P. W. D.

Consulting Architect's Office,
Chepauk, Madras,
14th May 1886.

No. 208

From

The Consulting Architect
to the Government of Madras,

To

The Chief Engineer
Public Works Department.

Sir,

Enclosure.

one detailed estimate
one duplicate abstract.

In compliance with G. O. No. 824 dated the 29th March 1886, I have the honor to submit a detailed Estimate amounting to Rs 36,158 for the purchase of the land occupied by the fishing village situated on the South side of the Presidency College, and for raising the land on the west side of the canal for locating the same.

2. In his letter No. 1841 dated the 20th March 1885, the Offg: Consulting Architect to Government estimated the cost of this undertaking at Rupees 26,500. The excess of Rupees 9,658/- is due to the following reasons: —

(a) The area of the village was taken as 80 grounds, upon a careful survey being

being made it was found to contain 85 grounds and 902.09 feet, making a difference in cost of _____ Rs 1,062

(b) Rupees (3,000+7,000) 10,000 was provided for pulling the new site, and compensation to be paid to the fishermen for removing and Constructing their houses, huts and pagoda on it. But it was found unnecessary to purchase the houses, on a valuation and resell the materials, and thus the difference, excess on these two items amounts to _____ " 7,047

(c) The repair and setting up of the foot Bridge in accordance with Chief Engineers Office Note No. 701 dated 22nd February 1886 _____ " 863

(d) Planting trees and fencing them with brickwork including charge for watering for 12 months " 686

Total excess Rupees 9658

3 The last two items were not provided for the original Estimate

4. Funds have been already provided for this works to the full extent. Viz. Rs 39,050.

I have the honor to be
Sir
Your Most Obedient Servant

Por Thompson
Colonel RE
Executive Engineer in Charge
Consulting Architect Office

Encl

14 MAY 86

B. No 636 W 9.3.86
" 634 W 9.3.86
G.C 1641 W 23.2.86
B. No 869 W 9.4.86
" 9324 W 6.4.86
" 8644 W 29.3.86
" 8014 W 25.3.86
" 7134 W 17.3.86
" 631 W 9.3.86
No 812 C 26.2.86
G.C 959 W 23.4.83
No 1428 C 8.4.86
B. No 800 W 25.3.86
No 612 C 21.3.83
G.C 1015 W 19.4.86
No 1576 C 21.4.86
G.C 231 W 27.1.86
B. No 364 W 10.2.86
" 392 W 12.2.86
No 397 C 29.1.86
G.C 211 W 25.1.86
No 701 C 22.2.86

Public Works Department.

From

The Consulting Architect

to the Government of Madras,

To

The Chief Engineer

P. W. Department.

No. 208

Dated 14th May 1886

Received

No. of Enclosures. 2.

Subject.

Submits an Estimate amounting to Rs 36,158 for acquiring the site of the fishing village south of the Presidency College.

C. No. 3683.

P. W. Secretariat.

Note by Budget Section.

Work: Purchase of the land occupied by the fishing village south of the Presidency College and locating the village on a different site.

Remarks and References.

Fund	Provincial		
Service Head	Civil Buildings		
Departmental Head	Original Works.		
Amount of Estimate	Rs. 36,158	× Rs 20,000	G. O. No: 364 W 10-2-86
~~Expenditure~~ Allotment in previous year ...	,, 39,050 ×	,, 950	G. O. No: 800 W 25-3-86
Allotment in current year	,, ,,	,, 20,000	G. O. No: 844 W 29-3-86
Balance required to complete ...	,, ,,		
Total Rs...	,,		

Note of available funds.

A sum of Rs. 39,050 or Rs 2,892 in excess of the estimate now submitted was provided for the work in 1885-86.

18th May 1886.

25

Budget Clerk.

Note by Budget Section.

No. 1324 W.

PUBLIC WORKS DEPARTMENT.

PROCEEDINGS OF THE MADRAS GOVERNMENT.

26th May 1886.

READ the following

From the Consg. Architect to Govt. M. E. No. 208 dt/ 14th May 1886.

The estimate amounting to Rs. 36,158, for the purchase of the land occupied by the fishing village south of the Presidency College, and for locating the village on a different site, is sanctioned.

+ Go. No 211 W dt/ 25 January 86
" " 824 W dt/ 29 March 86

2. A sum of Rs. 39,050 having been provided for the work in 1885-86, the excess over the present estimate will be written back in the accounts.

3. This sanction has been registered as Provincial No: 30 W of 1886-87, and classified as Civil Buildings, Original Works.

Issued 27/5/86

To The Consg. Architect to Govt. with 5 enclos.
" Examiner of P. W. Accts with the duplicate abstract estimate
" ~~Financial Department~~

18/5/1886

21.5.86

No. 1324 Wdy 26 July 1806

B5

A4

GOVERNMENT OF MADRAS.

FINANCIAL DEPARTMENT.

Read—again the following papers :—

G.O., dated 22nd June 1885, Mis. No. 217 M., Financial.

Abstract.—Recording certain papers from the Collector of Madura requesting early sanction to the water-project scheme in Dindigul, submitted with the Collector's letter, dated 31st March 1885, No. 31.

G.O., dated 26th June 1885, Mis. No. 225 M., Financial.

Read—the following papers :—

From C. S. CROLE, Esq., President, Municipal Commission, Madura, to the Chief Secretary to Government, dated Dindigul, 31st March 1885, No. 31.

I have the honor to submit, for the sanction of Government, an application from the Municipal Commissioners of Dindigul for leave to raise a loan of Rs. 16,000 for the purpose of completing the works designed for the supply of water to that town.

2. Government is aware that the subject has already been before them in its initial stages, and that the project has elicited a considerable amount of controversial criticism. This is, perhaps, matter for some satisfaction, for everything that can be said *pro* and *con* is already in its possession, and a final decision is possible without the delay which would be prudent in the case of a scheme which had not already passed through that preliminary ordeal.

3. The question *qua* the Government stands thus. There are two orders to be satisfied. They run as follows :—

* * * "The Government do not feel called upon to pronounce any opinion on the matter, which should be determined after taking the best professional advice available" * * * * (G.O., 8th October 1884, Mis. No. 2393, Financial).

"The papers promised in paragraph 4" (of the President's letter) "will be awaited" (G.O., 6th November 1884, Mis. No. 2365, Financial).

4. These last are now submitted.

5. In regard to professional opinion, touching a scheme to supply a town with water by pumping out of the bowels of the earth, the experts concerned are :

(1) The projector or water-supply engineer.
(2) The geologist.
(3) The chemical analyst.
(4) The mechanical engineer.

As things stand now in the south of India, rôles Nos. 1 and 2 have to be taken by the Collector. At all events, this has been my experience in Madura and Dindigul, for both of which towns I have had to prepare schemes of water-supply.

6. The cardinal doctrine of Indian water-supply, as it appears to me, is to look for a pure uncontaminated source in the waters under the earth, before seeking to face the heavy expense of first cost and subsequent upkeep, the sanitary risks, and the many uncertainties attending every project which depends on storage of rainfall in

any form. In the case of both Madura and Dindigul, I have been so fortunate as to discover inexhaustible subterranean supplies, and have gladly placed such geological knowledge as I possess at the disposal of the local bodies concerned. The experiments, which have been at work in both places, have been submitted to public criticism for several months past. No rival scheme has been started. The townspeople freely use the water in both places. The supply has been proved to be practically inexhaustible. So much for quantity.

7. Next as to quality. The following table shows the result of the examination made by the Chemical Examiner to Government of all the possible waters available for drinking purposes in Dindigul :—

—	Sippanuthee centre and west centre well.	Well in south-west corner of do.	Devaraja Aiyar's well.	Gopala Samudrum.	Dindigul rock.	Betel garden well.	Weekly market well, Nagalnayakkenpatty.
	1	2	3	4	5	6	7
Total solids, grammes per litre ..	1·13	0·92	0·8	0·9	0·18	1·06	0·8
Volatile solids, grammes per litre..	0·24	0·25	0·44	0·51	0·07	0·49	0·35
Chlorine, grammes per litre ..	0·269	0·018	0·092	0·114	0·021	0·192	0·106
Total hardness, Clark's scale ..	23°·1	21°·7	20°·3	22°·4	4°·9	24°·5	21°·0
Permanent hardness, Clark's scale.	2°·45	0°·28	9°·45	10°·8	1°·4	9°·45	8°·4
Free ammonia, milligrammes per litre.	0·48	0·28	0·009	0·016	0·48	0·008	0·24
Albuminoid ammonia, milligrammes per litre.	0·16	0·12	0·12	0·16	0·56	0·16	2·4
Nitric acid, milligrammes per litre.	10·5	11·25	15·0	18·0	7·5	12·0	39·0
Apparent quality of the water, as inferred from the results obtained on examination.	Bad.	Suspicious.	Bad.	Bad.	Suspicious.	Bad.	Bad.

Remarks.—Nos. 3, 4 and 6 are hopelessly bad on account of mineral impurity (culnic sulphats*). The other waters in order of purity, 5, 2 and 1, if carefully guarded from dangerous organic contamination, may be usable, but, in their present state, they cannot be regarded as safe for drinking without boiling.

* *Sic.*

8. Plainly put, this means that the water now proposed to be used was, even before the well was carried down to its present depth and hermetically protected against any water which did not come from a depth of over 30 feet below the surrounding ground, at least as good as the hitherto supposed unapproachably-pure rock fort water, and better than the other waters in use in the municipality. The Sanitary Commissioner has practically tested it, and agrees that it is the best available. For my own part, I believe that it is the best and the only water to be got. The people are at this moment using it largely. They have put down their money to get it. They cry for more of it, and I do not see what better test can be applied to a new source of supply.

9. I shall briefly then summarise the history of the subject up to date.

10. The town of Dindigul stands high, and has, in the past, suffered much from want of a sufficient supply of water. Several schemes have been put forth during the last eleven years to remedy the defect. They have all been dropped one after the other, because of their acknowledged impracticability or prohibitive cost. In July 1882, His Excellency the Governor was addressed on the subject when he visited the place. The result of this was the formation of a Water-project Committee, composed of private residents, and the floating of the scheme now submitted for sanction. At first, the committee in question seems to have got on tolerably well with the then municipal commissioners. Subsequently, however, owing to the delays which took place in the removal of, what was admitted on all sides to be, a crying evil, the committee broke away from the municipal commission, and the result is that they introduced, by private subscription, a pioneer scheme, by which at this present moment, some 30,000 or 40,000 gallons of water are being pumped into the town every day. The municipality, by resolution, took over the works from the committee on the 22nd November 1884, and is now working it very successfully. Frequent

applications are received from private parties to lead pipes into their streets, and even into their houses, at their own cost. Many of these must, of course, be refused pending the introduction of the scheme now submitted, as the existing pipe branching from the main will not carry the quantity of water required. In July of the year last mentioned, the result of an election, which took place for the first time in Dindigul, had again placed the municipality in accord with the committee of the rate-payers on the water question.

11. Now, I have to observe again in regard to this point, that the analysis of the Sippanuthee well, recently excavated by the Water-project Committee, was taken at a time when the elaborate precautions now existing to ensure purity were imperfect. But I accept it. Every drop of the water now being pumped into Dindigul is drawn from an impermeable stratum, 40 feet below the mean level of the town. The sides of the pumping shaft are encased in solid masonry, pointed with Portland cement. The very taste of the water is improving in popular estimation from day to day, owing probably to continued pumping having removed some of the redundant mineral constituents. Surgeon-General Furnell, a scientist whose speciality is water-supply, when Sanitary Commissioner, visited the town (in November last), and fully confirmed the opinion of the analyst. I have reason to believe that he has most strongly recommended the scheme to the support of Government.

12. Quantity and quality being thus disposed of, I turn to the question of cost. The total sum required will be Rs. 31,551. This gives a ratio of Rs. 2·19 per head of population (14,182, census of 1881). It is estimated that, excluding municipal expenditure for ameliorating the existing cruelly deficient and impure supply from surface drainage, tanks and wells, the cost to the town in private water establishments, loss of service and so on, amounts to no less than Rs. 20,000, or Rs. $1\frac{3}{8}$ per head *in a single year*. The burden removed from the town by the introduction of the present scheme will thus be enormous.

13. I shall now describe the works proposed. They are of a most simple character. The details have been designed by Mr. C. E. Crighton, Locomotive Superintendent, South Indian Railway. For the working out of the scheme is one almost entirely for the mechanical engineer. In making the above statement, I am nearly repeating the opinion of Colonel H. R. Mead, R.E., Superintending Engineer of the VI Circle, under whose advice I originally called in the aid of Mr. Crighton.

14. The works consist of three parts :—

1*st. The Source of Supply.*—The town of Dindigul lies, roughly, midway between the Sirumalai Mountains, average height 3,000 feet, and the river Kodavanár. The fall is very great, and the underlying gneiss is covered by a stratum of shaley kunkur of considerable thickness, beneath which it was reasonable to look for a copious water sheet. After much toilsome search, I struck upon a comparatively thin skin of kunkur, mixed with the shells of fresh water molluces, and below that, soft sandstone with mica. This was in the bed of an abandoned stone-built tank, situated near the foot of the Fort Rock, to the south-west of the town. The surface is some 25 feet below the general level of the ground on which the houses are built.

15. A well measuring 21 × 17 and 19 feet deep has been sunk here, and built after the manner described in the foregoing part of this letter. It appears to be little affected by the season. The water in it stands always about 18 feet, and the result of pumping an average of about 40,000 gallons during 12 to 14 hours daily has hitherto been to reduce the water in the well 8 inches a day, the original level being recovered next morning ; so that, as far as has yet been seen, this single well promises to prove ample for the supply of the whole town. Experience, of course, can alone settle this point ; but should another well become necessary, another, the excavation of which was stopped by the inflow of water, can be sunk.

16. It is proposed to purchase two pumping engines, capable of raising 10,000 gallons per hour each, at a cost of Rs. 7,900.

They are duplicated in order to provide against breaks down and repairs. The town has at present a steam pulsometer at work, which has been lent by the Madura Municipality. It is proposed to supplement it by another of somewhat larger capacity, till the new engines come out from England. Even with the pump, which has been at work under the Water-project Committee for several months, a very large supply of water can be raised. Taking the population under supply for the present as 11,000, the pulsometer working for 18 hours would give a supply of 66,000 gallons, or 6 gallons a head, which is ample to commence with:—

3,800 × 18 = 68,400 gallons.

17. It is proposed, further, to acquire 16¼ acres round the Sippanuthee tank in which the well is now situated, so as to obtain sanitary and conservancy control over it. It is in contemplation also to fill in the tank by levelling in the excavated soil, so as to prevent the storage of any water in it for the future. The purchase of the land, which will, as is always the case in the Madura district, require to be carried out under the powers given by the Land Acquisition Act, will cost about Rs. 2,000, and the filling in of the tank, the levelling of the surrounding ground and fencing is estimated at about Rs. 1,000. These items of expenditure are vital to the scheme, and cannot be deferred, as it would be unsafe to omit any precaution to secure and preserve the purity of the water.

18. *2nd. The Storage Reservoir.*—A service tank capable of holding 200,000 gallons, or one-and-a-half full day's supply at 10 gallons per head of 13,000 people under eventual supply, is to be constructed. This is to be partly cut out of solid rock on a small spur of disintegrating gneiss, standing at the corner of Arisikara street. The stone thus obtained is to be used for the walls. See plan enclosed. It will be 45 feet above the roadway, and will give a head varying from 54·97 to 68·6 feet over the different portions of the town. The local stone-cutters are adepts at this class of work, which they perform, thanks to the tractable nature of the rock, with great cheapness. The cost is estimated at Rs. 2,965.

19. Another reservoir should eventually be constructed near the one now estimated for, so that it may be possible to store three days' supply, and also to provide for cleansing. The design and position of these reservoirs are, it is believed, unique. They will be very cheap, and insure the town practically against failure of supply.

3rd. The Pipes, &c.—The water is to be pumped through a six-inch main into the reservoir. The total height from mean water-level to reservoir is 84·38 feet, and the distance 2,080 feet. The engines will have a forcing power of 250 feet. The diameter of the main is, therefore, more than ample.

20. It has been decided by Mr. Crighton to employ only two diameters of pipes (cast iron) for street service—six inches for the main and three inches elsewhere. It is not economical to have smaller pipes than three inches, as they would require to be of wrought iron, which is very expensive. Smaller sizes are, it is believed, never used in England for this reason also that they are liable to choke. The taps are to be plain bends, with as many cocks as may be required for each particular locality.

21. It is to be remembered that the present is not a paper scheme, proposed for acceptance on a confused maze of figures. We have to do with completing and perfecting a system of water-supply already in practical working. The Water-project Committee has actually introduced the proposed system of water-supply into a certain portion of Dindigul. It has spent Rs. 7,500 out of the moneys privately raised, in such a manner that, while the town has obtained the boon of good water, the operations of the committee have been undertaken in such a way as to fit in with the larger scheme now submitted for sanction. Very little will require to be done over again. The supply given by the committee is indicated on the enclosed map by a blue line. It will be observed that it almost coincides with Mr. Crighton's line of pipes, laid down in red. In some respects, it may be considered to be an improvement, as it tends to make the supply circulating, which is a substantial advantage.

This being so, the estimate submitted herewith, amounting to Rs. 31,551, is subject to a deduction of Rs. 15,000.

22. In this connection, I have the honor to support the prayers of the commissioners that Government should make a grant for the execution of the project equal to the sum voluntarily raised by the inhabitants. I submit that it is very expedient to mark the approval of Government of these enterprises in self-help for public purposes. Moreover, Dindigul is a station of many public offices. It is the head-quarters of a Sub-Collector, a munsif's court, a tahsildar's office, and several others. As Government is aware, it is also an important station on the line of railway, and the starting point for the new State Railway, which is to connect Dindigul with Pálghat. In every way it is a town whose importance and size is likely to increase. The water-supply, while it will tend thus to develop the town, seems also to be a matter in which the Government has duties to fulfil. I therefore recommend most strongly that, for this reason, as well as to encourage public spirit elsewhere, Government be pleased to make a grant-in-aid of Rs. 7,500.

23. Sanction to raise the balance, viz., Rs. 16,000, by loan, bearing interest at 5 per cent. and repayable in thirty years, is now solicited by the commissioners on the assumption that Government will contribute. Failing that, they request permission to raise the whole, Rs. 24,000. A draft of the prescribed statement, for publication in the Gazette, is enclosed.

24. The total cost to the Municipality of Dindigul by the carrying out of the water project will be Rs. 24,000, and the incidence 1 1/10 rupee per head, or Rs. 16,000 and 1⅔ rupee per head of population, according as the Government grant is calculated or omitted. The Government will be able to judge regarding the lightness of the burden thus imposed by comparing these figures with the cost elsewhere. It has been calculated that the chronic water difficulty has, as stated above, been hitherto equivalent to an annual tax of at least Rs. 20,000 on the inhabitants of Dindigul.

25. The working of the scheme will cost about Rs. 1,688 per annum, as detailed below:—

	Rs.
Firewood, 180 tons, at Rs. 4½ per ton	810
Driver's and fireman's pay, at Rs. 31½ per mensem	378
Repairs and contingencies	500
Total ..	1,688

26. Part of this will be met out of savings under annual expenditure, say, Rs. 500, for clearing the inferior tanks upon which the town has till now depended for water, and out of the annual unexpended balance, Rs. 1,000, which is available. The balance (Rs. 188) will be met from the water-tax provided for under the new Act. This is calculated to produce a maximum of Rs. 1,800 per annum for the present.

27. The water assets available, without the slightest squeezing, amount thus to an annual income of Rs. 3,300 against a provision of Rs. 1,688 for current expenditure. The balance is more than sufficient to provide for the loan, even during the first year, in which occur the highest payments, thus:—

	Rs.
Interest on Rs. 16,000, at 5 per cent.	800
One-thirtieth payment to sinking fund, say	550
Total ..	1,350

against Rs. 1,612, the available balance.

28. The small tax required will be gladly paid, for the townspeople will be considerably richer under the new scheme, as shown above.

29. Since Colonel Mead's remarks (Enclosure 14) were written, the estimate has been thrown as much into Public Works Department form as the nature of such a project permitted.

30. As to Colonel Mead's other remarks, they are satisfactorily explained by Mr. Crighton in his letter, dated 5th January 1885 (Enclosure 15).

31. The proposed works are intended to be carried out by the District Mechanical Engineer, lately sanctioned as a joint charge by the Local Fund Board and the Municipalities of Madura and Dindigul, through the agency of the municipal staff. Several of the commissioners have already distinguished themselves in supervision, and we have the very great advantage in Dindigul of an ingenious native workman, Sangaralinga Asari, who is thoroughly competent to deal with machinery, and whose name is probably known to Government. The works will therefore be carried out with great economy, and we are always sure of Mr. Crighton's advice in the case of any unexpected difficulty.

32. I have to submit to Government that the successful manner in which the Water-project Committee, whose labors the municipality has now taken over, has conducted its pioneer enterprise, reflects great credit on the public spirit of the inhabitants; and I have the honor to bring to their notice, in this connection, the name of Mr. Ethupathi Row, a private Brahmin gentleman, who has acted as Secretary of the committee, and who has devoted nearly all his time, for many months, to its business.

33. This report would not be complete unless, also, I brought to the signal notice of Government the services of Mr. C. E. Crighton, Locomotive Superintendent of the South Indian Railway. He has given me his gratuitous services in working out both the Madura and Dindigul schemes, the former a very laborious task. It will also be submitted very shortly. It may be said, with small danger of exaggeration, that had it not been for the sympathetic spirit in which he has placed his special knowledge at the disposal of these towns, without an idea of fee or reward, the long-standing puzzle of water-supply for Indian towns would still have remained an unsolved enigma In place of this, I claim that it has been solved, and I would strongly recommend that Government mark its sense of the services rendered by Mr. Crighton in an emphatic and appropriate manner.

34. In addition to the papers in the accompanying list, I beg to enclose two addresses delivered by me at different stages of the working out of this water project, the history and discussion of which they illustrate in detail. They have already appeared in some of the Madras papers.

No. 26.

Referred to the Chief Engineer and Secretary to Government, Public Works Department, for remarks.

(By Order.)

Madras,
29th April 1885. (Signed) M. HAMMICK,
Ag. Under Secy. to Govt.

No. 903 C.

Forwarded to the Superintending Engineer, VI Circle, for scrutiny of the estimates and favor of early opinion on the details of the project.

(By Order.)

Chepak,
12th May 1885. (Signed) C. BOWEN, Major, R.E.,
Under Secy. to Govt., P.W.D.

From Lieutenant-Colonel H. R. MEAD, R.E., Superintending Engineer, VI Circle, to the Chief Engineer, Public Works Department, dated Kodaikánal, 23rd May 1885, No. 38 C—M.D.

With reference to your endorsement, No. 903 C., dated 12th May 1885, I have the honor to return the papers and to point out that I have already in my note, No. 563 M.D., dated 2nd January 1885, given my general opinion of the project.

2. The two important points first to be considered are—

1*st*.—Quality of the water.
2*nd*.—Is the supply likely to be sufficient?

With regard to the first point, quality, Mr. Crole, in paragraphs 7 and 8 of his letter, states that the Chemical Examiner gave his opinion that it is bad; but Mr. Crole says that he has reason to believe that it is now of better quality and that it will improve, also that it is the best water procurable in or near Dindigul; he further states that the Sanitary Commissioner has practically tested it and agrees that it is the best water available. I think it would be as well for Government to call on the Sanitary Commissioner for a special report on the quality of the water, if this has not been done already.

3. With regard to the second point, sufficiency of supply, it is proposed to draw off 120,000 gallons per day, or 8 gallons per head of population. There is nothing to show that this water is available; the mere statement that 40,000 gallons were pumped up in 12 to 14 hours daily for a time (not stated) is not, in my opinion, sufficient. There is nothing in the papers to show what time of the year this was done, for how many days, or how the water was measured. I consider that definite information on these points should be recorded. My own opinion is that Mr. Crole's estimate of the quantity of water that has been raised by the pulsometer that has been for some time at work, is far in excess of the actual.

4. It is useless for me to further point out that the project is not complete, and has not been worked out properly. Mr. Crighton's remark that the engines could lift the required supply 250 feet, if necessary, but that only 70 or 80 feet have to be lifted, to me shows that the whole scheme has not been properly considered. I cannot agree that "the most important thing is to get pipes laid and the water-supply introduced as soon as possible, so that the public benefit may be secured and further improvements made from time to time." I consider that before this is done, a complete scheme should be worked out in proper detail; this, of course, will cost money, as it necessitates the employment of a man competent for the work, but I think experience has shown in India and elsewhere this procedure is, as a rule, the cheapest.

5. Mr. Crole estimates the cost of working the engines &c. at Rs. 1,688 a year. I consider this estimate far too low; and have to point out that nothing is allowed for wear and tear or maintenance.

6. Mr. Crole has done much towards the water-supply of Dindigul and Madura, and, in my opinion, he is working on the right track, and, if properly advised, his schemes will succeed; his letter, however, shows that much more than he considers necessary is required for a sound good water project for the supply of a town.

Note by the Chief Engineer.

In his letter, No. 38-C—M.D., dated 23rd May 1885, reporting on the water-supply scheme for the town of Dindigul, the Superintending Engineer, VI Circle, deals first with the important points of quality and quantity of the water in the source whence it is proposed to supply the town of Dindigul; and he rightly remarks that further and more definite information on those points is necessary before the expenditure of a large sum can be recommended.

2. With respect to *quality*, the adjective used by the Chemical Examiner to Government in describing the water in the "Sippanuthee" wells is "*bad*;" and he adds, "if carefully guarded from dangerous organic contamination, they may be usable, but in their present state they cannot be regarded as safe for drinking without boiling." Mr. Crole states that the conditions affecting the wells have been improved since that analysis was made, but I strongly advise that a second analysis under those improved conditions be made, and the opinion of the Sanitary Commissioner obtained thereon, before sanction is accorded to the scheme.

3. With respect to *quantity*, there appears to be nothing on record except Mr. Crole's statement that he has discovered "inexhaustible subterranean supplies;" and the opinion expressed by Mr. Crighton that there "will be ample quantity for the town supply during the dry years." I concur in Colonel Mead's opinion that more definite and accurate information on this important point is necessary.

4. With respect to the general details of the scheme, I entirely concur in Colonel Mead's remark that the project is at present incomplete. Until it is thoroughly worked out in all details, and the data accurately tested and recorded, it is impossible to form an opinion upon its merits, or upon the probable cost.

5. It is to be hoped that further investigation of the project will bear out all that Mr. Crole expects from it; but in its present shape it is impossible to recommend it for sanction, or for the grant of a large contribution from Provincial funds in aid of the cost.

* * * * *

Ootacamund, 2*nd June* 1885. (Signed) J. SHAW-STEWART, Col., R.E., *Chief Engineer, P.W.D.*

No. 180-E.

Transferred to the Financial Department with advertence to its endorsement No. 26, dated 29th April 1885; the original papers received with which are herewith returned.

Ootacamund, 3*rd June* 1885. (Signed) J. SHAW-STEWART, Col., R.E., *Secretary to Govt., P.W.D.*

To the Financial Department, with 22 enclosures.

Order—dated 26th June 1885, Mis. No. 225 M., Financial.

The papers read above, with their enclosures, will be forwarded to the Collector of Madura who will communicate the substance of the Chief Engineer's note to the Chairman, Municipal Council, Dindigul, in view to the scheme being reconsidered with reference to the remarks of the Superintending Engineer and the Chief Engineer. A fresh analysis of the water should be made, and the Sanitary Commissioner's opinion obtained on its quality.

(True Extract.)

(Signed) E. F. WEBSTER, *Chief Secretary.*

To the Collector of Madura, with papers in original.

G.O., dated 30th December 1885, Mis. No. 982 M., Financial.

Read—the following papers:—

From G. STOKES, Esq., Chairman, Municipal Council, Dindigul, to the Chief Secretary to Government (through the Sub-Collector of Madura), dated Dindigul, 27th October 1885, No. 118.

Referring to G.O., dated 26th June 1885, Mis. No. 225 M., I have the honor to submit for instructions copy of a resolution passed by this council at a meeting held on the 19th instant in connection with the water-supply scheme of Dindigul. Copies of analysis of two samples of water of the Sippanuthee well obtained through the Sanitary Commissioner for Madras are herewith submitted, in original, for the information of Government, together with a copy of the Superintending Engineer's letter containing suggestions on the test of the quantity of water alluded to in the resolution of the council.

Enclosures.

Extract from the Proceedings of the Municipal Council, Dindigul, passed at a meeting held 19th October 1885.

* * * * *

VI. Read docket No. 922, dated 6th instant, from the Sanitary Commissioner for Madras, forwarding copy of analysis of the two samples of Sippanuthee well water sent from Dindigul.

The reference to the chairman of the municipality involves two questions—

1*st.*—The quality of the Sippanuthee water.

2*nd.*—Its quantity or the available supply.

The present analysis answers the first question. The water is certified bad and contaminated by organic and other remains. For testing the second, the Superintending Engineer proposes a test which is excessively difficult to carry out and without much more careful observation and record than the resources of the municipality can supply is likely to be deceptive. Before going to the expense of making the experiments suggested and having regard to the quality of the water, the council resolve to ask whether some simpler test than that laid down will not be satisfactory to Government. The supply of water to Dindigul is a matter of great importance to the town, and the supply of the Sippanuthee water is regarded as a very great boon by the townspeople. The council think that efforts should be made to bring from wells in the Kodavanar river water to the town by pumping, should it be decided that the Sippanuthee water ought not to be introduced. The present connection of the municipal council with the water-supply scheme is simply that the council has undertaken to pay the working expenses of the engine at present employed in pumping.

(Signed) G. STOKES, *Chairman.*

—	Sippanuthee well water, sample No. 1.	Microscopic examination.
Total solids, grammes per litre	1·73	Some yellowish white flocculent sediment consisting of organic *debris*, including remains of insects and living Entomostraca (*Cyclops*).
Volatile solids, do. do.	0·65	
Chlorine, do. do.	0·426	
Total hardness, Clark's scale	35°·0	
Permanent hardness, Clark's scale	15°·4	
Free ammonia, millegrammes per litre	0·24	
Albumenoid ammonia, do. do.	0·16	
Nitric acid do. do. (as ammonia).	45·0	
Apparent quality of the water as inferred from the results obtained on examination	Bad.	

—	Sippanuthee well water, sample No. 2.	Microscopic examination.
Total solids, grammes per litre	1·460	Slight deposit of sharp sand mixed with decaying vegetable matters and containing infusoria, diatoms, and other organisms.
Volatile solids do. do.	0·440	
Chlorine do. do.	0·369	
Total hardness, Clark's scale	25°·9	
Permanent hardness, Clark's scale	14°·7	
Free ammonia, millegrammes per litre	0·24	
Albumenoid ammonia do. do.	0·12	
Nitric acid do. do. (as ammonia)	45·0	
Apparent quality of the water as inferred from the results obtained on examination	Bad.	

From Colonel H. R. MEAD, R.E., Superintending Engineer, VI Circle, to the Chairman of the Municipal Council, Dindigul, dated Kodaikánal, 16th September 1885, No. 323 M.D.

With reference to your letter, No. 92, dated 8th September, I have the honor to inform you that in my opinion the best course to be adopted for testing the quantity of water in Sippanuthee well is as follows:—

When the wells and springs in the town and neighbourhood are at their lowest, by means of steam or other appliance to pump water from the well, keeping a careful record of the depth of water in the well. The water pumped out to be carefully gauged or measured (the best way of doing this will be to press it over a gauge-board of suitable length). It would probably be best to pump for eight hours a day a quantity of water from the well equivalent to double what is calculated as a full supply for the town and to do this for at least twenty-one days. Should this prove satisfactory and the level of the water in the well be not materially lowered (the record of the depth in the well will show if this is the case), it will be as well if there are appliances to do it for the well to be pumped out as low as practicable the quantity of water taken out being gauged and then for the pumping to be stopped and the rate at which the water again entered the well to be noted. This might be done three or four times, so that it may be seen if this rate materially decreased.

2. The above, I think, will show us fairly what supply could be hoped for; but of course any other series of carefully-conducted experiments would do as well. I believe that the Dindigul Municipality have for a considerable period pumping water from the well and if then a careful record of the results as regards quantity of water pumped out and depth of water in the well has been kept, there is no reason why, if properly reported, it should not be sufficient proof to Government and others that the supply is sufficient for the requirements.

Submitted.

2. The Collector's views have already been laid before Government in detail.

MADURA,
29*th October* 1885.

(Signed) C. S. CROLE,
Collector.

Telegram from the Secretary, Water-project Committee, Dindigul, dated 7th November 1885.

ABSTRACT.—Requesting to postpone disposal of the question regarding the Dindigul water-supply.

From the Collector of Madura, dated 26th November 1885, No. 6.

ABSTRACT.—Forwarding the original papers called for in the official memorandum No. 478, of 19th November 1885.

From the Secretary, Water-project Committee, Dindigul, dated 2nd December 1885.

ABSTRACT.—Regarding the water project of Dindigul.

Order—dated 30th December 1885, Mis. No. 982 M., Financial.

The file * of papers relating to the Dindigul water-supply will be communicated to the Sanitary Commissioner for opinion and eventual return.

1. *G.O., dated 26th June 1885, Mis. No. 225 M.
2. Letter from the Chairman, Municipal Council, Dindigul, dated 27th October 1885, No. 118.
3. Letter from the Secretary, Water-project Committee, Dindigul, dated 2nd December 1885.

2. The Dindigul Municipal Proceedings, dated 19th October 1885, show that the Municipal Board has been in communication with the Sanitary Commissioner, but no *opinion* of his is quoted. The Government are not aware whether

the Kodavanar water has been analysed. No reference to it by that name is found in the table in Mr. Crole's letter, dated 31st March 1885, No. 31, paragraph 7, though that table is said to include "all the possible waters available for drinking purposes in Dindigul."

3. Information should be afforded on this point and if the waters analysed do not include that of the Kodavanar, a specimen thereof should be analysed now and the opinion of the Sanitary Commissioner thereon be obtained.

(True Extract.)

(Signed) W. WILSON,
Acting Chief Secretary.

To the Sanitary Commissioner for Madras, with a file of papers, in original, to be returned.

" Collector of Madura.

READ—also the following paper:—

From Deputy Surgeon-General G. BIDIE, M.B., C.I.E., Sanitary Commissioner for Madras, to the Chief Secretary to Government, dated Madras, 1st April 1886, No. 497.

In returning the papers regarding the Dindigul water-supply, referred to me under G.O., Mis. No. 982 M., of 30th December 1885, I have the honor, after a personal inspection of the town, to submit the following remarks to the Right Honorable the Governor in Council.

2. Dindigul has hitherto been very badly off for potable water, and naturally the inhabitants have gladly welcomed the recent attempt which has been made to increase the supply by pumping from a well and delivery through iron pipes within the limits of the town.

3. In an undertaking of this kind the more important considerations from a sanitary point of view are—

1*st.*—Whether the water is wholesome, and
2*nd.*—Whether it can be got in sufficient quantity.

4. In the present instance the site selected for the source of supply is the bed of an old tank of very small size situated at Sippanuthee to the south-west of the town, and near the base of the rock on which the fort stands. The tank in question is considerably below the level of the town and although at some distance from it is in the line of natural drainage, and its water, so far as could be ascertained, has never at any time been used for drinking purposes, but only for washing clothing and such like purposes.

5. The well intended to supply the town with water has been sunk in the bed of the little tank, and from an examination of the excavated earth it would appear that the whole neighbourhood was originally the bed of a lake or swamp. The upper strata of the earth in the adjoining gardens apparently consist chiefly of thick deposits of *shell-marl*, containing shells which belong to such aquatic genera as *Melania*, *Paludina*, and *Unio*. The well is 19 feet deep and, after passing through the marl, soft sandstone is said to have been encountered resting on gneiss. Here the ground water is stated to have been reached and to yield a supply to pumping of about "40,000 gallons during 12 to 14 hours daily."

6. The probability of finding water in considerable quantity in such a locality as the bed of a former lake would, of course, be great, but unfortunately in this case the prospect of getting potable water is not equally favorable.

7. In paragraph 7 of Mr. Crole's letter, No. 31, of 31st March 1885, a table is given showing, amongst others, the results of the analyses of water from Sippanuthee well to be as shown below, and from these it appears that the water was then "bad" and "suspicious":—

——	Sippanuthee centre and west-centre well.	Well in south-west corner of do.	Remarks.
Total solids, grammes per litre	1·13	0·92	If carefully guarded from dangerous organic contamination may be usable, but in their present state they cannot be regarded as safe for drinking without boiling.
Volatile solids do. do.	0·24	0·25	
Chlorine do. do.	0·269	0·018	
Total hardness Clark's scale	23°·1	21°·7	
Permanent hardness, do.	2°·45	0°·7	
Free ammonia, millegrammes per litre	0·48	0·28	
Albumenoid ammonia do. do.	0·16	0·12	
Nitric acid, millegrammes per litre	10·5	11·25	
Apparent quality of the water as inferred from the results obtained from examination	Bad.	Suspicious.	

Subsequently to the time at which these specimens were taken, improvements were said to have been made on the main well from which the water is pumped with the object of excluding all water coming from the upper strata of the site, and restricting the influx to the ground water flowing on the surface of the gneiss.

8. Accordingly fresh samples were sent to the Chemical Examiner in September and October 1885 and his reports, as given below, show, I am sorry to say, no improvement in the quality of the water. In short, these latter analyses give a degree of impurity—organic and inorganic—beyond the line of safety and with no hope of amendment:—

——	Sippanuthee well water, sample No. 1 (*a*).	Sippanuthee well water, sample No. 2 (*b*).	Microscopic examination.
Total solids, grammes per litre	1·73	1·460	(*a*) Some yellowish white flocculent sediment consisting of organic *debris*, including remains of insects and living Entomostraca (*Cyclops*).—*22nd September* 1885.
Volatile solids, do. do.	0·65	0·440	
Chlorine do. do.	0·426	0·369	
Total hardness, Clark's scale	35°·0	25°·9	
Permanent hardness do.	15°·4	14°·7	
Free ammonia, millegrammes per litre	0·24	0·24	
Albumenoid ammonia do. do.	0·16	0·12	(*b*) Slight deposit of sharp sand mixed with decaying vegetable matters and containing infusoria, diatoms, and other organisms.—*1st October* 1885.
Nitric acid do. do. (as ammonia)	45·0	45·0	
Apparent quality of the water as inferred from the results obtained on examination	Bad.	Bad.	

9. As there is, however, evidently a large supply of ground water in this locality, it might be desirable to ascertain whether the current could not be tapped in some other spot out of the area of the marl deposits, where possibly a fluid of greater purity might be obtained. This is of course a question for the Engineer. There is just a suspicion that the water at the site of the present well may be polluted by the percolation of town sewage, and that the lake or marsh which formerly existed there may, in past times, have been the receptacle for years of foul drainage from the fort and attached buildings.

10. The entire table of analyses of Dindigul waters, as given in paragraph 7 of Mr. Crole's letter, is here recorded for ready reference, but in no case are the quality of the water and quantity yielded, so far as known to me, such as to enable me to recommend any one as a source from which the wants of the community could be met—

——	Sippanuthee centre and west-centre well.	Well in south-west corner of do.	Devarsja Aiyar's well.	Gopala-samudrum.	Dindigul rock.	Betel garden well.	Weekly market well. Nagalnagak-kempatty.
	1	2	3	4	5	6	7
Total solids, grammes per litre	1·13	0·92	0·8	0·9	0·18	1·06	0·8
Volatile solids do. do.	0·24	0·25	0·44	0·51	0·07	0·49	0·35
Chlorine do. do.	0·269	0·018	0·092	0·114	0·021	0·192	0·106
Total hardness, Clark's scale	23°·1	21°·7	20°·3	22°·4	4°·9	24°·5	21°·0
Permanent hardness do.	2°·45	0°·7	9°·45	10°·8	1°·4	9°·45	8°·4
Free ammonia, millegrammes per litre	0·48	0·28	0·009	0·016	0·48	0·008	0·24
Albumenoid ammonia, millegrammes per litre	0·16	0·12	0·12	0·16	0·56	0·16	2·4
Nitric acid, millegrammes per litre	10·5	11·25	15·0	18·0	7·5	12·0	30·0
Apparent quality of the water as inferred from the results obtained on examination	Bad.	Suspicious.	Bad.	Bad.	Suspicious.	Bad.	Bad.

Remarks.—Nos. 3, 4 and 6 are hopelessly bad on account of mineral impurity (culnic sulphats). The other waters it order of purity, 5, 2, and 1; if carefully guarded from dangerous organic contamination may be usable, but in their present state they cannot be regarded as safe for drinking without boiling.

11. With reference to paragraph 3 of the order under reply, a recent analysis of the Kodavanar river water is subjoined, and there seems no doubt that with the usual precautions of subsidence and filtration a good wholesome water can be got from this source—

——	Kodavanar river water.	Microscopic examination.	Remarks.
Total solids, grammes per litre	0·43	Some yellowish deposit of organic *debris* and sand.	This would be a good water if the suspended organic matter were removed by filtration or other means.
Volatile solids do. do.	0·15		
Chlorine do. do.	0·0213		
Total hardness, Clark's scale	11°·9		
Permanent hardness do.	1°·75		
Free ammonia, millegrammes per litre	0·08		
Albumenoid ammonia do. do.	0·12		
Nitric acid do. do. (as ammonia).	12·0		
Apparent quality of the water as inferred from the results obtained on examination	Suspicious.		

Order—dated 1st May 1886, No. 411 M., Financial.

Paragraph 9 of the Sanitary Commissioner's letter read above will be referred to the Public Works Department for inquiry and remark. If the proposal therein made is not found to be feasible, the Municipal Council will be asked to consider whether a scheme to bring in water from the Kodavanar river might not be worked out and adopted.

(True Extract.)

E. F. WEBSTER,
Chief Secretary.

To the Public Works Department.
" Chairman, Municipal Council, Dindigul,
through the Collector of Madura.
" Sanitary Commissioner for Madras.

Exd. A. Raitt.

Communicated to the
Actg Engr. M. Circle,
for investigation and
report, with reference
to para 9 of the Sanitary
Commissioner's letter

dated 2nd

W

Govt. of {1886} Madras.

FINANCIAL.

Issued

Read. *Encl.*

G.O., 1st May 1886, No. 411 M.

MAY.

Water-supply.

Referring to the Public Works Department, for inquiry and report, paragraph 9 of the Sanitary Commissioner's letter reporting on the project of — in Dindigul, and stating that, if the proposal made therein be not found feasible, the Municipal Council will be asked to report on the scheme of bringing water from Kodavanar.

C. S. Crole

Withdrawn

GOVERNMENT OF MADRAS.

FINANCIAL DEPARTMENT.

Read—again the following papers :—

G.O., dated 22nd June 1885, Mis. No. 217 M., Financial.

Abstract.—Recording certain papers from the Collector of Madura requesting early sanction to the water-project scheme in Dindigul, submitted with the Collector's letter, dated 31st March 1885, No. 31.

G.O., dated 26th June 1885, Mis. No. 225 M., Financial.

Read—the following papers :—

From C. S. CROLE, Esq., President, Municipal Commission, Madura, to the Chief Secretary to Government, dated Dindigul, 31st March 1885, No. 31.

I have the honor to submit, for the sanction of Government, an application from the Municipal Commissioners of Dindigul for leave to raise a loan of Rs. 16,000 for the purpose of completing the works designed for the supply of water to that town.

2. Government is aware that the subject has already been before them in its initial stages, and that the project has elicited a considerable amount of controversial criticism. This is, perhaps, matter for some satisfaction, for everything that can be said *pro* and *con* is already in its possession, and a final decision is possible without the delay which would be prudent in the case of a scheme which had not already passed through that preliminary ordeal.

3. The question *qua* the Government stands thus. There are two orders to be satisfied. They run as follows :—

* * * "The Government do not feel called upon to pronounce any opinion on the matter, which should be determined after taking the best professional advice available" * * * * (G.O., 8th October 1884, Mis. No. 2393, Financial).

"The papers promised in paragraph 4" (of the President's letter) "will be awaited" (G.O., 6th November 1884, Mis. No. 2365, Financial).

4. These last are now submitted.

5. In regard to professional opinion, touching a scheme to supply a town with water by pumping out of the bowels of the earth, the experts concerned are :

(1) The projector or water-supply engineer.
(2) The geologist.
(3) The chemical analyst.
(4) The mechanical engineer.

As things stand now in the south of India, rôles Nos. 1 and 2 have to be taken by the Collector. At all events, this has been my experience in Madura and Dindigul, for both of which towns I have had to prepare schemes of water-supply.

6. The cardinal doctrine of Indian water-supply, as it appears to me, is to look for a pure uncontaminated source in the waters under the earth, before seeking to face the heavy expense of first cost and subsequent upkeep, the sanitary risks, and the many uncertainties attending every project which depends on storage of rainfall in

any form. In the case of both Madura and Dindigul, I have been so fortunate as to discover inexhaustible subterranean supplies, and have gladly placed such geological knowledge as I possess at the disposal of the local bodies concerned. The experiments, which have been at work in both places, have been submitted to public criticism for several months past. No rival scheme has been started. The townspeople freely use the water in both places. The supply has been proved to be practically inexhaustible. So much for quantity.

7. Next as to quality. The following table shows the result of the examination made by the Chemical Examiner to Government of all the possible waters available for drinking purposes in Dindigul :—

—	Sippanuthee centre and west centre well.	Well in south-west corner of do.	Devaraja Aiyar's well.	Gopala Samudrum.	Dindigul rock.	Betel garden well.	Weekly market well, Nagalnayakkenpatty.
	1	2	3	4	5	6	7
Total solids, grammes per litre ..	1·13	0·92	0·8	0·9	0·18	1·06	0·8
Volatile solids, grammes per litre..	0·24	0·25	0·44	0·51	0·07	0·49	0·35
Chlorine, grammes per litre ..	0·269	0·018	0·092	0·114	0·021	0·192	0·106
Total hardness, Clark's scale ..	23°·1	21°·7	20°·3	22°·4	4°·9	24°·5	21°·0
Permanent hardness, Clark's scale .	2°·45	0°·28	9°·45	10°·8	1°·4	9°·45	8°·4
Free ammonia, milligrammes per litre.	0·48	0·28	0·009	0·016	0·48	0·008	0·24
Albuminoid ammonia, milligrammes per litre.	0·16	0·12	0·12	0·16	0·56	0·16	2·4
Nitric acid, milligrammes per litre .	10·5	11·25	15·0	18·0	7·5	12·0	39·0
Apparent quality of the water, as inferred from the results obtained on examination.	Bad.	Suspicious.	Bad.	Bad.	Suspicious.	Bad.	Bad.

Remarks.—Nos. 3, 4 and 6 are hopelessly bad on account of mineral impurity (culnic sulphats*). The other waters in order of purity, 5, 2 and 1, if carefully guarded from dangerous organic contamination, may be usable, but, in their present state, they cannot be regarded as safe for drinking without boiling.

* *Sic.*

8. Plainly put, this means that the water now proposed to be used was, even before the well was carried down to its present depth and hermetically protected against any water which did not come from a depth of over 30 feet below the surrounding ground, at least as good as the hitherto supposed unapproachably-pure rock fort water, and better than the other waters in use in the municipality. The Sanitary Commissioner has practically tested it, and agrees that it is the best available. For my own part, I believe that it is the best and the only water to be got. The people are at this moment using it largely. They have put down their money to get it. They cry for more of it, and I do not see what better test can be applied to a new source of supply.

9. I shall briefly then summarise the history of the subject up to date.

10. The town of Dindigul stands high, and has, in the past, suffered much from want of a sufficient supply of water. Several schemes have been put forth during the last eleven years to remedy the defect. They have all been dropped one after the other, because of their acknowledged impracticability or prohibitive cost. In July 1882, His Excellency the Governor was addressed on the subject when he visited the place. The result of this was the formation of a Water-project Committee, composed of private residents, and the floating of the scheme now submitted for sanction. At first, the committee in question seems to have got on tolerably well with the then municipal commissioners. Subsequently, however, owing to the delays which took place in the removal of, what was admitted on all sides to be, a crying evil, the committee broke away from the municipal commission, and the result is that they introduced, by private subscription, a pioneer scheme, by which at this present moment, some 30,000 or 40,000 gallons of water are being pumped into the town every day. The municipality, by resolution, took over the works from the committee on the 22nd November 1884, and is now working it very successfully. Frequent

applications are received from private parties to lead pipes into their streets, and even into their houses, at their own cost. Many of these must, of course, be refused pending the introduction of the scheme now submitted, as the existing pipe branching from the main will not carry the quantity of water required. In July of the year last mentioned, the result of an election, which took place for the first time in Dindigul, had again placed the municipality in accord with the committee of the rate-payers on the water question.

11. Now, I have to observe again in regard to this point, that the analysis of the Sippanuthee well, recently excavated by the Water-project Committee, was taken at a time when the elaborate precautions now existing to ensure purity were imperfect. But I accept it. Every drop of the water now being pumped into Dindigul is drawn from an impermeable stratum, 40 feet below the mean level of the town. The sides of the pumping shaft are encased in solid masonry, pointed with Portland cement. The very taste of the water is improving in popular estimation from day to day, owing probably to continued pumping having removed some of the redundant mineral constituents. Surgeon-General Furnell, a scientist whose speciality is water-supply, when Sanitary Commissioner, visited the town (in November last), and fully confirmed the opinion of the analyst. I have reason to believe that he has most strongly recommended the scheme to the support of Government.

12. Quantity and quality being thus disposed of, I turn to the question of cost. The total sum required will be Rs. 31,551. This gives a ratio of Rs. 2·19 per head of population (14,182, census of 1881). It is estimated that, excluding municipal expenditure for ameliorating the existing cruelly deficient and impure supply from surface drainage, tanks and wells, the cost to the town in private water establishments, loss of service and so on, amounts to no less than Rs. 20,000, or Rs. $1\frac{3}{8}$ per head *in a single year*. The burden removed from the town by the introduction of the present scheme will thus be enormous.

13. I shall now describe the works proposed. They are of a most simple character. The details have been designed by Mr. C. E. Crighton, Locomotive Superintendent, South Indian Railway. For the working out of the scheme is one almost entirely for the mechanical engineer. In making the above statement, I am nearly repeating the opinion of Colonel H. R. Mead, R.E., Superintending Engineer of the VI Circle, under whose advice I originally called in the aid of Mr. Crighton.

14. The works consist of three parts :—

1*st. The Source of Supply.*—The town of Dindigul lies, roughly, midway between the Sirumalai Mountains, average height 3,000 feet, and the river Kodavanár. The fall is very great, and the underlying gneiss is covered by a stratum of shaley kunkur of considerable thickness, beneath which it was reasonable to look for a copious water sheet. After much toilsome search, I struck upon a comparatively thin skin of kunkur, mixed with the shells of fresh water molluces, and below that, soft sandstone with mica. This was in the bed of an abandoned stone-built tank, situated near the foot of the Fort Rock, to the south-west of the town. The surface is some 25 feet below the general level of the ground on which the houses are built.

15. A well measuring 21 × 17 and 19 feet deep has been sunk here, and built after the manner described in the foregoing part of this letter. It appears to be little affected by the season. The water in it stands always about 18 feet, and the result of pumping an average of about 40,000 gallons during 12 to 14 hours daily has hitherto been to reduce the water in the well 8 inches a day, the original level being recovered next morning ; so that, as far as has yet been seen, this single well promises to prove ample for the supply of the whole town. Experience, of course, can alone settle this point ; but should another well become necessary, another, the excavation of which was stopped by the inflow of water, can be sunk.

16. It is proposed to purchase two pumping engines, capable of raising 10,000 gallons per hour each, at a cost of Rs. 7,900.

They are duplicated in order to provide against breaks down and repairs. The town has at present a steam pulsometer at work, which has been lent by the Madura Municipality. It is proposed to supplement it by another of somewhat larger capacity, till the new engines come out from England. Even with the pump, which has been at work under the Water-project Committee for several months, a very large supply of water can be raised. Taking the population under supply for the present as 11,000, the pulsometer working for 18 hours would give a supply of 66,000 gallons, or 6 gallons a head, which is ample to commence with :—

$$3{,}800 \times 18 = 68{,}400 \text{ gallons.}$$

17. It is proposed, further, to acquire $16\frac{1}{4}$ acres round the Sippanuthee tank in which the well is now situated, so as to obtain sanitary and conservancy control over it. It is in contemplation also to fill in the tank by levelling in the excavated soil, so as to prevent the storage of any water in it for the future. The purchase of the land, which will, as is always the case in the Madura district, require to be carried out under the powers given by the Land Acquisition Act, will cost about Rs. 2,000, and the filling in of the tank, the levelling of the surrounding ground and fencing is estimated at about Rs. 1,000. These items of expenditure are vital to the scheme, and cannot be deferred, as it would be unsafe to omit any precaution to secure and preserve the purity of the water.

18. *2nd. The Storage Reservoir.*—A service tank capable of holding 200,000 gallons, or one-and-a-half full day's supply at 10 gallons per head of 13,000 people under eventual supply, is to be constructed. This is to be partly cut out of solid rock on a small spur of disintegrating gneiss, standing at the corner of Arisikara street. The stone thus obtained is to be used for the walls. See plan enclosed. It will be 45 feet above the roadway, and will give a head varying from 54·97 to 68·6 feet over the different portions of the town. The local stone-cutters are adepts at this class of work, which they perform, thanks to the tractable nature of the rock, with great cheapness. The cost is estimated at Rs. 2,965.

19. Another reservoir should eventually be constructed near the one now estimated for, so that it may be possible to store three days' supply, and also to provide for cleansing. The design and position of these reservoirs are, it is believed, unique. They will be very cheap, and insure the town practically against failure of supply.

3rd. The Pipes, &c.—The water is to be pumped through a six-inch main into the reservoir. The total height from mean water-level to reservoir is 84·38 feet, and the distance 2,080 feet. The engines will have a forcing power of 250 feet. The diameter of the main is, therefore, more than ample.

20. It has been decided by Mr. Crighton to employ only two diameters of pipes (cast iron) for street service—six inches for the main and three inches elsewhere. It is not economical to have smaller pipes than three inches, as they would require to be of wrought iron, which is very expensive. Smaller sizes are, it is believed, never used in England for this reason also that they are liable to choke. The taps are to be plain bends, with as many cocks as may be required for each particular locality.

21. It is to be remembered that the present is not a paper scheme, proposed for acceptance on a confused maze of figures. We have to do with completing and perfecting a system of water-supply already in practical working. The Water-project Committee has actually introduced the proposed system of water-supply into a certain portion of Dindigul. It has spent Rs. 7,500 out of the moneys privately raised, in such a manner that, while the town has obtained the boon of good water, the operations of the committee have been undertaken in such a way as to fit in with the larger scheme now submitted for sanction. Very little will require to be done over again. The supply given by the committee is indicated on the enclosed map by a blue line. It will be observed that it almost coincides with Mr. Crighton's line of pipes, laid down in red. In some respects, it may be considered to be an improvement, as it tends to make the supply circulating, which is a substantial advantage.

This being so, the estimate submitted herewith, amounting to Rs. 31,551, is subject to a deduction of Rs. 15,000.

22. In this connection, I have the honor to support the prayers of the commissioners that Government should make a grant for the execution of the project equal to the sum voluntarily raised by the inhabitants. I submit that it is very expedient to mark the approval of Government of these enterprises in self-help for public purposes. Moreover, Dindigul is a station of many public offices. It is the head-quarters of a Sub-Collector, a munsif's court, a tahsildar's office, and several others. As Government is aware, it is also an important station on the line of railway, and the starting point for the new State Railway, which is to connect Dindigul with Pálghat. In every way it is a town whose importance and size is likely to increase. The water-supply, while it will tend thus to develop the town, seems also to be a matter in which the Government has duties to fulfil. I therefore recommend most strongly that, for this reason, as well as to encourage public spirit elsewhere, Government be pleased to make a grant-in-aid of Rs. 7,500.

23. Sanction to raise the balance, viz., Rs. 16,000, by loan, bearing interest at 5 per cent. and repayable in thirty years, is now solicited by the commissioners on the assumption that Government will contribute. Failing that, they request permission to raise the whole, Rs. 24,000. A draft of the prescribed statement, for publication in the Gazette, is enclosed.

24. The total cost to the Municipality of Dindigul by the carrying out of the water project will be Rs. 24,000, and the incidence $1\frac{1}{16}$ rupee per head, or Rs. 16,000 and $1\frac{3}{5}$ rupee per head of population, according as the Government grant is calculated or omitted. The Government will be able to judge regarding the lightness of the burden thus imposed by comparing these figures with the cost elsewhere. It has been calculated that the chronic water difficulty has, as stated above, been hitherto equivalent to an annual tax of at least Rs. 20,000 on the inhabitants of Dindigul.

25. The working of the scheme will cost about Rs. 1,688 per annum, as detailed below :—

	Rs.
Firewood, 180 tons, at Rs. $4\frac{1}{2}$ per ton	810
Driver's and fireman's pay, at Rs. $31\frac{1}{2}$ per mensem	378
Repairs and contingencies	500
Total ..	1,688

26. Part of this will be met out of savings under annual expenditure, say, Rs. 500, for clearing the inferior tanks upon which the town has till now depended for water, and out of the annual unexpended balance, Rs. 1,000, which is available. The balance (Rs. 188) will be met from the water-tax provided for under the new Act. This is calculated to produce a maximum of Rs. 1,800 per annum for the present.

27. The water assets available, without the slightest squeezing, amount thus to an annual income of Rs. 3,300 against a provision of Rs. 1,688 for current expenditure. The balance is more than sufficient to provide for the loan, even during the first year, in which occur the highest payments, thus :—

	Rs.
Interest on Rs. 16,000, at 5 per cent.	800
One-thirtieth payment to sinking fund, say	550
Total ..	1,350

against Rs. 1,612, the available balance.

28. The small tax required will be gladly paid, for the townspeople will be considerably richer under the new scheme, as shown above.

29. Since Colonel Mead's remarks (Enclosure 14) were written, the estimate has been thrown as much into Public Works Department form as the nature of such a project permitted.

30. As to Colonel Mead's other remarks, they are satisfactorily explained by Mr. Crighton in his letter, dated 5th January 1885 (Enclosure 15).

31. The proposed works are intended to be carried out by the District Mechanical Engineer, lately sanctioned as a joint charge by the Local Fund Board and the Municipalities of Madura and Dindigul, through the agency of the municipal staff. Several of the commissioners have already distinguished themselves in supervision, and we have the very great advantage in Dindigul of an ingenious native workman, Sangaralinga Asari, who is thoroughly competent to deal with machinery, and whose name is probably known to Government. The works will therefore be carried out with great economy, and we are always sure of Mr. Crighton's advice in the case of any unexpected difficulty.

32. I have to submit to Government that the successful manner in which the Water-project Committee, whose labors the municipality has now taken over, has conducted its pioneer enterprise, reflects great credit on the public spirit of the inhabitants; and I have the honor to bring to their notice, in this connection, the name of Mr. Ethupathi Row, a private Brahmin gentleman, who has acted as Secretary of the committee, and who has devoted nearly all his time, for many months, to its business.

33. This report would not be complete unless, also, I brought to the signal notice of Government the services of Mr. C. E. Crighton, Locomotive Superintendent of the South Indian Railway. He has given me his gratuitous services in working out both the Madura and Dindigul schemes, the former a very laborious task. It will also be submitted very shortly. It may be said, with small danger of exaggeration, that had it not been for the sympathetic spirit in which he has placed his special knowledge at the disposal of these towns, without an idea of fee or reward, the long-standing puzzle of water-supply for Indian towns would still have remained an unsolved enigma In place of this, I claim that it has been solved, and I would strongly recommend that Government mark its sense of the services rendered by Mr. Crighton in an emphatic and appropriate manner.

34. In addition to the papers in the accompanying list, I beg to enclose two addresses delivered by me at different stages of the working out of this water project, the history and discussion of which they illustrate in detail. They have already appeared in some of the Madras papers.

No. 26.

Referred to the Chief Engineer and Secretary to Government, Public Works Department, for remarks.

(By Order.)

Madras, 29*th April* 1885. (Signed) M. HAMMICK, *Ag. Under Secy. to Govt.*

No. 903 C.

Forwarded to the Superintending Engineer, VI Circle, for scrutiny of the estimates and favor of early opinion on the details of the project.

(By Order.)

Chepak, 12*th May* 1885. (Signed) C. BOWEN, Major, R.E., *Under Secy. to Govt., P.W.D.*

From Lieutenant-Colonel H. R. MEAD, R.E., Superintending Engineer, VI Circle, to the Chief Engineer, Public Works Department, dated Kodaikánal, 23rd May 1885, No. 38 C—M.D.

With reference to your endorsement, No. 903 C., dated 12th May 1885, I have the honor to return the papers and to point out that I have already in my note, No. 563 M.D., dated 2nd January 1885, given my general opinion of the project.

2. The two important points first to be considered are—

1*st.*—Quality of the water.
2*nd.*—Is the supply likely to be sufficient?

With regard to the first point, quality, Mr. Crole, in paragraphs 7 and 8 of his letter, states that the Chemical Examiner gave his opinion that it is bad; but Mr. Crole says that he has reason to believe that it is now of better quality and that it will improve, also that it is the best water procurable in or near Dindigul; he further states that the Sanitary Commissioner has practically tested it and agrees that it is the best water available. I think it would be as well for Government to call on the Sanitary Commissioner for a special report on the quality of the water, if this has not been done already.

3. With regard to the second point, sufficiency of supply, it is proposed to draw off 120,000 gallons per day, or 8 gallons per head of population. There is nothing to show that this water is available; the mere statement that 40,000 gallons were pumped up in 12 to 14 hours daily for a time (not stated) is not, in my opinion, sufficient. There is nothing in the papers to show what time of the year this was done, for how many days, or how the water was measured. I consider that definite information on these points should be recorded. My own opinion is that Mr. Crole's estimate of the quantity of water that has been raised by the pulsometer that has been for some time at work, is far in excess of the actual.

4. It is useless for me to further point out that the project is not complete, and has not been worked out properly. Mr. Crighton's remark that the engines could lift the required supply 250 feet, if necessary, but that only 70 or 80 feet have to be lifted, to me shows that the whole scheme has not been properly considered. I cannot agree that "the most important thing is to get pipes laid and the water-supply introduced as soon as possible, so that the public benefit may be secured and further improvements made from time to time." I consider that before this is done, a complete scheme should be worked out in proper detail; this, of course, will cost money, as it necessitates the employment of a man competent for the work, but I think experience has shown in India and elsewhere this procedure is, as a rule, the cheapest.

5. Mr. Crole estimates the cost of working the engines &c. at Rs. 1,688 a year. I consider this estimate far too low; and have to point out that nothing is allowed for wear and tear or maintenance.

6. Mr. Crole has done much towards the water-supply of Dindigul and Madura, and, in my opinion, he is working on the right track, and, if properly advised, his schemes will succeed; his letter, however, shows that much more than he considers necessary is required for a sound good water project for the supply of a town.

Note by the Chief Engineer.

In his letter, No. 38-C—M.D., dated 23rd May 1885, reporting on the water-supply scheme for the town of Dindigul, the Superintending Engineer, VI Circle, deals first with the important points of quality and quantity of the water in the source whence it is proposed to supply the town of Dindigul; and he rightly remarks that further and more definite information on those points is necessary before the expenditure of a large sum can be recommended.

2. With respect to *quality*, the adjective used by the Chemical Examiner to Government in describing the water in the "Sippanuthee" wells is "*bad;*" and he adds, "if carefully guarded from dangerous organic contamination, they may be usable, but in their present state they cannot be regarded as safe for drinking without boiling." Mr. Crole states that the conditions affecting the wells have been improved since that analysis was made, but I strongly advise that a second analysis under those improved conditions be made, and the opinion of the Sanitary Commissioner obtained thereon, before sanction is accorded to the scheme.

3. With respect to *quantity*, there appears to be nothing on record except Mr. Crole's statement that he has discovered "inexhaustible subterranean supplies;" and the opinion expressed by Mr. Crighton that there "will be ample quantity for the town supply during the dry years." I concur in Colonel Mead's opinion that more definite and accurate information on this important point is necessary.

4. With respect to the general details of the scheme, I entirely concur in Colonel Mead's remark that the project is at present incomplete. Until it is thoroughly worked out in all details, and the data accurately tested and recorded, it is impossible to form an opinion upon its merits, or upon the probable cost.

5. It is to be hoped that further investigation of the project will bear out all that Mr. Crole expects from it; but in its present shape it is impossible to recommend it for sanction, or for the grant of a large contribution from Provincial funds in aid of the cost.

* * * * *

Ootacamund, 2*nd June* 1885. (Signed) J. SHAW-STEWART, Col., R.E., *Chief Engineer, P.W.D.*

No. 180-E.

Transferred to the Financial Department with advertence to its endorsement No. 26, dated 29th April 1885; the original papers received with which are herewith returned.

Ootacamund, 3*rd June* 1885. (Signed) J. SHAW-STEWART, Col., R.E., *Secretary to Govt., P.W.D.*

To the Financial Department, with 22 enclosures.

Order—dated 26th June 1885, Mis. No. 225 M., Financial.

The papers read above, with their enclosures, will be forwarded to the Collector of Madura who will communicate the substance of the Chief Engineer's note to the Chairman, Municipal Council, Dindigul, in view to the scheme being reconsidered with reference to the remarks of the Superintending Engineer and the Chief Engineer. A fresh analysis of the water should be made, and the Sanitary Commissioner's opinion obtained on its quality.

(True Extract.)

(Signed) E. F. WEBSTER, *Chief Secretary.*

To the Collector of Madura, with papers in original.

G.O., dated 30th December 1885, Mis. No. 982 M., Financial.

Read—the following papers:—

From G. STOKES, Esq., Chairman, Municipal Council, Dindigul, to the Chief Secretary to Government (through the Sub-Collector of Madura), dated Dindigul, 27th October 1885, No. 118.

Referring to G.O., dated 26th June 1885, Mis. No. 225 M., I have the honor to submit for instructions copy of a resolution passed by this council at a meeting held on the 19th instant in connection with the water-supply scheme of Dindigul. Copies of analysis of two samples of water of the Sippanuthee well obtained through the Sanitary Commissioner for Madras are herewith submitted, in original, for the information of Government, together with a copy of the Superintending Engineer's letter containing suggestions on the test of the quantity of water alluded to in the resolution of the council.

Enclosures.

Extract from the Proceedings of the Municipal Council, Dindigul, passed at a meeting held 19th October 1885.

* * * * *

VI. Read docket No. 922, dated 6th instant, from the Sanitary Commissioner for Madras, forwarding copy of analysis of the two samples of Sippanuthee well water sent from Dindigul.

The reference to the chairman of the municipality involves two questions—

1*st.*—The quality of the Sippanuthee water.

2*nd.*—Its quantity or the available supply.

The present analysis answers the first question. The water is certified bad and contaminated by organic and other remains. For testing the second, the Superintending Engineer proposes a test which is excessively difficult to carry out and without much more careful observation and record than the resources of the municipality can supply is likely to be deceptive. Before going to the expense of making the experiments suggested and having regard to the quality of the water, the council resolve to ask whether some simpler test than that laid down will not be satisfactory to Government. The supply of water to Dindigul is a matter of great importance to the town, and the supply of the Sippanuthee water is regarded as a very great boon by the townspeople. The council think that efforts should be made to bring from wells in the Kodavanar river water to the town by pumping, should it be decided that the Sippanuthee water ought not to be introduced. The present connection of the municipal council with the water-supply scheme is simply that the council has undertaken to pay the working expenses of the engine at present employed in pumping.

(Signed) G. STOKES, *Chairman.*

—	Sippanuthee well water, sample No. 1.	Microscopic examination.
Total solids, grammes per litre	1·73	Some yellowish white flocculent sediment consisting of organic *debris*, including remains of insects and living Entomostraca (*Cyclops*).
Volatile solids, do. do.	0·65	
Chlorine, do. do.	0·426	
Total hardness, Clark's scale	35°·0	
Permanent hardness, Clark's scale	15°·4	
Free ammonia, millegrammes per litre	0·24	
Albumenoid ammonia, do. do.	0·16	
Nitric acid do. do. (as ammonia).	45·0	
Apparent quality of the water as inferred from the results obtained on examination	Bad.	

—	Sippanuthee well water, sample No. 2.	Microscopic examination.
Total solids, grammes per litre	1·460	Slight deposit of sharp sand mixed with decaying vegetable matters and containing infusoria, diatoms, and other organisms.
Volatile solids do. do.	0·440	
Chlorine do. do.	0·369	
Total hardness, Clark's scale	25°·9	
Permanent hardness, Clark's scale	14°·7	
Free ammonia, millegrammes per litre	0·24	
Albumenoid ammonia do. do.	0·12	
Nitric acid do. do. (as ammonia)	45·0	
Apparent quality of the water as inferred from the results obtained on examination	Bad.	

From Colonel H. R. MEAD, R.E., Superintending Engineer, VI Circle, to the Chairman of the Municipal Council, Dindigul, dated Kodaikánal, 16th September 1885, No. 323 M.D.

With reference to your letter, No. 92, dated 8th September, I have the honor to inform you that in my opinion the best course to be adopted for testing the quantity of water in Sippanuthee well is as follows:—

When the wells and springs in the town and neighbourhood are at their lowest, by means of steam or other appliance to pump water from the well, keeping a careful record of the depth of water in the well. The water pumped out to be carefully gauged or measured (the best way of doing this will be to press it over a gauge-board of suitable length). It would probably be best to pump for eight hours a day a quantity of water from the well equivalent to double what is calculated as a full supply for the town and to do this for at least twenty-one days. Should this prove satisfactory and the level of the water in the well be not materially lowered (the record of the depth in the well will show if this is the case), it will be as well if there are appliances to do it for the well to be pumped out as low as practicable the quantity of water taken out being gauged and then for the pumping to be stopped and the rate at which the water again entered the well to be noted. This might be done three or four times, so that it may be seen if this rate materially decreased.

2. The above, I think, will show us fairly what supply could be hoped for; but of course any other series of carefully-conducted experiments would do as well. I believe that the Dindigul Municipality have for a considerable period pumping water from the well and if then a careful record of the results as regards quantity of water pumped out and depth of water in the well has been kept, there is no reason why, if properly reported, it should not be sufficient proof to Government and others that the supply is sufficient for the requirements.

Submitted.

2. The Collector's views have already been laid before Government in detail.

Madura,
29*th October* 1885.

(Signed) C. S. CROLE,
Collector.

Telegram from the Secretary, Water-project Committee, Dindigul, dated 7th November 1885.

Abstract.—Requesting to postpone disposal of the question regarding the Dindigul water-supply.

From the Collector of Madura, dated 26th November 1885, No. 6.

Abstract.—Forwarding the original papers called for in the official memorandum No. 478, of 19th November 1885.

From the Secretary, Water-project Committee, Dindigul, dated 2nd December 1885.

Abstract.—Regarding the water project of Dindigul.

Order—dated 30th December 1885, Mis. No. 982 M., Financial.

The file * of papers relating to the Dindigul water-supply will be communicated to the Sanitary Commissioner for opinion and eventual return.

1. *G.O., dated 26th June 1885, Mis. No. 225 M.
2. Letter from the Chairman, Municipal Council, Dindigul, dated 27th October 1885, No. 118.
3. Letter from the Secretary, Water-project Committee, Dindigul, dated 2nd December 1885.

2. The Dindigul Municipal Proceedings, dated 19th October 1885, show that the Municipal Board has been in communication with the Sanitary Commissioner, but no *opinion* of his is quoted. The Government are not aware whether

the Kodavanar water has been analysed. No reference to it by that name is found in the table in Mr. Crole's letter, dated 31st March 1885, No. 31, paragraph 7, though that table is said to include "all the possible waters available for drinking purposes in Dindigul."

3. Information should be afforded on this point and if the waters analysed do not include that of the Kodavanar, a specimen thereof should be analysed now and the opinion of the Sanitary Commissioner thereon be obtained.

(True Extract.)

(Signed) W. WILSON,
Acting Chief Secretary.

To the Sanitary Commissioner for Madras, with a file of papers, in original, to be returned.
" Collector of Madura.

Read—also the following paper:—

From Deputy Surgeon-General G. BIDIE, M.B., C.I.E., Sanitary Commissioner for Madras, to the Chief Secretary to Government, dated Madras, 1st April 1886, No. 497.

In returning the papers regarding the Dindigul water-supply, referred to me under G.O., Mis. No. 982 M., of 30th December 1885, I have the honor, after a personal inspection of the town, to submit the following remarks to the Right Honorable the Governor in Council.

2. Dindigul has hitherto been very badly off for potable water, and naturally the inhabitants have gladly welcomed the recent attempt which has been made to increase the supply by pumping from a well and delivery through iron pipes within the limits of the town.

3. In an undertaking of this kind the more important considerations from a sanitary point of view are—

1*st.*—Whether the water is wholesome, and
2*nd.*—Whether it can be got in sufficient quantity.

4. In the present instance the site selected for the source of supply is the bed of an old tank of very small size situated at Sippanuthee to the south-west of the town, and near the base of the rock on which the fort stands. The tank in question is considerably below the level of the town and although at some distance from it is in the line of natural drainage, and its water, so far as could be ascertained, has never at any time been used for drinking purposes, but only for washing clothing and such like purposes.

5. The well intended to supply the town with water has been sunk in the bed of the little tank, and from an examination of the excavated earth it would appear that the whole neighbourhood was originally the bed of a lake or swamp. The upper strata of the earth in the adjoining gardens apparently consist chiefly of thick deposits of *shell-marl*, containing shells which belong to such aquatic genera as *Melania*, *Paludina*, and *Unio*. The well is 19 feet deep and, after passing through the marl, soft sandstone is said to have been encountered resting on gneiss. Here the ground water is stated to have been reached and to yield a supply to pumping of about "40,000 gallons during 12 to 14 hours daily."

6. The probability of finding water in considerable quantity in such a locality as the bed of a former lake would, of course, be great, but unfortunately in this case the prospect of getting potable water is not equally favorable.

7. In paragraph 7 of Mr. Crole's letter, No. 31, of 31st March 1885, a table is given showing, amongst others, the results of the analyses of water from Sippanuthee well to be as shown below, and from these it appears that the water was then "bad" and "suspicious":—

——	Sippanuthee centre and west-centre well.	Well in south-west corner of do.	Remarks.
Total solids, grammes per litre	1·13	0·92	If carefully guarded from dangerous organic contamination may be usable, but in their present state they cannot be regarded as safe for drinking without boiling.
Volatile solids do. do.	0·24	0·25	
Chlorine do. do.	0·269	0·018	
Total hardness Clark's scale	23°·1	21°·7	
Permanent hardness, do.	2°·45	0°·7	
Free ammonia, millegrammes per litre	0·48	0·28	
Albumenoid ammonia do. do.	0·16	0·12	
Nitric acid, millegrammes per litre	10·5	11·25	
Apparent quality of the water as inferred from the results obtained from examination	Bad.	Suspicious.	

Subsequently to the time at which these specimens were taken, improvements were said to have been made on the main well from which the water is pumped with the object of excluding all water coming from the upper strata of the site, and restricting the influx to the ground water flowing on the surface of the gneiss.

8. Accordingly fresh samples were sent to the Chemical Examiner in September and October 1885 and his reports, as given below, show, I am sorry to say, no improvement in the quality of the water. In short, these latter analyses give a degree of impurity—organic and inorganic—beyond the line of safety and with no hope of amendment:—

——	Sippanuthee well water, sample No. 1 (*a*).	Sippanuthee well water, sample No. 2 (*b*).	Microscopic examination.
Total solids, grammes per litre	1·73	1·460	(*a*) Some yellowish white flocculent sediment consisting of organic *debris*, including remains of insects and living Entomostraca (*Cyclops*).—22*nd September* 1885.
Volatile solids, do. do.	0·65	0·440	
Chlorine do. do.	0·426	0·369	
Total hardness, Clark's scale	35°·0	25°·9	
Permanent hardness do.	15°·4	14°·7	
Free ammonia, millegrammes per litre	0·24	0·24	(*b*) Slight deposit of sharp sand mixed with decaying vegetable matters and containing infusoria, diatoms, and other organisms.—1*st October* 1885.
Albumenoid ammonia do. do.	0·16	0·12	
Nitric acid do. do. (as ammonia)	45·0	45·0	
Apparent quality of the water as inferred from the results obtained on examination	Bad.	Bad.	

9. As there is, however, evidently a large supply of ground water in this locality, it might be desirable to ascertain whether the current could not be tapped in some other spot out of the area of the marl deposits, where possibly a fluid of greater purity might be obtained. This is of course a question for the Engineer. There is just a suspicion that the water at the site of the present well may be polluted by the percolation of town sewage, and that the lake or marsh which formerly existed there may, in past times, have been the receptacle for years of foul drainage from the fort and attached buildings.

10. The entire table of analyses of Dindigul waters, as given in paragraph 7 of Mr. Crole's letter, is here recorded for ready reference, but in no case are the quality of the water and quantity yielded, so far as known to me, such as to enable me to recommend any one as a source from which the wants of the community could be met—

——	Sippanuthee centre and west-centre well.	Well in south-west corner of do.	Devaraja Aiyar's well.	Gopala-samudrum.	Dindigul rock.	Betel garden well.	Weekly market well, Nagalnagak-kenpatty.
	1	2	3	4	5	6	7
Total solids, grammes per litre	1·13	0·92	0·8	0·9	0·18	1·06	0·8
Volatile solids do. do.	0·24	0·25	0·44	0·51	0·07	0·49	0·35
Chlorine do. do.	0·269	0·018	0·092	0·114	0·021	0·192	0·106
Total hardness, Clark's scale	23°·1	21°·7	20°·3	22°·4	4°·9	24°·5	21°·0
Permanent hardness do.	2°·45	0°·7	9°·45	10°·8	1°·4	9°·45	8°·4
Free ammonia, millegrammes per litre	0·48	0·28	0·009	0·016	0·48	0·008	0·24
Albumenoid ammonia, millegrammes per litre	0·16	0·12	0·12	0·16	0·56	0·16	2·4
Nitric acid, millegrammes per litre	10·5	11·25	15·0	18·0	7·5	12·0	30·0
Apparent quality of the water as inferred from the results obtained on examination	Bad.	Suspicious.	Bad.	Bad.	Suspicious.	Bad.	Bad.

Remarks.—Nos. 3, 4 and 6 are hopelessly bad on account of mineral impurity (culnic sulphats). The other waters it order of purity, 5, 2, and 1; if carefully guarded from dangerous organic contamination may be usable, but in their present state they cannot be regarded as safe for drinking without boiling.

11. With reference to paragraph 3 of the order under reply, a recent analysis of the Kodavanar river water is subjoined, and there seems no doubt that with the usual precautions of subsidence and filtration a good wholesome water can be got from this source—

——	Kodavanar river water.	Microscopic examination.	Remarks.
Total solids, grammes per litre	0·43	Some yellowish deposit of organic *debris* and sand.	This would be a good water if the suspended organic matter were removed by filtration or other means.
Volatile solids do. do.	0·15		
Chlorine do. do.	0·0213		
Total hardness, Clark's scale	11°·9		
Permanent hardness do.	1°·75		
Free ammonia, millegrammes per litre	0·08		
Albumenoid ammonia do. do.	0·12		
Nitric acid do. do. (as ammonia).	12·0		
Apparent quality of the water as inferred from the results obtained on examination	Suspicious.		

Order—dated 1st May 1886, No. 411 M., Financial.

Paragraph 9 of the Sanitary Commissioner's letter read above will be referred to the Public Works Department for inquiry and remark. If the proposal therein made is not found to be feasible, the Municipal Council will be asked to consider whether a scheme to bring in water from the Kodavanar river might not be worked out and adopted.

(True Extract.)

E. F. WEBSTER,
Chief Secretary.

To the Public Works Department.
„ Chairman, Municipal Council, Dindigul, through the Collector of Madura.
„ Sanitary Commissioner for Madras.

Exd. A. Raitt.

Communicated to the Supdg Engineer, W. Circle for investigation and report, with reference to para 9 of the Sanitary Commissioner's letter dtd 2 Ult

Govt. of {1886} Madras.

FINANCIAL.

Issued

Recd. *Encl.*

G.O., 1st May 1886, No. 411 M.

MAY.

Water-supply.

Referring to the Public Works Department, for inquiry and report, paragraph 9 of the Sanitary Commissioner's letter reporting on the project of —— in Dindigul, and stating that, if the proposal made therein be not found feasible, the Municipal Council will be asked to report on the scheme of bringing water from Kodavanar.

Withdrawn.