

Local & Munl. (1898) Department.

MISCELLANEOUS.

G.O., No. 154841.

DATED 5-9-98

INDEXED.

[Despatch Abstract.]

Water supply.

Requesting with remarks, the Sanitary
Engineers, to undertake the preparation of
a scheme for the ——— of balance on
the lines approved by the Sanitary
Board.

BACK PAPERS.

G.O.	No.	Department.	Date.	G.O.	No.	Department.	Date.

FURTHER PAPERS.

G.O.	No.	Department.	Date.	G.O.	No.	Department.	Date.

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No. 1548 M., 5TH SEPTEMBER 1898.
GOVERNMENT OF MADRAS.
LOCAL AND MUNICIPAL DEPARTMENT.

2
READ—the following paper :—
Proceedings of the Sanitary Board, No. 371/S., dated 27th June 1898.
Read—the following paper :—
Office-note—from J. A. JONES, Esq., Sanitary Engineer to Government.
To—the Secretary, Sanitary Board.
Dated—the 10th May 1898.
No.—940.

Calicut Water-supply.

About the year 1890 a suggestion was made by this Department that a supply of water for the Mappilla quarters of Calicut should be obtained from the Mananchera tank situated near the centre of and at the highest point of Calicut. After much discussion the Municipal Council accepted the proposal, but as doubts as to the quality and quantity of the supply were raised, the Sanitary Board in its Proceedings No. 2 of 24th February 1896 (copy attached) ordered certain investigations to be made.

2. There has been a good deal of delay in getting the well sunk, the well first sunk was a failure and progress with a second one has been very slow.

3. The results of sinking the well, however, are now available and will be found reported in the overseer's report forwarded with the Chairman's letter No. 15 of 6th January 1898 (copy attached).

4. The overseer has, however, not identified the various samples from the strata correctly and these are correctly shown in a note by the Assistant Sanitary Engineer (copy herewith). I have examined the samples and concur with his remarks.

5. The main question at issue has been whether the Mananchera tank receives any supply from a pure source—that it does so cannot now be doubted because the white sand layers 8 feet in thickness are perfectly pure indeed, no whiter sand could possibly be found.

6. Under this is a bed of lignite which forms the bed of the tank and this is 4 feet thick; below this again there is coarse sand and gravel so that even if enough water were not procurable from the white sand, this lower strata can be drawn on.

7. It may be noted in passing that a similar bed of lignite to that already referred to was found when boring at Cochin.

8. From the position of strata, I think it possible that wells sunk into the white sand or the lower coarse sand will yield artesian water.

9. The water of the Mananchera tank has been declared usable, the albumenoid ammonia was slightly high, but this can be understood with an open tank.

10. That pure water can be obtained from wells sunk around the tank cannot be doubted and the quantity should be ample, but this it has been impossible to test as the well sunk cannot be baled out by manual labour and no steam pump is available near Calicut. The contents of the tank itself which fills yearly, however, would yield an ample supply as shown in Chairman's letter quoted below so that with constant pumping there can be no fear of insufficiency.

11. It is proposed that a scheme should be prepared for the supply to the Mappilla quarters of Calicut. The main feature of this scheme being a series of wells adjacent to the Mananchera tank, a small elevated reservoir and distribution pipes therefrom.

12. The scheme cannot be taken up for sometime yet but will be put on the programme at the earliest opportunity.

13. The following is a list of the papers accompanying—

(1) Report of Assistant Sanitary Engineer to Government, 1890.
(1-A) Letter from the Acting Sanitary Engineer to Government, No. 2417, of 29th October 1894.

No. 940

GOVERNMENT OF MADRAS,
Office of Sanitary Engineer to Govt.,
Fort St. George, 10th. May 1898.

Recd 12 May 1898.

OFFICE NOTE

BY

THE SANITARY ENGINEER.

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curable from the white sand, this lower strata can be drawn on.

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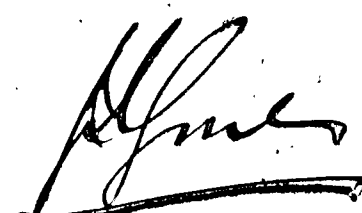
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- (2) Letter from the Sanitary Engineer to Govt, No. 813 of 26-3-95
- (3) Letter from the Chairman, Municipal Council, Calicut, No. 915 of 3rd. October 1895.

- (4) Note of Sanitary Commissioner, No. 2195 of 2-12-95.
- (5) Note by Col. Campbell, No. 12/S of 27-1-96. - ~~to be sent to the Sanitary Board~~
- (6) Resolution of the Sanitary Board, No. 2 of 24-2-96 S.B.P.
- (7) Report of overseer and Chairman's letter, No. 15 of 6-1-98.
- (8) Note by Assistant Sanitary Engineer to Govt dated 9-5-98.


Sanitary Engineer to Govt.

To
The Secretary,
Sanitary Board.

No. 148.

Calicut

4th. January 1898.

To

The Chairman, Municipal Council,
Calicut.

Sir,

I beg to report that I have herewith sent the sample of earth packed up, in a tin case, taken at every 4ft. of the depth of the pot well lately sunk at the Municipal garden near Mananchira tank, Calicut for the inspection of the Sanitary Engineer, Madras.

The sub-joined is the list of the earth enclosed.

1 to 4 ft.....	Sandy soil, light black
4 to 8ft.....	do a little white
8 to 12 ft.....	Reddish
12 to 16ft.....	chalk white clay
16 to 20ft.....	do do pure white
20 to 24 ft.....	Black clay
24 to 28 ft.....	Reddish clay
28 to 30ft	do the total depth of the pot well.

Handwritten notes:
} said pure white
definite
fail sand

I also beg to report that in sounding Mananchira tank I have found it in all 1'9½ ft. deep to the ground level Viz depth of water 15 feet above water to the road level 4½ ft.

I beg to remain &c

(sd) P. Parichan

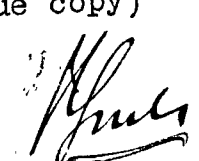
Road Overseer.

(True copy)

(sd) R. Rama Rao

Chairman.
7-1-98.

(True copy)


Sanitary Engineer to Government.

No. 15
98

Municipal office.
Calicut, 6th. January 1898.

From

M.R.PY. P. Rama Pao Avl

Chairman, Municipal Council,
Calicut.

To

The Sanitary Engineer to the Govt. of Madras.

Sir,

In continuation of this office letter No. 1298
dated 30th. June 1897, I have the honor to inform you that the
pot well has been sunk to a depth of 30 ft.

A copy of the road Overseer's report on the
subject together with samples of earth excavated from the
well are also forwarded herewith.

*sent by railway
parcel.*

I have the honor to be,

Sir,

Your most obedieint servant,

(sd) P. Rama Pao

Chairman,

(True copy)

[Signature]
Sanitary Engineer to Government.

S
S.C. No 287 of 98.
9
2169/98

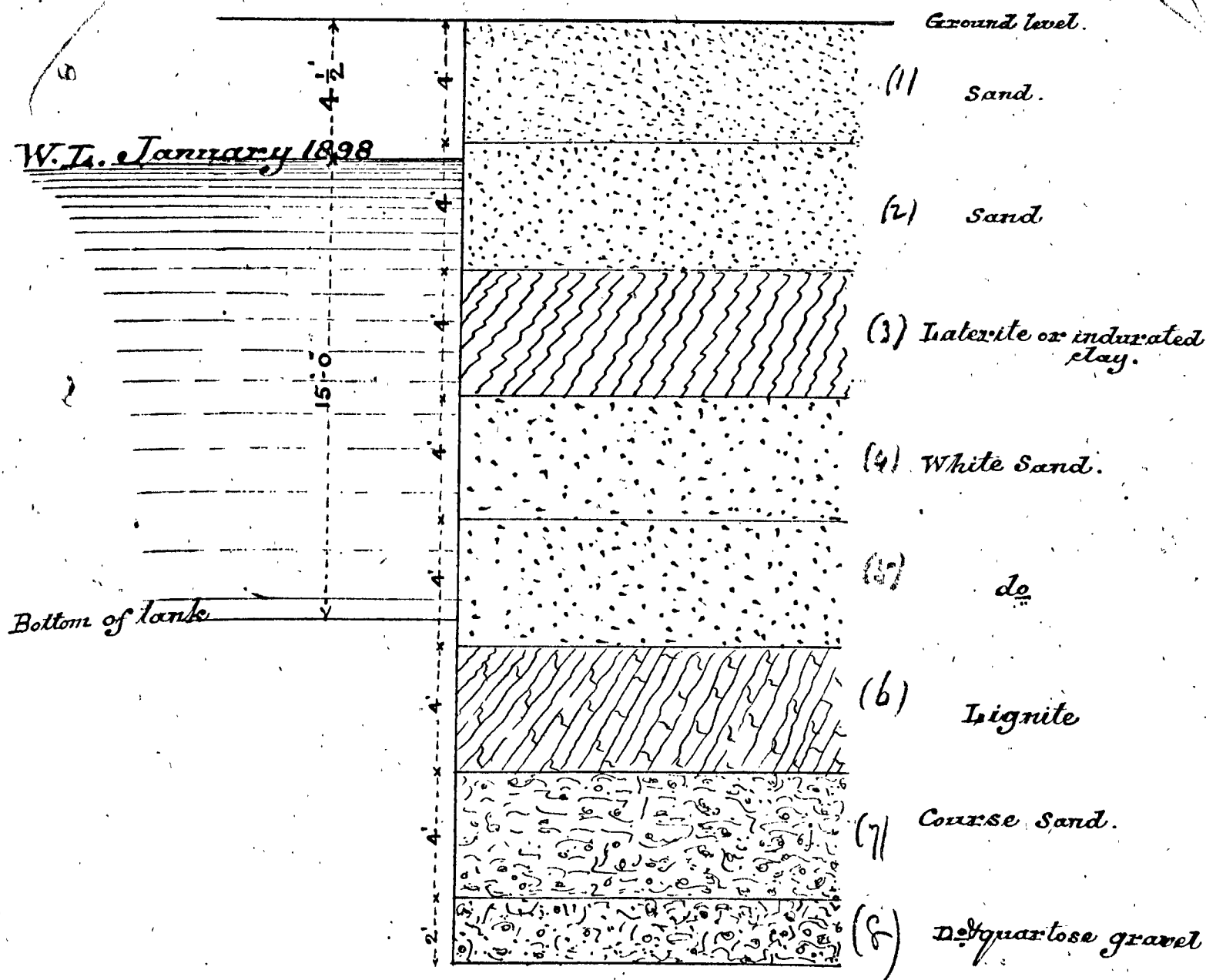
W.B.

Calicut Water supply.

I had intended to go to Calicut, but subsequently found that doing so would be of little use because:-

- (1) The well could not be baled out by manual labor.
- (2) There was no steam pump available there.
- (3) Even if one were available, I don't think the well would stand pumping. It would collapse as it frequently did before.

A section of the boring (vide sketch below) proves Dr. King's theory to be true. Strata (1) & (2) are sandy, porous and water-bearing; Stratum (3) is impermeable indurated clay; Strata (4) & (5) are porous water-bearing sands, and below these there is a bed of lignite.



The tank, therefore, its supply from a sand layer at the top naturally open to contamination, and 2ndly from another porous layer, bedded between two impermeable layers - this water, therefore, being presumably purer than that obtained from the top layers.

I may note here that the section of the well indicates a fair prospect of a good supply being obtained by a deep boring.

I may also mention that it is popularly believed, that there is a well in the bed of the tank. If it be so, the tank must also be deriving a supply from the stratum of gravel below the lignite bed.

(Signed) Hormusji Nowroji

Asstt. Sanitary Engineer to Government.
9th. May 1898.

(True copy)



Sanitary Engineer to Govt.

Local & Munl. (1898) Department.

CURRENT No. 2169k

From

The Secretary, Sanitary Board.

Order.

No. 371/5

Dated 27 June 1898

Received

Registered

Enclosures - with papers in original (12)

Spare copies

SUBJECT.

Public Water Supply

Approving the final plan of the scheme and recommending it to Government.

9
S.C. No 287 of 1898

11
21/6/98

2 148

6-7-98

The tank, therefore, its supply from a sand layer at the top, naturally contaminated and, andly

BACK PAPERS.

G.O.	No.	Department.	Date.
10	2280	h	19-10-97
"	1889	h	7-11-96
"	1725	h	9-1-96
"	669	h	24-5-96
"	583	h	31-3-96
"	582	h	5-5-96
"	496	h	19-6-96

FURTHER PAPERS.

G.O.	No.	Department.	Date.

* Proceedings No. 2-508 dated 24 Feb. 1896.

Government of Madras.

SANITARY BOARD OFFICE.

PROCEEDINGS OF THE SANITARY BOARD, No. 371, DATED 27 June 1898.

LOCAL & MUNICIPAL DEPT.

CURRENT No. 2169 M

Read the following:-

Letter from the Sanitary Engineer to Government, No. 940, dated 10 May 1898.

Resolution

The question of a water supply scheme for the Moplah quarters of the town of Calicut has been under consideration for some years, the proposed source of supply being the Mananchera tank. Before deciding on the use of this water, the late Sanitary Board considered it necessary that an exploratory boring well or excavation should be made in the immediate proximity of the tank, in order to ascertain whether there exists, as suspected, a subterranean supply of good quality.

2. The Sanitary Engineer now submits the results of the boring which shows that the tank receives its supply from two distinct sources, viz.,

- (1) An upper sandy layer liable to contamination,
- (2) A porous layer below an impermeable stratum - presumably a pure water.

3. Judging from the position of the Shaba the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water.

4. He proposes that a scheme should be prepared

The tank, therefore, is supply from a sand layer at the top, nature of the tank, provided for the supply of the tank, of which the main features would be a series of wells adjacent to the Mananchan Tank, a small elevated reservoir, and distribution pipes therefrom.

5. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that, before sinking below the laterite, each well is lined with latite in cement, to prevent the ingress of water from the upper porous strata. The scheme would be, however, of little practical value unless all wells in Mappala yards are closed beyond possibility of secret use. On these lines the general idea of the scheme is approved by the Sanitary Board and is recommended to Government.

(True Extract)

R. Karim S
Secretary, Sanitary Board.

To
The Secretary to Government,
Local and Municipal Department,
with papers in original.

Local and Municipal Department.

2169 m

His ORDER. No. 1548 mms
5/9/98

The Sanitary Engineer is requested to undertake, as soon as possible, the preparation of a scheme for the water-supply of Calicut on the lines approved by the Sanitary Board.

2. The attention of the Municipal Council is drawn to the Sanitary Board's remark that all the wells in Mappala yards should be closed when the scheme has been carried out.

P.R.
20/8/98

26 8 98

To the Chairman Dist. Calicut. }
" " Colls. of Malabar. }
Sanitary Board, with enclosures returned. }
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do. Enquiry }
with enclosure }
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no 1 to 8
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R. Barlow
Secretary, Sanitary Board.

To
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with papers in original.

mis ORDER. No 1548 Stucco
5796

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V.R.
20/8/98

26 8 98

To the Chairman Dist. Council.

" " Collr. of Malabar.

Sanitary Board, with enclosure returned.

do. common

do. Enquiries

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vrs-7/9/90

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189

Serial G.O. No.
189

Serial No.

Serials to G. No.

Serials of Government

Serials of Government

Serials with ditto

NOT FILLED UP, BEING MEANT FOR DESPATCH
IN ORIGINAL.

A A A A A A A

A = Copy in full.
B = Not to be copied.
P = Copy abstract only.
Q = Copy heading only.

Handwritten notes in Urdu script, including the word 'تاریخ' (Tareekh) and other illegible text.

The tank, therefore,

its supply from a sand

contaminatio

12-8-53 DI

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd.

Enclosures

1898.

Regd.

Spare copies

G.O., No. 1548 M., 5th September 1898.

Water-supply.

Requesting, with remarks, the Sanitary Engineer to undertake the preparation of a scheme for the — of Calicut on the lines approved by the Sanitary Board.

12853 DI

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

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- (4) Note of Sanitary Commissioner, No. ²¹⁹⁵ 8, of 2nd December 1895.
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- (8) Note by Assistant Sanitary Engineer to Government, dated 9th May 1898.

ENCLOSURES.

Letter—from M.R.Ry. P. RARICHAN, Road Overseer, Calicut.
To—the Chairman, Municipal Council, Calicut.
Dated—the 4th January 1898.
No.—148.

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8 " 12 feet	..	..	..	..	Reddish.
12 " 16 feet	..	..	..	..	Chalk white clay
16 " 20 feet	..	..	..	..	Do. pure white } Sand pure white.
20 " 24 feet	..	..	..	..	Black clay lignite.
24 " 28 feet	..	..	..	..	Reddish clay—gravel and sand.
28 " 30 feet	..	..	..	..	do. the total depth of the pot well.

I also beg to report that in sounding Mananchera tank I have found it in all 19½ feet deep to the ground level, viz., depth of water 15 feet, above water to the road level 4½ feet.

Letter—from M.R.Ry. R. RAMA RAO Avargal, Chairman, Municipal Council, Calicut.
To—the Sanitary Engineer to Government.
Dated—the 6th January 1898.
No.—¹⁵ 98

In continuation of this office letter No. 1298, dated 30th June 1897, I have the honour to inform you that the pot well has been sunk to a depth of 30 feet.

A copy of the road overseer's report on the subject together with samples of earth excavated from the well are also forwarded herewith.

Note by Assistant Sanitary Engineer on Calicut Water-supply, dated 9th May 1898.

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No. 1548 M., 5TH SEPTEMBER 1898.

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(1) an upper sandy layer liable to contamination, and

(2) a porous layer below an impermeable stratum, presumably a pure water.

3. Judging from the position of the strata the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water.

4. He proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchera tank, a small elevated reservoir, and distribution pipes therefrom.

5. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that, before sinking below the laterite, each well is stained with laterite in cement, to prevent the ingress of water from the upper pervious strata. The scheme would be, however, of little practical value unless all wells in Mappilla yards are closed beyond possibility of secret use. On these lines the general idea of the scheme is approved by the Sanitary Board and is recommended to Government.

(True Extract.)

R. PARSONS,
Secretary, Sanitary Board.

To the Secretary to Government, Local and Municipal Department,
with papers in original.

Order—No. 1548 M., dated 5th September 1898.

The Sanitary Engineer is requested to undertake, as soon as possible, the preparation of a scheme for the water-supply of Calicut on the lines approved by the Sanitary Board.

2. The attention of the Municipal Council is drawn to the Sanitary Board's remark that all the wells in Mappilla yards should be closed when the scheme has been carried out.

(True Extract.)

H. TREMENEER,
Secretary to Government.

To the Chairman, Municipal Council, Calicut.
" Collector of Malabar.
" Sanitary Board, with enclosures returned.
" Commissioner.
" Engineer.

LOCAL AND MUNICIPAL DEPARTMENT.

NOTES CONNECTED WITH G.O., No. 1548 M., DATED
5TH SEPTEMBER 1898.

Previous papers.

G.O., No. 1871 M., dated	8th December	1890.
" " 1396 M. "	31st August	1891.
" " 930 M. "	26th May	1892.
" " 1114 M. "	28th June	"
" " 513 M. "	23rd April	1894.
" " 582 M. "	5th May	"
" " 583 M. "	31st March	1896.

[SUBJECT.—Calicut water-supply scheme.]

From the Sanitary Board, dated 27th June 1898, No. 371-S.

In his report on the inspection of Calicut in September 1890, the Assistant Sanitary Engineer stated—

(1) that the water-supply of the town which was chiefly obtained from private wells, of which there was one in almost every compound and garden, was good, except in the Mappilla quarters, where the water level was so little below the surface of the ground, that the drainage of the place, though preventing the further progress of mischief, would be powerless in checking the causes of pollution that already existed in the soil;

(2) that a good and sufficient supply of water could be obtained for the Mappillas from the Mananchira tank, which was situated to the north-east of the town on a high level and was therefore less liable to contamination; and

(3) that as this tank was not used by the people on account of its distance, the only way to induce them to use the water would be to bring it to their doors by means of pipes.

He therefore suggested the preparation of a scheme for the water-supply of the Mappilla quarters from this tank, the cost of which was roughly estimated by him to be between Rs. 75,000 and Rs. 1,00,000.

2. The Municipal Council of Calicut, however, did not approve the proposal for the reasons, firstly, that its financial condition did not admit of any expenditure being incurred towards the scheme and secondly, that the drainage of the town was more important than water-supply. But the Government overruled the Council's objection on the ground that the report of the Sanitary Engineer afforded ample proof of the immediate necessity for improving the sanitation of the town and considered that the water-supply scheme should have precedence over the drainage scheme. The Municipal Council was accordingly directed to make the

Vide Council's resolution in G.O., No. 1396 M., dated 31st August 1891.

Vide Council's resolution in G.O., No. 930 M., dated 26th May 1892.

Paragraph 2 of G.O., No. 1396 M., dated 31st August 1891.

G.O., No. 1114 M., dated 28th June 1892.

necessary provision for the investigation of the water-supply project, which was

G.O., No. 582 M., dated 5th May 1894.

thereupon put down on the Sanitary Engineer's programme for 1895.

3. In the meantime, the Sanitary Commissioner, who inspected Calicut in 1894, considered that before deciding upon the Mananchira tank as the source for the future water-supply of the Mappilla

quarters, it was necessary that certain matters should be investigated. He doubted the sufficiency of water in the Mananchira tank and also the quality of the supply. He considered that the tank was apparently fed by a special stratum of water under pressure confined between two impervious strata, one of which had been penetrated, as well as from the ordinary subsoil water, and that, as the subsoil water was evidently open to much pollution, it should not be drawn upon for the supply of Calicut, if it was possible to do otherwise. He therefore suggested that exploratory borings should be made for the purpose of ascertaining more as to subsoil conditions, and especially to find out whether any impervious stratum of clay underlay the previous upper

Vide pages 13 and 14 in G.O., No. 513 M., dated 23rd April 1894.

stratum on which the surface water was supported, and that if this was found to be the case, bored or driven wells could be

used within the interior of the town or even the Mananchira tank might be employed, if by iron cylinders or other measures the subsoil water were excluded. He added that, if this was not proved and if it was found necessary to depend upon the subsoil water, it would be requisite to select an area sufficiently removed from the town to guarantee the purity of the soil.

4. The Sanitary Engineer Mr. Ellis, to whom the Sanitary Commissioner's letter

Vide Current No. 2656 M., in G.O., No. 583 M., dated 31st March 1896.

was referred for remarks, visited Calicut in 1894, and reported that as the position of the Mananchira tank was certainly not

very desirable, it would be much better to go beyond the town for a source of supply and that there were several springs at the foot of the Poloor Hill, which was about 3 miles from Calicut, where wells yielding a pure supply might be sunk. He estimated the cost of this scheme at 4 lakhs and recommended that, if the finances of the Municipality did not permit of its being undertaken for some years to come, the Mananchira tank might be tested with regard to its yield, with the view of making it the source of supply as a temporary measure for the Mappilla quarters until such time as the Municipality could find the necessary funds for a larger scheme. He also observed that whatever pipes were laid as a temporary measure could form part of the larger scheme, whenever that came into existence, and added that the urgent need for a water-supply scheme for the Mappilla quarters had already been fully explained in the Assistant Sanitary Engineer's report of 1890, that the popular opinion about the water of the Mananchira tank was that it was good, that it was used by Europeans and Eurasians living near the tank, that the chemical analysis showed that the only impurity which was in excess of the standard fixed for 'usable' water was albumenoid ammonia and that there were indications that this impurity was of vegetable origin and therefore not very dangerous.

5. The Municipal Council, to which the Sanitary Engineer's letter was referred

Vide Current No. 3436 M. in G.O., No. 583 M., dated 31st March 1896.

for remarks, stated that it was not ambitious to provide a correct scheme of water-supply to the whole town, which extended

over an area of $13\frac{1}{4}$ square miles, as its cost, viz., 4 lakhs, was beyond its means and as the A, G and H Divisions of the town obtained a good supply of potable water from wells, and that it resolved to accept the scheme for the supply of water from the Mananchira tank. The Sanitary Board, to whom the whole correspondence was sent

Vide Current No. 715 M. in G.O., No. 583 M., dated 31st March 1896.

for remarks, was of opinion that, before the question of the advisability of using the water of this tank could be deter-

mined, an exploratory boring well or excavation should be made in the immediate proximity of the tank in view to ascertaining the existence or non-existence of water of good quality at the lower stratum, as supposed by Dr. King, and stated that, when this had been done and the quantity of the source and the feasibility of

measures providing for the exclusion of the subsoil water had been determined, the Board would be in a position to advise finally as to the adoption of the Mananchira tank scheme or the alternative Poloor Hill scheme proposed by Mr. Ellis.

6. The Municipal Council which was thereupon requested to take steps to furnish the information required by the Sanitary Board, carried out the necessary

G.O., No. 583 M., dated 31st August 1896. experiments and reported the results to the Board through the Sanitary Engineer, and the Sanitary Board now submits the Sanitary Engineer's report in the matter with its resolution thereon. The Sanitary Engineer states that the results of the experiments show that the Mananchira tank receives its supply from two distinct sources, viz., (1) an upper sandy layer liable to contamination and (2) a porous layer below an impermeable stratum—presumably containing a pure water. Judging from the position of the strata, the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water and accordingly proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchira tank, a small elevated reservoir and distribution pipes therefrom. He states that the scheme cannot be taken up for some time yet, but will be put on the programme at the earliest opportunity. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that before sinking below the laterite, each well is steined with laterite in cement to prevent the ingress of water from the upper pervious strata, and approves the general idea of the scheme on the said lines. The Sanitary Board, however, observes that the scheme would be of little practical value, unless all wells in Mappilla yards are closed beyond possibility of secret use.

7. In these circumstances, it is submitted that the Sanitary Engineer may be requested to undertake the preparation of the scheme, as soon as possible, on the lines approved by the Sanitary Board and that the attention of the Municipal Council may be drawn to the Sanitary Board's remark regarding the closure of all private wells in the Mappilla quarters, when the scheme has been executed. The accompanying draft order is submitted for approval.

V. RAGHAVA CHARLU—20-8-98.

H. TEEMENHEER—26-8-98.

[G.O., No. 1548 M., dated 5th September 1898.]

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its supply

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Government of Madras.
LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd.

Regd.

} 1898.

Enclosures

Spare copies

G.O., No. 1548 M., 5th September 1898.

Water-supply.

Requesting, with remarks, the Sanitary Engineer to undertake the preparation of a scheme for the — of Calicut on the lines approved by the Sanitary Board.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following paper :—

Proceedings of the Sanitary Board, No. 371/S., dated 27th June 1898.

Read—the following paper :—

Office-note—from J. A. JONES, Esq., Sanitary Engineer to Government.
To—the Secretary, Sanitary Board.
Dated—the 10th May 1898.
No.—940.

Calicut Water-supply.

About the year 1890 a suggestion was made by this Department that a supply of water for the Mappilla quarters of Calicut should be obtained from the Mananchera tank situated near the centre of and at the highest point of Calicut. After much discussion the Municipal Council accepted the proposal, but as doubts as to the quality and quantity of the supply were raised, the Sanitary Board in its Proceedings No. 2 of 24th February 1896 (copy attached) ordered certain investigations to be made.

2. There has been a good deal of delay in getting the well sunk, the well first sunk was a failure and progress with a second one has been very slow.

3. The results of sinking the well, however, are now available and will be found reported in the overseer's report forwarded with the Chairman's letter No. 15 of 6th January 1898 (copy attached).

4. The overseer has, however, not identified the various samples from the strata correctly and these are correctly shown in a note by the Assistant Sanitary Engineer (copy herewith). I have examined the samples and concur with his remarks.

5. The main question at issue has been whether the Mananchera tank receives any supply from a pure source—that it does so cannot now be doubted because the white sand layers 8 feet in thickness are perfectly pure indeed, no whiter sand could possibly be found.

6. Under this is a bed of lignite which forms the bed of the tank and this is 4 feet thick; below this again there is coarse sand and sand and gravel so that even if enough water were not procurable from the white sand, this lower strata can be drawn on.

7. It may be noted in passing that a similar bed of lignite to that already referred to was found when boring at Cochin.

8. From the position of strata, I think it possible that wells sunk into the white sand or the lower coarse sand will yield artesian water.

9. The water of the Mananchera tank has been declared usable, the albumenoid ammonia was slightly high, but this can be understood with an open tank.

10. That pure water can be obtained from wells sunk around the tank cannot be doubted and the quantity should be ample, but this it has been impossible to test as the well sunk cannot be baled out by manual labour and no steam pump is available near Calicut. The contents of the tank itself which fills yearly, however, would yield an ample supply as shown in Chairman's letter quoted below so that with constant pumping there can be no fear of insufficiency.

11. It is proposed that a scheme should be prepared for the supply to the Mappilla quarters of Calicut. The main feature of this scheme being a series of wells adjacent to the Mananchera tank, a small elevated reservoir and distribution pipes therefrom.

12. The scheme cannot be taken up for sometime yet but will be put on the programme at the earliest opportunity.

13. The following is a list of the papers accompanying—

- (1) Report of Assistant Sanitary Engineer to Government, 1890.
- (1-A) Letter from the Acting Sanitary Engineer to Government, No. 2417, of 29th October 1894.
- (2) Letter from the Sanitary Engineer to Government, No. 813, of 26th March 1895.
- (3) Letter from the Chairman, Municipal Council, Calicut, No. 915, of 3rd October 1895.
- (4) Note of Sanitary Commissioner, No. 2195, of 2nd December 1895.
- (5) Note by Colonel Campbell, No. 12/S, of 27th January 1896.
- (6) Resolution of the Sanitary Board, No. 2, of 24th February 1896.
- (7) Report of overseer and Chairman's letter, No. 15, of 6th January 1898.
- (8) Note by Assistant Sanitary Engineer to Government, dated 9th May 1898.

ENCLOSURES.

Letter—from M.R.Ry. P. RARICHAN, Road Overseer, Calicut.
To—the Chairman, Municipal Council, Calicut.
Dated—the 4th January 1898.
No.—148.

I beg to report that I have herewith sent the sample of earth packed up, in a tin case, taken at every 4 feet of the depth of the pot well lately sunk at the Municipal garden near Mananchera tank, Calicut, for the inspection of the Sanitary Engineer, Madras.

The subjoined is the list of the earth enclosed :—

1 to 4 feet	.. .. .	Sandy soil, light black.
4 „ 8 feet	.. .. .	do. a little white.
8 „ 12 feet	.. .. .	Reddish.
12 „ 16 feet	.. .. .	Chalk white clay
16 „ 20 feet	.. .. .	Do. pure white } Sand pure white.
20 „ 24 feet	.. .. .	Black clay lignite.
24 „ 28 feet	.. .. .	Reddish clay—gravel and sand.
28 „ 30 feet	.. .. .	do. the total depth of the pot well.

I also beg to report that in sounding Mananchera tank I have found it in all 19½ feet deep to the ground level, viz., depth of water 15 feet, above water to the road level 4½ feet.

Letter—from M.R.Ry. R. RAMA RAO Avargal, Chairman, Municipal Council, Calicut.
To—the Sanitary Engineer to Government.
Dated—the 6th January 1898.
No.—15
98

In continuation of this office letter No. 1298, dated 30th June 1897, I have the honour to inform you that the pot well has been sunk to a depth of 30 feet.

A copy of the road overseer's report on the subject together with samples of earth excavated from the well are also forwarded herewith.

Note by Assistant Sanitary Engineer on Calicut Water-supply, dated 9th May 1898.

I had intended to go to Calicut, but subsequently found that doing so would be of little use because—

- (1) The well could not be baled out by manual labour.
- (2) There was no steam pump available there.
- (3) Even if one were available, I don't think the well would stand pumping. It would collapse as it frequently did before.

A section of the boring (vide sketch below) proves Dr. King's theory to be true. Strata (1) and (2) are sandy, porous and water-bearing; stratum (3) is impermeable indurated clay; strata (4) and (5) are porous water-bearing sands, and below these there is a bed of lignite.

No. 1548 M., 5TH SEPTEMBER 1898.

The tank, therefore, receives its supply from a sandy layer at the top naturally open to contamination, and secondly from another porous layer, bedded between two impermeable layers—this water, therefore, being presumably purer than that obtained from the top layers.

I may note here that the section of the well indicates a fair prospect of a good supply being obtained by a deep boring.

I may also mention that it is popularly believed that there is a well in the bed of the tank. If it be so, the tank must also be deriving a supply from the stratum of gravel below the lignite bed.

Resolution—No. 371/S., dated 27th June 1898.

The question of a water-supply scheme for the Mappilla quarters of the town of Calicut has been under consideration for some years, the proposed source of supply being the Mananchera tank. Before deciding on the use of this water, the late Sanitary Board considered * it necessary that

* Proceedings No. ² S.E.F., dated 24th February 1896. an exploratory boring well or excavation should be made in the immediate proximity of the tank, in order to ascertain whether there exists, as suspected, a subterranean supply of good quality.

2. The Sanitary Engineer now submits the results of the boring which shows that the tank receives its supply from two distinct sources, viz.—

- (1) an upper sandy layer liable to contamination, and
- (2) a porous layer below an impermeable stratum, presumably a pure water.

3. Judging from the position of the strata the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water.

4. He proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchera tank, a small elevated reservoir, and distribution pipes therefrom.

5. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that, before sinking below the laterite, each well is stained with laterite in cement, to prevent the ingress of water from the upper pervious strata. The scheme would be, however, of little practical value unless all wells in Mappilla yards are closed beyond possibility of secret use. On these lines the general idea of the scheme is approved by the Sanitary Board and is recommended to Government.

(True Extract.)

R. PARSONS,
Secretary, Sanitary Board.

To the Secretary to Government, Local and Municipal Department,
with papers in original.

Order—No. 1548 M., dated 5th September 1898.

The Sanitary Engineer is requested to undertake, as soon as possible, the preparation of a scheme for the water-supply of Calicut on the lines approved by the Sanitary Board.

2. The attention of the Municipal Council is drawn to the Sanitary Board's remark that all the wells in Mappilla yards should be closed when the scheme has been carried out.

(True Extract.)

H. TREMENHEERE,
Secretary to Government.

To the Chairman, Municipal Council, Calicut.
" Collector of Malabar.
" Sanitary Board, with enclosures returned.
" Commissioner.
" Engineer.

LOCAL AND MUNICIPAL DEPARTMENT.

NOTES CONNECTED WITH G.O., No. 1548 M., DATED
5TH SEPTEMBER 1898.

Previous papers.

G.O., No. 1871 M.,	dated	8th December	1890.
" " 1396 M.	"	31st August	1891.
" " 930 M.	"	26th May	1892.
" " 1114 M.	"	28th June	"
" " 513 M.	"	23rd April	1894.
" " 582 M.	"	5th May	"
" " 583 M.	"	31st March	1896.

[SUBJECT.—Calicut water-supply scheme.]

From the Sanitary Board, dated 27th June 1898, No. 371-S.

In his report on the inspection of Calicut in September 1890, the Assistant Sanitary Engineer stated—

(1) that the water-supply of the town which was chiefly obtained from private wells, of which there was one in almost every compound and garden, was good, except in the Mappilla quarters, where the soil was so far contaminated already and the water level was so little below the surface of the ground, that the drainage of the place, though preventing the further progress of mischief, would be powerless in checking the causes of pollution that already existed in the soil;

(2) that a good and sufficient supply of water could be obtained for the Mappillas from the Mananchira tank, which was situated to the north-east of the town

on a high level and was therefore less liable to contamination; and

(3) that as this tank was not used by the people on account of its distance, the only way to induce them to use the water would be to bring it to their doors by means of pipes.

He therefore suggested the preparation of a scheme for the water-supply of the Mappilla quarters from this tank, the cost of which was roughly estimated by

him to be between Rs. 75,000 and Rs. 1,00,000.

2. The Municipal Council of Calicut, however, did not approve the proposal for the reasons, firstly, that its financial condition did not admit of any expenditure being incurred towards the scheme

and secondly, that the drainage of the town was more important than water-supply. But the Government overruled

the Council's objection on the ground that the report of the Sanitary Engineer afforded ample proof of the immediate necessity for improving the sanitation of the town and considered that the water-supply scheme should have precedence over the drainage scheme. The Municipal Council was accordingly directed to make the

Paragraph 2 of G.O., No. 1396 M., dated 31st August 1891.

G.O., No. 1114 M., dated 28th June 1892.

2

No. 1548 M., 5TH SEPTEMBER 1898.

necessary provision for the investigation of the water-supply project, which was thereupon put down on the Sanitary Engineer's programme for 1895.

G.O., No. 582 M., dated 5th May 1894.

3. In the meantime, the Sanitary Commissioner, who inspected Calicut in 1894, considered that before deciding upon the Mananchira tank as the source for the future water-supply of the Mappilla

quarters, it was necessary that certain matters should be investigated. He doubted the sufficiency of water in the Mananchira tank and also the quality of the supply. He considered that the tank was apparently fed by a special stratum of water under pressure confined between two impervious strata, one of which had been penetrated, as well as from the ordinary subsoil water, and that, as the subsoil water was evidently open to much pollution, it should not be drawn upon for the supply of Calicut, if it was possible to do otherwise. He therefore suggested that exploratory borings should be made for the purpose of ascertaining more as to subsoil conditions, and especially to find out whether any impervious stratum of clay underlay the previous upper stratum on which the surface water was supported, and that if this was found to be the case, bored or driven wells could be used within the interior of the town or even the Mananchira tank might be employed, if by iron cylinders or other measures the subsoil water were excluded. He added that, if this was not proved and if it was found necessary to depend upon the subsoil water, it would be requisite to select an area sufficiently removed from the town to guarantee the purity of the soil.

Vide pages 13 and 14 in G.O., No. 513 M., dated 23rd April 1894.

4. The Sanitary Engineer Mr. Ellis, to whom the Sanitary Commissioner's letter was referred for remarks, visited Calicut in 1894, and reported that as the position of the Mananchira tank was certainly not

very desirable, it would be much better to go beyond the town for a source of supply and that there were several springs at the foot of the Poloor Hill, which was about 3 miles from Calicut, where wells yielding a pure supply might be sunk. He estimated the cost of this scheme at 4 lakhs and recommended that, if the finances of the Municipality did not permit of its being undertaken for some years to come, the Mananchira tank might be tested with regard to its yield, with the view of making it the source of supply as a temporary measure for the Mappilla quarters until such time as the Municipality could find the necessary funds for a larger scheme. He also observed that whatever pipes were laid as a temporary measure could form part of the larger scheme, whenever that came into existence, and added that the urgent need for a water-supply scheme for the Mappilla quarters had already been fully explained in the Assistant Sanitary Engineer's report of 1890, that the popular opinion about the water of the Mananchira tank was that it was good, that it was used by Europeans and Eurasians living near the tank, that the chemical analysis showed that the only impurity which was in excess of the standard fixed for 'usable' water was albumenoid ammonia and that there were indications that this impurity was of vegetable origin and therefore not very dangerous.

5. The Municipal Council, to which the Sanitary Engineer's letter was referred for remarks, stated that it was not ambitious to provide a correct scheme of water-supply to the whole town, which extended

over an area of $13\frac{1}{4}$ square miles, as its cost, viz., 4 lakhs, was beyond its means and as the A, G and H Divisions of the town obtained a good supply of potable water from wells, and that it resolved to accept the scheme for the supply of water from the Mananchira tank. The Sanitary Board, to whom the whole correspondence was sent

for remarks, was of opinion that, before the question of the advisability of using the water of this tank could be determined, an exploratory boring well or excavation should be made in the immediate

proximity of the tank in view to ascertaining the existence or non-existence of water of good quality at the lower stratum, as supposed by Dr. King, and stated that, when this had been done and the quantity of the source and the feasibility of

measures providing for the exclusion of the subsoil water had been determined, the Board would be in a position to advise finally as to the adoption of the Mananchira tank scheme or the alternative Poloor Hill scheme proposed by Mr. Ellis.

6. The Municipal Council which was thereupon requested to take steps to furnish the information required by the Sanitary Board, carried out the necessary

experiments and reported the results to the Board through the Sanitary Engineer, and the Sanitary Board now submits the Sanitary Engineer's report in the matter with its resolution thereon. The Sanitary Engineer states that the results of the experiments show that the Mananchira tank receives its supply from two distinct sources, viz., (1) an upper sandy layer liable to contamination and (2) a porous layer below an impermeable stratum—presumably containing a pure water. Judging from the position of the strata, the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water and accordingly proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchira tank, a small elevated reservoir and distribution pipes therefrom. He states that the scheme cannot be taken up for some time yet, but will be put on the programme at the earliest opportunity. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that before sinking below the laterite, each well is steined with laterite in cement to prevent the ingress of water from the upper pervious strata, and approves the general idea of the scheme on the said lines. The Sanitary Board, however, observes that the scheme would be of little practical value, unless all wells in Mappilla yards are closed beyond possibility of secret use.

7. In these circumstances, it is submitted that the Sanitary Engineer may be requested to undertake the preparation of the scheme, as soon as possible, on the lines approved by the Sanitary Board and that the attention of the Municipal Council may be drawn to the Sanitary Board's remark regarding the closure of all private wells in the Mappilla quarters, when the scheme has been executed. The accompanying draft order is submitted for approval.

V. RAGHAVA CHARLU—20-8-98.

H. TREMENHEERE—26-8-98.

[G.O., No. 1548 M., dated 5th September 1898.]

Government of Madras.
LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd.

Regd.

} 1898.

Enclosures

Spare copies

G.O., No. 1548 M., 5th September 1898.

Water-supply.

Requesting, with remarks, the Sanitary Engineer to undertake the preparation of a scheme for the — of Calicut on the lines approved by the Sanitary Board.

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2. There has been a good deal of delay in getting the well sunk, the well first sunk was a failure and progress with a second one has been very slow.

3. The results of sinking the well, however, are now available and will be found reported in the overseer's report forwarded with the Chairman's letter No. ¹⁵₉₈ of 6th January 1898 (copy attached).

4. The overseer has, however, not identified the various samples from the strata correctly and these are correctly shown in a note by the Assistant Sanitary Engineer (copy herewith). I have examined the samples and concur with his remarks.

5. The main question at issue has been whether the Mananchera tank receives any supply from a pure source—that it does so cannot now be doubted because the white sand layers 8 feet in thickness are perfectly pure indeed, no whiter sand could possibly be found.

6. Under this is a bed of lignite which forms the bed of the tank and this is 4 feet thick; below this again there is coarse sand and sand and gravel so that even if enough water were not procurable from the white sand, this lower strata can be drawn on.

7. It may be noted in passing that a similar bed of lignite to that already referred to was found when boring at Cochin.

8. From the position of strata, I think it possible that wells sunk into the white sand or the lower coarse sand will yield artesian water.

9. The water of the Mananchera tank has been declared usable, the albumenoid ammonia was slightly high, but this can be understood with an open tank.

10. That pure water can be obtained from wells sunk around the tank cannot be doubted and the quantity should be ample, but this it has been impossible to test as the well sunk cannot be baled out by manual labour and no steam pump is available near Calicut. The contents of the tank itself which fills yearly, however, would yield an ample supply as shown in Chairman's letter quoted below so that with constant pumping there can be no fear of insufficiency.

11. It is proposed that a scheme should be prepared for the supply to the Mappilla quarters of Calicut. The main feature of this scheme being a series of wells adjacent to the Mananchera tank, a small elevated reservoir and distribution pipes therefrom.

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ENCLOSURES.

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To—the Chairman, Municipal Council, Calicut.

Dated—the 4th January 1898.

No.—148.

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The subjoined is the list of the earth enclosed :—

1 to 4 feet	..	..	..	..	Sandy soil, light black.
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8 „ 12 feet	..	..	..	..	Reddish.
12 „ 16 feet	..	..	..	..	Chalk white clay
16 „ 20 feet	..	..	..	..	Do. pure white } Sand pure white.
20 „ 24 feet	..	..	..	..	Black clay lignite.
24 „ 28 feet	..	..	..	..	Reddish clay—gravel and sand.
28 „ 30 feet	..	..	..	..	do. the total depth of the pot well.

I also beg to report that in sounding Mananchera tank I have found it in all 19½ feet deep to the ground level, viz., depth of water 15 feet, above water to the road level 4½ feet.

Letter—from M.R.Ry. R. RAMA RAO Avargal, Chairman, Municipal Council, Calicut.

To—the Sanitary Engineer to Government.

Dated—the 6th January 1898.

No.—¹⁵₉₈

In continuation of this office letter No. 1298, dated 30th June 1897, I have the honour to inform you that the pot well has been sunk to a depth of 30 feet.

A copy of the road overseer's report on the subject together with samples of earth excavated from the well are also forwarded herewith.

Note by Assistant Sanitary Engineer on Calicut Water-supply, dated 9th May 1898.

I had intended to go to Calicut, but subsequently found that doing so would be of little use because—

(1) The well could not be baled out by manual labour.

(2) There was no steam pump available there.

(3) Even if one were available, I don't think the well would stand pumping. It would collapse as it frequently did before.

A section of the boring (*vide* sketch below) proves Dr. King's theory to be true. Strata (1) and (2) are sandy, porous and water-bearing; stratum (3) is impermeable indurated clay; strata (4) and (5) are porous water-bearing sands, and below these there is a bed of lignite.

The tank, therefore, receives its supply from a sandy layer at the top naturally open to contamination, and secondly from another porous layer, bedded between two impermeable layers—this water, therefore, being presumably purer than that obtained from the top layers.

I may note here that the section of the well indicates a fair prospect of a good supply being obtained by a deep boring.

I may also mention that it is popularly believed that there is a well in the bed of the tank. If it be so, the tank must also be deriving a supply from the stratum of gravel below the lignite bed.

Resolution—No. 371/S., dated 27th June 1898.

The question of a water-supply scheme for the Mappilla quarters of the town of Calicut has been under consideration for some years, the proposed source of supply being the Mananchera tank. Before deciding on the use of this water, the late Sanitary Board considered it necessary that an exploratory boring well or excavation should be made in the immediate proximity of the tank, in order to ascertain whether there exists, as suspected, a subterranean supply of good quality.

2. The Sanitary Engineer now submits the results of the boring which shows that the tank receives its supply from two distinct sources, viz.—

(1) an upper sandy layer liable to contamination, and

(2) a porous layer below an impermeable stratum, presumably a pure water.

3. Judging from the position of the strata the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water.

4. He proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchera tank, a small elevated reservoir, and distribution pipes therefrom.

5. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that, before sinking below the laterite, each well is stained with laterite in cement, to prevent the ingress of water from the upper pervious strata. The scheme would be, however, of little practical value unless all wells in Mappilla yards are closed beyond possibility of secret use. On these lines the general idea of the scheme is approved by the Sanitary Board and is recommended to Government.

(True Extract.)

R. PARSONS,
Secretary, Sanitary Board.

To the Secretary to Government, Local and Municipal Department,
with papers in original.

Order—No. 1548 M., dated 5th September 1898.

The Sanitary Engineer is requested to undertake, as soon as possible, the preparation of a scheme for the water-supply of Calicut on the lines approved by the Sanitary Board.

2. The attention of the Municipal Council is drawn to the Sanitary Board's remark that all the wells in Mappilla yards should be closed when the scheme has been carried out.

(True Extract.)

H. TREMENHEERE,
Secretary to Government.

To the Chairman, Municipal Council, Calicut.
" Collector of Malabar.
" Sanitary Board, with enclosures returned.
" Commissioner.
" Engineer.

NOTES CONNECTED WITH G.O., No. 1548 M., DATE
5TH SEPTEMBER 1898.

Previous papers.

G.O., No. 1871 M., dated	8th December	1890.
" " 1396 M. "	31st August	1891.
" " 930 M. "	26th May	1892.
" " 1114 M. "	28th June	"
" " 513 M. "	23rd April	1894.
" " 582 M. "	5th May	"
" " 583 M. "	31st March	1896.

[SUBJECT.—Calicut water-supply scheme.]

From the Sanitary Board, dated 27th June 1898, No. 371-S.

In his report on the inspection of Calicut in September 1890, the Assistant Sanitary Engineer stated—

(1) that the water-supply of the town which was chiefly obtained from private wells, of which there was one in almost every compound and garden, was good, except in the Mappilla quarters, where the soil was so far contaminated already and the water level was so little below the surface of the ground, that the drainage of the place, though preventing the further progress of mischief, would be powerless in checking the causes of pollution that already existed in the soil;

(2) that a good and sufficient supply of water could be obtained for the Mappillas from the Mananchira tank, which was situated to the north-east of the town on a high level and was therefore less liable to contamination; and

(3) that as this tank was not used by the people on account of its distance, the only way to induce them to use the water would be to bring it to their doors by means of pipes.

He therefore suggested the preparation of a scheme for the water-supply of the Mappilla quarters from this tank, the cost of which was roughly estimated by

him to be between Rs. 75,000 and Rs. 1,00,000.

2. The Municipal Council of Calicut, however, did not approve the proposal for the reasons, firstly, that its financial condition did not admit of any expenditure being incurred towards the scheme

and secondly, that the drainage of the town was more important than water-supply. But the Government overruled the Council's objection on the ground that the report of the Sanitary Engineer afforded ample proof of the immediate necessity for improving the sanitation of the town and considered that the water-supply scheme should have precedence over the drainage scheme. The Municipal Council was accordingly directed to make the

Paragraph 2 of G.O., No. 1396 M., dated 31st August 1891.

G.O., No. 1114 M., dated 28th June 1892.

necessary provision for the investigation of the water-supply project, which was thereupon put down on the Sanitary Engineer's programme for 1895.

3. In the meantime, the Sanitary Commissioner, who inspected Calicut in 1894, considered that before deciding upon the Mananchira tank as the source for the future water-supply of the Mappilla quarters, it was necessary that certain matters should be investigated. He doubted the sufficiency of water in the Mananchira tank and also the quality of the supply. He considered that the tank was apparently fed by a special stratum of water under pressure confined between two impervious strata, one of which had been penetrated, as well as from the ordinary subsoil water, and that, as the subsoil water was evidently open to much pollution, it should not be drawn upon for the supply of Calicut, if it was possible to do otherwise. He therefore suggested that exploratory borings should be made for the purpose of ascertaining more as to subsoil conditions, and especially to find out whether any impervious stratum of clay underlay the previous upper stratum on which the surface water was supported, and that if this was found to be the case, bored or driven wells could be used within the interior of the town or even the Mananchira tank might be employed, if by iron cylinders or other measures the subsoil water were excluded. He added that, if this was not proved and if it was found necessary to depend upon the subsoil water, it would be requisite to select an area sufficiently removed from the town to guarantee the purity of the soil.

4. The Sanitary Engineer Mr. Ellis, to whom the Sanitary Commissioner's letter was referred for remarks, visited Calicut in 1894, and reported that as the position of the Mananchira tank was certainly not very desirable, it would be much better to go beyond the town for a source of supply and that there were several springs at the foot of the Puloor Hill, which was about 3 miles from Calicut, where wells yielding a pure supply might be sunk. He estimated the cost of this scheme at 4 lakhs and recommended that, if the finances of the Municipality did not permit of its being undertaken for some years to come, the Mananchira tank might be tested with regard to its yield, with the view of making it the source of supply as a temporary measure for the Mappilla quarters until such time as the Municipality could find the necessary funds for a larger scheme. He also observed that whatever pipes were laid as a temporary measure could form part of the larger scheme, whenever that came into existence, and added that the urgent need for a water-supply scheme for the Mappilla quarters had already been fully explained in the Assistant Sanitary Engineer's report of 1890, that the popular opinion about the water of the Mananchira tank was that it was good, that it was used by Europeans and Eurasians living near the tank, that the chemical analysis showed that the only impurity which was in excess of the standard fixed for 'usable' water was albumenoid ammonia and that there were indications that this impurity was of vegetable origin and therefore not very dangerous.

5. The Municipal Council, to which the Sanitary Engineer's letter was referred for remarks, stated that it was not ambitious to provide a correct scheme of water-supply to the whole town, which extended over an area of $13\frac{1}{2}$ square miles, as its cost, viz., 4 lakhs, was beyond its means and as the A, G and H Divisions of the town obtained a good supply of potable water from wells, and that it resolved to accept the scheme for the supply of water from the Mananchira tank. The Sanitary Board, to whom the whole correspondence was sent for remarks, was of opinion that, before the question of the advisability of using the water of this tank could be determined, an exploratory boring well or excavation should be made in the immediate proximity of the tank in view to ascertaining the existence or non-existence of water of good quality at the lower stratum, as supposed by Dr. King, and stated that, when this had been done and the quantity of the source and the feasibility of

measures providing for the exclusion of the subsoil water had been determined, the Board would be in a position to advise finally as to the adoption of the Mananchira tank scheme or the alternative Poloor Hill scheme proposed by Mr. Ellis.

6. The Municipal Council which was thereupon requested to take steps to furnish the information required by the Sanitary Board, carried out the necessary experiments and reported the results to the Board through the Sanitary Engineer, and the Sanitary Board now submits the Sanitary Engineer's report in the matter with its resolution thereon. The Sanitary Engineer states that the results of the experiments show that the Mananchira tank receives its supply from two distinct sources, viz., (1) an upper sandy layer liable to contamination and (2) a porous layer below an impermeable stratum—presumably containing a pure water. Judging from the position of the strata, the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water and accordingly proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchira tank, a small elevated reservoir and distribution pipes therefrom. He states that the scheme cannot be taken up for some time yet, but will be put on the programme at the earliest opportunity. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that before sinking below the laterite, each well is steeled with laterite in cement to prevent the ingress of water from the upper pervious strata, and approves the general idea of the scheme on the said lines. The Sanitary Board, however, observes that the scheme would be of little practical value, unless all wells in Mappilla yards are closed beyond possibility of secret use.

7. In these circumstances, it is submitted that the Sanitary Engineer may be requested to undertake the preparation of the scheme, as soon as possible, on the lines approved by the Sanitary Board and that the attention of the Municipal Council may be drawn to the Sanitary Board's remark regarding the closure of all private wells in the Mappilla quarters, when the scheme has been executed. The accompanying draft order is submitted for approval.

V. RAGHAVA CHARLU—20-8-98.
H. TREMENHEERE—26-8-98.

[G.O., No. 1548 M., dated 5th September 1898.]

Government of Madras.
LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

<i>Recd.</i>	} 1898.	<i>Enclosures</i>
<i>Regd.</i>		<i>Spare copies</i>

G.O., No. 1548 M., 5th September 1898.

Water-supply.

Requesting, with remarks, the Sanitary Engineer to undertake the preparation of a scheme for the — of Calicut on the lines approved by the Sanitary Board.

Government of Madras.
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Requesting, with remarks, the Sanitary Engineer to undertake the preparation of a scheme for the — of Calicut on the lines approved by the Sanitary Board.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following paper:—

Proceedings of the Sanitary Board, No. 371/S., dated 27th June 1898.

Read—the following paper:—

Office-note—from J. A. JONES, Esq., Sanitary Engineer to Government.
To—the Secretary, Sanitary Board.
Dated—the 10th May 1898.
No.—940.

Calicut Water-supply.

About the year 1890 a suggestion was made by this Department that a supply of water for the Mappilla quarters of Calicut should be obtained from the Mananchera tank situated near the centre of and at the highest point of Calicut. After much discussion the Municipal Council accepted the proposal, but as doubts as to the quality and quantity of the supply were raised, the Sanitary Board in its Proceedings No. ² S.B.F. of 24th February 1896 (copy attached) ordered certain investigations to be made.

2. There has been a good deal of delay in getting the well sunk, the well first sunk was a failure and progress with a second one has been very slow.

3. The results of sinking the well, however, are now available and will be found reported in the overseer's report forwarded with the Chairman's letter No. ¹⁵ of 6th January 1898 (copy attached).

4. The overseer has, however, not identified the various samples from the strata correctly and these are correctly shown in a note by the Assistant Sanitary Engineer (copy herewith). I have examined the samples and concur with his remarks.

5. The main question at issue has been whether the Mananchera tank receives any supply from a pure source—that it does so cannot now be doubted because the white sand layers 8 feet in thickness are perfectly pure indeed, no whiter sand could possibly be found.

6. Under this is a bed of lignite which forms the bed of the tank and this is 4 feet thick; below this again there is coarse sand and sand and gravel so that even if enough water were not procurable from the white sand, this lower strata can be drawn on.

7. It may be noted in passing that a similar bed of lignite to that already referred to was found when boring at Cochin.

8. From the position of strata, I think it possible that wells sunk into the white sand or the lower coarse sand will yield artesian water.

9. The water of the Mananchera tank has been declared usable, the albumenoid ammonia was slightly high, but this can be understood with an open tank.

10. That pure water can be obtained from wells sunk around the tank cannot be doubted and the quantity should be ample, but this it has been impossible to test as the well sunk cannot be baled out by manual labour and no steam pump is available near Calicut. The contents of the tank itself which fills yearly, however, would yield an ample supply as shown in Chairman's letter quoted below so that with constant pumping there can be no fear of insufficiency.

11. It is proposed that a scheme should be prepared for the supply to the Mappilla quarters of Calicut. The main feature of this scheme being a series of wells adjacent to the Mananchera tank, a small elevated reservoir and distribution pipes therefrom.

12. The scheme cannot be taken up for sometime yet but will be put on the programme at the earliest opportunity.

13. The following is a list of the papers accompanying—

- (1) Report of Assistant Sanitary Engineer to Government, 1890.
- (1-A) Letter from the Acting Sanitary Engineer to Government, No. 2417, of 29th October 1894.
- (2) Letter from the Sanitary Engineer to Government, No. 813, of 26th March 1895.
- (3) Letter from the Chairman, Municipal Council, Calicut, No. 915, of 3rd October 1895.
- (4) Note of Sanitary Commissioner, No. ²¹⁹⁵ S., of 2nd December 1895.
- (5) Note by Colonel Campbell, No. 12/S, of 27th January 1896.
- (6) Resolution of the Sanitary Board, No. ² S.B.F., of 24th February 1896.
- (7) Report of overseer and Chairman's letter, No. 15, of 6th January 1898.
- (8) Note by Assistant Sanitary Engineer to Government, dated 9th May 1898.

ENCLOSURES.

Letter—from M.R.Ry. P. RABICHAN, Road Overseer, Calicut.
To—the Chairman, Municipal Council, Calicut.
Dated—the 4th January 1898.
No.—148.

I beg to report that I have herewith sent the sample of earth packed up, in a tin case, taken at every 4 feet of the depth of the pot well lately sunk at the Municipal garden near Mananchera tank, Calicut, for the inspection of the Sanitary Engineer, Madras.

The subjoined is the list of the earth enclosed:—

1 to 4 feet	..	..	..	..	Sandy soil, light black.
4 " 8 feet	..	..	..	..	do. a little white.
8 " 12 feet	..	..	..	..	Reddish.
12 " 16 feet	..	..	..	..	Chalk white clay
16 " 20 feet	..	..	..	..	Do. pure white } Sand pure white.
20 " 24 feet	..	..	..	..	Black clay lignite.
24 " 28 feet	..	..	..	..	Reddish clay—gravel and sand.
28 " 30 feet	..	..	..	..	do. the total depth of the pot well.

I also beg to report that in sounding Mananchera tank I have found it in all 19½ feet deep to the ground level, viz., depth of water 15 feet, above water to the road level 4½ feet.

Letter—from M.R.Ry. R. RAMA RAO Avargal, Chairman, Municipal Council, Calicut.
To—the Sanitary Engineer to Government.
Dated—the 6th January 1898.
No.—¹⁵ 98

In continuation of this office letter No. 1298, dated 30th June 1897, I have the honour to inform you that the pot well has been sunk to a depth of 30 feet.

A copy of the road overseer's report on the subject together with samples of earth excavated from the well are also forwarded herewith.

Note by Assistant Sanitary Engineer on Calicut Water-supply, dated 9th May 1898.
I had intended to go to Calicut, but subsequently found that doing so would be of little use because—

- (1) The well could not be baled out by manual labour.
 - (2) There was no steam pump available there.
 - (3) Even if one were available, I don't think the well would stand pumping. It would collapse as it frequently did before.
- A section of the boring (vide sketch below) proves Dr. King's theory to be true. Strata (1) and (2) are sandy, porous and water-bearing; stratum (3) is impermeable indurated clay; strata (4) and (5) are porous water-bearing sands, and below these there is a bed of lignite.

No. 1548 M., 5TH SEPTEMBER 1898.

The tank, therefore, receives its supply from a sandy layer at the top naturally open to contamination, and secondly from another porous layer, bedded between two impermeable layers—this water, therefore, being presumably purer than that obtained from the top layers.

I may note here that the section of the well indicates a fair prospect of a good supply being obtained by a deep boring.

I may also mention that it is popularly believed that there is a well in the bed of the tank. If it be so, the tank must also be deriving a supply from the stratum of gravel below the lignite bed.

Resolution—No. 371/S., dated 27th June 1898.

The question of a water-supply scheme for the Mappilla quarters of the town of Calicut has been under consideration for some years, the proposed source of supply being the Mananchera tank. Before deciding on the use of this water, the late Sanitary Board considered * it necessary that an exploratory boring well or excavation should be made in the immediate proximity of the tank, in order to ascertain whether there exists, as suspected, a subterranean supply of good quality.

* Proceedings No. ² S.E.P., dated 24th February 1896.

2. The Sanitary Engineer now submits the results of the boring which shows that the tank receives its supply from two distinct sources, viz.—

(1) an upper sandy layer liable to contamination, and

(2) a porous layer below an impermeable stratum, presumably a pure water.

3. Judging from the position of the strata the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water.

4. He proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchera tank, a small elevated reservoir, and distribution pipes therefrom.

5. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that, before sinking below the laterite, each well is stained with laterite in cement, to prevent the ingress of water from the upper pervious strata. The scheme would be, however, of little practical value unless all wells in Mappilla yards are closed beyond possibility of secret use. On these lines the general idea of the scheme is approved by the Sanitary Board and is recommended to Government.

(True Extract.)

R. PARSONS,
Secretary, Sanitary Board.

To the Secretary to Government, Local and Municipal Department,
with papers in original.

Order—No. 1548 M., dated 5th September 1898.

The Sanitary Engineer is requested to undertake, as soon as possible, the preparation of a scheme for the water-supply of Calicut on the lines approved by the Sanitary Board.

2. The attention of the Municipal Council is drawn to the Sanitary Board's remark that all the wells in Mappilla yards should be closed when the scheme has been carried out.

(True Extract.)

H. TREMENHÈRE,
Secretary to Government.

To the Chairman, Municipal Council, Calicut.
" Collector of Malabar.
" Sanitary Board, with enclosures returned.
" " Commissioner.
" " Engineer.

LOCAL AND MUNICIPAL DEPARTMENT.

NOTES CONNECTED WITH G.O., No. 1548 M., DATED
5TH SEPTEMBER 1898.

Previous papers.

G.O., No. 1871 M., dated	8th December	1890.
" " 1396 M. "	31st August	1891.
" " 930 M. "	26th May	1892.
" " 1114 M. "	28th June	"
" " 513 M. "	23rd April	1894.
" " 522 M. "	5th May	"
" " 583 M. "	31st March	1896.

[SUBJECT.—Calicut water-supply scheme.]

From the Sanitary Board, dated 27th June 1898, No. 371-S.

In his report on the inspection of Calicut in September 1890, the Assistant Sanitary Engineer stated—

(1) that the water-supply of the town which was chiefly obtained from private wells, of which there was one in almost every compound and garden, was good, except in the Mappilla quarters, where the soil was so far contaminated already and the water level was so little below the surface of the ground, that the drainage of the place, though preventing the further progress of mischief, would be powerless in checking the causes of pollution that already existed in the soil;

(2) that a good and sufficient supply of water could be obtained for the Mappillas from the Mananchira tank, which was situated to the north-east of the town on a high level and was therefore less liable to contamination; and

(3) that as this tank was not used by the people on account of its distance, the only way to induce them to use the water would be to bring it to their doors by means of pipes.

He therefore suggested the preparation of a scheme for the water-supply of the Mappilla quarters from this tank, the cost of which was roughly estimated by

him to be between Rs. 75,000 and Rs. 1,00,000.

2. The Municipal Council of Calicut, however, did not approve the proposal for the reasons, firstly, that its financial condition did not admit of any expenditure being incurred towards the scheme and secondly, that the drainage of the town was more important than water-supply. But the Government overruled the Council's objection on the ground that the report of the Sanitary Engineer afforded ample proof of the immediate necessity for improving the sanitation of the town and considered that the water-supply scheme should have precedence over the drainage scheme. The Municipal Council was accordingly directed to make the

Paragraph 2 of G.O., No. 1396 M., dated 31st August 1891.
Vide Council's resolution in G.O., No. 1396 M., dated 31st August 1891.
Vide Council's resolution in G.O., No. 930 M., dated 26th May 1892.
G.O., No. 1114 M., dated 28th June 1892.

necessary provision for the investigation of the water-supply project, which was thereupon put down on the Sanitary Engineer's programme for 1895.

G.O., No. 582 M., dated 5th May 1894.

3. In the meantime, the Sanitary Commissioner, who inspected Calicut in 1894, considered that before deciding upon the Mananchira tank as the source for the future water-supply of the Mappilla quarters, it was necessary that certain matters should be investigated. He doubted the sufficiency of water in the Mananchira tank and also the quality of the supply. He considered that the tank was apparently fed by a special stratum of water under pressure confined between two impervious strata, one of which had been penetrated, as well as from the ordinary subsoil water, and that, as the subsoil water was evidently open to much pollution, it should not be drawn upon for the supply of Calicut, if it was possible to do otherwise. He therefore suggested that exploratory borings should be made for the purpose of ascertaining more as to subsoil conditions, and especially to find out whether any impervious stratum of clay underlay the previous upper stratum on which the surface water was supported, and that if this was found to be the case, bored or driven wells could be used within the interior of the town or even the Mananchira tank might be employed, if by iron cylinders or other measures the subsoil water were excluded. He added that, if this was not proved and if it was found necessary to depend upon the subsoil water, it would be requisite to select an area sufficiently removed from the town to guarantee the purity of the soil.

Vide pages 13 and 14 in G.O., No. 513 M., dated 23rd April 1894.

4. The Sanitary Engineer Mr. Ellis, to whom the Sanitary Commissioner's letter was referred for remarks, visited Calicut in 1894, and reported that as the position of the Mananchira tank was certainly not very desirable, it would be much better to go beyond the town for a source of supply and that there were several springs at the foot of the Puloor Hill, which was about 3 miles from Calicut, where wells yielding a pure supply might be sunk. He estimated the cost of this scheme at 4 lakhs and recommended that, if the finances of the Municipality did not permit of its being undertaken for some years to come, the Mananchira tank might be tested with regard to its yield, with the view of making it the source of supply as a temporary measure for the Mappilla quarters until such time as the Municipality could find the necessary funds for a larger scheme. He also observed that whatever pipes were laid as a temporary measure could form part of the larger scheme, whenever that came into existence, and added that the urgent need for a water-supply scheme for the Mappilla quarters had already been fully explained in the Assistant Sanitary Engineer's report of 1890, that the popular opinion about the water of the Mananchira tank was that it was good, that it was used by Europeans and Eurasians living near the tank, that the chemical analysis showed that the only impurity which was in excess of the standard fixed for 'usable' water was albumenoid ammonia and that there were indications that this impurity was of vegetable origin and therefore not very dangerous.

5. The Municipal Council, to which the Sanitary Engineer's letter was referred for remarks, stated that it was not ambitious to provide a correct scheme of water-supply to the whole town, which extended over an area of $13\frac{1}{4}$ square miles, as its cost, viz., 4 lakhs, was beyond its means and as the A, G and H Divisions of the town obtained a good supply of potable water from wells, and that it resolved to accept the scheme for the supply of water from the Mananchira tank. The Sanitary Board, to whom the whole correspondence was sent for remarks, was of opinion that, before the question of the advisability of using the water of this tank could be determined, an exploratory boring well or excavation should be made in the immediate proximity of the tank in view to ascertaining the existence or non-existence of water of good quality at the lower stratum, as supposed by Dr. King, and stated that, when this had been done and the quantity of the source and the feasibility of

measures providing for the exclusion of the subsoil water had been determined, the Board would be in a position to advise finally as to the adoption of the Mananchira tank scheme or the alternative Puloor Hill scheme proposed by Mr. Ellis.

6. The Municipal Council which was thereupon requested to take steps to furnish the information required by the Sanitary Board, carried out the necessary experiments and reported the results to the Board through the Sanitary Engineer, and the Sanitary Board now submits the Sanitary Engineer's report in the matter with its resolution thereon. The Sanitary Engineer states that the results of the experiments show that the Mananchira tank receives its supply from two distinct sources, viz., (1) an upper sandy layer liable to contamination and (2) a porous layer below an impermeable stratum—presumably containing a pure water. Judging from the position of the strata, the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water and accordingly proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchira tank, a small elevated reservoir and distribution pipes therefrom. He states that the scheme cannot be taken up for some time yet, but will be put on the programme at the earliest opportunity. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that before sinking below the laterite, each well is steined with laterite in cement to prevent the ingress of water from the upper pervious strata, and approves the general idea of the scheme on the said lines. The Sanitary Board, however, observes that the scheme would be of little practical value, unless all wells in Mappilla yards are closed beyond possibility of secret use.

7. In these circumstances, it is submitted that the Sanitary Engineer may be requested to undertake the preparation of the scheme, as soon as possible, on the lines approved by the Sanitary Board and that the attention of the Municipal Council may be drawn to the Sanitary Board's remark regarding the closure of all private wells in the Mappilla quarters, when the scheme has been executed. The accompanying draft order is submitted for approval.

V. RAGHAVA CHARLU—20-8-98.

H. TREMENHEERE—26-8-98.

[G.O., No. 1548 M., dated 5th September 1898.]

Government of Madras.
LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

<i>Recd.</i>	} 1898.	<i>Enclosures</i>
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G.O., No. 1548 M., 5th September 1898.

Water-supply.

Requesting, with remarks, the Sanitary Engineer to undertake the preparation of a scheme for the — of Calicut on the lines approved by the Sanitary Board.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

Read—the following paper :—

Proceedings of the Sanitary Board, No. 371/S., dated 27th June 1898.

Read—the following paper :—

Office-note—from J. A. JONES, Esq., Sanitary Engineer to Government.
To—the Secretary, Sanitary Board.
Dated—the 10th May 1898.
No.—940.

Calicut Water-supply.

About the year 1890 a suggestion was made by this Department that a supply of water for the Mappilla quarters of Calicut should be obtained from the Mananchera tank situated near the centre of and at the highest point of Calicut. After much discussion the Municipal Council accepted the proposal, but as doubts as to the quality and quantity of the supply were raised, the Sanitary Board in its Proceedings No. ²S.E.P. of 24th February 1896 (copy attached) ordered certain investigations to be made.

2. There has been a good deal of delay in getting the well sunk, the well first sunk was a failure and progress with a second one has been very slow.

3. The results of sinking the well, however, are now available and will be found reported in the overseer's report forwarded with the Chairman's letter No. ¹⁵98 of 6th January 1898 (copy attached).

4. The overseer has, however, not identified the various samples from the strata correctly and these are correctly shown in a note by the Assistant Sanitary Engineer (copy herewith). I have examined the samples and concur with his remarks.

5. The main question at issue has been whether the Mananchera tank receives any supply from a pure source—that it does so cannot now be doubted because the white sand layers 8 feet in thickness are perfectly pure indeed, no whiter sand could possibly be found.

6. Under this is a bed of lignite which forms the bed of the tank and this is 4 feet thick; below this again there is coarse sand and sand and gravel so that even if enough water were not procurable from the white sand, this lower strata can be drawn on.

7. It may be noted in passing that a similar bed of lignite to that already referred to was found when boring at Cochin.

8. From the position of strata, I think it possible that wells sunk into the white sand or the lower coarse sand will yield artesian water.

9. The water of the Mananchera tank has been declared usable, the albumenoid ammonia was slightly high, but this can be understood with an open tank.

10. That pure water can be obtained from wells sunk around the tank cannot be doubted and the quantity should be ample, but this it has been impossible to test as the well sunk cannot be baled out by manual labour and no steam pump is available near Calicut. The contents of the tank itself which fills yearly, however, would yield an ample supply as shown in Chairman's letter quoted below so that with constant pumping there can be no fear of insufficiency.

11. It is proposed that a scheme should be prepared for the supply to the Mappilla quarters of Calicut. The main feature of this scheme being a series of wells adjacent to the Mananchera tank, a small elevated reservoir and distribution pipes therefrom.

12. The scheme cannot be taken up for sometime yet but will be put on the programme at the earliest opportunity.

13. The following is a list of the papers accompanying—

- (1) Report of Assistant Sanitary Engineer to Government, 1890.
- (1-A) Letter from the Acting Sanitary Engineer to Government, No. 2417, of 29th October 1894.
- (2) Letter from the Sanitary Engineer to Government, No. 813, of 26th March 1895.
- (3) Letter from the Chairman, Municipal Council, Calicut, No. 915, of 3rd October 1895.
- (4) Note of Sanitary Commissioner, No. ²¹⁹⁵8, of 2nd December 1895.
- (5) Note by Colonel Campbell, No. 12/S, of 27th January 1896.
- (6) Resolution of the Sanitary Board, No. ²S.E.P., of 24th February 1896.
- (7) Report of overseer and Chairman's letter, No. 15, of 6th January 1898.
- (8) Note by Assistant Sanitary Engineer to Government, dated 9th May 1898.

ENCLOSURES.

Letter—from M.R.Ry. P. RABICHAN, Road Overseer, Calicut.
To—the Chairman, Municipal Council, Calicut.
Dated—the 4th January 1898.
No.—148.

I beg to report that I have herewith sent the sample of earth packed up, in a tin case, taken at every 4 feet of the depth of the pot well lately sunk at the Municipal garden near Mananchera tank, Calicut, for the inspection of the Sanitary Engineer, Madras.

The subjoined is the list of the earth enclosed :—

1 to 4 feet	.. .. .	Sandy soil, light black.
4 „ 8 feet	.. .. .	do. a little white.
8 „ 12 feet	.. .. .	Reddish.
12 „ 16 feet	.. .. .	Chalk white clay
16 „ 20 feet	.. .. .	Do. pure white } Sand pure white.
20 „ 24 feet	.. .. .	Black clay lignite.
24 „ 28 feet	.. .. .	Reddish clay—gravel and sand.
28 „ 30 feet	.. .. .	do. the total depth of the pot well.

I also beg to report that in sounding Mananchera tank I have found it in all 19½ feet deep to the ground level, viz., depth of water 15 feet, above water to the road level 4½ feet.

Letter—from M.R.Ry. R. RAMA RAO Avargal, Chairman, Municipal Council, Calicut.
To—the Sanitary Engineer to Government.
Dated—the 6th January 1898.
No.—¹⁵98

In continuation of this office letter No. 1298, dated 30th June 1897, I have the honour to inform you that the pot well has been sunk to a depth of 30 feet.

A copy of the road overseer's report on the subject together with samples of earth excavated from the well are also forwarded herewith.

Note by Assistant Sanitary Engineer on Calicut Water-supply, dated 9th May 1898.

I had intended to go to Calicut, but subsequently found that doing so would be of little use because—

- (1) The well could not be baled out by manual labour.
- (2) There was no steam pump available there.
- (3) Even if one were available, I don't think the well would stand pumping. It would collapse as it frequently did before.

A section of the boring (*vide* sketch below) proves Dr. King's theory to be true. Strata (1) and (2) are sandy, porous and water-bearing; stratum (3) is impermeable indurated clay; strata (4) and (5) are porous water-bearing sands, and below these there is a bed of lignite.

No. 1548 M., 5TH SEPTEMBER 1898.

The tank, therefore, receives its supply from a sandy layer at the top naturally open to contamination, and secondly from another porous layer, bedded between two impermeable layers—this water, therefore, being presumably purer than that obtained from the top layers.

I may note here that the section of the well indicates a fair prospect of a good supply being obtained by a deep boring.

I may also mention that it is popularly believed that there is a well in the bed of the tank. If it be so, the tank must also be deriving a supply from the stratum of gravel below the lignite bed.

Resolution—No. 371/S., dated 27th June 1898.

The question of a water-supply scheme for the Mappilla quarters of the town of Calicut has been under consideration for some years, the proposed source of supply being the Mananchera tank. Before deciding on the use of this water, the late Sanitary Board considered it necessary that an exploratory boring well or excavation should be made in the immediate proximity of the tank, in order to ascertain whether there exists, as suspected, a subterranean supply of good quality.

2. The Sanitary Engineer now submits the results of the boring which shows that the tank receives its supply from two distinct sources, viz.—

(1) an upper sandy layer liable to contamination, and

(2) a porous layer below an impermeable stratum, presumably a pure water.

3. Judging from the position of the strata the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water.

4. He proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchera tank, a small elevated reservoir, and distribution pipes therefrom.

5. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that, before sinking below the laterite, each well is stained with laterite in cement, to prevent the ingress of water from the upper pervious strata. The scheme would be, however, of little practical value unless all wells in Mappilla yards are closed beyond possibility of secret use. On these lines the general idea of the scheme is approved by the Sanitary Board and is recommended to Government.

(True Extract.)

R. PARSONS,
Secretary, Sanitary Board.

To the Secretary to Government, Local and Municipal Department,
with papers in original.

Order—No. 1548 M., dated 5th September 1898.

The Sanitary Engineer is requested to undertake, as soon as possible, the preparation of a scheme for the water-supply of Calicut on the lines approved by the Sanitary Board.

2. The attention of the Municipal Council is drawn to the Sanitary Board's remark that all the wells in Mappilla yards should be closed when the scheme has been carried out.

(True Extract.)

H. TREMENHÈRE,
Secretary to Government.

To the Chairman, Municipal Council, Calicut.
" Collector of Malabar.
" Sanitary Board, with enclosures returned.
" " Commissioner.
" " Engineer.

LOCAL AND MUNICIPAL DEPARTMENT.

NOTES CONNECTED WITH G.O., No. 1548 M., DATED
5TH SEPTEMBER 1898.

Previous papers.

G.O., No. 1871 M., dated 8th December 1890.	
" " 1396 M. " 31st August 1891.	
" " 930 M. " 26th May 1892.	
" " 1114 M. " 28th June "	
" " 513 M. " 23rd April 1894.	
" " 542 M. " 5th May "	
" " 583 M. " 31st March 1896.	

[SUBJECT.—Calicut water-supply scheme.]

From the Sanitary Board, dated 27th June 1898, No. 371-S.

In his report on the inspection of Calicut in September 1890, the Assistant Sanitary Engineer stated—

(1) that the water-supply of the town which was chiefly obtained from private wells, of which there was one in almost every compound and garden, was good, except in the Mappilla quarters, where the soil was so far contaminated already and the water level was so little below the surface of the ground, that the drainage of the place, though preventing the further progress of mischief, would be powerless in checking the causes of pollution that already existed in the soil;

(2) that a good and sufficient supply of water could be obtained for the Mappillas from the Mananchira tank, which was situated to the north-east of the town on a high level and was therefore less liable to contamination; and

(3) that as this tank was not used by the people on account of its distance, the only way to induce them to use the water would be to bring it to their doors by means of pipes.

He therefore suggested the preparation of a scheme for the water-supply of the Mappilla quarters from this tank, the cost of which was roughly estimated by him to be between Rs. 75,000 and Rs. 1,00,000.

2. The Municipal Council of Calicut, however, did not approve the proposal for the reasons, firstly, that its financial condition did not admit of any expenditure being incurred towards the scheme

and secondly, that the drainage of the town was more important than water-supply. But the Government overruled

the Council's objection on the ground that the report of the Sanitary Engineer afforded ample proof of the immediate necessity for improving the sanitation of the town and considered that the water-supply scheme should have precedence over the drainage scheme. The Municipal Council was accordingly directed to make the

Paragraph 2 of G.O., No. 1396 M., dated 31st August 1891.

G.O., No. 1114 M., dated 28th June 1892.

necessary provision for the investigation of the water-supply project, which was thereupon put down on the Sanitary Engineer's programme for 1895.

3. In the meantime, the Sanitary Commissioner, who inspected Calicut in 1894, considered that before deciding upon the Mananchira tank as the source for the future water-supply of the Mappilla quarters, it was necessary that certain matters should be investigated. He doubted the sufficiency of water in the Mananchira tank and also the quality of the supply. He considered that the tank was apparently fed by a special stratum of water under pressure confined between two impervious strata, one of which had been penetrated, as well as from the ordinary subsoil water, and that, as the subsoil water was evidently open to much pollution, it should not be drawn upon for the supply of Calicut, if it was possible to do otherwise. He therefore suggested that exploratory borings should be made for the purpose of ascertaining more as to subsoil conditions, and especially to find out whether any impervious stratum of clay underlay the previous upper stratum on which the surface water was supported, and that if this was found to be the case, bored or driven wells could be used within the interior of the town or even the Mananchira tank might be employed, if by iron cylinders or other measures the subsoil water were excluded. He added that, if this was not proved and if it was found necessary to depend upon the subsoil water, it would be requisite to select an area sufficiently removed from the town to guarantee the purity of the soil.

Vide pages 13 and 14 in G.O., No. 513 M., dated 23rd April 1894.

4. The Sanitary Engineer Mr. Ellis, to whom the Sanitary Commissioner's letter was referred for remarks, visited Calicut in 1894, and reported that as the position of the Mananchira tank was certainly not very desirable, it would be much better to go beyond the town for a source of supply and that there were several springs at the foot of the Poloor Hill, which was about 3 miles from Calicut, where wells yielding a pure supply might be sunk. He estimated the cost of this scheme at 4 lakhs and recommended that, if the finances of the Municipality did not permit of its being undertaken for some years to come, the Mananchira tank might be tested with regard to its yield, with the view of making it the source of supply as a temporary measure for the Mappilla quarters until such time as the Municipality could find the necessary funds for a larger scheme. He also observed that whatever pipes were laid as a temporary measure could form part of the larger scheme, whenever that came into existence, and added that the urgent need for a water-supply scheme for the Mappilla quarters had already been fully explained in the Assistant Sanitary Engineer's report of 1890, that the popular opinion about the water of the Mananchira tank was that it was good, that it was used by Europeans and Eurasians living near the tank, that the chemical analysis showed that the only impurity which was in excess of the standard fixed for 'usable' water was albumenoid ammonia and that there were indications that this impurity was of vegetable origin and therefore not very dangerous.

5. The Municipal Council, to which the Sanitary Engineer's letter was referred for remarks, stated that it was not ambitious to provide a correct scheme of water-supply to the whole town, which extended over an area of $13\frac{1}{2}$ square miles, as its cost, viz., 4 lakhs, was beyond its means and as the A, G and II Divisions of the town obtained a good supply of potable water from wells, and that it resolved to accept the scheme for the supply of water from the Mananchira tank. The Sanitary Board, to whom the whole correspondence was sent for remarks, was of opinion that, before the question of the advisability of using the water of this tank could be determined, an exploratory boring well or excavation should be made in the immediate proximity of the tank in view to ascertaining the existence or non-existence of water of good quality at the lower stratum, as supposed by Dr. King, and stated that, when this had been done and the quantity of the source and the feasibility of

Vide Current No. 3436 M. in G.O., No. 583 M., dated 31st March 1896.

Vide Current No. 715 M. in G.O., No. 583 M., dated 31st March 1896.

measures providing for the exclusion of the subsoil water had been determined, the Board would be in a position to advise finally as to the adoption of the Mananchira tank scheme or the alternative Poloor Hill scheme proposed by Mr. Ellis.

6. The Municipal Council which was thereupon requested to take steps to furnish the information required by the Sanitary Board, carried out the necessary experiments and reported the results to the Board through the Sanitary Engineer, and the Sanitary Board now submits the Sanitary Engineer's report in the matter with its resolution thereon. The Sanitary Engineer states that the results of the experiments show that the Mananchira tank receives its supply from two distinct sources, viz., (1) an upper sandy layer liable to contamination and (2) a porous layer below an impermeable stratum—presumably containing a pure water. Judging from the position of the strata, the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water and accordingly proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchira tank, a small elevated reservoir and distribution pipes therefrom. He states that the scheme cannot be taken up for some time yet, but will be put on the programme at the earliest opportunity. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that before sinking below the laterite, each well is steeled with laterite in cement to prevent the ingress of water from the upper pervious strata, and approves the general idea of the scheme on the said lines. The Sanitary Board, however, observes that the scheme would be of little practical value, unless all wells in Mappilla yards are closed beyond possibility of secret use.

7. In these circumstances, it is submitted that the Sanitary Engineer may be requested to undertake the preparation of the scheme, as soon as possible, on the lines approved by the Sanitary Board and that the attention of the Municipal Council may be drawn to the Sanitary Board's remark regarding the closure of all private wells in the Mappilla quarters, when the scheme has been executed. The accompanying draft order is submitted for approval.

V. RAGHAVA CHARLU—20-8-98.
H. TREMENHEERE—26-8-98.

[G.O., No. 1548 M., dated 5th September 1898.]

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd.

Regd.

} 1898.

Enclosures

Spare copies

G.O., No. 1548 M., 5th September 1898.

Water-supply.

Requesting, with remarks, the Sanitary Engineer to undertake the preparation of a scheme for the — of Calicut on the lines approved by the Sanitary Board.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

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2. There has been a good deal of delay in getting the well sunk, the well first sunk was a failure and progress with a second one has been very slow.

3. The results of sinking the well, however, are now available and will be found reported in the overseer's report forwarded with the Chairman's letter No. ¹⁵₉₈ of 6th January 1898 (copy attached).

4. The overseer has, however, not identified the various samples from the strata correctly and these are correctly shown in a note by the Assistant Sanitary Engineer (copy herewith). I have examined the samples and concur with his remarks.

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7. It may be noted in passing that a similar bed of lignite to that already referred to was found when boring at Cochin.

8. From the position of strata, I think it possible that wells sunk into the white sand or the lower coarse sand will yield artesian water.

9. The water of the Mananchera tank has been declared usable, the albumenoid ammonia was slightly high, but this can be understood with an open tank.

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ENCLOSURES.

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Dated—the 4th January 1898.

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(3) Even if one were available, I don't think the well would stand pumping. It would collapse as it frequently did before.

A section of the boring (*vide sketch below*) proves Dr. King's theory to be true. Strata (1) and (2) are sandy, porous and water-bearing; stratum (3) is impermeable indurated clay; strata (4) and (5) are porous water-bearing sands, and below these there is a bed of lignite.

The tank, therefore, receives its supply from a sandy layer at the top naturally open to contamination, and secondly from another porous layer, bedded between two impermeable layers—this water, therefore, being presumably purer than that obtained from the top layers.

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(True Extract.)

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To the Chairman, Municipal Council, Calicut.
" Collector of Malabar.
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LOCAL AND MUNICIPAL DEPARTMENT.

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5TH SEPTEMBER 1898.

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used within the interior of the town or even the Mananchira tank might be employed, if by iron cylinders or other measures the subsoil water were excluded. He added that, if this was not proved and if it was found necessary to depend upon the subsoil water, it would be requisite to select an area sufficiently removed from the town to guarantee the purity of the soil.

4. The Sanitary Engineer Mr. Ellis, to whom the Sanitary Commissioner's letter was referred for remarks, visited Calicut in 1894, and reported that as the position of the Mananchira tank was certainly not

very desirable, it would be much better to go beyond the town for a source of supply and that there were several springs at the foot of the Poloor Hill, which was about 3 miles from Calicut, where wells yielding a pure supply might be sunk. He estimated the cost of this scheme at 4 lakhs and recommended that, if the finances of the Municipality did not permit of its being undertaken for some years to come, the Mananchira tank might be tested with regard to its yield, with the view of making it the source of supply as a temporary measure for the Mappilla quarters until such time as the Municipality could find the necessary funds for a larger scheme. He also observed that whatever pipes were laid as a temporary measure could form part of the larger scheme, whenever that came into existence, and added that the urgent need for a water-supply scheme for the Mappilla quarters had already been fully explained in the Assistant Sanitary Engineer's report of 1890, that the popular opinion about the water of the Mananchira tank was that it was good, that it was used by Europeans and Eurasians living near the tank, that the chemical analysis showed that the only impurity which was in excess of the standard fixed for 'usable' water was albumenoid ammonia and that there were indications that this impurity was of vegetable origin and therefore not very dangerous.

5. The Municipal Council, to which the Sanitary Engineer's letter was referred for remarks, stated that it was not ambitious to provide a correct scheme of water-supply to the whole town, which extended

over an area of $13\frac{1}{4}$ square miles, as its cost, viz., 4 lakhs, was beyond its means and as the A, G and H Divisions of the town obtained a good supply of potable water from wells, and that it resolved to accept the scheme for the supply of water from the Mananchira tank. The Sanitary Board, to whom the whole correspondence was sent

for remarks, was of opinion that, before the question of the advisability of using the water of this tank could be deter-

mined, an exploratory boring well or excavation should be made in the immediate proximity of the tank in view to ascertaining the existence or non-existence of water of good quality at the lower stratum, as supposed by Dr. King, and stated that, when this had been done and the quantity of the source and the feasibility of

measures providing for the exclusion of the subsoil water had been determined, the Board would be in a position to advise finally as to the adoption of the Mananchira tank scheme or the alternative Poloor Hill scheme proposed by Mr. Ellis.

6. The Municipal Council which was thereupon requested to take steps to furnish the information required by the Sanitary Board, carried out the necessary experiments and reported the results to the Board through the Sanitary Engineer, and the Sanitary Board now submits the Sanitary Engineer's report in the matter with its resolution thereon. The Sanitary Engineer states that the results of the experiments show that the Mananchira tank receives its supply from two distinct sources, viz., (1) an upper sandy layer liable to contamination and (2) a porous layer below an impermeable stratum—presumably containing a pure water. Judging from the position of the strata, the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water and accordingly proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchira tank, a small elevated reservoir and distribution pipes therefrom. He states that the scheme cannot be taken up for some time yet, but will be put on the programme at the earliest opportunity. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that before sinking below the laterite, each well is steined with laterite in cement to prevent the ingress of water from the upper pervious strata, and approves the general idea of the scheme on the said lines. The Sanitary Board, however, observes that the scheme would be of little practical value, unless all wells in Mappilla yards are closed beyond possibility of secret use.

7. In these circumstances, it is submitted that the Sanitary Engineer may be requested to undertake the preparation of the scheme, as soon as possible, on the lines approved by the Sanitary Board and that the attention of the Municipal Council may be drawn to the Sanitary Board's remark regarding the closure of all private wells in the Mappilla quarters, when the scheme has been executed. The accompanying draft order is submitted for approval.

V. RAGHAVA CHARLU—20-8-98.

H. TREMENHEERE—26-8-98.

[G.O., No. 1548 M., dated 5th September 1898.]

Government of Madras.
LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd.

Regd.

} 1898.

Enclosures

Spare copies

G.O., No. 1548 M., 5th September 1898.

Water-supply.

Requesting, with remarks, the Sanitary Engineer to undertake the preparation of a scheme
for the — of Calicut on the lines approved by the Sanitary Board.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

Read—the following paper:—

Proceedings of the Sanitary Board, No. 371/S., dated 27th June 1898.

Read—the following paper:—

Office-note—from J. A. Jones, Esq., Sanitary Engineer to Government.
To—the Secretary, Sanitary Board.
Dated—the 10th May 1898.
No.—940.

Calicut Water-supply.

About the year 1890 a suggestion was made by this Department that a supply of water for the Mappilla quarters of Calicut should be obtained from the Mananchera tank situated near the centre of and at the highest point of Calicut. After much discussion the Municipal Council accepted the proposal, but as doubts as to the quality and quantity of the supply were raised, the Sanitary Board in its Proceedings No. ² S.B.P. of 24th February 1896 (copy attached) ordered certain investigations to be made.

2. There has been a good deal of delay in getting the well sunk, the well first sunk was a failure and progress with a second one has been very slow.

3. The results of sinking the well, however, are now available and will be found reported in the overseer's report forwarded with the Chairman's letter No. ¹⁵ 98 of 6th January 1898 (copy attached).

4. The overseer has, however, not identified the various samples from the strata correctly and these are correctly shown in a note by the Assistant Sanitary Engineer (copy herewith). I have examined the samples and concur with his remarks.

5. The main question at issue has been whether the Mananchera tank receives any supply from a pure source—that it does so cannot now be doubted because the white sand layers 8 feet in thickness are perfectly pure indeed, no whiter sand could possibly be found.

6. Under this is a bed of lignite which forms the bed of the tank and this is 4 feet thick; below this again there is coarse sand and sand and gravel so that even if enough water were not procurable from the white sand, this lower strata can be drawn on.

7. It may be noted in passing that a similar bed of lignite to that already referred to was found when boring at Cochin.

8. From the position of strata, I think it possible that wells sunk into the white sand or the lower coarse sand will yield artesian water.

9. The water of the Mananchera tank has been declared usable, the albumenoid ammonia was slightly high, but this can be understood with an open tank.

10. That pure water can be obtained from wells sunk around the tank cannot be doubted and the quantity should be ample, but this it has been impossible to test as the well sunk cannot be baled out by manual labour and no steam pump is available near Calicut. The contents of the tank itself which fills yearly, however, would yield an ample supply as shown in Chairman's letter quoted below so that with constant pumping there can be no fear of insufficiency.

11. It is proposed that a scheme should be prepared for the supply to the Mappilla quarters of Calicut. The main feature of this scheme being a series of wells adjacent to the Mananchera tank, a small elevated reservoir and distribution pipes therefrom.

12. The scheme cannot be taken up for sometime yet but will be put on the programme at the earliest opportunity.

13. The following is a list of the papers accompanying—

- (1) Report of Assistant Sanitary Engineer to Government, 1890.
- (1-A) Letter from the Acting Sanitary Engineer to Government, No. 2417, of 29th October 1894.
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ENCLOSURES.

Letter—from M.R.Ry. P. RARICHAN, Road Overseer, Calicut.
To—the Chairman, Municipal Council, Calicut.
Dated—the 4th January 1898.
No.—148.

I beg to report that I have herewith sent the sample of earth packed up, in a tin case, taken at every 4 feet of the depth of the pot well lately sunk at the Municipal garden near Mananchera tank, Calicut, for the inspection of the Sanitary Engineer, Madras.

The subjoined is the list of the earth enclosed:—

1 to 4 feet	.. .. .	Sandy soil, light black.	
4 " 8 feet	.. .. .	do. a little white.	
8 " 12 feet	.. .. .	Reddish.	
12 " 16 feet	.. .. .	Chalk white clay	} Sand pure white.
16 " 20 feet	.. .. .	Do. pure white	
20 " 24 feet	.. .. .	Black clay lignite.	
24 " 28 feet	.. .. .	Reddish clay—gravel and sand.	
28 " 30 feet	.. .. .	do. the total depth of the pot well.	

I also beg to report that in sounding Mananchera tank I have found it in all 19½ feet deep to the ground level, viz., depth of water 15 feet, above water to the road level 4½ feet.

Letter—from M.R.Ry. R. RAMA RAO Avargal, Chairman, Municipal Council, Calicut.
To—the Sanitary Engineer to Government.
Dated—the 6th January 1898.
No.—¹⁵ 98

In continuation of this office letter No. 1298, dated 30th June 1897, I have the honour to inform you that the pot well has been sunk to a depth of 30 feet.

A copy of the road overseer's report on the subject together with samples of earth excavated from the well are also forwarded herewith.

Note by Assistant Sanitary Engineer on Calicut Water-supply, dated 9th May 1898.

I had intended to go to Calicut, but subsequently found that doing so would be of little use because—

- (1) The well could not be baled out by manual labour.
- (2) There was no steam pump available there.
- (3) Even if one were available, I don't think the well would stand pumping. It would collapse as it frequently did before.

A section of the boring (*vide* sketch below) proves Dr. King's theory to be true. Strata (1) and (2) are sandy, porous and water-bearing; stratum (3) is impermeable indurated clay; strata (4) and (5) are porous water-bearing sands, and below these there is a bed of lignite.

No. 1548 M., 5TH SEPTEMBER 1898.

The tank, therefore, receives its supply from a sandy layer at the top naturally open to contamination, and secondly from another porous layer, bedded between two impermeable layers—this water, therefore, being presumably purer than that obtained from the top layers.

I may note here that the section of the well indicates a fair prospect of a good supply being obtained by a deep boring.

I may also mention that it is popularly believed that there is a well in the bed of the tank. If it be so, the tank must also be deriving a supply from the stratum of gravel below the lignite bed.

Resolution—No. 371/S., dated 27th June 1898.

The question of a water-supply scheme for the Mappilla quarters of the town of Calicut has been under consideration for some years, the proposed source of supply being the Mananchera tank. Before deciding on the use of this water, the late Sanitary Board considered it necessary that an exploratory boring well or excavation should be made in the immediate proximity of the tank, in order to ascertain whether there exists, as suspected, a subterranean supply of good quality.

Proceedings No. 2 S.E.P., dated 24th February 1896.

2. The Sanitary Engineer now submits the results of the boring which shows that the tank receives its supply from two distinct sources, viz.—

(1) an upper sandy layer liable to contamination, and

(2) a porous layer below an impermeable stratum, presumably a pure water.

3. Judging from the position of the strata the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water.

4. He proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchera tank, a small elevated reservoir, and distribution pipes therefrom.

5. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that, before sinking below the laterite, each well is stained with laterite in cement, to prevent the ingress of water from the upper pervious strata. The scheme would be, however, of little practical value unless all wells in Mappilla yards are closed beyond possibility of secret use. On these lines the general idea of the scheme is approved by the Sanitary Board and is recommended to Government.

(True Extract.)

R. PARSONS,
Secretary, Sanitary Board.

To the Secretary to Government, Local and Municipal Department,
with papers in original.

Order—No. 1548 M., dated 5th September 1898.

The Sanitary Engineer is requested to undertake, as soon as possible, the preparation of a scheme for the water-supply of Calicut on the lines approved by the Sanitary Board.

2. The attention of the Municipal Council is drawn to the Sanitary Board's remark that all the wells in Mappilla yards should be closed when the scheme has been carried out.

(True Extract.)

H. TREMENERRE,
Secretary to Government.

To the Chairman, Municipal Council, Calicut.
" Collector of Malabar.
" Sanitary Board, with enclosures returned.
" " Commissioner.
" " Engineer.

LOCAL AND MUNICIPAL DEPARTMENT.

NOTES CONNECTED WITH G.O., No. 1548 M., DATED
5TH SEPTEMBER 1898.

Previous papers.

G.O., No. 1871 M.,	dated	8th December	1890.
" " 1396 M.	"	31st August	1891.
" " 930 M.	"	26th May	1892.
" " 1114 M.	"	28th June	"
" " 513 M.	"	23rd April	1894.
" " 542 M.	"	5th May	"
" " 583 M.	"	31st March	1896.

[SUBJECT.—Calicut water-supply scheme.]

From the Sanitary Board, dated 27th June 1898, No. 371-S.

In his report on the inspection of Calicut in September 1890, the Assistant Sanitary Engineer stated—

(1) that the water-supply of the town which was chiefly obtained from private wells, of which there was one in almost every compound and garden, was good, except in the Mappilla quarters, where the soil was so far contaminated already and the water level was so little below the surface of the ground, that the drainage of the place, though preventing the further progress of mischief, would be powerless in checking the causes of pollution that already existed in the soil;

(2) that a good and sufficient supply of water could be obtained for the Mappillas from the Mananchira tank, which was situated to the north-east of the town on a high level and was therefore less liable to contamination; and

(3) that as this tank was not used by the people on account of its distance, the only way to induce them to use the water would be to bring it to their doors by means of pipes.

He therefore suggested the preparation of a scheme for the water-supply of the Mappilla quarters from this tank, the cost of which was roughly estimated by

him to be between Rs. 75,000 and Rs. 1,00,000.

2. The Municipal Council of Calicut, however, did not approve the proposal for the reasons, firstly, that its financial condition did not admit of any expenditure being incurred towards the scheme

and secondly, that the drainage of the town was more important than water-supply. But the Government overruled

the Council's objection on the ground that the report of the Sanitary Engineer afforded ample proof of the immediate necessity for improving the sanitation of the town and considered that the water-supply scheme should have precedence over the drainage scheme. The Municipal Council was accordingly directed to make the

Paragraph 2 of G.O., No. 1396 M., dated 31st August 1891.

Vide Council's resolution in G.O., No. 930 M., dated 26th May 1892.

G.O., No. 1114 M., dated 28th June 1892.

necessary provision for the investigation of the water-supply project, which was thereupon put down on the Sanitary Engineer's programme for 1895.

G.O., No. 582 M., dated 5th May 1894.

3. In the meantime, the Sanitary Commissioner, who inspected Calicut in 1894, considered that before deciding upon the Mananchira tank as the source for the future water-supply of the Mappilla quarters, it was necessary that certain matters should be investigated. He doubted the sufficiency of water in the Mananchira tank and also the quality of the supply. He considered that the tank was apparently fed by a special stratum of water under pressure confined between two impervious strata, one of which had been penetrated, as well as from the ordinary subsoil water, and that, as the subsoil water was evidently open to much pollution, it should not be drawn upon for the supply of Calicut, if it was possible to do otherwise. He therefore suggested that exploratory borings should be made for the purpose of ascertaining more as to subsoil conditions, and especially to find out whether any impervious stratum of clay underlay the previous upper stratum on which the surface water was supported, and that if this was found to be the case, bored or driven wells could be used within the interior of the town or even the Mananchira tank might be employed, if by iron cylinders or other measures the subsoil water were excluded. He added that, if this was not proved and if it was found necessary to depend upon the subsoil water, it would be requisite to select an area sufficiently removed from the town to guarantee the purity of the soil.

Vide pages 13 and 14 in G.O., No. 513 M., dated 23rd April 1894.

4. The Sanitary Engineer Mr. Ellis, to whom the Sanitary Commissioner's letter was referred for remarks, visited Calicut in 1894, and reported that as the position of the Mananchira tank was certainly not very desirable, it would be much better to go beyond the town for a source of supply and that there were several springs at the foot of the Poloor Hill, which was about 3 miles from Calicut, where wells yielding a pure supply might be sunk. He estimated the cost of this scheme at 4 lakhs and recommended that, if the finances of the Municipality did not permit of its being undertaken for some years to come, the Mananchira tank might be tested with regard to its yield, with the view of making it the source of supply as a temporary measure for the Mappilla quarters until such time as the Municipality could find the necessary funds for a larger scheme. He also observed that whatever pipes were laid as a temporary measure could form part of the larger scheme, whenever that came into existence, and added that the urgent need for a water-supply scheme for the Mappilla quarters had already been fully explained in the Assistant Sanitary Engineer's report of 1890, that the popular opinion about the water of the Mananchira tank was that it was good, that it was used by Europeans and Eurasians living near the tank, that the chemical analysis showed that the only impurity which was in excess of the standard fixed for 'usable' water was albumenoid ammonia and that there were indications that this impurity was of vegetable origin and therefore not very dangerous.

5. The Municipal Council, to which the Sanitary Engineer's letter was referred for remarks, stated that it was not ambitious to provide a correct scheme of water-supply to the whole town, which extended over an area of 13½ square miles, as its cost, viz., 4 lakhs, was beyond its means and as the A, G and H Divisions of the town obtained a good supply of potable water from wells, and that it resolved to accept the scheme for the supply of water from the Mananchira tank. The Sanitary Board, to whom the whole correspondence was sent for remarks, was of opinion that, before the question of the advisability of using the water of this tank could be determined, an exploratory boring well or excavation should be made in the immediate proximity of the tank in view to ascertaining the existence or non-existence of water of good quality at the lower stratum, as supposed by Dr. King, and stated that, when this had been done and the quantity of the source and the feasibility of

measures providing for the exclusion of the subsoil water had been determined, the Board would be in a position to advise finally as to the adoption of the Mananchira tank scheme or the alternative Poloor Hill scheme proposed by Mr. Ellis.

6. The Municipal Council which was thereupon requested to take steps to furnish the information required by the Sanitary Board, carried out the necessary

experiments and reported the results to the Board through the Sanitary Engineer, and the Sanitary Board now submits the Sanitary Engineer's report in the matter with its resolution thereon. The Sanitary Engineer states that the results of the experiments show that the Mananchira tank receives its supply from two distinct sources, viz., (1) an upper sandy layer liable to contamination and (2) a porous layer below an impermeable stratum—presumably containing a pure water. Judging from the position of the strata, the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water and accordingly proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchira tank, a small elevated reservoir and distribution pipes therefrom. He states that the scheme cannot be taken up for some time yet, but will be put on the programme at the earliest opportunity. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that before sinking below the laterite, each well is steeled with laterite in cement to prevent the ingress of water from the upper pervious strata, and approves the general idea of the scheme on the said lines. The Sanitary Board, however, observes that the scheme would be of little practical value, unless all wells in Mappilla yards are closed beyond possibility of secret use.

7. In these circumstances, it is submitted that the Sanitary Engineer may be requested to undertake the preparation of the scheme, as soon as possible, on the lines approved by the Sanitary Board and that the attention of the Municipal Council may be drawn to the Sanitary Board's remark regarding the closure of all private wells in the Mappilla quarters, when the scheme has been executed. The accompanying draft order is submitted for approval.

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[G.O., No. 1548 M., dated 5th September 1898.]

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

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2. There has been a good deal of delay in getting the well sunk, the well first sunk was a failure and progress with a second one has been very slow.

3. The results of sinking the well, however, are now available and will be found reported in the overseer's report forwarded with the Chairman's letter No. $\frac{15}{98}$ of 6th January 1898 (copy attached).

4. The overseer has, however, not identified the various samples from the strata correctly and these are correctly shown in a note by the Assistant Sanitary Engineer (copy herewith). I have examined the samples and concur with his remarks.

5. The main question at issue has been whether the Mananchera tank receives any supply from a pure source—that it does so cannot now be doubted because the white sand layers 8 feet in thickness are perfectly pure indeed, no whiter sand could possibly be found.

6. Under this is a bed of lignite which forms the bed of the tank and this is 4 feet thick; below this again there is coarse sand and sand and gravel so that even if enough water were not procurable from the white sand, this lower strata can be drawn on.

7. It may be noted in passing that a similar bed of lignite to that already referred to was found when boring at Cochin.

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9. The water of the Mananchera tank has been declared usable, the albumenoid ammonia was slightly high, but this can be understood with an open tank.

10. That pure water can be obtained from wells sunk around the tank cannot be doubted and the quantity should be ample, but this it has been impossible to test as the well sunk cannot be baled out by manual labour and no steam pump is available near Calicut. The contents of the tank itself which fills yearly, however, would yield an ample supply as shown in Chairman's letter quoted below so that with constant pumping there can be no fear of insufficiency.

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ENCLOSURES.

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The subjoined is the list of the earth enclosed :—

1 to 4 feet		Sandy soil, light black.
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I also beg to report that in sounding Mananchera tank I have found it in all 19½ feet deep to the ground level, viz., depth of water 15 feet, above water to the road level 4½ feet.

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A section of the boring (*vide sketch below*) proves Dr. King's theory to be true. Strata (1) and (2) are sandy, porous and water-bearing; stratum (3) is impermeable indurated clay; strata (4) and (5) are porous water-bearing sands, and below these there is a bed of lignite.

No. 1548 M., 5TH SEPTEMBER 1898.

The tank, therefore, receives its supply from a sandy layer at the top naturally open to contamination, and secondly from another porous layer, bedded between two impermeable layers—this water, therefore, being presumably purer than that obtained from the top layers.

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Order—No. 1548 M., dated 5th September 1898.

The Sanitary Engineer is requested to undertake, as soon as possible, the preparation of a scheme for the water-supply of Calicut on the lines approved by the Sanitary Board.

2. The attention of the Municipal Council is drawn to the Sanitary Board's remark that all the wells in Mappilla yards should be closed when the scheme has been carried out.

(True Extract.)

H. TREMENHEERE,
Secretary to Government.

To the Chairman, Municipal Council, Calicut.
" Collector of Malabar.
" Sanitary Board, with enclosures returned.
" " Commissioner.
" " Engineer.

LOCAL AND MUNICIPAL DEPARTMENT.

NOTES CONNECTED WITH G.O., No. 1548 M., DATED
5TH SEPTEMBER 1898.

Previous papers.

G.O., No. 1871 M., dated	8th December	1890.
" " 1396 M., "	31st August	1891.
" " 930 M., "	26th May	1892.
" " 1114 M., "	28th June	"
" " 513 M., "	23rd April	1894.
" " 542 M., "	5th May	"
" " 583 M., "	31st March	1896.

[SUBJECT.—Calicut water-supply scheme.]

From the Sanitary Board, dated 27th June 1898, No. 371-S.

In his report on the inspection of Calicut in September 1890, the Assistant Sanitary Engineer stated—

(1) that the water-supply of the town which was chiefly obtained from private wells, of which there was one in almost every compound and garden, was good, except in the Mappilla quarters, where the soil was so far contaminated already and the water level was so little below the surface of the ground, that the drainage of the place, though preventing the further progress of mischief, would be powerless in checking the causes of pollution that already existed in the soil;

(2) that a good and sufficient supply of water could be obtained for the Mappillas from the Mananchira tank, which was situated to the north-east of the town on a high level and was therefore less liable to contamination; and

(3) that as this tank was not used by the people on account of its distance, the only way to induce them to use the water would be to bring it to their doors by means of pipes.

He therefore suggested the preparation of a scheme for the water-supply of the Mappilla quarters from this tank, the cost of which was roughly estimated by him to be between Rs. 75,000 and Rs. 1,00,000.

2. The Municipal Council of Calicut, however, did not approve the proposal for the reasons, firstly, that its financial condition did not admit of any expenditure being incurred towards the scheme and secondly, that the drainage of the town was more important than water-supply. But the Government overruled the Council's objection on the ground that the report of the Sanitary Engineer afforded ample proof of the immediate necessity for improving the sanitation of the town and considered that the water-supply scheme should have precedence over the drainage scheme. The Municipal Council was accordingly directed to make the

Vide Council's resolution in G.O., No. 1396 M., dated 31st August 1891.

Vide Council's resolution in G.O., No. 930 M., dated 26th May 1892.

Paragraph 2 of G.O., No. 1396 M., dated 31st August 1891.

G.O., No. 1114 M., dated 28th June 1892.

necessary provision for the investigation of the water-supply project, which was thereupon put down on the Sanitary Engineer's programme for 1895.

3. In the meantime, the Sanitary Commissioner, who inspected Calicut in 1894, considered that before deciding upon the Mananchira tank as the source for the future water-supply of the Mappilla quarters, it was necessary that certain matters should be investigated. He doubted the sufficiency of water in the Mananchira tank and also the quality of the supply. He considered that the tank was apparently fed by a special stratum of water under pressure confined between two impervious strata, one of which had been penetrated, as well as from the ordinary subsoil water, and that, as the subsoil water was evidently open to much pollution, it should not be drawn upon for the supply of Calicut, if it was possible to do otherwise. He therefore suggested that exploratory borings should be made for the purpose of ascertaining more as to subsoil conditions, and especially to find out whether any impervious stratum of clay underlay the previous upper stratum on which the surface water was supported, and that if this was found to be the case, bored or driven wells could be

Vide pages 13 and 14 in G.O., No. 513 M., dated 23rd April 1894.

used within the interior of the town or even the Mananchira tank might be employed, if by iron cylinders or other measures the subsoil water were excluded. He added that, if this was not proved and if it was found necessary to depend upon the subsoil water, it would be requisite to select an area sufficiently removed from the town to guarantee the purity of the soil.

4. The Sanitary Engineer Mr. Ellis, to whom the Sanitary Commissioner's letter was referred for remarks, visited Calicut in 1894, and reported that as the position of the Mananchira tank was certainly not

very desirable, it would be much better to go beyond the town for a source of supply and that there were several springs at the foot of the Poloor Hill, which was about 3 miles from Calicut, where wells yielding a pure supply might be sunk. He estimated the cost of this scheme at 4 lakhs and recommended that, if the finances of the Municipality did not permit of its being undertaken for some years to come, the Mananchira tank might be tested with regard to its yield, with the view of making it the source of supply as a temporary measure for the Mappilla quarters until such time as the Municipality could find the necessary funds for a larger scheme. He also observed that whatever pipes were laid as a temporary measure could form part of the larger scheme, whenever that came into existence, and added that the urgent need for a water-supply scheme for the Mappilla quarters had already been fully explained in the Assistant Sanitary Engineer's report of 1890, that the popular opinion about the water of the Mananchira tank was that it was good, that it was used by Europeans and Eurasians living near the tank, that the chemical analysis showed that the only impurity which was in excess of the standard fixed for 'usable' water was albumenoid ammonia and that there were indications that this impurity was of vegetable origin and therefore not very dangerous.

5. The Municipal Council, to which the Sanitary Engineer's letter was referred for remarks, stated that it was not ambitious to provide a correct scheme of water-supply to the whole town, which extended

over an area of 13½ square miles, as its cost, viz., 4 lakhs, was beyond its means and as the A, G and H Divisions of the town obtained a good supply of potable water from wells, and that it resolved to accept the scheme for the supply of water from the Mananchira tank. The Sanitary Board, to whom the whole correspondence was sent

Vide Current No. 715 M. in G.O., No. 583 M., dated 31st March 1896.

for remarks, was of opinion that, before the question of the advisability of using the water of this tank could be determined, an exploratory boring well or excavation should be made in the immediate proximity of the tank in view to ascertaining the existence or non-existence of water of good quality at the lower stratum, as supposed by Dr. King, and stated that, when this had been done and the quantity of the source and the feasibility of

measures providing for the exclusion of the subsoil water had been determined, the Board would be in a position to advise finally as to the adoption of the Mananchira tank scheme or the alternative Poloor Hill scheme proposed by Mr. Ellis.

6. The Municipal Council which was thereupon requested to take steps to furnish the information required by the Sanitary Board, carried out the necessary experiments and reported the results to the Board through the Sanitary Engineer, and the Sanitary Board now submits the Sanitary Engineer's report in the matter with its resolution thereon. The Sanitary Engineer states that the results of the experiments show that the Mananchira tank receives its supply from two distinct sources, viz., (1) an upper sandy layer liable to contamination and (2) a porous layer below an impermeable stratum—presumably containing a pure water. Judging from the position of the strata, the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water and accordingly proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchira tank, a small elevated reservoir and distribution pipes therefrom. He states that the scheme cannot be taken up for some time yet, but will be put on the programme at the earliest opportunity. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that before sinking below the laterite, each well is steined with laterite in cement to prevent the ingress of water from the upper pervious strata, and approves the general idea of the scheme on the said lines. The Sanitary Board, however, observes that the scheme would be of little practical value, unless all wells in Mappilla yards are closed beyond possibility of secret use.

7. In these circumstances, it is submitted that the Sanitary Engineer may be requested to undertake the preparation of the scheme, as soon as possible, on the lines approved by the Sanitary Board and that the attention of the Municipal Council may be drawn to the Sanitary Board's remark regarding the closure of all private wells in the Mappilla quarters, when the scheme has been executed. The accompanying draft order is submitted for approval.

V. RAGHAVA CHARLU—20-8-98.
H. TREMENHEERE—26-8-98.

[G.O., No. 1548 M., dated 5th September 1898.]

Government of Madras.
LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd.

Regd.

} 1838.

Enclosures

Spare copies

G.O., No. 1548 M., 5th September 1898.

Water-supply.

Requesting, with remarks, the Sanitary Engineer to undertake the preparation of a scheme for the — of Calicut on the lines approved by the Sanitary Board.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following paper :—

Proceedings of the Sanitary Board, No. 371/S., dated 27th June 1898.

Read—the following paper :—

Office-note—from J. A. JONES, Esq., Sanitary Engineer to Government.
To—the Secretary, Sanitary Board.
Dated—the 10th May 1898.
No.—940.

Calicut Water-supply.

About the year 1890 a suggestion was made by this Department that a supply of water for the Mappilla quarters of Calicut should be obtained from the Mananchera tank situated near the centre of and at the highest point of Calicut. After much discussion the Municipal Council accepted the proposal, but as doubts as to the quality and quantity of the supply were raised, the Sanitary Board in its Proceedings No. ²/_{S.B.P.} of 24th February 1896 (copy attached) ordered certain investigations to be made.

2. There has been a good deal of delay in getting the well sunk, the well first sunk was a failure and progress with a second one has been very slow.

3. The results of sinking the well, however, are now available and will be found reported in the overseer's report forwarded with the Chairman's letter No. ¹⁵/₉₈ of 6th January 1898 (copy attached).

4. The overseer has, however, not identified the various samples from the strata correctly and these are correctly shown in a note by the Assistant Sanitary Engineer (copy herewith). I have examined the samples and concur with his remarks.

5. The main question at issue has been whether the Mananchera tank receives any supply from a pure source—that it does so cannot now be doubted because the white sand layers 8 feet in thickness are perfectly pure indeed, no whiter sand could possibly be found.

6. Under this is a bed of lignite which forms the bed of the tank and this is 4 feet thick; below this again there is coarse sand and sand and gravel so that even if enough water were not procurable from the white sand, this lower strata can be drawn on.

7. It may be noted in passing that a similar bed of lignite to that already referred to was found when boring at Cochin.

8. From the position of strata, I think it possible that wells sunk into the white sand or the lower coarse sand will yield artesian water.

9. The water of the Mananchera tank has been declared usable, the albumenoid ammonia was slightly high, but this can be understood with an open tank.

10. That pure water can be obtained from wells sunk around the tank cannot be doubted and the quantity should be ample, but this it has been impossible to test as the well sunk cannot be baled out by manual labour and no steam pump is available near Calicut. The contents of the tank itself which fills yearly, however, would yield an ample supply as shown in Chairman's letter quoted below so that with constant pumping there can be no fear of insufficiency.

11. It is proposed that a scheme should be prepared for the supply to the Mappilla quarters of Calicut. The main feature of this scheme being a series of wells adjacent to the Mananchera tank, a small elevated reservoir and distribution pipes therefrom.

12. The scheme cannot be taken up for sometime yet but will be put on the programme at the earliest opportunity.

13. The following is a list of the papers accompanying—

- (1) Report of Assistant Sanitary Engineer to Government, 1890.
- (1-A) Letter from the Acting Sanitary Engineer to Government, No. 2417, of 29th October 1894.
- (2) Letter from the Sanitary Engineer to Government, No. 813, of 26th March 1895.
- (3) Letter from the Chairman, Municipal Council, Calicut, No. 915, of 3rd October 1895.
- (4) Note of Sanitary Commissioner, No. ²¹⁹⁵/_S, of 2nd December 1895.
- (5) Note by Colonel Campbell, No. 12/S, of 27th January 1896.
- (6) Resolution of the Sanitary Board, No. ²/_{S.B.P.}, of 24th February 1896.
- (7) Report of overseer and Chairman's letter, No. 15, of 6th January 1898.
- (8) Note by Assistant Sanitary Engineer to Government, dated 9th May 1898.

ENCLOSURES.

Letter—from M.R.Ry. P. RARICHAN, Road Overseer, Calicut.
To—the Chairman, Municipal Council, Calicut.
Dated—the 4th January 1898.
No.—148.

I beg to report that I have herewith sent the sample of earth packed up, in a tin case, taken at every 4 feet of the depth of the pot well lately sunk at the Municipal garden near Mananchera tank, Calicut, for the inspection of the Sanitary Engineer, Madras.

The subjoined is the list of the earth enclosed :—

1 to 4 feet	.. .. .	Sandy soil, light black.
4 „ 8 feet	.. .. .	do. a little white.
8 „ 12 feet	.. .. .	Reddish.
12 „ 16 feet	.. .. .	Chalk white clay
16 „ 20 feet	.. .. .	Do. pure white } Sand pure white.
20 „ 24 feet	.. .. .	Black clay lignite.
24 „ 28 feet	.. .. .	Reddish clay—gravel and sand.
28 „ 30 feet	.. .. .	do. the total depth of the pot well.

I also beg to report that in sounding Mananchera tank I have found it in all 19½ feet deep to the ground level, viz., depth of water 15 feet, above water to the road level 4½ feet.

Letter—from M.R.Ry. R. RAMA RAO Avargal, Chairman, Municipal Council, Calicut.
To—the Sanitary Engineer to Government.
Dated—the 6th January 1898.
No.—¹⁵/₉₈

In continuation of this office letter No. 1298, dated 30th June 1897, I have the honour to inform you that the pot well has been sunk to a depth of 30 feet.

A copy of the road overseer's report on the subject together with samples of earth excavated from the well are also forwarded herewith.

Note by Assistant Sanitary Engineer on Calicut Water-supply, dated 9th May 1898.
I had intended to go to Calicut, but subsequently found that doing so would be of little use because—

- (1) The well could not be baled out by manual labour.
- (2) There was no steam pump available there.
- (3) Even if one were available, I don't think the well would stand pumping. It would collapse as it frequently did before.

A section of the boring (*vide* sketch below) proves Dr. King's theory to be true. Strata (1) and (2) are sandy, porous and water-bearing; stratum (3) is impermeable indurated clay; strata (4) and (5) are porous water-bearing sands, and below these there is a bed of lignite.

The tank, therefore, receives its supply from a sandy layer at the top naturally open to contamination, and secondly from another porous layer, bedded between two impermeable layers—this water, therefore, being presumably purer than that obtained from the top layers.

I may note here that the section of the well indicates a fair prospect of a good supply being obtained by a deep boring.

I may also mention that it is popularly believed that there is a well in the bed of the tank. If it be so, the tank must also be deriving a supply from the stratum of gravel below the lignite bed.

Resolution—No. 371/S., dated 27th June 1898.

The question of a water-supply scheme for the Mappilla quarters of the town of Calicut has been under consideration for some years, the proposed source of supply being the Mananchera tank. Before deciding on the use of this water, the late Sanitary Board considered it necessary that an exploratory boring well or excavation should be made in the immediate proximity of the tank, in order to ascertain whether there exists, as suspected, a subterranean supply of good quality.

2. The Sanitary Engineer now submits the results of the boring which shows that the tank receives its supply from two distinct sources, viz.—

(1) an upper sandy layer liable to contamination, and

(2) a porous layer below an impermeable stratum, presumably a pure water.

3. Judging from the position of the strata the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water.

4. He proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchera tank, a small elevated reservoir, and distribution pipes therefrom.

5. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that, before sinking below the laterite, each well is stained with laterite in cement, to prevent the ingress of water from the upper pervious strata. The scheme would be, however, of little practical value unless all wells in Mappilla yards are closed beyond possibility of secret use. On these lines the general idea of the scheme is approved by the Sanitary Board and is recommended to Government.

(True Extract.)

R. PARSONS,
Secretary, Sanitary Board.

To the Secretary to Government, Local and Municipal Department,
with papers in original.

Order—No. 1548 M., dated 5th September 1898.

The Sanitary Engineer is requested to undertake, as soon as possible, the preparation of a scheme for the water-supply of Calicut on the lines approved by the Sanitary Board.

2. The attention of the Municipal Council is drawn to the Sanitary Board's remark that all the wells in Mappilla yards should be closed when the scheme has been carried out.

(True Extract.)

H. TREMENEERE,
Secretary to Government.

To the Chairman, Municipal Council, Calicut.
" Collector of Malabar.
" Sanitary Board, with enclosures returned.
" " Commissioner.
" " Engineer.

LOCAL AND MUNICIPAL DEPARTMENT.

NOTES CONNECTED WITH G.O., No. 1548 M., DATED
5TH SEPTEMBER 1898.

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" " 582 M. "	5th May	"
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[SUBJECT.—*Calicut water-supply scheme.*]

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In his report on the inspection of Calicut in September 1890, the Assistant Sanitary Engineer stated—

(1) that the water-supply of the town which was chiefly obtained from private wells, of which there was one in almost every compound and garden, was good, except in the Mappilla quarters, where the soil was so far contaminated already and the water level was so little below the surface of the ground, that the drainage of the place, though preventing the further progress of mischief, would be powerless in checking the causes of pollution that already existed in the soil;

(2) that a good and sufficient supply of water could be obtained for the Mappillas from the Mananchira tank, which was situated to the north-east of the town

on a high level and was therefore less liable to contamination; and

(3) that as this tank was not used by the people on account of its distance, the only way to induce them to use the water would be to bring it to their doors by means of pipes.

He therefore suggested the preparation of a scheme for the water-supply of the Mappilla quarters from this tank, the cost of which was roughly estimated by

him to be between Rs. 75,000 and Rs. 1,00,000.

2. The Municipal Council of Calicut, however, did not approve the proposal for the reasons, firstly, that its financial condition did not admit of any expenditure being incurred towards the scheme

and secondly, that the drainage of the town was more important than water-supply. But the Government overruled

the Council's objection on the ground that the report of the Sanitary Engineer afforded ample proof of the immediate necessity for improving the sanitation of the town and considered that the water-supply scheme should have precedence over the drainage scheme. The Municipal Council was accordingly directed to make the

Paragraph 2 of G.O., No. 1396 M., dated 31st August 1891.
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necessary provision for the investigation of the water-supply project, which was thereupon put down on the Sanitary Engineer's programme for 1895.

G.O., No. 582 M., dated 5th May 1894.

3. In the meantime, the Sanitary Commissioner, who inspected Calicut in 1894, considered that before deciding upon the Mananchira tank as the source for the future water-supply of the Mappilla quarters, it was necessary that certain matters should be investigated. He doubted the sufficiency of water in the Mananchira tank and also the quality of the supply. He considered that the tank was apparently fed by a special stratum of water under pressure confined between two impervious strata, one of which had been penetrated, as well as from the ordinary subsoil water, and that, as the subsoil water was evidently open to much pollution, it should not be drawn upon for the supply of Calicut, if it was possible to do otherwise. He therefore suggested that exploratory borings should be made for the purpose of ascertaining more as to subsoil conditions, and especially to find out whether any impervious stratum of clay underlay the previous upper stratum on which the surface water was supported, and that if this was found to be the case, bored or driven wells could be used within the interior of the town or even the Mananchira tank might be employed, if by iron cylinders or other measures the subsoil water were excluded. He added that, if this was not proved and if it was found necessary to depend upon the subsoil water, it would be requisite to select an area sufficiently removed from the town to guarantee the purity of the soil.

Vide pages 13 and 14 in G.O., No. 513 M., dated 23rd April 1894.

4. The Sanitary Engineer Mr. Ellis, to whom the Sanitary Commissioner's letter was referred for remarks, visited Calicut in 1894, and reported that as the position of the Mananchira tank was certainly not very desirable, it would be much better to go beyond the town for a source of supply and that there were several springs at the foot of the Poloor Hill, which was about 3 miles from Calicut, where wells yielding a pure supply might be sunk. He estimated the cost of this scheme at 4 lakhs and recommended that, if the finances of the Municipality did not permit of its being undertaken for some years to come, the Mananchira tank might be tested with regard to its yield, with the view of making it the source of supply as a temporary measure for the Mappilla quarters until such time as the Municipality could find the necessary funds for a larger scheme. He also observed that whatever pipes were laid as a temporary measure could form part of the larger scheme, whenever that came into existence, and added that the urgent need for a water-supply scheme for the Mappilla quarters had already been fully explained in the Assistant Sanitary Engineer's report of 1890, that the popular opinion about the water of the Mananchira tank was that it was good, that it was used by Europeans and Eurasians living near the tank, that the chemical analysis showed that the only impurity which was in excess of the standard fixed for 'usable' water was albumenoid ammonia and that there were indications that this impurity was of vegetable origin and therefore not very dangerous.

5. The Municipal Council, to which the Sanitary Engineer's letter was referred for remarks, stated that it was not ambitious to provide a correct scheme of water-supply to the whole town, which extended over an area of $13\frac{1}{4}$ square miles, as its cost, viz., 4 lakhs, was beyond its means and as the A, G and H Divisions of the town obtained a good supply of potable water from wells, and that it resolved to accept the scheme for the supply of water from the Mananchira tank. The Sanitary Board, to whom the whole correspondence was sent for remarks, was of opinion that, before the question of the advisability of using the water of this tank could be determined, an exploratory boring well or excavation should be made in the immediate proximity of the tank in view to ascertaining the existence or non-existence of water of good quality at the lower stratum, as supposed by Dr. King, and stated that, when this had been done and the quantity of the source and the feasibility of

measures providing for the exclusion of the subsoil water had been determined, the Board would be in a position to advise finally as to the adoption of the Mananchira tank scheme or the alternative Poloor Hill scheme proposed by Mr. Ellis.

6. The Municipal Council which was thereupon requested to take steps to furnish the information required by the Sanitary Board, carried out the necessary experiments and reported the results to the Board through the Sanitary Engineer, and the Sanitary Board now submits the Sanitary Engineer's report in the matter with its resolution thereon. The Sanitary Engineer states that the results of the experiments show that the Mananchira tank receives its supply from two distinct sources, viz., (1) an upper sandy layer liable to contamination and (2) a porous layer below an impermeable stratum—presumably containing a pure water. Judging from the position of the strata, the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water and accordingly proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchira tank, a small elevated reservoir and distribution pipes therefrom. He states that the scheme cannot be taken up for some time yet, but will be put on the programme at the earliest opportunity. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that before sinking below the laterite, each well is steined with laterite in cement to prevent the ingress of water from the upper pervious strata, and approves the general idea of the scheme on the said lines. The Sanitary Board, however, observes that the scheme would be of little practical value, unless all wells in Mappilla yards are closed beyond possibility of secret use.

7. In these circumstances, it is submitted that the Sanitary Engineer may be requested to undertake the preparation of the scheme, as soon as possible, on the lines approved by the Sanitary Board and that the attention of the Municipal Council may be drawn to the Sanitary Board's remark regarding the closure of all private wells in the Mappilla quarters, when the scheme has been executed. The accompanying draft order is submitted for approval.

V. RAGHAVA CHARLU—20-8-98.

H. TREMENHEERE—26-8-98.

[G.O., No. 1548 M., dated 5th September 1898.]

Government of Madras.
LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd.

Regd.

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Enclosures

Spare copies

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Water-supply.

Requesting, with remarks, the Sanitary Engineer to undertake the preparation of a scheme for the — of Calicut on the lines approved by the Sanitary Board.

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2. There has been a good deal of delay in getting the well sunk, the well first sunk was a failure and progress with a second one has been very slow.

3. The results of sinking the well, however, are now available and will be found reported in the overseer's report forwarded with the Chairman's letter No. ¹⁵ of 6th January 1898 (copy attached).

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5. The main question at issue has been whether the Mananchera tank receives any supply from a pure source—that it does so cannot now be doubted because the white sand layers 8 feet in thickness are perfectly pure indeed, no whiter sand could possibly be found.

6. Under this is a bed of lignite which forms the bed of the tank and this is 4 feet thick; below this again there is coarse sand and sand and gravel so that even if enough water were not procurable from the white sand, this lower strata can be drawn on.

7. It may be noted in passing that a similar bed of lignite to that already referred to was found when boring at Cochin.

8. From the position of strata, I think it possible that wells sunk into the white sand or the lower coarse sand will yield artesian water.

9. The water of the Mananchera tank has been declared usable, the albumenoid ammonia was slightly high, but this can be understood with an open tank.

10. That pure water can be obtained from wells sunk around the tank cannot be doubted and the quantity should be ample, but this it has been impossible to test as the well sunk cannot be baled out by manual labour and no steam pump is available near Calicut. The contents of the tank itself which fills yearly, however, would yield an ample supply as shown in Chairman's letter quoted below so that with constant pumping there can be no fear of insufficiency.

11. It is proposed that a scheme should be prepared for the supply to the Mappilla quarters of Calicut. The main feature of this scheme being a series of wells adjacent to the Mananchera tank, a small elevated reservoir and distribution pipes therefrom.

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1 to 4 feet	..	..	..	..	Sandy soil, light black.
4 " 8 feet	..	..	..	..	do. a little white.
8 " 12 feet	..	..	..	..	Reddish.
12 " 16 feet	..	..	..	..	Chalk white clay
16 " 20 feet	..	..	..	..	Do. pure white } Sand pure white.
20 " 24 feet	..	..	..	..	Black clay lignite.
24 " 28 feet	..	..	..	..	Reddish clay—gravel and sand.
28 " 30 feet	..	..	..	..	do. the total depth of the pot well.

I also beg to report that in sounding Mananchera tank I have found it in all 19½ feet deep to the ground level, viz., depth of water 15 feet, above water to the road level 4½ feet.

Letter—from M.R.Ry. R. RAMA RAO Avargal, Chairman, Municipal Council, Calicut.
To—the Sanitary Engineer to Government.
Dated—the 6th January 1898.
No.—¹⁵/₉₈

In continuation of this office letter No. 1298, dated 30th June 1897, I have the honour to inform you that the pot well has been sunk to a depth of 30 feet.
A copy of the road overseer's report on the subject together with samples of earth excavated from the well are also forwarded herewith.

Note by Assistant Sanitary Engineer on Calicut Water-supply, dated 9th May 1898.
I had intended to go to Calicut, but subsequently found that doing so would be of little use because—

- (1) The well could not be baled out by manual labour.
- (2) There was no steam pump available there.
- (3) Even if one were available, I don't think the well would stand pumping. It would collapse as it frequently did before.

A section of the boring (vide sketch below) proves Dr. King's theory to be true. Strata (1) and (2) are sandy, porous and water-bearing; stratum (3) is impermeable indurated clay; strata (4) and (5) are porous water-bearing sands, and below these there is a bed of lignite.

The tank, therefore, receives its supply from a sandy layer at the top naturally open to contamination, and secondly from another porous layer, bedded between two impermeable layers—this water, therefore, being presumably purer than that obtained from the top layers.

I may note here that the section of the well indicates a fair prospect of a good supply being obtained by a deep boring.

I may also mention that it is popularly believed that there is a well in the bed of the tank. If it be so, the tank must also be deriving a supply from the stratum of gravel below the lignite bed.

Resolution—No. 371/S., dated 27th June 1898.

The question of a water-supply scheme for the Mappilla quarters of the town of Calicut has been under consideration for some years, the proposed source of supply being the Mananchera tank. Before deciding on the use of this water, the late Sanitary Board considered it necessary that an exploratory boring well or excavation should be made in the immediate proximity of the tank, in order to ascertain whether there exists, as suspected, a subterranean supply of good quality.

2. The Sanitary Engineer now submits the results of the boring which shows that the tank receives its supply from two distinct sources, viz.—

(1) an upper sandy layer liable to contamination, and

(2) a porous layer below an impermeable stratum, presumably a pure water.

3. Judging from the position of the strata the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water.

4. He proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchera tank, a small elevated reservoir, and distribution pipes therefrom.

5. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that, before sinking below the laterite, each well is stained with laterite in cement, to prevent the ingress of water from the upper pervious strata. The scheme would be, however, of little practical value unless all wells in Mappilla yards are closed beyond possibility of secret use. On these lines the general idea of the scheme is approved by the Sanitary Board and is recommended to Government.

(True Extract.)

R. PARSONS,
Secretary, Sanitary Board.

To the Secretary to Government, Local and Municipal Department,
with papers in original.

Order—No. 1548 M., dated 5th September 1898.

The Sanitary Engineer is requested to undertake, as soon as possible, the preparation of a scheme for the water-supply of Calicut on the lines approved by the Sanitary Board.

2. The attention of the Municipal Council is drawn to the Sanitary Board's remark that all the wells in Mappilla yards should be closed when the scheme has been carried out.

(True Extract.)

H. TREMENHEERE,
Secretary to Government.

To the Chairman, Municipal Council, Calicut.
" Collector of Malabar.
" Sanitary Board, with enclosures returned.
" Commissioner.
" Engineer.

LOCAL AND MUNICIPAL DEPARTMENT.

NOTES CONNECTED WITH G.O., No. 1548 M., DATED
5TH SEPTEMBER 1898.

Previous papers.

G.O., No. 1871 M., dated	8th December	1890.
" " 1396 M. "	31st August	1891.
" " 930 M. "	26th May	1892.
" " 1114 M. "	28th June	"
" " 513 M. "	23rd April	1894.
" " 542 M. "	5th May	"
" " 583 M. "	31st March	1896.

[SUBJECT.—Calicut water-supply scheme.]

From the Sanitary Board, dated 27th June 1898, No. 371-S.

In his report on the inspection of Calicut in September 1890, the Assistant Sanitary Engineer stated—

(1) that the water-supply of the town which was chiefly obtained from private wells, of which there was one in almost every compound and garden, was good, except in the Mappilla quarters, where the soil was so far contaminated already and the water level was so little below the surface of the ground, that the drainage of the place, though preventing the further progress of mischief, would be powerless in checking the causes of pollution that already existed in the soil;

(2) that a good and sufficient supply of water could be obtained for the Mappilla quarters from the Mananchira tank, which was situated to the north-east of the town

on a high level and was therefore less liable to contamination; and

(3) that as this tank was not used by the people on account of its distance, the only way to induce them to use the water would be to bring it to their doors by means of pipes.

He therefore suggested the preparation of a scheme for the water-supply of the Mappilla quarters from this tank, the cost of which was roughly estimated by

him to be between Rs. 75,000 and Rs. 1,00,000.

2. The Municipal Council of Calicut, however, did not approve the proposal for the reasons, firstly, that its financial condition did not admit of any expenditure being incurred towards the scheme and secondly, that the drainage of the town was more important than water-supply. But the Government overruled the Council's objection on the ground that the report of the Sanitary Engineer afforded ample proof of the immediate necessity for improving the sanitation of the town and considered that the water-supply scheme should have precedence over the drainage scheme. The Municipal Council was accordingly directed to make the

Paragraph 2 of G.O., No. 1396 M., dated 31st August 1891.

Vide Council's resolution in G.O., No. 930 M., dated 26th May 1892.

G.O., No. 1114 M., dated 28th June 1892.

necessary provision for the investigation of the water-supply project, which was thereupon put down on the Sanitary Engineer's programme for 1895.

3. In the meantime, the Sanitary Commissioner, who inspected Calicut in 1894, considered that before deciding upon the Mananchira tank as the source for the future water-supply of the Mappilla quarters, it was necessary that certain matters should be investigated. He doubted the sufficiency of water in the Mananchira tank and also the quality of the supply. He considered that the tank was apparently fed by a special stratum of water under pressure confined between two impervious strata, one of which had been penetrated, as well as from the ordinary subsoil water, and that, as the subsoil water was evidently open to much pollution, it should not be drawn upon for the supply of Calicut, if it was possible to do otherwise. He therefore suggested that exploratory borings should be made for the purpose of ascertaining more as to subsoil conditions, and especially to find out whether any impervious stratum of clay underlay the previous upper stratum on which the surface water was supported, and that if this was found to be the case, bored or driven wells could be used within the interior of the town or even the Mananchira tank might be employed, if by iron cylinders or other measures the subsoil water were excluded. He added that, if this was not proved and if it was found necessary to depend upon the subsoil water, it would be requisite to select an area sufficiently removed from the town to guarantee the purity of the soil.

4. The Sanitary Engineer Mr. Ellis, to whom the Sanitary Commissioner's letter was referred for remarks, visited Calicut in 1894, and reported that as the position of the Mananchira tank was certainly not very desirable, it would be much better to go beyond the town for a source of supply and that there were several springs at the foot of the Poloor Hill, which was about 3 miles from Calicut, where wells yielding a pure supply might be sunk. He estimated the cost of this scheme at 4 lakhs and recommended that, if the finances of the Municipality did not permit of its being undertaken for some years to come, the Mananchira tank might be tested with regard to its yield, with the view of making it the source of supply as a temporary measure for the Mappilla quarters until such time as the Municipality could find the necessary funds for a larger scheme. He also observed that whatever pipes were laid as a temporary measure could form part of the larger scheme, whenever that came into existence, and added that the urgent need for a water-supply scheme for the Mappilla quarters had already been fully explained in the Assistant Sanitary Engineer's report of 1890, that the popular opinion about the water of the Mananchira tank was that it was good, that it was used by Europeans and Eurasians living near the tank, that the chemical analysis showed that the only impurity which was in excess of the standard fixed for 'usable' water was albumenoid ammonia and that there were indications that this impurity was of vegetable origin and therefore not very dangerous.

5. The Municipal Council, to which the Sanitary Engineer's letter was referred for remarks, stated that it was not ambitious to provide a correct scheme of water-supply to the whole town, which extended over an area of 13½ square miles, as its cost, viz., 4 lakhs, was beyond its means and as the A, G and H Divisions of the town obtained a good supply of potable water from wells, and that it resolved to accept the scheme for the supply of water from the Mananchira tank. The Sanitary Board, to whom the whole correspondence was sent for remarks, was of opinion that, before the question of the advisability of using the water of this tank could be determined, an exploratory boring well or excavation should be made in the immediate proximity of the tank in view of ascertaining the existence or non-existence of water of good quality at the lower stratum, as supposed by Dr. King, and stated that, when this had been done and the quantity of the source and the feasibility of

measures providing for the exclusion of the subsoil water had been determined, the Board would be in a position to advise finally as to the adoption of the Mananchira tank scheme or the alternative Poloor Hill scheme proposed by Mr. Ellis.

6. The Municipal Council which was thereupon requested to take steps to furnish the information required by the Sanitary Board, carried out the necessary experiments and reported the results to the Board through the Sanitary Engineer, and the Sanitary Board now submits the Sanitary Engineer's report in the matter with its resolution thereon. The Sanitary Engineer states that the results of the experiments show that the Mananchira tank receives its supply from two distinct sources, viz., (1) an upper sandy layer liable to contamination and (2) a porous layer below an impermeable stratum—presumably containing a pure water. Judging from the position of the strata, the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water and accordingly proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchira tank, a small elevated reservoir and distribution pipes therefrom. He states that the scheme cannot be taken up for some time yet, but will be put on the programme at the earliest opportunity. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that before sinking below the laterite, each well is steined with laterite in cement to prevent the ingress of water from the upper pervious strata, and approves the general idea of the scheme on the said lines. The Sanitary Board, however, observes that the scheme would be of little practical value, unless all wells in Mappilla yards are closed beyond possibility of secret use.

7. In these circumstances, it is submitted that the Sanitary Engineer may be requested to undertake the preparation of the scheme, as soon as possible, on the lines approved by the Sanitary Board and that the attention of the Municipal Council may be drawn to the Sanitary Board's remark regarding the closure of all private wells in the Mappilla quarters, when the scheme has been executed. The accompanying draft order is submitted for approval.

V. RAGHAYA CHARLU—20-8-98.

H. TREMENHEERE—26-8-98.

[G.O., No. 1548 M., dated 5th September 1898.]

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd.

Regd.

} 1898.

Enclosures

Spare copies

G.O., No. 1548 M., 5th September 1898.

Water-supply.

Requesting, with remarks, the Sanitary Engineer to undertake the preparation of a scheme for the — of Calicut on the lines approved by the Sanitary Board.

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

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G.O., No. 1548 M., 5th September 1898.

Water-supply.

Requesting, with remarks, the Sanitary Engineer to undertake the preparation of a scheme for the — of Calicut on the lines approved by the Sanitary Board.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

Read—the following paper :—

Proceedings of the Sanitary Board, No. 371/S., dated 27th June 1898.

Read—the following paper :—

Office-note—from J. A. JONES, Esq., Sanitary Engineer to Government.
To—the Secretary, Sanitary Board.
Dated—the 10th May 1898.
No.—940.

Calicut Water-supply.

About the year 1890 a suggestion was made by this Department that a supply of water for the Mappilla quarters of Calicut should be obtained from the Mananchera tank situated near the centre of and at the highest point of Calicut. After much discussion the Municipal Council accepted the proposal, but as doubts as to the quality and quantity of the supply were raised, the Sanitary Board in its Proceedings No. ²/_{S.B.P.} of 24th February 1896 (copy attached) ordered certain investigations to be made.

2. There has been a good deal of delay in getting the well sunk, the well first sunk was a failure and progress with a second one has been very slow.

3. The results of sinking the well, however, are now available and will be found reported in the overseer's report forwarded with the Chairman's letter No. ¹⁶/₉₈ of 6th January 1898 (copy attached).

4. The overseer has, however, not identified the various samples from the strata correctly and these are correctly shown in a note by the Assistant Sanitary Engineer (copy herewith). I have examined the samples and concur with his remarks.

5. The main question at issue has been whether the Mananchera tank receives any supply from a pure source—that it does so cannot now be doubted because the white sand layers 8 feet in thickness are perfectly pure indeed, no whiter sand could possibly be found.

6. Under this is a bed of lignite which forms the bed of the tank and this is 4 feet thick; below this again there is coarse sand and sand and gravel so that even if enough water were not procurable from the white sand, this lower strata can be drawn on.

7. It may be noted in passing that a similar bed of lignite to that already referred to was found when boring at Cochin.

8. From the position of strata, I think it possible that wells sunk into the white sand or the lower coarse sand will yield artesian water.

9. The water of the Mananchera tank has been declared usable, the albumenoid ammonia was slightly high, but this can be understood with an open tank.

10. That pure water can be obtained from wells sunk around the tank cannot be doubted and the quantity should be ample, but this it has been impossible to test as the well sunk cannot be baled out by manual labour and no steam pump is available near Calicut. The contents of the tank itself which fills yearly, however, would yield an ample supply as shown in Chairman's letter quoted below so that with constant pumping there can be no fear of insufficiency.

11. It is proposed that a scheme should be prepared for the supply to the Mappilla quarters of Calicut. The main feature of this scheme being a series of wells adjacent to the Mananchera tank, a small elevated reservoir and distribution pipes therefrom.

12. The scheme cannot be taken up for sometime yet but will be put on the programme at the earliest opportunity.

13. The following is a list of the papers accompanying—

(1) Report of Assistant Sanitary Engineer to Government, 1890.

(1-A) Letter from the Acting Sanitary Engineer to Government, No. 2417, of 29th October 1894.

(2) Letter from the Sanitary Engineer to Government, No. 813, of 26th March 1895.

(3) Letter from the Chairman, Municipal Council, Calicut, No. 915, of 3rd October 1895.

(4) Note of Sanitary Commissioner, No. ²¹⁹⁵/₈, of 2nd December 1895.

(5) Note by Colonel Campbell, No. 12/S, of 27th January 1896.

(6) Resolution of the Sanitary Board, No. ²/_{S.B.P.}, of 24th February 1896.

(7) Report of overseer and Chairman's letter, No. 15, of 6th January 1898.

(8) Note by Assistant Sanitary Engineer to Government, dated 9th May 1898.

ENCLOSURES.

Letter—from M.R.Ry. P. RARICHAN, Road Overseer, Calicut.
To—the Chairman, Municipal Council, Calicut.
Dated—the 4th January 1898.
No.—148.

I beg to report that I have herewith sent the sample of earth packed up, in a tin case, taken at every 4 feet of the depth of the pot well lately sunk at the Municipal garden near Mananchera tank, Calicut, for the inspection of the Sanitary Engineer, Madras.

The subjoined is the list of the earth enclosed :—

1 to 4 feet	.. .. .	Sandy soil, light black.
4 " 8 feet	.. .. .	do. a little white.
8 " 12 feet	.. .. .	Reddish.
12 " 16 feet	.. .. .	Chalk white clay
16 " 20 feet	.. .. .	Do. pure white } Sand pure white.
20 " 24 feet	.. .. .	Black clay lignite.
24 " 28 feet	.. .. .	Reddish clay—gravel and sand.
28 " 30 feet	.. .. .	do. the total depth of the pot well.

I also beg to report that in sounding Mananchera tank I have found it in all 19½ feet deep to the ground level, viz., depth of water 15 feet, above water to the road level 4½ feet.

Letter—from M.R.Ry. R. RAMA RAO Avargal, Chairman, Municipal Council, Calicut.
To—the Sanitary Engineer to Government.
Dated—the 6th January 1898.
No.—¹⁵/₉₈

In continuation of this office letter No. 1298, dated 30th June 1897, I have the honour to inform you that the pot well has been sunk to a depth of 30 feet.

A copy of the road overseer's report on the subject together with samples of earth excavated from the well are also forwarded herewith.

Note by Assistant Sanitary Engineer on Calicut Water-supply, dated 9th May 1898.

I had intended to go to Calicut, but subsequently found that doing so would be of little use because—

(1) The well could not be baled out by manual labour.

(2) There was no steam pump available there.

(3) Even if one were available, I don't think the well would stand pumping. It would collapse as it frequently did before.

A section of the boring (vide sketch below) proves Dr. King's theory to be true. Strata (1) and (2) are sandy, porous and water-bearing; stratum (3) is impermeable indurated clay; strata (4) and (5) are porous water-bearing sands, and below these there is a bed of lignite.

The tank, therefore, receives its supply from a sandy layer at the top naturally open to contamination, and secondly from another porous layer, bedded between two impermeable layers—this water, therefore, being presumably purer than that obtained from the top layers.

I may note here that the section of the well indicates a fair prospect of a good supply being obtained by a deep boring.

I may also mention that it is popularly believed that there is a well in the bed of the tank. If it be so, the tank must also be deriving a supply from the stratum of gravel below the lignite bed.

Resolution—No. 371/S., dated 27th June 1898.

The question of a water-supply scheme for the Mappilla quarters of the town of Calicut has been under consideration for some years, the proposed source of supply being the Mananchera tank. Before deciding on the use of this water, the late Sanitary Board considered it necessary that

*Proceedings No. ²_{S.B.P.}, dated 24th February 1896. an exploratory boring well or excavation should be made in the immediate proximity of the tank, in order to ascertain whether there exists, as suspected, a subterranean supply of good quality.

2. The Sanitary Engineer now submits the results of the boring which shows that the tank receives its supply from two distinct sources, viz.—

- (1) an upper sandy layer liable to contamination, and
- (2) a porous layer below an impermeable stratum, presumably a pure water.

3. Judging from the position of the strata the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water.

4. He proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchera tank, a small elevated reservoir, and distribution pipes therefrom.

5. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that, before sinking below the laterite, each well is stained with laterite in cement, to prevent the ingress of water from the upper pervious strata. The scheme would be, however, of little practical value unless all wells in Mappilla yards are closed beyond possibility of secret use. On these lines the general idea of the scheme is approved by the Sanitary Board and is recommended to Government.

(True Extract.)

R. PARSONS,
Secretary, Sanitary Board.

To the Secretary to Government, Local and Municipal Department,
with papers in original.

Order—No. 1548 M., dated 5th September 1898.

The Sanitary Engineer is requested to undertake, as soon as possible, the preparation of a scheme for the water-supply of Calicut on the lines approved by the Sanitary Board.

2. The attention of the Municipal Council is drawn to the Sanitary Board's remark that all the wells in Mappilla yards should be closed when the scheme has been carried out.

(True Extract.)

H. TREMENHERR,
Secretary to Government.

To the Chairman, Municipal Council, Calicut.
Collector of Malabar.
Sanitary Board, with enclosures returned.
Commissioner.
Engineer.

LOCAL AND MUNICIPAL DEPARTMENT.

NOTES CONNECTED WITH G.O., No. 1548 M., DATED
5TH SEPTEMBER 1898.

Previous papers.

G.O., No. 1871 M., dated	8th December	1890.
" " 1396 M. "	31st August	1891.
" " 930 M. "	26th May	1892.
" " 1114 M. "	28th June	"
" " 513 M. "	23rd April	1894.
" " 582 M. "	5th May	"
" " 583 M. "	31st March	1896.

[SUBJECT.—Calicut water-supply scheme.]

From the Sanitary Board, dated 27th June 1898, No. 371-S.

In his report on the inspection of Calicut in September 1890, the Assistant Sanitary Engineer stated—

(1) that the water-supply of the town which was chiefly obtained from private wells, of which there was one in almost every compound and garden, was good, except in the Mappilla quarters, where the soil was so far contaminated already and the water level was so little below the surface of the ground, that the drainage of the place, though preventing the further progress of mischief, would be powerless in checking the causes of pollution that already existed in the soil;

(2) that a good and sufficient supply of water could be obtained for the Mappillas from the Mananchira tank, which was situated to the north-east of the town

on a high level and was therefore less liable to contamination; and
(3) that as this tank was not used by the people on account of its distance, the only way to induce them to use the water would be to bring it to their doors by means of pipes.

He therefore suggested the preparation of a scheme for the water-supply of the Mappilla quarters from this tank, the cost of which was roughly estimated by

him to be between Rs. 75,000 and Rs. 1,00,000.

2. The Municipal Council of Calicut, however, did not approve the proposal for the reasons, firstly, that its financial condition did not admit of any expenditure being incurred towards the scheme

and secondly, that the drainage of the town was more important than water-supply. But the Government overruled

Council's objection on the ground that the report of the Sanitary Engineer afforded ample proof of the immediate necessity for improving the sanitation of the town and considered that the water-supply scheme should have precedence over the drainage scheme. The Municipal Council was accordingly directed to make the

Paragraph 2 of G.O., No. 1396 M., dated 31st August 1891.
G.O., No. 1114 M., dated 28th June 1892.

necessary provision for the investigation of the water-supply project, which was thereupon put down on the Sanitary Engineer's programme for 1895.

G.O., No. 582 M., dated 5th May 1894.

3. In the meantime, the Sanitary Commissioner, who inspected Calicut in 1894, considered that before deciding upon the Mananchira tank as the source for the future water-supply of the Mappilla quarters, it was necessary that certain matters should be investigated. He doubted the sufficiency of water in the Mananchira tank and also the quality of the supply. He considered that the tank was apparently fed by a special stratum of water under pressure confined between two impervious strata, one of which had been penetrated, as well as from the ordinary subsoil water, and that, as the subsoil water was evidently open to much pollution, it should not be drawn upon for the supply of Calicut, if it was possible to do otherwise. He therefore suggested that exploratory borings should be made for the purpose of ascertaining more as to subsoil conditions, and especially to find out whether any impervious stratum of clay underlay the previous upper stratum on which the surface water was supported, and that if this was found to be the case, bored or driven wells could be used within the interior of the town or even the Mananchira tank might be employed, if by iron cylinders or other measures the subsoil water were excluded. He added that, if this was not proved and if it was found necessary to depend upon the subsoil water, it would be requisite to select an area sufficiently removed from the town to guarantee the purity of the soil.

Vide pages 13 and 14 in G.O., No. 513 M., dated 23rd April 1894.

4. The Sanitary Engineer Mr. Ellis, to whom the Sanitary Commissioner's letter was referred for remarks, visited Calicut in 1894, and reported that as the position of the Mananchira tank was certainly not

Vide Current No. 2656 M., in G.O., No. 583 M., dated 31st March 1896.

very desirable, it would be much better to go beyond the town for a source of supply and that there were several springs at the foot of the Poloor Hill, which was about 3 miles from Calicut, where wells yielding a pure supply might be sunk. He estimated the cost of this scheme at 4 lakhs and recommended that, if the finances of the Municipality did not permit of its being undertaken for some years to come, the Mananchira tank might be tested with regard to its yield, with the view of making it the source of supply as a temporary measure for the Mappilla quarters until such time as the Municipality could find the necessary funds for a larger scheme. He also observed that whatever pipes were laid as a temporary measure could form part of the larger scheme, whenever that came into existence, and added that the urgent need for a water-supply scheme for the Mappilla quarters had already been fully explained in the Assistant Sanitary Engineer's report of 1890, that the popular opinion about the water of the Mananchira tank was that it was good, that it was used by Europeans and Eurasians living near the tank, that the chemical analysis showed that the only impurity which was in excess of the standard fixed for 'usable' water was albumenoid ammonia and that there were indications that this impurity was of vegetable origin and therefore not very dangerous.

5. The Municipal Council, to which the Sanitary Engineer's letter was referred

Vide Current No. 3436 M. in G.O., No. 583 M., dated 31st March 1896.

for remarks, stated that it was not ambitious to provide a correct scheme of water-supply to the whole town, which extended over an area of $13\frac{1}{4}$ square miles, as its cost, viz., 4 lakhs, was beyond its means and as the A, G and H Divisions of the town obtained a good supply of potable water from wells, and that it resolved to accept the scheme for the supply of water from the Mananchira tank. The Sanitary Board, to whom the whole correspondence was sent

Vide Current No. 715 M. in G.O., No. 583 M., dated 31st March 1896.

for remarks, was of opinion that, before the question of the advisability of using the water of this tank could be determined, an exploratory boring well or excavation should be made in the immediate proximity of the tank in view to ascertaining the existence or non-existence of water of good quality at the lower stratum, as supposed by Dr. King, and stated that, when this had been done and the quantity of the source and the feasibility of

measures providing for the exclusion of the subsoil water had been determined, the Board would be in a position to advise finally as to the adoption of the Mananchira tank scheme or the alternative Poloor Hill scheme proposed by Mr. Ellis.

6. The Municipal Council which was thereupon requested to take steps to furnish the information required by the

G.O., No. 583 M., dated 31st August 1896.

Sanitary Board, carried out the necessary experiments and reported the results to the Board through the Sanitary Engineer, and the Sanitary Board now submits the Sanitary Engineer's report in the matter with its resolution thereon. The Sanitary Engineer states that the results of the experiments show that the Mananchira tank receives its supply from two distinct sources, viz., (1) an upper sandy layer liable to contamination and (2) a porous layer below an impermeable stratum—presumably containing a pure water. Judging from the position of the strata, the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water and accordingly proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchira tank, a small elevated reservoir and distribution pipes therefrom. He states that the scheme cannot be taken up for some time yet, but will be put on the programme at the earliest opportunity. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that before sinking below the laterite, each well is steined with laterite in cement to prevent the ingress of water from the upper pervious strata, and approves the general idea of the scheme on the said lines. The Sanitary Board, however, observes that the scheme would be of little practical value, unless all wells in Mappilla yards are closed beyond possibility of secret use.

7. In these circumstances, it is submitted that the Sanitary Engineer may be requested to undertake the preparation of the scheme, as soon as possible, on the lines approved by the Sanitary Board and that the attention of the Municipal Council may be drawn to the Sanitary Board's remark regarding the closure of all private wells in the Mappilla quarters, when the scheme has been executed. The accompanying draft order is submitted for approval.

V. RAGHAVA CHARLU—20-8-98.

H. TREMENHEERE—26-8-98.

[G.O., No. 1548 M., dated 5th September 1898.]

Government of Madras.
LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

<i>Recd.</i>	} 1898.	<i>Enclosures</i>
<i>Regd.</i>		<i>Spare copies</i>

G.O., No. 1548 M., 5th September 1898.

Water-supply.

Requesting, with remarks, the Sanitary Engineer to undertake the preparation of a scheme for the — of Calicut on the lines approved by the Sanitary Board.

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

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G.O., No. 1548 M., 5th September 1898.

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Requesting, with remarks, the Sanitary Engineer to undertake the preparation of a scheme for the — of Calicut on the lines approved by the Sanitary Board.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

Read—the following paper :—

Proceedings of the Sanitary Board, No. 371/S., dated 27th June 1898.

Read—the following paper :—

Office-note—from J. A. JONES, Esq., Sanitary Engineer to Government.
To—the Secretary, Sanitary Board.
Dated—the 10th May 1898.
No.—940.

Calicut Water-supply.

About the year 1890 a suggestion was made by this Department that a supply of water for the Mappilla quarters of Calicut should be obtained from the Mananchera tank situated near the centre of and at the highest point of Calicut. After much discussion the Municipal Council accepted the proposal, but as doubts as to the quality and quantity of the supply were raised, the Sanitary Board in its Proceedings No. ² S.B.F. of 24th February 1896 (copy attached) ordered certain investigations to be made.

2. There has been a good deal of delay in getting the well sunk, the well first sunk was a failure and progress with a second one has been very slow.

3. The results of sinking the well, however, are now available and will be found reported in the overseer's report forwarded with the Chairman's letter No. ¹⁶ of 6th January 1898 (copy attached).

4. The overseer has, however, not identified the various samples from the strata correctly and these are correctly shown in a note by the Assistant Sanitary Engineer (copy herewith). I have examined the samples and concur with his remarks.

5. The main question at issue has been whether the Mananchera tank receives any supply from a pure source—that it does so cannot now be doubted because the white sand layers 8 feet in thickness are perfectly pure indeed, no whiter sand could possibly be found.

6. Under this is a bed of lignite which forms the bed of the tank and this is 4 feet thick; below this again there is coarse sand and sand and gravel so that even if enough water were not procurable from the white sand, this lower strata can be drawn on.

7. It may be noted in passing that a similar bed of lignite to that already referred to was found when boring at Cochin.

8. From the position of strata, I think it possible that wells sunk into the white sand or the lower coarse sand will yield artesian water.

9. The water of the Mananchera tank has been declared usable, the albumenoid ammonia was slightly high, but this can be understood with an open tank.

10. That pure water can be obtained from wells sunk around the tank cannot be doubted and the quantity should be ample, but this it has been impossible to test as the well sunk cannot be baled out by manual labour and no steam pump is available near Calicut. The contents of the tank itself which fills yearly, however, would yield an ample supply as shown in Chairman's letter quoted below so that with constant pumping there can be no fear of insufficiency.

11. It is proposed that a scheme should be prepared for the supply to the Mappilla quarters of Calicut. The main feature of this scheme being a series of wells adjacent to the Mananchera tank, a small elevated reservoir and distribution pipes therefrom.

12. The scheme cannot be taken up for sometime yet but will be put on the programme at the earliest opportunity.

13. The following is a list of the papers accompanying—

- (1) Report of Assistant Sanitary Engineer to Government, 1890.
- (1-A) Letter from the Acting Sanitary Engineer to Government, No. 2417, of 29th October 1894.
- (2) Letter from the Sanitary Engineer to Government, No. 813, of 26th March 1895.
- (3) Letter from the Chairman, Municipal Council, Calicut, No. 915, of 3rd October 1895.
- (4) Note of Sanitary Commissioner, No. ²¹⁹⁶ S, of 2nd December 1895.
- (5) Note by Colonel Campbell, No. 12/S, of 27th January 1896.
- (6) Resolution of the Sanitary Board, No. ² S.B.F., of 24th February 1896.
- (7) Report of overseer and Chairman's letter, No. 15, of 6th January 1898.
- (8) Note by Assistant Sanitary Engineer to Government, dated 9th May 1898.

ENCLOSURES.

Letter—from M.R.Ry. P. RARICHAN, Road Overseer, Calicut.
To—the Chairman, Municipal Council, Calicut.
Dated—the 4th January 1898.
No.—148.

I beg to report that I have herewith sent the sample of earth packed up, in a tin case, taken at every 4 feet of the depth of the pot well lately sunk at the Municipal garden near Mananchera tank, Calicut, for the inspection of the Sanitary Engineer, Madras.

The subjoined is the list of the earth enclosed :—

1 to 4 feet	..	..	..	..	Sandy soil, light black.
4 " 8 feet	..	..	..	..	do. a little white.
8 " 12 feet	..	..	..	..	Reddish.
12 " 16 feet	..	..	..	..	Chalk white clay
16 " 20 feet	..	..	..	..	Do. pure white } Sand pure white.
20 " 24 feet	..	..	..	..	Black clay lignite.
24 " 28 feet	..	..	..	..	Reddish clay—gravel and sand.
28 " 30 feet	..	..	..	..	do. the total depth of the pot well.

I also beg to report that in sounding Mananchera tank I have found it in all 19½ feet deep to the ground level, viz., depth of water 15 feet, above water to the road level 4½ feet.

Letter—from M.R.Ry. R. RAMA RAO Avargal, Chairman, Municipal Council, Calicut.
To—the Sanitary Engineer to Government.
Dated—the 6th January 1898.
No.—¹⁵ 98

In continuation of this office letter No. 1298, dated 30th June 1897, I have the honour to inform you that the pot well has been sunk to a depth of 30 feet.

A copy of the road overseer's report on the subject together with samples of earth excavated from the well are also forwarded herewith.

Note by Assistant Sanitary Engineer on Calicut Water-supply, dated 9th May 1898.

I had intended to go to Calicut, but subsequently found that doing so would be of little use because—

- (1) The well could not be baled out by manual labour.
- (2) There was no steam pump available there.
- (3) Even if one were available, I don't think the well would stand pumping. It would collapse as it frequently did before.

A section of the boring (vide sketch below) proves Dr. King's theory to be true. Strata (1) and (2) are sandy, porous and water-bearing; stratum (3) is impermeable indurated clay; strata (4) and (5) are porous water-bearing sands, and below these there is a bed of lignite.

No. 1548 M., 5TH SEPTEMBER 1898.

The tank, therefore, receives its supply from a sandy layer at the top naturally open to contamination, and secondly from another porous layer, bedded between two impermeable layers—this water, therefore, being presumably purer than that obtained from the top layers.

I may note here that the section of the well indicates a fair prospect of a good supply being obtained by a deep boring.

I may also mention that it is popularly believed that there is a well in the bed of the tank. If it be so, the tank must also be deriving a supply from the stratum of gravel below the lignite bed.

Resolution—No. 371/S., dated 27th June 1898.

The question of a water-supply scheme for the Mappilla quarters of the town of Calicut has been under consideration for some years, the proposed source of supply being the Mananchera tank. Before deciding on the use of this water, the late Sanitary Board considered * it necessary that an exploratory boring well or excavation should be made in the immediate proximity of the tank, in order to ascertain whether there exists, as suspected, a subterranean supply of good quality.

2. The Sanitary Engineer now submits the results of the boring which shows that the tank receives its supply from two distinct sources, viz.—

(1) an upper sandy layer liable to contamination, and

(2) a porous layer below an impermeable stratum, presumably a pure water.

3. Judging from the position of the strata the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water.

4. He proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchera tank, a small elevated reservoir, and distribution pipes therefrom.

5. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that, before sinking below the laterite, each well is stained with laterite in cement, to prevent the ingress of water from the upper pervious strata. The scheme would be, however, of little practical value unless all wells in Mappilla yards are closed beyond possibility of secret use. On these lines the general idea of the scheme is approved by the Sanitary Board and is recommended to Government.

(True Extract.)

R. PARSONS,
Secretary, Sanitary Board.

To the Secretary to Government, Local and Municipal Department,
with papers in original.

Order—No. 1548 M., dated 5th September 1898.

The Sanitary Engineer is requested to undertake, as soon as possible, the preparation of a scheme for the water-supply of Calicut on the lines approved by the Sanitary Board.

2. The attention of the Municipal Council is drawn to the Sanitary Board's remark that all the wells in Mappilla yards should be closed when the scheme has been carried out.

(True Extract.)

H. TREMENHEERE,
Secretary to Government.

To the Chairman, Municipal Council, Calicut.
" Collector of Malabar.
" Sanitary Board, with enclosures returned.
" Commissioner.
" Engineer.

LOCAL AND MUNICIPAL DEPARTMENT.

NOTES CONNECTED WITH G.O., No. 1548 M., DATED
5TH SEPTEMBER 1898.

Previous papers.

G.O., No. 1871 M., dated	8th December	1890.
" " 1396 M. "	31st August	1891.
" " 930 M. "	26th May	1892.
" " 1114 M. "	28th June	"
" " 513 M. "	23rd April	1894.
" " 522 M. "	5th May	"
" " 583 M. "	31st March	1896.

[SUBJECT.—Calicut water-supply scheme.]

From the Sanitary Board, dated 27th June 1898, No. 371-S.

In his report on the inspection of Calicut in September 1890, the Assistant Sanitary Engineer stated—

(1) that the water-supply of the town which was chiefly obtained from private wells, of which there was one in almost every compound and garden, was good, except in the Mappilla quarters, where the soil was so far contaminated already and the water level was so little below the surface of the ground, that the drainage of the place, though preventing the further progress of mischief, would be powerless in checking the causes of pollution that already existed in the soil;

(2) that a good and sufficient supply of water could be obtained for the Mappillas from the Mananchira tank, which was situated to the north-east of the town on a high level and was therefore less liable to contamination; and

(3) that as this tank was not used by the people on account of its distance, the only way to induce them to use the water would be to bring it to their doors by means of pipes.

He therefore suggested the preparation of a scheme for the water-supply of the Mappilla quarters from this tank, the cost of which was roughly estimated by him to be between Rs. 75,000 and Rs. 1,00,000.

2. The Municipal Council of Calicut, however, did not approve the proposal for the reasons, firstly, that its financial condition did not admit of any expenditure being incurred towards the scheme and secondly, that the drainage of the town was more important than water-supply. But the Government overruled the Council's objection on the ground that the report of the Sanitary Engineer afforded ample proof of the immediate necessity for improving the sanitation of the town and considered that the water-supply scheme should have precedence over the drainage scheme. The Municipal Council was accordingly directed to make the

Paragraph 2 of G.O., No. 1396 M., dated 31st August 1891.
G.O., No. 1114 M., dated 28th June 1892.

necessary provision for the investigation of the water-supply project, which was thereupon put down on the Sanitary Engineer's programme for 1895.

3. In the meantime, the Sanitary Commissioner, who inspected Calicut in 1894, considered that before deciding upon the Mananchira tank as the source for the future water-supply of the Mappilla quarters, it was necessary that certain matters should be investigated. He doubted the sufficiency of water in the Mananchira tank and also the quality of the supply. He considered that the tank was apparently fed by a special stratum of water under pressure confined between two impervious strata, one of which had been penetrated, as well as from the ordinary subsoil water, and that, as the subsoil water was evidently open to much pollution, it should not be drawn upon for the supply of Calicut, if it was possible to do otherwise. He therefore suggested that exploratory borings should be made for the purpose of ascertaining more as to subsoil conditions, and especially to find out whether any impervious stratum of clay underlay the previous upper stratum on which the surface water was supported, and that if this was found to be the case, bored or driven wells could be used within the interior of the town or even the Mananchira tank might be employed, if by iron cylinders or other measures the subsoil water were excluded. He added that, if this was not proved and if it was found necessary to depend upon the subsoil water, it would be requisite to select an area sufficiently removed from the town to guarantee the purity of the soil.

4. The Sanitary Engineer Mr. Ellis, to whom the Sanitary Commissioner's letter was referred for remarks, visited Calicut in 1894, and reported that as the position of the Mananchira tank was certainly not very desirable, it would be much better to go beyond the town for a source of supply and that there were several springs at the foot of the Poloor Hill, which was about 3 miles from Calicut, where wells yielding a pure supply might be sunk. He estimated the cost of this scheme at 4 lakhs and recommended that, if the finances of the Municipality did not permit of its being undertaken for some years to come, the Mananchira tank might be tested with regard to its yield, with the view of making it the source of supply as a temporary measure for the Mappilla quarters until such time as the Municipality could find the necessary funds for a larger scheme. He also observed that whatever pipes were laid as a temporary measure could form part of the larger scheme, whenever that came into existence, and added that the urgent need for a water-supply scheme for the Mappilla quarters had already been fully explained in the Assistant Sanitary Engineer's report of 1890, that the popular opinion about the water of the Mananchira tank was that it was good, that it was used by Europeans and Eurasians living near the tank, that the chemical analysis showed that the only impurity which was in excess of the standard fixed for 'usable' water was albumenoid ammonia and that there were indications that this impurity was of vegetable origin and therefore not very dangerous.

5. The Municipal Council, to which the Sanitary Engineer's letter was referred for remarks, stated that it was not ambitious to provide a correct scheme of water-supply to the whole town, which extended over an area of $13\frac{1}{4}$ square miles, as its cost, viz., 4 lakhs, was beyond its means and as the A, G and H Divisions of the town obtained a good supply of potable water from wells, and that it resolved to accept the scheme for the supply of water from the Mananchira tank. The Sanitary Board, to whom the whole correspondence was sent for remarks, was of opinion that, before the question of the advisability of using the water of this tank could be determined, an exploratory boring well or excavation should be made in the immediate proximity of the tank in view to ascertaining the existence or non-existence of water of good quality at the lower stratum, as supposed by Dr. King, and stated that, when this had been done and the quantity of the source and the feasibility of

measures providing for the exclusion of the subsoil water had been determined, the Board would be in a position to advise finally as to the adoption of the Mananchira tank scheme or the alternative Poloor Hill scheme proposed by Mr. Ellis.

6. The Municipal Council which was thereupon requested to take steps to furnish the information required by the Sanitary Board, carried out the necessary experiments and reported the results to the Board through the Sanitary Engineer, and the Sanitary Board now submits the Sanitary Engineer's report in the matter with its resolution thereon. The Sanitary Engineer states that the results of the experiments show that the Mananchira tank receives its supply from two distinct sources, viz., (1) an upper sandy layer liable to contamination and (2) a porous layer below an impermeable stratum—presumably containing a pure water. Judging from the position of the strata, the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water and accordingly proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchira tank, a small elevated reservoir and distribution pipes therefrom. He states that the scheme cannot be taken up for some time yet, but will be put on the programme at the earliest opportunity. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that before sinking below the laterite, each well is steined with laterite in cement to prevent the ingress of water from the upper pervious strata, and approves the general idea of the scheme on the said lines. The Sanitary Board, however, observes that the scheme would be of little practical value, unless all wells in Mappilla yards are closed beyond possibility of secret use.

7. In these circumstances, it is submitted that the Sanitary Engineer may be requested to undertake the preparation of the scheme, as soon as possible, on the lines approved by the Sanitary Board and that the attention of the Municipal Council may be drawn to the Sanitary Board's remark regarding the closure of all private wells in the Mappilla quarters, when the scheme has been executed. The accompanying draft order is submitted for approval.

V. RAGHAVA CHARLU—20-8-98.

H. TREMENHEERE—26-8-98.

[G.O., No. 1548 M., dated 5th September 1898.]

Government of Madras.
LOCAL AND MUNICIPAL DEPARTMENT.

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2. There has been a good deal of delay in getting the well sunk, the well first sunk was a failure and progress with a second one has been very slow.

3. The results of sinking the well, however, are now available and will be found reported in the overseer's report forwarded with the Chairman's letter No. ¹⁵ of 6th January 1898 (copy attached).

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5. The main question at issue has been whether the Mananchera tank receives any supply from a pure source—that it does so cannot now be doubted because the white sand layers 8 feet in thickness are perfectly pure indeed, no whiter sand could possibly be found.

6. Under this is a bed of lignite which forms the bed of the tank and this is 4 feet thick; below this again there is coarse sand and sand and gravel so that even if enough water were not procurable from the white sand, this lower strata can be drawn on.

7. It may be noted in passing that a similar bed of lignite to that already referred to was found when boring at Cochin.

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9. The water of the Mananchera tank has been declared usable, the albumenoid ammonia was slightly high, but this can be understood with an open tank.

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ENCLOSURES.

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To—the Chairman, Municipal Council, Calicut.

Dated—the 4th January 1898.

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The subjoined is the list of the earth enclosed:—

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12 " 16 feet	..	..	..	..	Chalk white clay
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24 " 28 feet	..	..	..	..	Reddish clay—gravel and sand.
28 " 30 feet	..	..	..	..	do. the total depth of the pot well.

I also beg to report that in sounding Mananchera tank I have found it in all 19½ feet deep to the ground level, viz., depth of water 15 feet, above water to the road level 4½ feet.

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A section of the boring (*vide* sketch below) proves Dr. King's theory to be true. Strata (1) and (2) are sandy, porous and water-bearing; stratum (3) is impermeable indurated clay; strata (4) and (5) are porous water-bearing sands, and below these there is a bed of lignite.

No. 1548 M., 5TH SEPTEMBER 1898.

The tank, therefore, receives its supply from a sandy layer at the top naturally open to contamination, and secondly from another porous layer, bedded between two impermeable layers—this water, therefore, being presumably purer than that obtained from the top layers.

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(True Extract.)

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Secretary, Sanitary Board.

To the Secretary to Government, Local and Municipal Department,
with papers in original.

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To the Chairman, Municipal Council, Calicut.
" Collector of Malabar.
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" Engineer.

LOCAL AND MUNICIPAL DEPARTMENT.

NOTES CONNECTED WITH G.O., No. 1543 M., DATED
5TH SEPTEMBER 1898.

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" " 582 M.	"	5th May	"
" " 583 M.	"	31st March	1896.

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He therefore suggested the preparation of a scheme for the water-supply of the Mappilla quarters from this tank, the cost of which was roughly estimated by

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2. The Municipal Council of Calicut, however, did not approve the proposal for the reasons, firstly, that its financial condition did not admit of any expenditure being incurred towards the scheme and secondly, that the drainage of the town was more important than water-supply. But the Government overruled the Council's objection on the ground that the report of the Sanitary Engineer afforded ample proof of the immediate necessity for improving the sanitation of the town and considered that the water-supply scheme should have precedence over the drainage scheme. The Municipal Council was accordingly directed to make the

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necessary provision for the investigation of the water-supply project, which was thereupon put down on the Sanitary Engineer's programme for 1895.

G.O., No. 582 M., dated 5th May 1894.

3. In the meantime, the Sanitary Commissioner, who inspected Calicut in 1894, considered that before deciding upon the Mananchira tank as the source for the future water-supply of the Mappilla quarters, it was necessary that certain matters should be investigated. He doubted the sufficiency of water in the Mananchira tank and also the quality of the supply. He considered that the tank was apparently fed by a special stratum of water under pressure confined between two impervious strata, one of which had been penetrated, as well as from the ordinary subsoil water, and that, as the subsoil water was evidently open to much pollution, it should not be drawn upon for the supply of Calicut, if it was possible to do otherwise. He therefore suggested that exploratory borings should be made for the purpose of ascertaining more as to subsoil conditions, and especially to find out whether any impervious stratum of clay underlay the previous upper stratum on which the surface water was supported, and that if this was found to be the case, bored or driven wells could be used within the interior of the town or even the Mananchira tank might be employed, if by iron cylinders or other measures the subsoil water were excluded. He added that, if this was not proved and if it was found necessary to depend upon the subsoil water, it would be requisite to select an area sufficiently removed from the town to guarantee the purity of the soil.

Vide his remarks in G.O., No. 513 M., dated 23rd April 1894.

4. The Sanitary Engineer Mr. Ellis, to whom the Sanitary Commissioner's letter was referred for remarks, visited Calicut in 1894, and reported that as the position of the Mananchira tank was certainly not very desirable, it would be much better to go beyond the town for a source of supply and that there were several springs at the foot of the Poloor Hill, which was about 3 miles from Calicut, where wells yielding a pure supply might be sunk. He estimated the cost of this scheme at 4 lakhs and recommended that, if the finances of the Municipality did not permit of its being undertaken for some years to come, the Mananchira tank might be tested with regard to its yield, with the view of making it the source of supply as a temporary measure for the Mappilla quarters until such time as the Municipality could find the necessary funds for a larger scheme. He also observed that whatever pipes were laid as a temporary measure could form part of the larger scheme, whenever that came into existence, and added that the urgent need for a water-supply scheme for the Mappilla quarters had already been fully explained in the Assistant Sanitary Engineer's report of 1890, that the popular opinion about the water of the Mananchira tank was that it was good, that it was used by Europeans and Eurasians living near the tank, that the chemical analysis showed that the only impurity which was in excess of the standard fixed for 'usable' water was albumenoid ammonia and that there were indications that this impurity was of vegetable origin and therefore not very dangerous.

5. The Municipal Council, to which the Sanitary Engineer's letter was referred for remarks, stated that it was not ambitious to provide a correct scheme of water-supply to the whole town, which extended over an area of $13\frac{1}{4}$ square miles, as its cost, viz., 4 lakhs, was beyond its means and as the A, G and H Divisions of the town obtained a good supply of potable water from wells, and that it resolved to accept the scheme for the supply of water from the Mananchira tank. The Sanitary Board, to whom the whole correspondence was sent for remarks, was of opinion that, before the question of the advisability of using the water of this tank could be determined, an exploratory boring well or excavation should be made in the immediate proximity of the tank in view to ascertaining the existence or non-existence of water of good quality at the lower stratum, as supposed by Dr. King, and stated that, when this had been done and the quantity of the source and the feasibility of

measures providing for the exclusion of the subsoil water had been determined, the Board would be in a position to advise finally as to the adoption of the Mananchira tank scheme or the alternative Poloor Hill scheme proposed by Mr. Ellis.

6. The Municipal Council which was thereupon requested to take steps to furnish the information required by the Sanitary Board, carried out the necessary experiments and reported the results to the Board through the Sanitary Engineer, and the Sanitary Board now submits the Sanitary Engineer's report in the matter with its resolution thereon. The Sanitary Engineer states that the results of the experiments show that the Mananchira tank receives its supply from two distinct sources, viz., (1) an upper sandy layer liable to contamination and (2) a porous layer below an impermeable stratum—presumably containing a pure water. Judging from the position of the strata, the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water and accordingly proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchira tank, a small elevated reservoir and distribution pipes therefrom. He states that the scheme cannot be taken up for some time yet, but will be put on the programme at the earliest opportunity. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that before sinking below the laterite, each well is steined with laterite in cement to prevent the ingress of water from the upper pervious strata, and approves the general idea of the scheme on the said lines. The Sanitary Board, however, observes that the scheme would be of little practical value, unless all wells in Mappilla yards are closed beyond possibility of secret use.

7. In these circumstances, it is submitted that the Sanitary Engineer may be requested to undertake the preparation of the scheme, as soon as possible, on the lines approved by the Sanitary Board and that the attention of the Municipal Council may be drawn to the Sanitary Board's remark regarding the closure of all private wells in the Mappilla quarters, when the scheme has been executed. The accompanying draft order is submitted for approval.

V. RAGHAVA CHARLU—20-8-98.

H. TREMENHEERE—26-8-98.

[G.O., No. 1548 M., dated 5th September 1898.]

Government of Madras.
LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

<i>Recd.</i>	} 1898.	<i>Enclosures</i>
<i>Regd.</i>		<i>Spare copies</i>

G.O., No. 1548 M., 5th September 1898.

Water-supply.

Requesting, with remarks, the Sanitary Engineer to undertake the preparation of a scheme for the — of Calicut on the lines approved by the Sanitary Board.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following paper :—

Proceedings of the Sanitary Board, No. 371/S., dated 27th June 1898.

Read—the following paper :—

Office-note—from J. A. JONES, Esq., Sanitary Engineer to Government.
To—the Secretary, Sanitary Board.
Dated—the 10th May 1898.
No.—940.

Calicut Water-supply.

About the year 1890 a suggestion was made by this Department that a supply of water for the Mappilla quarters of Calicut should be obtained from the Mananchera tank situated near the centre of and at the highest point of Calicut. After much discussion the Municipal Council accepted the proposal, but as doubts as to the quality and quantity of the supply were raised, the Sanitary Board in its Proceedings No. ²/_{S.B.F.} of 24th February 1896 (copy attached) ordered certain investigations to be made.

2. There has been a good deal of delay in getting the well sunk, the well first sunk was a failure and progress with a second one has been very slow.

3. The results of sinking the well, however, are now available and will be found reported in the overseer's report forwarded with the Chairman's letter No. ¹⁶/₉₈ of 6th January 1898 (copy attached).

4. The overseer has, however, not identified the various samples from the strata correctly and these are correctly shown in a note by the Assistant Sanitary Engineer (copy herewith). I have examined the samples and concur with his remarks.

5. The main question at issue has been whether the Mananchera tank receives any supply from a pure source—that it does so cannot now be doubted because the white sand layers 8 feet in thickness are perfectly pure indeed, no whiter sand could possibly be found.

6. Under this is a bed of lignite which forms the bed of the tank and this is 4 feet thick; below this again there is coarse sand and sand and gravel so that even if enough water were not procurable from the white sand, this lower-strata can be drawn on.

7. It may be noted in passing that a similar bed of lignite to that already referred to was found when boring at Cochin.

8. From the position of strata, I think it possible that wells sunk into the white sand or the lower coarse sand will yield artesian water.

9. The water of the Mananchera tank has been declared usable, the albumenoid ammonia was slightly high, but this can be understood with an open tank.

10. That pure water can be obtained from wells sunk around the tank cannot be doubted and the quantity should be ample, but this it has been impossible to test as the well sunk cannot be baled out by manual labour and no steam pump is available near Calicut. The contents of the tank itself which fills yearly, however, would yield an ample supply as shown in Chairman's letter quoted below so that with constant pumping there can be no fear of insufficiency.

11. It is proposed that a scheme should be prepared for the supply to the Mappilla quarters of Calicut. The main feature of this scheme being a series of wells adjacent to the Mananchera tank, a small elevated reservoir and distribution pipes therefrom.

12. The scheme cannot be taken up for sometime yet but will be put on the programme at the earliest opportunity.

13. The following is a list of the papers accompanying—

- (1) Report of Assistant Sanitary Engineer to Government, 1890.
- (1-A) Letter from the Acting Sanitary Engineer to Government, No. 2417, of 29th October 1894.
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- (3) Letter from the Chairman, Municipal Council, Calicut, No. 915, of 3rd October 1895.
- (4) Note of Sanitary Commissioner, No. ²¹⁹⁵/₈, of 2nd December 1895.
- (5) Note by Colonel Campbell, No. 12/S, of 27th January 1896.
- (6) Resolution of the Sanitary Board, No. ²/_{S.B.F.}, of 24th February 1896.
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ENCLOSURES.

Letter—from M.R.Ry. P. BARICHAN, Road Overseer, Calicut.
To—the Chairman, Municipal Council, Calicut.
Dated—the 4th January 1898.
No.—148.

I beg to report that I have herewith sent the sample of earth packed up, in a tin case, taken at every 4 feet of the depth of the pot well lately sunk at the Municipal garden near Mananchera tank, Calicut, for the inspection of the Sanitary Engineer, Madras.

The subjoined is the list of the earth enclosed :—

1 to 4 feet	.. .. .	Sandy soil, light black.
4 " 8 feet	.. .. .	do. a little white.
8 " 12 feet	.. .. .	Reddish.
12 " 16 feet	.. .. .	Chalk white clay
16 " 20 feet	.. .. .	Do. pure white } Sand pure white.
20 " 24 feet	.. .. .	Black clay lignite.
24 " 28 feet	.. .. .	Reddish clay—gravel and sand.
28 " 30 feet	.. .. .	do. the total depth of the pot well.

I also beg to report that in sounding Mananchera tank I have found it in all 19½ feet deep to the ground level, viz., depth of water 15 feet, above water to the road level 4½ feet.

Letter—from M.R.Ry. R. RAMA RAO Avargal, Chairman, Municipal Council, Calicut.
To—the Sanitary Engineer to Government.
Dated—the 6th January 1898.
No.—¹⁵/₉₈.

In continuation of this office letter No. 1298, dated 30th June 1897, I have the honour to inform you that the pot well has been sunk to a depth of 30 feet.

A copy of the road overseer's report on the subject together with samples of earth excavated from the well are also forwarded herewith.

Note by Assistant Sanitary Engineer on Calicut Water-supply, dated 9th May 1898.

I had intended to go to Calicut, but subsequently found that doing so would be of little use because—

- (1) The well could not be baled out by manual labour.
 - (2) There was no steam pump available there.
 - (3) Even if one were available, I don't think the well would stand pumping. It would collapse as it frequently did before.
- A section of the boring (*vide* sketch below) proves Dr. King's theory to be true. Strata (1) and (2) are sandy, porous and water-bearing; stratum (3) is impermeable indurated clay; strata (4) and (5) are porous water-bearing sands, and below these there is a bed of lignite.

No. 1548 M., 5TH SEPTEMBER 1898.

The tank, therefore, receives its supply from a sandy layer at the top naturally open to contamination, and secondly from another porous layer, bedded between two impermeable layers—this water, therefore, being presumably purer than that obtained from the top layers.

I may note here that the section of the well indicates a fair prospect of a good supply being obtained by a deep boring.

I may also mention that it is popularly believed that there is a well in the bed of the tank. If it be so, the tank must also be deriving a supply from the stratum of gravel below the lignite bed.

Resolution—No. 371/S., dated 27th June 1898.

The question of a water-supply scheme for the Mappilla quarters of the town of Calicut has been under consideration for some years, the proposed source of supply being the Mananchera tank. Before deciding on the use of this water, the late Sanitary Board considered it necessary that

* Proceedings No. ² S.B.F., dated 24th February 1896. an exploratory boring well or excavation should be made in the immediate proximity of the tank, in order to ascertain whether there exists, as suspected, a subterranean supply of good quality.

2. The Sanitary Engineer now submits the results of the boring which shows that the tank receives its supply from two distinct sources, viz.—

(1) an upper sandy layer liable to contamination, and

(2) a porous layer below an impermeable stratum, presumably a pure water.

3. Judging from the position of the strata the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water.

4. He proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchera tank, a small elevated reservoir, and distribution pipes therefrom.

5. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that, before sinking below the laterite, each well is stained with laterite in cement, to prevent the ingress of water from the upper pervious strata. The scheme would be, however, of little practical value unless all wells in Mappilla yards are closed beyond possibility of secret use. On these lines the general idea of the scheme is approved by the Sanitary Board and is recommended to Government.

(True Extract.)

R. PARSONS,
Secretary, Sanitary Board.

To the Secretary to Government, Local and Municipal Department,
with papers in original.

Order—No. 1548 M., dated 5th September 1898.

The Sanitary Engineer is requested to undertake, as soon as possible, the preparation of a scheme for the water-supply of Calicut on the lines approved by the Sanitary Board.

2. The attention of the Municipal Council is drawn to the Sanitary Board's remark that all the wells in Mappilla yards should be closed when the scheme has been carried out.

(True Extract.)

H. TREMENHEERE,
Secretary to Government.

To the Chairman, Municipal Council, Calicut.
" Collector of Malabar.
" Sanitary Board, with enclosures returned.
" Commissioner.
" Engineer.

LOCAL AND MUNICIPAL DEPARTMENT.

NOTES CONNECTED WITH G.O., No. 1548 M., DATED
5TH SEPTEMBER 1898.

Previous papers.

G.O., No. 1871 M.,	dated	8th December	1890.
" " 1396 M.	"	31st August	1891.
" " 930 M.	"	26th May	1892.
" " 1114 M.	"	28th June	"
" " 513 M.	"	23rd April	1894.
" " 542 M.	"	5th May	"
" " 583 M.	"	31st March	1896.

[SUBJECT.—Calicut water-supply scheme.]

From the Sanitary Board, dated 27th June 1898, No. 371-S.

In his report on the inspection of Calicut in September 1890, the Assistant Sanitary Engineer stated—

(1) that the water-supply of the town which was chiefly obtained from private wells, of which there was one in almost every compound and garden, was good, except in the Mappilla quarters, where the soil was so far contaminated already and the water level was so little below the surface of the ground, that the drainage of the place, though preventing the further progress of mischief, would be powerless in checking the causes of pollution that already existed in the soil;

(2) that a good and sufficient supply of water could be obtained for the Mappillas from the Mananchira tank, which was situated to the north-east of the town

on a high level and was therefore less liable to contamination; and
(3) that as this tank was not used by the people on account of its distance, the only way to induce them to use the water would be to bring it to their doors by means of pipes.

He therefore suggested the preparation of a scheme for the water-supply of the Mappilla quarters from this tank, the cost of which was roughly estimated by

him to be between Rs. 75,000 and Rs. 1,00,000.

2. The Municipal Council of Calicut, however, did not approve the proposal for the reasons, firstly, that its financial condition did not admit of any expenditure being incurred towards the scheme and secondly, that the drainage of the town was more important than water-supply. But the Government overruled the Council's objection on the ground that the report of the Sanitary Engineer afforded ample proof of the immediate necessity for improving the sanitation of the town and considered that the water-supply scheme should have precedence over the drainage scheme. The Municipal Council was accordingly directed to make the

Paragraph 2 of G.O., No. 1396 M., dated 31st August 1891.
G.O., No. 1114 M., dated 28th June 1892.

necessary provision for the investigation of the water-supply project, which was

G.O., No. 582 M., dated 5th May 1894.

thereupon put down on the Sanitary Engineer's programme for 1895.

3. In the meantime, the Sanitary Commissioner, who inspected Calicut in 1894, considered that before deciding upon the Mananchira tank as the source for the future water-supply of the Mappilla quarters, it was necessary that certain matters should be investigated. He doubted the sufficiency of water in the Mananchira tank and also the quality of the supply. He considered that the tank was apparently fed by a special stratum of water under pressure confined between two impervious strata, one of which had been penetrated, as well as from the ordinary subsoil water, and that, as the subsoil water was evidently open to much pollution, it should not be drawn upon for the supply of Calicut, if it was possible to do otherwise. He therefore suggested that exploratory borings should be made for the purpose of ascertaining more as to subsoil conditions, and especially to find out whether any impervious stratum of clay underlay the previous upper

Vide his remarks in G.O., No. 513 M., dated 23rd April 1894. stratum on which the surface water was supported, and that if this was found to be the case, bored or driven wells could be used within the interior of the town or even the Mananchira tank might be employed, if by iron cylinders or other measures the subsoil water were excluded. He added that, if this was not proved and if it was found necessary to depend upon the subsoil water, it would be requisite to select an area sufficiently removed from the town to guarantee the purity of the soil.

4. The Sanitary Engineer Mr. Ellis, to whom the Sanitary Commissioner's letter was referred for remarks, visited Calicut in 1894, and reported that as the position of the Mananchira tank was certainly not

very desirable, it would be much better to go beyond the town for a source of supply and that there were several springs at the foot of the Poloor Hill, which was about 3 miles from Calicut, where wells yielding a pure supply might be sunk. He estimated the cost of this scheme at 4 lakhs and recommended that, if the finances of the Municipality did not permit of its being undertaken for some years to come, the Mananchira tank might be tested with regard to its yield, with the view of making it the source of supply as a temporary measure for the Mappilla quarters until such time as the Municipality could find the necessary funds for a larger scheme. He also observed that whatever pipes were laid as a temporary measure could form part of the larger scheme, whenever that came into existence, and added that the urgent need for a water-supply scheme for the Mappilla quarters had already been fully explained in the Assistant Sanitary Engineer's report of 1890, that the popular opinion about the water of the Mananchira tank was that it was good, that it was used by Europeans and Eurasians living near the tank, that the chemical analysis showed that the only impurity which was in excess of the standard fixed for 'usable' water was albumenoid ammonia and that there were indications that this impurity was of vegetable origin and therefore not very dangerous.

5. The Municipal Council, to which the Sanitary Engineer's letter was referred for remarks, stated that it was not ambitious to provide a correct scheme of water-supply to the whole town, which extended

over an area of 13½ square miles, as its cost, viz., 4 lakhs, was beyond its means and as the A, G and H Divisions of the town obtained a good supply of potable water from wells, and that it resolved to accept the scheme for the supply of water from the Mananchira tank. The Sanitary Board, to whom the whole correspondence was sent

Vide Current No. 715 M. in G.O., No. 583 M., dated 31st March 1896. for remarks, was of opinion that, before the question of the advisability of using the water of this tank could be deter-

mined, an exploratory boring well or excavation should be made in the immediate proximity of the tank in view to ascertaining the existence or non-existence of water of good quality at the lower stratum, as supposed by Dr. King, and stated that, when this had been done and the quantity of the source and the feasibility of

measures providing for the exclusion of the subsoil water had been determined, the Board would be in a position to advise finally as to the adoption of the Mananchira tank scheme or the alternative Poloor Hill scheme proposed by Mr. Ellis.

6. The Municipal Council which was thereupon requested to take steps to furnish the information required by the Sanitary Board, carried out the necessary

experiments and reported the results to the Board through the Sanitary Engineer, and the Sanitary Board now submits the Sanitary Engineer's report in the matter with its resolution thereon. The Sanitary Engineer states that the results of the experiments show that the Mananchira tank receives its supply from two distinct sources, viz., (1) an upper sandy layer liable to contamination and (2) a porous layer below an impermeable stratum—presumably containing a pure water. Judging from the position of the strata, the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water and accordingly proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchira tank, a small elevated reservoir and distribution pipes therefrom. He states that the scheme cannot be taken up for some time yet, but will be put on the programme at the earliest opportunity. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that before sinking below the laterite, each well is steined with laterite in cement to prevent the ingress of water from the upper pervious strata, and approves the general idea of the scheme on the said lines. The Sanitary Board, however, observes that the scheme would be of little practical value, unless all wells in Mappilla yards are closed beyond possibility of secret use.

7. In these circumstances, it is submitted that the Sanitary Engineer may be requested to undertake the preparation of the scheme, as soon as possible, on the lines approved by the Sanitary Board and that the attention of the Municipal Council may be drawn to the Sanitary Board's remark regarding the closure of all private wells in the Mappilla quarters, when the scheme has been executed. The accompanying draft order is submitted for approval.

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Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

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G.O., No. 1548 M., 5th September 1898.

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2. There has been a good deal of delay in getting the well sunk, the well first sunk was a failure and progress with a second one has been very slow.

3. The results of sinking the well, however, are now available and will be found reported in the overseer's report forwarded with the Chairman's letter No. ¹⁵/₉₈ of 6th January 1898 (copy attached).

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6. Under this is a bed of lignite which forms the bed of the tank and this is 4 feet thick; below this again there is coarse sand and sand and gravel so that even if enough water were not procurable from the white sand, this lower strata can be drawn on.

7. It may be noted in passing that a similar bed of lignite to that already referred to was found when boring at Cochin.

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Dated—the 4th January 1898.
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A section of the boring (*vide sketch below*) proves Dr. King's theory to be true. Strata (1) and (2) are sandy, porous and water-bearing; stratum (3) is impermeable indurated clay; strata (4) and (5) are porous water-bearing sands, and below these there is a bed of lignite.

No. 1548 M., 5TH SEPTEMBER 1898.

The tank, therefore, receives its supply from a sandy layer at the top naturally open to contamination, and secondly from another porous layer, bedded between two impermeable layers—this water, therefore, being presumably purer than that obtained from the top layers.

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* Proceedings No. ² S.E.P., dated 24th February 1896. an exploratory boring well or excavation should be made in the immediate proximity of the tank, in order to ascertain whether there exists, as suspected, a subterranean supply of good quality.

2. The Sanitary Engineer now submits the results of the boring which shows that the tank receives its supply from two distinct sources, viz.—

(1) an upper sandy layer liable to contamination, and

(2) a porous layer below an impermeable stratum, presumably a pure water.

3. Judging from the position of the strata the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water.

4. He proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchera tank, a small elevated reservoir, and distribution pipes therefrom.

5. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that, before sinking below the laterite, each well is stained with laterite in cement, to prevent the ingress of water from the upper pervious strata. The scheme would be, however, of little practical value unless all wells in Mappilla yards are closed beyond possibility of secret use. On these lines the general idea of the scheme is approved by the Sanitary Board and is recommended to Government.

(True Extract.)

R. PARSONS,
Secretary, Sanitary Board.

To the Secretary to Government, Local and Municipal Department,
with papers in original.

Order—No. 1548 M., dated 5th September 1898.

The Sanitary Engineer is requested to undertake, as soon as possible, the preparation of a scheme for the water-supply of Calicut on the lines approved by the Sanitary Board.

2. The attention of the Municipal Council is drawn to the Sanitary Board's remark that all the wells in Mappilla yards should be closed when the scheme has been carried out.

(True Extract.)

H. TREMENEER,
Secretary to Government.

To the Chairman, Municipal Council, Calicut.
" Collector of Malabar.
" Sanitary Board, with enclosures returned.
" Commissioner.
" " Engineer.

LOCAL AND MUNICIPAL DEPARTMENT.

NOTES CONNECTED WITH G.O., No. 1543 M., DATED
5TH SEPTEMBER 1898.

Previous papers.

G.O., No. 1871 M., dated	8th December	1890.
" " 1396 M. "	31st August	1891.
" " 930 M. "	26th May	1892.
" " 1114 M. "	28th June	"
" " 513 M. "	23rd April	1894.
" " 582 M. "	5th May	"
" " 583 M. "	31st March	1896.

[SUBJECT.—Calicut water-supply scheme.]

From the Sanitary Board, dated 27th June 1898, No. 371-S.

In his report on the inspection of Calicut in September 1890, the Assistant Sanitary Engineer stated—

(1) that the water-supply of the town which was chiefly obtained from private wells, of which there was one in almost every compound and garden, was good, except in the Mappilla quarters, where the soil was so far contaminated already and the water level was so little below the surface of the ground, that the drainage of the place, though preventing the further progress of mischief, would be powerless in checking the causes of pollution that already existed in the soil;

(2) that a good and sufficient supply of water could be obtained for the Mappillas from the Mananchira tank, which was situated to the north-east of the town on a high level and was therefore less liable to contamination; and

(3) that as this tank was not used by the people on account of its distance, the only way to induce them to use the water would be to bring it to their doors by means of pipes.

Vide paragraph 9 *ibid.*

He therefore suggested the preparation of a scheme for the water-supply of the Mappilla quarters from this tank, the cost of which was roughly estimated by

Vide paragraph 11 *ibid.*

him to be between Rs. 75,000 and Rs. 1,00,000.

2. The Municipal Council of Calicut, however, did not approve the proposal for the reasons, firstly, that its financial condition did not admit of any expenditure being incurred towards the scheme and secondly, that the drainage of the town was more important than water-supply. But the Government overruled the Council's objection on the ground that the report of the Sanitary Engineer afforded ample proof of the immediate necessity for improving the sanitation of the town and considered that the water-supply scheme should have precedence over the drainage scheme. The Municipal Council was accordingly directed to make the

Paragraph 2 of G.O., No. 1396 M., dated 31st August 1891.
Vide Council's resolution in G.O., No. 1396 M., dated 31st August 1891.
Vide Council's resolution in G.O., No. 930 M., dated 26th May 1892.
G.O., No. 1114 M., dated 23th June 1892.

necessary provision for the investigation of the water-supply project, which was thereupon put down on the Sanitary Engineer's programme for 1895.

3. In the meantime, the Sanitary Commissioner, who inspected Calicut in 1894, considered that before deciding upon the Mananchira tank as the source for the future water-supply of the Mappilla quarters, it was necessary that certain matters should be investigated. He doubted the sufficiency of water in the Mananchira tank and also the quality of the supply. He considered that the tank was apparently fed by a special stratum of water under pressure confined between two impervious strata, one of which had been penetrated, as well as from the ordinary subsoil water, and that, as the subsoil water was evidently open to much pollution, it should not be drawn upon for the supply of Calicut, if it was possible to do otherwise. He therefore suggested that exploratory borings should be made for the purpose of ascertaining more as to subsoil conditions, and especially to find out whether any impervious stratum of clay underlay the previous upper stratum on which the surface water was supported, and that if this was found to be the case, bored or driven wells could be

used within the interior of the town or even the Mananchira tank might be employed, if by iron cylinders or other measures the subsoil water were excluded. He added that, if this was not proved and if it was found necessary to depend upon the subsoil water, it would be requisite to select an area sufficiently removed from the town to guarantee the purity of the soil.

4. The Sanitary Engineer Mr. Ellis, to whom the Sanitary Commissioner's letter was referred for remarks, visited Calicut in 1894, and reported that as the position of the Mananchira tank was certainly not very desirable, it would be much better to go beyond the town for a source of supply and that there were several springs at the foot of the Poloor Hill, which was about 3 miles from Calicut, where wells yielding a pure supply might be sunk. He estimated the cost of this scheme at 4 lakhs and recommended that, if the finances of the Municipality did not permit of its being undertaken for some years to come, the Mananchira tank might be tested with regard to its yield, with the view of making it the source of supply as a temporary measure for the Mappilla quarters until such time as the Municipality could find the necessary funds for a larger scheme. He also observed that whatever pipes were laid as a temporary measure could form part of the larger scheme, whenever that came into existence, and added that the urgent need for a water-supply scheme for the Mappilla quarters had already been fully explained in the Assistant Sanitary Engineer's report of 1890, that the popular opinion about the water of the Mananchira tank was that it was good, that it was used by Europeans and Eurasians living near the tank, that the chemical analysis showed that the only impurity which was in excess of the standard fixed for 'usable' water was albumenoid ammonia and that there were indications that this impurity was of vegetable origin and therefore not very dangerous.

5. The Municipal Council, to which the Sanitary Engineer's letter was referred for remarks, stated that it was not ambitious to provide a correct scheme of water-supply to the whole town, which extended over an area of $13\frac{1}{2}$ square miles, as its cost, viz., 4 lakhs, was beyond its means and as the A, G and H Divisions of the town obtained a good supply of potable water from wells, and that it resolved to accept the scheme for the supply of water from the Mananchira tank. The Sanitary Board, to whom the whole correspondence was sent for remarks, was of opinion that, before the question of the advisability of using the water of this tank could be deter-

mined, an exploratory boring well or excavation should be made in the immediate proximity of the tank in view to ascertaining the existence or non-existence of water of good quality at the lower stratum, as supposed by Dr. King, and stated that, when this had been done and the quantity of the source and the feasibility of

measures providing for the exclusion of the subsoil water had been determined, the Board would be in a position to advise finally as to the adoption of the Mananchira tank scheme or the alternative Poloor Hill scheme proposed by Mr. Ellis.

6. The Municipal Council which was thereupon requested to take steps to furnish the information required by the Sanitary Board, carried out the necessary experiments and reported the results to the Board through the Sanitary Engineer, and the Sanitary Board now submits the Sanitary Engineer's report in the matter with its resolution thereon. The Sanitary Engineer states that the results of the experiments show that the Mananchira tank receives its supply from two distinct sources, viz., (1) an upper sandy layer liable to contamination and (2) a porous layer below an impermeable stratum—presumably containing a pure water. Judging from the position of the strata, the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water and accordingly proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchira tank, a small elevated reservoir and distribution pipes therefrom. He states that the scheme cannot be taken up for some time yet, but will be put on the programme at the earliest opportunity. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that before sinking below the laterite, each well is steeined with laterite in cement to prevent the ingress of water from the upper pervious strata, and approves the general idea of the scheme on the said lines. The Sanitary Board, however, observes that the scheme would be of little practical value, unless all wells in Mappilla yards are closed beyond possibility of secret use.

7. In these circumstances, it is submitted that the Sanitary Engineer may be requested to undertake the preparation of the scheme, as soon as possible, on the lines approved by the Sanitary Board and that the attention of the Municipal Council may be drawn to the Sanitary Board's remark regarding the closure of all private wells in the Mappilla quarters, when the scheme has been executed. The accompanying draft order is submitted for approval.

V. RAGHAVA CHARLU—20-8-98.
H. TREMENHEERE—26-8-98.

[G.O., No. 1548 M., dated 5th September 1898.]

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd.

Regd.

} 1898.

Enclosures

Spare copies

G.O., No. 1548 M., 5th September 1898.

Water-supply.

Requesting, with remarks, the Sanitary Engineer to undertake the preparation of a scheme for the — of Calicut on the lines approved by the Sanitary Board.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

Read—the following paper :—

Proceedings of the Sanitary Board, No. 371/S., dated 27th June 1898.

Read—the following paper :—

Office-note—from J. A. JONES, Esq., Sanitary Engineer to Government.
To—the Secretary, Sanitary Board.
Dated—the 10th May 1898.
No.—940.

Calicut Water-supply.

About the year 1890 a suggestion was made by this Department that a supply of water for the Mappilla quarters of Calicut should be obtained from the Mananchera tank situated near the centre of and at the highest point of Calicut. After much discussion the Municipal Council accepted the proposal, but as doubts as to the quality and quantity of the supply were raised, the Sanitary Board in its Proceedings No. ² S.B.P. of 24th February 1896 (copy attached) ordered certain investigations to be made.

2. There has been a good deal of delay in getting the well sunk, the well first sunk was a failure and progress with a second one has been very slow.

3. The results of sinking the well, however, are now available and will be found reported in the overseer's report forwarded with the Chairman's letter No. ¹⁵ of 6th January 1898 (copy attached).

4. The overseer has, however, not identified the various samples from the strata correctly and these are correctly shown in a note by the Assistant Sanitary Engineer (copy herewith). I have examined the samples and concur with his remarks.

5. The main question at issue has been whether the Mananchera tank receives any supply from a pure source—that it does so cannot now be doubted because the white sand layers 8 feet in thickness are perfectly pure indeed, no whiter sand could possibly be found.

6. Under this is a bed of lignite which forms the bed of the tank and this is 4 feet thick; below this again there is coarse sand and sand and gravel so that even if enough water were not procurable from the white sand, this lower strata can be drawn on.

7. It may be noted in passing that a similar bed of lignite to that already referred to was found when boring at Cochin.

8. From the position of strata, I think it possible that wells sunk into the white sand or the lower coarse sand will yield artesian water.

9. The water of the Mananchera tank has been declared usable, the albumenoid ammonia was slightly high, but this can be understood with an open tank.

10. That pure water can be obtained from wells sunk around the tank cannot be doubted and the quantity should be ample, but this it has been impossible to test as the well sunk cannot be baled out by manual labour and no steam pump is available near Calicut. The contents of the tank itself which fills yearly, however, would yield an ample supply as shown in Chairman's letter quoted below so that with constant pumping there can be no fear of insufficiency.

11. It is proposed that a scheme should be prepared for the supply to the Mappilla quarters of Calicut. The main feature of this scheme being a series of wells adjacent to the Mananchera tank, a small elevated reservoir and distribution pipes therefrom.

12. The scheme cannot be taken up for sometime yet but will be put on the programme at the earliest opportunity.

13. The following is a list of the papers accompanying—

- (1) Report of Assistant Sanitary Engineer to Government, 1890.
- (1-A) Letter from the Acting Sanitary Engineer to Government, No. 2417, of 29th October 1894.
- (2) Letter from the Sanitary Engineer to Government, No. 813, of 26th March 1895.
- (3) Letter from the Chairman, Municipal Council, Calicut, No. 915, of 3rd October 1895.
- (4) Note of Sanitary Commissioner, No. ²¹⁹⁵ S., of 2nd December 1895.
- (5) Note by Colonel Campbell, No. 12/S, of 27th January 1896.
- (6) Resolution of the Sanitary Board, No. ² S.B.P., of 24th February 1896.
- (7) Report of overseer and Chairman's letter, No. 15, of 6th January 1898.
- (8) Note by Assistant Sanitary Engineer to Government, dated 9th May 1898.

ENCLOSURES.

Letter—from M.R.Ry. P. RARICHAN, Road Overseer, Calicut.
To—the Chairman, Municipal Council, Calicut.
Dated—the 4th January 1898.
No.—148.

I beg to report that I have herewith sent the sample of earth packed up, in a tin case, taken at every 4 feet of the depth of the pot well lately sunk at the Municipal garden near Mananchera tank, Calicut, for the inspection of the Sanitary Engineer, Madras.

The subjoined is the list of the earth enclosed :—

1 to 4 feet	..	..	..	..	Sandy soil, light black.
4 " 8 feet	..	..	..	..	do. a little white.
8 " 12 feet	..	..	..	..	Reddish.
12 " 16 feet	..	..	..	..	Chalk white clay
16 " 20 feet	..	..	..	..	Do. pure white } Sand pure white.
20 " 24 feet	..	..	..	..	Black clay lignite.
24 " 28 feet	..	..	..	..	Reddish clay—gravel and sand.
28 " 30 feet	..	..	..	..	do. the total depth of the pot well.

I also beg to report that in sounding Mananchera tank I have found it in all 19½ feet deep to the ground level, viz., depth of water 15 feet, above water to the road level 4½ feet.

Letter—from M.R.Ry. R. RAMA RAO Avargal, Chairman, Municipal Council, Calicut.
To—the Sanitary Engineer to Government.
Dated—the 6th January 1898.
No.—¹⁵ 98

In continuation of this office letter No. 1298, dated 30th June 1897, I have the honour to inform you that the pot well has been sunk to a depth of 30 feet.

A copy of the road overseer's report on the subject together with samples of earth excavated from the well are also forwarded herewith.

Note by Assistant Sanitary Engineer on Calicut Water-supply, dated 9th May 1898.

I had intended to go to Calicut, but subsequently found that doing so would be of little use because—

- (1) The well could not be baled out by manual labour.
- (2) There was no steam pump available there.
- (3) Even if one were available, I don't think the well would stand pumping. It would collapse as it frequently did before.

A section of the boring (vide sketch below) proves Dr. King's theory to be true. Strata (1) and (2) are sandy, porous and water-bearing; stratum (3) is impermeable indurated clay; strata (4) and (5) are porous water-bearing sands, and below these there is a bed of lignite.

No. 1548 M., 5TH SEPTEMBER 1898.

The tank, therefore, receives its supply from a sandy layer at the top naturally open to contamination, and secondly from another porous layer, bedded between two impermeable layers—this water, therefore, being presumably purer than that obtained from the top layers.

I may note here that the section of the well indicates a fair prospect of a good supply being obtained by a deep boring.

I may also mention that it is popularly believed that there is a well in the bed of the tank. If it be so, the tank must also be deriving a supply from the stratum of gravel below the lignite bed.

Resolution—No. 371/S., dated 27th June 1898.

The question of a water-supply scheme for the Mappilla quarters of the town of Calicut has been under consideration for some years, the proposed source of supply being the Mananchera tank. Before deciding on the use of this water, the late Sanitary Board considered it necessary that an exploratory boring well or excavation should be made in the immediate proximity of the tank, in order to ascertain whether there exists, as suspected, a subterranean supply of good quality.

2. The Sanitary Engineer now submits the results of the boring which shows that the tank receives its supply from two distinct sources, viz.—

- (1) an upper sandy layer liable to contamination, and
- (2) a porous layer below an impermeable stratum, presumably a pure water.

3. Judging from the position of the strata the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water.

4. He proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchera tank, a small elevated reservoir, and distribution pipes therefrom.

5. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that, before sinking below the laterite, each well is stained with laterite in cement, to prevent the ingress of water from the upper pervious strata. The scheme would be, however, of little practical value unless all wells in Mappilla yards are closed beyond possibility of secret use. On these lines the general idea of the scheme is approved by the Sanitary Board and is recommended to Government.

(True Extract.)

R. PARSONS,
Secretary, Sanitary Board.

To the Secretary to Government, Local and Municipal Department,
with papers in original.

Order—No. 1548 M., dated 5th September 1898.

The Sanitary Engineer is requested to undertake, as soon as possible, the preparation of a scheme for the water-supply of Calicut on the lines approved by the Sanitary Board.

2. The attention of the Municipal Council is drawn to the Sanitary Board's remark that all the wells in Mappilla yards should be closed when the scheme has been carried out.

(True Extract.)

H. TREMENEER,
Secretary to Government.

To the Chairman, Municipal Council, Calicut.
" Collector of Malabar.
" Sanitary Board, with enclosures returned.
" Commissioner.
" Engineer.

LOCAL AND MUNICIPAL DEPARTMENT.

NOTES CONNECTED WITH G.O., No. 1548 M., DATED
5TH SEPTEMBER 1898.

Previous papers.

G.O., No. 1871 M., dated	8th December	1890.
" " 1396 M. "	31st August	1891.
" " 930 M. "	26th May	1892.
" " 1114 M. "	28th June	"
" " 513 M. "	23rd April	1894.
" " 522 M. "	5th May	"
" " 583 M. "	31st March	1896.

[SUBJECT.—Calicut water-supply scheme.]

From the Sanitary Board, dated 27th June 1898, No. 371-S.

In his report on the inspection of Calicut in September 1890, the Assistant Sanitary Engineer stated—

(1) that the water-supply of the town which was chiefly obtained from private wells, of which there was one in almost every compound and garden, was good, except in the Mappilla quarters, where the soil was so far contaminated already and the water level was so little below the surface of the ground, that the drainage of the place, though preventing the further progress of mischief, would be powerless in checking the causes of pollution that already existed in the soil;

(2) that a good and sufficient supply of water could be obtained for the Mappillas from the Mananchira tank, which was situated to the north-east of the town on a high level and was therefore less liable to contamination; and

(3) that as this tank was not used by the people on account of its distance, the only way to induce them to use the water would be to bring it to their doors by means of pipes.

He therefore suggested the preparation of a scheme for the water-supply of the Mappilla quarters from this tank, the cost of which was roughly estimated by

Vide paragraph 11 ibid.

him to be between Rs. 75,000 and Rs. 1,00,000.

2. The Municipal Council of Calicut, however, did not approve the proposal for the reasons, firstly, that its financial condition did not admit of any expenditure being incurred towards the scheme and secondly, that the drainage of the town was more important than water-supply. But the Government overruled the Council's objection on the ground that the report of the Sanitary Engineer afforded ample proof of the immediate necessity for improving the sanitation of the town and considered that the water-supply scheme should have precedence over the drainage scheme. The Municipal Council was accordingly directed to make the

Vide Council's resolution in G.O., No. 1396 M., dated 31st August 1891.

Vide Council's resolution in G.O., No. 930 M., dated 26th May 1892.

Paragraph 2 of G.O., No. 1396 M., dated 31st August 1891.

G.O., No. 1114 M., dated 23th June 1892.

necessary provision for the investigation of the water-supply project, which was thereupon put down on the Sanitary Engineer's programme for 1895.

3. In the meantime, the Sanitary Commissioner, who inspected Calicut in 1894, considered that before deciding upon the Mananchira tank as the source for the future water-supply of the Mappilla quarters, it was necessary that certain matters should be investigated. He doubted the sufficiency of water in the Mananchira tank and also the quality of the supply. He considered that the tank was apparently fed by a special stratum of water under pressure confined between two impervious strata, one of which had been penetrated, as well as from the ordinary subsoil water, and that, as the subsoil water was evidently open to much pollution, it should not be drawn upon for the supply of Calicut, if it was possible to do otherwise. He therefore suggested that exploratory borings should be made for the purpose of ascertaining more as to subsoil conditions, and especially to find out whether any impervious stratum of clay underlay the previous upper stratum on which the surface water was supported, and that if this was found to be the case, bored or driven wells could be used within the interior of the town or even the Mananchira tank might be employed, if by iron cylinders or other measures the subsoil water were excluded. He added that, if this was not proved and if it was found necessary to depend upon the subsoil water, it would be requisite to select an area sufficiently removed from the town to guarantee the purity of the soil.

4. The Sanitary Engineer Mr. Ellis, to whom the Sanitary Commissioner's letter was referred for remarks, visited Calicut in 1894, and reported that as the position of the Mananchira tank was certainly not

very desirable, it would be much better to go beyond the town for a source of supply and that there were several springs at the foot of the Poloor Hill, which was about 3 miles from Calicut, where wells yielding a pure supply might be sunk. He estimated the cost of this scheme at 4 lakhs and recommended that, if the finances of the Municipality did not permit of its being undertaken for some years to come, the Mananchira tank might be tested with regard to its yield, with the view of making it the source of supply as a temporary measure for the Mappilla quarters until such time as the Municipality could find the necessary funds for a larger scheme. He also observed that whatever pipes were laid as a temporary measure could form part of the larger scheme, whenever that came into existence, and added that the urgent need for a water-supply scheme for the Mappilla quarters had already been fully explained in the Assistant Sanitary Engineer's report of 1890, that the popular opinion about the water of the Mananchira tank was that it was good, that it was used by Europeans and Eurasians living near the tank, that the chemical analysis showed that the only impurity which was in excess of the standard fixed for 'usable' water was albumenoid ammonia and that there were indications that this impurity was of vegetable origin and therefore not very dangerous.

5. The Municipal Council, to which the Sanitary Engineer's letter was referred for remarks, stated that it was not ambitious to provide a correct scheme of water-supply to the whole town, which extended

over an area of 13½ square miles, as its cost, viz., 4 lakhs, was beyond its means and as the A, G and II Divisions of the town obtained a good supply of potable water from wells, and that it resolved to accept the scheme for the supply of water from the Mananchira tank. The Sanitary Board, to whom the whole correspondence was sent

for remarks, was of opinion that, before the question of the advisability of using the water of this tank could be deter-

mined, an exploratory boring well or excavation should be made in the immediate proximity of the tank in view to ascertaining the existence or non-existence of water of good quality at the lower stratum, as supposed by Dr. King, and stated that, when this had been done and the quantity of the source and the feasibility of

measures providing for the exclusion of the subsoil water had been determined, the Board would be in a position to advise finally as to the adoption of the Mananchira tank scheme or the alternative Poloor Hill scheme proposed by Mr. Ellis.

6. The Municipal Council which was thereupon requested to take steps to furnish the information required by the Sanitary Board, carried out the necessary

experiments and reported the results to the Board through the Sanitary Engineer, and the Sanitary Board now submits the Sanitary Engineer's report in the matter with its resolution thereon. The Sanitary Engineer states that the results of the experiments show that the Mananchira tank receives its supply from two distinct sources, viz., (1) an upper sandy layer liable to contamination and (2) a porous layer below an impermeable stratum—presumably containing a pure water. Judging from the position of the strata, the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water and accordingly proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchira tank, a small elevated reservoir and distribution pipes therefrom. He states that the scheme cannot be taken up for some time yet, but will be put on the programme at the earliest opportunity. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that before sinking below the laterite, each well is steeled with laterite in cement to prevent the ingress of water from the upper pervious strata, and approves the general idea of the scheme on the said lines. The Sanitary Board, however, observes that the scheme would be of little practical value, unless all wells in Mappilla yards are closed beyond possibility of secret use.

7. In these circumstances, it is submitted that the Sanitary Engineer may be requested to undertake the preparation of the scheme, as soon as possible, on the lines approved by the Sanitary Board and that the attention of the Municipal Council may be drawn to the Sanitary Board's remark regarding the closure of all private wells in the Mappilla quarters, when the scheme has been executed. The accompanying draft order is submitted for approval.

V. RAGHAVA CHARLU—20-8-98.

H. TREMENHEERE—26-8-98.

[G.O., No. 1548 M., dated 5th September 1898.]

Government of Madras.
LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

<i>Recd.</i>	} 1898.	<i>Enclosures</i>
<i>Regd.</i>		<i>Spare copies</i>

G.O., No. 1548 M., 5th September 1898.

Water-supply.

requesting, with remarks, the Sanitary Engineer to undertake the preparation of a scheme
for the — of Calicut on the lines approved by the Sanitary Board.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

Read—the following paper:—

Proceedings of the Sanitary Board, No. 371/S., dated 27th June 1898.

Read—the following paper:—

Office-note—from J. A. Jones, Esq., Sanitary Engineer to Government.
To—the Secretary, Sanitary Board.
Dated—the 10th May 1898.
No.—940.

Calicut Water-supply.

About the year 1890 a suggestion was made by this Department that a supply of water for the Mappilla quarters of Calicut should be obtained from the Mananchera tank situated near the centre of and at the highest point of Calicut. After much discussion the Municipal Council accepted the proposal, but as doubts as to the quality and quantity of the supply were raised, the Sanitary Board in its Proceedings No. ² S.B.F. of 24th February 1896 (copy attached) ordered certain investigations to be made.

2. There has been a good deal of delay in getting the well sunk, the well first sunk was a failure and progress with a second one has been very slow.

3. The results of sinking the well, however, are now available and will be found reported in the overseer's report forwarded with the Chairman's letter No. ¹⁶ 98 of 6th January 1898 (copy attached).

4. The overseer has, however, not identified the various samples from the strata correctly and these are correctly shown in a note by the Assistant Sanitary Engineer (copy herewith). I have examined the samples and concur with his remarks.

5. The main question at issue has been whether the Mananchera tank receives any supply from a pure source—that it does so cannot now be doubted because the white sand layers 8 feet in thickness are perfectly pure indeed, no whiter sand could possibly be found.

6. Under this is a bed of lignite which forms the bed of the tank and this is 4 feet thick; below this again there is coarse sand and sand and gravel so that even if enough water were not procurable from the white sand, this lower strata can be drawn on.

7. It may be noted in passing that a similar bed of lignite to that already referred to was found when boring at Cochin.

8. From the position of strata, I think it possible that wells sunk into the white sand or the lower coarse sand will yield artesian water.

9. The water of the Mananchera tank has been declared usable, the albumenoid ammonia was slightly high, but this can be understood with an open tank.

10. That pure water can be obtained from wells sunk around the tank cannot be doubted and the quantity should be ample, but this it has been impossible to test as the well sunk cannot be baled out by manual labour and no steam pump is available near Calicut. The contents of the tank itself which fills yearly, however, would yield an ample supply as shown in Chairman's letter quoted below so that with constant pumping there can be no fear of insufficiency.

11. It is proposed that a scheme should be prepared for the supply to the Mappilla quarters of Calicut. The main feature of this scheme being a series of wells adjacent to the Mananchera tank, a small elevated reservoir and distribution pipes therefrom.

12. The scheme cannot be taken up for sometime yet but will be put on the programme at the earliest opportunity.

13. The following is a list of the papers accompanying—

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- (1-A) Letter from the Acting Sanitary Engineer to Government, No. 2417, of 29th October 1894.
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ENCLOSURES.

Letter—from M.R.Ry. P. RARICHAN, Road Overseer, Calicut.
To—the Chairman, Municipal Council, Calicut.
Dated—the 4th January 1898.
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I beg to report that I have herewith sent the sample of earth packed up, in a tin case, taken at every 4 feet of the depth of the pot well lately sunk at the Municipal garden near Mananchera tank, Calicut, for the inspection of the Sanitary Engineer, Madras.

The subjoined is the list of the earth enclosed:—

1 to 4 feet	..	..	..	..	Sandy soil, light black.
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28 " 30 feet	..	..	..	..	do. the total depth of the pot well.

I also beg to report that in sounding Mananchera tank I have found it in all 19½ feet deep to the ground level, viz., depth of water 15 feet, above water to the road level 4½ feet.

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To—the Sanitary Engineer to Government.
Dated—the 6th January 1898.
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In continuation of this office letter No. 1298, dated 30th June 1897, I have the honour to inform you that the pot well has been sunk to a depth of 30 feet.

A copy of the road overseer's report on the subject together with samples of earth excavated from the well are also forwarded herewith.

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I had intended to go to Calicut, but subsequently found that doing so would be of little use because—

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A section of the boring (vide sketch below) proves Dr. King's theory to be true. Strata (1) and (2) are sandy, porous and water-bearing; stratum (3) is impermeable indurated clay; strata (4) and (5) are porous water-bearing sands, and below these there is a bed of lignite.

No. 1548 M., 5TH SEPTEMBER 1898.

The tank, therefore, receives its supply from a sandy layer at the top naturally open to contamination, and secondly from another porous layer, bedded between two impermeable layers—this water, therefore, being presumably purer than that obtained from the top layers.

I may note here that the section of the well indicates a fair prospect of a good supply being obtained by a deep boring.

I may also mention that it is popularly believed that there is a well in the bed of the tank. If it be so, the tank must also be deriving a supply from the stratum of gravel below the lignite bed.

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The question of a water-supply scheme for the Mappilla quarters of the town of Calicut has been under consideration for some years, the proposed source of supply being the Mananchera tank. Before deciding on the use of this water, the late Sanitary Board considered it necessary that

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an exploratory boring well or excavation should be made in the immediate proximity of the tank, in order to ascertain whether there exists, as suspected, a subterranean supply of good quality.

2. The Sanitary Engineer now submits the results of the boring which shows that the tank receives its supply from two distinct sources, viz.—

(1) an upper sandy layer liable to contamination, and

(2) a porous layer below an impermeable stratum, presumably a pure water.

3. Judging from the position of the strata the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water.

4. He proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchera tank, a small elevated reservoir, and distribution pipes therefrom.

5. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that, before sinking below the laterite, each well is stained with laterite in cement, to prevent the ingress of water from the upper pervious strata. The scheme would be, however, of little practical value unless all wells in Mappilla yards are closed beyond possibility of secret use. On these lines the general idea of the scheme is approved by the Sanitary Board and is recommended to Government.

(True Extract.)

R. PARSONS,
Secretary, Sanitary Board.

To the Secretary to Government, Local and Municipal Department,
with papers in original.

Order—No. 1548 M., dated 5th September 1898.

The Sanitary Engineer is requested to undertake, as soon as possible, the preparation of a scheme for the water-supply of Calicut on the lines approved by the Sanitary Board.

2. The attention of the Municipal Council is drawn to the Sanitary Board's remark that all the wells in Mappilla yards should be closed when the scheme has been carried out.

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To the Chairman, Municipal Council, Calicut.
" Collector of Malabar.
" Sanitary Board, with enclosures returned,
" Commissioner,
" Engineer.

LOCAL AND MUNICIPAL DEPARTMENT.

NOTES CONNECTED WITH G.O., No. 1548 M., DATED
5TH SEPTEMBER 1898.

Previous papers.

G.O., No. 1871 M., dated	8th December	1890.
" " 1396 M. "	31st August	1891.
" " 930 M. "	26th May	1892.
" " 1114 M. "	28th June	"
" " 513 M. "	23rd April	1894.
" " 542 M. "	5th May	"
" " 583 M. "	31st March	1896.

[SUBJECT.—Calicut water-supply scheme.]

From the Sanitary Board, dated 27th June 1898, No. 371-S.

In his report on the inspection of Calicut in September 1890, the Assistant Sanitary Engineer stated—

(1) that the water-supply of the town which was chiefly obtained from private wells, of which there was one in almost every compound and garden, was good, except in the Mappilla quarters, where the soil was so far contaminated already and the water level was so little below the surface of the ground, that the drainage of the place, though preventing the further progress of mischief, would be powerless in checking the causes of pollution that already existed in the soil;

(2) that a good and sufficient supply of water could be obtained for the Mappillas from the Mananchira tank, which was situated to the north-east of the town on a high level and was therefore less liable to contamination; and

(3) that as this tank was not used by the people on account of its distance, the only way to induce them to use the water would be to bring it to their doors by means of pipes.

He therefore suggested the preparation of a scheme for the water-supply of the Mappilla quarters from this tank, the cost of which was roughly estimated by

Vide paragraph 11 ibid.
him to be between Rs. 75,000 and Rs. 1,00,000.

2. The Municipal Council of Calicut, however, did not approve the proposal for the reasons, firstly, that its financial condition did not admit of any expenditure being incurred towards the scheme and secondly, that the drainage of the town was more important than water-supply. But the Government overruled the Council's objection on the ground that the report of the Sanitary Engineer afforded ample proof of the immediate necessity for improving the sanitation of the town and considered that the water-supply scheme should have precedence over the drainage scheme. The Municipal Council was accordingly directed to make the

Vide Council's resolution in G.O., No. 1396 M., dated 31st August 1891.
Vide Council's resolution in G.O., No. 930 M., dated 26th May 1892.
Paragraph 2 of G.O., No. 1396 M., dated 31st August 1891.
G.O., No. 1114 M., dated 28th June 1892.

necessary provision for the investigation of the water-supply project, which was thereupon put down on the Sanitary Engineer's programme for 1895.

G.O., No. 582 M., dated 5th May 1894.

3. In the meantime, the Sanitary Commissioner, who inspected Calicut in 1894, considered that before deciding upon the Mananchira tank as the source for the future water-supply of the Mappilla quarters, it was necessary that certain matters should be investigated. He doubted the sufficiency of water in the Mananchira tank and also the quality of the supply. He considered that the tank was apparently fed by a special stratum of water under pressure confined between two impervious strata, one of which had been penetrated, as well as from the ordinary subsoil water, and that, as the subsoil water was evidently open to much pollution, it should not be drawn upon for the supply of Calicut, if it was possible to do otherwise. He therefore suggested that exploratory borings should be made for the purpose of ascertaining more as to subsoil conditions, and especially to find out whether any impervious stratum of clay underlay the previous upper stratum on which the surface water was supported, and that if this was found to be the case, bored or driven wells could be used within the interior of the town or even the Mananchira tank might be employed, if by iron cylinders or other measures the subsoil water were excluded. He added that, if this was not proved and if it was found necessary to depend upon the subsoil water, it would be requisite to select an area sufficiently removed from the town to guarantee the purity of the soil.

Vide pages 13 and 14 in G.O., No. 513 M., dated 23rd April 1894.

4. The Sanitary Engineer Mr. Ellis, to whom the Sanitary Commissioner's letter was referred for remarks, visited Calicut in 1894, and reported that as the position of the Mananchira tank was certainly not very desirable, it would be much better to go beyond the town for a source of supply and that there were several springs at the foot of the Poloor Hill, which was about 3 miles from Calicut, where wells yielding a pure supply might be sunk. He estimated the cost of this scheme at 4 lakhs and recommended that, if the finances of the Municipality did not permit of its being undertaken for some years to come, the Mananchira tank might be tested with regard to its yield, with the view of making it the source of supply as a temporary measure for the Mappilla quarters until such time as the Municipality could find the necessary funds for a larger scheme. He also observed that whatever pipes were laid as a temporary measure could form part of the larger scheme, whenever that came into existence, and added that the urgent need for a water-supply scheme for the Mappilla quarters had already been fully explained in the Assistant Sanitary Engineer's report of 1890, that the popular opinion about the water of the Mananchira tank was that it was good, that it was used by Europeans and Eurasians living near the tank, that the chemical analysis showed that the only impurity which was in excess of the standard fixed for 'usable' water was albumenoid ammonia and that there were indications that this impurity was of vegetable origin and therefore not very dangerous.

Vide Current No. 2656 M., in G.O., No. 583 M., dated 31st March 1896.

5. The Municipal Council, to which the Sanitary Engineer's letter was referred for remarks, stated that it was not ambitious to provide a correct scheme of water-supply to the whole town, which extended over an area of 13½ square miles, as its cost, viz., 4 lakhs, was beyond its means and as the A, G and H Divisions of the town obtained a good supply of potable water from wells, and that it resolved to accept the scheme for the supply of water from the Mananchira tank. The Sanitary Board, to whom the whole correspondence was sent for remarks, was of opinion that, before the question of the advisability of using the water of this tank could be determined, an exploratory boring well or excavation should be made in the immediate proximity of the tank in view to ascertaining the existence or non-existence of water of good quality at the lower stratum, as supposed by Dr. King, and stated that, when this had been done and the quantity of the source and the feasibility of

Vide Current No. 3436 M. in G.O., No. 583 M., dated 31st March 1896.

measures providing for the exclusion of the subsoil water had been determined, the Board would be in a position to advise finally as to the adoption of the Mananchira tank scheme or the alternative Poloor Hill scheme proposed by Mr. Ellis.

6. The Municipal Council which was thereupon requested to take steps to furnish the information required by the Sanitary Board, carried out the necessary experiments and reported the results to the Board through the Sanitary Engineer, and the Sanitary Board now submits the Sanitary Engineer's report in the matter with its resolution thereon. The Sanitary Engineer states that the results of the experiments show that the Mananchira tank receives its supply from two distinct sources, viz., (1) an upper sandy layer liable to contamination and (2) a porous layer below an impermeable stratum—presumably containing a pure water. Judging from the position of the strata, the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water and accordingly proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchira tank, a small elevated reservoir and distribution pipes therefrom. He states that the scheme cannot be taken up for some time yet, but will be put on the programme at the earliest opportunity. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that before sinking below the laterite, each well is steined with laterite in cement to prevent the ingress of water from the upper pervious strata, and approves the general idea of the scheme on the said lines. The Sanitary Board, however, observes that the scheme would be of little practical value, unless all wells in Mappilla yards are closed beyond possibility of secret use.

7. In these circumstances, it is submitted that the Sanitary Engineer may be requested to undertake the preparation of the scheme, as soon as possible, on the lines approved by the Sanitary Board and that the attention of the Municipal Council may be drawn to the Sanitary Board's remark regarding the closure of all private wells in the Mappilla quarters, when the scheme has been executed. The accompanying draft order is submitted for approval.

V. RAGHAVA CHARLU—20-8-98.
H. TREMENHEERE—26-8-98.

[G.O., No. 1548 M., dated 5th September 1898.]

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd.

Regd.

} 1898.

Enclosures

Spare copies

G.O., No. 1548 M., 5th September 1898.

Water-supply.

Requesting, with remarks, the Sanitary Engineer to undertake the preparation of a scheme for the — of Calicut on the lines approved by the Sanitary Board.

GOVERNMENT OF MADRAS.

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Read—the following paper:—

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Read—the following paper:—

Office-note—from J. A. JONES, Esq., Sanitary Engineer to Government.
To—the Secretary, Sanitary Board.
Dated—the 10th May 1898.
No.—940.

Calicut Water-supply.

About the year 1890 a suggestion was made by this Department that a supply of water for the Mappilla quarters of Calicut should be obtained from the Mananchera tank situated near the centre of and at the highest point of Calicut. After much discussion the Municipal Council accepted the proposal, but as doubts as to the quality and quantity of the supply were raised, the Sanitary Board in its Proceedings No. 387/S. of 24th February 1896 (copy attached) ordered certain investigations to be made.

2. There has been a good deal of delay in getting the well sunk, the well first sunk was a failure and progress with a second one has been very slow.

3. The results of sinking the well, however, are now available and will be found reported in the overseer's report forwarded with the Chairman's letter No. 15 of 6th January 1898 (copy attached).

4. The overseer has, however, not identified the various samples from the strata correctly and these are correctly shown in a note by the Assistant Sanitary Engineer (copy herewith). I have examined the samples and concur with his remarks.

5. The main question at issue has been whether the Mananchera tank receives any supply from a pure source—that it does so cannot now be doubted because the white sand layers 8 feet in thickness are perfectly pure indeed, no whiter sand could possibly be found.

6. Under this is a bed of lignite which forms the bed of the tank and this is 4 feet thick; below this again there is coarse sand and sand and gravel so that even if enough water were not procurable from the white sand, this lower strata can be drawn on.

7. It may be noted in passing that a similar bed of lignite to that already referred to was found when boring at Cochin.

8. From the position of strata, I think it possible that wells sunk into the white sand or the lower coarse sand will yield artesian water.

9. The water of the Mananchera tank has been declared usable, the albumenoid ammonia was slightly high, but this can be understood with an open tank.

10. That pure water can be obtained from wells sunk around the tank cannot be doubted and the quantity should be ample, but this it has been impossible to test as the well sunk cannot be baled out by manual labour and no steam pump is available near Calicut. The contents of the tank itself which fills yearly, however, would yield an ample supply as shown in Chairman's letter quoted below so that with constant pumping there can be no fear of insufficiency.

11. It is proposed that a scheme should be prepared for the supply to the Mappilla quarters of Calicut. The main feature of this scheme being a series of wells adjacent to the Mananchera tank, a small elevated reservoir and distribution pipes therefrom.

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LOCAL AND MUNICIPAL DEPARTMENT.

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5TH SEPTEMBER 1893.

Previous papers.

G.O., No. 1871 M., dated	8th December	1890.
" " 1396 M. "	31st August	1891.
" " 930 M. "	26th May	1892.
" " 1114 M. "	28th June	"
" " 513 M. "	23rd April	1894.
" " 5*2 M. "	5th May	"
" " 583 M. "	31st March	1896.

[SUBJECT.—Calicut water-supply scheme.]

From the Sanitary Board, dated 27th June 1893, No. 371-S.

In his report on the inspection of Calicut in September 1890, the Assistant Sanitary Engineer stated—

(1) that the water-supply of the town which was chiefly obtained from private wells, of which there was one in almost every compound and garden, was good, except in the Mappilla quarters, where the soil was so far contaminated already and the water level was so little below the surface of the ground, that the drainage of the place, though preventing the further progress of mischief, would be powerless in checking the causes of pollution that already existed in the soil;

(2) that a good and sufficient supply of water could be obtained for the Mappillas from the Mananchira tank, which was situated to the north-east of the town

on a high level and was therefore less liable to contamination; and

(3) that as this tank was not used by the people on account of its distance, the only way to induce them to use the water would be to bring it to their doors by means of pipes.

He therefore suggested the preparation of a scheme for the water-supply of the Mappilla quarters from this tank, the cost of which was roughly estimated by

him to be between Rs. 75,000 and Rs. 1,00,000.

2. The Municipal Council of Calicut, however, did not approve the proposal for the reasons, firstly, that its financial condition did not admit of any expenditure being incurred towards the scheme and secondly, that the drainage of the town was more important than water-supply. But the Government overruled the Council's objection on the ground that the report of the Sanitary Engineer afforded ample proof of the immediate necessity for improving the sanitation of the town and considered that the water-supply scheme should have precedence over the drainage scheme. The Municipal Council was accordingly directed to make the

Paragraph 2 of G.O., No. 1396 M., dated 31st August 1891.
G.O., No. 1114 M., dated 28th June 1892.

No. 1548 M., 5TH SEPTEMBER 1898.

2

necessary provision for the investigation of the water-supply project, which was thereupon put down on the Sanitary Engineer's programme for 1895.

G.O., No. 582 M., dated 5th May 1894.

3. In the meantime, the Sanitary Commissioner, who inspected Calicut in 1894, considered that before deciding upon the Mananchira tank as the source for the future water-supply of the Mappilla quarters, it was necessary that certain matters should be investigated. He doubted the sufficiency of water in the Mananchira tank and also the quality of the supply. He considered that the tank was apparently fed by a special stratum of water under pressure confined between two impervious strata, one of which had been penetrated, as well as from the ordinary subsoil water, and that, as the subsoil water was evidently open to much pollution, it should not be drawn upon for the supply of Calicut, if it was possible to do otherwise. He therefore suggested that exploratory borings should be made for the purpose of ascertaining more as to subsoil conditions, and especially to find out whether any impervious stratum of clay underlay the previous upper stratum on which the surface water was supported, and that if this was found to be the case, bored or driven wells could be used within the interior of the town or even the Mananchira tank might be employed, if by iron cylinders or other measures the subsoil water were excluded. He added that, if this was not proved and if it was found necessary to depend upon the subsoil water, it would be requisite to select an area sufficiently removed from the town to guarantee the purity of the soil.

Vide his remarks in G.O., No. 513 M., dated 23rd April 1894.

4. The Sanitary Engineer Mr. Ellis, to whom the Sanitary Commissioner's letter was referred for remarks, visited Calicut in 1894, and reported that as the position of the Mananchira tank was certainly not very desirable, it would be much better to go beyond the town for a source of supply and that there were several springs at the foot of the Poloor Hill, which was about 3 miles from Calicut, where wells yielding a pure supply might be sunk. He estimated the cost of this scheme at 4 lakhs and recommended that, if the finances of the Municipality did not permit of its being undertaken for some years to come, the Mananchira tank might be tested with regard to its yield, with the view of making it the source of supply as a temporary measure for the Mappilla quarters until such time as the Municipality could find the necessary funds for a larger scheme. He also observed that whatever pipes were laid as a temporary measure could form part of the larger scheme, whenever that came into existence, and added that the urgent need for a water-supply scheme for the Mappilla quarters had already been fully explained in the Assistant Sanitary Engineer's report of 1890, that the popular opinion about the water of the Mananchira tank was that it was good, that it was used by Europeans and Eurasians living near the tank, that the chemical analysis showed that the only impurity which was in excess of the standard fixed for 'usable' water was albumenoid ammonia and that there were indications that this impurity was of vegetable origin and therefore not very dangerous.

5. The Municipal Council, to which the Sanitary Engineer's letter was referred for remarks, stated that it was not ambitious to provide a correct scheme of water-supply to the whole town, which extended over an area of 13½ square miles, as its cost, viz., 4 lakhs, was beyond its means and as the A, G and H Divisions of the town obtained a good supply of potable water from wells, and that it resolved to accept the scheme for the supply of water from the Mananchira tank. The Sanitary Board, to whom the whole correspondence was sent for remarks, was of opinion that, before the question of the advisability of using the water of this tank could be determined, an exploratory boring well or excavation should be made in the immediate proximity of the tank in view to ascertaining the existence or non-existence of water of good quality at the lower stratum, as supposed by Dr. King, and stated that, when this had been done and the quantity of the source and the feasibility of

measures providing for the exclusion of the subsoil water had been determined, the Board would be in a position to advise finally as to the adoption of the Mananchira tank scheme or the alternative Poloor Hill scheme proposed by Mr. Ellis.

6. The Municipal Council which was thereupon requested to take steps to furnish the information required by the G.O., No. 583 M., dated 31st August 1896. Sanitary Board, carried out the necessary experiments and reported the results to the Board through the Sanitary Engineer, and the Sanitary Board now submits the Sanitary Engineer's report in the matter with its resolution thereon. The Sanitary Engineer states that the results of the experiments show that the Mananchira tank receives its supply from two distinct sources, viz., (1) an upper sandy layer liable to contamination and (2) a porous layer below an impermeable stratum—presumably containing a pure water. Judging from the position of the strata, the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water and accordingly proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchira tank, a small elevated reservoir and distribution pipes therefrom. He states that the scheme cannot be taken up for some time yet, but will be put on the programme at the earliest opportunity. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that before sinking below the laterite, each well is steined with laterite in cement to prevent the ingress of water from the upper pervious strata, and approves the general idea of the scheme on the said lines. The Sanitary Board, however, observes that the scheme would be of little practical value, unless all wells in Mappilla yards are closed beyond possibility of secret use.

7. In these circumstances, it is submitted that the Sanitary Engineer may be requested to undertake the preparation of the scheme, as soon as possible, on the lines approved by the Sanitary Board and that the attention of the Municipal Council may be drawn to the Sanitary Board's remark regarding the closure of all private wells in the Mappilla quarters, when the scheme has been executed. The accompanying draft order is submitted for approval.

V. RAGHAVA CHARLU—28-98.

H. TREMENHEERE—26-98.

[G.O., No. 1548 M., dated 5th September 1898.]

Government of Madras.
LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd.

Regd.

} 1898.

Enclosures

Spare copies

G.O., No. 1548 M., 5th September 1898.

Water-supply.

Requesting, with remarks, the Sanitary Engineer to undertake the preparation of a scheme for the — of Calicut on the lines approved by the Sanitary Board.

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GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

Read—the following paper :—

Proceedings of the Sanitary Board, No. 371/S., dated 27th June 1898.

Read—the following paper :—

Office-note—from J. A. JONES, Esq., Sanitary Engineer to Government.
To—the Secretary, Sanitary Board.
Dated—the 10th May 1898.
No.—940.

Calicut Water-supply.

About the year 1890 a suggestion was made by this Department that a supply of water for the Mappilla quarters of Calicut should be obtained from the Mananchera tank situated near the centre of and at the highest point of Calicut. After much discussion the Municipal Council accepted the proposal, but as doubts as to the quality and quantity of the supply were raised, the Sanitary Board in its Proceedings No. ² S.B.P. of 24th February 1896 (copy attached) ordered certain investigations to be made.

2. There has been a good deal of delay in getting the well sunk, the well first sunk was a failure and progress with a second one has been very slow.

3. The results of sinking the well, however, are now available and will be found reported in the overseer's report forwarded with the Chairman's letter No. ¹⁵ of 6th January 1898 (copy attached).

4. The overseer has, however, not identified the various samples from the strata correctly and these are correctly shown in a note by the Assistant Sanitary Engineer (copy herewith). I have examined the samples and concur with his remarks.

5. The main question at issue has been whether the Mananchera tank receives any supply from a pure source—that it does so cannot now be doubted because the white sand layers 8 feet in thickness are perfectly pure indeed, no whiter sand could possibly be found.

6. Under this is a bed of lignite which forms the bed of the tank and this is 4 feet thick; below this again there is coarse sand and sand and gravel so that even if enough water were not procurable from the white sand, this lower strata can be drawn on.

7. It may be noted in passing that a similar bed of lignite to that already referred to was found when boring at Cochin.

8. From the position of strata, I think it possible that wells sunk into the white sand or the lower coarse sand will yield artesian water.

9. The water of the Mananchera tank has been declared usable, the albumenoid ammonia was slightly high, but this can be understood with an open tank.

10. That pure water can be obtained from wells sunk around the tank cannot be doubted and the quantity should be ample, but this it has been impossible to test as the well sunk cannot be baled out by manual labour and no steam pump is available near Calicut. The contents of the tank itself which fills yearly, however, would yield an ample supply as shown in Chairman's letter quoted below so that with constant pumping there can be no fear of insufficiency.

11. It is proposed that a scheme should be prepared for the supply to the Mappilla quarters of Calicut. The main feature of this scheme being a series of wells adjacent to the Mananchera tank, a small elevated reservoir and distribution pipes therefrom.

12. The scheme cannot be taken up for sometime yet but will be put on the programme at the earliest opportunity.

13. The following is a list of the papers accompanying—

(1) Report of Assistant Sanitary Engineer to Government, 1890.

(1-A) Letter from the Acting Sanitary Engineer to Government, No. 2417, of 29th October 1894.

(2) Letter from the Sanitary Engineer to Government, No. 813, of 26th March 1895.

(3) Letter from the Chairman, Municipal Council, Calicut, No. 915, of 3rd October 1895.

(4) Note of Sanitary Commissioner, No. ²¹⁹⁵ S., of 2nd December 1895.

(5) Note by Colonel Campbell, No. 12/S, of 27th January 1896.

(6) Resolution of the Sanitary Board, No. ² S.B.P., of 24th February 1896.

(7) Report of overseer and Chairman's letter, No. 15, of 6th January 1898.

(8) Note by Assistant Sanitary Engineer to Government, dated 9th May 1898.

ENCLOSURES.

Letter—from M.R.Ry. P. RARICHAN, Road Overseer, Calicut.

To—the Chairman, Municipal Council, Calicut.

Dated—the 4th January 1898.

No.—148.

I beg to report that I have herewith sent the sample of earth packed up, in a tin case, taken at every 4 feet of the depth of the pot well lately sunk at the Municipal garden near Mananchera tank, Calicut, for the inspection of the Sanitary Engineer, Madras.

The subjoined is the list of the earth enclosed :—

1 to 4 feet	.. .. .	Sandy soil, light black.
4 " 8 feet	.. .. .	do. a little white.
8 " 12 feet	.. .. .	Reddish.
12 " 16 feet	.. .. .	Chalk white clay
16 " 20 feet	.. .. .	Do. pure white } Sand pure white.
20 " 24 feet	.. .. .	Black clay lignite.
24 " 28 feet	.. .. .	Reddish clay—gravel and sand.
28 " 30 feet	.. .. .	do. the total depth of the pot well.

I also beg to report that in sounding Mananchera tank I have found it in all 19½ feet deep to the ground level, viz., depth of water 15 feet, above water to the road level 4½ feet.

Letter—from M.R.Ry. R. RAMA RAO Avargal, Chairman, Municipal Council, Calicut.

To—the Sanitary Engineer to Government.

Dated—the 6th January 1898.

No.—¹⁵ 98

In continuation of this office letter No. 1298, dated 30th June 1897, I have the honour to inform you that the pot well has been sunk to a depth of 30 feet.

A copy of the road overseer's report on the subject together with samples of earth excavated from the well are also forwarded herewith.

Note by Assistant Sanitary Engineer on Calicut Water-supply, dated 9th May 1898.

I had intended to go to Calicut, but subsequently found that doing so would be of little use because—

(1) The well could not be baled out by manual labour.

(2) There was no steam pump available there.

(3) Even if one were available, I don't think the well would stand pumping. It would collapse as it frequently did before.

A section of the boring (vide sketch below) proves Dr. King's theory to be true. Strata (1) and (2) are sandy, porous and water-bearing; stratum (3) is impermeable indurated clay; strata (4) and (5) are porous water-bearing sands, and below these there is a bed of lignite.

No. 1548 M., 5TH SEPTEMBER 1898.

The tank, therefore, receives its supply from a sandy layer at the top naturally open to contamination, and secondly from another porous layer, bedded between two impermeable layers—this water, therefore, being presumably purer than that obtained from the top layers.

I may note here that the section of the well indicates a fair prospect of a good supply being obtained by a deep boring.

I may also mention that it is popularly believed that there is a well in the bed of the tank. If it be so, the tank must also be deriving a supply from the stratum of gravel below the lignite bed.

Resolution—No. 371/S., dated 27th June 1898.

The question of a water-supply scheme for the Mappilla quarters of the town of Calicut has been under consideration for some years, the proposed source of supply being the Mananchera tank. Before deciding on the use of this water, the late Sanitary Board considered * it necessary that

* Proceedings No. 2 S.B.F., dated 24th February 1896. an exploratory boring well or excavation should be made in the immediate proximity of the tank, in order to ascertain whether there exists, as suspected, a subterranean supply of good quality.

2. The Sanitary Engineer now submits the results of the boring which shows that the tank receives its supply from two distinct sources, viz.—

(1) an upper sandy layer liable to contamination, and

(2) a porous layer below an impermeable stratum, presumably a pure water.

3. Judging from the position of the strata the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water.

4. He proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchera tank, a small elevated reservoir, and distribution pipes therefrom.

5. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that, before sinking below the laterite, each well is stained with laterite in cement, to prevent the ingress of water from the upper pervious strata. The scheme would be, however, of little practical value unless all wells in Mappilla yards are closed beyond possibility of secret use. On these lines the general idea of the scheme is approved by the Sanitary Board and is recommended to Government,

(True Extract.)

R. PARSONS,
Secretary, Sanitary Board.

To the Secretary to Government, Local and Municipal Department,
with papers in original.

Order—No. 1548 M., dated 5th September 1898.

The Sanitary Engineer is requested to undertake, as soon as possible, the preparation of a scheme for the water-supply of Calicut on the lines approved by the Sanitary Board.

2. The attention of the Municipal Council is drawn to the Sanitary Board's remark that all the wells in Mappilla yards should be closed when the scheme has been carried out.

(True Extract.)

H. TREMENSEN,
Secretary to Government.

To the Chairman, Municipal Council, Calicut.
Collector of Malabar.
Sanitary Board, with enclosures returned.
Commissioner.
Engineer.

LOCAL AND MUNICIPAL DEPARTMENT.

NOTES CONNECTED WITH G.O., No. 1548 M., DATED
5TH SEPTEMBER 1898.

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(1) that the water-supply of the town which was chiefly obtained from private wells, of which there was one in almost every compound and garden, was good, except in the Mappilla quarters, where the soil was so far contaminated already and the water level was so little below the surface of the ground, that the drainage of the place, though preventing the further progress of mischief, would be powerless in checking the causes of pollution that already existed in the soil;

(2) that a good and sufficient supply of water could be obtained for the Mappillas from the Mananchira tank, which was situated to the north-east of the town on a high level and was therefore less liable to contamination; and

(3) that as this tank was not used by the people on account of its distance, the only way to induce them to use the water would be to bring it to their doors by means of pipes.

He therefore suggested the preparation of a scheme for the water-supply of the Mappilla quarters from this tank, the cost of which was roughly estimated by him to be between Rs. 75,000 and Rs. 1,00,000.

2. The Municipal Council of Calicut, however, did not approve the proposal for the reasons, firstly, that its financial condition did not admit of any expenditure being incurred towards the scheme and secondly, that the drainage of the town was more important than water-supply. But the Government overruled the Council's objection on the ground that the report of the Sanitary Engineer afforded ample proof of the immediate necessity for improving the sanitation of the town and considered that the water-supply scheme should have precedence over the drainage scheme. The Municipal Council was accordingly directed to make the

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necessary provision for the investigation of the water-supply project, which was thereupon put down on the Sanitary Engineer's programme for 1895.

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3. In the meantime, the Sanitary Commissioner, who inspected Calicut in 1894, considered that before deciding upon the Mananchira tank as the source for the future water-supply of the Mappilla quarters, it was necessary that certain matters should be investigated. He doubted the sufficiency of water in the Mananchira tank and also the quality of the supply. He considered that the tank was apparently fed by a special stratum of water under pressure confined between two impervious strata, one of which had been penetrated, as well as from the ordinary subsoil water, and that, as the subsoil water was evidently open to much pollution, it should not be drawn upon for the supply of Calicut, if it was possible to do otherwise. He therefore suggested that exploratory borings should be made for the purpose of ascertaining more as to subsoil conditions, and especially to find out whether any impervious stratum of clay underlay the previous upper stratum on which the surface water was supported, and that if this was found to be the case, bored or driven wells could be used within the interior of the town or even the Mananchira tank might be employed, if by iron cylinders or other measures the subsoil water were excluded. He added that, if this was not proved and if it was found necessary to depend upon the subsoil water, it would be requisite to select an area sufficiently removed from the town to guarantee the purity of the soil.

Vide pages 13 and 14 in G.O., No. 513 M., dated 23rd April 1894.

4. The Sanitary Engineer Mr. Ellis, to whom the Sanitary Commissioner's letter was referred for remarks, visited Calicut in 1894, and reported that as the position of the Mananchira tank was certainly not very desirable, it would be much better to go beyond the town for a source of supply and that there were several springs at the foot of the Poloor Hill, which was about 3 miles from Calicut, where wells yielding a pure supply might be sunk. He estimated the cost of this scheme at 4 lakhs and recommended that, if the finances of the Municipality did not permit of its being undertaken for some years to come, the Mananchira tank might be tested with regard to its yield, with the view of making it the source of supply as a temporary measure for the Mappilla quarters until such time as the Municipality could find the necessary funds for a larger scheme. He also observed that whatever pipes were laid as a temporary measure could form part of the larger scheme, whenever that came into existence, and added that the urgent need for a water-supply scheme for the Mappilla quarters had already been fully explained in the Assistant Sanitary Engineer's report of 1890, that the popular opinion about the water of the Mananchira tank was that it was good, that it was used by Europeans and Eurasians living near the tank, that the chemical analysis showed that the only impurity which was in excess of the standard fixed for 'usable' water was albumenoid ammonia and that there were indications that this impurity was of vegetable origin and therefore not very dangerous.

5. The Municipal Council, to which the Sanitary Engineer's letter was referred for remarks, stated that it was not ambitious to provide a correct scheme of water-supply to the whole town, which extended over an area of $13\frac{1}{2}$ square miles, as its cost, viz., 4 lakhs, was beyond its means and as the A, G and H Divisions of the town obtained a good supply of potable water from wells, and that it resolved to accept the scheme for the supply of water from the Mananchira tank. The Sanitary Board, to whom the whole correspondence was sent for remarks, was of opinion that, before the question of the advisability of using the water of this tank could be determined, an exploratory, boring well or excavation should be made in the immediate proximity of the tank in view to ascertaining the existence or non-existence of water of good quality at the lower stratum, as supposed by Dr. King, and stated that, when this had been done and the quantity of the source and the feasibility of

Vide Current No. 3436 M. in G.O., No. 583 M., dated 31st March 1896.

Vide Current No. 715 M. in G.O., No. 583 M., dated 31st March 1896.

measures providing for the exclusion of the subsoil water had been determined, the Board would be in a position to advise finally as to the adoption of the Mananchira tank scheme or the alternative Poloor Hill scheme proposed by Mr. Ellis.

6. The Municipal Council which was thereupon requested to take steps to furnish the information required by the Sanitary Board, carried out the necessary experiments and reported the results to the Board through the Sanitary Engineer, and the Sanitary Board now submits the Sanitary Engineer's report in the matter with its resolution thereon. The Sanitary Engineer states that the results of the experiments show that the Mananchira tank receives its supply from two distinct sources, viz., (1) an upper sandy layer liable to contamination and (2) a porous layer below an impermeable stratum—presumably containing a pure water. Judging from the position of the strata, the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water and accordingly proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchira tank, a small elevated reservoir and distribution pipes therefrom. He states that the scheme cannot be taken up for some time yet, but will be put on the programme at the earliest opportunity. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that before sinking below the laterite, each well is steined with laterite in cement to prevent the ingress of water from the upper pervious strata, and approves the general idea of the scheme on the said lines. The Sanitary Board, however, observes that the scheme would be of little practical value, unless all wells in Mappilla yards are closed beyond possibility of secret use.

7. In these circumstances, it is submitted that the Sanitary Engineer may be requested to undertake the preparation of the scheme, as soon as possible, on the lines approved by the Sanitary Board and that the attention of the Municipal Council may be drawn to the Sanitary Board's remark regarding the closure of all private wells in the Mappilla quarters, when the scheme has been executed. The accompanying draft order is submitted for approval.

V. RAGHAVA CHARLU—20-8-98.

II. TREMENHEERE—26-8-98.

[G.O., No. 1548 M., dated 5th September 1898.]

Government of Madras.
LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd.

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Water-supply.

Requesting, with remarks, the Sanitary Engineer to undertake the preparation of a scheme for the — of Calicut on the lines approved by the Sanitary Board.

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2. There has been a good deal of delay in getting the well sunk, the well first sunk was a failure and progress with a second one has been very slow.

3. The results of sinking the well, however, are now available and will be found reported in the overseer's report forwarded with the Chairman's letter No. ¹⁵₉₈ of 6th January 1898 (copy attached).

4. The overseer has, however, not identified the various samples from the strata correctly and these are correctly shown in a note by the Assistant Sanitary Engineer (copy herewith). I have examined the samples and concur with his remarks.

5. The main question at issue has been whether the Mananchera tank receives any supply from a pure source—that it does so cannot now be doubted because the white sand layers 8 feet in thickness are perfectly pure indeed, no whiter sand could possibly be found.

6. Under this is a bed of lignite which forms the bed of the tank and this is 4 feet thick; below this again there is coarse sand and sand and gravel so that even if enough water were not procurable from the white sand, this lower strata can be drawn on.

7. It may be noted in passing that a similar bed of lignite to that already referred to was found when boring at Cochin.

8. From the position of strata, I think it possible that wells sunk into the white sand or the lower coarse sand will yield artesian water.

9. The water of the Mananchera tank has been declared usable, the albumenoid ammonia was slightly high, but this can be understood with an open tank.

10. That pure water can be obtained from wells sunk around the tank cannot be doubted and the quantity should be ample, but this it has been impossible to test as the well sunk cannot be baled out by manual labour and no steam pump is available near Calicut. The contents of the tank itself which fills yearly, however, would yield an ample supply as shown in Chairman's letter quoted below so that with constant pumping there can be no fear of insufficiency.

11. It is proposed that a scheme should be prepared for the supply to the Mappilla quarters of Calicut. The main feature of this scheme being a series of wells adjacent to the Mananchera tank, a small elevated reservoir and distribution pipes therefrom.

12. The scheme cannot be taken up for sometime yet but will be put on the programme at the earliest opportunity.

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8. From the position of strata, I think it possible that wells sunk into the white sand or the lower coarse sand will yield artesian water.

9. The water of the Mananchera tank has been declared usable, the albumenoid ammonia was slightly high, but this can be understood with an open tank.

10. That pure water can be obtained from wells sunk around the tank cannot be doubted and the quantity should be ample, but this it has been impossible to test as the well sunk cannot be baled out by manual labour and no steam pump is available near Calicut. The contents of the tank itself which fills yearly, however, would yield an ample supply as shown in Chairman's letter quoted below so that with constant pumping there can be no fear of insufficiency.

11. It is proposed that a scheme should be prepared for the supply to the Mappilla quarters of Calicut. The main feature of this scheme being a series of wells adjacent to the Mananchera tank, a small elevated reservoir and distribution pipes therefrom.

12. The scheme cannot be taken up for sometime yet but will be put on the programme at the earliest opportunity.

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Letter—from M.R.Ry. P. RARICHAN, Road Overseer, Calicut.
To—the Chairman, Municipal Council, Calicut.
Dated—the 4th January 1898.
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with papers in original.

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4. He proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchera tank, a small elevated reservoir, and distribution pipes therefrom.

5. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that, before sinking below the laterite, each well is stained with laterite in cement, to prevent the ingress of water from the upper pervious strata. The scheme would be, however, of little practical value unless all wells in Mappilla yards are closed beyond possibility of secret use. On these lines the general idea of the scheme is approved by the Sanitary Board and is recommended to Government.

(True Extract.)

R. PARSONS,
Secretary, Sanitary Board.

To the Secretary to Government, Local and Municipal Department,
with papers in original.

Order—No. 1548 M., dated 5th September 1898.

The Sanitary Engineer is requested to undertake, as soon as possible, the preparation of a scheme for the water-supply of Calicut on the lines approved by the Sanitary Board.

2. The attention of the Municipal Council is drawn to the Sanitary Board's remark that all the wells in Mappilla yards should be closed when the scheme has been carried out.

(True Extract.)

H. TREMENEERE,
Secretary to Government.

To the Chairman, Municipal Council, Calicut.
" Collector of Malabar.
" Sanitary Board, with enclosures returned.
" Commissioner.
" Engineer.

13. The following is a list of the papers accompanying—

- (1) Report of Assistant Sanitary Engineer to Government, 1890.
- (1-A) Letter from the Acting Sanitary Engineer to Government, No. 2417, of 29th October 1894.
- (2) Letter from the Sanitary Engineer to Government, No. 813, of 26th March 1895.
- (3) Letter from the Chairman, Municipal Council, Calicut, No. 915, of 3rd October 1895.
- (4) Note of Sanitary Commissioner, No. ²¹⁹⁵ S, of 2nd December 1895.
- (5) Note by Colonel Campbell, No. 12/S, of 27th January 1896.
- (6) Resolution of the Sanitary Board, No. ² S.B.F., of 24th February 1896.
- (7) Report of overseer and Chairman's letter, No. 15, of 6th January 1898.
- (8) Note by Assistant Sanitary Engineer to Government, dated 9th May 1898.

ENCLOSURES.

Letter—from M.R.Ry. P. PARICHAN, Road Overseer, Calicut.
To—the Chairman, Municipal Council, Calicut.
Dated—the 4th January 1898.
No.—148.

I beg to report that I have herewith sent the sample of earth packed up, in a tin case, taken at every 4 feet of the depth of the pot well lately sunk at the Municipal garden near Mananchera tank, Calicut, for the inspection of the Sanitary Engineer, Madras.

The subjoined is the list of the earth enclosed:—

1 to 4 feet	.. .. .	Sandy soil, light black.
4 " 8 feet	.. .. .	do. a little white.
8 " 12 feet	.. .. .	Reddish.
12 " 16 feet	.. .. .	Chalk white clay
16 " 20 feet	.. .. .	Do. pure white } Sand pure white.
20 " 24 feet	.. .. .	Black clay lignite.
24 " 28 feet	.. .. .	Reddish clay—gravel and sand.
28 " 30 feet	.. .. .	do. the total depth of the pot well.

I also beg to report that in sounding Mananchera tank I have found it in all 19½ feet deep to the ground level, viz., depth of water 15 feet, above water to the road level 4½ feet.

Letter—from M.R.Ry. R. RAMA RAO Avargal, Chairman, Municipal Council, Calicut.
To—the Sanitary Engineer to Government.
Dated—the 6th January 1898.
No.—¹⁵ 98

In continuation of this office letter No. 1298, dated 30th June 1897, I have the honour to inform you that the pot well has been sunk to a depth of 30 feet.

A copy of the road overseer's report on the subject together with samples of earth excavated from the well are also forwarded herewith.

Note by Assistant Sanitary Engineer on Calicut Water-supply, dated 9th May 1898.

I had intended to go to Calicut, but subsequently found that doing so would be of little use because—

- (1) The well could not be baled out by manual labour.
- (2) There was no steam pump available there.
- (3) Even if one were available, I don't think the well would stand pumping. It would collapse as it frequently did before.

A section of the boring (vide sketch below) proves Dr. King's theory to be true. Strata (1) and (2) are sandy, porous and water-bearing; stratum (3) is impermeable indurated clay; strata (4) and (5) are porous water-bearing sands, and below these there is a bed of lignite.

No. 1548 M., 5TH SEPTEMBER 1898.

The tank, therefore, receives its supply from a sandy layer at the top naturally open to contamination, and secondly from another porous layer, bedded between two impermeable layers—this water, therefore, being presumably purer than that obtained from the top layers.

I may note here that the section of the well indicates a fair prospect of a good supply being obtained by a deep boring.

I may also mention that it is popularly believed that there is a well in the bed of the tank. If it be so, the tank must also be deriving a supply from the stratum of gravel below the lignite bed.

Resolution—No. 371/S., dated 27th June 1898.

The question of a water-supply scheme for the Mappilla quarters of the town of Calicut has been under consideration for some years, the proposed source of supply being the Mananchera tank. Before deciding on the use of this water, the late Sanitary Board considered it necessary that an exploratory boring well or excavation should be made in the immediate proximity of the tank, in order to ascertain whether there exists, as suspected, a subterranean supply of good quality.

2. The Sanitary Engineer now submits the results of the boring which shows that the tank receives its supply from two distinct sources, viz.—

(1) an upper sandy layer liable to contamination, and

(2) a porous layer below an impermeable stratum, presumably a pure water.

3. Judging from the position of the strata the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water.

4. He proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchera tank, a small elevated reservoir, and distribution pipes therefrom.

5. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that, before sinking below the laterite, each well is stained with laterite in cement, to prevent the ingress of water from the upper pervious strata. The scheme would be, however, of little practical value unless all wells in Mappilla yards are closed beyond possibility of secret use. On these lines the general idea of the scheme is approved by the Sanitary Board and is recommended to Government.

(True Extract.)

R. PARSONS,
Secretary, Sanitary Board.

To the Secretary to Government, Local and Municipal Department,
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The Sanitary Engineer is requested to undertake, as soon as possible, the preparation of a scheme for the water-supply of Calicut on the lines approved by the Sanitary Board.

2. The attention of the Municipal Council is drawn to the Sanitary Board's remark that all the wells in Mappilla yards should be closed when the scheme has been carried out.

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" Collector of Malabar.
" Sanitary Board, with enclosures returned.
" Commissioner.
" Engineer.

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd.

Regd.

1898.

Enclosures

Spare copies

G.O., No. 1548 M., 5th September 1898.

Water-supply.

Requesting, with remarks, the Sanitary Engineer to undertake the preparation of a scheme for the — of Calicut on the lines approved by the Sanitary Board.

No. 1548 M., 5TH SEPTEMBER 1898.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following paper:—

Proceedings of the Sanitary Board, No. 371/S., dated 27th June 1898.

Read—the following paper:—

Office-note—from J. A. JONES, Esq., Sanitary Engineer to Government.
To—the Secretary, Sanitary Board.
Dated—the 10th May 1898.
No.—940.

Calicut Water-supply.

About the year 1890 a suggestion was made by this Department that a supply of water for the Mappilla quarters of Calicut should be obtained from the Mananchera tank situated near the centre of and at the highest point of Calicut. After much discussion the Municipal Council accepted the proposal, but as doubts as to the quality and quantity of the supply were raised, the Sanitary Board in its Proceedings No. ² E.B.P. of 24th February 1896 (copy attached) ordered certain investigations to be made.

2. There has been a good deal of delay in getting the well sunk, the well first sunk was a failure and progress with a second one has been very slow.

3. The results of sinking the well, however, are now available and will be found reported in the overseer's report forwarded with the Chairman's letter No. ¹⁵ of 6th January 1898 (copy attached).

4. The overseer has, however, not identified the various samples from the strata correctly and these are correctly shown in a note by the Assistant Sanitary Engineer (copy herewith). I have examined the samples and concur with his remarks.

5. The main question at issue has been whether the Mananchera tank receives any supply from a pure source—that it does so cannot now be doubted because the white sand layers 8 feet in thickness are perfectly pure indeed, no whiter sand could possibly be found.

6. Under this is a bed of lignite which forms the bed of the tank and this is 4 feet thick; below this again there is coarse sand and sand and gravel so that even if enough water were not procurable from the white sand, this lower strata can be drawn on.

7. It may be noted in passing that a similar bed of lignite to that already referred to was found when boring at Cochin.

8. From the position of strata, I think it possible that wells sunk into the white sand or the lower coarse sand will yield artesian water.

9. The water of the Mananchera tank has been declared usable, the albumenoid ammonia was slightly high, but this can be understood with an open tank.

10. That pure water can be obtained from wells sunk around the tank cannot be doubted and the quantity should be ample, but this it has been impossible to test as the well sunk cannot be baled out by manual labour and no steam pump is available near Calicut. The contents of the tank itself which fills yearly, however, would yield an ample supply as shown in Chairman's letter quoted below so that with constant pumping there can be no fear of insufficiency.

11. It is proposed that a scheme should be prepared for the supply to the Mappilla quarters of Calicut. The main feature of this scheme being a series of wells adjacent to the Mananchera tank, a small elevated reservoir and distribution pipes therefrom.

12. The scheme cannot be taken up for sometime yet but will be put on the programme at the earliest opportunity.

No. 1548 M., 5TH SEPTEMBER 1898.

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ENCLOSURES.

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The tank, therefore, receives its supply from a sandy layer at the top naturally open to contamination, and secondly from another porous layer, bedded between two impermeable layers—this water, therefore, being presumably purer than that obtained from the top layers.

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2. The Sanitary Engineer now submits the results of the boring which shows that the tank receives its supply from two distinct sources, viz.—

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4. He proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchera tank, a small elevated reservoir, and distribution pipes therefrom.

5. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that, before sinking below the laterite, each well is stained with laterite in cement, to prevent the ingress of water from the upper pervious strata. The scheme would be, however, of little practical value unless all wells in Mappilla yards are closed beyond possibility of secret use. On these lines the general idea of the scheme is approved by the Sanitary Board and is recommended to Government.

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To the Chairman, Municipal Council, Calicut.
" Collector of Malabar.
" Sanitary Board, with enclosures returned.
" " Commissioner.
" " Engineer.

LOCAL AND MUNICIPAL DEPARTMENT.

NOTES CONNECTED WITH G.O., No. 1548 M., DATED
5TH SEPTEMBER 1898.

Previous papers.

G.O., No. 1871 M., dated	8th December	1890.
" " 1396 M. "	31st August	1891.
" " 930 M. "	26th May	1892.
" " 1114 M. "	28th June	"
" " 513 M. "	23rd April	1894.
" " 542 M. "	5th May	"
" " 583 M. "	31st March	1896.

[SUBJECT.—Calicut water-supply scheme.]

From the Sanitary Board, dated 27th June 1898, No. 371-S.

In his report on the inspection of Calicut in September 1890, the Assistant Sanitary Engineer stated—

(1) that the water-supply of the town which was chiefly obtained from private wells, of which there was one in almost every compound and garden, was good, except in the Mappilla quarters, where the soil was so far contaminated already and the water level was so little below the surface of the ground, that the drainage of the place, though preventing the further progress of mischief, would be powerless in checking the causes of pollution that already existed in the soil;

(2) that a good and sufficient supply of water could be obtained for the Mappillas from the Mananchira tank, which was situated to the north-east of the town on a high level and was therefore less liable to contamination; and

(3) that as this tank was not used by the people on account of its distance, the only way to induce them to use the water would be to bring it to their doors by means of pipes.

He therefore suggested the preparation of a scheme for the water-supply of the Mappilla quarters from this tank, the cost of which was roughly estimated by him to be between Rs. 75,000 and Rs. 1,00,000.

2. The Municipal Council of Calicut, however, did not approve the proposal for the reasons, firstly, that its financial condition did not admit of any expenditure being incurred towards the scheme and secondly, that the drainage of the town was more important than water-supply. But the Government overruled the Council's objection on the ground that the report of the Sanitary Engineer afforded ample proof of the immediate necessity for improving the sanitation of the town and considered that the water-supply scheme should have precedence over the drainage scheme. The Municipal Council was accordingly directed to make the

Paragraph 2 of G.O., No. 1396 M., dated 31st August 1891.
G.O., No. 1114 M., dated 28th June 1892.

No. 1548 M., 5TH SEPTEMBER 1898.

necessary provision for the investigation of the water-supply project, which was thereupon put down on the Sanitary Engineer's programme for 1895.

3. In the meantime, the Sanitary Commissioner, who inspected Calicut in 1894, considered that before deciding upon the Mananchira tank as the source for the future water-supply of the Mappilla quarters, it was necessary that certain matters should be investigated. He doubted the sufficiency of water in the Mananchira tank and also the quality of the supply. He considered that the tank was apparently fed by a special stratum of water under pressure confined between two impervious strata, one of which had been penetrated, as well as from the ordinary subsoil water, and that, as the subsoil water was evidently open to much pollution, it should not be drawn upon for the supply of Calicut, if it was possible to do otherwise. He therefore suggested that exploratory borings should be made for the purpose of ascertaining more as to subsoil conditions, and especially to find out whether any impervious stratum of clay underlay the previous upper stratum on which the surface water was supported, and that if this was found to be the case, bored or driven wells could be used within the interior of the town or even the Mananchira tank might be employed, if by iron cylinders or other measures the subsoil water were excluded. He added that, if this was not proved and if it was found necessary to depend upon the subsoil water, it would be requisite to select an area sufficiently removed from the town to guarantee the purity of the soil.

4. The Sanitary Engineer Mr. Ellis, to whom the Sanitary Commissioner's letter was referred for remarks, visited Calicut in 1894, and reported that as the position of the Mananchira tank was certainly not very desirable, it would be much better to go beyond the town for a source of supply and that there were several springs at the foot of the Poloor Hill, which was about 3 miles from Calicut, where wells yielding a pure supply might be sunk. He estimated the cost of this scheme at 4 lakhs and recommended that, if the finances of the Municipality did not permit of its being undertaken for some years to come, the Mananchira tank might be tested with regard to its yield, with the view of making it the source of supply as a temporary measure for the Mappilla quarters until such time as the Municipality could find the necessary funds for a larger scheme. He also observed that whatever pipes were laid as a temporary measure could form part of the larger scheme, whenever that came into existence, and added that the urgent need for a water-supply scheme for the Mappilla quarters had already been fully explained in the Assistant Sanitary Engineer's report of 1890, that the popular opinion about the water of the Mananchira tank was that it was good, that it was used by Europeans and Eurasians living near the tank, that the chemical analysis showed that the only impurity which was in excess of the standard fixed for 'usable' water was albumenoid ammonia and that there were indications that this impurity was of vegetable origin and therefore not very dangerous.

5. The Municipal Council, to which the Sanitary Engineer's letter was referred for remarks, stated that it was not ambitious to provide a correct scheme of water-supply to the whole town, which extended over an area of $13\frac{1}{4}$ square miles, as its cost, viz., 4 lakhs, was beyond its means and as the A, G and H Divisions of the town obtained a good supply of potable water from wells, and that it resolved to accept the scheme for the supply of water from the Mananchira tank. The Sanitary Board, to whom the whole correspondence was sent for remarks, was of opinion that, before the question of the advisability of using the water of this tank could be determined, an exploratory boring well or excavation should be made in the immediate proximity of the tank in view to ascertaining the existence or non-existence of water of good quality at the lower stratum, as supposed by Dr. King, and stated that, when this had been done and the quantity of the source and the feasibility of

measures providing for the exclusion of the subsoil water had been determined, the Board would be in a position to advise finally as to the adoption of the Mananchira tank scheme or the alternative Poloor Hill scheme proposed by Mr. Ellis.

6. The Municipal Council which was thereupon requested to take steps to furnish the information required by the Sanitary Board, carried out the necessary experiments and reported the results to the Board through the Sanitary Engineer, and the Sanitary Board now submits the Sanitary Engineer's report in the matter with its resolution thereon. The Sanitary Engineer states that the results of the experiments show that the Mananchira tank receives its supply from two distinct sources, viz., (1) an upper sandy layer liable to contamination and (2) a porous layer below an impermeable stratum—presumably containing a pure water. Judging from the position of the strata, the Sanitary Engineer thinks it possible that wells sunk below the impermeable strata will yield artesian water and accordingly proposes that a scheme should be prepared for the supply of the Mappilla quarters of the town, of which the main features would be a series of wells adjacent to the Mananchira tank, a small elevated reservoir and distribution pipes therefrom. He states that the scheme cannot be taken up for some time yet, but will be put on the programme at the earliest opportunity. The Sanitary Board is of opinion that the proposed scheme should give a supply of usable water, provided that before sinking below the laterite, each well is steined with laterite in cement to prevent the ingress of water from the upper pervious strata, and approves the general idea of the scheme on the said lines. The Sanitary Board, however, observes that the scheme would be of little practical value, unless all wells in Mappilla yards are closed beyond possibility of secret use.

7. In these circumstances, it is submitted that the Sanitary Engineer may be requested to undertake the preparation of the scheme, as soon as possible, on the lines approved by the Sanitary Board and that the attention of the Municipal Council may be drawn to the Sanitary Board's remark regarding the closure of all private wells in the Mappilla quarters, when the scheme has been executed. The accompanying draft order is submitted for approval.

V. RAGHAVA CHARLU—20-8-98.
H. TREMENHEERE—26-8-98.

[G.O., No. 1548 M., dated 5th September 1898.]