5/12/38 A
22-4-40 H
28-7-41 D
13-8-41 H
28-1-53 SB

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MADRAS RECORD OFFICE.

Government of Madras.

Public Works DEPARTMENT.
Irrigation Branch

G.O. No. 38 Irrigation Press ~~Mis.~~

Dated 14th January 1878.

Not to be folded or roughly handled

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GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

14th January 1878, No. 38 I.

Irrigation.

Read the following paper :—

No. 35. Endorsement of the Chief Engineer for Irrigation, dated Camp, Ellore Canal, 17th December 1877, No. 278 I.

From Colonel P. O'CONNELL, R.E., Superintending Engineer, Chingleput, to the Chief Engineer for Irrigation, dated Camp, Red Hills, 4th December 1877, No. 3,670.

One Appendix A.
,, Section.
,, Letter from the Assistant Engineer, Serooloor Range, No. 1,260, dated 25th November 1877.
,, do. from Assistant Engineer, Mount Range, No. 2,247, dated 21st November 1877.

IN replying to the memorandum No. 129, dated 23rd November 1877, signed by Major P. Montgomerie, Acting Deputy Chief Engineer for Irrigation, and calling for a full report explaining the exact state of the Red Hills Reservoir at the earliest date, I explained that a full report could not be submitted until after the monsoon, and gave a few details respecting the work done with the view of preventing further injury to the bund and to the surplus sluice.

2. On reconsidering the matter, I have come to the conclusion that the actual condition of the surplus sluice will not be known until some months after the termination of the North-east Monsoon, and that it will therefore be better to give some further account of the reservoir and the operations undertaken for its preservation without waiting until our knowledge is complete. What is wanting in this report may in fact be supplied in a subsequent one.

3. On Saturday, November 17th, I received at St. Thomas' Mount at 2 P.M. a report that the bund of the Red Hills Tank was in danger, owing to a portion of the earthwork in its rear slipping down. I directed Conductor D. Falvey to proceed at once to the Red Hills and followed him myself as soon as a carriage could be obtained, my own having unfortunately been sent into Madras that very morning to Messrs. Waller and Co. in order that a good pair of horses might be substituted for one previously provided by them which was not up to much while the roads were heavy with rain. The consequence was that I did not reach the tank until 7 P.M. Mr. Falvey, trusting himself to a small native carriage drawn by a single country pony, succeeded in reaching the bund by 8 P.M., and at once superintended the coolies at work on the bund. Obtaining a passing view of the slip on my way, I proceeded directly to the waste weir in order to ascertain its capacity for relieving the reservoir and to learn what use was being made of it for this purpose. I was there informed that 160 feet of its crest had been lowered one foot and thus reduced from a level 46·31 feet to one 45·31 feet above mean sea level. The water flowing over the higher of these levels was 4 inches in depth at 7 P.M. when I first saw it; its depth at 6 A.M. having been $7\frac{1}{2}$ inches. The lowering of the crest to a length of 160 feet

had been carried out under the orders of Sub-Conductor J. B. Sanderson. At the south end of the waste weir is a surplus sluice which would have done all the work of relieving the reservoir had it been in working order. It contains ten vents each 6 feet wide and 6 feet in height, and would have been capable when the water stands at the level of the crest of the weir of discharging at the rate of nearly 6,300 cubic feet per second, a rate exceeding the highest rate at which the reservoir was receiving water during the cyclone of May last. This fact I have of course since ascertained from registers and by computations, the results of which I give in an appendix.* A large volume of water was then passing through the sluice although all its shutters were not raised and none of the vents were fully open. One cut-stone had been washed out of some part of the masonry about the seventh vent, but whence it came from could not be exactly ascertained, owing to some of the screw rods of the shutters bending under the pressure applied to them, the shutters remaining all the time unmoved. Moreover it would not then have been expedient to confine attention to the sluice, even if we had that complete command over it, which, had it been in perfect order, we should have had.

* Appendix A.

4. I then proceeded to the slip the condition of which will best be seen from the accompanying section taken by Lieutenant Wiffen, whose report† I also forward. On arriving at the slip I met Mr. Burrows, the President of the Municipal Commission, Madras; Mr. Stephenson, the Acting Executive Engineer to the Commission; Mr. Jones, Deputy Collector of the Chingleput District; Conductor D. Falvey; Sub-Conductor J. B. Sanderson from Range No. 1; and Lieutenant Wiffen, who is in charge of Range No. 1. A number of coolies were at work on the slip bringing basket loads of laterite to raise the bund, the appearance of which certainly seemed dangerous, especially as the work done by the coolies, who were tired out with a previous day's work, was trifling. At 10 o'clock heavy rain fell, and the coolies all left the work. Mr. Stephenson kindly undertook to send a gang of 500 wudders to the work the next morning. Mr. Wiffen, Mr. D. Falvey, the Deputy Collector and Tahsildar all exerted themselves, and the next day (Sunday) the labor, especially that of the wudders, gradually showed itself able to keep pace with the slip, so that as we have since learnt actual danger at this point ceased before the morning of Monday the 19th of November, but, at the time, I was not quite sure that this was the case.

† Appendix B.

5. In order to supplement the work of the waste weir and surplus sluice, I directed Lieutenant Wiffen on Sunday morning to make a temporary breach in the southern extremity of the northern half of the bund. The water in front of the portion ordered to be removed being only about three feet in depth, this could be done, as I knew by experience, with perfect safety. This temporary breach served its purpose well until the water in the reservoir fell below the level of the breach.

6. On Monday morning the rear or northern end of the seventh pier of the surplus sluice, counting from its eastern abutment, began to turn on its eastern edge. Two more granite or gneiss stones having been washed out of the seventh vent, and this vent having been less utilized than any of the first five, I began to suspect that it was not scour, but hydraulic pressure, acting on the lower surface of the flooring stones that had removed them. It was only necessary for the water to get fairly under these stones to enable it to raise them with ease. If good mortar or cement had formed their beds, no doubt the water would have failed to get under and so left them, as it in fact failed to do with the flooring stones of the other vents. I am aware that no design is safe against bad workmanship, but for floorings to sluices of this kind I prefer cut-stone inverted arches. I think them safer than flat stones, though of course they are not safe if badly executed. By the evening the seventh pier had turned still more on its eastern edge though it was still touching the masonry above, which it ought to have been fully supporting. I let more water flow through this vent and the turning over of the pier seemed to be checked. That night by moonlight Mr. Falvey and I superintended the cutting, lowering and fixing of struts made of solid sections of palmyras between the eastern abutment and the

first pier, and in each vent up to the seventh. The unstable pier ceased to move, but the third pier afterwards moved, but only very slightly. It was fortunate that the batter which each of the rear faces of the piers has enabled us to place these struts from above; for no man could have stood in the roaring current below, which sent heavy stones and bags of clay rolling into the pool beyond the apron.

7. I will here explain the circumstances which led to my ordering a short length of the waste weir being blown away with gunpowder. After having seen the waste weir and surplus sluice and having ascertained that a temporary breach of moderate length could be safely made at the southern end of the northern portion of the bund, I had not the slightest intention of using explosives of any kind; but at first there was a good deal of alarm in Madras, not merely lest the city should lose a year's supply of drinking water, but even, I fancy, lest property, if not life, might be lost. Some such ideas appear even to have entered the precincts of the Civil Secretariat through whom the alarm was first communicated to Colonel Foord, Colonel Mullins, the Chief Engineer for Irrigation, being absent. Colonel Foord at once suggested that the easiest way to relieve the earthen bank of the tank from danger was to blow in a portion of the calingulah, Colonel Foord not being then aware of the existence of the surplus sluice. As I had left the Mount, the letter reached Lieutenant Martin, R.E., Assistant Engineer in charge of No. 2 Range, who at once applied to Lieutenant-Colonel Gloag, R.A., Commanding at the Mount, and to Captain Twynam, R.A., Commissary of Ordnance, and these officers promptly and kindly placed at his disposal powder, men, horses, wagon, and plant. On their arrival here, I told Lieutenant Martin that I did not intend to use powder, but I was not the less thankful to the Artillery Officers named for the hearty manner in which they assisted us, and I trust that they will receive the thanks of Government for the prompt assistance given by them, at a time when there was every appearance of its being immediately required. When the surplus sluice began to give way, it became evident that measures must be taken to save it, and the first was to relieve it from pressure and then endeavour to support it by blocking up the vents most in danger. Mr. Grainger, the Superintendent of the Madras Workshops, came out to assist us by closing the sluice shutters. His endeavours were unsuccessful, and after consultation with Colonel Foord it was decided to close the vents in front as well as we could with rough wooden framings, matting, and bags of clay. To assist in giving relief from pressure I directed Lieutenant Martin to blow away a section of the waste weir. His report* is forwarded herewith. The gap made in the weir did good service as a surplus channel. At the same time I ordered the crest of the weir to be still further lowered as already reported in my last letter.

* Appendix C.

8. While the surface of the reservoir was being lowered by the outflow over the weir crest and through the gap blasted in it, the flow of water through the surplus sluice was being gradually diminished until men could work standing on its rear apron. The vents in danger were then filled in with laterite blocks; a continuous wall parallel to the body was raised to a height of three feet, cross walls were built as buttresses connecting each pier of the sluice with the new longitudinal wall. What water still flowed through the vents of the surplus sluice after the 23rd of November has all been used for irrigation, in lieu of what would otherwise have been let out through the irrigation sluices.

9. On the 16th November the surface of the water in the reservoir was 46·93 feet above mean sea level or ·62 of a foot, or about 7½ inches above the crest of the weir before it was lowered. The surface fell until at 5-30 P.M. of the 24th, when it stood at 42·54 feet above mean sea level. It then commenced to rise again, and after fluctuating for a while it recommenced on the night of the 30th to rise and continued to do so until at 6 A.M. on the 2nd December; it stood at 43·31 feet, or exactly three feet below the crest of the weir before it was lowered, *i.e.*, below what has been hitherto called "full tank level."

10. According to the printed "table showing water surface, areas and cubical contents at half foot vertical intervals up to crest of new calingulah of the Red Hill

tank." The contents at the level 46·31 being that of the crest of the new calingulah are

are	101,981,815	cubic yards.
at the level 43·31 at which the surface of the water stood at 6 A.M., 2nd December	80,401,616	"
at the level 31·31 which is that of the floor of the surplus sluice	20,477,034	"
at the level 22·31 which is the lowest given in the table, and a little higher than the bed of the reservoir opposite the slip	944,514	"

so that it may be said in round numbers that we have by our operations lost 21½ millions of cubic yards in order to save ourselves from the loss of 81½ millions had the surplus sluice been breached, or 101 millions had the slipped portion of the bund been breached. If more rain falls this month without being excessively violent or too small in quantity, we hope to reduce still further the loss of 21½ millions.

11. The Red Hill tank contained at 6 A.M. 2nd December 81½ millions, and the Cholaveram tank 28½ millions. In fact the two reservoirs of the so-called "Madras Water Works Project" contained 110 millions of cubic yards, while the Municipal Budget published in a late Gazette shows that the city is only prepared to use 5 millions.

12. With reference to the future condition of this reservoir, Colonel Mullins, in a note dated 14th March 1874 expressed himself as follows, paragraph 6 :—"It is possible rather than probable that there may be no more slips at the Red Hills tank. The composition of the bund is not favorable to complete stability; at the most recent slip, very various soils were to be seen, and water reaching these could penetrate in all directions; elsewhere, and notably to the south of the more northerly slips, similar conditions are to be found."

13. In the Government Order on this, No. 1,045, dated 23rd April 1874, it is observed that "the concluding paragraph of the memorandum by the Chief Engineer for Irrigation is not consolatory as regards the state of the Red Hills tank bund."

14. At that time the surplus sluice had not been constructed, and the crest of the waste weir was two feet lower than it was before we began to lower it last month, *i.e.*, its level was 44·31 feet above mean sea level. At present the surplus sluice is closed. The state of the crest of the weir is nearly as follows :—

At the level 46·31 for a length of 569·83 feet.
45·31 " 84· "
44·40 " 78·5 "
44·31 " 22· "
43·40 " 442· "
43·18 " 205· "

I had ordered the crest to be covered with fine concrete and its levels to be brought up to the four 46·31, 48·31, 44·40, and 43·40, but before the work was finished rain again began to fall, and I ordered a turf bund to be erected in the lower levels of the crest. In consequence of this the water is now retained at the level 43·48, that is, it stood at that level at 6 A.M., 3rd December. If the crest levels were exactly as in the list given in this paragraph, the discharges over the weir when the water stood flush with each successive stage of the crest would be as follows :—

Heights above mean sea level of each stage of the weir crest. 1	Discharge in cubic feet per second when the water stood at the level entered in column. 2
FEET.	CUBIC FEET PER SECOND.
43·40	70·2
44·31	2,170·
44·40	2,445·
45·31	6,507·
46·31	12,672·

The average rate at which water flowed into the tank between 6 A.M. of the 18th and 6 A.M. of the 19th May 1877, during and soon after the height of the cyclone, was only about 3,740 cubic feet a second. Taking its maximum to be 50 per cent. greater than the average rate for the 24 hours, we have a maximum rate of about 5,610 cubic feet per second. Considering, however, that the maximum rate would only be kept up for a short time, I do not think it at all likely that the water-surface would rise higher than to a level of 44·6, or 44·7 feet above mean sea level, that is, to a level nearly 2¼ feet below what it rose to on the 16th November last. I do not attempt to settle this point by actual calculation, which would require a knowledge of the rate at which the water was flowing into the tank at each instant of the day; we only know the average rate for the day. Some people may think that it is no use speculating about a cyclone during the North-east Monsoon. The heaviest rainfall I know of was that which fell in October 1846, when 20 inches fell in one day of 24 hours. Unfortunately I do not remember the day, or how much rain fell before it during that month; the total rain for the month was 30·59 inches. To show, however, that heavy rainfalls may be expected when the tank is nearly full, I would draw attention to the rainfall of the next year 1847. This amounted to 80·99 inches, of which 57·13 fell during the last three months of the year. Taking these facts into consideration I would not recommend that the crest of the weir be raised to the level 46·31 until the rear of the bund has been well drained, and until the surplus sluice has been thoroughly repaired. Estimates for these works are under preparation, but the question whether they ought to be sanctioned will need consideration, seeing that hitherto the additional returns expected from irrigation and from water supplied to the city of Madras have not been realised. I am an advocate for the construction of deep reservoirs in India with the view of providing water in years of scarcity, but this particular reservoir is scarcely deep enough for this purpose, nor is a site so near the sea where the fall of the ground is gentle a suitable site for such a work; a careful study of this and of the Chembrambaukam tank registers will no doubt furnish useful hints for the designing of reservoirs on more suitable sites, and, so far as my other duties permit, I hope to attend to this.

14. In conclusion, I would express my thanks for the assistance afforded me by Mr. Barlow, the Collector of Chingleput, by the Deputy Collector, and the Tahsildar of Sydapett, by Colonel Gloag, R.A., and Captain Twynam, R.A., Mr. Burrows the President, Mr. Stephenson the Acting Executive Engineer of the Madras Municipal Commission, Lieutenant Martin, R.E., Lieutenant Wiffen, Conductor D. Falvey, Sub-Conductor Sanderson and Mr. Claudius, Overseer. The hardest work has fallen to the share of the last three. They have worked cheerfully every day Sundays included, and often at night. The cheerful and intelligent conduct of Mr. Falvey especially deserves to be noticed.

APPENDIX A.

The Maximum Rate at which water has been received into the Red Hills Tank during Cyclone in May 1877.

In the cyclone which visited Madras in May 1877 the surface of the tank rose as shown below.

—	Level of water surface in feet at 6 A.M.	Daily difference in level of water surface in feet.	THIS REPRESENTS AN ADDITIONAL VOLUME.		DRAINAGE AREA, 23 SQUARE MILES.
			Per Diem, Cubic Yards.	Per Second, Cubic Feet.	Drainage in inches of Rain.
1	2	3	4	5	6
17th May	27·30	3·65	9,877,166	2,087	4·98
18th "	30·95	3·30	11,976,614	3,743	6·02
19th "	34·25	·74	3,132,490	979	1·56
20th "	34·99				

The figures in columns 4, 5, and 6 are obtained as follows:—

From the printed tables of the areas in square yards of water surface of the Red Hill Tank &c., the following figures are taken.

Height above Mean Sea Level.	Areas at level in Column 1.	Contents at level in Column 1.
27·31	6,856,585	9,467,808
27·81	7,108,655	...
28·31	7,360,725	...
28·81	7,769,509	...
29·31	...	...
29·81	...	...
30·31	8,995,861	...
30·81	9,404,645	18,873,401
31·31	9,813,430	...
31·81	...	...
32·31	...	...
32·81	...	...
33·31	...	...
33·81	11,900,846	29,510,484
34·31	12,318,330	31,542,914

From the above the following contents of the tank are deduced:—

at 27·31 as given in table 9,467,808
Deduct difference for ·01 22,556

at 27·30 as deduced 9,445,252

at 30·81 as given in table... 18,873,401
add for a difference in depth of ·14 foot... 449,017

19,322,418

1,603,633
·28

449,017·24

at 34·31 as given in table 31,542,914
Deduct for a difference in depth of ·06 foot 243,892

31,299,032

2,032,430
·12

243,891·60

9,445,252		
19,322,418	9,877,166	4·98
31,299,032	11,976,614	6·02
34,431,522	3,132,490	1·56

$\frac{27}{86,400} = \frac{1}{3,200}$

32) 98,771·66
2,086·61

32) 119,766·14
3,742·69

32) 31,324·9
978·8

$\frac{23 \times 3,097,600}{36}$

36) 3,097,600
86,444
23
1,988,212

11,929

It will be interesting to complete this calculation in order to compare the rainfall with the drainage into the tank. On the 28th May the level of the water-surface was 34·99.

CUBIC YARDS.
at 34·81 the contents of the tank as per table is 33,646,893
add for a difference in depth of ·18 foot 784,629

34,431,522

2,179,506
·36

784,629·36

Mr. Conductor D. Falvey having read the above has made the following remarks:—

Red Hills Tank.

Rainfall during cyclone of May 1877—

On 17th May 1877	1·00
18th „	12·03
19th „	4·88
	17·91

The rise in the surface of the water during the cyclone was entirely due to the drainage from the catchment basin of 23 square miles. No water came from the Cholaveram tank till the 27th May when the head sluice was opened.

D. FALVEY.

The quantity run off the drainage area between
the 17th and 18th represented 4·98 inches of rain.
18th and 19th „ 6·02 „
19th and 20th „ 1·56 „

Total in 3 days 12·56 „

and water still continued to run off slowly for nearly a week after the rain had ceased to fall, but the total quantity thus run off was small not exceeding ⅓rd of an inch, so that the total quantity run off the drainage basin fell short of 13 inches. This however probably represents nearly all the rain which fell on the drainage basin, for this lies to the westward of the tank where 17·91 inches was registered, and the rainfall during a cyclone always diminishes as the distance of a station from the sea coast increases.

The first table given in this note shows that the *average* rate at which the rain was discharged from the drainage basin between the 18th and 19th was 6·02 inches per diem. I think it probable that the *maximum* rate at which it was discharged exceeded the *average* by 50 per cent., so that the rain was probably discharged at the rate of 9·03 inches per diem or about 5,615 cubic feet per second. This gives a co-efficient of about 695 for Ryves' formula for $5,615 = 695\ (23)^{\frac{2}{3}}$ nearly.

(Signed) P. O'CONNELL, Colonel, R.E.,
Superintending Engineer, Chingleput.

From Lieutenant G. E. WIFFEN, Assistant Engineer, Serooloor Division, to Colonel P. O'CONNELL, R.E., Superintending Engineer, Chingleput, dated Camp, Red Hills, 25th November 1877, No. 1,260.

ON the order from the Chief Engineer Colonel Foord, I came down to the Red Hills Tank on the evening of the 17th instant. On my arrival I met you on the tank bund and received instructions for my guidance. I beg to report what has been done since my arrival on those portions of the work I have had charge of.

2. The slip in the bund which occurred immediately south of the one in 1874, section of which is appended, has been closed to within ⅓rd of the regular formation. In closing this breach great difficulty was found in first stopping the slipping; this has now I believe been successfully done by forming platforms by means of placing rows of piles wherever requisite and filling in layers of 6 inches of moroomboo which had to be brought a distance by coolies of above 900 feet; the work was on the first day done by the famine coolies brought by Supervisor Mr. Sanderson and Overseer Claudius from the Trunk Road No. 1. The Sydapett Tahsildar gave us great help from Sunday the 18th; but the greater portion of our coolies were brought in by the subordinates and contractors in the No. 1 or Serooloor Division, as immediately I received the

Chief Engineer's order I wrote out direct to the Ponnany Overseer to bring in all the coolies he could collect, he brought us nearly 200, one of my contractors Streenevassa Moodelly sent in 150 wudders, Mr. Sanderson brought in about 500; these were all on the work. On Sunday the 18th instant subsequently the Municipal Executive Engineer sent in about 500 wudders, the Tahsildar has also sent in from the villages above 1,000 coolies, and Supervisor Mr. Falvey has got in the remainder.

3. In obedience to your orders I have opened out a breach in the south portion of the bund near Ritchie's bungalow; it is now about 150 in length, the same is being protected temporarily by side revetments and rear retaining wall with an earthen bund in front 2 feet high, which at any moment can be breached should we get any very heavy rain which should rise the water in the tank above 43·75; the breach is to be excavated out to 300 feet; the work is now in rapid progress, and I trust will be completed in three days. I have also taken the section of the bund at site of slip as before stated, showing the depth of water in rear to a distance of 246 feet. I have the estimate with plans, &c., ready for a new calingulah of 300 feet, also estimate for putting a platform 10 feet in width, and for a distance of 3,552 × 8 feet in height, and for the remaining distance of 690 × 9 feet in width on an average height of 5 feet; this supports the highest portion of the bund from the slip to where the bund turns at right angles to the high ground near Ritchie's bungalow.

4. In conclusion, I most respectfully beg to bring to your most favorable notice the conduct of Supervisor Mr. Sanderson and Overseer Claudius; both these officers are employed in the No. 1 or Serooloor Division, they are employed on Famine Works to Trunk Road No. 1. Immediately Mr. Sanderson was informed that the tank was in danger through the slip, he collected the whole of his famine coolies and was the first man on the work with Overseer Mr. Claudius, who brought all his coolies, and showed great skill in first stopping the slipping of the bund. With reference to Supervisor Mr. Falvey, the Sub-divisional Officer of the Mount Range, I merely add that you are personally acquainted with the way in which he has worked day and night; I need add no more.

I beg to enclose papers below:—

Report of the state of the surface of the fields immediately below the slip in Red Hills tank.

From the slip to a distance of 159 feet north there is a pit 186 feet broad by 4-10 in depth, from there north the pits are only 3 feet in depth with a width of only 76 feet.

From south of the slip to a distance of 387 feet the pits in rear are 4-10 in depth with an average breadth of 168 feet, from thence to high ground a distance of 259 feet the pits are only from 3 to 2-6 in depth.

Distance of Poolal sluice to centre of breach is 1,555 feet, from centre of slip to the north sluice is 3,304 feet, total distance from slip to end of revetment at under sluices 3,947 feet.

The total distance from slip to where the tank bund runs at right angles to high ground and for which an estimate for putting a platform is submitted is 4,242 feet.

(Signed) G. E. WIFFEN, Lieutenant,
Assistant Engineer, Serooloor Division.

From Lieutenant M. MARTIN, R.E., Assistant Engineer, Mount Division, to Colonel P. O'CONNELL, R.E., Superintending Engineer, Chingleput, dated Mount, 21st November 1877, No. 2,247.

I HAVE the honor to forward an account of the hasty demolition of a portion of the weir at the Red Hills Tank near Madras.

At St Thomas' Mount on the 17th November 1877 at 9 P.M. I received a letter from the Chief Engineer stating that the main earthen bank was in danger of "breaching and that" the easiest way to relieve it from pressure was to blow in a portion of the calingulah.

2. On receipt of this letter I applied to Colonel Gloag, R.A., Commanding at the Mount, who promptly and kindly placed at my disposal powder, men, horses, wagons, and plant.

At 8-30 A.M. on the 18th we marched out with two stripped wagons carrying eight barrels, (774 lbs) R.L.G. powder, , Bickford's fuze, mining tools, &c., full teams spare pair, one Non-Commissioned Officer, in all one Officer, eight Non-Commissioned Officers and Drivers, and sixteen horses, all rationed for two days.

At 1-30 P.M. (walk and trot) we arrived at the Red Hills tank, unhooked and picketted.

3. The main fault in the earthen bank was then repaired and out of danger and it was not considered advisable on the 18th to use the powder for demolition.

4. On the 19th November at 8 A.M. when preparing to March back, I received your orders to stand fast, as a pier of the calingulah between two sluice gates had parted in the centre and threatened to fall or be forced out altogether by the pressure of the water.

5. To relieve this failure it was deemed expedient to blow up a portion of the weir between two buttresses to form a gap four feet deep and 16 to 20 feet wide, through which the stream might flow and relieve the overstrained sluice, while escaping itself harmlessly into a natural channel.

Two chambers were commenced at 8-45 A.M. drawn in the laterite masonry weir eight feet apart, the chambers were to be three feet deep, and the lines of least resistance were four feet for each mine.

As the mines were only hastily tamped a proportionately large charge was used roughly calculated 75 lbs., appeared ample, but the chambers were damp and a whole barrel (90 lbs. after deductions) was placed in each mine, oaken barrels and all as they stood.

The Bickford's fuze on trial was found extremely unsatisfactory and made of a Natives' breach cloth or thoties was sewn up by a dirze (or native tailor) on the spot, filled with the R.L.G. powder and inserted through augerholes made in the barrel heads.

About six feet of wet sand, laterite blocks, &c., was heaped up round the charges as tamping, (*i. e.*, 1½ lines of least resistance). This tamping was unrammed. Finally the powder hose were crossed and united by a ligature at the joint, and a bunch of three stalks of the Bickford fuze taken from the apparently most serviceable coils was inserted into one of the hose. The mines were fired at 2-45 P.M., being just six hours from the commencement of jumping the chambers. The explosion was successful, as the portion of the weir between the buttresses was hurled into the air and the water flowed through in a broad stream. I was unable to gauge the effect as the men had to be marched home.

6. The marches were fatiguing as the sun was hot and the roads heavy and horses and men were not in training. The distance was 18 miles on each day (18th and 19th).

* * * * * * * *

The men worked very well and bore fatigue and a large share of extra work and discomfort with the best humour. The horsekeepers had very heavy work and did it well.

7. A supplementary report showing effects of explosion will be attached.

8. The operation was of a semi military character being a hasty demolition at some distance from the base, and is similar to what would be required from Cavalry or Engineers on service. I have therefore reported more fully than would be necessary from a public works point of view; and in conclusion I would request to bring to your notice the readiness with which Colonel Gloag, R.A., Captain Twynam, R.A.,* and the officers O/1 R.A. rendered all the assistance in their power to the Public Works Department at a time of pressure.

* Commissary of Ordnance.

Hours were then important and the assistance given was opportune and merits the grateful recognition of the Public Works Department.

SUBMITTED for the information of Government.

2. The extent of danger involved in the slip depended considerably upon the height of the old bund at the point where the slip occurred. If that bund was within a few feet of the present F.T.L. 46·31, the risk of the slip continuing until the bund was reduced to water level was small.

2. The cause of the slip was probably the saturation of the lower part of the rear of the bund, and this saturation may have resulted from porous sub-soil (laterite). It will be necessary to drain the bund wherever there is ooze or leakage visible at the rear toe, and on this subject the undersigned has written to the Superintending Engineer. A berm bank in rear of the bund will not, it is considered, be necessary unless under special circumstances in addition to the drains.

3. The failure of the new sluices in the waste weir is much to be regretted, and will be dealt with when the Superintending Engineer is able to report more completely on the cause. It is possible that hydrostatic pressure below the granite flooring was, as the Superintending Engineer has suggested, the cause of the displacement of some of the floor stones, but at present it is not understood how such displacement

---

Note.—Bickford's fuze is generally untrustworthy especially in India.

The coils we used fizzed off like squibs or burnt a few inches and went out. There was no certainty about them.

would have affected the piers. The sluices are built on a considerable depth of laterite masonry, and though this is certainly permeable by water, the water should have found a more easy escape to the rear than upwards through the stone floor, and the stability of the piers should not have been affected. It appears also that the shutters of the sluice vents could not be put down. The undersigned inspected them with the late Superintending Engineer on the 17th November 1876, when the tank water was about level with the sluice floor, and there was a little water lying on the latter behind the shutters. It was then noticed that the face wall above the beam stones wanted a little dressing back to ensure the shutters clearing it, and a doubt was expressed as to the sufficiency of the power provided to work the shutters. Though the tank did not fill in 1876 there was probably a sufficient depth of water to test the gear, and the arrangements generally; and it should be shown what was done after the date named to make the sluices efficient.

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

No. 36. ORDER THEREON, 14th January 1878, No. 38 I.

HIS GRACE the Governor in Council notices with satisfaction the energy with which the apparently dangerous slip which occurred in November at the bund of the Red Hills Tank was dealt with, and remedial measures successfully applied. The valuable assistance rendered by the several officers named in the concluding paragraph of the Superintending Engineer's letter merits the approbation of Government, which will be conveyed to them through the Departments to which they severally belong.

2. Measures should be taken for lessening the liability of the tank bund to slip whenever the circumstances indicate that there is any probability of danger from this cause.

3. A further report on the inefficiency and partial failure of the sluices in the waste weir will be awaited.

(True Extract.)

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

To the Revenue Department.
„ Military „
„ President, Madra sMunicipal Commission.
„ Superintending Engineer, Chingleput.
„ Chief Engineer for Irrigation.

Exd. E. C. Shunker.

Spare Copies

IRRIGATION.

Govt. of (1878) Madras.

PUBLIC WORKS.

To

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

Dated January 14th.

Issued.

Recd.

Encl.

G. O., 14th January 1878, No. 38 I.

JANUARY.
Nos. 35-36.

Red Hills Tank, Chingleput District.—Notices with satisfaction the energy displayed and the remedial measures successfully applied to the apparently dangerous slip which occurred in November at the bund of the —.

No. 3670

Chingleput Superintending Engineer's Office,
Camp Red Hills ~~Saint Thomas' Mount~~, 4th December 1877

Despd. 5th Decr/77

[illegible]

From

THE SUPERINTENDING ENGINEER,
Chingleput

To

The Chief Engineer
for Irrigation

Enclosures 4

1 Appendix A.
1 Section
1 Letter from the Asstt Engr [illegible] Range No. 1260 of 25th Novr/77.
1 Do. from [illegible] Range No. 2247 of 21st Novr/77.

SIR,

In replying to the Memorandum No. 129 dated 23rd November 1877 signed by Major C. Montgomerie Acting Deputy Chief Engineer for Irrigation and calling for a full report explaining the exact state of the Red Hills reservoir at the earliest date I explained that a full report could not be submitted until after the Monsoon, and gave a few details respecting the work done with the view of preventing further injury to the bund and to the Surplus Sluice.

2. On reconsidering the matter, I have come to the conclusion that the actual condition of the Surplus Sluice will not be known until some months after the termination of the North East Monsoon, and that it will therefore be better to give some further account of the Reservoir and the operations undertaken for its preservation, without waiting until our knowledge is complete. What is wanting in this report, may in fact be

supplied in a subsequent one.

3. On Saturday November 17th I received at Saint Thomas's Mount at 2 P.M. a report that the bund of the Red Hills Tank was in danger, owing to a portion of the earth work in its rear slipping down. I directed Conductor D. Fahey to proceed at once to the Red Hills and followed him myself as soon as a carriage could be obtained, my own having unfortunately been sent into Madras that very morning to Meſsrs. Waller and Co. in order that a good pair of horses might be substituted for one previously provided by them which was not up to much while the roads were heavy with rain. The consequence was that I did not reach the tank until 7 P.M. Mr. Fahey, trusting himself to a small native carriage drawn by a single country pony, succeeded in reaching the bund by 8 P.M., and at once superintended the coolies at work on the bund. Obtaining a passing view of the slip on my way, I proceeded directly to the waste weir in order to ascertain its capacity for relieving the reservoir and to learn what use was being made of it for this purpose. I was there informed that 160 feet of its crest had been lowered 1 foot and thus reduced from a level 46.31 feet to one 45.31 ft. above mean sea level. The water flowing over the higher of these levels was 4 inches in depth at 7 P.M. when I first saw it; its depth at 6 A.M. having been 7½ inches. The

lowering of the crest to a length of 160 feet had been carried out under the orders of Sub Conductor J. B. Sanderson. At the South end of the waste weir is a Surplus Sluice which would have done all the work of relieving the reservoir had it been in working order. It contains ten vents each 6 feet wide and 6 feet in height and would have been capable when the water stands at the level of the crest of the weir of discharging at the rate of nearly 6300 cubic feet per second, a rate exceeding the highest rate at which the reservoir was receiving water during the Cyclone of May last. This fact I have of course since ascertained from registers and by computations the results of which I give in an appendix. A large volume of water was then passing through the sluice although all its shutters were not raised and none of the vents were fully open. One cut stone had been washed out of some part of the masonry about the seventh vent, but whence it came from could not be exactly ascertained, owing to some of the screw rods of the shutters bending under the pressure applied to them, the shutters remaining all the time unmoved. Moreover it would not then have been expedient to confine attention to the sluice, even if we had that complete command over it, which, had it been in perfect order, we should have had.

Appendix A

4. I then proceeded to the slip the

condition of which will best be seen from the accompanying section taken by Lt Wippen, whose report I also forward. On arriving at the slip, I met Mr Burrows the President of the Municipal Commission Madras. Mr Stephenson the Acting Executive Engineer to the Commission Mr Jones Deputy Collector of the Chingleput District. Conductor D. Fahey. Sub Conductor J. B. Sanderson from Range No 1 and Lt Wippen who is in charge of Range No 1. A number of coolies were at work on the slip bringing basket loads of laterite to raise the bund, the appearance of which certainly seemed dangerous, especially as the work done by the coolies, who were tired out with a previous day's work, was trifling. At ten o'clock heavy rain fell. and the coolies all left the work. Mr Stephenson kindly undertook to send a gang of 500 wodders to the work the next morning. Mr Wippen. Mr D. Fahey. the Deputy Collector and Tahsildar all exerted themselves and the next day (Sunday) the labor, especially that of the wodders, gradually showed itself able to keep pace with the slip, so that as we have since learnt actual danger at this point ceased. before the morning of Monday the 19th of November, but, at the time, I was not quite sure that this was the case.

5. In order to supplement the work

of the waste weir and Surplus Sluice I directed Lt Wippen on Sunday morning to make a temporary breach in the Southern extremity of the Northern half of the bund. The water in front of the portion ordered to be removed, being only about three feet in depth, this could be done as I knew by experience with perfect safety. This temporary breach served its purpose well until the water in the reservoir fell below the level of the breach.

6. On Monday morning, the rear or northern end of the seventh pier of the Surplus Sluice, counting from its eastern abutment, began to turn on its eastern edge. Two more granite or gneiss stones having been washed out of the seventh vent, and this vent having been less utilised than any of the first five, I began to suspect that it was not scour, but hydraulic pressure, acting on the lower surface of the flooring stones, that had removed them. It was only necessary for the water to get fairly under these stones to enable it to raise them with ease. If good mortar or cement had formed their beds, no doubt the water would have failed to get under and so left them, as it in fact failed to do with the flooring stones of the other vents. I am aware that no design is safe against bad workmanship, but for floorings to sluices of this kind I pref

cutstone inverted arches. I think them safer than flat stones, though of course they are not safe if badly executed. By the evening, the seventh pier had turned still more on its eastern edge though it was still touching the masonry above, which it ought to have been fully supporting. I let more water flow through this vent and the turning over of the pier seemed to be checked. That night by moonlight Mr. Halney and I superintended the cutting, lowering and fixing of struts made of solid sections of palmyras between the eastern abutment and the first pier, and in each vent up to the seventh. The unstable pier ceased to move, but the third pier afterwards moved, but only very slightly. It was fortunate that the batter, which each of the rear faces of the piers has, enabled us to place these struts from above, for no man could have stood in the roaring current below, which sent heavy stones and bags of clay rolling into the pool beyond the apron.

7. I will here explain the circumstances which led to my ordering a short length of the waste weir being blown away with gunpowder. After having seen the waste weir and Surplus Sluice and having ascertained that a temporary breach of moderate length could be safely made at the southern end of the northern portion of the bund, I had not the slightest intention of using explosives of any kind but at first there was a good deal of alarm in Madras not merely lest the city should lose a year's supply of drinking water, but even, I fancy, lest property, if not life might be lost. Some such ideas appear even to have entered the precincts of the Civil Secretariat through whom the alarm was first communicated to Colonel Foord. Colonel Mullins, the Chief Engineer for Irrigation, being absent. Colonel Foord at once suggested that the easiest way to relieve the earthen bank of the tank from danger was to blow in a portion of the calingula. Colonel Foord not being then aware of the existence of the Surplus Sluice. As I had left the Mount, the letter reached Lt. Martin R.E. Assistant Engineer in charge of No. 2 Range, who at once applied to Lt. Colonel Gloag R.A. Commanding at the Mount and to Captain Twynam R.A. Commissary of Ordnance and these officers promptly and kindly placed at his disposal powder, men, horses, waggon, and plant. On their arrival here, I told Lt. Martin that I did not intend to use

powder, but I was not the less thankful to the Artillery Officers named for the hearty manner in which they assisted us, and I trust that they will receive the thanks of Government for the prompt assistance given by them, at a time when there was every appearance of its being immediately required. When the surplus sluice began to give way, it became evident that measures must be taken to save it, and the first was to relieve it from pressure and then endeavour to support it by blocking up the vents most in danger. Mr Grainger the Superintendent of the Madras Workshops came out to assist us by closing the Sluice Shutters. His endeavours were unsuccessful and after consultation with Colonel Foord it was decided to close the vents in front as well as we could with rough wooden framing, matting and bags of clay. To assist in giving relief from pressure I directed Lt. Martin to blow away a section of the waste weir. His report is forwarded herewith. × Appendix C The gap made in the weir did good service as a surplus channel. At the same time, I ordered the crest of the weir to be still further lowered as already reported in my last letter.

8. While the surface of the reservoir was being lowered by the outflow over the

weir

weir crest and through the gap blasted in it, the flow of water through the Surplus Sluice was being gradually diminished until men could work standing on its rear apron. The vents in danger were then filled in with laterite blocks; a continuous wall parallel to the body was raised to a height of three feet, cross walls were built as buttresses connecting each pier of the sluice with the new longitudinal wall. What water still flowed through the vents of the Surplus Sluice after the 23rd of November has all been used for irrigation, in lieu of what would otherwise have been let out through the irrigation sluices.

9. On the 16th November the surface of the water in the reservoir was 46.93 ft. above mean sea level or .62 of a foot or about 7½ inches above the crest of the weir before it was lowered. The surface fell until at 5.30 P.M. of the 24th when it stood at 42.54 ft. above mean sea level. It then commenced to rise again and after fluctuating for a while it recommenced on the night of the 30th to rise and continued to do so until at 6 A.M. on the 2nd December, it stood at 43.31 ft. or exactly three feet below the crest of the weir before it was lowered. i.e. below

what has been hitherto called "Full Tank Level"

10. According to the printed "Table showing water surface. Areas and Cubical contents at half foot vertical intervals up to crest of new Calingula" of the Red Hill Tank". The contents

at the level 46.31 being that of the crest of the new calingula are	101,981,815 Cub yds
at the level 43.31 at which the surface of the water stood at 6 A.M. December 2d	80,401,616
at the level 31.31 which is that of the floor of the Surplus Sluice	20,477,034
at the level 22.31 which is the lowest given in the table, and a little higher than the bed of the reservoir opposite the slip.	944.514

so that it may be said in round numbers that we have by our operations, lost 21½ millions of cubic yards in order to save ourselves from the loss of 81½ millions had the Surplus Sluice been breached, or 101 millions had the slipped portion of the bund been breached. If more rain falls this month without being excessively violent or too small in quantity, we hope to reduce still farther the loss of 21½ millions.

11. The Red Hill Tank contained at 6 A.M. December 2d, 81½ millions and the Cholaveram tank 28½ millions. In fact the

two reservoirs of the so called "Madras Water Works Project" contained 110 millions of cubic yards, while the Municipal Budget published in a late Gazette shows that the city is only prepared to use 5 millions.

12 With reference to the future condition of this reservoir Colonel Mullins in a Note dated 14th March 1874 expressed himself as follows para 6 "It is possible rather than probable that there may be no more slips at the Red Hills Tank. The composition of the bund is not favourable to complete stability; at the most recent slip, very various soils were to be seen and water reaching these could penetrate in all directions; Elsewhere, and notably to the South of the more northerly slips, similar conditions are to be found."

12. In the Government order on this, No 1045 dated 23d April 1874, it is observed that "The concluding paragraph of the Memorandum by the Chief Engineer for Irrigation is not consolatory as regards the state of the Red Hills Tank bund".

13. At that time the Surplus Sluice had not been constructed, and the crest of the waste weir was two feet lower than it was before we began to lower it last month i.e. its level was 44.31 feet above

mean sea level. At present the Surplus Sluice is closed. The state of the crest of the weir is nearly as follows.

At the level	46·31	for a length of	569·83	feet
	45·31	"	84.	"
	44·40	"	78·5	"
	44·31	"	22.	"
	43·40	"	442.	"
	43·18	"	205.	"

I had ordered the crest to be covered with fine concrete and its levels to be brought up to the four 46·31, 48·31, 44·40, and 43·40, but before the work was finished rain again began to fall and I ordered a turf bund to be erected in the lower levels of the crest. In consequence of this the water is now retained at the level 43·48 that is, it stood at that level at 6 A.M. December 3rd. If the crest levels were exactly as in the list given in this para, the discharges over the weir when the water stood flush with each successive stage of the crest would be as follows

Heights above mean sea level of each stage of the weir crest. (1)	Discharge in cubic feet per second when the water stood at the level entered in column 1. (2)
Feet	Cubic feet per second.
43·40	70·2
44·31	2170.
44·40	2445.
45·31	6,507.
46·31	12,672.

The average rate at which water flowed into the tank between 6 A.M. of the 18th and 6 A.M of the 19th May 1877 during and soon after the height of the Cyclone was only about 3740 cubic feet a second. Taking its maximum to be 50 per cent greater than the average rate for the 24 hours we have a maximum rate of about 5610 cubic feet per second. Considering however that the maximum rate would only be kept up for a short time I do not think it at all likely that the water surface would rise higher than to a level of 44·6 or 44·7 feet above mean sea level that is to a level nearly 2¼ feet below what it rose to on the 16th November last I do not attempt to settle this point by actual calculation which would require a knowledge of the rate at which the water was flowing in to the tank at each instant of the day. We only know the average rate for the day. Some people may think that it is no use speculating about a cyclone during the North East Monsoon. The heaviest rainfall I know of was that which fell in October 1846, when 20 inches fell in one day of 24 hours. Unfortunately I do not remember the day, or how much rain fell before it during that month. The total rain for the month was 30·59 inches. To show however that heavy rainfalls may be expected when the tank is nearly full I would draw attention to the rainfall of the next year 1847. This amounted to 80.99 inches of which 57.13 fell during the last three months of the year. Taking these facts into consideration I would not recommend that the crest of the weir be raised to the level 46.31 until the rear of the bund has been well drained, and until the Surplus Sluice has been thoroughly repaired. Estimates for these works are under preparation but the question whether they ought to be sanctioned will need consideration, seeing that hitherto the additional returns expected from irrigation and from water supplied to the City of Madras have not been realised. I am an advocate for the construction of deep reservoirs in India with the view of providing water in years of scarcity, but this particular reservoir is scarcely deep enough for this purpose, nor is a site so near the sea where the fall of the ground is gentle a suitable site for such a work. A careful study of this and of the Chembrambakam Tank Registers will no doubt furnish useful hints for the designing of reservoirs on more suitable sites. and so far as my other duties permit I hope to attend to this.

14. In conclusion I would express my thanks for the assistance afforded me by Mr Barlow the Collector of Chingleput, by the Deputy Collector, and the Tahsildar

of Sydapett, by Colonel Gloag R.A. and Captain Twynam R.A., Mr Burrows the President and Mr Stephenson the Acting Executive Engineer of the Madras Municipal Commission. Lt Martin R.E., Lt Wiffen, Conductor D. Falvey. Sub Conductor Sanderson, Mr Claudius Overseer. The hardest work has fallen to the share of the last three. They have worked cheerfully every day Sundays included and often at night. The cheerful and intelligent conduct of Mr Falvey especially deserves to be noticed.

I have the honor to be
Sir
Your most obedient servant

R Hamell Colonel R.E.
Supg Engineer Chingleput

CHIEF ENGINEER
202
7-12-77
FOR IRRIGATION

From

The Superintending Engr.
Chingleput Dist.

No. 3670

Dated 4th
Despt'd 5th } December /77
Received

Enclosures 4.

Red Hills Reservoir -

Reporting the state of ________

Appendix A

The Maximum rate at which water has been received into the Red Hills Tank during Cyclone in May 1877.

In the Cyclone which visited Madras in May 1877. the surface of the Tank rose as shown below.

	Level of water surface in feet at 6 A.M.	Daily difference in level of water surface in feet	This represents an additional volume		Drainage area 23 sqre miles
			Per diem Cubic yds	Per second Cub ft	Drainage in inches of rain
1	2	3	4	5	6
May 17	27·30	3·65	9,877,166	2087	4·98
18	30·95	3·30	11,976,614	3743	6·02
19	34·25	·74	3,132,490	979	1·56
20	34·99				

The figures in columns 4-5. and 6 are obtained as follows.
From the printed tables of the areas in sqre yards of water surface of the Red Hill Tank & the following figures are taken

Height above Mean Sea Level	Areas at level in column 1	Contents at level in column 1.
27·31	6,856,585	9,467,308
27·81	7,108,655	
28·31	7,360,725	
28·81	7·769·509	
29·31		
29·81		
30·31	8,995,861	18,878,401
30·81	9,404,645	
31·31	9,813,430	
31·81		
32·31		
32·81		
33·31		29,510,484
3·81	11,900,846	31,542,914

From the above the following contents of the Tank are deduced.

at 27·31 as given in table	9,467,808
Deduct difference for ·01.	22,556
at 27·30 as deduced	9,445,252

at 30·21 as given in table	18,873,401
add for a difference in depth of ·14 foot	449,017
	19,322,418

1,603,633
·28
44901 7·24

at 34·31 as given in table	31,542,914
Deduct for a difference in depth of ·06 foot	243,892
	31,299,032

2,032,430
·12
243,891·60

9,445,252		
19,322,418	9,877,166	4·98
31,299,032	11,976,614	6·02
34,431,522	3,132,490	1·56

$\frac{27}{86,400} = \frac{1}{3200}$

$32)\frac{98771·66}{2086·61}$

$32)\frac{119766·14}{3742·69}$

$32)\frac{31324·9}{978·8}$

$\frac{23 \times 3,097,600}{36}$

$36)\frac{3,097,600}{86,444}$

23

1,988,212

11,929.

It will be interesting to complete this calculation
in order to compare the rainfall with the drainage
into the tank.

on the 28th May the level of the water surface was 34·99.

	Cubic yards.
at 34·81 the contents of the tank as per table is	33,646,893
add for a difference in depth of ·18 foot	784,629
	34,431,522

2179506
·36
784,629·36

Mr Conductor D Falvey having read the above has
made the following remarks.

Red Hills Tank

Rainfall during Cyclone of May 1877

On 17th	May 1877	1·00
18th	Do	12·03
19th	Do	4·88
		17·91

The rise in the surface of the water during the
Cyclone was entirely due to the drainage from the catch-
-ment basin of 23 Sqre miles. No water came from the
Cholaveram tank till the 27th May when the head
Sluice was opened.

D. Falvey.

The quantity run off the drainage area between
the 17th and 18th represented 4·98 inches of rain
18th and 19th — " — 6·02 — "
19th and 20th — " — 1·56 — "
Total in 3 days — 12·56 — "
and water still continued to run off slowly for
nearly a week after the rain had ceased to fall, but
the total quantity thus run off was small not exceeding
1/3 of an inch. so that the total quantity run off the drainage
basin fell short of 13 inches. This however probably re=
-presents nearly all the rain which fell on the drainage

basin, for this lies to the Westward of the Tank where 17.91 inches was registered, and the rainfall during a cyclone usually diminishes as the distance of a station from the sea coast increases.

The first table given in this note shows that the average rate at which the rain was discharged from the drainage basin between the 18th and 19th was 6.02 inches per diem. I think it probable that the maximum rate at which it was discharged exceeded the average by 50 per cent, so that the rain was probably discharged at the rate of 9.03 inches per diem or about 5615 Cubic feet per second. This gives a coefficient of about 695 for Ryves formula

for $5615 = 695 (23)^{\frac{2}{3}}$ nearly.

P. Mannell Colonel R.E.
Supg Engineer Chingleput

CHIEF ENGINEER
202
FOR IRRIGATION

Appendix C Mount Division Office
21st November 1877

No. 2247.

From
Lieut. M. Martin R.E.
Assistant Engineer Mount Division

To
Colonel P. Mannell R.E.
Superintending Engineer
Chingleput

Sir

I have the honor to forward an account of the hasty Demolition of a portion of the weir at the Red Hills tank near Madras.

At Saint Thomas Mount on the 17th November 1877 at 9 P.M. I received a letter from the Chief Engineer stating that the main earthen bank was in danger of "breaching and that" the easiest way to relieve it from pressure was to blow in a portion of the Calingulah.

I on receipt of this letter I applied to Colonel Gloag R.A. Commanding at the Mount who promptly and kindly placed at my disposal powder, men, horses, — waggons.

waggons and plant.

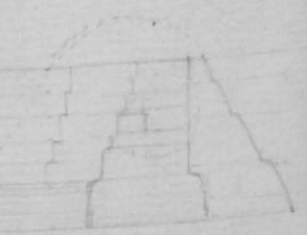
At 8.30 A.M. on the 18th we marched out with 2 stripped waggons carrying 8 barrels (774 lbs) R.L.G. Powder Bickford's fuze mining tools &c. full teams spare pair. 1 Non Commissioned Officer in all 1 Officer, 8 Non Commissioned Officers and Drivers and 16 horses. all rationed for 2 days.

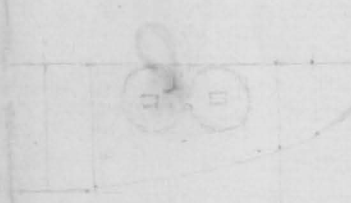
At 1.30 P.M. (walk and trot) we arrived at the Red Hills tank, unhooked and picketted.

3. The main fault in the earthen bank was then repaired and out of danger and it was not considered advisable on the 18th to use the powder for demolition.

4. On the 19th November at 8 A.M. when preparing to march back, I received your orders to stand fast, as a pier of the Kalingulah between two sluice gates had parted in the centre and threatened to fall or be forced out altogether by the pressure of the water.

5. To relieve this failure it was deemed expedient to blow up a portion of the weir between two buttresses to form a gap





gap 4 feet deep, and 16 to 20 feet wide, through which the stream might flow and relieve the over strained sluice, while escaping itself harmlessly into a natural channel

Two chambers were commenced at 8.45 A.M., drawn in the laterite masonry. Weir 8 feet apart the chambers were to be 3 feet deep - and the lines of least resistance were 4 feet for each mine

As the mines were only hastily tamped a proportionately large charge was used Roughly calculated 75 lbs. appeared ample but the chambers were damp and a whole barrel (90 lbs after deductions) was placed in each mine, oaken barrels and all as they stood

The Bickford's fuze on trial was found extremely unsatisfactory and hose made of a Native's breech cloth or dhotie was sewn up by a dirzee (or Native tailor) on the spot, filled with the R.L.G. Powder and inserted through auger holes made in the barrel heads.

Note Bickford's fuze is generally untrustworthy especially in India. The coils we used fizzed off like squibs or burnt a few inches and went out. There was no certainty about them.

About 6 feet of wet sand, laterite blocks &c. &c. was heaped up round the charges as tamping (i.e. 1½ line of least resistance) This tamping was unrammed - Finally the powder hose were crossed and united by a ligature at the joint and a bunch of 3 stalks of the Bickford fuze taken from the apparently most serviceable coils was inserted into one of the hose. The mines were fired at 2.45 P.M. being just 6 hours from the commencement of pumping the chambers. The explosion was successful — as the portion of the vein between the buttresses was hurled into the air and the water flowed through in a broad stream. I was unable to gauge the effect as the men had to be marched home.

6. The marches were fatiguing as the sun was hot and the roads heavy — and horses and men were not in training. The distance was 18 miles on each day. (18th and 19th

omit

The following is an account of casualties on the march.

Officer riding horse — Cast off fore shoe

No. 1. Team

Near wheeler. — Raw on buttock
(due to imperfect fitting of breeching.)

No. 2. Team

Off Leader. Nausea from over work.
(This mare is 16 years old and was replaced from spare pair)

(1st) Off Centre Girth raw.

omit

Bad saddling or badly rubbed up horse. — This horse was replaced from the spare pair

(2nd) Off. Centre. Cast of fore shoe

Two other horses showed signs of exhaustion and refused gram, while all but the Off Leader No. 2 Team eagerly ate the grass which was fragrant good and plentiful.

1. Driver (Lead No. 2) was exhausted and being lately from hospital with liver) and was transferred to spare pair

The men worked very well and bore fatigue and a large share of extra work and discomfort with the best humour. — The horse keepers had very heavy work and did it well.

7. A supplementary report showing effects of explosion will be attached.

8. The operation was of a same military character being a hasty demolition at some distance from the base, and is similar to what would be required from Cavalry or Engineers on Service. I have therefore reported more fully than would be necessary from a P.W. point of view and in conclusion I would request to

bring to your notice the readiness with which Colonel Gloag R.A. Captain Dunyan* R.A; and the Officers Of R.A rendered all the Assistance in their power to the Public Works Department at a time of pressure

Ours were then important and the assistance given was opportune and merits the grateful recognition of the P.W. Department

* Commissary of Ordnance.

CHIEF ENGINEER
202 C.W.
1 92
FOR IRRIGATION

I have the honor to be
Sir
Your Most Obedient Servt.
(Signed) M. Marten. Lieutt R.E.
Assistant Engineer

Report of the State of the Surface of the Fields immediately below the Slip in Red Hills Tank;

From the Slip to a distance of 159 feet north, there is a pit. 186 feet. long by 4-10 in depth, from there north the Pits are only 3 feet in depth with a width of only 76 feet.

From South of the Slip to a distance of 387 feet the pits in rear are 4-10 in depth with an average breadth of 168 feet, from thence to high ground a distance of 259 feet, the pits are only from 3 to 2.6 in depth.

Distance of Toolal Sluice to Center of breach is 1555 feet, from Center of Slip to the North Sluice is 3304 feet, total distance from Slip to end of revetment at under Sluices 3947 feet.

The total distance from Slip to Where the tank bund runs at right angles to high Ground, and for which an Estimate for putting a platforms is submitted is 1,242 feet.

Geo. S. Wessell Lieutent.

Assistant Engineer

Sermlan Division.

CHIEF ENGINEER
2020
3
IRRIGATION

Camp Red Hills
No. 1 Range Office,
25 November 1877.

NO. 1260

FROM

Assistant
THE ~~EXECUTIVE~~ ENGINEER
No. 1 Range, Chingleput District.
Sorrolur Division

To

THE SUPERINTENDING ENGINEER OF
CHINGLEPUT.

SIR,

On the order from the Chief Engineer Colonel Orrord, I came down to the Red Hill Tank on the evening of the 17th Instant, On my arrival I met you on the tank bund, and received instructions for my guidance, I beg to now report what has been done since my arrival on those portion of the works I have had charge of.

The Slip in the bund, which occurred immediately South of the one in 1874. Section of which is appended has been Closed to within 3 ft of the regular formation in Closing this breach great difficulty was found in first stopping the slipping, this has now I believe been successfully done by forming platforms by means of placing rows of piles wherever requisite, and filling in, in layers of 6 inches of Moorambor which had to be brought a distance by Coolies of above 900 feet, the work was on the first day done by the Famine Coolies brought by Supervisor Mr Sanderson and Overseer Claudius from the Trunk Road No 1; the Sydapett Thaseldar gave us great help from Sunday the 18th but the greater portion of our Coolies were brought in by the Subordinates and Contractors in the No 1 or Sowcar Division, as immediately I received the Chief Engineer's order, I wrote out direct to the Ponnary Overseer to bring in all the Coolies he could collect, he brought is nearly 200. One of my Contractors Streenevassa Moodelly sent in 150 Wodders. Mr Sanderson brought in about 500; these were all on the work on Sunday the 18th Instant. Subsequent the Municipal Executive Engineer sent in about 500 Woddars, the Tahsildar has also sent in from the Villages above 1000 Coolies and Supervisor Mr Fraley has got in the remainder

In

South end of North Bund
Rh
9/ix/77

In obedience to your orders I have opened out a breach in the South portion of the bund near Ritchie's Bungalow it is now about 150 in length, the same is being protected temporarily by side revetments and rear retaining wall with an earthen bund in front 2 feet high, which at any moment can be breached should we get any very heavy rain, which should rise the water in the Tank above 43.75, the breach is to be excavated out to 300 feet the work is now in rapid progress, and I trust will be completed in 3 days. I have also taken the Section of the bund at site of slip as before stated, showing the depth of water in rear to a distance of 246 feet. I have the Estimate with Plans &c ready for a new Calingulah of 300 feet, also Estimate for putting a platforms 10 feet in width, and for a distance of 3552 × 8 feet in height, and for the remaining distance of 690 × 9 feet in width on an average height of 5 feet; this supports the highest portion of the Bund from the slip to where the bund turns at right angles to the high ground near Ritchie's Bungalow.

In Conclusion I most respectfully beg to bring to your most favorable notice, the Conduct of Supervisor Mr. Sanderson and Overseer Mr Clawdens; both these Officers; are employed in the No. 1 or Serrolor Division; they are employed on Famine Works to Trunk Road No. 1 immediately Mr. Sanderson was informed that the tank was in danger thro the Slip, he Collected the whole of his Famine Coolies, and was the first man on the work with Overseer Mr Clawdens, he brought all his Coolies and showed great skill in first stopping the slipping of the bund with reference to Supervisor Mr Galvey the Sub Divisional Officer of the Mount Range I merely add that you are personally acquainted in the way in which he has worked day and night. I need add no more.

I beg to enclose papers as per margin.

I have the honor to be
Sir
Your Most obedient Servant
(Signed) G. C. Muzzen Cutt.
Assistt Engineer

CHIEF ENGINEER FOR IRRIGATION

No. 278-I

Letter from the Superintending Engineer Chingleput No. 3670 - 4th December 1877.

Enclos 6.

Submitted for the information of Government.-

The extent of danger involved in the slip depended considerably upon the height of the old bund at the point where the slip occurred. If that bund was within a few feet of the present F.T.L, 46.31, the risk of the slip continuing until the bund was reduced to water level was small.

2 The cause of the slip was probably the saturation of the lower part of the rear of the bund, and this saturation may have resulted from porous sub-soil (laterite). It will be necessary to drain the bund wherever there is ooze or leakage visible at

the rear toe and on this subject the undersigned has written to the Superintending Engineer. A berm bank in rear of the bund will not, it is considered, be necessary unless under special circumstances in addition to the drains.

~~No.~~ ~~date~~

3 The failure of the new sluices in the waste weir is much to be regretted, and will be dealt with when the Superintending Engineer is able to report more completely on the cause. It is possible that hydrostatic pressure below the granite flooring was, as the Superintending Engineer has suggested, the cause of the displacement of some of the floor stones, but at present it is not understood how such displacement would have affected the piers. The sluices are built on a considerable depth of laterite masonry, and though this is certainly permeable by water, the water should have found a more easy escape to the rear than upwards through the stone floor, and the stability of the piers should not have been affected. It appears also that the shutters of the sluice vents could not be put down. The undersigned inspected them with the late Superintending Engineer on the 17th November 1876 when the tank water was about level with the sluice floor, and there was a little water lying on the latter behind the shutters. It was then noticed that the face wall above the beam stones wanted a little dressing back to ensure the shutters clearing it; and a doubt was expressed as to the sufficiency of the power provided to work the shutters. Though the tank did not fill in 1876 there was probably a sufficient depth of

water to test the gear, and the arrangements generally; and it should be shown what was done after the date named to make the sluices efficient.–

Camp Kistna
Ellore Canal
17th Decr. 1877.

Colonel R.E.
Chief Engineer for Irrigation

To,
The Joint Secretary to Government
P. W. D. Irrigation Branch.–

1877

No. 231

From

The Chief Engr. for Irrign.

Dated 17 Dec 1877
Despd. 8 Jany. 1877

Encls 6 ×

No. 278 I

× One section returned
to E I Office —
29-1-78

80 23 Apl. 1874 No. 1045.
" 1 Aug 1873 " 1926.
" 18 Decr 1872 " 3014.
" 26 Apl 1870 " 1100.

Red Hills Tank bund. — Slip in the —. Chingleput District. — Submits, with remarks, S.E.'s letter reporting further in connection with the [illegible]

E. I. From No. 22.

Irrn 55 19

Print all the papers
except the part of [illegible]
letter which I have marked
to be omitted.

No 38 I

Public Works Department.

PROCEEDINGS OF THE MADRAS GOVERNMENT.

UNDER date the 14 Jany 78

Read the following :—

Note by the Ch. Engineer for Irrigation (No. 278 I of 17th Decr 1877)

His Grace the Governor in Council notices with satisfaction the energy with which the apparently dangerous slip which occurred in November at the Bund of the Red Hills Tank was dealt with, and remedial measures successfully applied. The valuable assistance rendered by the several Officers named in the concluding paragraph of the Superintending Engineer's letter merits the approbation of Government, which will be conveyed to them through the Departments to which they severally belong.—

2 Measures should be taken for lessening the liability of the tank bund to slip whenever the circumstances indicate that there is any probability of danger from this cause.—

3 A further report on the inefficiency and partial failure of the sluices in the waste weir will be awaited.—

Wy. 18/12

5 copies of Section of Bund
desp. to S.E. Chingleput
28-1-78.—
20 — do to E.I. Office —

Rev: Dept. 21 ✓
Mily: — " — 15 ✓
President Madras 3 ✓
Municipal Commission
S.E. Chingleput ✓ 6 ✓
C.E. for Irrigation 9
desp.d — 25-1-78 17

Rev Wills [illegible] Clark

Hon W Huddleston

Hon Sir W Robinson K.C.S.

His Grace the Governor

C/o 31

Govt. of {1878} Madras.

PUBLIC WORKS.

11/7/29 BIII

To the Revenue ~~Department~~

Rev 16

Dated

Issued

Recd. Encl.

G. O., 14 Jany 1878, No. 38

Nos. 35 to 36

Red Hills Tank Chinglepu

Do. — Notices with satisfaction the energy displayed & the remedial measures successfully applied to the apparently dangerous slip which occurred in Nov at the bund of the —

IIIB 20/2/11