

14/7/29 1911

2029

Gobt. of (1883) Madras.

PUBLIC.

No 805 Waf 12 March 83

Recorded

Atto

7/3/83

Miss J. C.

Issued

Recd.

7/3/83

Encl.

G.O., 3rd March 1883, No. 452.

MARCH.

No 805 Waf 12 March 83

Red Hills Lake.

Communicating to the District Magistrate, Chingleput, and to the Sanitary Commissioner, letter from the President, Municipal Commission, Madras, offering suggestions for the conservancy of the —; and referring to the Financial Department, for consideration, the suggestion to extend to the lake and its shores the power which the Municipal Commissioners now possess over the water-supply channel from the lake to Madras.

Day 11

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With an Order

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funds to an object almost exclusively intended for the benefit of the people of Madras. The removal of objectionable hamlets and the extension of Municipal powers over the area affected as described above in paragraph 5 are, I think, the steps to be first adopted. As a minor matter, I would add that a boat is required, and will be provided, to enable the Municipal Officers to visit the hamlets on the opposite shores of the lake. The distance round by the margin of the lake is practically prohibitive.

7. I have already addressed Government on the necessity of filtering beds for the Red Hills water before its distribution throughout the city, and will therefore on this point merely refer to my letter, No. G 566, paragraph 17, quoted in G.O., No. 2845 W., dated 30th October 1882.

ORDER—dated 3rd March 1883, No. 452, Public.

Mr. Arundel's letter will be communicated to the District Magistrate, Chingleput, and to the Sanitary Commissioner.

2. The suggestions made in paragraph 5 of the letter will be referred to the Financial Department for consideration.

(True Extract.)

Chief Secretary.

To the District Magistrate, Chingleput.
„ Sanitary Commissioner.
„ President of the Municipal Commission, Madras.
„ Financial Department.
„ Public Works Department.

Exd. J. Wright.

6. With all deference to the Sanitary Commissioner, I agree with the President of the Municipality that the only real remedy is the removal of the villages themselves and a system of watchers. This would, no doubt be expensive, but I do not see how, if it is desired to keep the water pure, expense is to be avoided. If the villages which I have mentioned are removed and no cattle are allowed to graze or drink in the tank the water of the Red Hills will be no doubt considerably benefited.

From A. T. ARUNDEL, Esq., President of the Municipal Commission, Madras, to the Chief Secretary to Government, dated Madras, 21st February 1883, No. 197 W.W.

In reply to reference on No. 3160, Public Department, with endorsement, No. 1469, dated 4th December last, I have the honor to submit the following remarks.

2. I have postponed replying to this reference until I could visit the Red Hills Lake and its surroundings, and after my visit consult with the Collector of Chingleput, Mr. Price, on the best course to be pursued. The question under reference is of importance, and a hasty reply based on incomplete information seemed undesirable.

3. On the 19th, 20th, and 21st January, I inspected the Red Hills Lake and the villages and hamlets from the north-east to the south-west shores. The largest and most important village in the neighbourhood of the lake is Tuluka Chattram on the east, and this village fortunately lies below the bank and along the water-course that carries away the surplus waters from waste weir of the lake. I inspected the margin of the lake both in the afternoon and also in the early morning when contamination of the water is most likely to take place, and found that the population of the village resorted to the waste weir water-course and to the fields below the bank for purposes of nature. In no case had the bank or shore of the tank been polluted, and this was natural as to visit it involved an up-hill walk to a very exposed position. As far therefore as the main village of Tuluka Chattram is concerned no additional safeguards are just now required. The conformation of the ground secures to the water of the lake a general immunity from pollution and the officers and watchmen of the village and of the lake reside on the spot and are able to exercise a close supervision.

4. To the north-east of Tuluka Chattram and within a short distance of it is a small parcherry of about 25 huts, called Naravarikuppam, which it would be advisable to remove to a greater distance from the lake. The residents of this hamlet, who had no knowledge of the object of my inspection, came to me to beg that they might be allowed to shift their quarters to a rising ground a few hundred yards away, as they had long felt great inconvenience and discomfort from their present close proximity to the lake. The inhabitants of another hamlet named Marudakallikuppam of Sorapattu on the south of the lake made a similar request personally and by petition. In both these cases the Collector, Mr. Price, has promised to give his assistance, and I hope the hamlets may soon be shifted.

5. There remain a few larger hamlets on the western shore which should also be removed in order to prevent contamination of the water-supply. Compensation to the owners of huts and houses will be necessary, and to effect the object in view and at the same time to prevent the erection of other dwellings in the same place or in any other places equally near the lake it will be necessary to take legal powers. The revision of the Municipal Act affords a favorable opportunity for the change. I therefore beg leave to suggest, and the Collector of Chingleput, whom I have consulted, concurs with me, that the powers which the Commissioners now possess over the water-supply channel from the Red Hills Lake to Madras should be extended to the lake itself and to its shores. In Section 217 of Act V of 1878, after the words "are to run" the following words should be added, "and with the sanction of the Governor in Council over such lake and over all lands extending to 1,000 yards beyond high water-level of such lake."

6. The conservancy of the Red Hills Lake cannot, I fear, be secured by the Police Act, as suggested by the Sanitary Commissioner, or by building latrines as proposed by Dr. King, and the Local Fund Board may reasonably hesitate to devote

Order—dated 24th October 1882, Mis. No. 1250, Public.

The correspondence will be communicated to the District Magistrate, Chingleput. Under the circumstances brought to notice he will at once consider the propriety of putting in force the provisions of Section 48 of the Police Act in the villages referred to, and he will bring the matter under the notice of the Local Fund Board in view to sanitary arrangements being carried out therein.

2. The matter is one of pressing importance.

(True Extract.)

C. G. MASTER,
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„ President of the Municipal Commission, Madras.

READ—also the following papers:—

From J. F. PRICE, Esq., Magistrate of the Chingleput District, to the Chief Secretary to Government, dated Sadras, 13th November 1882, No. 592.

I have the honor to acknowledge the receipt of G.O., Public Department, Mis. No. 1250, dated 24th ultimo.

2. There are five villages near the bed of the Red Hills Tank, viz., 1, Errangooppam (Government); 2, Pammadukullam (Government); 3, Pothur (Izara); 4, Tirumalavoyal (Government); and 5, Oragadam (Shrotrium). The distance of these from the nearest Police station (Tuluka Chattram) is as follows. Nos. 1 and 2, 1½ miles; No. 3, two miles; No. 4, 3½ miles; No. 5, three miles. Their distance from the nearest Magistrate (Poonamallee) is from seven to nine miles. From Saidápet the nearest is about seventeen miles.

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4. The question of putting up latrines and employing a Sanitary Establishment will be put forward at the next meeting of the Local Fund Board; but I think that the Board will very possibly demur at being asked, when there are many other large places requiring latrines, to put them up in four or five out-of-the-way villages for the benefit of the water-supply of Madras. That the water-supply of the metropolis should be protected from contamination, is, I admit, an important point; but I venture to submit that provision for this should be made by the Municipality and not fall upon rural rate-payers who do not derive the most distant benefit from the supply of water to Madras.

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6. With all deference to the Sanitary Commissioner, I agree with the President of the Municipality that the only real remedy is the removal of the villages themselves and a system of watchers. This would, no doubt be expensive, but I do not see how, if it is desired to keep the water pure, expense is to be avoided. If the villages which I have mentioned are removed and no cattle are allowed to graze or drink in the tank the water of the Red Hills will be no doubt considerably benefited.

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3RD MARCH 1883, No. 452, PUBLIC.

GOVERNMENT OF MADRAS.

PUBLIC DEPARTMENT.

READ—again the following paper:—

G.O., dated 24th October 1882, Mis. No. 1250, Public.

Read—the following letter from Deputy Surgeon-General M. C. FURNELL, M.D., F.R.C.S., Sanitary Commissioner for Madras, to the Chief Secretary to Government, dated Madras, 19th September 1882, No. 791:—

I have the honor to forward, for the information of Government, an extract from Surgeon King's report on the sanitary condition of the city of Madras, during the epidemic of cholera, 1881-82, and the correspondence which has taken place between the Municipal authorities of Madras and myself on the subject.

2. I do not agree with the Vice-President that the only remedy lies in the removal of the villages. One would imagine the evil complained of might be combatted by Police supervision, at any rate that very simple remedy might be tried, but apparently no action whatever has been taken on either Surgeon King's letter, dated as far back as March 1882, or my reminder; and thus the only attempt at pure water-supply for the city of Madras is tamely allowed to be poisoned at its very source.

ENCLOSURE.

APPENDIX H.

From Surgeon W. G. KING, Special Sanitary Officer, Madras, to the President of the Municipal Commission Madras, dated ———, No. 12.

I have the honor to inform you that I have this day inspected a portion of the tank at the Red Hills whence the water-supply for this town is taken. I proceeded to the village Pollu Madavaram. This village is situated on the banks of the tank, and consists of straggling houses and huts sheltering between two and three hundred persons. There is no public latrine. It is therefore no matter for surprise that, as is usual with the lower classes of natives, defecation and washing of clothes should take place as near the edge of the water as possible. That this actually occurs, I had ocular demonstration this morning on my arrival there at an early hour. The configuration of most of the ground used would permit surface water to flow in a direction contrary to that which would ensure its entrance to the tank. But this is far from being universally the case. Hence contamination of the water on the occasion of rain is calculable to a certainty.

2. There is, I believe, another village on the opposite side of the tank similarly closely situated to the edge. I had, however, no time to visit it.

3. I would recommend your serious attention to this detail with reference to preservation of the purity of the water-supply. Communication with the Local Fund Board would probably prevent further extension of the village in a direction where surface impurities might reach the tank, as well as result in a latrine being erected for the inhabitants. The sanitary clauses of the Penal Code might also be usefully enforced.

4. I understand arrangements are made to protect the banks of the open channel which conveys the supply towards the town; but would point out that expenditure incurred in this way must to a certain extent be regarded as useless, if contamination is allowed at the main source.

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Red Hills Lake.

Communicating to the District Magistrate, Chingleput, and to the Sanitary Commissioner, letter from the President, Municipal Commission, Madras, offering suggestions for the conservancy of the —; and referring to the Financial Department, for consideration, the suggestion to extend to the lake and its shores the power which the Municipal Commissioners now possess over the water-supply channel from the lake to Madras.



6. With all deference to the Sanitary Commissioner, I agree with the President of the Municipality that the only real remedy is the removal of the villages themselves and a system of watchers. This would, no doubt be expensive, but I do not see how, if it is desired to keep the water pure, expense is to be avoided. If the villages which I have mentioned are removed and no cattle are allowed to graze or drink in the tank the water of the Red Hills will be no doubt considerably benefited.

From A. T. ARUNDEL, Esq., President of the Municipal Commission, Madras, to the Chief Secretary to Government, dated Madras, 21st February 1883, No. 197 W.W.

In reply to reference on No. 3160, Public Department, with endorsement, No. 1469, dated 4th December last, I have the honor to submit the following remarks.

2. I have postponed replying to this reference until I could visit the Red Hills Lake and its surroundings, and after my visit consult with the Collector of Chingleput, Mr. Price, on the best course to be pursued. The question under reference is of importance, and a hasty reply based on incomplete information seemed undesirable.

3. On the 19th, 20th, and 21st January, I inspected the Red Hills Lake and the villages and hamlets from the north-east to the south-west shores. The largest and most important village in the neighbourhood of the lake is Tuluka Chattram on the east, and this village fortunately lies below the bank and along the water-course that carries away the surplus waters from waste weir of the lake. I inspected the margin of the lake both in the afternoon and also in the early morning when contamination of the water is most likely to take place, and found that the population of the village resorted to the waste weir water-course and to the fields below the bank for purposes of nature. In no case had the bank or shore of the tank been polluted, and this was natural as to visit it involved an up-hill walk to a very exposed position. As far therefore as the main village of Tuluka Chattram is concerned no additional safeguards are just now required. The conformation of the ground secures to the water of the lake a general immunity from pollution and the officers and watchmen of the village and of the lake reside on the spot and are able to exercise a close supervision.

4. To the north-east of Taluka Chattram and within a short distance of it is a small parcherry of about 25 huts, called Naravarikuppam, which it would be advisable to remove to a greater distance from the lake. The residents of this hamlet, who had no knowledge of the object of my inspection, came to me to beg that they might be allowed to shift their quarters to a rising ground a few hundred yards away, as they had long felt great inconvenience and discomfort from their present close proximity to the lake. The inhabitants of another hamlet named Marudakallikuppam of Sorapattu on the south of the lake made a similar request personally and by petition. In both these cases the Collector, Mr. Price, has promised to give his assistance, and I hope the hamlets may soon be shifted.

5. There remain a few larger hamlets on the western shore which should also be removed in order to prevent contamination of the water-supply. Compensation to the owners of huts and houses will be necessary, and to effect the object in view and at the same time to prevent the erection of other dwellings in the same place or in any other places equally near the lake it will be necessary to take legal powers. The revision of the Municipal Act affords a favorable opportunity for the change. I therefore beg leave to suggest, and the Collector of Chingleput, whom I have consulted, concurs with me, that the powers which the Commissioners now possess over the water-supply channel from the Red Hills Lake to Madras should be extended to the lake itself and to its shores. In Section 217 of Act V of 1878, after the words "are to run" the following words should be added, "and with the sanction of the Governor in Council over such lake and over all lands extending to 1,000 yards beyond high water-level of such lake."

6. The conservancy of the Red Hills Lake cannot, I fear, be secured by the Police Act, as suggested by the Sanitary Commissioner, or by building latrines as proposed by Dr. King, and the Local Fund Board may reasonably hesitate to devote

Order—dated 24th October 1882, Mis. No. 1250, Public.

The correspondence will be communicated to the District Magistrate, Chingleput. Under the circumstances brought to notice he will at once consider the propriety of putting in force the provisions of Section 48 of the Police Act in the villages referred to, and he will bring the matter under the notice of the Local Fund Board in view to sanitary arrangements being carried out therein.

2. The matter is one of pressing importance.

(True Extract.)

C. G. MASTER,
Chief Secretary.

To the District Magistrate, Chingleput.

„ Sanitary Commissioner.

„ President of the Municipal Commission, Madras.

READ—also the following papers:—

From J. F. PRICE, Esq., Magistrate of the Chingleput District, to the Chief Secretary to Government, dated Sadras, 13th November 1882, No. 592.

I have the honor to acknowledge the receipt of G.O., Public Department, Mis. No. 1250, dated 24th ultimo.

2. There are five villages near the bed of the Red Hills Tank, viz., 1, Errangooppam (Government); 2, Pammadukullam (Government); 3, Pothur (Izara); 4, Tirumalavoyal (Government); and 5, Oragadam (Shrotrium). The distance of these from the nearest Police station (Tuluka Chattram) is as follows. Nos. 1 and 2, $1\frac{1}{2}$ miles; No. 3, two miles; No. 4, $3\frac{1}{2}$ miles; No. 5, three miles. Their distance from the nearest Magistrate (Poonamallee) is from seven to nine miles. From Saidápet the nearest is about seventeen miles.

3. I would, as regards the question of the introduction of the provisions of Section 48 of the Police Act, invite attention to the marginally-noted Government Orders in the Judicial Department. Hitherto, when the Act has been introduced into any village more than two

miles from a Magistrate's Head-quarters, it has been done only in cases where the village is a large one and where there are Police stations. All the villages now under consideration are small ones, and are at some little distance from a Police station, and to work the Act with any effect in them would call for the employment of an extra constable at Tuluka Chattram. The present strength of the Police Establishments is only sufficient to provide for the ordinary beat and other work, and to allow of sanitation being, to a certain degree, looked to in some of the places where stations are located. If Government desire it, the experiment of working the Act can be tried, but I doubt its being of any real use. Things are bad enough even where there are Europeans constantly dogging the Police to see that they prosecute nuisances.

4. The question of putting up latrines and employing a Sanitary Establishment will be put forward at the next meeting of the Local Fund Board; but I think that the Board will very possibly demur at being asked, when there are many other large places requiring latrines, to put them up in four or five out-of-the-way villages for the benefit of the water-supply of Madras. That the water-supply of the metropolis should be protected from contamination, is, I admit, an important point; but I venture to submit that provision for this should be made by the Municipality and not fall upon rural rate-payers who do not derive the most distant benefit from the supply of water to Madras.

5. I fear that Police Act and latrines will not render the obnoxious villages clean or anything like it, and I believe that the experience of any officer who has attempted to enforce sanitation in rural villages will bear me out.

Gobt. of (1882) Madras.
PUBLIC WORKS.

GOVERNMENT OF MADRAS.

PUBLIC DEPARTMENT.

READ—again the following paper :—

G.O., dated 24th October 1882, Mis. No. 1250, Public.

Read—the following letter from Deputy Surgeon-General M. C. FURNELL, M.D., F.R.C.S., Sanitary Commissioner for Madras, to the Chief Secretary to Government, dated Madras, 19th September 1882, No. 791 :—

I have the honor to forward, for the information of Government, an extract from Surgeon King's report on the sanitary condition of the city of Madras, during the epidemic of cholera, 1881-82, and the correspondence which has taken place between the Municipal authorities of Madras and myself on the subject.

2. I do not agree with the Vice-President that the only remedy lies in the removal of the villages. One would imagine the evil complained of might be combatted by Police supervision, at any rate that very simple remedy might be tried, but apparently no action whatever has been taken on either Surgeon King's letter, dated as far back as March 1882, or my reminder; and thus the only attempt at pure water-supply for the city of Madras is tamely allowed to be poisoned at its very source.

ENCLOSURE.

APPENDIX H.

From Surgeon W. G. KING, Special Sanitary Officer, Madras, to the President of the Municipal Commission Madras, dated ———, No. 12.

I have the honor to inform you that I have this day inspected a portion of the tank at the Red Hills whence the water-supply for this town is taken. I proceeded to the village Pollu Madavaram. This village is situated on the banks of the tank, and consists of straggling houses and huts sheltering between two and three hundred persons. There is no public latrine. It is therefore no matter for surprise that, as is usual with the lower classes of natives, defecation and washing of clothes should take place as near the edge of the water as possible. That this actually occurs, I had ocular demonstration this morning on my arrival there at an early hour. The configuration of most of the ground used would permit surface water to flow in a direction contrary to that which would ensure its entrance to the tank. But this is far from being universally the case. Hence contamination of the water on the occasion of rain is calculable to a certainty.

2. There is, I believe, another village on the opposite side of the tank similarly closely situated to the edge. I had, however, no time to visit it.

3. I would recommend your serious attention to this detail with reference to preservation of the purity of the water-supply. Communication with the Local Fund Board would probably prevent further extension of the village in a direction where surface impurities might reach the tank, as well as result in a latrine being erected for the inhabitants. The sanitary clauses of the Municipal Code might also be usefully enforced.

4. I understand arrangements are made to protect the banks of the open channel which conveys the supply towards the town; but would point out that expenditure incurred in this way must to a certain extent be regarded as useless, if contamination is allowed at the main source.

Dated October, 30th.

Recd.

Encl.

G.O., 30th Oct. 1882, No. 2845 W.

OCTOBER.

Nos. 201-202.

Sanitary condition of Madras.

Ordered that the Secretary of State be addressed on the subject of the — with reference to the remarks made by the Army Sanitary Commission on the Report of the Madras Municipality for 1880.

GOVERNMENT OF MADRAS.

PUBLIC DEPARTMENT.

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GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

No. 201.

READ—the following papers :—

From the Most Honorable the Secretary of State for India, to His Excellency the Right Honorable the Governor in Council, Fort St. George, dated India Office, London, 22nd June 1882, No. 12, Statistics and Commerce.

I forward 70 * copies of a memorandum by the Army Sanitary Commission on the Report of the Madras Municipality for 1880.

2. The strong remarks made in this paper on the sanitary conditions prevailing in the Presidency town, to which there is apparently no prospect of a remedy being applied by any action of the Municipality, call for the serious attention of your Excellency in Council; and I shall be glad to receive a special report from you on the whole subject at an early date.

ENCLOSURE.

MEMORANDUM of the Army Sanitary Commission on the Report of the Madras Municipality for 1880.

The year 1880 was not an epidemic year in the south of India, and the town of Madras had only two deaths from cholera, while the small-pox deaths were fewer than those of the preceding year. The following statistics may therefore be assumed as representing more or less accurately the death-rate from local diseases and their causes.

2. According to the census of 1881 the population of Madras was 406,117. Deaths from all causes numbered 14,907, which would give a death-rate on this census number of 36·7 per 1,000.

The following abstract gives the total deaths from the chief death-causes in 1880 :—

Diseases.	Total Deaths.
Small-pox	869
Measles	105
Fevers	3,549
Dysentery	1,516
Diarrhoea	733
Cholera	2
Injuries	123
Other diseases	8,010

The different divisions of the city yielded the following varieties of death-rates:—

Divisions.	Population.	Death-ratio per 1,000.
VI.	19,390	17.2
V.	65,491	31.9
VIII.	41,482	33.9
III.	52,545	34.4
I.	65,121	36.6
IV.	9,791	37.6
II.	73,738	38.8
VII.	69,568	39.4

This abstract gives a better idea of the general sanitary state of Madras than does the death-ratio taken over the whole area, but as each division contains a number of villages, it is only by comparing the death-rates of villages with the general average death-rate that the real practical facts of the case become apparent. The village death-rates of course vary from year to year, but we shall take those for 1880 for our present purpose.

The average death-rate for Madras in this year was, as has been already stated, 36.7 per 1,000. Of village rates exceeding this proportion the following may be cited:—

Villages.	Population.	Death-ratio per 1,000.
Chintadripettah	15,120	38.3
Royapettah	5,255	39.5
Pursewalkum	19,006	39.1
Peddoo Naickpettah	65,639	43.4
Poodoopettah	3,774	45.5
Triplacane	33,258	45.7
Perambú	5,650	53.0
Meersaibpettah	2,050	57.5
Moothalpettah and Uttapaulium	40,957	56.3
Ráyapuram	11,089	60.7

The chief causes of these great losses of life in 1880 were endemic diseases, fevers, diarrhoeas, dysenteries, &c.

These village death-rates give in a few lines the Madras sanitary problem in a non-epidemic year, and, like similar village facts all over India, they point directly to foul undrained subsoil, imperfect cleansing, and bad water as their removable causes.

3. We shall next show what has been done in the course of past years to prevent these great losses of life, and what steps are now being taken in the same direction. In the first place, although the facts have been known for many years, and although two separate surveys, reports, and drainage schemes have been before the Municipal Commissioners, not a single step, so far as can be learned from the Report, has been taken either to drain the villages or to cleanse the subsoil. The Commissioners have simply pleaded poverty, and there the matter has ended.

4. The latest aspect which the drainage question has assumed is simply adjournment *sine die*, and the adoption of a system of surface concrete channels, intended not only for removing rainfall, which is their proper function, but to receive house and court sewage, and to leave the foul subsoil as it is.

In a report given in the present year's proceedings, Colonel Sankey, R.E., Public Works Department, makes the following remarks on this scheme:—"It is impossible to overlook or disguise the fact that there may be the most perfect system for removing all offensive matter from the point at which such is discharged into the street drains, while there may exist side by side with this complete system a state of house-drains that may be little less than poisonous. It is not of course proved that such is really the case in Madras, but if not (and there is nothing to the contrary in the Report), the Native houses and courtyards must be in a very different state from what they are in all other Native towns where, away from all view, sewage is allowed to sink into the ground of the little back-yards, and produces a rotten soil, the effects of which

cannot in any way be remedied by the most scrupulous cleanliness of the street drains outside. If a thoroughly healthy state of things is to be produced in Madras, and not merely a palliative, this fact must be looked fairly in the face." In these views we entirely concur. On the question of economy, Colonel Sankey says, "It is not to be supposed that a mere skin of cement one-fourth of an inch in thickness can for a long series of years resist, not only the corroding action of the sewage acids, but the endless sources of injury to which town drains are subjected," and he proposes to substitute V-shaped drains of stone.

5. The Report under review does not contain any Officer of Health's Report on the courtyards, but in our Memorandum on the Report of the Sanitary Commissioner for Madras we have quoted part of a Report by the Commissioner which reveals a condition of matters in these courtyards absolutely incredible. And Mr. Jones, the proposer of the surface drainage scheme, now tells us, that "the house drainage itself is one of the most important sanitary questions, but its improvement forms no part of my scheme," which is simply a tacit confession that, after this surface drainage work is completed, the sanitary state of Madras will remain precisely what it now is, as shown by the deplorable village death-rates we have given above.

Such being the case, we would strongly urge the inexpediency of wasting money upon the incomplete and unsatisfactory surface drainage plan now in process of execution, which does not fulfil any conditions of a proper drainage system, and we would recommend at the same time that a complete system of town and house drainage in combination with an improved and extended water-supply for removing house sewage, separately from the rainfall, be at once adopted.

6. *Water-supply.*—Little or no improvement appears to have been effected in this important element during the year. The population of Madras exceeds 400,000, while the Report estimates that only half this number uses the pipe water. The remainder must of necessity use the impure subsoil well water. The estimated amount of pipe water-supply is 14.2 gallons per head per diem for those who use it. The following approximate analysis shows the character of the Red Hill water after it arrives in Madras:—

	Grains per Gallon.
Total solids	14.70
Volatile solids	4.90
Sodium chloride	5.32
Total hardness	6.65
Free ammonia	0.025
Albumenoid ammonia	0.028
Nitric acid as ammonia	0.336

The water contains a large proportion of organic matter and numerous large infusoria and other evidences of organic impurity.

The pipes collect silt, which has to be washed out by a scour. During one of these operations it is stated that, "a piece of iron 16 inches in area was forced out of the pipe." Much impurity in the water appears to be derived from the open channel by which the Red Hill water is conveyed to the city, in reference to which the following remark occurs:—"Its bed is still in an uneven state, and this cannot be rectified without a very large expenditure of money, or without shutting off the supply from Madras for some considerable time."

Practically this conclusion amounts to a statement that, notwithstanding the present advanced state of practical engineering, and the real economy of a good water-supply, nothing can be done to remedy the present deplorable condition of the water-supply of Madras.

7. *Conservancy.*—The work done under this head is the most satisfactory of the year's proceedings, and the Report states that, "it is by no means complete, and a very great deal remains to be done." The present cleansing staff consists of 1,068 coolies and 504 carts, at a cost for 1880 of 21,761*l*. Part of the house sewage is removed separately and part is taken by rubbish carts, so that the costs of street and house cleansing cannot be separated. There can be little doubt that the great death-rates in some of the villages point to want of thorough removal of house sewage and growing impurity in the subsoil and subsoil well water in consequence. If the cleansing were better accomplished its cost would probably considerably exceed the whole present conservancy outlay, and it would be a moderate estimate to place this cost at 20,000*l*. a year, a sum which, if capitalized at 5 per cent., would enable a capital of 400,000*l*. to be spent on drainage and water-supply works.

8. Year after year we have called attention to the state of Madras, and up to the present time nothing effectual has been done to protect the people of this large Presidency capital from the enormous death-rates which prevail in it. Only palliatives, such as the present Black Town surface drainage scheme, have been tried. Under the circumstances we consider it to be quite useless to make any detailed recommendations, and we would rather conclude with a similar suggestion to the one already made by us in our Memorandum on the Report of the Madras Sanitary Commissioner, viz., that as it is apparently a hopeless matter to expect any improvement from the present Municipal administration, the whole subject should be taken in hand by the Govern-

ment of Madras Presidency, and the works required for the protection of the people from well-known local disease and death-causes should be carried out as speedily as possible.

18th April 1882.

No. 567.

Referred to the President, Madras Municipality, for his early remarks.

OOTACAMUND,
14th July 1882.

(Signed) G. S. FORBES,
Acting Under Secretary.

No. 201-A.

From A. T. ARUNDEL, Esq., President, Municipal Commission, to the Chief Secretary to Government, dated Madras, 4th August 1882, G. No. 566.

I have the honor, as requested, to submit my remarks on the memorandum of the Army Sanitary Commission on the Report of the Madras Municipality for 1880, a memorandum upon the perusal of which the Right Honorable the Secretary of State has requested a special report "on the sanitary conditions prevailing in the Presidency town to which there is apparently no prospect of a remedy being applied by any action of the Municipality."

2. I will first examine the memorandum of the Army Sanitary Commission, and then do myself the honor to explain the present conditions and future prospects of the Municipality in regard to sanitation, conservancy, and water-supply.

3. With regard to the first point, I have to premise that the Army Sanitary Commission have advanced certain statements which are not only incorrect, but also at variance with the facts detailed in the report that lay before them.

This I shall now proceed to prove.

4. In paragraph 3 of the memorandum, the Army Sanitary Commission state " * * In the first place, although the facts have been known for many years, and although two separate surveys, reports, and drainage schemes have been before the Municipal Commissioners, not a single step, so far as can be learned from the Report, has been taken either to drain the villages or to cleanse the subsoil. The Commissioners have simply pleaded poverty, and there the matter has ended." Apart from the question of cleansing the subsoil, of which more anon, I must demur to the statement of the Army Sanitary Commission, and assert on the contrary that the

* Peddunaikpettah.
Big Paricherry.
John Pereira's Gardens.
Moothalpettah.
Uttapauliam.

Report narrates the various steps that were taken towards the drainage of the most important of the villages of Madras, viz., those* that unitedly form what is known as Black Town.

The Madras Municipal Report for 1880 (before the Army Sanitary Commission) stated, paragraph 7, "In the course of the year under report the Vice-President, Mr. Jones, successfully completed an experimental section to illustrate the method he will adopt in carrying out the drainage of Black Town * * *."

"The section of drainage thus completed was examined by His Grace the Duke of Buckingham and by His Excellency the late Mr. Adam, and the approval expressed by the Governors personally has been recorded by Government. The scheme for the drainage of the whole of Black Town has been prepared; and it may be noted that at the date of writing this Report, application has been made to the Government for a loan of one lakh to commence the work."

In another part of the Report (Appendix IV) the following remarks by Colonel Sankey, the Chief Engineer, Public Works Department, appear:—"In G.O. of 27th October 1879, No. 2698 W., it was observed that arrangements would be made to place at disposal an officer of this department for investigating Mr. Jones' scheme for the drainage of Black Town, Madras. Captain Awdry, the officer selected, has

reported the results of his examination in his letter * * and as the detailed report on the scheme itself has now been furnished by the President, Municipal Board, the matter is ripe for the decision of Government * *."

2. Owing to the inherent difficulties of the question itself * * * the details of this scheme have been subjected to more prolonged professional investigation and discussion than probably any other of a similar kind in India * * *."

4. In doing this and availing himself of the best points of the schemes of his predecessors, especially those of Major Tulloch, R.E.,* and the late Mr. Clarke, Mr. Jones has shown a wise discretion, and has produced a scheme which in its general outlines solves to all appearances the question in the best possible way * *." So much in disproof of the statement of the Army Sanitary Commission that "not a single step so far as can be learned from the Report has been taken * to drain the villages * *."

5. In paragraph 4 the Army Sanitary Commission quote paragraphs 8, 9 and 10 of Colonel Sankey's remarks, as to the absolute necessity of a complete system of house-drains and backyard-drains in conjunction with the system of street-drains, paragraph 10 ending thus—

"If a thoroughly healthy state of things is to be produced in Madras and not merely a palliative, this fact must be looked fairly in the face." The Army Sanitary Commission remark, "In these views we entirely concur." They omit to quote or refer to paragraphs 7 and 12 of the same remarks which are as follow:—

"7. The house connections and disposal of the liquid portions of the house-refuse are dealt with in paragraphs 21 to 24 and 61 to 64 of Mr. Jones' Report, from which it will be seen that by the extremely small outlay of Rs. 2 per tenant he hopes to deal in a sufficiently satisfactory manner with this, which after all is probably by far the most important, as it is certainly the most difficult, portion of any scheme for draining a native town.

"8.
"9. } Quoted by the Army Sanitary Commission.
"10.
"11. * * *

"12. From the nature of the case connected as it is more or less intimately with the private concerns of individuals, and not a little with caste prejudices, the question cannot be dealt with entirely as one of constructive devices (though of course these must be as perfect as the nature of the case admits), but must go very much further, and enlist the co-operation of all concerned; it is a matter which, though calling apparently for early and serious attention on the part of the President and Municipal Engineer in connection with this scheme, need not be further remarked on here."

It will be seen that a perusal of the passage now added from Colonel Sankey's note are essential in order to understand the drift of the whole.

6. In paragraph 5 of their memorandum, the Army Sanitary Commission have quoted a portion only of a sentence by the Municipal Engineer, Mr. Jones, omitting the remainder which contradicts their inference. They write, "And Mr. Jones, the proposer of the surface drainage scheme, now tells us that 'the house drainage itself is one of the most important of sanitary questions, but its improvement forms no part of my scheme,' which is simply a tacit confession that after this surface drainage work is completed, the sanitary state of Madras will remain precisely what it now is, as shown by the deplorable village death-rates we have given above." What Mr. Jones actually wrote was this:—"The house drainage itself is one of the most important of sanitary questions, but its improvement forms no part of my scheme,

* The italics are mine. Sections 267 to 271 of the Municipal Act enable the Executive to compel house-owners to do what is needed at their own expense.

as such expense under the Municipal Act falls on the owner and not on the general public,* and it is only when the house-drains become a public nuisance, which they do at the junctions with the street-drains, that I have endeavoured to improve matters." Mr. Jones goes on in the next sentence to add, "The inspection and improvement of house-drainage is urgently

called for, and it was my intention to request that one or two Inspectors should be appointed, whose sole duty it would be to report as to each house-drain, and when defective to urge their reconstruction on the owners and undertake the work ourselves at their cost when they neglected to do so * * * It is needless to say more in contravention of the charge thus made by the Army Sanitary Commission against the Municipal Engineer.

7. The Army Sanitary Commission conclude paragraph 5 as follows :—

"Such being the case we would strongly urge the inexpediency of wasting money upon the incomplete and unsatisfactory surface drainage plan now in process of execution, which does not fulfil any conditions of a proper drainage system, and we would recommend at the same time that a complete system of town and house drainage in combination, with an improved and extended water-supply for removing house sewage, separately from the rainfall, be at once adopted."

On this I would remark that the system of drainage thus condemned by the Army Sanitary Commission has been approved not only by the professional Engineer who framed it, but also by Captain Awdry, R.E., and Colonel Sankey, R.E., the latter of whom states, as already quoted, that "the details of this scheme have been subjected to more prolonged professional investigation and discussion than probably any other of a similar kind in India," and that Mr. Jones has "exercised a wise discretion in availing himself of the best points of the schemes of his predecessors, especially of Major Tulloch, R.E., and the late Mr. Clarke." It has been approved also by the Municipal Commissioners guided by the professional advice above quoted. An experimental section has been completed and examined in person with approval by two different Governors of the Madras Presidency, and finally the scheme has received the formal sanction of the Madras Government itself.

8. It seems scarcely credible that the Army Sanitary Commission should have taken upon themselves to condemn without reservation a system of drainage thus endorsed by the highest professional and official authority in the Madras Presidency without procuring and perusing a copy of the drainage scheme report itself. Yet this, it would appear, must be the case, for had the Army Sanitary Commission examined the pages of the Drainage Scheme Report they would have found not merely the letter press account of the method proposed for the drainage of the internal courts and yards of houses (which they declare to be entirely overlooked), but also a large wood-cut giving a sectional view of the interior of a native house and of the way in which such a house would be drained.

9. In paragraph 6 of their memorandum the Army Sanitary Commission discuss the water-supply of Madras. I do not propose to do more than to state, first, that the sum of Rs. 2,50,000 is now being expended in extending the Red Hills water to those parts of Madras intended to be supplied, and, second, that the Commission seem to be under a most erroneous impression that all subsoil well water in Madras is impure. So far is this from being the case, that the best drinking water is always procured from wells—not of course in densely crowded localities—and not from the Red Hills pipes.

10. In paragraph 7 the Army Sanitary Commission discuss conservancy and conclude as follows :—

"If the cleansing were better accomplished its cost would probably considerably exceed the whole present conservancy outlay, and it would be a moderate estimate to place this cost at 20,000% a-year, a sum which if capitalized at 5 per cent. would enable a capital of 400,000% to be spent on drainage and water-supply works."

It is difficult to discuss gravely so singular a proposition. It means the abolition of the whole existing staff and means of street and house conservancy, comprising over 500 carts and 1,000 men, in order to raise capital to carry out a system of drainage which the Government of Madras no less than the Municipal Commissioners consider unadvisable. London itself, with all its excellent drainage, would be a sorry city if the proposal now made were tried there—every dust-bin and filth heap left untouched, and every dirt and mud cart abolished.

11. In the concluding paragraph of their memorandum the Army Sanitary Commission state, " * * that as it is apparently a hopeless matter to expect any improvement from the present Municipal Administration, the whole subject should be taken in hand by the Government of Madras Presidency, and the works required to protect the people from well-known local disease and death-causes should be carried out as speedily as possible." As I have already shown that every step taken by the Municipal Commissioners has been with express approval and countenance of the Madras Government, it is needless for me to do more than to leave this final accusation of the Army Sanitary Commission to be dealt with by Government, while for convenience of reference I note the following Proceedings of Government discussing and sanctioning the project :—

G.O., No. 1212,	dated	11th July	1878.
" " 1506,	"	6th August	1879.
" " 2698, W.,	"	27th October	"
" " 3351, W.,	"	27th December	"
" " 1344,	"	6th September	1880.
" " 2953,	"	28th December	"
" " 744,	"	27th April	1881.
" " 1199,	"	27th June	"
" " 1569,	"	27th August	"
" " 1821,	"	28th September	"
" " 2505,	"	23rd December	"

12. I now beg leave to indicate the actual condition and future prospects of the City of Madras as regards sanitation, conservancy, and water-supply.

13. The drainage scheme for Black Town has been completed and the work is in progress. Black Town is the largest and most densely populated of the numerous towns and villages that form the aggregate called City of Madras. The City of Madras covers 27 square miles, with a population of 406,000. The area of Black Town is 1.65 miles and the population is 128,700. The scheme provides for carrying off all the liquid sewage from the houses and streets by surface drains wherever surface drains will answer the purpose, and by covered or under-ground drains elsewhere. The courts and yards of the houses will be connected with street drains under professional supervision, at the cost of the owners, by means of covered drains passing through or under the houses. The street drains will be flushed from the water pipes and will discharge their contents into three large underground sewers which will meet at a pumping station, whence the whole sewage will be forced first through a closed iron pipe over a mile in length, and then in an open channel to a large sewage farm north of the town, or into the sea, as may be desired.

14. It is not proposed by this system to drain the subsoil. No scheme yet proposed for Madras has provided for more than the most rudimentary and imperfect drainage of subsoil. Where the courts and yards are flagged the surface drain and the closed drain will each keep the yard dry, but the surface drain is preferred in this tropical climate. Where the yards are unpaved no subsoil drainage is complete unless sufficient to drain the whole area. No such scheme has ever been designed for Madras. Mr. Clarke's proposals in this respect were limited and scanty, while Major Tulloch made no provision for it at all. The subsoil is sandy almost every where in Black Town, and the ground is not water logged. Subsoil drainage cannot be effected without enormous expenditure which it is impossible for the Municipality to incur, and meanwhile the professional advisers of Government and of the Municipality consider it the immediate duty of the Commissioners to provide for the daily removal of all the liquid filth and sewage in the manner above described. The cost of the present scheme of drainage will be about Rs. 8,00,000, Rs. 1,00,000 is being spent this year, and about Rs. 3,00,000 more will, I hope, be spent in 1883.

15. There remain however other densely populated parts of Madras which are so imperfectly drained that completely new schemes must be formed and carried out for each of them. These with the approximate cost, &c., of each are as follows :—

	Area.	Population.	Cost.
	MILES.	NO.	RS.
Ráyapuram	0.84	52,000	1,40,000
Choolay and Vepery	1.0	33,000	1,20,000
Pursewakam	0.65	16,000	60,000
Triplicane and Chintadripettah	1.48	63,000	3,20,000
St. Thomé	.96	20,000	80,000
Add Black Town under construction ..	1.65	128,000	7,20,000
	6.58	312,000	8,07,500
			15,27,500

16. *Conservancy.*—The conservancy department now employ 532 carts of all kinds, besides four large canal barges, and 1,079 coolies for the daily removal of all solid refuse and filth throughout the town. The good done by this work cannot be over-estimated, but it is very far indeed from being complete. After the recent cholera epidemic in Madras, the Vice-President, Mr. Jones, drew up estimates of the additional staff that would be required to carry out, with thorough efficiency, the duties connected with street and house conservancy, and for the house to house cleansing of privies. For the former service above 100 more carts and 250 more men would be needed at a cost of over Rs. 40,000 per annum. For the latter the staff was estimated to cost about Rs. 60,000, about Rs. 1,00,000 per annum therefore would be required in addition to the present charges for thoroughness and efficiency in the very essentials of sanitation.

17. *Water-supply.*—The water-supply of Madras, so far as it is not obtained from wells, is derived from the Red Hills Lake, about 7 miles distant. The water is brought into Madras in a high level open channel, which is carefully protected by fence and hedge and by watchmen posted at regular intervals along its banks. Before being let from the channel into the delivery pipes the water passes through charcoal strainers. These however are insufficient to eliminate vegetable and animal products, and regular filtering beds are much required. The delivery channel runs at so high a level that the supply falls short while the lake has still a considerable depth of water available for use. A main in lieu of the channel would cost about Rs. 6,00,000, and the filtering beds would cost about Rs. 4,00,000 more.

18. The supply to Madras, though it has several times run low, has never failed except during the famine year 1877. The supply pipes are being extended throughout those portions of the whole area of Madras which it is intended to supply, but of course it is impossible to make a net work of pipes over the whole 27 square miles of town and country within the city limits. A sum of Rs. 2,50,000 is being expended during the present year in carrying out this extension of the water-supply. The water-supply loans now amount to Rs. 16,80,000.

19. *Causes of high Death-rate.*—Without going into any detailed remarks on this subject, I would note that increased efficiency in sanitation and in drainage must be looked to as a main factor in reducing the death-rate. I would call attention to the number of deaths, 869 in 1880, 1,654 in 1881 from small-pox which, under a compulsory system of vaccination would be almost entirely prevented. The Municipal Commissioners have expressed themselves in favor of such a system and await the action of Government to pass it into law.

The appointment of a Health Officer in Madras has again and again been postponed owing to lack of funds, but it may now be said to have become a necessity, and provision has been made for it in the new Municipal Bill submitted to Government.

20. *Ways and Means.*—The financial condition of the Municipality has long proved a bar to the sanitary progress that is so urgently needed. For several years the charges for Police thrown on the Municipality by Government arrested all

progress and even led to reductions of questionable wisdom. These impediments indeed are now happily removed, but no material change can take place until the income of the Municipality is largely increased. As shown above, at least Rs. 1,00,000 per annum will be required for conservancy and sanitation, while loans to the amount of 24 or 25 lakhs of rupees must be contemplated, involving further charges which may in the course of years amount to about Rs. 1,75,000 for interest and sinking funds.

The Municipal revenue requires therefore additional sources of income, capable of expansion so as eventually to bring from Rs. 2,00,000 to Rs. 3,00,000 in addition to the present income of Rs. 7,95,000.

21. This matter and my report No. 409, dated 26th May, on the impossibility of raising the needful funds except by a moderate octroi or by town duties on articles consumed within the city, are now before Government and await their decision as soon as the further information they have called for has been supplied.

No. 201-B.

From T. K. ROGERS, Esq., M.B.—F.R.C.S. & F.C.S., Lond., Chemical Examiner, to the Chief Secretary to Government, Financial Department, dated Madras, 22nd August 1882, No. 319.

In continuation of my letter No. 306, dated 10th August 1882, I have the honor to forward a copy of the results obtained from the examination of samples of soil taken from various localities in Madras.

2. On account of the pressure of Judicial work, and on account of other circumstances known to Government, the method of examination adopted was not that usually resorted to in Europe. The method used may be described briefly as follows: The soils were frequently washed with water, so that all matters soluble in water were almost completely dissolved out. The washings thus obtained were subsequently chemically examined.

3. I consider the results obtained to indicate a far greater immunity from filth contamination than could have been expected.

ENCLOSURE.

HYGIENIC Examination of Soils taken at a depth of four feet from different localities in Madras.

	Ummen Pagoda Street, Junction of Appoo Maistry Street at Xavier's Parahary.	Triplicane High Road, Junction of Wallajah Road.	Aroonochella Naick Street, Junction of Ninnappah Naick Street, Chintadripettah.	Mint Street, Junction of Annah Pillay Street.	Thimboo Chetty Street, Junction of Oodacall Street.	Cox Street, Chintadripettah.	Aroonochella Naick Street, Junction of Iyah Moodally Street, Chintadripettah.	Mint Street, Junction of China Bazaar Road.	Ramany Street, Junction of Nallapa Vadiyar Street.
Volume of Air contained .. per cent.	47	46	51	55	39	35	36	52	37
Moisture of Soil as received	12.382	12.42	13.92	15.45	0.021	2.005	1.100	16.600	0.052
Volatile matters	1.078	4.24	1.94	2.53	0.099	0.175	0.440	1.92	0.188
Inorganic Ammonia*	0.00032	0.0006	0.0008	0.0004	0.0004	0.0005	0.00008	0.0002	0.00008
Organic do.	0.0008	0.0005	0.0007	0.0007	0.0006	0.0004	0.0004	0.0007	0.0003
Nitric Anhydride*	0.02283	0.02473	0.0265	0.0305	0.0153	0.0191	0.0172	0.0305	0.0229
Chlorine as Chloride of Sodium	0.117	0.004	1.872	0.082	0.035	0.059	0.017	0.0234	0.117

* Obtained by Aqueous extraction.

MADRAS,
22nd August 1882.

(Signed) T. K. ROGERS, M.B., F.R.C.S.,
Chemical Examiner.

No. 201-C.

From A. T. ARUNDEL, Esq., President, Municipal Commission, to the Chief Engineer, Public Works Department, dated Madras, 9th September 1882, No. 1181.

With reference to your letter No. 638 E., dated 25th August, I have the honor to enclose a letter from the Vice-President, Mr. Jones, giving so far as he can the information you desire.

2. As regards the question of the connection of the house-drains with the surface-drains of the streets, Mr. Jones estimates the cost at an average of Rs. 20 per house, or Rs. 2,65,000 for 13,255 houses in Black Town, and Rs. 8,00,000 for 40,000 houses throughout Madras.

The Municipal Act makes the house-owners responsible for all such house-drain connections, and as the recovery of the cost could be spread if necessary over a series of years I see no reason why the greater portion of the expenditure should not be recovered. I have consulted with the Revenue Vice-President, Mr. Ramasawmy Chettiar, on this matter, and should say that there would be no difficulty in recovering at least 50 per cent., and that in all probability the final burden on the Municipality would be very small. Mr. Jones' estimate need therefore to be corrected on this point, as he has debited the whole amount of Rs. 8,00,000 to the Municipality.

3. The map asked for in paragraph 8 of your letter is being prepared and will follow as soon as it is ready.

ENCLOSURE.

From J. A. JONES, Esq., M.INST.C.E., Vice-President and Engineer, Municipal Commission, to the President, Municipal Commission, dated Madras, 7th September 1882.

The following memorandum contains, as far as I am able to give it, the information required by the Chief Engineer, Public Works Department, in his No. 638 E., dated 25th August 1882.

2. The amount actually expended up to the 1st April last was as follows:—

Drainage	...	...	...	...	...	...	Rs. 24,023
Water-supply extension*	...	...	...	...	...	...	„ 12,788

* This is in addition to the Rs. 14,30,000 expended in 1869—74 on the water-supply.

3. The only estimate for drainage which has received sanction is that for the drainage of Black Town, amounting to Rs. 8,07,500, and this work is now in course of execution.

4. The estimates for the other portions of Madras are merely approximate and were determined with reference to area and population, and not with reference to actual levels or surveys. These estimates are—

	RS.
Ráyapuram	1,40,000
Choolay and Vepery	1,20,000
Pursewakum	60,000
Triplicane and Chintadripet	3,20,000
St. Thomé	80,000
Total	7,20,000

5. Each of these, except a small portion of Ráyapuram which will be a portion of the Black Town area, will form an independent drainage area with its own outfall, and are shown on the accompanying* 6-inch map of Madras.

* To follow. The sewage is in all cases proposed to be utilized on land and raised thereto by small engines or picottahs.

6. The above total added to the estimate for Black Town amounts to Rs. 15,27,500, and there therefore remained at the 1st April last the sum of Rs. 15,03,477 which is roughly estimated to be required.

7. The above estimates provide only for the improvement of surface-drains to enable them to carry off sewage and storm-waters and for the necessary sewers to carry off sewage alone, the storm-waters passing on to their present outlets. The estimates do not include the improvement of the house drainage. They include a sum for altering house-drains which communicate with *existing* under-ground drains which from their low level must be altered so as to join the new open side drains. The existing house-drains are probably not in a satisfactory condition, but it is not necessary, under the present scheme, that all existing house drains should be taken up and replaced by closely jointed air tight pipes, as proposed in Mr. Clarke's scheme, at a cost of Rs. 50, nor is it necessary that these should be raised up inside the back-yards so high as to secure the exclusion of surface waters, in fact the pipe or drain must be kept below the level of the back-yard to carry off rainfall. Mr. Clarke's estimate was for pipes sufficient to carry off night-soil and other such matters which it is not now intended to carry off by house-drains, which need not therefore be of a very elaborate description. In fact if they are formed of country brick in chunam and well plastered with cement it will be sufficient. The length of these drains would probably not exceed 50 feet, and could be built, say, six inches square of new material and well plastered with cement for a sum of Rs 28, but many of the existing drains would require little more than plastering. I have taken 50 feet, but this is probably an excessive length, as the drains end at the front of the house and not in centre of the street (as in Mr. Clarke's scheme), and I am inclined to think that if Rs. 20 per house were taken on an average it would cover all necessary expenditure under this head. This for Black Town, containing 13,255 houses, would amount to Rs. 2,65,100. Taking this amount for the whole of the portions of Madras proposed to be drained the amount would be for 40,000 houses Rs. 8,00,000.

8. *Flushing*.—The present water-supply would be sufficient to flush these drains where such supply exists, and where it does not do so they could be flushed by an ordinary pail-full of water. But in schemes where a close-jointed pipe from house to sewer form portion of the design a water-supply service to each house would be a *sine qua non* and the average cost per house may be taken at Rs. 61 as shown below:—

	RS.	A.	P.
50 feet of 1½-inch piping at 6 annas	...	...	...
1½-inch stop cock and cover	...	...	...
1-inch discharge cock	...	...	...
Labour in cutting and jointing and masonry, &c.	...	...	...
Contingencies 10 per cent., say	...	...	...
Total	61	0	0

Cost for 13,255 houses in Black Town	...	...	...	8,08,000
Do. 40,000 „ Madras	...	...	...	24,40,000

9. I find that the cost of extending the mains throughout each street in the district to be drained, to enable the above service to be laid on, would be Rs. 8,000 per mile, and that about 100 miles of new mains would be required, costing Rs. 8,00,000, in addition to the Rs. 24,40,000 required for house connections.

10. *Subsoil Drainage*.—The level of the subsoil water, or level of permanent saturation, stands about 1½ feet above mean sea level and slightly higher in the rainy season.

11. If the rainfall of Madras be taken as 50 inches per annum, which is about the average, and if half this amount be taken as the amount evaporated, we get 25 inches which must percolate through into the subsoil; this taken over an area of 7.48 square miles (the area to be drained) would yield a supply of 312,500 gallons per hour (Mr. Clarke proposed to carry off 248,000 per hour). In the rainy season the amount is of course much larger.

12. The major part of the sewers will have to be laid below the level of permanent saturation, and in the scheme now being carried out are at their lowest levels some 7½ feet below this line.

13. In pumping out all the waters from the pump well at Ráyapuram just constructed, which is sunk about 6½ feet below the above depth, or 15 feet below water level, I noticed that while the water in a well within 30 feet of this was not lowered a single inch, the water in the open excavation (the bottom of which was also below the level of saturation for sewer No. 4 which commences at this well, and was then excavated in length 210 feet and to a depth of about 12 inches below level of saturation and about 9 feet broad) only subsided from 3 inches to 4 inches. This well had to be pumped about every quarter of an hour at this depth and the water would rise to 5 feet (*i.e.*, from 15 feet to 10 feet below saturation level) in about a quarter of an hour.

14. Considerable difficulty has also been experienced in putting in a pumping well at Napier Park, where the level of the bottom of foundation is only 8 feet below saturation level. The discharge at this place from an area of 700 square feet was about 250 gallons per minute.

15. From these facts it may, I think, be supposed that if wells were sunk 60 feet apart (double what the two wells were at Ráyapuram) over the entire area to be drained and to 8 feet below saturation level we would probably get a constant supply of 250 gallons per minute, and on this basis we would get $\frac{250 \times 60 \times 5280^2 \times 7.48}{60 \times 60}$ or 871,200,000 gallons per hour from the 7.48 square miles. This result is almost 300 times in excess of that determined on the basis of rainfall alone, and being deduced from a limited area cannot be made applicable except with extreme caution to the whole area to be drained. There can, however, be little doubt that the less quantity is exceedingly under the mark, and that if that quantity were drawn off regularly the level of the subsoil water would not be affected a single inch.

16. The water in the wells, as before stated, stands usually to about 1 foot to 1½ feet above mean sea level, and I think it probable that the level of the subsoil water is somewhat dependent on the sea level. At present there is a hydraulic head against the sea and fresh water can be had from wells on the shore itself. What would occur were the subsoil water lowered to any considerable extent would merely, I presume, be the introduction of salt water where fresh now is.

17. I cannot of course positively assert that such would be the case, but I do not think any other conclusion can be arrived at from a careful consideration of what has already been stated.

18. The following shows depth, length, and diameter, &c., of the sewers (as at present being constructed) under the permanent level of saturation :—

					Length.	Depth below the level of Saturation.		Mean Depth.
						HIGH END.	LOW END.	
Sewer No. 1	...	{	18 inches diameter	...	2,155	1.0	2.5	1.75
			24 do. do.	...	3,732	2.5	5.0	3.75
			30 do. do.	...	1,263	5.0	6.60	5.85
Sewer No. 2	...	{	18 do. do.	...	3,326	0	2.25	1.12
			24 do. do.	...	4,593	2.25	5.25	3.75
Sewer No. 3	...		24 do. do.	...	2,498	0	7.66	3.83

19. The subsoil water could therefore be tapped to depths 6 feet 8 inches, 5 feet 3 inches and 7 feet 8 inches below permanent level of saturation, but it is not intended to allow subsoil water to pass into these sewers as their dimensions will not admit of this being done, and I believe were the subsoil water admitted there is no means by which the fine sand could be prevented entering; the means proposed by Mr. Clarke for this purpose would undoubtedly fail and the sewers would eventually be choked with sand.

20. Having regard, therefore, to all the points already noted, I am unable to give any idea of what would be the cost of subsoil drainage, nor can I see any feasible plan of carrying it out by which the level of the subsoil water would be affected in the very slightest degree.

Water Supply.

21. My report on the improvement of the Madras Water Supply, dated June 1877, gives in detail an estimate of the cost of the works necessary for pumping the water on to the summit of the hills about the Red Hills Lakes, there filtering the same and supplying Madras thence with a 27-inch main.

22. The total head which would be obtained by the scheme would be 60 feet above mean sea level, or about 30 feet above the highest ground in Madras and 40 to 50 feet above the mean level of the town. This would be sufficient pressure for all purposes, and would give an extremely good water-supply even in those distant portions of the town whither we are now extending our pipes. The additional head over our present head would be 30 feet. I would deprecate the adoption of any greater head than this, as with a very high pressure system the waste of water in Madras would be enormous and the sewers would become insufficient.

23. The extension of the distribution pipes at present being made, complete the water-supply as far as there is any present intention of doing so. It is not intended to bring any additional portion of the town within the limits of the water-supply area. There may be some cases, however, in which it would be advisable to afford a better supply within the present area and Rs 1,00,000 would certainly meet all cases of this kind. The estimate for pumps, fitters and main was Rs. 13,66,000, and copy of the report is herewith sent for information, though it is believed that several must be available in the Government Office.

24. The total cost of necessary improvements to our water-supply, supposing the scheme of surface drainage to be adhered to, may therefore be taken at Rs. 14,66,000.

25. The following estimate No. 1 will show, having regard to the foregoing remarks, the probable cost of the works for drainage and water supply if these were carried out in accordance with the views expressed by the Army Sanitary Commission :—

No. 1 Drainage.

	RS.
Main Sewers and Pipe Sewers in streets	45,00,000
House Drainage 40,000* at 50	20,00,000
House Service 40,000 at 61	24,40,000
Subsoil Drainage †	5,00,000
Total	94,40,000

Water Supply.

Extended Distribution to put main in streets to be drained so as to afford water-supply to each dwelling, 100 miles at 8,000	8,00,000
Improvement of water-supply to allow of extended service and to give increase head with proper fitting arrangement.	13,60,000
Total	21,60,000
Add Drainage	94,40,000
	1,16,00,000

Captain Tulloch's scheme would cost the same amount less the amount of subsoil drainage.

Mr. Clarke's Scheme.

	RS.
Main Sewers	25,00,000
House Drainage 38,000 at 50	19,00,000
House Service water-supply 38,000 at 61	23,18,000
	67,18,000
Extension of Mains	8,00,000
Improvement of water	13,60,000
Total	88,78,000

Present Scheme.

Street Drainage	15,27,500
Add for land for farms, lifts, &c.	3,00,000
	18,27,500
House Drainage (see para 7)	8,00,000
	26,27,500
Improved water-supply, increased head and contingent extra distribution (see para 24)	14,66,000
	40,93,500

26. The estimated cost of each of the four schemes would then be as follows including the necessary water-supply for each scheme as designed :—

	RS.
As advocated by Army Sanitary Commission	1,16,00,000
Major Tulloch	1,11,00,000
Mr. Clarke	88,00,000
Mr. Jones	41,00,000

* Captain Tulloch says 32,000, but he drains Ráyapuram in addition to the number of houses proposed to be drained by Mr. Clarke which I make 38,000.

† I have entered the amount put down in Colonel Sankey's rough memorandum, but I doubt if anything could be done for that amount.

No. 201-D.

From A. T. ARUNDEL, Esq., President, Municipal Commission, Madras, to the Chief Engineer, Public Works Department, dated Madras, 29th September 1882, No. 1258.

I have the honor to forward a letter, No. 1256, dated 27th September, from the Vice-President Mr. Jones, giving the information asked for in your letter, No. 742 E., dated 14th instant.

From J. A. JONES, Esq., Vice-President, Municipal Commission, to the President, Municipal Commission, Madras, dated Madras, 27th September 1882, No. 1256.

The amount of Rs. 12,788 which set down as the amount spent on the original expenditure of Rs. 14,880.

The amount of Rs. 12,788 which set down as the amount spent on water-supply in addition to the original expenditure of Rs. 14,30,000 was the amount spent up to 1st April last for new works only. Such sum does not include any payment on account of interest and maintenance of the water-supply. Such expenditure is detailed in the following table:—

		RS.	A.	P.	
From Current Revenue.	{	Outlay previous to 1873-74, advanced by Municipal Fund	35,715	9	9
		New works from 1873 to January 1882	46,340	11	1
		Maintenance from do. do.	1,40,630	3	5
		Interest from 1870 to July 1882	6,00,229	10	6
		Sinking Fund	3,53,390	9	2
	{	Red Hills water from 1873 to July 1882.	11,76,306	11	11
		25,226	2	9	
		12,01,532	14	8	

Loan of 1869-74	..	..	Rs.	A.	P.
Loan of 1882	..	..	14,30,000	0	0
From Revenue	..	..	12,788	0	0
	..	..	12,01,532	14	8
			26,44,320	14	8

The total up to 1st April including this amount is therefore Rs. 26,44,320-14-8.

With reference to paragraph 5 (1) of Colonel Sankey's letter, I fear I am not able to give an indisputable reply, but I will endeavour to give such facts as will enable Colonel Sankey to place it where he will be noticed that I have merely done as he did beyond Major Tulloch's, when he made one outfall over a large area, by the omission of an outfall of its own. I might contend that if that is to say the principle of giving places and independent outfalls, there can be no reason why it should be unfair not to point out that in case of a river flowing by gravitation into the sea. What is not difficult to foresee.

Against the fact however that in St. Thomé no pumping would be required, I have to submit that where pumping is required, as it would be in most of the independent areas I propose, we have the income from the crops raised on the land irrigated, and taking three of our farms which respectively receive the sewage of (1) Choolay and Vepery; (2) Triplicane (north of Pycroft's Road); (3) Triplicane (south of Pycroft's Road), we have the following as the results of four years' working:—

Years.	D'MELLOWS.						TRIPPLICANE.						KISHINAMPET.					
	Receipts.			Disbursements.			Receipts.			Disbursements.			Receipts.			Disbursements.		
	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.
1878	1,362	2	4	1,378	4	11	1,125	10	3	965	8	6	2,641	1	7	1,843	6	5
1879	2,766	15	6	1,660	2	5	1,931	3	6	1,945	9	6	4,059	15	7	2,141	15	6
1880	1,762	13	1	1,716	1	8	2,791	10	5	3,086	8	9	3,086	8	9	2,696	10	4
1891	1,837	9	7	1,952	14	4	1,676	12	3	3,099	14	3	4,600	0	2	3,756	15	11
Total ..	7,749	8	6	6,707	7	4	6,374	5	9	8,802	10	8	14,387	10	1	10,349	0	2

This is a profit over the three farms of Rs. 2,650 in four years. I do not imagine that any farmer would do that.

I do not imagine that when each of these portions of the town are properly drained that our present arrangements for raising the sewage by picottahs will avail, but still whatever be the cost of such raising the net income will not be less than it is now and will most probably increase.

It may be urged that the sewage wherever raised and put on land, if suitable, will produce the same income, but any place where the sewage of the whole town has to be disposed of must necessarily be at some distance from the town itself, and the crops produced would either have to be carried into the town or sold at a reduced rate on the spot.

The saving due to each separate locality having its own outfall in a town having a somewhat uniform density of population would be little, but in a place such as Madras, where the populated portions are widely separated, forming almost independent towns, the saving is very considerable, while at the same time suitable areas are rendered available for sewage farming. The saving is due not alone to the actual length of sewer saved between these detached portions, but also to the decreased size of sewers throughout.

There is another saving in having detached areas, and that I think the most important one and one which goes I think far to decide the question as to whether the extra cost involved in several pumping stations would not, when capitalized, pay for the extra cost which would be incurred in constructing continuous sewers towards one well to the north of the town; for it has been decided by all who have considered the question that no other site is feasible as a single outfall for the drainage. The point to which I draw attention is this, that where there are very long sewers the lift at the pumping station, owing to the gradient necessary for the sewers, is very much greater than when the sewers are in comparatively short lengths, and this comes to be of considerable importance, as in addition to the extra length of sewer you have this increased height to which the sewage has to be raised, and the cost of this, it appears to me, would be as great as any extra cost which would result from any extra establishment required at the different stations of independent drainage areas.

To the second question in paragraph 5 I can speak positively and reply that there is available ground for sewage irrigation contiguous to the different drainage areas, and have further to add that of such ground the major part is already in the possession of, or available for, the Municipality. The different areas are colored on the map referred to in my letter of 7th September 1882, and the land which can be used in connection with these areas is colored of a darker shade of the same color as the area whose sewage it is proposed it should receive.

Paragraph (5) 3 opens up a question on which there must necessarily be many different opinions. Sewage farming in India is not however handicapped by many of the disadvantages to which such a process is subject in England. We have in India the aid of a powerful sun throughout the year, and our experience in Madras is that the complaints arising from sewage farming are very few and far between. The chief, and I may say the only, nuisance on a sewage farm is at the lift worked by picottahs, but this is one which can be overcome by providing proper wells and means of raising the sewage, by which it would not be continually stirred up and the odours continually disseminated. When the Municipality asked some time ago to be allowed to utilize a portion of waste land belonging to the Madras Railway Company close to the Central Station as a sewage farm, the Agent Mr. Saunders and the Acting Chief Engineer Mr. West visited the farms at D'Mellows Road and elsewhere, and finding from their own observations that no nuisance was to be feared, immediately gave permission for the construction of the farm. No complaint whatever has been received from the Company as to this farm, although it has now been in existence over a year.

The following is from the Madras Manual of Hygiene compiled under the orders of Government by Dr. H. King, A.M., M.B., &c., page 226, paragraph 570:—

“Sewage irrigation yields on the whole more satisfactory results than any other of the wet methods and is more generally applicable. It requires a surface of about one acre for every 100 persons in the community, and 70 yards square will receive 2,000 gallons of sewage in 24 hours. Large crops of grasses, cereals, roots and culinary vegetables can be raised, year after year, from land thus irrigated. The sewage should be brought to the land as rapidly as possible, and putrefaction may be advantageously delayed or prevented by the addition of small quantities of carbolic acid. The liquid trickles down a prepared slope, over the ground to be irrigated, at the rate of 8 feet per hour, saturation of the soil being guarded against by deep draining unless where it is so sandy or otherwise permeable as to render the precaution unnecessary. The effluvia are rarely such as to constitute a nuisance, but it is desirable to choose ground distant from houses. Enteric fever, dysentery, and the prevalence of entozoa have been predicted as probable consequences of sewage irrigation, but there is no evidence of the occurrence of such results, nor need they be apprehended if reasonable care be used. In some places the practice has been pursued for years without any bad effect. The water is not freed from impurity by irrigation to the same extent as by filtration; but it loses its suspended matters and some of its dissolved organic impurities, if not allowed to run too quickly off the land. The financial results of this method are more satisfactory when rain and surface water are excluded from the sewage.”

Coming to paragraphs 7 to 12 of Colonel Sankey's letter I must first state that Captain Tulloch has been drawn into some strange error in making the statement quoted by Colonel Sankey in regard to the house drainage. In no house I or the Sanitary Inspector have visited has the house drain ever been common to two adjoining houses or under the mean wall. Mr. Ramasawmy Chetty, the Revenue Vice-President, who has abundant opportunities for knowing, states that no house has its drain in common with an adjoining house, and that in the majority of houses there is always sufficient fall to run off the water quickly from the back portions of the house which are invariably higher there than towards the street. In the 600 houses in the experimental section of surface drainage executed no house drain was in such a position. In fact to begin with few houses have a mean wall at all, and in the majority of houses the drain is to the left hand side of the house. These remarks, I think, entirely dispose of Captain Tulloch's statement as to the position of the house drain.

In the experimental section of drainage executed as before stated about 600 houses were included. Of these I had to execute work in 14 houses, in order to alter the house drain to a proper level to allow of its flowing into the new street drain. The total length of house drains so altered was 257 feet and the total cost Rs. 76-10-7.

In order to determine the actual length of drain which would require to be altered if all the house drains had to be laid anew, I have had the house drains of all the houses in the three following streets measured with the result shown. Yedapollum Street is one of the streets already drained:—

	Number of houses.	Total length of house drain.	Average length.
Yedapollum Street ...	83	FEET. 2,442	FEET. 30
Sevarama Sastry Street ...	26	1,395	54
Ummen Covil Street ...	38	2,431	63

Mean Average ... 49'

This is very nearly the length I gave in my former letter.
Now for 10 feet of a new 4" house drain the cost would be—

	RS.	A.	P.
Brickwork ...	2	8	0
Plastering ...	0	10	0
Excavation ...	0	2	0
Total ...	3	4	0
For 50 feet ...	16	4	0
Breaking walls and repairs ...	2	0	0
Outer nozzle to drain ...	2	0	0
Grating ...	1	0	0
Total ...	21	4	0

This is supposing that all drains have to be laid anew. It does not however allow for flooring back-yards, and this expense would be considerable, some houses having as many as three separate court-yards. Nor has such an expenditure been anticipated either by Captain Tulloch or the late Mr. Clarke, and therefore whatever is added to the one scheme on this account a similar amount must be added to each of the other two. Now it should be noted that all the Municipality had of necessity to expend to connect the house drains and the new surface drain in regard to 600 houses was Rs. 76-10-4. I do not claim that this amount covered all that ought to be done, for every house drain even where the level needs no alteration should be inspected and put into thorough repair, but it shows the extent to which the Municipality was actually liable. I do not see with these facts in view on what I can base a higher estimate than Rs. 20 per house for house drainage, seeing that Rs. 21 odd will on average give every house a new drain, which would in many, certainly 50 per cent., of the houses not be required. If flooring however is considered a necessity I would on that account add Rs. 10 per house, making in all Rs. 30 on the average for house drainage. There will be exceptional cases in which the whole flooring of the houses may have to be raised, but against this it may be said that such houses are of small size, and the length of drain would be considerably less than the average. The longest

house drain measured in any of the three streets mentioned was 135 feet, the shortest 8 feet. The longest length of drain altered in the experimental section of drainage was —

	RS.	A.	P.
82 feet, cost ...	21	13	5
The shortest 8 feet, cost ...	6	10	9
	28	8	2
Average per foot ...	0	5	0
For 50 feet ...	16	0	0

Paragraph 13 of Colonel Sankey's letter. My remark in paragraph 19 of my last letter had reference to Mr. Clarke's method of preventing sand entering sewers and not pipes and regarded the method of putting a drain pipe through the side of the sewer and packing broken brick at the end of it to prevent the entrance of sand.

I have made some experiments with the sand taken from the line of sewer now being excavated. I find that by mere oscillation in the water and without any head of water at all 100 per cent. of the sand passes through wire gauze of 256 meshes to the square inch and 80 per cent. of the sand passes through muslin of 1,600 meshes to the square inch. I do not see how it can be doubted that sand under the pressure of 6 to 14 feet head of water would be prevented entering any sewer by means of a lump of broken bricks. I must admit that Mr. Clarke's method of packing a pipe joint with well-tampered clay and covering it with concrete would prevent any sand entering.

In Calcutta the subsoil water is admitted to the sewers by no special contrivance, and the only subsoil water which is admitted is that which soaks through the brick-work, it being impossible to make sewers of country brick-work water-tight. I think therefore that it may be concluded that Mr. Clarke did not find the plan feasible, or he certainly would have adopted it in Calcutta.

It is no doubt a practice in Madras for persons building mud-huts, or huts of brick and mud, to obtain the mud clay or earth at as short a distance as possible from the building being erected. These cases however are usually confined to parcherries, and the pits are of small area. The borings carried out by Major Tulloch and the depths of soil marked "made soil" can however have no reference to such cases. It will be seen by referring to the sections that such soil is found from one end of Madras to the other up to depths of 7 to 9 feet, and in one case this soil is marked "unbottomed." In certain places it is shown above the surface, and it will be seen that it is found close to the sea and a distance of two miles north of the inhabited portions of the town. This can scarcely have connection with places which have been raised by rubbish, and it may be further noticed that where the line of the sewer crosses rubbish heaps near boring No. 8, these are distinctly marked as such, and neither in this place nor near to it is there any made ground at all. I do not understand what Captain Tulloch means by made ground, but I think it is obvious that he does not mean rubbish heaps.

The best way to deal with rubbish heaps is to cultivate crops from them, such as cholam and other coarser kinds of grain. This method more than anything else tends to remove anything that is unsanitary in the upper strata at any rate, and the more crops the deeper does the purification take place. No building would of course be allowed on such sites, and no house system of drainage would therefore be necessary.

I have replied so far as I have been able to Colonel Sankey's question, and though in reference to paragraph 5 (1) I have not been able to give a decided answer, I think I have said enough to enable a clear opinion to be formed on the matter.

No. 201-E.

Note by the Chief Engineer, Public Works Department.

The Secretary of State in despatch, No. 12, "Statistics and Commerce," dated 22nd June 1882, calls the serious attention of the Madras Government to the condition of matters prevailing in the Presidency Town as set forth in a memorandum by the Army Sanitary Commission, dated 18th April 1882.

2. The latter body, after reviewing the Report of the Madras Municipality for 1880, observe (paragraph 5) that they "would strongly urge the inexpediency of wasting money upon the incomplete and unsatisfactory surface drainage plan now in process of execution, which does not fulfil any conditions of a proper drainage system," and "recommmend at the same time that a complete system of town and house drainage in combination with an improved and extended water-supply for removing house

sewage separately from the rainfall be at once adopted." They conclude their report by observing that the whole subject should be taken in hand by the Government of the Madras Presidency.

3. The delays in regard to the drainage of Madras, which have appeared incomprehensible and unreasonable to the Army Sanitary Commission, have arisen from inherent difficulties of a very serious character, which notwithstanding the reports of such well-known professional Engineers as Major Tulloch, R.E., and the late Mr. W. Clarke, M.I.C.E., and the strenuous efforts of a succession of Government officers and Presidents of the Municipal Commission, who one and all have certainly spared no pains in their endeavours, have hitherto proved to be insuperable.

4. To state the difficulties in detail is unnecessary, but the mention of a few of the leading facts may be useful. Madras has a population of 406,000 distributed in at least six different centres over an area of 27 square miles. No portion of the latter is raised more than 24 feet, and some places are only $2\frac{1}{2}$ feet above mean sea level; during cyclones, when the surface of the sea along the coast is abnormally raised, much of the place is even below mean sea level. In ordinary times the sea is practically tideless, as even during "springs" the difference between high and low water being not more than $3\frac{1}{2}$ feet. To add to the difficulty of collecting and discharging the sewage of the many large and scattered aggregations of population the north is separated from the south of Madras by a winding river, which for the most part is a backwater receiving the contents of natural drainage channels which are shallower and if anything more straggling than itself.

5. To any one acquainted with the difficulties which for the most part have proved insuperable, as regards the effective drainage of the cities and towns situated along the littoral of the Mediterranean, the bearing of the above facts will be sufficiently evident. Were Madras a flourishing commercial centre with a rapidly expanding trade, it is possible that the needful funds might be raised for dealing in some effective way with its drainage, but as the population is of the poorest, and trade not apparently increasing, it may at once be assumed that, without Government aid, the Municipality are quite unable to carry out the needful sanitary works on a large scale, and for want of means are compelled to confine themselves to palliatives. The Government on its side have been equally unable to come to the rescue, as from the manner in which the Imperial burdens have been distributed, this Presidency has hitherto not had its rateable share as compared with other provinces.

6. Major Tulloch's scheme of 1864-65, amounting to $39\frac{1}{2}$ lakhs, provided for a perfectly closed system of drainage excluding rain and storm waters. A main sewer starting from St. Thomé was to be carried under the Cooum River to a well north of the town, from which the liquid sewage was to be pumped into a channel two miles in length, along the course of which it was to be employed in irrigation.

7. Mr. Clarke in 1875 followed Major Tulloch's scheme in the main, but by cutting off several of the outlying tracts, and particularly St. Thomé, which was to have a separate sewer discharging direct into the sea, he was enabled to reduce his estimated total outlay to $23\frac{1}{2}$ lakhs.

8. Both Engineers however omitted from their schemes the expense of two items, one and other of which it is thought should be taken into account in estimating the total outlay required. The first of these is a supply of water under pressure all over the town. This would be quite essential in any system such as that apparently advocated by the Army Sanitary Commission and forming part of Major Tulloch's and Mr. Clarke's schemes, where the excreta of each house are carried off by a pipe of small dimensions (exclusive of all surface drainage) discharging into a system of closed town sewers. The second item is that of the cost of the house connections. The Municipal Act of Madras, like that of other towns where such institutions exist, confers the needful powers on the Commissioners to enforce the construction of all house connections at the cost of the proprietors; but to any one acquainted with the extreme poverty of the majority of the Madras population, it is quite clear that with a very large number it would be useless to attempt to put this provision of the Act in operation.

9. It will be observed from the correspondence which has lately taken place with the President of the Municipal Commission that both the above points have now received careful consideration, with the following results as regards probable outlay—See Mr. Jones' letter, No. 1, of 7th September 1882:—

(1) Water-supply extended so as to meet the requirements of a completely closed system—

	RS.
(a) Improved arrangements to give increased head of pressure throughout the town	13,60,000
(b) Extension of the street mains	8,00,000
(c) House service 24,40,000, half, say, recoverable from house-holders	12,20,000

	Total, Water-supply ...	33,80,000
(2) House drainage Rs. 20,00,000, of which say half would be recoverable		10,00,000
	Total ...	43,80,000

N.B.—Half of the cost under (c) and (2) has been taken as recoverable under the opinion expressed by Mr. Arundel, President, Municipal Commission.

Major Tulloch's scheme with the above additions, but excluding arrangements for dealing with the drainage of the subsoil (of which more presently), is the only one which would apparently fully meet the requirements of the Army Sanitary Commissioners; there can however be little doubt that his estimate if put in actual execution would not cost less than 45 lakhs. The total outlay which would thus have to be met from public funds is $45 + 43.8 = 88.8$ lakhs. Under Mr. Clarke's restricted scheme, amounting to $23\frac{1}{2}$ lakhs, the extent of house drainage and water service would be less than in Major Tulloch's. If the cost of both the latter items be taken at 40 lakhs, the total under his proposed system of works would be $40 + 23.5 = 63.5$ lakhs.

10. The Army Sanitary Commission lay considerable stress on the foul condition of the subsoil and the necessity of dealing with this as part of a well-designed and comprehensive scheme; but as will be observed from the letter from the Chemical Examiner, No. 319, dated 22nd August 1882, that officer is of opinion from the analysis of soils taken at a depth of 4 feet from different localities in Madras that "the results obtained indicate a far greater immunity from filth and contamination than could have been expected."

11. Again that there are considerable difficulties in deciding both as to the measures to be taken, and the probable effect of such in regard to the drainage of the subsoil waters, will be seen from the observations contained in paragraphs 12 to 20 of Mr. Jones' letter, No. 1181, of the 9th September 1882. As remarked by him in paragraph 16 the water in the wells "stands usually to about 1 foot to $1\frac{1}{2}$ feet above mean sea level," and if the result of any considerable lowering of the subsoil water level as he supposes to "the introduction of salt water where fresh is now," the general effect would, it is thought, be extremely injurious, as the admixture of salt with fresh water is understood to increase fourfold the effect in dissolving sewage matter held in suspension.

12. This is a matter to be decided by Chemical experts, but as a question of professional engineering there can be little doubt that to deal in any comprehensive way with the subsoil water, would need a very extensive net-work of underground drains which should have contrivances for admitting freely all such water and dissolved sewage matters, without at the same time allowing the fine particles of sand, of which the soil to a great extent consists, to be washed out.

13. Looking at the question in this light it would appear undesirable to attempt anything more than the arrangement contemplated in Mr. Clarke's scheme for placing small inlet pipes, well protected, at sufficiently short intervals along the lines of main sewers so as to get rid, as far as may be possible, of the dissolved sewage matters which

may have soaked into the soil in the immediate neighbourhood of each. Should there be any sensible washing out of the sand, it is needless to say that in process of time, as one of the evil results, the stability of buildings in the neighbourhood must necessarily become endangered. On the whole, therefore, in dealing with this part of the subject, it will be best not to contemplate any very extensive subsoil drainage works, and a sum of 5 lakhs may be assumed as the limit of necessary outlay.

14. The approximate cost of the several schemes would therefore stand as follows, taking into account the several adjustments as above :—

	RS.
(1) Major Tulloch's scheme with the cost of house water-supply service and drainage	88,80,000
Mr. Clarke's do. do. do. do. do. do.	63,50,000
Army Sanitary Commission's (being Major Tulloch's scheme with 5 lakhs added for dealing with subsoil water)	93,80,000

Each and all of these schemes, it must be remembered, leave out of account the following sums which would have to be borne directly by such of the house-holders as may be called on to bear the needful outlay for house connections, both water-supply and drainage, viz. :—

	RS.
Half of the house water-supply head (1) (c) para. 9 above	12,20,000
Half of the house drainage head (2) above	10,00,000
Total	22,20,000

15. With a population taxed it is believed very nearly to the utmost, it is needless to say that the expenditure of enormous sums of this character cannot be thought of. Even were Government in any way able (which it is not) to meet the outlay demanded by the scheme understood to be advocated by the Army Sanitary Commission, it is very questionable whether in justice to the many other pressing demands on account of other matters of the highest importance to the welfare of the Presidency, it could venture to do so, and again to compel even the well-to-do inhabitants to spend over 22 lakhs out of their own pockets, in addition to meeting the demands of increased taxation, is to say the least chimerical. On all accounts therefore it is necessary to consider whether there are not other means for bringing about as far as possible sound sanitation.

16. Mr. Jones' scheme is in this view the only one which has up to the present time been put forward as holding out reasonable prospects of success. As generally described, it, like both Major Tulloch's and Mr. Clarke's schemes, proposes to deal almost entirely with the removal of sewage matters, to the exclusion of the storm waters, but as with chiefly saucer-shaped open surface drains he has no need of water under pressure in each house, or of a closed system of house or street drains, excepting where for the requirements of slope the latter have to be converted into underground sewers, the cost is at once sensibly reduced.

17. Acting moreover on the principle that the sewage of each of the several centres of population, shall be employed in irrigating and raising crops on available land in the immediate vicinity, two very serious items of charge are minimised. In the first place there is no need for a very long sewer or sewers of large capacity, to convey the liquid sewage to any one point for the whole town, and in the second the sewage has ultimately to be lifted through a diminished height. These and other matters connected with Mr. Jones' scheme, including the very important facts tending to show that the plan of utilizing the sewage in irrigation has been proved by actual experiment to be rather remunerative than otherwise, and to be open to but small objection on the grounds of being offensive to the public, are very fully explained in his letter, No. 1256, dated 27th September, and the map which accompanies it.

18. The method of dealing with the separate house drainage is fully and apparently satisfactorily explained, and on the whole it would be fair to accept his estimate for the work as specified by him, viz. :—

	RS.
Street drainage	15,27,000
Land for sewage farms	3,00,000
House drains 8,00,000, half cost of	4,00,000
Improved water-supply	14,66,000
Total	36,93,000

To which may possibly be added—

To levelling and paving back-yards (See Mr. Jones' letter No. 1256)	2,00,000
Grand Total	38,93,000

This last item of two lakhs would, if admitted, have also to be added to all the other schemes if put in comparison. There can be no doubt that the drainage of the back-yards must be thoroughly dealt with if sound sanitation is to be secured, and this item must therefore apparently be included.

19. Mr. Jones is still apparently satisfied that his saucer drains will stand sufficiently well all wear and tear with a cement surface, but on this point there is room for doubt, and it would be advisable to keep in view that stone surfaced drains may as previously recommended have to be adopted, in which case not less than 2½ lakhs should be added to the probable cost of his scheme, bringing the total with the addition for floorings of the back-yards to Rs. 41,43,000. In addition to this house-holders, who can equitably be compelled under the Act to supply proper house drainage and connections, would have to incur the following items of expenditure from their private means, viz. :—

	RS.
To half cost of house drains 8 lakhs	4,00,000
Do. of levelling and paving the back-yards	2,00,000
Total	6,00,000

On the whole therefore it may be broadly stated that Mr. Jones' scheme would entail an outlay of not half that apparently contemplated by the Army Sanitary Commission so far as concerns the expenditure of public funds, but what is even of greater importance the compulsory outlay by private individuals would be reduced to 6 as against 22.2 lakhs. Even thus however reduced to a minimum the total charge is quite beyond the means at the disposal of the Municipality, who must consequently, unless aided by Government, content themselves with carrying out as they are now doing the Black Town portion of Mr. Jones' scheme, which is clearly the one of most pressing importance.

20. Great stress has been laid in the report by the Army Sanitary Commission on the preferability of a closed as compared with an open system of drains for Madras, but on this point there is reason to doubt whether the opinion is well founded.

21. In a hot climate the evolution of sewage gases must of necessity be much more rapid and therefore more likely to produce mischief than in a cold one, and considering the habits and the small means possessed by the natives anything approaching to a water closet system is not for a moment to be thought of.

22. On the other hand house drains which can be easily got at for daily cleansing or for occasional repair, have much to recommend them both on the score of cleanliness and economy, while for the outer street drains the arguments in favor of these being kept, as far as possible, open to the action of the sun and air as also for ready scavenging appear to be unanswerable.

23. The sun which is an enemy to be dreaded with all closed pipes and drains is the reverse where organic matter is exposed, as all who have had sufficient acquaintance

with India can attest. Here in fact the sun is the best of friends, and should, if properly turned to account, do more to keep Madras healthy than perhaps anything else save the benificent sea breeze, which no doubt holds the first place as a sanitary agent. The real difficulty is how to have sufficient lengths of drain kept open and exposed to the action of the sun, as the requirements of slope demand their being but too soon converted into underground sewers.

4th October 1882.

(Signed) R. H. SANKEY, Colonel, R.E.,
Chief Engineer, P.W.D.

No. 202.

ORDER—dated 30th October 1882, No. 2845 W., Public Works.

Ordered that the Secretary of State be addressed.

(True Extract.)

(Signed) J. SHAW-STEWART, Colonel, R.E.,
Offg. Secretary to Govt., P.W.D.

To the President, Madras Municipal Commission,
" Select Committee for the amendment of the Municipal Act, } with copy of despatch.
" Financial Department.
" Sanitary Commissioner for the district

Exd. S. T. Austin.
Spare Copies

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of (1882) Madras.
PUBLIC WORKS.

Dated October, 30th.

Recd.

Encl.

G.O., 30th Oct. 1882, No. 2845 W.

OCTOBER.
Nos. 201-202.

Sanitary condition of Madras.

Ordered that the Secretary of State be addressed on the subject of the — with reference to the remarks made by the Army Sanitary Commission on the Report of the Madras Municipality for 1880.

B5

A4