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Not to be folded or roughly handled

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No. 183.

ORDER THEREON

June 1875, No. 1,612.

IRRIGATION, No. 157

P. Narayana
The foregoing able and very useful memorandum by the Chief Engineer for Irrigation containing notes of inspection in

the Nellore District will be communicated to the District Engineer for information and guidance.

2. The surplus and other works needed to render the Chennoor and Gudur tanks and their supply channels safe and efficient should receive early attention.

3. The Government are gratified to find that the Irrigation works in the southern delta of the Pennair sustained but little damage during the great floods of October 1874, that could not readily be made good, and that the crops suffered generally only to a slight extent. The Chief Engineer for Irrigation is of opinion that, although the river embankments on this side breached in several places, their great utility has been forcibly demonstrated by the contrast presented by the results of the flood on this and on the north side, which latter was unprotected by a flood bank. It will be necessary to look at the financial aspect of the question when the estimates come under consideration, and to this end it is desirable that the information, pointed out in the 42nd paragraph of the above notes as requisite, should be made as complete as possible.

4. The exertions and cordial co-operations of the District Officers during, and immediately after, the flood have already been acknowledged by Government, and they are glad to find that since that time so much has been accomplished in the repair of damage.

(True Extract.)

Major, R.E.,

Off. Joint Secretary to Government.

To the District Engineer, Nellore...

„ Chief Engineer for Irrigation.

Notes of inspection in the Nellore District.—Passing orders on memorandum by the Chief Engineer for Irrigation, containing—in the months of February and March 1875.

Exd. A. Grubert.

1875
11/6

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MEMORANDUM.

THE following notes on works inspected in the Nellore District in February and March 1875 are submitted for the information of Government.

2. This sluice which was constructed to regulate the supply by the river channel to the Chennoor tank is in good order. Its position at the extreme end of the channel leaves its front wings much exposed, and care must be taken that a sufficient protection with rough stone is maintained to prevent undermining; the revetment of the left bank at its junction with the left front wing should be much more substantial and should overlap the wing.

3. The channel is generally in fair order. Where ramps are provided for traffic, drainage must be excluded. The channel bank (left) is in good order, but a great deal of upland drainage is received, and it is essential that means of escape for surplus should be at once provided. The channel has been from time to time extensively breached, and some breaches occurred this year. It has no surplus weir from the head to the tank, and that it should breach is not at all surprising, seeing that several square miles drain and several tanks surplus into it. The subject of providing accommodation bridges for the villages situated near the channel is under consideration, with reference to G. O., No. 2,556, dated 9th September 1874; some information has been obtained, but the District Engineer's hands have been very full of work, rendered necessary by the floods of October last, and so he has not had time to reply to that order. Whether bridges should or should not be allowed depends principally on the number of days during which the channel is not fordable. But a short distance to the westward is the Gudur tank supplying channel which is much deeper, and from having an anicut at its head, as well as from taking off from a larger river, it is fordable only at comparatively few places generally and is impassable more frequently. However, it is proposed to build an anicut at the head of the Chennur channel, and the alteration which this will effect should be fully considered. Moreover, the present head sluice would be convenient for traffic were the embankment on either side of it 9 or 10 feet wide. At present it is not used, though as the banks are 6 or 7 feet wide it would be made use of were the want much felt. The village cattle cross a couple of hundred yards or so below the head; if this arrangement is to be continued, there should be a ramp on the left side of the channel parallel to the axis of the latter, and on the other side either a similar or a direct ramp, and the earthworks alongside should be revetted. It is quite clear that something is needed to be done for the convenience of the villagers and for the protection of the channel from injury wherever crossings are required, and wherever therefore these crossings are otherwise than by bridges definite arrangements according to the circumstances should be made.

4. The tank is by no means in good order. At the west end much of the bund is weak, low, and irregular. In the deeper part the protection of nanel or other long grass is much required, and year by year the planting up should be carried out until all wash on the interior slope has been effectually stopped. All bushes should be

cleared away entirely, and no trees should be allowed on any part of the bund, except that any fine trees standing below the middle of the exterior slope may be retained. It will be necessary to take longitudinal and cross sections of this bund in order to the preparation of a proper estimate for its repair. The tank has two calingulahs, the capacity of which, judging from the catchment basin as indicated by the atlas sheet, is inadequate, added to which that at the east end is difficult of management. These calingulahs should be superseded by flush escapes of a length proportioned to the area of the drainage basin proper of the tank itself, the area draining into its supply channel being provided for by weirs in the latter. It will be desirable to discharge as much as possible of the tank surplus at the west end. The sluices should be examined and such repairs and improvements as they need should be attended to.

5. This anicut is a very old work, which has always stood well and has cost very little for repairs. Only very little repair work is needed. It will be well to take a few cross sections by soundings to ascertain the depth of the pool in rear, and the condition of the base of the masonry on this side should be likewise ascertained.

6. The channel has an open head, and it will be requisite to provide a head sluice, for a good deal of damage results from the large quantity of water entering the channel in high freshes, added to that received from upland drainage. The sluice can be looked after by the Superintendent in charge of the Chennai channel head sluice with the aid of two or three lascars. It will be necessary to provide for the requirements of this channel as regards the disposal of surplus, and the need of such works has been unfortunately but too often demonstrated. A couple of miles or so above the Gudur tank the channel passes through a shallow tank called the Moosilly Madagu, and here accidents have been of frequent occurrence. Recently too the bridge across the channel on the Rapur road was carried away. The drainage area to be taken account of is the whole of that above the Chennai tank and channel and several square miles besides. Probably upland drainage can continue to cross the upper miles of the channel as hitherto, but below Kundaly or Thipparapad a certain maximum W. L. should be fixed and surplus effectually got rid of.

7. The bund is in fair order. The growth of grass for the protection of the interior slope should be persevered with, and it should be ascertained whether additional means of disposing of surplus are required.

8. As already fully reported by the District Engineer, the unprecedented flood of October 1874 made a complete breach behind the north wing wall, and the scour undermined this and damaged a short length of the weir adjacent thereto. The breach has been closed by an excellent stone dam forming a ring bund, and cart traffic had been resumed over the anicut by this means. Below the anicut the bank has been scooped out by the rush of water considerably beyond the proper alignment, and the anicut extension* will be carried considerably beyond the point contemplated at first by the District Engineer, and beyond that suggested in the memorandum on the approximate estimate. Every additional foot will be an advantage, the length of the

weir being so much less than the average width of the river. All the details of the arrangements were settled on the spot, and the work will be pushed forward as fast as possible. Labor was very scarce at the time of my visit, but soon afterwards it began to come in freely, and there is every probability of its being abundant at any rate up to the time for the commencement of next season's cultivation. Lieutenant Henderson is in executive charge of the work, and his energy and attention to details, including the prompt and regular payment of the work-people, promise good results. The preparation of materials was in active progress; some of Bull's dredgers for well-sinking were ordered with a view to expedite the putting down of the foundations, and to give the officer in charge greater control over the well-sinkers. There is a very large amount of work to be done, and the preliminaries have absorbed a good deal of time and labor. The railways required relaying throughout, and the quarry plant was in great need of reformation. Most of the cranes have been in use for nearly twenty years, and though several of them were capable of being made efficient, they were not fit for work in the first half of March.

9. The damage sustained by the anicut south of the centre was very serious, as had it extended a little further a breach might have resulted. All the rough stone apron and the four retaining walls were washed away, the great mass of the stone being piled up in rear. The anicut suffered at this point once before, and there can be no doubt of the cause, though the exact way in which it operates in intensifying the action of the water so greatly as to remove stones of two tons weight and more is not easy of comprehension. Above the anicut on the right bank there is a great bay, the further erosion and extension of which in an easterly direction has been stopped by a mass of laterite rock on part of which the head works stand and through which the main channel runs. The water entering this bay has to leave it at a considerable angle with the proper axis of the river, and the result of the two currents meeting close to and above the anicut is to cause violent action. The remedy is obvious; the great bay must be filled up so as to make the approach to the anicut more direct, and to the same end a great slice off the left bank extending to some distance above the north end of the anicut must be taken. The land on the north bank is inam and was of some value, but the floods have reduced that value to almost nothing by covering the ground with nearly a yard of sand, so that there is no longer any need for hesitation in carrying out this much-needed improvement. The reclamation of the bay and the establishment of a good alignment on the right side of the river will take time, but with the aid of a few groynes by means of nanel plantations the accumulation will be rapid. Arrangements should be made for planting up the foreshore and following the receding waters on the subsidence of the freshes of the north-east monsoon of 1875, and thereafter full advantage should be taken of each season to extend and secure the ground gained in the same way. Ultimately this bay will be an excellent site for a tree plantation, and it may then be offered to the Forest Department. If not utilized in that department a firewood plantation may be established at a nominal expense by the District Engineer, and it will be very useful for the delta works—wood is now both scarce and dear. The bed of the river near the Civil Hospital has silted up greatly since some groynes were constructed some fifteen or sixteen years ago to secure this result, the proper alignment should be laid down on a large scale survey (probably the Revenue Survey will do very well), and the part outside this alignment should be all planted up with nanel. This place is the upper part of the great bay the reclamation of which is so desirable.

* Now about 450 feet.

Proceedings of the Madras Government, No. 198, dated 23rd January 1875.

10. The river when at its highest was just up to the roadway of the principal head sluice. It will therefore be necessary to raise the roadway 2 feet and the parapet walls to 3 feet thereabove. There will then be no risk of the head works being turned even by a flood of considerably greater magnitude.

11. The Civil Hospital stands at the western part of high ground on which Flood embankments.

a part of the town of Nellore is to the eastward situated, and this ground is in part many feet above any possible flood. Between this ground and the south end of the anicut there is a length of low ground, and here the flood bank was never very strong, and it was exposed to the strong current entering the bay already referred to. The soil too was sandy, and the bank was not designed for so high a flood. It is not practicable at present to get a really good alignment here throughout, but the principal bend can be considerably improved; the bank can be made much higher and stronger, and on the river side the strip of ground should be thickly planted so as to check the current. Ultimately the stream of the river will be a long way from this embankment, and there will be comparatively still water even in a flood of a magnitude equal to that of last October.

West of the Civil Hospital the embankment runs at some distance from the river for the first two miles or so. Evidently great attention had been paid to it, and the greater part of it sustained no injury. Close to the Civil Hospital it was topped and breached, and it gave way also near Potapollim; a short distance west of this village it turns southward and joins the bund of the Nellore tank. At some few places the bank is liable to erosion, but it is believed that all danger from this cause will be capable of obviation by navel plantations extending from the embankment up to the proper alignment of the river, and by closing one or two shallow bye-washes. Of course the level of the embankments will have to be revised throughout. It appears to be quite certain that although this flood bank gave way at several points above the anicut, its value and utility were very great, and to its presence the comparatively small amount of damage to the southern delta is attributable.

12. At Baba Row's chuttrum, immediately below an extremely narrow part of the river at Jennawada, are the head sluice Nellore tank channel head sluice.

of this channel, and a surplus weir in connection with it. From the head sluice to the high ground to the south there is a flood bank. The water rose just over the parapet of the head sluice, topped the flood bank and breached it extensively, and thus the river obtained comparatively free access to the tank. The masonry works sustained hardly any injury, and how it happened that the surplus weir was not swept away it is difficult to understand, for the water went completely over the wings and the channel bank to the westward. It will be desirable to raise the wings and torevet the bank for a few yards beyond the west wing all over, so that all danger of a breach in the bank near thereto may be avoided. The head sluice road-way will be raised to the general revised level of the embankment.

13. Provision has been made in the Budget of 1875-76 for a surplus weir for Nellore tank.

the Nellore tank to discharge into the river west of the terminus of the embankment proper, but it was doubtful whether this was altogether feasible owing to the high level of the water in the river. Should however the levels show that in a maximum flood no discharge at this point could take place, it will nevertheless be desirable

usually to get rid of surplus here, and a weir capable of discharging all surplus due to the drainage of the catchment basin of the tank under ordinary circumstances should be designed, and river flood water should, if liable to rise above the weir crest, be excluded by furnishing it with self-acting swing shutters opening outwards. The tank breached slightly close to where the additional weir will be built, but this damage was easily made good. Ultimately also a breach occurred at the deep end of the tank near the station, but not until the water had risen to the top of the bund, and some 11 feet of water had been discharging at the lower end of the calingulah. The excellence of the bund was evidenced by the fact that not a weak point showed itself in several miles. The discharge from the calingulah was doing so much damage in the station that it was considered desirable to breach the bund, and this would have been done, but it was the only means of escape for the villagers living between the tank and the river. The breach has been completely closed. The calingulah should as has been long intended be converted into a surplus weir with a crest at full tank or 6 inches above full tank level, at the same time that the new weir may be built. In the crest wall some vents for irrigation purposes may be provided.

14. This tank holds the reserve for a large part of the cultivation in the southern and south-eastern portion of the delta.

Survapully tank.

The earthworks of the bund are in good order, and much of the revetment is very good and substantial, but a great deal of it was in the first instance constructed without adequate foundations, and underpinning has become necessary. Some portions too were built with such inferior or small laterite not well packed that they failed to afford any protection, and had to be taken down and rebuilt. In one or two places from the gravelly nature of the soil and sub-soil excessive leakage and resulting slips occurred; these have been effectually dealt with by a puddle facing and drains, and the bund is to all appearance now perfectly stable. The District Engineer in submitting the revised estimate for the Survapully project will show exactly what alterations have been made and what additional work has been

done. The tank up to 10 feet above the sill of the Idagaly head sluice contains 52.58 millions up to 12 feet. It is not clear however how the calculations of capacity were made.

It has been proposed, or rather it was intended to retain an additional 2 feet of water, but this must not be done without a corresponding raising of the bund and its revetment. The maximum water level is to

be 2 feet above F. T. L., and the top of the bund then affords a margin of only 4 feet,*

* 4½ or 4.55 feet in the sections. Irrigation Series No. 2. a very small one for so large a reservoir. The surplus weir has its crest at 2 feet below the project full tank level, but it has cast-iron posts and shutters for retaining water to a higher level. It will be better not to run the risk, and the shutters should be taken away, the posts being at the same time removed. At some future time it may be deemed desirable to increase the capacity of the reservoir, and if so, it will be a very simple matter when the bund shall have been raised to raise the crest of the escape to the new full tank level. The length of the weir at present is 170 feet, and for the stated area of twenty-five square miles of catchment basin the proper length, with 2 feet going over, would be 500 feet; as however the basin proper of the tank is only about half the total area, the remainder

being included by the supply channel, it will be better, and indeed necessary, to provide for the discharge of a part of the flood waters from the channel, and probably if fifteen square miles be allowed for at the tank and ten in the channel bank, three or four miles to the northward, a sufficiently close approximation will be arrived at. Then the tank weir should be 350 feet long, and that in the channel 275 feet. The latter may be divided between two weirs if the circumstances should make this convenient. These arrangements for the disposal of surplus should be carried out this season, and the 180 feet additional for the tank should be considered of primary importance.

15. Both tank bunds are in good order, but although the area under them is about 1,200 acres, neither has either sluices or surplus weir. Their requirements in these respects should receive early attention.

16. This tank has a very long bund which would be the better for levelling. Mootkoor tank. There are no sluices, irrigation being carried on by cuts with palmyrah spouts. The surplus weir, 30 feet long, requires a lower apron and some plastering with hydraulic mortar. Some provision should be made for the relief of the tank when the existing weir proves insufficient.

17. This adjoins the former and is another of the shallow tanks of this part of the delta. It has some masonry sluices and irrigation cuts as well. The surplus weir, 70 feet long, wants a lower apron 3 feet below the present one. In parts the soil is white loam, and there are many pot-holes in the bund. The approach to the weir wants clearing. There is a little prickly-pear which should be got rid of.

18. The bund of this and of the former are connected. The bund is in good order. It should be connected with that of the small tank. There is no surplus weir, and one is required if only to prevent waste of water, for surplus is now discharged at the north end in a way that is far from efficient. It is intended to improve the supply of this tank from the Kistnapatam channel.

19. This has a surplus weir 61 feet long at the south end, and some repairs are needed. There are two sluices in good order.

20. The bund is in fair order. The surplus weir at the north end has been damaged, and much more waterway is needed. The south weir requires reconstruction. This tank receives a good deal of drainage, and ample provision for the discharge of surplus should be made.

21. The soil of the bund of this tank is very sandy, and it is difficult to keep it in order. The levels are irregular and some parts appear to be higher than is necessary. It was breached by the floods of 1874. The calingulah, 72 feet long, is not in good order, and some of the stones were washed away; the upright stones should be removed; one or two sluice vents may be placed in the body wall for irrigation purposes. The tank has only one sluice and two more are required.

22. This runs immediately to the west of the above tank, and a short distance below it divides into the Wullur branch channel (left) and the Puntapolliem Wullur channel.

The floods went all over this part of the country and washed away some of the apron of the regulators, which however stood the severe trial well, and did other damage to the channel banks, but none of much consequence. There are some bulrushes which should be extirpated and not allowed to grow any where in the delta channels and tanks. The *Maduraz Gudur drop* is regulated by vertical planks which close the whole water-way when put in, and this is not a safe arrangement; it is much better to use shutters the top of which is at ordinary full supply level, then a considerable rise in the water level would be comparatively harmless as the water would flow over the shutters. Two irrigation sluices supply channels which take off on either bank just above the drop; the screw gearing is not suited to irrigation sluices, and the screws should be made use of for the large shutters of some of the regulating works, inch or inch and a quarter screws threaded for the lift of the small vents of the irrigation sluices being substituted at these. Bridges are to be built on this channel at the south-east corner of the Maduraz Gudur tank bund and at Kalave-tapalem. They will be included in the revised estimates of the Survapully channel project.

23. The 51 feet calingulah at the south side was carried away in the floods. Provision cannot be made for such extraordinary contingencies, but the new work should have a water-way suited to the drainage exclusive of river spill.

24. Looking to the difficulty now experienced in obtaining fuel for Public Works purposes, and to the ease with which some of the best kinds of trees for fuel may be grown in the delta, the attention of the District Engineer and the Range Officer should be given to the utilization of the many strips and patches of ground belonging to the Irrigation Works of the delta; tooma, portia, or puvarasu, shima chinta, &c., will grow readily if the ground be broken up and the seeds sown almost broadcast and then covered over. Tooma will grow on almost any soil, and shima chinta wherever the soil is pretty good and there is moisture. There should be no nurseries or expenditure on watering. For tooma plantations also no fencing will be necessary usually. Seed is cheap, and if it be sown moderately thickly in favorable situations the trees will grow in as great number as will be desirable, and thinning from time to time will be needed. A great deal may be done in all irrigated tracts in this way at a nominal cost, and not only will the Public Works Officers have fuel at hand when they want it, but this fuel will produce a considerable income under Revenue, Miscellaneous. All wood cut for fuel should be paid for by the works on which it may be used.

25. This channel is the first on the left bank of the river above the anicut. From the head to the point where the Vegur channal head sluice. Dorenal road crosses, the channel banks which are high afforded much protection to the lands near them, although the river water found its way round them at both ends. The head sluice was not entirely submerged, but there were $5\frac{3}{4}$ feet of water on the shutter platform (masonry) and $10\frac{1}{2}$ inches above the string course. A higher platform of wood, part of which has

vanished, is a comparatively recent addition; it will be better to raise the piers and throw arches across to make the platform at the proper level. The sluice needs some repairs.

26. All this ground was submerged, but the damage done appears to have been confined principally to the village road to the river, nearly all the earthworks of which were swept away.

Country between head of Vegur channel and Damaramadugu.

27. This great reservoir, the waterspread of which is the largest in the district, is supplied by a river channel* having its head at Sungum. The head sluice of this channel was turned by the breaching of the road bank on the north side, and the north wings fell. The water above rose to the top of the parapets. The tank was in imminent danger of breaching at the deep part near the south calingulah, and this risk must not be incurred again. The tank is one of the reservoirs proposed to be enlarged in connection with the Sungum project, and expenditure upon it has been kept at a minimum pending the disposal of the estimates for that project, which has been under consideration for some years. A substantial masonry right wing of the full height of the bund should be built for the calingulah, and the bund should be brought to a regular level. Part of the bund south and west of this was seriously weakened by the wash of the waves, and a length of from half a mile to 1,000 yards should be revetted. Fortunately the tank breached at the south bund to the westward where it was comparatively shallow, and so this reservoir was relieved.

Kanigherry Tank.

* The Gundaveram.

28. As abovementioned this sluice was turned and the north wings fell over, but in one mass; the space thus left has been filled with packed rubble, and the north Engineer purposes to postpone the repairs until bricklayers can be spared from the anicut at Nellore.

Gundaveram channel head sluice.

29. This sluice is nearer the river on a channel the offtake of which is a few yards above the head of the Gundaveram channel. The road-way is just about at the highest level reached by the Pennair flood, and the sluice was not injured, but a great breach occurred to the south by the water washing away the sandy soil between the rocks, and a flood bank will be required, the road-way of the sluice being raised at the same time $4\frac{1}{2}$ feet to correspond with the top of the flood bank.

Duyur channel head sluice.

30. The bund has recently been repaired at a cost of about 1,800 Rupees, but the repairs have not been carried, as they should have been, to the ends, so that another estimate will be required. The work has been carefully done, and with the exception of some gullies and cracks which should be looked to by the villagers it has stood very well. The revetment or pitching has been raised; it is all laid flush with the inner slope which is at 2 to 1. Elsewhere Vidavelly grass has been planted, and where it has taken well it is very thick. To be an effectual protection it should have a considerable width. This year almost the whole ayacut is under second crop, and the

Kaligiri large tank.

31. About two-thirds of the large calingulah, 273 feet in length, were swept away during the last monsoon. The state of the remaining part of the work looks as if necessary repairs had not from time to time been attended to. The tank requires a weir about 420 feet long. The bund is strong, but out of level and order; apparently the small and large tanks might very well be thrown into one by lowering the dividing bund to about one yard below F. T. L. for a length of 500 to 600 feet, revetting the lowered part on the surface, and there would then be free communication between the tanks when desirable, while the small and high level tank would retain water for the higher lands. The escape weir for both might then be at the south end. However, the gain would probably not be very great, as the surplus would have to be led away from the bund. It is said that 6 feet of water went over the calingulah, and that the bund was topped in several places. It seemed probable that 5 feet on the calingulah was about the extreme depth. A breach occurred at the north end but did no harm. The sluices need attention.

32. The bund of this tank is not in good order, and requires to be brought to a uniform level above full tank to be placed in proper section, and to have its interior slope protected throughout partly by stone pitching and partly by a belt of tank grass. The northern end of the bund is weak, and this, under present circumstances, is an advantage. The lower apron of the calingulah is in disorder; originally the design was not adapted to the circumstances, there being a good deal of rock, the presence of which should have been taken into account. It was manifestly useless to cover the rock with small stone which was sure to be displaced, and which could not do any good. The nullah below is several feet below the crest level, and it will be well to drop the water at once rather than to extend aprons at a slight slope, as the outer edge is sure to give way if left unsupported, and the rest of the stone then follows suit. The upright stones should be removed and the crest raised to F. T. L. Then the overfall should be brought as near to the body wall as the circumstances of the rock when laid bare may show to be convenient, and between the rock masonry aprons should be constructed with retaining walls abutting on the several masses of rock. It may be necessary to construct more than one line of retaining wall with successive aprons, but this can be determined only after a complete clearance has been made of the stone and gravel below. The present length from wing to wing is 114 feet, and the effective length much less. The catchment basin is twenty square miles, and the proper length of weir can be finally fixed only after longitudinal and cross sections of the bund have been taken so as to determine what the difference between F. T. L. and M. W. L. may conveniently

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and economically be allowed to be. The maximum discharge may be assumed to be 4,120 cubic feet a second, and the length of crest will be with

3 feet passing over 236 feet.
2½ " do. 310 "

probably one or other of these or an intermediate depth will be suitable.

33. Much of the bund of this tank is composed of very soluble soil, and it is in

Jaladunky tank.

very bad order. A great deal of the before backing was deemed necessary to stability, has from the washing out of the soil fallen into disrepair. The calingulah is at a favorable site, their being rock below it, but its length is very inadequate, the drainage basin being fifteen square miles, and the proper length should be given according to the level which may be fixed for the top of the bund above F. T. L.; as in the last mentioned tank 560 may be taken as the co-efficient in the formula for calculating the discharge, which will then be 3,400 cubic feet a second. Attention should be paid to the sluices also.

34. This tank has been much improved, and requires comparatively little work to be done to make the bund all that is necessary. The provision of adequate escapes for surplus water should be attended to at once, so that a final stop may be put to the breaching at the south end, which has been usual in every heavy monsoon.

Allur Ramanah tank.

35. Much of the bund has been carefully sectioned and is in excellent order, and most of the remainder requires but little to complete it in the same manner. The village a crossing to high ground within the tank where bricks are made should be provided with a ramp so that the proper level of bund may be maintained. The tank still retained a large quantity of water.

Allur large tank.

36. The lands below the two fine tanks of Allur have always been liable to inundation to an extent which seriously injures the crops by the overflow in a southerly direction of the drainage of the Musunur valley, the outfall of which is at Juvaladinni. In the Sungum project provision was made for an embankment to prevent this overflow, and as, whether that project be carried out or not, the protection which this embankment will afford is equally necessary, the District Engineer should submit an estimate for entry in the Budget of 1876-77. It is thought also that the condition of this part of the country may be very materially improved by cutting one or two capacious drains to facilitate the passage of water into the Isakapully backwater, and it should be ascertained whether such relief can be afforded at a moderate cost.

Protection of lands from inundation.

37. Pains are being taken to get the tank bunds generally into order, and in many cases, the soil being naturally bad, white loam for instance, this is not an easy matter, and it will be impracticable to maintain them in section if the attraction which they offer in the way of grazing be not counteracted by fencing. The aloe is the most easily grown and maintained of live fences, and it will be well to introduce this generally where necessary, and especially in all cases where the bunds may be along-

side made roads or village tracts. At as many points as crossings for cattle or village paths may reasonably be allowed ramps should be made, and the sides of these and the bunds for some distance on either side should always be fenced.

38. This tank suffered greatly from the floods of October 1874. Not only was it breached in two places for lengths of seventy-two and thirty-three yards respectively, but

Chowkicherla tank.

the interior slope was washed away entirely in many places and the southern part of the bund was overtopped for a long distance. The latter circumstance indicates that safety on a recurrence of floods may be secured by making a length of some 200 or 300 yards of this very low bund only 1 foot or so above full tank level. Very little damage was done by the overflow, and even this little would have been greatly reduced had the water found freer vent. The masonry surplus weir is 60 feet in length, and will with the aid suggested probably suffice. The bund of this tank will greatly benefit by the protection of aloe fences.

39. This tank escaped as the flood waters passed to the south of it. The bund has been carefully repaired, and considering the nature of the soil, a soluble white

Kodavalur tank.

loam, it is in remarkably good order. Fencing alongside the road should be given as soon as possible; all prickly-pear should be got rid of, and tooma trees may advantageously be grown in the small irregular spaces between the bund and the road which are now not turned to any useful account.

40. The floods from the river made a large breach in the bund on the south side of this tank. This has been temporarily closed by a substantial ring bund below,

Kovur tank.

but the restoration of the bund will have to be effected on a line slightly north of the destroyed part. The water-marks on the revetment of the east bund show that at some former period this tank held some 6 feet more water than in recent times, and there are indications that originally the bund was intended to join the Potareddypolliem hill, where are the anicut quarries. It is said that there are difficulties in the way of the adoption of this line owing to the submergence of shrotriem lands which it would necessitate. The eastern bund of the tank is very irregular, the massive revetment is out of repair, the calingulah is altogether inadequate to the disposal of surplus from the catchment basin proper of the tank independently of spill from the river, and it is advisable that a thorough reformation should be effected. Attention must be paid in selecting the site of the additional surplus weir or weirs to the direction the surplus will take as there are several tanks to the eastward which may be seriously affected thereby, and the requirements of the whole group must be provided for. The drainage basin is reported to be about twenty-one square miles, but there are many complications from the channels having their heads at Sungum and from the surplus of the Duvur and Kanigherry tanks, of which much in very heavy monsoons must find its way into the Kovur tank; consequently the allowance of escape weir should be liberal. The existing calingulahs have a total length of 183 feet, of which 138 feet are effective. Probably a difference of 3 feet between F. T. L. and M. W. L. may be allowed, and 350 feet of weir altogether will not be too much. This will dispose of drainage from twenty-five square miles with the high co-efficient of 700 to allow for spill from adjacent basins.

41. The overflow of the Pennair had its northern limits at the old coast road, just to the south of the Kodavalur tank; Floods between Kodavalur and anicut. after passing which it trended away in a north-easterly direction and submerged most of the country between this line and the river. Near the junction of the old coast road with the Trunk Road the high embankments were very greatly damaged. The high ground at Kovur formed an island in the midst of the great expanse of water, and south of this village the depth of water passing over the road varied from 3 or 4 feet to 7 and 8, and it is said that some of the drift on the trees is as much as 10 feet above ground level. The previously greatest flood on record, that of 1852, was a slight one compared with this, and it is marvellous that the loss of life was so small; that of property was necessarily great, for the destruction of most of the growing crops was complete, and everything that could be floated away was carried off.

42. The proposal of the District Engineer to embank the Pennair from Sungum to the sea will have to be considered more fully when the estimates are submitted, Embankment of the north or left bank of Pennair. and in forwarding them it will be desirable that Mr. R. Smith should obtain from the Collector and send up as full information as possible of the loss of property, public and private, on this side of the river, caused by the inundations of October last. The general result of my inspections of the country north and south of the river has been to convince me that such an embankment would be of very great utility, and that although in the event of such another flood occurring it would probably be too much to hope that a flood bank could be maintained intact from end to end, nevertheless the difference between unrestrained overflow over a length of margin of nearly thirty miles, and the breaking through of flood waters at a few points, is so enormous that it would not be wise, if financially the proposal should be found to be feasible, to omit to control the floods generally, because it may be impracticable to confine the water to the river bed entirely. Considerable as was the damage done south of the river it was comparatively trifling to that on the north side, and the loss of crops was very small. The difference was certainly principally due to the fact that the south margin of the river was embanked, though inadequately, and there is not, it is thought, much room for doubting that the money spent on the flood bank was very well laid out.

43. Great credit is due to all concerned for the energy displayed in repairing damage and re-opening communication. Energy shown in repairing damage. The Revenue Officers not only rendered every assistance, but themselves superintended much of the work. At the time of my visit near Nellore and in the Southern Delta the evidences of extensive damage would hardly have been noticed by a casual observer, the position of great breaches in roads and irrigation works being indicated principally by new turfing or unfinished revetments. The way in which an enormous amount of work in many directions was accomplished is a remarkable instance of what is possible where all the officers of Government in a district are willing to work together and to help each other heartily.

44. Nanel is not very abundant in Nellore, but it is to be found in small quantities in many localities, and if attention be steadily devoted to its increase

and propagation in a few years it will doubtless be available in large quantities. For all, or nearly all, the tanks in the delta, and generally in the country within twenty-five to thirty miles of the sea, its use for preventing erosion of earthworks will be extremely beneficial. Vidavelly is a grass of a somewhat similar kind, but it is not so luxuriant, or so well adapted for the purposes to which nanel is applied in the more southerly districts. It is however much more abundant, and appears to thrive without much trouble. The District Engineer should require the greatly extended use of these and other grasses, and it may be considered certain that by so doing not only will tanks be more economically maintained in good order but a great deal that would otherwise be impracticable in the way of the regulation of river channels, construction of groynes for temporary purposes, &c., will be easily and cheaply effected.

21st April 1875.

Chief Engineer for Irrigation.

Pr d
Pro: of the Madras Govt
Reas the following

Revised by the Chief Engineer for
District { H.L. No 397 A of 21 April/75. }
19

G.O. No: 1612 of 9th June 1875-

The above is a copy

Md
17

LB

The foregoing Memo-
randum by the Chief Engineer
for Irrigation containing notes
of inspection in the Nellore
District will be communicated
to the District Engineer for
information and guidance.

2. The surplus and other
works needed to render the
Chennur and Gudur Tanks,
and their supply channels,
safe and efficient should
receive early attention.

3. The Govt are gratified

to

to find that the irrigation
works in the Southern Delta
of the Pinar sustained
but little damage, during
the great floods of October
1874, that could not
readily be made good,
and that the crops suf-
fered generally only to a
slight extent. The Chief
Engineer for Irrigation
is of opinion that, although
the river embankments on
this side breached in
several places their great
utility has been forcibly
demonstrated by the contrast
presented by the results
of the flood on this and
on the North side, which
latter was unprotected by
a flood bank. It will
be necessary to look at
the

Progs. N^o 565 dated 26th
February 1875-

W. D. E. Kellum *240*
Off. Eng. for Irr. *4*
S C Dred
19-6-75-

the financial aspect of
the question when the
estimates come under con-
sideration, and to this end
it is desirable that the
information, pointed out
in the 42nd para of the
above notes as requisite,
should be made as com-
plete as possible
4. The exertions of the
District Officers during,
and immediately after, the
flood have already been
acknowledged by Govt.,
and they are gratified
to find that since that
time so much has been
accomplished in the repair
of damage.

W. D. E. Kellum

Am. Nat. Hist. Soc.
Nat. Hist. Soc.
Nat. Hist. Soc.

Dear
 My dear Mr. [unclear]
 I am very glad to hear
 from you and hope you are
 well. I am
 Yours truly
 [unclear]

Lee 34

f. No. 198. 23rd January / 95
 - No. 515. 25th Jan'y / 95
 No. 2556. 9th Sept / 94
 Rev. f. O. 955. 31st July / 94

No: 3742

No 397. A.

From

The Chief Engineer
for Irrigation

To The Secretary to Govt.
P. W. D.

Dated 21st April
disps 26th May—
Received } Library } 1875

Notes on works inspected in the Nellore District in February and March 1875. —

St. No. 1612-9-6-75.

✓K¹⁸182/3

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desp'd W. C. 27-5-25 R. J. 6-25

7. 11. 11/34 ✓

3742

Govt. of 1875

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7
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The St. Hugh
Nellie

26

Encl.

9 June No. 16/3

182-183

Notes of inspection in the
Nellie District.

Passing orders on Memorandum
by the Chief Engineer
for Irrigation, containing
in the months of
February and March
1875.