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Proceedings of the Madras Government, Public Works Department, 27th July 1871.

No. 471. Read the following letter from the Under Secretary to Government, Public Works Department, to the Secretary to Government, Public Works Department, dated Fort St. George, 6th July 1871 :—

I HAVE the honour to inform you that, in obedience to the orders of Government quoted in the margin, I inspected the Main Canal and works of the Madras Irrigation and Canal Company from Soonkasala to Cuddapah between the 7th and 27th June, and I beg to report as follows on the questions referred to me in my instructions.

No. 1,443, 26th May 1871.
" 1,444, 26th " "

2. An examination of the mileage notes and general remarks on each section appended hereto will show in detail the state of the canal at every point. It will be gathered that the earthwork in the first three sections, that is from the 1st to the 45th mile, is not altogether satisfactorily formed, and that some labour is still required to bring the banks and towpath into fair order. In the 4th and 5th Sections, or up to the 75th mile, a considerable improvement is noted ; while in the remaining portions of the canal, but especially in the 7th and 8th Sections, so far as external appearance is concerned, there is generally nothing further to be desired. The bed of the canal is clear of obstructions, the side slopes are neatly trimmed, and the embankments are of the regulated height, of full section, with towpath formed to a proper width. Unfortunately there is almost universal absence of consolidation in the embankments throughout the whole length of the canal, so that their satisfactory appearance is to a great extent delusive. Great exertions have been made by the Engineers in charge in laying fresh soil and trimming the slopes, and a very great amount of work has been done, but the banks are generally formed in bad soil, and they have been thrown up loosely and at random, and are for the most part bare of grass. When water is brought into the canal they will settle very considerably, and they will be guttered by rain, and the cost of maintaining and making them up annually will necessarily, for several seasons, be very great. In their present condition it will be necessary to use great caution, and to admit water very gradually and only to a small height during this year. It seems certain that with a full canal they would breach at many points. The walls used principally in the 2nd Section as substitutes for earthen embankments have been raised to a height of 3½ feet above water level, and they appear to be in good repair. In some cases a puddle bank has been laid at the toe where especially leaky and the rubble backing has been added to. Water passes more or less through all, and nothing but the test of a full supply in the canal can determine the question of their safety. There is no doubt that there are now many weak points, and that until the natural process of silting up in the hollows when they are built has gone on for a long time there will always be danger of failures taking place.

3. All the breaches which were made in the banks or walls last year have been repaired in accordance with the sanctioned plans, but the earthwork backing to the new wall closing the Hindry breach has slightly slipped since it was laid. The general unsatisfactory state of the canal at that particular point has been noted in the mileage observations appended.

4. The masonry works are, it may be said, completed, as the trifling amount of building remaining to be done in two or three instances could be finished in a

very few days. The character of the work is generally rough, and some portions recently completed very much so, and though it usually appears to be in a sound state, it is probable that frequent repairs will be necessary and the cost of maintenance considerable. All the lock gates have been hung, and the valves for the sluices are in their places, but this is not always the case with the lifting gear, and at almost every lock some small additional fittings are required, and some further adjustments are necessary to place them in proper working order. As at the time of inspection there was no water in the canal where the locks are placed, there was no means of actually filling and testing them, and no decided opinion can be pronounced as to their stability under working conditions until this has been done.

5. The approaches to the bridges and the roadways are all made up, and, except in one single instance, the parapet walls of the third-class bridges have been lowered to allow of the yokes of ploughs being drawn across them. In the case alluded to, the order for the alteration was given by the Chief Engineer and accidentally overlooked.

6. Notwithstanding that throughout the length of the canal there are not a few points where there is still something to be done to bring the works even in their outward aspect to a finished state, still on the whole, and in a general sense, the canal with its appurtenances may be considered to be completed in reference to the sanctioned plans; for it is excavated throughout to its full dimensions, the banks and walls are raised to full height and section, and the masonry works are constructed and in a state to deal with the water when it is admitted.

7. The question of improving the surplus discharge works in the first four sections of the canal is reported on in the Consulting Engineer's letter to Government, No. 131, dated 6th March 1871, and Order thereon No. 1,089, of the 8th April 1871, approves of the re-construction of calingulah No. 13 in the 2nd Section, and gives discretionary power to the Company's Officers to decide how improvements in the other calingulahs should be carried out. In accordance with the sanction thus given calingulah No. 13 has been rebuilt, its crest being placed at a level 5 feet above the normal bed of the canal, and planks are provided to close each bay for a further height of 3 feet. With this exception, all the surplus discharge works remain in the same condition they were in before the floods of August 1870, which demonstrated the insufficiency of the means of escape provided for flood water, having in view the insecure state of the canal walls and embankments.

The Chief Engineer of the Company has, however, taken certain measures tending to prevent the water from rising to an excessive height and to ensure that breaches should occur in the most favourable localities if breaching is really inevitable. He has raised or removed the shutters at the sluices in the calingulahs, and has laid in front of the vents earthen banks to a height 6 feet above canal bed level, and at intervals (generally where the canal is in cutting to a depth of 4 feet) he has lowered the earth bank to a height of 10 feet above bed level, the intention being that when the water rises to a height greater than 6 feet, the calingulah sluices should be opened by the breaching of the bank in front of them, and that, if any further and dangerous rising of the water should occur, the banks at the selected places should be cut and allowed to breach, while the ground would act as a

natural calingulah and retain a supply of water for irrigation. In their order above quoted Government have observed that such measures as have just been described are only admissible in the case of an incomplete canal, but not otherwise; and the fact that the Chief Engineer has considered it necessary, for the safety of the work, to adopt them, is evidence that this is in an incomplete state in respect of one of its most important parts.

8. The distribution works sanctioned by Government for the land under each section of the canal are in a more or less advanced state. All the sluices in the Main Canal have been built, and though a number of them were not provided with shutters and some were without lifting gear when inspected, these deficiencies will shortly be made good. The following abstract statement shows the length of the irrigation channels sanctioned and executed in each section, with the acreage commanded and which can, therefore, be readily supplied with water on a demand being made by the ryots:—

No. of Sections.	Irrigation Channels.		Amount of land now commanded.
	Sanctioned.	Executed.	
	Miles.	Miles.	Acres.
1st	14·00	14·00	1,386
2nd	14·00	14·00	1,956
3rd	26·14	26·14	9,837
4th	63·44	63·44	25,000
5th	26·16	23·04	9,000
6th	93·56	26·00	20,000
7th	28·41	27·00	12,000
8th	64·00		
9th	37·60	14·60	8,600
10th	10·00	7·87	3,788
Total...	377·31	216·09	91,567

As a rule it is the main distributing channels which have been excavated, and the heads of the subsidiary channels are not marked out or provided with masonry outlets, but temporary arrangements can easily be made to regulate the supply. The excavation of such channels has been checked in accordance with the recommendation of the Consulting Engineer in his letter No. 129, of the 17th November 1870, approved by Government, until formal application has been made by the village people.

9. I have found it impossible to obtain such definite information on the subject of the area which will probably be irrigated this year as would enable any very reliable estimate to be made of the revenue which will be collected. The ryots are, as a rule, exceedingly unwilling to make formal application for water, and appear to be under the impression that they will commit themselves to payment if they do so even if the supply should fail, and it is a fact that applications are not made. In some places they request the Company's Engineers to give them water, but do not apparently understand how to make their applications through the proper channel. Such a change as is involved in the habits of the people by the introduction through a large tract, of wet in lieu of dry cultivation, will only take place gradually. Special measures of encourage-

ment will be necessary, and they must acquire that confidence in the permanence of the supply of water, which only its presence in the canal for two or three seasons without disaster can give them, before they will make to any great extent those changes in their agricultural plant and processes which will be necessary. In order to obtain some data on which to found an estimate of the area of irrigated land and prospective revenue from the canal during this season just commencing, and in default of the receipt of regular applications for water, the Collectors of the Kurnool and Cuddapah Districts have caused inquiries to be made in the villages under the canal as to the intentions of the landholders and the extent to which they propose to irrigate. This is the only way in which any estimate can be made, and it is necessarily a very vague one. I questioned the Deputy Collectors of each district as to the result of their inquiries, and these officers admitted that any returns made must be considered mere approximations, and that the ryots are not at present very ready to come forward with their demands for water. I also obtained from them such statements as they had been able to compile of the probable extent of land which would be taken up in the event of the canal holding water for a complete season. An abstract of these is given below, and an estimate of revenue based thereon.

District.	Talook.	Mileage on Canal.		Probable cultivation.	Totals.
		From mile.	To mile.		
				Acres.	Acres.
Kurnool	Ramalakottah	1st	22nd	940	.....
Do.	Nundikotkur	23rd	86th	3,725	.....
Do.	Nundial	87th	109th	624	.....
Do.	Sirwell	110th	123rd	1,913	.....
Do.	Koilkoontla	124th	130th	681	7,883
*Cuddapah	.....	148th	189th	1,000	1,000
	Grand Total...	.....	.....	.....	8,883

Revenue.	Rs.
8,883 Acres, 1st crop, at 4 Rupees	35,532
2,221 ,, 2nd ,, at 2 ,, ...	4,442
Kurnool water-supply...	4,000
Total estimated revenue for 1871-72...	43,974

The area irrigated last season was 1,516 acres. The increase calculated on this season is, therefore, acres 7,367, and it is not probable that it will exceed the estimate; in fact, it is more likely to fall short of it.

10. On my arrival in Kurnool I addressed a letter to the Company's Chief Engineer directing his attention to the Government Order (quoted in the margin) approving of the testing of the canal and detailing the nature of the test which should be deemed sufficient to establish the fact of its being in working order; and I requested him to inform me what arrangements he had made for carrying the wishes of Government into effect.

G. O., No. 1,089, 18th April 1871.

* The villages are not given in the original statement and the mileage is only approximative.

From Mr. Latham's reply appended to this report (in original) it would appear as if in certain respects he had made or was making preparations to enable him to test the canal if required; while, on the other hand, other portions of his letter would lead to an inference directly the contrary.

He states in paragraph 2 that "arrangements have been made for passing water "down the canal as rapidly as possible," and in paragraph 3 that "arrangements will "be complete by the time the water is down the canal for hutting the necessary sluice-"keepers and watchers for testing it to any height required;" but in the same paragraph the Chief Engineer proceeds to say that "the temporary arrangements "described in paragraph 11 of the Consulting Engineer's letter attached to G. O. "No. 1,089, of the 18th April 1871, have been made," *i. e.*, that the sluice-shutters in the calingulahs had been removed and the earthen banks, described in paragraph 7 of this report, thrown up so as to breach if the water in the canal rose to a greater depth than 6 feet above bed-level, (the maximum test level being 9 feet,) and he concludes his answer to the question proposed to him with the information that "in the absence of any instructions or positive order of Government or the Board "to test the canal, he had not retained the staff necessary to do so." I must further remark that the admission of water into the canal on the occasion of the first fresh in the Toongabudra was by no means made with rapidity; quite the contrary. Probably Mr. Latham intended that it should always be understood that the degree of rapidity was to be only so great as was consistent with the safety of the banks, and accordingly when there was a discharge of one foot of water over the Toongabudra anicut and the depth of water in the canal could have been maintained at 8 feet only 2 feet was allowed to flow in; increased after my arrival to 3 feet 9 inches. I consider that this caution was necessary because of the generally unsafe condition of the embankments and walls, but it hardly seems to me to be consistent with readiness to test the canal in the manner desired by Government.

The Chief Engineer further deprecates the applications of the test apparently on the ground that it would alarm the ryots and injuriously affect the prospects of irrigation, and he appears to suggest that it should be postponed till the end of the season.

A careful inspection of the embankments and walls of the canal has convinced me that they would fail at many points if subjected now to the test proposed, which is, that the canal should be kept running for 24 hours with 9 feet of water in it or one foot above the present calingulah crests, and that it should carry for thirty days consecutively a full irrigation supply.

Under these circumstances, and seeing that in the event of any disasters to the works the loss must eventually fall on Government but for no other reason, I think it would be advisable to postpone the testing, provided the Company's Agents are willing to admit without qualification that the canal cannot retain the water which it was designed to carry.

11. In conclusion, I beg to state that I have received from the Engineers of the Company every assistance in carrying out my inspection and in obtaining all necessary information.

Mileage Notes on the Works of the Madras Irrigation and Canal Company, 7th to 27th June 1871.

1ST SECTION, (1ST TO 17¼ MILES).

Head Works.—The river was flowing over the crest of the Soonkasala Anicut to a depth of 9 inches at the time the head-works were inspected, and the condition of the masonry could not be ascertained. It is stated by the Engineer in charge to be in perfectly good repair, all defects having been made good during the preceding dry season. The under-sluices were open and the stone work appeared to be in good order. The shutters, which are balanced on a vertical pivot, are rather roughly fitted, and they are consequently liable to get jammed and are generally difficult to work. The water was flowing through the head-sluice into the canal, in which it stood at a depth of 3¼ feet. The shutters of this work are raised by tackle, and the only means of lowering them is by driving them down with blows of a plank or beam. They should, therefore, be ringed with iron. The apron and side walls of the sluice on the canal side have been repaired, and a water cushion has been formed by building a low wall across the canal between the side walls at a distance of about 70 feet from the cut waters of the sluice, the intermediate space being floored with rough stone and concrete. The wall for a length of about 10 feet on each side where it abuts against the side walls is raised somewhat higher than the middle portion, diminishing the outflow at the sides and protecting the walls from scour. The arrangement appears to be effectual. The front of the sluice is tolerably free from silt.

1*st Mile.*—The spoil banks are roughly formed, and the tow-path is in many places not well defined. The Engineer in charge states that the work-people have been engaged in trimming the earth-work in the next mile, and have not yet taken up the part referred to.

2*nd Mile.*—The self-acting shutters in the calingulah are badly fitted, and would admit flood-waters from the river into the canal. This defect was noticed in the Consulting Engineer's Inspection Report of the 17th November 1870. A culvert at 1 mile 72 chains has been abandoned and blocked up, the drainage-water being admitted into the canal instead. The earth-work and tow-path are in the same condition as in the 1st mile.

3*rd Mile.*—Culverts Nos. 7 and 8 and a drain beyond in this mile have been abandoned, and the canal-water is permitted to stand back on the upper side. At 2 miles 30 chains is a 2nd-class bridge, of which the approaches have been fairly formed. The earth-work generally is irregularly made up; the tow-path has been recently cut and trimmed, but for a considerable distance it is placed too low, and will be flooded when the canal is full. The side long slopes to the path are roughly cut and at too steep an angle. There is a "masked calingulah" at 2 miles 76 chains, *i.e.*, a wall built in the line of embankment and covered with earth formed to the ordinary section. The crest of the wall is at the level of the bed of the canal, which would therefore empty itself if the earth-works were breached or cut designedly. There would therefore be little advantage gained. The wall should be raised to 4 feet above bed-level so as to retain some moderate supply of water.

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4*th Mile.*—No. 1 breach made in the banks last year by flood has been efficiently repaired, the earth-work being brought up to the regular section. No. 9 culvert having been found quite insufficient to carry off the drainage-water, an inlet wall has been built across the upper end to admit the surplus into the canal. There are some irregularities in the form of the canal: for a distance of 30 chains the embankment has been thrown back from the edge of the cutting from 40 to 50 feet, leaving a berm two or three feet below the level of the canal-water when it is full, and the tow-path is led on the tops of the embankments. Traction under these circumstances would be difficult. The earth-work in this mile is better formed than it is above, and appears tolerably solid, but the tow-path requires flattening.

5*th Mile.*—At 4 miles 40 chains a rocky point has been left which projects, across the general alignment of the canal and embankments for a distance of 60 to 70 feet, and forms a complete obstruction to towing. The embankment for a length of 50 feet, has been lowered to a height of 10 feet above canal bed-level at a selected point to breach in the event of heavy floods. The earth-work is in fair condition, and the tow-path clear.

6*th Mile.*—The sluice shutters of No. 1 calingulah at 5 miles 3 chains have been removed, and an earthen bank has been laid in front of the vents to a height of 6 feet above the bed-level, with a view to its breaching and leaving the vents open should a flood occur. A similar arrangement has been made, or is in progress, at all the calingulahs in this section, except No. 9. The water in the canal stands at present 2·85 feet deep at this point. The revetment of the canal embankment at the Yedaroor tank will be raised to the level of the top of the earth-work; it is at present four feet below it. The breaches Nos. 2 and 3 of last year in the bund of this tank at 5·45 and 5·62 have been made good. At 5·67 stands a 2nd-class bridge. The approaches are completed. The embankment of the canal is generally fairly consolidated as far as can be judged from its outside appearance. There were a few leaky places, but they have recently been puddled. The tow-path is in serviceable condition.

7*th Mile.*—At 2 miles 27 chains, with 2 feet 9 inches of water in the canal, it was noticed that a small leak had commenced; it will receive immediate attention. At 2 miles 64 chains the embankment has been lowered as in the 5th mile. The banks tow-path are in the same condition as in the previous mile.

8*th Mile.*—The banks are in good form, and the tops in a condition for use as a tow-path.

9*th Mile.*—At 8 miles 17 chains the embankment has been lowered for a length of 100 feet as described above. At 8 miles 49 chains a supplementary irrigation-sluice has been built as sanctioned in Government Order No. 3,468, dated 28th October 1869. At 8 miles 60 chains there is an inlet with self-acting shutters and underneath a culvert and sub-way combined, all of which are in a very leaky condition. Streams of discoloured water are gushing out of the abutment walls of the tunnel. It appears that the canal-bed above was scoured away last year, and the hole at the back of the tunnel wall was filled up with dry rubble stone instead of puddled clay. The water is thus led down to the back of the wall. Immediate remedial measures are necessary. The banks and tow-path are in fair condition.

10th and 11th Miles.—At 9 miles 1 chain and 9 miles 50 chains the bankr breached last year have been substantially repaired, and they are throughout these miles is generally good form as also the tow-path.

12th Mile.—At calingulahs Nos. 5 and 6 the apron of rough stone laid dry has been partly carried away. It will be repaired. At 11 miles 20 chains is a 3rd-class bridge, the parapet walls of which have been lowered in accordance with the orders of Government. They stand at 2 feet 3 inches above the roadway. The approaches at the upper part are at a slope of 1 in 4, and probably impracticable for bullocks with a plough. The banks are generally fairly made up, and appear to be solid outside. The tow-path is led on the top, and is in tolerably good order.

13th Mile.—The apron of calingulah No. 7 is partly washed away; a 3rd-class bridge at 13 miles 36 chains has had its parapet walls lowered, but the approaches at the upper part are very steep (1 in 6). The embankments and tow-path are in fair condition.

14th and 15th Miles.—The banks are generally in good order, the tow-path in some places requires making up.

16th Mile.—The 3rd-class bridge at 15 miles 21 chains has been altered in regard to its parapet walls. The approaches at the upper part are steep.

17th Mile.—The canal is in rocky cutting in this mile, and the tow-path is led along the edge; it requires clearing in some places.

General Remarks.—The banks and tow-path in the 1st mile require reforming, and at many places in the section it will be found necessary, in order to ensure easy towage, to trim and remove portions of the canal sides which are irregular. The culverts for the drainage of the land on the upper side have, in several instances, been built too small, and it has been necessary to abandon them, and to admit the drainage-water into the canal. All the irrigation-sluices which have been sanctioned have been constructed, but the shutters for the most part have not been provided or have been lost. It is stated, however, that they will be supplied at once. The aprons to the calingulahs are not of a nature to withstand any considerable discharge over the crests of the works, and they have given way in several instances, and notably at No. 8. Lately, instead of packing the stone protection to the banks, and pitching it at right-angles to the slope, it has been thrown loosely down, and in some cases in excessive quantity. Except in the 1st and 17th mile, where the canal is for the most part in cutting, the banks are in fair form and consolidated on the outside; but as it is admitted that the earth was originally thrown up at haphazard, without ramming or laying in layers, and as it is generally of very bad quality, little confidence can be placed in them.

All the irrigation-channels and the works sanctioned for the 1st section have been completed. They command about 1,386 acres of land.

2nd Section (18th to 32nd Mile).

18th Mile. (Hindry Aqueduct).—The side walls of the aqueduct have now been raised to a height of 9½ feet above the floor, or 18 inches above the level of the water when the canal is full; the wings and the face-walls to the embankments in continuation of the wings to 3½ feet above water-level. The earth backing has, however, not been raised, and stands at 2 feet below the tops of the wall. The abutments of the aqueduct stand at the foot of the long slope of the river-bank, and the space between the back of the abutment and the tops of the banks enclosed at the sides by face-walls, and embankments has not been filled at all. The depth of the water when the canal is full will vary from 8 feet at the summit of the bank to something like 25 feet behind the abutment, and even now it is considerable. Under this pressure three leaks exhibit themselves; one at the toe of the south abutment at the level of the bed of the Hindry river, one at the face of the west wing wall on the same side of the river, and the third (only observed a few days ago) at the foot of the embankment on the west side. The Chief Engineer has commenced throwing in earth at the back of the abutment and in front of the face-wall opposite the leak last mentioned. The silting up of the hollow now existing by the canal-water will eventually, no doubt, stop all leakage, and the process should be encouraged if possible. A large breach on the lower side of the canal just below the aqueduct has been repaired as far as could be ascertained, in accordance with the design sanctioned by Government. The foundation of all the face-walls at this point rest on sand, which also underlies the embankments as far as the top of the river-bank. There has been a slight slip in the earth recently placed against the wall built to close the breach, and until the space within the embankments has silted up considerably, all this work will give cause for anxiety. Beyond the breach the face-wall had slipped forward for a length of 300 feet. This has been rebuilt, and the foundation is on hard soil.

19th Mile.—At 18 miles 14 chains the tow-path leaves the summit of the banks and descends to a berm, the canal being in cutting, and up to the 1st-class bridge at 18 miles 34 chains the spoil encroaches on the berm, which is too narrow and encumbered with stones. The approaches of the bridge are completed. At 18 miles 79 chains stands No. 10 calingulah. A berm, 100 feet in width, is left here in front of the work; towage would be interrupted.

20th Mile.—At 19 miles 17 chains in front of No. 11 calingulah the towage is broken as at No. 10. Again at 19 miles 41 chains a berm of great width is left, the tow-path being in the bank above. The spoil is thrown irregularly. At 19 miles 30 chains a core-wall extends for about 6 chains; it has not been improved as have similar walls at other places, and requires attention.

21st Mile.—The banks and tow-path are fairly formed. At 20 miles 25 chains there is a leak with about 2 feet 9 inches of water in the canal above normal bed-level. At 20 miles 72 chains there is also a small leak.

22nd Mile.—At 21 miles 23 chains the bank is leaky; at 21 miles 41 chains in front of No. 12 calingulah the towage is broken as there is rocky ground up to the crest-level for a width of at least 100 feet. The banks and tow-path are in other respects in fair order.

23rd Mile.—The banks are fairly formed and revetted but soft. From 22 miles 19½ chains to 22 miles 47½ chains is a wall in lieu of bank with 8 vents and shutters worked with screws. The shutters do not fit well.

24th Mile.—At the Kadrabagh aqueduct (23 miles 12 chains) all necessary repairs have been executed except the rough stone protection in the bed of the vagoo at the lower side. The stone has been collected. A breach in the retaining

wall at 23 miles 60 chains at its junction with the canal-embankment has been repaired. The bank has been lowered in this mile at a favourable site for a breach, in the event of an excessive flood, a precaution noticed in observations on the 1st section. The interior of the earthen bank as exposed shows very unfavourably; it is exceedingly loose and dry and formed of heaps of earth promiscuously thrown. The banks generally are trimmed to a fair section, and the tow-path is clear of obstruction.

25th Mile.—No. 13 calingulah, carried away by the flood of August 1870, has been newly reconstructed; the piers between the openings have been completed, and 20 out of 58 arches turned. It may be completed by the end of this month. The masonry is of inferior quality; the crest is at a height of 5 feet above bed-level of canal.

26th Mile.—The banks are loosely thrown up, and appear to be still soft. They are fairly trimmed and tow-path formed. The walls which extend for a considerable distance, where the canal alignment crosses ravines and forms deep reservoir, appear to be in good repair. All that required it have recently been raised to a height of 3½ feet above the canal water when full. They are backed with earth or dry rubble stone, and occasionally puddled and plastered in front where leaky. The backing or filling for tow-path is left 2 feet below the top.

27th Mile.—The lower side of the canal is formed partly by wall and partly by banks of earth. The former have been dealt with as in the previous two miles, the latter have been puddled in front when high.

28th Mile.—The canal at the Poodoor bungalow cuts through a saddle, and the tow-path has, for a short distance, not been properly formed. At 27 miles 50 chains a breach in a high wall has been efficiently repaired, a puddle bank with a layer of shingle being laid in front and a rubble packing behind the wall which has been rebuilt. The old wall has been left at its original height of 2 feet above full canal water-level; the new portion has been raised to 3½ feet above. The puddling and shingling have been continued along the old wall. The banks and tow-path in this mile are in tolerably good condition.

29th Mile.—Banks and tow-path as in last mile.

30th, 31st, and 32nd Miles.—At 30 miles 28 chains is a 2nd-class bridge very well built, the approaches also formed. The banks are in good repair, but appear loosely laid; the tow-path is in serviceable condition, and also the revetment. The banks where high have been generally puddled in front, and are protected throughout up to 2 feet above water-line with rough stone pitched and packed or loosely thrown.

General Remarks.—The general impression made by an inspection of the works of the 2nd section is not a favourable one. From the peculiar manner in which the canal has been laid so as to cross ravines where the ground is frequently many feet below the normal bed-level, the embankments or walls must be subjected to the pressure of bodies of water of considerable depth when the canal is running even half full, and there is much ground for believing that the work throughout is not of particularly good quality. Where an opportunity has been afforded of examining the interior of the earth-work, as where it has been lowered to breach in case of necessity, it has been found loose and dry, and was evidently thrown up at random,

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nor, as a rule, are the higher embankments of such thickness as to give a margin of stability which would compensate for the bad manner in which they seem to have been formed. In general also the soil is inferior. Again, in regard to the walls, it may be said that they have given way under a charge which could hardly be considered excessive if we remember for what they were designed, and the work where exposed to view by a breach has been, it is believed, generally found of inferior quality; neither have they been strengthened to any material extent since their disastrous failure last year, seeing that the only alterations carried out have been the raising of the masonry to 3½ feet about the full water-level of the canal, and a trifling addition in some cases to the rubble backing behind, with puddling at the toe where the leakage had been excessive. All the walls leak more or less; additions have been made to them where the leakage was greatest; still it is probable that the stability of many under a full head of water is very doubtful.

The other masonry works, such as bridges, calingulahs, culverts, etc., are completed, and in good repair; but the masonry built is in many cases of an inferior kind, and, even if failures do not occur, repairs will be frequently necessary.

All the breaches made last year have been repaired. The bridges and approaches have been completed, the parapet walls of the 3rd-class bridges being lowered in accordance with the orders of Government. No steps have been taken to improve the surplus discharge works beyond lowering the thirteenth calingulah. The tow-path is generally fairly formed, but there are various obstructions along the side of the canal, noticed in the mileage observations, which must be removed.

All the irrigation-sluices sanctioned for this section have been completed, and also the irrigation-channels comprising a length of 14 miles; these command 1,956 acres of ground.

3rd Section (33rd to 60th Mile).

33rd Mile.—The embankments in this portion are high and somewhat slight. They are now receiving a backing of earth. They are puddled along the front face.

34th Mile.—At 33 miles 29 chains a 2nd class bridge, sanctioned in lieu of the Sultanpoor tunnel which was destroyed by flood, has been completed with its approaches, but these are not connected with the road which passed through the tunnel a quarter of a mile distant. The embankment and towpath are in fair order and of considerably stronger section than those in the previous mile. No. 15 calingulah is banked with earth in front of the sluices, the shutters being removed.

35th and 36th Miles.—The canal is for the most part in cutting. The spoil is somewhat roughly formed, but the towpath is clear. A berm is left between the banks on which is the path, and the canal cutting this is unnecessary and, in fact, an impediment, as it is generally below full water level. At the Ulloor aqueduct the repairs necessary in consequence of last year's flood have been completed. Beyond the aqueduct the bank is lowered for 200 feet to breach if required.

37th Mile.—The towpath in some places is not made up on the summit of the bank which is very soft. The sides of the embankment and the shingling are left in a very rough state.

38th and 39th Miles.—From 37 miles 26 chains to 37 miles 33 chains is a core-wall of the old pattern, that is to say not puddled in front. At 27 miles 33 chains

a calingulah has been built. The banks are formed of good soil and are of strong section; but the stone revetment is pitched at too great a slope and has fallen out in places.

40*th Mile.*—At 39 miles 37 chains is a 3rd class bridge; the width is 7 feet in the clear, the parapet walls have been lowered, and the approaches are completed. It is passable for loaded bandies. At 39 miles 59 chains is a retaining wall No. 11. The top is $3\frac{1}{2}$ feet above full water level, the earth backing 2 feet lower.

41*st Mile.*—At 40 miles 16 chains is a masonry wall with rubble backing. The towpath in the wall is 1 foot 2 inches above full water level. A parapet wall 2 feet 4 inches high with protecting coping is built at the side of the towpath. This arrangement is objectionable as the coping would probably cut the towrope. At 40 miles 47 chains is a calingulah No. 19. The embankments are made of good soil and are with the towpath generally in good form.

42*nd Mile.*—At 41 miles 31 chains to 41 miles 48 chains there is a wall in lieu of bank without backing for half its length coped as in last mile; the level of the top is not accurately known, and it may require raising. In the wall is a sluice of 5 vents, the shutters are removed and an earthen bank thrown up in front to breach when the water rises to 6 feet above bed level. The southern half of the wall is leaky and has been backed with rubble. At 41 miles 57 chains to 41 miles 62 chains is another wall backed with rubble, it is also leaky. The banks and towpath are generally in good condition.

43*rd Mile.*—At 42 miles 14 chains, Mulliala village and 2nd class bridge. The approaches of the bridge are finished. The banks here are protected by stone thrown loosely down giving a rough unfinished appearance. At 42 miles 28 chains an irrigation sluice has been built of 4 vents closed by shutters worked by differential pulleys, and arranged with a down haul to close them. The gear is not perfectly in order, and is under repair. The banks and towpath are in good repair.

44*th Mile.*—At 43 miles 34 chains is a 3rd class bridge; the approaches are completed and parapet walls lowered. The canal water stands back and forms a tank. The embankment is of bad soil and leaky, and the ryots of Madigatla, which village lies immediately under it, have, on their petition, been allotted a new site for this village. There has, however, been as yet no slip or yielding in the embankment. It is protected on the inner side with large slabs of schistose rock loosely thrown. This seems insecure, and would probably be displaced by the wash of the water in windy weather.

45*th Mile.*—At 44 miles 17 chains is a scouring sluice of 5 vents, the shutters worked with screws. There is an earthen bank in front to 6 feet above bed level, and it is proposed to keep the shutters up and allow the bank to breach as at other places. At 44 miles 26 chains the embankment is lowered to a level of 10 feet above the canal normal bed. The interior of the earth-work as seen in this cutting is not consolidated; it is formed of fragments of shale mixed with earth, loose and full of interstices. At 44 miles 29 chains is a calingulah; the out-fall is bad and leads along the outer toe of the embankment. The Nagatore tank ends in this mile. It is of considerable depth; the bank seems solid and of fair soil, but it is badly protected in parts by shingling as it is called, with pieces of slatey stone

thrown at random so as to cover the slope. The canal banks and towpaths are neatly made up.

General Remarks.—The earth-work of this section of the canal presents generally a better appearance than that in the 2nd Section. The embankments in the first portion from the 33rd to the 35th mile, where the canal skirts the hill side which slopes rapidly, are exceptionally high, and appear to have been originally loosely thrown up; their section is slight and the additional earth now being laid on them is simply thrown from the top without benching the old work or removing grass. It is probable that they will require considerable additions to render them safe. The lower portions of the canal in the section are frequently in cutting, and the soil is of fair quality. At certain points the banks have a rather unfinished appearance but generally they have been trimmed, and there is a fair way on the top. Whenever the interior of the earth-work is exposed by cuttings it seems, however, to be loose and dry, and, until they have been thoroughly saturated by the water standing against them, and have fully settled, their stability under pressure is doubtful. The revetment or stone protection to the banks varies in quality. The system adopted of shingling or spreading stones loosely on the slopes may answer in the portions of the canal where the water does not spread, but where tanks are formed it is believed to be insufficient. There are but few walls in this part of the canal and where they have been constructed the depth of water against them will not be considerable, nevertheless they are generally leaky.

All the sanctioned masonry works have been completed, the quality of the work is the same as in the other sections, that is to say, rough and of a low class. The parapet walls of the 3rd class bridges have been lowered, and the approaches of all completed. The breaches in the upper banks at the Ulloor aqueduct have been repaired. The waterway of the under-tunnel is insufficient, and it is proposed to lower the side wall of the aqueducts on the upper side and to admit the water, in excess of that passed through the tunnel into the canal.

The surplus discharge works of the section remain in the same condition as they were in last year. The shutters of the sluices will, however, be removed and their place supplied by earthen banks raised to 6 feet above bed level as in the other sections. All the shutters and lifting gear to the sluices in the 1st, 2nd, and 3rd Sections are roughly made and fitted. The pitch of the screw for lifting the shutters of the calingulah sluices is very small, and it takes two men from 25 minutes to half an hour to raise each.

The irrigation sluices in the 3rd Section have been completed, and all the irrigation channels sanctioned.

4TH SECTION.—(45 MILES 33 CHAINS TO 61 MILES 70 CHAINS.)

46*th and* 47*th Miles.*—At 46 miles 43 chains, Nagatoor 1st class bridge. The approaches are completed. The banks and towpath are in good condition.

48*th and* 49*th Miles.*—The banks appear to be solid outside and are well formed, but too much rounded at the top for a towpath. There are some bushes on the inside slope which require removal. The inner slope is shingled.

50*th Mile.*—The canal forms a waterspread. The embankment is formed of good soil and is in good form. The slope is protected by shingling. At 49 miles

68 chains stands calingulah No. 1. The apron is excellent, and has stood for six years without repair. 49 miles 48 chains, bridge No. 1-A, 2nd class. Approaches completed.

51st to 54th Miles.—The banks are generally in good shape and appear never to have shown signs of weakness; the soil is of good quality. The cutting of the canal neatly executed.

54th Mile.—The canal forms a waterspread (Puggadial tank): the embankment is generally in good order, but has sunk in the line of a vagoo in the hollow.

55th Mile.—A subway and drainage under-tunnel, 14 feet wide, at Puggadial village. Banks in good repair.

56th and 57th Miles.—The canal spreads; the tank bank is revetted at the lower part and shingled above, the lower at a slope of $1\frac{1}{4}$ to 1, the upper 2 to 1. The embankment has had water against it to within 2 feet of full supply level.

58th and 59th Miles.—Canal banks in good order. At 58 miles 4 chains is a calingulah. The shutter and gear of the sluice are badly fitted, the former flimsy. An earthen bank is thrown up in front of them.

60th and 61st Miles.—At 59 miles 13 chains is a 3rd class bridge. The approaches are completed, but the parapet walls have not been lowered in accordance with the orders of Government. The canal at the end of this mile forms the Tangadanchia tank. The embankment is of full section and in good order, revetted on the slope. It breached in 1869, under it was supposed a full head of water, but has not given way since. About 20 chains from the termination of the spread at the lower side is a calingulah which forms the only outlet for the surplus water of this tank. The approach is narrowed to the width of the canal. The question of widening or lowering the crest of the calingulah and improving the approaches has to be considered. At the end of 61st mile is a culvert and subway 8 feet wide.

62nd Mile.—The canal bank in some parts is leaky, and the soil indifferent. At 61 miles 70 chains the 4th Section ends.

General Remarks.—In the 4th Section generally there is a considerable improvement in the appearance of the canal embankments, partly owing to the fact that the soil is of better quality. Where, however, the canal crosses valleys and depressions, and forms reservoirs, some of them of considerable depth, which is the case occasionally in the section, it is not unlikely that failures will occur. The embankments to these tanks are generally of full dimensions, and they have been kept in good repair; but there is reason to suppose that here as at other places they have not been carefully thrown up. They are for the most part of full width at the top and are formed into a fair path 6 feet wide. The masonry works are all completed, but the lifting gear of the sluice shutters is sometimes very roughly put together; the shutters themselves where of wood are of slight construction, and the same defect in the screws of the calingulah sluice shutters is noticed in this as in the 3rd Section. The approaches of all the bridges have been completed, but the parapet wall of the 3rd class bridge has not been lowered.

The surplus discharge works remain in the same condition as they were in last year, but the Chief Engineer has taken the precaution in this and in the upper sections of raising or removing all the shutters of the calingulah sluices, and has thrown up earthen banks in front of the vents calculated to breach when the

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canal water rises above 6 feet in depth. The banks of the canal are also lowered at intervals to a level 10 feet above that of the proper bed with the intention of allowing it to breach at selected places should an excessive flood occur.

All the irrigation sluices sanctioned for this section have been completed, and most of them are fitted with shutters and lifting gear; in certain cases, however, these are still in the workshop.

Sanction has been obtained for the execution of 63 miles of irrigation channels, of these 62 miles have been completed, commanding 24,000 acres of irrigable land.

5TH SECTION.—(61 MILES 70 CHAINS TO 74 MILES 57 CHAINS.)

63rd Mile.—The top of the bank in this mile is often too narrow, rounded and unsuitable for traffic; guttered also on the back slope. At the end of this mile is a 14-feet culvert in good masonry.

64th and 65th Miles.—The banks vary in condition and soil. At many places they are too narrow at the top, but are generally trimmed to a fair slope. In the 65th mile is a 6-feet culvert and an irrigation sluice, of which latter the gear has not been fitted. The Terrogopillay 2nd class bridge has been completed with its approaches.

66th Mile.—The Terrogopillay aqueduct is in this mile. The masonry seems to be sound, and there are no cracks or settlement. As there was no water in this part of the canal it could not be determined whether the work was water-tight or not; but nothing has been done to stop the leaks noticed in the Inspection report of the Consulting Engineer, dated 17th November 1870. The double banks from the village of Terrogopillay to and beyond the aqueduct are in a hollow, formed of very bad treacherous soil, and altogether untrustworthy. The depth of water against them will be considerable, and they appear to be low. There has been a slight slip inwards near the aqueduct on the upper side. The Chief Engineer will have the heights ascertained and raise them where required. Beyond the valley crossed by the aqueduct the embankment is very narrow and only 4 feet above the water line.

67th Mile.—The embankments are in much the same condition as in the previous mile, but the soil is better. An irrigation sluice of 6 vents has been built, but the gear is not fitted.

68th and 69th Miles.—The canal is partly in cutting in red gravelly soil, the sides are considerably guttered, the towpath has not been formed, and the banks are in a rough state; bushes growing on the inside slope and top, and the summit very narrow and rounded, unfit for traffic.

70th Mile.—For some distance the banks are formed of bad soil, and have cracked considerably; they are overgrown with bushes, and the top is narrow. There is a culvert of 3 arches of 10 feet span. In this mile there was a gang of coolies making good the earth-work, and a conservancy staff has been engaged on the miles generally.

71st Mile.—The banks have been cleared of bushes, and the towpath has been formed for a small distance. There is an irrigation sluice of which the gear is not fitted. The bank generally requires forming at the top.

72nd, 73rd, and 74th Miles.—The Pamulpad 2nd class bridge is completed with its approaches. The banks and towpath are in fair order. Cumbalpallai sluices for surplus water are completed, the masonry is sound but not of high quality. The shutters and lifting gear are very roughly put together, and the pitch of the screws very small. It would probably take two men three hours to open all the vents of which there are six.

75th Mile.—A 1st class bridge stands in the heavy cutting in rock in this mile which takes the canal through the watershed separating the drainage basin of the Kistna river from that of the Pennair. The bridge has been completed for some years and is in good repair. The cutting is completed, and the bed and towpath of the canal are cleared of rocks. The 5th Section ends at 74 miles 57 chains.

General Remarks.—Throughout a considerable portion of this section of the canal the soil is of good quality and it is partly in cutting, so that the stability of the banks is beyond suspicion; but they are often overgrown with bushes, occasionally cut and guttered by rain, or cracked by the sun, and for a great part of their length narrow at the top, which is unfit for use as a towpath. At certain places noticed in the mileage observations, and especially near the Terrogopillay aqueduct, the earth of which they are formed is of a very bad kind, and it is doubtful whether they would stand at the latter place under a full supply of water. The masonry works sanctioned are all completed, and though it cannot be said that the class of work is high still it appears sound, and there are no signs of failure.

The approaches to the bridges have been made up, and are in good order. The surplus discharge works are in the same condition as in the other sections already noticed, and earthen banks have also been laid in front of the calingulah sluices.

All the masonry works of the irrigation sluices have been completed, but most of them have not been supplied with lifting gear for the shutters.

Government have sanctioned for this section the execution of 26 miles of irrigation channels, of which 23 miles have been completed, commanding 9,000 acres of land.

6th Section, 74 Miles 57 Chains to 93 Miles 25 Chains.

75th Mile.—The first lock in the canal stands at the end of this mile It regulates the level of the water in the upper and lower reaches, the depth in the latter being reduced from 9 to 6 feet. The masonry is of fair quality, but the sills to the gates are somewhat roughly built. The gates are not very well fitted, and require caulking. The sluices and valves for filling and emptying the lock chamber are in working order; the latter are of wood, revolving pattern. Below the lock the canal is reduced in width from 90 feet to 50 feet at the bed, and a sluice above the lock discharges surplus water coming down the upper reach into the Caulee. There is also a head-sluice for regulating the supply passing down the canal. The shutters of all these are worked by screws with cut thread giving about 1 inch rise to a revolution, and they are far superior to those in the

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upper sections, which render the openings and closing of vents a very tedious operation.

76th, 77th, and 78th Miles.—The canal is carried over rocky ground, principally shale, the bed-level generally coinciding with that of the ground. The banks are fairly trimmed, but overgrown with bushes for the first two miles. They have generally been formed with a core of rammed earth supported on either side by shale and soil mixed, and, though reported leaky in some places, they ought to stand the moderate quantity of water which will be required to fill the canal to the proposed depth of 6 feet. Doubtless, however, there will be considerable loss of water from sub-soil leakage through fissures in the rock. The tow-path is in fair order, but the earth on it is soft and loose. Two 10-feet culverts, a double culvert with two 10-feet spans, and a 1st class bridge have been completed. The latter requires re-plastering.

79th and 80th Miles.—The canal is free from bushes, and the banks otherwise in the same state as in the previous three miles. There is a 10-feet culvert in the 80th mile used also as a su-bway.

81st Mile.—A sluice of three vents stands at the head of the Toorcherla Irrigation Channel, which takes off in this mile. The shutters and lifting gear have not been fitted. The channel is 5½ miles in length with 2½ feet fall per mile, and at its head is 24 feet wide at the bottom, with 3½ feet depth of water at full supply-level. No land has yet been irrigated from it. Lock No. 2, at 80 miles 53 chains, has two 10-feet drops and an over-bridge; it is completed. The masonry appears to be of fair quality: the foundations are on rock, as also the floor of the lock chamber. The valves of the filling sluices are of iron, revolving pattern, and are in good working order. Those of the emptying sluices are also of iron, working vertically on friction rollers, the gear consisting of a double rack and pinion with a counterpoise attached to one rack. This is the pattern adopted for all emptying sluices in the locks below, and as at present fitted it is not without defects. The gear requires re-arrangement, as there are at present no stops to prevent the rack with the counterpoise working through and ungearing itself. The alteration is a trifling one, and will readily be made. It has been noted by the Chief Engineer. The shutter works in angle iron guides, and is not properly kept in its place. The rollers, therefore, are apt to ride on the top of the flange instead of inside it. Some additional fittings are required, and will, it is understood, be supplied. The methed of attaching the guides to the masonry is a weak one. The gates are rather roughly adjusted, and require caulking.

At 80 miles 70 chains, Lock No. 2-A., one 10-feet drop. The filling sluices are worked with iron shutters, raised or lowered by rack and pinion without counterpoise. The shutters have rollers, and the arrangement has the defects noticed in regard to the guides of the lock above.

The emptying sluices have shutters and gear of the same pattern as No. 2, and the same remarks apply. The gates are hung, but require caulking. The masonry is of the same class as No. 2. The banks and tow-path in this mile are fairly trimmed, but appears to be loose and soft.

82nd Mile.—At 81 miles 28 chains, Lock No. 3, of one 7-feet drop and 12-feet culvert for drainage, used also as sub-way. The shutters and gear at the emptying

and filling sluices are of the same pattern as those at similar parts of Lock No. 2-A., and the same observations are applicable. The masonry is of fair quality. The gates are not caulked, and work rather stiffly; they may require some adjustment. The canal banks beyond the locks are somewhat unfinished, and grass and weeds are growing in the bed.

83*rd Mile.*—The canal banks are formed in bad soil; but are of strong section, and trimmed neatly. At 82 miles 14 chains, No. 4 lock, two 10-feet-10-inch drops and two 12-feet culverts for drainage and 2nd class passage under. The masonry is apparently of fair quality; the pointed sills are superior to those in locks above. The arrangements for working the sluices are the same as in the locks above, and require adjustment as before noted. The lock gates are hung, and shut with a fair degree of closeness. The foundations and bottom of the lock chamber are on rock.

84*th Mile.*—The banks of the canal are trimmed, and the tow-path formed. At 83 miles 30 chains, a double lock, with two 10-feet drops. The chamber has a concrete floor. The masonry is of fair quality, and the sills well cut. The shutters and lifting gear are the same as above, and require adjustment. The gates require caulking. They appear to be well hung.

85*th Mile.*—At 84 miles 44 chains, Lock No. 6, with one 13-feet drop. The foundations are on rock, which also forms the floor of the lock chamber. The machinery, etc., for the sluices and the gates is in the same condition as in the last lock. The masonry appears to be sound; the sills are well built, though the stones are rather thin. The gates are well hung, and work easily. Under the lock are three 15-feet culverts for drainage, and a passage of the 2nd class of 12 feet span.

The canal banks are formed of indifferent soil, but are fairly trimmed and of proper section.

86*th and* 87*th Miles.*—At 85 miles 34 chains, Lock No. 7, two 9-feet drops. The lock and its arrangements are in the same condition generally as in the previous one. One sill requires dressing as it is not true. The gates should be caulked.

There is a 2nd class passage of 12-feet span under the lock.

At 85 miles 72 chains is an aqueduct with seven spans of 12 feet completed and in good order. The canal banks are trimmed and the tow-path formed, but the soil is very loose.

88*th and* 89*th Miles.*—At 87 miles 12 chains is a 2nd class bridge, with two spans of 20 feet and one of 40 feet. The approaches are completed. At 87 miles 62 chains, a culvert of two 12-feet spans. The canal banks are in tolerably good order, and were thrown up a considerable time ago.

90*th Mile.*—At 89 miles 37 chains, Lock No. 8, with 2-feet drops and 2nd class over-bridge. The masonry has been completed. The gates are hung, and the valves and gear are fixed. The sill of the lower chamber at the tail-end requires a little dressing to fit the gates. The masonry is of rough quality, but appears outwardly sound. The lifting gear is precisely similar to that of the locks above, and requires adjustment and additional fittings of the same kind as noticed already. The canal banks above and below are trimmed to proper section,

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The approaches of the bridge have been completed. In this mile is a culvert recently built with two vents of 10 feet on inverts.

91*st Mile.*—At 90 miles 3 chains, No. 9 lock, two 8-feet drops. This work is completed. The upper chamber floor is an invert and half the lower floor is of the same construction, the other being on natural rock. The sill at the tail-end of the upper chamber requires dressing. The gates have not yet been caulked. They are hung, and swing easily. The valves and gear are in the same condition as those in the locks above. The canal banks are fairly trimmed, and the soil of average quality. At 90 miles 48 chains, Lock No. 9-A., one 8-feet drop and culvert with three spans of 15 feet for drainage and under-passage. The lock sills are tolerably well built. The floor is paved on a bed of kunker. The valves and gear are fitted, but require stops and guides as in other cases. The masonry is completed. The gates hung, but not caulked.

92*nd Mile.*—At 91 miles 38 chains, Lock No. 10, two 10-feet drops. The work is completed, as in the previous case, except that it requires fitting, as noted in others. The chamber is floored on concrete. The banks are trimmed to proper section but soft, and they have never had any quantity of water against them. There are numerous holes and cracks to be seen.

93*rd Mile.*—At 92 miles 8 chains, Lock No. 11, one 10-feet drop and 2nd class over-bridge. The work generally is in a complete state. The gates are hung, but not caulked. The sills are fairly built. The masonry, of the usual class, roughly built of small stones, but apparently sound. The valves and lifting gear in their places. The approaches of the bridge completed.

Lock No. 12, at 92 miles 30 chains, one 10-feet 9 inches drop. This work is in the same condition as the last. The lower gates do not appear to close well.

General Remarks.—This section contains a number of important works in the shape of locks, of which there are 14, giving a fall collectively of 190 feet 5 inches from the water-shed separating the Kistna and Pennair systems of drainage to the bed of the Caulee river. The details of their construction are the same, and, except in respect of certain trifling alterations or additions noted in the mileage observations, they may be considered complete. The masonry work in the section generally cannot be considered anything but inferior; it is composed of small stones, some of them not exceeding 3 inches in thickness, and the joints within the face of the works are large, nor in the cases where the masons were seen at work did it appear that much attention was paid to bond. Until the locks are filled and tested under a full head of water for some time it would be difficult to pronounce a decided opinion as to their stability. The gates are roughly made; but no doubt, when caulked and altered, as experience shows to be necessary, they will work satisfactorily.

So far as regards outward appearance, the canal banks are generally in a complete and satisfactory state; they are, as a rule, trimmed to a proper section, and the tow-path is found to full width. They have, however, never been tested by the presence of water to any depth approaching that which is to fill the canal, and they appear to be loosely formed, so that it is very doubtful whether they would stand such a trial as they would be subjected to by the sudden filling of the canal.

The masonry work sanctioned for this section, including bridges with their approaches, has been completed. There are no 3rd class bridges and no calingulahs.

As regards distribution works, 80¾ miles of irrigation channels and 13 miles of vagoo have been sanctioned and 27 miles executed, commanding 12,000 acres of land.

About 50 miles of main channel are included in the 80 sanctioned.

7TH SECTION, 94TH MILE TO 116TH MILE 69 CHAINS.

Jootoor Anicut and Head-works.—A small quantity of masonry work still requires to be built to raise the side wall of the regulating lock chamber to full level, and a little cutting to lower the bed of the canal in front of the lock. In other respects the works appear to be completed. The lock chamber is on rock foundation; the masonry is of the same character generally as in the works on the section already inspected; the lock sills are, however, of better construction, formed of thicker stones. The gates are caulked and hung, and fit fairly. The gear for the shutters of the under and head-sluices has been fitted, and is ready for use. It does not appear, however, to work easily, and the raising and lowering of the shutters will be rather a tedious process. The shutters do not fit closely to the masonry at the head of the vents, being kept out by the iron guide, which has not been countersunk into the masonry. Some wooden fittings will be added to close the aperture. A training wall to direct the river into the canal-head and scour the silt from the front of the lock and head-sluice has been completed. The whole of the masonry appears to be in good repair, and free from cracks and signs of unequal settlement.

94th Mile.—At 93 miles 70 chains is a 2nd class bridge of the usual pattern. The approaches have been completed; the canal is in cutting; and the slopes and tow-path are in fair order.

95th, 96th, and 97th Miles.—At 95 miles 0 chains is an inlet on the upper side with its crest about 5 feet above the country. A considerable quantity of land will be flooded by the standing water. At 95 miles 17 chains is a 2nd class bridge; at 96 miles 75 chains is an irrigation sluice of 5 vents calculated to deliver 10,000 cubic yards per hour. The banks and tow-path are neatly trimmed.

98th and 99th Miles.—At 97 miles 4 chains, culvert No. 5; at 97 miles 26 chains, calingulah No. 6, with a sluice of 5 vents fitted with English-made gear. The piers of this calingulah are unnecessarily thick, and contract the water-way. The banks beyond have been cut down to 8 feet above bed-level for a length of 350 feet as a precautionary measure. At 97 miles 53 chains, 2nd class bridge 7-A: the approaches are completed; the masonry is roughly built. At 98 miles 19 chains, an irrigation sluice, and at 98 miles 65 chains, a syphon culvert of 8-feet span have been built. The banks and slopes are in good condition, and the tow-path has been made up.

100th and 101st Miles.—At 99 miles 26 chains, calingulah No. 9, with sluice of 5 vents fitted with lifting gear as at No. 6: the masonry is rough. At 99 miles 79 chains, an irrigation sluice; at 100 miles 25 chains, a 2nd class bridge completed with approaches; at 100 miles 52 chains, a culvert of two spans; at 101 miles

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3 chains, an irrigation sluice completed. The canal banks and tow-path are in good order.

102nd and 103rd Miles.—At 101 miles 13 chains, culvert No. 10-A., two 5-feet vents. Masonry inferior. The lower bank of the canal in the 102nd mile has recently been raised; the earth is loosely laid on, not rammed or watered. At 101 miles 51 chains is a syphon culvert of one 5-feet vent; the outlet requires to be cleared, and the ground sloped up from the sill which is below the bed of the vagoo. At 101 miles 71 chains, Byup Coodoor, 3rd class bridge. The parapet walls are being completed. The roadway is 24 feet above the bed of the canal; the approaches are at an incline of 1 in 6, and almost impracticable for loaded bandies. The width of the roadway is 6 feet. Carts lightly loaded can be drawn over by hand with great exertion, but the passage with bullocks is dangerous.

The banks of the canal are generally in a neat state, and the tow-path formed, but soft.

104th to 109th Miles (both inclusive).—At 103 miles 29 chains, culvert with six 5-feet openings. The outlet requires opening out, as noted in a previous case. 104 miles 15 chains, a 2nd class bridge completed with approaches. At 105 miles 4 chains, a culvert of four 5-feet openings; the outlet too much confined. 106 miles 49 chains, an aqueduct, 5 spans of 8 feet; the masonry of this work is of inferior quality. 106 miles 58 chains, 2nd class bridge No. 19-A., completed; masonry very rough. 106 miles 72 chains, Nundial aqueduct, 22 vents of 10 feet span; this work was very leaky, and has recently been repaired: the masonry is of the same character as in other works noticed in the section. At 107 miles 79 chains is a culvert with three vents of 5 feet span. At 108 miles 9 chains, an irrigation sluice of 9 vents. At 108 miles 69 chains, a culvert of four 5-feet vents; and at 109 miles 9 chains, a 1st class bridge at Ayaloor with approaches. All these have been completed. When additions of masonry have been recently made, or when building is going on as at Byup Coodoor, the work last built is somewhat inferior to that of an earlier date, and more hastily put together.

110th and 111th Miles.—At 110 miles 13 chains, a culvert with one 8-feet vent; at 110 miles 19 chains, an irrigation sluice; and at 110 miles 22 chains, a 2nd class bridge with approaches. All completed. The banks and tow-path have been trimmed neatly to a proper section. The canal is generally in cutting.

112th and 113th Miles.—At 111 miles 39 chains, a culvert with four vents of 8 feet; at 111 miles 44 chains, an irrigation sluice; at 111 miles 61 chains, a 2nd class bridge with approaches. All completed. The banks and tow-path are in good form.

114th, 115th, and 116th Miles.—At 113 miles 40 chains a culvert of two vents of 10 feet. The outlet requires clearing, as the sill is below the level of the bed of the vagoo. 113 miles 56 chains Deepagoontla 1st class bridge completed. The upper portion of the masonry is more roughly built than the lower. The banks of the canal are neatly sloped and appear to be of full thickness, but the inner slope has bushes growing on it which should be rooted up.

General Remarks.—There is little to note in this section. The masonry works, with the exception of those at Jootoor, are comparatively few and unimportant, and the canal is generally more or less in cutting. The character of the masonry is the same as in the sections above. All the works sanctioned may be considered completed. The earthwork to outward appearance is generally in good condition; the banks are neatly trimmed, of full section, and the towpath formed; and, if the water is admitted with due caution, it is probable that there will be no failure. The approaches of the bridges have been made up, and the parapet walls of the 3rd class bridge lowered. There is only one lock in the section which is built in connection with the head works at Jootoor, and it will be fully completed by the 30th June.

The surplus discharge works have not been improved, but remain exactly in the same condition as before the floods of August 1870. The irrigation sluices are in all respects completed, and in readiness to deliver water when required. The cutting of the channel leading from the sluices has, in many cases, been suspended in accordance with the wishes of Government until a demand has been made by the villages for water.

In this section 29 miles of channel have been sanctioned for execution: 4 miles have been cut, commanding 1,800 acres of land.

8TH SECTION (116 MILES 69 CHAINS TO 143 MILES 25 CHAINS).

116*th Mile (continued).*—At 116 miles 69 chains a 2nd class bridge completed.

118*th and* 119*th Miles.*—At 117 miles 49 chains, a surplus calingulah with sluices for discharging surplus into the Koondaur river, a calingulah and inlet for passing irrigation supply round the lock, lock No. 1 with one 10 feet drop. All these works have been completed. The masonry is rubble coursed, some stones not exceeding 3 inches in thickness. The lock sills are fairly executed; the gates are hung and work easily. They are well made, much superior to those in the locks above. The valves and gear are in their places, their construction being uniform with that in locks already inspected. The racks carrying the balance weights require re-adjustment as they reach the stop before the valve is fully open. Other fittings are required to prevent the valves, when being lowered, from swinging off the guide and riding on the flange. The lower gates do not close sufficiently and require alteration. The canal banks are fairly trimmed and in good condition.

120*th Mile.*—At 119 miles 22 chains lock No. 2, one 10 feet drop, and 2nd class over-bridge completed. Calingulah and inlet. The masonry is the same as at No. 1, and the racks and valves require re-arrangement also. The gates are hung and work fairly. At 119 miles 72 chains lock No. 3 of one 10 feet drop, also calingulah and inlet and irrigation sluice of three vents all completed. The masonry as above. The gates do not fit well, and the valves and gear require alteration as noted before. The canal banks are of good section, trimmed, and the towpath formed.

121*st and* 122*nd Miles.*—The inside slope of the banks requires clearing of bushes. The canal bed is for a few yards too high and is being lowered. The banks are in good order.

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123*rd Mile.*—At 122 miles 7 chains lock No. 4 of one 10 feet drop. Calingulah and inlet, and 2nd class over-bridge, all completed. The remarks on lock No. 3 are applicable to this work. The canal banks are of good section and trimmed. At 123 miles 5 chains lock No. 5, one drop of 11½ feet, calingulah and inlet completed. Gates hung and valves and gear in their places. The upper gates work very stiffly. The remarks as to the masonry and gear of the locks above are also applicable here.

124*th and* 125*th Miles.*—At 124 miles 4 chains lock No. 6 of one 10 feet drop with calingulah and inlet as before and irrigation sluice on the right bank all completed. The gates are hung. Valves and gear require alteration as at lock No. 1. The canal banks require making. In some places coolies are at work.

At 124 miles 70 chains lock No. 7 with one 10 feet drop calingulah, inlet, 2nd class over-bridge, and irrigation sluice all completed. The gates fit fairly. Valves and gear in the same condition as before noted.

126*th Mile.*—At 125 miles 67 chains lock No. 8 with one 10 feet drop. Calingulah, inlet, irrigation sluice completed. Gates hung and valves and gear in their places. Re-adjustment required as at the other locks. The canal banks appear to be sound and of full section.

127*th Mile.*—At 127 miles 11 chains lock No. 9, with one drop of 11 feet, 2nd class over-bridge calingulah and inlet all completed. The gates work stiffly. The valves and gear require re-arrangement. The canal banks and towpath are in good order.

129*th*, 130*th, and* 131*st Miles.*—At 128 miles 35 chains lock No. 10 with one 10 feet drop and two irrigation sluices completed. The gates work easily. In other respects this work is in the same condition as No. 9 lock.

At 130 miles 50 chains lock No. 10A with one 8 feet drop and 2nd class over-bridge. The works and approaches are completed and the gates hung. The valves and gear require re-adjustment and some fittings as noted at the other locks.

132*nd and* 133*rd Miles.*—At 131 miles 64 chains is an irrigation sluice with shutters complete, and at 131 miles 29 chains a culvert. The canal banks continue in good condition.

134*th*, 135*th, and* 136*th Miles.*—At 133 miles 57 chains lock No. 11 with one 12½ feet drop and 2nd class over-bridge; all masonry completed. The lifting gear of the shutters has not been finally fitted. The foundation is on rock. The inner slope of the canal bank for some small distance has not been trimmed but for the greater portion of this mileage the earthwork is in good order.

At 135 miles 47 chains is a 2nd class bridge, with approaches, completed. The masonry is of better quality than usual.

137*th and* 138*th Miles.*—At 137 miles 1 chain is a 2nd class bridge, with approaches, completed. At 137 miles 69 chains lock No. 12 with one 13 feet drop. The gates are well made and fit fairly. The masonry is of better quality than has yet been observed in the locks. The lifting gear for the valves is in place, but not perfectly fitted. The canal banks immediately below the lock are in somewhat

rough condition, but throughout the greater part of this distance they have been neatly trimmed. The canal is generally more or less in cutting, and they are of strong section.

139*th and* 140*th Miles.*—At 138 miles 49 chains lock No. 13 with one 12½ feet drop. Foundations on rock, the masonry is equal in quality to that in No. 12. There is one overbridge with approaches, and an irrigation sluice also connected with an inlet below the lock; all the masonry and earthwork is completed, and the gates are hung, but the lifting gear to the valves requires to be properly fitted. The canal banks are in good order.

141*st and* 142*nd Miles.*—At 141 miles 70 chains lock No. 14 with one 12½ feet drop. The masonry is rough and not so good as in the two immediately above. There is an over-bridge of the 2nd class with approaches. The lifting gear to the sluice valves has not been permanently fitted. In other respects these works are completed. The canal bank and towpath are in good order, but loose and without grass.

143*rd and* 144*th Miles.*—At 143 miles 53 chains lock No. 15 with a drop of 12½ feet. This work is completed, and the valves and gear are in their places. The gates are hung. The canal banks are neatly trimmed and the towpath formed.

General Remarks.—There are 16 locks on this part of the canal, giving collectively a fall of 173 feet 6 inches to the bed of the Koondaur river. The masonry of all is completed and appears sound though not of a high class. The gates have all been hung and are in working order, but it is, of course, not improbable that some slight defects will show themselves when water is let in. The valves and lifting gear of all the sluices are in their places, but it cannot be said that they are in proper adjustment and some additional fittings are required to prevent the former from swaying off the bed of the guides. It should be remarked that the masonry in the 12th, 13th, and 15th locks is superior to that in other works in the section, all of which are completed.

The canal banks are throughout, or with very trifling exceptions, in excellent order; they have been neatly trimmed and the towpath formed and rammed. They present a very neat appearance, but unfortunately they are but little consolidated, and they must settle very considerably before they can be considered safe. The approaches of all the bridges are finished. Except at the head of the section there are no calingulahs for the discharge of surplus water. The canal is in a succession of still water reaches, that is to say, the bed has no fall between the locks. Water required for irrigation, which it is proposed to supply to a limited extent, is passed round each lock by means of a small calingulah above and an inlet below connected by a channel.

Sanction has been obtained for the excavation of 64 miles of irrigation channel, of which 23 miles are nearly completed, commanding 10,200 acres of land.

9TH SECTION, 143 MILES 25 CHAINS TO 178 MILES 40 CHAINS.

144*th Mile* (continued.)—At 143 miles 77 chains is a culvert No: 2 of three 5 feet openings. The banks are neatly shaped but soft.

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145*th Mile.*—At 144 miles 63 chains 2nd class bridge and approaches completed in fair masonry.

146*th Mile.*—At 145 miles 52 chains culvert No. 4; at 145 miles 62 chains lock No. 16, anicut across the Koondaur river, head-sluice, under-sluices, and supply branch of canal, constituting Rajoly head works.

The anicut is now perfectly sound, but the action of the river has been to tear up the rocky bed immediately below it, heaping up the fragments some 20 feet lower down. At present the result is the formation of a water cushion below the anicut crest, and it is possible that this will prevent the dislodgment of the rock from being carried so far as to endanger the foundations of the work which are exposed. On the other hand, repairs may become necessary. The only work remaining to be done is the raising of the masonry of the under-sluices eighteen inches, and this will be completed in a few days. The lock is in readiness for use. The canal at the sluice is in cutting in very bad soil, and it has been necessary to revet the slopes with rough-stone for a distance of ¾ of a mile.

147*th and* 148*th Miles.*—Near the head works the drainage water is led into the canal by means of small inlets. The earthwork and towpath are in a rough state.

At 147 miles 35 chains is a culvert of two spans of 12 feet. At 147 miles 70 chains Velala 2nd class bridge with approaches completed. The outer slope of the canal cutting is fairly trimmed, but the towpath is not formed and the soil is so bad that in rainy weather it would be almost impossible to make way. Above the bridge the lower bank of the canal has been cut down to a level of 2 feet above water to breach in case of flood.

149*th Mile.*—Canal partly in cutting; banks rough on the top but fairly trimmed on the inside. At 148 miles 32 chains is a culvert.

150*th*, 151*st*, 152*nd Miles.*—The soil of which the canal banks are composed is of the worst possible kind, and they are not consolidated. At 151 miles 64 chains the Vaikalair aqueduct carries the canal across the river of that name. This work appears to be in good order, but the banks near it are dangerous; they are said to have breached last year. As they have had water against them, probably they have improved. They are fairly trimmed.

153*rd*, 154*th*, 155*th*, and 156*th Miles.*—The following masonry works are noticed. At 153 miles 1 chain a 1st class bridge on the Cuddapah road with approaches completed. The masonry of the usual kind. At 153 miles 26 chains an aqueduct with 5 spans of 8 feet in good order. At 153 miles 22 chains a culvert with two 5 feet vents. At 155 miles 30 chains a 2nd class bridge and irrigation sluice. At 155 miles 77 chains there is a small culvert passing the water of an irrigation channel under the canal. The masonry is very leaky. At 156 miles 6 chains a culvert of 3 vents of 12 feet span. All these works are completed. The banks of the canal are in far better condition in this part of the section than near the head works. The soil is gravelly or mixed with kunkur and the earthwork is neatly trimmed.

157*th*, 158*th*, and 159*th Miles.*—At 156 miles 77 chains an irrigation sluice, the shutter not fitted. At 156 miles 78 chains a culvert. At 157 miles 26 chains an irrigation sluice. At 157 miles 40 chains a 2nd class bridge. At 158 miles

8 chains a culvert. The banks are neatly trimmed and sloped; the canal is mostly in cutting.

160*th mile.*—At 160 miles 21 chains an irrigation culvert. At 160 miles 25 chains Dhoor aqueduct with two 20 feet span, one used as a subway. The masonry appears sound though roughly put together. The banks on either side are formed of bad soil and they are not consolidated. They would hardly stand against a full head of water.

161*st and* 162*nd Miles.*—The canal is mostly in cutting and the banks are fairly trimmed. At 161 miles 40 chains there is a 1st class bridge with approaches completed.

163*rd to* 167*th Miles* (inclusive).—The banks and side cuttings of the canal are neatly sloped and present a good appearance, but the soil is of bad quality generally. In the 167th mile they were breached for two years successively, and the earthwork has been puddled and strengthened at the weak point. The following completed masonry works were noticed. At 162 miles 17 chains Dhoor irrigation sluice. At 162 miles 27 chains a culvert of one 12 feet span used as an under-passage. At 162 miles 30 chains a calingulah and scouring sluice with two vents. At 163 miles 12 chains an irrigation sluice of two vents. At 165 miles 25 chains Beempad irrigation sluice. 165 miles 40 chains a culvert and subway of three spans of 12 feet. In the roadway there was more than a foot of water. At 166 miles 32 chains a culvert of 4 vents each 9 feet span.

168*th Mile.*—The canal was breached last year by the Chintagoonta tank surplus water. The channel has now been diverted by a cut to the Bainapillay aqueduct. At 167 miles 16 chains is an irrigation sluice with shutters and gear completed.

169*th to* 171*st Miles* (inclusive).—The canal is generally more or less in cutting in fair soil. At the beginning of the 171st mile the banks are narrow at the top and too much rounded, otherwise they are in neat condition. Masonry works, as enumerated below, have been finished. At 168 miles 48 chains Bainapillay aqueduct with eight openings of 15 feet. At 169 miles 23 chains Peechapaud tank supply channel, culvert two vents of nine feet. At 169 miles 55 chains Peechapaud aqueduct with seven spans of 15 feet. The wing-walls are said to be somewhat leaky. At 169 miles 65 chains a calingulah 160 feet in length. All the masonry is sound though roughly built.

172*nd Mile.*—At 171 miles 30 chains, Yaitoor irrigation sluice of 10 vents is incomplete, the lifting gear stands have not been all built in. There is about three days' work to do. Also Maidkoor irrigation sluice at 171 miles 41 chains requires an addition of about 1½ feet of masonry at the top; a couple of days' work would complete it. At 171 miles 60 chains stands the 1st lock in the section. There is one drop of 8½ feet. The masonry is completed, the gates are hung, and the valves and gear of the sluices are in their places, but it is evident that the latter especially have been hastily put together, and they are by no means fully adjusted. The vents will be fitted with guiding stones or blocks to force the valves when they are about to close into their proper places and prevent them from swaying on to the projecting flange of the iron groove in which the rollers should work. In fact, the same arrangements should be made as have been proposed for the works

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in the upper sections, and the racks with balance weights require arrangement. The gates are well made and appear to fit fairly. The masonry is rough, but there are no settlements or cracks to be seen, the mortar, however, appears to have been a good deal washed out of the joints, so much so that in some places repointing is required; this would lead to the inference that the lime used was not very good. The banks of the canal are in good order.

173*rd and* 174*th Miles.*—At 172 miles 15 chains lock No. 2 with one 8½ feet drop. The racks belonging to the lifting gear of the emptying sluice valves have not yet been fitted. In other respects the condition of this work is generally the same as that of No. 1 lock. At 172 miles 61 chains lock No. 3 with one 10 feet drop. The upper gate on the east side will have to be rehung and the anchor refixed. When swung the masonry holding the anchor was torn away from its bed. The condition of the work is the same as No. 1 lock. The gates work very stiffly. The canal banks and towpath are in proper order. At 173 miles 32 chains is a culvert with two spans of five feet.

175*th Mile.*—At 174 miles 3 chains lock No. 4, one 12 feet drop. The masonry is completed and is of better quality than that at Nos. 1, 2, and 3. The gates are hung, but the upper pair do not fit properly, and, though the valves are placed in the guides, the gear for lifting them has not all been fixed. At 174 miles 75 chains lock No. 5 of one 10 feet drop. Masonry as at No. 4. The upper gates do not close well, and the gear for the valves requires adjustment. The banks and towpath are properly formed.

176*th to* 178*th Miles.*—At 175 miles 26 chains culvert with one 5 feet vent. At 176 miles 70 chains lock No. 6, one 10 feet drop. Masonry completed. The gates have been hung and work fairly. The valves are placed, but the lifting gear requires some more fitting. There is one over-bridge of the 2nd class with approaches completed.

178*th Mile.*—At 177 miles 34 chains, lock No. 7, one 8½ feet drop, masonry completed and appears sound. The gates are hung, but neither pair close properly. The lifting gear to the lower valves has not yet been fixed, but it is on the ground. The canal banks have been sloped and trimmed to a proper section.

General Remarks.—In the 1st mile below the Rajoly head works the earthwork is hardly in as finished a state as it might be, but throughout the remainder of the section the embankments are in fair form and of full dimensions, the canal bed is clear and the slopes neatly trimmed. The soil is however in many parts of exceedingly bad quality and not at all consolidated, and the banks will settle very considerably when water is admitted against them. There are not a few places where it seems almost certain that breaches would be made if a full supply were allowed to flow in. Great caution and watchfulness will be needed in working the irrigation supply in this section until all settlement has ceased. The top of the bank is only 3 feet above full water. All the masonry work has been completed except in some trifling instances, involving a few days' labour. The lock gates have been hung, and the sluice valves are in their places, but it cannot be said that all work in connection with these appurtenances is finished; on the contrary, there is hardly a single lock at which there is not something more to do in adjusting lifting gear, valves, or gates, and in some cases the gear has not been put up; certainly the

work to be done is, in each particular case, trifling in extent, but in the aggregate it amounts to something not inconsiderable. The bridge approaches have all been made up. In this as in all the other sections there has been no attempts to enlarge or improve the surplus discharge works. All the irrigation sluices in the canal banks have been built and the fittings still required for some of these may easily be supplied in a few days. As regards the irrigation channels, Government have sanctioned projects involving the cutting of 37 miles 60 chains of primary channel, of which 14 miles 60 chains have been completed, commanding, 8,600 acres.

10TH SECTION (179TH TO 189TH MILES).

179*th and* 180*th Miles.*—At 178 miles 52 chains lock No. 8, one 10 feet drop, and 2nd class over-bridge. The masonry all completed, and the gates hung, but the lifting gear is not fitted. The canal banks are very neatly trimmed, but they are soft. The high flood bank to the Pennair river commences at the lock on the west side of the canal.

182*nd Mile.*—At 181 miles 10 chains stands the Pennair tail lock, giving access to the river above the anicut. The masonry of this work has been completed except that part which is required to bed the wooden frames carrying the stands of the lifting gear. The gates are hung and fit fairly. The valves are placed, but the lifting gear is not fixed, and in fact some of it only arrived from Madras on the day on which the inspection was made. The quality of the masonry is good. The flood bank connecting the lock with the anicut wing-wall is completed and in good order. The whole of the anicut with the under-sluices is in a complete state and good repair, and the quality of the work is very good. The head-sluices are also completed in every respect and so is the head lock with the single exception of some fittings required for the lifting gear of the upper-sluice valves. There are no flood banks below the anicut, but they would seem to be necessary for the afflux caused by the anicut would probably not equal 18 inches in a high flood, and the water below would only be lower by that quantity which would leave the flood level considerably above the top of the existing canal bank on the east side.

182*nd and* 183*rd Miles.*—The canal is in cutting. The slopes are neatly cut. The water throughout the canal from the head-sluice on the Pennair to the Cuddapah terminus was on the average 1 foot 6 inches deep.

184*th Mile.*—The banks are trimmed and appear to be of proper dimensions, but they breached in two successive years with a small head of water. They have been puddled at the places in question. At 183 miles 51 chains is an aqueduct with seven spans of 30 feet crossing the Punkal wunkah. The work is completed, and there appeared to be no leakage worthy of notice.

185*th Mile.*—The small quantity of water now in the canal has had a considerable effect in the banks. In many places they are under cut by the wash, and they will require to be revetted.

186*th Mile.*—At 185 miles 48 chains culvert with one 10 feet vent and at 185 miles 55 chains a second with two 10 feet vents. At 186 miles 30 chains a 2nd class bridge and approaches and an irrigation sluice. All these are completed.

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187*th Mile.*—At 186 miles 69 chains an aqueduct of four spans of 10 feet, the masonry is of average quality. The face walls leak, but not to any serious extent. At the junction of the wing-wall with the earthwork, the earth has been cut away by the scour and it is being revetted to prevent a breach.

188*th and* 189*th Miles.*—The canal banks are cut by the water. They would hardly stand the wash caused by boats without considerable injury and frequent repairs. At 188 miles 8 chains, one 10 feet culvert and irrigation sluice (Mundla Pilly), completed. Also tail sluice with three vents of 4 feet square. The gear for the shutters is not yet fixed.

General Remarks.—The earthwork in the last section of the canal is very much in the same condition as in the portions above. The banks have been neatly trimmed, and they appear to be of proper height and section, but there is little appearance of consolidation and it seems very unlikely that they would throughout stand against a full head of water. There is very little appearance of grass which would protect the slopes, and those inside the canal are altogether too steep to be permanently maintained without revetment of some kind. They seem to yield at once to the lap of the water and fall in. All the masonry works will be completed by the end of the present month, as the quantity remaining to be done is very trifling. The lock gates are hung and work tolerably well and the valves of the sluices are placed, but there is still some gear to be fitted. All bridge approaches are made up. There are no surplus discharge works, properly so called, in the section. The irrigation sluices are all completed and fitted with shutters. Nine miles 57 chains of irrigation channel have been sanctioned for execution and seven miles 70 chains have been completed, commanding 3,788 acres.

(Signed) A. deC. SCOTT, Captain, R.E.,
Under Secy. to Government, P. W. D.

FORT ST. GEORGE,
6th July 1871.

From the Chief Engineer of the Madras Irrigation and Canal Company, to Captain A. deC. SCOTT, R. E., Under Secretary to Government, dated Lockonsula, 16th June 1871.

Testing Canal.

I HAVE the honour to acknowledge receipt of your letter, Kurnool, the 11th instant, and beg to reply as follows:—

2. Arrangements have been made for passing water down the canal as rapidly as possible after the admission of water at Soonkasoola, which, owing to my illness, took place on the 3rd of June, instead of the authorized date, which is the 1st June.

3. Arrangements have been made, or are making and will be complete by the time the water is down the canal, for hutting the requisite sluice-keepers and watchers for testing the canal to any height required. Further, the temporary arrangements described in the first part of paragraph 11 of Colonel Carpendale's letter, attached to G. O., 1,089, of 18th April 1871, have been made; also the banks where they are low, and may be breached without emptying the canal, have, in convenient places, been lowered to the lowest safe level, or are being so lowered, that is (see paragraph 11 of Consulting Engineer's letter attached to G. O., 3,195, of 15th October 1867,) they are being formed with a revetment to a height of 3 feet 6 inches above full water level; and the revetment is backed by an earth bank up to the same level; while the bulk of the bank in rear is reduced to 1 foot above water level. A hut is built close by, so that the bankers will see to the bank and will keep it secure. It will only be breached when it is breached by the bankers.

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4. I may add that the calingulah question will be put into the hands of Mr. Browning, I hope, within a month, in order that he may form working plans and estimates for calingulahs for the whole canal on the patterns approved in G. O., 1,089, of 18th April last, and on the principles approved in G. O., 1,505, of 2nd instant (unless these be modified as I have proposed in a recent letter written for submission to Captain Ryves before I read the last order). These plans and estimates will be submitted to the Government and the Board this autumn as early as possible.

5. In the absence of any instructions or positive order of Government or the Board to test the canal, I have not retained the staff necessary for testing the canal. In reply to your last paragraph I beg to submit the following remarks on the subject of testing :—

The advantages of testing seem to me to be—

(1.) To detect any weak places or cracks, burrows, etc., and so get them mended at once.

(2.) To detect any errors or omissions of the Engineers in the levels or measurements by which they have constructed the works.

(3.) When testing were completed and all necessary omissions made good, it may be that the ryots would be penetrated by confidence in the canal for the future.

It appears to me that these advantages are not of much value considering the known completeness of the works as a whole, and the loss of revenue which the experiments would probably cause and the cost of the experiments.

7. Any errors of level or omissions in the banks are known to be such as the staff of bankers alone may easily correct ; and *they* may also very well repair any cracks, leaks, etc., which occur in the banks while in ordinary use. The banks and many of the masonry works get stronger every year they are used, since the silt makes the earth in the banks, and at the junctions of banks with masonry, tighter and more secure yearly. Moreover, the canal was at first intended to be secure for current demand ; but not to be water-tight until it had been some time in use.

8. A more important question is that of how much calingulah power is advisable. But this is not a matter to be tried by filling the canal full. Government have (G. O., 1,505 of 2nd instant,) ruled that the calingulahs and sluices should suffice to discharge an inch of rain an hour. They do suffice for little over a quarter of this, but the deficiency may easily be made good before this time next year. It is manifestly prudent to wait till the calingulahs are complete, to whatever extent is agreed on, before filling the canal needlessly full.

9. The *most* important considerations are, however, those of staff and revenue.

10. The present conservancy staff will have full occupation on the canal until the water is, down the whole length to a depth of 5 feet or so, required for probable demands. *Every* available man will then need to be put on distribution for clearing out old channels, arranging field channels seeing that the water actually flows in all directions over the country, and repairing or preventing petty damage to the distributing works. I find that the Engineers will be engaged in July very much with examining and making over stores, office records of the state of the works, and the finances, and such work requiring great care and time. In August they will have to be incessantly in the field away from the canal, if there is to be any irrigation worth speaking of ; all their men have to be taught and trained, and the wishes of the villagers have to be ascertained and consulted as to every field and village requiring channels ; any channels not complete by the 1st September will be too late. All has to be done with a staff completely new to the work, if we except the practice got in July and the first week in August last year. As I have before said, I think caution as appropriate as for a railway first opened under a staff strange to their work, the skill required and risk run is at least as great in the case of a banker or sluice-keeper as in that of a pointsman or platelayer or crossing-keeper.

11. The knowledge that the canal is under test would cause all ryots, unless they possessed wells, to wait till the test is over before they commenced sowing wet crop, and would cause all who were doubtful of the result to sow dry crop at once before the sowing time for the first dry crop is over.

12. To wait until after the sowing and test in October would hardly be fair, unless the ryots were authoritatively forewarned that their crops would be submitted to that risk.

13. These most important objections do not apply if the testing be carried out after the 31st December. There is generally ample water during the months of January, and there is always enough at that time for testing all the portions of canal constructed for navigation only.

14. I am not disposed to object to any test which is within the means possessed by the Company, and does not in any way touch the security or interests of the ryots in irrigation.

No. 472. ORDER THEREON, 27th July 1871, No. 1,975.

IRRIGATION, No. 26.

THE above Report confirms the opinion which the Government have for some time held as to what would probably be the condition of the Madras Irrigation and Canal Company's works on the 30th June 1871, namely :—that although a good deal remains to be done to bring the works in even their outward aspect to a finished state, yet, in a general sense, the Main Canal and works, excepting those of distribution, may be considered finished in accordance with the sanctioned plans. But the state of completion falls far short of that contemplated by the 11th Article of the supplemental Agreement dated 2nd October 1866, and of what would be understood by the expressions satisfactorily completed, and placed in working order.

2. It appears that in some portions of the Main Canal the earthen banks have not been satisfactorily formed ; that there is a general absence of consolidation throughout ; and that their satisfactory appearance from neat superficial trimming and finish is delusive ; that in other portions the banks are formed of bad soil, and, being loosely thrown up and at random, are further deficient in the protection that a covering of grass would afford ; and that it seems certain that with a full canal the banks would breach at many points.

3. It is also observed that water in larger or smaller quantity passes through all the walls which take the place of earthen banks in certain places, and that nothing short of a full supply of water could determine the question of their stability.

4. It also appears that the Chief Engineer has taken measures to prevent the water in the canal rising beyond a fixed height, that height being much below the level of the canal when full, and to ensure, that if the canal should breach, it will do so in the most favourable localities. These precautions are precisely what the Government in G. O., No. 1,089, dated 18th April 1871, prescribed as admissible only in the case of an incomplete canal, and altogether unsuitable in connection with a work that is supposed to be complete in itself ; and the fact of the Company's Chief Engineer considering it necessary to adopt such measures is, in the opinion of the Government, the strongest evidence that the Company deem the undertaking deficient in its most essential particulars.

5. No definite information appears to have been obtainable as to the area that will be irrigated this year ; but, from inquiries made by the Collectors of Cuddapah and Kurnool, it is gathered that, in the event of the Main Canal carrying water throughout the season without breaching, it is possible that an extent of 8,883 acres might be irrigated, in which case the total revenue for the year would be Rupees 43,974. The Government cannot say that they have any confident

expectation that this hope will be realized, and the amount is so insignificant as a return for an expenditure of capital and interest thereon aggregating more than two millions sterling, besides being less than half what is required for annual outlay on maintenance or conservancy, that they cannot acquiesce in the propriety of the Company's proceedings in deferring, or more correctly speaking dispensing with, that test which the Government in the strongest terms prescribed the necessity for, and which has been dispensed with on the pretext that it would alarm the ryots and injuriously affect the prospects of irrigation.

6. The test which the Government approved of, and which is nothing more than the canal was designed for and was expected to be capable of sustaining, was that a depth of nine feet of water above bed should be maintained for 24 hours, and that for thirty days consecutively the canal should carry a full irrigation supply. In Captain Scott's opinion the embankments and walls would fail at many points if subjected to such a trial, and as the Company's Engineers have made provision for the canal breaching in the event of the water rising more than *six feet*, it must be presumed that they share the apprehensions of the Government officers who have reported on the subject.

7. Captain Scott's Report will be communicated to the Secretary of State, and to the Government of India, who will at the same time be informed that the canal has not been properly completed and placed in working order to the satisfaction of this Government.

(True Extract.)

(Signed) J. CARPENDALE, Colonel, R.E.,

Secretary to Government.

No. 473. DOCKET No. 1,976, dated 27th July 1871.

COPY of the above forwarded to the Government of India, in continuation letter No. 1,960, dated 26th July 1871.

(True Extract.)

Colonel, R.E.,

Secretary to Government.

Exd. E. C. Shunker.

Cuddapah 6th July 1871.

From

Captain Rundell Scott R.E.

Under Secretary to Government P.W.D.

To

Colonel J. Carpendale R.E.

Secretary to Government P.W.D.

Sir,

I have the honor to inform you that in obedience to the orders of Government quoted in the margin, I inspected the main canal and works of the Madras Irrigation and Canal Company from Sairkeralu to Cuddapah between the 4th and 27th June, and beg to report as follows on the questions referred to me in my instructions.

2. An examination of the mileage notes and general remarks on each section appended hereto, will show in detail the state of the canal at every point. It will be gathered that the earthwork in the first three sections that is from the 1st to the 115 mile is not altogether satisfactorily formed, and that some labour is still required to bring the banks and towpath into

Rc. 1443. 26th May 1871.

Rc. 1444. 26th May 1871.

into fair order. In the 1st and 5th Sections or up to the 3rd mile a considerable improvement is noted, while in the remaining portions of the canal, but especially in the 7th and 8th Sections, as far as external appearance is concerned, there is generally nothing further to be desired. The bed of the canal is clear of obstructions, the side slopes generally trimmed, and the embankments are of the regulated height, of full section, with tow path formed to a proper width. Unfortunately there is almost universal absence of consolidation in the embankments throughout the whole length of the canal, so that their satisfactory appearance is to a great extent delusive. Great exertions have been made by the Engineer in charge in laying fresh soil and trimming the slopes, and a very great amount of work has been done but the banks are generally formed in bad soil, and they have been thrown up loosely and at random, and are for the most part bare of grass. When water is brought into the canal they will settle very considerably and they will be guttered by rain, and the cost of maintaining and making them up annually will necessarily for several years be very great.

great. Until these precautions will be necessary to use great caution and to admit water very gradually and only to a small height during the year. It was found that with a full canal they would breach at many points. The walls used principally in the 2 Section as substitutes for earthen embankments, have been raised to a height of 3½ feet above water level, and they appear to be in good repair. In some cases a puddle trunk has been laid at the toe where especially leaky and the rubble backing has been added to. Water passes more or less through all and nothing but the test of a full supply in the canal can determine the question of their safety. There is no doubt that there are now many weak points, and that under the natural process of settling up in the hollows when they are built has gone on for a long time, there will always be danger of failures taking place.

3. All the breaches which were made in the banks or walls last year have been repaired in accordance with the same general plans, but the earthwork backing to the new wall closing the Hendry breach has slightly

slightly disrepair since it was laid. The general unsatisfactory state of the canal at that part therefore point has been noted in the mileage observations appended.

4. The masonry works are, it may be said completed, as the trifling amount of building remaining to be done in two or three instances, could be finished in a very few days. The character of the work is generally rough and some portions recently completed very much so, though it usually appears to be in a sound state it is probable that frequent repairs will be necessary and the cost of maintenance considerable. All the lock gates have been hung, and the valves for the sluices are in their places, but this is not always the case with the letting gear, and at almost every lock some small additional fittings are required, and some further adjustments are necessary to place them in proper working order. On at the time of inspection there was no water in the canal where the locks are placed, there was no means of actually filling and testing them, and no decided opinion can be pronounced as to their stability under working conditions, until this has been done.

5. The approaches to the bridges and the roadways are all made up, and except in one single instance the parapet walls of the 3 class bridges have been lowered to allow of the yokes of ploughs being drawn across them. In the case alluded to the order for the alteration was given by the Chief Engineer and accidentally overlooked.

6. Notwithstanding that throughout the length of the canal there are now a few points where there is still something to be done to bring the works over in the completed state, still on the whole and in general sense the canal with its appurtenances may be considered to be completed in accordance with the sanctioned plans for its excavation throughout to its full dimensions the banks and walls are raised to full height and section and the masonry works are constructed and in a state to deal with the water when it is admitted.

7. The question of improving the surplus discharge works in the first four sections of the canal is reported on in the Consulting Engineer's letter to Government No 131 dated 6 March and order thereon No 1099 of the 8th April 1871, approving of the reconstruction of culvert No 13 in the 2 Section and giving discretionary power

power to the company's officers to decide how improvements in the other calingulahs should be carried out. In accordance with the sanction thus given calingulah No. 13 has been rebuilt its crest being placed at a level 5 feet above the normal bed of the canal and planks are provided to close each bay to a further height of three feet. With the exception all the surplus discharge works remain in the same condition they were in before the floods of August 1870, which demonstrated the insufficiency of the means of escape provided for flood water, having as their inherent state of the canal walls and embankments.

The Chief Engineer of the company has however taken certain measures tending to prevent the water from rising to an excessive height and to ensure that breaches should occur in the most favourable localities if breaching is really necessary. He has raised or removed the shutters at the sluices in the calingulahs and has laid in front of the centre earthen banks to a height six feet above canal bed level and at intervals generally where the canal is in cutting to a depth of four feet he has lowered the earth bank to a height of 10 feet above bed level, the intention being that where the water rises to a height greater than 6 feet the calingulah sluices should be opened by the breaching of the bank in front of them, and that if any further and dangerous rising of the water should occur, the banks at the selected places should be cut and allowed to breach, after the ground would act as a natural calingulah and retain a supply of water for irrigation. In their order above quoted Government have observed that such measures as have just been described are only admissible in the case of an incomplete canal, but not otherwise; and the fact that the Chief Engineer has considered it necessary for the safety of the work to adopt them is evidence that it is in an incomplete state in respect of one of its most important parts.

8. The distribution works sanctioned by Government for the land under each section of the canal are in a more or less advanced state. All the sluices in the main canal have been built, and though a number of them were not provided with shutters and some were without lifting gear when inspected, these deficiencies will shortly be made good. The following abstract statement shows the

the length of the irrigation channels sanctioned and executed in each section with the acreage commanded and which can therefore be readily supplied with water on a demand being made by the ryots.

No of Section	Irrigation Channels Length from Head		Amount of land now commanded
	Miles.	Miles.	Acres.
1	14·00	14·00	1386
2	14·00	14·00	1956
3	26·14	26·14	9857
4	63·44	63·44	25000
5	26·16	23·04	9000
6	95·56	20·00	20000
7	25·40		
8	64·00	27·00	12000
9	37·60	14·60	8600
10	12·00	7·87	3788
Total	377·31	216·09	91567

As a rule it is the main distributing channel which have been excavated and the heads of the subsidiary channels are not marked out or provided with masonry outlets but temporary arrangements can easily be made to regulate the supply. The excavation of such channels has been seeked in accordance with the recommendation of the Consulting Engineer in his letter No 129 of the 17 November 1870, approved by Government under

formal

formal application has been made by the village people.

9. I have found it impossible to obtain such definite information on the subject of the area which will probably be irrigated this year, as would enable any very reliable estimate to be made of the revenue which will be collected. The ryots are as a rule exceedingly unwilling to make formal application for water and appear to be under the impression that they will commit themselves to payment if they do so even if the supply should fail, and it is a fact that applications are not made. In some places they request the Company's Engineers to give them water, but do not apparently understand how to make their applications through the proper channel. Such a change as is involved in the habits of the people by the introduction through a perpetual grant in lieu of dry cultivation will take place gradually. Special measures of encouragement will be necessary and they must acquire that confidence in the permanence of the supply of water which only to preserve in the canal for two or three seasons without disaster can give them before they will make to any great extent those changes in their agricultural plant and processes which will be necessary. In order to obtain some data on

on which to found an estimate of the area of irrigated land and prospective revenue from the canal during their season just commencing, and in default of the receipt of regular application for water, the Collectors of the Hurnool and Cuddapah districts have caused enquiries to be made in the villages under the Canal as to the intentions of the land holders and the extent to which they purpose to irrigate. This is the only way in which any estimate can be made and it is necessarily a very vague one. I questioned the Deputy Collectors of each district as to the results of their enquiries and these officers admitted that any returns made must be considered mere approximations, and that the ryots are not at present very ready to come forwards with their demands for water. I also obtained from them such statements as they had been able to compile of the probable extent of land which would be taken up in the event of the canal holding water for a complete season. An abstract of these is given below and an estimate of revenue based thereon.

District	Taluq	Village on Canal from mile	Village on Canal to mile	Irrigable cultivation acres	Total
Hurnool	Ramallakota	1st	2d	940	
	Nundikotkur	23d	1st	3725	
	Nundial	87th	109th	624	
	Serwell	110th	123d	1913	
	Kailkoontla	124th	130th	681	7883
Cuddapah		148th	159th	1000	1000
				Grand Total	8883

The villages are not given in the original statement & the mileage is only approximate.

Revenue.

8883 acres. 1st crop at 4 Rupees 35532

2221 — 2d — 2 — 4442

Hurnool water supply — 4000

Total estimated revenue for 1871-72 Rs 43974

The area irrigated last season was 1516 acres. The increase calculated on that season is therefore acres 7367 and it is not probable that it will exceed the estimate, nor that it is more likely to fall short of it.

10. On my arrival at Hurnool I addressed a letter to the Company's Chief Engineer directing his attention to the Government order (quoted in the margin) approving of the leasing

C. O. No. 1089 - 18
April 1871.

of the canal and detailing the nature of the test which should be deemed sufficient to establish the fact of it being in working order, and I requested him to inform me what arrangements he had made for carrying the wishes of Government into effect. I am now in receipt of Mr. Graham's reply dated 16th June 1871 a spended to this report (in original) it appears that he has made no arrangements of the kind required, and he also states that in the absence of positive orders of Government for the testing he has not retained the staff necessary to carry it out.

The Chief Engineer further deprecates the applications of the test on the ground that it would alarm the ryots, and injuriously affect the prospects of irrigation, and he appears to suggest that it should be postponed till the end of the season.

A careful inspection of the embankments and walls of the canal has convinced me that they would fail at many points of subjected now to the test proposed which is that the canal should be kept running for 24 hours with 9 feet of water in it or one foot above the present calingulah crests, and that it should carry for thirty days consecutively a full irrigation supply.

Under these circumstances and seeing that in the event of any disasters to the works the loss must eventually fall on Government but for no other reason I think it would be advisable to postpone the testing provided the company's Agents are willing to admit without qualification that the canal &c cannot retain the water which it was designed to carry.

In conclusion I beg to state that I have received from the Engineers of the company every assistance in carrying out my inspection and in obtaining all necessary information.

I have the honor to be,

Sir,

Your most obedient servant

A. Scott

Captain R.E.

Under Secretary to Government

P.W.D.

Mileage Rates on the Works of the Madras Irrigation and Canal Company

1st to 27th June 1871.

1st Section (1st to 17½ Miles)

Head works – The river was flowing over the crest of the Kombavala Anicut to a depth of 9 inches at the time the head works were inspected and the condition of the Reservoir could not be ascertained. The Engineer in charge to be impressed with the necessity of repair all defects having been made good during the preceding dry season. The under sluices were fitted with stone sunk appeared to be in good order. The shutters which are balanced on a vertical pivot are rather roughly fitted and they are generally difficult to work. The water was flowing through the head sluices into the canal which had a depth of 5½ feet. The shutters of these sluices are raised by tackle and the only means of lowering them is by driving them down with blows of a plank or beam. They should therefore be ringed with iron. The apron and side walls of the sluices on the canal side have been repaired and a water cushion has been formed by building a low wall
across

across the Canal between the side walls
at a distance of about 70 feet from the
Cutwaters of the sluice; the intermediate
space being floored with rough stone and
concrete. The wall for a length of about
10 feet on each side, where it abuts against
the side walls is raised 6 inches higher
than the middle portion, diminishing up
the outflow of the sides and protecting
the walls from scour. The arrangement
appears to be effectual & the front of the
sluices is tolerably free from silt.

1st Mile - The spoil banks are roughly
formed and the tow path is in course of
placement well defined. The Engineer
in charge states that the works generally
have been engaged in trimming the Earthwork
in the next mile and have not yet
taken up the path reserve &c.

2 Mile. The self acting shutters in the
Culvert are badly fitted and would
admit flood waters from the river into
the Canal. This defect was noticed in
the Consulting Engineer's Inspection
Report of the 17th November 1870. A Culvert at
1 Mile 72 Chains has been abandoned
and blocked up; the drainage water
being admitted into the Canal instead.
The Earthwork and tow path are in the
same condition as in the 1st Mile.

3 Miles - Culverts Nos 7 and 8 and a drain
beyond
beyond are this mile have been abandoned
and the Canal water is permitted to stand
back on the upper side of 2 Mile
30 Chains in a 2 Class bridge of which
the approaches have been fairly formed.
The Earthwork generally is irregularly
made up the towpath has been
recently pitched and trimmed but for a
considerable distance it is placed too
low, and will be flooded when the Canal
is full. The side long slopes to the path
are roughly pitched & is too steep an angle.
There is a "marked zalingulab" at 2 mile
76 Chains, i.e. a wall built in the line
of embankment and covered with Earth
formed to the ordinary Section. The
crest of the wall is 2 ft below the level of the
bed of the Canal, which would therefore
empty itself if the Earthworks were
breached or cut designedly. There would
therefore be little advantage gained.
The wall should be raised to 4 feet above
bed level so as to retain some moderate
supply of water.

4th Mile - No 1 Breach made in the bank
last year by flood has been efficiently
repaired the Earthworks being brought up
to the regular Section. No 9 Culvert having
been found quite insufficient to carry
off the drainage water an inlet wall has
been built across the upper end to admit
the surplus into the Canal. There
are some irregularities in the form of the
Canal

For a distance of 30 Chains the embankment has been thrown back from the edge of the cutting from 40 to 50 feet leaving a berm two or three feet below the level of the canal water when it is full and the towpath is laid on the top of the Embankment. Practically under these circumstances would be difficult. The Earthwork in this mile is better formed than in the aforesaid adjacent lengths solid but the towpath progressive flattening

5th Mile — At 5 miles 40 Chains a packing point has been left at each end of the 5 miles to the general alignment of the Canal Bank Embankments for a distance of 30 feet and 3 feet is completed to Bank level to towing. The embankment for a length of 50 feet has been lowered to a height of 10 feet above Canal bed level at a selected point to breach in the event of heavy floods. The Earthwork is in fair condition and the tow path clear.

6 Mile — The sluice shutters of the 12 Ft Diameter Culvert at 5 miles 3 Chains have been removed and an Earthen bank has been laid in front of the vents to a height of 6 feet above the bed level with a view to its breaching and leaving the vents free should a flood occur. A similar arrangement has been made or is in progress at all the Culverts in this section except at 7-7. The water in the Canal stands at present 2·85 feet deep at this point. The Embankment of the Canal Embankments at

at the Upper Bank will be raised to the level of the top of the Earthwork, viz at present 4 feet below it. The brick Culverts Nos 2 and 3 of last year in the bend of this Bank at 5·15 and 5·62 are in the course of being made good. At 5·63 stands a Bridge. Some repairs to the Bridge the approaches are completed. The Embankment of the Canal is generally fairly consolidated as far as can be judged from the outside appearance there were a few leaky places but they have recently been puddled. The towpath is in serviceable condition.

7th Mile — At 2 miles 27 Chains with 2 feet given as water in the Canal it was noticed that a considerable leak had commenced it will require immediate attention. At 2 miles 60 Chains the Embankment has been lowered in the 6th Mile. The Bank towpath are in the same condition as in the preceding mile.

8th Mile — The banks are in good form and the towpath in a serviceable condition.

9th Mile — At 8 miles 17 Chains the Embankment has been lowered for a length of 100 feet as described above. At 8 miles 49 Chains a substantial masonry irrigation sluice has been built as sanctioned in Government Order No 3468 dated 28th October 1869. At 8 miles 60 Chains there is an inlet with sluice shutters and underneath an Culvert and Railway combined all of which are in a very leaky condition. Streams of discoloured water are finding out of the Culvert walls of the Tunnel. It is feared that the Canal above was scoured out last year and

and the hole in the bank of the 11th mile Canal wall was filled up with dry puddle and stones instead of spreading the added clay. The master in this locality to be asked to give the necessary remedial directions as more necessary. The banks and towpaths are in fair condition.

10th Miles at 9 Miles 1 Chain and 9 Miles 60 Chains the banks breached last year have been rebuilt and all properly prepared and they are throughout these miles in generally good form as also the towpath.

12th Mile - At Calinguelabe Nos 5 and 6 the apron is thrown stone laid dry have been partly carried away & will be repaired at 11 Miles 20 Chains is a Cast bridge the parapet wall of which have been lowered in accordance with the notice of Government. They stand at 2 feet 3 inches above the roadway. The approaches at the either parapet are in practicable for vehicles although probably the banks are generally fairly made up and appear to be solid underneath. The towpath is level on the top and is in tolerably good order.

13th Mile the apron of Calinguelah No 7 is partly washed away, as is the Cast bridge at 13 Miles 3 Chains. Have lowered the parapet walls lowered but the approaches at either point are very steep (in b) the embankments and towpath are in fair condition.

The

11th and 15 Miles - the banks were generally in good order the towpath requires mending &c.

16th Mile - The Cast bridge at 15 Miles 21 Chains has been altered & prepared to its parapet walls - the approaches of the upper part are steep.

17th Mile - The canal is overbreken & cutting in this mile and the towpath is lost along the edge, it requires clearing in some places.

General Remarks - The banks and towpath in that mile require forming and at many places in the cutting it will be found necessary in order to ensure easy towage to trim and remove portions of the canal sides which are irregular - the contractor to pay for the damage of the banks that may be done in so doing - in places where it will be found necessary to abandon the canal to admit the drainage operations to proceed. All the irrigation sluices which have been constructed but the shelters for the most part have not been provided or have been destroyed by the natives however these will be supplied & erected once the approach to the Calinguelabe are out of the water to withstand any considerable discharge over the crests of the weirs and they have given way in several instances and notably at No 8. Lately instead of packing the stone protection to the banks and pitching it at right angles to the slope it

has

has been thrown loosely down and in some cases in excessive quantity - Except in the 1st and 17th Mile where the Canal is for the most part in Cutting the banks are in fair form and consolidated on the outside but as is admitted that the Earth was originally thrown in at hap hazard, without ramming or laying in layers and as it is generally of very bad quality little confidence can be placed in them.

All the irrigation Channels and the waste channel for the 1st Section have been completed - the excommunication about 1386 acres of land.

2nd Section - (18th to 35th Mile)

18th Mile (Sindry Aqueducts) The side walls of the Aqueducts have been raised to a height of 2½ feet above the floor in inches at one the level of the water when the Canal is full, the wings and the face walls to the Embankments is continuation of the Wings to 2½ feet above water level - the Earth backing has however not been raised and stands 2 feet below the tops of the wall. The Abutments of the Aqueducts stand out the foot of the long slope of the river bank and the space between the back of the abutment and the tops of the banks inclosed at the sides by face walls and Embankment has not been filled up all the depth

of the water when the Canal is full will vary from 8 feet at the summit of the bank to some thing like 20 feet behind the abutment and even more it is considerable. Under these pressure three banks exhibit themselves one at the East of the South abutment at the head of the Sindry river one at the face of the west wing wall on the same side of the river and the third (only observed a few days ago) at the foot of the Embankment on west side - the Chief Engineer has commenced throwing in earth at the back of the abutments and in front of the face walls opposite the leaks last mentioned - the settling of the bottom caused by the Canal water will soon greatly no doubt stop all leakage and the process should be encouraged if possible - the large breach on the lower side of the canal just below the Aqueducts have been repaired and have also been ascertained in accordance with the decision sanctioned by Government of the foundation of all the face walls sit their proper level and which also underlies the embankments and forms the bed of the river bank - there has been a slight slip in the Earth work at the wall built to close the breach and in the space within the embankment has silted up considerably all these works will give cause for anxiety - Except at the west wall the face wall had slipped forward for a distance of

1000 feet. This has been rebuilt & the foundations are on hand & the

12th Mile. At 18 Miles 14 Chains the towpath becomes the summit of the bank & descends to a berm, the Canal being in cutting round up to the 1st Class Bridge at 18 Miles 31 Chains. The spoil encroaches on the berm which is here narrow and encumbered with stones. The approaches of the bridge are completed. At 18 Miles 72 Chains Stands No 10 Cabingelah. Above 100 feet in width is left here in hand of the work, towards which he is encroached

20th Mile. At 19 Miles 17 Chains is the end of No 11. Cabingelah. The towage is broken up & for a short length it is left to the tow path. The berm is here of great width & is left to the spoil bank above. The spoil bank has been graded for about 19 Miles 30 Chains & Coarse rubble stone for about 6 Chains is here laid. The berm has not been trimmed & requires attention.

21st Mile. The bank & towpath are fairly formed. At 20 miles 25 Chains the berm is found with about 2 feet 9 inches of water in the Canal above. Here has been a small leak. At 20 Miles 72 Chains there is also a small leak.

22nd Mile. At 21 Miles 23 Chains the bank is broken up. At 21 miles 48 Chains in front of No 12 Cabingelah the towage is begun to the rock ground up to the creek bed for a width of 100 feet. The banks & towpath are in other respects in fair order.

23rd Mile. The banks are fairly formed and trimmed but soft. From 22 miles 19½ Chains to 22 miles 47½ Chains is a wall in lieu of bank

a bank with earth backing. Then a bank with earth backing. Then a bank with earth backing. Then

stone-ried occasionally produced a wet footpath
in front which leaks. The banking or puddling
for towpath is left 2 feet below the top
27th Mile. The lower side of the canal is
formed partly by wall and partly by banks
of earth. The former have been rebuilt with new
in the present two miles, the latter have
been per dotted in front further high.
28th Mile. The canal at the Bradon bridge
cuts through a rock able and the towpath
has for a short distance not been properly
formed. At 29 miles 50 Chains, A breach in
a high wall has been efficiently repaired
puddle bank with a layer of shingle being
laid in front and a pebble facing behind
the wall which have been rebuilt. The old
of 2 feet below full canal level, the
new portion have been raised to the full
The puddling and shingling have been con
continued along the old wall. The banks and
towpath are there in tolerably
good condition.
29th Mile. Banks and towpath are in bad
order.
30, 31 and 32 Miles. At 30 miles 20 Chains is a
2 Class bridge very well built, the approaches
also formed. The banks are in good repair
but appear lonely laid, the towpath is in
serviceable condition and also the pavement
the banks where high have been generally
puddled in front and are protected by
the ordinary up to 2 feet above water level with
rough stone pitched and packed closely thereon

General Remarks. The general expression

made

made by me in inspecting the works of the 2nd
Section is not a favorable one, but the peculiar
manner in which the Canal has been laid
in use as to prevent waters when the Canal is
frequently standing full behind the present
level — the Embankments will necessarily
be subjected to the pressure of bodies of water
of considerable depth when the Canal is running
even half full, and there is much ground
for believing that the work throughout is
not of sufficiently good quality. Where an
opportunity has been afforded of examining
the interior of the Embankment, where it has
been lowered to be reached, decayed or decaying
it has been found — and that may and
probably will be the case with a considerable
part of the whole — and the higher the embankments
shall be raised, the greater will be the
risk which would accrue to the Canal —
in a manner on which they appear to have
forfeited the general confidence of the Public
Against any progress to the walls it may be
said, that they have generally undergone a
change which would scarcely be considered
excessive if proper regard for what they
were designed and the work when executed
to arise by a series of years it is believed
several of them are of inferior quality. Neither
have they been strengthened to any material
extent since their disastrous failure last
year — seeing that the only alteration carried
out has been the raising of the towpath
to 3 ft. 6 in. above the full water line of the
canal and a trifling addition in some cases
to the puddle backing behind, with puddling
at the toe — in which the leakage had been
excessive. All the walls have received addition

Some

have been made to these arches the leakage was greatly [illegible] still it is probable that the stability of many under a full head of water is very doubtful.

The other masonry works such as bridges, culverts &c are complete and in good repair but the [illegible] built in many cases of inferior kind of stone & under if failure do not occur repairs will be frequently necessary.

All the bridges made to last year's line have been repaired & the bridges and approaches have been completed. The temporary wall of the 3 class bridges being lowered & wing walls with the earth of embankment to slope have been taken to improve the compleat discharge under the bridges. The towpath is generally fair formed but there are various obstructions along the sides of the Canal proceeding in the mileage observation which must be removed.

All the Irrigation sluices are complete for this Section have been completed and also the irrigation channels conveying a length of 11½ miles these Commands 1956 acres of ground.

3rd Section (33rd to 60th Mile)

33rd Mile – The embankments are formed of stiff clay and are high ground rising at slight slopes they are narrow, requiring a backing of earth. They are puddled along the front face.

34th Mile – At 53 links 29 Chains a 2nd class bridge was erected over the line of the Canal which was destroyed by flood. The bridge is complete with its approaches but these are not connected with the road which passed through the tunnel, a distance of a mile distant. The embankments are in fair order and of considerably stronger section than those in the previous mile. No 15 Caligula is banked with earth in front of the sluices the shutters being removed.

35th and 36th Mile – The canal is for the most part in cutting. The spoil is irregularly formed but the towpath is clear. A berm is left between the banks on which is the earth from the canal cutting this is unnecessary and is [illegible] an impediment as it is generally 5 feet below full water level.

All the bridges requiring repairs necessary in consequence of last year's flood have been completed. Beyond the 36th mile the bank is lowered for 200 feet to be raised if required.

37th Mile – The towpath in some places is not made use of the summit which is very soft. The sides of the embankments and the wing bridges are left in a very rough state.

38th & 39th Miles – From 37 miles 2 Chains to 37 miles 33 Chains is a cone wall of the old towpath that is to say not finished in front. At 27 miles 33 Chains a Caligula has been built. The banks are formed of gravel soil and are of strong section but the 38th one

[illegible] and has fallen out in places [illegible]

10th Mile – At 39 Chains is a 3 Class bridge the width is 2 feet in the clear the parapet walls have been lowered and the approaches are completed. The foundation for loaded landing At 39 Chains is a retaining wall No 11 the step is 2½ feet above full under base Otherwise both locking 2 feet lower.

11th Mile – At 40 Chains is a breastwork wall with pebble locking – The foundation the wall is 1.2" above full water level At parapet wall 2' 6" high with protecting Coping is laid at the side of the [illegible] arrangement is objectionable as the Coping would probably cover the lower rope. At 40 Chains 47 Chains is a Cabin gable. 1219 – The embankments are made of good soil and are with the tow path generally in good form.

12th Mile – At 41 Miles 31 Chains to 41st 58 Chains there is a wall in lieu of bank without backing for half its length sloped as in back mile the level of the top is not accurately known and it may require raising – In the wall is a sluice of 6 Vents, the shutters are removed and an earthen bank thrown up in front to break when the water rises to level – The Southern half of the wall is leaky and has been backed with pebbles At 41 Miles 57 Chains to 41 Miles 62 Chains is another wall backed with pebble [illegible]

[illegible] the banks and towpath are generally in good condition.

13th Mile – At 42 Miles 14 Chains is a Village and 2 Class bridge – The approaches of the bridge are finished. The banks here are protected by stone thrown loosely down giving a rough uneven surface – At 42 Miles 28 Chains the irrigation sluices have been built of 6 vents closed by shutters worked by differential pulleys and arranged with a common hand to close them. The sluice is not perfect in order and is under repair – The banks and towpath are in good repair.

14th Mile – At 42 Miles 34 Chains is a 3 Class bridge, the approaches are completed and parapet walls lowered. The canal is [illegible] and the Rivolo of Maddigatta which village lies immediately under it has on their petition been allotted a waste for this village. There has however been no yet no sluice or yielding in the embankment. It is protected on the inner slope with stone slabs & schistose rock loosely thrown. This is insufficient and would be protected by displaced by the wash of the waters in windy weather.

15th Mile At 43 Miles 17 Chains is a scouring sluice of 6 Vents the shutters worked with screws – There is an Earthen bank in front, to be 6 feet above bed line [illegible]

and if is proposed to take up the stone there
as and allow the bank to be used as at
other places. Above Brierley bridge the
embankment is lowered to 6 feet 6 inches
above the ordinary water level, the inside
of the earthwork as seen in this cutting
is not consolidated it is formed of
fragments of shale mixed with earth, loose
and full of interstices. At this mile 29
chains is a considerable thin out full in
bed and leading along the interior of the
embankment of the Stagston bank and in
this mile. Of its considerable depth the
the bank seems solid and of fair work
but it is badly protected from the
shingling as it is called, with pieces of
slatey stone thrown up and down
over the slope. The canal banks and
towpaths are neatly made up.

General Remarks. The Earthwork of the
Section of the Canal presents generally
a better appearance than that in the
2. Section. The embankments in the first
portion from the 33 to the 35th Mile, where
the canal skirts the hill side which
slopes rapidly, is exceptionally high and
appears to have been originally heavily
thrown up, there Section is slightly
the additional Earthwork now being laid
on them is simply thrown from the top
without benching the old work or removing
grass

of it is probable that they will require
considerable additions to render them
safe. The lower portions of the Canal
in the Section are frequently in cutting
and the soil is of fair quality. At certain
points the banks have a rather un-
finished ~~look~~ but generally
they have been trimmed and there
is a fair way on the top. Wherever the
interior of the Earthwork is exposed by
cuttings it seems however to be loose and
dry and until they have been thoroughly
situated by the water standing against
them and have fully settled, their stability
under pressure is doubtful. The treatment
or future protection to the banks varies in
quality. The system adopted of shingling
or spreading stone irregularly on the slopes
may answer in the portions of the Canal
where the water does not spread but where
banks are formed it is believed to be
insufficient. There are but few walls in
this part of the Canal and where they have
been constructed the depth of water against
them will not be considerable. Nevertheless
they are generally leaky.

All the sanctioned Masonry works have
been completed the quality of the work
that is to say rubble of a low class
and the same as in the other Sections. The
parapet walls of the 3rd class bridges have
been lowered and the approaches of all
completed. The breaches in the upper banks

at

of the Willow aqueduct have been repaired.
The waterway of the Bridge behind Civ is insufficient and it is proposed to lower the side wall of the aqueduct on the upper side which would admit the water in excess of that passed through the tunnel into the canal C— — — —
The surplus discharge works of the section remain in the same condition as they were in last year. The shutters of the sluices will however be removed and their place supplied by stir the[illegible] paved to 6 feet above bed level in the other sections. All the shutters and lifting gear to the sluices in the 1st 2nd and 3rd sections will require renewal and fitted. The piles of the screw for lifting the shutters of the Calingueh sluices is very small and it takes two men from 25 minutes to half an hour to raise each.
The irrigation sluices in the 3rd section have been completed and all the irrigation channels sanctioned.

4th Section – 55 Miles 33 Chains to 61 Miles 30 Chains.
46th & 47th Miles – At 46 Miles 63 Chains, Nagulur 1st class bridge. The approaches are completed. The banks and towpath are in good condition.
45th & 46th Miles – The banks appear to be solid and well formed but too much rounded and are well formed but too much rounded at the slope for a towpath. There are some bushes on the inside slope which require removal. The inner slope is shingled.
50th Mile – The canal forms a water spread. The embankment is formed of good soil and

and lies in good form. The slope is protected by shingling. All the sluices besides the Calingueh No. 1 are in good repair. The approaches to the bridges are completed.
51st to 52nd Miles. The banks are generally in good shape and appearance to [illegible] shows no signs of weakness. The soil is of good quality. The cutting of the canal is neatly executed.
54th Mile – The canal forms a water spread. Piggadiel Tank of the 3rd section is generally in good order but has sunk in the line of the Vagoo in the bottom.
55th Mile – A subway and drainage under 15 feet wide at Piggadiel Village bank is in good repair.
56th & 57th Miles – The Canal spreads, the Tank bank is repaired at the lower part and shingled above, the towpath is slightly higher, the parapet wall is 2 feet 6 inches. The embankment has had water running into it to within 2 feet of full supply level.
58th & 59th Miles – Canal banks in good order. At 58 Miles 11 Chains is a Calingueh sluice. The shutter and gear of the sluice are badly fitted, the former missing. An earthen bank throws out in front of the
60th & 61st Miles – At 59 Miles 12 Chains is a 3 Class bridge. The approaches are completed but the parapet walls have not been lowered in accordance with the

Orders

orders of Government. The Canal at the
end of this mile forms the Junction
Bank. The Embankment is of full section
and in good order, finished and the
Slopes pitched in 1869 and the towing
path spread & gravelled with
ballast & gravel. About 20 Chains
from the termination of the pitching and
the lower side is an Escape Culvert
formed of the only available stone
water of this description. The Canal
narrowed to the width of the Canal. The
junction of widening or lowering the
Cut of the Culvert and Aqueduct
the Approaches have to be considered.
At the end of 61 Miles is a Culvert and
Subway & Footside.

62 Mile. The canal bank in some parts
is leaky and the soil in different. At
61 Miles 70 Chains the 5th Section ends.

General Remarks. In the 4th Section
generally there is a considerable
mixture in the appearance of the Canal
Embankments starting, owing to the Puddle
that the soil is of better quality. Where
however the Canal passes valleys and
depressions and forms projecting slopes
of them of considerable depth, which is
the case occasionally in the section it is
not unlikely that failures will occur.
The Embankments to these banks are

Generally

generally of full dimensions and they have been kept in good repair but there is reason to suppose that where at other places they have not been carefully thrown up. They are for the most part of full width at base and are formed into a four path, six feet wide. The Masonry works are all completed but the lifting pier of the Canal Shutters, a continuous rough block together, the Shutters themselves where of wood are of slight construction and the piers in front of the Culverts & Aqueduct in the portions of the Culverts & Shutters in the 3rd Section. The approaches of all the bridges have been completed but the parapet wall of the 3rd Class bridges has not been lowered.

The surplus discharging weirs remain in the same condition as they were in last year but the Chief Engineer has taken the precautions during this and in the upper sections of raising & repairing all the Shutters of the Culverts & Aqueducts and has thrown up earthen banks in front of the Weirs calculated to keep back when the Canal water gives a lower depth. The banks of the Canal are also lowered at intervals to a level 10 feet above that of the proper bed with the intention of allowing it to break at selected places should an exceptional flood

flood

Flow Accounts

All the irrigation sluices contained for this Section have been completed and most of them are filled with shutters and casting screens containing cover however these are withheld in the meadow

Sanction has been obtained for the meadow of 63 Miles of irrigation channels of these 62 Miles have been completed containing 24,000 acres of irrigable land

5th Section — 62 Miles 70 chains to 63 Miles 57 chains

63 Mile — The top of the bank in this mile is often too narrow rounded and unsuitable for traffic, scattered above the back slope. At the end of this mile is a tank & culvert in good working order.

64th & 65th Miles — The banks require considerable repair at the top but are generally trimmed to a fair slope. In the 65th mile is a tank & culvert and one irrigation sluice of which latter the gear has not been fitted. The Serra d'Pilla 2 Class bridge has been completed with its approaches.

66th Mile The Serra d'Pilla Aqueduct is in this mile. The masonry remains to be pointed and there are no cracks or settlement. No shrubs are to be

30

the bed of the canal it could not be determined whether the work was watertight or not but nothing has been done to stop the leaks noticed in the inspection report of the Consulting Engineer dated 17th November 1870. The double banks from the Village of Serra d'Pilla to and beyond the aqueduct are in a hollow formed of very bad stone heaps and all together would retain the depth of water against them will be considerable and they appear to be low there has been a slight slip inwards near the aqueduct on the upper side. The Chief Engineer will have the heights ascertained and raise them where required. Beyond the valley crossed by the aqueduct the embankments are very narrow and only from 4 feet above the water line.

67th Mile — The embankments are in much the same condition as in the previous mile, but the soil is better. An irrigation sluice of six vents has been built, but the gear is not fitted.

68th & 69th Miles — The canal is partly in cutting in red gravelly soil, the sides are considerably guttered, the towpath has not been formed, and the banks are in a rough state, bushes growing on the inside slope and top and the summit very narrow and rounded, unfit for traffic.

70th Mile — For some distance the banks are formed

formed of bad soil and loam, cracked
considerably, they are overgrown with
bushes and the top is in many places
caved in. Stretches of 10 feet span the this
mile there are 2 pairs of scarcely noticing
yard the Earthwork and Culverts many
staff have been engaged on the mile generally.

71st Mile— The banks have been cleared of
bushes and the towpath have been formed,
for a small distance there is an irrigation
sluices of which the scarcely each filled.
The bank generally require forming, at
the top.

72, 73 & 74th Miles— The Pennyschack 2nd class.
bridge is completed with approaches.
The banks and towpath are in fair order.
Canalpallas sluices for overflow are
are completed, the masonry is sound
but not of high quality. The shutter and
lifting gear are very roughly put together
and the pitch of the screw very small.
It would probably take two men 3
hours to open all the sluices of which
there are six.

75th Mile— A 1st class bridge stands in
the heavy cutting in rock in the mile.
which takes the canal through the water
shed separating the drainage basin
of the Kinchah river from that of the
Pennaar. The bridge has been completed
for some years and is in good repair.
The cutting is completed and the bed and
towpath of the canal are cleared of rocks.

The

37

The 5th Section ends at 79th Miles 57 Chains.

General Remarks— Throughout a consi-
derable portion of this section of the canal
the soil is of good quality and this partly
in putting so that the stability of the
banks is beyond suspicion but they are
often overgrown with bushes, occasionally
cut and gathered by natives, or poached by
the cattle used for a great part of their length
drainage at the top, which is very little for
more or less compact but not carried
notice from the mileage observations
and especially near the Peroyaticlay
acqueous of the earth of which they are
formed is of a very hard texture and stan-
should fail when they should be stand
at the full place under full supply
of water. The masonry works sanctioned
are all completed and though it cannot
be said that this class of work is by skilled
it appears sound and there are no
signs of failure.

The bridges to the 3rd class culverts
are made with and are in good order. The
surplus discharge works are in the
same condition as in the other sections
already noticed with earthen banks
and no lining, and in front of the
calculated sluices.

All the masonry works of the irriga-
sluices have been completed but most of
them have not been supplied with the lifting
gear for the shutters.

Government

Steam power has been obtained for this section the execution of 2 branches of irrigation Channels of which 25 miles have been completed & commanding 9000 acres of land.

6th Section 7 miles 67 Chains to 93 Miles 25 Chains 75 Links. The first lock in the canal stands at the end of this mile it regulates the level of the water in the upper and lower reaches, the depth in the latter being reduced from 9 to 6 feet. The masonry is of fair quality, but the sills to the gates are somewhat rough & uneven the gates are mostly well fitted and require packing. The sluices and valves for filling and emptying the lock Chamber are in working order, the latter are of wood, revolving shutters. Below the lock the canal is reduced in width to 90 feet to 50 feet at the tail and has a sluice above the lock to discharge surplus water coming down the other reaches into the Canal. There is also a hand sluice for regulating the supply passing down the canal. The shutters & all these are worked by screws with cut thread giving about 1" rise to a revolution and they are far superior to

to those in the upper reaches which render the opening and closing of Locks a very tedious operation.

76th 77th 78th Miles. The canal is carried on rocky ground, principally shale, the bed being generally coinciding with that of the ground. The banks are fairly trimmed, but overgrown with bushes for the first 2 miles. They have generally been formed with a Core of puddle and sods supported on either side by shale and soil mixed, though protected by stakes in some places, they ought to stand the moderate quantity of water which will be required to fill the Canal to the proposed depth of 6 feet. Doubtless however within will be considerable loss of water through subsoil leakage through fissures in the rock. The towpath is in fair order but the earth on it is soft and loose. Two 10 feet Culverts, a double Culvert with two 10 feet spans and a 10 feet Clapbridge have been completed. The latter requires repointing.

79th 80th Miles. The canal is puddled in bushes and the banks otherwise in the same state as in the previous three miles. There is a 10 feet Culvert in the 80th Mile used also as a subway.

81st Mile. A sluice of 3 vents stands at the head of the Soorabeela irrigation channel which takes off in this mile. The shutters and lifting gear have not been fitted

fitted. The channel is 5¼ miles in length with 2½ feet fall per mile and at its head is 26 feet wide at the bottom with 3½ feet depth of water at full supply level. No land has yet been irrigated from it. Lock No 2 at 80 miles 58 chains has two 10 feet drops and an overbridge. It is complete. The masonry appears to be of fair quality the foundations are on rock as also the floor of the lock chamber. The valves of the filling sluices are of iron, revolving platteau and are in good working order. Those of the emptying sluices are also of iron working vertically on friction rollers the gear consisting of a double pack and pinion with a counterpoise attached to one pack. This is the pattern adopted for all emptying sluices in the locks in below and as at present fitted is not without defects. The gear requires rearrangement as there are at present no stops to prevent the pack with the counterpoise working through and ungearing itself. The alteration is a trifling one and will readily be made. It has been recommended by the Chief Engineer. The shutter works in angle iron guides and is not properly kept in its place. The rollers therefore are apt to ride on the top of the flange instead of inside it. Some additional fittings are required and will it is understood be supplied. The method of attaching the guides to the masonry is a weak one.

The gates are pretty generally adjusted and require painting.

At 80 miles 70 Chains Lock No 2A - Rise 10 feet 6 inches. The filling sluices are worked with iron shutters raised or lowered by rack and pinion actions & counterpoises. The shutters & guides and the arrangement has the defects noticed in regard to the sluices of the lock above.

The emptying sluices have shutters and gear of the same pattern as No 2 and the same remarks with the gates are being but require painting. The masonry is of the same class as No 2. The banks and towpath in this mile are fairly trimmed but appear to be loose and soft.

82 mile - At 81 miles 20 Chains Lock No 3 of one 7 feet drop and 12 feet culvert. Some changes required also as to sluices. The shutters and gear at the emptying and filling sluices are of the same pattern as those at similar parts of Lock No 2A and the same observations are applicable. The masonry is of fair quality. The gates are not caulked and work rather stiffly they may require some adjustment. The canal banks beyond the locks are somewhat unfinished and grass & weeds are growing in the beds.

83 Mile - The canal banks are formed as

had soil but are of strong stiff clay and
trimmed neatly. At 82 Miles 44 Chains
No 11 Lock, lift 10 feet 10 inches and has 12
feet Culvert for drainage and 2 Class
Passage under. The masonry is of the
same quality, the pointing is also
to those in Locks above. The arrangements
for working the Sluices are the same as
on the Locks above and require no alteration
as before noted. The Lock Gates are strong
and shut with a fair degree of closeness.
The foundations and bottom of the Lock
Chamber are on rock.
83rd Miles. The banks of the Canal are
trimmed and the Towpath formed. At
83 Miles 30 Chains a double Lock with
two 10 feet drops. The Chamber has a
Concrete floor. The masonry is of fair
quality and the Sills well cut. The Shutters
and lifting gear are the same as above
and require adjustment. The Gates require
caulking. They appear to be well hung.
85th Mile — At 84 miles 44 Chains Lock No 13 with
one 10 feet drop. The foundations are on rock
which also forms the floor of the Lock Chamber.
The machinery &c as for the Sluices and the
Gates are in the same condition as in the last
Lock. The Masonry appears to be sound,
the Sills are well built, though the stones
are rather thin. The Gates are all hung
work easily. Under this Lock are three 15 feet
Culverts for drainage and a 2 Class Passage of the
2 Class of 12 feet span.

The

The canal banks are formed of a different
soil but are of a fairly thick and of proper
section
At 85 Miles 44 Chains Lock No 12
Two 9 feet drops. The Lock and its arrange-
ments are in the same condition generally
as on the former ones. One will require
dressing as it is not known the Gates should
be caulked.
There is a 2 Class Passage of 12 feet Span
under the Lock.
At 85 Miles 72 Chains we pass the fourth
screw Span of 12 feet Completed and in good Order.
The canal banks are trimmed and the
towpath formed but the soil is very loose
88th & 89th Miles. At 87 Miles 12 Chains is a
Class Bridge with two Spans of 20 feet and one
of 10 feet. The Approaches are completed. At
87 Miles 62 Chains a Culvert of two 12 feet
Spans. The Passage is now in tolerable
good order and was thrown open some considerable
time ago.
90th Mile — At 89 Miles 37 Chains Lock No 8 with
two feet drops and 2 Class over bridge. The
Masonry has been completed, the Gates
are hung and the Valves and Gearing fixed
The Mill of the
lower Chamber at the tail, and requires a little
dressing to fit the Gates. The Masonry is of
rough quality but it appears outwardly
sound. The lifting gear is precisely similar
to that of the Locks above and requires ad-
justment and additional fittings of the
same kind as noticed above. The Canal
banks above and below are trimmed to

proper

93 Mile – Ch 97 Water Level Lock No 11
One 10 feet chase and 2 Chase under bridge. The
inside generally in a complete state. The
Gates remaining but not caulked. The sills
are fairly built. The Masonry of the usual
Chase roughly built of small stones but
otherwise sound. The values and Lifting
Gear in their places. The Approaches of the
bridge completed.

Lock No 12 at 92 Miles 30 Chains. One 10 feet
9 inches drop. This work is in the same
Condition as the last. The lower Gates do
not appear to close well.

General Remarks – This section contains
a number of important works in the shape
of locks of which there are fourteen giving a
fall collectively of 190 feet 9 inches from the
watershed separating the Kentish and
Romain systems of drainage to the bed of
the Canterbury. Hereto details of this section
there are the same and exist in respect of
certain trifling alterations or additions
noted in the mileage observations, they
may be considered complete. The masonry
noted in the section generally cannot be
considered anything but inferior as it is
composed of small stones some of them
not exceeding 3 inches in thickness and the
joints within the face of the works are large
even in the cases where the masons were
seen at work did it appear that much
attention was paid to bond. Until the
locks are filled and tested under a full
head of water for some time it would be
difficult

In respect to the Approaches of the Bridges
have been completed. On this mile is a
Culvert recently built with two ranges of 7 10
feet openings.

91 Mile – Ch 90 miles 3 Chains. No 12 Lock
two 8 feet drops. This work is completed.
The upper chamber floors are sound, and
half the long Flounder of the same, the
other being on natural Rock. The sill
at the tail end of the upper Chamber requires
dressing. The Gates have not yet been caulked
they are being overhauled. The balance
Beds and Sewerage in the same condition as
they were in the Locks above. The Canal Banks
are fairly straight and the toil of passage
generally. Ch 90 miles 18 Chains Lock No 13
One 8 feet drop. This Culvert with three
openings of 15 feet for drainage and under
passage. The Locks Gates are taken up
well built. The floor is paved on a bed of
Kunker. The values and Gear are filled.
but require Nuts and Spindles as in other
cases. The Masonry is completed. The Gates
being but not caulked.

92 Miles – Ch 91 Miles 38 Chains Lock No 10.
Two 10 feet drops. The work is completed
as in the previous case except that it
requires filling as noted in other cases. The
Chamber is floored in concrete. The banks
are trimmed to proper section but soft
and they have never had any quantity
of water against them. There are numerous
holes and cracks to be seen.

93 Miles

difficult to pronounce a decided opinion
as to their stability. The gates are roughly
made but work well when caulked and
altered as experience shows to be necessary
they will work satisfactorily.

The farms regards outwards & upwards
the canal banks are generally speaking
complete and satisfactory, where they are
not so they are being attended to.
The towpath is found to be full width. Hay
has however never been stacked by the proprietors
in order to save the expense of making that
which is to fill the canal and they appear
to be loosely formed so that they appear
doubtful whether with added slopes and
trial on the ground be subjected to be the
sides of the canal.

The masonry works and bridges with their approaches
including bridges with their approaches
have been completed. There are no
flash bridges and no cast iron plates.

Of rigid and distributing works 80¾
miles of irrigation channels and 18 miles
of drainage have been sanctioned and 27
miles executed commanding 12,000
acres of land.

About 50 miles of main channels
are included in the 80 sanctioned.

7 Mention

Mention of Bridges to be by Chairman

Mr Bridges and Headmasters Annual
Report of masonry work still required to the
principal of masonry work still required to the
bridges. Inside walls of the regulating lock
chamber to be pointed and a little cutting to lower
the bed of the canal in front of the lock. The
side walls to be completed.
The bridges appear to be completed.
The bridges generally and the foundation the
masonry in the canal generally are
in the most substantial manner. The
the locks will require of better construction
Chester stone. The gates are caulked
joined & chisseled. The gear for the
sluices of the underhead sluices has been
fitted and is ready for use. The doors
appear however to work easily and the raising
and lowering of the shutters will be a tedious
process. The shutters do not fit closely to the
grooves of the head of the sluices being kept
open by the rich gravel which has not been
cleared away into the masonry. Some wooden
fillings will be added to close the apertures
Attention will be directed to the main inlet to the
canal Headcourse over the river Weaver. The
piers of the lock and head sluices have been
completed. The whole of the Masonry
appears

appears to be in good repair and free from
cracks and vigour of original settlement.

94 Mile - at 93 Miles 70 Chains is a close
bridge of the usual pattern. The approaches have been
completed the canal is in working and the
slopes and two paths are in fair order.

95, 96 and 97 Miles - at 95 Miles 2 Chains
is an inlet on the offside with a sluice
about 5 feet above the country. A considerable
quantity of land will be flooded by the
standing water. At 95 Mile 17 Chains a close bridge
at 96 Mile 70 Chains is an irrigation sluice of 5 vents
calculated to deliver 10000 Cubic feet per hour.
The banks and two paths are neatly trimmed.

98 and 99 Miles - At 97 mile 1 Chains culvert
No. 5. At 97 Mile 26 Chains, Calingulak No. 6
with a sluice of 5 vents filled with English made
pipes. The piers of the Calingulak are unnecessar-
-ily thick and contract the waterway. The
banks beyond have been cut down to 8 feet above
bed level for a length of 350 feet as a preliminary
measure. At 97 miles 53 Chains a close bridge
at the approaches are completed. The
waterway is roughly here. At 98 miles 19 Chains
an irrigation sluice and at 98 miles 45 Chains
a syphon culvert of 5 feet span have been built.
The banks and slopes are in good condition and
the

the two paths have been made up
100 and 101 Miles - At 99 mile 20 Chains Calingu-
-lak No. 7 with sluice of 5 vents filled with
Portland pipes as above. The waterway is roughly
At 99 miles 79 Chains sluice At 100 miles 25 Chains
a close bridge completed with approaches. At
100 miles 32 Chains a culvert of two spans. At 101
miles 3 Chains an irrigation sluice completed.
The canal banks and two paths are in good order.

102 and 103 Miles At 101 miles 13 Chains culvert
No. 10 A two 5 feet vents waterway under the
towing-bank of the canal at the 102 mile has
become choked, the earth is loosely laid
in recently excavated waterway. At 101 mile 50
Chains a syphon culvert of one 5 feet vent
should be opened to cleared and the ground
about it opened up from the side which is behind the
slope up from the side which is behind the
bed of the bypass. At 102 miles 1 Chains Bypass
Culvert No. 1 close bridge. The parapet walls
are being rebuilt. The roadway is 24 feet
above the bed of the canal. The approaches are
in fair order. The canal banks have been trimmed almost throughout
a fair distance. The width of the
water level is 90 feet, the width of the
towing-path 20 feet, the width of the
channel 60 feet. The earthwork is loosely laid
in the passage with hurdles in dangerous
places. The channels of the canal are generally in a good
state of repair. The towing-path is in fair

104 to

104 to 109 Miles – (both inclusive) At 103 miles 29 chains culvert with six feet opening. The outlet requires opening and is noted in a previous case. 104 miles 15 chains 2 close bridges completed with approaches. At 105 miles 51 chains a culvert of four 5 feet openings. The outlet too much confined. 106 miles 49 chains an aqueduct line of plan of 8 feet the masonry of this work is of inferior quality. 106 miles 68 chains 2 close bridges No 19 & 20 completed. Masonry very rough. 107 miles 72 chains a culvert requires cleaning two waste weirs 8 feet of plan which will require very heavy work to be repaired. The masonry is of the same character as in other works noticed in the section. At 107 miles 79 chains an aqueduct of 8 feet plan. At 108 miles 9 chains an irrigation sluice of nine inches. At 108 miles 69 chains a culvert of four 6 feet waste and at 109 miles 9 chains a close bridge. At Agalawatte with approaches. All these have been completed. Other additions of masonry have been recently made or where building is going on. As the Bye wash Cadoan, the work has not been carried somewhat superior to that on either side and more hastily put together.

110 and 111 Miles – At 110 miles 22 chains a culvert with 6 feet waste. At 110 miles 69 chains an irrigation sluice and at 110 miles 72 chains a close bridge with approaches all completed. The banks and two paths have been commenced nearly to a proper section. The canal is generally in cutting.

112 and 113 Miles – At 111 miles 39 chains a culvert with four waste of 8 feet. At 111 miles 51 chains an irrigation sluice. At 111 miles 61 chains a close bridge with approaches all completed. The banks and two path are completed. The masonry good form.

114, 115, 116 miles – At 113 miles 40 chains a culvert of two waste of 10 feet. The outlet requires clearing as the sill is below the level of the bed of the lagoon. 113 miles 56 chains a close bridge completed. The approaches to the bridge with the upper portion of the masonry is more roughly finished than the lower. The banks of the canal are neatly sloped and appear to be of full thickness but the inner slope has broken away on which should be noted up.

General remarks – There is little to note in this section. The masonry works with the exception of the above portion are comparatively free and unimportant and the canal is generally more or less in cutting. The character of the masonry is the same as in the sections above.

All

All the works remain as they were reported on May 31st. The canal is completed. The earthwork towpath is generally in good condition, the banks are neatly trimmed of rubbish and the towpath formed and if the water is admitted with due caution it is probable that there will be no failure. The approaches of the bridges have been made up and the parapet walls of the 3 locks bridge lowered. There is only one lock in the section which is built in connection with the headwalls ab Footer and it will be fully completed by the 30th June.

The surplus discharge works remain as they were reported but remain exactly in the same condition as before the floods of August 1850. The waste weirs and in all respects completed and in readiness to deliver water when required. The cutting of the channel leading from the sluices has as many cases been suspended in accordance with the wishes of Government until a demand has been made by the villages for water.

On the section 29 miles 7 chains 50 links have been undertaken by contract with Richard Ross Cunningham for 1800 acres of land

Sections

Miles. Ch. 116.69 to 117.25.

8th Section

116 mile (continued) at 116 miles 69 chains a 2nd class bridge completed

118 mile 70 chains — at 117 miles 49 chains the

[illegible] with the [illegible] discharging surplus water to the Koondooloo River, a Paligulah and inlet for supplying irrigation supply round stock, lock 121 with these works have been completed. The masonry is suitable executed, the stones not exceeding 3 inches in thickness. The locks will be fully executed the gates are strong and well made, they are well made, the locks above. The valves and gearing [illegible] are complete, the [illegible] being inserted in the headwalls [illegible] inspected [illegible] the [illegible] before the culverts [illegible] fully open. Other fittings are required to prevent the valves when being lowered from [illegible] the sluice and the [illegible] the gauge. The lower gates do not close sufficiently and require alterations the [illegible] are fairly trimmed and in good condition.

120 Miles 119 miles 2 chains [illegible] bridge completed

Paligulah

Caliguilah and inlet. The gates are heavy & the same as at No 1 and the packs and valves require re-arrangement also. The gates are heavy and work faulty. At 119 miles 2 chains Lock No 8 of one 10 feet drop also Caliguilah and inlet. Bridge & irrigation channels of 2 route all completed. The masonry as above. The gates do not fit well and the valves and gear require alteration & repair. The canal banks are in good section trimmed and the towpath gravelled.

124 and 122 Miles - The inside slope of the bank requires clearing of brushes. The canal bed is for a few yards too high and is being lowered. The banks are in good order.

123 Mile - At 122 miles 7 chains Lock No 9 of one 10 feet drop Caliguilah and inlet & Clapp over bridge all completed. The towpath and Lock No 9 are applicable to the work. The canal banks are in good section and trimmed.

At 122 miles 5 chains Lock No 10 of one 10 feet Caliguilah and inlet & Clapp bridge all completed. The gates hung and valves and gear in their places. The upper gates work very stiff. The remarks as to the masonry and gear of the locks above are also applicable here.

124 and 125 Miles - At 124 miles 4 chains Lock No 6 of one 10 feet drop with Caliguilah and inlet as before and irrigation channel on the right bank all completed. The gates are hung, valves and gear require alteration as at Lock No 8.

The canal banks require making to the same section as at Lock No 8 and the towpath gravelled.

At 124 miles 6 chains Lock No 7 of one 10 feet drop Caliguilah and inlet & Clapp over bridge Caliguilah and inlet & Clapp bridge all completed. The gates hung, irrigation channels all completed. The gates require alteration & repair as before mentioned.

126 Mile - At 125 miles by chains Lock No 8 of one 10 feet drop Caliguilah inlet & irrigation channels all completed. The gates hung, valves and gear require readjustment & repair as before mentioned. The canal banks appear as the other locks. The towpath is in good order to this length of 11 miles.

127 Mile - At 126 miles 2 chains Lock No 9 of one 10 feet drop Caliguilah and inlet & Clapp over bridge all completed. The gates hung, irrigation channels all completed. The gates require readjustment & repair as before mentioned. The towpath is in good order.

128 and 129 Miles - At 128 miles 3 chains Lock No 10 of one 10 feet drop Caliguilah and inlet & Clapp bridge all completed. The gates hung, irrigation channels all completed. The gates require readjustment & repair as before mentioned. The towpath is in good order.

130 and 131 Miles - At 128 miles 3 chains Lock No 11 of one 10 feet drop and the irrigation channels complete. The gates work badly. The valves and gear require the same attention as the other locks. The towpath is in good order.

At 130 miles 7 chains Lock No 12 with one 9 feet lift & 50 chains long side pond. The work and gates of the lock are complete and the gates hung. The valves and gear require readjustment and same settings as noted at the other locks.

132 and 133 miles - At 131 miles 6 chains to an irrigation

irrigation sluice with shutter complete and at 131 mile 29 chains a culvert. The canal banks continue in good condition.

134, 135 and 136 miles - At 133 mile 67 Chains Lock No 8 Rock with 12½ feet drop and 2 C.S. over bridge all masonry completed. The lifting gear of the shutter has not been finally fitted. The foundation is on rock. The sides of the canal banks for some considerable distance has not been trimmed but for the greater portion of the mileage the earthwork is in good order.

At 135 mile 41 chains is a 2 class bridge with approaches completed. The masonry is of better quality than usual.

137 and 138 Miles - At 137 miles 7 chains is a 2 class bridge with approaches completed. At 137 mile 69 Chains Lock No 12 with and 13 feet drop. The gates are well made and fit neatly. The masonry is of better quality than usual. The lifting gear for the waiver is in place but not yet fitted. The canal banks immediately below the locks are in somewhat rough condition but throughout the greater part of the distance they have been neatly trimmed. The canal is generally more or less in cutting and they are of strong section.

139 and 140 Miles - At 138 miles 49 Chains Lock

Lock No 13 with one 12½ feet drop. Foundations on rock, the masonry is equal in quality to that in No 12. There is one over bridge with approaches, and an irrigation sluice above connected with and right below the lock, all the masonry and earthwork is completed, and the gates are hung but the lifting gear to the latter requires to be properly fitted.

The canal banks are in good order.

141 and 142 Miles - At 141 miles 70 Chains Lock No 14 with one 12½ feet drop. The masonry is rough and not so good as in the two immediately above. There is an over bridge of the 2nd class with approaches. The lifting gear to the waiver has not been permanently fitted. In other respects these works are completed. The canal banks, and towpath are in good order but loose and without grass.

143 and 144 Miles - At 143 miles 53 Chains Lock No 15 with a drop of 19½ feet. The work is completed, and the waiver and gear are in their places. The gates are hung. The canal banks are neatly trimmed and the towpath formed.

General Remarks - There are 16 locks on the part of the canal giving collectively a fall of 173 feet 6 inches to the bed of the Soundaur River. The masonry of

gate will be completed and repaired second. They are not of a high class. The gates have all been hung and are in working order, but it is of course most improbable that some slight defects will show themselves when the water is let in. The valves and lifting gear of all the sluices are in their places but it cannot be said that they are in proper adjustment and some additional fittings are required to prevent the former from swaying off the bed of the gates. It should be remarked that the masonry in the 12th, 13th and 15th locks is superior to that in other works in the section all of which are completed.

The canal banks are throughout or with very trifling exceptions in excellent order. They have been neatly trimmed and the towpath formed and rammed. They present a very neat appearance but unfortunately they are but little consolidated and they must settle very considerably before they can be considered safe. The approaches of all the bridges are finished. Except at the head of the section there are no caliguelahs for the discharge of surplus water. The canal is in a succession of still water reaches that is to say the bed has no fall between the locks. Water required for irrigation which it is proposed to supply to a limited extent is passed round each lock by means of a small caliguelah above and an inlet below connected by a channel.

gate on the east side will have to be relaced and the anchor re-fixed, the existing the masonry holding the anchor was torn away from its bed. The condition of the work is the same as the 1st lock. The gate work very stiffly. The canal banks and towpath are in proper order. At 173 mile 32 chains is a culvert with two spans of five feet.

175th Mile. At 174 mile 3 chains lock No 4 one 12 feet drop. The masonry is completed and is of better quality than that at No 1, 2 and 3. The gates are hung but the upper pair do not fit properly and though the sluices are placed in the guides the gear for lifting them has not all been fixed. At 174 mile 75 chains lock No 5 of one 10 feet drop masonry as at No 4. The upper gates do not close well and the gear for the valves requires adjustment. The banks and towpath are properly formed.

176th to 178th Miles. At 175 mile 26 chains culvert with one five feet vent. At 176 mile 70 chains lock No 6 one 10 feet drop. Masonry completed. The gates have been hung and work fairly. The valves are placed, but the lifting gear requires some more fitting. There is one over bridge of the 2 class with approaches

[illegible] Sluices [illegible]
[illegible] Mile [illegible]
[illegible] feet [illegible]
appear sound. The [illegible]
neither pair of [illegible]
to the lower gates [illegible]
but it is on the ground [illegible]
have been replaced and [illegible]
proper section.

General Remarks — [illegible]
the Navigable Headwork [illegible]
[illegible] feet [illegible]
but although both [illegible]
the [illegible] and [illegible]
of dull [illegible] and [illegible]
clear and the [illegible]
the wall is however [illegible]
evidently [illegible]
[illegible] and the banks will require
[illegible] where the [illegible]
against the [illegible]
where it was [illegible]
would be made [illegible]
to [illegible]
will be needed [illegible]
supply in this section until all [illegible]
have proved [illegible]
[illegible] and [illegible]
work has been [illegible]
[illegible]

[illegible] stopping
[illegible] Sluices
[illegible] Locks
[illegible] Sluices
[illegible] Locks
[illegible] Sluices
stopping in each case but
in the aggregate it amounts to something
and will provide valuable [illegible]
[illegible] all the [illegible]
in the canal banks have been built
and the gullings still require to [illegible]
of them [illegible]
[illegible] days. As regards the irrigation
channels, Government have [illegible]
project involving the cutting of 31 miles
of primary channel of which
11 miles each have been completed
commanding 8600 acres.

10th Section - 179th to 189th Miles

179th and 180th Miles At 178 miles 52 chains lock
No 8 one 10 feet drop with 2 clapper bridges
No 9 one 10 feet drop with 2 clapper bridges
The masonry all completed and the gates
hung

having got into the lifting gear is not yet fitted.
The canal banks are very neatly trimmed
but they are not the high flood bank to the
Lemair river, commencing at the lock
on the west side of the canal.

182 Miles - At 181 miles 10 Chains stands the
Lemair tail lock giving access to the river
above the ancient the masonry of this work
has been completed except that part which
is required to bed the wooden frame
carrying the extremities of the lifting gear
The gates are hung and fit fairly. The
valves are placed but the lifting gear
is not fixed in consequence of it only
arrived from Montreal on the day on which
the inspection was made. The quality of
the masonry is good. The flood bank
connecting the lock with the ancient
embankment is completed and in good
order. The whole of the ancient with the
under sluices is in a complete state
and good repair and the quality of the
work is very good. The head sluices are
also completed in every respect and so
is the head lock with the single exception
of some fittings required for the lifting
gear of the upper sluice valves. There are
no flood banks below the ancient but
they would appear to be necessary for the
efflux caused by the ancient would probably
not

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not equal 18 inches over high flood and the
water below would only be lower by about
a quarter which would leave two feet
of head considerably above the top of the
present existing canal bank on the east side

187 & 188 Miles - The canal is in cutting. The
slopes are neatly pitched with stone
the canal from the head sluices on the
Lemair to the Caldapat terminus except
the average depth being
186 Miles - The banks are trimmed and
respectable but of proper dimensions being
they have taken two successive years to
make all the deficiency they have been
gradually filled up the slopes neatly pitched
and the works completed and
there appears to be no leakage worthy of
notice.

185 Miles - The small quantity of water now
in the canal has had a considerable
effect on the banks the masonry of the
locks remains perfect they were evidently
built with hydraulic mortar
184 Miles - At 185 miles 40 chains we found
a bed of gravel and at 185 miles 50 chains
a bed of rock which at 186 miles
30 chains a stone breakwater 30 feet wide
and an irrigator sluice. All these are
completed

183 Miles - At 184 miles 60 chains we passed

a quarter of four spans of 10 feet. The
masonry is of average quality. The face
walls leak but not to any serious extent.
At the junction of the wing wall with
the earthwork the earth has been cut away
by the scour and it is being pitched
to prevent a breach.

188 & 189 Miles – The canal banks are cut
by the water. They would hardly stand
the wash caused by boats without consi-
derable injury and frequent repairs. At
188 miles 8 chains, one ten feet culvert
and irrigation sluice (Mundla Pilly)
completed. Also tail sluice with three
vents of 4 feet square. The gear for the
shutters is not yet fixed.

General Remarks – The earthwork in the
last section of the canal is very much in the
same condition as in the portions above.
The banks have been neatly trimmed and
they appear to be of proper height and section,
but there is little appearance of consolidation
and it seems very unlikely that they would
throughout stand against a full head of water.
There is very little appearance of grass
which would protect the slopes and those
inside the canal are altogether too steep
to be permanently maintained without
some kind of revetment. They seem to
yield at once to the lap of the water and
fall in. All the masonry

completed by the end of the present month
as the quantity remaining to be done is
very trifling. The lock gates are heavy and
work tolerably well and the valves of the
sluices are placed but there is still some
gear to be fitted. All bridge approaches are
made up. There are no surplus discharg-
ing weirs properly so called in the section.
The irrigation sluices are all completed
and fitted with shutters. 9 miles 57 chains
of irrigation channel have been cleared
for execution and 7 miles 70 chains have
been completed, commanding 3788 acres.

Adjt. Lieut. Captain R.E.

Fort St. George
6th July 1871

Under Secretary to Government
P.W.D.

Enclosure in a letter
from the Under Secretary
to Government P.W.D.
to the Secretary to Govt. P.W.
dated 6th July 1871.

P.W. 3516
3203 1/71

Chicago Letter on the
Works of the Illinois and
Michigan Canal
Company.

To be inserted
(See note page five of proof sheets)
Sheet 5

† From Mr. Latham's
reply appended to this
report (in original) it
would appear as if
in certain respects
he had made or
was making preparations
to enable him to test
the Canal if required;
while in the other hand
other portions of his letter
would lead to an inference
directly the contrary.
He states in par. 2
that "arrangements have
been made for passing
water down the Canal
as rapidly as possible."
And in par 3 that

"Arrangements will
be complete by the "
time the Water is drawn "
the Canal for hutting "
the necessary Sluices "
Keepers & Watchers for "
testing ~~the~~ it Canal to any
heights required: ~~the~~
~~the other head~~ but in
the same par: the Chief
Engineer proceeds to ~~State~~ Secy
that "the temporary ar- "
-rangements described "
in par 11 of the Consulting "
Engineers letter attached "
to Go No 1089 of the "
18 April 1871 have "
been made & ~~that~~ the
Sluice Shutters in the
Calingulahs had been
removed and the

level being 9 feet/

Earthen banks described
in par 7 of this report
~~raised~~ thrown up
so as to breach if the
water in the Canal
rose to a greater depth
than ~~six~~ feet above bed
level. The Chief Engineer concludes
his answer to the
question proposed to
him & with the in-
-formation that "in the
"absence of any instructions
"or positive orders of
"Government or the Board
"to test the Canal, he
"had not retained the
"staff necessary to do so.
I must further remark
that the admission of
water into the Canal
in the occasion of the

first push in the Ingabura was by no means made with rapidity - Quite the Contrary. Probably Mr Latham intended that it should always be understood that the degree of rapidity was to be only so great as was consistent with the safety of the banks & Accordingly when there was a discharge of one foot of water over the Ingabura ~~over~~ the depth of water in the Canal could have been maintained at 8 feet only 2 feet was allowed to flow in ~~-~~ increased after my arrival to 3 f. 9 in. I consider that this Caution was necessary because of the generally unsafe condition of the Embankments & Walls but it hardly seems to me to be consistent with reasons to test the Canal in the manner desired by Government. The chief Engineer further deprecates the .....
.....

P. W. Dept.

No. 1975

Proceedings of the Madras Government.
Under date the 27 July 1871
Read the following

From the Under Secretary to Govt. P.W.D. &c. &c. &c. ... dated 6th July 1871.

The above Report concerning the opinion which the Government have for some time held as to what would probably be the condition of the Madras Irrigation and Canal Company's works in the 30th June 1871; namely:- that although a good deal remains to be done to bring the works all even their outward aspect to a finished state; yet in a general sense the

P. W. 3203/71
3576

G.O. No. 1975-83
27th July 71

will be

Main Canal and works,
excepting those of distribution, may be considered
finished in accordance
with the sanctioned plans.
But the state of completion
falls far short of that
contemplated by the
the Supplemental Agreement
dated 2d Oct/16 and of
what would be understood
by the expressions satisfactorily completed and
placed in working order.

It appears that in some
portions of the Main Canal
the earthen banks have not
been satisfactorily formed
that there is a general
absence of consolidation

throughout, and that their
satisfactory appearance from
mere superficial trimming
and finish is delusive. That
in other portions the banks
are formed of bad soil,
and been loosely thrown
up and but carelessly
puddled deficient in the
protection that a covering
of grass would afford, and
that it seems certain that
when a full canal the
banks would breach at
many points.

It is also observed
that water in larger or
smaller quantity passes
through all the walls which
take the place of earthen

banks in certain places, and that nothing short of a full supply of water could determine the question of their stability.

It does appear that the Chief Engineer has taken measures to prevent the water in the Canal rising beyond a fixed height, that height being much below the bed of the Canal when full, and to ensure that if the Canal should breach it will do so in the most favourable localities. These precautions are precisely what the Govt. in Ly. Co. Nevis dated 18 April 91

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prescribed as admissible only in the case of an incomplete Canal, and altogether unsuitable in connection with a work that is supposed to be complete in itself; and the part of the Company's Chief Engineer considering it necessary to adopt such measures as in the opinion of the Govt. the strongest evidence that the Company deem the undertaking deficient in its most essential particulars.

No definite information appears to have been obtainable as to the area that will be

irrigated this year; but from enquiries made by the Collectors of Cuddapah and Kurnool it is gathered that in the event of the main canal carrying water throughout the season without breaching, it is possible that an extent of 8883 acres might be irrigated, in which case the total Revenue for the year would be Rs. 43974. The Govt. cannot say that they have any confident expectation that this hope will be realized, and the amount is so (paltry) insignificant as a return for an expenditure of Capital and interest thereon aggregating more than two millions Sterling; besides being less than half what is required for annual outlay on maintenance & contingency, that they cannot acquiesce in the propriety of the Company's proceeding in deferring, or more correctly speaking dispensing with, that test which the Govt. in the strongest terms prescribed the necessity for dispensing with ~~it~~ on the pretext that it would derive the profits and injuriously affect the

prospects of irrigation
the last which the
Government approved
and which is making
more than the Canal
was designed for and was
expected to be capable
of sustaining was that
a depth of nine feet of
water above bed should
be maintained for
24 hours and that for
thirty days consecutively the Canal
should carry a full
irrigation supply. The
Capt. Scotts opinion the
embankments and
walls would fail at
many points if subjected

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to such a trial, and as
the Company's Engineers
have made provision for
the Canal breaching in
the event of the water rising
more than Six feet it
cannot be presumed that
they share the apprehen-
sions of the Govt. Officers
who have reported on the
subject.

Capt. Scotts Report will
be communicated to the
Secretary of State, and to
the Govt of India, who
will at the same time
be informed that the
Canal has not been
properly completed

and placed in working
order to the satisfaction
of this Govt.
Docket No 197 dated
Copy of the above forwarded to the
Govt of India in continuation of letter &c. dated

21/

for the Chief Engr for Irrigation
& Asstt Engr for Inundation Works

Dated 29/7/71

Dated 29/7/71 with 25 enclosures

P. W. Dr to Engr dated 11th Augt 1871

No. 3511 A.

Sobt. of 1871 Works.

PUBLIC WORKS.

Secty Chief Engr for Irrigation and Asst Secretary to the Govt of India

27 July 1875-1876.

Nos. 471-472 1873

Forwards Estimate for the Expenditure on account of inspection of the works for Indus Steam Navigation and Company in the Year of the Famine 1873