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REPORT
OF THE
COMMITTEE APPOINTED UNDER THE FAMINE COMMISSION
TO ENQUIRE INTO THE
MANAGEMENT OF IRRIGATION WORKS
IN
MADRAS, ORISSA, AND MIDNAPUR;
TOGETHER WITH A SUPPLEMENT ON
THE IRRIGATION SYSTEM OF THE SOANE CANALS, BEHAR.



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PREFACE.

ON the 26th July 1878, the Government of India resolved on the appointment of this Committee, but although one of its members was enabled at the end of August to begin the necessary inquiries, the two others were not nominated nor relieved from their current duties until later, and it was not until the 2nd October that they could hold their first conference. They were directed so to restrict their inquiries as to admit of their Report being before the Famine Commission by the 1st January 1879 at latest, and the points to which their attention was specially directed were as follows:—

2. (i.)—The best way of administering works of irrigation so as to return a fair profit to Government without making them in any way vexatious or oppressive to the people.
- (ii.)—The hindrances or objections to irrigation which might be found to exist, and whether for any reason dry crops are ever grown in preference to wet.
- (iii.)—The condition of irrigation in zamindaris, the obligation of the owners to maintain irrigation works, and the expediency of Government interfering to enforce this obligation; also as to whether, where there are Government lands passing through zamindari villages, the ryots receive a fair share of the water and pay a proper sum for the benefits they receive.
- (iv.)—The best agency for the maintenance of irrigation works, the respective duties of Revenue and Public Works officers, and the extent to which the maintenance may be left to the cultivators themselves.
- (v.)—Whether in the case of river-fed canals the volume of water in the river is fully utilised at all seasons, and how far the deficiency to meet actual demands is due to defects in the canals themselves.
- (vi.)—How far defects in the construction of works of irrigation have hindered its development: whether vested rights in water have interfered with its utility and led to waste: the history of such rights and how they should be dealt with.
- (vii.)—The effects of the combination of navigation with irrigation, and how far the benefits secured by the former compensate for the greater cost of the works and the reduced extent of irrigation.
- (viii.)—Whether, in the case of recently opened canals, the irrigation has spread rapidly or not; whether the cultivation has been changed and has required outlay in the adaptation of the fields; and what special measures have been taken, if any, to stimulate the development of irrigation on its first introduction.

(ix.)—Tank irrigation, and the expediency of restoring the ancient system of tank maintenance by the cultivators, the improvement of the supply of tanks by river channels, and the practicability of enabling tanks to hold water for two seasons.

(x.)—The works of the Madras Irrigation and Canal Company, their utility and financial position, the effect of climate, soil, &c., on the extent of their irrigation, and the means recommended for the removal of difficulties found to exist, without dispensing with the agency of the Company.

(xi.)—The present condition and the probable future of the canals of Orissa and Midnapur.

(xii.)—Legislation as connected with irrigation.

(xiii.)—Any other matters alluded to in paragraphs 21 to 31, Chapter IV, of the Famine Commissioner's Circular of 22nd June 1878.

3. These instructions were not to exclude the consideration by the Committee of any matter of importance to which they might think it desirable to direct their attention, and particularly they were asked, should they have time, to report on the value of irrigation and on the feasibility of its extension; but this was to be considered of secondary importance to the points enumerated above, and to be too large a subject to admit of investigation within the prescribed time.

4. The Committee have endeavoured to keep these instructions before them, and although they have not adhered to the order in which they were laid down, they believe they have not overlooked any point in the following chapters:—

	Page
CHAPTER I.—General description of the Government irrigation works of Madras	1
II.—The state of irrigation in the zamindaris or estates of private landholders	4
III.—The principles to be followed in defining the respective duties of officers of the Revenue and Public Works Departments in the administration of irrigation works	6
IV.—How far the maintenance of irrigation works should be defrayed by Public Funds, how far it should devolve on those who directly benefit by them, and the possibility of reviving the ancient system of <i>Khudi Maramat</i> , or the execution of petty repairs to works by the unpaid labour of the people depending on them	8
V.—The direction which should be taken in improving and extending irrigation works in Madras	13
VI.—The sufficiency of existing legislation in Madras for the proper administration of its irrigation works, and the treatment of vested rights in water	19
VII.—The combination of navigation with irrigation	21
VIII.—The state of the affairs of the Madras Irrigation Company, and the best means of improving them	23
IX.—The irrigation of Orissa	32
X.—Irrigation in Midnapur	42

5. After the Committee had dissolved and its President had started for England, the Famine Commission expressed a wish that the other two members of the Committee should report on the system pursued on the Soane Canals. Their report will be found in the Supplement.

IRRIGATION REPORT.

CHAPTER I.

GENERAL DESCRIPTION OF THE GOVERNMENT IRRIGATION WORKS IN MADRAS.

THE Government Irrigation Works of Madras vary alike in magnitude, in character, and in origin. There are works that yearly irrigate 1,000 square miles; others that do not irrigate 5 acres. Some derive their water from the great perennial rivers of India; others from springs drawn from the sandy beds of rivulets, or from the rainfall of half a square mile ponded up in a valley. Some works date from periods of which we have no historical record; others are the latest outcome of British engineering science.

2. Beginning from the north, there are the two great modern systems of irrigation in the deltas of the Godavari and Kistna. At the apex of each delta a weir or anicut has been thrown across the river holding up the water and enabling it to be diverted into a great system of canals and distributary channels, some of which are adapted for navigation and form the highways of the country. The entire maintenance of the works, and the control and distribution of the water from the time it enters the canal to where it issues from the village sluice, is generally in the hands of Public Works officers, who are in possession from day to day of exact information as to the state of the supply at all the principal regulating works. Once discharged from the village sluice, the field distribution rests with the peasants themselves. The area irrigated by the Godavari canals amounts to about 540,000 acres, and by the Kistna canals to 265,000 acres, and both systems are being extended.

3. Further south, in Nellore, we have irrigation depending on the anicut built between 1855 and 1860 across the Pennair, a river having a catchment basin about 20,000 square miles of uncertain supply, and subject to considerable floods. By means of this work water is diverted into two old native channels recently improved and extended, and these supply a great series of tanks. Advantage is taken of every fresh in the river to replenish the tanks, and so the irrigation is carried over the periods when the river itself is dry. The regulation of the water-supply among the several channels of this system and their maintenance is in the hands of Public Works officers. The distribution from the tanks rests with the ryots.

4. Still going south, irrigation is effected in a like manner by a combination of channels and tanks from the Rivers Cortiliar, Palár, Cheyáir, and Vellár in North and South Arcot and Chingleput. In most cases these existed before the British rule, but the supply of the tanks has been rendered more certain by the erection of weirs across the rivers, and many tanks have been brought into connection with the rivers which formerly depended solely on local rainfall. The Palár drains an extensive basin, but its upper waters are so carefully stored in the tank system of Mysore, that in years of ordinary rainfall but little is available for irrigation below. Opportunity is taken of the short-lasting floods to fill the long series of tanks by rapidly-discharging channels, and these have been very materially improved by the works undertaken for relief in the recent famine.

5. Still going south, the next river is the Cauvery, which, from the earliest times, has been used for irrigation from its source in the Coorg mountains to its delta in the Tanjore District. It waters probably a greater area than any river in India. In the upper part of its course, as it flows through the Coimbatore, Salem, and Trichinopoly Districts, along with its tributaries, the Bhowani,

the Noyel, and the Ambravati, it feeds a whole succession of irrigating channels, while in the Tanjore delta every branch is utilised to irrigate rice lands.

6. The irrigation of the Noyel is effected by a series of tanks in the way already described. The canals of the Bhowani, Ambravati, and Upper Cauvery irrigate directly from their banks, and their supply is maintained either by weirs across the rivers, or by temporary dams made year after year. The strip they irrigate is necessarily long and narrow, for they never rise out of the valleys, but following a serpentine course along the contours, they water every field between them and the rivers from which they are derived. The irrigation thus effected in the Coimbatore District exceeds 40,000 acres, yielding a revenue of about 4 lakhs. The water administration presents some interesting features, and two typical cases may be given.

7. Second in point of size and first in efficiency is the Kalingaroyan channel that is drawn from the Bhowani and flows through the Erode Taluq. It is 60 miles long, waters 9,000 acres in 33 villages, and produces a revenue of a lakh. Of its area, 8,247 acres are double-cropped, bearing an assessment, in some cases, as high as Rs. 16-10-8 per acre. The regulation of the supply from the river is managed by the Public Works Department, and an annual grant is made of Rs. 6,000 from Imperial Revenue to maintain the works. The distribution of the water is in the hands of the tahsildar; and in order to maintain the necessary establishment and to effect repairs not covered by the Imperial grant, the villagers pay along with their land assessment a voluntary cess of 3 annas 3½ pies per acre in the upper portion of the canal, and of 4 annas 6½ pies in the lower portion. The cess of 3 annas 3½ pies represents the commutation price of a certain quantity of grain formerly paid. The additional 1 anna 3 pies is the commutation for unpaid labour, which used once to be rendered. In the upper part of the canal the villagers still profess to give this free labour, but practically they do not.

In the 60 miles of canal there are no less than 1,945 irrigating sluices of bad construction and causing great wastage of water. Were these improved, there would be water enough to raise double crops along the whole canal and to supplement the supply of the Pogalur channel below it.

8. The Daraparam channel of the Ambravati is 15 miles long and waters 2,337 acres. The control of the water as well as the maintenance of the works is entirely in the hands of the ryot, and no Revenue or Public Works officer meddles with them. The villagers among themselves contribute a certain quantity of grain according to the area they water, and with this is paid in kind an establishment of nine servants to look after the canal. There is nothing approaching systematic water distribution, and the ryots failing to agree among themselves have expressed a wish that the district officers would arrange a commutation of their grain payment into money, and would take in hand the distribution of the water as they have done on the Kalingaroyan channel.

9. The irrigated area of Tanjore and the revenue derived from it greatly exceed those of any other district in India, and nowhere is less due to artificial means, or has there been less Government outlay on the construction and maintenance of works.

The Cauvery has many deltaic branches, the water surface in which is generally higher than in the surrounding country. These are kept from overflowing by artificial banks; minor channels have been drawn from them, and the whole country is a net-work of streams. The system is very ancient, and was in full operation when Tanjore became a British province; but its continuance was endangered by the increasing tendency of the Cauvery waters to flow down the Coleroon, which forms the northern boundary of the delta, and to desert the southern channels on which alone the irrigation depended. This was effectually prevented in 1836 by Sir A. Cotton's great work,—the Upper Coleroon Anicut at the head of the delta,—which enables the Engineer to turn the whole supply of the river into the different irrigating-streams, but does not enable him to exclude floods. From time to time dams, regulators, and escape weirs have been built throughout the delta, with the object of systematically distributing the water and disposing of floods; but a good deal remains still to be done.

10. In Tanjore, therefore, the numerous branches of the Cauvery take the place of the canals in the northern deltas, and the sluices built across their heads are managed by the Executive Engineers. The regulation of the distributary channels rests generally with the peasant proprietors of the soil, locally termed the *merassidars*. Some of these channels are as much as 20 miles long, and irrigate a number of villages. In such cases there is a well-recognised custom, defined generally in a written document, settling the days and hours during which each village is to take water, and similar rules lay down each man's turn within the village. An establishment paid and appointed by the *merassidars* manages the distribution of water to the fields. Complaints of unfair appropriation of water rarely occur, and are easily settled by the tahsildars. The maintenance and repair of all masonry works and of embankments, and the clearance of channels down to those that water only two or three villages, is effected by the Public Works Department. The villagers themselves clear the smaller channels.

11. In the Madura District some irrigation is effected by channels drawn from the River Vaigai to feed tanks. But the supply of this river is uncertain: the channels are managed by the villagers themselves, and are of a very rude description. To improve this irrigation, it has been proposed to construct a dam across the Periyar River, which rises in the Western Ghâts and flows to the sea westward, and to divert its waters by a tunnel through the ridge into the Vaigai. More will be said of this project in Chapter V.

This district is so covered with tanks, that there seems to be more water than land. They are very shallow and much filled with silt.

12. The Tāmrapūrni in Tinnevely has a more constant flow than any river in Southern India, excepting the Godavari, the Kistna, and the Cauvery. These four alone draw their supply from tracts under the full influence of the south-west monsoon; but the Tāmrapūrni is a much smaller river than the other three. Along its course is a valuable strip of irrigation of 65,000 acres, yielding a consolidated revenue to Government of about eight lakhs of rupees. It is carried on by means of tanks supplied by channels, into which the river water is diverted by eight weirs. Seven of these are of old native construction; the eighth or lowest has been built within the last ten years, and is termed the Srivaikuntham Anicut.

The Executive Engineer controls the supply entering the upper channels and passing the several weirs, but he has no authority to check waste of water within the channels, or to see that it is fairly distributed. The field sluices are very imperfect, and each ryot practically takes as much water as he pleases. The Srivaikuntham Anicut picks up only the water that is unused above, and the available supply in the two canals depending on it falls far short of what was anticipated. The distribution of the water in these two canals is in the hands of the Executive Engineer; and if they are ever to irrigate the area for which they were designed, some saving must be effected in the consumption of water in the upper channels.

13. There remains to notice the rain-fed tanks which exist in vast numbers, large and small, throughout Madras. Most of these are of old native construction, although some few of them have been enlarged by the British Government, and their systematic improvement is being carried on year by year as far as money and establishment are available. The charge of so many small works, however, scattered over the country is a difficult and expensive one for any Government department, and frequent complaints are made on this score. In a future chapter it will be considered how far they may be managed by the ryots themselves. The disposal of the water stored in tanks rests nearly always with the ryots interested. They regulate the sluices, distribute the water, and manage for themselves every detail.

14. In all these systems of irrigation, water is eagerly sought for and highly prized. But there is one unfortunate instance of a large and costly canal having lately been made to supply irrigation to a peasantry who refuse to have it.

The Madras Irrigation Company's canal in Kurnool and Cuddapah will be fully reported on in Chapter VIII.

* The area annually paying wet assessment is about 725,000 acres. The consolidated revenue land and water rate about Rs. 36,00,000.

CHAPTER II.

THE STATE OF IRRIGATION IN ZAMINDARIES, AND THE EXPERIENCY OF GOVERNMENT INTERFERING FOR ITS IMPROVEMENT.

MORE than one-fifth of the whole Madras Presidency is held on zamindari tenure.* Some of these zamindaris were in existence prior to the British rule; others were created by the Madras Government Regulation XXV of 1802, which fixed a permanent settlement on these lands. The zamindar is required to pay the annual Government demand and to obey the law within his estate; and provided he complies with these two conditions, the whole policy of Government has been to leave him undisturbed. Regulation XXIX of 1802 requires the appointment in each zamindari village of an hereditary accountant or *karnam*, and lays down the records of cultivation, revenue, &c., which he is to maintain, and to produce when called on by the Collector. But the same Act goes on to say that Collectors are not to persist in demanding the attendance of these *karnams*, and virtually prevents their obtaining any knowledge of the state of agriculture in zamindaris. The result of this policy has been that, except in the case of estates that have been under the Court of Wards, Government has no definite information of the condition of these extensive tracts.

2. The Committee has been unable to obtain much accurate information as to the state of irrigation works in zamindaris, but the general opinion of those whom they have consulted has been that they were neglected, and where an official is appointed to look after them that he is underpaid and unqualified to deal with water works. On this subject Mr. Martin, Acting Collector of Madura, gives interesting evidence. Writing of the extensive zamindaris of that district he says: "Mostly they are neglected by the zamindars and the ryots utterly." He urges that in Madura it is peculiarly desirable that Government should exercise a control over the water-supply, since at present every important stream in the district is commanded by one or other of the zamindars, so that, if the right to the use of all the water passing through their lands were conceded to them, Government would be powerless to carry out any large measures for the extension of irrigation in the district. In the same strain the late Mr. Boyle, M.C.S., wrote (18th September 1873) of the great Raminad zamindari in Madura. He says: "Not only is the country in the condition in which men depict India fifty years ago in the utter absence of made roads, but this event (*sic*) has been intensified ten-fold by the utter neglect of all irrigation works, tanks, and channels for years."

3. Where Government canals pass through zamindari lands, as in the Kistna and Godavari deltas, the ryots usually avail themselves of irrigation as they do on Government lands; but instances have occurred where they have been deterred by threats on the part of the zamindar, that he would impose an excessive rate on their wet lands. It is true that by Act VIII of 1865 the zamindar is only empowered to raise the rents of his ryots with the concurrence of the Collector, but this useful check does not seem always to be observed.

4. In a recent case in North Arcot District, a series of tanks following a natural line of drainage was placed in connection with the Cheyair river, by an artificial channel fed by the Aliabad Anicut. Some of the tanks in the series belong to the Arni zamindar. It is impossible to exclude him from the benefit derived by the Government tanks, or exactly to estimate what that benefit is. But he asserts that the work has been done without his consent, and declines to bear any share in the cost, and Government is powerless to

compel him to pay, although the district officers allege that he has reaped considerable advantages from the new works. This case is given as an example of what may happen in any district at any time.

5. Since Government has taken on itself the heavy burden of providing food for the nation in a time of famine, and does not refuse to relieve the starving zamindari peasant who comes to the district officer for food, it seems to the Committee most important to possess some accurate knowledge of the state of zamindari irrigation works and of their capabilities of improvement. If, moreover, without breach of faith a Legislative Act can be framed empowering Government to insist on the zamindar's keeping his irrigation works in order, and devising the means of making him pay his proper share for the benefits he derives from Government works, they consider that the cause of agriculture would be advanced. But without further legislation nothing can be done, and until systematic inquiry has been made, nothing will be known of State interests which ought not to remain longer in the dark.

* Area of Madras Presidency
Area of zamindaris

Square miles.
138,218
82,895

CHAPTER III.

THE PRINCIPLES TO BE FOLLOWED IN DEFINING THE RESPECTIVE DUTIES OF OFFICERS OF THE REVENUE AND PUBLIC WORKS DEPARTMENTS IN THE MANAGEMENT OF IRRIGATION WORKS.

IN the Madras Presidency, as it has been seen, there is great diversity of practice as regards the responsibility of water distribution. In the later works it generally rests with the Engineers; in the older, it is divided between the Revenue and Public Works officers on no well-defined system.

The Committee would lay down the broad principle that where, in the distribution of water, any advantage is to be gained from a professional and technical knowledge of its laws, and where the interests involved are great enough to warrant the expense, it is desirable to entrust this distribution to an Engineer.

2. Applying this principle, they find that a vast area of irrigation is effected from tanks watering usually only one village and from small spring channels. Probably, the irrigation from these sources might be considerably extended were the water distributed with rigid economy; but to do so would require an establishment out of all proportion to the good to be effected, while it would entail an interference with village usage which would be most unpopular. Whether or not then the maintenance of these tanks should be effected at the cost of the State, there is no doubt that the water distribution should rest, as at present, with the villagers.

3. Where there is abundance of water in a river to meet the requirements of all the irrigation depending on it, and where, from the natural features of the country, it is impracticable to extend the area of wet cultivation, water distribution becomes a simple matter, and there is little to be gained from employing professional machinery. The ryots may settle for themselves when each shall water his field, or, if it is too large a concern for that, the Revenue officers can quite well decide it for them. The Engineer may then best confine himself to keeping the works in repair. Such a case as this is exceptional. More usually it happens that the water is not enough, or that, if it is enough, it requires skilful control to convey it to all the points required, and in all such cases the duty should be committed to the Engineer.

4. It is desirable, however, to fix some limit beyond which State interference should not extend, and the Committee would recommend the adoption of the rule laid down by the Madras Government* in 1873, confining the duties of officers of the Public Works Department

"to the regulation of the water-supply in channels which supply the lands of more than one village, and vesting in the village officers the charge of the water supplied to single villages from the moment it quits the regulation sluice, over which, however, they will have no control."

On after inquiry, it appeared to Government† that, in the districts of Tanjore, Trichinopoly, Coimbatore, and Madura, the ryots or village officers do more and the officers of the Public Works Department less than was contemplated in this rule. The circumstances of these districts will be considered in Chapter V.

5. Even in the most recent irrigation systems of Madras, the Public Works officers, who have entire control of the water, have no accurate information supplied to them regularly and at the proper time of the area they irrigate; and when remissions are granted on account of the alleged failure of crops for want of water, they are not consulted, except in the Godavari District, as to the accuracy of the statements made. The Committee would urge that,

where the control of the water is in the hands of the Engineer, the responsibility of the irrigation should be fixed distinctly upon him, and that his opinion should be taken on all matters where a decision must be based on a knowledge of the condition of the water-supply. Upon the Public Works officer, at least as much as upon the Revenue officer, must depend the success of irrigation, and without the hearty co-operation of both that success is impossible.

6. It may not be expedient to have in Madras, as in the rest of India, a distinct Irrigation Branch of the Public Works Department, and the Committee cannot agree as to whether or not it would be advantageous to place some of the larger systems under an Irrigation staff with no other duty to attend to. But it is essential to efficiency to have an adequate number of officers who are able to devote sufficient time to the important duties they have to perform. These duties do not necessarily involve the expenditure of large sums. A small outlay may serve to effect a large increase of revenue, or to ward off an accident, which would cause its diminution. The Committee notices that there are frequent changes in the officers in charge of the delta works; and that establishments do not appear to have been maintained regularly at the strength allowed to be necessary. Nor do they consider that, in the re-organisation of the Public Works Department recently ordered, the requirements of irrigation have been sufficiently provided for. They would point out, for example, that the engineer establishment of Tanjore is inadequate to the great interests involved in the management of the delta irrigation.

* Proceedings of the Madras Government, No. 713, Department Public Works, dated 5th March 1873.
† G. O. No. 307, dated 15th November 1874.

CHAPTER IV.

HOW FAR THE MAINTENANCE OF IRRIGATION WORKS SHOULD BE DEFRAIDED BY PUBLIC FUNDS, AND HOW FAR IT SHOULD DEVOLVE ON THOSE WHO DIRECTLY BENEFIT BY THEM.

THE consideration of the above question arises from the fact that, in the Madras Presidency, a very large proportion of the irrigation is effected by works individually small and insignificant, but collectively of great importance. These are the tanks to be numbered by thousands and the small channels drawn from the sandy beds of streams. The lands watered by all these works pay an enhanced assessment, and from this it has been argued that the State is bound to keep them in repair.

2. The repairs are executed through the agency of the Public Works Department, which, however, has not the means of dealing effectively with the vast number of small tanks existing in some districts. Much of the work to be done demands no professional supervision, and if the duty could be transferred to the ryots, a substantial advantage would have been gained; at the same time it has been proved by the state of the tanks left entirely in the ryots' hands, that without pressure of some kind they will not keep them in repair, and that self-interest is an insufficient inducement to do so. The Committee, after much consideration, have arrived at the conclusion that the following proposals afford the best prospect of a satisfactory solution of the difficulty.

3. They have no reason to suppose that the tanks in the Presidency, taken as a whole, are in a worse condition than they were thirty years ago, and, indeed, it is certain that large numbers of them have, within the last few years, been placed by the Department of Public Works in a thoroughly satisfactory state; but larger sums are now spent on them than formerly, and the question occurs how they were then maintained with less expenditure. There is no doubt as to the reply. During the first half of this century the ryots were admittedly under the obligation to watch over the safety of their tanks, and to carry out the petty repairs necessary from month to month. They received no pay for their labour, nor was any deduction made from the land assessment on account of it. It was the ancient and recognised rule of the land and was locally termed *Khudimaramat*. For much of the ordinary tank maintenance then the State paid nothing, but funds were occasionally given by Government and disbursed through the agency of the Revenue officers in the nature of a grant-in-aid for some specific repair, such as the closing of a breach, the renewal of a waste weir, or the improvement of a tank. For the villagers were not expected to give their unpaid labour to effect improvements, but only to maintain works *in statu quo*, or to keep them from falling into disrepair.

4. A Public Works Commission in 1854 pronounced against this system as open to many abuses, and in 1856-57 the Department of Public Works was established. The duty of initiating tank repairs was then removed from the Revenue officers and transferred to the new department; but it was not empowered to insist, as the Revenue Department could, on the ryots performing their *Khudimaramat*. The range Engineer carried with him none of the influence of the Deputy Collector or Tahsildar. He was left to get on as best he might unaided, and thus an amount of unpaid labour, representing probably some lakhs of rupees, was lost to the State. The ryots soon found that no more was expected of them. Why should they stop holes or cut down prickly pear when Government was going to do all that for them? And although, from the exigencies of the Budget and the want of supervising establishment, they must have since found out that minor works were receiving but little attention, still, since the Public Works Department has been in the habit of taking up every here and there a group of tanks and spending money on it, the ryots have refrained from exerting themselves in the hope that it will some day come to their turn too.

5. Where irrigation is effected by small spring channels, almost the only

repair needed is their silt clearance, and as this is absolutely necessary at short intervals to get water at all, it is still generally performed by the free labour of the ryot. The case of tanks is different. There irrigation will go on until the final moment when the embankment bursts, and there is not the same pressing need for the ryot to exert himself in repairing them. We have to consider then the best system of tank maintenance.

6. In the opinion of the Committee, the first measure to be taken is to revive the custom of *Khudimaramat*, and to place it on a satisfactory basis,—that is, to require from the peasantry of the country the execution from time to time of those petty repairs to irrigation works which are necessary for their safety and good order. This is no new proposal in Madras. Section VI of Act I of 1858 empowered the enforcement of this obligation, but it was worded in such an indefinite way that it has seldom, if ever, been used. This was prominently brought to notice in the report of the Public Works Commission of 1869-70. In paragraph 10 it is said,—

“There is, therefore, a very general agreement as to the necessity for providing more definite powers for the enforcement of the obligation than are conferred by Act I of 1858, section 6, and after hearing much evidence on the subject, and giving it, as its importance demanded, very full and careful consideration, we beg to make the following recommendations:—

“In the first place, we consider it to be both necessary and desirable in every way, that careful local inquiry should be made in and throughout each district as to the work of this kind, which is or has been customary.

“Secondly, that customary labour, so ascertained, should be enforced by a legal enactment. A draft Act has been prepared and discussed, and will be found appended to this report.”

7. The careful inquiry here referred to was, under instructions from Government, very completely carried out, and the Board of Revenue* came to the conclusion that the expediency of maintaining the system of *Khudimaramat* where it was already in force, and of reviving it where it had fallen into desuetude, had been satisfactorily established.

8. It seems to the Committee needless to take further evidence to prove the expediency of re-establishing this old custom. They have considered an alternative proposal to raise an irrigation cess for the maintenance of minor irrigation works; but they believe it would certainly not be more popular among the people while it could not really meet the difficulty. An irrigation cess would place more money in the hands of the Public Works Department, but the expensive machinery for supervising its disbursement would remain as at present. Labour requiring only village supervision is wanted rather than money, and labour is precisely what the ryot can most easily give. In Appendix A of this report will be found a draft Act, which the Committee beg to recommend for adoption. It has been based closely on that proposed by the Public Works Commission of 1869-70, modified by the result of the after-inquiries alluded to, and by the views expressed on them by the Board of Revenue.

9. Assuming that the custom of *Khudimaramat* is re-established, the Committee recommend that the irrigation works of the Presidency be divided into two classes, imperial and minor. It is not easy to lay down exact rules applicable to all districts defining into which class each work should fall, so they will describe generally what is intended to be the distinction; and Collectors, in communication with Superintending Engineers, might be required to submit a list for each district, and where they place a work in one class, which, from the following definition, should be in the other, they should explain their reasons.

10. Imperial works then are such as from their magnitude, financial value, relative position, or other like cause, have an importance beyond that of a few villages. All canals or channels on which there is navigation, or which irrigate more than three villages, or in which the regulation of the water-supply and distribution is in the hands of Public Works officers, and all tanks irrigating above 200 acres, should be classed as Imperial works. So should smaller works which have special importance from their position, such as tanks situated just above a line of railway or a town, which would suffer seriously from their breaching. All works not so specified should be considered minor works.

* Proceedings of the Board of Revenue, Madras, No. 1192, dated 6th May 1876.

11. Imperial works should remain, as at present, under the direct supervision of the Public Works Department; but on these, as on minor works, the delta canals and channels excepted, petty repairs should be executed by *Khudimaramat*. Minor works should ultimately be removed altogether from the Public Works Department, who should thereafter be required to execute repairs only to their masonry works, unless from any special cause, such as a cyclone, Government should see fit to afford assistance, and the work to be done may require professional supervision.

12. The Committee would divide minor tanks into three classes, and here again the limits about to be laid down are not intended to be adhered to rigidly and may vary in different districts:—

- (a) tanks irrigating above 50 acres, but not classed as Imperial works;
- (b) tanks irrigating less than 50 acres, and which it is desirable to keep in repair;
- (c) tanks irrigating generally less than 10 acres, the maintenance of which is of no importance to the State, and possibly of little consequence to the village concerned.

13. As regards tanks irrigating above 50 acres, it is desirable to have a standard laid down defining the proper height and section of the embankment. Executive Engineers should be required, in communication with Collectors, to submit lists shewing those already brought up to standard and those remaining to be done. The former should be at once removed from the Public Works registers and made over to the village officers to be kept up to the standard through the agency of *Khudimaramat*. The latter should be maintained through the same agency *in statu quo* until such time as they may be brought up to the required standard from the yearly grant of the Department of Public Works, and then they also should be removed from its registers.

14. As regards tanks irrigating less than 50 acres, it is not generally necessary to lay down any standard. All that is wanted is that they should be kept in working order, and this should be done by *Khudimaramat*. They should all therefore be made over forthwith to the village officers, and the Department of Public Works should have no further concern with them except as regards masonry repairs.

15. It can be no greater hardship on the ryots now than formerly to carry out *Khudimaramat*. But the Chief Engineer for Irrigation is of opinion that something beyond this must be required of them if the tanks are to be maintained in efficient repair, as, for instance, the occasional closing of a breach, the restoration of the inner slope of unrevetted *bunds*, the planting of grass to check wash, turfing, the complete clearance of prickly pear, &c. If this opinion be accepted, the Committee recommend that if, on yearly inspection, these matters be found to have been properly attended to, the Collector should be empowered to make some reduction on the wet assessment of lands under minor tanks. To carry out this system the Chief Engineer also considers that special legislation is necessary, but on this grave question the other members of the Committee are not in a position to give an opinion.

16. The system of *Khudimaramat* to be successful at all must be carried out thoroughly, and the Committee do not consider the present district establishments sufficient for the inspections required, for the state of a tank is not to be discovered at a glance. In many taluks the tahsildars would not have time to inspect all their tanks yearly, and the Committee learn on all sides that little is to be hoped for from the revenue inspectors. They recommend therefore the appointment of tank inspectors in each district, whose duty it should be to inspect and report to the Collector regularly once a year on every minor tank in their charge, besides making special reports when required on the state of any particular tank. These inspectors should be directly under the Collectors, and their salaries should not be less than Rs. 150 per mensem. It must be found experimentally how many tanks should constitute the beat of one inspector. Under the most favourable circumstances, the Committee do not think it should exceed one thousand. The post will be an important one, for on the inspector's recommendation will depend very much whether or not the villagers get the reduction on their assessment proposed in the last paragraph.

17. District Revenue officers will of course consider it their duty to keep a watchful eye on the work of the inspector. In every village must be kept a

tank book, in which should be entered, in the case of tanks watering more than 50 acres, the particulars of the standard to be maintained; and in every case the date of the inspector's visits and the state in which he found the works should be entered by him and signed. The tank book should be prepared on a regular printed form and kept by the *Kurnam* as one of his village records.

18. There remains to be considered what is to be done with the small tanks (class c of paragraph 12) which are of such little consequence that no harm would arise from their ceasing to be maintained. In some districts it is believed that there are many of these small tanks. The Department of Public Works has never had time or money to attend to more than a few of them. The tanks are in bad repair, they hold only a few weeks' supply of water, and although the lands they water are assessed as wet, remissions are so frequent that Government derive little more from them than the revenue of dry lands. Where therefore it can be done without financial loss to Government, it is recommended that the land under the tank should be offered to the ryots at the permanently improved dry rate on the understanding that they may maintain the tank or not just as they please, but that under no circumstances will the revenue be remitted on account of its breaching. Where the irrigated area is held by one person, he might be offered the bed of the tank as well as the lands he holds under it at one uniform dry rate, allowing him to grow wet or dry crops, and to maintain the tank or not as he pleases. Where the irrigated area is held by several persons, and they elect to allow the tank to fall out of repair, the bed might be made over in the usual way to applicants for it. Before determining on any such course as this (which was suggested by Mr. R. K. Puckle, C.S., in 1866 for the district of Tinnevely) the financial results must be calculated, and Collectors might be called on to find what has been the average rate per acre actually paid to Government for the lands under these small tanks taken over a series of years and the money spent on their repairs, and what would be the result of assessing them at a dry rate in the manner proposed. If the change can be made without serious loss in revenue, an advantage would be gained in diminishing the number of tanks to be maintained by the Revenue officers.

19. The Committee have been unable to obtain information as to the number of tanks of the several classes in all districts of Madras, and they fear that the figures given in the accompanying statement are not altogether reliable, especially as regards the smaller tanks. They are useful, however, in shewing the numbers to be dealt with. They would call attention to the great number of small tanks in Madura, a district in which perhaps more than any other they require consideration.

Statement of the number of Irrigating Tanks in some of the Districts of the Madras Presidency.

DISTRICT.	TANKS IRRIGATING AN AREA											TOTAL.
	Less than 10 acres.	10 to 20 acres.	20 to 30 acres.	30 to 40 acres.	40 to 50 acres.	50 to 100 acres.	100 to 150 acres.	150 to 200 acres.	200 to 300 acres.	300 to 1,000 acres.	Over 1,000 acres.	
Bellary	146	85	69	55	40	173	153	94	25	14		850
Kurnool	...	50	33	39	19	70	62	32	2	2		309
Kistna		384				201			52	15	5	657
Nellore	14	63	62	43	41	132	159	131	59	57		756
Salera	599	302	170	118	75	105	110	58	9	...		1,510
North Arcot	981	506	344	240	193	531	373	166	17	4		3,297
South Arcot	161	1,569				1,112		163	213	33	4	3,495
Cotnamore	23	29	17	11	6	31	26	28	10	2		181
Madura	5,518	2,673	1,113	574	626	1,457	916	536	127	43		13,291
Tinnevely	410	1,125				625			124	26	12	2,323

20. North Arcot may be taken to shew the effect of the foregoing proposals. Out of 3,297 tanks only 127 would be classed as imperial and 3,170 as minor works. Of the latter, 981 would be liable to be left to the ryots to maintain or abandon as they might deem fit, contingent on Government not suffering

distinct financial loss from the transference from wet to dry rates of the area now irrigated by them. The ryots would be required to maintain 1,283 tanks in good working order and 906 in addition according to a fixed standard to which the Public Works Department would gradually bring them, their wet assessment being reduced on this account. All these 2,189 tanks (1,283+906) would be under charge of the District Revenue officers, and to aid them two or perhaps three Tank Inspectors would be required.

CHAPTER V.

THE DIRECTION WHICH SHOULD BE TAKEN IN IMPROVING AND EXTENDING IRRIGATION WORKS IN MADRAS.

THE opinion seems not uncommon among those who have little knowledge of the subject, that irrigation may be extended in India till the whole country is one vast sheet of cultivation independent of drought. No sooner does famine threaten the land, than the press contains letters reflecting strongly on the apathy of Government regarding the extension of irrigation; and to prove that the cause of humanity will be rewarded by a financial harvest, its success in the deltas is confidently quoted. The unreliability of forecasts founded on such premises will hereafter be instanced in Chapter VIII. In this chapter it is proposed to indicate the direction which should be taken in the advancement of irrigation.

2. In the systems of the Godavari and Kistna deltas, a good deal still remains to be done, and large estimates for the latter are before the Government of India. The proposed works are extensions of branches to take in new irrigation, adjustment of slopes, and addition of locks and weirs to improve navigation and to diminish the yearly charges for silt clearance, and works of provision for cross drainage, by which serious mischief is done year after year. In the opinion of the Committee, it is highly desirable that these irrigation works, which are so pronounced a success, should be completed.

3. It may safely be said that no untried field of irrigation is left in Southern India which is likely to yield anything approaching the financial success of the deltaic works. Although the volume of the rivers is still far from being all expended, it is so intermittent that without storage only a small proportion can be utilised. The two expedients are—

- (a) to store the upper waters in great reservoirs during the season of floods, and thus to feed the diminished supply during the hot months;
- (b) to take advantage of the short freshes that may be expected at any time, and by a system of rapidly-discharging channels to replenish the tanks in the vicinity.

The difference between the two systems is obvious, and while the latter (as already stated*) has been successfully practised in several districts, no reservoir has yet been made with a view of keeping a constant supply in a river.

4. At first it may appear that sites for such reservoirs could easily be found in the valleys of the Western Ghâts and elsewhere, but this is not the case. If the slopes of the valley be too steep, a high embankment will hold up but a small volume of water; if they be too gentle, the embankments will often be inconveniently long, and the area submerged will bear a large proportion to the area to be irrigated. The configuration of the valley may be all that can be desired, but the area draining into it may be out of proportion to the size of the reservoir, or there may be no building materials available; or no suitable site for an escape weir which forms so essential a part of the construction; or what is not uncommon, the climate may be so deadly as to reduce the period for carrying on work to but a few months in the year.

5. The only river basin which has been systematically explored in search of reservoir sites is that of the Tungabhadra, the principal affluent of the Kistna. It rises in a country where, *prima facie*, there was as good probability as anywhere in Madras of finding what was required. But few favourable sites were found, and still fewer that were likely to prove a financial success. This river skirts the Bellary District, where the rainfall is always scanty and where the recent famine raged with terrible severity. If any large extent of land

* Chapter I, paragraphs 3 and 4.

in Bellary is to be rendered secure from famine, it must be by irrigation from the Tungabhadra, and more water cannot be drawn from that river for more than four or five months in the year, unless reservoirs are formed. The country to be traversed by a canal in Bellary is difficult, and no highly remunerative project is possible, even if the people would readily take water, which cannot be asserted. But this much has been learned that, with an outlay of about 1½ millions sterling, a canal could be constructed to irrigate 150,000 acres, yielding rice enough to support a million of people for six months. This canal also would supply the city and cantonment of Bellary which often suffers from drought. In the light then of an insurance against famine, the Committee consider that it would be expedient to depute an experienced Revenue officer to report whether the water would be quickly utilised, and on the assessment which ought to be charged. With this information Government could decide whether it would be right to carry out the project.

6. A good many individual projects for reservoirs have been completely or partially investigated, and some are only awaiting a favourable opportunity for execution. Amongst those on a large scale may be mentioned the two following:—

- (a). The Kistnagiri reservoir for the purpose of storing the upper waters of the Ponnár in the Salem District. It has been proposed to form here a reservoir with a water-spread of from 24 to 30 square miles, capable of irrigating from 96,000 to 120,000 acres. The scheme appears to be feasible, and the amount necessary to be paid for the lands submerged is now under consideration.
- (b). The Periyár project to supplement the supply of the Vaigai in Madura. This would be a magnificent engineering work, involving great difficulties of construction. The Periyár has its origin in the hills in Travancore, and flows westward into the Indian Ocean. It is proposed to throw across its valley a dam 168 feet in height, to pierce by a tunnel the hills dividing the water-shed between it and the Vaigai, which flows eastward, and through this tunnel to carry a canal of 1,600 cubic feet per second, capable of irrigating an area differently estimated at from 96,000 to 150,000 acres. The estimated cost of this work is 60 lakhs, and if it really costs no more, there is little doubt of its financial success. But many risks must attend its construction. So high a dam has not been hitherto built in India. The site is in a valley covered with dense jungle, rainy, feverish, and uninhabited. The project has been dropped for the present, but in the opinion of the Committee it should not be lost sight of.

7. Another important project is that termed the Rushikulyá in Ganjam, which has been fully elaborated with a view of drawing water from that river and from the Mahánadi, of supplementing their supplies by two large reservoirs, and of irrigating thereby an area of 120,000 acres. Ganjam is a backward district, where prices and consequently land assessment are abnormally low, so that it would be impossible to charge at present water rates for this irrigation high enough to pay over 4 per cent. On this ground, the scheme has been laid on one side. It appears to the Committee, however, that it is worth considering whether, by progressive rates, an adequate return could be secured within say 15 or 20 years. The project has been deemed of high value to the tract of country which would be brought within its influence.

8. It is recommended that, whenever the circumstances of the water-supply of a river or basin are not thoroughly known, an examination should be made comprehensive enough to enable Government to determine on the expediency of utilising its waters for irrigation. To do this, the natural features of the country, its geological formation, its rainfall, and many other points must be investigated. Such an inquiry cannot be made during the spare hours of the officers of the ordinary Public Works establishment, and it would be necessary to appoint a special staff to examine systematically the several sources of water-supply. It might occupy several years, and it might result in the fact being

established that in very few cases could projects be devised of financial success. But the Committee would point to the invaluable famine relief works with which the Bombay Presidency were furnished at the outbreak of the recent famine,—irrigation projects carefully prepared beforehand, but condemned as financially unsound, until the necessity arose for relieving the working classes. In return for the relief afforded the country has been enriched by a series of works which afford the best insurance against future famines. The Madras Presidency could not do better than follow this example.

9. In Chapter I has been generally described what has been done in some cases in the connection of tanks with rivers. In this direction much still remains to do, and it is advised that projects with this object should be systematically prepared. These projects will deal more with the minor rivers than with those on which depends the irrigation of the deltas. Generally, they will be found to represent few engineering difficulties, and individually not to cost very large sums. Among those that have been thoroughly investigated, the Committee would call special attention to the Sangam project in the Nellore District.

10. In 1870, this project was framed. It was to cost Rs. 25,83,800 and to yield a revenue of 7.88 per cent. The following year it was submitted to the Government of India for sanction from loan funds, and from that date until now it has been the subject of discussion and of correspondence between the Supreme and the Local Government. The former required the inclusion of several items omitted or understated in the original estimate, such as increased cost of establishment, rateable provision for leave and pension of those employed, and interest charges while the work was under construction; and each of these points was the subject of separate reference, until in 1876 the estimate had amounted to Rs. 43,79,304,* on which the revenue would only yield an interest of 4.28 per cent.

11. The Sangam project includes a weir across the Pennair River, and the formation of a channel from its northern flank to carry 7,000 cubic feet per second, and to utilise the flood waters of the river in replenishing a number of tanks. The Committee cannot doubt that this is a thoroughly sound scheme, and one likely to yield a sufficient return on the outlay. It is not for them to give an opinion how far the requirements of finance made it necessary to load the original estimate with indirect items, increasing it by 58 per cent, but they would note that, while in 1874 the Government of India recorded that Nellore "may be considered to be already protected from severe famine,"† the experience of the last two years tells a different tale, and they think it unfortunate that the Sangam project was not carried out when first proposed.

12. In whatever way it may be determined to provide in future for the maintenance of tanks, their improvement must be steadily pursued. What they generally most require is the means of disposing of surplus water, and the result is that in years of by no means excessive rainfall they breach in large numbers

* Estimate as submitted by Madras Government, 18th March 1871:—

	Rs.
For works	24,83,625
For establishment	2,73,000
TOTAL	27,56,625
Deduct—	
Value of land in bed of tanks	1,72,525
TOTAL	25,83,800
Estimate according to G. O. G. G., dated 12th November 1875:—	
For works	25,40,815
Establishment (25 per cent.)	6,35,211
Indirect charges—	
Capitalisation, land assessment	5,23,000
Leave and pensions	1,52,113
Accumulated interest on capital	6,52,754
TOTAL	43,08,623
Deduct—	
Value of land in bed of tanks	1,29,619
TOTAL COST	43,79,304

† G. O. G. G. No. 207 C. W. I., 27th November 1874.

to the great loss of the agricultural community and of the Government revenue. The latter amounts to from 70 to 80 lakhs per annum. Money has been given with more freedom in recent years than formerly, and many tanks have been improved; but the Irrigation Department calculate that, in order to make all the more important ones safe in seasons of ample rainfall, there is still required a period of twenty years, and an annual grant three times as great as that hitherto appropriated for this purpose.

13. It must not be supposed that, because the tanks as well as most of the minor rivers of Madras failed utterly in the recent severe famine, they are not of very great value to the country. They afford an effective protection against the far more common partial droughts which, though limited in extent and duration, occasion much suffering and loss, and fatally check all progress and improvement. Even in the last famine, these minor works were of value. Lands connected with them ceased to produce grain-food later and recommenced to produce earlier than others dependent only on rainfall, and so by the help of these works the period of suffering was shortened.

14. The Committee do not think that much should be expected from a proposal that has found favour to some extent to construct reservoirs capable of storing water for two years. Supposing that sites could be found for reservoirs capable of holding a two years' supply, and that they could be constructed for a moderate cost, which is most doubtful, still with the same sum a far larger number of tanks might be constructed or improved for one year's supply; and in ordinary years these would be just as useful; while in the two years' reservoir the loss by absorption and evaporation would be so great that the water retained for the second year would not do one-fourth as effective duty as if expended in the first. It seems better then, with a limited budget, to spend money in storing much water for immediate use than to provide a little to meet a possible future contingency.

15. Many improvements remain to be effected on existing canals. The boundaries of the Government property in the canals and their banks are generally very badly defined, and at some places the ryots have been in the habit of encroaching on the banks and levelling them down into their fields till what remains is too narrow for safety, when the water is higher than the country. The result is the occurrence of breaches. The Committee consider the subject deserving of attention. For systematic irrigation, water should be thoroughly under control, and any causes which may check its steady supply during seasons of demand should be removed. The Engineer should be able to warrant its unbroken flow, and to divert it to whatever part of the irrigated area most requires it. For this purpose proper works of regulation are necessary; head sluices that are not liable to be silted up, that can be opened with ease to take in what is required, and closed with equal ease to keep out floods; regulating works at the heads of the different branches within the canal; escape works to carry off to streams, where they can do no harm, surplus floods brought in by side drainage; and, not least important, well-contrived and yet inexpensive outlet sluices to discharge the water into the ryots' field channels. From want of these outlet sluices much waste occurs, and banks are endangered by the clumsy troughs and pipes used in their place. It is best to exclude drainage from a canal altogether; but this can only be done at great cost when canals run across the drainage of the country, as is very often unavoidable in Southern India. The drainage must be met by the canal from one side or the other. It is cheapest to let the water in, and to pass it out again by an escape weir or sluice; but the drainage brings with it a quantity of sand, perhaps of brushwood and grass, and these are apt to be deposited in the bed and seriously to check the flow of the water. If possible, then, it should be passed under the canal by an aqueduct, or by an inverted syphon; or if it is not meant for navigation, the canal may be passed by a syphon under the drainage, or when the drainage is very large the discharge of ordinary rainfall may be passed under or over the canal, and the excess when the rainfall is unusually heavy may be passed through it. Works of the above nature are much required on the irrigating channels of Coimbatore.

16. It has been said (Chapter I) that floods cannot be excluded from the irrigating branches of the Tanjore delta, and this occasions a yearly outlay in maintaining miles of river embankment to a height which would be unneces-

sary if there were no such floods. Within the delta the first great branch from the main Cauvery River is the Vennár, on which depends an irrigation of 393,000 out of 822,000 acres. The volume at the bifurcation should therefore be nearly equally divided. But although there are dams at the head of the Vennár across both it and the Cauvery, they are not capable of easy regulation, and it is difficult to keep the Vennár fully supplied, even at times when there is enough of water for both. In 1870, a complete project was submitted for effecting a thorough control over the heads of these two branches, and for restricting the flood water to be admitted by discharging into the Coleroon all above a certain quantity by an old native work termed the "grand anicut." These works were estimated to cost Rs. 5,20,620; and large annual savings in maintenance charges and more certain irrigation to the eastern taluks were anticipated from the improvements; but doubt was expressed by the Government of India as to whether the Coleroon could carry the flood water that would thus be thrown into it, as there would be an addition of about 17 per cent. to the volume it now carries in maximum floods. To solve this question, information was called for which has never yet been supplied. With these improvements, and the addition of about fourteen minor regulators, and the substitution of a number of really efficient irrigating sluices for old ones, the irrigation works of the Tanjore delta would be in a fairly satisfactory condition, and in the opinion of the Committee it is highly desirable that these improvements should be made. The wet revenue of the district is about 36 lakhs.

17. In Chapter III, the opinion of the Committee was stated as to the relative duties of officers of the Revenue and Public Works Departments in irrigation matters, and it was mentioned that in the four districts of Tanjore, Trichinopoly, Coimbatore, and Madura the control of the Engineer did not go as far as was contemplated by Government. The Committee are not prepared to recommend any great changes in these districts. The system in Tanjore has gone on so long unchanged and is so popular with the people that no benefits are likely to be gained commensurate with the evil of uprooting a good institution. In Trichinopoly, the irrigation does not warrant the expense of employing a Public Works officer on it. In Coimbatore there would rarely be a demand for water beyond what can be supplied by the present arrangements, if the improvements mentioned in paragraph 15 were carried out. Irrigation in Madura is in a very unsatisfactory state, but no good will arise there from mere change of administration, and some steps ought to be taken for utilising systematically the rainfall on its hill ranges.

18. In the Godavari and Kistna deltas, when a ryot wishes to take up fresh irrigation, he applies to the tahsildar, who grants the permission without consulting the Executive Engineer as to whether it is convenient to supply more water to this particular place. As long as there is abundance of water to spare, no great harm arises; but cases may be easily supposed when the ryot would get his permission to irrigate, although the Executive Engineer would be unable to give him his water; and it is recommended that for the future the tahsildar should grant leave to no ryot until he has produced a certificate from the Executive Engineer that the water is available.

19. In all cases where the control of the water is in the hands of the Executive Engineer, Collectors should not grant remissions of revenue on the ground of alleged short supply of water without hearing what the Executive Engineer has to say. In the *Godavari District Gazette* of the 30th September 1876, rules to this end were laid down,* and the Committee recommend that they should be generally adopted. It will be most convenient if the Executive Engineer or one of his assistants can accompany the Revenue officer in making his yearly settlement of irrigated lands.

20. In Chapter I, paragraph 12, it has been stated that some economy must be effected in the water consumption of the older canals of the Tanjore delta, if the irrigation depending on the new Srivaikuntham Anicut is ever to be fully developed. The Committee think it desirable that the Executive Engineer, who has complete control of the water distribution from the new work, should have equal charge over that of the old canals. The first step will be to make careful inquiry as to whether there is any preventible waste. Accurate knowledge

* See Appendix B.

must then be acquired of the state of the tanks on the older channels and of the river at all seasons; and having obtained this, the Executive Engineer will be able to decide when to fill up the upper tanks, and when to reserve the water of the occasional freshes for the tanks depending on the new works. Putting restraints on old irrigation is always a task wanting much judgment, and here it will be more difficult than usual, for the people are very tenacious of their rights, and the land is assessed heavily, more than 7,000 acres paying as much as Rs. 20 per acre. But the Committee consider that it is quite practicable to effect the necessary control over these channels, without injury to the cultivation under them, and with advantage to that depending on the Srivaikuntham weir. The Engineer employed should have his duties confined to the Tamrapurani Valley, where he will have full occupation for his time.

CHAPTER VI.

THE SUFFICIENCY OF EXISTING LEGISLATION IN MADRAS FOR THE PROPER ADMINISTRATION OF IRRIGATION AND THE TREATMENT OF VESTED RIGHTS IN WATER.

THERE exists in the Madras Presidency no legislation corresponding to the Canal Acts of Northern India and Bengal,* and after making many inquiries on the subject, the Committee are of opinion that an Irrigation Act is much needed. Without such an Act they consider that the proper distribution of water cannot be ensured, nor can the drainage, which must so often accompany irrigation, be effectively maintained.

2. The main irrigation channel is connected with the ryot's field by a water-course often several miles long, flowing through the lands of one village after another, and discharging water sufficient for each as it passes. Very likely there may not be water enough to supply all simultaneously, in which case each village receives it in turn. If the ryots of a village near the head of this channel choose to throw a few baskets-full of earth into it, there is nothing to prevent their appropriating the whole water-supply to the great injury of the villages further down. Cases of this sort are common. Prosecutions have occurred, but it is usually difficult to identify the offender; and by a ruling of the High Court of Madras, he who diverts to his own use water that rightly belongs to another, is not punishable as causing a diminution of the supply of water used for agricultural purposes as defined in Section 430 of the Penal Code. In fact, no interference by individuals with the volume of a non-navigable canal can it appears be prevented otherwise than by injunction or civil suit.

3. A large sum has been spent in recent years on the drainage of lands in the Kistna and Godavari Deltas, but there is no summary means of preventing obstructions from being placed in the drains, a common practice of the ryots, with the object of holding up water for the purpose of irrigation, fishing, &c.

4. The Northern India and Bengal Canal Acts effectually meet such cases as these. They authorise the imposition of a fine not exceeding Rs. 50, or of imprisonment not exceeding a month, on any one who obstructs, "interferes with, increases, or diminishes the supply of water" in a canal or drainage work; and where the offender cannot be identified, the person whose land has derived benefit from the obstruction is liable to pay an enhanced water-rate. The inconvenience arising from the absence of any canal legislation was particularly brought to the notice of the Committee by Mr. Lister, M.C.S., the officer specially sent to report on the management of the irrigation on the Kurnool Canal.

5. In Chapter IV, the Committee have already proposed a draft Act for reviving the old custom of executing minor repairs to irrigation works by unpaid village labour.

6. In this chapter has been included the subject of vested rights in water, for it is probable that without legislation such rights could not always be interfered with, however injurious they might be to the general interests. In Chapter II, paragraph 5, the opinion has been expressed that if it does not involve a breach of faith, it would be of value to have a legislative Act, empowering Government to insist on zamindars keeping their irrigation works in repair, and it may be necessary to give them some special powers to enable them to do so. But the want of such an Act cannot be said to have been felt yet, merely because no effort has ever been made to induce zamindars to attend to this matter. The same may be said of vested rights in irrigation. The cultivators of Tanjore and Tinnevely who have irrigated for generations according to their own customs would no doubt resent any interference, and if, in the interest of eco-

* The Northern India Canal and Drainage Act No. VIII of 1873; The Bengal Irrigation Act No. III of 1876.
† Section 70, Northern India Act; Section 93, Bengal Irrigation Act.

nomy of water, such interference is thought expedient (as the Committee think it is in the case of Tinnevely), it is not improbable that legislation may be necessary to enable Government to act. For although a vested right to the waste of water would hardly be entertained by any Law Court, a claim to an indefinite and excessive quantity might be admitted.

7. The Committee think it right to bring to notice how much zamindárs and inamdars often benefit by the improvements effected by Government to irrigation works without being required to pay any corresponding return. Because they formerly had the free use of a precarious water-supply from rain-fed tanks and unreliable village channels, they assert their right to continue irrigating free of charge, although the tanks have been connected with rivers, and the channels rendered secure by alicuts, and this right has sometimes been conceded by Government.

8. As an illustration, may be given the case of the Godavari district, in which 57,305 acres receive irrigation free of charge. This land is situated in zamindáris, and is exempted as *Mamit pallam*, or lands classed as wet before the canals were made. The water was derived generally from the overflow of the Godavari, or from inundation channels drawn from it, and this source of supply was cut off by the new canals. The proprietors claimed free irrigation for the lands so situated, and the question arose as to what area had been irrigated formerly. It was urged that only so much land should be exempted from charge as was on an average irrigated year by year. Reference was made to the village accounts, but they only shewed what was termed the *Gudicut*, or land assessed as wet, and it was never asserted that this area was actually watered in any one year. Government ratified the decision of the Board of Revenue that the zamindárs should have the benefit of all doubt and be allowed free irrigation for this whole *Gudicut*. The Committee believe it would be very difficult sometimes to find out how much the zamindárs have benefited by this decision; but even had the *Gudicut* not represented more land than was yearly watered, they submit that it would have been perfectly just to make the owners pay something in return for the money laid out by Government in making their irrigation certain.

9. Where, as in the case of the Nidathavole and Baharzalli estates, Government have agreed to recognise these claims, no alteration of arrangement seems now possible; but the Committee would urge that in future, and especially in dealing with zamindáris situated in the Kistna Delta (where a very material development of irrigation has yet to be effected), the claims of the State should not be entirely subordinated to the desire to deal liberally with the zamindárs.

CHAPTER VII.

THE COMBINATION OF NAVIGATION WITH IRRIGATION.

WITH the exception of the Madras Irrigation Company's canal, on which boats are not yet plying, the only irrigation canals in the Presidency which are adapted for navigation are those of the Godavari and Kistna deltas, and no one can pass along them without being convinced of the great benefit they are to the people, and that it would have been a serious mistake to have designed them for irrigation alone.

2. When a canal is intended only for irrigation, the one point to be aimed at is to convey the necessary volume of water from the head of the canal to the field as cheaply and with as little waste as possible. So long as the banks and bed are not eroded, the greater the velocity of the water the better, for the size of the channel to be excavated must be increased as the velocity diminishes, and the shorter time the water is in the canal, the less is lost by evaporation. The canal will be laid out as far as possible to avoid cross drainage, and there will be no object in bringing it near towns. The bridges need to be just high enough to allow the water to pass, and if economy of distribution is necessary, and there are a number of channels, the Engineer can manipulate the supply, closing one and opening another as irrigation requires.

3. If the canal is to be navigable, however, other considerations must be kept in view. Where the country is very flat, so that the water in a canal would flow naturally with a velocity not exceeding perhaps two feet per second, boats will ply with ease, and no special provision need be made for navigation on the irrigation channel. But this is exceptional. Supposing the slope of the country such that the velocity of the water would be 2.5 feet per second. As far as irrigation is concerned this is not too great,—that is, the banks and bed will not generally be eroded by it. But it is too great a velocity for successful navigation, and if it be resolved that 1.5 feet per second is as great a velocity as is permissible on the navigation canal, it follows that the channel must be increased in size by two-thirds to carry the same volume of water, and three miles of the earth-work of the navigable canal will cost as much as five miles of the canal only fit for irrigation. Not only so; but since the slope of the bed in the navigable canal is less than that of the country, locks and weirs must be built at intervals. The bridges, too, must be made high enough above the water to allow boats to pass, and as this will generally entail long sloping approaches, much will be added to the cost. This reduced slope of bed will favour the deposit of the silt carried in suspension in the water, and periodical dredgings or clearances will be required. It will be an object to bring the canal to centres of trade, and this may involve the cost of carrying it over rivers or drainage lines. When water is in high demand, too, it may be necessary temporarily to close certain branches which checks navigation, or else to allow irrigation to suffer; and the Engineer will have fewer facilities for distributing the water because regulating sluices at the heads of branches will be built more cheaply since each will involve the expense of a lock.

4. Now, it may easily be supposed that all these drawbacks may be sufficient to make it inexpedient to adapt an irrigation canal for navigation. If the slope of the district were excessive, it would entail a number of expensive locks; if the district were already supplied with a system of good roads or railroads, and the lines of trade were generally at right angles to the canal, frequent bridges would require to be built, and the traffic would be small. If the towns were not conveniently situated, branch canals would be required to approach them.

5. The circumstances, however, of the Godavari and Kistna deltas are most favourable for navigation. Few locks are required to enable the main lines to be carried over the gently sloping country. Few bridges have been required; for when the canals were made, there were no roads, and the cross traffic is now

sufficiently provided for by cheap ferries. There has not yet been any difficulty about the water-supply, which is generally equal to the demand at all seasons when the canals are open. On the Kistna, but not on the Godavari canals, silt clearances are expensive. Lastly, no part of the deltas is far from the sea, and ports such as Cocanada and Masulipatam are conveniently situated for export purposes.

6. Government has spent nothing on station-houses and goods-sheds, and but little on wharves. It has taken no particular measures for fostering and encouraging navigation (which was unknown in the district when the canals were made), nor has it ever assumed the functions of a carrier; but private boats carry the trade of these districts; and now that the Buckingham canal is opened along the east coast to Madras, boats are beginning to ply to that city all the way from Cocanada, a distance of nearly 400 miles. The navigation of the Godavari delta is much more complete than that of the Kistna.

7. Cargo boats, from which most of the revenue is derived, have until this year (1878) been licensed to use the canals of either delta on payment of a fee of one rupee per ton burden per annum, but in consideration of the outlay recently incurred in improving navigation in the Godavari delta this rate has now been doubled.

8. Prior to 1871-72 no capital account was kept of the outlay on navigation apart from that on irrigation, but there is no doubt that Government has never gained in direct revenue from the former, for the tollage on the boats has not yet been able to cover the annual working expenses.

The following is the Revenue abstract for 1877 shewing a deficit on the two deltas of Rs. 18,371 and Rs. 15,016 respectively. The interest is only on capital spent since 1871-72.

	GODAVARI DELTA.		KISTNA DELTA.	
	Receipts.	Charges.	Receipts.	Charges.
	Rs.	Rs.	Rs.	Rs.
	44,742	Working expenses . . . 37,959 Interest on capital . . . 25,154	14,876	Working expenses . . . 29,584 Interest on capital . . . 368
	44,742	63,113	14,876	29,952
Deficit . . .	18,371		15,016	
	63,113	63,113	29,952	29,952

Of the above, the tollage from cargo boats on the Godavari delta yielded Rs. 34,250. It is not anticipated that the rate being doubled will drive many boats off the water, so probably there may be a surplus revenue in 1878.

9. Although in direct returns Government has not gained by this navigation, there can be no question as to the indirect advantages arising from this cheap means of transport, which has certainly increased the wealth of the Godavari and Kistna districts, and the revenue derived from its lands, whether irrigated or not. The following statement, shewing the increase in the trade of the port of Cocanada during the last thirty years, is a fair indication of the value of the combined irrigation and navigation of the Godavari delta. Two navigable canals terminate in this port, and form almost the only trade routes between it and the interior.

Statement shewing the annual value of the exports from the port of Cocanada.

	Rs.
Mean of the five years ending 1852-53	12,71,886
" " " 1857-58	20,10,003
" " " 1862-63	33,51,924
" " " 1867-68	61,11,598
" " " 1872-73	76,08,175
" " " 1877-78	98,93,510

During the famine year 1876-77 rice husked and unhusked to the value of Rs. 52,75,156 was exported from Cocanada.

CHAPTER VIII.

THE MADRAS IRRIGATION AND CANAL COMPANY.

THE Madras Irrigation and Canal Company was formed in the year 1858, when the Government of India was inclined to receive very favourably proposals for the construction of remunerative public works, and particularly of canals for irrigation and navigation. The Company embraced in its scope the construction of extensive works throughout Southern India; and on the advice of the highest professional authority—Sir A. Cotton—they began with what was termed the Tungabhadra project, the estimated cost of which was £1,345,450.

2. The River Tungabhadra rises in the rainy hill country of West Mysore, and after skirting the dry district of Bellary, it joins the Kistna in that of Kurnool. It was proposed to take from this river a large canal through the Bellary District. Another was to start from its right bank at Sunkasala, a spot near the City of Kurnool, to cross the water-shed separating it from the Pennair, to join that river in the Cuddapah District, and largely to supplement its supply. A weir across the Pennair was then to divert the united waters into a canal on its southern bank, and ultimately a navigable connection was to be opened with Nellore and the eastern coast.

3. A great area of land was thus to be irrigated in the districts of Bellary, Kurnool, Cuddapah, and Nellore, while the produce was to be floated without impediment for about 400 miles to the coast. The uncertain supply of the Pennair was to be supplemented by that of the more reliable Tungabhadra; and to ensure the sufficiency of the latter throughout the year without interfering with the delta irrigation of the Kistna, it was proposed to form extensive reservoirs in Mysore and Bellary.

4. To begin with the Company were authorised in 1860 to raise a capital of one million sterling on a Government guarantee of 5 per cent., and it was agreed first to make the canal from Kurnool to Cuddapah.

5. Judging from the signal success of the irrigation works in the delta of the Godavari, no one appears to have doubted that this scheme would prove most successful. One of the officers on the spot, dwelling forcibly on the benefits that would be conferred on the "thirsty plains" of Kurnool, related how the ryots brightened up when he told them they were to have irrigation, and said that in that case they would not have to leave the district altogether. The shareholders at home were assured that they might confidently expect a return of 31½ per cent. on their investments. It is melancholy to have to point out now how fallacious were all these views, and how many considerations were wholly lost sight of that ought to have received the most careful and deliberate thought. The estimates of the cost of constructing the canal and of the revenue to be expected from it were based on the experiences of deltaic tracts. The difficulty of passing through a rugged country, the sparseness of population, the different character of the soil, and other like considerations were overlooked, so that, although the Kurnool canal is a most valuable work of insurance against famine, it can never be otherwise than a financial failure.

6. In this report the Committee propose to consider—

I.—The contract between the Madras Irrigation and Canal Company and the Government.

II.—The obstacles to the success of the enterprise which it is impossible now to remove.

III.—The obstacles which may and ought to be removed.

IV.—The measures to be adopted for the better management of the canal.

7. I.—The contract with Government.

The capital on which 5 per cent. interest was originally guaranteed was limited to one million sterling. This sum was found insufficient to complete the canal from Sunkasala to Cuddapah, and the "Madras Irrigation Canal

Act of 1866" authorised the Company to borrow from the Secretary of State the sum of £600,000 upon debentures payable at the end of five years, and bearing interest at 5 per cent., such interest being a first charge on the revenue of the canal. Section 6 of the above Act empowered the Company to borrow what money they required on mortgage or otherwise "for the purpose only of paying off or discharging the debentures to be given to the Secretary of State."

8. Doubts, however, arose as to whether the holders of mortgages or bonds under section 6 would be entitled to the same priority with respect to the interest of their money as that to which the Secretary of State was entitled with respect to the interest on his debentures. In order to remove these doubts; and to enable the Company to exercise their powers of borrowing, the "Madras Irrigation and Canal Act of 1872" was passed.

This Act provided that the interest of money borrowed under the authority of section 6 of the Act of 1866 should be a first charge on the revenue of the Company, "subject to the debentures held by the Secretary of State in Council or such of them as may for the time being remain undischarged."

9. Under the authority of this Act, the Company issued mortgage debentures for £408,955 at £82,* and from the capital of £335,342-2 thus obtained, they repaid the Secretary of State £228,000 of the £600,000 loan. From the balance of their capital £107,342-2, they devoted £82,933 to paying up to June 1877 the interest due to the holders of the debentures of £408,955.

10. The Committee cannot gather from any of the Acts passed that the Company were justified in applying to the payment of interest any portion of the money so borrowed. It seems to them that the Company having raised £335,342-2 were bound by section 6 of the Act of 1866 to pay the whole of it to the Secretary of State, and that the mortgagees were entitled to their interest only from the revenues of the canal. Moreover, in no case could the interest on the mortgage debentures be paid until the Secretary of State's claims for interest on the loan debentures had been satisfied.

11. There is still £372,000 of the Secretary of State's debentures unpaid. If the Company are justified in what they have done, there seems nothing to prevent their borrowing, say, £591,045 at £82, thus obtaining a capital of £484,657, reserving for interest to the lenders of the £591,045 a sum of £112,657, and paying the balance £372,000 to the Secretary of State. The Secretary of State's debentures would thus be paid off, and the Company would have incurred a debt of £408,955 + £591,045 = a million sterling; and then, before their revenue could be applied to reducing the Government guarantee of 5 per cent. to the shareholders of the original capital of one million, the claims of the mortgagees of this second million would require to be satisfied. From this and from what remains to be explained, the prospect of Government being relieved of any portion of the annual outlay of £50,000 (5 per cent. on one million sterling) seems most remote.

12. The contracts entered into with the Company did not contemplate the contingency of the revenue receipts ever falling short of the working expenses; and for this no provision was made, although, by clause 23 of the contract of 1863, the Secretary of State was empowered under certain circumstances to cause necessary repairs to be executed to the canal, and to recover their cost from the guaranteed interest. It has happened, however, that for every year up to 1876-77 the revenue has fallen short of the working expenses, and advances have been made by Government to the Company. These advances amount to Rs. 4,65,412.† In September 1876, the Secretary of State declined to make any further advances. The demand for water in the famine year raised the Company's revenue from Rs. 59,625 in the preceding year to Rs. 2,48,193, and gave them a balance of funds in hand; but the Committee think it improbable that the revenue of the current year will cover the cost of the canal's maintenance.

13. II.—The following reasons for the Company's want of success are now beyond remedy, and in the opinion of the Committee they render it impossible that it can ever be other than a financial failure:—

(a). The excessive cost of the works in relation to the capacity of the canal.

* See statements of receipts and payments to 31st December 1877, attached to the report of the Directors of the Company presented at the Ordinary General Meeting of 30th May 1878.

† See Proceedings, Madras Government, No. 567, dated 12th July 1878.

(b). The nature of a large portion of the soil commanded and the circumstances of the people.

14. The canal from Kurnool to Ouddapah was estimated to cost £415,250. In 1864 it was found that this estimate was likely to be greatly exceeded, while the design and execution of many of the works were equally faulty. The original million and the Secretary of State's loan of £600,000 have now, at the close of 1878, been nearly spent; and although the works are practically finished, it is doubtful whether, without further outlay, the canal is capable of safely carrying the 3,000 cubic feet per second originally proposed.

15. But the revenue would be sufficient to meet even this great outlay, if the demand for irrigation and the area capable of irrigation were anything like what was expected, and if the full supply of the canal were sufficient to water this area. The actual state of affairs is very different. Experience elsewhere forbids us to look for more than 200,000 acres of irrigation with the volume available, or for the irrigation of 300,000 acres out of a total area not much greater. Unfortunately also, it is too evident that water has been brought to a people who do not want it, and will only take it to a very limited extent.

16. The canal was opened throughout its length in 1871. The area of wet cultivation amounts after seven years to only 14,000 acres. The frequent occurrence of breaches in the canal had certainly shaken confidence in its stability, and other reasons will be given further on which have checked the extension of irrigation; but under the most favourable circumstances it would not have reached 100,000 acres.

17. Why irrigation so earnestly sought for elsewhere is so unpopular here is easily explained. Of the soil irrigable from this canal, a large proportion (probably 50 to 60 per cent.) is the well-known black cotton soil locally termed "regada." It is highly fertile, and, with a very slight ploughing, produces in years of ordinary rainfall fine crops of the large millet known throughout India as *cholum*, *jonna* or *jowar*, the *Sorghum vulgare* of botany.

18. The dry lands of Kurnool yield as much as 1,000 lbs of this nutritious grain per acre. The ease with which it is cultivated precisely suits the sparse population, not exceeding on an average 150 to the square mile. It is the staple food of the people, and the straw is the best fodder for the fine cattle on which they pride themselves. It is true that they consume rice to a small extent, and have far to send for it. If they understood how to grow it too, rice cultivation is the more profitable. But it requires a great deal of manual labour, and is considered locally to need a great deal of manure which they cannot always command. It is a new thing, and therefore a distasteful thing, and its straw is an inferior fodder. This is the main reason why the Kurnool canal has been such a failure. Had its cost not exceeded the original estimate, even then it would not have paid the guaranteed interest for many years.

19. The chances of extending rice cultivation would be improved were it possible to secure a second crop. The inducement to terrace and manure his lands might be increased if the peasant could count on two crops a year. But as the supply in the canal is only certain for seven months, this is impossible. It was to meet this difficulty, and to keep up unbroken navigation, that it was originally proposed to store the upper waters of the Tungabhadra in reservoirs. But the profits of these works would not, as things are, be commensurate with their cost.

20. In ordinary years, the millet crop requires no irrigation; indeed it often suffers from excessive rain. But in years of drought it perishes if unwatered, and it cannot be doubted that in such seasons the ryots will in time gladly avail themselves of the canal. This is the one bright feature in the project. In 1875-76 the area of millet watered was only 1,020 acres. In the famine of 1876-77 it rose to 66,901 acres, and, although a good crop was not obtained over all the area, it might have been even larger had the administration been more perfect. Should another such famine occur, the canal should be able to water 200,000 acres of millet and produce food to the value of 80 lakhs of rupees, enough to support a million of people with their cattle for five months.

21. III.—All the obstacles to the success of the Kurnool canal which can be removed may be included under the term "faulty administration."

It was laid down from the first that the Company were to deal with Government alone and not with the ryot. Government were to buy water from the

Company and the ryot from Government. A series of rules was framed in 1861, based on the supposition that the water would be in high demand. To secure the supply to those who asked for it in proper time, applications for water were required to be made before the beginning of the irrigation season. All irrigated lands were to be registered, and the Government were to make over to the Company whatever revenue they realised. It was believed that the ordinary village organisation was sufficient to deal with this new thing-irrigation. The village accountant or *karnam* was to receive applications, to open registers, to send in monthly reports. The tahsildars and revenue inspectors were to add to their multifarious duties the distribution and control of the water after it left the Company's sluices, and no provision was made for remunerating any of these officials for their additional trouble.

22. Owing to its climate, no district in Madras is more unpopular than Kurnool. Changes are frequent among its Collectors. Revenue subordinates who seek for promotion, or whose ability commands interest, are always on the look-out for employment in other districts. It is not to be wondered at then if the Revenue administration is not as efficient here as elsewhere, or if the Revenue subordinates performed their new duties in a somewhat perfunctory manner.

The officers of the Company complained that the *karnams* did not register water applications, that the ryot had no means of learning the terms on which he might irrigate or how he could get water, and that irrigation was thereby retarded. The Revenue officers denied the truth of these complaints and said the ryot did not take water because he did not want it, and because the frequent accidents to the canal made his rice crop uncertain. Government after much discussion consented to the Company's own officers registering applications and measuring up the crops. But this did not do much good. The Company's officers continued to complain of the indifference of the Revenue subordinates. The Revenue officers retorted that the complaints of the Company were exaggerated, that they showed a disregard to the feelings and prejudices of the ryots, and were harsh in their treatment of them. Complaints continued to be made, and Government were at length convinced that the appointment of a special Revenue officer of standing was necessary to ascertain the facts, to see that the rules were carried out, and to suggest such improvement as might be likely to conduce to a more efficient administration.

23. To this duty Mr. A. Lister, M.C.S., was nominated in December 1877. Mr. Lister's careful and exhaustive report No. 252, dated 15th August 1878, has been of great help to this Committee. They have studied it with interest, read up much correspondence, and taken evidence from various individuals in the Kurnool and Cuddapah Districts. Although, for reasons already given, they do not think that under the best auspices the canal could have been a success, they consider Mr. Lister is warranted in ascribing its failure partially to

- "(1) the absence of good revenue administration in the taluks traversed by the canal;
- (2) the unsatisfactory relations which have existed between revenue officers and the Company;
- (3) the feeling of antagonism that has risen between the Company and the ryots;

* * * * *

(6) the whole system of management which exposes the ryots to worries and exaction."

24. It is not necessary here to adduce evidence on any of these points save the last, nor will they be dwelt on further. Friction will arise where there is a dual administration. Mismanagement will arise when people are expected to perform duties they do not understand. Friction is often seen between two departments of the same Government. It is more likely to occur between officers of a Government and of a Company. The introduction of irrigation into Kurnool and Cuddapah is a difficult task, requiring much tact and special knowledge. No wonder that it has failed when these qualifications were wanting.

25. The part of the canal administration which has been the chief source of annoyance to the ryot has been the system of applications for water. As first arranged, the ryot had to apply to his village *karnam*, and afterwards he might go to the canal overseer instead; but in either case the application had to be recorded. If he watered his field without this previous application, if the

karnam forgot to record it, or if by mistake he recorded 3 acres instead of 4, the ryot was subject to a fine for anything in excess of the recorded area. In the year 1876-77 no less than 15 per cent. of the whole area irrigated was thus subjected to fine. On one village, Yerraguntla, Taluk Sirvill, a fine of Rs. 161 was inflicted in spite of the ryots' positive assurance and the *karnam's* admission that they had asked him to register their names for water, and that he had neglected to do so. The Committee are afraid that this is not the only case where the ryot has been fined for no fault of his, and where it is evident that, if the Company were entitled to the amount of the fine, it should have been paid by the *karnam* or by the Government whose officer the *karnam* is.

26. On this canal, where the ryot is so lukewarm about irrigation, it is particularly desirable to remove all impediments to his taking water, and this system of applications has been a distinct impediment, especially in the irrigation of what are termed dry crops. The ryot hesitates long before he waters his *cholum* field. His fathers never did so. He is not quite sure whether the canal water will be good for the crop. He will have to pay Rs. 2 per acre for it, and if he holds back and it should happen to rain next day he will be saved this sum. It may easily be conceived that in this frame of mind he will be deterred if he has to go in search of the *karnam*, who may perhaps be absent at the taluk head-quarters, and even then he is not quite certain that his application will be registered, and he has a shrewd suspicion that he may incur a fine.

It is the opinion of all whom the Committee have consulted that this system works badly, and that it should be abolished.

27. The Company at present are required to bring the water to the field of every ryot, and the field channels are not looked on as the property of any particular individual. The opinion of the Committee will be stated further on, that the Company should not have anything to do with the distribution of water; but whether or not this be approved, they consider it essential that the Company's interference should not go further than the sluice or sluices supplying a village, and that the individual distribution should rest with the village officers.

The ryot as at present would have to ask one of these officers to let him turn the water on to his field, and the *karnam* in due course would record the irrigated area in his accounts; but whether he did so or not would be immaterial to the ryot, as long as he got the water he wanted, and the amount he would have to pay would depend not on what the *karnam* had recorded, but on what the irrigated area proved to be.

28. The settlement and measurement of the fields irrigated should always be made before the crop is cut. This is seldom if ever done on the Kurnool canal. Measurements are made in August, or even later, of fields from which the irrigated crops have been cut in March, and where perhaps another crop has been sown. In such cases there is no possibility of proving from the field itself whether it has been watered or not. The proof of irrigation has been made still more impossible sometimes by the ryot not having been told for months after the measurements what he will have to pay. It is the rule that he should have a bill termed a *puttah* presented to him, explaining his charge before he is called on to pay it, but this rule has not always been observed. If full intimation were given in each village of the date on which the irrigation would be measured, so that the ryots concerned might be present if they liked, and if their *puttals* were presented to them before the harvest, the opportunities for fraud would be greatly reduced. The Committee know of no reason why this should not be done on the Kurnool canal as it is successfully elsewhere.

29. Although Mr. Lister thinks the canal rates were fixed too high at first, he does not recommend that they should now be reduced. On this very important matter, the Committee find it difficult to arrive at a conclusion. In 1862, Government started with a rate of Rs. 3 per acre on each crop watered, but a few months afterwards, considering there could be only one crop in the year, they changed it to Rs. 4.* In 1865, the Company urged that their works had been of so costly a nature that a higher rate was necessary to enable them to pay their dividends. The Madras Government on a full review of the case thereupon sanctioned a rate of Rs. 6 per acre on

* Proceedings, Madras Government, 24th May 1862 and 24th May 1863.

† Proceedings, Madras Government, No. 1348, dated 1st June 1866.

rice irrigation. This rate was fixed on the consideration that prices were then high and the country prosperous. The contingency does not seem to have been contemplated that the ryot might decline to irrigate on these terms. In 1865, the Collector of Kurnool pointed out that the rate was too high and that irrigation was falling off, and the Consulting Engineer to Government suggested an initial rate of Rs. 4 and an annual increase of Re. 1 up to Rs. 6. Government* left the Company to decide whether they would adopt this suggestion or adhere to their Rs. 6 rate. They did the latter. In 1874 new rules were framed.† Crops were divided into three classes—class (1) “requiring a continuous supply,” rice, sugarcane, betel-leaves, &c.; class (2) “requiring frequent floodings,” chiefly garden crops; class (3) “requiring occasional floodings,” *cholum* and *rugi*. The rates for these were Rs. 6, Rs. 4, and Rs. 2 per acre respectively; and with reference to the first, where the field had been properly terraced and embanked, the charge was raised by yearly increments of Re. 1 from Rs. 3 to Rs. 6. For these rates, rice received its supply throughout the season, but other crops only up to 31st December. After that date a rate of Re. 1 per mensem up to the closing of the canal was fixed. Provision was made specially for the filling of tanks. The rules of 1874 were revised last year, but the water rates were not changed.‡

30. The statistics of irrigation are so incomplete that it is difficult to say how these rules have worked. Until Mr. Lister's appointment, no separate record was kept of the area of second class irrigation at Rs. 4 apart from that of rice in its second year at the same rate. But it appears generally, as Mr. Lister remarks, that about

“one-half of the land taken up newly for rice is abandoned the following year, and only one-third of it is persevered with in the third year.”

This seems to indicate that the rates are too high, but nowhere did he hear complaints on the subject, and, as he points out, the first year is often one of experiment. At its conclusion, the ryot, finding his rice crop has not succeeded, or that it has involved more labour or manure than he can afford, goes back to his original *janna*.

31. Mr. Latham, the Chief Engineer of the Company, urges with justice that the present rates have really not had a fair trial. If that for rice were reduced at once to say Rs. 4, there would be temporary falling off of the revenue, and the Committee do not feel confident that this would be compensated for afterwards. At the same time it is evident that irrigation does not progress as it should; and it seems anomalous that the water rate on the Kurnool canal should be Rs. 6 per acre, while in the Kistna and Godavari deltas, where irrigation is eagerly sought for, the rate is only Rs. 4.

32. According to the best evidence, rice lands do not yield a full return for the first year or two. In some places the cost of terracing and manuring is much greater than in others. The Committee know of no reason why one initial rate should be charged throughout the canal, and in paragraph 40 they will submit some suggestions on this point.

33. The arrangements for supplying the few tanks on the line of the canal have not hitherto been satisfactory; but Mr. Lister and Mr. Latham have now agreed on what seem equitable terms which meet also the peculiar circumstances of the holders of wet *inam* lands.

34. The rate for millet irrigation, Rs. 2 per acre, is not too high. In years of ordinary rainfall it will not be irrigated at all, and in seasons of drought the ryot can well afford to pay so much for it.

35. Although it is not an obstacle to the spread of irrigation, this seems the right place to notice the burden placed on the revenue of the Kurnool canal by the extravagant charges for establishment. The Committee have no means of knowing the charges made at home on account of direction, &c. In India there are a Chief Engineer and Manager drawing Rs. 2,500, besides a fixed travelling allowance of Rs. 200 per mensem, and four Engineers drawing altogether Rs. 2,390 per mensem, making an annual charge of Rs. 61,080. Were this a Government canal, probably one Executive Engineer and three Assistant Engineers would be thought sufficient, and their salaries would amount to less

than Rs. 30,000. Government have repeatedly noticed the high salary still drawn by the Chief Engineer, although the outlay on construction has for several years been only nominal; but the Secretary of State has considered it inexpedient to bring pressure on the Company to lower it, and of their own accord they seem indisposed to do so. The Committee do not think that the total charges for maintenance are high, but they would like to see less spent on establishment and more on works; and the two Engineer Members of the Committee having inspected a large portion of the canal do not consider that it is in all respects kept in the efficiency it should be.*

36. IV.—In paragraphs 25 to 28 the Committee have already made recommendations for an improved management of the canal. There remain some others to bring forward, and in doing so it has been assumed that Government are not in a position to buy out the Company, and that as heretofore the Secretary of State will treat them with some indulgence, without which it is difficult to see how they can carry on at all. In the opinion of the Committee, the most satisfactory arrangement between the Company and Government would be that the latter should purchase the water by volume and take on itself all the details of its distribution. The Company would then be required to maintain a certain depth of water at certain points agreed on, and it would be paid accordingly. The Company would be responsible for the maintenance of the canal and the irrigation sluices. Where new ones were required they would be bound to build them. But the opening and closing of these sluices, the maintenance of existing and the construction of new distributary channels, and the whole management of the irrigation, would be in the hands of Government. By this plan the revenue of the Company would be a round sum representing the value of the water expended, and it would cease to be any concern of theirs whether the water were used to the utmost advantage or not. The Government would, as at present, charge the ryot according to the area watered, and they could then fix the water rates without any reference to the Company. They would be the losers in wet and the gainers in dry years. In the latter, too, they would have a valuable freedom of action in prompt water distribution, which is impossible at present. All friction would then cease between the officers of Government and of the Company, for distinct limits would be set to the functions of each.

37. *Prima facie*, this would be the best arrangement; but the Committee see difficulties in the way of its execution. The terms on which the contracts were framed, the absence of sufficient irrigation statistics since the canal has been opened, the uncertainty as to the volume wasted, and the extent to which the bed is likely to silt up, all form practical difficulties by no means insurmountable, but still to be avoided if possible. The Committee therefore suggest another basis of agreement which seems to them quite feasible, namely, that Government should annually pay to the Company a sum estimated from the revenue of the last few years, and increasing year by year on the assumption that irrigation will extend, and that Government shall then be entitled to take as much water as circumstances may render desirable within the capacities of the several sections of the canal. As proposed in the last paragraph, the Company would keep the canal works in repair, and the Government would have charge of the water distribution. The Company would engage to keep up the depth of water required within certain limits, and in the event of their failing to do so they would be liable to make good any remissions of revenue caused by their short supply.

38. In the following table the progress of the irrigation is shown year by year from the beginning:—

Year.	Acres irrigated.	Revenue.	Year.	Acres irrigated.	Revenue.
		Rs.			Rs.
1863-64	13	73	1871-72	7,556	32,564
1864-65	192	634	1872-73	9,405	48,455
1865-66	816	3,543	1873-74	13,355	65,510
1866-67	1,396	10,162	1874-75	13,408	49,385
1867-68	1,138	10,084	1875-76	14,765	56,357
1868-69	1,078	10,000	1876-77	90,285	2,47,351
1869-70	1,164	9,803	1877-78	50,918	1,49,130
1870-71	1,516	6,700			

* In this remark items such as the following are referred to: the state of repair of several bridges which are badly cracked; the want of pointing; the trees and vegetation requiring to be removed from masonry works; the state of the flooring of culverts; the disrepair of canal buildings; the earthen banks of section 7.

* Proceedings, Madras Government, No. 526, dated 1st March 1869.

† Proceedings, Madras Government, No. 836, dated 3rd July 1874.

‡ Proceedings, Madras Government, No. 8359, dated 5th December 1877.

In the year 1871-72 the canal was opened throughout its length: 1874-75 was exceptionally wet; in 1876-77 the great famine reached its greatest intensity; and in 1877-78 the rains did not set in till September, and the irrigation was abnormal. In any forecasts for the future, the famine year must be thrown out altogether, except so far as famine always does give an impetus to irrigation. Considering this, the dry year 1877-78 might be balanced against the wet year 1874-75. The mean revenue of the three years, beginning 1871-72, is Rs. 52,112, and of the three years 1874-75, 1875-76, and 1877-78, is Rs. 87,995. This denotes an average yearly increase of about Rs. 12,000. The Company relieved of the water distribution will be able to effect a saving in establishment of, perhaps, Rs. 20,000 per annum apart from economy in salaries, and a corresponding increase of burden will be laid on Government. Taking this into account on the one hand, and on the other the hope that by the arrangements now proposed irrigation will advance with a progress perhaps twice as fast as it has hitherto, the Committee consider that Government would be acting fairly and liberally if, for the water-supply of the year 1879-80, they were to offer the Company Rs. 1,20,000, and to increase that sum by Rs. 25,000 each successive year up to 1887-88, after which Government will have the option of taking over the canal altogether.

39. But the Committee do not consider that this change would be enough. They have not had reason to form a very high opinion of the subordinate Revenue officials of Kurnool and Cuddapah, and under no circumstances do they think that the spread of irrigation on this canal can be effected without an establishment specially trained and employed for the purpose. The conditions here are totally different from what they are in Tanjore, where irrigation has gone on unchanged for generations, or in the deltas of the Kistna and Godavari, where it is eagerly demanded.

40. Mr. Lister's appointment has been of undoubted benefit, and it seems necessary for the future to retain an officer in special charge of the irrigation. The cause has been injured hitherto from want of elasticity in management. The only way of securing this elasticity is to entrust the management of the irrigation to an officer possessing the confidence of Government, and to give him very free powers of action. He might be termed, perhaps, the Superintendent of Irrigation. Such an officer must be of strong constitution (for it is an unhealthy country), of active habits, and of sound judgment, taking a kindly interest in the agricultural classes, having a good knowledge of their language, some acquaintance with the native system of cultivation and some experience in a canal-irrigated district. It is not essential that he should be an Engineer, but if not, he should possess an aptitude for minor engineering work. He should also acquire some knowledge of the flow of water. To give him the necessary authority, he should have magisterial powers. The salary of such an officer should be about Rs. 1,200 per mensem, and he should get the appointment only on the understanding that, health permitting, he should hold it for at least five years.

41. It is questionable whether an officer possessing the necessary experience and qualifications, and who would accept these conditions, could be found in the ranks of the Covenanted Civil Service. But the Committee believe that he could be had from the Revenue Survey or Settlement or from the Irrigation Department. In his magisterial duties, he should be under the control of the District Magistrate, but in other respects he should correspond direct with the Board of Revenue. In all irrigation matters, the Revenue subordinates should be bound to obey his orders, and it would be necessary also to give him a subordinate establishment of inspectors, measuring amins, patrols, &c. Including his own pay, the whole establishment would cost perhaps Rs. 35,000 per annum. Against this there would be as a set off the estimated saving of Rs. 20,000 to the Company, and the cost of the present Revenue officer whose employment was not intended to be permanent, but which would require to be so, unless some other arrangement were introduced.

42. Government having laid down very generally the principles to be followed, the Superintendent of Irrigation should be left unfettered to act, only reporting what he has done. The Committee go so far as to recommend that he should be allowed within certain limits to fix the water rates to be levied for, say, the next five years, not insisting on all villages paying the same rate,

but taking into account the peculiar circumstances of each. In some, for instance, there is no question that rice cultivation will succeed. The ryots are numerous and well-to-do, and the land could easily be terraced. In other villages precisely the opposite conditions exist. To give the irrigation the best possible chance, varying rates might be demanded. The Irrigation Superintendent should be vested with the powers of a Collector under the Land Improvement Act XXVI of 1871, and should be encouraged to make free use of its provisions. If this officer were an Engineer, he might himself execute all improvements and extensions of distributary channels, and this would be most convenient. If not, the agency of the Public Works Department would require to be called in to do all requiring technical skill.

43. The Committee are aware that their proposals involve procedure which is supported by no precedent, and the results of which cannot be demonstrated; but they see no chance of the State being materially relieved of a serious and constantly increasing financial burden, unless the unreliable traditions of the past be abandoned.

44. Navigation is now about to begin on the Kurnool canal, and the Company, instead of deriving their profits as Government do on the State canals by a tollage on the boats, intend to take up the position of carriers, to allow only their own boats to use the canal, and to charge for the carriage of passengers and goods precisely as on a railway. This has involved the purchase of an extensive fleet of cargo boats from England, and the erection of wharves, goods-sheds, &c., which are not provided on the State canals. The Committee have no data from which to form any forecast of the profits likely to accrue from this traffic, but they are not sanguine as to the Company's thereby improving very much their financial position. Nor do they look for a rapid increase in rice irrigation, owing to the facilities which boat carriage will afford for taking it to distant markets. They have no doubt, however, that the Kurnool District will greatly benefit by the introduction of cheap navigation.

45. One point remains to be mentioned before closing this chapter. In Chapters I and V has been noticed the irrigation from the Pennair River in the Nellore District, and especially the Sangam project. Were the supply of that river more certain, it would be easier to replenish the tanks depending on it, and the channels leading to these works would not require to be so large or costly as now, when advantage has to be taken of very short freshes. Should the ryots of Kurnool persist in abstaining from irrigation, the Company's canal may be employed as a valuable means of transferring water from the Tungabhadra to the Pennair, where it will be highly prized in the rice fields of Nellore.

CHAPTER IX.

THE PRESENT CONDITION AND THE FUTURE PROSPECTS OF IRRIGATION WORKS IN ORISSA.

THE Province of Orissa covers an area of 7,355 square miles, of which about two-thirds is cultivated. It contains a population slightly exceeding three millions, and is divided into the three districts of Cuttack, Pooree, and Balasore, of which Cuttack is the most populous, containing 470 to the square mile. The land is held on the ordinary Zamindari tenure of Bengal. Its revenue was fixed at the settlement of 1837 at Rs. 17,05,591, and this was renewed for 30 years in 1867, when the Province was just recovering from its terrible famine. The average rain-fall is from 55 to 65 inches. The quantity is generally ample for cultivation, but its distribution throughout the year is so irregular that the crops are not unfrequently injured. In 1865 the rainfall was 47.45 inches, and the result was famine. In 1873 the rainfall was 35.84 inches, and tolerable crops were secured.* The food of the people is rice, and it is almost entirely grown in the crop sown in June and reaped in December.

2. The characteristics of the Province which have most struck the Irrigation Committee are the remarkable manner in which it is intersected by rivers, and the imperfect means notwithstanding of communicating with the surrounding districts.

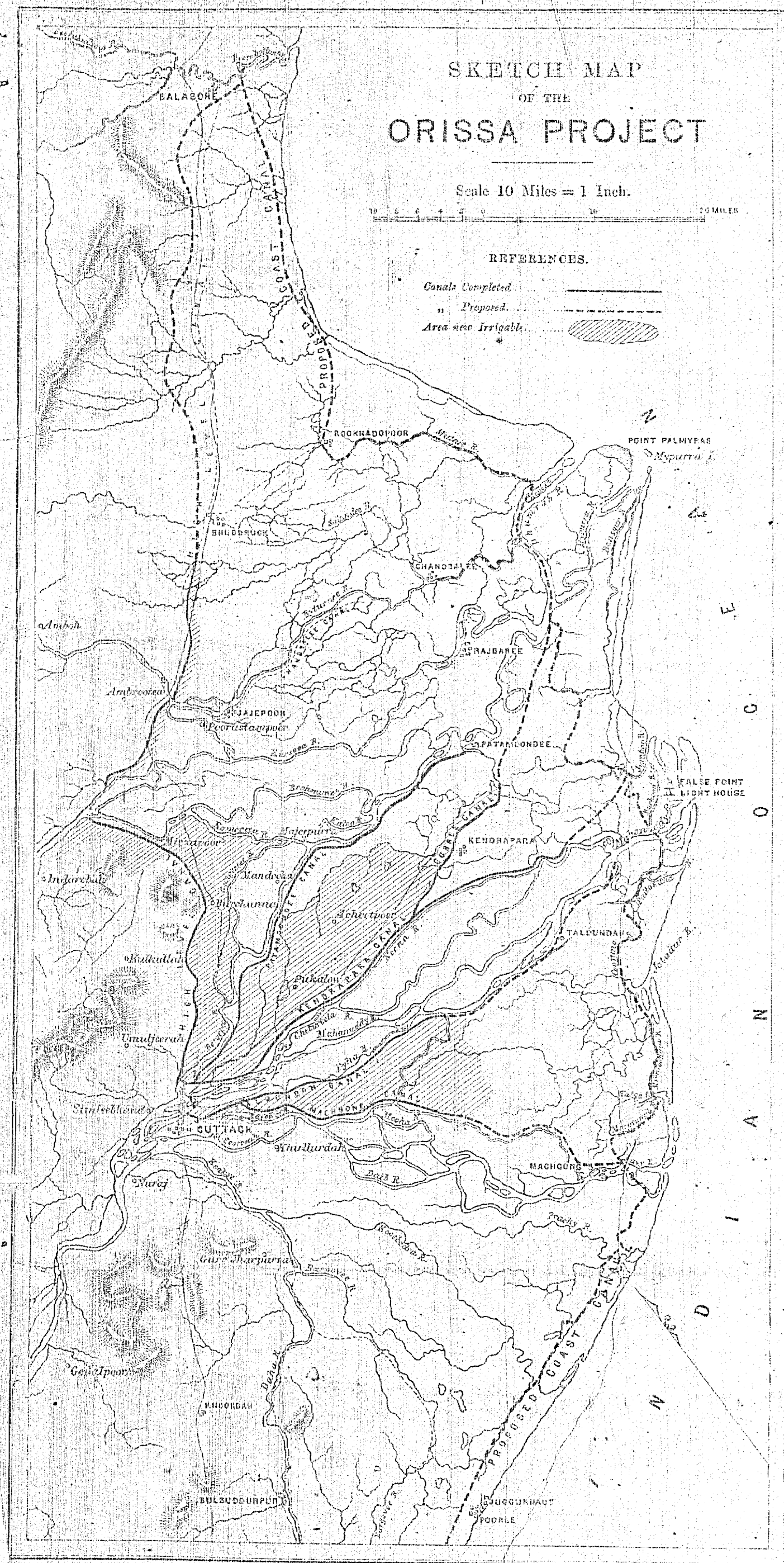
Orissa is traversed by seven rivers, of which by far the largest is the Mahanuddy. In the rainy season they are subject to great floods, which sweep across the country simultaneously, causing extensive damage. In the hot months most of them dwindle down to paltry streams. The Mahanuddy has a drainage area of 48,200 square miles above its delta. Its flood discharge is 1,570,000 cubic feet, and it has been measured as low as 400 cubic feet per second. These rivers keep splitting into branches, and again re-uniting so as to form a labyrinth of waters discharging into numerous creeks which run inland from the sea, and intersecting a long belt of land feverish and jungle-clad. Although there is a seaboard running the whole length of Orissa, 250 miles, it contains only two places of secure anchorage, False Point and Chandballi on the Baiturni River, about 20 miles from the coast, and the communications between these ports and the interior are still imperfect. There is also a metalled road to Calcutta 260 miles from Cuttack, but the rivers are unbridged, so that for some months every year it is almost closed. The originators of irrigation works in Orissa found, therefore, that they had difficulties to face unknown elsewhere, and it was evident that no system could meet the wants of the province which did not provide facilities for navigation and protection against floods.

3. The Committee have found an unusually large mass of literature connected with irrigation in Orissa. The subject has assumed different lights in a comparatively short period of years. Officers of great local experience and professional knowledge have entertained different views. Coming then as strangers to the Province, and with only a limited time at their disposal, they feel diffident in advancing opinions as to the promise of the future, or the measures to be recommended, and they cannot enter closely into the details of the proposals they have to make.

4. On 1st April 1878 the capital charges against irrigation works in Orissa amounted to Rs. 2,29,91,691. In return for this expenditure Government possess

- (a) 227 miles of irrigation canals, of which
- (b) 160 miles are navigable;
- (c) 548 miles of distributary channels and 102 miles of village channels capable of irrigating 182,950 acres;
- (d) embankments affording protection from floods to 621,400 acres, or nearly 1,000 square miles.

* Note by Lieutenant J. W. Ottley, R.E., dated 10th December 1874.



With more distributary channels the existing canals are capable of irrigating an additional area of 311,850 acres. The irrigation of the current year, which is the greatest yet effected, amounts to 130,000 acres, bearing a revenue of Rs. 1,95,000. The navigation revenue this year will be about Rs. 70,000.

5. The canals of Orissa and Midnapur were actually begun in November 1863 by the East India Irrigation and Canal Company, and were taken over by Government on the 1st January 1869 on payment to the Company of £1,040,050. This was a very liberal payment. The Company's £20 shares were not then worth more than £16 in the market. Government bought them for £21. A compensation bonus of £50,000 was paid to the Company's officers, besides £57,000 on account of home charges for direction. It may be safely said that for the million of money paid the Government bought works in Orissa and Midnapur intrinsically not worth more than £700,000.* This should be remembered in calculating the financial value of irrigation in Orissa. Viewed in a financial light, these works are crushed under the weight of their interest charges. If it were possible (which at present it is not) to obtain one rupee of net revenue for every acre watered, it would be necessary to irrigate 175,000 acres simply to pay the interest of the money paid to the Company over and above the value of the property bought.†

6. For several years the prospects of irrigation in Orissa were most discouraging. As in the case of the Kurnool canal, when irrigation works were started here the success attending them in the Godavari delta was quoted, and with more reason. Here too was a deltaic country, not very unlike the Godavari district. Here too the staple food was rice. One very important difference there was that here the rainfall was 55 inches or more, in the Godavari delta it was about 37 inches, and it may be added the cultivators of Orissa are far inferior to those of the southern deltas, and are noted for their want of energy and enterprise. Although they had just gone through a famine, they were indifferent to irrigation. The water-rates were unwisely fixed at first as high as Rs. 5, and these were by degrees lowered to Re. 1 per acre. Still the ryot was determined not to take water if he could grow his rice without it, and frequently when he did take it, it was difficult to exact the revenue from him. In the southern deltas the existence of a crop of rice at all is evidence of irrigation. Here it is grown of tolerable quality with the help of rain alone. The ryot was ready to deny that he had used canal water, and when he was proved to be lying, it was difficult to punish him until the Canal Act of 1876 was passed. The statistics of irrigation year by year are given in the following table:—

Area of Lands Irrigated year by year.

Year.	Acres leased.	Year.	Acres leased.
1869-70	1,729	1874-75	22,459
1870-71	22,128	1875-76	18,409
1871-72	11,653	1876-77	30,383
1872-73	4,753	1877-78	98,495
1873-74	12,571		

	Rs.
* Actual cost of works in Orissa up to 1st January 1869	32,67,926
Add 40 per cent. for establishment and tools and plant	13,07,179
Total Orissa works	45,75,096
Actual cost of works in Midnapur	16,99,689
Add 40 per cent. for establishment and tools and plant	6,79,867
Total for works, Orissa and Midnapur	62,54,621

† As if the Orissa irrigation works were not already sufficiently burdened, there seems rather a tendency to charge them with expenses hardly belonging to them. It may be doubted, for instance, whether all the outlay on flood embankments is fairly chargeable to irrigation: or the total cost of the cadastral survey which will be as valuable to the Revenue as to the Irrigation Department. Nor does it seem quite fair to impose on this department the maintenance of the massive flood walls built by the Maharattas to defend Cuttack from the floods of the Kathjori, since all that the Irrigation Department has to do with the matter has been to build, some miles higher up, the Naraj weir, of which the effect is to lessen these floods.

7. Until two years ago, writers on the subject of Orissa Irrigation have been generally despondent as to its ever being much in request. It is satisfactory to have to report the dawn of better things. Perhaps terrified by rumours of the Madras famine, and certainly alive to the rise it occasioned in prices, the Ooriyas seem at last to have overcome their dislike to irrigation. The area of rice watered in 1876-77 was 26,070 acres. In 1877-78 it was 95,080 acres. In 1878-79 it is estimated that 130,000 acres will have taken water, and that this is not likely to be exceptional is proved by the readiness of the ryots to enter into five years' contracts to pay a water-rate of Rs. 1-8 for every acre in their villages which they cultivate.* Already leases have been taken on the above terms for 90,000 acres, and the Revenue Superintendent, Mr. Wylly, is sanguine as to the whole of the irrigation being soon given on such leases.

8. It will be noticed that it has been considered necessary to fix a very low rate for irrigation in Orissa. For this there were several reasons. Where rice can be grown without canal water at all, sufficient to supply the wants of a populous province and to allow a margin for exportation, it is evident that irrigation is not so valuable as where the crop cannot be raised without it. In the Madras Presidency, where the ryotwari tenure prevails, the cultivator knows that beyond the Government assessment he will be liable to no other charge if he irrigates. In Orissa a large proportion of the ryots (variously estimated at from 80 to 50 per cent. of the whole) are mere tenants-at-will of the zamindar, who, if he pleases, may raise their rent and deprive them of every rupee of the benefit they receive from irrigation. In a minute of 19th December 1874 by Sir Richard Temple, then Lieutenant-Governor of Bengal, he recorded

"that the zamindars and landlords do not at all oppose the taking of canal water by their ryots, but, on the contrary, rather encourage it."

Some of the local officers whom the Committee have consulted hold by no means this opinion.

9. Another reason for fixing a low water-rate is that prices in Orissa are exceptionally low. This may be seen from the price of common rice given in the following table compiled from the gazettes. It will be noticed that in every column the prices at Cuttack or Balasore are lower than in any of the other districts quoted. Of course the Madras famine has largely affected the prices during 1877 and 1878.

Prices in seers (2 lbs.) per rupee of rice in the following Districts.

		1875.		1876.		1877.		1878.	
		1st January.	1st July.	1st January.	1st July.	1st January.	1st July.	1st January.	1st July.
BENGAL	Nadua	16.0	10.0	21.5	15.5	14.8	14.8	13.5	10.1
	Burdwan	20.0	15.0	23.4	22.6	16.4	16.4	16.0	12.8
	Hooahly	15.8	14.0	18.0	20.0	15.0	13.6	13.8	10.0
	Midnapur	23.0	14.0	20.0	23.0	15.0	21.0	16.0	12.0
ORISSA	Balasore	27.0	24.0	...	23.0	22.0	25.0	18.0	16.0
	Cuttack	24.14	22.0	30.2	25.0	21.0	17.1	14.7	13.2
	Pooree	20.0	22.1	23.4	21.0	17.1	15.1	11.3	10.8
	Gaujam	20.1	19.6	20.1	22.6	...	13.0	8.7	5.2
MADRAS	Vizagapatnam	15.8	14.7	15.8	13.6	9.6	9.0	6.3	5.2
	Godavari	15.0	21.0	21.5	19.2	9.8	6.1*	9.5	7.3
	Kistna	15.7	19.2	20.8	18.7	8.1	9.0	8.1	6.1
	Nellore	15.0	16.0	17.5	16.0	7.0	7.0	6.2	0.5

10. The Committee have been unable to obtain any accurate information as to whether the cheapness of rice in Orissa is at all due to its being in itself of inferior quality. But it appears that the average outturn per acre is only about 1,200 lbs of paddy or 700 lbs of rice, while Mr. Dalyell, M.C.S., states in

* In this is understood rice cultivation alone. The irrigation season practically lasts only from May to November; for although there is a cold weather crop grown and sometimes watered (consisting chiefly of cotton), it amounted only to 3.12 per cent. of the whole irrigation of 1877-78, and it does not appear likely to increase. A special rate of Rs. 6 is charged for sugarcane, but 336 acres is the highest area yet watered in one season.

his memoir on the Madras famine of 1866 that in that Presidency 1,120 lbs of paddy is the average outturn per acre on unirrigated and 2,240 lbs on irrigated land. In Orissa a higher outturn per acre is obtained from the best quality of unirrigated rice, but this is only grown in low favourably situated fields. From Mr. Apjohn's experiments in Midnapur (of which more will be said in the next chapter), it appears that on an average of some years the outturn of irrigated rice exceeded that of unirrigated by 40 and 22 per cent. in different parts of the district, although in years of good rainfall the yield of the one was quite equal to that of the other. Probably similar results would be found in Orissa and once the ryot has recognised this it may be hoped that he will grow the best description of rice wherever he can secure canal water, and that he will be willing to pay more for irrigation than he does at present.

11. On the 1st April 1878, the capital account of the Orissa canals stood as follows:—

	Rs.
Works	1,20,51,337
Establishment	33,95,454
Tools and plant	16,59,898
Suspense account	3,53,773
Accumulated interest charges	52,10,789
Capitalised abatement of land revenue	30,122
TOTAL	2,30,42,080
Deduct receipts on capital account	50,389
TOTAL	2,29,91,691
Interest at 4½ per cent. on this sum amounts to	10,34,626
And the average cost of maintenance has been during the last four years	2,08,694
TOTAL	12,43,320

Hence, to yield a profit of 4½ per cent. on the capital outlay, a gross revenue of nearly 12½ lakhs must be derived from the Orissa canals. Assume that the navigation tollage amounts to 1 lakh, and 11½ lakhs must be obtained from irrigation; and if the rate be only Rs. 1-8 per acre, this infers the irrigation of 767,000 acres, or nearly as much as will be shewn in paragraph 16 to be ultimately rendered irrigable by an additional outlay of 136 lakhs.

12. It will be seen that if irrigation in Orissa is ever to be financially successful (about which the Committee are not very hopeful), that success must be attained—

1. By a large increase in the area watered.
2. By a large outturn of crop per acre, and perhaps by the production of a superior class of rice.
3. By increased facilities for communicating with the outer world, whereby prices will approximate to those obtaining in the neighbouring districts.
4. By the protection by some means of the ryot from the rapacity of his landlord, should it be clearly proved that the latter is depriving him of the benefits he gets from irrigation; or by such an owner's rate on the landlord as will absorb all the profits of his rapacity.

13. As regards the extension of irrigation works in Orissa, the Committee have had to consider whether it would be better that Government should abstain from such extension altogether, confining itself to the completion of the distributaries necessary to bring within reach all the lands commanded by the present canals, or whether the financial position would be improved by the judicious outlay of further funds; and if so, how this could best be done so as to increase the irrigation revenue, and at the same time to render Orissa more prosperous and less liable to famine.

14. It has been assumed that if it is certain that the ryots will take the water, Government will certainly complete the distributaries belonging to the existing canals. For it wants very little proof to demonstrate that it would be

36 REPORT ON IRRIGATION WORKS IN MADRAS, ORISSA, AND MIDNAPUR.

an unwise policy to abstain from doing so much after having completed the most expensive part of the irrigation system, *viz.*, the weirs over the rivers, the head sluices, and the works for disposing of cross-drainage.

15. In paragraph 4 it has been stated that 311,850 acres are still irrigable from the existing canals if there were only distributaries for them. Estimates amounting to Rs. 9,32,291 and providing for the irrigation of 103,700 of these acres, have already been submitted to Government. The Committee offer no opinion here* as to whether so much money is necessary, or as to whether, if these lines were all made at once, the ryots would be willing to avail themselves directly of the water, but they have no doubt whatever that where the ryots will take the water and where it only wants distributary channels to convey this water to their fields, it is advisable to complete these channels to meet the demand. To irrigate the remaining 208,150 acres (*viz.*, 311,850 — 103,700) Mr. Walker, the Superintending Engineer, estimates that the cost will be Rs. 31,22,250, or Rs. 15 per acre, for here the land must all be embanked. Even accepting this high rate, the Committee believe that the expenditure of this capital would rather improve than otherwise the financial position of these irrigation works, and Orissa could then count on 491,000 acres of rice with which to meet a year of famine. But the communications with surrounding districts would in no way be improved. There is no reason to suppose that rice would rise in value except to the extent due to improved cultivation, and there would still be a heavy annual deficit. In four of the following six projects the improvement of communications is aimed at concurrently with the extension of irrigation, and although Government is more certain of a return for the money spent on supplying irrigation to willing ryots than on making canals for navigation, still, in the case of Orissa, navigation bears an unusual value. It is even possible that by improving communications Government may get a direct return (by means of higher water-rates) even greater than if it confined itself to making distributary channels, and it is certain that the prosperity of Orissa would be largely increased by the construction of navigation canals.

16. The following statement shews what remains in order to finish the system of canals from the Mahanuddy, Brahmini, and Baiturni Rivers in the Cuttack and Balasore districts. As no definite projects have yet been framed either for irrigation or navigation canals in the southern district, Pooree, no allusion will be made to it in this report.

No.	NAME OF WORK.	LENGTH IN MILES.			Area irrigable from these canals.	Estimated cost, including indirect charges.	Estimated cost of distributaries.	Total estimated cost.
		Open.	Remaining.	TOTAL.				
1	Kendrapam Canal	30½	14	53½	...	Rs. 5,41,242	...	Rs. ...
2	Gobri ditto	15	10	25	64,000	7,41,254	4,58,000	...
3	Patamundi ditto	47	3	50	...	...	...	...
4	Taldanda ditto	27½	24½	52	63,450	13,19,509	6,27,959	...
5	Machgaon ditto	19½	20½	40	32,500	6,47,523	3,37,150	...
6	High level canal to Balasore	65½	47	112½	150,000	31,55,310	16,07,433	...
TOTAL		211½	127½	339	303,950	64,07,037	31,08,589	95,15,626

Rs.

To complete then the distributaries of the canals already made there is required (Rs. 9,31,291 + Rs. 31,22,250) 40,53,541 and 491,800 acres would then be irrigable.

Rs.

To extend these canals to their intended termini the estimates amount to 61,97,637

To provide distributaries to these extensions, bringing under irrigation 303,950 acres, the estimate would be about 31,08,569

Making a total further outlay of about a hundred and thirty-six lakhs, and rendering irrigable an area of 798,750 acres.

The above supposes the work to be continued in the manner in which it has been so far executed; but the Committee think that it is well deserving of

* See paragraph 27.

consideration whether practical efficiency cannot be secured at a much reduced outlay, and in the following remarks this matter will be attended to. Even were funds available, the above outlay would necessarily be spread over many years, and it is proposed now to consider each of the six projects, and to give the opinion of the Committee as to their relative merits, and the order in which they should be carried out.

17. Work No. 1, the Kendrapam Canal, is the only one of the six projects sanctioned, and it is now nearly finished. The estimate of Rs. 5,41,242 provided for a navigable extension of 14 miles to Jamba, a place adjacent to the anchorage of False Point, with the view of bringing that port about 21 miles nearer Cuttack. At present boats from False Point have to pass up about 35 miles of creek and river before reaching the tail lock of the canal at Marsaghai. It is hoped that the work will be completed next August, and much benefit is anticipated.

18. No. 2 work, the extension of the Gobri Canal to Hansua, has for its chief object the completion of a really good line of communication between Cuttack and Chandballi, and it includes at the same time the irrigation of 54,000 acres. The Gobri Canal at present debouches into a creek leading into the Brahmini River, and although communication is maintained and a Government passenger steamer runs weekly between Chandballi and Cuttack, still it is only at high tides that any but small boats can ply up this creek, and the navigation cannot be called satisfactory, while this route is many miles longer than it would be with the canal carried on to Hansua.

19. No. 3, the Patamundi Canal, which has been designed for irrigation alone, is nearly finished, although its distributaries have not yet been made, and there is only a small extent of land irrigated by means of temporary arrangements.

20. No. 4. By the extension of the Taldanda Canal a second line of navigation will be secured between Cuttack and False Point, and a fertile tract of country will be rendered irrigable, the ryots of which are well disposed to use canal water. The tail lock of the canal into the Mahanuddy would be near the town of Bhaitmudi, a well-known depot for rice situated about 16 miles above False Point.

21. No. 5. The extension of the Machgaon Canal is for irrigating a tract adjoining and similar to that affected by the Taldanda Canal extension.

22. No. 6. The prolongation to Balasore of the high-level canal from Cuttack is a project that deserves and indeed has received the closest attention. The distance between these two towns is 110 miles along the line of the proposed canal, and 63½ miles of this canal are already completed, "terminating," as Colonel Haig expresses it, "abortively in a paddy field." The completion of the canal to Balasore would bring irrigation to 150,000 acres of land, regarding which Mr. Ravenshaw, the Commissioner of Orissa, wrote on 7th November 1874—

"The chances of returns from irrigation are greater on the high-level, I think, than on any other canals, as it runs across country more liable to drought than the lower part of the delta."

This canal forms an important link in the chain of communication between Cuttack and Calcutta, the completion of which "first and before all things" was urged by Colonel Haig in his exhaustive note of 29th May 1873. It was then proposed to carry on the line from Balasore through Midnapur to Calcutta; but doubts having risen afterwards as to whether the latter line would be a satisfactory one, the Bengal Government this year resolved in its stead to connect Balasore with Calcutta by a coast canal from the former town to the Hidgei Tidal Canal.

23. There appears to be no reason why a low-level canal between Balasore and Calcutta should not be linked on to a high-level canal between Balasore and Cuttack. But apparently when the advantages of the coast line north of Balasore were discovered, the question was raised as to whether a similar coast line southward to False Point would not also be preferable. A fresh estimate of the cost of completing the high-level canal was framed by Mr. Ver-tannes, Executive Engineer, and instead of its amounting to Rs. 31,55,310 as shewn in the statement in paragraph 16, it now appeared that the cost would be Rs. 57,06,240. The low-level canal was shewn to cost much less (about 13½

lakhs from Balasore to the Mitai River), and apparently upon this ground the Local Government resolved finally to abandon the High-Level Project.

24. Where a subject has been so carefully weighed by officers of local experience, this Committee are bound to exercise great caution in questioning the decision arrived at. And yet they feel it only their duty to urge a reconsideration of the question. They would not attach undue importance to the completion of the magnificent fragment of a canal already constructed for 63½ miles from Cuttack to Bhadrak. Better that it should remain always a fragment than that good money should be thrown after bad; and although even in Orissa it is important to increase the irrigation by 150,000 acres, they cannot doubt that the Local Government fully considered what they were losing in giving this up. The reason why the Committee urge a reconsideration of this subject is that they believe that its financial aspects were not properly presented to Government, and although they have not had an opportunity of seeing Mr. Vertannes' estimate, they are of opinion that the high-level canal might be constructed for less even than Mr. Walker's estimate of Rs. 31,55,310.

25. They can see nowhere in the papers that the possibility was ever contemplated of making anything but a canal of great size, and with practically no current. It was to have a longitudinal slope of 1 inch per mile, a depth of 8 feet, and a bottom width of 88 feet. The wants of the district for years to come, and the requirements of navigation, do not necessitate the construction of such a costly canal. With a bottom width of 60 feet, side slopes 1½ to 1, and a depth of 8 feet, a canal with a fall of 4 inches per mile would irrigate 96,000 acres, and it could be widened afterwards as irrigation spread. The result of these alterations would be to save the cost of a lock, and to reduce the cost of earthwork by about a half.

The estimate, it is believed, provides for passing under the canal by means of aqueducts the whole of the cross-drainage, and this must cost a large sum, as several streams have to be crossed, and they are doubtless liable to considerable floods. The Committee do not dispute that this is the most satisfactory way of disposing of drainage; but was the cheaper alternative ever considered, of providing culverts capable of passing under the canal all ordinary floods, and of allowing perhaps two-thirds of the discharge of extraordinary floods to enter the canal, and escape again by waste weirs? By means such as these they believe that the cost of the high-level canal may be very greatly reduced, and it only requires a visit to the Godavari and Kistna deltas to shew that the adoption of these expedients is not incompatible with the most satisfactory system of navigation.

The Ellore Canal in the Kistna District has been open for many years. It is 40 miles long, and crosses several large drainage basins. The provision for these crossings is not yet complete even on the design advocated above. The canal when completed is estimated to cost about Rs. 20,000 per mile, and incomplete as it is, it is a most valuable line of navigation. Rates are believed not to be higher in Orissa than in the Kistna District, and yet Mr. Vertannes' estimate for the high-level canal is Rs. 1,21,400 per mile.

26. As an alternative to the completion of the high-level canal, the Committee think that an estimate should be framed of the cost of diverting it at Bhadrak, along the left bank of the Salandi to the Mitai River, a tidal channel with which it is proposed to connect the coast canal. A weir would be required across the Salandi, and a large tract could thus be irrigated north-east of Bhadrak. This would cost perhaps six lakhs, and indeed, whether the high-level canal is completed or not, this would be a useful connecting link, which must surely be carried out some day.

27. In paragraph 12 it has been stated that the estimated cost of the distributaries still to be made amounts to from Rs. 9 to 15 per acre irrigable. This is a very high rate compared to their cost in other irrigation systems, but it includes items such as flood-banks, which are elsewhere separately provided for. The Committee are not in a position to say whether distribution could be effected here on a cheaper scale, although the price of the land taken up by the lines already made seems unusually high, viz., from Rs. 1-951 on the high-level to Rs. 2-695 on the Machgaon Canal, per acre irrigable. But what they would call in question is the necessity for so great a mileage of distributary channels, especially considering that so large an area as 500 acres is supposed to be

watered out of every square mile commanded. At first it was hoped that by bringing water to the ryot's very field, he might be induced to take it, and so naturally a great net-work of distributaries and minor channels was made over the country. Mr. Toynebee, B. C. S., Revenue Superintendent of Irrigation, writing on 19th June 1873,* remarks—

"Hitherto Government have, I think, done more in the way of constructing subsidiary channels than was warranted by the state of the irrigation revenue, and it will be better in future to leave ryots to conduct water from the main distributary to their fields by channels of their own construction, wherever such a course is practicable. The experience of the current year, and of that now under review, has shewn that the people will, when they really want water, lead it almost any distance of their own accord."

This view commends itself to the judgment of the Committee, and the would hope that the future extension of irrigation may be managed with the aid of fewer subsidiary channels than have been thought necessary hitherto.

28. Weighing the respective merits of the projects that have been enumerated, the Committee would urge, as the first measure, that the distributaries for the existing canals should be completed wherever this can be done without a large outlay on protective embankments, and wherever it is certain that the water will at once be taken. But they would deprecate the construction of a single line without good evidence on this last point.

Next, they would urge the importance of having a thoroughly good line of water communication between Cuttack and Chandballi, which from its position and natural advantages gives promise of being ere long a port of consequence. The present line does not meet the requirements of the case. There are one or two possible alternatives† to the proposed extension of the Gobri Canal to Hansua. On the merits of these the information available is insufficient to allow of a definite opinion being formed, but it should be remembered that canal navigation is greatly preferable to that by creeks and rivers, that the addition of several miles to the distance to be traversed is not unimportant, and that irrigation as well as navigation has to be taken into account.

Next in importance to opening out navigation to Chandballi the Committee would recommend the prosecution of the high-level canal to Balasore, but only on the supposition that it can be constructed very much under even Mr. Walker's estimate of Rs. 31,55,310. They hope they are not going beyond their sphere in suggesting that should this question be re-opened the officer employed to frame the new estimates should first be sent to see what has actually been done in the Godavari and Kistna deltas.

29. The Committee think it right to call attention to the maintenance charges on the Orissa canals, on which they think some reduction might perhaps be made. The average expenditure per mile of canal was Rs. 577 for the year 1876-77. In the Kistna delta for the same year the expenditure was Rs. 207, and in the Godavari delta still less. There are already 211 miles open, and as the canals come to be extended the rate of maintenance is a matter of importance.

30. The system of canal administration in Orissa differs both from that pursued in Madras and that of Northern India. In Orissa the canal officer has more to do with the irrigation than he has in Madras, and less than he has in the North-West Provinces or Punjab. The task of conveying water to the ryot's field, and of opening and closing irrigation sluices, rests with patrols who are directly under the Canal Engineers. The measurement of the area irrigated and its assessment rests with an officer termed the Revenue Superintendent, who acts directly under the orders of the Collector. The Canal Engineers submit annually tables shewing the area of each kind of crop receiving "illicit irrigation," of the number and class of boats plying on the canals and the tollage levied, of the miscellaneous receipts from plantations and other canal produce. But they have nothing to do with the levying of any of these charges, nor with the terms on which canal produce, such as trees, grass, &c., is sold. All this devolves on the Revenue Superintendent.

* Revenue Report for the year 1872-73, para. 83.

† e. g., making the Putamundi Canal navigable, or connecting the present terminus of the Gobri Canal with the Brahmini.

31. It has been said that the hope is entertained of soon having all the canal water leased for a term of years. This is no doubt a most desirable arrangement. Where leases have not yet been entered into, the present arrangement is for the Revenue subordinate (termed the irrigation tahsildar) to find from the ryots of a village the area which they would each like to water, and to send a memorandum to the patrol, who thereon supplies the water. Usually it is found that the ryots wish for a larger area than they have told the tahsildar of, but they are granted water for whatever fields they point out to the patrol, and are assessed at the rate of Rs. 1-8-0 or Re. 1-0-0, according as the irrigation is by flow or lift. Should they afterwards irrigate more fields than they have shewed to the patrol, the excess is termed "illicit irrigation," and a double rate is levied. In the meantime a formal "water indent" is in the course of manufacture between the tahsildar and the ryot, and perhaps months after this reaches the Executive Engineer's office and is recorded. What the object of this document is the Committee fail to see.

32. In the last chapter the Committee have expressed their objection to the system of applications for water, and although it is rather in the irrigation of dry crops than of rice that it is of harm, they would prefer to see it abolished here. It has, however, been explained that the system is necessary in Orissa from the constant practice of the ryots repudiating that they have willingly taken water. They say it has escaped from their neighbours' field unasked for by them, or they deny that they have had it at all, and so it has become necessary before supplying them with water to secure from them an application admitting that they want it and will pay for it. Should the five years' lease system become general, the necessity for applications will be limited to new irrigation.

33. There has been some discussion as to whether the irrigation measurements should be made by the Canal Engineer or by the Revenue Superintendent, each party claiming that it should be done by him. As things are just now, there is evidently a divided responsibility, and while the Committee cannot agree as to the direction in which improvements should be made,* they are at one in the opinion that while the present system is worked by the present officers irrigation matters will not go far wrong in Orissa. The difficulties attending irrigation measurements will be very much reduced when the cadastral survey is completed. In this each field is shewn in full detail. At present maps representing about 26,000 acres of irrigation have been made over to the Revenue Superintendent, and it is hoped that the survey will be finished in 1880.

34. It seems right to call attention to two sources of possible revenue in Orissa to help to cover the great canal deficit, *viz.*, the imposition of an "owners' rate" on the zamindars (already alluded to in paragraph 12); and an embankment cess on the lands protected from floods.

35. When the canals were partially opened at the end of 1865, and it became evident that the ryot shewed no wish for irrigation, it was generally ascribed to the fear that rents on irrigated lands would be raised at the coming settlement of 1867. At the earnest desire of the Irrigation Company, therefore, a proclamation was issued in August 1866—

"That zamindars and ryots may take water from the canal freely, and without the smallest fear; that by so doing they will not render the lands irrigated directly or indirectly liable on that account to any increased rate of assessment either now or at any future settlement."

Should this proclamation be considered as for ever preventing the imposition on the landholders of any increased assessment commensurate with the benefits their estates undoubtedly receive from irrigation, the alternative would seem to be so to protect the ryot from enhancement of rent as to enable him to afford to pay Government a higher water-rate.

At a conference presided over by His Honor the Lieutenant-Governor in 1874, it was decided that, although the people could afford to pay a cess of 8 annas per acre protected from floods, it could not be levied until the expiry of the present settlement in 1897.† The Committee do not know the grounds of this decision, but the subject might be worth reconsideration.

36. The Committee consider there is great room for improvement in the whole system of levying revenue from navigation, and that its development is

likely to be checked by the high rates demanded. Up to 1st November this year, the tolls in force were: On the high-level canal 33 miles, and on the Kendrapara Canal 39 miles, Rs. 1-8 per 100 maunds per mile. This is equivalent to 2-37 pies per ton per mile on the former, and 1 to 2 pies per ton per mile on the latter. The tonnage of the boat is measured by its displacement, so that as even an empty boat draws some water it never escapes a certain payment. From an analysis by the Superintending Engineer, it appears that from this tollage the Government demand would be 22 per cent. of the whole cost of the water transport, including the wages of the crew, the cost of the boat, and the income of the boatman. On 1st November, this rate was ordered to be doubled for the eight months included between 1st November and 1st July, the previous rate holding good for the other four months, during which there is generally sufficient water in the rivers for navigation.

37. In doubling these rates, Government seem to have considered that it was necessary somehow to increase the revenue, and that the best plan would be to keep raising the tollage till the point was reached beyond which an increase would cause a diminution of receipts, and defeat its own ends. The Committee submit that this is not the way either directly to increase the revenue or indirectly to foster boat traffic and open up Orissa. Coming from the less perfect canals of the southern deltas, teeming with life, they have been struck by the absence of boats on these stately canals of Orissa. On the canals of the Godavari delta alone some 2,000 boats ply. On the Orissa canals the number is a little over 300. There the owner pays Government annually Rs. 2 for each ton burden of his boat. Here, calculating on the average number of trips, he must pay about Rs. 15. There a passenger with a head-load of baggage is carried for a rate not exceeding 2 pies per mile. Here the only line on which there is any considerable passenger traffic is between Cuttack and Chandballi, where a passenger with a servant and 40 lbs of baggage is carried 92* miles at the rate of 16 pies per mile or 8 pies per head. He is towed by a Government steamer, and doubtless goes faster than on the southern canals, but his accommodation is inferior, and the very fact of the fare including a servant indicates that the poorer classes of natives are not contemplated among the travellers. It is not surprising, then, that there should be a constant stream of pilgrims on the roads from Balasore and Chandballi to Cuttack, visiting and returning from the temples of Jagannath.

38. As long as very few Government boats ply, and these boats are always filled, there is no objection to charging the above rates; but from what they have seen and heard, the Committee believe it would pay Government to increase the number of their boats largely, and to reduce the rate in proportion. There is no necessity for employing steam power within the canals. The pace attained by a steamer drawing a train of passenger boats does not exceed 4 miles an hour, including the long stoppages necessary at the locks. Boats for passengers and cargo can be towed or sailed, and keep up a certain pace of two miles an hour, which is generally fast enough for native passengers, and is much cheaper than using steam power. Where steamers are most valuable is in the rivers and tidal creeks, and they should be confined to these. Ultimately Government would probably find it better to retire altogether from the carrying trade, and to confine itself to charging a toll on private boats; but until private enterprise has been stirred, and in order to shew what can be done, a Government boat train would be a benefit to Orissa, and would probably pay its expenses.

39. Instead of measuring boats and requiring the payment of a tollage trip by trip, it would be better to adopt the system on the southern deltas of registering periodically every private boat, and then levying a tollage, on payment of which the boat would be free to use the canals until the next period of registration. On the Godavari and Kistna deltas, these boat licenses are taken out only once a year. In Orissa, the boats ply so much on the creeks and rivers, that it would probably be necessary to give the option to the boatmen of taking out licenses for short periods.

* Partly by canal and partly on the Brahmini and Baitural rivers.

* See Appendix C, containing the views of one of the Committee.

† See note by Colonel Gulliver, R.E., Officiating Chief Engineer for Irrigation Works, Bengal, dated 16th December 1874.

CHAPTER X.

IRRIGATION WORKS IN MIDNAPUR.

CANALS in this district as in Orissa were undertaken by the East Indian Irrigation and Canal Company, and an important part of their scheme was to connect Midnapur with Calcutta, from which it is 72 miles distant.

There had been an old tidal canal, 12 miles long, from a village on the Hooghly named Ulaberiah, 18 miles below Calcutta, to the Damoodur River, which was supplied with locks, and generally improved by the Company. A new cut, 4 miles long, to avoid a long detour of river navigation, was made to connect the Damoodur with the important River Roopnarayan, and this has just been provided with locks. Navigation was thus brought within 37 miles of Midnapur. To span this distance, and at the same time to irrigate the adjoining land, a weir was built across the Kánsái river at Midnapur, and a canal 25 miles long, and calculated to carry 885 cubic feet per second, was drawn from its right bank, falling into the same river again at Panchkúra. Here a second weir was built, and a canal was taken from the left bank of the Kánsái flowing a distance of 12 miles to a point in the Roopnarain 4 miles above the entrance of the canal leading to the Damoodur and Hooghly. The Company began operations in 1862-63. In 1866 the communication was complete between Calcutta and Midnapur. The same year some irrigation was effected below Panchkúra, and in 1869-70 it began in the larger field between that point and Midnapur. The canal works became the property of Government along with those in Orissa on 1st January 1869.

2. The irrigable part of Midnapur does not differ from Cuttack materially in climate; the average rainfall being about the same in both, viz., 55 inches. The Kánsái River, however, has a catchment area of only 2,000 square miles, and forms a source of supply much more uncertain than the Mahanuddy. The total area irrigable is only 148,600 acres, of which 118,350 are above Panchkúra, and from the uncertainty of the river supply until the monsoon is well assured it is doubtful whether this area could ever all be watered in those seasons of drought when irrigation is most highly prized.

It has hitherto been the custom of the ryots to abstain from taking water until the last moment, and then to demand it simultaneously, when, even if rain should have fallen in the catchment basin and there should be enough water in the river to fill the canal, every field cannot get its share in proper time, and so disappointment follows. With the five years' lease system now successfully started, it is to be hoped that ryots will begin to take water whenever it is available, and so, there being no longer a simultaneous pressure, a large increase may be effected in the irrigation, although Major Heywood, the Superintending Engineer, has no expectation with the present water-supply of its ever attaining the whole area irrigable.

3. The following table shows the area watered year by year since 1869-70, and it cannot be considered at all an encouraging record:—

Year.	Area irrigated. Acres.	Year.	Area irrigated. Acres.
1869-70	10,704	1874-75	72,318
1870-71	22,671	1875-76	55,995
1871-72	6,028	1876-77	32,681
1872-73	13,406	1877-78	19,819
1873-74	30,349		

In the current year 1878-79, an area of 56,000 acres of irrigation has been taken up on leases of five years, and this might seem to be a hopeful sign; but

it is explained that no rain fell in Midnapur until 21st July last, so water was much in demand. The local officers, moreover, do not appear to think that the ryot has yet learned really to appropriate canal water; and while in Orissa they are hopeful that, having got accustomed to irrigation during a five-year lease, the ryot will be willing to enter on another five years, here they think that the renewal of the leases will depend on whether the sixth year is one of heavy rain or drought.

4. The Irrigation Company began here, as in Orissa, by charging Rs. 5 per acre for rice irrigation. This was lowered to Rs. 2-8, which is now the rate where an engagement for only one year is made. The holders of five-year leases pay only Re. 1-8 per acre. The drought of 1873 brought irrigation into high favour, and it will be noticed that the area watered in 1874-75 was nearly double that of the previous year. The crop began well, but a disastrous cyclone swept over the country, occasioning much damage. The irrigated rice which was furthest advanced suffered most, and the ryot repented that he had rashly engaged to pay for water. Mr. H. L. Harrison, the Collector of Midnapur, writing of the year 1876-77, remarks as follows:

"The somewhat remarkable result of the last five years (including the current year among the five) appears to me conclusively to shew that the system of annual leases is totally inapplicable to the circumstances of the irrigable area. A single dry season brought the water into the highest possible favour, while three successive seasons unfavourable to irrigation have entirely neutralised this good effect and made the department as unpopular as can be. The water has proved to be invaluable to the ryot in one year, rendered almost valueless owing to a cyclone in the second, worth something but not much in the third, and totally valueless in the fourth of the years which have terminated. It is not in human nature for a system of this kind to produce content among any but very far-sighted persons."

5. Were it a question of introducing irrigation for the first time into Midnapur, Government would probably have no difficulty in deciding against it. But after reading evidence like this of Mr. Harrison's, the question even arises whether it is worth while to continue its maintenance, and whether it would not be better to dismiss the irrigation establishment altogether and let the distributory channels fall into disrepair (so saving the Rs. 25,000 spent annually on their maintenance) and to use the Midnapur canal exclusively for navigation. The answer to this question must depend to a large extent on the further consideration of whether or not in a period of years rice cultivation in Midnapur is benefited by artificial irrigation.

6. This point has been decided in favour of irrigation by a series of most careful and extensive experiments carried on under Mr. J. H. Apjohn, C.E., during the last six years.

The following table contains his abstract of results up to the end of 1877. It will be noticed that the irrigation was of enormous value in 1873, and of little or no value in 1876, but that on the average the produce of irrigated paddy was 40 and 23 per cent. and of irrigated straw 42 and 23 per cent. in excess of the produce of unirrigated lands under the Midnapur and Panchkúra weirs respectively. Under the Panchkúra weir the country is more level than under the Midnapur weir, so that water does not run off the land so fast in the former as in latter tract, and consequently in dry years the Panchkúra lands can make more of their limited rainfall, and the advantages of artificial irrigation are not so marked there as under the Midnapur weir. The high outturn of unirrigated paddy and straw in Hidgeli, the eastern portion of the Midnapur district, is worthy of note. There the rainfall is 70 inches per annum.

KANSÁI DIVISION.

Analysis of the results of experiments, shewing the difference between the crops on irrigated and unirrigated lands.

LOCALITY.	YEARS.	NUMBER OF EXPERIMENTS.		OUTTURN PER ACRE IN MAUNDS OF 80 TOLAHS.				DIFFERENCE IN FAVOUR OF IRRIGATION.				Rain-fall.	Area under irrigation.
		Irrigated.	Unirrigated.	IRRIGATED.		UNIRRIGATED.		IN MAUNDS PER ACRE.		IN PERCENTAGES.			
				Paddy.	Straw.	Paddy.	Straw.	Paddy.	Straw.	Paddy.	Straw.		
UNDER MIDNAPUR WEIR.	1873 . .	48	12	16.82	22.50	4.41	9.75	11.91	12.75	270	130	44.61	30,557
	1874 . .	257	65	12.80	42.48	11.23	32.87	1.53	9.61	14	29	57.46	61,563
	1875 . .	349	120	23.00	56.25	18.00	37.50	6.00	18.75	23	50	51.85	47,705
	1876 . .	153	143	15.56	45.00	18.74	43.22	...	...	...	...	70.89	23,721
	1877 . .	234	259	18.06	39.51	10.97	29.85	7.60	18.63	79	69	51.80	16,039
Average.		...	...	17.76	41.15	12.50	28.84	5.20	12.31	40*	42*	55.19	Average for 5 years at Midnapur.

* The average difference in percentages is obtained from the average difference in maunds of the irrigated and unirrigated crop; it is not of the mean of the percentages column which gives much too high a result in consequence of the abnormal difference in 1873.

UNDER PANCHKURA WEIR.	1875.	33	59	29.00	53.00	22.80	37.00	6.40	16.00	28	43	62.08	5,562
	1876.	28	23	31.22	55.52	29.40	70.03	1.50	9.49	8	12	66.03	2,774
	1877.	41	41	21.49	39.21	14.91	31.17	7.58	8.07	54	20	73.65	2,328
	Average.	...	...	27.21	59.25	22.21	48.07	5.00	11.19	22	23	65.80	Average for 3 years at Panchkura.

In Hidgeli there is no irrigation, but the country is protected by embankments from floods, and efficiently drained through sluices in the bunds.

HIDGELI.	1875.	...	229	...	...	23.00	69.00	...	...	...	...	69.02	
	1876.	...	351	...	...	21.30	48.15	...	...	...	...	70.62	
	1877.	...	528	...	...	21.31	36.97	...	...	...	...	65.04	
	Average.	...	...	...	...	21.85	48.37	...	...	...	...	70.18	Average for 3 years at Contal.

7. Except in the year 1876 the advantage of irrigation to the ryot was enough to pay his water-rent and make it worth his while to continue irrigating. But some of the local officers insist that, from his extreme poverty and state of indebtedness, the unfortunate Midnapur peasant reaps but a questionable benefit even from a bumper crop. Be it a good one or a bad one, it is said that all beyond a bare subsistence for a limited time is absorbed by the landlord's rent and the claims of his far more exacting creditor—the village money-lender—in whose toils he is hopelessly entangled, and who charges him at the rate of 39 per cent. per annum. When in addition to this comes the hard-and-fast demand of Government for a water-rate of even so little as Rs. 1-8 per acre, the ryot's difficulties increase, and he is unable to understand that in the long run if he obtains better crops his liabilities may be cleared off.

8. If this picture of the Midnapur peasant be true, State interests are involved far more important than that of Irrigation revenue. The Committee have no means of testing its truth, and they may be allowed here to point out how the singular absence in Bengal of the village system so universal elsewhere in India renders it difficult to arrive at any knowledge of the state of the agricultural community. Notwithstanding the alleged poverty of the ryot and the

dense population of the district, it is a remarkable fact that the canal officers find the greatest difficulty in obtaining labour for their works. The well-known Calcutta firm, Messrs. Burn and Company, failed in an earth-work contract within four miles of Midnapur and had to pay forfeit, merely because they could not command labourers, although they offered wages as high as 4 annas a day.

9. The price paid by Government at first for rice land between Midnapur and Panchkura was Rs. 60 per acre. Now its value is about Rs. 100, which seems to indicate that the zamindars at least have reaped a profit from irrigation. Perhaps it would be possible to charge them with an owner's water rate.

10. The irrigation works of Midnapur are now completed. The Committee have no original suggestions to make for their improvement, and they do not pretend to look on the prospect as satisfactory. They can only hope that by good management leases for a term of years may be taken for most of the irrigable land. They cannot recommend for the present at least that Government should go to any cost in storing up water to supply the deficiencies of the River Kansái, even should facilities for storage exist, and on this point there is no direct information.

11. The management of irrigation in Midnapur is much the same as that in Orissa. The control of the water-supply and its distribution to the ryots is in the hands of the Canal Engineers. The execution of leases, the measurement of the area watered, and the collection of the water-rates, are in the hands of the Deputy Revenue Superintendent, acting under the orders of the Collector. During the irrigating season, from June to November, the patois are under the orders of the Canal Engineers. For the rest of the year they are under the Revenue Department, and help in measuring up irrigation and collecting the water-rent. Applications for remissions of water-rate on account of damage caused by deficient supply are made to the Deputy Revenue Superintendent as a rule long after the irrigating season is over. This is evidently wrong. After the crops are off the ground it is most difficult to decide whether they have failed or succeeded, and there is no reason why the ryot whose crops have failed should not lodge his complaint, and have his field inspected, while the crop is standing to tell its own tale.

12. The prospects of navigation on the Midnapur canal are much more encouraging than those of irrigation, and this is not surprising in the vicinity of a great city like Calcutta, and among a people accustomed to look on their rivers as their highways.

The exact tonnage carried on the canal is not obtainable, for the printed returns are based on a system of measurement which it appears nearly doubles the true burden of the boats. During the year 1877-78 there appear to have been; however, from 100,000 to 120,000 tons of articles of food carried—chiefly towards Calcutta, and this would represent the whole produce of an area much in excess of that irrigable by the canal. In 1876-77 about 11,000 tons of salt passed along the canal, valued at 12½ lakhs of rupees, and since the canal was opened the price of salt in Midnapur has fallen from Rs. 8 to Rs. 7-8 per maund, a very material reduction considering the high Government duty. The traffic in the Midnapur canal has gone on increasing at a rapid rate, and is now more than four times as great as it was eight years ago. This is the more satisfactory, as there has been a succession of failures in the locks, and at present a very important one (at Dainan on the Roopnarayan) is closed to traffic. In a few months it is to be hoped that all these obstacles will be removed, and that there will be steady unbroken communication between Calcutta and Midnapur.

13. In paragraph 36 of the last chapter the Committee have expressed their opinion that the tollage of boats on the Orissa canals is too high, viz., 2-37 pies per gross ton per mile. On the Midnapur canal the tollage per mile is one anna per 100 maunds according to the measurements adopted, that is really nearly 2 annas per 100 maunds or 8-56 pies per ton per mile. With such a high charge as this it is surprising that there should be any traffic at all. But river navigation near Calcutta is very costly compared to what it is elsewhere, or indeed compared to transport on the railways. The usual rate charged by a boatman for conveying 100 maunds from Calcutta to Midnapur is Rs. 15, in addition to which the owner of the goods pays the canal toll Rs. 3, so that he has to pay altogether at the rate of 13-4 pies per ton per mile, viz., 11-2 pies to the

boatman and 2·2 pies to Government—a striking difference from the rates in the Godavari and Kistna deltas, where the total charge for carriage by water is about 4 pies per ton per mile, or on the upper waters of the Ganges, where it is usually 1 anna per 100 maunds or 3·27 pies per ton per mile. These charges too compare curiously with those on the East Indian Railway, where the usual freight is 9·07 pies per ton per mile for edible grains, salt, &c., but for distances exceeding 500 miles it is as low as 5·44 pies.

14. The Committee are not prepared to recommend any general reduction in the navigation rates of the Midnapur canal. The circumstances of the district are very different from those of Orissa, and it seems probable that the proximity of the great market of Calcutta admits of a much higher charge than would otherwise be desirable. The canal is of chief importance, in ordinary years, as a communication, and as its cost has been great, it is advisable to obtain as great a revenue as practicable from tolls, provided these are not so high as to prevent the people competing on favourable terms for the supply of Calcutta. In the Godavari the great bulk of the receipts are from irrigation, and the people pay the State chiefly in water-rates for the benefits conferred upon them.

They think, if it could be easily managed however, it would be an improvement to have discriminating rates to allow of the carriage of such commodities as straw, firewood, and perhaps laterite, at a reduced tollage. It might be well also to give the boats the option of being registered and taking out quarterly or yearly licenses, and so save the constant recurrence of measurements of tonnage. At the same time it will be desirable to watch carefully the effect of high tolls on the traffic, for it will be a misfortune to the country if the receipts are derived from a small rather than from a large traffic, supposing the amount of such receipts to be unchanged.

15. The following represented the financial condition of the Midnapur canal on 1st April 1878, and it will be easily understood that no possible extension of irrigation or navigation is likely to make it a paying concern. But the Committee would point out that the maintenance charges are excessively high, *viz.*, Rs. 1,170 per mile of canal and about Rs. 100 per mile of distributary. These charges are more than double those on the Orissa canals to which they have already taken exception as being too high,* and there seems no special reason to account for what they cannot but term extravagant expenditure.

The capital account up to 1st April 1878—

	Rs.
On account of works	48,61,300
" of establishment	16,58,586
Tools and plants	3,96,354
Suspense balance	1,55,561

TOTAL

70,71,811

Deduct receipts on account of capital account

20,038

70,51,773

Add accumulated interest

21,37,743

TOTAL CAPITAL

91,89,516

The receipts for the year 1877-78 were—

	Rs.
Water-rent	53,483
Canal produce	49
Navigation receipts	1,06,917
Miscellaneous receipts	9,644
TOTAL	1,70,093

The cost of maintenance, including direction, &c., was—

	Rs.
Maintenance of works	1,41,334
Direction and accounts	33,006
Revenue establishment	16,189
Navigation establishment	7,151
Tools and plant	6,117
TOTAL	2,03,797

That is, the maintenance charges exceeded the revenue by Rs. 33,704, when in order to pay 4½ per cent. on the above capital a net revenue is required of Rs. 4,13,528.

J. MULLINS, *Lieutenant-Colonel, R.E.*

E. FORSTER WEBSTER, *M.C.S.*

C. C. SCOTT MONCRIEFF, *Major, R.E.*

CALCUTTA,

Dated 27th December 1878.

SUPPLEMENT.

THE IRRIGATION SYSTEM OF THE SOANE CANALS IN BEHAR.

THE River Soane has its source near that of the Nerbudda and of the Mahanuddy in the Central India plateau, and after draining a catchment basin of 23,000 square miles of hills and jungle, it emerges into the plains and flows for about 100 miles northward to its junction with the Ganges, dividing the populous and highly cultivated districts of Patna and Gya on its right bank from Shahabad on its left. During its course through the plains, it is remarkable for its broad, sandy channel, which at places is as much as three miles wide. Its character in this part of its course is deltaic,—drainage rather turning from it than to it. Like the Mahanuddy, it is subject to great variations of volume, the monsoon floods far exceeding a million of cubic feet, and the supply in June falling as low as 620 cubic feet per second.

2. The Soane canals are drawn off the river by a weir 12,500 feet long lately constructed at Dehri, a few miles below the point where it leaves the hills. As originally planned, the project was to embrace on the left bank a system of canals for irrigation and navigation extending as far west as Mirzapur, and on the right bank as far east as Monghyr. But these dimensions have been curtailed, and all that is now contemplated is, on the left bank, two first class canals leading to Arrah and Buxar with numerous distributaries throughout Shahabad, and on the right a similar canal to Patna,—all three perfectly adapted for navigation and connected with the Ganges. Were there water sufficient, these canals might irrigate annually 1,300,000 acres. The Arrah canal approaches completion. Water was rudely supplied from it by cutting its banks in the drought of 1873. Its first year of regular irrigation was 1875-76, and last year it reached 165,358 acres. The Patna canal began to irrigate last year for the first time. The Buxar canal is still under construction, and will, it is hoped, be in full operation next monsoon crop. We have visited only the Arrah canal, so our remarks must be understood as applicable chiefly to it. Having passed along a considerable portion of it and seen some of its distributaries, we would bear witness to the faultless excellence with which the works have been constructed.

3. Although, as noticed, the Soane dwindles to a small stream in May and June like the rivers of Southern India, the demand for irrigation is continuous throughout the year as on the glacier fed canals of the North-West. The great variation of supply matters little to the irrigation systems extending from the Cauvery to the Mahanuddy; for one good crop of rice is as much as is generally looked for, and although there is a second crop it is not of much consequence. On the Soane canals, the chief crop of the year is no doubt the *aghani* rice, which is on the ground between July and November. Before it is cut, water is in demand for the *rabi* crops—wheat, barley, and pease; while year by year a larger area is being grown with sugar-cane, requiring water every month from January to January. It is evident that the people thoroughly appreciate irrigation, and were there water sufficient in April and May a large area would no doubt be devoted to indigo.

4. Colonel Haig, Chief Engineer of Irrigation Works in Bengal, estimates that in an average year a supply not less than 3,000 cubic feet per second may be counted on as late as the end of January, after which the *rabi* crops require no water; were it not for the sugar-cane, irrigation might then cease until the rains begin. But the value of the sugar-cane crop is very great, and it is worth making every effort to ensure it from failure. Last year it had only reached 6,714 acres, and arrangements were not sufficiently matured to allow of even that area being watered throughout the dry months unaided by wells. It may be assumed, however, that after allowing for percolation through the weir, the minimum supply of the canals will rarely fall below 600 cubic feet per second;

and although it is difficult to dispose of this volume to the best purpose, and at the same time to maintain navigation in channels adapted for 4,965 cubic feet, still, by restricting sugar-cane irrigation to certain distributaries, by exercising the most rigorous economy in water-supply, and by refusing altogether to allow of indigo irrigation, an area of perhaps 50,000 acres of sugar-cane might be reared; and since Rs. 8 per acre would not be too much to charge as water-rate for this crop, a revenue of Rs. 4,00,000 might be secured. From the inquiries made in Shahabad, we would lay stress on the value of this sugar-cane irrigation. The cultivation of the plant is spreading fast owing partly to the use of Messrs. Burrows, Thomson, and Mylne's excellent sugar-mill. The *rabi* crops should be sown in October, and as the rice is not all cut before the end of November, the cultivators are too fully occupied to make it likely that they will ever devote the attention to wheat which it receives in the Punjab and North-Western Provinces. But it is probable that if water is ensured to them, they will yearly increase the area of their sugar-cane. We would not have it supposed, however, that there will be no *rabi* irrigation, for barley and even pease are being freely watered during this dry season, and as more water is available for wheat than for sugar-cane, and each cubic foot effects twice as much irrigation of wheat as either of sugar-cane or rice, the area watered in the *rabi* will probably always be large. We have no information as to whether it would be possible to supplement the hot weather supply of the Soane by storage in the hills through which it flows, but it is improbable that this could be done within a reasonable cost.

5. The irrigation system of these canals has been assimilated to that of the North-Western Provinces and Punjab. The entire distribution of the water, the measurement of the irrigation, the assessment of the revenue, in fact every detail save the collection of the water-rate, is in the hands of the canal officers. It is true that the Bengal Irrigation Act of 1876 provides (section 91) that every order passed by the canal officer in matters of water-supply and distribution shall be appealable to the Collector. But this power is unlikely to be much exercised, and the canal officers must be held entirely responsible for the success of the irrigation.

6. In our inquiries we have turned our direction chiefly to the points in which this system fails, and it is satisfactory to have to report that the machinery works quite as smoothly as is to be expected, considering how recently it has been put in motion. The irrigation system of one province cannot be reproduced in every detail in another, and the points requiring alteration can only be found by experience. The officers of the Soane canals are doing their best to find where the arrangements of the North-Western Provinces and Punjab are inapplicable to Bengal, and in Shahabad they are fortunate enough to have a Collector (Mr. Edgar, C.S.I.) fully as interested as themselves in the problem.

7. At present there are two engineering obstacles which prevent the canal officers from utilising all the water at their disposal. Of these the most important is the absence of escapes to the distributary channels. The irrigation is still intermittent and uncertain. The slope of the country is high, about 3 feet per mile. The canal officer is prevented at times from sending a full supply down a distributary for fear of the water not being all used and escaping at the end into lands, where it does mischief. This point is being attended to. Escapes are under construction, and when the engineers have the water more thoroughly in hand there will be less chance of its doing mischief.

8. The other obstacle is due to the incompleteness of the works. The Arrah canal is taken off the Main Western canal five miles from its head at Dehri. Unfortunately no regulator has been built below its point of departure, so that its supply cannot be raised without raising that of the Main Western; but the latter is only an incomplete fragment, and the water would overflow its banks were its full supply (1,398 cubic feet per second) given to the Arrah. Nor can an earthen bank be thrown across the Main Western below the head of the Arrah canal, for some distributaries are taken off it below this point. The head of the Buxar canal is eleven miles further on; when it is opened the difficulty here complained of will probably disappear or be transferred to below its head. Should it interfere with the engineer's grasp over the supply of the Buxar canal, measures ought undoubtedly to be taken to remove it, and there should be no difficulty about doing so.

9. The chief administrative difficulties on these canals are—

- (a). The system of previous applications for water.
- (b). The total absence of any village organisation in Bengal.
- (c). The dislike entertained by the people to the canal measurements.
- (d). The collection of the water-rates.

To these may be added the difficulty of getting together an establishment of any value, seeing they can have had no previous experience of irrigation, and this has led to the employment of Bengali subordinates knowing nothing of the Hindi language spoken in Behar. This last difficulty will disappear in time.

10. The chief source of annoyance to the people is the system of applications, the objections to which are as strong here as on the Kurnool canal (see Chapter VIII, paragraph 25, page 26). Here as there, the ryots complain that before getting water they must apply to a canal officer, often at a distance, and sign papers which they do not understand and undergo vexatious delays. As though to stereotype this unfortunate system, it has been expressly ordered in the Bengal Irrigation Act, sections 74 and 75. Here it is laid down that "no person shall be liable to pay any rate or due whatever on account of water supplied to his land with the permission of the canal officer otherwise than on such application; nor shall water be supplied otherwise than on such application." It is believed that this provision was made in the interest of the ryot, and to prevent his being charged for water supplied to him, perhaps, against his will, or at least unasked for. On due representation, so much of this Act might probably be repealed, for it is a source of annoyance, not of protection, to the ryot. But without resorting to so extreme a measure, it might perhaps be legitimate to interpret the law as requiring an application for water to be made not crop after crop but once for all until such time as the ryot chose to withdraw it. This would get over the objections to the system. The revenue and canal officers, as well as the native gentlemen we consulted, all dwelt on the drawbacks of this application system, and we earnestly recommend its abolition.

11. The want of the village system existing elsewhere in India is felt in all parts of the canal administration. Water distribution within the village lands cannot be left here, as in Madras, to the villagers. There is no *karnam* or *reddi* to manage affairs. When the measurements come to be made, there is no *patwari* as in the North-West and Punjab with his map and *khusrch* to determine the area and the ownership of the lands. There is no *tumberdar* to collect the revenue. These officers belonging to the village carry weight in it, and are of great assistance in canal administration. Ultimately, canal *patwaris* may grow into existence, who will command respect; at present, they have none.

12. It is partly due to the want of village officers, and partly it may be to the novelty of the thing, that the cultivators look with great dislike on the canal measurements. Hitherto village maps have not existed, and no one knew exactly what was the size of his holding. He generally believed, however, that it was smaller than measurement has proved it to be, and when he has had to pay water-rate by the acre, the discovery of its true size has not been a welcome one. Where the settlement is made for thirty years and where any efforts are made to keep up statistics of agriculture, the village officer and his map are familiar objects. Here the settlement is permanent. No record is kept of cultivation, and the sight of land surveyors suggests to the village mind a new road or railroad or canal, possibly about to deprive him of a piece of his land, and therefore viewed with dislike. Then, too, the canal officers have had the drawback of having to conduct the measurement through an untried staff of surveyors—men on small pay and with large opportunities of receiving bribes. In the canals of the North-West, this bribery no doubt goes on, but there the system having been long in operation the surveyors or *amins* are better known and more under control, while the arrangements for supervision are more perfect. A cadastral survey on a scale of 32 inches to the mile has just been completed for all villages irrigable from the Arrah canal. The maps have hardly yet been brought into use, but when they are the measurements will be much simplified. We understand that for economical reasons this survey is not to be continued, and this is greatly to be regretted, for its value can hardly be over-

estimated. Possibly it might be prosecuted in a less expensive manner. The maps for instance might be drawn on half the present scale.

13. The Collector finds great difficulty in collecting the water-rates, and there are large outstanding arrears. In Southern India, where the ryotwari system prevails, or in the North-Western Provinces and Punjab, where the collection of the land revenue is done by a village officer, the machinery is ready made for collecting canal revenue also. In Bengal, the zamindar pays in his land revenue himself to the Government treasury, and no arrangements exist for dealing directly with the ryots. By the rules laid down by the Bengal Government for the management of the Soane canals (dated 21st October 1878), a headman is required to be appointed by the applicants for a village channel "known or ascertain 1 to be a substantial person possessed of property, to attend to their interests, to receive and carry out the orders of the canal officers, to distribute the water among the shareholders in the village channel according to their shares, and to collect and pay in to the Collector or other duly authorised person all water-rates leviable on the lands watered from the village channel."

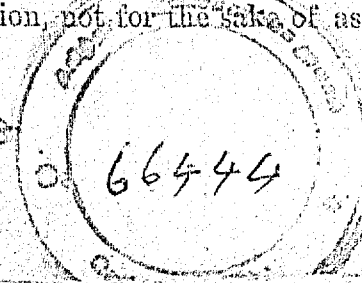
This headman is required to furnish security, and is entitled to receive for the proper performance of his duties no less than 8 per cent. on the water-rates assessed. Neither the Collector nor the canal officers think this arrangement practicable. "Substantial persons possessed of property" and carrying weight in their village will not undertake all that is required of them. Men of a humbler class can be found, but they have no power to coerce the high-caste ryot or to make him pay his water-rate. It is probable that the final solution of the difficulty will be the appointment of canal headmen, not for a channel but for a village. The canal officer must not expect so much from them as he now does, and irrigation in the North-Western Provinces flourishes quite well without the help of channel headmen. By degrees the headman will command respect, and it will be possible to reduce the very high charge of 8 per cent. on the assessments, since if one man is responsible for the collections of a whole village, his emoluments will be far more than if he has only to collect the water-rates from one channel.

14. The local officers look forward to the removal of many of the present difficulties by the institution of contracts or leases of water to certain defined blocks of land for fixed periods. Provision is made for these leases in the rules quoted in the last paragraph. The present water-rates are Rs. 5 per acre for sugar-cane and Rs. 2-8 per acre for all other crops, *khari* or *rabi*. Excluding sugar-cane, it is proposed to give leases for three years at the rate of Rs. 2-4 per acre for *rabi* and Re. 1-8 for *khari*, provided that the area leased is not less than the whole irrigable area within the block in the case of *khari*, or half the irrigable area in the case of *rabi* cultivation. "By irrigable area is to be understood, as a general rule, the extent of land for which water can be supplied at the rate of 80 acres in the *khari* and 180 acres in the *rabi* per cubic foot of available supply."

15. This system will no doubt save a great deal of trouble, and for the next three years may work fairly well, perhaps, being worth the considerable loss sustained by Government in reduced revenue. But there are objections to it which, in our opinion, ought not to be overlooked. When some years ago water leases were instituted on the Eastern Jumna canal in the North-Western Provinces, they were based on the principle of continuing to certain village lands the water-supply they had received for a number of years previous, the village paying the mean water rent of these same years less a certain deduction granted by Government. For instance, if a village had for the five previous years irrigated on an average 700 out of its total cultivated area of 1,200 acres, and if its average water rental had been Rs. 2,650, Government engaged for the next three years to continue the water-supply under the same conditions, the distributary running the same number of days a week and the number of irrigation outlets remaining unchanged, and for this water-supply the village promised to pay, perhaps, Rs. 2,300. One great object in this system was to induce economy of water, the villagers being allowed with the water supplied them to irrigate as many acres as ever they could within their area of 1,200 acres. Government yearly measured up the irrigation, not for the sake of assessment,

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but to keep up its information as to the water duty and the style of crops grown. The system failed, it is believed, chiefly because the contract did not specify the sum to be paid by each of the many small landholders of the 700 acres, and they could not afterwards agree among themselves as to the share to be paid by each. But this is a detail which could probably be easily arranged.

16. The system proposed on the Arrah canal is totally different. The applicants for a lease are to send in a form specifying the numbers and areas of the fields they propose to water. Assuming, for instance, that with a full distributary the outlets to irrigate the block discharge six cubic feet per second, the lease must be executed for an area not less than $6 \times 80 = 480$ acres kharif and $6 \times 180 \div 2 = 540$ acres of rabi. Now the duty is distinctly a high one, and it seems to us likely that for the first few years at least the cultivator will not easily effect 480 acres of rice irrigation (especially if the rains are scant) with six cubic feet of water. He will be dissatisfied, and although there will likely be plenty water available in the canal, the canal officer may be unable to give him more than the six cubic feet because the capacity of the distributary is limited. If the cultivator is a man of any education, he may ask the canal officer to prove that he is really getting six cubic feet, and the latter may not always find it easy to do so, for the volume discharged through a village outlet is not always easily determined. In the rabi the cultivator will easily irrigate 540 acres with six cubic feet per second. But he will waste water, and there is no inducement for him to economise it, since if he manages to irrigate 100 more acres he has to pay full rate for them; all the time too the canal patrol and *amin* must keep an eye on his fields, which he dislikes. We would urge that until irrigation is better understood in Shahabad, and until the canal officers understand more thoroughly the machine they have to work, contracts of this sort be given very sparingly. Where they are given we think the canal officer should be empowered to supply water only on alternate weeks or on a certain number of days a week, especially during rabi irrigation. We also strongly recommend that the areas actually watered should be accurately noted every crop, for with a young canal it is of the utmost importance to know the irrigation that is being effected by its water. We urge this last point, for the local officers did not seem to contemplate keeping such records.

17. Among the difficulties experienced in applying the North-West system on the Arrah canal may be noted the shortness of the *kharif* irrigating season. Although the rice is sown in July, if the rains are copious, irrigation may not begin until October, and in November the crop is cut. There is, therefore, not time enough to have the irrigation measured up and the demand-roll of the villages made out and published before the crop is off the ground, and should there be a dispute as to whether any field had water or not it is not easily determined. The contract system of course gets over this difficulty.

18. Both in the North-Western Provinces and in Southern India, the canal officer pays little attention to the channel conveying the water from the Government distributary to the field, and provided water is not wasted, little notice is bestowed on it. In the North-Western Provinces a register is kept of all village outlets, but there is no register of channels. When a man applies for an outlet he makes his own channel, and although the canal officer should always advise him and help him in laying it out, and although he will forbid his carrying it across public roads or drainage lines, still it is understood that the cultivators have to make the best arrangement they can for themselves, and a fine is inflicted where water is wasted. On the Arrah canal the officers are much occupied with the village channels, and before water is supplied to a field the channel is inspected and reported on. The outlet occupies a secondary place. The result will be likely that on the Arrah canal the village channels will be better made than in the North-Western Provinces, and decided benefit will accrue, but at first the progress of irrigation will be checked by the canal officers, requiring a higher standard than the villager thinks necessary. It is difficult, hardly practicable, to prevent young irrigation from being somewhat sloppy.

19. Rice irrigation was practised in Behar before the construction of the canals by holding up the water in hollows by long low embankments locally

termed *ahāras*. These exist all along the drainage depressions, but are falling into disrepair as irrigation extends. Still the cultivators try occasionally to fill the pools behind the *ahāras* by canal water, and to irrigate with it at their pleasure, evading canal rates by saying it is rain water. At first sight, it would appear a good plan to accept these as affording ready made facilities for irrigation which the people are accustomed to. But everywhere in Northern India it has been found that irrigation must sooner or later be accompanied by drainage or the land becomes water-logged; while these embankments last thorough drainage is impossible. So the canal officers are doing wisely in setting their faces against the use of *ahāras*.

20. Magisterial powers under the Bengal Irrigation Act have been conferred on the Executive and Assistant Engineers on the Arrah canal, and no doubt these officers have thereby attained a certain useful amount of respect in the eyes of the people. The appointment of a native Deputy Magistrate, who is so useful an officer on the canals of the North-Western Provinces and Punjab, would be of benefit here. The value is very great to an Executive Engineer of having beside him an intelligent and educated native thoroughly to be trusted and thoroughly acquainted with irrigation, while he makes himself useful to the irrigating community in many ways, as a referee in disputes, &c.

21. There are very few private boats plying on the Arrah canal in spite of the costly and perfect arrangements made for navigation. The system of tollage is the same as that pursued on the canals of Orissa and Midnapur, about which the Committee have already expressed an opinion.* A boat is liable to be three times measured in the 58 miles between Arrah and Dehri, and the Government demand for that distance amounts to about 3 pies per ton net of cargo per mile. The general rate paid by traders on this canal is about 9 pies per ton per mile, of which therefore about one-third goes to Government. We are not sanguine that navigation will develop fast on such terms, and we recommend that the tollage be greatly reduced, and that boats be licensed for certain fixed periods. The Patna and Buzar canals radiating from one point, Dehri, reach the Ganges about 80 miles apart. The Arrah canal, starting from the same point, flows between the two, and it seemed questionable to us whether it could ever pay to have made this intermediate line navigable, seeing that it required a total lockage of 160.5 feet and much additional expense in bridging.

22. The following is an abstract of the capital account of the Soane canals as it stood on 1st April 1877. The charge for tools and plant (including the large workshops at Dehri) is very high, and the capitalised abatement of land revenue seems much too small.

	Rs.
On account of works	1,26,49,691
„ establishment	31,78,659
„ tools and plant	12,43,827
„ suspense account	4,31,780
Accumulated interest charges	27,74,095
Capitalised abatement of land revenue	16,875
TOTAL	2,02,94,927
Deduct receipts on capital account	1,27,115
Total capital outlay	2,01,67,812

The works are still incomplete, and Colonel Haig (in a note, dated 6th March 1877,) states that the sanctioned estimates, exclusive of interest and other indirect charges, amount to Rs. 2,71,03,615. By the time the whole project is complete, we believe we shall not be above the mark in assuming that the total outlay including accumulated interest, &c., will be 320 lakhs of rupees. Interest on this sum at $4\frac{1}{2}$ per cent. amounts to Rs. 14,40,000, and working expenses, direction, &c., will exceed $6\frac{1}{2}$ lakhs. Altogether to pay $4\frac{1}{2}$ per cent. on the capital there should be a gross revenue of at least 21 lakhs.

* Chapter IX, paragraphs 33 to 39. Chapter X, paragraphs 12 to 14.

Assuming that 4,500 cubic feet per second are available for rice cultivation, 600 cubic feet for sugar-cane, and 2,400 cubic feet for *rabi* crops, and that the water duty is 80 acres per cubic foot for the first and second and 160 acres for the last, we shall have—

	Aeres.	
$4,500 \times 80 =$	360,000	rice.
$2,400 \times 160 =$	384,000	<i>rabi</i> crops.
$600 \times 80 =$	48,000	sugar-cane.
Total area watered	792,000	

The existing water-rate, Rs. 2-8 per acre, is very moderate for rice and *rabi* crops, while sugar-cane could, we believe, be rated at Rs. 8. If so, the income from the above area will be Rs. 22,44,000. Navigation and other miscellaneous receipts should swell the revenue to 25 lakhs. So large a revenue cannot be expected for some years to come, but we see no reason to doubt that it will ultimately be obtained, and that the Soane canals will prove a source of direct revenue to Government as well as an inestimable blessing to Behar and a sure safeguard against famine.

E. FORSTER WEBSTER, *M.C.S.*

C. C. SCOTT MONCRIEFF, *Major, R.E.*

APPENDIX A.

[SEE CHAPTER IV—PARAGRAPH 8.]

A BILL FOR THE REGULATION AND ENFORCEMENT OF KHUDIMARAMAT IN THE PRESIDENCY OF MADRAS.

I.—Section 6 of Act I of 1858 is hereby repealed.

II.—The following descriptions of work shall, to the extent hereinafter provided, be performed by Khudimaramat or unpaid village labour:—

- (1.)—To fill up gullies, ruts, and holes, and to do all petty repairs of a like nature on *bunds* of tanks, channel banks, or other irrigation works appertaining to the village.
- (2.)—To prevent the growth on village irrigation works of prickly pear, wild croton, and other objectionable vegetation.
- (3.)—To preserve such bushes and grasses as have been planted for the preservation of the interior water slopes of *bunds* of tanks, and to watch and protect these slopes and the *bunds* generally during the rainy season.
- (4.)—To clear silt from tank sluices and channels and from river and spring channels when not maintained by the State.
- (5.)—To clear and regulate *Kalingulaks* (waste weirs with upright stones) and to stop leaks.
- (6.)—To construct ring dams in front of breaches and to strengthen *bunds* of tanks where necessary during the rainy season.
- (7.)—To uncover sluices on the requisition of the inspecting officer.

III.—The local Government shall have power to require the performance of any description of work not included in section 2, on satisfactory evidence being adduced of its recognition as Khudimaramat in any district or part of a district, and similarly to declare that in any locality section 2 or any part of it shall not be applicable.

IV.—The quota of labour to be furnished by individuals will be determined by the proportion between the assessment of the lands occupied by them under the irrigation work and the total assessment of the lands under such work. Provided that whenever the ryots are willing to settle among themselves the details of the apportionment of labour, it shall be open to them to do so, the Collector being empowered to appoint a *panchayat* for this purpose.

V.—It will be the duty of the headman of the village to fix the quantity of labour or number of labourers required to carry out Khudimaramat work from time to time, and from his orders an appeal shall lie to the Collector, whose decision shall be final.

VI.—No one shall be liable to furnish labour for Khudimaramat to an irrigation work under which he does not hold land.

VII.—Whenever an irrigation work supplies the lands of more than one village, the whole of the villages concerned shall be liable to furnish labour for its Khudimaramat as prescribed in section 4. In such cases the shares of work to be done shall be, for tanks and their connected works, settled once for all under the orders of the Collector by apportioning to each village a definite length of the tank *lund*, supply channel, distributaries, &c., after which the headman of the village will be responsible that the share of his village is regularly performed. In the case of channels irrigating more than one village, the shares of individual villages shall be as far as possible settled permanently, and so far as such permanent settlement may be impracticable, arrangements shall be made from time to time with the Collector's approval.

VIII.—The actual cultivator or tenant of the land where the owner or proprietor of the land is not forthcoming shall be bound to contribute the quota of labour as defined by this Act, and it shall be lawful for such cultivator or tenant to deduct the value of such labour at the current rate of wages in the village from the rent payable to such owner or proprietor.

IX.—The head of each village and the tahsildar of the taluk in which the village is situated shall be responsible for the due performance of Khudimaramat as laid down in this Act.

X.—Whenever the labour required for such purpose is withheld without reasonable cause by the ryot bound to contribute the same, it shall be the duty of the head of the village to cause the immediate execution of the work by hiring such labour at the prevailing rate of wages. The hire shall be paid in the first instance as an advance from the Government treasury under arrangements sanctioned by the Collector acting under the orders of the Board of Revenue, and such advance shall be afterwards repaid from the local Khudimaramat fund to be created under this Act.

XI.—It shall be the duty of the head of the village to report his proceedings under the last preceding section to the tahsildar of the taluk, who shall thereupon hold such summary

inquiry as he may deem necessary and adjudge the recusant ryot to pay a penalty not exceeding four times the value of the labour withheld.

XII.—From every decision, act, or order of a tahsildar under this Act, an appeal shall lie to the Collector, provided such appeal be made within one month from the date of such decision, act, or order.

XIII.—The decision of the Collector on all appeals under the last preceding section shall be final.

XIV.—Any penalty imposed under this Act shall in case of non-payment be realised in the manner provided for the recovery of arrears of land revenue in the Madras Presidency.

XV.—The head of a village shall be liable to a fine not exceeding Rs. 100, or to dismissal from office, or to both, in case of proved neglect of the duty imposed by section 9 of this Act.

XVI.—All fines and penalties levied under this Act shall be carried to a fund to be called the local Khudimaramat fund and to be applied to Khudimaramat purposes.

XVII.—When the persons who are bound to furnish labour under this Act prefer to compound for the whole or any part of such obligation by an annual money payment, it shall be lawful for the Collector, under the orders of the Board of Revenue, to admit such composition for a period not exceeding three years at such rates as shall be fully equivalent to the labour, and to undertake the execution of the work so compounded for, provided that the whole of the sum so raised shall be spent on the irrigation work in respect of which it is collected.

APPENDIX B.

[SEE CHAPTER V—PARAGRAPHS 19.]

REVENUE CIRCULAR No. 18.—GODAVARI DISTRICT.

As applications for remission of land and water-tax are often made on the ground of alleged deficiency or excessive supply of water from Government sources of irrigation, and as it is necessary in such cases that the opinion of the Department of Public Works should be obtained as to the truth of the complaints and the best remedies that can be applied, Tahsildars and Deputy Tahsildars in charge of Zamindari Divisions are directed to attend to the following instructions:

1. A list of fields on which demand for remission is made on account of excess or deficiency of water should be prepared by the Karnam as usual, with the number of each field, its extent and assessment; the loss sustained and the reason for such loss as recorded by the Karnam.

2. This list should be carefully examined by the Revenue Inspector to whom it should be sent in duplicate by the Karnam by the 31st October. The former, after noting down his own opinion against each field, will forward it without fail as soon as possible, and never later than the 30th November, to the Tahsildar of the Taluk by a special village servant.

3. The Tahsildar will send on one copy of the lists as soon as he gets them to the Range Officer concerned to enable him to have the fields inspected before the crops are cut.

4. The remarks of the inspecting member of the Public Works Department will be entered on the lists in question, which will be returned to the Tahsildar to be produced at the Jamabandi.

5. It should be understood that the Tahsildars are not hereby relieved of the duty of inspecting the fields themselves or by their deputies.

6. On the receipt of the opinions of the Department Public Works, the Tahsildar, if he finds that there is any difference of opinion between himself and the inspecting member of the Department Public Works (not being a Range Officer) in regard to the remission of any fields, will at once send extracts from the lists of such fields to the Range Officer.

7. The Range Officer will probably as a general rule inspect such fields himself and return the lists after noting down the result of his inspection to the Tahsildar to be produced at the Jamabandi.

8. With this object in view, Tahsildars are particularly requested to do their best to finish their Azmaish as early as possible in the year, so as to be able to record the result of their inspection before the lists are sent in to the Range Officer. This will enable the Range Officer to inspect the fields, as soon as he finds a difference of opinion between a member of his own Department and the Tahsildar.

9. It is hoped that the Tahsildars will do their utmost to have all fields as to which differences of opinion may arise inspected by the Range Officer before the Jamabandi begins, so as to enable the settling officer to come to a decision at once.

10. These instructions apply to upland as well as to Delta Taluks.

11. The Deputy Tahsildars in charge of Zamindari Divisions who have no Revenue Inspector will themselves examine the fields and send in the lists before the 30th November to the Range Officer.

APPENDIX C.

NOTE ON THE ADMINISTRATION OF CANAL IRRIGATION.

It seems to me that, perhaps, the Famine Commission may consider that their Irrigation Committee have not in their report bestowed sufficient attention to the above subject, nor laid down, as definitely as they should, where the line ought to be drawn between the duties of the Revenue and the Engineer Officer. I wish to record no dissent from the system as it exists in Madras, partly because it generally works well, and much bitter feeling would be excited if it were altered, and partly because in my short stay in that Presidency, I do not feel that I have mastered the subject sufficiently to recommend decided changes. But I write this note to prevent its being supposed that I so far approve of the Madras system as to wish to see it, or anything like it, introduced in the North-Western Provinces or the Punjab.

2. The Committee have recorded (in Chapter III, paragraph 1) how far they consider the Engineer's duties should extend in the distribution of water. The principle there laid down is applicable everywhere; but this principle would lead to a very different conclusion in the conditions of irrigation in Northern and Southern India. In Northern India vastly the larger proportion of the lands irrigated bear what is termed "dry crops," that is, wheat, barley, gram, indigo; and sugarcane may be included in the category. In Madras the one great crop is rice. In Northern India the setting in of the monsoon is the signal for lowering the canal supply; and if the rains are good, the canals may be closed for repairs. In Southern India the irrigation begins with the monsoon showers, and is at its height when the rivers are rolling seaward in full flood.

3. In Northern India the area that may be irrigated always greatly exceeds that for which water is available. The same fields are not watered every year, and the constant task of the canal officer is to economise water and to increase the area of his irrigation. The cold weather crops—wheat, barley, and gram—require only four waterings between October and April, even in dry years, and, when the usual Christmas rains fall, the crop may be matured by two or even one watering. In the hot months of May and June almost the only crops watered are indigo and sugarcane. The water must be supplied every two or three weeks, and that at a season when it is being licked up by the blast of the hot winds, and when a check in the melting of the glaciers may at any time occur (especially on the Jumna Canals), and the volume in the canal may run down.

4. In a dry season in Northern India, the canal officer is mobbed by thirsty ryots imploring him to supply water. He spends his days, sometimes even his nights, in patrolling his distributaries and seeing that the volume at his command is being fairly dealt out. He gets daily reports (at times twice or thrice a day) of the depth of water at points three or four miles apart down his channels. He is always on the watch lest the flow of the water be checked by silt deposit, weeds, tufts of grass, or rubbish, and it is his pride to have clean orderly channels. Nor does his care end with the outlet from the distributary bank; but as he rides through the village lands he keeps an eye on the field channels and advises how they should be laid out so as to secure that as little water as possible should be lost in them. A glance at any Revenue Report of Irrigation in the North-Western Provinces or Punjab will shew how much prominence is given to "high water duty," that is, to the area irrigable from a given unit of discharge. The Engineer is held responsible for the water in his canal as he is for the money in his cash-box, and every year a more rigorous account is required of it.

5. The system pursued on the Godavari and Kistna Canals is the one which can be easiest compared with that of Northern India, and they have this point of resemblance, that in both the Engineer is responsible for the water distribution. But here the resemblance ceases. As has been said, the irrigation is in the monsoon, and hitherto there has been abundance of water for the irrigable area. The ryot may wish to flood his rice-field a foot deep, and the irrigation officer may know that six inches is enough, and dole it out accordingly. But, generally speaking, when the outlet has been granted to supply water to a certain area, the water flows uninterruptedly throughout the season, and, if one ryot gets twice as much as another, both get enough and they are tolerably contented. Distribution like this is rough indeed compared to that in a North India canal, where a two-inch flooding may save the crop, and an inch and a half may lose it, and where the ryot has only a chance of water at all three or four days in the fortnight. The Madras Canal Engineer then needs to bestow little attention on water duty. Nor does he care much if the distributary channel is untidy and wasteful of water. There is plenty more to draw from.

6. In Madras the Collector directs the canal officer to irrigate a certain area in a certain village. If he can, he complies, and has no more to do with the matter. The irrigation is measured up at the jamabandi season; but as the wet area is usually the same year after year this measurement need not be done with elaborate accuracy. In due course, the Collector reports to the Board of Revenue the area irrigated, and they pass it on to Government in the

Irrigation Department. Ultimately, it gets to the Executive Engineer, but he only knows the acreage in each village, and has no accurate information as to whether the improvements he may have made in any of his distributaries have been crowned with success.

7. I do not for a moment urge that a Collector has no more reason to exercise a control over a State canal than over a State railway in his district. He is the principal Government official, the highest revenue officer, and, if a system be proposed for depriving him of the control of a large portion of the revenue, the proof of its expediency lies with its proposer. But what I would urge is that the irrigation of dry crops with a limited supply of water is a scientific process, that to commit it to any chance Deputy Collector or Tahsildar would ensure its failure, and that its success can only be ensured by keeping the distributary channels in a high state of repair, which requires the personal inspection of the Engineer. If these premises be granted, and it be thought right to entrust the water distribution to the Engineer in the way I have described, it is contrary to all human nature to suppose that he will take as enthusiastic an interest in the spread of irrigation as if he is made responsible for the whole affair. If the ryot is to take his complaints not to him but to the Collector, how will the Engineer ever learn his wants? If he only hears months after what has been the result of his delicate water distribution, and then only imperfectly, what encouragement will he have to improve? I go a step further and say that, deprived of the control of his irrigation, the interest of the Engineer will cease when the canal and its branches are completed. And the officer who goes on after that regardless of how the water is being bestowed, and devoting his time to silt and jungle clearances and to the repairs of bridges and culverts, will merit a place among Engineers certainly no higher than the much-despised white-washer of barracks.

8. But it may be said this enthusiasm may be bought too dear. (I confidently appeal to any one conversant with our canal system in the North-Western Provinces and its officers to say whether it does not exist.) It may be urged that the Engineer knows little of revenue matters, and that the interests of the people, and therefore of the Government, would be better cared for if, after the canal and its branches were completed, a small staff of mediocre Engineers were employed merely to keep the works in repair and to see that water was conveyed where required, while all the details of the irrigation and its revenue management were administered by revenue officers. Now to this there are many practical objections.

9. Supposing there were a regular staff of irrigation revenue officers selected from the Covenanted Civil Service as settlement officers have been, and getting promotion in their own line: it would be inexpedient to attach one to each district, partly because there would not be work sufficient for him, and partly because canals and their subsidiary channels must be laid out according to the natural features of the country, and one distributary channel may intersect two or even three districts, while it is necessary that the same officer should have control over it from end to end. These officers would therefore be required either to work under the superior canal officer, which would probably be most unpopular among them, or under the Commissioner of the division. If they were to be paid as much as their contemporaries in other lines, either the canal establishment charges would be enhanced by the employment of men of some standing, or junior officers would have to be employed, knowing little about irrigation and requiring closer supervision than a Commissioner could bestow.

10. The Revenue Canal Superintendents might, however, be Deputy Collectors—Europeans or Natives, drawing salaries, say, not exceeding Rs. 500 per mensem. They would for the most part be elderly tried subordinates, and might be under the Commissioner or the Superintending Engineer. Now a full canal division consists of about 60 to 120 miles of canal with 500 to 600 miles of distributary channel, and about 200,000 acres of irrigation extended over an area of about 100 miles long by 15 miles wide. It may be managed by an Executive Engineer and three sub-divisional officers, besides a native Deputy Magistrate (a most useful functionary serving under the Executive Engineer), and their joint salaries may be about Rs. 2,000 per mensem or Rs. 12 per acre irrigated.* Supposing that, relieved of their revenue duties, the Executive Engineer could manage a division one-third larger with two Assistant Engineers and the Revenue Superintendent, instead of the present Deputy Magistrate. The joint salaries would be about Rs. 1,700 or Rs. 10 7/6 per acre irrigated. No doubt, an economy would be effected; but would the Revenue Superintendent be able to supervise irrigation spread over 1,800 square miles, and would the works be maintained efficiently if each sub-divisional officer had charge of 350 to 400 miles of distributary channel? If not, the Irrigation division must be smaller and little or no economy be effected; while surely there is better chance of success if 400 miles of distributaries and their irrigation be under two officers, each responsible for every detail in his charge of 200 miles, than if one has to supervise the maintenance and the other the irrigation of the whole length. A consideration of the distances to be traversed will shew this.

11. Nor is it a very difficult thing for a Canal Engineer to acquire a sufficient knowledge of revenue matters. Surely, an educated English gentleman is not disqualified for such information because he is an Engineer? Of course it is distasteful and uninteresting to some, and they should never be employed on running canals; but hitherto there has been no difficulty in finding officers very fond of the work and ready to pass the simple revenue examination required of them in the North-Western Provinces. They would pass a harder one if required.

* Canal officers in charge of irrigation are required to pass an examination in the Code of Criminal Procedure on their knowledge of the Northern India Canal Act, and the circulars on it. They are then invested with the powers of Magistrates of the 2nd class for the trial of offenders against the Canal Act, and in their magisterial functions are subordinate to the Magistrate of the District in which the case is tried. But practically, they do not try cases, but make them over to the native Deputy Magistrate.

No doubt there may be a difficulty in procuring qualified Engineers where there are not many Irrigation appointments, and where an officer may be employed one day on a running canal, and the next on a bill road. Fortunately, on the Irrigation systems of Northern India this difficulty need never occur, as the Irrigation officers form a large separate establishment, and rise by promotion only in their own line.

12. As said above, canals and their distributaries in Northern India must follow the natural features of the country, and so cannot be conformable with the boundaries of districts. Some executive divisions spread over three even four districts, and for this reason, if for no other, the Canal Engineer could not be placed under the orders of the Collector. But if this difficulty were overcome (as it would be if the districts were as large as those of Madras) any subordination of this sort would be most distasteful to the Engineer. They are equals in rank and often in education, while the difference in their years is not great. At present they meet as equals, and, with rare exceptions, each helps the other as becomes officers loyally serving the same Government. Were one placed over the other, friction would inevitably occur, and some of the best Engineers would try to serve in other branches of the Public Works Department.

13. While defending the existing system of canal administration in Northern India, I am far from wishing to see it stereotyped, and I trust that before many years have passed many improvements will have been effected, and that the canal management will be less costly to the State and more acceptable to the people. I look forward with great hopes to the extension of the system of giving irrigation to villages by contract for a term of years. I do not even despair of seeing self-help sufficient to enable a cluster of villages among them to take a contract for the whole supply of a small distributary channel, as the Spanish peasants have done since the days of the Moors. A more accurate system of recording village statistics may enable us to dispense with separate measurements of canal irrigation. These and many other improvements may be hoped for, but I do not think they will be furthered by taking from the canal officers the entire control of the irrigation on which they set such value.

14. The system pursued in Orissa and Midnapur has been described in Chapters IX and X. In Midnapur the Deputy Revenue Superintendent is an elderly native Government official, much of the class of the native Deputy Magistrates of the North-Western Provinces canals. I have no reason to suppose that he does not do his work well, but his pay is a heavy charge against that small field of irrigation, and, I believe, the Assistant Engineer who must be retained there anyhow would do it equally well in addition to his other duties. In Orissa the Deputy Revenue Superintendent, Mr. Wylly, is a young uncovenanted officer receiving a salary of Rs. 300 per mensem. All agree that he has rendered excellent service, but if he gets the promotion, he has a right to look forward to, he will not be contented to stop where he is. I should be sorry as things are at present to see any change introduced in Orissa which would necessitate Mr. Wylly's transfer elsewhere. But I think the work would be done more efficiently and with less friction if he were placed under the Superintending Engineer and were in the habit of looking for orders and for advice to an experienced officer whose whole thoughts are devoted to the advancement of irrigation rather than to a Collector who cannot possibly have much time to give to the subject, and who probably has never served in an irrigated district before. In our short stay in Cuttack, a case was brought incidentally to the notice of Mr. Walker, the Superintending Engineer, where a large area had been erroneously assessed at the lower rate for lift-irrigation instead of the higher rate for flush-irrigation. This error could not well have occurred if Mr. Wylly had been under Mr. Walker, and if the Executive and Assistant Engineers had all shared in the responsibility of the measurements.

15. In Midnapur and Orissa, as if to shew that Government distrust the Engineers having any sort of revenue charge, the sale of grass, timber, fruit, &c., on the canal banks, and the lease of the land belonging to the canal is all managed by the Deputy Revenue Superintendent without reference to the Canal Engineers. This is a source of irritation. The Engineer who looks after his canal banks likes to dispose of their produce, and if he can be entrusted with the control of the water-supply, he surely might be trusted here. In Madras as well as in Northern India the Engineer has the disposal of all canal produce.

16. While generally concurring with the irrigation system of Madras, there are parts of it which, in my opinion, might be improved. The best chance for the Kurnool Canal would be, I think, for Government to buy out the Irrigation Company and to introduce the system of Northern India. But this would infer the hearty co-operation of the revenue officers with the Engineer, and, as the system is so foreign to all Madras custom, this might not be easily secured.

17. At present there is in Madras a Chief Engineer over the roads and buildings, and another over irrigation works. Beyond this, there is no Irrigation Department, and the Superintending and Executive Engineers have charge of all the works within their circles, whether they be canals or kutcherries, roads or tanks, taking their orders from both the Chief Engineers. Theoretically, the system is a bad one that makes a man serve two masters. But although I saw instances where inconvenience arose, I believe, as I was generally assured, that practically works well. Where the irrigation is effected by tanks scattered over the country, in Salem or North Arcot, to maintain a separate staff of Irrigation officers would probably be too expensive, and the officers in charge of the roads may as well retain charge of the tanks. But in the deltas of the Godavari, Kistna, and Cauvery, in the irrigation of the rapids, and perhaps in some of the more important systems of tanks connected with rivers, I think it would be an improvement to have officers with nothing but irrigation to do to, and it would be in keeping with the spirit of the age, for it is the tendency of the Engineer's profession to split up into separate branches, and for the Engineer to select and

