BACK PAPERS.

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

FURTHER PAPERS.

G.O.	No.	Department.	Date.	G.O.	No.	Department.	Date.
Ccco 24th/99							

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Local & Munl. (190) Department.

PRINTED.

G.O., No. 879 M

DATED 22-6-1899

[Despatch Abstract.]

BACK PAPERS.

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

FURTHER PAPERS.

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

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd. } 1899. *Enclosures*

Regd. } 1899. *Spare copies*

G.O., No. 879 M., 22nd June 1899.

Water-supply.

Stating, with remark, that the proposal of the Sanitary Engineer to supply the Mappila quarters of the town of Calicut with water from the Mananchira tank is undesirable and requesting the Sanitary Engineer to investigate the matter on the lines indicated by the Sanitary Commissioner and report the result to Government.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

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Proceedings of the Sanitary Board, No. 285/S., dated 31st May 1899.

Read—the following papers :—

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2. The trial well is about 20 feet from the edge of the tank, is 6 feet inside diameter and is lined throughout with laterite masonry 9" in thickness. On the date on which the test was made (19th October 1898) the depth of the well was 28½ feet below ground, and the depth of water in it was 23½ feet. The well is said to have been sunk to a depth of 30 feet—the reduction of 1½ feet in the depth being accounted for as silting.

3. As a steam pump was not available, it was decided to bale out water by manual labour. Calculations made after careful observations showed that water was baled out at the rate of 50 gallons per minute. After baling was commenced water in the well fell rapidly until it was reduced by 8 feet and at this depth the water level remained stationary, showing that the inflow into the well with a head of 8 feet was 50 gallons per minute. Baling was kept up for about 20 minutes after the well attained the lowest level, *i.e.*, 8 feet below the normal, when the ground around the well suddenly sank, the depression in one place being three feet below ground level.

4. The depth of the well was 28½ feet before baling commenced. The well was guaged again after the sinking of the adjoining ground and the depth was found to be only 23 feet. There was thus an accumulation of 5½ feet of sand in the well. A little of this sand was brought up in a bucket. The sand was extremely fine.

5. The question that naturally occurs at once is "Where is the sand coming from?", because the last 10 feet of soil through which the well passed consists, according to the measurements and specimen of soil furnished by the Municipal Overseer, of 4 feet of lignite, 4 feet of coarse sand and 2 feet of gravel. After a careful consideration of the question, and enquiries as to the nature of soil passed through in sinking another well within 500 yards of the trial well, the undersigned is led to the conclusion that the depths of the various strata as given by the overseer must be inaccurate. This is evident from the fact all the strata are shown of the uniform thickness of 4 feet, a state of things rarely, if ever, met with in nature. All that can now be safely accepted from the record of the boring as submitted by the Municipal Overseer is, (1) that somewhere between the surface level and the bed of the tank there exists a lateritic bed presumably impervious or comparatively so, and (2) that below the lateritic bed the soil consists of sand intermixed with layers of lignite, gravel and loam.

They may be so to some extent but the position of the various strata is no doubt correct and samples of each strata were obtained so that their existence and their relative positions are probably correct.
J. A. JONES.

6. The result of the test made to find the yield from the trial well shows, that in any permanent infiltration well on the site in question it will be dangerous to pump with a head of 8 feet; and considering the fineness of the sand the undersigned considers that it would involve serious risks if the maximum head of pumping is fixed at anything above three feet. There are authenticated instances of sand blows having occurred when pumping with a head of 8 feet even in coarser sand than what has entered the trial well. With coarse sand 5 feet of head is admitted as the maximum, but it would be unwise to have a greater head than 3 feet for infiltration wells near the Mananchira tank.

7. The yield from a 6 feet well, under a head of 8 feet, was 50 gallons per minute. Assuming that the yield varies, other conditions being same, according to the square root of the head and diameter of the well, the yield from a well 15 feet diameter is not likely to exceed 75 gallons per minute.

8. It is not possible to sink more than two wells adjacent to the Mananchira tank. The only site available on the margin of the tank for locating infiltration works is a garden about 440 feet long to the north of the tank. This length admits of only two infiltration wells, the combined capacity of which will be 150 gallons per minute.

9. The population of the Mappila quarters, which this scheme is intended to serve, is about 18,000, that of the whole town being 66,000. The scheme should therefore provide for a population of at least 20,000, at 15 gallons per head; the supply required will be 420 * gallons per minute. The yield from two infiltration wells which is reckoned at 150 gallons will be most inadequate.

* Double the average supply.

10. In respect to potableness the tank water is much superior to the water in the trial well. In December last samples of water drawn at the same time from the Mananchira tank and the trial well were sent to the Chemical Examiner for analysis. His report is appended. The trial well water is originally purer, but the mineral impurities are in such excess as to render the water unacceptable to the people. The trial well water has a hardness of 17·50°, while the Mananchira tank water does not much exceed 1° of hardness. The well water of Calicut—the water which the people are accustomed to—is very soft, and they will not take kindly to a water whose characteristic is great hardness. The hardness of the trial well water is evidently due to some calcareous strata not reached by the tank, but which has been passed by the well which is 10 feet deeper than the tank. If the depth of infiltration wells is limited to the depth of the tank, with the view of avoiding the calcareous strata, the two proposed wells will yield even less than the quantity reckoned in paragraph 8 *supra*.

The difference between the results of the two analyses shows that the water is not derived from the same source and it is not quite understood how magnesia salts will be harmless to use for drinking and yet affect cooking pots. (See Chemical Examiner's note.)
J. A. JONES.

Probably the lower strata—see boring, section attached.
J.A.J.

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12. Successive Sanitary Commissioners have in their reports dwelt on the exceeding insanitary condition of the subsoil in the area occupied by the Moppilas at Calicut. The Moppilas obtain their drinking water from shallow wells in their own compounds. It is truth to say that the water so obtained is nothing but the affluent from a soil saturated with human excrementitious matter. It is, therefore, not to be wondered at that frequently cholera in a virulent form breaks out in the Moppila quarters and claims its victims by hundreds. In 1897 the incidence of mortality from cholera in all Municipalities was 4·8 per mille. In the same year in Calicut cholera was answerable for 1,497 deaths, which gives the high rate of 23·1 per mille, or nearly five times greater than the average for all Municipalities. If then, the water-supply of the Moppila wards can be improved at a moderate cost, it is but just that that improvement should be carried out, and the undersigned thinks that a marked improvement in the water-supply of the Moppila wards can be effected by adopting the scheme for pumping water from the Mananchira tank.

13. The Mananchira tank scheme will cost about Rs. 1,00,000 and will serve a population of about 20,000, mostly Moppilas. As regards sufficiency of water there is little doubt. The tank has an area, at summer level, of $440' \times 425' = 187{,}000$ sq. feet against an area not exceeding 400 sq. feet which infiltration wells in that locality would give. A depth of only 3″ in the tank represents the total supply required for a population of 20,000 people at 15 gallons per head per diem, and the tank could easily recoup itself in 24 hours.

14. As regards quality, repeated analysis of the Mananchira tank water has shown that it is such as can be classed as "usable".

15. The objections which the Sanitary Commissioner sees to the use of the tank water are, first, that the depression of water level during pumping might draw into it impurities from neighbouring areas. It has been shown that the whole quantity required is represented by a depth of only 3″ in the tank, and, as there will be inflow into the tank during pumping, the depression will not exceed an inch or two at most. With such a small depression the cone of depression and the velocity of inflow will be too small to cause any apprehensions as regards the attraction of impurities into the tank. His second objection is that the tank receives an impure supply from the upper layers of the soil, which mingles with the purer supply derived from the lower layers. This might be so, but there are no proofs of its being so. On the contrary there are reasons for believing that the upper layer of impure water is cut off and that the tank receives its supply only from the lower and comparatively purer layers. The sinking of the trial well has shown that an impermeable stratum intervenes between the upper and lower layers of water, while the tank itself is protected by a heavy revetment in the shape of a flight of steps, formed of laterite blocks, from the surface to the bottom of the tank. The flight of steps must have been built long ago, long before the memory of the oldest inhabitant, and the perfect state of preservation in which it is indicates that it must be of massive construction well backed by masonry or concrete which will not allow of any percolation of water. These facts go to show that the upper impure layer is cut off and the water enters the tank only at the bottom. The liability of the tank water to surface contamination can be minimised, if not avoided, by blocking up the entrance passages and perforations in the parapet wall of the tank; a wire netting can also be fixed above the top of the parapet wall to a height of 8 or 10 feet above ground as a further protection.

16. It is not claimed for the Mananchira tank that it will yield an ideal supply of water, but it will certainly afford a supply infinitely superior to the unwholesome water which the Moppilas now use. The Mananchira tank water has been pronounced "usable" after chemical analysis, and it is used for drinking purposes by Eurasians and Europeans living in the neighbourhood of the tank. It is popularly considered very good water, and the rich Moppilas, who can afford it, cart the water to their houses. There can be no comparison whatever between the tank water and the water used by the Moppilas generally. Though the Mananchira tank water may fall short of the standard of a perfect water, it ranks so much above the water ordinarily used by the Moppilas, that the introduction of the tank water into the Moppila wards cannot but result in much benefit to the health of the community.

17. The supply of water to the Mappila quarters from the Mananchira tank need not be looked upon as anything but a temporary measure to be in operation only until a comprehensive scheme for the whole town is adopted and executed. The expenditure on the Mananchira tank scheme will not be lost. The pipes laid will form portion of the distribution system of the larger scheme whenever that scheme is executed. The only loss will be the cost of the pumping house and engines, half at least of which can be realised after 10 years' use. The total loss will not exceed Rs. 10,000 which spread over 10 years gives a thousand rupees a year, which is not a heavy price to pay for the benefit of a good water-supply, the saving of many lives for which cholera is now responsible, and finally the general improvement of the health of the community.

MADRAS,
27th January 1899.

H. NOWROJI, A.M.I.C.E.,
Asst. Sanitary Engineer to Govt.

No. 140, *dated 2nd February* 1899.

True copy forwarded to the Secretary, Sanitary Board, through the Sanitary Commissioner for Madras.

The undersigned thinks that resort to the tank is the only means of giving the Mappila quarters a supply of water within a reasonable time.

He however suggests that the water from the tank be pumped on to filter beds and flow thence to a service reservoir which works would be situated in the gardens north of the tank. The water which is usable at present would then be much improved.

J. A. JONES,
Sanitary Engineer to Government.

Letter—from Major K. C. SANJANA, I.M.S., Acting Chemical Examiner, Madras.
To—the Assistant Sanitary Engineer to Government.
Dated—the 19th December 1899.
No.—1236.

With reference to your demi-official letter, dated 15th November 1898, and letter, dated 5th December 1898, No. 1724, I have the honour to submit herewith the analyses of the two samples of water received on the 6th instant.

From a comparison of the figures you will see that the trial well water is purer so far as free ammonia and albumenoid ammonia are concerned but contains more solids, chlorine and hardness. The hardness is due mainly to the presence of magnesium salts and is by itself not harmful for drinking purposes but may attack cooking metallic vessels.

If the tank could be purified and possible sources of organic pollution be prevented, the tank water seems to me to be much better suited for a town supply than the well water.

ENCLOSURE.

	Water from the Mananchira tank at Calicut.	Water from the trial well on the margin of the Mananchira tank at Calicut.
Total solids—Grms. per litre	0·060	0·520
Volatile solids—Grms. per litre	0·030	0·110
Chlorine—Grms. per litre	0·009	0·023
Total hardness—Clark's scale	1°·050	17°·500
Permanent hardness—Clark's scale	1°·050	17°·500
Free ammonia—Ml. grms. per litre	0·120	Trace.
Albumenoid ammonia—Ml. grms. per litre ..	0·128	0·064
Nitric acid—Ml. grms. per litre (as ammonia).	Trace.	0·600
Apparent quality of the water as inferred from the results obtained on examination.		

Note by the Sanitary Commissioner for Madras, dated 17th March 1899, *No.* 908/*S.*

[*Reference.*—Assistant Sanitary Engineer's note on the Mananchira scheme.]

To save the infliction of a longer note than necessary, I would refer to my inspection notes embodied in G.O., No. 513 M., dated 23rd April 1894, page 13, and my note No. 2195, dated 2nd December 1895, neither of which has a place in this correspondence.

2. Sanitary Board's Proceedings No. 2, dated 4th January 1896, so far as I knew, represented the scope of enquiry that was required of the Sanitary Engineer's department. It would seem, however, that the enquiry has been made with special reference to the possibility of making infiltration wells next the Mananchira tank. I am not aware whose suggestion it was. I consider so roughly have matters been pursued that little real information on the requirements of the Board in the last quoted Proceedings has been obtained. I see no reason to alter my opinion as to the necessity for correctly gathering the information required.

3. The plea for a sole supply for the Mappilas has much in it that is taking, but the ground on which this is made is not really correct. Some years back a very marked epidemic, 1890 or 1891, did prevail chiefly amongst the Mappilas, but in recent years there is no reason to think, as suggested by the Assistant Sanitary Engineer, the Hindu inhabitants of the town have not suffered as severely as the Muhammadans. Thus in 1897–98, there were 585 deaths from cholera in the Mappila quarters, against 735 in other parts of the town. It must be remembered if the Mappila buries in graveyards close to his house, the Hindu buries in his own compound close to his wells. It is unlikely that the total taxation necessary could be derived solely from the Mappila portion of the town. If the rest of the inhabitants have to pay increased taxes, yet not to be supplied with water, the action of the Municipal Council is not likely to be received with equanimity. On the other hand, if the Mappilas—the poorest part of the population—can afford this scheme, why should not the *average* inhabitant be able to meet the cost of the scheme for the entire town? In this connection, I would point out that Mr. Ellis's estimate of 4 lakhs was merely a guess, and that if the parts of Calicut really requiring a scheme were solely considered, it is probable this sum would be very greatly reduced.

4. The whole subject ought, in my opinion, to be handled in a much less haphazard way than it has been. I do not object to the scheme advanced with the idea of supporting this or that rival scheme; what I hold is that before adoption of a scheme, a properly exhaustive enquiry conducted with all the care requisite has not been effected. It cannot be said that a well sunk in such a manner as to allow of the entrance of water from every layer passed through, or so sunk that it is not recognized from which layer the water is derived, is a satisfactory method of conducting exploration! Nor do I consider the enquiry would be complete unless the depth were very much greater than stated to have been attained in the new wells.

5. I have stated that the area through which the subsoil water flows is liable to extensive pollution from human beings. As to pollution of the subsoil, both the Collector and the District Sanitary Officer concur. It is undeniable, as time advances, the chances of pollution will also increase. I have suggested that the dhobie's tank would form a possible source of pollution. The Assistant Sanitary Engineer replies that 3″ represents a day's supply; but he says nothing about the rate of inflow into the tank to make good this daily depression, nor of the influence of evaporation, nor of the maximum depression between the monsoons. It is not stated that the Mappilas only are to draw from this tank in future. On account of the Mappilas are others accustomed up to date to using this water to be prevented from using it? Hence, the depression will be that for the Mappillas *plus* that for other inhabitants *plus* that for the intermonsoon period. Actual rough experiments by the Chairman (*vide* note above referred to) support my views.

6. I suggested that the tank was really supplied from two sources—the subsoil and from a stratum below the subsoil, and that if this is proved to be the case, measures should be taken to draw from the latter source only, and that it should encourage exploration on clean sites somewhat removed from the town.

7. The Assistant Sanitary Engineer admits the existence of subsoil water and admits the existence of a subterranean water, but denies the entrance of a subsoil water. This he does on the mere assumption that the lining of the tank is so good as to prevent entrance; because it is old work it must be watertight. It is about this last idea that would have been entertained by the old tank diggers to cut off one supply in favour of that from another stratum. But, if this be the truth, why does he not enter into the nature of this highly "pucca work." But the chemical analyses show that if there be not a third source of water (not analysed as described) the water in the tank being obviously not that found in the experimental well, the tank must contain subsoil water. Indeed, I should say it is a matter that must be yielded without argument that the tank does contain subsoil water, and that if there be any other water in it, it is derived from the layer or layers below the first impermeable stratum.

8. In the copy of analyses, as supplied nothing is said about the quality of the water of the tank. Yet, the amount of free ammonia is such that it cannot escape condemnation as being derived from animal matter. Indeed, the water is well beyond the "suspicious" class and borders on the absolutely "bad" according to chemical classification.

9. Mr. Jones' suggestion to filter the water before delivery would get rid of much objection and would render the scheme acceptable, if it were ascertained nothing better could be done; but I think it is a most abnormal state of affairs to look for the water-supply of a community from a subsoil water source so bad as to demand filtration. No better source than subsoil water can be found if derived from a cleanly area. Both the sanitary survey and the chemical analysis prove that the water of the Mananchira tank is not derived from an area that can be so described.

10. As to the water found in the well, the experiment of exploration has been conducted under terms that prevent the supplying stratum being correctly recognized. It is an organically pure water although, as might be anticipated, it shows the influence of completely changed organic matter. I do not think, even as it is, that it would prove "unacceptable" on account of hardness to the ordinary native. But, the chances are that it is in the fine sand layer immediately below the first impermeable layer that this water really is contained. It does not follow that care in segregating the water from this layer, so as to prevent it mingling with that from other layers, may not prove it to be of less hardness than at present found.

11. In short, I consider that the loosely conducted exploration so far, has simply shown that a pure, but hard water exists below the stratum of the subsoil of Calicut. This being so, it is not necessary to hug the tank, but to find some clean area, if possible outside the inhabited portion, further inland and therefore higher up the natural slope towards the sea. Here, exploration ought to be made with tube wells; if as is probable, the same strata are hit off, a series of joined-up tube wells might be sunk instead of infiltration wells as suggested whence the supply could be pumped direct to the town—care being taken to draw only from the stratum desired; or even the subsoil water itself (thus avoiding the risk of hardness if the area be clean). In sinking tube wells the fine sand difficulty can be met, whilst the question of amount of supply need not be narrowed by the question of yield of two wells.

W. G. KING, Lieut.-Col., I.M.S.,
Sanitary Commissioner for Madras.

Resolution — No. 285/S., *dated* 31*st May* 1899.

In G.O., Mis. No. 1548 M., dated 5th September 1898, Government requested the Sanitary Engineer to undertake the preparation of a scheme for the water-supply of Calicut, on the lines approved by the Sanitary Board in its Proceedings No. 371/S., dated 27th June 1898. The source of supply therein proposed was a series of infiltration wells close to the Mananchira tank. Judging by the yield of a trial well sunk on the margin of the tank the Assistant Sanitary Engineer arrives at the conclusion that it is altogether hopeless to obtain an adequate supply from infiltration wells of which there is only room for two, the combined capacity of which will be 150 gallons

Note by the Sanitary Commissioner for Madras, dated 17th March 1899, No. 908/S.

[*Reference.*—Assistant Sanitary Engineer's note on the Mananchira scheme.]

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7. The Assistant Sanitary Engineer admits the existence of subsoil water and admits the existence of a subterranean water, but denies the entrance of a subsoil water. This he does on the mere assumption that the lining of the tank is so good as to prevent entrance; because it is old work it must be watertight. It is about this last idea that would have been entertained by the old tank diggers to cut off one supply in favour of that from another stratum. But, if this be the truth, why does he not enter into the nature of this highly "pucca work." But the chemical analyses show that if there be not a third source of water (not analysed as described) the water in the tank being obviously not that found in the experimental well, the tank must contain subsoil water. Indeed, I should say it is a matter that must be yielded without argument that the tank does contain subsoil water, and that if there be any other water in it, it is derived from the layer or layers below the first impermeable stratum.

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9. Mr. Jones' suggestion to filter the water before delivery would get rid of much objection and would render the scheme acceptable, if it were ascertained nothing better could be done; but I think it is a most abnormal state of affairs to look for the water-supply of a community from a subsoil water source so bad as to demand filtration. No better source than subsoil water can be found if derived from a cleanly area. Both the sanitary survey and the chemical analysis prove that the water of the Mananchira tank is not derived from an area that can be so described.

10. As to the water found in the well, the experiment of exploration has been conducted under terms that prevent the supplying stratum being correctly recognized. It is an organically pure water although, as might be anticipated, it shows the influence of completely changed organic matter. I do not think, even as it is, that it would prove "unacceptable" on account of hardness to the ordinary native. But, the chances are that it is in the fine sand layer immediately below the first impermeable layer that this water really is contained. It does not follow that care in segregating the water from this layer, so as to prevent it mingling with that from other layers, may not prove it to be of less hardness than at present found.

11. In short, I consider that the loosely conducted exploration so far, has simply shown that a pure, but hard water exists below the stratum of the subsoil of Calicut. This being so, it is not necessary to hug the tank, but to find some clean area, if possible outside the inhabited portion, further inland and therefore higher up the natural slope towards the sea. Here, exploration ought to be made with tube wells; if as is probable, the same strata are hit off, a series of joined-up tube wells might be sunk instead of infiltration wells as suggested whence the supply could be pumped direct to the town—care being taken to draw only from the stratum desired; or even the subsoil water itself (thus avoiding the risk of hardness if the area be clean). In sinking tube wells the fine sand difficulty can be met, whilst the question of amount of supply need not be narrowed by the question of yield of two wells.

W. G. King, Lieut.-Col., I.M.S.,
Sanitary Commissioner for Madras.

Resolution — No. 285/S., *dated* 31*st May* 1899.

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per minute, as against 420 gallons per minute actually required. Moreover, the water of the trial well contains an excess of mineral impurities, and is said to be inferior generally to that of the tank. He considers that unless the Sanitary Board accords its approval to taking the supply direct from the tank, the present scheme should be abandoned and the question of the water-supply of Calicut be deferred, until the Municipality is in a position to carry out the Pooloor Hill scheme, which is roughly estimated to cost Rupees 4 lakhs. In the meantime, he says that if the Mananchira tank scheme, *i.e.*, the scheme for pumping the tank water itself were carried out, it would do incalculable good to the people in the area which the scheme is intended to serve. This scheme is estimated to cost Rs. 1,00,000 and will serve a population of about 20,000 mostly Mappilas. The quality of this supply is classed as "usable." This scheme is only put forward as a temporary measure, but it is pointed out that much of the expenditure will not be lost, as the pipes laid will eventually form a portion of the larger scheme.

2. The Sanitary Engineer thinks that resort to the Mananchira tank is the only means of giving the Mappila quarters a supply of water within a reasonable time, and that the quality can be much improved by filtration.

3. The Sanitary Commissioner considers that the scope of the inquiry has been undesirably narrowed to the scheme of infiltration wells near the Mananchira tank. It should, in his opinion, be extended as required in Sanitary Board's Proceedings No. 2, dated 24th February 1896. He enters into details to show that the experiment with the infiltration wells made by the Assistant Sanitary Engineer was conducted in a perfunctory manner, and he questions the Assistant Sanitary Engineer's favourable opinion as to the quality of the water in the tank. Judging from the analysis he considers the water to be well beyond the "suspicious" class and that it borders on the absolutely "bad". As regards Mr. Jone's suggestion to filter the water he admits that this would get rid of much of the objection and would render the scheme acceptable, if nothing better were available, but he thinks it a most abnormal state of affairs to look for the water-supply of a community from a subsoil water source so bad as to demand filtration. No better source than subsoil water can be found, he says, if derived from a cleanly area, but both the sanitary survey and the chemical analysis prove that the water of the Mananchira tank is not derived from an area that can be so described.

4. The final conclusion he arrives at is that the loosely conducted exploration so far has simply shown that a pure but hard water exists below the stratum of the subsoil of Calicut. This being so, it is not necessary to hug the tank, but to find some clean area, if possible outside the inhabited portion, further inland, and therefore higher up the natural slope towards the sea. He indicates how this exploration ought to be made with tube wells.

5. The Sanitary Board concurs in the opinion that for so important a town as Calicut exploration should be made for a purer source of water outside the town.

(True Extract.)

R. PARSONS,
Secretary, Sanitary Board.

To the Secretary to Government, Local and Municipal Department.

Order—No. 879 M., dated 22nd June 1899.

The Government agrees with the Sanitary Commissioner and the Sanitary Board in considering that the proposal of the Sanitary Engineer to supply the Mappila quarters of the town of Calicut with water from the Mananchira tank is undesirable, as both the sanitary survey and the chemical analysis prove that the water of the tank is not derived from a cleanly area, and that for so important a town as Calicut

exploration should be made for a purer source of water outside the town. The Sanitary Engineer is requested to investigate the matter on the lines indicated by the Sanitary Commissioner and report the result to Government through the Sanitary Board. He is also requested to state the probable cost of this investigation.

(True Extract.)

C. J. WEIR,
Ag. Secretary to Government.

To the Sanitary Engineer.
" Sanitary Board.
" Chairman, Municipal Council, Calicut
(through the Collector of Malabar).

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C A L I C U T W A T E R S U P P L Y.

Report on a test made to ascertain the probable supply that would be available from wells sunk adjacent to the Mananchira Tank at Calicut.

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In G.O. No.1548 M. Mis, dated 5th.September 1898, Government requested the Sanitary Engineer to undertake the preparation of a scheme for the Water Supply of Cali -cut on the lines approved by the Sanitary Board in its Proceedings No.571/s, dated 27th. June 1898. The source of supply proposed was a series of infiltration wells adjacent to the Mananchira Tank. As there were no data available to determine the size and number of wells required for the supply of the Moplah quarters, it was decided to make a rough test of the yield of water from the trial well sunk last year by the Municipality on the mar- -gin of the Mananchira Tank. A copious yield of water was expected from the well, but the results have belied anticipations, and, as will be shewn presently, it is futile to hope to secure a sufficient supply of water from infiltration wells on the margin of the Mananchira Tank.

2. The trial well is about 20 feet from the edge of the tank, is 6 feet inside diameter and is lined throughout with laterite masonry 9" in thickness. On the date on which the test was made (19th. October 1898) the depth of the well was 38½ feet below ground, and the depth of water in it was 23½ feet. The well is said to have been sunk to a depth of 50 feet-the reduction of 1½ feet in the depth being accounted for as silting.

3. As a steam pump was not available it was decided to bale out water by manual labour. Calculations made after careful observations shewed that water was baled out at the rate of 50 gallons per minute. After baling

was commenced water in the well fell rapidly until it was reduced by 8 feet and at this depth the water level remained stationary, shewing that the inflow into the well with a head of 8 feet was 50 gallons per minute. Baling was kept up for about 20 minutes after the well attained the lowest level, i.e., 8 feet below the normal, when the ground around the well suddenly sank, the depression in one place being three feet below ground level.

4. The depth of the well was 28½ feet before baling commenced. The well was guaged again after the sinking of the adjoining ground and the depth was found to be only 23 feet. There was thus an accumulation of 5½ feet of sand in the well. A little of this sand was brought up in a bucket. The sand was extremely fine.

5. The question that naturally occurs at once is, "Where is the sand coming from?", because the last 10 feet of soil through which the well passed consists, according to the measurements and specimen of soil furnished by the Municipal Overseer, of 4 feet of lignite, 4 feet of coarse sand and 2 feet of gravel. After a careful consideration of the question, and enquiries as to the nature of soil passed through in sinking another well within 300 yards of the trial well, the undersigned is led to the conclusion that the depths of the various strata as given by the overseer must be inaccurate. This is evident from the fact that the strata are shewn of the uniform thickness of 4 feet, a state of things rarely, if ever, met with in nature. All that can now be safely accepted from the record of the boring as submitted by the Municipal Overseer is, (1) that somewhere between the surface level and the bed of the tank there exists a lateritic

They may be so to some extent but the position of the various strata is no doubt correct and samples of each strata were obtained so that their existence & their relative positions are probably correct.

(signed) J.A.Jones.

bed presumably impervious or comparatively so, and (2) that below the lateritic bed the soil consists of sand intermixed with layers of lignite, gravel and loam.

6. The result of the test made to find the yield from the trial well shews, that in any permanent infiltration well on the site in question it will be dangerous to pump with a head of 8 feet; and considering the fineness of the sand the undersigned considers that it would involve serious risks if the maximum head of pumping is fixed at anything above three feet. There are authenticated instances of sand blows having occurred when pumping with a head of 8 feet even in coarser sand than what has entered the trial well. With coarse sand 5 feet of head is admitted as the maximum, but it would be unwise to have a greater head than 5 feet for infiltration wells near the Mananchira Tank.

7. The yield from a 6 feet well, under a head of 8 feet, was 50 gallons per minute. Assuming that the yield varies, other conditions being same, according to the square root of the head and diameter of the well, the yield from a well 15 feet diameter is not likely to exceed 75 gallons per minute.

8. It is not possible to sink more than two wells adjacent to the Mananchira Tank. The only site available on the margin of the tank for locating infiltration works is a garden about 440 feet long to the north of the tank. This length admits of only two infiltration wells, the combined capacity of which will be 150 gallons per minute.

9. The population of the Moplah quarters, which this scheme is intended to serve, is about 18,000, that of the whole town being 66,000. The scheme should therefore provide for a population of at least 20,000, at 15 gallons per head; the supply required will be 420 gallons per minute. The yield from two infiltration wells which is reckoned at 150 gallons will be most inadequate.

✗ Double the average supply.

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They may be so to some extent but the position of the various strata is no doubt correct and samples of each strata were obtained so that their existence & their relative positions are probably correct. (signed) J.A.Jones.

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✗ Double the average supply.

10. In respect to potableness the tank water is much superior to the water in the trial well. In December last samples of water drawn at the same time from the Mananchira Tank and the trial well were sent to the Chemical Examiner for analysis. His report is appended.

The trial well water is originally purer, but the mineral impurities are in such excess as to render the water unacceptable to the people. The trial well water has a hardness of 17.50°, while the Mananchira Tank water does not much exceed 1° of hardness. The well water of Calicut-the water which the people are accustomed to-is very soft, and they will not take kindly to a water whose characteristic is great hardness. The hardness of the trial well water is evidently due to some calcareous strata not reached by the tank, but which has been passed by the well which is 10 feet deeper than the tank. If the depth of infiltration wells is limited to the depth of the tank, with the view of avoiding the calcareous strata, the two proposed wells will yield even less than the quantity reckoned in para 8 supra.

The difference between the results of the two analyses shews that the water is not derived from the same source and it is not quite understood how Magnesia salts will be harmless to use for drinking and yet affect cooking pots. (see Chemical Examiner's note)
(Signed) J.A. Jones.

Probably the lower strata see boring. section attached.
(Signed) J.A. Jones.

11. The undersigned considers that it is altogether hopeless to obtain an adequate supply of water from infiltration wells on the margin of the Mananchira Tank, and unless the Sanitary Board accords its approval to taking the supply scheme direct from the tank, the present should be abandoned and the question of the water supply of Calicut must be deferred until the Municipality is in a position to carry out the Pollour Hill scheme, which is roughly estimated to cost rupees 4 lacs: but the finances of the Calicut Municipality are at a very low ebb, and there are no prospects of the Pollour scheme being even commenced within the next ten years. In the meantime, if the Mananchira Tank scheme, i.e, the scheme for pumping the tank water itself, were carried out, it would do incalculable good to the people in the area which the scheme is intended to serve.

12. Successive Sanitary Commissioners have in their reports dwelt on the exceeding insanitary condition of the subsoil in the area occupied by the Moplahs at Calicut. The Moplahs obtain their drinking water from shallow wells in their own compounds. It is truth to say, that the water so obtained is nothing but the affluent from a soil saturated with human excrementitious matter. It is, therefore, not to be wondered at that frequently cholera in a virulent form breaks out in the Moplah quarter and claims its victims by hundreds. In 1897 the incidence of mortality from cholera in all Municipalities was 4.8 per mille. In the same year in Calicut cholera was answerable for 1497 deaths, which gives the high rate of 23.1 per mille, or nearly five times greater than the average for all Municipalities. If then, the water supply of the Moplah wards can be improved at a moderate cost, it is but just that that improvement should be carried out, and the undersigned thinks that a marked improvement in the water supply of the Moplah wards can be effected by adopting the scheme for pumping water from the Mananchira Tank.

13. The Mananchira Tank scheme will cost about Rs. 1,00,000, and will serve a population of about 20000, mostly Moplahs. As regards sufficiency of water there is little doubt. The tank has an area, at summer level, of 440′ × 425′ = 187,000 sq. feet against an area not exceeding 400 sq. feet which infiltration wells in that locality would give. A depth of only 3" in the tank represents the total supply required for a population of 20,000 people at 15 gallons per head per diem, and the tank could easily recoup itself in 24 hours.

14. As regards quality, repeated analysis of the Mananchira Tank water has shewn that it is such as can be classed as "usable".

15. The objections which the Sanitary Commissioner sees to the use of the tank water are, first, that the depression of water level during pumping might draw into it impurities from neighbouring areas. It has been shewn that the whole quantity required is represented by a depth of only 3" in the tank, and, as there will be inflow into the tank during pumping, the depression will not exceed an inch or two at most. With such a small depression the cone of depression and the velocity of inflow will be too small to cause any apprehensions as regards the attraction of impurities into the tank. His second objection is, that the tank receives an impure supply from the upper layers of the soil, which mingles with the purer supply derived from the lower layers. This might be so, but there are no proofs of its being so. On the contrary there are reasons for believing that the upper layer of impure water is cut off and that the tank receives its supply only from the lower and comparatively purer layers. The sinking of the trial well has shewn that an impermeable stratum intervenes between the upper and lower layers of water, while the tank itself is protected by a heavy revetment in the shape of a flight of steps, formed of laterite blocks, from the surface to the bottom of the tank. The flight of steps must have been built long ago, long before the memory of the oldest inhabitant, and the perfect state of preservation in which it is indicates that it must be of massive construction well backed by masonry or concrete which will not allow of any percolation of water. These facts go to shew that the upper impure layer is cut off and the water enters the tank only at the bottom. The liability of the tank water to surface contamination can be minimised, if not avoided, by blocking up the entrance passages and perforations in the parapet wall of the tank; a wire netting can also be fixed above the top of the parapet wall to a height of 8 or 10 feet above ground as a further protection.

16. It is not claimed for the Mananchira Tank that it will yield an ideal supply of water, but it will certainly afford a supply infinitely superior to the unwholesome water which the Moplahs now use. The Mananchira Tank water has been pronounced "usable" after chemical analysis, and it is used for drinking purposes by Eurasians and Europeans living in the neighbourhood of the tank. It is popularly considered very good water, and the rich Moplahs, who can afford it, cart the water to their houses. There can be no comparison whatever between the tank water and the water used by the Moplahs generally. Though the Mananchira Tank water may fall short of the standard of a per-fect water, it ranks so much above the water ordinarily used by the Moplahs, that the introduction of the tank water into the Moplah wards cannot but result in much benefit to the health of the community.

17. The supply of water to the Moplah quarters from the Mananchira Tank need not be looked upon as anything but a temporary measure to be in operation only until a comprehensive scheme for the whole town is adopted and executed. The expenditure on the Mananchira Tank scheme will not be lost. The pipes laid will form portion of the distribution system of the larger scheme whenever that scheme is executed. The only loss will be the cost of the pumping house and engines, half at least of which can be realised after 10 years use. The total loss will not exceed Rs. 10,000 which spread over 10 years gives a thousand rupees a year, which is not a heavy price to pay for the benefit of a good water supply, the saving of many lives for which cholera is now responsible, and finally the general improvement of the health of the community.

Office of Sany:Engr:to Govt) (Sd) Hormusji Nowroji,
Madras, 27th. Jany: 1 8 9 9) A.M.I.C.E.,
Asst. Sanitary Engineer to Government.

No 140.

True copy forwarded to the Secretary, Sanitary Board, through the Sanitary Commissioner for Madras.

The undersigned thinks that resort to the Tank

SANITARY COMMISSIONER
Received 4 FEB. 99
MADRAS

686.5

is the only means of giving the Moplah quarters a supply of water within a reasonable time.

He however suggests that the water from the tank be pumped on to filter beds and flow thence to a service reservoir which works would be situated in the gardens north of the tank. The water which is usable at present would then be much improved.

Office of Sany:Engr:to Govt.
Poonamallee Road,(Park Town)
Madras, 2nd. February 1899.

Sanitary Engineer to Government.

S.C. No 120 of 99

5
15/11/99

BACK PAPERS.

G.O.	No.	Department.	Date.
Ro	1548	Lc	8-7-98

FURTHER PAPERS.

G.O.	No.	Department.	Date.

Local & Munl. (1899) Department.

CURRENT No. 1501/M

From

The Secretary, Sanitary Board.

Order.

No. 285/5.

Dated 31st May 1899.

Received 3rd June 1899

Registered 5th —

Enclosures 5 (1 plan).

Spare copies Nil

SUBJECT.

Calicut Water Supply Scheme:

Submitting to Govt. a report by the Assistant Sanitary Engineer regarding the Manancheri tank to be used as a source for the ——, with the remarks of the Sanitary Engineer and the Sanitary Commissioner thereon, and stating that exploration should be made for a purer source of water outside the ...

1016

Rec'd 12 5 Sh.

No. 1256. Chemical Examiner's office,
Madras, 19th. December 1899.

From

The Chemical Examiner,
Madras.

To

The Assistant Sanitary Engineer to Govt.,
Madras.

Sir,

With reference to your Demi-official letter dated 15-11-98 and letter dated 5th. December 1898 No.1724, I have the honor to submit herewith the analyses of the two samples of water received on the 6th. instant.

From a comparison of the figures you will see that the trial well water is purer so far as Free ammonia and Albumenoid ammonia are concerned but contains more solids, chlorine and hardness. The hardness is due mainly to the presence of Magnesian salts and is by itself ~~is~~ not harmful for drinking purposes but may attack cooking metallic vessels.

If the tank could be purified and possible sources of organic pollution be prevented, the tank water seems to be to be much better suited for a town-supply than the well water.

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

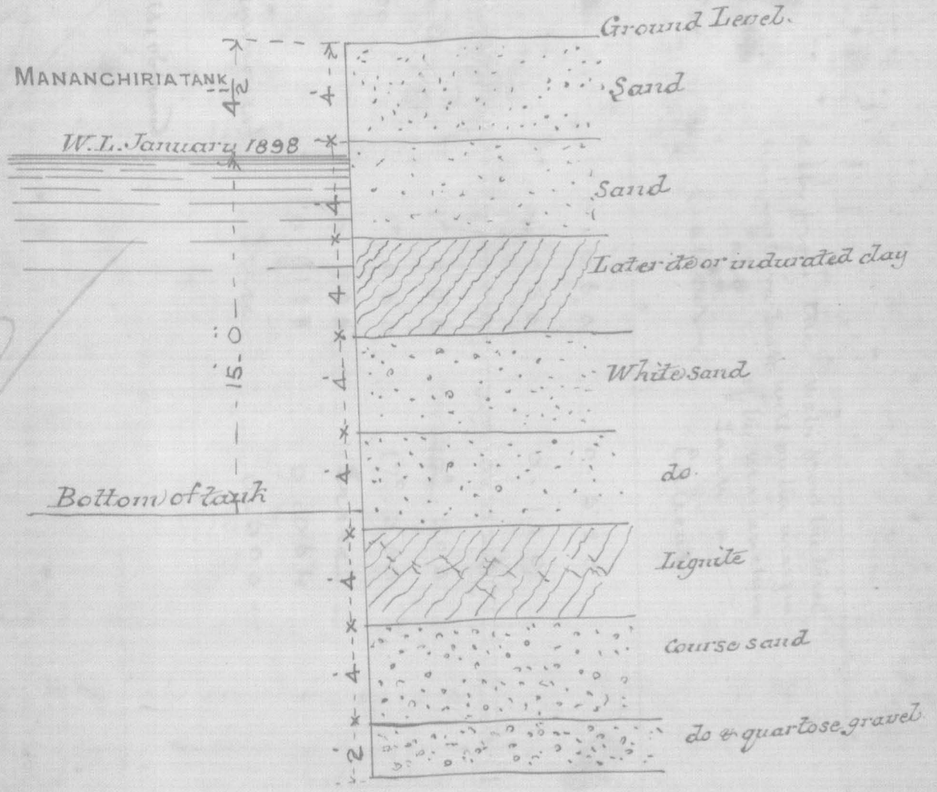
(Signed) K.C. Sanjana, Major, I.M.S.
Ag. Chemical Examiner.

(True copy)

Asst. Sanitary Engineer to Government.

2 Nos

Sketch shewing strata passed through by the trial well on the margin of Mananchirá Tank.



NOTE

The depths of the various strata are as given by the Municipal Overseer.

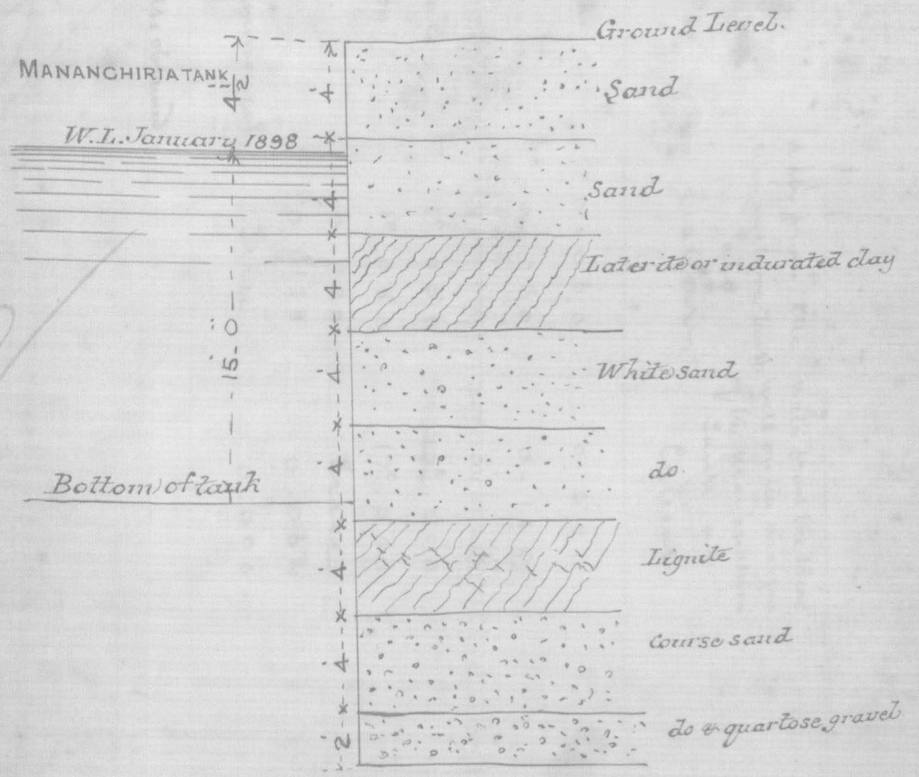
2-2-98

Mem Inst C.E
Sanitary Engineer
to Govt:

2

S.C. No 120 of 99

Sketch shewing strata passed through by the trial well on the margin of Manancherá Tank



NOTE

The depths of the various strata are as given by the Municipal Overseer.

2-2-98

Mem Inst C.E
Sanitary Engineer
to Govt:

	Water from the Manamelvira Tank at Calicut	Water from the Trial well on the margin of the Manamelvira Tank at Calicut
Total solids . . Grams per litre	0.060	0.520
Volatile Solids . . do do	0.030	0.110
Chlorine . . do do	0.009	0.023
Total hardness . . . Clark's scale	1°.050	17°.500
Permanent hardness . . . do do	1°.050	17°.500
Free ammonia . . Milgrms per litre . . .	0.120	Trace
Albuminoid ammonia . do . do	0.128	0.064
Nitric acid . . do do (as Ammonia)	Trace	0.600

Apparent quality of the water as inferred from the results obtained on examination.

SANITARY COMMISSIONER
Registered
4 FEB. 99 1899
WITH THE GOVERNMENT OF MADRAS.

From

The Chemical Examiner,
Madras

Dated 1st } December
Recd 3rd }

To

The Assistant Sanitary Engineer
to Govt
Madras.

Reference
Your letter No. 1724 dated 8th December 1898.

Subject

Has the honor to supply Analyses of two Samples of water as requested.

(Sd) W. C. Sangana
major I.M.S
Acting Chemical Examiner

True Copy

(Sd) Asst Sanitary Engineer to Govt

3
S.C. No. 120 of 99

No. 908/S

NOTE by the Sanitary Commissioner for Madras, dated 17th March 99

Reference.—

Enclosures 4

Assistant Sanitary Engineer's Note on the Manancheri scheme.

To save the infliction of a longer ~~Note~~ than necessary, I would refer to ~~the attached extract from~~ my Inspection notes embodied in G.O. No. 513 M. dated 23rd April 1894, page 13, and my Note No. 2195 dated 2nd December 1895, neither of which has a place in this correspondence.

2. Sanitary Board's Proceedings No. 2 dated 4th January 1896, so far as I knew represented the scope of enquiry that was required of the Sanitary Engineer's Department. It would seem, however, that the enquiry has been made with special reference to the possibility of making infiltration wells near the Manancheri tank. I am not aware whose suggestion it was. I consider so roughly have matters been pursued that little real information on the requirements of the Board in the last quoted Proceedings has been obtained. I see no reason to alter my opinion as to the necessity for correctly gathering the information required.

3. The plea for a sole supply for the Moplahs has much in it that is taking, but the ground on which this is made is not really correct.

Some

Some years back a very marked epidemic 1890 or 1891 did prevail chiefly amongst the Moplahs, but in recent years there is no reason to think, as suggested by the Assistant Sanitary Engineer, the Hindu inhabitants of the town have not suffered as severely as the Muhamedans. Thus in 1897-98 there were 585 deaths from Cholera in the Moplah quarters, against 735 in other parts of the town. It must be remembered if the Maplah buries in grave yards close to his house, the Hindu buries in his own compound close to his wells. It is unlikely that the total taxation necessary could be derived solely from the Maplah portion of the town. If the rest of the inhabitants have to pay increased taxes, yet not to be supplied with water, the action of the Municipal Council is not likely to be received with equanimity. On the other hand, if the Maplahs - the poorest part of the population - can afford this scheme, why should not the <u>average</u> inhabitant be able to meet the cost of the scheme for the entire town? In this connection, I would point out that Mr Ellis's estimate of 4 lakhs was merely a guess, and that if the parts of Calicut really requiring a scheme were solely considered, it is probable this sum would be very greatly reduced.

4. The whole subject ought, in my opinion, to be handled in a much less haphazard way than it has been. I do not object to the scheme advanced with the idea of supporting this or that rival scheme; what I hold is that before adoption of

a

scheme a properly exhaustive enquiry conducted with all the care requisite has not been effected. It cannot be said that a well sunk in such a manner as to allow of the entrance of water from every layer passed through, or so sunk that it is not recognized from which layer the water is derived, is a satisfactory method of conducting exploration! Nor do I consider the enquiry would be complete unless the depth were very much greater than stated to have been attained in the new wells.

5. I have stated that the area through which the subsoil water flows is liable to extensive pollution from human beings. As to pollution of the subsoil, both the Collector and the District Sanitary Officer concur. It is undeniable, as time advances, the chances of pollution will also increase. I have suggested that the dhobie's tank would form a possible source of pollution. The Assistant Sanitary Engineer replies that 3ft represents a days supply, but he says nothing about the rate of inflow into the tank to make good this daily depression, nor of the influence of evaporation, nor of the maximum depression between the monsoons. It is not stated that the Moplahs only are to draw from this tank in future. On account of the Moplahs are others accustomed up to date to using this water to be prevented from using? Hence, the depression will be that for the Moplahs <u>plus</u> that for other inhabitants <u>plus</u> that for the intermonsoon period. Actual rough experiments by the Chairman (Vide note above referred to) support my views.

6. I suggested that the tank was really supplied

supplied from two sources — the subsoil and from a stratum below the subsoil, and that if this is proved to be the case, measures should be taken to draw from the latter source only, and that it should encourage exploration on clean soils somewhat removed from the town.

7 The Assistant Sanitary Engineer admits the existence of subsoil water and admits the existence of a subterranean water, but denies the entrance of a subsoil water. This he does on the mere assumption that the lining of the tank is so good as to prevent entrance, because it is old work it must be water tight. It is about this last idea that would have been entertained by the old tank diggers to cut off one supply in favor of that from another stratum. But if this be the truth, why does he not enter into the nature of this highly "queer work". But the Chemical analyses show that if there be not a third source of water (not analysed as described) the water in the tank being obviously not that found in the experimental well, the tank must contain subsoil water. Indeed, I should say that it is a matter that must be yielded without argument, that the tank does not contain subsoil water, and that if there be any other water in it, it is derived from the layer or layers below the first impermeable stratum.

8 In the copy of analysis as supplied, nothing is said about the quality of the water of the tank. Yet the amount of free ammonia is such that it cannot escape condemnation as being derived from animal matter. Indeed, the water is well beyond the

the "suspicious" class and borders on the absolutely "bad" according to the Chemical classification.

9. Mr Jones' suggestion to filter the water before delivery would get rid of much objection and would render the scheme acceptable, if it were ascertained nothing better could be done, but I think it is a most abnormal state of affairs to look for the water supply of a community from a subsoil water source so bad as to demand filtration. No better source than subsoil water can be found if derived from a cleanly area. Both the sanitary survey and the Chemical analysis prove that the water of the Manamchera tank is not derived from an area that can be so described.

10 As to the water found in the well, the experiment of exploration has been conducted under terms that prevent the supplying stratum being correctly recognized. It is an organically pure water although, as might be anticipated, it shows the influence of completely changed organic matter. I do not think, even as it is, that it would prove "unacceptable" on account of hardness to the ordinary native. But the chances are that it is in the fine sand layer immediately below the first impermeable layer that this water really is contained. It does not follow that care in segregating the water from this layer, so as to prevent it mingling with that from other layers, may not prove it to be of less hardness than at present found.

11 In short, I consider that loosely conducted exploration so far, has simply shown that

a

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11 In short, I consider that loosely conducted exploration so far, has simply shown that

Sanitary Comment No. 120
Recd. 20th March 99
Enclos: 4 (1 plan)

a pure, but hard water exists below the stratum of the subsoil of Calicut. This being so, it is not necessary to hug the tank, but to find some clean area, if possible outside the inhabited portion, further inland and therfore higher up the natural slope towards the sea. Here, exploration ought to be made with tube wells; if as is probable, the same strata are hit off, a series of joined-up tube wells might be sunk instead of infiltration wells as suggested whence the supply could be pumped direct to the town — care being taken to draw only from the stratum desired, or even the subsoil water itself (thus avoiding the risk of pollution if the area be clean. In sinking tube wells the fine sand difficulty can be met, whilst the question of amount of supply need not be narrowed by the question of yield of two wells.

W R King
Lieut. R.E.
Sanitary Commissioner for Madras

Government of Madras.

SANITARY BOARD OFFICE.

LOCAL & MUNICIPAL
No. 1521/98

PROCEEDINGS OF THE SANITARY BOARD, No. 285/S, DATED 31st May 1899

READ the following:—

From the Sanitary Engineer to Govt No 140
dated 2 February 1899.
Note by the Sanitary Commissioner No 908/S
dated 17 march 1899.

Resolution:-

In G.O. No 1548 M. mis. dated 5th September 1898, Govt requested the Sanitary Engineer to undertake the preparation of a scheme for the water supply of Calicut, on the lines approved by the Sanitary Board in its Proceedings No 371/S of 27 June 1898. The Source of Supply thereon proposed was a Series of infiltration wells close to the Manaucheri tank. Judging by the yield of a trial well Sunk on the margin of the tank the Assistant-Sanitary Engineer arrived at the Conclusion that it is altogether hopeless to obtain an adequate supply from infiltration wells of which there is only room for two, the Combined Capacity of which well

be 150 gallons per minute as against 420 gallons per minute actually required. Moreover the water of the trial well contains an excess of mineral impurities and is said to be inferior generally to that of the tank. He considers that unless the Sanitary Board accords its approval to taking the Supply direct from the tank, the present Scheme should be abandoned and the question of the water Supply of Calicut be deferred, until the Municipality is in a position to carry out the Poolow Hill Scheme, which is roughly estimated to cost Rupees 4 lacs. In the meantime, he says that if the Manancheira tank Scheme i.e. the Scheme for pumping the tank water itself were carried out, it would do incalculable good to the people in the area which the Scheme is intended to Serve. This Scheme is estimated to cost Rs 100,000 and will Serve a population of about 20000 mostly moplahs. The quality of this Supply is classed as "usable". This Scheme is only put forward as a temporary measure, but it is pointed out that much of the expenditure will not be lost, as the pipes laid will eventually form a portion of the larger Scheme.

2. The Sanitary Engineer thinks that

that resort to the Manancheira tank is the only means of giving the moplah quarters a Supply of water within a reasonable time, and that the quality can be much improved by filtration.

3. The Sanitary Commissioner Considers that the Scope of the inquiry has been undesirably narrowed to the Scheme of infiltration wells near the Manancheira tank. It should, in his opinion, be extended as required in Sanitary Board's Proceedings No 2 dated 24th February 1896. He enters into details to show that the experiment with the infiltration wells made by the Assistant Sanitary Engineer was conducted in a perfunctory manner, and he questions the Assistant Sanitary Engineer's favourable opinion as to the quality of the water in the tank. Judging from the analysis, he Considers the water to be well beyond the "Suspicious" class and that it borders on the absolutely 'bad'. As regards Mr Jones' Suggestion to filter the water he admits that this would get rid of much of the objection and would render the Scheme acceptable, if nothing better were available, but he thinks it

P 5834 C. 31-3-96

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fo 5834 C.
31-3-96

it a most abnormal State of affairs to look for the water Supply of a Community from a Subsoil water Source So bad as to demand filtration. No better Source than Subsoil water Can be found, he says, if derived from a cleanly area, but both the Sanitary Survey and the Chemical analysis prove that the water of the Manuchira tank is not derived from an area that can be so described.

4. The final Conclusion he arrives at is that the loosely Conducted exploration So far has Simply Shown that a pure bed Land water exists below the Stratum of the Subsoil of Calicut. This being So, it is not necessary to hug the tank bed to find Some clean area, if possible outside the inhabited portion, further inland, and therefore higher up the natural Slope towards the Sea. He indicates how this exploration ought to be made with tube wells.

5. The Sanitary Board concurs in the opinion that for So important a town as Calicut exploration Should be made for a purer Source of water outside the town.

(True Extract,

R. Carlow S.

Secretary Sanitary Board.

To The Secretary to Govt, L.S.M.

Journal

[L. 25]

500—19-12-08.

LOCAL AND MUNICIPAL DEPARTMENT.

C. No 1501/11

SUBJECT.

Water supply of Calicut.

ORDER. No 879 Mcm dated 22/6/09

The Government agrees with the Sanitary Commissioner and the Sanitary Board in considering that the proposal of the Sanitary Engineer to supply the Mappila quarters of the town of Calicut, with water from the Manuchira tank is undesirable, as both the Sanitary Survey and the Chemical analysis prove that the water of the tank is not derived from a cleanly area, and that for so important a town as Calicut exploration should be made for a purer source of water outside the town. The Sanitary Engineer is requested to investigate the matter on the lines indicated by the Sanitary Commissioner and report the result to Govt. through the Sanitary Board.

V. Ad paras 3 of the Sanitary Bd's Resolution dated

He is also requested to state the probable Cost of this investigation.

12
14/6/99

6 copies
50 6.99

To

The Sanitary Engineer P.O
" Board P.O
" Chairman, Mc Calmont Hall
Pro the Colley Malabar P.O

Despd 28/6/99

When given for copying
When copied
When examined
When signed 27/6/99

169

HEAD AGAIN G.O., No. 130 , DATED

CURRENT No.

ENCLOSURES TO C. No.

NUMBER OF GOVERNMENT .. .. .. A A A A A A A A

NUMBER OF GOVERNMENT.

STATEMENT WITH DITTO.

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Enclosure to G. No. 1501 m of 99 — A

148

Enclosure to G. No. 1501 m of 99 — A

Order of Government — A

Letter of Government

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