

MADRAS RECORD OFFICE.

Government of Madras.

Public Works DEPARTMENT.*Cons* 9-4-1858

G.O. No.	601	Press Mis.
33-34		
Dated	7-4-	1858

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No. 33. Read the following letter from Colonel C. E. FABER, Chief Engineer; to H. FORBES, Esq., Acting Secretary to Government, dated 18th February 1858, No. 7478.

SIR,

1. With reference to Extract from Minutes of Consultation of the 12th August 1856 No. 1405, communicating a letter from Colonel Baker, under date the 11th July 1856, No. 3173, in the 12th para. of which information was called for to satisfy the doubts expressed by the Government of India, in a letter of the 22nd March 1856, No. 1215, regarding the propriety of commencing a system of embanking the Aska Mahanuddy, after the abandonment of a part of the embankments of the Damooda had been found necessary, I have the honor to forward with the papers noted in the margin* a report from Captain Harington, dated the 12th December 1857, submitting, with all the information required, a sketch Map of the river from a spot a short distance above Aska, where the embankments lately made terminate against two small hills, to Nowgaum a village near Russelcondah.

- * 1 Letter from Colonel F. C. Cotton, 13th May 1857, No. 5.
- 1 do District Engineer, Ganjam, dated 15th May 1857, No. 477.
- 1 do Lieut. Col., F. C. Cotton, dated 10th July 1857, No. 17.
- 1 do District Engineer, Ganjam, 2nd January 1858, No. 11.
- 1 do Collector of Ganjam, dated 8th January 1858, No. 14.
- 4 Plans.
- 1 Report.
- 1 Estimate.
- 1 Detailed do.
- 1 Abstract.

2. In the first of the documents above referred to in the margin, Lieutenant Colonel F. C. Cotton, who is a strong advocate of the embankments, argues that, as there is no possibility of the Delta of the Aska Mahanuddy extending, within any definite period, so as to reduce the slope of the River's bed, and consequently the velocity of its discharge, no apprehension need be entertained of the results of confining its stream between parallel dykes, judiciously placed and raised; but the District Engineer, in his letter of the 15th May 1857, takes a very different view of the case, for, after describing the origin and character of the river, he enters into a calculation to prove that the embankments lately formed near Aska are even now insufficient, and cannot be made strong enough, within reasonable limits, if the dykes be continued upwards along the banks of the river and of its tributaries.

3. Although Lieutenant Moberly's calculations are faulty, inasmuch as he makes no deduction for absorption and evaporation, and assumes that the time of discharge will be the same as that of the fall of heavy rain, which is impossible, even in so rapid a river as the Mahanuddy, yet, as on the other hand, he has taken the maximum fall at only 4 inches in the twenty-four hours, when it is well known that more than double that quantity may fall occasionally over a larger area than the basin of the river in question, his opinions of the inexpediency of constructing embankments, in continuation of those already made, are entitled to attention, notwithstanding the adverse criticism of them contained in Lieutenant Colonel Cotton's letter of the 10th July 1857, especially as they are supported by the latter and fuller report of Captain Harington, whose investigations shew that, although the river rarely overtops its banks, it does so occasionally at intervals of a few years, and that if it were embanked, the effect of preventing the dispersion of its waters, and thereby hastening its discharge, would at those times be the endangering of the embankments at Aska, and the incurrence of an expense, for maintenance, out of all proportion with the injury done by the present overflow.

4. Captain Harington states, that the floods are only complained of on the low lying lands near the hollow through which flow the channels that carry off the drainage from the ranges of hills, which, at an average distance of less than two miles, skirt the river, and that they are caused, not so much by its topping its banks as by its rushing down the open unprotected irrigation canals which are led from it on either hand, and by the want of out-fall to this water, and to the local drainage while the river is full. The length of the river being small, and its slope and that of the adjacent country very great, the submergence, is of too short duration to do much injury, and it seems more than doubtful whether the fertilizing effect of the rich deposits, left by the inundation, does not fully compensate for any damage done by it, for the cultivation,

consisting chiefly of Rice and Sugar Cane, cannot suffer unless several days under water, which it never is in consequence of the flood of the Mahanuddy. The injury done by these in Goomsoor has manifestly been greatly exaggerated, for the remissions granted on account of them are shewn to have averaged only Rupees 525 during the last twenty-two years, and though more will, in the Collector's opinion, perhaps have to be given hereafter in consequence of a change in the tenure of the soil, it is certain that the Government can expect to gain nothing in return for the heavy cost of making, and maintaining, an extensive line of embankments, where the loss they are calculated to prevent is so trifling, and the protection they are intended to afford so little as scarcely to be desired by the cultivators.

5. Captain Harington therefore would not form continuous embankments, but proposes to maintain and strengthen the small detached pieces, which, from time to time, have been thrown up for the protection of certain exposed localities, and to construct sluices to all the channels opening from or into the river, to prevent the flood water from rushing down them and committing, as it now does, the only ravages complained of, in tearing up their beds, and depositing sand on the fields in their neighbourhood. His estimate for these improvements amounting to Rupees (4,250) four thousand, two hundred and fifty, has met with the approval of the District Engineer, and Collector, both of whom strongly urge its immediate sanction, in order that the sluices may be built before the next rains, and that some employment may be provided, on their construction, to the poorer classes of the population, who are likely to suffer privations during the next few months from the partial failure of the late monsoon in the Northern Districts.

6. Being of opinion, after the most careful consideration, that the embankments already made at Aska have been of the greatest value, and may, with much advantage, be continued to the coast, but that it will not be expedient to divert any of our limited means to an undertaking of a character so doubtfully beneficial, or even safe, as their continuation upwards along the banks of the Mahanuddy and of its tributaries, I have no hesitation in recommending sanction being given to Captain Harington's estimate amounting, after deduction for a sluice, which is not considered necessary to a drainage Stream at Bonka, to Rupees 1,230 for earth work in repairing and extending old dykes, and to Rupees 2,850 for sluices to the Heads of the thirteen irrigating channels of Nowgadah, Ambapoor, Bungarada, Koocondra, Goghoo, Rajoogaree, Vishnookhakra, Bullemootah, Oosusta, Nowgam, Kozia, Nowgaum, Dankoony, Ratunga Boda, Komma, Koorly, and Dunchy, or in the aggregate to Rupees (4,080) four thousand and eighty.

7. These are individually all small works and may easily be made ready before the next freshes, if their construction be at once authorized.

8. Captain Harington, after touching on the nature of the works most immediately required for the improvement of Goomsoor, closes his report with a general description of the advantages to be derived from the formation of reservoirs and of annicuts on the Mahanuddy, with irrigating channels from them, but it not necessary to notice his remarks further in this place, as he has proposed no specific projects, and the District Engineer, in endorsing his views, has promised fuller and more special information.

Letter from Lieutenant Colonel F. C. COTTON, Engineers; to Colonel C. E. FABER, Chief Engineer, dated 13th May 1857, No. 15.

SIR,

Para. 1st. I do myself the honor with reference to the papers noted in the margin, to offer

Extract Minutes Consultation dated 12th August 1856, No. 1405.
Extract from the Proceedings of the Chief Engineer dated 29th April 1857.

the following explanation of my venturing to recommend the embankment of the Aska Mahanuddy, although I was fully aware that the Nuddea river embankments had caused great anxiety, and had been condemned by those who had the management of them.

2nd. When the embankments of a river are so placed and raised, that there is space between them for the existing volume of water, the only evil to be anticipated is I apprehend from the extension of the Delta, by which the fall of the bed, and consequently the velocity of the current, will be so diminished as to render necessary a greater channel than was before required for the discharge of the river's flood.

3rd. Before recommending the Aska embankments, I calculated that an additional rise of the surface of only a few inches, would so increase the rapidity of the Stream that the river would discharge without risk the further supply of water thrown into its channel. On this point I had no doubt whatever.

4th. With regard to the future state of the Delta and the prevention of the evils that might result from its extension, I felt equal confidence as to the safety of the works proposed. If I took the Cauvery for my guide, I had proof sufficient that the progress of a Delta forming on an open coast subjected to the action of strong ocean currents, was so exceedingly slow that no material difference in the fall of the river could be anticipated in hundreds of years. And had I had no further information on the subject than was possessed by those who commenced the Tanjore embankments in times past, I should still have felt that it would be well to save the great destruction and waste that is taking place now; leaving it to the Engineers of future ages to devise means for securing the lands endangered by the rising floods of the river. Knowing however, as we now do, not only that the construction of such works as will regulate the flow of water in the largest rivers is perfectly practicable, but that they may be made to yield a direct profit, even this distant cause of alarm was removed, and when recommending the river embankments, I felt perfectly certain that long ere the necessity occurred for reducing the floods of the Aska Mahanuddy, the waters of Ganjam would be otherwise employed than in forming deposits in the sea. And my further suggestions in the papers referred to were that works for this purpose should be commenced immediately, as a source of Revenue to the Government and profit to the people.

5th. Mr. Ellet in America has for many years shewn not only the advisability but the perfect practicability of storing so much of the waters of great rivers that their floods should be no longer dangerous; while Colonel Arthur Cotton has been as long employed in adding proof to proof that water so stored will yield a greater return for the money spent upon it than could be obtained by working the richest mine.

6th. Though it cannot be expected that those who do not follow the Engineer in his calculations will see clearly how simple the management of the Mississippi may be, or how enormous the value of stored water compared with its cost, the haze that has hung so hopelessly and impenetrably over this branch of Engineering is evidently clearing away. In France the control of a river by the detention of its waters has actually been taken in hand; and although that most remarkable document prepared by the Madras Board of Revenue, which shews that the whole of the irrigation works executed in 14 years, good and bad, yielded on an average a direct return to the Government of 69½ per cent. per annum, has never attracted the attention that it would had it shewn a return of only 20 per cent. from a silver mine; still the sound policy of investing the State money in Hydraulic works is now very generally admitted. The extent to which the surface of a river may be lowered by the removal of a certain proportion of its water is allowed to be a matter of the most simple calculation, and the old native tanks of this part of India give ocular proof that the capacity of such artificial reservoirs may be of any required capacity.

7th. With such facts admitted, so much knowledge already in our possession; and the science of Engineering so rapidly advancing, it would surely be a grievous error to allow any one of our rivers to devastate its banks for another season, lest its floods at some distant period should cause an Engineering difficulty. But in the particular case of the Aska Mahanuddy regarding which my explanation has been called for, nothing could in my opinion be more evident than the treatment required. It is a small river, with a considerable slope, falling into a deep sea, on a coast swept by rapid ocean currents; so that a thousand years might be allowed for discussing the advisability of storing the water of its tributaries without any risk whatever of

its condition approaching that of the Nuddea river with which it has been brought into comparison. The District through which it flows to the sea is well peopled and the soil of its vale only requiring irrigation to produce a crop of sugar as heavy as is raised upon the finest land in Jamaica, offers a profitable employment for its waters the value of which the present Government is fully alive to, and most anxious to take advantage of. The floods which might have been dreaded in some future age is thus immediately in demand for use and it is far more probable that the time will come when the value of the water of this river will be a subject for litigation than that its floods will be feared as a cause of mischief.

8th. That this is not an unfounded speculation I may instance the river Viga in Madura, the water of which is so completely disposed of by channels, and in reservoirs, that it rarely discharges a single drop into the sea.

9th. Under the explanation above afforded, I trust that my recommendation to commence the embankments of the Aska Mahanuddy will not be considered premature.

Letter from A. S. MOBERLY, Acting District Engineer, Ganjam; to Colonel C. E. FABER, Chief Engineer, dated Camp at Chicacole, 15th May 1857, No. 477.

SIR,

I have the honor to forward a report on the Mahanuddy embankments, in the Ganjam District.

2. The survey for the purpose was only commenced in the middle of March, and my means for carrying it on, were very limited. It is not therefore as complete as I could have wished; but as I am removed to another appointment, I think it better to submit my views.

3. The Mahanuddy rises in the hills about 40 miles above Aska. It receives a considerable tributary near Koolado, and 2 more, the Boodha Nuddee, and the Loharkundy, about 6 miles below Russelcondah.

4. The united Streams flow past the town of Aska, receive the Rooshkoolea about a mile below it, and discharge themselves into the sea near Ganjam.

5. From Koolado and Kothundah, it appears that the Mahanuddy and Loharkundy overflow their banks nearly every year. The Rooshkoolea only does so occasionally near Aska; and below this confluence, the river only inundates at a few points.

6. The town of Aska is situated in a narrow point of land, between the 2 rivers and Messrs. Binny and Co's. factory, is immediately to the south of it.

7. The Mahanuddy and all its tributaries above Aska are inundation Streams. Their banks are higher than the adjacent lands and between every 2 Streams is a hollow which receives the over-flowing water, and carries it into the main river.

8. In ordinary inundation Streams, the surplus water is carried off by other means to the sea, but the Mahanuddy is the only outlet for the drainage of the country.

9. To protect the land dangerously exposed to floods from the Mahanuddy, especially when dammed back by the Rooshkoolea (the higher and more rapid Stream), embankments were raised for about 6 miles on each side of the former, terminating on small hills, and for 2 miles on the left bank of the latter.

10. These embankments are constructed about yards from the river's edge, and with the hills to the north, enclose a small triangle of some 40 square miles; the drainage of which will be in future discharged by a breach near the confluence.

11. The road from Aska to Russelcondah running in the hollow, and the town and factory of Aska, are thus protected from river inundation; but are liable to local drainage being thrown back if the river is full at the same time.

12. Doubtless great benefit will be derived from the banks, but as the land enclosed is private property, the Government cannot receive any return for the outlay on them.

13. The existence of the embankments in the freshes of last year, does not however prove that they are sufficient for carrying off the drainage of the country. On the contrary the rain which fell in the 40 square miles about Aska, entered the river at their lower end and the whole country from Gunteepadoo to above Russelcondah was under water to a distance of 1,000 yards, or more on each side, and this probably did not reach the river in less than 10 days.

14. If the embankments are prolonged as proposed in the estimates, the river will be required to carry off all this water in a much shorter space of time, its surface will be considerably raised and the embankments at and near Aska, will not be found sufficient.

15. As I said above the sources of the river are only 40 miles from Aska; with its windings the farthest distance is perhaps 50 miles. The velocity at Russelcondah is nearly 10 miles per hour; at Aska about 5:—I have seen a storm in the Hills at 2 P. M., produce a small fresh in the river at Russelcondah which has entirely run off by the next morning.

16. I think therefore that we may safely say that any rain in the Hills should be expected at Aska within 24 hours of its fall.

17. By the rain register in the Aska Factory for 1856, it appears that 4 inches have fallen in one day. I am told that a far greater quantity (22 inches) has been known to fall in 50 to 40 hours of course at the same time a still larger amount would fall in the Hills, but for the sake of argument, I will suppose that 4 inches is the greatest fall in 24 hours, which we need provide against.

18. The area drained by the Mahanuddy is 870 square miles or 299, 434, 666 cubic yards per day, or 12, 476, 444 cubic yards per hour

19. At a particularly favorable point near Aska, we have a section of 447 square yards at the highest flood, this gives a depth of 11 feet 1 inch in the river, and 80 yards of inundation on each side.

20. This river section gives a hydraulic depth of 10 feet 3 inches, and with a fall of 4 feet per mile, a mean velocity of 9,974 yards per hour.

21. Dividing the 12,476,444 by 9,974, we have 1,250 square yards, as section required upwards of 2. 7 that now afforded.

22. The country falls rapidly from the river; we cannot therefore prudently embank far from its edge—but allowing 50 yards on each side and assuming that with a surface raised 7 feet above its highest known water mark, we can force the water to acquire a velocity of 10 miles per hour in its natural bed, and of 4½ miles on the inundated land, we shall barely be above the flood, with a bank averaging 4 yards high—and a section of 36 yards.

1½ at top.
2½ high.
1½ to 1.

23. We find that the cost of the embankments near Aska 12½ miles in length, and 19½ average section is 20,000 Rupees, and this without crossing any stream of importance.

24. Including the large tributaries which we must also embank, I believe that we shall not find less than 90 miles in length, requiring to be protected—cost at the same proportion as above Rupees 2,57,334, an outlay for which, I can see no prospect of a return.

25. On the whole therefore, I do not think it advisable that the embankments should be continued. I feel confident that I have under-rated the quantity of water, which we may find at Aska, at any time; and that I have rather over-rated our power of increasing the velocity &c., but even with this favorable view, the capacity of the river seems insufficient, and the cost of protection enormous.

26. I enclose the section of the river alluded to in para. 19, No. 1, and 2 others at Gongoo and Nowgaum, I do not think that a horizontal transverse line will shew the real height of the flood which probably fell considerably from the river, but as even deducting a very large quantity for exaggeration, the enormous amount of flood is well represented—I have left it as drawn by Mr. Colquhoun.

27. I acknowledge that a large tract of country is inundated probably every year, and that occasionally considerable injury is caused, but I believe that on the whole the river floods rather benefit the land; and if the remissions have been made with any pretensions to fairness, the loss in the past few years, has been very slight averaging 1,086 Rupees.

28. I do not however consider that we cannot remedy this mischief—we cannot carry off the water when it is once in the river, but there is no reason why we should not cut it off, nearer the sources.

29. There are the ruins of very large tanks in all parts of Goomsoor; and numerous favourable sites for the construction of new ones—if these works are executed, we shall relieve the pressure on the river, while we obtain an immediate and direct return of revenue from the cultivation under them.

30. The rule for ordinary estimates which requires that they shall be less than a year's revenue should be relaxed—the Assessment was made very light originally, because the works were out of order; and nothing that I can here of, has been done to improve the income of the State, since the country first came into the British possession.

31. A Revenue Survey is most urgently required—I believe there is no District in the Presidency which is so little known, or from which so small a revenue in proportion to its capability is collected—there appears to be a general acknowledgement that there is a very large amount of concealed cultivation. I have heard incidentally that the Schist as stated by the villagers is in more than one case higher than the revenue return given by the Tahsildar, the difference it is natural to conclude goes to the latter.

32. I have not had any opportunity of judging the capabilities of the Tahsildars—I believe I have not seen one of them; but from all I hear generally, they appear to consider it ink some to go about among the people; and they report unfavorably as to the profits to be derived from any work projected, to save themselves from further enquiries.

33. The Tahsildar of Goomsoor was particularly requested by Lieutenant Harington, to forward any petitions that he might receive from the Ryots—this was done because we were new to the country, and the Department with its new system was strange to them; but 2 or 3 months after, I found that he had returned everything to the people, desiring them to wait for “the Engineer,” a being, whom they had never heard of; and accordingly looked on the reply as refusal.

34. When the tanks are repaired and properly fitted with Sluices &c., a larger supply than the local rains afford, may be procured by constructing an Anicut across the Lobakundy near Kothundah, and excavating a Canal by Pilepada &c., to Aska. If water were stored in the tanks, from this, I believe it would be found sufficient to keep the Canal navigable.

35. If the traffic required it, this might be again continued by an Anicut across the Rooshkoolea, and Canal to Injelly, whence the Jeyamungalum channel would convey a boat to Ganjam, or the Chetterpore lake.

36. The Jeyamungalum channel has been neglected for some years, and now carries off most part of the water of the Injelly river. Lieutenant Philipps has proposed an Anicut across the latter, and a Head Sluice; estimates for which will, I hope be included in the next Budget.

37. The channel has a very considerable fall, but if properly arranged several tanks might be filled by branches taken off at high levels, which might irrigate the land between them, and the main stream; and supply it with water if it were required for Navigation.

38. The Survey which I now enclose, will give a general view of the country, the numbers in red ink being the levels above a standard at Aska, which I proposed afterwards to reduce to high water mark.

39. Mr. Colquhoun is continuing the investigation up the rivers, and I think a similar Survey of the main river valley to Ganjam, will be found very useful.

40. The large streams on the left banks, may I doubt not be turned to similar account, but the principal part of the land, belongs to Zemindars.

Letter from Lieutenant Colonel F. C. COTTON, Engineers; to Colonel C. E. FABER, Chief Engineer, dated 10th July 1857, No. 17.

SIR,

Para. 1st. After a careful examination of Mr. Moberly's paper upon the Mahanuddy embankments, I am sorry to be obliged to express my opinion that it does not contain the information required to determine what should be done regarding them.

2nd. If Mr. Moberly's calculation as to the sectional area of channel required to carry off the waters of this river were correct; and the space existing between the banks raised last season was as he states not $\frac{1}{2}$ of what it should be, the attempt to confine the stream should not be made until the construction of tanks upon the tributaries had materially reduced the supply of water in the river. But you will I am sure agree with me that the data used by Mr. Moberly is of little value and the mode of calculating from it altogether fallacious.

3rd. In the first place it will be evident to you that the maximum fall indicated by a fixed rain gauge, will never be the average maximum fall over the whole valley of a river. If the gauge has been long enough in position to be trusted it may indicate the maximum fall that may be anticipated in one spot in a given time, but as the fall of rain varies over every square mile, it will only shew on what day the maximum fall of the neighbourhood, fell upon the spot where the gauge stood. With regard therefore to the whole basin of the river this recorded maximum at Aska may be fairly considered as proving that the average fall over its surface is considerably less than that shown by the gauge. In the following calculation I will however suppose the quantity named by Mr. Moberly to be correct.

4th. It is usual in estimating the discharge of such rivers as the Mahanuddy to deduct $\frac{1}{4}$ of the whole fall as an allowance for evaporation and deep filtration through the soil; the former being lost entirely, and the latter finding its way to the river at another season of the year. The quantity therefore that we have to account for, as the immediate discharge is not 4 inches but 3 inches. And if we allow that $\frac{1}{2}$ of this quantity will flow in the channel of the river in the course of some one day we make most ample allowance; as after such a fall the river would have more or less flood water in it for many days. On the day of the greatest discharge there will however be some hours in which the river is above the average height of the 24 hours, I will suppose that this is the case for 4 hours, during which time $\frac{1}{4}$ more than the average is discharged. One inch being the quantity to be discharged in the day the average of the 24 hours will be $\frac{1}{4}$ of an inch to which, during each hour while the flood wave is at its height $\frac{1}{4}$ more or $\frac{1}{16}$ of an inch has to be added $\frac{1}{4} + \frac{1}{16} = \frac{5}{16}$ of an inch. By Mr. Moberly's calculation, the discharge per hour is $\frac{4}{24} = \frac{1}{6}$ of an inch, whereas if I am more correct it will be more nearly $\frac{1}{12}$ or less than a third of what he states even using the maximum at Aska as the average over the basin.

5th. But the report is altogether deficient in the data required. In the absence of all detailed information, allowance was made for embanking the river for a distance of 30 miles: it was not however to be expected in a river of that character that it would answer to make the embankments continuous. In such streams the spurs of the Hills, and other high lands strike the river at certain points; where this is not the case the country is flooded; and where the spaces between these points are extensive, embanking will be advisable; but spaces are frequently found so circumstanced that it would not be worth while to secure them and such in all probability is the case here and there on the Mahanuddy between Aska and Russelcondah. If there is much of this flooded land left open, the discharge of water will be very much slower than I have reckoned and before a detailed estimate is submitted, such points must be determined. At present we have only a most incomplete plan of the river with sections taken at points, the circumstances of which are not described. They may be where embankments are advisable or unadvisable; and there remains entirely unnoticed what must be by far the most extensive field to be saved from flood between Aska and the Sea.

6th. With regard to Mr. Moberly's remarks upon the character of this river, which he supposes to differ from other “inundation rivers” he must be comparing it with that portion only of a river which flows through a Delta, where alone the flood water finds other outlets to the Sea than the main channel. It does not appear however that such a peculiarity, if it existed

would lead to the supposition that the Mahanuddy was unfavorably circumstanced for embanking, but quite the reverse; as having the whole water to discharge by its main channel in its natural state, the change produced by confining the flood will be less considerable.

7th. From what I have said above you will I think agree with me that Mr. Moberly has left the question of the Mahanuddy embankment as nearly as possible where it was before he went to Ganjam, and I hope some other Officer may be deputed to make what he has not attempted, a minute examination of the stream throughout its whole length. I see on the Plan many lines of level taken with great labour which are valueless as data to determine what banks should be raised, while nothing is shown of the position of the high grounds on either side of the stream or the spaces injured by flood. There is hardly one name of any place mentioned in the report found on the Plan; and the position of only one section can be determined in any way.

P. S. The original paper which accompanied the Chief Engineer's letter and also a Plan are herewith returned.

Letter from Lieutenant E. K. BLAGRAVE, District Engineer, Ganjam; to Colonel C. E. FABER, Chief Engineer, dated Camp Chatterpore, 2nd January 1858, No. 11.

SIR,

I have the honor to forward the accompanying interesting and valuable report on the Mahanuddy; from the point where the present embankments cease to Nowgaun: together with estimate amounting to Rupees 4,250 for Head Sluices to certain channels taken off this river, for which I would earnestly solicit early sanction prior to May, to enable us to have these works completed before the next monsoon and observe their effect: we shall then be in a position to judge more clearly what should be done to control this stream. I look on these estimates as emergent not only as affording protection to the cultivation and ensuring full supply and equitable distribution of the water, but as regards the effect they may have in preventing any unnecessary expenditure in the way of embankments.

2. Captain Harington clearly shews the little pecuniary advantage (protection to Revenue) that may be expected from extensive additions to embankments in this part of the river.

3. In para. 25 he also urges the necessity of supplying means of irrigation during the dry season, and shews that such is practicable by improving existing and cutting new channels from the river. The means now adopted in doing this consist of the old and clumsy system of throwing up a bank of sands—in place of these I would suggest the expediency of adopting some such simple method as the following which have the advantage of offering no impediment whatever to the free flow of water in the river during freshes, of being inexpensive and easily repaired. What I propose is, a simple line of piles driven firmly into the bed 6 feet apart and ballasted with roughstone 6 yards broad and cut off at a suitable height, with a set of planks placed either above, or in grooves in the piles: or even double bamboo hurdles enclosing a space of 4" to 6" filled with puddled clay, (this latter construction although rude in the extreme would have the advantage of being understood by the natives by whom all repairs could easily be made.) If however a more permanent construction should be advisable, I would construct a continuous wall even with and across the bed of the stream, having either timber or iron uprights with grooves for planks as before, but terminating in masonry wing-walls and having a roughstone apron 8 or 10 yards broad. I propose the simple timber construction owing to the proximity of the jungles and great facilities of procuring suitable rough timber in any quantities at but a very trifling cost.

4. The Head Sluices &c. proposed by Captain Harington would also have the advantage of facilitating at all times the communications along the banks, a matter well worthy of consideration.

5. In para. 28 too Captain Harington shews the amount of drainage and capability of discharge of the river. This calculation of fall I consider as much above what actually takes place, but even with such a supposition he shews that the river except at one spot: (Gogho) is capable

of discharging the drainage, and it is at this spot he recommends partial embanking. The floods in the part reported on, he shews have but little injurious effect, and it is only in the neighbourhood of Aska where the great necessity of embankments appears to be; these embankments have already been constructed, and proved of great advantage to the valuable property in the neighbourhood, and if the reports of highest freshes he has received can be relied upon, the partial embanking and repairs to old embankments he proposes above will shew the necessity or otherwise of raising them, and if for this reason alone, I would urge the favorable consideration of Government to an early sanction for the works now proposed.

6. I proceed to Aska myself in a day or two, and when in Goomsur will take the opportunity of searching for, and examining sites for Reservoirs, the advantages likely to be derived from which for supply to hot weather crops appear unquestionable, and I have no doubt numerous favorable sites will be discovered.

7. The present report appears to me to answer most of the questions previously mooted and remaining unanswered, but I shall still direct my attention to the subject of continuous embankments from Russelcondah to the Sea. The complete survey, &c. of the river from Russelcondah to the Sea is not yet ready, but from what I have up to the present time learnt from Captain Philipps, I should consider such* altogether unnecessary, as floods appear due not so much to the river overtopping its banks, as from the flood water pouring unchecked into the numerous irrigation channels taken off on either bank, and at present unprotected with Head Sluices. The protection afforded to the lands influenced by the Heeradala channel lately provided with a Head Sluice shews the advantages of such works and the influence they would have in preventing all injury from river floods in similar situations.

8. I am unable at present to enter into calculation to shew the capabilities of the river below Aska to carry off its floods, as the surveys and sections have not yet been received; but will do so when framing my report on the subject of Reservoirs which I hope to do at an early period.

Letter from W. KNOX, Esquire, Acting Collector of Ganjam; to Colonel C. E. FABER, Chief Engineer, dated Berhampore, 8th January 1858, No. 14.

SIR,

Para. 1. I have the honor to forward a letter and report on the subject of the Mahanuddy embankments which will be found well worthy of perusal. The question however is one which must be decided rather by the Engineers than by the Collector, but I would draw attention to para. 7 in which Captain Harington more than hints at danger to the existing works and therefore to the Aska Factory a concern that I am bound to say deserves every protection from Government. I may also observe that no allowance is made for the effect of a high tide and strong wind driving back the river from the Sea and preventing the usual discharge.

2. The great point for me to wait on is the return from the work. From all I have learnt, I agree with Captain Harington that the Ryots do not care for an extended embankment but rather require banks at particular points. The Zemindar will not assist in any way and will ask for payment for his land, the remissions too have been very small, but it must not be forgotten that in former years nearly the whole of Goomsur was under rent and remissions were given with a very sparing hand. Now it is coming under a Ryotwaree Settlement and the Revenue Officer must be very liberal if he would see his District flourish. I fear there will be no very great increase in revenue in Goomsur for many years except from extended cultivation, it is an impoverished District owing to disturbances, and I may add rack rents in former years and to the want of any systematic improvements in the means of traffic and irrigation, I have therefore no hesitation in giving it as my opinion that until every other less costly experiment has been tried, it would be injudicious at any time and particularly now when money is scarce to lay out such a large sum as would be required for the continuous embankments from which little or no direct

benefit could be hoped particularly when so much remains to be done to improve the Talook, and at the same time alleviate the evil for which the embankments are proposed. I have no hesitation therefore in advocating the expenditure proposed by Captain Harington.

3. If the Government, as I trust will be the case, concur in the view taken of this question it merely remains to settle the time for commencing the work, and here I trust there will be no difference of opinion. Every day is of consequence, and I fear of great consequence, I refer you to the remarks in Captain Harington's Diary for last month. I have had no complaints, but I know there must be a scanty supply of water and disturbances in Sumbulpore have given rise to some uneasiness in the District, it is therefore not only a matter of humanity but of good policy to keep all who will work at work, and I think those now proposed will be found very advantageous to all, and at all events if completed they will enable the Engineer to satisfy himself of the necessity or otherwise of the larger works with which they may be incorporated at any future period.

4. I would therefore beg that sanction may be obtained for carrying out these estimates without a day's delay, should they meet your approval.

GANJAM DISTRICT.

TALOOK GOOMSUR.

Report on projects for embanking the Mahanuddy River.

Para. 1. The accompanying Survey shews the course of the Mahanuddy River, and the features of the adjacent country on both banks from a small hill, where the present embankments terminate, to Nowgaum a large village near Russulcondah, and about 3 miles below Konlada. The survey has not been taken north of Nowgaum on account of the thickness of the jungle, and because the proximity of hills and jungle to the river shewed embankments to be quite unnecessary.

2. At the small hill where the embankments terminate, and the present survey commences the river is 582 feet wide. The country on both banks belongs to the Zemindar of Daracotta, and his limits are shewn in the plan by a yellow border. There is so much to be done in the improvement of the Government lands in Goomsur, that I would not recommend embanking the river in the Zemindar's limits. More especially as (like the Aska Malookdar whose lands are protected by our lately constructed Lev'-ees) he would, so far from sharing in the expense, probably demand compensation for the land taken up by the works. In the case of the present Lev'-ees, the Aska Factory and Russulcondah road are protected, and so far, Government interests benefit, but no advantage whatever would result to Government were they to be extended through the Zemindary limits, as marked in the plan.

3. It may be convenient for examination of the survey and other plans, if I first describe the peculiarities of the country on each bank upwards from the Zemindary border, shewn yellow.

4. It will be seen that for about 2½ miles, the Government land on this bank between the river and the Zemindary is only between ¼ and ½ mile in width, bounded on the north, at the Government village of Kesrapoor by hills which extend for some distance inland. There is rarely, water over the banks, only on occasion of great floods, at some years interval, and then not above a foot or two. A cross section No. 1. from A. to B., shews the section of river and country which will be more fully noticed when I describe the left bank.

5. A little above Kesrapoor, the Goghayee Nullah joins the river, and it is this Nullah, which running parallel to the right bank of the river for some 5½ miles takes all the drainage so far of the Western hills, &c., and of the country on the right bank and discharges it into the Mahanuddy at this point. Levels Nos. 2 C. D. 3 E. F., shew how the land falls from the river towards this Nullah. No embank-

ments that we could make to the river would prevent the fields near this Nullah being occasionally, in heavy rains, under water, particularly when a full fresh in the river dams back and prevents its drainage for a few hours.

6. From Kesrapoor to a little above Nadar 1½ mile, the banks are very low as shewn in the Section No. 2 C. II. In 1853, if the flood marks shewn by the Nadar villagers are correct, the water was on the banks 3 feet, but this year and last year it did not overflow at all.

7. I must here remark that if these flood marks of 1853 are correct, the re-currence of such a flood will test the utmost the present embankment near Aska within 3 feet of the top of which the flood of this year reached. I think therefore that the Lev'-ees above should not be extended, unless absolutely necessary. Now with regard to the portion under consideration in this para., it is lower and more exposed to flood than almost any other, and yet I find by the revenue returns that the remission to these lands of Fusly 1262 or 1853 was only Rupees 20, and I believe that loss may be guarded against by the remedies which I will presently suggest.

8. From above Nadar to the Nowagada channel, about 5 miles, the country on the right bank is generally high, liable, but seldom, to any overflow, and then not above a foot or two. At the villages of Ambapoor, Bungarada, Koocoondia and Nowagada, irrigating channels have been taken off the river, favored by the fall of the country, which empty themselves into the above mentioned Goghayee Nullah. In the dry season and hot weather these channels are very valuable, and the Ryots of the villages under them assemble, bring all their bullocks, and by means of wooden ploughs called (Nollalus) make bunds of sand across the river, and turn the water into these channels. This is laborious, and very unsatisfactory, for these sand bunds constantly breach. An accident happening to one up the river occasions the destruction of all below it, and loss of valuable water. In the time of flood as these channels have no head works, the river water (whether it may happen to overtop the banks are not) rushes down them into the Goghayee Nullah, deluges the low lands, carries sand over some fields, and tears up and injures the beds of the channels. This is the evil about which the Ryots complain, and for which I have proposed (as per accompanying Plans and Estimates) the remedy of Head Sluices, which combined in some instances with bridges, where the village road crosses the channel, and where otherwise traffic is much impeded, and travelling along the river banks almost impossible in the height of the monsoon. I have made careful enquiries from the Ryots, and they all agree in saying that any loss from floods is due to the Hill drainage and river channel water coming at the same time into the low level Nullahs, which discharge at a lower point, and do not drain off till the river falls.

9. From Nowagada to the junction of the three rivers, about 4 miles; the country on the right bank is generally high, and not liable to floods. The river here and there takes sudden bends, and in such places, where its direct course is obstructed, its surface rises, and dykes to protect villages have been made, and should be kept up on ordinary estimate. So also in low portions of a few yards in length, where partial embankments have hitherto existed, it would be as well to repair them, and keep them in an efficient state, where necessary.

10. There is a curious branch, which leaving the river near Bennapilly, runs parallel to it at a short distance, and re-enters it above Doyamundaly. The head of this is now so choked with sand, that except in high freshes, the water of the river does not enter it. It receives drainage from the Hills and country near Goomsur.

11. Near Madavarada the existing embankments should be strengthened for 726 yards, and breaches repaired, as per item in accompanying estimate.

12. Near Madavarada the three rivers, the Loharakundee, Mahanuddy, and Boda Naddee join. Should they all come down at the same time, the fields on their banks are under water for a few hours. I do not see

any necessity for new embankments, Right bank, from the junction to Nowgaum. The two irrigation channels "Ratunga Boda Komma" and "Oosasta Komma," shewn in plan, should be provided with Head Sluices. The same system of sand bund is practised as noticed in para. 8, and the same remarks apply. These two channels are small, but still the unrestrained inlet of flood water through them should be prevented. The Loharakundee river has its course very near the Mahanuddy, and a little below Nowgaum, is only a few yards from it. It again approaches it near the village of Mundaree. For above 4½ miles below Nowgaum, the right bank is lined with thick tops of Mangoe trees, and no harm can be done if the flood water occasionally stands on it a foot deep for a few hours.

13. The Mahanuddy at Nowgaum is 150 feet wide. Below the junction of the three rivers, 370 feet. The width of the Loharakundee a little above point of junction is 150 feet. Of the Boda Naddee 180 feet.

14. LEFT BANK.—The Zemindary limit is shewn by a yellow line—Levels No. 1 A—B. shew a cross section of river and country a little above it near the Government village of Denja. The fall on left bank from the river is considerable. In the hollow lies the Bulleapadra Nullah which rising in the hills and jungles of the Boogooda Mootah joins the river at the Zemindary limit. On questioning the villagers, they state that any loss from too much water is caused by this Nullah, which receiving the drainage of a large extent of country is occasionally, at times of fresh in the river, unable to discharge its waters which till the river falls, must lie on the low lands. There was a remission in 1853 (the year of the highest flood known of late) of Rupees 80, but none since. Near Goghoo the Ranjoogaree channel is taken off the river, and joins the Bulleapadra Nullah. The remarks made in para. 8 respecting the irrigating channels on the right bank apply also to this and others on left bank, which I think should be provided with Head Sluices, for which I have prepared estimates. There can be no doubt, that if this is done a great deal of water will be kept from the low lands. In this case also, embankments to the river would not have remedied the evil.

15. From Denja to Vishnookhokrum the ground on left bank is generally high, and embankments not required, except perhaps above Goghoo, for a short distance, where the levels No. 2 C. II. shew that in high floods such as 1853, the lands are liable to be inundated. There has not however been any remission granted to these lands since Fusly 1259 or 1849, in which it amounted to Rupees 50. The construction of a Head Sluice will be a partial remedy—an embankment for a mile above Patanee might be made eventually, should the experience of another monsoon or two shew that the Aska embankments can contain a higher flood than those to which they have yet been exposed.

16. From Vishnookhokrum 4½ miles to Bonka, the Hills and Jungle approach the river so near, generally to within a quarter of a mile, that the expence of embankments for so small an area cannot be recommended. Floods in the Mahanuddee, with its fall of 4 feet a mile, run off in about 24 hours, and if water stands over paddy in most states of growth for three days, it does it no harm. The banks in this portion are high.

17. At Bonka, owing to an abrupt bend of the river, an embankment, partly new, partly repaired, is required from the range of hills to the small hill on which the village is built, 683 yards. This is the only place, where the ryots voluntarily came to ask for the protection of embankments. The hill stream shewn in the Plan should also be sluiced, as the flood water, when the river is at its height, finds inlet there. I have provided for both in the accompanying estimate.

18. From Bonka 2 miles to the junction of the 3 rivers, the banks are generally high, and the area of cultivation is small.

19. From the junction to above Nowgaum is a distance of 5½ miles. There is a portion of 1,540 yards between Danjapilly and Kojiapully, where existing embankments should be extended or improved. I have provided for this in the estimate. So also above Nowgaum at the site of the cross section a new embankment for 167 yards in length should be made.

20. Head Sluices are also recommended and are included in my estimate for 5 small irrigating channels shewn in the Plan viz.; Bullemootah channel, Koorly ditto, Dumchy ditto, Nowgam Kozia ditto, and Nowgaum Denkony ditto.

21. Accompanying the report is a Statement shewing the land and revenue under all the channels on right and left bank, for which the estimate provides regulating head works.

22. The estimate for these works and for new portions of embankment, amount to Rupees (4,250,) four thousand, two hundred and fifty, and should my suggestion be approved of, I would request that the sanction of Government should be solicited to their early execution, before next monsoon, so that they may come into operation before the floods of 1858, I am sure it will be a great point gained towards the regimen of the river.

23. These works would be necessary were the river to be fully embanked,* and the masonry portion would be in excess of the original estimate, which provides only for earthwork. I think it will be found that the execution of this estimate will render further large expenditure unnecessary.

24. The remissions granted on account of loss from floods to villages near the Mahanuddy amount to a total of Rupees 11,538 during 22 years, average 525 Rupees per annum. During the last two years there has been none. Government now allow Rupees 600 for annual repairs of a portion; so that it will be seen a further extension will involve expenditure, on which there will be no per-centage of profit to Government. Money can be laid out in Goomsur in other improvements, urgently required, far more beneficial to the people, and tending to an ultimate and considerable increase of revenue. I allude to District roads* and new works of irrigation, tanks, channels &c. It is from the want of these, that the advancement of Goomsur is sadly retarded.

25. I am convinced that a cheap system of Annicuts and channels might be applied to this river. The levels of the country shew that channels running parallel, and as near as possible, to the river banks would irrigate a large extent of land which now after the monsoon is over depends on the chance of rains, or on supplies of water obtained with difficulty by raising sand bunds as mentioned in para. 8, liable to be breached any moment. Consequently (as in this year) when rains fail, it is impossible to raise the hot weather crops, oil seeds, gram, &c. and if after October there is a scarcity of water, much of the paddy crops suffers. I have marked in the plan by red lines, the courses which I think 2 new channels might take from 2 annicuts, one across the Mahanuddy above Nowgaum. One across Loharakundee. An annicut might also no doubt be built across the Boda Nuddee, but it would be necessary to know more of the country before the course of a channel could be indicated, as the hills below Bonka and for some distance are so near the river left bank. Such annicuts and channels would without fail give a certain* supply of water for a hot weather dry crops. I am not sure whether it would be enough for a rice crop, but all this investigation can well be made, should the scheme be considered at all worthy of adoption, as I believe it to be. Now each village, or rather set of villages, looks to its own river channel, perhaps only a few yards from that of a neighbouring village; constructs for its supply their sand bunds, and will not allow if they can help it, a drop of their water to go to the fields of others. Hence constant disputes. This

* Which as regards saving of valuable property, Captain Harington has shewn to be unnecessary.—E. R. B.

* Although Captain Harington does not state what this supply as present may be, calculated to be yet a system of reservoirs would easily supply any deficiency that might occur. E. R. B.

Objections to present system of Irrigation.

Fort Saint George, Public Works Consultation of 9th April 1858.

clumsy, and unsatisfactory mode of irrigation might at once be superseded by masonry dams, and main channels with head sluices, and an establishment for the supply to all of the water. An annicut above Nowgaum, 4 feet high when the river is 50 yards wide, and falls 4 feet per mile, would bund above 58,500 cubic yards of water, which could be discharged in little more than 4 hours by a small channel 12 feet wide, and 4 feet deep, with a fall of 1 foot per mile. I do not now know the number of acres which could come under the channel, but as the above supply could be renewed and discharged several times during the hot weather, there could be ample for a hot weather dry crops, allowing 1,000 cubic yards, as per Colonel Cotton's data, to perfect an acre's yield. The cost of such annicut and channel 5 miles long would not exceed about 5,000* Rupees, and it would be strange indeed if (for the benefit of a certain supply) Rupees 250 per annum or 5 per cent. could not be realized off the land. More probably it would pay 25 per cent.

26. I should add that I merely propose this scheme for consideration, as one which has occurred to me in making the present examination of the river. Much more investigation will of course be necessary, if the project is approved of as feasible. Were such main channels to be made, there would be no necessity for building Head sluices to the five small irrigating channels of Nowgam, Kozia, Nowgam, Denkony, Dumchy, Koorly and Bullemootah, as these channels would be no longer required. But as an annicut &c., might not be built for another 2 or 3 years, it may perhaps be advisable to construct the head works. In any case, it would be as well to keep up the other larger channels taken off lower down the river, as Sugar-cane will be much grown, and in dry weather all the water that could be got would be required.

27. The above remarks are not irrelevant to the subject of embankments, for if the channels were excavated, their banks at a moderate distance from the river would serve as bunds against any overflow.

28. The following calculation serves to show that the channel of the river is generally equal to the discharge of its drainage. Suppose 6 inches the greatest fall of rain in 24 hours, a square mile = about 3 millions of square yards. Therefore 50,000 cubic yards of water with complete drainage should be discharged in 24 hours from each square mile, or 20,833 cubic yards per hour. But for any extent of country we may assume certainly that not more than one-third of this quantity would be discharged in the channel of the river in one day, for it probably would not rain at the same time over any extent of country, and besides a great deal of drainage would be arrested in its course, or at least not enter the river that day. We may require a discharge of 7,000 cubic

yards for each square mile drained, at Bennapilly (vide Section G. II.) the river will discharge 25,50,200 cubic yards per hour. The area drained seems to be about 367 square miles at 7,000 cubic yards per mile = 25,69,000 cubic yards per hour. At Nowagada vide Section E. F. the discharge is 29,41,200 cubic yards per hour; the area drained being nearly the same as above. At Denja Section A. B. discharge is 47,72,600 cubic yards per hour, area drained about 437 square miles at 7,000 cubic yards per mile = 30,59,000 cubic yards per hour. At Goghoo, Section C. D.

where I have remarked that the banks were low, the discharge is 23,21,000 cubic yards per hour, and the drainage per hour one to the area drained about 30,00,000 cubic yards so that an embankment on each side a yard high would contain the surplus water, for an increase of 3 feet to the mean depth could increase the discharge to above 40,00,000 cubic yards per hour, but as I before remarked as the present loss is very small, I think it would be prudent to watch the effect of another high flood on the present embankments near Aska, before we materially raise the height of water, by confining the stream above, between Lev-ees for any distance.

29. Reservoirs. I have no doubt eligible sites for reservoirs can be found, though the Goomsur Hills and jungles are thick and difficult to penetrate and explore. Reservoirs would undoubtedly have the great advantage of, at once, lessening the supply of river floods, and of retaining the water for irrigation.

Fort Saint George, Public Works Consultation of 9th April 1858.

A site for one in the Hills to the west of Pilapada has been reported to me and the Ryots state that by bunding across, between two Hills, a fine tank may be made. This I purpose examining when able.

30. The valley of the river is so completely cultivated with Sugar-cane, Paddy, &c. that there is hardly a square yard any where of waste land. This fact must influence us in recommending any large expenditure on its improvements, I believe the only sure way alike to benefit the people and increase the revenue is to afford water for their cultivation during the months between November and June. I have no doubt the Ryots would in time be only too glad to pay such an increase of kist as would realize a fair annual per-centage on the Government outlay, and ensure them water for raising Sugar-cane and Grain, for which the Aska Factory and the Merchants' Houses at the Ports present a certain market. I am told the profit to the Ryot from an acre's yield of "green gram" alone is 8½ Rupees after deducting price of seed and cost of cultivation.

Executive Engineer's office }
Ganjam District,
Camp Aska, 12th Decr. 1857.

(Signed) E. H. HARRINGTON, Lieut.,

Executive Engineer, 3rd Class.

GANJAM DISTRICT,

Talook—Goomsur.

Statement shewing land and Revenue dependent on irrigation channels taken off the Mahanuddy River.

Names of Channels.	Acres.	Revenue Rs.	Remark.
Goghoo Ranjoogaree channel.....	1,451	2,770	All these are irrigating channels taken off the Mahanuddy river. It is proposed to build sluices at their heads, to prevent the river flood water finding unrestrained discharge through them over the country, and also tearing up and otherwise injuring the channels themselves.
Vishnoochakrum Merka do.	174	556	
Ambapore..... do.	541	1,562	
Bungarada..... do.	116	297	
Koocoondia Amala..... do.	292	634	
Nowgada..... do.	451	1,307	
Bellemootah..... do.	180	620	
Rettunga..... do.	546	1,574	
Koorli Barthala..... do.	80	374	
Dumchy..... do.	145	880	
Oosastah..... do.	100	375	
Nowgam Kozia..... do.	200	750	
Nowgam Doonky..... do.	271	990	
Total.....	4,547	12,689	

Camp Aska, }
12th Dec. 1857.

(Signed) E. H. HARRINGTON, Lieut.,

Executive Engineer, 3rd Class.

GOOMSUR TALOOK.

Statement shewing amount of compensation paid from Fusly 1245 to Fusly 1266 on account of loss from floods in the Mahanuddy river, &c.

Talook.	Remission.																Total.
	Fusly 1245	Fusly 1246	Fusly 1247	Fusly 1248	Fusly 1249	Fusly 1250	Fusly 1251	Fusly 1252	Fusly 1253	Fusly 1254	Fusly 1255	Fusly 1256	Fusly 1257	Fusly 1258	Fusly 1259	Fusly 1260	
Goomsur.....				135		135	1,152	3,997	857	2,236					1,247	269	11,537

Camp Aska, }
12th Dec. 1857.

(Signed) E. H. HARRINGTON, Lieut.,

Executive Engineer, 3rd Class.

Fort Saint George, Public Works Consultation of 9th April 1858.

No. 34.

ORDER THEREON, No. 601; dated 7th April 1858.

Ordered that the above letter be forwarded to Lieutenant Colonel F. C. Cotton for any remarks he may wish to offer in support of the views expressed by him regarding the embankment of the Aska Mahanuddy.

(Signed) H. FORBES,
Acting Secretary to Government.

Public
Aska
Mahanuddy
Embankment

Enclosure
Letter from Col
F. C. Cotton

1st & 2nd Large Plans

Central Office of P.W.
No. 778. Fort St. George 18 February 1858.
From The Chief Engineer
To The Secretary to Government
P.W. Department.
Sir
1. With reference to Extract
from Minutes of Consultation of
the 12th August 1856 No. 1405, Communicating
a letter from Colonel Walker under
date the 11 July 1856 No. 3173, in the
12th para of which information was
called for to satisfy the doubts expressed
by the Government of India, in a letter
of the 22nd March 1856 No. 1215, regarding
the propriety of commencing a system
of embanking the Aska Mahanuddy,
after the abandonment of a part of the
embankments of the Damooda had been
found necessary, I have the honor to
forward, with the papers noted in the
margin, a report from Captain Parington
dated the 13th December 1857, submit-
ting, with all the information required,
a sketch map of the River from a
spot a short distance above Aska,
where the Embankments lately made
terminate against two small hills, to
Nowgann a Village near Rupselambah.
I am

2.- In the first of the documents, above referred to is the Mangin, Lieutenant Colonel J. C. Cotton, who is a strong advocate of the Embankments, argues that, as there is no possibility of the Delta of the Aswa Mahanuddy extending, within any definite period, so as to reduce the slope of the River bed, and consequently the velocity of its discharge, no apprehension need be entertained of the results of confining its stream between parallel dykes, judiciously placed and raised, but the District Engineer, in his letter of the 15th May 1837, takes a very different view of the case, for, after describing the origin and character of the River, he enters into a calculation to prove that the Embankments lately formed near Aswa are even now insufficient, and cannot be made strong enough, within reasonable limits, if the dykes be continued upwards along the banks of the River and of its tributaries.

3.- Although Lieutenant Moberly's calculations are faulty, inasmuch as he makes no deduction for absorption and evaporation, and assumes that the time of discharge will be the same as that of the fall of heavy rain, which is impossible.

19-5
impossible, even in so rapid a river as the Mahanuddy, but, as on the other hand, he has taken the maximum fall at only 4 inches in the twenty four hours, when it is well known that more than double that quantity may fall occasionally, over a larger area than the basin of the River in question, his opinions of the inexpediency of constructing Embankments, in continuation of those already made, are entitled to attention, notwithstanding the adverse criticism of them contained in Lieutenant Colonel Cotton's letter of the 10th July 1837, especially as they are supported by the later and fuller report of Captain Harrington, whose investigations shew that, although the River rarely overtops its banks, it does so occasionally at intervals of a few years, and that if it were embanked, the effect of preventing the dispersion of its waters, and thereby hastening its discharge, would at those times be the endangering of the Embankments at Aswa, and the incurring of an expense, for maintenance, out of all proportion with the injury done by the present overflow.

4.- Captain Harrington states, that the floods are only complained of on the low lying lands near the hollow through which

which flow the Channels that carry off
the drainage from the ranges of hills, which
at an average distance of less than two
miles, start the River, and that they are
caused, not so much by its topping its
banks as by its rushing down the open unpro-
tected irrigation Canals which are led
from it on either hand, and by the want
of outfall to this water, and to the local
drainage while the River is full. The
length of the River being small, and its
slope and that of the adjacent Country
very great, the submergence, is of too short
duration to do much injury, and it
seems more than doubtful whether
the fertilizing effect of the rich de-
posits, left by the inundation, does
not fully compensate for any damage
done by it, for the Cultivation, consisting
chiefly of Rice and Sugar Cane, can-
not suffer unless several days under
water, which it never is in consequence
of the flood of the Mahamuddy. The
injury done by these in Coomoor has
manifestly been greatly exaggerated, for
the remissions granted on account of
them are shown to have averaged only
Rs 525 during the last twenty two
years, and though more ill, in the
Collector's opinion, perhaps have to
be

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be given hereafter in consequence of a change
in the tenure of the soil, it is certain
that the Government can expect to
gain nothing in return for the heavy
cost of making, and maintaining, an
extensive line of Embankments, where
the loss they are calculated to prevent
is so trifling, and the protection they
are intended to afford so little as scarcely
to be desired by the Cultivators.
5:- Captain Harrington therefore
would not form continuous Embank-
ments, but proposes to maintain and
strengthen the small detached pieces,
which, from time to time, have been
thrown up for the protection of certain
exposed localities, and to construct
sluices to all the Channels opening
from or into the River, to prevent the
flood water from rushing down them
and committing, as it now does, the
only ravages complained of, in tearing
up their beds, and depositing sand
on the fields in their neighbourhood.
His Estimate for these improvements
amounting to Rupees 4,250 / Four thou.
and two hundred and fifty, has met
with the approval of the District
Engineer, and Collector, both of whom
strongly urge its immediate sanction,
in

in order, that the Sluices may be built before the next rains, and that some employment may be provided, on their construction, to the poorer classes of the population, who are likely to suffer privations during the next few months from the partial failure of the late Monsoon in the Northern Districts.

6.- Being of opinion, after the most careful consideration, that the Embankments already made at Asha have been of the greatest value, and may, with much advantage, be continued to the Coast, but that it will not be expedient to divert any of our limited means to an undertaking of a Character so doubtfully beneficial, or even safe, as their continuation upwards along the banks of the Mahanuddy, and of its tributaries, I have no hesitation in recommending sanction being given to Captain Harrington's Estimate Amounting, after deduction for a Sluice, which is not considered necessary to a drainage stream at Bonhaw, to Rupees 1,230 for Earth work in repairing and extending old dykes, and to Rupees 2,830 for Sluices to the Heads of the thirteen irrigating Channels of Nowgadah, Amba-poor, Bunganada,

Bunganada, Horcoondra, Loghoo, Rajoo-garree, Nishnoochatrum, Bullunotah, Oosutaw, Nowganu, Koria, Nowganu, Danhoony, Patunga, Boda, Komma, Hoory, and Dunchy, or in the aggregate to Rupees 4,080 / Four thousand and eighty.

7.- These are individually all small works and may easily be made ready before the next freshes, if their construction be at once authorised.

8.- Captain Harrington, after touching on the nature of the works most immediately required for the improvement of Coomoor, closes his Report with a general description of the advantages to be derived from the formation of Reservoirs and of Ancuts on the Mahanuddy, with irrigating Channels from them, but it is not necessary to notice his remarks further in this place, as he has proposed no specific projects, and the District Engineer, in Indorsing his views,

views, has promised fuller and more
special information..

I have the honor to be

Sir

Your most obed^t & servant

Central Office of Rm
Mr. St. George
18 February
1838.

Wm. Lister Colonel

Chief Engineer

W.L.

To
The Secretary to Government
P.W. Department

30 York 1838 & 1839
 1840 to 1849

Two

From the Chief Engineer
of the Navy Department
to the Secretary of the Navy
Dear Sir,

From the City & County of
St. Louis, Mo. to the
Hon. Secy of the
War Dept. Wash. D. C.
4th Jan'y 1862

Wm. H. Miller
Adm. - B. 1/4/85
No 1880
Wm. H. Miller
Adm. - B. 1/4/85
No 1880
Wm. H. Miller
Adm. - B. 1/4/85
No 1880

50 York St 1838
 - 100 to Louis G. -
 18374.

Paid for Edward 1835
 Paid 24th 3^d March 1835
 From the Dr of 1835
 Paid for 2^d March 1835
 Paid for 2^d March 1835
 Paid for 2^d March 1835

[illegible]

Feb 1

Ordered that the
above letter be forwarded
to Leitch Colonel A. C. Colton
for any remarks he may
wish to offer in respect of
the same accepted by him
regarding the endorsement
of the Order of the Attorney —

John W. Alden Esq
77. April 1858

*Copy to Mr. Colt
J. P. Colt
Returned to the Co. Aug^r 14 Aug^r 1860
728-5588*