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AMIL NADU ARCHIVES

GOVERNMENT OF TAMIL NADU

P. W. DEPARTMENT

G.O. No. B.P. No:	1128-29, W	Press. Mis.
Dated	5. 5. 1886	~~198~~ .

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5th May 1886, No. 1128 W., Public Works.

1128/1

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

Read—the following papers:—

From A. P. deCLOSETS, Esq., C.E., to the Secretary to Government, Public Works Department, and to the Sanitary Commissioner, dated Madras, 10th July 1885.

Water-supply of Madras.

Memorandum upon the boring of an artesian well 3 feet 3 inches (1 metre) diameter.

As the boring for one artesian well at the People's Park has been discontinued, owing to the tools having indicated the gneiss formation underlaying, and as it is intended, as far I understand, to make some other trial borings at some other spots in the Madras grounds, I have the honor to forward for your consideration the following opinions.

If trial borings are to be made, I will ask to be permitted to suggest that they should be executed into the alluvial valley of the Kortalayár, not far from the head of the canal conducting the waters of that river into the Cholaveram and Red Hills tanks, and that if the boring reaches an artesian water-sheet, that is, a water-sheet gushing and overflowing the level of the ground, an artesian well of 3 feet 3 inches (1 metre) diameter should be bored and its water diverted into the Red Hills supply channel.

My reasons for selecting the Kortalayár alluvium for such boring are—

(1) The negative results arrived at in the Kuam alluvium, its geological composition leaving very little hope of finding ascending water-sheets below Madras town.

(2) That the identical conformation of the Kortalayár alluvium with those of the Pondicherry (Gingee river) and of the Cauvery, into both of which artesian springs have been found to exist, tend to prove that the Kortalayár alluvium must contain also water-bearing strata which once tapped will overflow and gush above the level of the ground.

(3) That it is proved by a boring at Ennore that the Kortalayár alluvium could supply artesian water-sheets.

(4) That if a convenient water-sheet is found into this alluvium, it could be conveyed in town without extra cost by the means of the Red Hills canal.

(5) Finally that the cost of an artesian well of 3 feet 3 inches diameter could be repaid within 2 or 3 years by a tax at the rate of 3 pies per annum per head of the general population.

I will examine in detail each of the above reasons.

I. From the geological conformation of the ground upon which Madras and its suburbs are constructed, and of which a map is here annexed, it is perceived that the gneiss formation of the Little Mount near the river Adyar dipps into a northern direction under a certain angle and extends underground probably 12 or 13 miles, rising again to reappear in the neighbourhood of Calastry.

Several borings executed during last year in Madras seem to prove that such is the case.

The well No. 1, bored lately at the People's Park, reached the gneiss at about 60 feet.

Well No. 2 at Napier Foundry reached a rock supposed to be gneiss at 66 feet.

Well No. 3 at Ráyapuram came upon gneiss at a depth of about 72 feet.

Well No. 4 at Tondiarpet at about 75 feet.

Well No. 5 at Washermanpettah reached at 80 feet.

(A well bored years ago into the old Custom House at Madras found the gneiss at about 67 feet).

Well No. 6, bored at Ennore, has not encountered the gneiss; after tapping a layer of carbonate of lime (?) at 214 feet below ground, water rose into the pipe, and presently stand in the same at 6 feet above the level of the water of the Ennore lake.

The five wells 1 to 5 have been bored into the Kuam alluvium; the well No. 6 into that of the Kortalayár; the Kuam alluvium has an area of about 8 square miles, and is composed of sandy tracts covering some small patches of blue clay, laying generally upon the gneiss; the small thickness of this alluvium gives, therefore, no hope of finding artesian waters and sufficient head for such; this has been proved so far by the borings. The well at Napier Foundry tapped a water-sheet which overflowed the pipe, but I have ascertained afterwards that the water was the same as that of the Seven Wells; the overflow was due to the boring having been executed at a place below the level of the Seven Wells water. The Kuam alluvium is contiguous to that of the Kortalayár, and it could be supposed that the waters of the latter might penetrate into the Kuam alluvium; but this is dubious, as it is probable that the tertiary formation of the Red Hills dipping eastwards forms a ridge between the two alluviums underground.

II. The geological maps of the Kortalayár, of the Ponniár and Gingee rivers and of the Cauvery delta, will show that these alluvial basins are surrounded by identical formations, viz., on the west by gneiss, on the north and south by gneiss tertiary formation, cretaceous or Sríperumbudur series, on the east by the sea of Bay of Bengal.

All these strata superposed have a slope eastward.

It is to be observed that in the Kortalayár basin the cretaceous formation is replaced by the Sríperumbudur series.

These formations underlaying the alluviums mentioned offers a similar stratification, that is—

Under the alluvial deposits composed of layers of clay and sand, we found the tertiary formation laying upon the cretaceous or in case of Kortalayár upon the Sríperumbudur series, and under these the gneiss or granite. It is to be admitted that such being the case, and during the sitting process of these alluviums, the same or identical materials have been deposited upon the old formation constituting the former basin or valley of the Kortalayár and Narnaveram, of the Ponniár and Gingee, and of the Cauvery rivers.

Therefore, if artesian waters have been found in the two last basins, there is much probability that artesian waters will also be found in the Kortalayár alluvial basin.

Dr. King of the Geological Survey admits the hypothesis that near Cauverypakkam, at the upper end of the Kortalayár valley, there may be an underground outlet, through which the waters of the Pálár can reach the strata of the Kortalayár alluvium; a boring executed by Mr. Adrienne deClosets in 1883 for a native, at Pitchevakkam, 7½ miles south-east from Arkónam and 7 miles, south-west from Kadambatúr, would have tested Dr. King's theory if the funds at the disposal of the native had been sufficient, but the boring was stopped at 84 feet for want of pecuniary means.

III. The well bored at Ennore, although without the necessary precautions, has, however, reached the depth of 214 feet without coming in contact with the gneiss; we have been informed that at 214 feet the tools bored a stratum of carbonate of lime ? from under which the water rose into the pipe and stood at the present level about 6 feet above the level of the lake of Ennore.

From the report of the workmen we are led to surmise that, during the boring process, the pipe has traversed several water-bearing strata which, perhaps, would have supplied gushing streams if properly catched, but owing to powerless apparatus, the pipe was sunk loose into the bore-hole, and the consequence was that ascending

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waters would have flowed around the pipe outside and have been lost in the permeable sandy strata above, which the boring had traversed; this would explain why the waters stand now in the pipe at 6 feet only when the head obtainable could be at the rate of 7 to 8 feet per mile, if starting from the extremity of the alluvium at Nagari which is at an altitude of 396 feet above mean sea level, and considering that the altitude of the Kortalayár valley near Pólúr is 290 feet. From the above, I am led to believe that the Kortalayár and Narnaveram river alluvium contains water-bearing strata which could be turned to profit by artesian wells.

IV. Supposing, therefore, that the above considerations should induce to bore an artesian well into the Kortalayár alluvium, I should suggest that the spot upon which such boring is to be made should be as near as possible the head of the channel diverting the waters of the Kortalayár into the Cholaveram and Red Hills tank; for this purpose a trial boring would be made so as to ascertain whether an ascending water-sheet exists below, and what supply is to be relied upon; to minimise the expenditure of such boring for trial it could be made with a light apparatus, as may be had in the Public Works Department Stores, or by a set of our own tools; the large apparatus obtained from Europe would be employed further for larger boring.

After having found the convenient water-sheet, the following operation would be to sink an artesian well of 3 feet 3 inches (one metre), in diameter, and further to use the large boring apparatus. Artesian wells of such diameter have been already bored elsewhere, for instance at the Butteaux Caitles near Paris a well of 47 inches diameter was bored in 1867. Another well near Passy of a diameter of 3 feet 29 inches has been successfully bored. This well has a depth of 1,913 feet from the ground line to the water stratum, and delivers daily 3,799,000 gallons of water.

I consider that there will be not much difficulties in boring a well of the same diameter near the Kortalayár, previous boring, such that at Ennore, having only shown strata easily traversed without any interference from rock. The tertiary formation will have perhaps to be bored, but the materials composing its beds are soft enough, and will oppose no difficulties. It is even possible that a water-bearing stratum should be arrived at above the tertiary ground.

The quantity of gallons, supplied by a well of one metre diameter (3 feet 3 inches) will be, as far as our observation upon the several artesian wells of the Pondicherry and Cauvery basins has shown, 3,000,000 gallons in 24 hours.

The wells observed had pipes of 7½ inches, and their delivery per minute at 3 feet above the level of the ground was 100 litres per minute at 22·03 gallons, that is a supply of 31,680 gallons.

The well above supplying 3,000,000 gallons daily will allow 7·950 gallons per head of the Madras population. The cost of sinking an artesian well of 3 feet 3 inches diameter could be estimated about as follows; the time employed supposed to be 12 months:—

	RS.
Wages	1,440
Repairs and occasional tools	1,200
Engine, fuel, oil, grease and sundries	1,500
Iron pipe, half-inch thick rivets and packing	3,000
Superintendence	6,000
Contingencies	2,800
Total ...	15,740

To recoup this expenditure, a water-rate of 3 pice per head of inhabitant per annum will refund the cost within 2 or 3 years.

The advantage of the scheme is that no new works would be required so as to bring water in town, and that the objection as regards boring at great distance from it would disappear. Besides, the main and branches in Madras could be used for the water of the artesian well, and there would be no necessity for establishing a junction.

Admitting that an artesian well should be bored successfully inside Madras, nothing proves that the head obtained would be sufficient for the service.

In the case suggested above, that is if an artesian sheet is discovered in the Kortalayárs the head will be the same as that of the present water-works, and if a water deficiency from the Red Hills tank was arising, the artesian water will keep the same head, avoiding the necessity for pumping.

From Dr. W. KING, Superintendent, Geological Survey of India, to the Secretary to Government, Public Works Department, dated 30th January 1886, No. 75.

I have the honor to return, with thanks, the letter and accompanying map of Mr. A. deClosets on the subject of artesian exploration in Madras, referred to in G.O., No. 2676 W., dated 10th November 1885.

2. I have also to tender my thanks for the copy of Mr. L. Cornet's report of 20th June last, on the "People's Park boring," and the accompanying tracing giving the different strata passed through. The latter shall be returned in due course, as I have sent it on to the Director, Geological Survey of India, to be copied in our office for record.

3. Being personally acquainted with Mr. deClosets and knowing his praiseworthy endeavours in artesian boring in Southern India, it has given me great pleasure to read his proposal for trial in the Kortalayár alluvial tract, the geological relations of which he seems to have read up with great care. On the latter subject, and indeed generally with regard to the possibilities of the Kortalayár tract, I would, however, suggest, before any plan be decided on, that Mr. R. Bruce Foote be consulted. Mr. Foote is now the Superintendent, Geological Survey of India for Madras, and he surveyed and reported on the geology of the Madras country.

4. You will remember that in my last letter to Government, No. 1011, dated 30th October 1885, I confined myself exclusively to the neighbourhood of Madras itself, but in my original letter on the artesian capabilities of the Madras country generally, the possibly more hopeful condition of the Kortalayár basin was pointed out.

5. Now, with regard to Mr. deClosets' scheme for tapping this region, relying as he does upon the rise of water (reported to be 6 feet over the backwater level) in the boring at Ennore, I can only venture, in an unprofessional way, to suggest a few points which strike me as in the way of its success. It is to be noticed in the first place that his proposed site is at least 12 miles further inland than the Ennore work, and almost immediately at the northern end of the Red Hills plateau of tertiary sand-stones, where it may be presumed that the rise of water would be less than at Ennore. (I do not suppose that, for this distance inland, the gradient of the alluvial tract would be so rapid as indicated by Mr. deClosets, but it would be appreciable enough). The probability of a good depth of alluvium immediately to the north of the Red Hills plateau is, I think, doubtful, for, as far as I recollect, the Kortalayár river is, at that point, cutting its way in the sand-stones. [The foundations of the anicut or dam (if there be one) backing the river water into the channel to the Cholaveram tank ought to give evidence on this matter]. Next, it is a question with me whether the hoped-for rise of water in the proposed boring would be sufficient for the levels of the Cholaveram and Red Hills tank channels.

6. Mr. deClosets' proposal looks as feasible, provided the above objections can be met; while the cost would be as reasonable, taking his rate for the larger proposed work as compared with the excessive charges (excepting cost of plant) incurred at the People's Park boring, that I am fain to advise that trial should be made with a small tube and plant at any rate. I suppose Mr. deClosets would carry out the experiment more reasonably than any one else: it would be to his interest to do so. (On the matter of cost of boring, it may not be out of the way, I trust, to state that I am now having case borings carried out here by a European whose pay last year was Rs. 250 a-month, rising to Rs. 300 this year. This rate may help as a guide to charges on an experiment like that proposed which should only last for a few months).

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7. Mr. deClosets evidently fears the shallow sub-alluvial occurrences of the Red Hill sand-stones just as much as I do and looks to the contingency of having to bore into these rocks. A boring of this kind would open up the further question in artesian development in Southern India, viz., the water-bearing, or porous, condition of the tertiary sand-stones, that is provided the Red Hills rocks and those of the larger patch northward and the smaller patch westward (in deClosets' map) are continuous under the alluvial tract. If these are not continuous, then the floor of the Narnaveram river alluvium and some extent of that of the Kortalayár will consist of gneiss or crystalline rocks, in which case there is just a possibility that the water-bearing strata of the alluvial tract resting on the gneiss might be in communication with fortuitously arranged or disposed porous strata of the sand-stones on either side.

8. I do not place much reliance on such a tailing-in of porous deposits; but should the tube of the boring apparatus encounter sand-stones below the alluvium, it might be almost advisable — if only on scientific grounds — to run down into them also to the gneiss which cannot be at any great depth. I need scarcely point out that there is no use running into the gneiss, the presence of which will now be ascertained by its hardness.

From R. BRUCE FOOTE, Esq., F.G.S., Superintendent, Geological Survey of India, to the Under Secretary to Government, Public Works Department, dated Bellary, 6th March 1886, No. 774.

I have the honor to acknowledge receipt of reference, No. 763 C., dated 24th February 1886, giving cover to letters from Mons. A. deClosets and Dr. W. King about artesian borings to be tried in the alluvial valley of the Kortalayár, and requesting my opinion on the subject. In reply, I beg to state that on geological grounds I regard Mons. deClosets' proposal as a reasonably promising one, the alluvium of the Kortalayár being of considerable extent and depth, and there being great probability of its containing permanently water-bearing strata capable of being tapped by borings as in the case of the Gingee river near Pondicherry.

2. As I showed in my memoir on the geology of Madras (Memoirs, Geological Survey of India, Volume 18) the alluvium of the valley now drained by the Kortalayár river was really formed by the much larger Pálár river, whose course was subsequently diverted.

The Kortalayár river probably still receives a considerable supply of water from the Pálár by filtration, while the two principal affluents, the Tirutani and Nagari rivers, also bring large contributions, so that altogether the valley conveys seaward a very important volume of water.

3. Monsieur deClosets' site for the proposed borings does not, however, appear to be the most favorable that might be chosen. The probability of the alluvium occurring in its full depth close to the north end of the Red Hills is very small, for not only is the river cutting into the tertiary sand-stones on its southern bank (as pointed out by Dr. King), but there is also an inlier of the sand-stones rising through the alluvium about a mile to the north-west which forms the Manjakaranei hills. This inlier of the sand-stones which you will find given on my geological map of the Madras country (north-east $\frac{1}{4}$ sheet of atlas sheet No. 78) seems to indicate strongly by its position that the axis of the old Pálár valley lay to the north, or north-west, of it and not close to the present scarp of the Red Hills plateau. My idea would be to try the boring nearer to the axis of the valley where the alluvium is likely to be thickest.

4. Monsieur deClosets seems unaware of the existence of the Manjakaranei inlier; at least his map, which in other respects is only a copy of mine, omits the inlier.

Should the boring in the alluvium of the Kortalayár fail to show useful artesian water-sheets, I quite concur with Dr. King that it would be very desirable that the boring be carried deeper through the possibly underlying tertiary and secondary (Sríperambudur) formations, and, if necessary, down to the surface of the gneiss. The wells forming the tertiary and secondary formations of that region are of such very moderate hardness that the expense would be small (in case of the trial boring being made only of small diameter), while the knowledge to be gained as to the water-bearing conditions of those sub-alluvial rocks will be of great value.

From A. P. DECLOSETS, Esq., C.E., to the Secretary to Government, Public Works Department, dated Madras, 17th March 1886.

I have the honor to acknowledge the receipt of the letter from the Deputy Chief Engineer, Public Works Department, and dated 15th March 1886, referring me to the Chief Engineer, Public Works Department, and to inform you that I am prepared to carry out the experiment recommended by Dr. King in paragraph 6 of his letter at the site mentioned by Mr. Bruce Foote, and on the following terms.

1. Plant, implements and machinery necessary, to be supplied by Government on the spot selected for operations, and upon my indenting on the Public Works Department Workshops and Stores.

2. In case I shall use some of my own boring tools, the transport of the same will be paid by Government without any other charge.

3. Temporary sheds or huts, if necessary, will be erected at the Government expense.

4. A monthly sum of Rs. 250 will be affected for boring expenses, proper, and such as—

	RS.
Wages ...	82
Clerk ...	15
Assistant Boring Engineer ...	100
Sundries ...	53
Total ...	250

5. I am requesting that you shall be pleased to appoint myself temporarily under the title of Executive Engineer on special duty, with a pay of Rs. 500 per mensem during the time employed in boring operations, but without travelling or other allowances.

ENCLOSURES.

MEMORANDUM.

A well of say 70 yards deep will cost at the rates mentioned :—

	RS.
From 0 yards to 20 yards deep ...	400
" 20 " to 30 " ...	250
" 30 " to 40 " ...	300
" 40 " to 50 " ...	350
" 50 " to 60 " ...	400
" 60 " to 70 " ...	450
Total ...	2,150

Memorandum on Trial Borings.

In my report, dated 10th July 1885, I was proposing to bore an artesian well as near as possible the head of the channel leading the Kortalayár water in the Red Hills tank; this boring was to be done, if possible, near Cholaveram; but this site was so near the tertiary formation that the result may have been dubious, and I was then advocating a trial boring to be made previously. I am of the same opinion as Mr. Bruce Foote, that in boring in the north-west of the Manjakaranei hillock near Nuttong for instance, there would be more chance to find water perhaps with sufficient head to be conducted in the Cholaveram channel; but Nuttong is about two miles from the head of the Cholaveram channel.

Reverting to the trial borings to be made in the Kortalayár alluvium. Before trying on the site recommended by Mr. Bruce Foote, I think, first of all, a boring should be made at a spot not far from the lock of the Ennore canal about 2 miles north-west from Trivatore, as I have good reasons to believe that years ago a gushing stream was found there at a depth not exceeding 25 or 30 feet, and lost subsequently; such trial will be made within 5 or 6 days' work. It will be very important, under a geological point of view, to ascertain this in relation with the probable underground extension of the Red Hills formation eastwards; if water was found there it would not be difficult to convey it into town.

Subsequently, trial borings could be started on the site recommended by Mr. Bruce Foote at perhaps 13 or 14 miles north of Madras, and successively going up into the Kortalayár alluvium.

I can mention some more facts as to the probable existence of water-bearing strata which could be tapped for gushing waters. A boring at Pitchevakkum village situated near the Kortalayár 8 miles south-east of Arkónam was made two miles north from the outcropping tertiary formation and one mile south of the gneiss formation; the strata traversed constituting the alluvium were clays and sands diversely coloured, down to the depth of 39 feet; during the boring process the water in the piping was at a level of 12 feet below the ground; at that depth the boring traversed a stratum of greenish clay, and the water rose into the pipe to the level of 4 feet below the ground; the boring was continued to 84 feet deep, but discontinued for want of funds. However, it has proved the existence of an underground water-bearing stratum.

Lower down in the valley at Kadambatúr, Madras Railway Station, the surface water-sheet stands generally at 6 feet below the ground; but if a boring of 18 feet to 20 feet is made, the water rides to a level of about 2 feet from the ground; probably the water-sheet found at Pitchevakkum exists also under Kadambatúr.

It could be thought that if borings were made lower down in the valley near the village of Kilianur for instance, there would be some chance of tapping water strata supplying gushing stream and the more so in descending the valley down to the coast.

(Signed) A. P. DECLOSETS,
Civil Engineer.

MADRAS,
20th March 1886.

From A. P. DECLOSETS, Esq., C.E., to the Chief Engineer, Public Works Department, dated Madras, 20th March 1886.

I have the honor of informing you that my letter, dated 17th March 1886, had for object to propose arrangements for boring artesian wells of large diameter; but, as for the present, it would be only required to make trial borings, I have the honor to propose for such trial borings into the Kortalayár alluvium, another arrangement by contract, which will be more economical and suit Government views better than the arrangements mentioned in my letter of the 17th of March 1886.

2. I consider that a boring of $7\frac{1}{2}$ inches will be the more suitable for the object in view; and instead of using the Government boring apparatus which is too heavy for the diameter proposed, I will employ my own set of tools which can bore down to a depth of 500 feet.

3. For conducting the operations I intend to employ one of my sons who has great practice in artesian well boring, and who has already bored nine or ten wells, either in Pondicherry or elsewhere; but I will have myself the control of the operations.

The terms I have the honor of proposing are—

(*1st.*) I will contract to make a boring of $7\frac{1}{2}$ inches diameter upon the site pointed out by Mr. Bruce Foote, or any other at the following rates :—

From 0 yards to 20 yards deep, Rs. 20 per lineal yard.
Do. 20 " to 30 " " 25 do.
Do. 30 " to 40 " " 30 do.
Do. 40 " to 50 " " 35 do.
Do. 50 " to 60 " " 40 do.
Do. 60 " to 70 " " 45 do.

and so on increasing the cost per lineal yard by Rs. 5 at every 10 yards deep.

(*2nd.*) Government will supply, free of charge, if it was necessary, some plant, implement or machinery to assist my operations. I will supply myself the boring apparatus, free of charge.

(*3rd.*) Government will supply the iron pipes necessary for the boring or pay for the same supplied by myself at the rate of Rs. 4-8-0 per each length of 4 feet.

(*4th.*) If rocks other than gneiss or laterite are met in the boring process, the work, if continued, would be paid at the rate of Rs. 350 per mensem; this during the passing through the rock found.

(*5th.*) Temporary sheds or huts, when necessary, will be erected on the works at Government expense.

(*6th.*) Travelling allowance will be given to myself at the rate usual for Executive Engineer, whenever my presence will be required at the boring works.

Memorandum from the Under Secretary to Government, Public Works Department, to the Superintendent, Geological Survey of India, dated 23rd March 1886, No. 1182 C.

Forwarded to Mr. Bruce Foote, in continuation of No. 763 C., dated 24th February 1886, for favor of opinion as to the suitableness of the sites now proposed by Mr. deClosets in the memorandum attached to his letter.

From R. BRUCE FOOTE, Esq., F.G.S., Superintendent, Geological Survey of India, to the Deputy Chief Engineer, Public Works Department, dated Bellary, 1st April 1886, No. 802.

In reply to reference, No. 1182 C., dated 23rd March 1886, I have the honor to inform you that I can see no objection, on geological grounds, to the fresh boring sites proposed by Mons. deClosets, whether near the canal lock two miles north-west of Trivatore, or at a point 13 or 14 miles north of Madras, or at the two places he names higher up the Kortalayár valley, viz., Kilianur or Kadambatúr.

With regard to the boring site near the head of Cholaveram feeding channel, I am still of opinion that it should lie to the west or north-west of the Manjakaranei hill near Gannapur or Aerabáncum (of sheet 78). Monsieur deClosets is mistaken as to the exact position of the village of Nuttong (Nattam) which he now proposes; the place really lies two miles north-east of the hill and not to the north-west of it as he supposes.

I regret having had to delay my reply for several days owing to indisposition.

From Colonel H. L. PRENDERGAST, R.E., Superintending Engineer, V Circle, to the Chief Engineer, Public Works Department, dated Chepâk, 9th April 1886, No. 154.

In reply to your memorandum, No. 1142 C., (will follow) dated 26th March 1886, I have the honor to report that, judging by the experience of the expenses incurred on the artesian well in the People's Park, the cost of an experimental boring beyond the Red Hills, to a depth of 60 feet, will be not less than Rs. 550, making no allowance for special supervision.

2. Details are given in the enclosed estimate.

3. There is no subordinate in the division who has had practice in boring of this nature.

ORDER—dated 5th May 1886, No. 1128 W., Public Works.

1. Monsieur deClosets proposes to carry out trial artesian borings at a specified site in the Kortalayár basin, and in his letter, dated 20th March 1886, he mentions the rates at which he is prepared to carry out experiments on contract. The rate for a boring 60 feet deep is set down at Rs. 400. The Superintending Engineer's estimate for a boring of the same depth amounts to Rs. 550.

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2. As it is desirable that the proposed experiment should be made, the Government resolve to request Mons. deClosets to sink a well 60 feet deep at the approved site, on the understanding that the total cost will not exceed Rs. 400 in addition to the incidental expenses mentioned in the 2nd, 3rd, 5th, and 6th clauses of his letter. With advertence to the 4th clause, it must be understood that if rock be met with, such as is likely to prolong the work, further operations must be stayed pending receipt of the orders of Government.

3. Monsieur deClosets' letter referred to in paragraph 1 will be forwarded to the Superintending Engineer, V Circle, in view to an agreement being drawn up in communication with Mons. deClosets, based on the terms given in his letter. The draft agreement will be submitted for approval.

4. The following letter will be addressed to Mons. deClosets.

(Here enter No. 1129 W., dated 5th May 1886.)

(True Extract.)

Major, R.E.,
Under Secy. to Govt., P.W.D.

To the Superintending Engineer, V Circle, with enclosures.
To Dr. W. King, Superintendent, Geological Survey of India.
" R. Bruce Foote, Esq., F.G.S., Superintendent, Geological Survey of India.

Exd. A. Aubert.
Spare Copies

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of {1886} Madras.

PUBLIC WORKS.

Dated May, 5th.

Recd. *Encl.*

G.O., 5th May 1886, No. 1128 W.

MAY.

Artesian Well Boring

Orders for an experimental — in the Kortalayár basin being carried out by Monsieur A. P. deClosets.

1128/6

5th May 1886, No. 1129 W., Public Works.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

Letter—from

Colonel J. SHAW-STEWART, R.E.,
Secretary to the Government of Madras,
Public Works Department,

To

Monsieur A. P. DeCLOSETS.

Sir,

With reference to your letter, dated 20th March 1886, I have the honor to inform you that the Superintending Engineer, V Circle, has been directed to arrange with you for making a trial boring 60 feet deep. Please place yourself in communication with the Superintending Engineer on the subject.

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

Major, R.E.,
Under Secy. to Govt., P.W.D.

Fort St. George,
5th May 1886.

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PUBLIC WORKS.

Dated May, 5th.

Recd. Encl.

5th May 1886, No. 1129 W.

MAY.

Artesian Well Boring

Monsieur A. P. DeClosets requested to place himself in communication with Superintending Engineer, V Circle, to arrange for making a trial — in the Kortalayár basin.

P. W. Department.

No. 1142 Ca/ 20th March/86

Memorandum 1128/8

It has been suggested that the site specified in the margin* is likely to prove a profitable field for artesian borings, and as the subject is one of considerable importance, it seems ~~expedient~~ desirable to try an experimental boring.

*At or about the axis of the old Palar Valley (which is now drained by the Cartelliar river) lying to the north or north-west of the present scarp of the Red Hills Plateau. It is believed that the alluvium is likely to be thickest at this spot.

2. The undersigned has the honor to request that the Supg: Engineer V Circle will report whether he can undertake to sink a small artesian tube at the site named to the depth of 60 feet.

and, if so, at what cost.
The necessary boring apparatus is, it is believed, available at the R.W. Workshops, and as the experiment is to be made on a small scale, it is ~~probable~~ possible the work can be carried out without the assistance of a specialist.

3 In estimating the cost, the Supg: Engineer should be careful to include all likely charges.

19/3/86

19.3

To.

The Supg: Engineer

No. 1044 Ca/ 15-3-86
" 763 Ca/ 24-2-86
G.O. A 328 Wa/ 6-2-86
" B 2676 Wa/ 10-11-85
G.O. A 1732 Wa/ 28-7-85
No. 1137 Ca/ 4-7-85
" 867 Ca/ 4-5-85
G.O. A 3129 Wa/ 19-12-83
G.O. B 351 Da/ 2-6-80

Memo

No. 1142 Ca/ 0-3-86

Madras 16 July 85

1128/10

Dear Colonel Shaw Stewart,

I send you here a private communication upon artesian well boring according to my own opinion upon the subject, pray to have it communicated to Doctor Furnell who is taking much interest in the matter as Sanitary Commissioner, and believe me

yours sincerely

D Marotti

(2)

No 3
7636/6
1857

G. 27.7.85 P. 1-905

Water supply of Madras.

Memo upon the boring of an Artesian
well 3' 3" (1 metre) Diameter $\frac{1128}{12}$

From A. P. De Closets Esq. C.E.

To

Colonel Shaw Stewart R.E.
Secretary to Govert. D.P.W.

and To

Doctor Furnell the Sanitary
Commissioner - Madras -

Gentlemen:

As the boring for an artesian well at the Peoples Park has been discontinued, owing to the tools having indicated the Gneiss formation underlaying, and as it is intended, as far as I understand, to make some other trial borings at some other spots in the Madras grounds I have the honor to forward for your consideration, the following opinions.

If trial borings are

to be made I will ask to be permitted to suggest that they should be 1128 executed into the alluvial valley of the Cortilyar, near far from the head of the canal conducting the waters of that river, into the Sholaveram and Red, Hills tanks, and that if the boring reaches an Artesian water sheet; that is a water sheet gushing and overflowing the level of the ground, an Artesian well of 3' 3" (1m Diameter should be bored and its water diverted into the red hills supply channel.

My reasons for selecting the Cortilyar Alluvium for such boring are:

1° The negative results arrived at in the Cooum alluvium its geological composition leaving very little hope of finding ascending water sheets, below madras town.

2° That the identical conformation of the Cortilyar alluvium with those of

1128/14

the Pondicherry (Gingee river) and of the Cavery, into both of which artesian springs have been found to exist, tend to prove that the Cortelyar alluvium must contains also water bearing strata which once tapped will overflow and gush above the level of the ground.

3° that it is proved by a boring at Ennore, that the Cortelyar alluvium could supply artesian water sheets.

4° that if a [illegible] water sheet is found into this alluvium it could be conveyed in town without extra cost by the means of the red hills Canal.

5° Finally that the cost of an Artesian well of 3 feet 3 inch diameter could be repaid within 2 or 3 years by a tax at the rate of 3 pie per annum per head of the general population.

I will examine in detail each of the above reasons.

1128/15

I

From the Geological conformation of the ground upon which Madras and it's suburbs are constructed, and of which a map is here annexed, it is perceived that the gneiss formation of the little mount near the river Adyar, dipps into a Northern direction under a certain angle extends underground probably 12 or 13 miles raising again to reappear in the Neighbourhood of Calattry.

Several borings executed during the last year, in Madras, seems to prove that such is the case;

The Well no 1 bored lately at the Peoples park reached the gneiss at about — 60'

Well No 2 at Napier foundry reached a rock supposed to be gneiss at 66'

Well No 3 at Rayapooram

Came upon gneiss at a depth of about ——— 1128/16 72'

Well No 4 at Tondiarpett at about ——— 75'

Well No 5 at Wathermanpettah reached at ——— 80'

(a Well bored years ago into the old Custom house at Madras found the gneiss at about) ——— 64'

Well No 6 bored at Ennore has not encountered the gneiss, after tapping a layer of Carbonate of lime(?) at 214' below ground, water rose into the pipe, and presently stand in the same at 6 feet above the level of the water of the Ennore lake.

The five wells 1 to 5 have been bor into the Cooum alluvium the well No 6 into that of the Cortilyar; the Cooum alluvium has an area of about 8 square miles, and is composed of Sandy, tracts, Covering Some small patches of Blue

1128/22

clay laying generally upon the gravel, the small thickness of this alluvium give therefore no hope of finding artesian water and sufficient head for such; this has been proved so far by the borings.

the well at Napier foundry tapped a water sheet which overflowed the pipe, but I have ascertained afterwards, that the water. was the same as that of the seven-wells, the overflow was due to the boring having been executed at a place below the level of the seven wells water.

The Cooum alluvium, is contiguous to that of the Cortilyar and it could be supposed that ~~the~~ water of the latter might penetrate into the Cooum alluvium but this is dubious, as it is probable that the tertiary formation of the red-hills dipping eastward, forms a ridge between the two alluviums underground.

II

The Geological map of the Cortilyar, of the Pounear and Gingee rivers and of the Cavery Delta, will shew that these alluvial basins, are surrounded by identical formations, viz: on the west by gneiss, on the north and South by gneiss, tertiary formations, cretaceous or Stripermatoe Serie; on the East by the sea of Bay of Bengal.

All these strata superposed have a slope Eastward.

It is to be observed that in the Cortilyar basin, the cretaceous formation is replaced by the Streepermatoe serie.

these formations underlaying the alluviums mentionned offers a similar stratification that is:

under the alluvial deposits composed of layers of Clay and Sand, we found the tertiary formations laying upon the Cretaceous or in case of Cortilyar upon the Streepermatoe serie, and under these the gneiss or grain. It is to be admitted that such beeing the case and during the silting 1128/79 process of these alluviums, the same or identical materials have been deposited upon the old formation constituting the former basin or valley of the Cortilyar & Varnaveram, of the Pounear & Gingee and of the Cauvery rivers.

Therefore if Artesian waters have been found in the two last basins, there is much probability that Artesian waters will also be found in the Cortilyar alluvial basin.

Doctor King of the Geological Survey admits the hypothesis that near Caverypaukam at the upper end of the Cortilyar valley, there may be an underground outlet, through which the waters of the Palar can reach the strata of the Cortilyar alluvium; a boring executed by Mr Adrien de Closets in 1883 for a native, at Pitchevakkam 7 1/2 miles S.E. from Arconum and 7 mile S.W. from Cudambatoor

Would have tested Do
king theory if the funds
at the disposal of the n
have been sufficient, but
boring was stopped at
84 feet for want of pecun
means.

1128/20

III

The well bored at Enn
although without the nec
precautions, has however
reached the depth of 214
without coming in cont
with the granite, we h
been informed that
214' the tools bored a t
of Carbonate of lime
under which the water
into the pipe and sto
at the present level,
6 feet above the leve
the lake of Ennore.
From the report o
workmen, we are
to surmise that dur
the boring process, the
has traversed sever
water bearing strata,
perhaps, would have
gushing streams if pro
Catched, but owing to pa
apparatus, the pipe w

sunk loose into the bore
hole, and the consequence
was that ascending water
would have flowed around
the pipe outside and have been lost
in the permeable sandy
strata above which the
boring had traversed, this
would explains why the
waters stands now in the
pipe at 6' only, when the
head obtainable could be
at the rate of 7 to 8' ℘ h
if starting from the extrem
of the alluvium at Nagge
which is at an altitude o
396 feet above mean sea
level, and considering th
the altitude of the Corti
valley near Tolur is 29
From the above, I am lea
believe that the Corti
and Narnavaram river
alluvium, contains v
bearing strata which
be turned to profit b
artesian wells.

IV

Supposing therefore
the above consider
should inence to

an Artesian Well into the Cortilyar alluvium, I should suggest that the spot upon which such boring is to be made, should be as near as possible the head of the channell diverting the water of the Cortilyar, into the Cholaveram and red hill, tank; for this purpose a trial boring would be made so as to ascertain whether an ascending water sheet exists below, and what supply is to be relied upon. to minimize the expenditure of such boring for trial it could be made with a lighter apparatus, as may be had in the P. W. Dt stores or by a set of our own tools the large apparatus obtained from Europe would be employed further for larger boring.

After having found the convenient water sheet, The following operation would be to sink 1128 an Artesian Well of 3f 3"in (1 mètre) in Diameter, and for this to use the large boring apparatus Artesian Wells of such Diameter have been already bored elsewhere, for instance at the butte aux cailles near Paris a well of 47 inches Diameter was bored in 1867.

Another Well near Passy of a Diameter of 3'.29 has been successfully bored. this well has a depth of 1913 feet from the ground line to the water stratum, and delivers daily 3,795,000 gallons of water.

I consider that there will be not much difficulties in boring a Well of the same Diameter near the Cortilyar, previous boring such that at Ennore having only shewn strata easily traversed without any interference from rock.

The tertiary formation

will have perhaps to be bored, but the materials composing ~~these~~ its beds are soft enough, and will oppose no difficulties. It is even possible that a water bearing stratum should be arrived at, above the tertiary ground.

1128/24

The quantity of gallons supplied by a well of 1 mètre diameter (3'3") will be; as far our observations upon the several artesian wells of the Pondicherry & Cavery basins, had shewn 3.000.000 gallons in 24 hours.—

The wells observed had pipes of 7 inches ½ and their delivery per minute at 3' above the level of the ground was 100 litres ℘ minute or 22 gallons.03 that is a daily supply of 31680 gallons.

The well above supplying 3.000000 gallons daily will allow 7.50 gallons ℘ head of the Madras population

V

The cost of sinking an Artesian Well of 3' 3" Diameter, could 1128 25 be Estimated about as follows; the time employed supposed to be 12 months.

Wages	1440
Repairs & occasional tools	1200
Engine fuel, oil grease and sundries	1500
Iron Pipe ½" thick rivets & packing	3000
Superintendance	6000
Contingencies	2800
total Rupees	15940

To recoup this expenditure a water rate of 3 pice a head of inhabitant per annum, will refund the cost within 2 or 3 years.

The advantage of the scheme, is that no new works would be required so as to bring water to town, and thus the objection as regards

boring at great distance
from it would disappear.
Besides, the main pipes and branches
in Madras would be used
for the water of the artesian
well and there would be
no necessity for establishing
a junction.

Admitting that an Artesian
well should be bored success-
fully inside Madras, nothing
proves that the head obtained
would be sufficient for
the service.

In the case suggested
above, that is: if a artesian
sheet is discovered in the
Cortilyar the head will be
the same as that of the
present water works, and
if a water deficiency from
the red hill tank was
arising, the artesian
water will keep the
same head avoiding
the necessity for Pumps

I have the hono
to be Gentlem
your most ob

Madras 10th July
1885.

Declote
Pegran

(2) [illegible]

763

[illegible] 22/7/85.

[illegible]

No. 75

1128/27

FROM

Dr. Wm. King

Superintendent, Geological Survey of India,

TO

The Secretary to Government
Public Works Department
Madras.

Dated January 30th 1885.

Sir,

I have the honor to return with thanks the letter and accompanying map of Mr. A. de Closets on the subject of Artesian Explorations in Madras, referred to in G.O. No. 2676 W. of dated 10th Nov: 1885.

2. I have also to tender my thanks for the copy of Mr L. Cornelis' report of 20th June last, on the Peoples' Park Boring, and the accompanying tracing giving the different strata passed through. The latter shall be returned in due course as I have sent it on to the Director Geological Survey of India to be copied in our Office for record.

3. Being personally acquainted with Mr de Closets and knowing his

previously ascertained as
boring in S. India, it has given me great pleasure to read this proposal for trial in the Cortelliar alluvial tract, the geological relations of which he seems to have read up with great care. On the latter subject, and indeed generally with regard to the possibilities of the Cortelliar tract, I would however suggest, before any plan be decided on, that Mr R. Bruce Foote be consulted. Mr Foote is now the Supt. G. S. of I. for Madras; and he surveyed & reported on the geology of the Madras country.—

4. You will remember that in my last ~~original~~ letter to Government, No. 1011, dated Oct. 30th 1885, I confined myself exclusively to the neighbourhood of Madras itself; but in my original letter on the artesian capabilities of the Madras country generally, the possibly more hopeful conditions of the Cortelliar basin was pointed out.—

5.— Now, with regard to Mr de Closet's scheme for tapping this region, relying as he does upon the rise of water (reported to be 6 feet over the back-water level) in the boring at Ennore: I can only venture, in an unprofessional way, to suggest a few points which strike me as in the way of its success. It is to be noticed in the first place, that his proposed site is at least 12 miles further inland than the Ennore work, and almost immediately at the northern end of the Red Hills plateau of tertiary sandstones, where it may be presumed that the rise of water would be less than at Ennore. (I do not suppose that for this distance inland the gradient of the alluvial tract would be so rapid as indicated by Mr de Closet, but it would be appreciable enough.) The probability of a good depth of alluvium immediately to the north of the Red Hills plateau is I think doubtful: for as far as I recollect, the Cortelliar river is, at that

[illegible] [illegible] is [illegible] in the [illegible]
(the foundations of the [illegible] or
dam (if there be one) backing the
[illegible] water into the channel to
the Cholavaram tank, ought to give
evidence in this matter.) [illegible]
it is a question with me whether
the Result-[illegible] rise of water in the
proposed boring would be sufficient
for the levels of the Cholavaram
and Red Hill tanks channels.

6. Mr de Closets' proposals looks
so feasible, ~~that~~ provided the above
objections can be [illegible]; while the
cost would be so reasonable, taking
the rate for the larger proposed work
as compared with the [illegible] charges
(excepting cost of plant) incurred
at the Peoples' Park boring; that I
am fain to advise that trial should
be made with a small tube and plant
at any rate. I suppose Mr de Closets
would carry out the experiment, as one
[illegible] that anyone [illegible] it would
be to his interest to do so. (The
matter of cost of boring will only

No.

FROM

Superintendent, Geological Survey of India,

TO

Dated 188

SIR,

not be out of the way, I think, to
state that I am now having coal
borings carried out here by a
European ~~[illegible]~~ whose pay last year
was 250 Rs a month, rising to Rs 300
this year. This rate may help
as a guide to charges in an ex-
periment like that proposed which
should only last for a few months).

7. Mr de Closets [illegible] fears the
shallow sub-alluvial occurrence of the
Red Hill sandstones just as much as I
do; and looks to the contingency of
having to bore into these rocks. A
boring of this kind would open up
the further question as to the de-

velopment in S. India; viz:— the water-bearing, or porous, condition of the ~~Ind~~ Tertiary sandstones: that is provided the Red Hills rocks and those of the larger patch northward and the smaller patch westward (see Mr De Clerk's map), are continuous under the alluvial tracts. If they are not continuous, then the floor of the Narnavaram river alluvium and some extent of that of the Cortelliar will consist of gneiss or crystalline rocks: in which case there is just a possibility that the water-bearing strata of an alluvial tract resting on the gneiss might ~~communicate~~ be in communication with fortuitously arranged or disposed porous strata of the sandstones on either side.

8.— I do not place much reliance on such a tailing-in of porous deposits: but should the tubes of the boring apparatus encounter sandstones below the alluvium; it might be almost advisable — if only on scientific grounds — to drive them down into them also to the gneiss which can

not be at any great depth. I need scarcely point out that there is no use running into the gneiss, the presence of which will soon be ascertained by the hardness. ~~of the rock~~

I have the honor to be
Sir
Your most obdt. Servt.
Will: King
Superintendent
Geological Survey of India.

Padampur
Sambalpur District
Central Provinces.

x. Enclosures:—
1. Mr De Clerk's Paper.
2. Mr De Clerk's tracings.

9 Feb 86

G. S. I. Library

No. 163 Cap. 4th [illegible] 1886

From Mons: A. Deflosets - d 16.7.85. (with report & plan).*

From Dr Will King. No. 75 - d 30.1.86.× (forwarding his remarks on Artesian well boring at Madras)-

× C Nos 1038/86 }
* 6421/85 }
7635/85 }

Referred to the Supdt. Geo: Survey of India, for Madras, with the request that he will favor this Dept with his opinion as to the possibilities of the Sortellias tract as a field for Artesian borings.

Copies of the under mentioned orders are forwarded for ~~opinion~~ information

G.O. 1732. W. d 28/7/85.
G.O. 328. W. d 6/2/86.

15/2/86

To R. Bruce Foote Esq.
Supdt. G. S. of I. for Madras-

with papers & plan in original - return requested -

[illegible]

G.O. 4/ 328 W d/ 6-2-86
" 3/ 2676 W d/ 10-11-85
G.O. 1732 W d/ 28-7-85
" 3129 W d/ 19-12-84
No. 867 C d/ 4-5-85
" 1137 C d/ 4-7-85
G.O. 3/ 3519 d/ 2-6-80

No. 774

No. 19

Camp Bellary District
6th March 1886

1128/32

From R. B. Foote Esq F.G.S.
Superintendent, Geological Survey of India
To The Under Secretary to Government
Public Works Department
Madras

4

Sir,

I have the honor to acknowledge receipt of Reference No. 763 C., dated 24th February 1886, giving Cover letters from Mons. A. De Closets and Dr. W. King about Artesian borings to be tried in the Alluvial Valley of the Cortelliar, and requesting my opinion on the subject. – In reply I beg to state that on Geological grounds I regard Mons. De Closets proposal as a reasonably promising one, the alluvium of the Cortelliar being of considerable extent and depth, and there being great probability of its containing permanently water bearing strata, capable of being

tapped

tapped by borings as in the case of the
Gingee river near Pondicherry.-

2. As I showed in my Memoir on the
Geology of Madras (Memoirs G.S. of I.
Vol 18) the alluvium of the valley
now drained by the Cortelliar river was
really formed by the much larger Palar
river, whose course was subsequently diverted.

The Cortelliar river probably still receives
a considerable supply of water from the
Palar by filtration, while the two principal
affluents, the Trittany and Naggery rivers
also bring large contributions so that altogether
the valley conveys seaward a very
important volume of water.-

3. Mons. De Closets site for the proposed
boring does not however appear to be the
most favorable that might be chosen.
The probability of the Alluvium occurring
in its full depth close to the north end of
the Red Hills is very small for not only
is the river cutting into the Tertiary sand-
stones on its southern bank (as pointed out

by Dr. King) but there is also an inlier of
the sandstones rising thro' the Alluvium
about a mile to the north-west which forms
the Manja Karanei hills. This inlier of
the sandstones which you will find given on
my geological maps of the Madras Country
(N.E. 1/4 sheet of Atlas sheet No. 78) seems to
indicate strongly by its position that the
axis of the old Palar valley lay to the
north, or North-West, of its and not close to
the present scarp of the Red Hills plateau.
My idea would be to try the boring nearer
to the axis of the valley where the Alluvium
is likely to be thickest.-

4. Mons. De Closets seems unaware of the
existence of the Manja Karanei inlier; at
least his maps, which in other respects is al
a copy of mine, omits the inlier.-

Should the boring in the alluvium of
the Cortelliar fail to show useful Artesian
water sheets I quite concur with Dr. King
that it would be very desirable
that the boring be carried deeper through
the possibly underlying tertiary and Secon-
dary (Sripermatur) formations, and, if necess-

down to the surface of the Gneiss. – The rocks forming the tertiary and secondary formations [illegible] that region are of such very moderate hardness that the expense would be small (in case of the trial boring being made only of small diameter) while the knowledge to be gained as to the water bearing conditions of those suballuvial rocks will be of great value. –

I have the honor to be

Sir,

Your most obedient Servant

R. Bruce Foote F.G.S.

Supdt.

Geol. Survey of India

Public Works Department

No. 10 [illegible] Dept 15th March /86

Memorandum 1128/34

Letter from Mr. De Closets C.E. of 10th July 1885

Letter from Dr. W. King Supt. Geological Survey of India } No. 75 of 30th January 1886

Letter from Mr. Bruce Foote No. 774 of 6th March 1886.

Copies of the foregoing letters from Dr. King and Mr. Bruce Foote forwarded to Monsieur De Closets with reference to his letter and enclosure dated 16th July 1885 with a request that he will be so good as to inform the Chief Engineer whether he he is prepared to carry out the experiment recommended by Dr. King in para 6 of his letter at the site mentioned by Mr. Bruce Foote in para 3 of his letter - and, if so, on what terms.

2. The plant for the boring would be supplied by Government.

14/3/86

12.3

No. 763 Cap/ 24-2-86
G.O. A 328 Wa/ 6-2 86
G.O. 2676 Wa/ 10-11-85
G.O. 1732 Wa/ 28-7-85
No. 1137 Ca/ 4-7-85
867 Cap 4-5-85
G.O. 3177 Wa/ 13-12-84
G.O. 351 Cap/ 2-6-8[illegible]

To
Mons: De Closets

Madras 17 March 1889

p 21

From:
A. Pierres de Closets Esqr. C.E.
To
Colonel Shaw Stewart R.E.
Secretary to Government P.W.Dt.
Madras:

138/25

Sir

I have the honor to acknowledge the receipt of the letter from the Deputy Chief Engineer P.W.Dt. and dated 15th March 1886 referring me to the Chief Engineer P.W.Dt. and to inform you, that I am prepared to carry out the experiment recommended by Dr. King in para 6 of his letter at the site mentioned by Mr. Bruce-Foote and on the following terms.

1°. Plant implements and machinery necessary, to be supplied by Government on the spot selected for operations, and upon my indenting on the P.W.Dt. Workshops and Stores.

2° In case I shall use some of my own boring tools, the transport of the same will be paid by government without any other charge.

3° Temporary sheds or huts if necessary will be erected at the government expense.

4° A monthly sum of Rupees 250

250, will be affected for boring Expenses proper, and such as:

R.

Wages = 82.

Clerk — 15

Att. Boring Engin. 100

Sundries. 53

Total Rupees 250.

5° I am requesting that you shall be pleased to appoint myself temporarily under the title of Executive Engineer on Special duty, with a pay of Rs. 500 p mensem during the time employed in boring operations, but without travelling or other allowances.

I have the honor
to be
Sir
your most obedient

A. W. Closett C.E.
madras

office
52. Poonamallee Road.

Apl 20.80

Recd 17.3/86.

17 MA[illegible]

No. 1142 Ca 20-3-86

8/p 23

Memo

1128/31

A well of say 70 yards deep will cost at the rates mentioned

			Rup
from	0 yards	to 20 yards deep	400
"	20	30	250
"	30	40	300
"	40	50	350
"	50	60	400
"	60	70	450
		total	2150

Madras 20 March 1886

1/p 26

Memorandum on Trial Borings.

1128/38

In my report dated 10th July 1885, I was proposing to bore an artesian well as near as possible the head of the channel leading the Cortilyar water in the Red Hills tank; this boring was to be done if possible near Cholaveram; but this site was so near the tertiary formation that the result may have been dubious, and I was then advocating a trial boring to be made previously. I am of the same opinion as Mr Bruce Foote, that in boring in the N.W. of the Manjakarany hillock near Nattong for instance, there would be more chance to find water perhaps with sufficient head to be conducted in the Cholaveram channell, but Nattang is about 2 miles from the head of the Cholaveram channel.

Reverting to the trial borings to be made in the Cortilyar alluvium. Before trying on the site recommended by Mr Bruce Foote

I think, first of all, a boring should be made at a spot not far from the lock of the Ennore Canal about 2 miles N W from Trivatore, as I have good reasons to believe that years ago a gushing stream was found there at a depth not exceeding 25 or 30 feet, and lost subsequently. Such trial will be made within 5 or 6 days work. It will be very important under a Geological point of view to ascertain this in relation with the probable underground extension of the red hills formations eastward; if water was found there it would not be difficult to convey it into town.

Subsequently trial borings could be started on the site recommended by Mr Bruce Foote, or perhaps at 13 or 14 miles north of Madras, and successively going up into the Cortilyar alluvium.

W28/39

I can mention some more facts as to the probable existence of water bearing strata which could be tapped for gushing water.

A boring at Pirchivakkum, village situated near the Cortilyar 8 miles S.E. of Arconum was made two miles N from the outcropping tertiary formation and 1 mile south of the gneissic formation; the strata traversed constituting the alluvium, were clays and sands diversely coloured down to the depth of 39 feet. During the boring process the water in the piping was at a level of 12 feet below the ground, at that depth, the boring traversed a stratum of greenish clay, and the water rose into the pipe to the level of 4' below the ground, the boring was continued to 84 feet deep but discontinued for want of funds, however it was proved the existence of an underground water bearing stratum.

Lower down in the Valley

Audumbathoor M.R. Station the surface water sheet stands generally at 6 feet below the ground, but if a boring of 18' to 20' is made the water rises to a level of about 2 feet from the ground probably the water sheet found at Pitcharakkum exists also under Audumbathoor

It could be thought that if borings were made lower down in the valley near the village of Kilianoor for instance, there would be some chance of tapping water strata supplying gushing streams and the more so in descending the valley down to the coast.

P. de Mattei C.E.

Madras 20 March 1886

p. 26

From:
A. Pierres de Mattei Esq. C.E. 1128/40
To
Colonel Shaw Stewart R.E.
Chief Engineer Dep. P.W.
Madras.

Sir:

I have the honor of informing you that my letter dated 17 March 1886 had for object to propose arrangements for boring Artesian Wells of large diameter; but, as for the present it would be only required to make trial borings, I have the honor to propose for such trial borings into the Cortilyar alluvium, another arrangement by Contract, which will be more economical and suit Government views better than the arrangements mentionned in my letter of the 17th of March 1886.

2050

I consider that a boring of 7½ inches will be the more suitable for the object in view; and instead of using the Government boring apparatus which is too heavy for the diameter proposed, I will employ my own set of tools, which can bore down to a depth of 500'.

For conducting the operations, I intend to employ one of my son who has great practice in artesian well boring and who has already bored 9 or 10 wells, either Pondichery or elsewhere, but I will have myself, the control of the operations.

The terms I have the honor of proposing are:

1° I will contract to make a boring of 4''½ inches diameter upon the site pointed out by Mr Bruce Foote, or any other that at the following rates:

from 0^y to 20^yar deep, Rup. 20 ⅌ lineal yard
from 20 — 30 — 25. do
from 30 — 40 — — 30 — do

from 40^y to 50^y Rup — 35 ⅌ lineal yard
50 " 60 — do — 40 do
60 70 — " 45 — do.

and so on increasing the cost per lineal yard, by 5 rupees at every 10 yards deep.

2° Government will supply free of charge, if it was necessary some plant implement or machinery to assist my operations. I will supply myself the boring apparatus, free of charge.

3° Government will supply the Iron pipes necessary for the boring or pay for the same supplied by myself at the rate of 4 rupees 8 annas ⅌ each length of 4 feet.

4° If rocks other than gneiss or Laterite are met in the boring process, the work if continued would be paid at the rate of 350 Rupees per mensem, this during the passing through the rocks found.

temporary

When necessary will be erected on the works at Government expense.

P.W.L. 2182

6°. Travelling allowance will be given to myself at the rate usual for Executive Engineer, whenever my presence will be required at the boring works.

Recd 22/3/86

I have the honor to be

Sir

your Obedient

DeMosets C.E.

P. W. Dept.
To be returned with reply

Office.

52. Poonamallee Road.

No. 1182 of 23rd March 1886

From Monsieur DeMosets - d 20.3.86 1128

Forwarded to Mr Bruce Foote, in contn of no: 763. C. d 24.2.86, for favor of opinion as to the suitableness of the sites now proposed by M. DeMosets in the memo: attached to his letter.

22/3/86

C. No. 2182

22-3-86

Ar. fwd 23-3-86 with C. No 2182

No. 1142 C a/ 20-3-86
" 1046 C a/ 15-3-86
" 763 C a/ 24-2-86
G.O. A/328 W a/ 6-2-86
" A/2676 W a/ 10-11-85
" A/1732 W a/ 28-7-85
" 3129 W a/ 19-12-84
No. 867 C a/ 4-5-85
No. 1137 C a/ 4-7-8
G.O. A/3512 d/ 2-6-8

Memo

No. 1182 C a/ 23-3

---

763 C

10.35

To W.

The orders recently passed on Dr King's letter of 30-10-85 are now in the press.

This letter might perhaps stand over until printed copies of the order are available.

C.
9-2-86

Yes
M
9-2-86

fo 69

No 802

Camp – nr. Bellary
1st April 1886.

1128/43

From R. B. Foote Esq. F.G.S.
Superintendent
Geological Survey of India

To Major D. H. Campbell R.E.
Dy Chief Engineer
Public Works Department

Sir,

In reply to Reference No. 1182 C., dated 23rd March 1886, I have the honor to inform you that I can see no objection on Geological grounds to the fresh boring sites proposed by Mons. De Closets whether near the Canal lock 2 miles N.W. of Trivatur, or at a point 13 or 14 miles N. of Madras, or at the two places he names higher up the Cortelliar valley namely Kilianur or Cuddumbathoor.

With regard to the boring site near the head of Pholavaram feeding channel I am still of opinion that it should lie to the West or North West of the Manjakaranei hill near Cannapour or Acrathanam (of sheet 78).

The S.E. [illegible] the
[illegible] for boring at once

Mons. De Closets is mistaken as to the exact position of the village of Nattong (Nattam) which he now proposes; the place really lies 2 miles N.E. of the hill and not to the N.W. of it as he supposes. -

I regret having had to delay my reply for several days owing to indisposition.

I have the honor to be,

Sir,

Your obedient Servant

R. B. Foote

Supdt.

Geological Survey of India

1128/64

Bille 2672

Dw 5/4/56
in 3.

No. 1386 C of 6-4-56

5 Fw

Approximate Estimate of the Cost of Sinking an Experimental Artesian Well beyond the Red Hills to a depth of 60 feet.

1128
~~46~~ 48

	Rs		
Carriage of Tools & Material	50	.	.
Erecting Staging temporary Sheds &c	200	.	.
Cost of labour for Sinking 4½ inch diameter tubing 60 feet	160		
Black Smith & Bellows boy for one Month - and Coal,	35	.	.
Oil, rope, &c	20	.	.
Iron for repairing tools &c	20	.	.
Protecting the head with brick work should water be found	25		
Sundries & unforeseen charges	50	.	.
	550	.	

9 April 1856.

Chas Prendergast Col. R.E.
Supdg Engineer
5th Circle

No. 154

SUPERINTENDING ENGINEER'S OFFICE,
V CIRCLE, MADRAS,
Chepâk, 9 April 1886.

From

THE SUPERINTENDING ENGINEER,
V CIRCLE,

1128
46

To

THE Chief Engineer
P. W. Department.

SIR,

Enclosures.

* Will follow.

[illegible]

In reply to your Memo-randum No. 1142 C* dated 26th March 1886, I have the honor to report that judging by the experience of the expenses incurred on the Artesian Well in the Peoples Park, the cost of an Experimental boring beyond the Red Hills, to a depth of 60 feet, will be not less than 550 Rupees, making no allowance for Special Supervision –

Details are given in the enclosed Estimate,

There is no Subordinate in

the

the Division, who has had
practice in boring of this nature

I have the honor to be
Sir,
Your Most obt Servt
Hew Prendergast Co. M.E.
Supg Engineer 2nd Circle

B. No 351 I. 2.6.80
G.O. No 3129 W. 19.12.84
No 867 C. 4.5.85
" 1137 C. 4.7.85
G.O. 1732 W. 28.7.85 Orig.
B. No 2676 W. 16.11.85
G.O. No 328 W. 6.2.86 Orig.
No 763 C. 24.2.86
" 1014 C. 15.3.86
" 1142 C. 20.3.86
" 1182 C. 23.3.86
" 1386 C. 6.4.86

Pl. No 2865

(2)

From

THE SUPERINTENDING ENGINEER,
V CIRCLE,

To

THE Chief Engineer
P.W.D.

Dated 9th
Recd. 10 } April 1886.

ENCLOSURES. 1

No. 154

Artesian Well—

Reports that the approximate cost of sinking an experimental — near the Red Hills will be not less than 550 rupees.

To DW

D. 13.4.86 resubmitted [illegible]

Note

W. 1128/48

In his letter dated 20th March 1886, Monsieur de Closets proposes to carry out trial borings by contract under certain conditions, and he gives the rates at which he will carry out the work.

The Superintending Engineer V Circle now submits an estimate for a boring 60' deep carried out departmentally amounting to Rs. 550/. Monsieur de Closets' rate being only Rs. 400/. for the same depth. In these circumstances the work had much better be done by Monsieur de Closets, who has had experience. If it is decided that borings are to be taken, I would suggest that Monsieur de Closets' letter be sent to the Supg. Engineer

Engineer V Circle, who in communication with him will draw up a regular contract, based on the terms given in Monsieur de Closets letter.

Monsieur de Closets should be informed that the Superintending Engineer V Circle has been directed to arrange with him about the borings, and that he should communicate with the Superintending Engineer on the subject. It is to be considered whether the experiment should be carried out now, in face of the present financial condition and orders for reduction.

12/4/86

It is desirable that the proposed experiment should be made, on understanding that cost is within R 400/-.
Suggestions in Note approved.

Agt 27/4
a-13. ... & 22-4-86

(2)

Note by D.W.

78 25

117 79 Note
6.5.86

Rs 1000 a month for 3 or 4 months (the time M. de Closets told me probable) does seem a large sum for an experiment and it seems to me that if a suitable spot is pointed out by the Geological Departmt it is not necessary to employ a man on Rs 500 a month to superintend the boring.
Before answering M. de Closets the S.E. might be asked if he could carry out the work, and the probable cost of boring to say a depth of 600 ft. through [illegible] clay &c.

1128/49

8/5/86.

18-3-86

W

…ne

Mr. de Closets proposes to carry out the trial borings by contract. an answer had better be deferred till S. C.'s estimate is received.

1128/69

In his Memo on trial borings Mr. de Closets proposes trial borings in places other than those mentioned by Mr Bruce Foote & gives I think good reasons. perhaps the opinion of the latter might be asked

20/3/18[illegible]

UU

22/3

SKW

Engineer & Circle, who in

I think the letter should be sent to Mons de Closets, & he should be asked if he is willing to carry out the experiment

on what terms

& at what cost, the necessary plant being supplied by Govt

11/3/86

Yes. all three letters should be copied - or the originals will soon fall to pieces.

11.3.86

Monsieur

Engineer & Circle, who in
communication with hi

D.10.

For orders whether
these two letters
may be forwarded
to Mons De Closets
for his remarks.
Mr Bruce Foote
suggests a more
favorable site for
the Experiment. If
it be decided to
make an Experi-
-ment as advised
by Dr. King, Mons:
De Closets might
be asked if he will 1128/59
carry it out, and
at what cost. Govt
supplying the
necessary plant

HB.

11. 3. 86.

Engineer & Circle, who in communication with him will d

[illegible]

Dis:-

1128/54

Monsieur De Closets states the terms on which he is prepared to undertake the Experimental artesian boring advocated by Dr. King. M. De C's Establishment (including Rs: 500 for himself) is estimated to cost Rs: 750 p.m. including cost of conveyance &c. of tools - say Rs: 1,000 -

This is a large sum, and it should be remembered that India's financial restrictive orders have not yet been cancelled or even modified.

As the experiment

4.6 No 134 d/9th April 1880.

Engineer & Circle, who in
communication with him
will dra

is not to be on a
large scale - per-
-haps it would
be possible to
carry it out under
the S. E's orders
at small expense

FB
17

Wo

1128/55

It is proposed that
the agreement with
Mr de Closets shall
be submitted for
the approval of
Govt. & the draft
order might therefore
perhaps be passed
as it stands.

It is probable
however that the
cost of the boring
will exceed Rs 400.

In addition to the
contract rate of Rs
20 per yard asked
for by Mr de Closets,
he stipulates that
the Govt shall pay for
iron piping & supply
temporary sheds, & also
pay his travelling expenses
whenever his presence
may be required at
the boring - the further

4.6 No 134 of 7th April 188.

[illegible]

Engineer V Circle, who in
communication

Stipulate that if rock be met with, & the boring be prolonged, the cost shall be paid at the rate of Rs 350 per [illegible]

Cu
27.4.56

1128/56

Write to S.E. V & M. de Closets as suggested in my note. It may cost in not to exceed Rs 400 but this is only the cost for 60' depth & water may not be found at a depth of 150' or more, though M. de Closets tells me he expected to find water at 60'.

18/4/86

Engineer V Circle, who in
communication

E 1/128 W

Public Works Department.

38/57

PROCEEDINGS OF THE MADRAS GOVERNMENT.

d/ 5th May 1886

Read the following

Letter from Monsieur A. De Closets	A. E. dy 10th July 1885.
Letter from Supt. Geological Survey of India	A. E. No. 75 d/ 30th Janry 1886
Memo to Supt Geological Survey of India	No. 763 C d/ 24th Febry 1886.
Letter from Supt: Geological Survey of India	A. E. No. 774 d/ 6th March /86
Memo to Monsieur A De Closet	No. 1044 C d/ 15th March 1886
Letter from Monsieur A. De Closets	d/ 17th March / 86
Memo to Supdtg: Engr. V Circle	No. 1142 C d/ 20th March /86.
Letter from Monsieur De Closets	d/ 20th March 1886
Memo to Supt Geological Survey of India	No. 1182 C d/ 23rd March 1886.
Letter from Supt. Geological Survey of India	A E No. 802 d/ 1st April /86
Letter from Supdtg Engr. V Circle	A. E. No. 154 d/ 9th April 1886.

Monsieur

Monsieur DeClosets proposes to carry out trial artesian borings at a specified site ~~[illegible]~~ in the Cortelliar t Kadinjar and in his letter dated 20th March 1886 he mentions the rates at which he ~~would~~ is prepared to carry out experiments on contract. The rate for a ~~well~~ one 60 feet deep is set down at Rs 400. The Supdtg: Engineer's estimate for a boring of the same depth amounts to Rs 550.

As it is desirable that the proposed experiment should be made, the Government resolve to request Monsieur DeClosets to sink a well 60 feet deep at the approved site, on the understanding that the total cost will not exceed Rs 400, in addition to the incidental expenses mentioned in the 2d, 3d, 5th & 6th clauses of his letter. With advertence to the 4th clause, it must be understood that if rock be met with, such as is likely to prolong the work, further operations must be stayed pending receipt of the orders of Govt.

3. Monsieur DeClosets letter, referred to in para 1 will be forwarded to the Superintending Engineer V Circle, in view to an agreement being drawn up in communication with

Monsieur Deflossets, —
based on the terms given
in his letter. The draft
agreement will be sub-
-mitted for approval.

4. The following letter
will be addressed to
Monsieur Deflossets.

(H. E. [illegible] 5 May 86)

To

[illegible]ur A. S. Deflossets

Sir.

With reference to
your letter dated 20th
March 1886, I have the
honor to inform you
that the Depty Engineer

To S. E. v. C.
with Enclo.
- Dr. W. King -
Supt. G. S. of India
- R. Bruce Foote Esq.
F. G. S.
Supt. G. S. of India

2/5

825 4 lu

Govt. of 1886 Madras.

PUBLIC WORKS.

No. 7

Dated 5/4/86

Recd Recd 8/5/86 9

G.O., 5 May 1886, No. 1128 W
1129 W

Artesian well boring

Orders for ~~carrying~~ ~~[illegible]~~ an Experimental ~~[illegible]~~ in the Kotalayam basin being carried out by Monsieur Deslosses.

10/4
30

Artesian well boring

Monsieur A. P. Deslosses
engineer his plan
in co nnection with