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MADRAS RECORD OFFICE.

Government of Madras.

Public Works DEPARTMENT.

G.O. No.	Press Mis.
Dated	18 .

Not to be folded or roughly handled

No. 176. Read the following endors ... nt of the Chief Engineer for Irrigation, dated Fort St. George, 26th ... nuary 1877, No. 77 W :—

From Major J. BEATTY, R.E., Officiati ... Superintending Engineer, Godavery, to Lieutenant-Colonel J. MULLIN ... R.E., Chief Engineer for Irrigation, dated Camp at Kodir, 13th Dec ... ber 1876, No. 2,625.

As directed in G.O., No. 2,697 of 6t ... October* 1876, I have the honor to state my opinion on the causes of decline in the extent of irrigation in the Eastern Delta during the last two or three years, and I shall take the reasons given by Lieutenant Campbell in the same order that he has given them.

Lieutenant Campbell's letter, No. 481, of 22nd November.
Lieutenant Dorward's letter, No. 343, of 12th November, and
Mr. Larminie's letter, No. 172, of 23rd November.
* Received 2nd November.

2. *First Reason.*—Water being supplied late in the season. I quite agree with Lieutenant Campbell in considering this the chief cause of the falling off. And I believe that the reason why care was not taken to open the canals of the Eastern Delta early was that Lieutenant Campbell's predecessors held the erroneous idea that it was a matter of little importance when water was given for irrigation, that July or even the beginning of August was quite early enough; that the ryots only asked for it earlier for drinking purposes, or from ignorance or laziness; also that over a large portion of the delta the ryots were not independent of the canals and must take the water, *i.e.*, must cultivate wet or not at all.

I am now satisfied that this was a serious mistake, both from the result of the working of the early opening system in the Western Delta, and from my inquiries through the Revenue Department and others. It is of importance that cultivation *should* commence as early as practicable, especially in all low-lying tracts, so that the crops there may be strong and well-grown before the floods of September or October, for if so paddy can stand being submerged for a week or ten days even without injury. Another reason for giving the water early is that the work of transplanting 500,000 acres, with the limited amount of labor available, occupies a considerable time, and if begun late, owing to the pressing demand for labor, high rates may have to be given.

I am therefore of opinion that water should be given as early as possible. In the Western Delta for some years the canals have been opened on 15th April and water given for cultivation on 1st May, and this has undoubtedly had a great effect on the extension of irrigation.

3. *Second Reason.*—Because it is now optional with the ryots to cultivate wet or dry, as they feel disposed.

In the Western Delta, where there has been a steady increase of cultivation, I am informed that it is quite common to find ryots throwing up land where they have cultivated wet for years, and irrigating other land where they had previously grown dry crops; and this is given me by the Range Officer as one principal reason why Government should not attempt to interfere with minor distribution. You will also observe that according to Lieutenant Dorward's experience, "dry paddy is the next commonest crop to wet paddy; and that grown on good ground" (*i.e.*, well manured previously with Godavery water) "three crops can be raised in a year, also that it then pays better than wet paddy." Consequently ryots holding land well commanded

by our canals are really very independe t, and can afford to decline the use of the water, when, owing to any exceptional c uses, they fancy it will suit them best to do so. But where a ryot has for a series f years had his land well manured with Godavery water, it seems to me he shou l not be let off with a mere dry assessment if he ceases to cultivate wet; but sho d pay an enhanced rate as a contribution towards the cost of the works, which hav not only manured his land, but continue to give him the advantage of water by pe olation while he avoids paying water-tax. The ryots often make no secret of wha they are doing; they find it pays well to cultivate wet for a couple of years or so, nd then to grow dry crops on the same land for several years after.

4. *Third Reason.*—Preference of ryots for dry crops. This preference undoubtedly exists, because dry crops r quire less labor and looking after, besides not entailing payment of water-tax; but it operates especially where the land is not well commanded; or in cases where there is a doubt of getting an early supply, or of the supply being sufficiently regular throughout the season; as for instance, at the ends of long primary distributaries. From this it follows that as the delta system of supply is improved, a greater extent of irrigation may reasonably be looked for. As to the land under the Bank canals wherever it is brought well under command, and navigation also improved, there will be the same prospect of increase as in other parts of the delta.

5. *Fourth Reason.*—Improved drainage. This cause has no doubt had the effect of temporarily throwing some lands out of wet cultivation, which but for it must either have been cultivated wet or not at all; but if the supply in the canals be given early, where the system of distribution is good, it will cease to operate.

6. *Fifth Reason.*—The project being in progress. This is about the only reason Lieutenant Campbell has given in which I think he is quite mistaken. I believe that any suspicions or fears the ryots may have had in regard to the operations of the department have arisen from other causes, and not from the fact that the works of the completion project were in progress.

7. *Sixth Reason.*—New side Channels. These *have* caused a decrease of irrigated area as you anticipated when issuing the instructions* under which they were designed. For I there find you observing as follows:—"It has not been overlooked that possibly some lands now irrigated by the Samulcottah canal will be too high for these principal distributaries as now proposed to be constructed, but this fact will not necessarily make it requisite to alter the arrangements. In a recent communication† it has been remarked that it is not at all desirable that the efficiency of the irrigation generally should be deteriorated by endeavouring to irrigate lands on an exceptionally igh level from channels which have been designed to water those which are on a convenient level; and now that irrigation is optional there is the less reason for taking ch lands into account. If then any land now irrigated by flow is so nearly on a le with water surface in the Samulcottah canal as to make it necessary to place the branch channel water surface but a few inches lower at most, either such land mu cease to be irrigated, or baling must be substituted for flow."

* Memorandum No. 695 of 10th September 1874

† No. 661 of 1st September 1874.

Your instructions regarding primary distributaries were communicated to all the Delta Ranges, and the difficulty in the Eastern Delta Range appears to have arisen from the fact that Lieutenant Campbell and his predecessor have assumed that no liberty was given them to use their own judgment in designing new distributaries, but that one hard and fast rule was to be followed without reference to the special circumstances of each tract of country to be irrigated. The officers of the Western Delta, on the contrary, have continued to settle the alignment of new distributaries with a view to (1) bringing more land under irrigation; (2), abolishing, where practicable, direct irrigation by palmyra spouts in canal banks; and (3), improving the means of irrigation generally; while at the same time taking care to avoid throwing land out of cultivation, or obstructing the natural flow of drainage. Clause 3, paragraph 10 of your Note printed with the Government Order under reference, shows that the interpretation adopted by the Western Delta Range Officers was the correct one, and all that is now necessary is that the officers in the Eastern Delta should reconsider the circumstances of all distributaries, whether already designed or in contemplation, and propose such modifications and improvements as appear to be necessary to their greater efficiency.

I may here observe that the general system of irrigation under the Godavery anicut is now, and has always been, by means of three classes of channels, viz., (1) "Canals" which are navigable and at the same time carry water for irrigation; (2) "Village Channels," intended only for supplying irrigation with water which is admitted at their heads by means of masonry sluices in the canal banks. These village channels, which are branches from the canals, are so called because they irrigate one, two, or more villages. They are known to the ryots simply as "panta kalwalu," *i.e.*, channels for the supply of water to cultivation. They have also been termed principal or primary distributaries. (3) "The field channels," or "bodhis" as they are called by the natives, are small branches from the village channels dug by the ryots and entirely under their management. These have also been called "Minor Distributaries." According to the system pursued since the anicut works began, canals and village channels have been made and maintained by the Public Works Department, and all minor distribution has been left to the ryots. This is the system which has been so successfully carried out in the Western Delta, and I would strongly deprecate any attempt to alter it, both on the ground of the great expense that must be incurred for works and establishments, and because I consider it uncalled for. It seems to me to be the duty of the Irrigation Officers to make their canals and village channels as efficient as possible, and that of the conservancy establishment to watch over the supply of water until it leaves the village channel, seeing that each village gets its fair share; but beyond that nothing should be attempted.

Water is now supplied from the village channels to the bodhis by palmyra spouts,* which are "supplied and put in the bank (of the village channel) *under supervision* at the ryots' expense, and they can be moved about easily. They have therefore two considerable advantages over masonry works, and if carefully put and wrapped round with straw are not inefficient regulators." The chief objection to masonry sluices in the banks of village channels is that the ryots are constantly ceasing to irrigate one part of the village ayacut and taking up for irrigation another

* *Vide* Lieutenant Dorward's letter, para. 20.

part, so that the minor distribution works constructed one season might be useless the next. And if we did undertake the supply of masonry regulators, about twelve thousand would be required at a cost of Rupees 60 each, or upwards of seven lakhs of Rupees.

8. *Seventh Reason.*—The selling price of paddy as compared with dry grains. That this has had some effect in reducing the area under irrigation is certain, for I have heard of several cases of villagers expressing regret that they had thrown up land this year, and this has been chiefly due to rise in price owing to the drought.

9. *Eighth Reason.*—Excessive Water-tax. I agree with Lieutenant Campbell that there is no reason to consider the water-tax excessive.

10. With reference to the remarks in paragraph 15 of your Note, Lieutenant Dorward has stated the result of his observation and experience as to the incorrect figures given by the Revenue Department. The source of information of both the Revenue and Irrigation Officers is now the same; viz., the village Curnams, who know from what canals irrigation is supplied, and generally give it to the Public Works Officers quite correctly, but the Revenue Department is only concerned with registering irrigation correctly by villages, and naturally mistakes arise as the information in regard to canals passes from the Curnam through the Revenue Inspector to the Tahsildar, from him to the Divisional Revenue Officer, and then through the Collector's office. As suggested by Lieutenant Dorward, the proper system would be for the Collector to furnish the Range Officer with a statement by villages, and request him to settle the areas irrigated by each canal and send it to him for entry in the returns submitted by the Collector's office to the Board of Revenue. Until this is done it will be useless reviewing the figures given by the Revenue Department for the areas under canals. For instance, there was a considerable area of cultivation in 1873-74 under the Yennamadurru, but the Revenue Department reported there was none. In 1874-75 that area was reduced* to 89 acres, but the Revenue Department, for some cause unknown, reported there was 2,974. Considering that the Revenue Department have thus of their own accord shown a change in the source of irrigation, it is not clear how the responsibility for incorrect figures lies with this department, as you seem to think.

* The previous year's irrigation being supplied by new channels under other canals.

11. In conclusion, as regards suggestions for preventing further decrease of wet cultivation in the Eastern Delta, and hastening the extension of irrigation to the full area anticipated when the project estimates were submitted, I consider it of the first importance that the range should be provided with efficient Divisional and Sub-divisional Officers, and that these officers should not be removed elsewhere as soon as they have acquired some knowledge of its wants. Since Mr. Walch joined the Western Delta the Eastern Delta has passed through the hands of Major Hasted, Mr. Hannan, Major Mead, Captain Brockman and Lieutenant Campbell, and now the last-named officer has applied for furlough. Major Mead and Captain Brockman I know had only time to discover how erroneous were the ideas they had brought with them from southern districts as to the best data for giving water for cultivation when they were removed. In fact the too frequent changes in the Eastern Delta go far to account for the less favorable condition of the works and irrigation there than in

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the Western, and in future it should be clearly understood that no officer will be appointed to the Eastern Delta who is not willing to stop there some years, and if his health continue good he should be permitted to do so. On a system of frequent changes it cannot be expected that officers will take that interest in the works which is essential to satisfactory progress, and their short tenure of office prevents the ryots acquiring that confidence in them which is indispensable to the successful administration of a Delta Range.

As already reported, in submitting Lieutenant Campbell's application for furlough, I know of no officer better fitted to correct deficiencies of design or system in the Eastern Delta than Mr. Walch, who has already, with the able assistance of Lieutenant Dorward, done so much for the Western Delta.

My second suggestion for effecting the rapid extension of irrigation in the Eastern Delta is the same as Lieutenant Campbell's first. I would arrange to give water for irrigation in May.

Thirdly, the Range Officer should give his best attention to correcting defects in the design of all his primary distributaries, and to giving them, where necessary, better means of supply, bearing in mind that sports of every description are to be gradually abolished wherever they now exist in the banks of navigable canals, as is now being done on all the canals of the Western Delta.

If these three suggestions be attended to, I have no doubt the area under irrigation in the Eastern Delta will rapidly attain its maximum.

12. I lately called upon Lieutenant Campbell, Lieutenant Dorward, and Mr. Larminie to report their views on distributaries with reference to the remarks in your Note above referred to, and I send their replies for your information.

From Lieutenant D. McNIEL CAMPBELL, R.E., Executive Engineer, Godavery, to Major J. BEATTY, R.E., Officiating Superintending Engineer, Godavery, dated Camp, Dowlaishweram, 22nd November 1876, No. 481.

With reference to paragraph 10 of Chief Engineer's Note No. 2,697, of 6th October 1876, and your memorandum thereon, No. 2,244, dated 9th November 1876, I have the honor to submit the following remarks.

2. You will see from my letter, No. 1,436, dated 22nd August 1876, to which Colonel Mullins' Note is an answer, that I never objected to distributaries or even side channels taken off above locks, and that I never advocated numerous offtakes and small channels to supply the place of distributaries properly aligned, but Colonel Mullins appears to think that this is what I meant, and it is therefore not surprising that he considers that I am not competent to write on the subject without advice. The sixth reason I gave in my letter was "new side channels." I did not mention distributaries or parallel channels except to say that long distributaries are objectionable, and I am sure that every Irrigation Officer will agree with me on that point. What I was writing against was side channels taken off from any point in a canal so that they have not so much command over the country as the main canal itself, and consequently cannot irrigate land which could be irrigated by the latter, and in such cases, I consider, direct irrigation by means of pipes preferable.

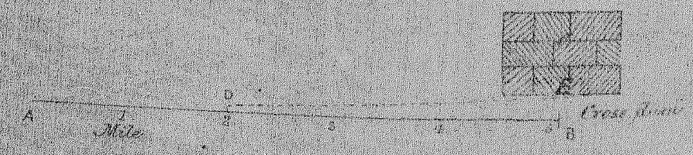
3. Clauses 1 and 2 of the Chief Engineer's paragraph 10 are written entirely under the impression that I would like to have the whole delta irrigated by means of iron pipes and small channels; this not being the case, I need here make no remarks on what he has said. I can only express my regret that my letter should have been so badly worded as to lead him into this mistake.

4. In clause 3 the Chief Engineer states my views exactly, when he says "side or parallel channels may or may not be in particular cases the proper alignment of distributaries," though why side and parallel channels should be classed together I do not know. In the same clause it is stated in general terms that the alignment of distributaries must depend on circumstances which of course cannot be doubted, and such being the case does it not seem strange that the proper alignment for the distributaries of all of the following canals, Samulcottah, Cocanada, Injeram, Mundapetta and Coringa, should be following the line of these channels and close outside their banks.

5. In clause 5 Colonel Mullins states that the head of an irrigation channel should be placed where the levels afford sufficient command, and I never thought otherwise; I mentioned the position of above a lock as there is seldom any other point in a main canal where the command is sufficient. The statement that my remarks about loss of head in distributaries "are at any rate as stated erroneous," I cannot understand. I merely said that in the Samulcottah canal side channels there was a loss of head of 1 foot, and so there is, that is the water in the side channel is 1 foot lower than in the main canal, and as the latter is only just high enough to command the land, surely this loss of 1 foot is a consideration; of course if the main canal water were well above the country the 1 foot loss would be of no consequence, in fact it would perhaps be an advantage.

6. In your memorandum under reply you ask for my opinion on several points connected with distribution arrangements in general, and it is with the greatest hesitation I comply with your request, for, as the Chief Engineer states, I have had so little experience in these matters.

7. What I consider to be the great fault of most of the existing distributaries is that the water is not carried at a sufficiently high level, thereby rendering cross-dams necessary. Colonel Mullins thinks that this can be obviated by the head of the main channel from the distributary being taken off higher up; but, as stated by the Chief Engineer, ryots, if left to themselves, naturally endeavour to obtain a supply for their fields from a point on the channel nearest to their lands, and it certainly seems to me that a distributary should, if possible, be made to command all the land on each side of it. The case of the Nizampatam side channels mentioned by the Chief Engineer is as follows:—



Let A B be the side channels. The water level being low, in order to irrigate the land at E a cross-dam has to be erected at B and a minor channel taken off immediately above; instead of this Colonel Mullins thinks that the cross-dam should not have been put up, but the minor channel should have had its head higher up, say, about the point D; but I consider that it would have been much preferable had the channel A B been designed to carry water at a sufficiently high level to irrigate the land all along its course, and this might easily have been done as the channel takes off from above a lock where the water is very high, of course there would have been a little extra expense in banking, but the embanked channel D E would not be required.

8. The Chief Engineer wishes to have distributaries with minor channels taken from them, all to be provided with regulators at their heads, this is no doubt quite feasible, though the number of regulators required will be something considerable, but he also considers that all field channels should be provided with regulators; now what the number of these is I am afraid to say, but, in my opinion, it is impracticable to go into such detail in the supply of water. I should say make a distributary with a head sluice to carry water at a sufficiently high level, and let the ryots take water by pipes and dig their own field channels unless there is land to be irrigated at such a

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distance that the ryots could not dig a channel themselves, in which case a minor channel with a regulator at its head may be given, and in cases where water in the main canal is just above the level of the country, and consequently the land close to it on either side cannot be conveniently irrigated by distributaries, I would give water by means of pipes.

9. Colonel Mullins seems to consider that the fewer offtakes there are from main canals the better now, of course the fewer main distributaries there are the more minor ones or the more field channels there must be, and I certainly think it would be easier to have control over regulators on main canals than on distributaries, so I therefore consider that there is a limit to reducing the number of distributaries.

10. I will now proceed to describe what I consider the proper arrangement for distributaries, &c. In a main canal with locks it is generally the case that above the lock the water commands the country, while for several miles below it is in cutting; in such cases I would have side channels taken off from above the locks, and running as far as that point in the lower reach where the main canal water comes above the level of the country, this would in most cases make the side channels 4 or 5 miles long, which is ample; from where the side channel ends I would take off distributaries at about every 1 or 2 miles and run each along the lines, but suited to the fall of bed unless circumstances rendered another line desirable, these distributaries would be provided with head sluices, and as the distance between any two would not be more than 2 miles minor channels would not be required, only field channels that the ryots would dig would be necessary. The whole of the regulation of the water-supply would be done from the main canal, and I would make no attempt to regulate the supply to the fields unless it were to provide the ryots with pot sluices or pipes to prevent them from cutting gaps in the banks. There might perhaps be a strip of land along each side of the main canal (as in the case of the Samulcottah canal) which could not be conveniently irrigated by these distributaries this land I would irrigate by pipes. I would endeavour to make the length of each distributary not more than 4 miles, and I would rather make a short channel directly through the land to be irrigated than make a cheaper and larger channel following the line suited to the bed fall. In this delta there are so many main channels that it is seldom a distributary would have to be more than 5 miles long. In cases like the Samulcottah and Injeram canals I would have no side channels at all, but would arrange the distributaries as described in the latter part of this paragraph.

11. For the Samulcottah canal Colonel Mullins proposes parallel channels; these would probably run about a mile from the main canal and nearly parallel to it; to irrigate the land under this parallel channel, minor channels would be required (I suppose about one to every 2 miles of distributary), running somewhere about at right angles to the parallel channel. Now I can see no reason why the minor channels should not take off from the main canal direct and the parallel channel be left out. As regards the cost; supposing the length of parallel channel to be 6 miles. By Colonel Mullin's proposal there would be the cost of one head sluice in main canal, 6 miles of distributary, three minor sluices and three minor channels, say each three miles long, besides cattle-crossings and bridges which would be necessary on a parallel channel. By the method I propose there would be three small sluices and three minor channels each four miles long. Colonel Mullins wishes cheap regulators built in distributaries, but I would observe that the cost of building even what he proposes would be considerable, for any where distant from a navigable canal the cost of conveying materials is great, there are no roads, and everything would have to be carried by coolies. As regards the regulation, I do not think it can be disputed but that it would be easier to regulate three sluices in the main canal than three in the distributary and one in the main canal.

12. From what I have written it will be seen that what I propose amount to this, that where the main canal is an irrigation channel, that is, where the water in it commands the country, it should be treated as the distributary and minor channels made from it, that the number of these channels should be about one to every one or two miles (if the position is suitable) on each bank of the canal and that they should each be provided with a head sluice, and that land near the main canal which cannot conveniently be irrigated by them should be irrigated by pipes.

That no attempt should be made to regulate the supply to field channels except to see that no breaches are cut in the minor channels.

13. In clause 1 of paragraph 10, Colonel Mullins objects to numerous offtakes from main canals, and, as he may call, one in every 1 or 2 miles too many. I will answer the objections that he makes. He first says that they cause great waste of water and complicate drainage arrangement. As regards the waste of water this need not be considered, as I propose to provide head sluices to all the minor channels from main canals, consequently there will be no waste except for the few pipes that may in some cases be required. As regards complicating drainage arrangements, I cannot see that numerous offtakes from main canal will have more effect in this way than numerous offtakes from distributaries or minor channels. As regards the second objection, that numerous offtakes are costly, I think I have shown in paragraph 11 that they are not more costly than other arrangements.

14. With reference to your paragraph 3, I consider that cross-dams can easily be done away with by making the distributaries able to carry water at a higher level and limiting their length; but to substitute regulators with shutters for palmyra spouts in field channels is, in my opinion, quite impossible; but even if possible, it cannot for an instant be supposed that the ryots would regulate them properly and take the exact amount of water required; palmyra spouts might be abolished by providing the ryots with pipes or pot sluices; but as some thousands of them would be required, the cost would be considerable.

15. I have endeavoured to state my views clearly, but I by no means maintain that the method of distribution I have proposed is suitable for all cases,* and it is quite impossible in a letter like this to enter fully into this important subject of distribution; it is a subject that requires a great deal of consideration, and on which I do not think any opinion can be formed except after having seen the existing distributaries at different periods of the irrigation season.

* The distance between the main canals may be great, in which case main distributaries with minor channels would be necessary.

From Lieutenant A. R. F. DORWARD, R.E., Assistant Engineer in charge Western Delta Division, Godavery District, to Major J. BEATTY, R.E., Officiating Superintending Engineer, Godavery District, dated Godavery District, 12th November 1876, No. 342.

With reference to your memorandum No. 2,274, of 9th instant, I have the honor to report as follows:—

2. In paragraph 6 of his Note the Chief Engineer, referring to dry paddy, states, "it is doubtful whether this species of cultivation will be other than exceptional, for it would not in general pay a ryot to cultivate inferior paddy in order to avoid the water-tax."

3. I think dry paddy is the next commonest crop to wet paddy, at any rate it is a common crop. When grown on good ground three crops of it can be raised in a year; it then pays better than wet paddy. It is largely grown as a mixed crop with cotton and some grains.

4. There can be no two opinions as to the superiority of a system of few over numerous offtakes, and I was surprised to see from the Chief Engineer's Note that Lieutenant Campbell was strongly in favor of the latter. I have therefore read Lieutenant Campbell's letter carefully, and fancy that the Chief Engineer has misunderstood him. What Lieutenant Campbell seems to me to advocate is a system of comparatively numerous offtakes as opposed to a system of side channels. This is a very different matter.

5. In laying out a system of distributaries the following points should be borne in mind:—

The irrigating length of the channels should not be too long, they should run through the centre of the land to be irrigated at or nearly at right angles to the canal, and should carry water at a sufficient level for irrigation when the water in the canal is considerably below full

7. I have spoken above of the irrigating length of a channel as being the length to be considered, as a channel if properly designed may run for miles in cutting and require very little repair.

8. We have in this range channels of all lengths, from 1 mile to about 20. Up to about 6 miles a channel can be kept in an efficient state without much trouble. Channels of more than 6 miles long are in bad seasons failures, the land at the end of such channels being always more or less dependent on the rainfall.

9. Distributaries should not have minor branches other than the small field channels of the ryots. Small channels are expensive and apt to get out of order.

10. The longest field channels I know of are about one mile long. Such channels the ryots are always anxious to hand over to the care of Government. I think therefore that a distributary should be within three-fourths of a mile of all land it is intended to irrigate from it. A strip of land three-fourths of a mile wide on each side would give about 1,000 acres of irrigation per mile of channel. To get this amount it is necessary either that the channel should run on a ridge, which is most advantageous, or that its water should be carried at a considerable height above the country.

11. Owing to the nature of the country over which it runs a channel will rarely irrigate as much land on one side of it as on the other. Taking three-fourths of a mile as the maximum distance at which irrigation can be efficiently carried on, it will be understood why we so rarely irrigate 1,000 acres per mile of channel. Had we to lay out our channels again we should get much nearer to this result, but in this delta our endeavours have of necessity been directed towards the improvements of an existing system of distributaries.

12. The irrigated area per mile of a channel is the principal proof of its efficiency. The inferiority of side or parallel channels, which can only irrigate from one bank, to channels which diverge from the canal line is therefore evident.

13. Without minor branches a parallel channel can rarely irrigate more than 500 acres per mile. In what side or parallel channels we have minor branches are nearly always present, and if Lieutenant Campbell in condemning side channel means that it would be preferable to have the heads of those minor branches in the main canal, and do away with the side channels altoge her, I perfectly agree with him.

14. For some distance below a lock or weir the water level in the canal is too low to irrigate the land on each side of it, and if it be determined to irrigate such land a side or parallel channel is necessary. This I take to be Lieutenant Campbell's meaning when he exempts side chan e s taken off from above locks from the condemnation he otherwise accords them. Except in su h cases an alignment parallel to the canal of supply can only rarely be proper for an irrigation channel.

15. In this range the great examples of parallel channels are the mid and low level channels which run parallel to the Ellore canal. Apart from the question of their obstructing drainage, I do not think that any one now doubts that it would have been better to irrigate the land they now irrigate by several channels from the Ellore canal running at or nearly at right angles to it. The mid and low level channels run at right angles to the junction canal, but that canal was an afterthought and introduced solely in the interests of navigation.

16. The water in our canals is during the irrigation season, when the supply in the river is small, often from 1 to 2 feet before full supply level. At those periods in many irrigation channels we cannot do without temporary cross-bunds.

17. In this range an authorized cross-bund list is kept, and ryots are allowed at certain times to put cross-bunds for stated periods. This system is the outcome of necessity, and is owing to [illegible] and execution of embankments. As regards new channels there ought to be no necessity for them.

18. Of late years a great many of these cross-bunds have been done away with. Where small areas were affected ryots have been told that they must cultivate at their own risk, and that cross-bunds would not in future be allowed. As the improvements contemplated in the completion

estimates are carried out many more will become unnecessary. But even when these improvements are finished a very considerable number will remain. Then each individual cross-bund will have to be dealt with on its own merits, the cultivation under it being provided for by a separate channel or a masonry dam, or it may be decided to refuse water to the land so irrigated altogether. Any sweeping measure is now, and will be then, impossible without an immediate and large loss of revenue.

19. Masonry dams are great improvements on bunds of mud and straw, and if the régime of the channel be altered to suit the circumstances they induce, little inconvenience will be felt from their use. Still a channel is better without them, and efficient channels can be designed and executed without them. Masonry drops are often necessary to get rapidly over a steep, falling country, but they are different things from dams.

20. Owing to pressure of work and to always having other work to do, a Delta Range Officer has very little time to spend in attending to irrigation details. Yet, in the interests of Government, his time could not be spent better nor be more directly remunerative. A special officer might well be employed on such work. To settle the number of palmyra spouts required on a channel, and the position of each is no light work. It is very difficult to get at exact areas, the representations of each ryot have to be listened to, and his ideas of "manul" have to be humoured or overcome. When all is considered settled, and the ryots have expressed themselves satisfied with the new order of things, it is not a little irritating to find that they at once go home and write petitions to every official in the district, who they think can in any way help them, praying for a return to the old system. By far the greater portion of these petitions are sent from various sources to the Range Officer for inquiry and report. For a long time to come the supply of ryots' channels will be carried on by means of palmyra spouts, and it is at present of little use considering the nature of the sluice that should take their place. Palmyra spouts are supplied and put into the bank (under supervision) at the ryots' expense, and they can be moved about easily. They have therefore two considerable advantages over masonry works, and, if carefully put and wrapped round with straw, are not inefficient regulators.

21. Referring to the remarks in paragraph 15 of the Chief Engineer's Note, I would point out that it has never been the practice to inform the Revenue Department of the sources of irrigation of various villages. It never consequently struck me that it was my duty to do so, and I do not know now whom I ought to inform. The revenue statements of irrigation are based on the accounts of village Curnams submitted to Revenue Inspectors. The Curnams know perfectly well the sources of irrigation for their particular villages, and, as a rule, give them correctly enough in their monthly statements. The Revenue Inspector compiles the statements of the various Curnams in his division, and numerous mistakes occur in their statements. I often have copies of their statements sent to me and so notice the errors. The Revenue Inspector then submits his statement to the Tahsildar, who, in turn, submits a statement compiled from those of the various Revenue Inspectors in his taluq to his divisional officer, for submission to the Collector. When the statement leaves the hands of the Revenue Inspector it passes through the office of no one who has any special knowledge of sources of irrigation. It is not therefore to be wondered at that the statements showing irrigation under each canal are inaccurate and unsuited for purposes of review. It seems to me that the proper system would be for the Collectors to send a statement showing the area cultivated in each village to Range Officers at the end of each year, and to call upon them to show the area irrigated by each canal.

From J. C. LARMINIE, Esq., Assistant Engineer in charge Rajahmundry Division, to Major J. BEATTY, R.E., Officiating Superintending Engineer, Godavery District, dated Rajahmundry, 23rd November 1876, No. 172.

I HAVE the honor to reply to your memorandum, No. 2,241, of the 9th instant, and I think the best way to do so will be to consider, in detail, some of the irrigation channels of the Eastern Delta, with which I am acquainted. 1*st*, channel from above Thapaswaram lock, left bank;

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this runs for a little way direct from the canal and then bifurcates into the Nadoorabada and Vadroopaka channels, which, in their turn, give off other branches, and the average length of each from the head sluice may be taken at about 7 miles. These are very good examples of parallel channels, (though not exactly parallel,) there is an ample head of water and there is seldom any real difficulty about the cultivation, but there is a recognized system of cross-bunding, so many days to each village, and as the channels have been run too much into cutting, I do not see how a system of distributaries as proposed in clause 4, paragraph 10 of the Chief Engineer's Note, can be carried out unless the level of water in the channel be considerably raised, or else an arrangement, noticed further on, carried out.

2*nd*.—Side channels from the right bank, at the same lock. It seems to me that the lower end of this channel has also been run too much into cutting by means of masonry drops and the advantages due to head lost, the same remark applies to the side channel along the left bank, and in which cross-bunding was allowed, in both channels the water level must be raised before minor distributaries can well be carried out.

3*rd*.—Side channels from above Thossipoodi lock. These are comparatively new channels; that along the right bank is nearly 5 miles in length; and was intended to supply several direct channels, each having a sluice in the canal bank in addition to the irrigation along the canal, but since its (the side channels) construction there have been many complaints from the cultivators along these direct channels, and I believe some land at the end of the side channel has ceased to be cultivated with wet crop, and at present I understand that cross-bunds are allowed in the side channel which would consequently appear to have been run too deep into cutting.

The channel from the left bank is a very long one, extending to below Peddapoodi, a distance of fully 8 or 9 miles from Thossipoodi; it is only a side channel up to about 3 miles below Thossipoodi, where it joins the old Peddapoodi channel, (which before the improvements to the canal had its sluice here,) which runs for a mile or so direct from the canal and then turns off in a direction parallel to the canal. There is a large extent of cultivation under this channel, and no difficulty is experienced in the upper reaches, or for 5 miles or so from the head, but regarding the lower reaches complaints are common, and were the water-supply adequate a considerable area of waste land near Peddapoodi would be cultivated. It has come to my knowledge that the ryots interested in the land near Peddapoodi are anxious to supplement the supply to the channel by a channel carried across the Biccavole drain, from the Samulcottah canal, as they seem to think that they cannot get an increased supply from the Cocanada canal; that they are to a certain extent justified in this supposition I shall notice further on.

4*th*.—Side channels from above Vellah lock. These are about 6 miles in length, under which and their numerous branches is a large extent of cultivation, and cross bunding as on all the other large channels is carried out according to a regular scale. Unless at the extreme ends of some of the branches I do not remember any difficulty being experienced in cultivation.

5*th*.—Channels from above Yerrapotharam lock. These are not long channels (without a map of the delta I cannot give accurately the channel lengths, and am to a great extent writing from memory), and answer all requirements; cross-bunding is allowed. I might mention several other channels having their head sluices above locks, but their characteristics are pretty much the same as those detailed. I can remember only one channel like the new Samulcottah canal channels, viz., the Wootroomilly, taking off about the 22nd mile Coringa canal right bank. This channel runs nearly direct from the canal for a little way and then takes a direction slightly divergent to the canal. Cross-bunding is usual on the channel, there is but little loss of head at the sluice.

I have not seen much of the new side irrigation channels; those from the Samulcottah canal I naturally take some interest in; as I drew up the original sluice plans and sections for the channels I am acquainted with the changes in the general arrangements, but as far as I can see my original proposals, for side channels with a bed-fall not much greater than that of the canal and sluices with a waterway equal to that of the channel, were better adapted to the requirements of the irrigation than those now being carried out, and in this opinion much more experienced officers than myself, viz., Captains Mead and Brockman, aquiesced. It is true that a wide channel

with small bed-fall is open to several objections, but it would be difficult to devise an arrangement free from objections of some kind or other, and, as regards the greater waterway to the sluices; an extra vent or an increased size of vent does not add much to the cost of a sluice; the wings and abutments, within certain limits as to size or number of vents, remaining pretty much the same. Regarding minor distributaries, what is intended, I presume, is a minor side channel, branching off from the main side channel, and feeding the existing field channels formed by the ryots. Now, I should think one of these minor distributaries to each village would be the least that could well be provided, and owing, as I have already mentioned, to most of the channels being too much in cutting, to obtain a sufficient head on each minor distributary, its sluice should probably be placed somewhere in the lands of the next upper village, and this, I think, would be very objectionable. The ryots of the upper village would constantly interfere with the channel passing through their lands, (even though they had their own channel from a still higher level,) they would endeavour to cross-bund it and take any water they could get, thus giving rise to perpetual disputes. If the sluices of the minor distributaries are placed at the upper end of each extent of land to be supplied, my impression is that under the existing circumstances of most of the channels, the old system of cross-bunding must remain to get a supply, at a high enough level, down the distributary. Such being the case I do not see what is to be gained by a smaller system of distributaries than the side or parallel channels, these in every instance take up the existing field channels. What is required in each channel are iron pipes or small masonry sluices, instead of existing palmyra trees, and the number of these is, after all, not excessive. So much for the old side and parallel channels, and I cannot agree with Lieutenant Campbell in preferring direct cultivation from at number of sluices in the canal banks; but the principles that would guide me in designing new side and parallel channels are—

1*st*.—Place the sluice if possible above a lock so as to obtain ample head.

2*nd*.—Form the channel, as it is called in the delta, a bodhi, *i.e.*, as much as is convenient in embankment, thus obtaining command over all the land it passes through.

3*rd*.—As far as circumstances permit, align the channel so that every field hitherto watered direct from the canal may still be cultivated. In a country where many of its districts are liable to periodical famines, it would appear better policy to incur some little extra expenditure constructing new works; where, as in the delta, the crop being insured they must pay indirectly, if not directly, in the long run.

4*th*.—There should be a limit to the length of the channels, which might be fixed at about 5 miles, when they are longer, be the channels ever so correctly designed in theory, it is difficult to ensure to the lands along the lower reaches their fair share of water (*vide* remarks on the different channels), and hence the ryots' idea to supplement the supply to the Peddapoodi channel from the Samulcottah canal. I may here mention that the delta ryot is rather a pampered individual, and unless he can cultivate with ease he will not cultivate at all, and I have seen many instances of fields being allowed to wither when a single baling basket at work for a few hours would have saved them. In the upland taluqs they will incur a good deal of labor to save a field. Where the sluice cannot be placed above a lock, I would, as in the quoted example, (the Wootroomilly channel,) and as I drew up the Samulcottah canal sluices, make the waterway equal to that of the take off channel, there would thus be no loss of head, and I am not acquainted with any instance in the Eastern Delta where this is not a matter of importance; but of course I do not hold that this should be an invariable rule, as there may be many localities in other deltas where the head can be spared. Before I left the Eastern Delta I drew up sluices and channels for the Mundapettah canal, in accordance with the Chief Engineer's memorandum, enjoining that sluices should be designed with a head of 1 foot, and the channels with a bed fall of 1 foot per mile. Now the Mundapettah canal in its upper reaches has apparently ample command of the country, and one would have supposed that there could not have been much objection to these arrangements, but Lieutenant Campbell informs me that they are likely to result in a decrease of irrigation, and this under a canal where the crop was invariably earlier than under any of the others.

As regards minor distributaries to new channels. If the channels are laid out as bodhis and furnished with suitable sluices or pipes to the existing field channels, care being taken that the number of these is not in excess, I do not think anything further is required, and the head sluice being designed to pass down the proper quantity, there can be no waste of water.

I am well aware that my remarks on these difficult details of irrigation are exceedingly crude and imperfect, but the subject is one requiring much thought and a careful investigation into the requirements of each case, which should rather, I think, be dealt with according to its circumstances than under a hard and fast rule.

SUBMITTED to Government.

The papers contain much valuable information, and the inquiries which have been made into the circumstances of the irrigation of the Godavery Delta cannot fail to have a beneficial effect, by ensuring early water-supply and more efficient distribution where this may be found to need improvement.

2. The undersigned entirely agrees with Major Beatty's remarks in paragraph 11 on the importance of providing Delta Ranges with efficient Divisional and Sub-divisional Officers, and avoiding frequent changes. The subject has been frequently noticed before, and it clearly is bad economy to let important irrigation charges be undermanned.

3. Mr. Walch is about to rejoin the Godavery District with the intention of resuming charge of the Western Delta, his old range, but there can be no objection to his being posted to the Eastern Delta, in which he could probably remain for several years, leaving Lieutenant Dorward in charge of the Western Delta, which he has managed very well.

4. The Collector will doubtless be quite willing to adopt some such arrangement as that noticed in paragraph 10 of Major Beatty's letter for ensuring the correct distribution of areas in the Revenue statements.

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

No. 177. ORDER THEREON, 5th February 1877, No. 405.

IRRIGATION, No. 20.

RECORDED and communicated to the Revenue Department in continuation of G.O., No. 2,697, of the 6th October last.

2. His Grace the Governor in Council is glad to find from these interesting papers that the subject of the decrease of irrigation in the Eastern Delta of the Godavery has been thoroughly gone into by the Officers of the Irrigation Department; that two chief causes, viz., late supply of water and insufficient distribution arrangements have been ascertained, and that these defects can and will be duly attended to and remedied.

3. Major Beatty has brought prominently to notice that repeated changes in the Officers who have held charge of the Eastern Delta may have had considerable influence in producing the unfavorable results which have led to these inquiries. While changes in the ordinary course of the service cannot be avoided, the Chief

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Engineer for Irrigation will do all that may be practicable to obviate the necessity for frequent transfers of the Delta charges.

4. The Government will await with interest the result of improved arrangements in the Eastern Delta.

(True Extract.)

Lieut.-Colonel, R.E.,
Secretary to Government.

To the Revenue Department.
" Superintending Engineer, Godavery.
" District Engineer, Kistna.
" " Tinnevelly.
" " South Arcot.
" Chief Engineer for Irrigation.
" Board of Revenue.

Paper for official 22-1-77

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6th January 1877. No. 405

No. 176 ~~Read the following letter~~ from Major J. BEATTY, R.E., Officiating Superintending Engineer, Godavery, to Lieutenant-Colonel J. MULLINS, R.E., Chief Engineer for Irrigation, dated Camp at Kodir, 13th December 1876, No. 2,625 :—

As directed in G.O., No. 2,697 of 6th October* 1876, I have the honor to state my opinion on the causes of decline in the extent of irrigation in the Eastern Delta during the last two or three years, and I shall take the reasons given by Lieutenant Campbell in the same order that he has given them.

Lieutenant Campbell's letter, No. 481, of 22nd November.
Lieutenant Dorward's letter, No. 343, of 12th November, and
Mr. Larminie's letter, No. 172, of 23rd November.
* Received 2nd November.

2. *First Reason.*—Water being supplied late in the season. I quite agree with Lieutenant Campbell in considering this the chief cause of the falling off. And I believe that the reason why care was not taken to open the canals of the Eastern Delta early was that Lieutenant Campbell's predecessors held the erroneous idea that it was a matter of little importance when water was given for irrigation, that July or even the beginning of August was quite early enough; that the ryots only asked for it earlier for drinking purposes, or from ignorance or laziness; also that over a large portion of the delta the ryots were not independent of the canals and must take the water, *i.e.*, must cultivate wet or not at all.

I am now satisfied that this was a serious mistake, both from the result of the working of the early opening system in the Western Delta, and from my inquiries through the Revenue Department and others. It is of importance that cultivation should commence as early as practicable, especially in all low-lying tracts, so that the crops there may be strong and well-grown before the floods of September or October, for if so paddy can stand being submerged for a week or ten days even without injury. Another reason for giving the water early is that the work of transplanting 500,000 acres, with the limited amount of labor available, occupies a considerable time, and if begun late, owing to the pressing demand for labor, high rates may have to be given.

I am therefore of opinion that water should be given as early as possible. In the Western Delta for some years the canals have been opened on 15th April and water given for cultivation on 1st May, and this has undoubtedly had a great effect on the extension of irrigation.

3. *Second Reason.*—Because it is now optional with the ryots to cultivate wet or dry, as they feel disposed.

In the Western Delta, where there has been a steady increase of cultivation, I am informed that it is quite common to find ryots throwing up land where they have cultivated wet for years, and irrigating other land where they had previously grown dry crops; and this is given me by the Range Officer as one principal reason why Government should not attempt to interfere with minor distribution. You will also observe that according to Lieutenant Dorward's experience, "dry paddy is the next commonest crop to wet paddy; and that grown on good ground" (*i.e.*, well manured previously with Godavery water) "three crops can be raised in a year, also that it then pays better than wet paddy." Consequently ryots holding land well commanded

Your instructions regarding primary distributaries were communicated to all the Delta Ranges, and the difficulty in the Eastern Delta Range appears to have arisen from the fact that Lieutenant Campbell and his predecessor have assumed that no liberty was given them to use their own judgment in designing new distributaries, but that one hard and fast rule was to be followed without reference to the special circumstances of each tract of country to be irrigated. The officers of the Western Delta, on the contrary, have continued to settle the alignment of new distributaries with a view to (1) bringing more land under irrigation; (2), abolishing, where practicable, direct irrigation by palmyra spouts in canal banks; and (3), improving the means of irrigation generally; while at the same time taking care to avoid throwing land out of cultivation, or obstructing the natural flow of drainage. Clause 3, paragraph 10 of your Note printed with the Government Order under reference, shows that the interpretation adopted by the Western Delta Range Officers was the correct one, and all that is now necessary is that the officers in the Eastern Delta should reconsider the circumstances of all distributaries, whether already designed or in contemplation, and propose such modifications and improvements as appear to be necessary to their greater efficiency.

I may here observe that the general system of irrigation under the Godavery anicut is now, and has always been, by means of three classes of channels, viz., (1) "Canals" which are navigable and at the same time carry water for irrigation; (2) "Village Channels," intended only for supplying irrigation with water which is admitted at their heads by means of masonry sluices in the canal banks. These village channels, which are branches from the canals, are so called because they irrigate one, two, or more villages. They are known to the ryots simply as "panta kalwalu," *i.e.*, channels for the supply of water to cultivation. They have also been termed principal or primary distributaries. (3) "The field channels," or "bodhis" as they are called by the natives, are small branches from the village channels dug by the ryots and entirely under their management. These have also been called "Minor Distributaries." According to the system pursued since the anicut works began, canals and village channels have been made and maintained by the Public Works Department, and all minor distribution has been left to the ryots. This is the system which has been so successfully carried out in the Western Delta, and I would strongly deprecate any attempt to alter it, both on the ground of the great expense that must be incurred for works and establishments, and because I consider it uncalled for. It seems to me to be the duty of the Irrigation Officers to make their canals and village channels as efficient as possible, and that of the conservancy establishment to watch over the supply of water until it leaves the village channel, seeing that each village gets its fair share; but beyond that nothing should be attempted.

Water is now supplied from the village channels to the bodhis by palmyra spouts,* which are "supplied and put in the bank (of the village channel) *under supervision* at the ryots' expense, and they can be moved about easily. They have therefore two considerable advantages over masonry works, and if carefully put and wrapped round with straw are not inefficient regulators." The chief objection to masonry sluices in the banks of village channels is that the ryots are constantly

* *Vide* Lieutenant Dorward's letter, para. 20.

by our canals are really very independent, and can afford to decline the use of the water, when, owing to any exceptional causes they fancy it will suit them best to do so. But where a ryot has for a series of years had his land well manured with Godavery water, it seems to me he should not be let off with a mere dry assessment if he ceases to cultivate wet; but should pay an enhanced rate as a contribution towards the cost of the works, which have not only manured his land, but continue to give him the advantage of water by percolation while he avoids paying water-tax. The ryots often make no secret of what they are doing; they find it pays well to cultivate wet for a couple of years or so, and then to grow dry crops on the same land for several years after.

4. *Third Reason.*—Preference of ryots for dry crops. This preference undoubtedly exists, because dry crops require less labor and looking after, besides not entailing payment of water-tax; but it operates especially where the land is not well commanded; or in cases where there is a doubt of getting an early supply, or of the supply being sufficiently regular throughout the season; as for instance, at the ends of long primary distributaries. From this it follows that as the delta system of supply is improved, a greater extent of irrigation may reasonably be looked for. As to the land under the Bank canals wherever it is brought well under command, and navigation also improved, there will be the same prospect of increase as in other parts of the delta.

5. *Fourth Reason.*—Improved drainage. This cause has no doubt had the effect of temporarily throwing some lands out of wet cultivation, which but for it must either have been cultivated wet or not at all; but if the supply in the canals be given early, where the system of distribution is good, it will cease to operate.

6. *Fifth Reason.*—The project being in progress. This is about the only reason Lieutenant Campbell has given in which I think he is quite mistaken. I believe that any suspicions or fears the ryots may have had in regard to the operations of the department have arisen from other causes, and not from the fact that the works of the completion project were in progress.

7. *Sixth Reason.*—New side Channels. These *have* caused a decrease of irrigated area as you anticipated when issuing the instructions* under which they were designed. For I there find you observing as follows:—"It has not been overlooked that possibly some lands now irrigated by the Samulcottah canal will be too high for these principal distributaries as now proposed to be constructed, but this fact will not necessarily make it requisite to alter the arrangements. In a recent communication† it has been remarked that it is not at all desirable that the efficiency of the irrigation generally should be deteriorated by endeavouring to irrigate lands on an exceptionally high level from channels which have been designed to water those which are on a convenient level; and now that irrigation is optional there is the less reason for taking such lands into account. If then any land now irrigated by flow is so nearly on a level with water surface in the Samulcottah canal as to make it necessary to place the branch channel water surface but a few inches lower at most, either such land must cease to be irrigated, or baling must be substituted for flow."

* Memorandum No. 695 of 10th September 1874.

† No. 661 of 1st September 1874.

No. . Read the following endorsement of the Chief Engineer for Irrigation, dated Fort St. George, 26th January 1877, No. 77 W :—

SUBMITTED to Government.

The papers contain much valuable information, and the inquiries which have been made into the circumstances of the irrigation of the Godavery Delta cannot fail to have a beneficial effect, by ensuring early water-supply and more efficient distribution where this may be found to need improvement.

2. The undersigned entirely agrees with Major Beatty's remarks in paragraph 11 on the importance of providing Delta Ranges with efficient Divisional and Subdivisional Officers, and avoiding frequent changes. The subject has been frequently noticed before, and it clearly is bad economy to let important irrigation charges be undermanned.

3. Mr. Walch is about to rejoin the Godavery District with the intention of resuming charge of the Western Delta, his old range, but there can be no objection to his being posted to the Eastern Delta, in which he could probably remain for several years, leaving Lieutenant Dorward in charge of the Western Delta, which he has managed very well.

4. The Collector will doubtless be quite willing to adopt some such arrangement as that noticed in paragraph 10 of Major Beatty's letter for ensuring the correct distribution of areas in the Revenue statements.

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

No. 177 ORDER THEREON, 5th February 1877, No. 405.

IRRIGATION, No. 20

RECORDED and communicated to the Revenue Department in continuation of G.O., No. 2,697, of the 6th October last.

2. His Grace the Governor in Council is glad to find from these interesting papers that the subject of the decrease of irrigation in the Eastern Delta of the Godavery has been thoroughly gone into by the Officers of the Irrigation Department; that two chief causes, viz., late supply of water and insufficient distribution arrangements have been ascertained, and that these defects can and will be duly attended to and remedied.

3. Major Beatty has brought prominently to notice that repeated changes in the Officers who have held charge of the Eastern Delta may have had considerable influence in producing the unfavorable results which have led to these inquiries. While changes in the ordinary course of the service cannot be avoided, the Chief Engineer for Irrigation will do all that may be practicable to obviate the necessity for frequent transfers of the Delta charges.

4. The Government will await with interest the result of improved arrangements in the Eastern Delta.

(True Extract.)

Lieut.-Colonel, R.E.,
Secretary to Government.

To the Revenue Department.
„ Superintending Engineer, Godavery.
„ District Engineer, Kistna.
„ „ Tinnevelly.
„ „ South Arcot.
„ Chief Engineer for Irrigation.
„ Board of Revenue.

Eastern Delta, Godavery District.—Passing orders on Note by the Chief Engineer for Irrigation submitting papers from the Superintending Engineer, Godavery, relative to the decrease of irrigation in the —.

Exd. S. T. Austin.

14/2/77 S.T.

ceasing to irrigate one part of the village ayacut and taking up for irrigation another part, so that the minor distribution works constructed one season might be useless the next. And if we did undertake the supply of masonry regulators, about twelve thousand would be required at a cost of Rupees 60 each, or upwards of seven lakhs of Rupees.

8. *Seventh Reason.*—The selling price of paddy as compared with dry grains. That this has had some effect in reducing the area under irrigation is certain, for I have heard of several cases of villagers expressing regret that they had thrown up land this year, and this has been chiefly due to rise in price owing to the drought.

9. *Eighth Reason.*—Excessive Water-tax. I agree with Lieutenant Campbell that there is no reason to consider the water-tax excessive.

10. With reference to the remarks in paragraph 15 of your Note, Lieutenant Dorward has stated the result of his observation and experience as to the incorrect figures given by the Revenue Department. The source of information of both the Revenue and Irrigation Officers is now the same; viz., the village Curnams, who know from what canals irrigation is supplied, and generally give it to the Public Works Officers quite correctly, but the Revenue Department is only concerned with registering irrigation correctly by villages, and naturally mistakes arise as the information in regard to canals passes from the Curnam through the Revenue Inspector to the Tahsildar, from him to the Divisional Revenue Officer, and then through the Collector's office. As suggested by Lieutenant Dorward, the proper system would be for the Collector to furnish the Range Officer with a statement by villages, and request him to settle the areas irrigated by each canal and send it to him for entry in the returns submitted by the Collector's office to the Board of Revenue. Until this is done it will be useless reviewing the figures given by the Revenue Department for the areas under canals. For instance, there was a considerable area of cultivation in 1873-74 under the Yennamadurru, but the Revenue Department reported there was none. In 1874-75 that area was reduced* to 89 acres, but the Revenue Department, for some cause unknown, reported there was 2,974. Considering that the Revenue Department have thus of their own accord shown a change in the source of irrigation, it is not clear how the responsibility for incorrect figures lies with this department, as you seem to think.

* The previous year's irrigation being supplied by new channels under other canals.

11. In conclusion, as regards suggestions for preventing further decrease of wet cultivation in the Eastern Delta, and hastening the extension of irrigation to the full area anticipated when the project estimates were submitted, I consider it of the first importance that the range should be provided with efficient Divisional and Sub-divisional Officers, and that these officers should not be removed elsewhere as soon as they have acquired some knowledge of its wants. Since Mr. Walch joined the Western Delta the Eastern Delta has passed through the hands of Major Hasted, Mr. Hannan, Major Mead, Captain Brockman and Lieutenant Campbell, and now the last-named officer has applied for furlough. Major Mead and Captain Brockman I know had only time to discover how erroneous were the ideas they had brought with them from southern districts as to the best data for giving water for cultivation when they were removed. In fact the too frequent changes in the Eastern Delta go far to account for the less favorable condition of the works and irrigation there than in the Western, and in future it should be clearly understood that no officer will be appointed to the Eastern Delta who is not willing to stop there some years, and if his

health continue good he should be permitted to do so. On a system of frequent changes it cannot be expected that officers will take that interest in the works which is essential to satisfactory progress, and their short tenure of office prevents the ryots acquiring that confidence in them which is indispensable to the successful administration of a Delta Range.

As already reported, in submitting Lieutenant Campbell's application for furlough, I know of no officer better fitted to correct deficiencies of design or system in the Eastern Delta than Mr. Walch, who has already, with the able assistance of Lieutenant Dorward, done so much for the Western Delta.

My second suggestion for effecting the rapid extension of irrigation in the Eastern Delta is the same as Lieutenant Campbell's first. I would arrange to give water for irrigation in May.

Thirdly, the Range Officer should give his best attention to correcting defects in the design of all his primary distributaries, and to giving them, where necessary, better means of supply, bearing in mind that spouts of every description are to be gradually abolished wherever they now exist in the banks of navigable canals, as is now being done on all the canals of the Western Delta.

If these three suggestions be attended to, I have no doubt the area under irrigation in the Eastern Delta will rapidly attain its maximum.

12. I lately called upon Lieutenant Campbell, Lieutenant Dorward, and Mr. Larminie to report their views on distributaries with reference to the remarks in your Note above referred to, and I send their replies for your information.

From Lieutenant D. McNIEL CAMPBELL, R.E., Executive Engineer, Godavery, to Major J. BEATTY, R.E., Officiating Superintending Engineer, Godavery, dated Camp, Dowlaishweram, 22nd November 1876, No. 481.

With reference to paragraph 10 of Chief Engineer's Note No. 2,697, of 6th October 1876, and your memorandum thereon, No. 2,244, dated 9th November 1876, I have the honor to submit the following remarks.

2. You will see from my letter, No. 1,426, dated 22nd August 1876, to which Colonel Mullins' Note is an answer, that I never objected to distributaries or even side channels taken off above locks, and that I never advocated numerous offtakes and small channels to supply the place of distributaries properly aligned, but Colonel Mullins appears to think that this is what I meant, and it is therefore not surprising that he considers that I am not competent to write on the subject without advice. The sixth reason I gave in my letter was "new side channels." I did not mention distributaries or parallel channels except to say that long distributaries are objectionable, and I am sure that every Irrigation Officer will agree with me on that point. What I was writing against was side channels taken off from any point in a canal so that they have not so much command over the country as the main canal itself, and consequently cannot irrigate land which could be irrigated by the latter, and in such cases, I consider, direct irrigation by means of pipes preferable.

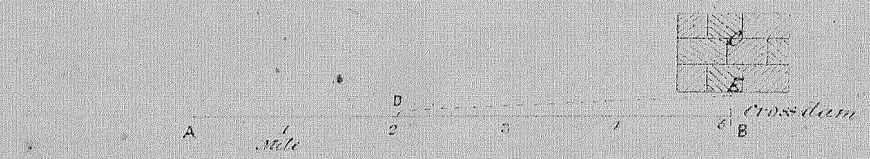
3. Clauses 1 and 2 of the Chief Engineer's paragraph 10 are written entirely under the impression that I would like to have the whole delta irrigated by means of iron pipes and small channels; this not being the case, I need here make no remarks on what he has said. I can only express my regret that my letter should have been so badly worded as to lead him into this mistake.

4. In clause 3 the Chief Engineer states my views exactly, when he says "side or parallel channels may or may not be in particular cases the proper alignment of distributaries," though why side and parallel channels should be classed together I do not know. In the same clause it is stated in general terms that the alignment of distributaries must depend on circumstances, which of course cannot be doubted, and such being the case does it not seem strange that the proper alignment for the distributaries of all of the following canals, Samulcottah, Cocanada, Injeram, Mundapetta and Coringa, should be following the line of these channels and close outside their banks.

5. In clause 5 Colonel Mullins states that the head of an irrigation channel should be placed where the levels afford sufficient command, and I never thought otherwise; I mentioned the position of above a lock as there is seldom any other point in a main canal where the command is sufficient. The statement that my remarks about loss of head in distributaries "are at any rate as stated erroneous," I cannot understand. I merely said that in the Samulcottah canal side channels there was a loss of head of 1 foot, and so there is, that is the water in the side channel is 1 foot lower than in the main canal, and as the latter is only just high enough to command the land, surely this loss of 1 foot is a consideration; of course if the main canal water were well above the country the 1 foot loss would be of no consequence, in fact it would perhaps be an advantage.

6. In your memorandum under reply you ask for my opinion on several points connected with distribution arrangements in general, and it is with the greatest hesitation I comply with your request, for, as the Chief Engineer states, I have had so little experience in these matters.

7. What I consider to be the great fault of most of the existing distributaries is that the water is not carried at a sufficiently high level, thereby rendering cross-dams necessary. Colonel Mullins thinks that this can be obviated by the head of the main channel from the distributary being taken off higher up; but, as stated by the Chief Engineer, ryots, if left to themselves, naturally endeavour to obtain a supply for their fields from a point on the channel nearest to their lands, and it certainly seems to me that a distributary should, if possible, be made to command all the land on each side of it. The case of the Nizampatam side channels mentioned by the Chief Engineer is as follows:—



Let A B be the side channels. The water level being low, in order to irrigate the land at E a cross-dam has to be erected at B and a minor channel taken off immediately above; instead of this Colonel Mullins thinks that the cross-dam should not have been put up, but the minor channel should have had its head higher up, say, about the point D; but I consider that it would have been much preferable had the channel A B been designed to carry water at a sufficiently high level to irrigate the land all along its course, and this might easily have been done as the channel takes off from above a lock where the water is very high, of course there would have been a little extra expense in banking, but the embanked channel D E would not be required.

8. The Chief Engineer wishes to have distributaries with minor channels taken from them, all to be provided with regulators at their heads, this is no doubt quite feasible, though the number of regulators required will be something considerable, but he also considers that all field channels should be provided with regulators; now what the number of these is I am afraid to say, but, in my opinion, it is impracticable to go into such detail in the supply of water. I should say make a distributary with a head sluice to carry water at a sufficiently high level, and let the ryots take water by pipes and dig their own field channels unless there is land to be irrigated at such a distance that the ryots could not dig a channel themselves, in which case a minor channel with a regulator at its head may be given, and in cases where water in the main canal is just above the level of the country, and consequently the land close to it on either side cannot be conveniently irrigated by distributaries, I would give water by means of pipes.

9. Colonel Mullins seems to consider that the fewer offtakes there are from main canals

the better now, of course the fewer main distributaries there are the more minor ones or the more field channels there must be, and I certainly think it would be easier to have control over regulators on main canals than on distributaries, so I therefore consider that there is a limit to reducing the number of distributaries.

10. I will now proceed to describe what I consider the proper arrangement for distributaries, &c. In a main canal with locks it is generally the case that above the lock the water commands the country, while for several miles below it is in cutting; in such cases I would have side channels taken off from above the locks, and running as far as that point in the lower reach where the main canal water comes above the level of the country, this would in most cases make the side channels 4 or 5 miles long, which is ample; from where the side channel ends I would take off distributaries at about every 1 or 2 miles and run each along the lines, but suited to the fall of bed unless circumstances rendered another line desirable, these distributaries would be provided with head sluices, and as the distance between any two would not be more than 2 miles minor channels would not be required, only field channels that the ryots would dig would be necessary. The whole of the regulation of the water-supply would be done from the main canal, and I would make no attempt to regulate the supply to the fields unless it were to provide the ryots with pot sluices or pipes to prevent them from cutting gaps in the banks. There might perhaps be a strip of land along each side of the main canal (as in the case of the Samulcottah canal) which could not be conveniently irrigated by these distributaries, this land I would irrigate by pipes. I would endeavour to make the length of each distributary not more than 4 miles, and I would rather make a short channel directly through the land to be irrigated than make a cheaper and larger channel following the line suited to the bed fall. In this delta there are so many main channels that it is seldom a distributary would have to be more than 5 miles long. In cases like the Samulcottah and Injeram canals I would have no side channels at all, but would arrange the distributaries as described in the latter part of this paragraph.

11. For the Samulcottah canal Colonel Mullins proposes parallel channels; these would probably run about a mile from the main canal and nearly parallel to it; to irrigate the land under this parallel channel, minor channels would be required (I suppose about one to every 2 miles of distributary), running somewhere about at right angles to the parallel channel. Now I can see no reason why the minor channels should not take off from the main canal direct and the parallel channel be left out. As regards the cost; supposing the length of parallel channel to be 6 miles. By Colonel Mullin's proposal there would be the cost of one head sluice in main canal, 6 miles of distributary, three minor sluices and three minor channels, say each three miles long, besides cattle-crossings and bridges which would be necessary on a parallel channel. By the method I propose there would be three small sluices and three minor channels each four miles long. Colonel Mullins wishes cheap regulators built in distributaries, but I would observe that the cost of building even what he proposes would be considerable, for any where distant from a navigable canal the cost of conveying materials is great, there are no roads, and everything would have to be carried by coolies. As regards the regulation, I do not think it can be disputed but that it would be easier to regulate three sluices in the main canal than three in the distributary and one in the main canal.

12. From what I have written it will be seen that what I propose amount to this, that where the main canal is an irrigation channel, that is, where the water in it commands the country, it should be treated as the distributary and minor channels made from it, that the number of these channels should be about one to every one or two miles (if the position is suitable) on each bank of the canal and that they should each be provided with a head sluice, and that land near the main canal which cannot conveniently be irrigated by them should be irrigated by pipes. That no attempt should be made to regulate the supply to field channels except to see that no breaches are cut in the minor channels.

13. In clause 1 of paragraph 10, Colonel Mullins objects to numerous offtakes from main canals, and, as he may call, one in every 1 on 2 miles too many. I will answer the objections that he makes. He first says that they cause great waste of water and complicate drainage arrangement. As regards the waste of water this need not be considered, as I propose to provide head sluices to all the minor channels from main canals, consequently there will be no waste except for the few pipes that may in some cases be required. As regards complicating drainage arrangements, I cannot see that numerous offtakes from main canal will have more effect in this way than numerous offtakes from distributaries or minor channels. As regards the second objection, that numerous offtakes are costly, I think I have shown in paragraph 11 that they are not more costly than other arrangements.

14. With reference to your paragraph 3, I consider that cross-dams can easily be done away with by making the distributaries able to carry water at a higher level and limiting their length; but to substitute regulators with shutters for palmyra spouts in field channels is, in my opinion, quite impossible; but even if possible, it cannot for an instant be supposed that the ryots would regulate them properly and take the exact amount of water required; palmyra spouts might be abolished by providing the ryots with pipes or pot sluices; but as some thousands of them would be required, the cost would be considerable.

15. I have endeavoured to state my views clearly, but I by no means maintain that the method of distribution I have proposed is suitable for all cases,* and it is quite impossible in a letter like this to enter fully into this important subject of distribution; it is a subject that requires a great deal of consideration, and on which I do not think any opinion can be formed except after having seen the existing distributaries at different periods of the irrigation season.

* The distance between the main canals may be great, in which case main distributaries with minor channels would be necessary.

From Lieutenant A. R. F. DORWARD, R.E., Assistant Engineer in charge Western Delta Division, Godavery District, to Major J. BEATTY, R.E., Officiating Superintending Engineer, Godavery District, dated Godavery District, 12th November 1876, No. 343.

With reference to your memorandum No. 2,244, of 9th instant, I have the honor to report as follows:—

2. In paragraph 6 of his Note the Chief Engineer, referring to dry paddy, states, "it is doubtful whether this species of cultivation will be other than exceptional, for it would not in general pay a ryot to cultivate inferior paddy in order to avoid the water-tax."

3. I think dry paddy is the next commonest crop to wet paddy, at any rate it is a common crop. When grown on good ground three crops of it can be raised in a year; it then pays better than wet paddy. It is largely grown as a mixed crop with cotton and some grains.

4. There can be no two opinions as to the superiority of a system of few over numerous offtakes, and I was surprised to see from the Chief Engineer's Note that Lieutenant Campbell was strongly in favor of the latter. I have therefore read Lieutenant Campbell's letter carefully, and fancy that the Chief Engineer has misunderstood him. What Lieutenant Campbell seems to me to advocate is a system of comparatively numerous offtakes as opposed to a system of side channels. This is a very different matter.

5. In laying out a system of distributaries the following points should be borne in mind:—

The irrigating length of the channels should not be too long, they should run through the centre of the land to be irrigated at or nearly at right angles to the canal, and should carry water at a sufficient level for irrigation when the water in the canal is considerably below full supply level.

6. In laying out any particular channel there will always be special circumstances to be considered, but in taking a general view they may be disregarded.

7. I have spoken above of the irrigating length of a channel as being the length to be considered, as a channel if properly designed may run for miles in cutting and require very little repair.

8. We have in this range channels of all lengths, from 1 mile to about 20. Up to about 6 miles a channel can be kept in an efficient state without much trouble. Channels of more than 6 miles long are in bad seasons failures, the land at the end of such channels being always more or less dependent on the rainfall.

9. Distributaries should not have minor branches other than the small field channels of the ryots. Small channels are expensive and apt to get out of order.

10. The longest field channels I know of are about one mile long. Such channels the ryots are always anxious to hand over to the care of Government. I think therefore that a distributary should be within three-fourths of a mile of all land it is intended to irrigate from it. A strip of land three-fourths of a mile wide on each side would give about 1,000 acres of irrigation per mile of channel. To get this amount it is necessary either that the channel should run on a ridge, which is most advantageous, or that its water should be carried at a considerable height above the country.

11. Owing to the nature of the country over which it runs a channel will rarely irrigate as much land on one side of it as on the other. Taking three-fourths of a mile as the maximum distance at which irrigation can be efficiently carried on, it will be understood why we so rarely irrigate 1,000 acres per mile of channel. Had we to lay out our channels again we should get much nearer to this result, but in this delta our endeavours have of necessity been directed towards the improvements of an existing system of distributaries.

12. The irrigated area per mile of a channel is the principal proof of its efficiency. The inferiority of side or parallel channels, which can only irrigate from one bank, to channels which diverge from the canal line is therefore evident.

13. Without minor branches a parallel channel can rarely irrigate more than 500 acres per mile. In what side or parallel channels we have minor branches are nearly always present, and if Lieutenant Campbell in condemning side channel means that it would be preferable to have the heads of those minor branches in the main canal, and do away with the side channels altogether, I perfectly agree with him.

14. For some distance below a lock or weir the water level in the canal is too low to irrigate the land on each side of it, and if it be determined to irrigate such land a side or parallel channel is necessary. This I take to be Lieutenant Campbell's meaning when he exempts side channels taken off from above locks from the condemnation he otherwise accords them. Except in such cases an alignment parallel to the canal of supply can only rarely be proper for an irrigation channel.

15. In this range the great examples of parallel channels are the mid and low level channels which run parallel to the Ellore canal. Apart from the question of their obstructing drainage, I do not think that any one now doubts that it would have been better to irrigate the land they now irrigate by several channels from the Ellore canal running at or nearly at right angles to it. The mid and low level channels run at right angles to the junction canal, but that canal was an afterthought and introduced solely in the interests of navigation.

16. The water in our canals is during the irrigation season, when the supply in the river is small, often from 1 to 2 feet before full supply level. At those periods in many irrigation channels we cannot do without temporary cross-bunds.

17. In this range an authorized cross-bund list is kept, and ryots are allowed at certain times to put cross-bunds for stated periods. This system is the outcome of necessity, and is owing to mistakes in the design and execution of distributaries. In digging new channels there ought to be no necessity for them.

18. Of late years a great many of these cross-bunds have been done away with. Where small areas were affected ryots have been told that they must cultivate at their own risk, and that cross-bunds would not in future be allowed. As the improvements contemplated in the completion estimates are carried out many more will become unnecessary. But even when these improvements are finished a very considerable number will remain. Then each individual cross-bund will have to be dealt with on its own merits, the cultivation under it being provided for by a

separate channel or a masonry dam, or it may be decided to refuse water to the land so irrigated altogether. Any sweeping measure is now, and will be then, impossible without an immediate and large loss of revenue.

19. Masonry dams are great improvements on bunds of mud and straw, and if the régime of the channel be altered to suit the circumstances they induce, little inconvenience will be felt from their use. Still a channel is better without them, and efficient channels can be designed and executed without them. Masonry drops are often necessary to get rapidly over a steep, falling country, but they are different things from dams.

20. Owing to pressure of work and to always having other work to do, a Delta Range Officer has very little time to spend in attending to irrigation details. Yet, in the interests of Government, his time could not be spent better nor be more directly remunerative. A special officer might well be employed on such work. To settle the number of palmyra spouts required on a channel, and the position of each is no light work. It is very difficult to get at exact areas, the representations of each ryot have to be listened to, and his ideas of "mamul" have to be humoured or overcome. When all is considered settled, and the ryots have expressed themselves satisfied with the new order of things, it is not a little irritating to find that they at once go home and write petitions to every official in the district, who they think can in any way help them, praying for a return to the old system. By far the greater portion of these petitions are sent from various sources to the Range Officer for inquiry and report. For a long time to come the supply of ryots' channels will be carried on by means of palmyra spouts, and it is at present of little use considering the nature of the sluice that should take their place. Palmyra spouts are supplied and put into the bank (under supervision) at the ryots' expense, and they can be moved about easily. They have therefore two considerable advantages over masonry works, and, if carefully put and wrapped round with straw, are not inefficient regulators.

21. Referring to the remarks in paragraph 15 of the Chief Engineer's Note, I would point out that it has never been the practice to inform the Revenue Department of the sources of irrigation of various villages. It never consequently struck me that it was my duty to do so, and I do not know now whom I ought to inform. The revenue statements of irrigation are based on the accounts of village Curnams submitted to Revenue Inspectors. The Curnams know perfectly well the sources of irrigation for their particular villages, and, as a rule, give them correctly enough in their monthly statements. The Revenue Inspector compiles the statements of the various Curnams in his division, and numerous mistakes occur in their statements. I often have copies of their statements sent to me and so notice the errors. The Revenue Inspector then submits his statement to the Tahsildar, who, in turn, submits a statement compiled from those of the various Revenue Inspectors in his taluq to his divisional officer, for submission to the Collector. When the statement leaves the hands of the Revenue Inspector it passes through the office of no one who has any special knowledge of sources of irrigation. It is not therefore to be wondered at that the statements showing irrigation under each canal are inaccurate and unsuited for purposes of review. It seems to me that the proper system would be for the Collectors to send a statement showing the area cultivated in each village to Range Officers at the end of each year, and to call upon them to show the area irrigated by each canal.

From J. C. LARMINIE, Esq., Assistant Engineer in charge Rajahmundry Division, to Major J. BEATTY, R.E., Officiating Superintending Engineer, Godavery District, dated Rajahmundry, 23rd November 1876, No. 172.

I HAVE the honor to reply to your memorandum, No. 2,244, of the 9th instant, and I think the best way to do so will be to consider, in detail, some of the irrigation channels of the Eastern Delta, with which I am acquainted. 1*st*, channel from above Thapaswaram lock, left bank; this runs for a little way direct from the canal and then bifurcates into the Nadoorabada and Vadroopaka channels, which, in their turn, give off other branches, and the average length of each from the head sluice may be taken at about 7 miles. These are very good examples of parallel

channels, (though not exactly parallel,) there is an ample head of water and there is seldom any real difficulty about the cultivation, but there is a recognized system of cross-bunding, so many days to each village, and as the channels have been run too much into cutting, I do not see how a system of distributaries as proposed in clause 4, paragraph 10 of the Chief Engineer's Note, can be carried out unless the level of water in the channel be considerably raised, or else an arrangement, noticed further on, carried out.

2*nd*.—Side channels from the right bank, at the same lock. It seems to me that the lower end of this channel has also been run too much into cutting by means of masonry drops and the advantages due to head lost, the same remark applies to the side channel along the left bank, and in which cross-bunding was allowed, in both channels the water level must be raised before minor distributaries can well be carried out.

3*rd*.—Side channels from above Thossipoodi lock. These are comparatively new channels; that along the right bank is nearly 5 miles in length; and was intended to supply several direct channels, each having a sluice in the canal bank in addition to the irrigation along the canal, but since its (the side channels) construction there have been many complaints from the cultivators along these direct channels, and I believe some land at the end of the side channel has ceased to be cultivated with wet crop, and at present I understand that cross-bunds are allowed in the side channel which would consequently appear to have been run too deep into cutting.

The channel from the left bank is a very long one, extending to below Peddapoodi, a distance of fully 8 or 9 miles from Thossipoodi; it is only a side channel up to about 3 miles below Thossipoodi, where it joins the old Peddapoodi channel, (which before the improvements to the canal had its sluice here,) which runs for a mile or so direct from the canal and then turns off in a direction parallel to the canal. There is a large extent of cultivation under this channel, and no difficulty is experienced in the upper reaches, or for 5 miles or so from the head, but regarding the lower reaches complaints are common, and were the water-supply adequate a considerable area of waste land near Peddapoodi would be cultivated. It has come to my knowledge that the ryots interested in the land near Peddapoodi are anxious to supplement the supply to the channel by a channel carried across the Biccavole drain, from the Samulcottah canal, as they seem to think that they cannot get an increased supply from the Cocanada canal; that they are to a certain extent justified in this supposition I shall notice further on.

4*th*.—Side channels from above Vellah lock. These are about 6 miles in length, under which and their numerous branches is a large extent of cultivation, and cross bunding as on all the other large channels is carried out according to a regular scale. Unless at the extreme ends of some of the branches I do not remember any difficulty being experienced in cultivation.

5*th*.—Channels from above Yerrapotharam lock. These are not long channels (without a map of the delta I cannot give accurately the channel lengths, and am to a great extent writing from memory), and answer all requirements; cross-bunding is allowed. I might mention several other channels having their head sluices above locks, but their characteristics are pretty much the same as those detailed. I can remember only one channel like the new Samulcottah canal channels, viz., the Wootroomilly, taking off about the 22nd mile Coringa canal right bank. This channel runs nearly direct from the canal for a little way and then takes a direction slightly divergent to the canal. Cross-bunding is usual on the channel, there is but little loss of head at the sluice.

I have not seen much of the new side irrigation channels; those from the Samulcottah canal I naturally take some interest in; as I drew up the original sluice plans and sections for the channels I am acquainted with the changes in the general arrangements, but as far as I can see my original proposals, for side channels with a bed-fall not much greater than that of the canal and sluices with a waterway equal to that of the channel, were better adapted to the requirements of the irrigation than those now being carried out, and in this opinion much more experienced officers than myself, viz., Captains Mead and Brockman, aquiesced. It is true that a wide channel with small bed-fall is open to several objections, but it would be difficult to devise an arrangement free from objections of some kind or other, and, as regards the greater waterway to the sluices; an extra vent or an increased size of vent does not add much to the cost of a sluice; the wings and abutments, within certain limits as to size or number of vents, remaining pretty much the same. Regarding minor distributaries, what is intended, I presume, is a minor side channel, branching off from the main side channel, and feeding the existing field channels formed by the ryots. Now, I should think one of these minor distributaries to each village would be the least that could well be provided, and owing, as I have already mentioned, to most of the channels being too much in cutting, to obtain a sufficient head on each minor distributary, its sluice should probably be placed somewhere in the lands of the next upper village, and this, I think, would be very objectionable. The ryots of the upper village would constantly interfere with the channel passing through their lands, (even though they had their own channel from a still higher level,) they would endeavour to cross-bund it and take any water they could get, thus giving rise to perpetual disputes. If the sluices of the minor distributaries are placed at the upper end of each extent of land to be supplied, my impression is that under the existing circumstances of most of the channels, the old system of cross-bunding must remain to get a supply, at a high enough level, down the distributary. Such being the case I do not see what is to be gained by a smaller system of distributaries than the side or parallel channels, these in every instance take up the existing field channels. What is required in each channel are iron pipes or small masonry sluices, instead of existing palmyra trees, and the number of these is, after all, not excessive. So much for the old side and parallel channels, and I cannot agree with Lieutenant Campbell in preferring direct cultivation from a number of sluices in the canal banks; but the principles that would guide me in designing new side and parallel channels are—

1*st*.—Place the sluice if possible above a lock so as to obtain ample head.

2*nd*.—Form the channel, as it is called in the delta, a bodhi, *i.e.*, as much as is convenient in embankment, thus obtaining command over all the land it passes through.

3*rd*.—As far as circumstances permit, align the channel so that every field hitherto watered direct from the canal may still be cultivated. In a country where many of its districts are liable to periodical famines, it would appear better policy to incur some little extra expenditure constructing new works; where, as in the delta, the crop being insured they must pay indirectly, if not directly, in the long run.

4*th*.—There should be a limit to the length of the channels, which might be fixed at about 5 miles, when they are longer, be the channels ever so correctly designed in theory, it is difficult to ensure to the lands along the lower reaches their fair share of water (*vide* remarks on the different channels), and hence the ryots' idea to supplement the supply to the Peddapoodi channel from the Samulcottah canal. I may here mention that the delta ryot is rather a pampered individual, and unless he can cultivate with ease he will not cultivate at all, and I have seen many instances of fields being allowed to wither when a single baling basket at work for a few hours would have saved them. In the upland taluqs they will incur a good deal of labor to save a field. Where the sluice cannot be placed above a lock, I would, as in the quoted example, (the Wootroomilly channel,) and as I drew up the Samulcottah canal sluices, make the waterway equal to that of the take off channel, there would thus be no loss of head, and I am not acquainted with any instance in the Eastern Delta where this is not a matter of importance; but of course I do not hold that this should be an invariable rule, as there may be many localities in other deltas where the head can be spared. Before I left the Eastern Delta I drew up sluices and channels for the Mundapettah canal, in accordance with the Chief Engineer's memorandum, enjoining that sluices should be designed with a head of 1 foot, and the channels with a bed fall of 1 foot per mile. Now the Mundapettah canal in its upper reaches has apparently ample command of the country, and one would have supposed that there could not have been much objection to these arrangements, but Lieutenant Campbell informs me that they are likely to result in a decrease of irrigation, and this under a canal where the crop was invariably earlier than under any of the others.

As regards minor distributaries to new channels. If the channels are laid out as here and furnished with suitable sluices or pipes to the existing field channels, care being taken that the

number of these is not in excess, I do not think anything further is required, and the head sluice being designed to pass down the proper quantity, there can be no waste of water.

I am well aware that my remarks on these difficult details of irrigation are exceedingly crude and imperfect, but the subject is one requiring much thought and a careful investigation into the requirements of each case, which should rather, I think, be dealt with according to its circumstances than under a hard and fast rule.

Exd. S. T. Austin.

1760 Z.F.J
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No 77 Ms

Submitted to Government.

Suml

The papers contain much valuable information, and the enquiries which have been made into the circumstances of the irrigation of the Godavery Delta cannot fail to have a beneficial effect, by ensuring early water supply, and more efficient distribution where this may be found to need improvement.

2 The undersigned entirely agrees with Major Beatty's remarks in favour of on the importance of providing Delta Ranges with efficient Divisional and Sub Divisional officers, and avoiding frequent changes. The subject has been frequently noticed before and it clearly is bad economy to let important irrigation charges be undermanned.

3 Mr. Walch is about to rejoin the Godavery District with the intention of resuming charge of the Western Delta his old Range - but there can be no

objection to his being posted to the Eastern Delta in which he could probably re=
=main for several years, leaving Lieut.t Dorward in charge of the Western Delta which he has managed very well.-

4 The Collector will doubtless be quite willing to adopt some such arrangement as that noticed in pa=
=ra 10 of Major Beatty's letter for en=
=suring the correct distribution of areas in the Revenue statements.-

Fort Saint George
26 January 1877

Lieut.t Col.o R.E.
Chief Engr. for Irrigation.-

To,
The Secretary to Government
P. W. D.

The undersigned
has to remark that
all the changes
referred to have
been due to Inspec=
=tions and
Jamabandhis and
that it will be
impossible to
dispense the ne=
=cessity of such com=
=munications - Mr.
Welch who has just
been sent back to
the Godavery by
this standing,
entitled to Dis=
=trict charge -

In the opinion
of the undersigned
the District Engi=
=neer might have
done much more
than he apparently
has done in keep=
=ing Range Offi=
=cers straight in

The matter of inter distributions and not allowing any crude or experimental notions to act injuriously on the Revenues - although therefore he has initialled Colonel Mullins' Dispr he cannot order that pumping operations -

Cypher
29.1.

P.W.D.
1877 29 JAN 77
No. 254

From
The Chief Engr for Irrign

Dated 26 } Jany. 1877.
Dept. 29 }

Encl 1

No. 77-W

Decrease of Irrigation in the Eastern Delta - Godavery Dist. — Submits papers from the S.E. Godavery, relative to the —

06-10-76 No. 2697.

Cir 28-1-77.

L. R. Form No. 22.

No 405 Public Works Department.

PROCEEDINGS of the MADRAS GOVERNMENT.

UNDER date the 5 Feb 77

Read the following:—

From
The Chief Engineer & Secy to Govt. No. 77/W dd 26th Jany 1877
for Irrigation

Recorded and communicated to the Revenue Department in continuation of G. O. No. 2697 of the 6th October last.-

2 His Grace the Governor in Council is glad to find that the subject of the decrease of irrigation in the Eastern Delta of the Godavery has been thoroughly gone into by the officers of the Irrigation Department, that the chief causes

causes viz late supply of water, and less efficient distribution arrangements than are desirable, have been ascertained and that these defects can and will be duly attend-
-ed to.-

3 Major Beatty has brought prominently to notice that repeated changes in the officers who have held charge of the Eastern Delta have had con-
-siderable influence in producing the unfavour-
-able results which have led to these enquiries. There can be no doubt of the correctness of this conclusion, and the Chief Engineer for Irrigation will do all that may be practicable to obviate the

the necessity for frequent transfers of the Delta charges.-

4 The Government will await with interest the result of improved arrangements in the Eastern Delta.-

Ly. 27/1

Govt

Revenue Deptt ✓
S.E. Godavery ✓
D.E. Kistna ✓
" Tinnevelly ✓
" South Arcot ✓
Chief Engr Irrign ✓
Board of Revenue ✓

Drft) 22-2-77

Ge 854

Govt. of 1877 Madras.

PUBLIC WORKS.

To The Revenue Dept.

Dated

Issued

Recd. Encl.

G. O., Public, 1877, No. 405

Nos. 176-7

Public Works Dept.

Eastern Delta, Godavery

Dr. Sowing orders on papers
sold by the Chief Engr
on building papers from the
Superintg Engr Godavery relative
to the decrease of irrigation
in the ——