

[FILE NO. $\frac{M}{5}$ P OF 1912]

1912.
ASSAM SECRETARIAT.

POLITICAL DEPARTMENT.

POLITICAL—A.

May 1912.

Nos. 1-64.

Manipur Waterworks.

Grant of a loan of two lakhs of rupees to the Manipur Durbar.

Governor's Secretariat
State Records.

1041
1912

REFERENCES TO FORMER CASES.

Department, date, and Nos., or File No. and year.	Brief Title of File.
1. Pol., A, June 1910 M Nos. 32-49 (-P). 69
2. Ditto, Jan, 1911, M Nos. 10-15 (-P). 6
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Pol: A. Sept/12 = 10-12 (14/12) - B. Dec/12 = 100-105 (16/12) Fin A Aug/14 = 4 (14/14) 7 in B Aug/14 = 258-260 (12/97/12) Fin B Sept/16 = 28-39 (12/7/16) Fin B Aug/18 = 70-71 (12-247) Pol B, July/20 = 258-259 (24) Fin A Sept/20 = 126-127 (To be continued on back, if necessary.)	

PAPERS OTHER THAN PROCEEDINGS.

- I.—Printed.
Notes and orders.
II.—Not printed.
Originals.

M
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Manipur Waterworks.

Grant of a loan of two lakhs of rupees to the Manipur Durbar.

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POLITICAL—A, MAY 1912.

Nos. 1-64.

Manipur Waterworks.

Grant of a loan of two lakhs of rupees to the Manipur Darbar.

FROM THE SECRETARY TO THE GOVERNMENT OF INDIA, FOREIGN DEPARTMENT, NO. 1451.A., DATED
THE 24th JANUARY 1911.

TO THE POLITICAL AGENT, MANIPUR, NO. 307P., DATED THE 21st JULY 1911.

Secretary,

In our last letter to India we requested that His Honour would prefer the repayment of the in twenty years and not in ten years as suggested by India. In spite of this they have made it possible in *ten* years. This will mean that the State will have to pay annually Rs. 24,658 instead of Rs. 14,716 as previously arranged.

The Political Agent reported that the compensation for the Kubo Valley paid by Government (Rs. 6,270) and the forest revenues of Manipur collected by Government officers in Cachar (average for the last three years is Rs. 19,926-2-8) should be earmarked for the payment of the loan. In addition there are the proceeds of the export tax on rice which will exceed more than Rs. 1 lakh a year. There will thus be no difficulty in repaying the loan punctually.

The only action that remains to be taken is to forward a copy of India's letter officially to the Political Agent and the Financial Department, and it is for orders whether the former should be asked whether the Darbar would experience any difficulty in repaying the loan.

A. T. C.—28th January 1911.

His Honour,

This is satisfactory. I have already wired to Political Agent and we will send him a copy officially. The State will not really have any *difficulty in repaying in ten years*.

28th January 1911.

B. C. ALLEN.

Secretary,

Seen. I am not so sure. The Delhi Darbar will be a heavy tax.

2nd February 1912.

L. HARE.

Extract from notes from Financial Department No. II-L—2F. of 1911.

Secretary, Financial,

Perusal. The Darbar will find it difficult to repay. The conditions are hard.

30th January 1911.

L. HARE.

I would like to see the papers again before orders issue if General Department will kindly let us see them. We should examine whether the State can repay within ten years. The ultimate liability is ours and we should run no risks.

31st January 1911.

L. J. KERSHAW.

His Honour,

The financial position of the Manipur State is discussed in Mr. Higgins' note and my note on pages 4-5 of the Collection put up. My note was written on the assumption that we should have to pay Rs. 14,716 a year for the service of the loan, whereas under India's present orders we shall now have to find Rs. 24,658 per annum for the loan, and about Rs. 1,000 for maintenance charges (Mr. Disney has accepted the figure) or say Rs. 32,000 altogether. The financial position of the State is, however, far from unsatisfactory. In paragraph 3 of the Administration Report for 1909-10 it will be seen that the reserve at the end of the year amounted Rs. 2,92,462 and that the Political Agent considered that a lakh of rupees could be safely diverted to the waterworks at once from the reserve.

The estimated cost of the waterworks is Rs. 2,66,000, but to be on the safe side we will assume three lakhs. The additional two lakhs will be provided by the loan which will be repaid at the rate

of Rs. 24,658 per annum. During the last completed five years the relation of revenue to expenditure has been as follows :—

Year.						Total revenue of the year.	Total expenditure.	Surplus.
1						2	3	4
						Rs.	Rs.	Rs.
1905-06	...	...	...	...	...	4,12,798	3,62,270	+ 50,528
1906-07	...	...	...	...	...	4,21,437	4,00,812	— 9,375
1907-08	...	...	...	...	...	4,47,130	4,53,209	— 6,079
1908-09	...	...	...	...	...	4,50,479	4,72,614	— 22,135
1909-10	...	...	...	...	...	4,79,164	4,34,642	+ 44,522

and the nett surplus has been Rs. 57,461, or roughly about Rs. 11,500 a year. To this we can add eleven or twelve thousand rupees on account of the export duties, Rs. 9,000 for water rate and probably not less than Rs. 1,000 for water supplied to the troops and British subjects in the reserve. These items will therefore approximately meet our demand of Rs. 32,000, but our great source of financial strength is the cessation of the heavy expenditure on the palace. During the five years (1905-06 to 1909-10) the average expenditure on the palace has been Rs. 47,700 per annum. That work is now finished and an allowance of Rs. 10,000 a year would be handsome for maintenance and improvements. This gives us another Rs. 37,000 to our credit which can be used for the waterworks, roads and other public works. If my estimates are correct, we shall really want nothing from this Rs. 37,000 for the waterworks and we have the comfortable balance of Rs. 57,000 to set against possible errors in the estimate and for other original works.

In 1903 the Raja spent Rs. 34,000 upon the Delhi Durbar. Colonel Woods, the officer who was then in charge, is a man of distinctly liberal ideas and the Manipur camp was well done. The Raja was accompanied by a native officer and 29 rifles of the State Police as escorts, 20 private servants, 16 polo players and 20 polo ponies and at least one special train was engaged for his use. I do not suppose that his Durbar visit will cost him more this time. When His Honour has seen this note, perhaps he will allow Private Secretary to send it to the Hon'ble Mr. Kershaw, as the Financial Department wish to be satisfied that we are running no undue risk.

11th February 1911.

B. C. ALLEN.

My dear Allen,

Disney sent in his note about the waterworks some day ago, and he has suggested that work should be begun on collecting the material for the weir at the head works and that the pipe line should be nicked out on the ground through the town. He points out that Mitchell's map of the pipe line is only approximate, and that no final estimate can be made till that is accurately measured on the ground. Mitchell's plans of the weir are also not reliable enough to be worked on, as he had no information as to the actual formation below ground at that point, as no pits had been taken down to ground level. Disney has taken with him a sketch and a number of cross sections of the place and pits are being dug down to the rock in places marked by him. When he gets this information, he will design the head works. There is some doubt apparently whether steel piping will last more than ten years. McCabe says it will not, the makers say, it will last 20 to 30. Disney is inclined to risk it but is making enquiries. This is the most difficult matter to be settled, for we cannot possibly put down 11 miles of main, which may have to be relaid the very year that the State completes paying off the loan; on the other hand, cast iron, on account of its weight, means a heavy extra cost for carriage.

Will you do your best to keep the ball rolling now it has really started? I left Imphal on the 2nd and caught up the column that night. We have 95 men of the 17th, two officers, one doctor, and Higgins here. Twenty men of the State police with 16 days' rations for the whole column are a day behind. I divided the column, as the string of coolies would be too long to be pleasant over narrow roads. We halt probably for one day at the last camp in Manipur territory, and thence all go on together. I should like to have been supplied with information about Woods and his movements in Makware land. The more we know of each other's movements the better. Though our two expeditions are quite unconnected, yet it is sound policy that we should know all about each other's movements and orders; believe it is not mere curiosity which prompts me to say this.

4th February 1911.

J. SHAKESPEAR.

Secretary,

Paragraph 1 of Colonel Shakespear's demi-official relates to the technical question and may be considered in the Public Works Department. Our portion of the case may be said to end with the sanction of the loan.

Paragraph 2 may be extracted to our file *re* Satyapan expedition. I doubt if it is worth while now even to send a report of the result of the expedition, but Political Agent may perhaps be given a copy of the final report when printed.

15th February 1911.

H. K. BRISCOE.

Please send* copy of first paragraph to Public Works Department. Put up* copy of second paragraph in Satyapan file, with demi-official saying that we have received no information from Woods other than that he punished Makware,

killing 5 and wounding more and sustaining two casualties, all of which appeared in the paper. We will send him a copy of report.

16th February 1911.

B. C. ALLEN.

* Done.—A. T. C.—18-2-1911.

FROM THE SANITARY ENGINEER TO THE GOVERNMENT OF EASTERN BENGAL AND ASSAM, No 483-87,
DATED THE 18TH FEBRUARY 1911.

Under-Secretary,

Perusal. The note deals with technical questions connected with the waterworks scheme and is submitted to us for information. It will be properly dealt with in the Public Works Department.

A. T. C.—22nd February 1911.

Secretary,

1. *Mr. Disney's note*—In the absence of our previous papers, in Press, it is rather difficult to note. It also seems that the Public Works Department: it is not clear whether that Department has a copy and we may send file over to inquire if they will take action. He also does not say that Political Agent, Manipur, has a copy of the note.

2. *Government of India letter dated the 24th January 1911*.—I am not quite sure what is the outcome of notes, dated the 11th February 1911. Are we now to forward a copy of Government of India's orders to Financial, for Accountant General, and to Political Agent officially?

23rd February 1911.

H. K. BRISCOE.

Issue demi-official below to Mr. Disney. Final orders should not apparently issue until Financial have satisfied themselves as to the solvency of the State, *vide* Mr. Kershaw's note of 31st January 1911. As soon as His Honour's orders have been received on my note dated the 11th February 1911, they should be put up to me without delay.

24th February 1911.

B. C. ALLEN.

My dear Disney,

(Demi-official No. 123P.) Will you kindly refer to your memorandum No. 483-87, dated the 18th February 1911, with which you forwarded a copy of your note on the Manipur waterworks? I understand (1) that experiments have been made to see whether steel pipes can be substituted for cast iron, (2) that surveys are being made to ascertain whether a small tank can be constructed at the head works, and (3) that the pipe line should be nicked out through the town.

2. Will you kindly let me know whether, when you were in Manipur, arrangements were made for actually doing the necessary work and what the proposals are for the actual execution of the work when once the scheme has been finally approved by you? Am I right in supposing that tenders should be called for from Calcutta, and would the contracting firm then order out the material? Orders should of course go home in time to allow of the material being brought up the road as soon as it is open after the next rains.

24th February 1911.

B. C. ALLEN.

* * * * *

Send to Secretary (Financial).

15th February 1911.

L. HARE.

Seen and returned with thanks. The security seems reasonably safe, but I think that the Raja's Delhi Durbar budget should be carefully scrutinised.

24th February 1911.

L. J. KERSHAW.

Copy of India's letter can now go to Political Agent and to Financial for communication to Accountant General.

1st March 1911.

B. C. ALLEN.

TO THE POLITICAL AGENT, MANIPUR, AND THE FINANCIAL DEPARTMENT OF THIS GOVERNMENT,
Nos. 129-30P., DATED THE 3RD MARCH 1911.

My dear Allen,

Your demi-official No. 123Pl. of the 24th February. In the absence of papers I am replying from memory.

(1) Steel pipes are of recent adoption for waterworks. The argument against them is that there is a lesser thickness of metal to corrode through before destruction than for cast iron ones. Where freight and breakage charges bear a high proportion to that of first cost, as at Manipur, the use of steel pipes, taking all known precautions in coating, etc., is, I consider, justifiable, and I am upheld in this view by recent practice of eminent English specialists.

(2) Surveys are being made to locate the position of the small tanks at the head works in order to determine their most economical location.

(3) Detailed instructions have been given to work out the pipe lines: I went over the most difficult one with Colonel Shakespear who fully understands my views. Owing to the local conditions great care will have to be taken to avoid buildings and consequent expense for compensation.

2. I have arranged, as far as possible, for the execution of the work. Mr. Pritchard, the State Engineer, has been detailed to work out the pipe lines before he retires, as his lengthy experience of Manipal and knowledge of the language makes him especially fitted for this work, and as he retires in May, I believe, the actual construction work should go on under the control of his successor, whom I expect will be Benson, a man I know, and who will do his share of the work all right. As soon as the pipe lines have been laid out and measured up, tenders might be called for from Calcutta firms,

Steward's and Lloyds' are practically the only firm. As only stocks sizes are being used, these probably can be procured in Calcutta, but, if not, could be got out from England in less than two months from date of order.

As I am out in camp, I have no office with me, so shall be greatly obliged if you will send a copy of this letter to Colonel Shakespear.

It would pay the State to keep up a motor car for convenience of inspection. I cannot often afford 15 days for the march. But could give 5 days occasionally.

1st March 1911.

G. W. DISNEY.

Under-Secretary,

A copy of Mr. Disney's demi-official may be sent demi-officially to the Political Agent, Manipur, and to the Public Works Department as well. In the last paragraph Mr. Disney suggests that the State should have a motor car. I believe the Raja has a motor car, but I am not quite sure. If he has, Mr. Disney may be allowed to use it. It is perhaps impossible for a State to have a motor car now. It will be an easement; but one which would be simply temporary and which is in the interests of the State itself. It will be left to Political Agent to make such an arrangement with the Durbar.

W. H. A.—7th March 1911.

Secretary,

I will send a demi-official to Political Agent with a copy of Mr. Disney's demi-official, and a copy may also go to Public Works Department with an unofficial note.
Send copy to Public Works Department as proposed.—B. C. A.—19-3-11.

I venture to think the closing suggestion for a motor car may be left out of both copies, as contrary to present financial conditions.

7th March 1911.

H. K. BRISCOE.

My dear Shakespear,

(Demi-official No. 154P.) Will you kindly refer to your demi-official of the 4th February about the waterworks? Disney has asked me to send you a copy of his enclosed demi-official to me. I hope now that the finances have been arranged for, no time will be lost in completing the actual work, but action has now to be taken rather in Manipur than in Shillong.

I see from to-day's telegram that you are contemplating purchasing two motors for the Durbar and it might perhaps pay you to keep one for the use of the State.

11th March 1911.

B. C. ALLEN.

Under-Secretary,

Please see A of your note dated the 9th February 1910 at page 15 of Political, A, June 1910, Nos. 32-49. Before calculating the Government contribution, it is for decision on what principle it should be paid, i.e., whether a water-tax levied in the British reserve and the proceeds paid to the State, or payment should be payment for water actually supplied per head of population. In the latter case we want the population of the reserve and perhaps we may ask the Political Agent to supply this information. We have the figures of the census of 1901, but they are presumably inaccurate now. A draft is put up.

Ashootosh—31st March 1911.

The draft may issue. I find it very difficult to make out the exact position of affairs. India have sanctioned a loan of two lakhs repayable in 10 years, and it has been decided that the State can find money for repayment in due course. Preliminary work is being done at Imphal, and this should clearly be pushed on as rapidly as possible in order that tenders may be invited and the main work begun. Meanwhile we have to settle the question of the contributions to be made (a) for the British reserve and (b) for the cantonment.

4th April 1911.

J. F. GRUNING.

TO THE POLITICAL AGENT, MANIPUR, No. 229P., DATED THE 7TH APRIL 1911.

Dear Mr. Disney,

(Demi-official No. 232P.) Would you please refer to your memorandum No. 483-87, dated the 18th February 1911, forwarding a copy of your note on the Manipur water-supply project and very kindly let me know what progress has been made with the scheme?

8th April 1911.

H. K. BRISCOE.

My dear Briscoe,

Your demi-official No. 232P. of the 8th instant only reached me on my arrival here, as it missed me on tour.

The Manipur waterworks file is on its way up here, on arrival I hope to complete the project and get it through the remaining stages without delay.

19th April 1911.

G. W. DISNEY.

FROM THE POLITICAL AGENT, MANIPUR, No. 35M. S., DATED THE 19TH APRIL 1911.

Draft telegram to Political Agent, Manipur.

Steel pipes wrapped in Hessian coated with Angus Smith's solution and again redipped at site before laying approved for Manipur waterworks. Seven inch main to be $\frac{3}{16}$ inch thickness, with

alternative tender for $\frac{1}{2}$ inch pipes under 2 inch diameter to be galvanized. Suggest you now call for tenders for pipe laying as referred to in last paragraph of note 27th January, under standard specification for tests. Tracing of amended pipe lines being sent me to Shillong, where contractors could see drawings.

SENEVGER.

Secretary, Political Department, unofficially,

Chief Engineer has accepted steel pipes for the Manipur waterworks. So, to save time, I propose with your approval, issuing the telegram above. The preparation of the final estimate and project will now proceed.

27th April 1911.

G. W. DISNEY.

Secretary,

Please see Mr. Disney's note above proposing to telegraph to the Political Agent, Manipur regarding the pipes to be used for the waterworks there. As the Chief Engineer approves their use we may agree to the issue of the proposed telegram.

A. T. C.—27th April 1911.

27th April 1911.

H. K. BRISCOE.

Sanitary Engineer,

As the Chief Engineer approves of the use of steel pipes, there is no objection to the issue of the telegram which you propose to send.

27th April 1911.

J. F. GRUNING.

Under-Secretary,

The Political Agent has reported the population of the British Reserve and Cantonment at Manipur (17 Europeans and 2,334 Indians). The question of payment of water-tax by the Military and by the inhabitants of the reserve will be settled as soon as the figures of total cost are known. The principle on which the tax is to be levied requires decision.

W. H. A.—28th April 1911.

Secretary,

Please see your note dated the 4th April 1911, which states the position. The Political Agent has now reported the population figures required. Should we wait further for the total estimate of cost, or proceed to try and determine the principle of assessment in the Cantonment and Civil Station?

In marked passages,* pages 11-12 and 14-17, payment is proposed on a basis of the water supplied to the Military (and the Reserve) in proportion to total supply. I am not sure whether Mr. Allen meant to change his ground in his note* when discussing the proposed 4 annas rate for Manipuris, I think not.

* Pol. A, June 1910, Nos. 32-49

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8th May 1911.

H. K. BRISCOE.

Please try and work out the principles of assessment for the Cantonment and Civil Station.

9th May 1911.

J. F. GRUNING.

Secretary.

Please see the following papers regarding the principles:—

(1) Mr. Allen's demi-official, dated the 18th December 1909, to the General Officer Commanding

Page 11 of notes of Pol. A, June 1910, Nos. 32-49.

and the General's reply in the note below it.

(2) Captain Humphrey's demi-official No. 50R., dated the 15th January 1910, in continuation of the General Officer Commanding's reply.

Page 12 of notes of Pol. A, June 1910, Nos. 32-49.

Page 14, *ibid.*

(3) Mr. Allen's demi-official No. 113P., dated the 8th February 1910, to Colonel Shakespear.

Page 16, *ibid.*

(4) Colonel Shakespear's reply dated the 14th February 1910.

I think it may be taken that the Military and the Civil Station should pay their share of—

- (a) interest for the full capital outlay;
- (b) annual charge of working, including maintenance and repairs, as calculated on the proportion of the water taken by them to the total supply.

As regards the Civil Station, the calculation will be made and then rate fixed per head.

Colonel Shakespear, however, makes a further important suggestion that depreciation also should be taken into account, and I venture to think that this is only fair. We should have to make a reference to the Military on this point and I think they would probably accept.

We therefore require to know three things:—

- (i) proportion of water for ^{(a) Military;}
(b) Civil;
- (ii) total capital outlay;
- (iii) total annual charge.

For (i) we have no accepted data. Mr. Allen asked Mr. Mitchell at page 17 of the notes,* but he has not replied. I have spoken to Mr. Disney, who is now taking

* Pol. A, June 1910, Nos. 32-49.

charge of the case: he thinks that we might roughly be guided by the estimates framed by Mr. Davis in Appendix I to his proposals (page 4 of correspondence*), that Europeans would take 20 gallons a head and Indians 5 gallons a head.

The average demand for Imphal is taken as 175,000 gallons per day.

For (ii) the scheme is estimated to cost Rs. 2,66,842 (*vide* page 5 of not s*). Mr. Disney, however, tells me that we should be wise to take at least Rs. 2,90,000 as our figure in order to be absolutely safe.

• Pol., A, Jan. 1911, Nos 10-15.

For (iii) Mr. Allen in his note, dated the 11th February 1911, says that Mr. Disney accepts Rs. 7,000 as maintenance charges. This does not include depreciation. I asked Mr. Disney if 5 per cent. on capital outlay would be reasonable, and he considers this would do perhaps as a rough calculation.

Taking figures of the population supplied by the Political Agent in Manipur the Cantonment requires 160 gallons and 5,280 gallons for Europeans and Indians, respectively = 5,440 in all.

The British Reserve requires 180 and 6,390 gallons for Europeans and Indians, respectively = 6,570 gallons in all.

Therefore their proportion will be $\frac{5,440}{1,75,000}$ and $\frac{6,570}{1,75,000}$.

As regards (a) on capital outlay, 4 per cent. on Rs. 2,90,000 = Rs 11,600.

As regards (b), total annual charge thus will be Rs. 7,000 for maintenance, plus 5 per cent. on Rs. 2,90,000 = Rs. 14,500. Total Rs. 21,500. The share of the Military Cantonment, therefore, will be $5,440 \times 33,100 \div 1,75,000 = 1,029$.

* Rupees 21,500 + 11,600.

The total charge of the Civil Station will be $6,570 \times 33,100 \div 1,75,000 = 1,242$.

In the case of the Military there would be no collection expenses and absolute security, so an offer of Rs. 1,000 a year might be very fair.

From the Civil Rs. 1,243 is required from 1,278 Indians and 9 Europeans. A charge of Re. 1 per head for former and Rs. 4 for Europeans might not be unsuitable, unless it be decided to make allowances for *children*, in which case it would probably be all right to charge Re. 1-8 per Indian adult and 12 annas per child, Europeans in proportion; assuming that 2 out of every five are adults, the State would get about Rs. 100 above its Rs. 1,243.

You may like to ask Mr. Disney about these figures.

31st May 1911.

H. K. BRISCOE.

FROM THE POLITICAL AGENT, MANIPUR, No. 200M.S., DATED THE 26TH MAY 1911.

I have discussed this case with Mr. Disney and he is of opinion that the suggestions made by Under-Secretary may be accepted. Please write to the Military authorities, giving them figures, and asking if they are prepared to pay Rs. 1,000 a year as their contribution to the scheme on account of the Cantonment. When we get the reply, we will write to Political Agent, and if he concurs, I will submit the case to His Honour for orders.

9th June 1911.

J. F. GRUNING.

Secretary,

I put up a draft. I have ventured to add that the terms are moderate, and it is hoped they will see there is no undue extravagance or wastage.

14th June 1911.

H. K. BRISCOE.

His Honour,

I have consulted Mr. Disney and we consider that the Military authorities should pay Rs. 1,000 a year for the Cantonment as their contribution to the waterworks. I submit a draft for approval.

For the British Reserve it is estimated that the contribution should be Rs. 1,243 which would be recovered by a rate of Rs. 4 for each European and Re. 1 for each native living in the Reserve. I propose to wait until we get a reply from the Military authorities about the Cantonment and then to consult the Political Agent.

16th June 1911.

J. F. GRUNING.

Secretary,

I think the charges proposed fair. Five per cent. is ample for depreciation however. It supposes a life of only 20 years.

17th June 1911.

L. HARE.

Issue the draft. When we get a reply, we must write to Political Agent, Manipur.

17th June 1911.

J. F. GRUNING.

TO THE GENERAL OFFICER COMMANDING ASSAM BRIGADE, No. 434P., DATED THE 20TH JUNE 1911.

My dear Gruning,

1. I have personally made over the plans, estimate, and report for the Manipur waterworks this morning to Manners Smith who has promised that these be sent on to you without delay. If any occurs, you might worry up the Public Works Department Secretariat which remains here for the present.

2. I would suggest that you get the reports and estimates printed. I can supply vandyked copies of the drawings for 4 sets, which should suffice for record purposes. The remaining copies need not be illustrated by drawings.

3. I am informed by wire from Imphal that the tenders for pipe laying and other construction works are shortly expected and have wired Shakespear as follows:—

“Plans and estimates, Manipur waterworks, personally made over to Local Government this day. The submission of tender for the work now rests with you.”

4. I am leaving here on tour to-morrow morning and do not expect to reach Dacca before the 1st August, but any references of an urgent nature will reach me on tour if addressed there.

15th July 1911.

G. W. DISNEY.

Place this on the file and note that we should remind Public Works Department if there is any delay in forwarding the papers.

19th July 1911.

J. F. GRUNING.

FROM THE SANITARY ENGINEER TO THE GOVERNMENT OF EASTERN BENGAL AND ASSAM, No. 290C.,
DATED THE 15TH JULY 1911.

Secretary, Political Department,

These papers are now made over to you, as the Public Works Department are not concerned with the execution of, or provision of funds for, this work.

The project is in accordance with Mr. McCabe's recommendations, with the exception that "steel" pipes have been provided in place of "cast iron" pipes so as to minimise cost of carriage and risk of breakage on transit.

17th July 1911.

G. S. MARSH.

Secretary,

The Public Works Department do not wish to keep the case: I think we could make out a case for their keeping it, cf. the previous scheme, while from Mr. Allen's note* it will be seen that he expected Public Works Department to deal with it.

* Pol., A, Jan. 1911, Nos. 10-15.

To save trouble, however, this Department can take over.

Apparently it only remains—

(1) to print up the papers as suggested by Mr. Disney;

(2) to see that the Manipur authorities keep going: this is their concern however, and we need not inquire, say, till September next.

It will be seen that the estimate is very near the Rs. 290 we took for total capital outlay in addressing the Military (paragraph 4).

20th July 1911.

H. K. BRISCOE.

I think that the Public Works Department ought to take this case, but there is not much more to do and we had better keep it.

20th July 1911.

J. F. GRUNING.

Under-Secretary,

Please see orders above. We are not aware whether the Political Agent, Manipur, has got the plans and estimates from the Sanitary Engineer. Should we not send a copy to the Political Agent? We have received a duplicate copy of the papers and these may be sent to the Political Agent.

Nalini—21st July 1911.

Yes. I presume he has, but no matter.

21st July 1911.

H. K. BRISCOE.

TO THE POLITICAL AGENT, MANIPUR, No. 526P., DATED THE 26TH—28TH JULY 1911.

TELEGRAM FROM THE SANITARY ENGINEER, EASTERN BENGAL AND ASSAM, DATED THE 28TH JULY 1911.

Under-Secretary,

A copy of the plans and estimates and of the notes received with Sanitary Engineer's letter No. 290C., dated the 15th July 1911, has been sent to the Political Agent, Manipur. It is for consideration whether this Department should sanction the scheme formally.

Nalini—23th July 1911.

A. T. C.—28th July 1911.

Wire to Political Agent, Manipur, as in the draft put up.

28th July 1911.

H. K. BRISCOE.

TELEGRAM TO THE POLITICAL AGENT, MANIPUR, No. 537P., DATED THE 29TH JULY 1911.

TELEGRAM FROM THE POLITICAL AGENT, MANIPUR, No. 77P., DATED THE 29TH JULY 1911.

Under-Secretary,

In reply to his telegram, dated the 28th July 1911, Mr. Disney may be told that the Political Agent called for tenders long ago and has already received some. But the question remains whether a sanction is necessary and whether it should be given by the Political Department.

Should the General Officer Commanding be reminded for a reply to our letter No. 434P., dated the 21st June 1911?

Nalini—31st July 1911.

Issue the telegram put up to the Sanitary Engineer.

31st July 1911.

H. K. BRISCOE.

TELEGRAM TO THE SANITARY ENGINEER, EASTERN BENGAL AND ASSAM, No. 540P., DATED THE 31ST JULY 1911.

Under-Secretary,

Please see rule 21 of the rules for keeping State accounts. Political Agent is to submit the plans and estimates of all works costing over Rs. 5,000 after approval by the Member in charge, to the Superintending Engineer, Assam Circle, for criticism and suggestions. The Member can sanction the schemes after the criticisms and suggestions of the Superintending Engineer have been given effect to. But this case is a different thing, the plans and estimates having been prepared by the Sanitary Engineer. On the analogy of the previous scheme we may ask the Public Works Department to issue formal sanction. The rules did not contemplate such big scheme as the Imphal waterworks, and under the terms of the *sanad* to the Raja Government reserved full power of interference in the affairs of the State, and it would be well if the orders issued from the Public Works Department.

A. T. C.—1st August 1911.

Secretary,

Please see Mr. Disney's telegram. I then wired to Political Agent to make sure that matters were not being hung up, and his reply is reassuring. I have given Mr. Disney an *ad interim* reply to reassure him regarding the necessity for a sanction. Please see office note above. I am inclined to think a formal sanction might be sound. Public Works Department apparently accepts plans and estimates.

I put up a draft to Political Agent—

- (1) approving plans and estimates;
- (2) insisting on inclusion of second Jewell filter;
- (3) saying he will be addressed shortly *re* contribution for British Reserve and Military detachment.

Copies to go to Accountant General, Public Works Department, and Mr. Disney. We may also tell General Officer Commanding, in continuation of letter, dated the 21st June 1911, that we have passed plans and estimates at Rs. 2,89,269 which may be treated as = Rs. 2,90,000 formerly adopted for calculation and may ask for early reply.

I put up another draft accordingly.

2nd August 1911.

H. K. BRISCOE.

The drafts may issue. Public Works Department refuse to take over this case and we must give formal sanction.

6th August 1911.

J. F. GRUNING.

TO THE POLITICAL AGENT, MANIPUR, NO. 539P., DATED THE 8TH AUGUST 1911.

TO THE Public Works Department of this Government,
Accountant General, Eastern Bengal and Assam,
Sanitary Engineer to this Government, NOS. 540-42P., DATED THE 8TH AUGUST 1911.

TO THE GENERAL OFFICER COMMANDING ASSAM BRIGADE, NO. 543P., DATED THE 8TH AUGUST 1911.

Extract from the Summary of events in Manipur for July 1911 (File No. M—17P. of 1911).

"The tenders for the water-supply scheme are being received, but they are so incomplete that I consider it necessary for Mr. Benson to interview the contractors and explain matters fully, as it is clear that the case is not fully understood.

J. SHAKESPEAR."

My dear Colonel Shakespear,

Many thanks for your letter and telegram received. I am very glad to hear you are satisfied with Benson and that my recommendation has been a good one, but at the same time I cannot advise that he be put in what is really independent charge of a highly technical work such as waterworks are, a subject with which, as far as I know, he has had no experience of. His work further shows me he has not got the sense of proportion to any great extent, as he hung up the submission of the project for some time for what were really working details. His training moreover has been that of a contractor, not an Engineer, otherwise he would not have suggested, after calling for tenders, having a Dutch Auction among contractors for the work.

I have discussed the matter fully with Gruning, the result being that after I have gone into the question in Calcutta I accept the tender I consider best, inform Government of my action, and ask for confirmation of this. Owing to the delays already incurred this is the only way the work can be got through next cold weather. As far as my information goes, only two firms are in the running at all, Simpson's who have quoted for the Jewell filter specified, and Jessops' who have run off the rails and have quoted for a Patterson filter of which I know nothing. The former firm has done a lot of work for me in a very satisfactory manner. The result must be obvious.

12th August 1911.

G. W. DISNEY.

My dear Gruning,

Herewith copy of my letter to Shakespear in confirmation of our conversation on the *Brahmakund* yesterday.

12th August 1911.

G. W. DISNEY.

My dear Gruning,

I have had a long letter about the tenders for the water-supply scheme, from Disney, who tells me that he has discussed the matter with you. He has got quite a wrong notion of what Mr. Benson and

I proposed doing before coming to any final decision as regards these contracts. The contracts were not advertised for, but all firms likely to tender were asked to do so, no time was given for opening the tenders, nor did we bind ourselves in any way as which tender we would take. Except Simpson & Co., none of the tenders were complete, and yet it was clear that some of the firms might submit tenders worth considering, if the matter was clearly represented to them. We therefore proposed that Benson should visit Calcutta and see all the tenderers and give them whatever information they might want and then ask each whether he would submit a revised tender, and on these revised tenders Disney should decide. You see there is nothing objectionable in this. It is most important for the State to get the lowest tender, as long as the firm is capable of carrying out the contract. Jessops, Burn and one or two others certainly are reliable. I consider that it is our duty to the State to give every one a fair chance. As far as I can see, Simpson's tender is likely to be lowest, but I want to get real tenders from the others first, before letting them have the contract. Some items in Simpson's tender are extraordinarily high and I feel sure that when Benson has explained matters to them, they will be able to reduce their estimate in this matter. Benson is a very careful fellow and has been doing most excellent work since he came here; unfortunately, both the men left him by Mr. Pritchard turned out broken reeds, and have had to be dismissed and this has caused great delay and thrown much extra work on Benson. When I tell you that by carefully thought out changes he has made a saving of over Rs. 15,000 in the cost of the distributary pipes alone, you will admit that he has not done badly.

17th August 1911.

J. SHAKESPEAR.

My dear Gruning,

I am sending you officially my recommendations and note of action taken about the Manipur waterworks tenders. You might send a wire to Messrs. James Simpson & Co., registered address "Agnosty, Calcutta," if you accept my views. This should be done as soon as possible, as I shall be out of reach after to-morrow on tour.

29th August 1911.

G. W. DISNEY.

My dear Gruning,

I am enclosing Appendix A to my letter of yesterday's date re Manipur waterworks. I think we have at last got the matter on a going basis.

Shakespear's idea is to accept the lowest tender, but I consider it better to pay a little more for brains and efficient supervision.

30th August 1911.

G. W. DISNEY.

FROM THE SANITARY ENGINEER TO THE GOVERNMENT OF EASTERN BENGAL AND ASSAM, No. 1C.—C.,
DATED THE 29TH AUGUST 1911.

His Honour,

I am afraid that I must submit these papers for orders without the main file which is with Sanitary Engineer. The scheme for the Manipur waterworks was worked out finally by Mr. Disney and duly sanctioned. Mr. Disney states that he has accepted the tender of Messrs. James Simpson & Co., to do the whole work and hand it over as a going concern. I think that we may approve his action for which he has given good reasons. Messrs. Masbeth Brothers submitted a lower tender, but it is very doubtful if that firm has sufficient experience to carry out a big scheme, and a failure would be most expensive.

I may mention that Colonel Shakespear wrote to me to suggest that the State Engineer, Mr. Benson, should go to Calcutta and interview all the firms who had tendered, with a view to ensuring that the State did not pay more than was absolutely necessary. This seemed to me to be a useless proposal. Mr. Benson is young and has little experience; it is far better for the Sanitary Engineer, who is an expert, to deal with the matter.

I am very doubtful about the propriety of telegraphing to Messrs. Simpson & Co. as Mr. Disney suggests, as I am not sure, in the absence of the main file, whether the tender should not be formally accepted by the Manipur Durbar. I suggest therefore that we should (1) write to Sanitary Engineer and approve the action taken by him, and (2) inform Political Agent in Manipur. We might also suggest that Colonel Shakespear should consider the advisability of buying a motor car. The State can get one cheap after the Delhi Durbar.

1st September 1911.

J. F. GRUNING.

I agree.

2nd September 1911.

C. S. BAXLEY.

TELEGRAM TO THE SANITARY ENGINEER, EASTERN BENGAL AND ASSAM, DATED THE 3RD SEPTEMBER 1911.

TO THE POLITICAL AGENT IN MANIPUR, No. 249P.T., DATED THE 5TH SEPTEMBER 1911.

TO THE SANITARY ENGINEER, EASTERN BENGAL AND ASSAM, No. 260P.T., DATED THE 5TH SEPTEMBER 1911.

My dear Disney,

(Demi-official No. 25P.T.) I am writing to you officially to say that the Lieutenant-Governor approves of your action in accepting the tender of Messrs. James Simpson & Co. for the Manipur waterworks. I have not the file with me, however, and do not consider it advisable to wire to the firm, as I am not sure whether the tender should not be formally accepted by the Manipur Durbar.

5th September 1911.

J. F. GRUNING.

Mr. Disney unofficially,

Will you please see Colonel Shakespear's demi-official letter, dated the 12th August 1911? It seems to me that the question of the firm to be employed is one for you to decide and you have probably gone into the matter at Calcutta. If that is so, it is not apparent what advantage will be gained by Mr. Benson going to Calcutta and interviewing the tenderers.

28th August 1911.

J. F. GRUNING.

Mr. Gruning unofficially,

I met Mr. Benson in Calcutta where he had been deputed by the Durbar. He had induced Messrs. Simpson & Co. to reduce their tender, and as I have just received a telegram from you informing me that His Honour approves of the acceptance of that firm's tender as amended, there is no necessity for taking further action. I have informed Messrs. Simpson & Co. that their tender is accepted, subject to the execution of the usual contract form in which details as to duration of maintenance by the contractors after opening the waterworks, payments, and other particulars will be specified. In the meantime the work of collecting the necessary materials will proceed.

5th September 1911.

G. W. DISNEY.

My dear Gruning,

Herewith copy of letter from Colonel Shakespear. Every one seems pleased, so this is all right.

Shall I sign the contract, or will you do so on behalf of Government? I do not know of any rule applicable to this case. As a Superintending Engineer in the Public Works Department my powers are only up to Rs. 20,000, but this is not a Public Works Department work.

26th September 1911.

G. W. DISNEY.

Extract from demi-official letter, dated the 4th September 1911, from Lieutenant-Colonel John Shakespear, C.I.E., D.S.O., Political Agent, Manipur, to Mr. G. W. Disney, Sanitary Engineer to Government, Eastern Bengal and Assam.

Many thanks for your demi-officials of 30th and 27th ultimo. I am very glad the contract has been signed. I quite agree with you that it is better to pay a little more and get a sound contractor, whom you can trust. The Raja is quite satisfied. The contract seems in every way satisfactory and it is a pleasant surprise to find an estimate of Mitchell's, which has not been exceeded. I have heard nothing about your motor car. The last letter about the cars was a strict order that both were to be sold after the Durbar. However, I dare say we shall manage to retain one, but you will have to worry the Public Works Department about the road or it will not be much use to you except for three months.

I think it was well worth while sending Benson down to Calcutta, for the contractors will not now be able to complain that they did not understand things and he has got them to reduce their tenders a good deal.

This is very satisfactory. Please let me know who should sign the contract. I should not sign, as it is not Government but the Manipur State which is entering into it.

27th September 1911.

J. F. GRUNING.

Secretary,

Please see this Government letter No. 875J., dated the 6th March 1907, regarding the agreement between the Manipur Durbar and Messrs. Anderson Wright & Co. for the introduction of silk industry in that State. It was in that case decided that the agreement was to be executed by the Member in charge and sealed with the State seal if the agreement was to be signed after the administration had been entrusted to the Durbar. That decision applies to this case also apparently. The contract seems to have been signed and in that event no further action will be necessary.

14th October 1911.

H. K. BRISCOE.

Mr. Disney unofficially,

I should like to make quite certain that the contract has been signed. Can you tell me definitely and, if so, who signed it on behalf of the Manipur State?

16th October 1911.

J. F. GRUNING.

Mr. Gruning unofficially,

The tender for the works submitted by Messrs. James Simpson & Co. was provisionally accepted by me, but the contract has not as yet been executed. The draft should, I think, be approved by me and then formally executed, as the contractors are working on my action.

16th October 1911.

G. W. DISNEY.

Secretary,

Shall I ask Political Agent demi-officially to send the contract to Mr. Disney, before execution by Durbar?

17th October 1911.

H. K. BRISCOE.

Yes please.

18th October 1911.

J. F. GRUNING.

FROM THE POLITICAL AGENT, MANIPUR, No. 737M.S., DATED THE 14TH OCTOBER 1911.

Secretary,

The first instalment of the loan of Rs. 2,00,000 granted to the State for the waterworks is to be drawn this month (*vide* paragraph 6 of this Government letter No. 826P., dated the 26th October 1910). In this connection paragraph 5 of Political Agent's letter No. 56M.S., dated the 22nd April 1911, may be read along with Mr Higgin's note on the waterworks, forwarded with Political Agent's letter No. 825M.S., dated the 18th August 1910.

Government did not specifically discuss Mr. Higgin's proposals in this respect, either when made nor in the budget file put up: still I take it we are more or less committed: in any case we can always insist on the reserve being replenished.

Proposal may be sanctioned by telegram.

20th October 1911.

H. K. BRISCOE.

We may sanction as proposed. Please do not forget to ask Political Agent to send the contract to Mr. Disney for examination before it is executed by the Durbar.

20th October 1911.

J. F. GRUNING.

TELEGRAM TO POLITICAL AGENT, MANIPUR, NO. 588P., DATED THE 21ST OCTOBER 1911.

TO THE ACCOUNTANT GENERAL, EASTERN BENGAL AND ASSAM, NO. 854P., DATED THE 21ST OCTOBER 1911.

Dear Colonel Shakespear,

(Demi-official No. 849P.) I am desirous to refer to your demi official letter, dated the 4th September 1911, to Mr. Disney regarding the contract for the Manipur waterworks. It is understood that the contract with Messrs. James Simpson & Co. has not yet been executed and Government thinks it would be a good thing if you would very kindly send the draft of the contract to Mr. Disney for scrutiny before it is finally executed by the Durbar.

20th October 1911.

H. K. BRISCOE.

My dear Mr. Briscoe,

In reply to your demi-official No. 849P. of 20th instant, I must explain that, when Mr. Benson returned from Calcutta, he informed me that the contract would be sent in due course. On receipt of your demi-official, I wrote to ask him the state of the case and I enclose his reply.

A few days ago I received a letter from Mr. Disney, saying that after consulting with Mr. Gruning he thought Mr. Higgins should sign the contract after he, Mr. Disney, had approved it, and I have telegraphed that I agreed. It would appear that Messrs. Simpson & Co. are responsible for the delay.

27th October 1911.

J. SHAKESPEAR.

Demi-official from H. BENSON, Esq., to Colonel J. SHAKESPEAR, dated the 26th October 1911.

It was arranged by Disney that Simpson & Co. were to draw up a contract, same as one they had already done for him, and that it was to be forwarded to him and a copy to me.

I asked Simpson & Co. in Calcutta to let me have this at once and I have since written to them I think on two occasions, but they have paid no attention to my requirements.

I think Disney should take up this matter and point out to them the urgency of the matter.

Mr. Disney unofficially,

Will you please read these demi-officials about the contract for the Manipur waterworks? Perhaps you can induce Messrs. Simpson & Co. to expedite matters.

2nd November 1911.

J. F. GRUNING.

Secretary,

I have telegraphed to Messrs. Simpson & Co. to complete the contract without further delay.

3rd November 1911.

G. W. DISNEY.

Seen.

7th November 1911.

J. F. GRUNING.

FROM THE POLITICAL AGENT, MANIPUR, NO. 784M.S., DATED THE 26TH OCTOBER 1911.

Secretary,

The withdrawal of Rs. 15,000 from the reserve was sanctioned in this Department telegram No. 588P., dated the 21st October 1911. The Political Agent now wants to withdraw a further sum of Rs. 1,20,500.

The Political Agent also wants to draw Rs. 1,20,000 out of the loan of Rs. 2,00,000 sanctioned for the waterworks scheme. In paragraph 6 of this Department letter No. 826P., dated the 26th October 1910, it was proposed that the money should be drawn on the following dates:—

M
(—)
69

Rs. 1,00,000 in October 1911.

Rs. 75,000 in June 1912.

Rs. 25,000 in the latter part of 1912.

We may ask Financial Department whether the sanction is sufficiently general to allow us to make the full advance desired now.

1st November 1911.

H. K. BRISCOE.

Financial Secretary,

We asked the Government of India to sanction a loan of two lakhs to the Manipur State to be repaid in 20 years and proposed that the loan should be drawn in the following instalments :—

	Rs.
October 1911	1,00,000
June 1912	75,000
Latter part of 1912	25,000

Political Agent now wants to draw Rs. 1,20,000 on December 1st next.

In their letter India sanctioned the loan but stipulated that it was to be repaid in 10 years. They said nothing about instalments.

Is there any objection to the first instalment of Rs. 1,20,000 being drawn on December 1st, 1911? I do not want to do anything which may delay the work.

2nd November 1911.

J. F. GRUNING.

Political unofficially,

In our Loans budget for this year we have only Rs. 1,00,000 under class III. This amount can be made available on 1st December. We have savings under other heads, but must get India's permission before we can transfer another Rs. 20,000 to class III. We will ask for this if you wish us to do so, but perhaps the Durbar would rather draw on their Reserve for the present.

13th November 1911.

W. J. REID.

Secretary,

I send this case to you direct, as an answer is wanted soon. The Durbar may be asked to arrange for the payment of the remaining Rs. 20,000 out of the Reserve as soon as funds will permit.

In any case it would be impossible to obtain the sanction of the Government of India before December 1st.

16th November 1911.

S. K. SAWDAY.

Shown to His Honour. Issue as amended.

21st November 1911.

J. F. GRUNING.

My dear Shakespear,

(Demi-official No. 28P.T.) Will you please refer to your letter No. 784M.S., dated the 26th October 1911, on the subject of expenditure on the Manipur waterworks? There is some difficulty in accepting your proposals as they stand, for we have only Rs. 1,00,000 in our Loans budget this year under class III, and if we are to add another Rs. 20,000, we shall have to get the sanction of the Government of India and this will take time. If the Durbar can draw this Rs. 20,000 from their Reserve, it will simplify matters and we can sanction the rest of your proposals at once, but if that is impossible, we must refer the case to the Government of India.

P. S.—If the Durbar cannot find the extra money, would it not be possible to arrange with the contractors that the Rs. 20,000 should stand over till the beginning of the next financial year?

21st November 1911.

J. F. GRUNING.

FROM THE POLITICAL AGENT, MANIPUR, No. 833M.S., DATED THE 3TH NOVEMBER 1911.

FROM THE SANITARY ENGINEER, EASTERN BENGAL AND ASSAM, No. 516G., DATED THE 15TH NOVEMBER 1911.

FROM THE FINANCIAL DEPARTMENT OF THIS GOVERNMENT, No. 6310F., DATED THE 16TH DECEMBER 1911.
Special Officer,

The Political Agent has not yet replied to our demi-official No. 28P.T., dated the 21st November 1911. Financial Department may be requested unofficially to take steps that the loan of Rs. 1,00,000 may be placed to the credit of the Vice-President, Manipur State Durbar, with the Bank of Bengal, Calcutta, instead of in the Imphal Treasury, as desired by the Political Agent in his letter No. 833M.S., dated the 8th November 1911.

Nalini—19th December 1911.

Financial unofficially,

Would you kindly instruct the Accountant General to have the money put to the credit of the Vice-President of the Durbar with the Bank of Bengal, Calcutta?

18th December 1911.

G. E. SOAVES.

We may ask Accountant General unofficially kindly to arrange for the payment of one lakh in Calcutta to the credit of the Vice-President, Manipur State Durbar, with the Bank of Bengal. No formal modification of the orders seems necessary.

U. M. Sen—28th December 1911.

Accountant General unofficially,

Kindly refer to Financial Department letter No. 6309F., dated the 16th December 1911, regarding the payment of a loan of Rs. 1,00,000 to the Manipur State in 1911-1912. The Political Agent asks that the loan may be placed to the credit of the Vice-President, Manipur State Durbar, with the Bank of Bengal, Calcutta. Will you kindly arrange for the payment accordingly?

28th December 1911.

G. E. SOAMES.

Under-Secretary,

The Accountant General, Bengal, has been asked to arrange.

2nd January 1912.

W. ALDER.

TELEGRAM FROM THE GENERAL OFFICER COMMANDING ASSAM BRIGADE, No. 13R., DATED THE 3RD JANUARY 1912.

TO THE POLITICAL AGENT IN MANIPUR, No. 11P., DATED THE 5TH JANUARY 1912.

Under-Secretary,

The General Officer Commanding was asked in our letter No. 434P., dated the 21st June 1911, whether the military authorities were prepared to pay Rs. 1,000 as annual contribution for the supply of water from the State waterworks to the military detachment at Imphal. The General now asks for the capital cost of extension of pipe to the Cantonment. The estimates are being printed and both the original and the proof are with the Sanitary Engineer for examination. Mr. Disney may be requested unofficially to let us know what would be the capital cost of extension.

Nalini—4th January 1912.

Sanitary Engineer unofficially,

Would you kindly let us know the cost asked for in the telegram put up?

4th January 1912.

S. K. SAWDAY.

Secretary, General,

The General Officer Commanding is apparently going to argue that if the cost of the pipe lines inside the Cantonment from the water main on the road outside its limits is a sum of X, the military authorities should not be called on to pay Rs. 1,000 a year for water, omitting altogether the cost of some 10 miles of water main from the intake thereto. I can of course easily give the cause of the distributary pipes inside Cantonment limits, but it is not I think advisable to give him this information. He might be given a diplomatic reply to the effect that the cost of the distribution pipes inside Cantonment must include a percentage of the cost of the main and waterworks, that this can be done but will entail some delay, that Rs. 1,000 per annum is considerably less than 1 per cent. on the capital cost of the waterworks, and that the contribution asked for has been calculated on lines very favourable for him.

6th January 1912.

G. W. DISNEY.

Secretary,

There is little doubt that Mr. Disney's surmise is right, but there does not seem any objection to telegraphing the figures asked for. The argument is scarcely worthy of notice and can at once be refuted if advanced.

8th January 1912.

S. K. SAWDAY.

Reply as Mr. Disney suggests.

9th January 1912.

J. F. GRUNING.

TELEGRAM TO THE GENERAL OFFICER COMMANDING ASSAM BRIGADE, No. 12P., DATED THE 10TH JANUARY 1912.

Revenue Secretary (by wire),

(Telegram No. 200P.) Your No. 11P. of 5th January. Vice-President reports money waterworks not placed with Bank Bengal, Calcutta, to his credit. Please arrange.

2nd March 1912.

J. SHAKESPEAR.

Look up the papers and see what arrangements were made.

2nd March 1912.

J. F. GRUNING.

Under-Secretary,

Our main file was sent to His Honour on 2nd March 1912. We asked the Financial Department to arrange to place Rs. 1,00,000 with the Bank of Bengal, Calcutta, to the credit of the Vice-President, Manipur Durbar, and we were informed that they had made the necessary arrangement through the Accountant General. Financial Department may be asked unofficially as to why this reference has been made.

Nalini—4th March 1912.

Accountant General unofficially,

Will you kindly inform us what has been done?

4th March 1912.

S. K. SAWDAY.

Under-Secretary,

Please refer to my No. 184Bk., dated the 14th February 1912, to Financial Secretary, in which I asked for further information. A reply is being awaited.

5th March 1912.

W. ALDER.

Extract from Financial Department File No. IIL-27 of 1912.

Accountant General,

I shall be much obliged if you will kindly let me know what the difficulty is. The Manipur State wants Rs. 1,00,000, part of the loan granted for the waterworks placed at the disposal of the Vice-President in the Bank of Bengal, Calcutta. We are told that this cannot be done, because the Vice-President has no account there, but to a lay man it would seem quite easy to open one. It will be of great assistance to me if you will advise what action should be taken.

4th March 1912.

J. F. GRUNING.

Secretary,

I think the only course is for the Vice-President to open an account. If you will tell him to do so at once and will let me know, I will then ask Accountant General, Bengal, to arrange for the payment on the account being opened.

6th March 1912.

W. ALDER.

Under-Secretary,

We may wire to the Political Agent, Manipur, as suggested by the Accountant General and return the linked file to the Financial Department with the intimation of the steps we are taking. Then the file may be shown again to the Accountant General unofficially. A draft put up.

Nalini—7th March 1912.

Issue and send to Accountant General.

7th March 1912.

S. K. SAWDAY.

I am asking Accountant General, Bengal, to pay into the account when opened.

8th March 1912.

W. ALDER.

Political Agent, Manipur (by wire),

(No. 30P.) Your telegram No. 206P. of 2nd. Secretary and Treasurer, Bank of Bengal, Calcutta, reports that there is no account with Bank in the name of Vice-President, Manipur Durbar. Please ask Vice-President to open account at once. Arrangement will be made for payment of waterworks money on the account being opened.

7th March 1912.

S. K. SAWDAY.

FROM THE SANITARY ENGINEER TO THE GOVERNMENT OF EASTERN BENGAL AND ASSAM, No. 580-83,
DATED THE 5TH MARCH 1912.

His Honour,

I think His Honour will wish to see Mr. Disney's report on the Manipur waterworks. We will remind General Officer Commanding Division again about the cantonments.

8th March 1912.

J. F. GRUNING.

12th March 1912.

C. S. BAYLEY.

TELEGRAM FROM THE POLITICAL AGENT, MANIPUR, No. 209P., DATED THE 15TH MARCH 1912.

Under-Secretary,

Some months ago sanction was given to the withdrawal of Rs 15,000 from the Reserve and the Political Agent again wanted to withdraw more money, but sanction was not given, as the first instalment of the loan of two lakhs was due in October 1911. Financial Department have made arrangement with the Accountant General to place one lakh of this loan to the credit of the Vice-President of the Durbar with the Bank of Bengal, Calcutta. The next instalment of Rs. 75,000 is due in June 1912. Perhaps more money is required to pay the contractors and the Political Agent asks for sanction to withdraw Rs. 1,20,500 from the Reserve. Paragraphs 6 to 8 of the note on the waterworks by the Vice-President may be read. It was anticipated that their call on the Reserve will be some Rs. 2,73,000. In these circumstances the sanction asked for may perhaps be accorded.

Pol., A, Jan. 1911, Nos. 10-15 ($\frac{M}{69}$ -P).

Nalini—16th March 1912.

Secretary,

The Political Agent estimated withdrawals during January and February at Rs. 1,10,000 + Rs. 15,000. He now asks for Rs. 1,20,500. Moreover he estimated that Rs. 25,000 would have to be withdrawn in December. Only Rs. 15,000 was taken, so that there is a margin on both occasions. Sanction may be given.

16th March 1912.

S. K. SAWDAY.

Sanction.

16th March 1912.

J. F. GRUNING.

TELEGRAM TO THE POLITICAL AGENT, MANIPUR, No. 46P., DATED THE 18TH MARCH 1912.

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TO THE ACCOUNTANT GENERAL, EASTERN BENGAL AND ASSAM, NO. 158P., DATED THE 18TH MARCH 1912.

FROM THE POLITICAL AGENT, MANIPUR, NO. 1193M.S., DATED THE 12TH MARCH 1912.

FROM THE SANITARY ENGINEER TO THE GOVERNMENT OF EASTERN BENGAL AND ASSAM, NO. 661-62, DATED 18TH MARCH 1912.

FROM THE SANITARY ENGINEER TO THE GOVERNMENT OF EASTERN BENGAL AND ASSAM, NO. 663-64, DATED THE 18TH MARCH 1912.

FROM THE FINANCIAL DEPARTMENT, EASTERN BENGAL AND ASSAM GOVERNMENT, NO. 1638F., DATED THE 19TH MARCH 1912.

Chief Secretary,

Political Agent's letter of the 12th March 1912.—Please see Assam Brigade letter No. 382R., dated the 18th March 1912. The military authorities have not yet come to any decision as to the annual contribution of Rs. 1,000, to be paid by them towards the water-supply scheme at Imphal, as proposed in our letter No. 434P., dated the 21st March 1911, a copy of which may be forwarded to the Political Agent for information. The notes and orders, dated the 31st May 1911 and dated the 16th June 1911, may be read and it will be seen that the contribution was calculated in consultation with the Sanitary Engineer to Government who prepared the estimates for the work.

Sanitary Engineer's letters dated the 18th March 1912.—For information.

Financial Department letter dated the 19th March 1912.—India Government orders regarding the repayment of the loan in 10 years were communicated to the Political Agent, Manipur, in memorandum No. 129-30P., dated the 3rd March 1911. Financial Department have now decided that the loan should be recovered in ten equal instalments. Copy may be sent to Political Agent.

Two drafts put up for approval.

Nalini—15th April 1912.

Issue.

15th April 1912.

W. J. REID.

TO THE POLITICAL AGENT, MANIPUR, NO. 187P., DATED 17TH APRIL 1912.

TO THE POLITICAL AGENT, MANIPUR, NO. 188P., DATED THE 17TH APRIL 1912.

19

ASSAM SECRETARIAT.

POLITICAL DEPARTMENT.

POLITICAL--A.

MAY 1912.

Manipur Waterworks.

Grant of a loan of two lakhs of rupees to the Manipur Durbar.

No. 1.

No. 145I.A., dated Fort William, the 24th January 1911.

From—The Assistant Secretary to the Government of India in the Foreign Department,

To—The Secretary to the Government of Eastern Bengal and Assam, Revenue and General Department.

I am directed to refer to the correspondence ending with your letter No. 951P., dated the 16th December 1910, regarding the application of the Manipur Durbar for a loan of Rs. 2,00,000 to enable them to construct waterworks to supply the town of Imphal.

2. In the circumstances explained, I am to convey sanction to a loan of rupees two lakhs at 4 per cent. per annum being granted to the Manipur State through the Provincial Loan Account, but on the condition that the advance is repaid in 10, and not 20 years.

No. 2.

Telegram No. 307P., dated Shillong, the 27th January 1911.

From—Secretary to Government of Eastern Bengal and Assam, Revenue Department,

To—Political Agent in Manipur.

India have sanctioned loan of two lakhs for waterworks at four per cent., repayable in ten years.

No. 3.

No. 483-87, dated Dacca, the 18th February 1911.

Memo. by—The Sanitary Engineer to the Government of Eastern Bengal and Assam.

Note by Mr. G. W. Disney, Sanitary Engineer to Government, Eastern Bengal and Assam, on the Manipur water-supply project, dated Manipur, the 27th January 1911, is forwarded to the Secretary to the Government of Eastern Bengal and Assam in the Political Department for information.

No. 4.

Note by Mr. G. W. Disney, Sanitary Engineer to Government, Eastern Bengal and Assam, on the Manipur water-supply project, dated Manipur, the 27th January 1911.

1. *History.*—After much preliminary correspondence extending over a period of two years, Mr. E. J. Mitchell, Executive Engineer, Manipur Division, submitted an estimate amounting to Rs. 1,81,289 in July 1902 for providing a water-supply for Manipur. This was for a pipe supply for 8,000 persons, the source being the Palok stream, situated in the hills some 10½ miles distant. I have no correspondence to show why it fell through. In 1908 this project was revived, and Mr. Mitchell again placed on special duty towards the end of 1909, in order to reconsider and recast his scheme, which came before me and was noted on, see my notes of the 20th October and 2nd November 1910. Mr. C. A. White, Officiating Chief Engineer, Eastern Bengal and Assam, in his note of the 30th October 1910, suggested that Mr. MacCabe Chief Engineer to the Calcutta Corporation, who is probably the greatest authority on water-supply in India, be consulted, and it is in accordance with his report, dated the 30th December 1910, that this note is written, after personal inspection of the proposed sites of Intake and Service Reservoir, and of the Distribution system.

2. *Project.*—(a) *Scheme to be adopted.*—This is for a water-supply for 35,000 persons at 5 gallon per head per day. Mr. MacCabe suggests that the Palak source be, in the first instance, alone depended on, with provisions for its augmentation from the Maylong stream in the supply main, and in this view after I have seen the sources and weighed the local arguments, I fully concur.

(b) *Head works.*—Surveys are being made in order to ascertain if local conditions of site of Head Works permit of two small tanks being constructed in which the velocity of the water can be reduced to less than 1 foot per second, in order to induce the silt to deposit. The fact that there is no reliable data as to high flood-level however complicates this. A duplicate set of Jewell filters is highly desirable, and specially so, taking into consideration the difficulty and danger of charging the main with water after temporary interruptions.

(c) *Main line of pipes.*—The suggestions made by Mr. MacCabe are very pertinent and will be adhered to.

(d) *Diameter of main pipes.*—It would be a decided improvement to substitute 7" diameter pipes for 6" ones for the length from the Intake to the Service Reservoir, a distance of 39,270 feet, in order to allow for corrosion and silting up.

(e) *Service Reservoir.*—The cost of portland cement being prohibitive at the site of the works, and in view of the fact that earthquake shocks are by no means of rare occurrence, I propose substituting mild steel for a concrete reservoir. Mr. Mitchell in his estimate provided for a storage capacity of 300,000 gallons in this and of say 35,000 gallons in his subsidiary distribution tanks, a total of 335,000 gallons, or nearly 2 days' supply ($175,000 \times 2 = 350,000$). Mr. MacCabe states the requirements of the case to be "The Service Reservoir should be of ample size to balance the difference between the maximum demand rate and the average rate of flow into it," and gives the rate and duration of the former in Calcutta as three times of the average demand rate for 3 hours. The average demand rate in Imphal may be calculated at $\frac{175,000}{8} = 21,875$ per hour for 8 hours and the maximum demand $21,875 \times 3 = 65,625$. The rate of flow into the Service Reservoir may be assumed to be $\frac{175,000}{20}$ allowing 4 hours per day for washing filters and other interruption $= 8,750$ gallons per hour. Therefore $21,875 - 8,750 = 13,125$ gallons per hour, or $13,125 \times 3 = 39,375$ gallons for the period of maximum demand. Irrespective of the Subsidiary storage tanks a circular steel Service Reservoir 42' 6" in diameter and 10' high would afford storage for, say, 83,500 gallons, or more than half a day's demand; one of these might be constructed in the first instance, provision being made at the site for the duplication, or further multiplication of these as may later on be found necessary. According to the data afforded by the cost of steel tank recently erected at Nimthing Tank in Imphal, a 42½' diameter tank would cost some Rs. 14,500 as compared with Rs. 18,000 provided for in Mr. Mitchell's estimate for a concrete tank, but the storage capacity will be much less. It will probably be found that this estimate will be largely reduced on quotations being asked for.

(f) *Service mains.*—Mr. MacCabe strongly opposes steel pipes, and is in favour of corrugated iron on the grounds of their longer life, but it is only the proposed adoption of steel that has made the project a financial possibility owing to the cost of carriage. The preservation of steel piping has been the subject of a Commission of eminent Engineers and Chemists in connection with the Koolgardie water-supply (Western Australia). I have sent samples of the water from the Palak and Maylong streams to the Provincial Laboratory at Dacca for analysis, with special reference to their corrosive properties, and am making extensive enquiries on the life of steel pipes generally, and refrain, with all due deference to Mr. MacCabe, from accepting subjection on this point, pending further information being received by me on the subject.

3. *Source of supply.*—It is worthy of notice that the valleys of the Palak and Maylong streams are very suitable for the construction of large impounding reservoirs, which may in future years be found advantageous to adopt. The proposed pipe line could also be utilised in this event, and it may very possibly be found in the future, with improved appliances for the storage of electricity, that the waste water from the impounding reservoirs could be used for generating electrical power.

4. *Distribution.*—In the absence of a good map of Imphal from which the pipe lines could be accurately scaled off, it is very necessary that the alignment of the various distributories from the main be laid out on the ground, dovetailed in a permanent and efficient manner, and the sites of the subsidiary distribution tank clearly marked on the ground. The lengths of the different pipe lines should then be accurately measured, and the estimate corrected accordingly; bends, technically known as specials, are much more costly than straight pipes, and if the alignment is carefully

made, with a view of minimising the necessity of using these, a large sum of money may be avoided being wasted. As the distributories, for the most part, pass through gardens and compounds covered with tree and bamboo jungle, much scope for good work is afforded in this preliminary stage, and as considerable doubt exists as to the actual lengths of the various pipe lines, it is the more necessary to have this done at an early date, so as to ensure accurate ordering of the different pipes. I most strongly advise that this work be taken up at once.

5. *Drainage*.—It should be remembered that no water-supply system is complete without an efficient drainage system, and that ample provision should be made for spillage from standposts being rapidly carried off by suitable drains. The conditions obtaining at Imphal are for the most part such as to render dry season drainage a very simple matter, as the level of the water in the Imphal river is many feet below that of the stagnant water in the tanks and depressions in its vicinity. With an efficient water-supply the necessity for most of these will disappear, and public health would much improve by their drainage from, say, October until June. The rainy season drainage for the station would be a very costly project, but the dry season one should be comparatively inexpensive and very efficient.

6. *Silt*.—The waters flowing across the valley in the rains obviously carry a large proportion of silt, which, owing to the rivers being confined to their courses by marginal embankments, silt up their beds and impede the rapid flow off during flood time. This is a striking instance of where the Italian process of "Bonificazione" might with great effect be introduced, but this is perhaps, under existing circumstances, a council of perfection. This system, as has been conclusively proved, would not only immensely improve the value of the property in Manipur Valley, but also its sanitary condition, and is by no means a different subject to master.

7. *Urgency*.—In conclusion, I must place on record that, in view of the various epidemic of cholera which have occurred in Imphal, I am of opinion that the question of a pure water-supply is an urgent necessity and recommend that the State undertake at once the collection of rubble dressed stone at the proposed Intake at Irong, and in clearing and marking out the alignment of the distributories, as alluded to in paragraph 4 of this note. The levels and lengths of the pipe main should also be checked, as there is not sufficient definite information available to give proposed contractors. Tenders for the work might then be invited and I suggest the following firms:—

1. Messrs. Martin & Co.,
2. „ James Simpson & Co.,
3. „ Burn & Co.,
4. „ Jessop & Co.,

all of Calcutta, but this cannot be done until the question of steel or corrugated iron pipes is settled.

No. 5.

No. 129-30P., dated Shillong, the 3rd March 1911.

Memo. by—The Under-Secretary to [the Government of Eastern Bengal Assam, Political Department.

[Extract paragraph 6 from Political Department letter No. 826P., dated the 26th October 1910, to the Government of India in the Foreign Department], letter No. 145I.A., dated the 24th January 1911, from the Government of India in the Foreign Department, is forwarded to [To Financial Department only.]
Political Agent in Manipur
Financial Department of this Government for information in continuation of this Department letter No. 307P., dated the 27th January 1911, for favour of communication to the Accountant General, Eastern Bengal and Assam.

No. 6.

No. 229P., dated Shillong, the 7th April 1911.

From—H. K. BRISCOE, Esq., I.C.S., Under-Secretary to [the Government of Eastern Bengal and Assam, Political Department,

To—The Political Agent in Manipur.

In connection with the Imphal waterworks scheme, I am directed to request that you will be so good as to favour Government with a statement showing the population of (1) the British Reserve and (2) the Cantonment in Manipur at the recent census. Europeans and Indians should be shown separately.

No. 7.

No. 35M.S., dated Imphal, the 19th April 1911.

From—Lieutenant-Colonel J. SHAKESPEAR, C.I.E., D.S.O., I.A., Political Agent in Manipur,
To—The Secretary to the Government of Eastern Bengal and Assam, Revenue and General Department.

Referring to your letter No. 229P., dated the 7th instant, I have the honour to enclose herewith a statement showing the population of—

- (1) the British Reserve, and
(2) the Cantonment in Manipur
at the recent census as asked for therein.

No. 8.

Population of British Reserve and Cantonment in Manipur.

Name of place.	Europeans.	Indians.	Total.	Remarks.
1	2	3	4	5
1. British Reserve	9	1,278	1,287	
2. Cantonment	8	1,056	1,064	
Total	17	2,334	2,351	

No. 9.

No. 200M.S., dated Imphal, the 26th May 1911.

From—Lieutenant-Colonel J. SHAKESPEAR, C.I.E., D.S.O., I.A., Political Agent in Manipur,
To—The Secretary to the Government of Eastern Bengal and Assam in the Revenue and General Department.

I have the honour to report that the scheme for the supply of drinking water to Imphal has progressed so far now that it is necessary for definite arrangements to be made as regards the supply of water to the Cantonment, and therefore I beg to draw your attention to paragraph 3 of my letter No. 825M.S. of 18th August 1910, to your address, and to enquire whether the Military authorities are prepared to accept the terms therein proposed, *viz.*, that if the Military Department wish the distribution pipes extended to the Military lines, it should pay a water-rate which should be calculated so as to cover all working and maintenance charges and also give a fair return on the capital cost, *i.e.*, the rate shall be calculated just as if the State were a Company supplying water, only that no exorbitant interest shall be calculated on. I have directed Mr. Benson, State Engineer, to do nothing as regards the distribution scheme within Cantonment till he receives further orders.

Major Tytler informs me that he is addressing the General Officer Commanding the Brigade regarding this matter and that the distribution scheme proposed by Mr. Mitchell is unsatisfactory. I have told him that Mr. Mitchell's scheme was only a rough idea to enable the lengths of pipes to be estimated for, and that if the Military Department agree to pay a water-rate calculated as proposed in my letter above referred to, any distribution scheme approved of by the Department can be carried out as long as the supply does not exceed 5 gallons per head of the population.

No. 10.

No. 434P., dated Shillong, the 21st June 1911.

From—The Hon'ble Mr. J. F. GRUNING, I.C.S., Secretary to the Government of Eastern Bengal and Assam, Political Department,
To—The General Officer Commanding Assam Brigade.

I am directed to address you regarding the supply to the troops stationed at Imphal, the capital of the Manipur State, of water from the State waterworks which, it is hoped, will be completed before the hot weather of 1912.

2. It is understood that the Military Department approve the proposal that the troops at Imphal should be supplied with water from the new waterworks, and it remains therefore to decide the terms of payment.

3. It is suggested that the Military Department should pay their proportionate share, calculated on the ratio of their requirements to the total supply, of interest at 4 per cent. on the total capital outlay and the annual cost of working, including depreciation which is an item that the Lieutenant-Governor thinks must be taken into consideration.

4. The entire cost of construction has been taken at Rs. 2,90,000, and interest on that sum at 4 per cent. amounts to Rs. 11,600 per annum. The annual cost of working and maintenance has been estimated at Rs. 7,000 per annum; while the Lieutenant-Governor is advised that for depreciation an allowance of 5 per cent. per annum should be made on the total capital outlay, or Rs. 14,500 per year. The three items amount in all to Rs. 33,100.

5. The total daily supply from the new waterworks is estimated at 175,000 gallons.

It is assumed that Europeans will require roughly 20 gallons a day and Indians 5 gallons. At the census in March last 8 Europeans and 1,056 Indians were returned from the cantonment. Their daily demand would, therefore, be 5,440 $[(8 \times 20) + (1,056 \times 5)]$ gallons approximately.

6. The proportionate annual contribution for the cantonment would, therefore, be $\frac{5,440}{175,000}$ of Rs. 33,100, or roughly Rs. 1,029.

In view, however, of the fact that no trouble or expense in collection would be entailed on the State and that payment would be absolutely secure, the Lieutenant-Governor considers that an annual contribution of Rs. 1,000 would be very suitable and I am now to enquire whether the Military authorities are prepared to pay that sum.

7. A charge of less than Re. 1 per head per annum is, His Honour thinks, a very moderate price, and he would ask that, in view of the favourable terms offered, special care should be taken by the cantonment authorities to guard against undue extravagance or wastage of the water.

24
No. 290C.

FROM

G. W. DISNEY, Esq.,

SANITARY ENGINEER TO THE GOVERNMENT OF
EASTERN BENGAL AND ASSAM,

TO

THE SECRETARY TO THE GOVERNMENT
IN THE PUBLIC WORKS DEPARTMENT,
EASTERN BENGAL AND ASSAM.

Camp Shillong, the 15th July 1911.

SIR,

I HAVE the honour to forward herewith plans and estimates (in duplicate) for the Manipur State Water Works at Imphal. This estimate has had to be cut very fine in order to work within the limited amount the Durbar will agree to, but if necessary, the second Jewell filter may be omitted for the present. It was included on Mr. MacCabe's advice and should therefore not be cut out unless absolutely necessary.

I have the honour to be,

SIR,

Your most obedient Servant,

G. W. DISNEY,

*Sanitary Engineer to the Government of
Eastern Bengal and Assam.*

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(Note by Mr. G. W. DISNEY, Sanitary Engineer to Government, Eastern Bengal and Assam, on the Manipur Water Works Project, dated the 12th July 1911.)

The accompanying estimate provides for the necessary work in giving Imphal a water supply from the Palak stream, and is based on the scheme got out by Mr. E. Mitchell, Executive Engineer, Public Works Department, in 1910. This project was criticised by Mr. C. A. White, Officiating Chief Engineer, by Mr. W. MacCabe, Chief Engineer, Calcutta Corporation, and by myself. The pipe lines have been measured up by the State Engineer of Manipur, in accordance with instructions given by me on the 28th January 1911, during my visit to Imphal.

2. With the exception of the fact that steel pipes have been adopted instead of cast iron, the cost of carriage from Dimapur to Imphal by cart, and risk of breakages being prohibitive for the latter, the project has been revised in accordance with Mr. MacCabe's recommendations.

3. The estimated cost of the work as revised amounts to Rs. 2,89,269 as compared with the original estimate of Rs. 2,88,188 for scheme No. 1, and Rs. 2,66,342 for No. 2.

4. The following papers are appended :—

- (1) Note by Sanitary Engineer, dated the 20th October 1910.
- (2) Note by Mr. C. A. White, Officiating Chief Engineer, dated the 30th October 1910.
- (3) Note by Sanitary Engineer, dated the 2nd November 1910.
- (4) Note by Mr. W. B. MacCabe, Chief Engineer, Calcutta Corporation, dated the 30th December 1910.
- (5) Inspection note by Sanitary Engineer, dated the 27th January 1911.

(Note by Mr. G. W. DISNEY, Sanitary Engineer to Government, Eastern Bengal and Assam, on the proposed Manipur Water Works, dated the 20th October 1910.)

Mr. E. Mitchell, Executive Engineer, Public Works Department, Chittagong Division, who was deputed to prepare this project, has submitted 5 alternative proposals—

Source of supply.	Cost.	Supply in gallons per head.
	Rs.	
I.—Palok and Maglong ...	2,88,188	5
II.—Palok only ...	2,66,342	5
III.—Palok and Maylong ...	2,28,077	3
IV.— Ditto ...	2,72,188	3
V.— Ditto ...	{ 2,55,106 60,000	3 3

I, II and V only appear worth consideration, the latter may be eliminated, as tending to confuse the issue.

2. The Manipur Durbar prefer Scheme II, estimated to cost say Rs. 2,66,000 which trusts solely to the supply from the Palok source. Mr. Housden, in his note dated the 29th December 1908, recommends that both the Palok and Maglong streams be utilized, and points out that the discharge in the former fell as low as 29 c. ft. per minute in 1902-1903, or affording only about 8 c. ft. per minute margin above the actual requirements. Scheme I, estimated to cost, say, Rs. 2,88,000, provides for taking advantage of both sources of supply, and is, in the absence of conclusive evidence that the Palok one is reliable for all requirements, highly preferable.

3. The distance from the proposed weirs, or intakes, on the Maglong and Palok streams to the junction of their pipe lines is 7,173 and 5,870 feet

respectively. It is proposed to use 5" pipes for this in Scheme I. In the event of only the Palok supply being utilised a 6 inch main will be necessary. According to the figures supplied by Mr. Mitchell, the cost works out:—

	Rs.
7,173 feet 5" diameter piping at Re. 1-8-6 =	10,983.
5,870 ditto ditto 1-8-6 =	8,987.
5,870 feet 6 inch ditto 1-13-3 =	10,731.

4. It is quite feasible to utilise the Palok supply alone in the first instance, subsequently augmenting this from the Maglong, when proved by a shortage of water to be necessary. The data afforded, however, indicates the danger of this occurring in the near future, but in the water supply for a town, where the first essential is the discharge available at the intake, and where by far the larger proportion of the capital cost is due to the distributory piping and other permanent buildings, I am of opinion that it would be unwise to endanger the success of a project during an exceptionally dry season, probably a cholera epidemic one, possibly occurring during the first season the water works were opened, simply to effect a tentative saving of Rs. 22,000 with an enhanced expenditure, small though it may be, in capital cost at a subsequent period. In the desirability of taking advantage of the double water supply both Messrs. Housden, Mitchell and myself are in accord.

5. The distribution appears to have been correctly worked out, but I have neither local knowledge nor sufficient information available to check the estimates. In order to save delay, as it is desirable that materials be carted up from Dimapur Railway Station during the months of December, January and February, when rates for carting are low, this project may, I think, go on.

6. I cannot find any allusion to the material to be used in the reservoir at Eroisemba, but presume it is Portland Cement concrete.

(Note by Mr. C. A. WHITE, Officiating Chief Engineer, dated the 30th October 1910.)

This case cannot be rushed. It requires very careful consideration and more information about the supply. It is very unfortunate if, as it would appear, no discharge observations of the Palok were taken last dry

It should be considered which is the safer season. Those taken of the Maglong supply as regards quality. suggest that possibly that river might alone supply the necessary amount of water.

Arrangement should be made for very careful discharge experiments of both rivers, Maglong and Palok, during March and April next. An Assistant Engineer should be specially deputed for the work. Perhaps Mr. A. F. Harrison, he has had some experience in taking discharges at Shillong. Each river should be gauged in 2 places for a check. Say, in one place with a ☐ notch, in the other with a ☐ notch.

The question whether the Maglong, or the Palok, or both can be tapped at a higher level should be further investigated.

Settling tanks at the source would probably be more satisfactory than Jewell Filters.

With the papers and conditions before me I am inclined to think that it would be more economical to provide a 7" main from Ching-Klong to Eroisemba instead of a 6". The sizes of pipes to be adopted from the Palok, or Maglong, or both to Ching-Klong depend entirely on the supplies available.

Having read through the papers concerned with Mr. Mitchell's original project, 1902, I cannot find that that project has ever been criticised and examined by an expert. Mr. Housden, Sanitary Engineer, on 29th December 1908, wrote a short note on the project, recommending that a 6" main be adopted instead of a 5" and steel pipes instead of cast-iron. He also wrote a note, dated the 7th January 1910, on the preliminary arrangement necessary to prepare a scheme in detail.

Mr. Disney, Sanitary Engineer, has written a note on 20th October 1910.

Neither Mr. Housden nor Mr. Disney has visited Manipur, and personally I only know Manipur itself, and not the proposed site of tank or Head Works.

I suggest, and General Secretary agrees with me, that a case should be prepared, collecting all the information available, and that Colonel Shakspear, Political Agent, be asked to recommend the Manipur Durbar, to send the papers to Mr. MacCabe, Engineer of the Calcutta Corporation, who designed the Tallah overhead reservoir, now under construction for Calcutta and that he be asked to advise. Mr. MacCabe is the best waterworks expert this side of India, and possibly in the whole of India.

I am loath to do anything to delay the project. Colonel Denne, Officer Commanding, Assam Brigade, only yesterday impressed on me the extreme necessity of pushing on the work, because of the many outbreaks of cholera, due to bad water at Manipur, but I feel that Government cannot advise the Manipur State to spend over two lakhs of rupees on an immature scheme which may fail.

With the facts before us, the questions for consideration are:—

- (i) Whether the scheme as proposed for a supply from the Palok, or Maglong, or both, will be a success, with a velocity in the main of under 2 feet per second.
- (ii) If so, what precautions should be taken to prevent the pipes silting up, and to prevent bursting the pipes from dynamic shock when the flow of water is interrupted.
- (iii) Whether the supply should be drawn from the Palok, Maglong, or both, and what sizes of pipes should be adopted. This question cannot be definitely answered as insufficient data are available, but it may be noted that whereas it was originally supposed that the catchment area of the Palok was about 15 square miles and that of the Maglong 10 square miles, it appears that the catchment of the Palok is only 4 square miles, and that of the Maglong is not quoted; the index map is misleading.
- (iv) Should Jewell filters or settling tanks be adopted.
- (v) Should (if the ground permits) the service reservoir be located at the head works or at Eroisemba.
- (vi) The size of pipes to be adopted. I am inclined to recommend a 7" main to give 50 per cent. more water at an extra cost of Rs. 20,000 to Rs. 30,000.
- (vii) What length and sizes of pipes can be safely ordered at once from England.
- (viii) Are the details of the scheme including the distribution satisfactory?

The following information may be collected:—

All informations of discharges and rainfall to be collected into a statement.

Hydraulic gradients to be drawn for (v) (calculated).

Calculations of Mr. Mitchell's and Mr. Housden's figures for discharge of pipes to be checked, including the mains, and principal distribution pipes.

Note by Mr. G. W. Disney, Sanitary Engineer to Government, Eastern Bengal and Assam, on the calculations for the Manipur water-supply distribution system, dated the 2nd November 1910.

1. The discharges of the pipe lines have been taken from Mr. A. E. Silk's tables, as the original calculations were made on Mr. Housden's. The check is therefore a double one.

2. Palok weir to Eroisemba.

Demand 121.5 galmins or 7,290 gallons per hour, say 7,300.

Distance from the proposed Palok intake to Eroisemba

Reservoir, 39,270 ft.

Fall— 185.

$$\text{H. G.} = \frac{100 \times 185}{39,270} = .47 \text{ per cent.}$$

A 6" pipe would give a discharge of 7,941 gallons per hour with a velocity of 1.80. The cusec discharge being .35.

A 6" pipe has been provided for in the project.

3. Eroisemba reservoir to r³ main X.

(a) Demand at head of distribution system .486 cusecs.

Distance, 35,833 feet.

Fall— 156

$$\text{H. G.} = \frac{100 \times 156}{35,833} = .44 \text{ per cent.}$$

A 7" pipe would give a discharge of .50 cusecs = 11,410 gallons per hour, or 190 galmins.

A 7" pipe has been provided for in the project.

(b) Demand 102 galmins, or 6,120 gallons per hour.

Distance, 5,720 feet.

H. G. = .44.

A 6" pipe with a H. G. of .42 will give a discharge of 7,499, say 7,500 gallons per hour, with a velocity of 1.70.

A 5" one with H. G. = .46, supplies 4,903 with a velocity of 1.60.

A 6" pipe has been provided for in the estimate.

(c) Demand 74 galmins, or 4,440 gallons per hour.

H. G. = .44.

A 5" diameter pipe with a H. G. of .46 will supply 4,903 gallons per hour, with a velocity of 1.60. A 4" one 2,746.

A 5" diameter pipe has been provided for.

(d) Demand 40 galmins, or 960 gallons per hour.

H. G. = .44.

A 3" pipe with a H. G. of .40 will give a discharge of 1,213 gallons per hour, with a velocity of 1.10. A 3" diameter pipe, diminishing in size to a 2½" one further down the line, has been provided for.

4. Branch from G. to r³

Main Z.

Demand 42 galmins, or 2,520 gallons per hour.

Distance, 12,320 feet.

R. L. of H. G. at .9 = 2,705

Ditto ditto r³ = 2,597

Fall, 108

$$\text{H. G.} = \frac{100 \times 108}{12,320} = .88 \text{ per cent.}$$

A 4" pipe with a H. G. of .84 will give a discharge of 3,726 gallons per hour, with a velocity of 1.90, and a 3" one with a slope of .85, 1,765 gallons, with a velocity of 1.60.

A 4" pipe has been provided for.

5. Blocks J and H.

Demand 22.4 galmins, or 1,324 gallons per hour.

Distance, 3,190

H. G. at 2,677

K 2,590

Fall— 87

$$\text{H. G.} = \frac{100 \times 87}{3,190} = 2.72 \text{ per cent.}$$

A 2" pipe with a H. G. of 2.72 would give discharge of 1,077 gallons per hour, with a velocity of 2.20, and a 3" one with a slope of 2.61, 3,089 gallons, with a velocity of 2.80.

A 3" diameter pipe has been provided for, but a 2½" one would suffice.

6. Branch from f. to d.

Demand 24.5 galmins, or 1,470 gallons per hour.

Distance, 5,115 feet.

H. G. to G. = 2,656

$$\begin{array}{r} 2,578 \\ \text{Fall—} \quad \underline{78} \end{array}$$

$$\frac{100 \times 78}{5,115} = 1.52 \text{ per cent.}$$

A 3" pipe with a H. G. of 1.47 will give a discharge of 2,316 gallons per hour, with a velocity of 2.10 and a 2" one, with a slope of 1.44, 784 gallons with a velocity of 1.60.

A 3" pipe has been provided for. This might be reduced to 2½".

N.B.—The marginal noted figures refer to those noted in blue pencil on Mr. Mitchell's calculation, for sizes of pipes.

7. Should the reservoir be situated at the head intake at Irong instead of at Eroisemba, the conditions will be modified as follows: demand 7,300 gallons per hour. Distance from Irong to high ground near end of 7" pipe line, say 50,500 feet.

R. L. Irong, 2,938

R. L. High Ground, 2,696

$$\begin{array}{r} \text{Fall—} \quad \quad \quad \underline{242} \end{array}$$

$$\frac{100 \times 242}{50,500} = .48 \text{ per cent.}$$

or no better than from Irong to Eroisemba (paragraph 2).

A 6" diameter pipe with a H. G. of .47 would give a discharge of 7,941 gallons per hour, with a velocity of 1.80.

Were the reservoir situated at the intake a Service Reservoir would be necessary at or near G. If 42' of head is sacrificed for this, the calculation works out—

$$\frac{100 \times 200}{50,500} = \text{say } .40.$$

A 6" pipe with a H. G. of .42 would discharge 7,500 gallons per hour with a velocity of 1.70.

If the local conditions admit of the reservoir being situated at the head intake at least 11,113 of 6" piping could be substituted for 7" which according to the abstract "of cost of various pipes" would effect a saving of as. -/8/- a ft. run or $\frac{11,113}{2} = 5,556$ rupees as a set off against the cost of a Service Reservoir. The abstract of cost, however, does not correspond with the result of "Calculations for sizes of pipes," and as it is unsigned by Mr. Mitchell may have crept in-advertently into the file.

8. No useful information is likely to be obtained from criticising the gauge readings of the Palok and Maglong streams taken last year as they are obviously misleading.

(Note by Mr. W. B. MacCABE, dated the 30th December 1910.)

MANIPUR WATER SCHEME.

Scheme to be adopted.—I am of opinion that the scheme which should be carried out is the one for supply of five gallons per head per day, from the river Palok only.

As regards the ability of this river to supply the requisite quantity of water, nothing but careful gaugings taken over a long series of dry seasons would place the matter beyond doubt, but I advise the Palok scheme first, because it is probable that it will give the required quantity of water,

second, because if in future years it is found that it will not do this, or that it is necessary to increase the supply, the supply can be supplemented from the river Maglong at no appreciable disproportionate cost, compared with what it would cost to do so at the beginning; and third, because it appears to be important to keep the initial cost as low as possible.

Head works.—I understand from Colonel Shakespear that the river when in flood carries down a lot of silt such as sand and gravel, which will settle quickly, as well as silt of a much lighter nature. I am therefore of opinion that *two small tanks* should be constructed in which the water can deposit its heavy suspended matter. To get rid of this heavy matter it would be sufficient to construct tanks in which the velocity of the water in the stream would be slowed down to as low a figure as possible (say) less than one foot per second. *Two* such tanks should be constructed side by side with an arrangement of sluices so that the water from the river could be turned into one or other of them, so as to allow of the deposited silt being dug out when necessary. This arrangement, which really amount to silt pits as used in front of pumps on a sewerage scheme, should get rid of all heavy suspended matter, comparatively cheap teak wood sluices would answer the purpose quite well.

Filters.—I am very strongly of opinion that the water should be filtered before entry into the main line of pipe. This will make the water above suspicion, so far as cholera is concerned, the cholera bacillus being so easy to filter out of water. In addition it will remove the possibility of the main line of pipes silting up, and will prevent the service reservoir and mains from silting up also. The silting up of the service reservoir would possibly not be of great consequence, as it could be cleaned out periodically, but the silting of the various small service mains would in all probability become a very serious matter in a very few years, and if it occurred, it might be very difficult to remove the silt. I cannot, however, give a confident opinion on this latter point, not knowing the nature of the silt, but it would in my opinion be much better to prevent such a possibility. Jewell filters would be very suitable; they produce an excellent filtrate, are thoroughly well made and should remain in order for many years, and occupy little space. A duplicate set should be put in to allow for cleaning, and to prevent the necessity of ever shutting off the water, or of allowing unfiltered water into the mains. Both of these points are important, the former because charging a main with a steep gradient on it, such as the one in question has, is extremely likely to cause serious water-ram in the pipes, with consequent bursts and interruption of supply; unless such charging is done in a skilful and experienced manner, and I take it that this experience will not be readily available.

The pipe line as shown on the plan and Section No. 217 or 219 (I am not sure of the latter figure on the drawing) has far too many scour valves on it. In my opinion it would be sufficient to have one scour valve at the depression in ground shown between chainage 372 and 378, and another at the depression shown between chainage 180 and 186, which is practically the lowest point on the main. These scour valves should be three inch double-faced sluice valves of good quality fixed on Y \times 3" Tees branch. Y representing the diameter of the main. A reflux valve is shown at chainage 175. I am not in favour of these unless they are absolutely essential as they check the flow, and many years of experience has shown me that they generally do not act when required, as they become set from rust or other causes at the position they usually are in, when the water is flowing through them. In this case I see no necessity for a reflux if the pipe delivers into the service reservoir at top water level as it should do. A suitable sized Tee junction (say seven inches \times five inches) with valve on the branch should be left in the pipe line at the point where the Maglong supply would connect to provide for the future; about five stop valves should be put in at convenient places on the main, the exact number not being of great importance.

The quantity of water required is five gallons per head per day for 35,000 persons. This amounts to 35,000 \times 5 = 1,75,000 gallons per day which must be delivered by the main pipe line. The total length of the line from

Diameter of main pipes.

the Intake to Service Reservoir, as shown on the section already referred to, is 39,270 feet, and the R. L. of take off at weir at head works is shown as 2,938 above datum. In order to allow for loss of head owing to settling tanks and filters will call this figure 2,900 feet above datum, which should give an ample allowance. The R. L. at Service Reservoir is 2,753.25 above datum. This level I take to be top water in the Service Reservoir.

This gives a total available fall of 147 feet, neglecting fractions of a foot, as they are not worth considering in long lines such as this is. The hydraulic inclination from Intake to Service Reservoir is therefore 1 in 267.

This figure does not agree with that given in the file owing to the allowance I have made at head works probably, but it is a safe figure to adopt, and I will call the required quantity of water 20 cubic feet per minute which is also a safe figure. *To do this, and allow for future corrosion in the pipe would require a 7" pipe.* I calculate that a 6" pipe would just do the work, but it would have no margin, and would not do it if it was a little rougher than usual inside, or if it became in the least corroded or silted up.

Service Reservoir.—I do not know what it is proposed to construct this of, but probably it is Portland Cement concrete. I do not object to this, but I would point out the difficulty of getting cement properly handled in India and the difficulty of making it absolutely watertight with the labour available. If found not to be watertight after construction, the only way to cure leaks in a satisfactory way is to line the reservoir with a bitumastic composition, the cheapest that I know of being "Floatine" which has been very successfully used for this very purpose. The Arracan Company, Calcutta, are Agents for it, and it is not costly. I am at present using it for the waterproofing of the large roof of the elevated reservoir at Tallah. I suggest, however, that under the circumstances, better results would be got by building the reservoir of bricks in Cement mortar.

The Service Reservoir should be of ample size to balance the difference between the maximum demand rate, and the average rate of flow into it. I can offer no opinion as to how much the maximum demand rate will exceed the average rate in the place under discussion, *but it is probable that the difference will not be so great at first, as it may afterwards become.* In Calcutta the maximum demand rate is quite three times the average demand rate and it lasts for about three hours at present, but these figures will I think be somewhat reduced both as regards magnitude and duration, when a really continuous supply is an accomplished fact.

Service mains.—Not knowing the locality I have not all the data necessary to check the sizes of these, as shown on the plan, but I have no reason to doubt the figures as shown. I would, however, point out that in no case would I advise the laying of a smaller cast iron pipe than 2" diameter and not even this if the water is likely to corrode the pipes. If smaller pipes than this are to be laid, they should be galvanized mild steel pipes of good repute, *i.e.*, made by a well known manufacturer. All odd sized pipes such as 1½"—2½" should also be galvanized steel as it does not pay to get these odd sized pipes cast, and they are much heavier than they need be. There is now no necessity to import cast iron pipes of less than about 12" diameter, as excellent small cast iron water pipes are now made at Barrackur Iron Works, the Managing Agents of which are Messrs. Martin & Co., Clive Street, Calcutta. I have used large quantities of these pipes here, and can thus speak from experience.

Estimates.

check the estimate.

Not knowing local conditions or cost of carriage I am unable to, in any way,

General.—I find that I omitted to point out that if, and when the water is shut off at its point of inflow to the Service Reservoir, or at or near the lowest point on the main pipe line, the pipe at its lower levels will be subjected to a very considerable pressure. The pipe therefore should not be less than half inch thick at the lower levels, but it may be ¾ inch thick above the point where the junction is to be left for the Maglong supply, and similarly, the upper half of the main

on the rising ground towards the Service Reservoir may be $\frac{7}{16}$ inch thick. I doubt, however, whether it will pay to thus alter the thickness of pipes, in this case the saving being so small, and the liability of putting the thinner pipes in the wrong place so great. In no case should the 7" pipe be ordered of less thickness than $\frac{7}{16}$ inch. Cast iron pipes of smaller size than 6" diameter should not be ordered of less thickness than $\frac{3}{8}$ inch as satisfactory castings for water under pressure cannot be turned out if of less thickness. I do not think it would pay to lay the main line of pipes in steel instead of cast iron, as the life of a steel main is very much shorter than that of a cast iron pipe. This applies with special force to steel pipes of small size as they are so thin and consequently corrode so quickly when corrosion once begins. This point might be considered with reference to the distribution pipes, but of course galvanizing greatly prolongs the life of a steel pipe. Galvanizing would, however, cost a considerable sum for pipes larger than 2" diameter. The satisfactory joining of cast iron valves with small steel pipes is difficult. I therefore do not advise the use of steel for the main pipe line. The cast iron pipes should be of the pattern known as "turned and bored" except in the 2" size, and their proper laying requires a man with some experience of them, and in all cases any form of spigot and socket pipes should be laid with the sockets looking up the hill, as otherwise it is very difficult to lead them up in case of a leakage at a joint on steep ground. Turned and bored joints in my experience are not satisfactory in pipes of less than 3" diameter, lead joints being by far the best for such small cast iron pipes.

In conclusion, I have only to add that I shall be pleased to advise on any other points, if necessary.

(Note by Mr. G. W. Disney, Sanitary Engineer to Government, Eastern Bengal and Assam, on the Manipur water supply project, dated Manipur, the 27th January 1911.)

1. *History*.—After much preliminary correspondence extending over a period of two years, Mr. E. J. Mitchell, Executive Engineer, Manipur Division, submitted an estimate amounting to Rs. 1,81,289 in July 1902, for providing a water supply for Manipur. This was for a pipe supply for 8,000 persons, the source being the Palok stream, situated in the hills some $10\frac{1}{2}$ miles distant. I have no correspondence to show why it fell through. In 1908 this project was revived, and Mr. Mitchell again placed on special duty towards the end of 1909, in order to reconsider and recast his scheme, which came before me and was noted on, see my notes of the 20th October and 2nd November 1910; Mr. C. A. White, Officiating Chief Engineer, Eastern Bengal and Assam, in his note of the 30th October 1910, suggested that Mr. MacCabe, Chief Engineer to the Calcutta Corporation, who is probably the greatest authority on water supply in India, be consulted, and it is in accordance with his report dated the 30th December 1910, that this note is written, after personal inspection of the proposed sites of Intake, and Service Reservoir, and of the distribution system.

2. *Project (a) scheme to be adopted*.—This is for a water supply for 35,000 persons at 5 gallons per head per day. Mr. MacCabe suggests that the Palok source be, in the first instance, alone depended on, with provision for its augmentation from the Maglong stream in the supply main, and in this view, after I have seen these and weighed the local arguments, I fully concur.

(b) *Head works*.—Surveys are being made in order to ascertain if local conditions of site of head works permit of two small tanks, being constructed in which the velocity of the water can be reduced to less than 1 foot per second, in order to induce the silt to deposit. The fact that there is no reliable data as to H. F. L., however, complicates this. A duplicate set of Jewell filters is highly desirable and especially so taking into consideration the difficulty and danger of charging the main with water after temporary interruptions.

(c) *Main line of pipes*.—The suggestions made by Mr. MacCabe are very pertinent and will be adhered to.

(d) *Diameter of main pipes.*—It would be a decided improvement to substitute 7" diameter pipes for 6" ones for the length from the intake to the Service Reservoir, a distance of 39,270 feet, in order to allow for corrosion and silting up.

(e) *Service Reservoir.*—The cost of Portland Cement being prohibitive at the site of the works, and in view of the fact that earthquake shocks are by no means of rare occurrence, I propose substituting mild steel for a concrete reservoir. Mr. Mitchell in his estimate provided for a storage capacity of 3,00,000 gallons in this and of say 35,000 gallons, in his subsidiary distribution tanks, a total of 3,35,000 gallons or nearly 2 days' supply ($1,75,000 \times 2 = 3,50,000$). Mr. MacCabe states the requirement, of the case to be the "The Service Reservoir should be of ample size to balance the difference between the maximum demand rate and the average rate of flow into it," and gives the rate and duration of the former in Calcutta as 3 times that of the average demand rate for 3 hours. The average demand rate in Imphal may be calculated at $\frac{1,75,000}{8} = 21,875$ per hour for 8 hours and the maximum demand $21,875 \times 3 = 65,625$. The rate of flow into the service reservoir may be assumed to be $\frac{1,75,000}{20}$ allowing 4 hours per day for washing filters and other interruptions = 8,750 gallons per hour.

Therefore $21,875 - 8,750 = 13,125$ gallons per hour or $13,125 \times 3 = 39,375$ gallons for the period of maximum demand. Irrespective of the subsidiary storage tanks a circular steel service reservoir 42' 6" in diameter and 10" high would afford storage for say 88,500 gallons, or more than half a day's demand; one of these might be constructed in the first instance, provision being made at the site for the duplication, or further multiplication of these as may later on be found necessary. According to the data afforded by the cost of steel tank recently erected at Nimthing tank in Imphal, a 42½ diameter tank would cost some Rs. 14,500 as compared with Rs. 18,000, provided for in Mr. Mitchell's estimate for a concrete tank, but the storage capacity will be much less. It will probably be found that this estimate will be largely reduced on quotations being asked for.

(f) *Service mains.*—Mr. MacCabe strongly opposes steel pipes, and is in favour of cast iron on the grounds of their longer life, but it is only the proposed adoption of steel that has made the project a financial possibility owing to the cost of carriage. The preservation of steel piping has been the subject of a commission of eminent Engineers and Chemists in connection with the Koolgardie water supply (Western Australia). I have sent samples of the water from the Palok and Maglong streams to the Provincial Laboratory at Dacca for analysis, with special reference to their corrosive properties, and am making extensive enquiries on the life of steel pipes generally, and refrain, with all due deference to Mr. MacCabe, from accepting his opinion on this point, pending further information being received by me on the subject.

3. *Sources of supply.*—It is worthy of notice that the valleys of the Palok and Maglong streams are very suitable for the construction of large impounding reservoirs, which may in future years be found advantageous to adopt. The proposed pipe line could also be utilised in this event, and it may very possibly be found in future with improved appliances for the storage of electricity, that the waste water from the impounding reservoirs could be used for generating electrical power.

4. *Distribution.*—In the absence of a good map of Imphal from which the pipe lines could be accurately scaled off, it is very necessary that the alignment of the various distributories from the main be laid out on the ground, dak baled in a permanent and efficient manner, and the sites of the subsidiary distribution tanks clearly marked on the ground. The lengths of the different pipe lines should then be accurately measured, and the estimate corrected accordingly; bends, technically known as specials are much more costly than straight pipes, and if the alignment is carefully made, with a view of minimising the necessity of using these, the waste of a large sum of money may be avoided. As the distributories, for the most part, pass through gardens and compounds covered with tree and bamboo jungle, much scope for good work is afforded in this preliminary stage, and as considerable doubt exists as to the actual lengths

of the various pipe lines, it is the more necessary to have this done at an early date so as to ensure accurate ordering of the different pipes. I most strongly advise that this work be taken up at once.

5. *Drainage*.—It should be remembered that no water supply system is complete without an efficient drainage system, and that ample provision should be made for spillage from standposts being rapidly carried off by suitable drains. The conditions obtaining at Imphal are, for the most part, such as to render dry season drainage a very simple matter, as the level of the water in the Imphal River is many feet below that of the stagnant water in the tanks and depressions in its vicinity. With an efficient water supply the necessity for most of these will disappear, and public health would much improve by their drainage from, say, October until June. The rainy season drainage for the station would be a very costly project, but the dry season one should be comparatively inexpensive, and very efficient.

6. *Silt*.—The waters flowing across the valley in the rains obviously carry a large proportion of silt, which owing to the rivers being confined to their courses by marginal embankments, silt up their beds and impede the rapid flow off during flood time. This is a striking instance of where the Italian process of "Bonificazione" might with great effect be introduced, but this is perhaps, under existing circumstances, a council of perfection. This system, as has been conclusively proved, would not only immensely improve the value of the property in Manipur valley, but also its sanitary condition, and is by no means a difficult subject to master.

7. *Urgency*.—In conclusion, I must place on record that, in view of the various epidemics of cholera which have occurred in Imphal, I am of opinion that the question of a pure water supply is an urgent necessity and recommend that the State undertake at once the collection of rubble dressed stone at the proposed intake at Irong, and in clearing and marking out the alignment of the distributories, as alluded to in paragraph 4 of this note. The levels and lengths of the pipe main should also be checked, as there is not sufficient definite information available to give proposed contractors. Tenders for the work might then be invited and I suggest the following firms:—

1. Messrs. Martin & Co.,
2. „ James Simpson & Co.,
3. „ Burn & Co.,
4. „ Jessop & Co.,

all of Calcutta, but this cannot be done until the question of steel or cast iron pipes is settled.

MANIPUR WATER WORKS.

Bill of Quantities.

Detail of work.	No.	Measurements.			Quantities.		
		L.	B.	H.	Contents.	Deductions.	Total.
1	2	3	4	5	6	7	8
<i>Main Head.</i>							
I.—Head works—							
(a) Weir at Irong ...	1	...	...	...	1 No.		
(b) Settling tanks ...	1	...	...	...	1 "		
(c) Pair, jewel filters ...	1	...	...	...	1 item.		
II.—Main—							
(a) 7" Main from Palok Intake to Eroisemba and from service reservoir to distribution system.	1	50,000	...	...	50,000 r.ft.		
(b) Valves—							
Air valves, 7" ...	5	...	...	...	5 Nos.		
Scour, " 7" ...	2	...	...	...	2 "		
7"×5" Tee with sluice valve.	1	...	...	...	1 No.		
7"×3" Tee with sluice valve.	2	...	...	...	2 Nos.		
Stop valves, 7" ...	5	...	...	...	5 "		
Bends, 7" ...	3	...	...	...	3 "		
III. (a) Service Reservoir at Eroisemba.							
(b) Levelling site ...	1	...	...	...	1 item.		
IV.—Distribution—							
6" Pipes ...	1	6,400	...	...	6,400 r.ft.		
5" " ...	1	8,000	...	...	8,000 "		
4" " ...	1	9,000	...	...	9,000 "		
3" " ...	1	12,000	...	...	12,000 "		
2½" " ...	1	17,500	...	...	17,500 "		
2" " ...	1	26,000	...	...	26,000 "		
1½" " ...	1	8,000	...	...	8,000 "		
1¼" " ...	1	16,500	...	...	16,500 "		
Bends for connections to tanks.	86	...	...	...	86 Nos.		
Cast iron compound, special 4"×2½".	1	...	...	...	1 No.		
Specials, 7" ...	1	...	...	...	1 "		
Ditto, 6" ...	2	...	...	...	2 Nos.		
Ditto, 5" ...	2	...	...	...	2 "		

Bill of Quantities—continued.

Detail of work.	No.	Measurements.			Quantities.		
		L.	B.	H.	Contents.	Deductions.	Total.
1	2	3	4	5	6	7	8
IV.—Distribution—concl'd.							
Specials, 4" ...	1	...	...	...	1 No.		
Ditto, 3" ...	1	...	...	...	1 "		
Ditto, 2½" ...	1	...	...	...	1 "		
Cast iron bends, 6" ...	1	...	...	...	1 "		
Ditto, 5" ...	1	...	...	...	1 "		
Ditto, 4" ...	1	...	...	...	1 "		
Ditto, 3" ...	1	...	...	...	1 "		
Ditto, 2½" ...	2	...	...	...	2 Nos.		
Ditto 2" ...	1	...	...	...	1 No.		
Cast iron Tees—							
6" double reducing Tee ...	1	...	...	...	1 No.		
6" ordinary Tee ...	1	...	...	...	1 "		
5" reducing Tees ...	2	...	...	...	2 Nos.		
4" ordinary " ...	4	...	...	...	4 "		
4" reducing " ...	3	...	...	...	3 "		
5" ordinary Tee ...	1	...	...	...	1 No.		
3" " Tees ...	3	...	...	...	3 Nos.		
2½" " " ...	3	...	...	...	3 "		
3" reducing " ...	2	...	...	...	2 "		
2½" " " ...	2	...	...	...	2 "		
Galvanized Tees—							
2" Tee ...	5	...	...	...	5 Nos.		
2½"×2" reducing Tee ...	1	...	...	...	1 No.		
2" reducing Tees ...	6	...	...	...	6 Nos.		
1½" Tees ...	3	...	...	...	3 "		
1½" reducing Tee ...	1	...	...	...	1 No.		
1¼" Tee ...	12	...	...	...	12 Nos.		
Galvanized bends, 2" ...	9	...	...	...	9 "		
Ditto ditto, 1½" ...	10	...	...	...	10 "		
Ditto ditto, 1¼" ...	12	...	...	...	12 "		
Valves at places in the distribution system.	1	1 item.		
Distribution tanks ...	43	43 Nos.		

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MANIPUR WATER WORKS.

Abstract List of Piping in Distribution Pipe lines.

Size of piping.	7".	6".	5".	4".	3".	2½".	2".	1½".	1¼".	Remarks.
1	2	3	4	5	6	7	8	9	10	11
Tank 1 to 2	...	2,021	...	...	...	...	...	...	...
Tank 2 to 3	...	1,731	...	...	...	...	...	...	...
Tank 3 to 4	...	1,905	...	...	...	...	...	...	...
Tank 4 to junction, 5"	...	672	...	...	...	...	...	...	...
Junction 5" to tank 19	2,402	...	...	...	...	...	...
Tank 19 to 20	1,673	...	...	...	...	...	...
Tank 20 to 21	2,184	...	...	...	...	...	...
Tank 1 to 15	1,740	...	...	...	...	...	...
Junction 5" to tank 5	1,940	...	...	...	...	...
Tank 21 to 24	1,644	...	...	...	...	...
Tank 15 to 23	1,983	...	...	...	...	...
Tank 23 to 29	1,642	...	...	...	...	...
Tank 29 to 32	1,694	...	...	...	...	...
Tank 2 to 13	1,586	...	...	...	...
Tank 5 to 43	2,617	...	...	...	...
Tank 43 to 8	1,810'-6"	...	...	...	...
Tank 24 to 38	2,187	...	...	...	...
Tank 15 to 14	975	...	...	...	...
Tank 29 to 30	1,463	...	...	...	...
Tank 30 to 31	1,331	...	...	...	...
Tank 11 to 12	1,955'-6"	...	...	...
Tank 12 to 13	2,300	...	...	...
Tank 22 to 5" pipe	1,585	...	...	...
Tank 38 to 39	1,664	...	...	...
Tank 39 to 40	2,172	...	...	...
Tank 14 to 17	1,986	...	...	...
Tank 32 to 40	5,427	...	...	...
Tank 6 to 7	2,903	...	...
Tank 7 to 8	1,921'-6"	...	...
Tank 8 to 9	2,530'-6"	...	...
Tank 9 to 10	2,817	...	...
Tank 10 to 11	2,850	...	...
Tank 22 to 23	3,250	...	...
Tank 40 to 41	3,143	...	...
Tank 41 to 42	2,782	...	...
Tank 16 to 33	896	...	...
Tank 16 to 17	813	...	...
Tank 17 to 18	2,077	...	...
Tank 24 to 25	1,735	...	
Tank 25 to 26	896	...	
Tank 26 to 27	1,745	...	
Tank 27 to 18	1,109	...	
Tank 33 to 34	811	...	
Tank 32 to junction 35	1,375	...	
Tank 6 to 20	3,340	
Tank 32 to 34	1,768	
Tank 35 to 36	1,886	
Tank 35 to 37	3,636	
Tank 37 to 36	2,325	
To Residency from pipe line	610	
Residency to tank 36	1,842	
Grand Total	...	6,329'	7,999'	8,903'	11,968'-6"	17,149'-6"	25,983'	7,641'	15,405'	
As estimated by Sanitary Engineer.	50,000	6,400	8,000	9,000	12,000	17,500	26,000	8,000	16,500	Including Tank Branches.

MANIPUR WATER WORKS.

Abstract List of Pipes (Tank Branches) in Distribution Pipe lines.

<i>Horizontal pipes.</i>				1½"
For tank 18 from main	...	...	...	189'-0"
For tank 29 from main	...	...	...	90'-0"
For tank 16 from main	...	...	...	30'-0"
For other 40 tanks. Say 8' of piping per tank	...	...	...	320'-0"
<i>Vertical pipes.</i>				
For 43 tanks 43 pipes, say 7 feet each	...	...	...	301'-0"
Add 2 right angle bends per tank—86 bends.				
Total				930 say 1,000 feet.

The 7th July 1911.

H. BENSON,
State Engineer.

Abstract of cost.

Quantities.	Item of work.	Rate.		—	Total.
		At	Per		
1	2	3	4	5	6
I.—Main head—		Rs. a. p.		Rs.	Rs.
	HEAD WORKS.				
	(a) Weir at Irong ... ..	...	...	2,075	
	(b) Settling tanks ... ..	...	...	5,000	
	(c) Pair jewel filters ... ..	...	...	32,000	
					39,075
II.—Main—					
50,000 r. ft. ...	(a) 7" main to Eroisemba and on to distribution system.	2 8 0	r. ft.	1,25,000	
	(b) Valves—				
5 Nos. ...	Air valves, 7"	150 0 0	Each	750	
2 " ...	Scour valves, 7"	80 0 0	"	160	
1 No. ...	7" x 5" Tee with sluice valve ...	350 0 0	"	350	
2 Nos. ...	7" x 3" ditto ditto	350 0 0	"	700	
5 " ...	Stop valves, 7"	60 0 0	"	300	
3 " ...	Bends 7"	300 0 0	"	900	
					1,28,160
III.—					
1 No. ...	(a) Service reservoir at Eroisemba ...	...	L. S.	9,000	
	(b) Levelling site at Eroisemba ...	...	L. S.	500	
					9,500
IV.—Distributaries—	(a) Distributary pipes—				
6,400 r. ft. ...	6" pipe	1 13 3	r. ft.	11,700	
8,000 " ...	5" "	1 8 6	"	12,250	
9,000 " ...	4" "	1 3 6	"	10,969	
12,000 " ...	3" "	0 13 6	"	10,125	
17,500 " ...	2½" "	0 12 0	"	13,125	
26,000 " ...	2" "	0 10 3	"	16,656	
8,000 " ...	1½" "	0 7 3	"	3,625	
16,500 " ...	1¼" "	0 6 0	"	6,187	
	Tees, bends and specials—				
86 Nos. ...	Bends, 1¼" for connections to tanks	5 0 0	Each	430	
1 No. ...	Cast iron compound special, 4" x 2½"	150 0 0	"	150	
1 No. ...	Cast iron compound special, 7"	100 0 0	"	100	
2 Nos. ...	Ditto, ditto, 6"	85 0 0	"	170	
2 Nos. ...	Ditto, ditto, 5"	70 0 0	"	140	
1 No. ...	Ditto, ditto, 4"	60 0 0	"	60	
1 No. ...	Ditto, ditto, 3"	45 0 0	"	45	
1 No. ...	Ditto, ditto, 2½"	45 0 0	"	45	
1 No. ...	Cast iron bends, 6"	100 0 0	"	100	
1 No. ...	Ditto 5"	75 0 0	"	75	
1 No. ...	Ditto 4"	40 0 0	"	40	
1 No. ...	Ditto 3"	30 0 0	"	30	
2 Nos. ...	Ditto 2½"	20 0 0	"	40	
1 No. ...	Ditto 2"	20 0 0	"	20	
	Carried over ... ..	...		86,082	

Abstract of Cost—concl'd.

Quantities.	Item of work.	Rate.		—	Total
		At	Per		
	Brought forward	Rs. a. p.		Rs.	Rs.
		...	...	86,082	1,76,735
	Cast Iron Tees—				
1 No. ...	6" double reducing Tee ...	50 0 0	Each	50	
1 No. ...	6" ordinary Tee ...	40 0 0	"	40	
2 Nos.	5" reducing Tees ...	50 0 0	"	100	
4 Nos.	4" ordinary Tees ...	40 0 0	"	160	
3 Nos.	4" reducing Tees ...	30 0 0	"	90	
1 No. ...	5" ordinary Tees ...	70 0 0	"	70	
3 Nos.	3" ditto ...	15 0 0	"	45	
3 Nos.	2½" ditto ...	15 0 0	"	45	
2 Nos.	3" reducing Tee ...	15 0 0	"	30	
2 Nos.	2½" ditto ...	15 0 0	"	30	
	Galvanized Tees—				
5 Nos.	2" Tee ...	15 0 0	"	75	
1 No. ...	2½" x 2" reducing Tee ...	10 0 0	"	10	
6 Nos.	2" reducing Tee ...	10 0 0	"	60	
3 Nos.	1½" Tee ...	12 0 0	"	36	
1 No. ...	1½" reducing ...	15 0 0	"	15	
12 Nos.	1¼" Tee ...	15 0 0	"	180	
9 Nos.	Galvanized bends, 2" ...	5 0 0	"	45	
10 Nos.	ditto 1½" ...	5 0 0	"	50	
12 Nos.	ditto 1¼" ...	5 0 0	"	60	
1 Set ...	Valves at places in the distribution system.	L. S.	...	1,596	
43 Nos.	Distributary tanks ...	230 0 0	"	9,890	
					98,739
	Add contingencies at ...	5 per cent.	...	...	2,75,494
					19,775
					2,89,269

G. W. DISNEY,

Sanitary Engineer to the Government of

Eastern Bengal and Assam.

The 15th July 1911.

Abstract of Cost.

Main Head.	Item of work.	Rate.		—	Total.
		At	Per		
				Rs.	Rs.
I	Head works—				
	(a) Weir at Irong ... ..	...	...	2,075	
	(b) Settling tanks ... ..	...	...	5,000	
	(c) Pair jewel filters ... ..	...	...	32,000	
					39,075
II	(a) 7" Main to Eroisemba and on to distribution system.	...	...	1,25,000	
	(b) Valves, Tees and bends ... ..	...	...	3,160	
					1,28,160
III	(a) Service reservoir at Eroisemba ... ..	...	...	9,000	
	(b) Levelling site ... ..	...	...	500	
					9,500
IV	Distributaries—				
	(a) Distributary pipes ... ..	...	...	84,637	
	Valves, Tees, bends, etc. ... ..	...	...	4,232	
	(b) 43 Distributary tanks ... ..	...	...	9,890	
					98,759
					2,75,494
	Add contingencies at	5 per cent.	...	...	13,775
					2,89,269

G. W. DISNEY,

Sanitary Engineer to the Government of
Eastern Bengal and Assam.

The 15th July 1911.