channel might be ^{very} easily connected with the Krishna channel by a cut running in a parallel direction to the great Nallamada drainage, without crossing it, and joining the Condamore channel to the south of the Nallamada Escape. The length of such a line, would be not much in excess of 20 miles, whereas a channel passing Gunter would be 50 miles in length. The width at sill might be 25 feet, and 27 Class Locks provided to overcome the fall of the country. The shorter and easier line would not probably be constructed under 20000 Ruppes a mile. Considering the fall to be overcome, the longer would probably cost 25000 Ruppes a mile. The shorter line would therefore add 4 Lacs to the estimate, and make it 41,00,000 Rs. the longer 12½ Lacs, and make it 49,50,000 Ruppes.

26. The Revenue that may be expected. As stated above, it is estimated that sufficient water can be stored ordinarily to cultivate 150000 acres. This would return at 4 Ruppes an acre 6 Lacs or 16½ per cent on an outlay of

of 37 Laes. If a navigable canal were constructed, the percentage of return would be with the shorter line mentioned above 14.6, with the longer 12.1, as the direct returns from navigation, which rightly or wrongly, are all that are taken into account in the Kistna Delta, would amount to a very trifling sum.

27. The return supposes that the full extent of land which, in ordinary seasons, a full supply could be given is taken up, and while on the one hand, it is possible that a further extent of land might be supplied in a good year, a year of scanty rainfall must lead to a reduction of cultivation. There is another question which very seriously affects the returns that must now be taken into consideration, supposing that after completion of the work, we are in a position to supply water to 15,000 acres yearly.

28. The population of the country is scanty, and though there are traces of considerable irrigation works existing

in former years, well cultivation does not appear to be now much sought after. Steps have been taken towards restoring some of the old reservoirs in the Virubhava Taluk, and a project (among others) for restoring the Dondapadu Tank was investigated. The officer who made the investigation reported that it was improbable, the full extent of land that could be cultivated would be taken up for some time, and that the returns must be expected gradually. The Peddancherla Tank, which has lately been restored and which, it was estimated, would irrigate about 2000 acres, gave a supply the first year to only 50 acres. The Kuppakousa Tank, an old existing reservoir favourably situated with a bund between 2 high hills, with a drainage area of about 20 square miles, the bund being 30 feet in height above stream floor, and nearly 50 feet in the highest point, supplies only 77 acres; the average revenue including land assessment, being Rs 90 Rupees.

29. It appears from the returns of ^{the} last census, that the total male population above 10 years of age, of the Vinuconda Taluq, is 21,784 or about 39 to the square mile. Comparing this with some of the Delta Taluqs.

In Gudemabad it is 33,503 or about 63 to the square mile.

Repally " " 67,089 " " 192 " "

Bapatla " " 48,435 " " 69 " "

In Gudemabad, there are 76,532 acres under wet cultivation

Repally " " 37,302 " " " "

Bapatla " " 30,382 " " " "

It therefore follows that the population cannot, under favorable circumstances, be expected to take up one half of the land for which water is available, and that there must be a very considerable increase of population before the project can be remunerative. Captain Taylor has mentioned that villagers offered before him to cultivate 13,800 acres, if the reservoir was made, but in my opinion, it is very improbable that the cultivation within 10 years would reach 50,000

50,000 acres or a return of 5 per cent on the expenditure he made. 81

30. Although, under the circumstances, the project cannot be considered a remunerative one, there can be no doubt that the country would benefit greatly by the construction of reservoir, and the indirect returns would be considerable. A great portion of ^{the} Vinuconda Taluq might, from a bare parched up country, devoid of trees and thinly populated and cultivated as the season permits only, with dry crops, be turned into a garden and with a population as dense as in the Delta provide a supply of food for the dry districts adjoining, where a year of scanty rainfall causes scarcity of food and wide spread distress.

I have the honor to be
Sir

Yours Most Obedt Servant

Johd asul Major R.E.
Suff Engineer District

To The Secy & Jnt Sec 3107/19
March/75-

No 153

From C. I. No 299
Res
The Supg Engineer
1st Divⁿ Krishna

To
The Chief Engineer
for Irrigation

Dated 5th March 1875
Received 15th — " — "

Enclosures 6/11

Reports on the
reservoir proposed
by Captain Taylor
at Oamadavaram
in Kurnul District

O. N. 2037/55
2/

No 183-

19/3 1875

No 310.

Note by the Chief Engineer for Irrigation.

Captain F. Taylor when Acting
District Engineer of Kurnool having
brought to notice that he had discovered
a very favourable site for a large reser-
-voir where the Gundlakuruma passes
through the hills dividing the Kurnool
from the Krishna District, the Superin-
-tending Engineer, Krishna, was requested
to take an opportunity, when near Vinu-
konda, of examining the site and reporting
on its capabilities, and the letter now
submitted contains the results of his
inspection.

2 It will be seen that in some
respects the site is favourable, while in
other and not unimportant respects it
presents difficulties which would tend to
make the reservoir costly. The gap in
the hills through which the river passes

No 14-24th
July 1874.

No 581D-11th
August 1874.

is 3000 feet ^{wide} at ground level, and a bund 120 feet high would be about 5000 feet long at the top. There are 2 saddles to the North-ward at about 140 feet above bed of river, and surplus would have to be discharged at one or both of these.

The drainage basin is above 2,00 square miles, of which about 1630 square miles are available for the ordinary supply of the tank, which would cover an area of 90 square miles, and hold 2509 millions of cubic yards, while in ordinary seasons the supply at $\frac{3}{5}$ of 27 inches over the whole area drained would amount to 2272 millions of cubic yards. The country which would be submerged contains but few villages, and is poor and barren.

3 There is no soil in the neighbourhood suited for the construction of an earthen bund, and the dam would have to be made of rubble masonry or concrete.

95 122
4 Major Wasted has given in para 24 of his report a rough computation of the probable cost of the reservoir and distributaries, which amounts to 37 lakhs of Rupees. Adding to this establishment charges the approximate estimate would become 50 lakhs.

5 The tank would be capable of irrigating 150 thousand acres, and it will be safer to assume that the average water rate would be 4 rather than 6 Rupees an acre exclusive of land assessment, so that 6 lakhs would then be the gross return or 12 per cent on the outlay.

6 The Superintending Engineer notices however that the population of the country which would be capable of irrigation is very small; that under some existing tanks in the neighbourhood the cultivation is extremely limited e.g.

Huppakonda

Huppakonda tank

Drainage basin — 20 square miles

Area irrigated — 77 acres.

Revenue (land appts.
- ment and water) } 490 Rupees.

Here then a square mile of drainage basin irrigates less than 4 acres, but it is not said whether the whole water supply is utilized.

Again only 50 acres were cultivated the first year under the lately restored Peddacherla tank, which it was supposed would irrigate 2000 acres.

7 Were the whole area of 150,000 acres to be brought under cultivation within 5 years the reservoir would probably only just pay the interest on cost and provide for maintenance, and as it is unlikely that ~~that~~ 50 years would see the whole of the land irrigated, it may be concluded that the scheme would not pay.

8 The formation of a reservoir would no doubt confer very considerable benefits on the country commanded by it, but half a million sterling would be too high a price to pay for these benefits, when the people to enjoy them are so few.

9 Moreover for a great many years to come the Krishna Delta works, which will benefit a large population in a neighbouring part of the country, will afford full occupation to all the establishment likely to be available and will at the same time absorb a very large sum of money.

10 Captain Taylor deserves credit for his investigations, and some day they may not be without their value.

Camp at
Rumore - 19
March 1875

91 23.
When in India, Lieut. W. A. R.
Chief Engineer for Irrigation

To The Secretary to Government
P. W. D.

Proceedings of the head and foot
 Read the following
 from

The Chief Engineer for Irrigation } (H.E. Dec 310 / 19th March 1905)

The papers submitted in connection with a proposed reservoir on the Gundla-kumma near Monadiwaran are of considerable interest, and the report of the Superintending Engineer, Thistua, shows that possibly such a reservoir might be constructed so as, under more favourable circumstances, to be not unremunerative. With however the scanty population of the country commanded it is not

PM

P. M. 1895 Dec 11
 No. 2037.

From
 The Chief Engineer for Irrigation
 To the Secretary to Govt.
 P. W. D.

Dated 19th Dec 1895
 Received 29th Dec 1895

Enclosure 1

Submits report of
 the Capt. R. S. S. S. S.
 regarding the reservoir
 proposed by Capt. S.
 Taylor near the Gundla-
 kumma near Monadiwaran
 the hills dividing the
 Monadiwaran and Thistua
 waters.

F. I. No. 1095. 19-4-95

1895-96-1904-95

not at all likely, that the water supply would be made full use of until after the lapse of many years, and, as the Chief Engineer for Irrigation has pointed out in the neighbouring Delta of the Flietna it is in contemplation to expend large sums within the next 20 or 25 years, which will fully occupy the Public Works establishments and prove of much greater benefit than any single reservoir, however large could be, taking the population of the two localities into account.

2 Such being the case His Excellency the Governor in Council, while ^{fully appreciating} ~~recognizing~~ the service which Captain F. Taylor has done in looking into the capabilities of the Kurnool District in which he was recently employed, is of opinion

10/ 25
opinion that further investigation of the proposed reservoir may well be postponed indefinitely.

W. 27/2/75
M. M.

32
To the Supt. Engr. Flietna ✓
5 - Dist. Engr. Kurnool ✓
5 - Chief Engr. for Irrigation with ^{five} ~~enclosures~~ ✓
1 - Asst. Chief Engr. ✓
Desp. 23-6-75

2037

1875

PUBLIC WORKS.

10
Capt. Lyman

Director

Dated

Recd.

Encl.

10. 192/100 1875, No. 1095-

No. 10. 192/100

Proposed Reservoir on

to Kuala Kurnna near
Mamadivaram, Kistna

It is - Directing the further
investigation of the -
to be postponed -

12483/4

c. 31-3-78. R-2-4-78

ORDINARY, PRINTED.

Public Works DEPARTMENT.
G.O., DATED 19 April 1875
No. 1095

21-1-72

14-4-78

2/4/01

12-2-29

First copy sent to Press.

Returned for signature.

Despatched in print.

483 — 484

[Despatch Abstract.]

Proposed Reservoir on the
Lyndhurst near the
deanery, Bristol District.

Resolving the further in-
-vestigation of the — to be
postponed.