

P.W.C. No. 7728

B. No. 2601. W. 5th Oct/86.

Recorded.
Revised

4/10/86

See
4/10/88

P.W.C. No. 7691

Govt. of (188) Madras.

5

To

The Pub. Works Dept.



Recd: 4-10-86

Proceedings, dated 28th September 1886
No. M 957 (mss).

B. No. 2601 W. 5-10-86. Subject

Referring to the
President Municipal Commission
Madras for remarks, Memorandum
by the Army Sanitary Commission
on the Report of the Madras
Municipality for 1884-85.

See
4/10/86

in the order

Financial Department

Proceedings of the Madras Government.

Read the following:-

India Office,
London, 19th August 1886.

Statistics and Commerce,
No. //

To His Excellency The Right Honourable The Governor
in Council, Fort St. George.

SIR,

* 12 by mail; 58 by parcels post.

Para. 1. I forward, for your information, 70* copies of a Memorandum by the Army Sanitary Commission on the Report of the Madras Municipality for 1884-85. The health statistics of the Municipality appear to be very unfavourable, and fully to deserve the strong comments made in the appended Memorandum, and to call for the serious attention of your Government.

2. For the reason stated in the despatch to the Government of India, No. 150, dated 20th November 1884, of which a copy is enclosed, I request that the health statistics in the Reports of the Madras Municipality may continue to be made up for the calendar year, the next returns commencing from the 1st January 1885.

I have the honour to be,

Sir,

Your most obedient humble Servant,
(Signed) ~~R. Assheton~~ Cross.

ENCLOSURE.

MEMORANDUM of the Army Sanitary Commission on the Administration
Report of the Madras Municipality for the fifteen months from
1st January 1884 to 31st March 1885.

1. In our Memoranda on previous Reports of the Madras Municipality, we discussed the vital statistics of the population with special reference to the epidemic history of the city, and we were enabled, by the aid of local inquiries conducted by officers of the municipality, to show to what probable causes the high death-rates were due. These causes, indeed, appear to have been fully recognized in Madras itself, for on two separate occasions surveys and plans of works were prepared and submitted to the local authorities, but, apparently on account of the outlay required to give effect to either of them, they were not adopted. It was understood, however, at the time that there was still a hope that the city might be drained when the requisite funds were available.
2. At that date a new and better water-supply was introduced, but the available amount of it is still too limited to supply the whole population with a sufficiency for all domestic purposes, and a large part of the population is still dependent on bad or doubtful wells for their daily wants.
3. There was an active cleansing system in operation, as it still is, but it was and is confined chiefly to surface work, and within the last year or two we have quoted from Madras Reports the reports of medical inspections, showing the condition of house compounds, and the need of extending cleansing operations to them as well as to the streets.
4. The house sewage has been usually collected and removed by hand labour and carts, and this work appears to have been done with considerable efficiency in the divisions to which it has been extended, but the Report states that the fourth, fifth, and eighth divisions, which contain 17 villages, and an aggregate population of 115,388, "are yet "without any system of house conservancy."
5. At different times underground sewers have been constructed here and there, chiefly as it appears to relieve localities from flood water, and there are no fewer than 12 sewage farms on which sewage of various kinds is in course of application for agricultural purposes, and a great improvement has been carried out recently in diverting sewage from the Cooum.
6. In default of a proper system of drainage and sewerage, a proposal was made to surface drain Black Town by side impervious drains, at an estimated cost of 85,000*l.*, of which 30,000*l.* has been already expended, so that it would be safe to include this drainage work along with the other sanitary works and measures as having exercised, possibly, some favourable influence on the public health.
7. But, besides these works, a quantity of bad unwholesome house property has been from time to time removed, and its disease causes along with it, and, in addition to these sanitary measures, Madras has a hospital and dispensary service, including a vaccination department, under five inspectors, 20 vaccinators, and eight probationers.

8. Altogether, therefore, Madras presents a not unfavourable amount of work of one kind or another, the object of which has been to diminish the sick and death rate of the population, and as the proceedings have been in operation for some 20 years, it is a not unfair question to ask what has been the result. The question is further justified by the fact that the course of improvement which has been adopted by the Madras municipality for a populous city has been based on principles opposed to those which have been acted on in localities similarly situated elsewhere.

9. In dealing with these questions we shall try to avoid all controversial discussion. The whole subject was fully discussed by us long ago. At present we have simply to deal with the facts, as these are presented by the vital statistics of the present Report. There is, however, a slight preliminary difficulty, arising from a change in the beginning of the statistical year from the 1st of January to the 1st April, which has to be dealt with, and objected to, as being contrary to all statistical rule and to the principles of uniformity in statistical periods everywhere else adopted. The key to the resolutions adopted at the International Statistical Congress of London many years ago was this very uniformity. In making up accounts of work and expenditure, the change is not of so much importance. But it is a cardinal principle in all public health questions that the year for vital statistics should be the calendar year, and not the official year, and the Report under review shows the inconveniences of this very change. Take, for instance, the following examples:—

	Births per 1,000.	Deaths per 1,000.
Calcutta, 1883	17.6	30.50
Bombay	18.79	29.12
Madras	41.20	39.20
Madras, 1884-85	39.80	49.20

Or take such numbers as these:—

Deaths, 15 months ending 31st March 1885	24,067
Reduced to 12 months	19,253.16

Of course, we cannot accept the 15 months' data or the calculated deaths, and we shall, instead, abstract the numbers for the 12 months of 1884.

10. We hope, however, that in all future Reports the uniform calendar year may be reverted to, as we believe has been the case in Calcutta, where the official style had been tried. The questions involved are purely scientific in character, and have no relation to official convenience.

11. The population on which the ratios in the Report under review are calculated is that of the census of 1881, which was 398,777. The calculated births on this number were 16,133, and the calculated deaths for the complete year 1884 were 19,253.16, and this, when compared with the registered number of 1883, which was 15,487, shows an increase of 3,766 deaths during the calendar year 1884.

12. The death-rates among children were enormous. Above a third of the entire mortality of the year took place in infants under one year of age, and the deaths under five years were above 10,162, out of a population of 46,088, at the same ages.

13. The next abstract shows the death causes, but these figures include the numbers for 15 months, 1884-85.

Diseases.	Deaths.	Deaths per 1,000.
Small-pox	4,074	8.1
Measles	146	0.2
Fevers	4,863	10.7
Dysentery	2,158	4.3
Diarrhoea	1,301	2.5
Cholera	1,358	2.7
Injuries	109	0.1
Other diseases	10,473	20.9
Total	24,482	49.2

In order to keep the disease history in the proper order, however, it will be necessary to deduct under each head the deaths registered during the first three months of 1885, and the table will then stand as follows:—

Diseases.	Total Deaths in 1884.
Small-pox	4,064
Measles	133
Fevers	3,779
Dysentery	1,560
Diarrhoea	1,014
Cholera	1,193
Injuries	82
Other diseases	8,298
All causes	20,123

These figures would give a death-rate from all causes in 1884 on the census population of 1881 of above 5 per cent., and of this great death-rate, in a city which has been professedly under the hands of the improver for nearly a quarter of a century, upwards of 58 per cent. was due to epidemic and endemic diseases.

14. We may further call attention to the fact that the actual registered deaths in 1884 were 20,123, while by the back calculation method they were 19,253.16, or 870 below the truth.

15. It is clear from these data that the sanitary problem in Madras is mainly an epidemic one, while to understand it fully we shall have to carry the epidemic history for a number of years backwards. This is shown in the following abstract:—

Epidemic Diseases.	Total Annual Deaths.		
	1884.	1883.	Previous 10 Years' Average.
Small-pox	4,064	1,957	733.5
Measles	133	138	53.0
Fevers	3,779	3,470	3,229.2
Bowel complaints	2,574	2,284	2,327.9
Cholera	1,993	169	376.0
Epidemic causes	11,743	8,018	9,719.6
All causes	20,123	15,882	15,059.3

The registered facts show distinctly enough that the public health in Madras has been deteriorating, and not improving. The ten years' ratios in the last column are exclusive of the enormous losses of the famine year, but they bear marks of the famine nevertheless, as these showed themselves in subsequent years. There is no such difficulty in comparing the years 1883 and 1884, and the conclusion is inevitable that the sanitary authorities in Madras have not as yet been able to make any impression on the epidemic susceptibility of the population. After many years of work and great outlay, their city has the most unfavourable health statistics of any large population group in India. This result could only have happened from some mistake in comprehending the nature of the problems to be dealt with, or in the methods employed. It may be safely said that, for a seaside city in India, were the death-rate reduced to half the present rate it would still be too high.

16. High as the present rate is, it differs in different groups of villages which go to make up the city. The lowest death-rate was 28.9 per 1,000 in four villages having a population of 19,010. In another group of eight villages, with 66,655 inhabitants, the rate was 40.8 per 1,000. In another group of three villages the death-rate was 45.7 per 1,000, over 77,497 people. In other three villages, with 52,443 people, the death-rate was 47.1. In five villages, the population of which was 71,095, the rate was 50.4. In another group of four villages, the rate was 52.2 per 1,000, among 63,344 people. Another group of 37,940 people in six villages yielded a death-rate of 53.7, and another of 10,793 people in three villages had the enormous rate of 55.6 per 1,000.

17. With these facts before us, are we wrong in asking what would be the death-rates if there was no municipal sanitary administration at all, and also where is the proof that any efficient sanitary work has been done hitherto? The facts are so striking and so unlike any similar facts which have been presented by sanitary experience anywhere else, that, with the information before us that Madras has had its water-supply largely improved, and also an extensive cleansing system in operation for years, we must either consider the registration of deaths to be altogether untrustworthy, or that the past public health work has not been based on the true principles of prevention of disease.

18. With the statistical facts before us, it seems scarcely necessary to discuss the statements in the Report about the year's sanitary works, or to return to past controversies on their nature. It will perhaps be better simply to start from the fundamental facts already stated, which show that Madras is perhaps the most unhealthy city in India, and that its great death-rate is made up chiefly of epidemic diseases, which carried off 11,743 of its inhabitants out of a total loss of 20,123 by death. All the year's deaths except 8,380 were due to these diseases.

19. Now, all sanitary procedure which is intended to diminish or abolish liability to any class of diseases must be based on acquired knowledge of their causes, which comes by careful observation and experience. The causes differ according to locality and climate, and according to the manner in which locality is dealt with by the population covering it. Epidemic diseases may appear on mountain ranges or on seaside levels. In either case there must be local causes, but it does not follow that the causes should be the same. India presents examples of both classes of cases, as well as of intermediate ones, and it is one of the commonplaces of sanitary experience that, wherever there is stagnant subsoil water, so that the water table rises near the surface, there epidemics find their victims. It does not matter what other causes may be dealt with. This is the fundamental cause wherever it is present, and it can be added to

almost indefinitely by filth being washed into the subsoil by rain or by foul drainage.

20. There is a report of 19 folio pages appended to the Municipal Report, and signed by the Officer of Health, but it throws no light on the local disease causes of Madras during 1884. It scarcely alludes to them, and it concerns itself more with the births and deaths, and what may be called the medical aspect of the facts, than with their causes.

21. Many years ago there was at least one municipal officer who told us what he had seen and learned on this all-important subject, but his facts and conclusions were subsequently denied by others. A year or two ago we inserted a statement showing the condition of the dwellings and compounds of the humbler classes. We adopted it as an instalment towards further knowledge, which was never supplied.

22. The most instructive sanitary fact in the present Report relates to the old controverted question of subsoil water level. Sewers have been laid in connection with certain drainage operations, and the condition of the subsoil is thus stated:—"This portion of the sewer, from first to last, has given a great deal of trouble. The soil met with was dark, black, and slushy mud, which extended from 11 to 16 feet below ground level, while the foundation of the sewer was at the depth of 13 feet." We know not how far this experience represents the condition of subsoil under the villages, but it seems to be matter for inquiry.

Alongside this statement regarding the subsoil of Madras may be quoted from the Report the following statement from the Executive Engineer of Calcutta, who writes:—"The brick sewers are built with the very best hard burnt bricks and by hydraulic mortar. The pipe sewers are laid in concrete, and jointed with a mixture of blue clay and Portland cement. Although the sewers were not designed specially for that purpose, it is an undoubted fact that the level of the subsoil water has been very considerably reduced all over the town. The subsoil water gets into the sewers by an insensible percolation through the walls and joints of the sewers, and the walls of the numerous manholes and lampholes. The proof of it lies,—(1) in the every-day fact that much more fluid is drawn out of the sewers at the drainage pumping station than is supplied through the water-works; (2) in the evidence as to the drier condition of the ground floors of houses than was formerly the case."

To this statement of the Calcutta Executive Engineer, we may add the following facts from our Memorandum on the Calcutta Report for 1882-83:—"Referring to the work done by the sewage pumping engines, we stated that 'during a period of 15 months, up to 31st March 1883, there were raised on an average daily 15,514,836 gallons of sewage to a height of 8.78 feet to be discharged into the outfall. Now it appears that the total daily water-supply, filtered and unfiltered, amounted at the same time to 9,663,301, hence making no allowance for evaporation, which, however, is an important exit for water, the amount of sewage raised and discharged by pumping exceeded the total water-supply by 5,851,535 gallons, and to this extent the sewage system of Calcutta afforded daily relief to the low water-logged site it is built on.' Where sewage is pumped a large proportion of subsoil water enters the sewers and is pumped also. This must be beneficial, and should be extended.

23. Indeed, sewer systems may be, and have sometimes been, so constructed as to afford free ingress of subsoil water to the sewer, while the risk of escaping sewage has been provided against. Where

the subsoil is wet and has been built over, special drains may be laid as deep as practicable and the water removed by pumping. Sewers in wet subsoils, if water enters to a moderate extent, will work better in a tropical climate than a dry sewer in a dry subsoil. Centrifugal pumps will raise large volumes of water 10 or 15 feet at a very small cost.

So far as this subsoil water question is concerned, Madras supplies one of the best illustrations of its disastrous effects on the public health, while Calcutta has shown what the remedy is, and how to apply it.

We may further contrast the death-rates of the two cities as follows:—

	Death-rates per 1,000.	
	Epidemic Diseases.	Total Deaths.
Madras - - - - -	30	50
Calcutta - - - - -	18.2	30.5

24. It seems unnecessary to pursue the subject further; our object, as already stated, is not controversial. We desire simply to call attention to the facts in order that their importance may be recognized and suitable improvements adopted by the Madras authorities, for the practical result of past experience is that the sanitary improvement of this great city has still to be undertaken.

22nd June 1886.

H.S. & C.

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India Office,

London, 20th November 1884.

Statistics and Commerce,

No. 150.

To His Excellency The Most Honourable The Governor
General of India in Council.

MY LORD MARQUIS,

Para. 1. I forward for your information, 30* copies of a Memorandum by the Army Sanitary Commission on the Report of the Calcutta Municipality for 1882-83.

* 12 by mail; 18 by Parcels Post.

2. You will observe that the Army Sanitary Commission point out the inconvenience of the health statistics of the Municipality being made up for the financial instead of the calendar year. The reason of the alteration effected by Act I. (B. C.) of 1882 is explained in the Statement of Objects and Reasons appended to that Act. But the inconvenience of framing your health statistics for a different period from that universally adopted elsewhere would be so great that I cannot doubt that your Excellency will agree with me that arrangements should be made for furnishing the figures in all cases for the calendar year.

I have the honour to be,

My Lord Marquis,

Your Lordship's most obedient humble Servant,

(Signed) KIMBERLEY.

ENCLOSURE.

MEMORANDUM of the Army Sanitary Commission on the Administration Report of the Commissioners of the Town of Calcutta for 1882-83.

1. In the following paragraphs we shall first give some account of the public health in Calcutta during the year 1882, and the first point which appears to require notice is the opening paragraph of the Health Officer's Report, which states that, "in accordance with the provisions of Act I. (B. C.) of 1882, annual reports will for the future be prepared for the "official year (ending 31st March) in place of the calendar year as "heretofore." This change in a current system of health statistics which prevails in all civilized states, and which, moreover, is in contradiction with the principles of statistical uniformity aimed at by the London International Statistical Congress cannot be otherwise than matter of regret. Annual statistics of this class have to deal with scientific points alone, and have no relation to official convenience.

The year ending 31st March cannot be accepted as giving a true account of the public health and its relations to other elements unless the whole of these elements were recalculated on this basis. In the present state of the law the best course apparently to take would be to have two sets of figures, one for the calendar year, the other for the official year, and to print both.

2. The present year's report gives the figures for 1882 with a supplement for the first quarter of 1883, from the 31st March of which the statistics will be reckoned hereafter. These remarks apply to all the health statistics of India, and we have introduced them partly for the purpose of pointing out the injury which would arise from the Calcutta example being followed elsewhere.

3. The following table gives the population of Calcutta according to race for the 12 months of 1882 :—

Race.	Population.		
	Males.	Females.	Total.
Non-Asiatics - - -	9,193	4,658	13,851
Mixed races - - -	4,515	4,389	8,904
Hindoos - - -	180,084	98,678	278,762
Mahomedans - - -	90,667	33,763	124,430
Other classes - - -	4,358	2,914	7,272
Total - - -	288,817	144,402	433,219

This table presents the usual anomaly of the male population being double that of females, showing apparently that many families live beyond municipal limits, while the husbands lodge in Calcutta for convenience of work. But the discrepancies between the sexes are partly due to the fact that, in the preceding totals are included 3,002 males against 346 females in Fort William, and 28,037 males against 163 females in the Port population.

If both be deducted the population of Calcutta registering sections will be :—

Males - - -	-	-	257,778
Females - - -	-	-	143,893
Total - - -	-	-	401,671

4. Among this population, the births registered in 1882 amounted to 7,505 or 17·3 per 1,000, and the deaths to 13,177 or 30·4 per 1,000, against 29·3 per 1,000 which was the previous 10 years' average.

This comparison is not a satisfactory one, but, even high as the rate is after the sanitary work which has been carried out, there is nevertheless abundant proof of the saving of life within the precincts of municipal Calcutta, by comparing its death-rate with the rate which prevailed in 1882 among above 250,000 people in the suburbs beyond the influence of sanitary work. The deaths in the suburbs were 10,470 or 41·6 per 1,000, and this ratio showed a great reduction, chiefly in fevers, bowel complaints, and other causes, over the previous five years' suburban average which was 53·8 per 1,000. Notwithstanding the higher town rate of 1882, it also showed a reduction over the previous five years' average, which was 31·3 per 1,000.

During the last year or two there have, we believe, been some improvements in bustees, water-supply, &c., in hand by the suburban authorities, which may have been of service, but we have no means of knowing the facts.

5. The next abstract gives the death causes within municipal Calcutta, under the customary headings, for 1882 and 1881.

Death causes.	Total Deaths.	
	1882.	1881.
Cholera - - - - -	2,240	1,693
Small-pox - - - - -	17	133
Fevers - - - - -	3,618	3,765
Bowel complaints - - - - -	1,454	1,491
Injuries - - - - -	236	5,948
All other causes - - - - -	5,612	
All causes - - - - -	13,177	13,030

There were 147 more deaths in 1882 than in 1881, partly accounted for by reductions as well as by augmentations. If we take the so-called zymotic diseases we find in 1882 an increase of 547 cholera deaths, but a decrease of 116 deaths from small-pox, 147 from fevers, and 47 from bowel complaints. The decrease in these diseases was 310, against an increase of 547 from cholera.

There was an increase of 100 deaths under all other causes. We are thus brought to augmentation of cholera as the real cause in the rise of Calcutta death-rate, for if the cholera rate had been the same in both years the death-rate of 1882 would have been a shade lower than that of 1881. We can go a step further in this analysis by comparing the cholera death-rates for the last five years in municipal and suburban Calcutta, which have stood as follow:—

Years.	Cholera Deaths per 1,000.	
	Calcutta.	Suburbs.
1878 - - - - -	3·0	9·3
1879 - - - - -	2·7	7·4
1880 - - - - -	1·8	3·8
1881 - - - - -	3·9	7·4
1882 - - - - -	5·1	9·3

This table affords evidence that both in the improved and unimproved areas the cholera mortality is determined by epidemic intensity as well as by local sanitary condition. But the influence of local causes on the mortality is strikingly shown at the same time by contrasting

the annual rates of improved municipal Calcutta with the rates of the unimproved suburbs, and the practical lesson taught by the facts is that, whatever may be the intensity of a cholera invasion, the loss of life from it is greatly augmented by bad sanitary condition.

6. In our Memorandum on the Calcutta Report of 1881 we dwelt strongly on imperfect cleansing as a probable cause of increasing cholera mortality shown in the preceding table, but since that date there has been a great epidemic of cholera in Lower Bengal; in other words, there was in 1882 a notable increase of epidemic intensity, and municipal Calcutta showed the highest cholera death-rate of many past years.

The Officer of Health has shown that this increase included in it rural districts around Calcutta, and there is hence every reason to believe that the same lethal influence permeated the city and suburbs, and that their respective death-rates from cholera showed the results of their comparative insanitary conditions. The whole argument from the cholera of 1882 results in no discouragement so far as sanitary works are concerned. On the contrary, their efficacy in lessening predisposition among the inhabitants of municipal Calcutta to cholera when it is over the country has been satisfactorily established, while the experience affords every encouragement for pressing forwards every required improvement, and, as we formerly stated, the most important work, under present circumstances, is rigid attention to cleansing and keeping clean, and the speedy provision of wholesome water for the whole bustee population.

7. As the year 1882 was an epidemic year, it may be useful to give a tabular comparison between the chief climatic elements and the monthly cholera deaths as follows:—

Months.	Mean Temperature.	Temperature Range.	Humidity.	Rainfall.	Deaths from Cholera.
January - - - - -	67·3	22·5	73	Inches. 0·13	129
February - - - - -	70·2	22·8	69	0·42	111
March - - - - -	80·0	23·2	67	0·52	170
April - - - - -	83·4	21·5	67	0·25	318
May - - - - -	83·4	19·3	71	6·05	380
June - - - - -	83·8	12·2	84	9·99	254
July - - - - -	82·8	10·1	86	11·76	54
August - - - - -	81·8	9·8	88	10·87	52
September - - - - -	82·5	10·2	86	10·50	38
October - - - - -	79·0	11·7	84	11·08	91
November - - - - -	73·1	14·2	75	1·61	232
December - - - - -	66·3	19·9	73	—	411
Mean, 1882 - - -	77·8	16·4	77	66·18	2,240
Mean of 24 years -	79·2	—	75	66·38*	1,341†

* Mean of 48 years.

† Mean of 10 years.

This abstract shows increase of cholera deaths with rising temperature and little rain; great reduction of cholera mortality with increase of rain; great increase of cholera with cessation of rain and increasing range accompanying reduction of temperature. The element of air humidity appears to exert little influence on cholera, the actual amount of which appears to be more connected with the rainfall than with any other element.

8. We shall next trace the distribution of epidemic death-rates in different districts of Calcutta, selecting for this purpose cholera and fever, as being of most importance.

Registering Sections.	Population.	Persons per acre	Deaths per 1,000.		
			Cholera.	Fever.	All Cases.
Shampookur - - -	25,487	78	6.1	8.8	35.9
Coomertooly - - -	25,682	129	7.3	6.6	29.2
Burtollah - - -	25,527	85	5.7	9.0	32.8
Sookia Street - - -	20,572	89	5.8	8.5	35.4
Jorabagan - - -	36,318	148	7.2	8.3	33.3
Jorasanko - - -	32,824	131	6.1	9.0	37.1
Burra Bazaar - - -	20,769	100	6.8	10.5	33.1
Colootollah - - -	47,323	208	5.1	10.1	32.0
Moocheepara - - -	39,241	148	3.8	8.0	30.0
Bow Bazaar - - -	21,627	150	3.3	8.5	31.1
Puddopookur - - -	20,516	124	4.3	8.1	30.5
Waterloo Street - - -	5,785	28	3.9	5.1	17.6
Fenwick Bazaar - - -	26,051	137	4.7	8.0	25.4
Taltollah - - -	26,063	125	3.2	9.8	33.7
Collinga - - -	11,840	70	4.2	10.3	33.2
Park Street - - -	4,968	26	2.0	5.6	16.7
Bamun Bustee - - -	6,125	36	2.2	14.2	31.8
Hastings Street - - -	4,953	87	6.0	13.7	40.9
Total - - -	401,671	107	5.2	8.8	32.0
Fort William - - -	3,348	—	2.6	3.8	48.5
Port of Calcutta - - -	28,200	—	4.1	1.1	15.0
Grand Total - - -	433,219	—	5.1	8.3	30.4

This abstract connects the death-rates with one element only, namely, crowding on the surface, but in some of the least crowded districts the population is of a better class than it is in the crowded areas, and, besides this, the condition of the subsoil and general sanitary state must be considered in estimating the influence of surface crowding.

Some of the densities are, no doubt, high, such, for example, as Colootollah, containing a population of 133,120 to the square mile, which is, nevertheless, below some home averages. All the district death-rates from all causes are high, except those for Park and Waterloo Streets. With the exception of five districts which had fever-rates at and above 10 per 1,000, none of the fever-rates can be considered high for India, especially for a town population.

9. The general localizing causes of cholera in Calcutta have been so often discussed that it is unnecessary to do more in the present Memorandum than to quote the result of special instances where inquiry was made by the Officer of Health in 1882. He states as the year's experience, that "In all cases in which the disease presented any tendency to grouping, special investigation was made, and in every instance in which several cases had occurred in a house or village, or within circumscribed limits, glaring insanitary defects were discovered,—a foul tank, obstructed drainage, fetid ditches, ill-kept byres, offensive latrines, and so forth. Numerous cases might be detailed in support of this statement, but the conclusion forced upon me by all that I have seen of cholera since I became Health Officer of Calcutta is that the disease flourishes in places and among communities where cleanliness is neglected, and filth of all kinds allowed to lodge and fester in various ways and under various circumstances."

10. *Fevers.*—The fever death-rate in Calcutta appears to be undergoing gradual reduction, as may be inferred from the following number of deaths registered in 11 successive years.

Years.	Registered Fever Deaths.	Years.	Registered Fever Deaths.
1872 - - -	4,895	1878 - - -	6,086
1873 - - -	4,632	1879 - - -	4,796
1874 - - -	4,461	1880 - - -	3,797
1875 - - -	5,328	1881 - - -	3,765
1876 - - -	4,361	1882 - - -	3,618
1877 - - -	5,151		

This abstract includes the augmented fever mortality for the scarcity years 1877–78, but the general result is satisfactory and shows the benefit of improving the condition of the subsoil of towns by under drainage. The fever death-rate in Calcutta, including districts undrained or only partially drained, was 8.8 per 1,000 or about one half of the rate for undrained suburban Calcutta, which was 16.7 per 1,000. It is now fully admitted that the prevalence of paroxysmal fevers, which are the main causes of Indian death-rates, is chiefly due to undrained subsoil in connection with general neglect of house hygiene.

The Officer of Health had continued his inquiries into the alleged occurrence of enteric fever deaths among the Native population of Calcutta, with the result stated, "that it is quite certain that enteric fever is a rare disease in Calcutta."

11. *Small-pox and Vaccination.*—There were only 17 small-pox deaths in 1882, but safety cannot be inferred from this small mortality as the law of prevalence of small-pox in Calcutta is that of severe recurring epidemics, with almost complete disappearance of the disease in the intervals. During the year 1882, there were 7,802 vaccinations and revaccinations performed, or above one thousand more than during the preceding year. It is worthy of remark that, while the small-pox death-rate was 0.04 per 1,000 in municipal Calcutta, it was 0.09 per 1,000 in the suburbs. In the same way, the death-rate from bowel complaints which was below the average, notwithstanding the prevailing cholera epidemic, ruled at 3.5 per 1,000 in Calcutta against 5.1 in the suburbs. As the people are the same and are really part of the same community, the argument appears to lead to the conclusion that the municipal authorities in Calcutta have done good work, and it is very much to be desired that their example may be followed outside their limits.

We shall next give a brief outline of the sanitary work in Calcutta proper in 1882 beginning with the—

12. *Water-supply.*—We may here repeat what has been said on former occasions, that the water-supply of Calcutta is pumped out of the Hoogly at a sufficient distance above the town to be unaffected by tidal influences. It is first passed into subsidence reservoirs, where it is aerated; it is next filtered and conveyed in a 42-inch main to the pumping station at Tallah where it is forced into the mains for supplying the town.

There is another pumping station at Wellington Square, where part of the water which has accumulated during the night is forced into the mains and thence distributed for use.

There is an unfiltered water-supply raised from the river near at hand, which is used solely for street watering, sewer flushing, and the like. It may be stated as matter of home experience that iron or steel water vans are best for street watering. With a strong horse, these vans might contain 450 gallons.

Portable flush tanks where there is a water-supply and street hydrants will be cheaper than fixed flush tanks for flushing tributary sewers or drains.

The filtered water only is supplied for domestic purposes. Its daily amount in 1882 was 7,824,576 gallons showing a satisfactory increase of 616,123 gallons, or in all about 18 gallons per head per diem for the municipal population. The total connections of premises with the water mains, up to 31st March 1883, amounted to 14,245, of which 859 were made during the preceding 15 months.

13. Calcutta appears to have an active staff of water inspectors, who made, during the 15 months, 28,773 house service inspections, on which they issued 3,083 notices of defects which were remedied in one way or other. Besides this house work the inspectors examined personally 538 stand posts, 50 ground hydrants, and 41 cattle troughs, and ordered the necessary repairs. The cost levied for water inside the town was Re. 1 for 1,500 gallons.

With the exception of a few bursts, the whole machinery appears to have worked well during the year. The supply drawn for use at Barrackpore was 48,393 gallons per day, from storage capable of supplying 120,000 gallons per day.

14. The amount of unfiltered water for cleansing purposes averaged 1,838,725 gallons per day, which is distributed from 994 ground hydrants. This unfiltered water has also been supplied to 23 premises, four for privies, six for business, one for a latrine, and 12 for building purposes. It is a very obvious recommendation to make, that house supplies of this kind should be so provided as to prevent the use of unfiltered water for drinking or cooking. The supply of unfiltered water was being extended.

15. The filtered supply is not sufficient for the wants of the population and further extension is under discussion. A needless question has been imported into the discussion, namely, the comparative advantages of open and closed conduits, because one of the axioms of water engineering is that water once filtered should not again be exposed to any risk of impurity before it is delivered to the consumer. The practical result has been that the Commissioners have decided to lay down a second 48-inch main, to supply 8,000,000 gallons per day additional to the town and 4,000,000 gallons per day to the suburbs. This, though a very considerable improvement, is of course far below the wants of a quarter of a million of suburban population.

16. The corporation analyst, Mr. Pedler, has given an instructive account of the filtered water-supply for 1882, from which it appears that the quality and filtration have both been improving, although the quality is subject to the influence of dry weather and rainfall, affording in this matter a kind of index to the influence of climate on tank and well waters generally.

During dry weather the solids, including chlorine compounds, are all notably increased until the rainy weather sets in to restore the balance. Perhaps the readiest way to show the quality of Calcutta water will be to place the average analyses of 1882 alongside the corresponding facts for London water as follows:—

	Calcutta Hydrant Water, 1882.	London Water Average, 1877.
Total solid impurity	16.91	31.00
Organic carbon	0.053	0.160
Organic nitrogen	0.035	0.024
Ammonia	—	—
Nitrogen (as nitrates and nitrites)	0.021	0.328
Total combined nitrogen	0.056	0.352
Chlorine	0.91	1.80
Total hardness	7.18	19.73

Out of 103 analyses made during the official year 1882-83, the water was colourless and transparent in 67. In 36 the filtration was imperfect, but all of these defects, except one, took place during a storm.

17. Although not part of his official report we may quote the following statement from a lecture "On the Sanitary Past, Present, and Future of Calcutta," delivered by Dr. McLeod, the Calcutta Officer of Health, on the 10th April 1884, at the Bethune Society. He says, "In quality the water is declared by chemical analyses to be of unquestionable purity, and Dr. Koch's microscopic researches recently confirmed the results of analyses." Unfortunately those who used this chemically and microscopically pure water did not all escape cholera, showing that this pestilence has other origins than bad water.

18. *Drainage.*—The Chairman of the Commissioners, in his interesting account of the year's drainage work, alludes to the opposition formerly raised to the drainage of Calcutta on purely theoretical grounds, the truth of which has been long disproved by the result. The entire main brick sewers of the original scheme and some more appear to be completed. These had a projected length of 33.78 miles. The actual lengths constructed are 39.21 miles. The length of pipe sewers laid down up to 31st March 1883 was about 113 miles out of 154 in the original scheme.

The secondary drainage work, namely, widening lanes and obliteration of offensive surface drains, and providing man holes, lamp holes, gully grates, &c., has been pushed forwards rapidly, so that during 1882 there were laid 476 feet of 15-inch sewer pipe, 1,714 feet of 12-inch, 11,354 feet of 9-inch, and 83,200 feet of 6-inch pipes, in all 18.32 miles, with the requisite man holes, lamp holes, &c.

The work for the first quarter of 1883 amounted to 2.35 miles of similar pipe sewers, so that the whole original scheme, with the exception of 15 miles of pipe sewers, has been completed. There are few municipalities which can show so much work in the time. House drainage has also been making progress. The demand for house connections depends on the street drainage, but in 1881-82 and the first quarter of 1883 there were 4,650 houses connected with the sewers. This work is done by authorized contractors under a staff of municipal inspectors. The drainage of bustees is also in hand.

19. The sewage is passed by gravitation to the pumping station, and during a period of 15 months up to 31st March 1883 there were raised, on an average, daily, 15,514,836 gallons of sewage to an average height of 8.78 feet, to be discharged into the outfall. Now it appears that the total daily water-supply, filtered and unfiltered, amounted at the same time to 9,663,301, hence, making no allowance for evaporation, which however is an important exit for water, the amount of sewage raised and discharged by pumping exceeded the total water-supply by 5,851,535 gallons, and to this extent the sewerage system of Calcutta afforded daily relief to the low water-logged site it is built on.

20. Works of drainage and water-supply being now in a sufficiently advanced state to enable house improvements to be undertaken, we are glad to see that the municipality is determined to grapple with the all important, though very difficult, question of *bustee improvement*, because it is in these foul places that the Calcutta epidemics have their origin. Without drainage and water the only remedy against this bustee property was simply clearance of the site, but now that the foundation has been laid many of them will no doubt admit of being improved in construction and in sanitary arrangements.

Up to the end of the official year 1883 there had been carried through the bustee districts 4,969,000 superficial feet of roads, and 19,684,000 superficial feet of ditch surfaces had been drained and converted into paths, making a total improved area of 24,653,000 feet, or 1,714 bigahs

Order thereon dated 28th September 1886 No 957 M. S. 1110

Referred for remarks to the President
Madras Municipal Commission whose
attention will be specially called to para 17
of the Memorandum. Paras 18 and 20 will
also be referred for remarks to the Acting
Sanitary Commissioner.

(True Extract)

Subd. Secy

Under Secretary.

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The President, Municipal Commission, Madras.

" " Sanitary Commissioner

Copy to the Public Works Department.

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