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MADRAS RECORD OFFICE.

Government of Madras.

Public Works DEPARTMENT.

Irrigation Branch

G.O. No. 374 Irrigation Press

Dated 1st July 1879.

Not to be folded or roughly handled

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

1st July 1879, No. 374 I.

Irrigation.

Read the following papers :—

No. 1. Endorsement of the Chief Engineer for Irrigation, dated Ootacamund, 28th May 1879, No. 167 I.

From Major H. W. WOOD, R.E., Superintending Engineer, Third Circle, to the Chief Engineer for Irrigation, dated Chepauk, 24th May 1879, No. 3,099.

In my letter, No. 3,098, dated 24th May 1879, I did myself the honor of submitting a report on the damaged sluice weir of the Red Hills lake.

2. My inspection of the work was made between the 17th and 19th May. On the latter day, feeling rather uneasy regarding the aspect of the weather, I requested my Assistant Mr. Ussher (who had been at the Red Hills on the 18th and was returning to Madras on the 19th) to inquire from the Government Astronomer whether there was any chance of a cyclone taking place. His reply dated 19th reached me on the 20th, and though very cautiously worded quite reassured me. (*Vide* extract of letter annexed).

3. Having no fear of anything unusual occurring, I left the Red Hills on the afternoon of the 20th, intending to return the following afternoon to complete my examination of the sluices. I reached Madras at sundown, and soon afterwards it was evident that a cylone was on the point of breaking. The height of the storm occurred between 3 and 4 A.M. the following morning.

4. At noon 21st May I received a report from Major Clarke, whom I had left in charge, that the ring bund in front of the sluices had been entirely washed away, and that the water of the lake was pouring out of the five vents on the north-west portion of the work. Considering the knowledge I had recently acquired regarding the layer of concrete material upon which the piers of the sluices stood, it may be imagined that the above report gave me serious anxiety regarding the safety of the work.

5. I communicated at once with the Collector of Chingleput and the President, Municipal Commission, and asked to be assisted with labor, and I despatched Serjeant Bragg to the Red Hills with twenty lascars by *jutka* and with 500 gunny bags. Arrangements were also made for the early despatch of ample further supplies of bags and other materials. I myself reached the Red Hills sluices at $3\frac{1}{2}$ P.M.

6. On my way it seemed from the number of avenue trees which had been blown down that the storm must have been at least as intense inland as at Madras itself. The fallen trees, more especially near the Red Hills, were lying with their heads to the north, so that the cyclone must have blown its hardest from the south, or in other words straight against the face of the temporary ring bund which had been erected in front of the sluices. On reaching the lake I saw that at a point about 200 yards east of the sluices the rear slope of the bund had been deeply furrowed by water, which had been driven up and over the revetment, and had swept the road which runs below the lake embankment.

7. Before the occurrence of the storm the level of the lake was +39·41 M.S.L. and it had been raised to +40·20 M.S.L. by the rainfall.* The fact of the waves having, on this occasion, topped the revetment whose level is + 52·31 M.S.L. raises

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* Said to have been 7 inches.

the very serious question how far it is justifiable to fill the lake even to a provisional level of + 43·31 M.S.L., which is the present diminished height of the escape weir.

8. On ascending the bund I found the waves to be still running very high. Against the weir, west of the sluices, a continuous mass of spray was breaking and rendered it somewhat dangerous for workmen to walk on the top of the wall. Along the laterite revetment of the bund the waves slid upwards in fanlike sheets of water, which all but reached the crest, but did not overtop the masonry, as had occurred during the crisis of the cyclone at about 3½ A.M.

9. At the sluice weir I found water issuing through the five vents of the western portion of the work. A violent stream nearly 3 feet deep was rushing through No. 2 vent (from the north-west end), while about a foot of water was flowing through No. 5 vent. The depth in the other vents was inconsiderable. Most of the sluice gate spears of all these vents were previously bent, and the gates could not consequently be forced down into their seats. There was therefore nothing to be done but to endeavour to close the openings in front by throwing in bags of clay which had been stored near the spot previously.

10. With the labor that was available every effort was made that evening to get in a sufficient number of bags in front of the sluices. Operations could not, however, be carried on far into the night, owing to the people being knocked up both from the work done and from the exposure undergone during the day. Work was resumed the following morning, 22nd May, and the flow of water was gradually checked and reduced to 8 inches depth at 2 P.M. in No. 2 vent, where it had been deepest. There being no necessity for my continued presence I returned to Madras where I have received subsequent reports from Major Clarke of an almost entire cessation of flow except through vents Nos. 2, 4, and 5, in which a small quantity of water still runs. This will doubtless cease as the mass of clay in bags in front of the sluices gets consolidated.

11. As regards the destruction of the ring bund I beg to submit my opinion that nothing short of a lofty solid and expensive coffer dam of piles in front of the sluices could have effectually withstood the force of the storm of the night of the 20th-21st May. Precautionary measures had been taken against all reasonable risks to the work, but these were dictated rather in the interests of economy than by apprehensions of a cyclone. Had I received on the afternoon of the 20th a specific warning regarding the imminence of a cyclone, I might possibly have been able to take some partially defensive steps. But the somewhat sudden bursting of the storm and the fact that it broke after sundown are circumstances which would have very much embarrassed, if they would not have entirely prevented, anything worthy of mention being done. No harm, therefore, resulted from the guarded and scientific nature of the reply I received from the Government Astronomer.

12. In conclusion I am glad to report that Serjeant Bragg, Overseer, Public Works Department, maintained his high reputation for energy and devotion to duty while in charge of workmen at the Red Hills under Major Clarke's immediate orders.

Extract of letter from Government Astronomer, dated 19th May (afternoon).

"I see no present reason for anticipating a cyclone at or near Madras or any unusually heavy fall of rain. It is, however, quite impossible to say that nothing of the kind will occur, but all I look for agreeably to present indications is ordinary much needed rain * * *. Should decided symptoms of either cyclone or abnormal rain be exhibited, I will not fail to inform you as soon as I feel justified in giving a warning worthy of reliance."

Submitted for the information of Government.

2. The Superintending Engineer's report of his examination of the Red Hills tank weir surplus, or under sluices is not complete, as he had not been able to ascertain the state of the work at those parts which had not been outwardly affected when the sluice was closed by an earthen bank, after the flooring of the 3rd and 4th vents, and the pier between them failed at the end of 1877. Instructions have been sent to the Superintending Engineer on the treatment of the damaged vents and of all other parts of the flooring which may be found to be insecure.

3. The cyclonic storm of the 21st May resulted in no damage of consequence apparently to the Red Hills tank itself, but at the time of its occurrence the water level was at 39·41 or 6·90 feet below full tank level. The rain which fell raised the water level 0·79 feet or 9·48 inches, which is very little for the reported rainfall of 7 inches, but the catchment basin is small. Had the tank been full, undoubtedly a good deal of the top and rear slope of the bund would have been cut away by the water which, in that case, would have been driven out of the tank and over the bund by the great force of the wind. The tank revetment is not reported to have sustained damage, and the description given by the Superintending Engineer, in paragraph 8, of the fanlike sheets of water sliding up it indicates that the stones remained in position. This form of revetment—a smooth slope—is favorable to stability, but of course the water is the more readily driven up to the top of and over the bund. The undersigned had the opportunity of witnessing the effect of the second part of the great cyclone of 1857 on the Nellore tank, having been in a temple on the bund at the time. There the water was driven out of the tank in continuous sheets which were so dense that a large two-storeyed house, distant about 300 yards, was invisible for considerably more than an hour. The old native revetment of the tank was destroyed, and the bund cut down by the water driving over and falling on the rear slope, to nearly water level. The tank was not breached where revetted, probably because, as in cyclonic storms generally, the wind did not remain in one quarter long enough to work through the great mass of bund. The cyclone of 1857 occurred in November, and should such a storm, which was of enormously greater severity than that now under notice, take place at the same time of the year at Madras, the Red Hills tank might be full, and, with the wind from the westward, the risk of a breach would be very great, and nothing could be done to protect any threatened part of the bund.

4. Major Wood considers it a very serious question how far it would be justifiable, under such circumstances, to fill the lake even to 3 feet below its proper full level. It has previously been shown, in connection with slips that have occurred at different times and occasioned considerable alarm, that the breaching of this large reservoir would not be so serious a matter as might be supposed. It would destroy the cultivated lands in the immediate neighbourhood, and destroy crops on lands for a considerable distance; but beyond this the damage would be chiefly the loss of the water and the cost of repair. Most of the discharged water would find its way to Ennore, and be there discharged into the sea, and at a distance of a mile or two from the tank it would produce only a moderate inundation. The risk cannot be altogether removed, but it may be reduced to a minimum in the following way:—

(1) The masonry of the surplus weir, where now at 43·31, or at 3 feet below normal full tank level, may be kept at that level, and the means of retaining water at 46·31 may be provided by cast-iron posts fixed in the crest and supporting hinged shutters which can be released as required. By this arrangement together with the suplus sluices the level of the tank water can if necessary be rapidly lowered.

(2) The top of the bund of the tank is at 52·31, but there is a dwarf parapet of laterite stone at the top of the revetment which makes the margin above F.T.L. nearly 7 feet. It would add considerably to safety to raise this parapet to 55·31 along the deeper parts of the reservoir, and to 54·31 along those parts which are of intermediate depth. The present arrangements will, it is considered, suffice where the depth of water is, with a full tank, less than 12 to 15 feet; for on an emergency the tank could be lowered to 6 feet below F.T.L. or still lower.

5. The damage during this storm has apparently been confined to the ring bund in front of the sluices in the surplus weir. The mass of earth which rested

against, and closed these has recently been converted into a ring bund, to allow of the sluices being got at for repair. Major Clarke reported the total destruction of this ring bund, but from paragraphs 7 and 9 of the Superintending Engineer's letter it may be concluded that the destruction was but partial; for as the level of the tank water was at 8·89 feet above the sill of the sluices, had the bund been even nearly washed away, the depth of water passing through the sluices would have been much greater than the 3 feet (paragraph 9) which was the greatest depth at any vent. Much of the bund therefore will probably be found uninjured, and the damage may be found to be confined to the upper and less consolidated part recently formed by turning over the soil which rested against the sluices. By means of a pitching of laterite boulders it is hoped that this bund, when restored, may be effectually protected; for it is not likely that piles, even were their use desirable, could be driven into the hard laterite soil which is met with at this place.

6. The measures adopted for stopping the flow of water through the sluices are considered to have been judicious. Sergeant Bragg's good service will be brought to the notice of the Chief Engineer, Public Works Department.

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

MEMORANDUM.

No. 169 I.

THE following papers are submitted in addition to those which accompanied the endorsement of the Chief Engineer for Irrigation, No. 167 I., dated 28th May 1879:—

Letter No. 3,098, dated 24th May 1879, from the Superintending Engineer, Third Circle.

Memorandum No. III-23 C.N., dated 28th May 1879, to the Superintending Engineer, Third Circle.

The reason why the above letter from the Superintending Engineer was not submitted to Government was that the information, as to responsibility for the failure of the sluice, and for the defective work which led to that failure, was incomplete.

2. A later letter, No. 1,774, of the 30th May, received with the Superintending Engineer's endorsement, No. 3,226, of the 31st idem, is also submitted. No reply has been made to this, as it was written before this office No. III-23 C.N. of the 28th May had reached the Superintending Engineer. The proper remedy for the instability of the bund, alluded to in paragraph 3 of the Executive Engineer's letter, is drainage; and this will be provided for in the revised estimate for the Madras Water Works and Irrigation Extension Project.

3. With regard to the question of the necessity for having surplus, or under sluices in the weir, the objects to be secured by them are stated in Proceedings, Madras Government, No. 2,322, of the 11th August 1875, and are—

(1) to make it practicable to lower the water level in the reservoir, should the insecurity of the bund from slips or other causes render it desirable or necessary to do so:

(2) to allow of the discharge of surplus without the water rising above full tank level, or above the crest of the surplus weir.

The surplus weir is more than adequate to discharge the greatest amount of flood water ever likely to be received by the tank from its small catchment basin,* for from Appendix A to Colonel O'Connell's letter, printed in Proceedings, Madras Government, No. 38 I., 14th January 1878, it appears that even in the great cyclonic

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* Reported to be 23 square miles.

rainstorm of May 1877, when upwards of six inches of rain drained off the basin in twenty-four hours, the quantity of water received was only 3,743 cubic feet a second. Supposing however it to be necessary to prevent the water rising above any given level, say, 40·31, full tank level being 46·31, or when above any level to lower it, no extent of surplus weir will enable this to be done, and either the sluices must be made efficient, or the command over the water level which they are intended to secure will have to be abandoned. The experience in the recent storm is, the undersigned considers, an additional and very cogent reason for the retention of the under sluices, for it would not be prudent to retain water in the reservoir at anything approaching to full tank level during a storm of even that severity, comparatively small as this was, and much less so in storms like some of those which have been experienced.

OOTACAMUND,
9th June 1879.

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

From Major H. W. WOOD, R.E., Superintending Engineer, Third Circle, to the Chief Engineer for Irrigation, dated Chepauk, 24th May 1879, No. 3,098.

I HAVE the honor to report, for your information and orders, the results of my examination of the Red Hills sluice weir.

2. This work runs along a north-west and south-east line, and the pier between the third and fourth vents from the north-west end was ruined in 1877 by the action of water issuing through these vents. The accompanying two photographs show either side of the ruined pier.

3. As you are aware a mass of earth was thrown in front of the sluices at the time of the accident. Upon this mass of earth a ring bund having its top at the level + 46 M.S.L. was recently erected and an excavation behind this was made to a depth of + 31·31 M.S.L., or in other words to the level of the sluice floors. This excavation extended in front of the five vents on the westerly portion of the work.

4. At the bottom of the excavation I had a trench dug 3 feet broad and 3 feet deep immediately in front of the floors of the vents which flank the ruined pier. The front elevation of the sluice floors and their foundations was thus exposed to view, and no disturbance of the work was apparent. The sluice floors consisted of a course of ashlar masonry 12″ thick, resting on from 9″ to 12″ of what was evidently designed to be concrete. This again rested on the laterite masonry of the old calingulah of the Red Hills tank, the surface of which appears to have been plastered before the concrete was put on.

5. The concrete was, however, nothing more than a tolerably compact layer of laterite gravel, with probably an intermixture of sand and surki. Whatever lime may originally have been contained in combination with the materials just specified had been entirely melted or washed out. The plaster mentioned as underlying the concrete I found to be in a soft state. It had evidently never set properly, in consequence of having been kept in a state of saturation by water pressed upwards through the joints of the laterite masonry upon which it was placed. Having obtained the above facts, I had the trench immediately in front of Nos. 3 and 4 vents closed with clay, after baling out the water which had collected therein.

6. My intention was to open up the floors of the two vents in question on the rear side, but finding that it would involve great risk to the workmen, from the precarious state of the intermediate pier, I suspended the operations which I commenced in this locality.

7. I then opened out a central strip along the floor of No. 2 sluice (counting from the north-west end) upon the rear side, and found the same materials in the same condition as described in preceding paragraphs 4 and 5. It seemed that the closeness alone of the ashlar masonry joints prevented water issuing through this vent from disturbing the loose underlying concrete material and from so ruining the ashlar floor and the piers which were built thereupon.

8. It therefore appears to result that there must have been some defect in the joints of the ashlar floor of Nos. 3 and 4 vents, and that when the gates of these were opened the rush of issuing water penetrated the bad joints, washed away the underlying material, and so ruined the work above.

9. At the conclusion of paragraph 4 the laterite masonry of the old calingulah was alluded to. A native contractor who was on the spot told me, however, that when the sluices were constructed some courses of the old work were removed and rebuilt. The ultimate cause consequently of the disintegration of the layer of concrete may therefore reside in the bad joints of this new laterite masonry. Whether this masonry be actually new or old I found that water sprung up through the joints on a crowbar being stuck into them.

10. The Tank Monegar informed me that on the occasion of the damage being done, which forms the subject of this report, the five sluices on the south-east portion of the work had been opened and no damage had resulted from the streams of issuing water. A slight leakage has, however, been continually going on, since the date of the accident, apparently from some point in the masonry near the junction of the old and new work. I thought it would be well to examine one of the floors of the sluices at this end of the work and gave orders for the ashlar to be taken up on the rear side. Events, however, supervened which have prevented me from completing this examination. Those events I shall submit a report of in another letter.

No. III-23 C.N.

MEMORANDUM.

Two photographs.

IN reply to the letter, No. 3,098, of the 24th instant, from the Superintending Engineer, Third Circle, the undersigned has the honor to say that it is tolerably clear that the damage sustained by the third and fourth vents of the under sluices in the weir of the Red Hills tank was due to defective workmanship when the concrete and flooring of the sluices were laid down. It is difficult to believe that the usual proportion of lime was not mixed with the concrete, but it was probably shell or fat lime, and whether mixed with surki or not it apparently did not set, for even had the flooring stones been removed it could not, if hardened into a solid mass, have been scoured out in the short time that the sluices discharged in 1877. It is also difficult to suppose that, had the ashlar flooring been laid with well fitted stones, these could have been displaced unless, by unequal settlements in the material below, the flooring became disintegrated and portions of the sides of the stones thus exposed to the force of the water.

2. The undersigned can suggest no improvement in the design of this part of the work. A properly laid ashlar floor on a bed of concrete is the strongest form of work for sluices, and however porous the old laterite masonry below may be, there has never been any question of its stability. The remedy therefore must be the reconstruction of the flooring with concrete in cement, so as to ensure the perfect setting of the bed on which the ashlar is to rest, and the resetting of the ashlar in cement with fine and perfectly well fitted joints. Either Morgan's or Portland cement may be used, whichever may be the more readily procurable in first rate condition. Some of Morgan's cement as supplied to the Harbour Works has proved useless, so it will be desirable if that cement is to be used to ask the Superintendent of the Harbour Works to supply the small quantity required out of his stock of tested cement, and to ascertain from him the best mode of using it and the proportion required to be used in making reliable concrete. On the other hand, if Portland cement be used, it should be ascertained that the casks are in good order, *i.e.*, that the cement is in powder, and not already set, as is often the case.

3. For good Portland cement the proportions would be—

1 cement,
2 clean sharp sand,
6 to 8 clean gravel,

and the cement and sand should first be mixed dry or without water, then the gravel added, then as little water as will moisten the whole while mixing the ingredients, which should be done *in situ*, or as close as possible to the place where the concrete is to be laid. The ramming should be quickly completed, and should be just sufficient to bring a little of the cement mortar to the surface. If the surface becomes sloppy while tamping, it will show that too much water has been used in the mixing. A watering pot with a rose should be used for wetting the ingredients—it cannot be properly done with a chatty. Mr. Thorowgood will be able to give the proper quantity of water to a given quantity of material.

Should there be any delay in laying the ashlar upon the concrete, this latter must be kept under an inch or two of water to secure proper setting.

Every ashlar stone must be carefully cleaned so as to be free from dust and dirt, and must be well wetted before it is set in cement.

4. The third and fourth arches will have to be partly taken down to allow of the third pier being rebuilt, but apparently, if the lintel stones of the third and fourth vents be shored up, the face wall and the front portions of these arches will not need to be disturbed.

5. All the other vent floors must in due course be examined by removing one or more stones and ascertaining the state of the underlying concrete. Should it be found that this is not solid, the concrete must be taken out as far as can be done without disturbing the piers, and relaid in cement; but before commencing this relaying, it will be advisable to build a brick-in-mud wall along each face of the pier and, say, 3 inches therefrom to a height of about 4½ feet above sill level, and to fill this space or chamber with rather liquid cement composed of 2 sand and 1 cement, which will thus penetrate into any spaces there may be in the concrete under the piers,

and so remedy its defects. Of course the chambers should be filled simultaneously on the two sides of each pier, their contents should be measured as accurately as possible; and the quantity of cement mortar poured in should be measured; the quantity absorbed by the concrete under the piers will then be ascertained.* The mortar in the chambers to be kept well stirred.

6. The Superintending Engineer is requested to ascertain and report—

(1) The name of the Executive Engineer in charge of the Range at the time of the construction of the sluices; the specific orders he issued or gave in the specifications as to the composition of the concrete; the dates of his inspection of the work with the notes or orders recorded by him.

(2) The name of the member of Public Works Department who was in immediate charge of the construction at the time the concrete and floor were laid, and, if he is still in the Third Circle, his evidence as to the exact way in which the work was done should be taken and compared with the instructions which may be found to be on record.

7. It is gathered from paragraphs 7 and 9 of the Superintending Engineer's letter, No. 3,099, of the 24th instant, that though Major Clarke supposed on the 21st idem that the ring bund had been entirely washed away, much of it must remain, otherwise the depth† of water passing through the sluices for a time would have been much greater seeing that the water level in the tank was 40·20 or 8·89 feet above the sill of the sluices.

The restoration of the ring bund should now be undertaken, and its front slope can be protected by a pitching of rough large lumps of laterite, which no doubt can be quarried close at hand and should be obtained as far as possible from the ground which has to be lowered to secure a free outflow from the northern (Mr. Fraser's curved) portion of the tank surplus weir. The pitching may be about 2½ feet thick; the laterite used for the purpose to be from 1½ cubic feet to ½ a cubic foot; variations in size within this limit will make closer self packing than would result from using stone of uniform size.

OOTACAMUND,
28th May 1879.

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

To the Superintending Engineer, Third Circle.

From Major S. C. CLARKE, R.E., Executive Engineer, Chingleput Division, to the Superintending Engineer, Third Circle, dated St. Thomas' Mount, 30th May 1879, No. 1,774.

I HAVE the honor to inform you that having filled in the excavation, in front of the 10-vent sluice Red Hills tank up to 40 *mean sea datum* or present water level, I have discharged my cooly gangs, considering that nothing further in the way of protection is needed, and that it will be necessary to obtain definite instructions before the work of repairing the damaged pier can be put in hand.

Already asked for.—H.W.

2. The leakage through the vents 1 to 5 (commencing from the north end) may be regarded as entirely stopped, but through the remaining five vents there still exists a leakage, of no considerable degree, which evidently finds its way through or over the old weir.

Probably Major Clarke means N.-W. end.—H.W.

3. As far as I can judge by measurement, there has been no further subsidence of the tank bank, where the breach took place in 1877, but I would strongly urge again that the Chief Engineer may be solicited to sanction "footing walls" being constructed, at this and two other points, along the toe (rear) of the bank before the heavy north-east monsoon breaks over the locality, for I am convinced that nothing but some such immovable abutment will prevent another catastrophe taking place, at any time, during a heavy downpour of rain, the laterite soil of which the bank is composed will not bind, and as the bank is now abutting against a "slough" what can be looked for but an annual subsidence.

This is a matter which the Chief Engineer for Irrigation can pronounce upon better than I can with my limited experience of the work.—H.W.

No. 3,226.

SUBMITTED in original for the information of the Chief Engineer for Irrigation.

CHEPAUK,
31st May 1879.

(Signed) H. W. WOOD, Major, R.E.,
Supg. Engr., Third Circle.

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* Or the space occupied by the mortar which has settled down into the concrete may be measured.

† Three feet as the maximum.

No. 2. ORDER THEREON, 1st July 1879, No. 374 I.

BEFORE passing orders on these papers, His Grace the Governor in Council desires to have complete information on the following points :—

1st, the cost of draining the rear portion of the bund of the Red Hills tank in the manner proposed by the Chief Engineer for Irrigation after an inspection made in September 1878 ;

2nd, the cost of raising the parapet wall of the bund of the tank in the way suggested in paragraph 4 (2) of the Chief Engineer's endorsement of the 28th May last, recorded above ;

3rd, the cost of repairing the surplus sluices in the waste weir of the tank, regarding which repairs instructions have been given in the Chief Engineer's Memorandum No. III-23 C.N. of the 28th May, and including the improvement of the gear of the shutters as also the restoration of the ring bund ;

4th, the cost of rendering the tank bund, from the right wing of the surplus weir to the end of the apparent leakage, a short distance south of the Polal sluice, completely secure by the insertion of a puddle core wall in the bund, with a longitudinal drain at the back of the puddle and cross drains to the rear toe of the bund at intervals of from 50 to 75 feet, according to the amount of leakage heretofore manifested, after the manner laid down in Irrigation Circular No. 79.

2. With these data His Grace in Council will be prepared to decide what further work is to be undertaken for the security of this important reservoir ; and in the meantime the surplus sluices will be left unrepaired, and the surplus weir will be kept at its present level, water being retained after the first burst of the north-east monsoon, up to or as near to the F.T.L. of 46·31, as circumstances may indicate to be prudent, by means of temporary arrangements as in recent years.

3. A further report as to the officers responsible for the failure of the surplus sluices will be awaited.

(True Extract.)

Lieut., R.E.,
Ag. Under Secy. to Govt., P.W.D.,
Irrigation Branch.

To the Chief Engineer for Irrigation.
,, Superintending Engineer, Third Circle.

Exd. C. Howarth.
Spare Copies

IRRIGATION.

Govt. of {1879} Madras.

PUBLIC WORKS.

To

THE CHIEF ENGINEER FOR IRRIGATION,
&c., &c., &c.

Dated July 1st.

Issued

Recd. *Encl.*

G. O., 1st July 1879, No. 374 I.

JULY.
Nos. 1-2.

Red Hills Tank.—Calls for complete information on certain points, and further report as to the officers responsible for the failure of the surplus sluices of the —.

No. 3099.

3rd Circle
~~CHINGLEPUT~~ SUPERINTENDING ENGINEER'S OFFICE,
Chepauk
~~SAINT THOMAS' MOUNT~~, 24th May 1879.

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From

THE SUPERINTENDING ENGINEER,
~~CHINGLEPUT.~~ 3rd Circle.

To

The Chief Engineer
for Irrigation.

Sir,

In my letter No 3098 dated 24th May/79 I did myself the honor of submitting a report on the damaged sluice ne of the Red Hills Lake.

2. My inspection of the work, wa made between the 17th and 19th May. On the latter day feeling rather uneasy regarding the aspect of the weather, I requested my Asstt Mr Ussher (who had been at the Red Hills on the 18th and was returning to Madras on th 19th), to enquire from the Government Astronomer whether there was any chance of a cyclone taking plac His reply dated 19th reached me on the 20th and tho' very cautiousl worded, quite reassured me. (vide extract of letter annexed)

Having no fear of anything unusual occurring, I left the Red Hills on the afternoon of the 20th intending to return the following afternoon to complete my examination of the sluices. I reached Madras at sundown and soon afterwards it was evident, that a cyclone was on the point of breaking. The height of the storm occurred between 3 and 4 A.M. the following morning.

4. At noon 21st May I received a report from Major Clarke, whom I had left in charge, that the ring-bund in front of the sluices had been entirely washed away and that the water of the Lake was pouring out of the five vents on the N.W. portion of the work. Considering the knowledge I had recently acquired regarding the layer of concrete material upon which the piers of the sluices stood, it may be imagined that the above report gave me serious anxiety regarding the safety of the work.

Not by any means entirely, as appears from paras 7 & 9

5. I communicated at once with the Collector of Chingleput and the President Municipal Commission and asked to be assisted with labo and I despatched Sergt. Bragg to the Red Hills with twenty lascars by jutka and with 500 gunny bags. Arrangements were also made for the early despatch of ample further supplies of bags and other materials. I myself reached the Red Hills Sluic at 3½ P.M.

6. On my way, it seemed from the number of avenue trees which had bee blown down, that the storm must have been at least as intense inland as at Madras itself. The fallen trees, more especially near the Red Hills, were lying with their heads to the North, so that the cyclone must have blown its hardest from the Sout or in other words straight against the face of the temporary ring bund which had been erected in front of the sluices. On reaching the Lake, I saw that at a point about 200 yards Eas of the sluices, the rear slope of the Bund had been deeply furrowed by water, which had been driven up and over the revetment and

had swept the road which runs below the Lake embankment.

7. Before the occurrence of the storm, the level of the Lake was + 39.41 M.S.L and it had been raised to + 40.20 M.S.L by the rainfall.× The fact of the waves, having, on this occasion, topped the revetment whose level is + 52.31 M.S.L. raises the very serious question, how far it is justifiable to fill the Lake even to a provisional level of + 43.31 M.S.L., which is the present diminished height of the escape weir.

× said to have been 7 inches

40.20
31.31
8.89

8. On ascending the Bund, I found the waves to be still running very high. Against the weir, west of the sluices, a continuous mass of spray was breaking and rendered it somewhat dangerous for workmen to walk on the top of the wall. Along the laterite revetment of the Bund, the waves slid upwards in fan like sheets of water which all but reached the crest but did not over top the masonry, as had ccurred during the crisis of the

Cyclone

cyclone, at^{3} about 3½ A.M.

9. At the sluice weir, I found wate issuing through the five vents of the Western portion of the work. A violen stream nearly three feet deep was rushing thro' No 2 vent (from the N.W end) while about a foot of water wa flowing thro' No 5 vent. The depth in the other vents was inconsiderable. Most of the sluice gate spear of all these vents, were previously bee and the gates could not consequently be forced down into their seats. There was therefore nothing to be done, but to endeavour to close the openings in front, by throwing in bags of clay whic had been stored near the spot previously.

10. With the labor that was available every effort was made that evening to get in a sufficient number of bags in front of the sluices. Operations could not however be carried on far into the night, owing to the people bein knocked up both from the work done and from the exposure und-gone during the day. Work was

resumed the following morning 22d May, and the flow of water was gradually checked and reduced to 8 inches depth at 2 P.M. in No 2 vent, where it had been deepest. There being no necessity for my continued presence, I returned to Madras where I have received subsequent reports from Major Clarke of an almost entire cessation of flow except thro' vents Nos 2, 4 and 5 in which a small quantity of water still runs. This will doubtless cease as the mass of clay in bags in front of the sluices, gets consolidated.

11. As regards the destruction of the ringbund, I beg to submit my opinion, that nothing short of a lofty solid and expensive coffer dam of piles in front of the sluices, could have effectually withstood the force of the storm of the night of the 20th–21st May. Precautionary measures had been taken against all reasonable risks to the work, but these were dictated rather in the interests of economy than by apprehensions of a cyclone. Had I rec on the afternoon of the 20th a specific warning regarding the imminence of a cyclone, I might possibly have been able to take some partially defensive steps. But the somewhat sudden bursting of the storm and the fact that it broke after sundown, are circumstances which would have very much embarassed, if they would not have entirely prevented, anything worthy of mention being done. No harm therefore resulted from the guarded and scientific nature of the reply I received from the Govt Astronomer.

I do not think piles can be driven in the laterite soil. A pitching of large lumps of laterite would protect the water slopes of the ring bund

12. In conclusion I am glad to report, that Sergt Bragg Overseer P.W.D. maintained his high reputation for energy and devotion to duty, while in charge of workmen at the Red Hills under Major Clarke's immediate orders.

I have the honor to be
Sir
Your most obedient Servant
A. W. Wood Major
Supt Engineer 3d Circle

Extract of letter from Govt. Astronomer dated 19th May (afternoon)

"I see no present reason for
"anticipating a cyclone at or near
"Madras or any unusually heavy
"fall of rain. It is however quite
"impossible to say that nothing of
"the kind will occur but all I
"look for agreeably to present
"indications is ordinary much needed
"rain × × × Should decided
"symptoms of either cyclone or ab=
"=normal rain be exhibited I
"will not fail to inform you as
"soon as I feel justified in
"giving a warning worthy of reliance"

From
The Supg Engineer
3rd Circle.
To
The Chief Engineer
for Irrn
G.O. No 3743 of 1st July 1879

Dated 24th } May 1879
Received }

No 3099.

Red Hills Sluice
Weir -

Reports on the effe
of the storm which
occurred on the
20 - 21st May - at
the. -

1

Cir 30-5-79

5

From Supg. Engr. 3rd Circle No. 3099 - 24 May/79

No. 167 - I.

Submitted for the information of Government.

Enclo 1

2. The Superintending Engineer's report of his examination of the Red Hills Tank weir surplus, or under sluices is not complete, as he had not been able to ascertain the state of the work at those parts which had not been outwardly affected when the sluice was closed by an earthen bank after the flooring of the 3rd and 4th vents and the pier between them failed at the end of 1877. Instructions have been sent to the Superintending Engineer on the treatment of the damaged vents and of all other parts of the flooring which may be found to be insecure.

3. The cyclonic storm of the 21st May resulted in no damage

of consequence apparently to the Red Hills tank itself, but at the time of its occurrence the water level was at 39.41 or 6.90 feet below full tank level. The rain which fell raised the water level 0.79 feet, or 9.48 inches, which is very little for the reported rainfall of 7 inches, but the catchment basin is small. Had the tank been full undoubtedly a good deal of the top and rear slope, of the bund would have been cut away by the water, which in that case would have been driven out of the tank and over the bund by the great force of the wind. The tank revetment is not reported to have sustained damage and the description given by the Superintending Engineer, in para 8, of the fanlike sheets

of water sliding up it indicates that the stones remained in position. This form of revetment - a smooth slope - is favourable to stability but of course the water is the more readily driven up to the top of and over the bund. The undersigned had the opportunity of witnessing the effect of the 2nd part of the great cyclone of 1857 on the Nellore Tank, having been in a temple on the bund at the time. There the water was driven out of the Tank in continuous sheets which were so dense that a large two-storeyed house distant about 300 yards was invisible for considerably more than an hour. The old native revetment of the tank was destroyed and the bund cut down, by the water driving over and falling on the rear slope, to nearly water level. The tank was not breached where revetted, probably because, as in cyclonic storms generally the wind did not remain in one quarter long enough to work through the great mass of bund. The cyclone of 1857 occurred in November and should such a storm, which was of enormously greater severity than that now under notice, take place at the same time of the year at Madras, the Red Hills Tank might be full and with the wind from the westward the risk of a breach would be very great and nothing could be done to protect any threatened part of the bund.

4. Major Wood considers it a very serious question how far it would be justifiable under

such circumstances to fill the lake even to 3 feet below its proper full level. It has previously been shown in connection with slips that have occurred at different times and occasioned considerable alarm, that the breaching of this large reservoir would not be so serious a matter as might be supposed. It would destroy the cultivated lands in the immediate neighbourhood and destroy crops on lands for a considerable distance but beyond this the damage would be chiefly the loss of the water and the cost of repair. Most of the discharged water would find its way to Ennore and be there discharged into the sea and at a distance of a mile or two from the Tank it would produce only a moderate inundation. The risk cannot be altogether removed but it may be reduced to a minimum in the following way.

(1). The masonry of the surplus weir, where now at 43.31 or at 3 feet below normal full tank level may be kept at that level and the means of retaining water at 46.31 may be provided by cast iron posts fixed in the crest and supporting hinged shutters which can be released as required. By this arrangement together with the surplus sluices the level of the tank water can if necessary be rapidly lowered.

(2). The top of the bund of the tank is at 52.31 but there is a dwarf parapet of laterite stone at the top of the revetment which makes the margin above F.T.L nearly 7 feet. It would add considerably to safety to raise this parapet to 55.31 along the deeper parts of the reservoir, and to 54.31 along those parts which are of intermediate depth. The present arrangements will it is considered suffice where the depth of water is, with a full tank, less than 12 to 15 feet, for on an emergency the tank could be lowered to 6 feet below F.T.L or still lower.

5. The damage during this storm has apparently been confined to the ring bund in front of the sluices in the surplus weir. The mass of earth which rested against and closed these has recently been converted into a ring bund to allow of the sluices being got

at for repair. Major Clarke reported the total destruction of this ring bund, but from paras 7 and 9 of the Superintending Engineer's letter it may be concluded that the destruction was but partial, for as the level of the tank water was at 8.89 feet above the sill of the sluices, had the bund been even nearly washed away, the depth of water passing through the sluices would have been much greater than the 3 feet (para 9) which was the greatest depth at any vent. Much of the bund therefore will probably be found uninjured and the damage may be found to be confined to the upper and less consolidated part recently formed by turning over the soil which rested against the sluices. By means of a pitching

of laterite boulders it is hoped that this bund when restored may be effectually protected, for it is not likely that piles even were their use desirable, could be driven into the hard laterite soil which is met with at this place.

6. The measures adopted for stopping the flow of water through the sluices are considered to have been judicious. Sergeant Bragg's good service will be brought to the notice of the Chief Engineer P.W.D.

[illegible] Colonel R.E.
Chief Engineer for Irrign.

Ootacamund
28th May 1879

G.O. 389. 14.1.78.

14937

G. O. No. 374 90/1st July 1879

Cir 30/5.
O L Sheet 12 - May/79

[illegible] heading 10 P1 31

To be printed in Proceedings as altered

Memorandum. No. 169-I.

Enclos 3.

The following papers are ~~circulated for information with reference to the remarks on the sheet for orders on~~ submitted in addition to those which accompanied the endorsement of the Chief Engineer for Irrigation No. 167 I dated 28th May 1879.–

Letter No. 3098 dated 24th May 1879 from Superintending Engineer Third Circle.

Memo No. $\frac{III}{23 C.N.}$ dated 28th May 1879 to Superintending Engineer Third Circle.

The reason why the above letter from the Superintending Engineer was not submitted to Government was that the information, as to responsibility for the failure of the sluice and for the defective work which led to that failure, was incomplete.

2. A later letter No. 1774 of the 30th May received with the Superintending Engineer's endorsement No. 3226 of the 31st idem is also submitted. No reply has been made to this as it was written before this office No. $\frac{\text{III}}{\text{23 C.N.}}$ of the 28 May had reached the Superintending Engineer. The proper remedy for the instability of the bund alluded to in para 3 of the Executive

This is not complete yet — Surely the reasons & statements can be obtained without further ref[illegible] —

It has to be given in reply to this office No. $\frac{\text{III}}{\text{23 C.N.}}$ 28 May last & it is impossible that the S.E. could have made the investigations required before

Ver

11 p12 33

but S.D. the drainage should be shown as a separate charge not worked in with [illegible] works estimate?

[illegible] Government sanction of money can be appropriated

Engineer's letter is drainage and this will be provided for in the revised estimate for the Madras Water works and Irrigation Extension project

3. With regard to the question of the necessity for having surplus, or under, sluices in the weir, the objects to be secured by them are stated in P.W.G. No. 2322 of the 11th August 1875 and are

(1) to make it practicable to lower the water level in the reservoir, should the insecurity of the bund from slips, or other causes render it desirable, or necessary to do so.

(2) to allow of the discharge of surplus without the water rising above full tank level or above the crest of the surplus weir.

The surplus weir is more than adequate to discharge the greatest amount of flood water ever likely to be received by the tank from its small catchment basin,+ for from Appendix A to Colonel O'Connell's letter printed in B.M.G. No. 38. I. 14th January 1878 it appears that even in the great cyclonic rainstorm of May 1877, when upwards of 6 inches of rain drained off the basin in 24 hours, the quantity of water received was only 3743 cubic feet a second. Supposing however it to be necessary to prevent the water rising above any given level, say, 40.31, full tank level being 46.31, or when above any level to lower it, no extent of surplus weir will enable this to be done and either the sluices must be made efficient or the command over the water level which they are intended to secure will have to be abandoned. The experience in the recent storm is, the undersigned considers, an additional and very

+reported to be 23 square miles

below the crest of weir?

No doubt but the chief value of the Tank is the Madras supply - this requires as high a level as can be maintained + a minimum of 6 feet

cogent reason for the
retention of the under-
sluices, for it would
not be prudent to retain
water in the reservoir
at anything approaching
to full tank level
during a storm of
even that severity, com-
paratively small as
this was, and much
less so in storms like
some of those which
have been experienced.

[illegible] Colonel RE
Chief Engr. for Irrign.

Ootacamund
9 June 1879

See G.O. No 2748 of 1-7-77

Cir 11-6-79. Retd 17.6.79
O.L. Sheil br. May

No 54

be a serious matter
in that supply—
Recd 30th June
When it has been
just short ... when
water is too supply is
bad — [illegible]
at least very unpleasant
+ it deserves consideration
whether [illegible] the
[illegible] of the
[illegible] so as to maintain
supply the contemplated
supply may not be
[illegible] of the
of repairing [illegible]
the damaged sluices—
the whole of which is
[illegible]
damaged + useless— some by
failure of masonry— some
by utterly insufficient [illegible]
[illegible] — J Sheil

No. 3098-

3rd Circle
~~Chingleput~~ Superintending Engineer's
Chepauk
~~Saint Thomas' Mount,~~ 24th May

From

THE SUPERINTENDING ENGINEER,

~~Chingleput.~~ 3rd Circ

To

The Chief Engineer
for Irrigation.

Sir,

Enc: 2.

I have the honor to report for
information and orders the res
my examination of the Red H
Weir.
2. This work runs along a N. W.
S. E. line and the pier between
3rd and 4th vents from the N. W.
was ruined in 1877, by the actio
water issuing through these
The accompanying two photog
show either side of the ruined
3. As you are aware, a ma
earth was thrown in front of
at the time of the accident. E
mass of earth a ring bund
its top at the level + 46 M. S.
recently erected and an exca
-tion behind this was made
depth of + 31.31 M. S. L. or in a

words to the level of the sluice floors.
his excavation extended in front
f the five vents on the Westerly portion
the work.

At the bottom of the excavation,
had a trench dug, three feet broad
nd three feet deep immediately
front of the floors of the vents
hich flank the ruined pier. The
ront elevation of the sluice floors and
heir foundations, was thus exposed
o view - and no disturbance of the work
as apparent. The sluice floors con=
isted of a course of ashlar masonry
" thick, resting on from 9" to 12" of what
as evidently designed to be con=
ete. This again, rested on the laterite
asonry of the old Calingulah of the
ed Hills Tank, the surface of which
pears to have been plastered before
e concrete was put on.

The concrete was, however, nothing
ore than a tolerably compact layer
laterite gravel, with probably
intermixture of sand and soorkee.
hatever lime may originally have
en contained in combination with
e materials just specified, had

been entirely melted or wash
The plaster mentioned as under
the concrete I found to be in a
state. It had evidently nev=
properly, in consequence of hav
kept in a state of saturatio
water pressed upwards through
joints of the laterite masonry up
which it was placed. Ha
obtained the above facts, I had
trench immediately in front of
4 vents closed with clay, after
out the water which had colle
therein.

6. My intention was to open up
floors of the two vents in questio
the rear side, but finding that
would involve great risk to the
=ment, from the precarious state of
intermediate pier, I suspended th
operations which I commenced
this locality.

7. I then opened out a central strip
the floor of No 2 sluice (counting f
the N.W. end) upon the rear side,
found the same materials in t
condition as described in pre
paras 4 and 5. It seemed th

oseness alone, of the ashlar masonry
ints, prevented water issuing through
his vent from disturbing the loose under-
lying concrete material and from
o ruining the ashlar floor and the
iers which were built thereupon.

It therefore appears to result
at, there must have been some defect
the joints of the ashlar floor of
Nos 3 and 4 vents and that when
the gates of these were opened, the
ush of issuing water, penetrated
the bad joints; washed away the
nder-lying material and so ruined
the work alone.

At the conclusion of para 4, the
laterite masonry of the old Calin-
gulah was alluded to. A native
contractor who was on the spot told
me, however, that when the sluices
were constructed, some courses of the
old work were removed and rebuilt.
The ultimate cause consequently of the
isintegration of the layer of concrete may
herefore reside in the bad joints of
of this new laterite masonry. Whether
this masonry be actually new or old,
found that water sprung up through

the joints on a crowbar being stu
them.

10. The Tank Monegar informed
on the occasion of the damage being
which forms the subject of this re
five sluices on the S. E. portion o
had been opened and no dama
resulted from the streams of
water. A slight leakage ha
been continually going on, since
date of the accident, apparen
some point in the masonry ne
junction of the old and new m
thought it would be well to e
one of the floors of the sluices a
end of the work and gave orde
the ashlar to be taken up or
side. Events however supervene
have prevented me from complet
examination. Those events I sh
=mit a report of in another le

I have the hon
Sir

Your most obedient s

A. T. Wood M

Supg Engineer

From
The Supg Engineer
3rd Circle.
See G.O. No 3743 of 1st July 1879
To
The Chief Engineer
for Irrigation

Dated 24th
Received } May 1879

No 3098.

Enclosures 2.

Red Hill Lake
damaged Sluice
weir—

Reports on the—

No III/23C.N

Memorandum

Irrigation.

Enclos: 2.
2 Photographs

Neglect under Mr Moberly

In reply to the letter No 3098 of the 24th instant from the Superintending Engineer 3rd Circle, the undersigned has the honour to say that it is tolerably clear that the damage sustained by the 3rd and 4th vents of the under sluices in the weir of the Red Hills Tank was due to defective workmanship when the concrete and flooring of the sluices were laid down. It is difficult to believe that the usual proportion of lime was not mixed with the concrete, but it was probably shell or fat lime and whether mixed with surki or not it apparently did not set, for even had the flooring stones been removed it could not, if hardened into a solid mass, have been scoured out in the short time that the sluices discharged in 1877. It is also difficult to suppose that had the ashlar flooring been laid with well fitted stones these could have been displaced unless, by unequal settlements in the material below, the flooring became disintegrated and portions of the sides of the stones thus exposed to the force of the water.

2. The undersigned can suggest no improvement in the design of this part of the work. A properly laid ashlar floor on a bed of concrete is the strongest form of work for sluices, and however porous the old laterite masonry below may be there has never been any question of its stability. The remedy therefore must be the reconstruction of the flooring with concrete in cement so as to ensure the perfect setting of the bed on which the ashlar is to rest, and the resetting of the ashlar in cement with fine and perfectly well fitted joints. Either Morgan's or Portland cement may be used whichever may be the more readily procurable in first rate condition. Some of Morgan's cement as supplied to the Harbour works has proved useless, so it will be desirable if that cement is to be used to ask the Superintendent of the Harbour works to supply the small quantity required out of his stock of tested cement, and to ascertain from him the best mode of using it and the proportions required to be used in making reliable concrete. On the other hand if Portland cement be used it should be ascertained that the casks are in good order i.e. that the cement is in powder and not already set as is often the case.

3. For good Portland cement

the proportions would be

1 cement
2 clean sharp sand
6 to 8 clean gravel

and the cement and sand should first be mixed dry or without water, then the gravel added, then as little water as will moisten the whole while mixing the ingredients, which should be done in situ, or as close as possible to the place where the concrete is to be laid. The ramming should be quickly completed and should be just sufficient to bring a little of the cement mortar to the surface. If the surface becomes sloppy while tamping, it will show that too much water has been used in the mixing. A watering pot with a rose should be used for wetting the ingredients - it cannot be properly done with a chatty. Mr Thoroughgood will be able to give the proper quantity of water to a given quantity of material.

Should there be any delay in laying the ashlar upon the concrete this latter must be kept under an inch or two of water to secure proper setting.

Every ashlar stone must be carefully cleaned so as to be free from dust and dirt, and must be well wetted, before it is set in cement.

4. The 3rd and 4th arches will have to be partly taken down to allow of the 3rd pier being rebuilt, but apparently, if the lintel stones of the 3rd and 4th vents be shored up, the face wall and the front portions of these arches will not need to be disturbed.

5. All the other vent floors must in due course be examined by removing one or more stones and ascertaining the state of

the underlying concrete. Should it be found that this is not solid the concrete must be taken out as far as can be done without disturbing the piers and relaid in cement, but before commencing this relaying it will be advisable to build a brick-in-mud wall along each face of the pier and, say, 3 inches therefrom to a height of about 4 1/2 feet above sill level and to fill this space or chamber with rather liquid cement composed of 2 sand and 1 cement, which will thus penetrate into any spaces there may be in the concrete under the piers and so remedy its defects. Of course the chambers should be filled simultaneously on the two sides of each pier: their contents should be measured as accurately as possible and the quantity of cement mortar poured in

should be measured; the quantity absorbed by the concrete under the piers will then be ascertained.* The mortar in the chambers to be kept well stirred.

*or the space occupied by the mortar which has settled down into the concrete may be measured

6. The Superintending Engineer is requested to ascertain and report

(1) the name of the Executive Engineer in charge of the Range at the time of the construction of the sluices; the specific orders he issued or gave in the specifications as to the composition of the concrete; the dates of his inspection of the work with the notes or orders recorded by him.

also

Colonel F. J. [illegible]

(2) the name of the member of P.W.D. who was in immediate charge of the construction at the time the concrete and floor were laid, and, if he is still in the 3rd Circle, his evidence as to the exact way in which the work was done should be taken and

compared with the instructions which may be found to be on record.

7. It is gathered from paras 7 and 9 of the Superintending Engineer's letter No. 3099 of the 24th instant that though Major Clarke supposed on the 21st idem that the ring bund had been entirely washed away much of it must remain, otherwise the depth+ of water passing through the sluices for a time would have been much greater seeing that the water level in the tank was 40.20 or 8.89 feet above the sill of the sluices.

+3 feet as the maximum

The restoration of the ring bund should now be undertaken and its front slope can be protected by a pitching of rough large lumps of laterite which no doubt can be quarried close at hand and should be obtained as far as possible from the ground which has to be lowered to secure a free outflow from the Northern (Mr. Fraser's curved) portion of the tank surplus weir. The pitching may be about 2½ feet thick: the laterite used for the purpose to be from 1½ cubic feet to ½ a cubic foot; variations in size within this limit will make closer self packing than would result from using stone of uniform size.

(Signed) John Mullins Col. R.E.
Chief Engineer for Irrign.

Ootacamund }
28 May 1879 }

To The Superintending Engineer
Third Circle.

(True Copy)

J. Mullins Colonel R.E.
Chief Engineer for Irrign.

In G.O. No ~~1374~~ 374 dd/ 1-7-79

53

No 1774. 21 Chingleput Divisional Office
St Thomas' Mount. 30th May 1879.

13

From
The Executive Engineer
Chingleput Division

To
The Superintending Engineer
3rd Circle

Sir,

I have the honour to inform you that having filled in the excavation in front of the 10 Vent Sluice Red Hills Tank up to 40 M~~ean~~ Sea Datum or present water level, I have discharged my Cooly gangs, considering that nothing further in the way of protection is needed and that it will be necessary to obtain definite instructions, before the work of repairing the damaged Pier can be put in hand -

Already asked for
Wr

2/ The leakage through the vents 1 to 5 (commencing from the North end) may be regarded, as entirely stopped but through the remaining 5 Vents there still exists a leakage, of no considerable degree

Probably Major C. means N.W. end.
Wr

degree, which evidently finds its way through or over the old Weir.

3/ As far as I can judge by measurement, there has been no further subsidence of the Tank Bank, where the breach took place in 1877 but I would strongly urge again that the Chief Engineer may be solicited to sanction "footing walls" being constructed, at this and two other points, along the toe (rear) of the bank before the heavy North East Monsoon breaks over the locality, for I am convinced that nothing but some such immovable abutment will prevent another catastrophe taking place, at any time, during a heavy downpour of Rain; the laterite soil of which the bank is composed, will not bind and as the bank is now abutting against a "slough" what can be looked for, but an annual subsidence

This is a matter which the Chief Engr for Irrigation can pronounce upon better than I can with my limited experience of the work.
WW

I

De

I have the honor to be,
Sir,
Your Most Obedient Servant
M'Neil Major R.E.
Executive Engineer
Chingleput Division

No. 3226. P 14

Submitted in original for the information of the Chief Engineer for Irrigation

Chepauk. 31 May 1879

Major R.E. Supg Engineer 3rd Circle

No 4541.

From

M 4954

FOR IRRIGATION III

The Executive Engineer Chingt Dn

To

The Supg. Engineer 3rd Circle

In G.O. No 374 dt 1st July /79

Dated 30th
Recd 31st } May 79.

No 1774

10 Vent Sluice Red Hill

Informs that the works to the ——— have been stopped considering that nothing further protection is needed.

Endorsement of the Chief Engineer for Irrign. No. 167 I dt. 28 May 1879.

Memorandum · V 169 I dt. 9th June "

FOR ORDERS. with previous file.

Colonel R.E.
Joint Secretary to Govt.
P.W.D. Irrigation Branch

10/6

The whole question of the capacity of the tank as reduced to 40 - from 46 for the Madras supply should be reported on before any decision is come to for if a level of 40 will suffice for full the calculations may be [illegible]

1/6

Seen.

I suppose the C.E. will deal with Major Clarke's suggestion of a footwalk at rear of the bund where bank is liable to be topped. E.H.

Hon. M. Huddleston
His Grace the Govr

FOR ORDERS.

Red Hills Sluice
Weir

Recd 26.6.79
Cir 26.6.79 Dtel 17-6-79
P.L. Sheet 62 May

PUBLIC WORKS DEPARTMENT.

Endorsement of the Chief Engineer for Irrigation
No. 167 I. d/ 28th May 1879.

FOR ORDERS.

Colonel R.E.
Joint Secretary to Govt.
P.W.D. Irrigation Branch.

30/5

I think full report
of steps being taken
& proposed to be submitted
to Govt. & Minute [illegible]
may be involved & [illegible]
expenditure which may
not be needed

When at Madras I visited
the [illegible] with Col. [illegible] &
Col. [illegible] Cornwell &
[illegible] was there a

See the letter of
No. 3048
26th Aug. [illegible] last
[illegible]

I presume the C.E.
[illegible]
[illegible] this proposal
for further
[illegible] necessary
[illegible]

generally the case, this [illegible]

strong impression on
the mind of the latter
that the stations are
not necessary at all
& that the necessary
[illegible] for a [illegible]
of certain unaccounted
along the Latitude
work - beyond the
Calculation - & the
the Earth [illegible]
allowed to [illegible]
in front of the stations
& not be [illegible] -
Have any [illegible]
time?

generally the case, the former

Mr. H. Huddleston
[illegible] [illegible] the same

FOR ORDERS.

Recd 26-6-79. D

Recd 11.6.79. Dted 17-6-79

Cir - 30/5. Retd 7-6-79.
O-L. Sheet - 62 - May/79

2

46.31

Contract

The remarks of H. E. the G. on my Memo No. — 29/6/79 appear to have been made on the supposition that it is intended by means of the sluices to keep the water of the Red Hills Tank below the present F.T.L or in other words to reduce the F.T.L permanently. Such is not the intention but merely temporarily to lower the level whenever this may be essential to safety e.g.

(1) in case of slips
(2) during cyclones.

H. E. the G. suggests the strengthening of the weakest parts of the bund as a preferable outlay to the repair or reconstruction of the sluices. The weakness of the bund is due to inadequate arrangements when the tank was enlarged for making the bund watertight. Instead of a puddle facing carried down only to a small depth below the flat foreshore of the old bund or into what was made soil, there should have been a puddle core carried down into solid ground with, if, as is believed to be generally the case, this ground be formed laterite, a longitudinal drain immediately in rear of the puddle wall and cross drains therefrom to the outer toe of the bund.

The insertion of a puddle core in the bund with drains as above would make the bund stable but such insertion would with much water in the tank be a work of difficulty and it would not be practicable to estimate its cost with accuracy

It would be necessary to cut a trench down from the top of the bund to the required level – This trench would be about 10 feet wide & top of bund is at 52.31

probable bottom of puddle trench	16.31
depth of trench	36.00

With much water in the tank the work could be done only in 50 or 60 feet lengths and the trench would have to be planked from top to bottom & strutted – The trench would also have to be unwatered

The length to be treated is probably about 5000 feet – Perhaps the mean depth of trench would be 30 feet

A rough estimate of cost assuming

250 feet to be undertaken at once would be

Excavation	5000 × 10 × 30 = 1,500,000 C.F. at 1 Rupee 100 C.F.	15,000
Puddle.	$5000 \times \frac{9+2}{2} \times 28$ = 770,000 C.F. at 2 Rupees 100 C.F.	15,400
Planking –	2 × 250 × 30 × $\frac{1}{8}$ = 1875 C.F. at R 1½	2,812
Struts.	No 50 × 20 × 10 × $\frac{2}{3}$ × $\frac{2}{3}$ = 4444 at 1¼	5,555
Wedges	1200 × $\frac{3}{4}$ × $\frac{2}{3}$ × $\frac{1}{8}$ = 75 at 2	150
Pumping	say	5,000
		43,917
	Contingencies	4083
		48,000
	or say 10 Rupees a foot run	

Drains longitudinal

Excavation	5000 × 2 × 30 = 300,000	3,000
Stone	5000 × 2 × 2 = 20,000 at 5 Rupees 100 C.F.	1,000

Drains cross at 50 feet intervals

Excavation	100 × 45 sq. feet × 75 = 337500 C.F. at 1 Rupee 100	3,375
Stone	100 × 2 × 2 × 75 = 30,000 at 5 Rupees 100	1,500
Turf –	say –	525
		9,400
	Contingencies	600
		10,000
	or 2 Rupees a foot run.	
	Total	58,000

An outlay of 12 Rupees a foot run would probably suffice to make the bund safe for retaining water at 46.31 the present F.T.L except during cyclones

What has on the other hand been contemplated with a view to make the bund comparatively safe is to drain the rear part of the bund & by making a sufficient section of this slope to get rid of the ~~[illegible]~~ tendency to slip. The S.E. submitted in February last an estimate ~~[illegible]~~ of Rupees 3000 for draining 2345 feet out of a continuous length of 4207½ feet & this estimate ~~was~~ is based it is stated on instructions given in August 1878, but such is not the case and the instructions given after an inspection made in Sept. 1878 are not even referred to. Further instructions were sent about April last and no answer appears to have been received. Probably this system of drainage would cost 8 to 9 thousand Rupees. It might prove sufficient to ensure stability but necessarily there must be uncertainty that some weak point had been left unsecured for where material leakage has not yet occurred it might occur in the future either from subsoil springs or from infiltration at a higher level.

Wy. 18/6/79

No. 659 - 10 Feby. 79

No. 68 C.N. 24 Aug. 78.

G.O. No. 374 I

Council on 20/6/79
Wy

Taken into Council & a draft despatch herewith sent in connection with the instructions received.

Wy 24/6 Wy.

No. 374 I Public Works Department.

PROCEEDINGS OF THE MADRAS GOVERNMENT.

UNDER date the 1st July 1879

Read the following:—

Endorsement No. 167. I of the 28 May 1879 by Ch. Engr for I.
Memo No. 169 I. of 9th June by Chief Engineer for I.
Letter No. 3099. 24 May 1879. from S.E. 3d Circle.
Memo No. $\frac{111}{23C.N.}$ 28 May " to do.
Letter No. 1774 - 30 May " from Ex. Engr. Chingleput Divn.
with endorsement No. 3226. 31 May 1879 by S.E. 3d Circle

Before passing orders on these papers His Grace the Governor in Council desires to have complete information on the following points:-

1st the cost of draining the rear portion of the bund of the Red Hills Tank in the manner proposed by the Chief Engineer for

Irrigation after an inspection made in September 1878.

2nd the cost of raising the parapet wall of the bund of the Tank in the way suggested in para 4.(2) of the Chief Engineer's endorsement of the 28th May last, recorded above.

3rd the cost of repairing the surplus sluices in the waste weir of the tank, regarding which repairs instructions have been given in the Chief Engineer's Memo No. $\frac{\text{III}}{23C.N}$ of the 28th May, and including the improvement of the gear of the shutters as also the restoration of the ring bund.

4th the cost of rendering the Tank bund, from the right wing of the surplus weir to the end of the apparent leakage a short distance South of the Iolal Sluice, completely secure by the insertion of a puddle core wall in the bund, with a longitudinal drain at the back of the puddle and cross drains to the rear toe of the bund at intervals of from 50 to 75 feet according to the amount of leakage heretofore manifested, after the manner laid down in Irrigation Circular

No. 79.

2. With these data His Grace in Council will be prepared to decide what further work is to be undertaken for the security of this important reservoir, and in the meantime the surplus sluices will be left unrepaired, and the surplus weir will be kept at its present level, water being retained after the first burst of the N. E. monsoon, up to or as near to the F. T. L of 46.31, as circumstances may indicate to be prudent, by means of temporary arrangements as in recent years.

3. A further report as to the officers responsible for the failure of the surplus sluices will be awaited.

Wy. 2/6

Ch. Eng. I. 8 ✓
S.E. III Circle I D
Despd 8.7.79

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20
40
3

[illegible] [illegible] the [illegible]

[illegible] [illegible] [illegible]
27/6

111

Cir 26-6-79.
O.L. Sheel 62 - May

11/7/29 BIII

Compd

Govt. of {1879} Madras.

PUBLIC WORKS.

To ✓

Dated

Issued

Recd. Encl.

G. O., 1st July 1879, No. 374 I.

Nos. 1-2

Red Hills Tank. Calls for complete information on certain points, & further report as to the Officers responsible for the ~~damage caused~~ failure of the surplus sluices of the —

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