M.R.O. 14—13,000—27-9-24.

MADRAS RECORD OFFICE.

Government of Madras.

Revenue **DEPARTMENT.**

G.O. No.	501 – 503
	Press ~~Misc~~
	276.282
Dated	23. 3– ~~19~~ 1864

Not to be folded or roughly handled

Proceedings of the Madras Government, Revenue Department, 23rd March 1864.

No. 276. Read the following papers :—

MEMORANDUM No. 3,916.

1. Forwards, by desire of His Honor the Lieutenant-Governor of the Punjab, one copy of printed papers on Canal Revenue Establishments, and distribution and economy of water.

2. The Punjab Government would be glad to receive any remarks on the points adverted to in these papers, which may aid in leading to practical conclusions on the subjects discussed.

LAHORE, *19th December* 1863. (Signed) ROBERT MACLAGAN, *Lieutenant-Colonel, Secretary to Government, Punjab.*

No. 277. NOTE BY THE HONORABLE THE PRESIDENT.

1. The accompanying Memoranda have been forwarded by the Punjab Government, with a statement that any remarks would be acceptable which might aid in leading to practical conclusions on the subjects under discussion. As similar or rather analogous questions have, for some time past, been discussed in this Presidency, and as I, after a good deal of consideration, have arrived at conclusions differing in many respects from those which seem to be laid down as axioms in these Memoranda, I may as well submit my views for the consideration of the Government of the Punjab.

2. I cannot of course pretend to give an opinion upon the suggestions made for utilizing the various classes of Officers now employed, either by the Canal Department or that of the Revenue ; but I am in a position to discuss the primary question of the mode of assessing the water-rate, as well as the secondary questions of the position, whether under or above the soil, of the distributing channels, and of the mode of determining the area of irrigated land.

3. In dealing with the question of the mode of assessing the water-rate, Mr. Cust lays down, as a sort of axiom, "that all land, irrigated by canals, should be assessed for the Land Tax at "dry (Baranee) rates only, and the Canal authorities should, with the sanction of the Government, "be allowed to raise the water-rate to such a scale as is justified on commercial principles ;" he then goes on to say that there are two modes of assessing the water-rate :—

A.—By the volume of water discharged.

B.—By the area of land irrigated.

I infer from this that the Canal authorities are to be permitted to make the most of the article they have to sell, subject to the reservation that the rate charged be uniform, whether it be by the cube yard *or unit of volume*, or the Acre, as the *unit of area irrigated.*

4. Is however this rule of assessing land at dry rates, and adding a separate charge for water supplied, so thoroughly established as to justify us, in dealing with the state of things in India, to assume it as an axiom? If it be so, why is it necessary to limit its application to water supplied by *canals?*

5. The experience of the Madras Presidency is decidedly adverse to such a system. In the first place, the dry assessment is, with reference to a great deal of land, a purely hypothetical assumption of value, for much of the land which is valuable when irrigated, would never be cultivated at all unless water could be supplied to it; and, in the second place, the dry assessment, if we go so far as to suppose it to be an accurate measure of the relative value of the soils of different fields when under dry cultivation, is not in any way an exponent of that relative value when these soils are irrigated ; at all events the dry assessment, added to a fixed charge for water, is found in Madras to be a mode of deriving a revenue from the land which acts most unfairly upon both tenant and landlord, upon the people and the Government. For instance, it is a pretty general rule throughout the Madras Presidency that the dry assessment varies from 8 Annas to 3 Rupees per Acre, while the wet assessment ranges from 2½ Rupees to 10 Rupees per Acre. The difference between the two lowest rates, viz., 8 Annas and 2½ Rupees, may be taken to represent the Government share of the additional produce due to the action of water upon the poorer quality of soil ; while that between the two higher rates of 3 Rupees

and 10 Rupees is the value of the Government share of the additional crop from a similar application to the best soil. The experience then, of this Presidency, goes to show that the occupant of the poorer quality of soil can afford to pay 2 Rupees for the water required to irrigate an Acre, without any undue pressure; while the occupant of the better description of soil can pay, and, if treated upon the same principle as the occupant of the poor soil, should be called upon to pay 7 Rupees for an equivalent quantity of water.

6. What, however, would be the result if the dry assessment were adopted as the exponent of the value of the soil, and a fixed rate be demanded for the water, say of 3 Rupees per Acre?

7. The occupant of the poor soil would have to pay a mixed sum, partly land assessment, partly water-rate of 3½ Rupees or 1 Rupee per Acre more than he is now called upon to pay; while the lucky occupier of rich land would get his Acre for 6 Rupees instead of 10; and thus put 4 Rupees, in excess of what is assumed to be his fair profit, into his pocket. The assessment on all land, irrigated or unirrigated, is calculated upon an average of crops, after making all necessary deductions, and is assumed to represent the value of one-third of the *net* crop. In the case then of the occupier of poor land, who is made to pay 3½ Rupees joint land assessment and water-rate, a demand of $\frac{7}{15}$ths or very nearly one-half of his net crops is made upon him, while the occupant of rich soil is only called upon to pay one-fifth of his net crops instead of one-third.

8. I cannot then but think that the system hitherto followed in India, of computing the rent or assessment upon land, whether irrigated or not, with direct reference to its productiveness, as evidenced by the average crops, is not only a simpler plan than that of mixing up the hypothetical value of land under dry cultivation with a fixed charge for water, but also a fairer plan both as regards landlord and tenant, Government and people.

9. I will now consider the relative merits of the two modes of assessing the water-rate mentioned by Mr. Cust, viz.:—

A.—By the volume of water discharged.

B.—By the area of land irrigated.

Here again it is assumed as a matter of course that, though the first mode cannot be adopted, and though every attempt to introduce it has failed, it is in itself, *theoretically*, so superior to the second, that we ought always to look upon some mode of measuring the discharge as an object to be attained, and the measurement by area as only a temporary arrangement. We are not told in what this superiority consists, but from the context I gather that the measurement of the water is supposed to be a more economical mode of arranging with the occupier for the quantity required by him, than the measurement of the area irrigated. In order, however, to determine this, it will be necessary to examine into the circumstances upon which the *cost* and the *value* of the water depend.

10. The *cost* to the Government is the interest of the money expended upon the works, added to the cost of maintenance and repairs, and that of management. In Madras the money expended upon some of the large irrigation schemes varies from 10 to 20 Rupees per Acre irrigated. If we take 15 Rupees as the average, the interest at 5 per cent. would be ¾ of a Rupee, and if we allow another ¼ Rupee per Acre for repairs, &c., the cost to the Government will be 1 Rupee per annum per Acre. The quantity of water supplied varies of course with the character of the soil, the crop, &c., but the maximum may be put at 5,000 cube yards for a single crop, and if we take 4,200 cube yards as the mean, we shall not be far wrong. The *cost* therefore to Government is 1 Rupee for 4,200 cube yards of water—the supply being spread over a period of about three months.

11. The *value* to the Government is the amount at which it sells this water. In Madras as I have before shown, this value varies according to the quality of the soil to which the water is applied, and ranges between 2 Rupees and 7 Rupees. Assuming, however, that a fixed water-rate is established, this, so far as we can see at present, will be estimated at from 3 to 4 Rupees per Acre or per 4,200 cube yards or, say, 1 Rupee per 1,000 cube yards.

12. We have thus arrived at an approximation to the cost and value of water, that is the cost in the canal and the value when sold, but we have yet to bring it to market, and the question we have to consider is, what is the most economical mode of doing this? That is of delivering to the occupier of the land the amount of water which he may require.

13. We will dismiss, for the present, at all events, all considerations arising out of peculiar tenures of land; assuming only that in order to arrive at the dry assessment of land to which the Government, under any circumstances is entitled, the area of the holdings must be ascertained, *that is the land must be surveyed.*

14. Should the Government determine to measure the water as it issues from the canal, it must erect the necessary distributing and measuring sluices. There are no data by which the cost of these can be determined; but they are by no means simple either in construction or in management, and will require to be watched and worked by a special class of servants. If on the contrary, the Government prefer to charge upon the irrigated land a fixed rate per Acre, then the ordinary means of discharging and distributing the water will answer, and the only question to be solved is the amount of land actually irrigated. I have, however, before observed that the land must be surveyed, with a greater or less degree of exactness, in order to determine the amount of the dry assessment, and the process which is considered sufficient, for the one may for the present answer sufficiently for the other. However, I shall be prepared to discuss this more fully when I allude to the mode of determining the areas of the cultivated land generally.

15. With reference then to the mode of assessing the water-rate, the conclusion at which I have arrived are as follows:—

First.—That the system of charging a single rent or assessment upon the land, the amount of which is determined, whether the land be irrigated or unirrigated, by the productive power of the land as determined by the actual crop, is in every respect fairer to the Government and to the Ryot, than that of assuming a hypothetical assessment, based upon the supposition that the land is cultivated for a dry crop, and adding to this hypothetical assessment some arbitrary water-rate based upon commercial principles, which I suppose to mean as high a rate as the Ryot can be made to pay.

Second.—That under circumstances analogous to those which characterize the relation between the Government and the cultivator of the soil in India, the measurement should be applied to the land and not to the water that is the rate, whatever it may amount to, should be an acreable charge.

AREA OF IRRIGATED LAND.

16. It would seem from the remarks of the Punjab authorities that difficulties have been experienced, or at all events have been anticipated in the determination of the areas of the holdings to which water is supplied.

17. This may be the effect of the system of assessing the village and leaving the individual payments to be determined by the village authorities. It is a difficulty which is not experienced in Madras, when the village Map and Register determines the form and area of each individual occupation, so that all that the Revenue authorities have to find is the number on the Register of the fields to which water has not been distributed: and as generally speaking, all the land under the irrigation channel is irrigable, there is but little difficulty in determining the portion left dry during any season.

18. The cost of surveying the irrigated land annually, however roughly such an operation may be performed, must cause a serious deduction from the profits of the water-rate, or a serious addition to the *cost* of the water.

19. I cannot but think that a village survey carefully executed would remove all difficulties as to the distribution of water, and would probably pay its own expenses by bringing to light a quantity of cultivation both irrigated and unirrigated, from which the Government has hitherto derived little or no revenue.

20. A village survey should provide for permanent boundary marks, indicating not only the external boundary of the village, but also such sub-divisions of its area, when no lines of separation, either natural or artificial occur, as would split it into blocks of from 50 to 100 Acres. Within these blocks the outlines and areas of cultivated portions should be surveyed and marked on the Plan, and it would be easy to mark the outline of land capable of being irrigated, all of which might be considered liable to the rate, while it would be left to the occupier, who declined to make use of his privilege, to show that he had not irrigated his land.

21. A simple measurement of the area of unirrigated holding, which would form but a small proportion of the irrigable land, would settle all questions as to the supply of water; while the existence of the boundary marks would make this a short and simple process.

POSITION OF DISTRIBUTING CHANNELS.

22. Stress has been laid upon the waste of water caused by the position of the irrigating channels above the surface of the ground to be irrigated, and it has also been said that the leakage from these, causing swampy patches of ground here and there, is prejudicial to the health of the community.

23. It has been proposed as a means of remedying these evils, but principally, I believe, to secure the imaginary benefit of measuring the water, that all the water required for irrigation should be lifted from channels carried below the level of the ground.

24. I question in the first place the existence, or at all events the extent of the evils complained of. I do not think that the leakage from the channel above ground need be great; at all events the fact of a leak is detected at once, while the waste arising out of the permeability of the subsoil does not make itself visible for some time. As to the action of the leakage upon the health of the people, its quantity must be so small in proportion to that of the water applied to irrigation as hardly to deserve notice.

25. The main objection, however, to the proposal of lifting the water is the enormous cost of the labor required to perform the work. If we take 4,200 cube yards as the supply required for an Acre and suppose this to be spread over a period of three months, the quantity of the daily supply to the Acre would be about 48 cube yards. Now a cubic yard of water weighs $27 \times 62\frac{1}{2} = 1,687{\cdot}5$ lbs., 48 cube yards will therefore weigh 81,000 lbs., and if this has to be raised 2 feet, a height only just sufficient to give it a sufficient head for distribution, the weight raised 1 foot high will be 1,63,200 lbs.

26. The labor of an Englishman is considered as equivalent to 5,000 lbs. raised 1 foot high per minute, that of a Hindoo would not probably be equivalent to raise more than 3,000 lbs., but taking the Englishman, $\frac{163200}{5000} = 32{\cdot}6$ the number of minutes employed daily in raising sufficient water for the daily irrigation of an Acre, if this be multiplied by 90 the number of days during which water is required $90 \times 32{\cdot}6 = 2,934$ minutes is the number of minutes during which the man would have to work to raise water sufficient to irrigate an Acre, and this divided by 60 would give 48·9 hours or, at ten hours per day, very nearly 5 days. If however we take the co-efficient of labor of an Hindoo as 3,000 lbs., then the 5 days would be transmuted into 8¼, and the cost would amount to very near 2 Rupees to be added to the *cost* of the water, or deducted from the profits: such a proposition could not be entertained for an instant.

27. Before I conclude I may as well say a few words upon the subject of the collection of the water-rate.

28. Several of the difficulties, out of which the Government of the Punjab is striving to extricate itself, seem to me to have orginated in the fact that the Canal Department has overstepped the proper limit of its functions. As a general rule the Public Works Department should execute, or superintend the execution of, the canal itself, and of all the various sluices and major channels required for the distribution of water. It should also keep these works in repair, but here, it appears to me, its legitimate functions cease. If, on the plea that the water in the canal is the property of the Department, its Officers proceed to dispose of it, and to collect the

proceeds of the sales, they assume to themselves functions altogether foreign to their organization, and are obliged to employ a separate set of agents.

29. I do not think that it would be wise to throw upon the Public Works Department the charge of levying the money payable for water supposing it were possible to determine the quantity by a measuring sluice, though it might record the quantity passing through; but I am quite sure that its Officers would be placed in a very invidious position were they called upon to collect a rate chargeable upon the acre of irrigated land.

30. Even in Madras, where the Officers of the Revenue Department collect the Land Assessment, which includes a water-rate on irrigated land, a sufficiently angry correspondence has occasionally passed between the Collector and the District Engineer on the subject of the addition made to the Land Revenue by the action of certain works of irrigation. Were the two Departments called upon to go over the same ground, one to levy a dry assessment and the other a water-rate, all sorts of complications would arise.

W. T. DENISON.

No. 278. NOTE BY THE HONORABLE E. MALTBY.

1. I concur generally in the Minute which the President has written on the subject of Canal Irrigation at the request of His Honor the Lieutenant-Governor of the Punjab.

2. The loss of revenue to the state on the richer lands, and the heavy burden imposed on the poorer soils, by attempting to introduce a general dry assessment and supplement it by a water-cess where irrigation is supplied, have been often pointed out by me in my Minutes arguing in favor of a Nunjah assessment, that is to say, an assessment based on a portion of the staple crop raised on wet lands.

3. I concur in the advisability of employing the revenue Officers to collect the water-cess. There seems no difficulty on this point especially when the charge for water is made according to the area irrigated at so much per acre.

16*th March* 1864. (Signed) E. MALTBY.

No. 279. NOTE BY THE HONORABLE T. PYCROFT.

1. I concur in the views of His Excellency the President and of the Honorable E. Maltby upon this question.

2. The assessment on irrigated land should, in my opinion, be a consolidated rate, fixed in reference to the value of the produce of the land when under irrigation. All attempts to fix separate rates for the land—as dry land—and for the water, must as shown by Sir W. Denison result in complication and inequality of assessment, and will not be fair either to the Government or to the cultivator.

3. The Officers of the Public Works Department cannot be too strictly confined to the performance of their own proper duties—the construction, repair and maintenance of Public Works. They should have nothing to do with the assessment or collection of the public revenue.

4. In the bringing to account the revenue derivable from irrigated lands—as in any other process in which subordinate native agency must be largely employed—frauds to a considerable extent are, I fear, unavoidable. The best remedy lies in a good Village Survey and Village Maps, which facilitate the control of the superior over the inferior Revenue servants, and the detection of their irregularities.

5. The device suggested by some of the Officers in the Punjab for enforcing economy of water by making its application to the land laborious and therefore expensive, will hardly find approval in this part of India. Here it has always been found that a Ryot will till as much land, wet or dry, as he can cultivate at a profit. If the assessment on his land be moderate he will extend his cultivation, and make the water that he gets go as far as possible. In such case if he does waste water it is not wilfully and because he is insensible to its value, but because of his

ignorance and the backward state of agriculture in India. The progress of agricultural science and diffusion of education will do more to correct his mistakes in this respect than the creation of artificial restraints and difficulties.

(Signed) T. PYCROFT.

No. 280. ORDER THEREON, 23rd March 1864, No. 501.

Resolved that the Notes of His Excellency the Governor and the Honorable Members of Council be forwarded to the Government of India and the Government of the Punjab, and be communicated to the Department Public Works, Revenue Board and Revenue Settlement Department for their information.

(True Extract.)

(Signed) J. D. SIM,
Secretary to Government.

To the Department Public Works.
„ Board of Revenue.
„ Director of Revenue Settlement.
„ Superintendent of Revenue Survey.

Exd. S. T. Augustin.

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(True Extract.)

Secretary to Government.

To the Department Public Works.
„ Board of Revenue.
„ Director of Revenue Settlement.
„ Superintendent of Revenue Survey.

REVENUE DEPARTMENT.
FORT SAINT GEORGE,
23rd March 1864.

No. 502.

No. 281.

From

J. D. SIM, Esq.,

Secretary to the Government of Fort Saint George,

To

The Secretary to the Government of the Punjab and its Dependencies.

SIR,

1. I am directed to forward, for the information of your Government, Notes regarding Canal Irrigation recorded by the Members of this Government with reference to the papers on the subject received with your Memorandum of 19th December 1863, No. 3,916.

2. I am at the same time to request that with the permission of your Government, you will be good enough to forward to this Office twelve more copies of the papers above referred to.

I have the honor to be,
Sir,
Your most obedient servant,

(Signed) J. D. SIM,
Secretary to Government.

Exd. S. T. Augustin.

REVENUE DEPARTMENT.
FORT SAINT GEORGE,
23rd March 1864.

No. 503.

No. 282.

From

J. D. SIM, Esq.,
Secretary to the Government of Fort Saint George,

To

The Secretary to the Government of India.

SIR,

I am directed to forward, for the information of your Government, Notes on certain points connected with Canal Irrigation recorded by the Members of this Government at the request of the Punjab Government.

I have the honor to be,
Sir,
Your most obedient servant,

(Signed) J. D. SIM,
Secretary to Government.

Exd. S. T. Augustin.

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Hy de Muttusawmy Esqr

Copy of Memo No
3916 of 19. Decr 63
from the Secretary
to Govt. Punjaub, com-
municd. to this Dept some
days ago - The enclosed
is evidently intended
for the New Dept.

for Secy
20. J Broad

MEMO No. 898

AGRICULTURE.

Irrigation Canals.

Forwards, by desire of His Honor the Lieutenant Governor of the Punjab, three copies of printed papers on Canal Revenue Establishments, and distribution and economy of water.

2. The Punjab Government would be glad to receive any remarks on the points adverted to in these papers, which may aid in leading to practical conclusions on the subjects discussed.

ROBERT MACLAGAN, *Lieutenant Colonel,*
Secretary to Government Punjab.

LAHORE,
19 December 1863.

Canal Revenue Establishments.

Distribution and economy of water.

Minute by Judicial Commissioner, April 14, 1863.
Memo. by Financial Commissioner, June 1, „
Financial Commissioner's No. 2,015, *June* 4, „

Note.—By Secretary to Government Punjab, Public Works Department.

The first of these papers is the Minute prepared by Mr. Cust, after the meetings of the Committee appointed by His Honor the Lieutenant Governor, to enquire into the present system of periodical measurements of irrigated lands, and the means of remedying the evils attendant upon it.

This Minute and other papers belonging to the subject were afterwards forwarded to the Financial Commissioner. With the return of the papers, he sent the Memo. dated June 1. And this was followed by the letter of June 4, containing suggestions on the subject of the distribution and economy of water.

The question first started arose from a review of the Canal measuring establishments employed periodically in re-measuring the lands irrigated by the Canals.

The Sudder Board of Revenue, N. W. Provinces, had, some time ago, raised the question of collection of Canal Revenue in those Provinces by the ordinary Revenue Establishments, instead of, as at present, by special Revenue Establishments under the Canal Officers. The Financial Commissioner having addressed the Superintendent Western Jumna Canals, on the subject, and requested his opinion of the probable reduction of expense by the adoption of this arrangement on those Canals, received reply

from Major Merrick that the reduction would be inconsiderable, as the establishments would still have to be retained for measurement of the irrigated areas, though relieved of the collection of the Water Revenue.

The whole Public Works Establishments of Punjab and N. W. Provinces were under review of Government of India, and their orders were awaited before doing anything further with regard to the question of these measuring establishments. The orders ultimately received did not embrace the Revenue Establishments attached to the Public Works Department. The question of these measuring establishments was then ordered by His Honor the Lieutenant Governor] to be taken up by a Committee, which was appointed after His Honor's return to Lahore from Delhi, (Mr. Cust, President).

Mr. Cust's Minute expresses his views after the discussions held by the Committee.

The system of water rate levied according to amount of water discharged, instead of according to area of land irrigated, obviates the necessity for land measuring establishments altogether; with the additional advantage of economizing water. This system had been introduced on the Ganges Canal. It has been found to be attended with certain practical difficulties due mainly to the quantity of silt carried by the waters of these Canals, and to the variations of discharge by the same opening under the variable conditions of the main channel.

On this account the system has not been adhered to on the Ganges Canal. It has been found expedient to revert to the levying of water rate by area irrigated. The other has been retained in a few instances, when desired by the people using the water. But it is felt by the Officers concerned to be practically untrustworthy.

The arrangement for regulating the volume of water discharged from the Canal into the main distributing channels, as proposed for introduction on the Ganges Canal, is described in paras. 11, 12 and 13 of Colonel Baird Smith's letter, No. 168 A., of 20th May, 1854, to the Secretary to Government, N. W. Provinces, printed with other papers on the subject, by order of the Govarnment. The practical difficulties and probable sources of error were foreseen, and are adverted to in paras. 7, 10, and 11 of that letter, and in para. 7 of the reply, Mr. Muir's No. 1,454 A. of December 11, 1854. But, it was believed, that the errors were capable of being reduced within such moderate limits that the system might be accepted as, for practical purposes, correct. The errors and the uncertainty are found, in practice, according to the experience of the system as hitherto worked on the Ganges Canal, to be of greater import than was anticipated. The introductionof reliable measurement of discharge is, for the reasons before mentioned, very desirable. At present this cannot be done. Till some mode is devised of overcoming the present practical difficulties, the basis of the water rate must continue to be irrigated area.

When the system of measurement of discharge was thus proposed to be adopted on the Ganges Canal, it was at the same time proposed that the system of water assessment should be ultimately a system of contracts for fixed periods; and that with a view to obtain the most reliable data for adjustment of the terms of such contracts and gradual improvement of the whole arrangements, a series of careful measurements should be made, for some time, of the areas irrigated, in connection with the distribution of water by volume, and an Officer should be specially appointed to superintend these measurements, and collect all the information required. The scale for the contracts,

in the first instance, was to be fixed on the basis of the average results obtained on the Jumna Canals. But it was felt how imperfect was the knowledge derived from these for the purpose in view. And though, to begin with, a certain standard of irrigating work done by a given quantity of water had to be adopted,—(the standard was 300 beegahs* per annum for each "paymanah" of water (a defined theoretical discharge†), yet this was nothing more than a rough guide for a commencement. It was obvious that the ratio of the quantity of water to area irrigated is affected by local qualities of soil, as well as by the different requirements of different crops. And further, and more especially, that the area which any given quantity of water was made to irrigate, under a system of assessment according to irrigated area, which offered no inducement to economising of the water, was likely to be a fallacious measure of the work that would be done by a given quantity, under a system which made it the interest of every one using the water to make the most of it and allow no waste.

this is equivalent to a constant supply of about 1565 C feet per acre in 3 months.

* Beegah=625 of an acre.

† 1 Cubic foot per second.

The proposed careful measurement would supply the Canal Officers with the information required to determine the volumes of water to be issued, and to settle the water rate. The same information is required for apportionment of water rate according to the existing system. It is for this purpose that the present periodical re-measurements are made. The disadvantages of these repeated complete measurements were adverted to in connection with the proposals in 1855, for introducing the improved system of water measurement on the Jumna Canals, and "the larger use by the Canal Officers of the land revenue "records of village areas, with the view of reducing the "actual measurement work to a minimum," was one of

the improvements proposed. (Colonel Baird Smith's No. 2,568, 20th February, 1855.)

When this point was discussed by the Lahore Committee, it was agreed that the existing land revenue records in Punjab do not afford sufficiently accurate data for employment for the purposes of irrigation assessment. And one principal reason for the re-measurement each season, namely, that the boundaries of fields are changed by the cultivators, is not met by the use of the land revenue records, unless they are kept corrected up to date with the minuteness required for Canal assessment purposes. And this leads to the question, cannot this be done by the ordinary revenue establishments, so that their records shall, at any time, be correct up to date, and available for the purposes of the irrigation assessment?

It was believed by some of the members of the Committee that this could be done. But it was the President's conclusion, after full discussion of the question, that a separate measuring establishment is required, at least so long as the irrigation in question has not nearly reached its limits, and is extending yearly, as on the Baree Doab Canal.

Mr. Cust, with reference to the proposal that the Putwarees should be utilised for this purpose, states the objections. If the Putwarees kept the land measurement records correct up to date, with the accuracy required for Canal purposes, this would be an extra duty for which they would have to be paid. They have at present, as Mr. Cust observes, to test the village maps annually. For Canal purposes this would be required twice a year.

Mr. Cust's objection to the employment of the Putwarees for the required half-yearly Statement of areas, instead of paying a special measuring establishment, is

that the Putwarees could not do what is required without neglecting their proper duties. This would be a decisive reason against the arrangement. But the objection appears to be made on the supposition that the Putwarees' services would be placed at the disposal of the Officers of the Canal Department. This would, certainly, be objectionable. But it is not necessary, and this has not, it is believed, been contemplated by any of the Officers who have advocated the employment of the land revenue records for Canal assessment purposes, and the periodical correction of these land revenue records by the ordinary land revenue establishments. This would be done under the Officers of their own department. Some of the Civil Officers on the Committee expressed a readiness to try, in their own Divisions or Districts, the system proposed, to carry out the necessary correction of measurements up to date, as required for Canal purposes, and to furnish the Canal Officers, in good time for each irrigation assessment, with the required detailed record of areas. If this could be carried out, the Canal department would still be required to make a few check measurements here and there in order to be satisfied of the general correctness of the measurements on which the work done by the Canal was being exhibited and charged. It is proposed by Mr. Cust that this should be tried in two Pergunnahs.

There are still obvious advantages in keeping the Agency for supplying the data for Canal assessment, which must be ready by a certain time, independent of the possible requirements of another department. But the work required for the purposes of both is so closely the same, that it appears most desirable to save what must clearly be, in a great measure, superfluous,—a direct repetition of work already done and recorded, and the record of which

is available. The annual cost of the separate measuring establishment attached to the Canal department is large. And it has to be considered whether (supposing the land revenue establishments capable by any arrangement of furnishing the data required for Canal purposes) the advantage gained by the employment of a separate establishment justifies the cost at which it is obtained.

Difficulty has been caused by Zemindars altering the boundaries of fields, also by their irrigating at times only part of certain fields. The alteration of boundaries and form of fields cannot be absolutely prohibited, but it might be required that this should not be done without notice; and penalties might be attached to the neglect of this rule. And with regard to partial irrigation of a field area, it might be ruled that no smaller division of land than the recorded fields would be recognised for irrigation purposes,—that the irrigation assessment would be on the area of the field any part of which is irrigated. When this is known, arrangements would be made accordingly, and there would be no hardship or inconvenience.

The further difficulty stated by Mr. Cust, arising from the question—"Did the crop have water, and sufficient water?"—is one which may occur under any system of measurement, and is not necessarily connected with the question of the agency by which the measurements are made. The Canal Department would still, in any case, have to record which fields are irrigated; but this does not require measurement. And the question of sufficiency of water is apart altogether from the question of measurement and record of areas.

Mr. Cust states his conclusions in the form of ten propositions. I, II, V, VI, belong to the general treatment of Canal irrigated lands, and the proposals are, in my opi-

nion, right. The other propositions relate to the question immediately under consideration, and should likewise be accepted; only X. I would put in the form above suggested, which is in accordance with Mr. McLeod's recommendation. VII is the proposal for trial of the plan of obtaining the required field measurements from the Putwarees' records.

Mr. McLeod, in his memo: on Mr. Cust's paper, concurs generally with Mr. Cust, but differs in a few important particulars.

Mr. McLeod remarks on the great importance of the arrangements for distribution of water, and observes that "if this duty were effectively and faithfully performed," "the other duties of measuring and assessing would be altogether subsidiary, and the charge on account of these might be reduced to a minimum," and that "if the several departments of work be systematised and placed on a really efficient footing," "both the cost and the harassment attending the half-yearly measurements will be reduced to something very inconsiderable."

Mr. McLeod does not explain in what manner the improvement of the arrangements for distribution of water would affect the arrangements for measurement of fields irrigated. With the most perfect system of distribution, (except under the system before referred to of assessment by volume of water) the correct knowledge of the precise areas irrigated is still required. So long as irrigated area is the basis of the assessment, the most complete efficiency of the distribution arrangements cannot dispense with the accurate record of field areas. And it is to obtain this that the present half-yearly measurements are made.

Mr. McLeod strongly advocates (para. 9) the retention of the measurement for Canal assessment in the

hands of the Canal Officers, and dissents from Mr. Cust's proposal to give the other plan a trial in two Pergunnahs. The proposal, however, which he adds, is in substance that which was advocated, which would dispense with the detail measurements by the Canal Department, using the Land Revenue records for Canal purposes; the necessary corrections up to date being made by the Land Revenue Establishments, and these corrected data supplied to the Canal Department; thus relieving that department of the costly measurements now under consideration, and requiring only the ordinary check measurements to test the correctness of the data. This, if it can be arranged, will in the fullest manner accomplish the object in view.

Mr. McLeod lastly seconds Mr. Cust's proposal for the entire separation of the Canal Revenue establishments, and their cost, from Public Works Schedules. This last is certainly right. This is not a charge which should belong to a Public Works Budget. But, it has to be remembered, that these special Revenue Establishments do not represent the whole, and that the results shown by their separation and their charge to Revenue would not be completely correct. The Canal Officers themselves, who are Public Works Officers, are the principal members of the Canal Revenue Establishments.

And with respect to the two classes of duties: there are some advantages in their being in the hands of the same establishment, who, in charge of all that relates to their respective sections of Canal, can, along with the supervision of the distribution of water, and land measurements, also execute all necessary repairs and be responsible for the condition of the works. There are obvious disadvantages, besides the cost, in having separate subordinate establishments, on the same ground, in charge of

operations so closely interdependent. But the cost can be distributed.

The question of combined assessment of the Land and Canal Revenues has not entered into the present discussion. But it can hardly be kept altogether apart from the present questions connected with the relation between the Canal and Land Revenue Departments. This combination of assessments is an arrangement which, at one time opposed by the late Colonel Baird Smith, was afterwards fully accepted by him and advocated. He says in 1851:—"It might, to a certain extent, simplify accounts, "and be a slight relief to the people in a single form, to "consolidate the Land and Canal Revenues, and to col- "lect them by means of the Civil Establishment; but "this arrangement is open to so many objections, and "would produce so much embarrassment and difficulty in "carrying on the duties of the Canals, that its introduc- "tion would be followed by consequences far too injurious "to the interests of the State and the people to be in any "degree compensated for by the trifling benefits to be "anticipated from it." (Calcutta Review, No. 23, and Appendix B. Report on Italian Irrigation, Vol. I. p. 326). In 1861 he writes (Report on the Famine of 1860-61, para. 158, page 78).—"I have already explained the "manner in which the Canal and Land Revenue systems "have become partially interwoven. The Settlement Of- "ficer, as a general rule, increases his assessment on "estates watered from Canals by reason of the increased "assets which the command of Canal water insures; and "the proportion of increase may be taken on the average "at about 25 per cent. of the Government demand. Now, I "believe, it will be found to simplify matters exceedingly "if the identification of Land Revenue and Irrigation

"Demands, now made in a partial, be made hereafter in a "perfect manner; and that for a mixed levy, part col- "lected by the Collector, and part by the Canal Officer, "there be substituted a single levy, collected exclusively "by the Collector, but carefully discriminated in Record "and Account, and credited duly to the Land Revenue "and Irrigation Departments in its proper proportions." The collection of Canal Revenue by the Civil Establishments is now carried out on the Baree Doab Canal; but the Land Revenue and Irrigation Demands are not identified in the manner here proposed.

Mr. Cust adverts, before the conclusion of his Minute, to the system of contracts for water, and expresses regret that the system has been abandoned on the Western Jumna Canals. We should look to contracts, he observes, as our great object, whether we arrive at the data on which a contract can be based, by a measurement of the water discharged through a regulated outlet, or by a consideration of the statistics of area irrigated for a long period of years.

Contract based on measurement of water discharged is comparatively simple. There is of course a possible disturbing element in the length and form of minor distributing channel along which the water flows between the regulated outlet where it is measured, and the field where it is used; also in the nature of the soil in which the channel is dug, on the conditions of which depends the amount of loss after measurement.

Contract by area irrigated is affected by varying circumstances in the application of the water. One soil absorbs the water rapidly and consumes a large quantity; another is more retentive at the surface and consumes less. The fields are not used year by year for the

same description of crop. One year there is a crop needing much water, another year a different crop needing little. But the contracts, being for a term of years, and based on the experience of a series of years, would cover the inequalities of requirement of one year with another, and meet the case of special local conditions of soil.

But the point requiring to be taken into consideration in dealing with this subject of contracts based on experience of present practice, is that in the working of the existing system of assessment by area irrigated, there is great waste of water and no inducement to economy. Experience has given the measure before mentioned of average irrigation work done by a given quantity of water, but this is under the operation of a system in which it is known there is waste; and the uncertainty and probable incorrectness of this measure, as a measure of irrigation work which *may* be done by a certain quantity of water, is generally acknowledged. We want, then, as a true basis for contracts, a system which economises the water to the utmost, rather than the existing arrangement which offers no inducement to economy. This is what the system of charge by volume of water issued would furnish. An arrangement is required which, similarly encouraging economy under the present system of charge by irrigated area, shall furnish right data for contracts under this system. Mr. McLeod's letter, No. 2,015 of 4th June, 1863, which is the third of the papers named at the head of this Memo. proposes a plan by which, along with other important ends in view, this much desired object might be effected.

Mr. McLeod's proposition is briefly this. At present the distribution channels are made, for the most part, to deliver the water on the surface of the ground,

so that irrigation is effected by natural flow from openings in the banks of the channel. This method of water supply, which reduces the field labour to a minimum, is that which is most valued on this account, and most highly paid for. Land thus irrigated by water delivered on the surface is charged a high water rate. Land irrigated from channels carrying the water below the ground level, and from which the water has to be raised or thrown, is charged at a lower rate. But it is the easily obtained water which is not economised. The same area of land, when the water has to be obtained by a certain amount of labour, can be served by a smaller total quantity of water. And (which is the important point), the same quantity of water can be made to irrigate a larger area. Mr. McLeod's proposition is that the distributing channels should carry the water altogether below the surface, so that it should not in any case be delivered on the fields by natural flow, but in all cases require to be raised.

By this arrangement the water would everywhere be economized. A certain amount of labour, however small, being required to obtain it, no more would be used than actually required, and the whole Canal supply would go much further, that is, would irrigate a larger area of the whole country. Mr. McLeod has other objects in view in his proposition. In particular the waste which occurs at present, throwing large quantities of water abroad, unused, in the neighbourhood of villages, and which is a fruitful source of sickness, would cease. On this account it has lately been arranged that all the irrigation from the Baree Doab Canal, in the neighbourhood of Umritsur, should be from channels kept within soil.

That the arrangement proposed would, by economy of water, furnish more proper data for a system of con-

The whole water has to be lifted from the channel & such a height above the surface as would enable it to reach the furthest portion of the field - that is it would have to be lifted an average at least 2 feet - a Native would lift say 3000 lb 1 foot high in a man's skin or 1500 lb 2 feet high in the same time 1500 lb = 23·25 Cubic feet so that a man would lift 1395 Cubic feet in an hour, that is he would raise in one hour enough to irrigate fully an acre - 8 acres therefore would require his constant labour for a year - 2000 hours in a year - 365 Jan mull = 4·3 acres duty 4·3 = ·54 of an acre per diem duty ·54 × 90 days = 48·6 Acres for the Crop = 8 persons

tracts than the present arrangement, is a point to be specially taken into consideration. It is very desirable that we should adopt data obtained from the most economical application of water, as the basis of a system of contracts; which it should be our great aim to establish as soon as reliable data of this kind have been obtained. The great importance of fixity of demand on account of water for irrigation in place of fluctuating charge, is set forth in Colonel Baird Smith's Report on the Famine of 1860-61, (paras. 154, 155, 166, &c,) and can scarcely be too strongly insisted on. Colonel Baird Smith's arguments on behalf of fixity of demand are applied to his proposal of a settlement of demand in perpetuity, under a system of measurement of water; and are equally applicable, with but little modification of the value of the results, to demands fixed for a term of years by contract, under a system of charge by area irrigated with utmost economy of water.

Mr. McLeod (see para. 11 of his letter) referred to Captain Dyas for his opinion of the proposed measure,—keeping the supply channels within soil, and allowing no irrigation by natural flow. His reply was that the sacrifice of revenue would be so enormous that it could not be thought of. Mr. McLeod, in his paras. 13, 14, rightly disposes of this objection. Even were this a necessary and permanent consequence, the other interests involved are of greater importance than the realization of Revenue; and if the other benefits anticipated can be secured, the results would be profitable to the country and to the Government. But, perhaps, the permanent diminution of Revenue also is over estimated. The Government Revenue would, in the first instance, be reduced, for all the area irrigated would be charged at a lower rate, for water

requiring to be raised. But the extension of area irrigated, owing to the greater economy of the water, would again make an addition to this item of Revenue, whilst it has the far higher advantage of benefiting, with the same quantity of water, a much larger extent of country, enlarging the shield of protection against unfavorable seasons, and placing a larger body of the people in circumstances of comparative ease and 'security.'

It is true that where irrigation by water delivered on the surface is already enjoyed, the proposed arrangement would require more field labour. And, possibly, as a result of this, labour generally might become more scarce and dear in irrigated districts. But it is questionable whether in reality more hands altogether would have to be employed, or whether the amount of labour required in connection with irrigation would not be merely a more full and wholesome employment of hands now in great measure idle, where the water required is obtained with so little trouble. Nor is it to be forgotten that the very facility with which the water is obtained, when on or above the level of the land, occasions frequent demands for active exertion without option as to time, and so requires attendance and watchfulness, while water below the surface would give no occasion for anxiety or trouble of this kind.

The amount of labour also, to raise the water, would not require to be great, for the water need not be far below the surface. Just below the surface would answer the ends in view. None of the more costly and laborious appliances for raising water from a depth would be required. Various mechanical arrangements of a simple and economical kind would be used, requiring a very small amount of labour.

In Sindh, where the irrigation has hitherto been entirely from Inundation Canals, carrying the water generally at some depth below the ground level, and only partially supplying lands on which the water can be run without being raised, it is now desired to have permanent canals, delivering the water on the surface. But the inconvenience felt there, and the dissatisfaction expressed with the present style of irrigation canal, are due to the amount of labour required, for the most part, to raise the water to the surface, and, more especially, to the fluctuating height of the supply, dependent on the varying conditions of the river; requiring different applications of labour at different times, and so interfering with all fixed arrangements for employment of available labour; occasioning superfluous expense, and affecting the confidence and comfort with which the field operations are carried on. See Captain Fife's Sketch of Irrigation in Sindh, with proposal for its improvement. (Selections from Records of Bombay Government, No. LXIX. 1863.)

Captain Fife states the requirements of an irrigating canal to be "*first* that it shall contain a stream, which may "be increased or diminished at pleasure according to the "demand, and quite independent of the changes of the "river; and *second*, that it shall feed or supply the water "at a proper level— that is, a little higher than the level "of the land to be irrigated." (para. 59.) And the resolution of the Bombay Government on Captain Fife's projects observes:—"The last named advantage," (a higher level supply) "is as, a general rule, the only one which "greatly increases the Revenue. If a man can cultivate a given area when he has to raise the water, "say three or more feet, it is obvious that if he can "obtain water by a smaller expenditure of labour, or,

"better still, without raising it at all, he can cultivate "a very much larger area. Improvements therefore "which afford a high level supply of water directly meet "the great obstacle to an increase of revenue, by "enabling one man to do the work of many." (para. 75.) This observation is made with reference to the scanty population of Sindh as the great obstacle to increase of revenue. And, it is assumed, that by liberating a large proportion of the labour now employed in raising the water for irrigation, a larger area of land will be brought under cultivation, and more revenue raised. The argument appears to be applied entirely to the extension of cultivation, not to the higher water rate to be charged on irrigation by free flow on the surface. A large extent of irrigation, it is true, will follow from the arrangements which provide a constant instead of a temporary and fluctuating supply of water. The possible extent of irrigation is dependent on the quantity of water available. But, the constant supply having been secured, it will, for the reasons above given, not follow that the quantity of water available will go further when delivered on the surface, unless it is paid for by volume discharged. So long as we have not the means of satisfactorily carrying out this inducement to economy, the best mode of securing this object and the maximum irrigating power of a given quantity of water, is by keeping the supply slightly below the surface of the ground and requiring a known small amount of labour for its application.

It should be observed that with water-courses carrying the water only a little below the surface, it would be necessary to adopt measures for carefully guarding against the practice of furtively damming up the water-course so as to raise the level and obtain a surface flow.

One other point, with reference to keeping the distribution channels within soil, has to be noticed. In one of his lectures at Calcutta, Sir Arthur Cotton, adverting to the measures adopted for rectifying some of the evils experienced on existing Canals in the N. W. Provinces, by carrying the main Canal within soil, observes that this, which has been done on the Ganges Canal on the recommendation of the Committee appointed to report on the project, is a measure of doubtful propriety, and may lead to some of the evils it was intended to correct or prevent, inasmuch as by cutting a deeper channel, a retentive soil near the surface may be cut through, and a more permeable soil reached, which will allow percolation producing swamps, besides occasioning great loss of water.—(That is, loss of water to the Canal and Canal irrigation. Much of this percolation goes to raise the water level in adjoining wells). This argument against making the channel within soil may be of force in the case of the larger excavations for main Canals; and not with such frequency there as to discourage the arrangement referred to; for the conditions of soil near and below the surface which are assumed in the argument, are not general, though they have been found to exist to some extent. More retentive soils are also met with under surface soils more permeable, and advantage gained with respect to the point in question, instead of loss incurred, by carrying the channel within soil. But in any case, the argument used with reference to main Canal channels would not be applicable to the minor water-courses; and objection on this score could not be brought against the proposal now made by Mr. McLeod.

The advantages of the arrangement, effectively worked, are great. The economy of the water and consequent

extension of the usefulness of any given supply, the enlargement of the area of cultivation secured, the reduction of waste causing unwholesome swamps,—these are objects so important that it seems most desirable to try the proposed system on a large scale as suggested by Mr. McLeod, in laying out the distributing channels of the next of the new divisions of the Baree Doab Canal not yet constructed, with a view to the extension of the system, should it then be seen to be advisable, to the other Divisions.

With such a system, on which it would be the interest of all using the water to economise it, we should obtain more satisfactory data for a system of contracts, than we can have at present.

There is yet one method by which the advantages could be obtained of dispensing the water by volume, instead of measuring by area irrigated. Various circumstances before referred to prevent measurement of direct discharge being depended upon, and used as the basis of the water rate. But water delivered into reservoirs of definite form periodically filled from the Canal channels, and from which reservoirs the field water courses could be supplied, could be measured with precision. An immovable water-gauge marked on the vertical side of a reservoir would allow of water being supplied in any desired quantity with exactness, and according to a measure unmistakeable; and of its being charged for by bulk in the most simple manner like any other commodity. And with a still water supply which could be used at pleasure, and not at particular times only when the water is admitted into the distributing channels, the convenience of the cultivator would be served while the desired inducement to economy of water would be furnished.

"In any system of measurement of water for irri-
"gation," Colonel Baird Smith observes, in his Report on Italian Irrigation (vol. II., p. 6) "there are two distinct "ideas involved, which it is desirable to define clearly, "and to keep separate in the mind. There is first the "idea of a unity of measure, apart altogether from the "means which may be taken to insure its application "in actual practice. Considerations of expediency will "determine, in different localities, the special selection "of this unity. It is sometimes the quantity of water "which issues from an opening of fixed dimensions, with "or without a certain pressure; at other times it is the "quantity of water which irrigates a given area of land "under certain fixed conditions, and so on in different "terms under different circumstances; for while one "unit might suit the agricultural conditions of Italy, "another might better suit those of India. The second "idea involved in a measurement system is that of the "special apparatus by which the volume of water as defi-"ned in terms of the established units, is measured and "issued." With Canals employed to feed reservoirs, we should have a third and still more direct and simple mode of measurement of water, and altogether independent of a special apparatus—the second idea above referred to as involved in a measurement system; or rather, the special apparatus being simply the reservoir itself.

It is of course certain that reservoirs so numerous as would be required for the general adoption of this system on any Canal would involve a very large first outlay. But it need not be prohibitory—the system would effect much gain and admit of compensating savings in other ways.

The frequency with which the reservoirs would have to be filled would depend on their size. There would be

economy of first outlay in making them small. There would be greater advantages in having them large.

One special advantage of the use of reservoirs (and particularly large ones) would be this. At present during the time the Canal is necessarily closed for annual clearance and repairs, no water can be obtained for irrigation This closing of the Canal takes place at times specially chosen, when it is not generally likely to lead to inconvenience. But the weather may, during this interval after the Canal has been closed and the repairs commenced, be unfavorable, and water be much wanted. By having the reservoirs filled just before the closing of the Canal, there would be a store available in case of necessity; and the inconvenience and loss would be, in great measure at least, if not altogether, provided against.

It is scarcely worth while to consider that these reservoirs would likewise serve to store a small supply of rain water. The quantity thus collected would not be of great value, but so far as it goes it is another utility of the arrangement.

Canal water is at present charged at different rates according to estimated volume, for irrigation purposes, and for supply of village tanks. When water is given out by measured volume for both purposes, the arrangements would be simplified by discontinuance of this distinction. Indeed this might be done, though not with the same certainty, even now. It is in reality a matter of no possible concern to the proprietor of the water, what is done with it, once it is given out. All that is required is a fixed rate for a defined quantity.

Special precautions would of course be necessary, in managing a system of water supply to reservoirs, to

prevent irregularities. It would probably not be difficult, for instance, to apply a detective syphon gauge, which would check the height to which a reservoir had been filled: and such other checks as might be necessary would be employed.

The use of reservoirs, furnishing simple and intelligible means of giving out water by volume with accuracy would attain the three great objects which have been under consideration,—economising water, and so enlarging the area of protected cultivation as well as preventing abuse leading to unhealthiness,—supplying ready and reliable data for contracts,—and dispensing with the vexatious and costly periodical field measurements. And if not found open to insuperable objections, the arrangement seems worth a trial.

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Minute on the Revenue Establishments of the Punjab Canals.

The result to be aimed at is to secure economy without sacrificing efficiency, and to utilize existing Government Establishments without impairing the independent action of the Canal Department.

All land irrigated by Canals should be assessed for the Land Tax at dry (Baranee) rates only: the Canal authorities should with the sanction of Government be allowed to raise the water rate to such a scale as is justified on commercial principles: all percentage allowance to village officials must be taken into consideration, when we fix the Establishments.

I lay great stress on these points, as the percentage of the Establishments which are now to be fixed, will be greatly affected by the amount of water rate which can be levied; and if we are going to reduce Canal extravagance, we must do justice on the other side also.

There are two possible ways of assessing the water rate.

A. By the volume of water discharged.

B. By the area of land irrigated.

It is admitted for the present, that the first expedient cannot be adopted, but we ought always to look to that, as an object to be attained, and consider our present arrangements as only temporary; and we should collect statistics, even if this caused some increase of cost of Establishments.

In adopting the second expedient, we have the alternative of

A. Employing the Tuhseel Establishments.

B. Entertaining a separate Establishment.

The Canal requires Establishments for the following

purposes in the Revenue Department, as distinguished from Works and Repairs:—

I.—Protection.

II.—Distribution of water.

III.—Assessment of demand.

IV.—Collection of Water Tax.

V.—Collection of Statistics.

It is admitted on all hands that for Class I and II separate Canal Establishments must be entertained; and the same may be said of Class V.

Round Class III and IV there ranges a considerable controversy. The extreme right—the Canal Officers—would entertain separate Establishments, as is the case in the Western Jumna Canal: the extreme left would entrust both these duties to the ordinary Revenue Establishments in whole or part. I confess that I myself occupy a middle position. I would never surrender the principle that the collection of water tax is to be made by the same officials who collect the Land Tax—(Class IV), such is the practice in the Baree Doab Canal, and I would at once peremptorily introduce it on Western Jumna Canals, as in fact is already the case with the Raja of Jheend on that Canal.

But I can go no further: I consider the circumstances of the Baree Doab Canal very exceptional, as irrigation has not nearly reached its maximum, or even an average development. For the next five (5) years this Canal must have a separate Establishment for class III. As regards the Western Jumna Canal this argument will not hold, and I should like to have some further discussion. But for the present I must assume the two Canals to be similarly situated.

Establishments will thus be required for class I, II, III and V, but we may leave class V for subsequent discussion, and confine ourselves to the three first classes.

Major Gulliver has handed in a scheme, but to bring the discussion to a profitable end we must have proper English Nomenclature to each post. It appears to me that the following posts are required:—

Class I.—Watchman, ... (Chowkydar.)

Class II.—Water distributor, (Zillahdar.)

Class III (1).—Land Measurer, (Mohurrir Paimaish.)

(2).—Chain man,..... (Mirduha.)

(3).—Tester,..... (Mohurrir Pertal.)

Over all would be the

Supervisor, ... (Nat. Dep. Collector.)

The exact number and salaries of these officials can be fixed for each Division of the Canal on a general principle.

At present the village Lumberdars receive (5) five per cent and the village Putwary receives (1) one per cent on the Water Tax of their village for *general* service. I would propose to allow the Lumberdars (2) two per cent for the trouble of collection, and the village Putwary nothing, for no *extra* work would be demanded from him.

The idea has been started that the Village Putwaries can be utilized, and that a large portion of the duties of Class. III could be delegated to them: of course they would have to be paid: the extra duty could not be thrust on them. The Canal Officers are of course opposed to this measure, and I agree with them, though perhaps from different reasons. I would certainly employ the Revenue Establishments of Government, if I thought that they could do the work: but I do not think that they can without neglecting their own proper duties. Moreover I look upon the Putwary as a private soldier in a Regiment, in which Canoongoes are the officers, and the Tuhseeldar the Commandant; and I object to the Putwary's services being placed at the disposal of Canal Officers.

I feel sure that such a plan would end in grief: the Putwary would play off the Canal officer against the Tuhseeldar. No man can serve two masters, or render a divided homage: certainly not a village official.

The Putwary is the village accountant, not only of one village, but of a cluster of villages. In some of them there may be Canal irrigation—in others there will not be, *but he is the servant of all*:—he must live within his jurisdiction, he is the indispensable witness in every summary suit, the necessary witness in every Regular Revenue suit: he has to visit the Tuhseel periodically to exhibit his Diary, he has to note every change in the proprietary: he has to test the village map annually, and to file his annual papers by the agricultural year: great delay even now occurs: the Putwaries are not handled satisfactorily: they are constantly absent:—the existing arrangements are often anomalous, and in no District final.

Now the demand for the Water Tax must be ready at a certain date: it can only be made up after careful measurements of the land, well tested, and then applied to certain facts, which are only known to the water distributors. The collections have at once to be made on this demand by the Tuhseeldar, and a ready answer must be available to all objections to the entry, or claims for remission.

The Putwary can never manage this: he is *supposed* to inspect the cultivation of each village, and correct the field map, or at least make memoranda of the changes; but I much doubt whether this is ever done, and it would require a frightful pressure to get it done, and it would never be done in time to enable the collection to be made.

I by no means however wish the Canal Officers to revert to the pernicious practice of annual or half yearly measurements of irrigated area by untrustworthy measurers,

nor do they wish it themselves. Once for all let a good field measurement be made of all Canal lands, or lands capable of irrigation: let a separate field map and index be made, and become the basis of the Canal Revenue Record: and this must be tested every year, and corrected up to date, before the demand paper is prepared. Thus an unusually large establishment will be required this year to conduct the measurement: the Putwary will of course be in attendance, *as it is his duty to be so*, both during the measurement and the annual testing; but it must be conducted by a separate body of men, Class III of the Canal Establishment.

Khusrah and Shujrah.

Girdawuree.

Jumabundie abpashee.

As regards identity of fields, the Zemindars must be informed that the Canal Officers will not supply water to parties who capriciously alter the size and physical appearance of their field. It is believed to be quite unnecessary to do so, when once irrigation is established.

Then Captain Dyas's two requirements will be met.

I.—To identify a field when once it has been measured.

II.—To prevent the Zemindars from altering its size and shape.

In the Districts of Goordaspore and Amritsur the Settlement Officers could have these maps prepared at small cost: in Lahore District, and on the Western Jumna Canal the new Map must be specially prepared.

The Salaries of the Canal Establishment should be regulated according to the analogous grade of Revenue officials holding similar posts. Nothing is so bad as capricious salaries in different Departments of Government Service. The same classes of men should be employed, and the machine will work much easier, if this point is attended to, and Canal men get occasionally promotion

in the District Office, and *vice versâ*. The natural antagonism of rival Departments will die away.

However, with a view of satisfying ourselves on the point, whether the services of the Putwaries can or cannot be utilized, I propose that two Pergunnahs be selected Puthankote in Goordaspore District, and Lahore; and that the duty of preparing the jumabundie abpashee from Rubee 1863-64 be specially entrusted to the Tuhseeldars, who will work through their own establishments. The Canal Officers would in those Pergunnahs entertain no establishments, with the exception of the Testers (Mohurrir purtal) who would follow the Putwaries, and check so many fields.

I am by no means sanguine about the success of this, but Mr. Robert Egerton states that it can be done, and I have therefore selected one Pergunnah in his old and one in his new District:—the measurements should be at once commenced upon. I understand that Mr. Egerton insists on the field Map and Index being correct, and tested by Canal subordinates, as a condition precedent to his undertaking to prepare the jumabundie. It must never be forgotten that when the Putwaries have made their annual inspection of the field, and have certain columns in their return filled up, showing the area, and proprietory, and cultivators, and crop, they have still to apply to the Distributor of water, and Watchman, both Canal servants (Class I and II,) to know the facts about the supply of water; and it is just here that the difficulty will arise: the issue will be—"Did the crop have water, and sufficient water?" On this the justice of enforcing the demand will depend, and just at this critical point there will be a collision of the Canal Servants and the villagers—*for* the Putwary will certainly side with the villagers, whether they are right or wrong.

I would make the supervisor Deputy Magistrate, and vest him with the power of a Sub-Magistrate of 2nd class under the Sessions Judge; and of a Deputy Collector under the Commissioner of Revenue. The Officers selected should be well paid, and carefully selected.

My propositions are therefore:—

I.—That all Canal land be assessed at baranee rates.

II.—That the water rate be at once raised, and fixed on commercial principles.

III.—That the percentage paid to Lumberdars and Putwaries be included in the Schedule under consideration.

IV.—That separate Establishments be maintained by the Canal Department for Class I, II, III, V.

V.—That on the Western Jumna Canal the collections be at once transferred to the Tuhseeldars.

VI.—That a moderate but sufficient scale of Establishments with a fixed English nomenclature of posts, and a scale of salaries analogous to the other Revenue Establishments of Government be fixed.

VII.—That the experiment of employing the Putwaries be tried in two Pergunnahs.

VIII.—That two per cent be allowed to Lumberdars for the trouble of collection: if the water tax is properly raised and irrigation extended, this two per cent will be as good as 4 per cent on the old rates.

IX.—If the Putwaries are employed, they must receive two per cent on the collection for their extra trouble: if they are not employed they should get nothing.

X.—That Zemindars be warned that if they alter the shape of their fields, after they have once assumed a proper contour for irrigation, the Canal Officers will refuse to deal

tention of very much the largest portion of the Fiscal Establishments of the Canal. It is in this Department that by far the greatest opportunities for peculation, favouritism, and injustice, must occur, as in dry seasons especially large sums will readily be given by Zamindars for a copious supply of water at the critical moment. All sorts of fraudulent practices on the part of the Zamindars have to be guarded against, as well as peculation and collusion on the part of the Canal Establishments; and efforts to prevent or counteract these must be continued during the whole period that water is being drawn from the Canal.

5. For so delicate a duty I consider that a very reliable and trustworthy description of Establishments should be provided. At present it is performed by Choukidars acting under the control of Zilladars and their Deputies, and I doubt much whether the pay of either of these classes is such as to render them proof against ordinary temptation. If this duty were effectively and faithfully performed, I believe that the other duties of measuring and assessing would be altogether subsidiary; and the charge on account of these might be reduced to a minimum. I would strongly advise, therefore, that these Establishments be put on a thoroughly effective footing. Whether their numbers could or could not safely be reduced, I cannot undertake to say, but I am of opinion that the scale of monthly pay for an ordinary chowkidar ("Mehr-ab" as he is called in Peshawur) should certainly not be less than 6 rupees, while there should be superior grades drawing 7 and 8 rupees respectively with Jemadars drawing 10 and 12 Rupees, to keep them under control. The Zilladars or Overseers, and their Naibs, should, I think, in like manner have gradations of pay, the former ranging from 50 to 80 Rupees per mensem, the latter from

25 to 40 Rupees, with Darogahs or Superintendents over them ranging from Rupees 100 to Rupees 150.

6. The other Department to which I have above referred, that of Judicial Establishments for adjustment of disputes, does not appear to have been in any way provided for since Mr. Birnie Browne was withdrawn from the Canals, and I consider it most essential that it should be so without delay. It is not to be expected that Officers selected for their Engineering qualifications and untrained to Judicial proceedings, can as a general rule be qualified for hearing and disposing of complaints brought by Zamindars or others, and I should anticipate the occurrence of very great evils, if this matter be not looked to at an early date.

Judicial Establishments.

7. I agree with Mr. Cust in thinking that the functionaries entrusted with such investigations should be of the grade of Extra Assistants and assimilated to these in gradations of pay, though whether their interchange with those employed in the general Civil Administration would be expedient, may, I think, be doubted. I would have it understood, that the primary duty of these functionaries must be the adjudication of disputes, but there would probably be no objection to their exercising a general control over other establishments, especially those engaged in measuring and testing.

8. In principle these Establishments should, I think, in their Judicial capacity at all events, be independent of the Canal Officers; and if ever Canals be made over to private associations, they must necessarily be rendered so. But Captain Dyas is of opinion that an appeal should lie from them, in the first instance, to the Executive Engi-

neer; and if he deliberately adhere to this opinion I would not oppose him, for the present at all events.

Measuring Establishments.

9. As regards the work of measurement and assessment; I have remarked above that if the duty of Distribution be effectively conducted, I believe the requirements for the other duty may be reduced to a minimum. But however this may be, I agree with Mr. Cust in thinking it must remain under the Canal Officers; and for the reasons given by him, I should consider it wholly inappropriate to entrust this duty to the Putwaries, in so much that I would altogether deprecate even the partial experiment which he consents to concede in a few Parganahs. A copy of the Shujrah of each village prepared in connection with the Settlement, may appropriately be made over to the Canal, with all alterations noted on it that may have subsequently taken place; but it will still be necessary for the Canal Establishments to test and satisfy themselves of its correctness.

Maintaining form and distribution of fields unaltered.

10. I am not prepared to support any proposition prohibiting all alterations in the size and shape of fields. But I would make it obligatory on the Putwarie to report to the Canal Department, immediately after each sowing has been completed, any changes of these that may have been effected. The Proprietor of the land might be held jointly responsible, and penalties might be attached by the legislature to the omission of this report. Whether a system of contracts will ever be practicable, remains to be seen. I doubt it myself; as it would be likely to fetter the Department in regard to improvements, arrangements for distribution, and in other ways. But however this may be, if the several departments of work be systematized and placed on a really efficient footing, I believe that both the cost and the harassments attending the half yearly measurements will be reduced to something very inconsiderable.

Remuneration of Lumbardars and Putwaries.

11. Lastly, as regards the remuneration of Lumbardars and Putwaries, I can conceive no reason whatever why the percentage allowed them should be less for their duties connected with Abiâna, than for those in connection with the ordinary Land-Revenue. As regards the enhanced rate of Abiâna, it is obvious that whatever increase is made in this, there must be a corresponding decrease in the Land Revenue; while the responsibilities of the Lumbardar in regard to general control, supervision, and collection, will remain the same. The responsibilities of the Putwarie, in like manner, as to accounts and records of all kinds, will be the same as regards this item of Revenue as in respect to Land Revenue, and I look upon it as of very great importance that in all cases of dispute, his evidence shall be available to the Canal Judicial Authorities; and that he be required therefore to keep himself informed as to the state of affairs, in connection with irrigation, no less than with cultivation. The Lambardar and Putwarie should, I think, be regarded, to some extent, as a check upon the Canal Establishments.

12. Having now adverted to all the points on which I have to any extent differed from Mr. Cust, I would very earnestly second his representation as to the absolute necessity for entirely separating these Establishments and their cost from the Public Works schedules. Whether they be provided for by a percentage on the income, or drawn for in abstracts according to schedules previously sanctioned, it is quite obvious that they are fairly chargeable against the Revenue derived from irrigation, and cannot properly be regarded as a Public Works charge. So long as they continue combined with the Establish-

ments for construction and repair, an injustice is done to the Department of Public Works. While justice will not be done to the fiscal interests of the Canal until this is rectified.

D. F. McLEOD,
Financial Commissioner for the Punjab.

1*st June* 1863.

No. 2,015. *From D. F. McLeod Esq., Financial Commissioner Punjab, dated Lahore, 4th June,* 1863. *To the Secretary to Government D. P. W. Punjab.*

SIR,—Having recently forwarded to you (demi-officially) a Memorandum on the subject of establishments for the fiscal administration of Canals, I have now the honor to offer the following remarks on a branch of the subject not referred to therein, vizt. arrangements for economizing the water supplied by Canals.

REVENUE. Arrangements for economizing the water supplied by Canals.

2. That it is very desirable to economize the supply of water is no doubt generally felt and admitted, but to realize and appreciate the immense interests that are involved, it seems to me that we must look deeper than many of us are wont to do, and I purpose accordingly to advert separately to each of the following considerations, which I regard as comprising the principal points to be dealt with, in discussing the subject.

1st. The importance of turning to the fullest account, in the interests of the Agricultural population at large, the limited supply of water available for each of our permanent Canals.

2nd. The duty incumbent upon the Government, of preventing such flooding of the country as must prove injurious in a sanitary point of view.

3rd. The desirableness of regulating the supply afforded to each individual; with a view to render our taxation just, equal, and easily adjusted.

3. As regards the first of these I would observe, that in my opinion the most important function of Canals or other artificial means of irrigation in India, is that of PREVENTING

Extending irrigation to its utmost limits.

FAMINES. However great may be the gain to the country and the Government of extending cultivation and population, and increasing production, I regard it as a much greater gain to be able to guard against famine over the area so cultivated. It is, I believe, a very general impression both here and in Europe, that improvement of communication, by equalizing prices of food, is the one measure required to prevent famines; but this appears to me to be quite a mistake. The equalization and lowering of prices which improved communications must effect, will, no doubt, be an immense boon; and the increased activity and progress in the nation at large, necessarily resulting thereupon, will afford greater scope for the starving agriculturist to find occupation. But famine, properly so called, only occurs when the preparation and sowing of the land has become impossible, from want of rain; and the liability to this can only be averted by artificial irrigation of a reliable character.

Which, however important as a means of increasing production, is mainly urged on the ground that irrigation is the only effectual preventive of Famine.

4. Where a crop has been sown, but the out-turn proves deficient, great distress will, no doubt, be experienced —but there will not be a real famine. Where, however, the land remains unsown, the occupation and the credit of those who have no capital and wholly depend on agriculture, are at an end—famine being the necessary result. In the Peshawar valley, wheat flour was selling in December 1854, at 6 or 7 seers per rupee; which is a higher price, I believe, than was at any time attained in the famine Districts during 1860—yet there was no famine; as the people were employed, and a harvest was in prospect; and none of those appalling scenes occurred, which were witnessed in Delhi, Goorgaon and elsewhere, during the late famine period.

5. Those who have witnessed such scenes will fully appreciate the terrible character of the danger which we

have ever at our doors; and the vast importance of every thing which may tend to avert it. Happily for India, however deficient the rain fall in the plains may be, the supplies derived in various ways from the hill regions, always keep our rivers more or less filled. They never dry up, as the Nile must have done, on the few occasions when a famine is recorded to have occured in Egypt. And although towards the close of the spring harvest, their waters sometimes fall below the desired level, I believe that no deficiency is ever felt, when the land has to be prepared for, and sown with crops of that harvest. The cultivation of the soil, therefore, and the production of a crop more or less abundant, being an absolute certainty wherever the water of our Canals can be conveyed, how paramount a consideration it becomes, that the available supply be made to go as far as possible.

6. The next point on which I have to remark is that which relates to the unhealthiness caused by Canals. How fearful have been its effects in the alkaline soils watered by the Western Jumna Canals, the Government is well aware. But familiar instances of unhealthiness in a less aggravated form, might be adduced from many quarters. It has been urged that where a Canal is carried along a watershed, the same evil results will not ensue, as where its alignment is defective; and this no doubt is true. But nevertheless experience appears conclusively to show,—and all fresh enquiries corroborate the fact,—that wherever flooding takes place, and the water is allowed to stagnate, there spleen diseases and fever are sure to follow: in so much that not a few of our medical men anticipate an entire change in the sanitary condition of the country watered by the Bari Doab Canal, when it shall have been a few years in operation. Of what moment then it must be, to

Prevention of flooding as productive of disease.

devise, if possible, some method by which the supply of water may be regulated, and flooding prevented.

Equalising the incidence of the water Tax.

7. The third point which I have noted above as calling for remark, is the inequality of incidence of the water tax under existing arrangements, and the desirableness of amending this, if possible. All attempts to measure the flow of water have entirely failed. The actual measurement of area irrigated involves many sources of uncertainty and inequality; especially in consequence of the great difference in the amount of water absorbed by different crops, so that even where these are charged at different rates, a mere rough approximation to the truth is all that can be attained. The evils and grounds of dissatisfaction resulting from this inequality, it cannot well be doubted, are many and various.

8. Having now adverted to the principal evils which appear to me to result from the want of a method by which the supply of water can be regulated, I proceed to consider whether this want can be supplied, and how.

9. If a module could be devised capable of showing with even tolerable correctness the flow of water through any given aperture, this most desirable object would be attained in the most satisfactory manner; every cultivator would be charged in proportion to the quantity of water he received. The people themselves would take care that there should be no waste, and flooding might, I believe, be entirely prevented. But the large majority of officers most competent to judge, appear now to despair of its ever being possible to apply such a module here. Captain Dyas states that a velocity of 2½ feet per second is necessary to prevent silting,—that where the silting is at all considerable, no module can act; and as it is quite impossible to

obtain in our Râjbahas, or main water courses, except near the head of the Canal, a slope any thing approaching that required to secure the above velocity, he entirely abandons as hopeless all endeavour to measure by means of a module; and I am myself strongly impressed with the belief that he is right.

10. The only other method, it appears to me, by which the supply of water can be controlled is by keeping our supply channels *below surface*, so that water can only be supplied to the fields by the application of some mechanical arrangement for raising it; and it is with a view to urge enquiry and collection of statistics on this point, that I now address you.

11. I lately enquired of Captain Dyas what he would think of such a measure, and his reply was that the sacrifice of Revenue would be so enormous, that it could not be thought of. I have since learned, that owing to the unhealthiness produced by Canal irrigation around Amritsar, its adoption there has been determined on; and that although a large outlay is considered necessary in order to carry it out, the required amount has been sanctioned.

12. What engineering difficulties might be involved in the adoption of the principle generally, I am not competent to judge. It would no doubt be a most serious matter, if it should involve a remodelling of either our Canals or Râjbahas, as they at present exist; but it seems to me that no such necessity would exist, if mechanical devices can be suggested, by which the height of water at the head of the smaller distributing Channels might be kept uniform, in somewhat the same way as the supply of water to smaller cisterns from larger ones is ordinarily regulated.

13. As regards the loss of Revenue, I think it not unlikely that it might ultimately prove less than may at

first sight appear. The height to which the water would have to be raised, and the consequent amount of labor required, would be small, while improved methods for applying this labor, of a simple but effective character, could doubtless be devised; so that there should be no very serious diminution in the value of the water to the cultivators, while the increased area from which a water tax would be obtainable, should go far to make up the difference.

14. The other interests involved however, upon which I have dwelt in the foregoing paragraphs, appear to me to be in the aggregate of vastly greater importance than the realization of Revenue; so that even if there should be a considerable loss of income, yet if the other benefits resulting from the power to regulate the supply of water, can be secured, I believe that the country and the Government would be very greatly the gainers.

15. The extension of irrigation from the Bari Doab Canal appears to me to afford an admirable opportunity for putting the question to a practical test, if there should not be valid reasons to preclude a trial being made at all. The supply of water from the Rávi is wholly inadequate to afford a moiety of the irrigation required for this Doab, so that nowhere can the utmost economy of water be more indispensable. In the comparatively moist tracts near the head of the Canal, some, no doubt, would refuse to pay for water, if labour were required to raise it to their fields; but this would be a boon to the thirsty tracts lower down, where artificial irrigation is an absolute necessity, and where, in consequence, no such objections could prevent the people from gladly taking water; while in tracts to which no water has hitherto been supplied, Government is entirely free to enforce such conditions as it may deem advisable.

16. Irrigation is the great want of most parts of India – of none perhaps more than of many portions of the Punjab. The subject is one which yields in importance to none. If then my suggestions should be deemed impracticable, I trust I shall not be regarded as having gone out of my province in thus urging them.

I have &c.,

D. F. McLEOD,

Financial Commissioner for the Punjab.

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Memorandum

The accompanying Memo-
-randa having been forwar-
-ded by the Punjab Govt.
with a statement that
any remarks would be
acceptable which might
aid in leading to practi-
-cal conclusions on the sub-
-ject under discussion.
As similar, ~~[illegible]~~ or rather
analogous questions have
for some time past been
discussed in this Presi-
-dency, and as, after a
good deal of consideration,
I have arrived at conclu-
-sions differing in many
respects from those which
seem to be laid down as
Axioms in the ~~[illegible]~~
Memoranda, I may
as well submit my
views for the consider-
-ation of the Govt of the
Punjab —
I cannot, of course, pretend
to give an opinion upon
the suggestions made for

...ntelligency for various classes
...f officers now employed,
...taken by the Canal Despt;
...without of the Revenue, but
...Dam in a position to dec-
...cide the primary question
...of the mode of shewing the
...Water Rate; as well as the
...secondary questions of
...the position, whether under
...or above the Lock, of the dis-
...tributary channels; and
...the mode of determining
...the Area of Irrigated Land —
...In dealing with the question
...of the mode of shewing the
...Water Rate, Mr Crust lays
...down, as a broad Axiom,
..."that all Land, irrigated
..."by Canals, should be
..."charged for the Land Tax
..."at any (Variance) rates
..."only." and the Canal
..."authorities should, with
..."the sanction of the Govt,
..."be allowed to raise the Water
..."Rate to such a scale as is
..."justified on commercial
..."principles" he then goes
...on to say that there are
...two modes of shewing the
...Water Rate
A. by the volume of water discharged
...by Canals
...The experience of the Madras
...Presidency is decidedly ad-
...verse to such a system —
...In the first place this dis-
...proportionment is, with refe-
...rence to a great deal of land,
...a purely hypothetical opera-
...tion of value; for
...much of the land which
...is valuable when irrigated,
...would never be cultivated
...at all unless water could
...be supplied to it — and, in
...the second place, this dis-
...proportionment, if we go so far as
...to suppose it to be an accurate
...measure of the relative value

I suppose this that the Canal
authorities are to be permitted
to make the most of the article
they have to sell, subject to
the reservation that the rate
should be uniform, whether
it be by the Acre Land, or Unit
of Volume, or the Acre, as the
Unit of Area irrigated —
Whenever this rule of
dispensing Land at dry rates
and adding a separate
charge for water supplied,
do thoroughly established
as to justify us, in dealing
with the state of things in
India, to assume it as an
Axiom — if not be so, why is
it necessary to limit the
application of water supplied
by Canals?
The experience of the Madras
Presidency is decidedly ad-
verse to such a system —
In the first place this dis-
proportionment, with refe-
rence to a great deal of land,
a purely hypothetical opera-
tion of value; for
much of the land which
is valuable when irrigated,
would never be cultivated
at all unless water could
be supplied to it — and, in
the second place, this dis-
proportionment, if we go so far as
to suppose it to be an accurate
measure of the relative value

[illegible] soil of the present year
whereunder dry cultivation
is not in any way affected
=ment of that relation takes
place when these Soils are irrigated
at all events the dry assess
=ment added as a fixed
charge for water, is found
in Madras to be a source
of deriving a Revenue from
the Land which acts very
unfairly upon both Landlord
and Landlord, upon the
people & the Govern[t] —
for instance. It is a pretty
General rule throughout the
Madras Presidency that
the dry Assessment varies
from 8 annas to 3 Rupees
per Acre while the wet
assessment-range from
2½ Rupees to 10 Rupees
per Acre — The difference
between the two Soils
value 7½: 8 annas and
2½ Rupees may be taken
to represent the Government
share of the additional
produce due to the action
of water upon the poorer
quality of Soil: while
that between the two
higher values of 3 R: and
10 R is the value of
and Govt share of the addi
=tional [illegible]

application to the best Soil —
The experience then of the Pre=
=sidency goes to show that
the occupant of the poorer
quality of Soil can afford
to pay 2 Rupees for the
water required to irrigate
an Acre, without any un=
=due pressure: while the
occupant of the better Soil
=can pay Govt can pay
and is treated upon the
same principle as the occu=
=pant of the poor Soil, should
be called upon to pay 7 R:
for an equivalent quantity
of water. —
What however would be the
result of the dry assessments
were adopted as the expo=
=nent of the value of the Soil
and a fixed rate be de=
=manded for the water say
of 3 R per Acre?
The occupant of the poor
Soil would have to pay a
mixed sum, partly dry and
assessment, partly water
rate of 3½ R: or 1 Rupee
Acre more than he is now
called upon to pay; while
the lucky occupant of rich
Land would get his Acre
for six Rupees, instead
of ten; and thus lose 4
R: in excess of what is
assumed the fair sum
to get, under Govt

The assessment on all land, irrigated or unirrigated, is calculated upon an average crop, after making all necessary deductions, and is assumed to represent the value of one third of the net crop in the case of the occupier of Government land who is made to pay 3½ per cent land assessment. Water rate a demand of $\frac{7}{15}$ or very nearly one half of his net crop is made upon him - while the occupant of rich soil is only called upon to pay one fifth of the net crop instead of one third - I cannot then but think that the system hitherto followed in India of computing the rent or assessment upon land, whether irrigated or not, with direct reference to its productiveness as evidenced by the average crop, is utterly a simple sham than that of mixing up the hypothetical value of land under dry cultivation with a fancied charge for water, but also a

payment both as regards landlord & tenant, Govt & people — 3?

I will now consider the relative merits of the two modes of assessing the water Rate mentioned by Mr Chatterton viz:- A by the volume of water discharged

B - by the area of land irrigated

Now as it is assumed as a matter of course that, though the first mode cannot be adopted, and though every attempt to introduce it has failed, it is in itself theoretically so superior to the second that we ought always to look upon some mode of measuring the discharge as an object to be attained, & the measurement by area merely a temporary arrangement. We are not told in what the superiority consists, but from the context I gather that the measurement of the water is supposed to be a more economical mode of assessing to the occupier than the measurement of the area irrigated in order however to determine what would be necessary

to examine into the circumstances upon which the cost & the value of the water depend - The cost to the Govt is the interest of the money expended upon the works, added to the cost of maintenance & repairs, and that of management - In Madras the money expended upon large irrigation schemes varies from 10 to 20 Rs per acre irrigated - Let us take 15 R as the average. The interest at 5 per cent would be 3/4 of a Rupee & we allow another 1/4 R; per acre for repairs &c - The cost to the Govt would be 1 R per annum per acre - The quantities of available supplied vary of course with the character of the soil & the crop &c - but the Board may be put at 5000 Cubic feet for a single crop & we take two Cubic feet as the mean we shall not be far wrong - The cost therefore to Govt is one Rupee for two Cubic feet of water the supply being spread over a period of about 8 months -

The value to the Govt is the amount at which sells the water - In Madras as shewn before shewn this value varies according to the quantity of soil to which the water is applied and ranges between 2 Rupees and 7 Rupees - assuming however that a fixed water Rate is established, this, so far as we can see at present will be estimated at from 3 to 4 Rupees per acre or per two Cubic yds. or day, 1 Rupee per 1000 Cubic feet - We have thus arrived at an approximation to the cost and value of water - that is the cost in the Canal & the value when sold, but we have yet to bring the market, and the question we have to consider is, what is the most Economical mode of doing this - that is of delivering to the occupier of the land the amount of water which he may require - We will deal with this point at all events, all considerations arising out of freedom of action, assuming only that in order to avoid at the dry & deposit land

to which the Govt. under
any circumstances is
entitled, the Area of the
holdings must be ascer-
tained. that is the Land
must be Surveyed -
Should the Govt determine
to measure the water as it
issues from the Canal it
must erect the necessary
distributing & measuring
devices - there can no data
by which the cost of this
can be determined, but
they can by no means
simple when we con-
sider the numerous
structures will require to be
and will require to be
watched & worked by a
special staff of Servants -
If on the contrary the Govt
prefer to charge upon
the Irrigated land a fixed
Water rate, then the
ordinary means of dis-
charging & distributing
the water will answer
and the only question to
be solved is the amount
of land actually irrigated
I have however before stated
that the land must be
Surveyed, with a plain
ship drawn graduated
outline to delineate the
condition of the different

and the process which is con-
sidered sufficient for the
one may for the present
answer sufficiently for
the other. However shall
be prepared to discuss this
more fully when I allude
to the modes of determining
the Area of the cultivated
Land generally - -
With reference then to the
modes of ascertaining the Water
Rate, the conclusions at
which I have arrived are
as follows:
1st That the system of
charging a simple Rate or
assessment upon the
Land, the amount of
which is determined,
whether the Land be
irrigated or unirrigated,
by the production from
the Land as determined
by the actual Crop, is
in every respect fairer
to the Govt & to the Ryot
than that of assessing
a hypothetical Assess-
ment based upon the
supposition that the
Land is cultivated for
a dry Crop, and adding
to this hypothetical
assessment some arbi-
trary Water Rate based

upon Commercial principles - which I suppose by means as high a rate as the Ryot can be made to pay - and that under any circumstances analogous to those which characterize the relation between the Govt & the Cultivator of the soil in India the measurement should be applied to the land and not to the water - that is the Rate, whatever it may amount to, should be an Acreable charge -

Area of Irrigated Land

It would seem from the remarks of the Irrigation authorities that difficulties have been experienced, or at all events have been anticipated in the determination of the Area of the holdings to which water is supplied - How may be the effect of the departure of dispensing the Irrigation of villages, and leaving the Irrigation to be considered payments to be determined by the village authorities - This a difficulty which is not experienced in Madras, where the village Mirasdar and Ryotwar determines the area of each individual holding, so that all that [illegible]

in the number on the Register of the Fields to which water has been distributed: and as generally speaking all the Land under the Irrigation channel is irrigable - there is but little difficulty in determining the portion left dry during any season - The cost of conveying the irrigated Land annually, however varying and an operation which may be performed, must cause a serious deduction from the Profits of the water Rate, or a serious addition to the Cost of the water - I cannot but think that a valley Survey carefully executed would remove all difficulty and the distribution of water, and would probably pay for itself by bringing in on an expenses by bringing to light a quantity of cultivation [illegible] and irrigation which the Govt has hitherto derived little or no revenue - A village Survey should provide for permanent Boundary marks indicating not only the external Boundary of the village but also and subdivisions of the village fields, when necessary for purposes of separation, either natural or artificial, occur, as would subdivide into Blocks of from 50 to 100 Acres - within these Blocks the outlines of cultivated portions should be surveyed & recorded on the

flow, and it would be easy to reach the outlying land capable of being irrigated - all which might be cultivated & able to the rate - which is would be left to the discretion who declined to make use of this privilege, & know that he had not irrigated his land.—

A simple measurement of the area of municipal holding, which would form but a small proportion of the irrigable land, would settle all questions as to the supply question - while the existence of the Boundary marks would make this a simple process.

Position of distributary Channels

Stress has been laid upon the waste of water caused by the position of the Irrigatory Channels above the surface proposed to be irrigated, & it has also been said that the leakage from them, causing Swampy patches of ground here & there, is prejudicial to the health of the Community —

If this has been proposed as a means of remedying these evils, but principally, I believe, to secure the imaginary benefit of measuring the water, that all the water required for irrigation should be led from channels carried below the level of the Ground —

Speculation on the first plan the existence, or at all events the extent of the evils complained of — I do not think that the leakage from the channels above proposed need be great; & all events the fact of a leakage detected at once, while the waste arising out of the permeability of the subsoil does not make itself visible for some time - the leakage & the action of the leakage upon the health of the people are questions must be decided & small proportion to that of the water applied to irrigation - as hardly to deserve notice —

In the main direction however the proposed plan of the proposed channels is economic cost. water in the economic cost. of the labour required to perform the work — of course take two cubic feet as the supply required for an acre and suppose this to be spread over a period of 3 months the quantity of the daily supply to the Acre would be about

4 8 Cubic feet

how a Cubic Foot of water
weighs $27 \times 62\frac{1}{2} = 1687 \cdot 5$ lbs
so Cubic Yards will therefore
weigh $\cdot 81600$ lbs. and so
the bucket be raised 2 feet,
a height only just sufficient
to prevent a sufficient head
for distribution, the weight
raised 1 foot-high will be
163200 lbs. —
The labour of an Englishman
is considered as equivalent
to 5000 lbs raised 1 foot-high
per minute — that of a Kanaka
would not probably be
equivalent to raising more
than 3000 lbs, but taking
the Englishman, $\frac{163200}{5000} = 32 \cdot 6$
the number of minutes
employed daily in raising
sufficient water for the
daily irrigation you are
daily irrigation you are
to be multiplied by
90 the number of days
during which water is required $\cdot 90 \times 32 \cdot 6 = 2934$
is the number of minutes
during which the man
would have to work to
raise water sufficient to
irrigate an acre — and
this divided by 60 would
then divided by 60 would
give 48·9 hours or, at
ten hours per day, very
nearly five days. —
If however we take the
sufficient Kanaka man
at 3000 lbs then

the 5 days would be trans-
-muted into $8\frac{1}{3}$, and the
cost would amount
to one man 2 Rupees
to be added to the cost of
the water as distributed
from the Serpentine. and
a proposition could not
be entertained for an
-stant —

~~Irrigation~~

Before I conclude I may as
well say a few words upon
the subject of the collection
of the water Rents.
Several very difficulties,
and opposition the Govt in this
Country is strongly exter-
-cised chiefly, seem to me to
arise out of the fact that
the Canal department over-steps
the proper limit of its functions
and for the sake of the public
as a special rule the public
works dept should execute,
or superintend the execution
of, the Canal itself, and all
the various clerical & Engineering
Channels required for the
distribution of water. It
should also keep them work
in repair. but here, it
appears to me, its legitimate
functions cease. If as in
Ceylon the water in the Canals
is the property of the Govt
its officers proceed to dispose
of it, and to collect the pro-
-ceeds of the sale, they appear
to themselves functions

altogether foreign to their
organization; and are
obliged to employ a separate
set of agents.
I do not think that it would
be wise to throw upon the
Water Dept. the charge of
keeping the money payable
for water rents proposing to
were possible to determine
the quantity by a measure
therein, though it might
result the quantity paying
through: but I am quite
sure that its officers would
be placed in a very awk-
ward position were they
called upon to collect a rate
chargeable upon the occu-
pier of irrigated land.
Evening Madam when the
officers of the Revenue Dept.
collect the Land assessment
which includes a water rate
on irrigated land, a distinc-
tion only appears on the
half yearly receipt given
between the Collector and the
District Engr - on the subject
of the ~~rules~~ additions made
to the Land Revenue by the
assessment of certain working
cotton irrigation - were the two
Depts. to be called upon to pro-
duce the same printed re-
turn to levy a dry assessment
and the other a water
rate all distinctions
would cease.

W. Dellon

- I concur generally in the remarks which the President has written on the subject of Canal irrigation at the request of Her Honor the Lt Governor of the Punjab

2/ The loss of revenue to the State on the richer lands, and the heavy burden imposed on the poorer soils, by attempting to introduce a general levy of supplement~~s~~ for it by a water cess where irrigation is supplied, have been often pointed out by me in my Remarks regarding in favor of a ~~consolidated~~ Khanjahi (~~rate~~) supplement, that is levy an supplement based on a portion of the staple crop raised on wet lands. -

3 - I concur in the advisability of employing the Revenue Officers to collect-

the water cess - There seems no difficulty on this point especially when the charge for water is made according to the area irrigated at so much per acre -

E Hartley

16 March/64

Minute of the Punjab Government

40

I concur in the views of H.E. the President and of the Hon'ble Member upon this question.

An assessment on irrigated land should in my opinion be considered distinct from that on unirrigated land - as the value of the produce of the former is much greater than that of the latter, and the cultivation of irrigated land involves a much greater expenditure of labour and capital. The assessment on irrigated land should not only be sufficient to yield the Government a fair profit on the capital outlay, but should also be sufficient to cover the cost of maintenance of the irrigation works, and the interest on any future outlay which may be required for their improvement or extension. The Government should also receive a fair share of the profits arising from the increased value of land, which is due entirely to the existence of the irrigation works. The Government should also receive a fair share of the profits arising from the increased value of land, which is due entirely to the existence of the irrigation works.

[illegible] one person [illegible] the contra-
[illegible] repair and maintenance of Public
Works - They should [illegible] nothing
to with the necessary and [illegible]
of the public Income -

In this way it is recommended
[illegible] principle for the
Land - It is a very [illegible] process in
which [illegible] and [illegible] injury
[illegible] Labour is employed - [illegible]
[illegible] maintained in [illegible]
[illegible] - [illegible] [illegible]
[illegible] [illegible] [illegible]
[illegible] [illegible] [illegible]
[illegible] [illegible] [illegible]
[illegible] [illegible] [illegible]
[illegible] [illegible] [illegible]
[illegible] [illegible] [illegible]
[illegible] [illegible] [illegible]
[illegible] [illegible] [illegible]
[illegible] [illegible] [illegible]

[illegible] principle of [illegible] Labour
in the Public Works of India - How it has
always been found that a ryot will
[illegible] much Land to work as he,
[illegible] as he can cultivate to profit - If
[illegible] assistance on his Land he more
[illegible] for he will extend his cultivation,
and he will make the work that he pays
for more productive - In such case if he
does not [illegible] it is not lastly,
because he is [illegible] [illegible]
[illegible] - but because Capital employed
[illegible] and to [illegible] and [illegible]
of agriculture [illegible] India
the proper [illegible] agricultural science and

diffusion of education with the more
consult his mistakes, respect
creation of artificial restraints and
difficulties.

Revenue 1864. Oct 15th
Pros: of Govt for March
No. 785.

Minute by the Hon: the President.

Dated 16th March 1864.
Received

Copy via letter to Govt
23d March 64 No 24.
No. 785.

Minute by the Hon:
J. Pycroft.

Dated 16th March.
Received 1864.

Concerning the Proceedings of the Board and the Honorable Mr Bathy Esqr on the Canal Revenue Establishments and distribution and economy of water

Recording his views on the papers forwarded by the Govr of Bengal on Canal Revenue Establishments and distribution and economy of water.

No. 784.
Minute by the Hon: Mr Maltby.

Dated 16th March
Received 1864.

Concerning the Proceedings of the Board on the above subject.

No 277 to 279.

No 501.
23d March 64

Revenue department.

No. 501. 43

Proceedings of the Madras Government under date the 23d March 1864

Read the following papers.

From the Secy. to the Govt. of Punjaub.

Forwarding three copies of printed papers on Canal Revenue Establts and distribution and economy of water, and states that that Govt will be glad to receive any remarks on the points adverted to in these papers which may aid in leading to practical conclusion on the subjects discussed.

(Here enters 19th Decr 1863.)

Note by His Excellency the President.

(Here enters

Note by the Honorable Mr Maltby.

(Here enters 16th March 1864.)

Note by the Honorable Mr Pycroft.

(Here enters

Resolved

Resolved that the notes of His Excellency the Governor and the Honorable Members of Council be forwarded to the Govt of India and the Govt of Punjab, and be communicated to the Department Public Works, Revenue Board and Revenue Settlement Department for their information.-

2 Copies D.P. Works Dispatched.
14 — Bs of Revs
13 — Ds of Rev. Settlements
10 — Supt. of Rev. Surveys
4 — Punjab Govt
9 — Govt of India

Copy in a Letter to Govt
of 23d March 64 No 24

Revenue 1864 Departt.
Recd of Govt for March.

No 501.

Recd of the Madras Govt
23d March 1864.

Minutes of Governor
and Members of Council on
Canal Revenue Establish:
ments, and distribution
and economy of water
ordered to be forwarded
to Govt of Punjaub.

Nos 276 & 280.

No. 502. to 45

R D

The Secretary to the
Govt of the Punjab
and its Dependencies

Sir,

I am directed to
forward for the information
of your Govt Notes re-
garding Canal Irri-
gation received by the
Members of this Govt
with reference to
the papers on the sub-
ject received with your
Memo of 19th Decr 1863
No 3916.

I am at the same
time to request that
with the permission of
your Govt, you will be
good enough to forward
to this office twelve
more copies of the
papers above referred to

Fort St George
23d March 1864

Copy in a letter to Govt
23 March/64 N 24

Revenue 1864 Sept.
Proc. of Govt. for March

N. 502.

To the Secretary
to the Govt. of Punjab
and its Dependencies.

Dated 23d March/64.

Forwarding Notes
regarding Canal
Irrigation recorded
by the Members of the
Government.

N. 281

Revenue 1864 Dec. 165
Govt. of Govt. for March
No. 503

To the Secretary to the
Govt. of India.
Dated 23d March 1864

Copy in Letter to Govt
23 March 64 No. 24.

Forwarding statistics
on certain points
connected with Canal
Irrigation recorded
by the Members of the
Government at the
request of the Punjab
Government.

No 282