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Revenue DEPARTMENT

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No. 447. Read the following letter from Lieutenant-Colonel J. H. M. SHAW-STEWART, R.E., Consulting Engineer for Railways, to Colonel G. W. WALKER, R.E., Secretary to Government, Public Works Department, dated Madras, 13th May 1875, No. 272 :—

ADVERTING to paragraph 3 of my letter, dated the 5th ultimo, No. 195, also to the Order of Government, dated the 13th March 1875, No. 719-A, I have the honor to

lay before Government a letter* from the Agent of the South Indian Railway, with enclosure from the Chief Engineer, in

which Mr. Logan submits the results of the investigations which have been made, with reference to the floods of October 1874, into the question of the waterway which must be provided between the 102nd and 108th miles of the Northern Extension.

2. It will be seen that Mr. Logan proposes to provide only a moderate increase to the waterway already sanctioned; but his proposals are based upon the condition that certain works shall be undertaken by the Public Works Department. These works are :—

- (1.) Embankment of the Panar river.
- (2.) Provision of regulating sluices to the irrigation channels led from the river between the Trikalore anicut and the railway; and
- (3.) The reconstruction of the Koryaur embankment.

Mr. Logan also alludes to the necessity of maintaining in good order the numerous tanks in the valley of the Panar, especially near its source in the Mysore territory.

3. Captain Thompson has lately had an opportunity of examining into this question; and from his opinion, which is enclosed, it will be seen that he agrees with Mr. Logan as to the sufficiency of the proposals brought forward.

4. I have asked the Agent to forward the revised estimates as soon as possible, and they shall be laid before Government in due course, along with those of the rest of the line.

5. I beg that arrangements may be made for the early commencement of the works specified by Mr. Logan.

From W. S. BETTS, Esq., Agent of the South Indian Railway, to Lieutenant-Colonel J. H. M. SHAW-STEWART, R.E., Consulting Engineer for Railways, dated Negapatam, 5th May 1875, No. 571.

YOUR letter, No. 232, of the 20th ultimo. I forward, herewith, copy of the Chief Engineer's report and plans relative to the provision for waterway between the 102nd and 108th miles of the Northern Extension.

2. The revised station estimates shall follow directly they are rendered to me.

From the Chief Engineer, to the Agent of the South Indian Railway, dated Trichinopoly, 3rd May 1875, No. 5485.

DURING the heavy floods in October last, I became somewhat apprehensive as to the sufficiency of our waterway provision where the line of the Northern Extension crosses the basin of the river Panar between the 102nd and 108th miles.

In course of my late inspection of the Northern Extension, I took the opportunity personally to investigate the locality in the immediate neighbourhood of the line of railway and for about 20 miles up the valley of the Panar as far as the Trikalore anicut. I have since come to the conclusion, after very careful study, that with slight increase the proposals already made will

suffice to carry off the drainage of the Panar catchment basin, provided the Public Works Department (1) embank the Panar so as to confine it to its proper course and prevent the flood water from spreading all over the country, (2) put head-works to all channels taking off the river between the Trikalore anicut and the Railway, and (3) form a strong and sufficient dam or embankment to prevent the Panar from overdrawing into the Mulatar at a place some 14 miles above the Railway, and known to the Department Public Works as the Koryaur embankment.

If these works be sufficiently carried out and the numerous large tanks along the river Panar, and especially near its source in the Mysore country, be kept in good order, I believe that the provision already made with slight increases to be hereafter described will meet the requirements of the case; but the works indicated must be soundly carried out and maintained beyond the reach of accident, or the Railway will not be safe without an enormous increase to our present proposals for waterways.

I base my opinion on the state of affairs in October last, when the Panar not being banded in to any extent overtopped its natural banks and flooded the country for miles on each side.

On the north it found its way out chiefly by two large irrigation channels (marked channels Nos. 1 and 2 on accompanying map) which cross the Railway on the 103rd and 104th miles respectively. On the south the country falls in the direction of the Railway more rapidly than the bed of the river, so that when the water topped the river bank it drew off with great rapidity along the upper side of our embankment.

The Koryaur embankment intended to keep the Panar from flowing down the Mulatar was topped and swept away, and a large volume of water reached the line in the hollow between the Panar and the 108th mile by this route.

Altogether taking into account the openings caused by the floods being dammed back by our embankment, and finally topping and breaching them at various points, the aggregate length of gaps, inclusive of the Panar and other rivers and streams through which flood water flowed across the line in October last between the 102nd and 108th miles, amounted to over 9,000 lineal feet.

The grounds upon which I base my belief that our proposed allowance of waterway will suffice to meet such floods as swept down the Panar in October are these:—

At the Trikalore anicut and one mile above and one mile below it, the river channel is well defined, and I had a cross section (see map accompanying) taken at each of these three points. The upper and lower sections turned out identical, being 17,112 square feet.

Again, between 8 and 9 miles below the anicut, two other cross sections taken one mile apart give, respectively, 18,500 and 15,200 feet. From these data I think it will be safe to assume that the cross sectional area of the river in a flood like that of October last is 17,400 square feet, the mean of the four sections given above.

The fall of the river is 8 feet per mile, and taking our hydraulic mean depth of 5.5 feet, we get a discharge of 146,890 cubic feet (*i.e.*, $17,400 \times .9 \sqrt{2 \times 8 \times 5.5}$). To meet this the proposed Railway bridge is to consist of 17-100 foot spans equal 1,700 lineal feet. The fall of the river above the Railway is 8 feet, and below 4 feet per mile. Taking the latter fall a velocity of from $8\frac{1}{2}$ to 9 feet per second with an average depth of about 10 feet of water above the present bed of the river, though our bridge will carry off a discharge equal to that calculated above from the data furnished by the cross sections and the flood marks of October last, I say a depth of water of 10 feet above the present bed of the river, because I think that the bed of the channel will under the proposed treatment—of bunding in the river—scour and to some extent become lower, so that with the new flood level at 156 above datum the depth of water will be more than 10 feet and sufficient to ensure the required velocity.

A depth of water 10 feet above the present level of the river bed at the Railway bridge will place flood level about 4 feet above the natural banks of the river, and it follows, as I have already pointed out, that strong bunds must be maintained by the Public Works Department to confine the river to its course. If this is done, I think the 1,700 lineal feet of waterway already allowed by us across the Panar will suffice.

During the floods a large quantity of water found its way down to about the 103rd mile, and I propose to raise the embankment here to 166 as shown in the accompanying section, and to provide 2-25 feet girder flood openings at 102 miles 77 chains in lieu of the 10 feet at present estimated for. If the openings now proposed north of the 3-40 feet girders at 103 miles 41 chains should prove insufficient to carry off the flood water collecting here at any future time the embankment being at this height (166.00) would not be topped, the water would flow south to 103 miles 41 chains, and if the bridge there proved insufficient the water would flow past towards the Panar, where in the hollow at 104 miles 40 chains I propose to place another flood opening of 4-25 feet girders. If the Panar embankments are maintained and if the channels leading off from the river are provided with head-works as I have already indicated, no large body of flood water ought to be able to reach the line, and I think these extra provisions now proposed will suffice.

At the Panar itself if the flood level is to stand 10 feet above the present level of the bed, which is say 146 above datum, the new flood line will be 156.00, and as formation is at present arranged (159.50) this would leave 3.00 only from flood level to the bottom of the girders. The cross girders hang from the main girders, and the bottom of the former is about 6 inches below formation level.

I do not think that there ought to be less than 5 feet between flood level and the girders to guard against damage from floating trees or other objects likely to be carried down in times of flood. I propose, therefore, to raise formation at the bridge from 159.50 to 161.50, in the hope that this will allow 5 feet in the clear between the bottom of the girders and flood level.

To the south of the Panar I propose to raise the embankments slightly between the river and the 106th mile-post, making one continuous gradient of 1 in 350 over that length, as shown on the accompanying section (drawing No. 401), and at 106 miles 37 chains I would provide a flood opening of 4-25 feet girders, as a good deal of drainage, even in ordinary times, is said to cross the line here.

Along this part of the line between the Panar and 107th mile 40th chain, I do not consider that we can do anything to guard against floods, by raising the Railway embankment. If the line were raised so as to be above flood level, unless at the same time we provided an enormous increase to our waterways, the whole country between the Panar and Panrutti would be swept and destroyed.

This will be evident by an inspection of the working section. The level of the bank of the Panar where the Railway crosses is 152.00; the level of the country about one mile to the south is 144.00, or a fall of 8 feet in one mile. The fall of the Panar in one mile below the Railway is only 4 feet, so that immediately the river finds a way over its banks its tendency is to run south.

The average fall between the Panar banks Panrutti is 6 feet per mile, the difference in level being in a distance of 6 miles 36 feet. It will be seen, therefore, if our embankment be raised any higher than it is at present without providing openings sufficient to prevent the floods from rising beyond a certain limit, we shall ensure the destruction of the neighbouring country and villages, while the surplus water would find its way to the river Guddelum.

Under the circumstances, I consider that it is better to leave the embankment as it is. To provide waterway sufficient to guard against the risk of failure of the Panar embankments would be to spend a very large sum of money on works which might never be required, or if required it might only be at intervals of 50 or 100 years.

Should any burst unfortunately occur under the conditions I now propose, the Railway embankment would be topped and breached probably along part of the 107th mile, but this could soon be remade, as it is not over 6 feet in height and averages from 4 to 5 feet only.

I have here adopted the name Panar for this river in preference to Pooniar, which it has hitherto borne on our drawings and other documents, because Panar is the name by which it is distinguished on the Grand Trigonometrical Survey Map, and because that is, I am informed, the more correct name. It is also that by which the Madras Railway know the river when it is crossed by their Railway, and by our adopting the same name, it will, I think, tend to avoid confusion.

*Proceedings of the Madras Government, Public Works Department,
26th May 1875.*

If the Consulting Engineer concurs in the views here set forth, I will arrange to submit the requisite revised estimate.

I HAVE read Mr. Logan's letter, No. 5,485, of 3rd May 1875 to the Agent of the South Indian Railway, regarding the waterways to be provided in the valley of the Panar.

2. The sections, Nos. 1, 2, 3, 4 and 5, bear Mr. Logan out in the conclusion he has arrived at, viz., that a bridge having a lineal waterway of 1,700 feet will be sufficient for the Panar. A clear height of 5 feet being given between the level of the highest known flood and the bottoms of the girders, I quite agree with Mr. Logan in believing that a bridge giving this amount of waterway will be sufficient. A careful examination of the river-bed in February last with Mr. Logan at the Trikalore anicut and several points below enables me to speak with confidence on the subject.

3. The waterways proposed for the line between the 102nd mile and the north bank of the Panar are, I believe, sufficient, but not excessive.

4. I have no doubt that they are sufficient, provided the north embankment of the Panar and the head-works of the two considerable channels leading off from the north bank are properly constructed and maintained.

5. The proposed waterways for the portion of line between the south bank of the Panar and the 108th mile are, I believe, quite sufficient for the ordinary drainage of the country, but they are most emphatically nothing like sufficient to dispose of spill from the Panar, in the event of the south embankment giving way during a high flood.

6. If the Panar is strongly embanked on the south, if the Koryaur embankment is strongly reconstructed, and if these embankments are well maintained, the line and the country between the south bank of the Panar and the 108th mile will be safe with the proposed waterways, but as such a terrible amount depends on these "ifs" I would strongly advise the precaution being taken of keeping this portion of the line as much as possible on the surface of the country just sufficiently above the ordinary drainage of the country, but no more. In the event of the Panar embankment giving way, the flood water would then get away easily. If the Railway embankment is kept much above the surface, and if sufficient waterways are not provided, a large tract of country between the Panar and Panratty will be devastated.

7. To keep the Railway embankment above all floods in this portion of line, and to provide sufficient waterways in it, would be absurd. To keep it as much as possible a surface line, and to provide only sufficient waterway for the ordinary drainage, would be safe.

8. Mr. Logan provides for quite sufficient waterway for the ordinary drainage, but as it is quite possible for the embankment of the south side of the Panar to give way during heavy floods at any time, I would strongly urge the advisability of keeping the line between the south bank of the river and the 108th mile so low as to give a minimum of hindrance to the flood waters flowing eastwards.

FORT ST. GEORGE,
11th May 1875.

(Signed) R. THOMPSON, Captain, R.E.

No. 448.

ORDER THEREON, 26th May 1875, No. 1,436.

RAILWAY, No. 5.

THE Honorable the Governor in Council concurs with the South Indian Railway Officers and the Consulting Engineer for Railways as to the propriety of keeping the formation level of the Northern Extension, south of the Panar or Pooniar, but little above the surface of the country.

2. The subject of the embankment of the Pooniar is under investigation, and these papers will be communicated to the Chief Engineer for Irrigation and to the District Engineer, South Arcot, with a view to the completion of the surveys and levels for the portions of the embankment above the Railway crossing as early as may be practicable. Attention will be given to the regulation of the heads of all channels

*Proceedings of the Madras Government, Public Works Department,
26th May 1875.*

between the Trikalore anicut and the Railway crossing as soon as the details of the embankments have been settled. The repair or reconstruction of the Koryaur embankment is believed to be in progress.

(True Extract.)

John A. ...

Major, R.E.,

Offg. Joint Secretary to Government.

To the Consulting Engineer for Railways.

„ Chief Engineer for Irrigation.

„ District Engineer, South Arcot.

„ Revenue Department.

Exd. E. C. Shunker.

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Gobt. of 1875 Madras.

PUBLIC WORKS.

To
The CONSULTING ENGINEER
FOR RAILWAYS.
&c. &c.

Dated May 26th.

Issued

Recd. June 7th Encl.

G. O., 26th May 1875, No. 1,436.

See Memo

MAY.

Nos. 447-448

14. To the Board of Revenue, 15th June

Northern Extension, South Indian Rail-
way. — Passing orders on the Consulting
Engineer's letter laying before Government
a letter from the Agent with enclosures
regarding the question of the waterway to
be provided between the 102nd and 108th
miles.

N^o 1209

Comm^d to the
Board of Revenue

9 June 75. *Alu*