

Bombay Municipality

REPORT

BY

J. A. TURNER, M.B., D.P.H.,

EXECUTIVE HEALTH OFFICER,

ON

MALARIA IN BOMBAY

From 1901 to 1909.

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PUBLIC HEALTH DEPARTMENT,

MUNICIPAL OFFICES,

Bombay, 24th September 1909.

EXECUTIVE HEALTH OFFICER'S REPORT

ON

MALARIA IN BOMBAY FROM 1901—1909.

I put these notes forward with a view of showing what has been done in the City of Bombay with regard to Malaria during the past 8 years, the period that has elapsed since the Mosquito Malaria theory was accepted in 1900. I do not say that a great deal more could not have been done in the light of later knowledge; but I offer no excuse for not undertaking such work on the scale which mosquito enthusiasts demand without taking into consideration certain practical issues. The reasons that special campaigns were not undertaken were that other and more important duties claimed our attention. The incidence of Malaria in Bombay was not sufficient to warrant the enormous increase in expenditure. The finances of the City were being strained to the utmost in measures to control plague, cholera and small-pox and improve sanitation generally. These notes are no sort of apology for the Health Department nor for the Corporation of Bombay. They are the facts as they occurred and if the time has arrived when the pressure of work in Plague, &c., is less and more attention can be given to the prevention of Malaria in Bombay, the Corporation and its executive will be willing and able to carry out such work bearing in mind the practical difficulties to be overcome and with a due sense of the enormous work to be done in a City like Bombay.

The Malaria parasite was first discovered in the blood of human beings by Laveran in 1880. It was not, however, until 1900 that the theory of the transmission of the parasites by means of the mosquito was established and accepted due to the experiments carried out by Ross, Sir Patrick Manson, Sambon and Low and Dr. P. Manson and the experiments carried on in India, Italy and the London School of Tropical Medicine.

Ross's work is well known. His observations in 1895-1900 were confirmed by both English and Foreign observers and since then many others have worked, with more or less success, in elaborating the theory.

Sir Patrick Manson remarks "that the Mosquito Malaria theory has now, therefore, passed from the region of conjecture to that of fact." From 1900, therefore, we may say that the scientific knowledge thus available has been used and measures based on that knowledge have been carried out in many parts of the world with more or less success.

In September 1901 a Committee of 11 members of the Corporation of Bombay was appointed to consider the measures necessary for the prevention of Malaria in the City. Thus Bombay was the first City in the world to make any attempts to combat Malaria on the then most recent knowledge.

Every day for the past 8 years every section of the City has been, to some extent, dealt with. Had this not been so, what would have been the position of Malaria in Bombay to-day can only be conjectured.

From the first the measures taken by the Health Department with regard to Malaria were part of the routine work of the Health Department always in the direction of improved sanitation, draining, levelling and filling in, cleaning of wells and tanks and sanitary measures as well as mosquito exterminating. No so-called campaign *per se* against Malaria has been undertaken for this reason.

In 1901 the whole of plague measures were taken over by the Health Department. It was considered that Plague, Cholera and Small-pox should receive more attention than Malaria.

Table showing the number of attacks and deaths from Plague, Small-pox and Cholera from 1901 to 1908 :—

YEAR.	PLAGUE.		SMALL-POX.		CHOLERA.	
	Attacks.	Deaths.	Attacks.	Deaths.	Attacks.	Deaths.
1901	21,006	18,736	318	159	213	198
1902	16,423	13,820	576	288	85	75
1903	23,344	20,788	2,954	1,477	24	17
1904	15,488	13,538	1,338	568	290	219
1905	16,308	14,198	3,202	2,161	29	26
1906	12,323	10,823	511	276	1,484	1,241
1907	7,353	6,389	211	86	524	439
1908	6,134	5,361	1,859	1,026	122	95
Total ...	118,379	103,653	10,969	6,041	2,771	2,310

In addition to this the ordinary work of Public Health Administration and conservancy of the city has also been carried out. Special Malaria campaigns on modern methods in other places have always been attempted by a special staff, generally a very highly paid one, and with a free hand as to expense and strong powers, in countries and places which were uninhabitable owing to Malaria and no large city has ever yet been dealt with in this way.

In 1905 the Corporation of Bombay asked the Government of Bombay to appoint a Committee to enquire into the prevalence and causation of Malarial and other fevers in Bombay. The Committee were comprised of the representatives of the Government Medical Service, Sanitary Service and Mosquito Experts, Members of the Corporation and Medical men and took a large amount of evidence from Medical and lay residents in Bombay and were provided with two special Officers of the Municipal Staff—Medical and Engineering—and the whole of the reports of the Health Department for the past 20 years. The Committee sat from 1906 to 1908 and issued a report and the following is an extract from that report :—

“We may premise the consideration of this part of our report by attempting to
 “arrive at some understanding of the expression ‘Malaria and other fevers’.
 “The term ‘fever’ is popularly used in India to denote a condition of ill-being
 “which is known by the modern medical practitioners to be produced in a

"number of diseases. At one time, however, the term 'fever' was held, in India at least, to be practically synonymous with the term 'Malaria.' But as medical knowledge has year by year progressed, various types of fever have been differentiated, so that now among the more advanced physicians, fever is regarded as a symptom of a disease rather than as a disease in itself. It thus comes about that the expression 'Malaria and other fevers' has a different significance for different persons, according as each is more or less *au fait* with the recent advances in the scientific study of disease. Unfortunately, however, even those medical men who are more anxious to be accurate in the names they apply to diseases are forced at times, on account of a defective nomenclature for tropical diseases, to erroneously classify, for the purposes of registration, a fever as Malarial, which may not in any way be connected with the presence of the Malaria parasite in the blood."

"The year 1900 marked the turning point in the health of the City, for from that year till 1907 the death-rate has fallen with slight fluctuations to 39.56 in 1907."

"If we compare the mean annual death-rate for the ten-year period before the advent of plague in 1896, *viz.*, the period 1886 to 1895, which had a mean annual death-rate of approximately 29, with the ten-year period after the advent of the plague, 1896 to 1905, which had a mean annual death-rate of nearly 65, we observe that the death-rate had more than doubled. It should, however, be remembered that within the latter period are embraced four years of scarcity and famine which were attended, as has already been remarked, by an enormous mortality from small-pox, cholera, dysentery and diarrhoea. Bearing this in mind and allowing a wide margin on this account, we are struck by the sudden and remarkable increase in the death-rate of the City coincidentally with the advent of the plague. *We are thus forced to the conclusion that the increased unhealthiness of the City must, in large part, be accounted for, by the presence of this disease.*"

"In seeking for confirmatory evidence for this conclusion, we may refer to the recorded deaths from plague and observe that out of 517,952 deaths from all causes, during the years 1896 to 1905, no less than 141,285 deaths have been recorded as deaths due to the plague. That is to say, that more than three-tenths of the total deaths during this period were attributed to this disease. It is well known, however, to those who have had the opportunity of studying the plague in the City that only a portion of the total deaths actually due to this disease are recorded as plague deaths. Many deaths which are really due to plague are registered under such terms as phthisis, fever, asthma and the like, in order that the friends of the deceased may avoid the inconveniences associated with anti-plague measures. We will not be making an over-estimate, we believe, if we state that during the first ten years of plague four-tenths of the total deaths within the City were due to the plague. Fortunately during the past two years, *viz.*, 1906 and 1907, there has been a marked diminution in the number of deaths from plague and the death-rate for these two years shows a steady improvement."

"In our opinion the importance and magnitude of this element (the plague) in the unhealthiness of the City, places all other diseases in the background and demands even greater attention than has of recent years been given to it."

Thus the incidence of Malarial fever up to 1908 in Bombay appears not to have been of sufficient importance to justify the Committee in recommending any extraordinary Malaria measures.

In the months of July to October 1908, however, about the time the report of this Committee was published, a wave of Malaria spread over India, including Bombay, and the following is a short history of the epidemic in the city.

During the year 1908, the month of October witnessed the highest mortality from fevers and registered 407 deaths; in June the lowest figure was recorded, *viz.*, 217, January to June were months of diminishing prevalence; and July to October of increasing prevalence; thereafter a decline is again visible.

The following is the mortality from fevers by years :—

Years,							Number of deaths from fevers,
1895	...	...	...	...	...	...	6,404
1896	...	...	...	...	...	...	8,776
1897	...	...	...	...	...	...	6,951
1898	...	...	...	...	...	...	4,114
1899	...	...	...	...	...	...	5,063
1900	...	...	...	...	...	...	7,928
1901	...	...	...	...	...	...	7,921
1902	...	...	...	...	...	...	4,518
1903	...	...	...	...	...	...	2,333
1904	...	...	...	...	...	...	2,416
1905	...	...	...	...	...	...	2,878
1906	...	...	...	...	...	...	4,882
1907	...	...	...	...	...	...	3,663
1908	...	...	...	...	...	...	3,403

The figures indicate a decreasing mortality since 1901; there is a further reduction in the number of deaths by 230 below that of the previous year.

Malaria.

During the third quarter of the year, a wave of Malaria, severer than usual, swept over India, and Bombay suffered in common with the rest. A and B wards suffered most, and in the former especially Fort North. Reports on the prevalence of Malaria and anti-malarial measures taken and suggested, with an enumeration of the various breeding places in the City of the malaria-bearing mosquitoes were, from time to time, submitted to the Commissioner and the Corporation. They were to the following effect :—

The importance of the disease in relation to its influence on the public health cannot be overestimated; it is not the death-rate that is appalling, the majority of cases are not immediately fatal, but the more or less permanent injury to the constitution resulting from neglect.

A careful examination of different localities in the City revealed several breeding places of mosquitoes :—

- I.—The New Dock Works :—Very frequent and extensive inspections of the works were made in company of the Port Trust Engineer and the Agent of the Dock Contractors : the measures comprised the cutting of all rank vegetation, the filling in of all pools where necessary and possible, and the frequent treatment of others with Pesterine by this Department ; the issue of prophylactic doses of Quinine to the workmen. The authorities co-operated with this Department and did everything that could be reasonably expected of them. Mosquito-breeding places and Anti-malarial measures.
- II.—The deep excavation at the western extremity of the New General Post Office Buildings ; letters were addressed to the Consulting Architect to Government who ordered the pool to be treated with kerosine twice weekly.
- III.—The compound of St. George's Hospital, owing to the presence of rank vegetation and accumulation of barrels, empty tins and iron basins. The Physician-in-charge was addressed with a view to the removal of these.
- IV.—The yards of the B. B. & C. I. and the G. I. P. Railways to the west and to the north-west of the hospital ; in the former there were two large old quarries full of stagnant water and the surroundings were overgrown with rank vegetation : in one of these, stable refuse was being deposited : this particular area being highly insanitary and a source of danger. In the latter yard two or three shallow pools of rain water were found to contain larvæ of the Anopheles mosquito. These were immediately treated with Pesterine by this Department and the Railway authorities were requested to fill them up and remove the rank grass.
- These places contributed largely to the Plague of mosquitoes in A Ward ; there are other large compounds in this and in every other Ward where old iron empty tins and barrels, disused chatties, garden tubs, and other receptacles are allowed to accumulate rain water and thus afford a breeding place for mosquitoes during the rainy season, more especially towards its close.
- V.—The extensive building operations in progress in different parts of the City ; these involve soil disturbances and afford ideal sites for water to collect. Anopheles larvæ in large quantities exist in such pools and also in tubs used for steeping brick.
- VI.—Innumerable private wells to be found inside the houses : these constitute a grave potential danger and much of the Malaria in Fort North was probably due to this.
- The remedy lies in filling up or permanently covering the wells proved to contain larvæ and the provision of a small hand-pump for raising water when required ; the cost would be negligible and the improvement in the health of the residents of the neighbourhood considerable.
- VII.—The large number of tanks and public wells in the different parts of the City (2,294 in all), many of which, on examination, were found to contain mosquito larvæ in large numbers.
- VIII.—Cisterns and storage tanks : these should be kept covered and where this is not the case, the owners are written to and requested to remedy the defect and meanwhile any larvæ found are destroyed.

- IX.—In various parts of the City, particularly in its outskirts, large areas of lowlying ground exist which in the monsoon become flooded and overgrown with rank vegetation, thus forming an ideal breeding ground. In process of time these will be rendered more healthy by the extension of the City; meanwhile these should be drained; failing drainage these areas should be filled, though the process would be very expensive to a private owner.
- X.—Many of the unlicensed stables in the City constitute a source of danger as they are not paved and drained, and the surroundings become a swamp in the monsoon and even in other seasons. The question is under consideration with a view to amend the existing bye-laws and make proposals for abolishing such places entirely
- XI.—The drains of the City, especially the storm-water drains, particularly about the close of the monsoon when short breaks occur. During the dry season also house and stable sullage finding entry into them breeds mosquitoes in various parts; the only way to obviate this is to permanently close up, as far as possible, all openings into the storm-water drains other than the regular catch-pits and close these latter by a tightly fitting and well secured cover during the dry season, and to disconnect any premises discharging sullage water into the storm-water drains.
- XII.—The Septic Tank Installation at Malabar Hill: here conditions have improved since the adoption of measures decided upon in consultation with the Drainage Engineer. The risk of a recurrence of the nuisance would be further lessened by the covering in of the storage beds so as to present an arched surface upwards and provide for free removal of rain-water.
- XIII.—The unpaved open spaces between rows of chawls; such areas are not dependent entirely on rainfall for their moisture; nahans and wells allowed to fall into disrepair furnish an ample supply. Until these rainsodden patches of ground covered with pools and in immediate proximity to overcrowded houses are paved and drained under the authority of bye-laws, the filth and damp cannot be eliminated from the surroundings of the poor.
- XIV.—Private lanes and streets in the City, many of which, during the monsoon, are practically impassable and several in the heart of the City resemble lakes. The sooner these are taken over by the Municipality, lighted and drained and kept in repair the better. There is no precedent for such a state of things in any collection of houses above the size of a village in Great Britain.
- XV.—The Reservoirs on Malabar Hill and in Mazagaon: both of these saturate the ground in the vicinity and afford countless breeding places. To use kerosine oil or Pesterine for such is wasteful and also ineffective. Much has been written in reports in the past and nothing fresh can or need be added.
- XVI.—The open half-channel rain water pipes under roofs; and junctions of two sloping roofs allowing water to collect.
- XVII.—Imperfectly cleansed open half-channel storm-water drains; especially in private premises they become choked with weeds and silt; the obvious remedy is to remove obstructions and permit water to flow freely.

The modern sanitarian is largely dependent on public support and interest in all measures affecting their health: these measures must of necessity be divided into public and private.

Private measures :—Private individuals can do much by seeing that no accumulation of water is allowed to remain in or near their houses by preventing waste and overflow of water, by seeing that all cisterns and tanks on their premises are properly covered; by cutting down rank vegetation where such exists, and in the case of gardens by seeing that no larvæ exist in the water tubs. In regard to wells a remedy has already been indicated. Many complaints regarding mosquitoes from private individuals have been found to be due to collections of water (containing larvæ) in old tins and chatties: small details of this sort are easily under the control of individuals. For those in a suitable financial position the use of a small mesh mosquito curtain would result in a reduction of the chances of infection.

The use of prophylactic doses of quinine cannot be too strongly urged. The Government have placed this remedy within the reach of all; and large employers of labour should be urged to press this measure.

The City is committed to large improvement schemes which must take many years to accomplish, and side by side must occur a corresponding improvement in the habits of the poor. This can only happen as the result of popular lectures and of the manifestation of personal interest in their welfare. The City owes much to those who under the auspices of the Sanitary Association are quietly yet surely disseminating elementary hygienic principles among the poorer classes, and it is to such measures in the long run that we must look if an improved standard of living is to be attained.

Public measures :—The Deputy Health Officers and Sanitary staff are well-acquainted with the various breeding places of mosquitoes, and diligent search is made by them in their respective wards. But these places are so many and so universal that, considering the varied duties of the Sanitary staff, only a portion of their time can be devoted to anti-malarial work. If mosquitoes are to be seriously combated, a determined and constant attack must be made on them and this can be done only by wholetime men.

There are also certain difficulties under which this Department has to work: first, we have no power to ourselves remove or remedy the hundred and one breeding places that exist in many compounds, etc. What is done is, a letter is addressed to those responsible requesting them to remove the source of nuisance, and meanwhile the larvæ found by us are destroyed and a constant watch is kept until the reforms demanded are complied with. Secondly, the wells in private houses can only be dealt with compulsorily through the Standing Committee. It is, however, a pleasure to record that many owners in the Fort area have voluntarily given permission to our staff to treat their wells with pesterine. This can only be a temporary measure, and a more permanent and effective method has already been described. Thirdly, the systematic treating of pools is a matter of considerable difficulty in the showery weather accompanying the conclusion of the monsoon, as the work done is liable to be nullified by a heavy fall of rain at a subsequent date. This cannot be obviated, however, as it would be impolitic to leave untreated a pool in which larvæ have been found. Fourthly, the extensive building operations going on in the City add considerably to the difficulties, but as far as possible all such places are dealt with. Fifthly, the unlicensed bullock stables already mentioned.

As a step in the direction of systematic campaigns, four gangs consisting of a Sub-Inspector and four men in each have been organised to deal with mosquito breeding areas.

Their work is supplementary to that of the Sanitary staff and the whole of their working day is devoted to this object. Diligent search is made for all breeding places and, when found, suitable measures are adopted as far as possible.

Pamphlets are distributed to house-holders describing the various precautions that should be taken to prevent the breeding of mosquitoes, and in all the Municipal Dispensaries the use of quinine as a prophylactic is urged; this is also urged on all those who write to us complaining of the prevalence of Malaria.

Four gangs are, however, quite insufficient for the whole City, but, under existing circumstances, it is impossible to augment the staff without further weakening the Conservancy Branch. A special anti-malarial staff of sufficient size under the immediate control of one of the Assistants to the Health Officer and under the general supervision of the Executive Health Officer is necessary. A special course of 2 or 3 lectures and demonstrations should be given to the Sub-Inspectors in charge of the gangs, in order to make them well conversant with the main varieties of mosquitoes and their breeding places. The cost is likely to be more than recovered in the saving of life and of loss of labour and in the lessening of the gradual undermining of the constitution of the inhabitants.

A continuous campaign on the lines indicated will not only lessen Malaria but will also remove other mosquito-borne diseases and contribute to the increased comfort of residents.

Our information of the cause of Malaria compared with our knowledge of the cause of other diseases is comparatively recent, and like many other discoveries hardly complete and somewhat variable, but working on the knowledge we have, a very large amount of work has been done in Bombay during the past 8 years.

The Corporation went keenly into the question of obtaining expert advice and ultimately asked Government to appoint a Committee and to depute an expert to consider the measures that should be adopted.

In January 1909, a Committee comprised of representatives of the Port Trust, Improvement Trust, Railways and Chamber of Commerce and Municipality was appointed and Capt. McKendrick, I. M. S., deputed as expert Malarialogist. Capt. McKendrick was recalled and later on Dr. Bentley was appointed and in August Dr. Bentley submitted his report which I include.

The Corporation appointed a Committee to consider the report in consultation with the Health Officer and the Commissioner. The Health Officer reported on the measures he proposed and the Committee resolved that these measures should be adopted for 6 months and the Corporation adopted this report. Subject to a few details there is nothing in Dr. Bentley's report which is new or has not already been said by this Department. He has however pointed out in very strong terms the necessity of applying very stringent measures to prevent the wells in private houses becoming the chief causes of the propagation of the *Anopheles Stephensi* and other mosquitoes and when he has completed his work in Bombay we shall no doubt have a very interesting and exhaustive report on the malariology of the City.

The question now is, are the measures suggested by the Health Officer sufficiently inclusive to combat the position as pointed out by Dr. Bentley—or will the Corporation undertake to adopt a campaign against Malaria on more extensive lines and appoint a special Officer, special department and special staff with power to spend and special acts to carry out the work as it is done in Panama, Ismailia, Hongkong, the Malay States and other places which are quoted as having been freed from Malaria.

Hongkong is the only City of any size where Malaria measures have been seriously attempted. The population of Hongkong is 336,488 or 1/3 that of Bombay. The measures taken are said to have reduced Malaria.

The latest figures available are those of the report of the Health Officer for 1908.

Average annual total number of deaths from Malaria.

1899 to 1903 (mean of 5 years) ...	...	480
1904 to 1908 (mean of 5 years) ...	...	422

Thus it will be seen there is a reduction of 58 or 8 per cent.

In Bombay the mean annual mortality for the past 5 years from Malaria is given in the Health Officer's report as 231. The mortality from all Fevers has been reduced from 7,600 the mean of the 5 years previous to 1902, to 3,500 the mean of the past 5 years 1904 to 1908, or a reduction by more than fifty per cent. From this it appears that some benefit has been derived from the measures adopted.

The public will naturally inquire what is being done and they will only judge by results. If the number of mosquitoes is noticeably reduced and the cases of Malaria diminished then nothing will be said. It will be taken for granted that something has been done.

Nothing but converting the Island into a water-less, well-less and perfectly drained and reclaimed condition can prevent the breeding of mosquitoes, and while pushing on with sanitary measures the Health Department will be improving the sanitation of the City and also reducing the breeding places for mosquitoes, and by augmenting the staff for malaria purposes it will be possible to deal energetically and systematically with such places as can be dealt with by such staff. Owners and occupiers of premises where mosquito nuisance occurs will be called upon to abate the nuisance and for that purpose, if necessary, will be served with a notice under Section 381 of the Municipal Act.

My opinion therefore is, that it is not necessary to create a special officer and special department. Bombay is not uninhabitable because of Malaria and in spite of all that can be done, for some time, periods of acute Malaria will prevail, as it must not be forgotten that thousands of people come to Bombay yearly from other malaria-infected parts of India and the population is a very shifting one.

Commissioner's letter forwarding Dr. Bentley's report.—Letter from the Commissioner, No. 12940, dated the 24th July 1909 :

"I have the honour to forward herewith for the information of the Corporation two reports on the subject of Malaria, Nos. 114 and 116, dated the 17th instant, submitted by Dr. Charles A. Bentley, M. B., D. P. H., the Officer appointed by Government to specially investigate the causes of Malaria in Bombay. It will be seen that special attention is drawn to the very dangerous condition of many of the wells situated inside houses in the Fort and to the necessity for a definite organization for mosquito destruction. These measures, it is suggested, should be carried out under the control of the Executive Health Officer. As considerable expenditure seems likely to be involved and the question of filling in or closing wells is one of great importance to the inhabitants of the Fort, I am of opinion, that it is desirable that a Committee of the Corporation should be specially appointed without delay to discuss in consultation with the Executive Health Officer and myself and report to the Corporation at an early date what action it is desirable that we should take."

Letter No. 114, dated 17th July 1909, from Dr. Charles A. Bentley, M. B., D. P. H., on Special Duty, Malaria Investigation Committee, Bombay, to the Municipal Commissioner for the City of Bombay :—

“ In accordance with the minutes of the Committee Meeting held on June 30th, 1909, I have the honour to submit for your consideration, the enclosed Memorandum dealing with Malaria in Bombay with especial reference to the steps which, in my opinion, should be undertaken by the Municipality with a view to mitigating the disease during the present season and eventually attempting its complete control.”

Memorandum.

The Investigation into the distribution of Malaria within the City of Bombay has shown the disease to be prevalent over a very large area.

In particular it appears to be present in a persistent form in—

Ward A—Lower Colaba and Middle Colaba.

South Fort.
North Fort.
Esplanade.

Ward B—Mandvi.

Chakla.
Umarkhadi.
Dongri.

Ward C—Market.

Dhobi Talao.
Fanaswadi.
Bhuleshwar.
Khara Talao.

Ward D—Walkeshwar (and to a less extent Chaupati).

Girgaum.

Ward E—Tardeo.

2nd Nagpada.
Byculla.
Tarwadi.
Mazagon.

It may be observed that it thus affects the most densely populated portion of the City involving an area with a population of over 650,000 people.

It is not suggested that other parts of the Island are Malaria free, for this is very far from being the case and there is evidence to show that cases of Malaria occur in practically every part of Bombay during certain times of the year, but it may be broadly stated that, in the abovementioned areas Malaria exists to such an extent as to give indications of its presence throughout the year.

The incidence of Malaria is especially marked along the whole of the east coast of the Island between Kasara Basin, Mazagon and the Sassoon Dock, Colaba, but it is also prevalent in the west coast where a centre occurs in Walkeshwar in an area below the Malabar Hill Reservoir.

Broadly speaking, severe Malaria may be said to exist over an area including :—

Mazagon—south of Gunpowder Road.

Tarwadi—south of Nesbit Road.

Dongri.

Umarkhadi.

Khara Talao.

Mandvi.

Chakla.

Market.

Dhobi Talao.

Esplanade.
North Fort.
South Fort.
Lower Colaba.
Portions of Walkeshwar.

The population of this area numbers over 375,000 persons or very nearly two-fifths of that resident upon the whole Island of Bombay, and out of this population the proportion actually suffering from Malaria must be very large.

A recent microscopical examination made by myself of specimens of blood taken from nearly 700 residents in North Fort and Esplanade Sections, a portion of the intensely malarious area has shown that 35 per cent. to over 50 per cent. of the adults are infected with Malaria parasites, while among children the rate may be even higher.

In one instance in a mixed community of adults and children the examination of 63 (46 adults and 17 children) showed that no less than 44 or nearly 70 per cent. were harbouring the infection.

A statement showing the admissions of Malaria among some 1,882 Bombay Police during 1908, kindly supplied to me by Dr. Powell, throws further light upon the morbidity caused by Malaria in Bombay.

Statement showing proportion of admission for fever from each district in the City of Bombay from 1st May 1908 to 31st April 1909.

	No of Police Sta- tioned.	No. of Admissions.	Admission per one thousand.
* Fort	825	440	1353.9
* Dockyard	81	287	3296.3
* Mandvi	77	140	1818.1
* Chakla	63	56	898.8
* Umarkhadi	70	38	542.6
* Dongri	45	29	644.4
* Market	72	51	708.3
* Dhobi Talao	81	102	1259.2
Bhuleshwar	69	24	326.2
Null Bazar... ..	76	22	289.4
Girgaum	33	22	666.6
* Walkeshwar	55	46	836.3
Mahalaxmi	45	17	377.7
Kandewadi	72	32	444.4
* Mazagon	51	56	1,098
Tarwadi	68	27	397
Kamatipura	58	15	253
Nagpada	38	7	212.12
Jacob Circle	43	21	488.4
Parol	54	36	666.6
Matunga	55	29	527.27
Mahim	81	23	296.3
Worli	72	19	263.8
* Water Police	96	110	1145.8
* Prince's Dock	112	81	2776.8
Total	1,828	1,941	1091.3

* 1,128—1459.2 per 1,000. This refers to Police engaged in the specially malarious areas.
N. B. —Office, Detective, Armed and Mounted Police are omitted owing to their residence being scattered.

These observations serve to give some idea of the amount of sickness produced by this disease within the City. As to the financial loss resulting directly and indirectly from this cause no estimate can be given, but there is little question that it must amount to many lakhs of rupees annually. Such loss is necessarily very greatly increased when Malaria becomes epidemic as it has done in Bombay recently.

But it must not be supposed that the disease was not present in considerable amount within the City previously. Enquiry shows that it has existed in certain parts of Bombay for many years and there is no likelihood of its dying out spontaneously. On the other hand, there appear to be grave reasons for believing that in the absence of organized measures for its suppression, the disease will persist, and may even extend and increase in intensity in certain localities from time to time; while so long as it remains unchecked the City will be exposed to the danger of epidemics similar to the one which has been witnessed during 1907-08.

Malaria presents in Bombay certain peculiarities both as regards distribution and propagation which are in marked contrast to generally recorded observations in other parts of India.

In this City Malaria, which is generally considered to be a disease of scattered rural districts and tracts of jungle and unopened country, may be found widely distributed through densely populated areas, such as Chakla, Umarkhadi and Khara Talao with populations of from 500 to over 600 persons per acre.

The explanation of this fact is given by a study of the habits of the mosquito which serves as the common carrier of the infection in this City.

For the species of Anopheles—*Nyssorhynchus Stephensi*, which serves to propagate Malaria within Bombay, is found to breed readily in wells, cisterns, tanks, tubs and in fact in almost any conceivable receptacle for water—natural or artificial—whereas in many places where other varieties of Anopheles are concerned—only natural breeding places such as streams, ponds, ditches and puddles are dangerous.

These facts have a considerable bearing upon the problem of Malaria prevention for Bombay, but it appears to me that organized and systematic mosquito destruction will afford a means of controlling the disease within definite limits, and provided it is carried out with due care, should reduce the liability to epidemic manifestations or even entirely prevent their occurrence.

It must not be supposed that the task of mosquito destruction to an extent sufficient to actually control Malaria will be an easy one. But given a proper staff and organization, adequate powers, and sufficient expenditure, I believe it will be quite possible to obtain the desired results.

I wish to make it clear from the outset that in my opinion in order to deal with the matter effectively it will be necessary to create a Special Department engaged solely in mosquito destruction, and working under the control of the Executive Health Officer.

Such a Department must be a permanent one and must possess a small regular staff of skilled men whose sole duty all the year round must be anti-mosquito work. In addition arrangements must be made for increasing the staff by the addition of unskilled men during the period between the outset of the rains and the complete establishment of the dry season.

In this short Memorandum it is impossible to go into details which will require careful discussion. But I would suggest as a tentative measure that steps be taken to organize such a Department for immediate work in Wards A and B and possibly Walkeshwar with a

view to subsequently extending operations over the whole southern portion of the City south of a line drawn between Kasara Basin, Mazagon and Mahaluxmi Battery, and possibly in other parts of the Island.

Briefly I would suggest that the area in which operations are to be commenced should be divided into sections of a size to allow of each being inspected thoroughly by a responsible officer at weekly intervals.

Each one of these sections must be sub-divided and put in charge of a trained muddam who must control one to three or four men.

Large sized plans must be prepared of each section and sub-section, wherein all possible breeding places must be plainly marked and every place in which mosquito larvæ have been found must be indicated.

In addition, section and sub-section registers must be drawn up of every potential breeding place for mosquitoes and a diary or journal must be kept by each Inspector recording his visit to each sub-section and the result of his inspection.

The whole staff must be made clearly to understand that their sole duty is to prevent mosquitoes breeding within the area under their charge. Reports must be made at stated intervals to the Executive Health Officer or the Officer specially deputed to control the Department. Failure to prevent the breeding of mosquitoes must be at once reported to head-quarters. Failure to prevent mosquitoes breeding or to report such failure and its reasons should entail liability to dismissal.

It will be clear that the areas under the control of each Inspector must not be made too large or there will be inadequate supervision which will result in certain failure.

Further it must be pointed out that the whole question of mosquito destruction in a City such as Bombay presents a problem for the solution of which little assistance can be gained from examples of such work elsewhere.

General principles only can be laid down to guide us in framing a workable scheme, and actual experiment in a limited area must be undertaken to determine the minimum staff necessary, the powers of control required and the probable expenditure that will be involved in order to attain success. It is for these reasons that I suggest that steps should be taken for the organization of a Special Department to work in a limited area in A and B Wards in connection with similar work to be carried out by the Port Trust and Railway Authorities.

We must not lose sight of the fact that mosquito destruction must be carried on indefinitely, although there is little question but that it will become easier year by year.

In this connection it must be mentioned that the question of wells, public and private, has a special importance. In the North Fort, at Mazagon and at Colaba unguarded wells form the breeding places of large numbers of *Nyssorhynchus Stephensi* and unless adequate control of wells can be ensured it will be impossible to effectually carry out any measure of mosquito destruction with hope of success.

I am preparing a special report dealing with this question which I shall forward separately.

I am also preparing a report upon the question of "quinine" which I shall hope to submit shortly.

Letter No. 116, dated the 17th July 1909, from Dr. Charles A. Bentley, M.B., D.P.H., on Special Duty, Malaria Investigation Committee, Bombay, to the Municipal Commissioner for the City of Bombay, *re* State of Wells private and public, within the area of Fort North:—

In accordance with the minutes of the Committee Meeting held on the 30th June 1909, I have the honour to draw your attention to the dangerous state of the wells, private and public within the area of the Fort North.

A careful examination has been made of 511 wells within this section with the following result:—

1. 240 have been found to contain very numerous larvæ of Anopheles Mosquitoes.
2. 32 of these contain larvæ of Culex or Stegomyia in addition.
3. A total of 83 wells have been found to contain larvæ of either Culex or Stegomyia Mosquitoes.

It is stated by a large proportion of householders that many of these wells are unused. In a few cases wells have been discovered whose existence was unknown to the present occupiers of the houses in which they were situated.

Many occupants of houses with mosquito-infected wells complained of being troubled with mosquitoes, but few, if any, appeared to know that the source of their trouble was the open or improperly guarded well in the house itself. A certain proportion of wells are provided with wooden covers but many of such covers are useless and in other cases there is evidence that they are frequently left open. A few wells have been found blocked up and in certain cases, particularly in the neighbourhood of Frere Road, wells have been treated recently with Pesterine and are free from mosquito larvæ.

Species of Mosquitoes breeding in the wells.

Among the 240 wells infested by the larvæ of Anopheles nearly every one is found to be the breeding place of Nyssorhynchus Stephensi, a most dangerous carrier of Malaria.

The few exceptions show the presence of Mysomyia Rossi.

It has been shown experimentally that this species of Anopheles can be readily infected with Filaria and in all probability it is one of the agents in the propagation of Filarial Disease.

In the course of the present investigation adult mosquitoes of this species, that have been caught and examined in order to test the possibility of their serving as carriers of Malaria, have been found to be very heavily infected with Filarial Embryos.

In this connection it may be remarked that certain common species of Culex Mosquito are known to be also concerned in the transmission of Filarial Disease, and among the 83 wells which contain other than Anopheles larvæ Culex Mosquitoes of this kind are to be found breeding. A certain proportion of the wells contain the larvæ of Stegomyia Calopus (formerly known as Stegomyia) Fasciata the species of Mosquito concerned in the propagation of Yellow Fever in the Western Hemisphere.

Malaria in the Fort.

Enquiry shows that Malaria has been present in the North Fort Section for many years, while a reference to past history reveals the fact that for generations this portion of the City has suffered from the evil effects of "dangerous miasmata." It is certain that Anopheles

Mosquitoes must have existed in this part of Bombay for a very long time and it is probable that their distribution has been extended from time to time.

For mosquitoes can be conveyed long distances in covered vehicles, &c., and they may frequently be found taking shelter in shigrams and the hoods of victorias. It appears probable that among the many carriages of all kinds which daily visit and sometimes remain for hours within the busy-trading centre of Fort North, a large proportion carry away mosquitoes from the locality and in this way serve to transit them to other parts of the City. Dangerous mosquitoes of the same species as those breeding in such large numbers in the wells of the Fort can be found at Malabar Hill and in wells at Mazagon and Colaba, and exist in smaller numbers in many other parts of Bombay.

It is certain that so long as such large numbers are permitted to breed unchecked within the wells of the Fort, many of them will be carried thence to other localities and from time to time new centres of infection will thus be set up in places at present but little affected.

It appears probable that such an extension of the distribution of dangerous Anopheles Mosquitoes has been going on for very many years within Bombay, and that this condition of things has been one of the primary causes at work in bringing about the increased prevalence of Malaria which culminated in the recent epidemic manifestation of the disease.

At the present time Malaria is rife within the Fort, especially the North Section which contains so many wells.

A recent examination of 2,782 children resident in this locality revealed the fact that 40.9 per cent. were suffering from enlarged spleen. This compares very unfavourably with the result of an examination of 2,761 children in Wards F and G, among whom only 1.4 per cent. showed splenic enlargement.

A more recent microscopical examination of the blood of 170 persons resident in Fort North showed no less than 78 to be infected with Malaria parasites. The people examined included 57 adults and 113 children. Of the adults 28 were infected and of the children 49. Among the children a considerable number had been undergoing quinine treatment or the proportion of infections would undoubtedly have been much higher. It may be mentioned that for the purposes of this examination no selection of cases was made, blood films being taken from any persons who were willing.

These observations show that the present sanitary condition of North Fort, especially as regards the existence of such an extraordinary number of unguarded wells, is a menace to the health of the whole City. For the danger resulting from the continuous breeding of such large number of mosquitoes is not confined to residents in that locality only. There are many wells in other parts of the City at present free from mosquitoes, but sooner or later they will become infected if dangerous centres such as those in the North Fort are permitted to remain unchecked, and so long as this is the case the whole City must necessarily be exposed to the danger of recrudescences of epidemic Malaria.

In my opinion there should be no delay in taking adequate steps to control this danger.

All unused wells should be filled in as soon as possible. Those that are required for use should be provided with permanent covers suitably designed and arrangements made for raising the water by means of a hand pump. The depth of no well that I have seen would preclude the use of a simple suction pump.

It is probable that the most suitable form of covering would be a permanent cover of re-inforced concrete.

The cost of protecting these wells efficiently need not be great, while the benefit to the health of the residents in the locality will be enormous. Moreover, a constant source of danger to the whole of the City will have been removed.

It must be remarked that it will not be sufficient to protect the wells in which larvæ are at present breeding. There are probably millions of adult mosquitoes already existing in the Fort and as soon as their favourite breeding places are abolished, numbers of these will seek other suitable locations. This being the case it will certainly follow that any well in the neighbourhood to which they can obtain access if not already infected will speedily become so. In addition it is more than likely that a far larger proportion of wells actually harbour mosquito larvæ than has been shown in the course of the present inquiry, for unless they are present in very large numbers it is exceedingly difficult to dip them out with either a bucket or a net, and in many cases the water can be reached in no other way.

In my opinion a well which serves as a breeding place of mosquitoes should be declared a *dangerous nuisance* and a house which contains a well in which *Anopheles* Mosquitoes are allowed to breed should be declared *unfit for habitation*.

In conclusion I beg to point out that it is my belief that until steps have been taken to remedy the condition of the wells in Fort North, all other forms of anti-malarial sanitation within this area will be rendered futile and moreover the continued existence of numerous uncontrolled breeding places of *Anopheles* in this locality will tend to annul efforts at mosquito destruction in adjoining areas.

Health Officer's Suggestions on Dr. Bentley's Report.

Memorandum from the Commissioner, No. 17413, dated the 24th August 1909—
Forwarding the Executive Health Officer's report No. 18322, dated the 23rd August 1909, regarding the measures taken by the Health Department against the spread of Malaria in the City as follows :—

"I have the honour to state that the measures taken by this Department against the spread of Malaria have been :—

1. To examine wells in and out of houses, collect samples and use pesterine wherever practicable. A weekly report of wells examined with result and whether pesterined or not is sent to the Executive Health Officer.
2. All storm water entrances, all gully traps and catchpits and any collections of water on the road are pesterined during the break in the rains and weekly reports of this work are also sent.
3. A special officer is detailed in each Ward to inspect compounds and storage tanks over water-closets and other tanks in houses and report, if necessary, daily. A systematic inspection is made taking each locality at a time.

To do this work on a larger scale, a special staff has to be organised. The men should be specially chosen and should be engaged solely in Anti-Malarial work, the whole of the working day being devoted to this purpose.

The staff will be trained in the life-history and habits of the various species of mosquitoes. This Anti-Malarial staff should be employed throughout the year as, quite apart from pools occasioned by the rainfall, many breeding places exist. Their work is to be supplementary to that of the ordinary Sanitary staff and not in lieu thereof.

This special staff will be divided into a definite number of gangs and one or more such gangs will be allocated to each ward of the City according to requirements. It will be under the immediate supervision of one of the Assistants to the Health Officer (acting under the

Health Officer's orders) and the Inspector in charge of each gang should forward direct to Head Office, at the close of each working day, a brief record of the places visited by him during the day.

Proposed Special Staff and Estimated Cost.

	Yearly.
10 Sub-Inspectors @ Rs. 40 per mensem ...	Rs. 4,800
10 Gangs of 5 men in each gang, each man to receive Rs. 11-1-18, 50 × 12 = 600 × 12 =	... .. „ 7,200
Yearly total cost, Rs. 12,000	

Administration.

The system on which these gangs should work must be arranged at the Head Office by the Executive Health Officer and special care must be paid to see that the work is done in a definite systematic manner, so as to prevent overlapping and omissions. This can only be done by defining for each gang its sphere of operations.

Details of the nature of the work to be done by these gangs will be decided by the Executive Health Officer.

Scope of the Work.

The measures suggested by me are preventive and curative and not merely scientific investigations into species of *Anopheles* mosquito.

It would be easy and much more practical if the measures adopted are directed towards cleaning away all possible mosquito breeding places which means a general improvement in the sanitary condition of the City. This statement is not a new one as it emanated from this Department early in 1901, and every year since, the Health Department has not only been advocating measures but have been actively carrying them out.

In order to ascertain the sickness index in any one or all parts of the City, inquiries are made by the District Registrars at all dispensaries and hospitals, schools, factories and railway docks and other places where large number of people congregate. This must be supplemented by a physical examination of the person and a bacteriological examination of the blood and a free distribution of quinine.

Samples of blood and variety of mosquitoes and larvæ are daily examined in the Laboratory.

Side by side with this work action will have to be taken to fill up, drain or otherwise deal with places where water accumulates and where mosquitoes breed. Letters will be written to owners or occupiers that action will be taken against them if they fail to comply with the first notice. The working staff will be empowered to visit all the places where it is expected such accumulation exists. They will treat with pesterine or kerosine all places which can be so treated.

The Sub-Inspector of each gang will, through his immediate superior officer, serve such notices on the owner or occupiers.

For example, such places as drains, sewers, tanks, wells as are vested in the Municipality will be dealt with at Municipal expenses. Such places as are vested in the control of the Railways will be dealt with by serving a notice on the owner or occupier and in default action will be taken before the Presidency Magistrate. Places in control of Government, viz., E. G. Hospital, J. J. Hospital, all Government buildings and compounds will be dealt with by Government and notices will be served on the Officers in charge in the same way as any other authority.

The Port Trust and the New Docks, the Improvement Trust and the owners of large open spaces will be treated in the same way.

Mills, factories, stables will be examined and notices served on their owners and action taken in default. Private houses containing wells and private stables and godowns will all be visited and letters written, pointing out that the wells are a danger and must be covered in. Quinine should be freely supplied by the employers of labour, Municipal Dispensaries and Hospitals and instructions in the Vernacular and English freely circulated. These are the measures suggested by me and which have with the exception of a special staff and legal action been taken for the past seven years.

To control severe epidemic of diseases it is always necessary to augment the staff and spend money, and as Malaria is prevalent in Bombay as well as the rest of India, it is necessary to augment that staff on the lines I suggest. This deals with the question only so far as it includes investigation and temporary remedies.

The work and the expenses in connection with getting rid of all collections of water in the Island of Bombay cannot be estimated.

We cannot foresee what this will lead to considering the effect climatic condition has on Malaria in Bombay.

It is now found necessary to close up all storm water entrances as soon as the rains are over and open them in June to prevent mosquito breeding. There are about 6,000 of the above which require covering, and to do this properly will cost Rs. 90,000. The leaking and defective hydrants and the leakage from Malabar Hill and Bhandarwada Reservoirs and the cost in connection therewith need not be repeated here.

To properly drain and fill in the undrained parts of the City so that no low-lying land remains even after the rains although absolutely necessary in any scheme for exterminating Malaria will naturally require time and a large expenditure of money.

This is routine work which any sanitary authority can undertake provided powers to carry out the measures and money to pay for them are provided. This deals only with the breeding places of mosquitoes. The other and equally important factors are the presence of children and adults who are already suffering from latent Malaria and who provide the focus or infection of others in their neighbourhood and their treatment with quinine. Assuming that the measures advocated for exterminating the mosquitoes are temporarily successful it cannot be hoped that all Malaria bearing mosquitoes will disappear, unless the measures are continued from year to year. The poorer people of Bombay have been for years exposed to malarial condition rendering them all more or less malarial subjects capable of spreading the disease. Thousands come to Bombay yearly from other malarial districts. We cannot expect these people very rapidly to assimilate the reasons for exterminating mosquitoes, nor for altering their customs and habits so as to use mosquito curtains and take quinine regularly or not to allow accumulation of water in their gardens or houses—but much can be done by giving quinine if it can be guaranteed that the quinine will be taken. Assuming that 500,000 people are treated with quinine for 6 months, each receiving 10 grains of quinine per week, the cost of quinine alone will be over Rs. 2,00,000 per annum. It should not be forgotten that Bombay has a very large and mixed population whose ideas do not always coincide with our sanitary advice and cannot be compared with any other places where measures are said to have been successful, where the population is very small, where the facilities for work are so much greater and where the people are willing and anxious to co-operate. To be successful in coping with the human factor the people must be instructed so that they can protect themselves."

REPORT ON THE MEASURES TAKEN
BY THE
HEALTH DEPARTMENT TO LESSEN MALARIA
FROM THE YEAR 1901 TO DATE.

On 9th September 1901, a Committee of 11 Members of the Corporation was appointed to report on :—

- (1) The presence of anopheles larvæ in the Gowalia Tank.
- (2) To prepare and submit to the Corporation a list of tanks, etc., in the City, where such larvæ were found.
- (3) To report on the practicability of keeping such tanks, etc., free from the larvæ and the measures they would recommend for this purpose. The Committee were asked to work in consultation with the Executive Health Officer.

On 7th October 1901, the Committee requested the Municipal Commissioner to ask the Executive Health Officer and the Divisional Health Officers to—

- (1) Supplement the list of places where anopheles larvæ are found—from their own knowledge and also by examining a few wells in private houses in every district and the pools formed by waste water round about the wells, especially in places where Malaria is prevalent; a few gully traps, and a few storm water drains not having a free flow, and,
- (2) To report as to what in their opinion is the best method of destroying anopheles.

On 19th December 1901, the Executive Health Officer submitted the following report to the Commissioner :—

“With reference to your Nos. 16884 and 18925 of the 21st September and 11th October 1901, respectively, I have the honour to forward the subjoined report on the presence of anopheles larvæ. In this connection I would mention that the Divisional Health Officers have for some time past been devoting their attention to the presence of larvæ in various parts of the City and are able to supplement the places where larvæ have been found by many other places.

It will be seen from the summary of the Divisional Health Officers' reports which I append that their investigations practically extend all over the City.

The chief specimens of anopheles mosquitoes found in Bombay are :—

Anopheles Rossei, Barbarosei, Jamesei, Culicifacias, Stephensei, Listonii.

Of these the anopheles Culicifacias and Listonii are the only malarial-bearing mosquitoes known here at present.

The anopheles larvæ are found where water collects for any time. In large collections of water or large open tanks, the presence of larvæ has been detected—but only in small numbers and these chiefly in the dry weather when more shallow pools are dried up; in a few wells inside houses, and in puddles on the roadside, and wherever small quantities of water collect, in roadside ditches where there is very little fall, the presence of a small quantity of sewage or polluted water does not appear to be inimicable to the larvæ and they have been found on the foreshore of Nepean Sea Road in water which is actually salt.

That the anopheles larvæ are ubiquitous must be accepted and that a small puddle of water in the compound of a house is more dangerous than a tank or swamp half a mile away.

I advise the Committee therefore that the best known means of preventing the breeding of anopheles is to drain all marshy and low-lying land by providing surface drainage with a sufficient fall to keep the water running freely—to drain and fill in all places where water collects and remains for any time; that when the land cannot be so drained and filled in—the only means for destroying the larvæ is by introducing some larvicide as kerosine, tar, or any of the substances known in the market—as Anophelecidum—a hydro-carbon compound which is now being used.

The Divisional Health Officers have anticipated the report of the Committee and have for some time been taking steps to destroy larvæ in their respective districts and have instructed their Inspectors in the methods to be observed and the reason for doing so.

The Committee can however strengthen the hands of the Health Department by recommending to the Corporation the necessity for keeping all existing tanks well supplied with fish and by draining and filling in all lands where water collects and making all roadside open drains of sufficient fall with smooth impervious sides.

The fact that a species of anopheles mosquito is the vehicle which conveys Malaria is now widely known, but any attempt made to permanently destroy the larvæ will be futile until the public generally recognise that the anopheles mosquito cannot breed without water and they are educated to appreciate the fact that malarial fevers are the cause of most of the sickness in the City, that mosquitoes hate light and air and love darkness and damp. The aim then should be to get rid of the possible breeding places and to take such steps as are necessary to prevent the collection of water near houses.

Summary of Divisional Health Officers' reports on breeding places of anopheles larvæ:—

- (1) Various public fountains.
- (2) Marshy ground at Pilot Bunder, Chowpaty and Wari Bunder.
- (3) Various public tanks and wells.
- (4) The countless pools found throughout the Island.
- (5) Certain storm water drains.
- (6) Certain quarry holes.
- (7) Pools in rice-fields at Matunga.
- (8) Trenches by the sides of the Railway embankments.

On 6th March 1902, the Corporation at their Ordinary Monthly Meeting resolved—

That the report dated 4th February 1902 of the majority of the Committee appointed by Corporation Resolution No. 7232, dated 9th September 1901, to suggest measures for keeping the tanks, etc., of the City free from anopheles larvæ be approved and adopted and a copy be forwarded to the Commissioner with the request that he will take action as suggested by the Committee.

The Report of the Committee stated that anopheles larvæ had been found in every part of the City and in a great variety of situations and only to a limited extent in banks and wells, but abundantly in fountains, in pools formed by leakage from reservoirs, stand-pipes and water taps, etc.; that, as the six species of anopheles mentioned, are all very much alike in outward appearance, it was not practicable to discriminate between them in carrying out measures for their destruction, and that though the distinction between the two main varieties of mosquitoes, *viz.*, anopheles and culices is marked—yet the Committee thought that it would be better if the Officers of the Corporation did not restrict their efforts to ano-

phales, but rather aim at the destruction of all mosquito larvæ as, although culices have not been shewn to convey Malaria, yet they might convey other diseases and, moreover, the annoyance and irritation caused by them might not be without effect on the health of the people. The Committee further stated that they recognised the importance of securing the co-operation of the public if any success is to attend the operations of the Municipality.

For practical purposes the Committee divided the breeding places into two classes, *viz.*, (a) those which are permanent and (b) those which are formed by rain during the monsoon season only.

With respect to class (a), they recommended that vigorous action be taken at once; that all wells, fountains and tanks which it is desirable to retain should be cleaned up if necessary, and stocked with fish; others should be drained or filled up. In some cases (*e. g.*, wells within houses, cisterns and storage tanks,) the water should be protected by wire gauze or perforated metal sheets; that collections of water round stand pipes, hydrants, or storage tanks and also those formed by leakage from the reservoirs be dealt with by surface drainage. These and also gully traps found to contain larvæ might be treated with kerosine oil or tar once a week.

Places where anopheles larvæ are found in private premises should be dealt with under Section 381 of the Municipal Act.

To deal with class (b), the Committee thought that the whole of the subordinate staff of the Health Department and, if possible, the Drainage and Road Departments also should be taught to distinguish mosquito larvæ and to watch for pools, etc., containing larvæ and treat such, when found, with kerosine or tar, and that when they found such measures impracticable they were to report to their superiors, and that the Executive Engineer be requested to co-operate with the Executive Health Officer.

In his No. 433 of 7th April 1902 the Executive Engineer informed the Executive Health Officer that he would render every assistance in his power and asked for information in what respect it could be given.

The Executive Health Officer in his No. 6813 of 14th July 1902 replied, stating that if the Executive Engineer's Department helped in the following way mosquitoes would probably be much reduced :—

- (1) By expediting the connection of house drains with Municipal sewers.
- (2) By improving the construction and fall of the existing open storm water drains.
- (3) By seeing that the excavations made for laying or cleaning pipe drains are closed up as soon as possible.
- (4) By securing proper provision for free drainage of all subsoil water pumped from excavations, etc., made for drains of sewers.
- (5) By seeing that the usual drainage channels of premises are not obstructed during the progress of Municipal drainage works.
- (6) By securing the provision of properly paved and drained nahnies and by not allowing such to be connected to imperfectly constructed drains.

On 21st March 1902 the Executive Health Officer forwarded a copy of the Corporation Resolution No. 14595 of 6th March 1902 to the Divisional Health Officers for information, and ordered that the action indicated by the Committee be taken, and in his No. 6620 of

29th July 1902 to the Municipal Commissioner the Executive Health Officer reported as under—

I have the honour to forward herewith reports from the four Divisional Health Officers giving an account of the action taken by them for the extermination of mosquito larvæ; the Executive Engineer has also been requested to take measures to prevent the stagnation of water and sewage.

The Divisional Health Officers have pointed out specific instances where improvements could be made, but the number of low lying places and undrained areas and the innumerable localities which allow water to accumulate are so many that no appreciable effect could be made on them unless an army of men were engaged. Under the circumstances I advise that the surface and subsoil drainage and the sewerage of the north part of the Island be pushed on and that the connection of house drains and Municipal sewers be expedited and that the existing storm water drains be improved in construction and fall, so as to permit the water to flow away rapidly.

SYNOPSIS OF REPORTS.

No. 1 Divisional Health Officer reports that demonstrations were given to the Inspectors and Sub-Inspectors of mosquito larvæ and the differences between culices and anopheles, and also lectures on where mosquitoes were most likely to be found breeding. For each Ward of No. 1 Division a mosquito gang, consisting of a Sub-Inspector and four men, was formed. Each gang had kerosine oil and tar, and practical demonstrations in the necessary procedure were given. Diaries were kept. Anopheles larvæ were chiefly found in fountain basins, drinking troughs, tubs and buckets, open cisterns and certain open drains.

Culex larvæ were chiefly found in wells, gullies and storm water catchpits. The action taken was to treat gullies, catchpits and unused wells with a mixture of kerosine oil and tar. Holes in the ground were filled in when possible. Open drains were cleared of any obstructions. Fish were introduced into fountain basins; drinking troughs, tubs and buckets (in cases of fire) were emptied and cleaned once a week. In places where the drainage was at fault, reference was made to the Drainage Engineer.

No. 2 DIVISION.

Particular attention has been given to gully traps, etc., and to the ravine on the west slope of Malabar Hill where countless anopheles have been found from time to time. The education of the staff in methods for distinguishing larvæ has progressed.

On 23rd March 1903 the Corporation passed the Resolution No. 14594 asking the Municipal Commissioner to obtain from the Executive Health Officer a list of the measures taken since the date of the passing of Corporation Resolution No. 14595, dated 6th March 1902, adopting the report of the Committee appointed to suggest measures for keeping the tanks, etc., of the City free from anopheles larvæ.

The Executive Health Officer in his No. 331 of 7th April 1903 referred them to his No. 6620 of 29th June 1902, adding that action on the lines indicated therein was being continued, and stating that the Health Officer had recently delivered a lecture on Malaria and was having it translated into the vernacular with a view to circulation.

A list was submitted showing a very large number of pools, ditches, wells, fountains, quarry holes, etc., dealt with (835).

On 16th July 1903 the Corporation recorded the Municipal Commissioner's letter reporting the measures adopted to keep the tanks, etc., of the City free from anopheles larvæ, and resolved that the Municipal Commissioner be requested to organise a regular system of cleaning public wells and tanks at fixed intervals.

In his No. 7260 of 29th August 1903 the Executive Health Officer reported that there were many public tanks and wells in the City none of which were in charge of the Health Department; with the exception of a few in charge of the Improvement Trust—nearly all are in charge of the Engineer's Department. The Mint Tank, Babula Tank, Dhobi Talao and Gowalia Tank are cleansed by the Health Department men in a punt. These men removed weeds and filth but it was not possible to cleanse these tanks in such a way as to affect the growth of anopheles larvæ. No good, as far as mosquito larvæ are concerned, will be obtained by periodical cleansing, such as the Health Department was able to do. The Heads of Departments in whose charge the wells and tanks are should be asked to arrange for systematic cleansing at fixed intervals.

The Executive Engineer in his No. 19496 of 9th March 1904, to the Municipal Commissioner, forwarding Executive Health Officer's No. 7261 of 29th August 1903, remarks that—

“The Health Officer recommends either to fill in the wells or to cover them over with closely-fitting planks to prevent mosquito breeding in them, and he further adds that if once cleaned and covered, the wells not in use will not require further cleaning, nor will the wells actually in use, if, after being cleaned, they have fish introduced into them and the growth of weeds and water plants prevented.

On 21st July 1905 in his No. 4532 the Executive Engineer addressed the Health Officer forwarding copies of correspondence with the Deputy Executive Engineer, Drainage (O. B.), regarding the use of water from Malabar Hill for cultivation of rice fields in Chowpatti, and in a report on the subject the Divisional Health Officer No. 2 reported that diligent and repeated search had failed to reveal the presence of anopheles larvæ in the pools in the fields, and that the cultivation of that field did not tend to the production of Malaria there, and that the Malaria experienced there was due rather to the sluggish streams on the side of the hill and between the foot of the hill and the open drain built by the Public Works Department.

Owing to the prevalence of Malaria in the Inspectors' Quarters, Malabar Hill Reservoir, wire gauze was fixed to the verandahs and windows of the quarters to exclude mosquitoes as a result of representations by the Executive Engineer in June 1905. The Fire Brigade men in the hill were also incapacitated and were withdrawn on 17th May 1907 from duty on the hill.

On 17th August 1905 the Corporation passed resolution No. 2039 asking the Municipal Commissioner to report on the probable cause or causes of the reputed unhealthiness of the houses in the neighbourhood of Malabar Hill Reservoir and those in the vicinity of the nullah between the reservoir and Nepean Sea Road, and also to report what steps he proposed taking to remove the cause of the unhealthiness and the cost thereof.

In his No. 10115 of 29th September 1905 the Health Officer reported that a careful house to house enquiry had been made in all the bungalows on the Malabar Hill round about the Reservoir, and there was then only one bungalow in which there was a case of fever; that Fever cases were very common after the moonsoon in many houses in that locality, due probably to the mosquito breeding places in the ravine, and that although there was considerable improvement since the construction of the drain below the reservoir, yet there were places by the side of the drain where water oozed out forming puddles for mosquitoes to breed.

In the same letter the following causes are given as to the persistence of Malaria in the neighbourhood :—

- (1) The presence of the reservoir and filtering tanks and the leakage therefrom.
- (2) The water from the washing of the sand filters.

- (3) The formation of pools along the side of the open channel.
- (4) The presence of dhobi ghats.
- (5) The collection of water in the compounds of the bungalows.
- (6) The extensive growth of grass and shrubs.

Although search has been made for the anopheles larvæ in the reservoir tank and filter, they have not been found, and it is asserted that they do not exist. I am of opinion that in the dark covered places inaccessible to the searches this mosquito can breed and nothing but mosquito proof netting can keep them out.

There is also a thick growth of jungle on the Chowpaty side which hides water pools and favours the breeding of mosquito. Much of the growth should be cut and kept down. The open channel drain should be covered and continued higher up and all the places from whence water oozes should be drained. The dhobi ghat should be abolished. The occupiers of houses in the neighbourhood should be given a leaflet explaining how to prevent the breeding of mosquitoes.

On 21st December 1905 the Municipal Commissioner directed the Health Officer to undertake the work of cutting away undergrowth and of connecting the sand washing tanks with the existing channel drain.

On 13th January 1906 the Executive Health Officer informed the Municipal Commissioner that the directions mentioned in his letter of 21st December 1905 had been carried out.

On 27th September 1905 report came from the Divisional Health Officer, No. 2, regarding Clerk Road storm water basin in which no larvæ were found. On 5th October 1905 some were found and, as a temporary measure, kerosine oil was used and the Deputy Executive Engineer, Drainage, was requested to pump out the water into the sewer. (See also No. 3-9109 of 30th September 1904 from the Divisional Health Officer, No. III, to the same effect.)

The main drain running at right angles to Clerk Road was also inspected and no larvæ found.

On 26th October 1905 the Deputy Executive Engineer, Drainage, reported that the work had been completed.

On 16th December 1905 a complaint was received from Officer Commanding Bombay Brigade reporting anopheles mosquitoes had been seen in the pond in the immediate vicinity of Mahaluxmi Battery and requesting action.

On 3rd February 1906 the Executive Health Officer reported to the Municipal Commissioner that no larvæ could be found and that the pond was full of fish, frogs and tadpoles, and that this Department had taken the necessary action for cleansing the pond in question which is in the grounds of Cumballa Hotel, and that the mosquitos complained of were probably due to the faulty arrangements of drainage on Cumballa Hill.

On 31st January 1906 letters were addressed to those in charge of the ten schools in Mazagaon area asking permission to examine the blood of the scholars with a view to ascertain the prevalence of malaria in the neighbourhood of Bhandarwada Reservoir.

Apparently all but one refused permission.

On 20th March 1906 a complaint was received from Mr. Wagstaff regarding storm water reservoir, Hornby Vellard.

On 17th April 1906 report came from the Divisional Health Officer stating that the two pools had been regularly treated with kerosine, and on 12th June 1906 the Executive Engineer reported that the storm water reservoir was then dry. The old main drain having also been cleaned there was no apparent cause for complaint now.

On 7th January 1908 the Deputy Health Officer, A Ward, was requested to report on mosquito breeding places in the neighbourhood of the Improvement Trust Offices.

On 10th January 1908 the Deputy Health Officer, A Ward, reported that the storm water catchpits attached to the Chartered Bank of India and the South-West drain behind J. Cannon School and Improvement Trust Offices were swarming with *Stegomya*.

On 7th January 1908 Rev. J. Nicholson complained of persons suffering from Malaria at the School, especially in the servants' quarters behind the New Church, Mazagaon. Several tubs containing water were found to be breeding larvæ in the compound.

23rd January 1908.—Messrs. Phillips & Co. complain of mosquitoes.

28th January 1908.—The Deputy Health Officer reports that the storm water drains in the locality behind the Oriental Building were swarming with *Stegomya*. The drain receives the water from the washing place in the yard at the rear of the building.

Measures Adopted in Reference to Localised Areas.

MALABAR HILL.

Order to Deputy Health Officer "D" Ward dated 2nd April 1908. A special attempt should be made to discover all breeding places and action taken.

Abolition of Catchpits and Cesspools where possible.

All Fountains and Mali's pots to be examined.

Letter to Walkeshwar Temple Trustees dated 2nd April 1908 regarding cleansing of tank, and measures necessary to keep it clean and to supply fish.

Letter to Deputy Executive Engineer, Drainage, dated 2nd April 1908, regarding septic tank, suggesting—

1. That covers be kept on the tanks permanently;
2. Pesterine be used;
3. Not to allow effluent to be discharged on to the Storage beds to a greater height than two inches from the surface or to cover with mosquito proof gauze.

21st April 1908. Certain House-owners on the Hill notified of the completion of the Sewage works advising conversion of existing basket privies into water-closets.

21st April 1908. Resolution No. 735. Corporation asked Commissioner to report regarding the plague of mosquitoes during the last few months on Malabar Hill, especially that portion lying between the Walkeshwar Temple and Mount Nepean, and asking:

(a). Reasons assigned by the Health Department for the extraordinarily large number this year.

(b). Individual efforts having proved useless what steps have been or are being taken by the Health Department?

(c). If the planting of Eucalyptus trees in large numbers is practicable, and if so, has it been tried?

(d). Have the Municipal Sewage Works on the Hill anything to do with the large increase?

The Health Officer in his No. 3038 of 1st May replied:

With reference to your No. 1747 of 22nd April 1908 forwarding copy of the Corporation Resolution No. 735 of 9th April 1908 asking for report on the different points regarding the plague of mosquitoes during the last few months on Malabar Hill, especially on that portion

lying between the Walkeshwar Temple and Mount Napean, I have the honour to state that before reporting on the points raised by the Corporation, I would give below a short summary of the action taken by the Health Department with regard to mosquitoes and Malaria in this City since 1901.

2. *In December 1901* I reported to the Municipal Commissioner on the presence of anopheles mosquitoes in the City. The report included investigations into places all over the island where anopheles larvæ were to be found and the measures taken to prevent their breeding.

3. *In July 1902* I again reported on the action taken by the Health Department for the extermination of mosquito larvæ. This includes, besides actual practical measures taken by the Department, suggestions to the Executive Engineer and lectures and pamphlets and instructions in the vernacular.

4. *In May 1903* I submitted a list of every place where larvæ were found and the action taken by the Divisional Health Officers. This included over 1,000 places and came before the Corporation in July 1903, and I was asked to report on a system to clean public wells and tanks at fixed intervals.

5. A list of all the wells and tanks was submitted with the suggestion that as far as the breeding of mosquitoes was concerned, it was no use periodically cleaning the wells and tanks, but that wells should be filled in or covered over, and that the tanks which could not be filled in or covered over should be periodically cleaned and kept supplied with fish. A long correspondence followed as to ways and means and some wells were covered.

6. The presence of Malaria in the neighbourhood of Bhandarwada Reservoir has been the subject of many reports and the filter beds and reservoir are being rendered water tight. The presence of Malaria and mosquitoes in the neighbourhood of the Frere Road due to the working out the New Docks have been also brought to the notice of the Corporation.

7. With regard particularly to Malabar Hill, this year, the two great sources of mosquito breeding are the leakages from the Reservoir west and east of the Malabar Hill and the Septic tanks. The correspondence about these places is too voluminous to append to this report.

8. In 1900 a drain was partly laid down part of the ravine but proved a failure as it neither began near enough to the sand washing basin nor did it collect and conduct the water directly to the sea.

9. The drain was not allowed to be taken through Sir Jehangir Readymoney's land, and consequently the breeding places for mosquitoes remained. The drain was constantly choked by dhobis, and cultivators and the water spread on each side of it formed places for mosquitoes to breed. The Health Department put men to protect this drain and prevent the dhobis blocking it and treated all the water with oil. In 1905, with the sanction of the Municipal Commissioner, the Health Department cut down the brushwood which grew on the west side, and they cut channels to get rid of the water with a very good result. Eventually the Drainage Engineer acquired powers to continue the drain and this, I understand, will be done. The Corporation sanctioned in April 1907.

10. It will be thus seen that although much has been done, the leakage from the reservoir is the chief cause of the presence of mosquitoes, and nothing short of rendering the reservoir and filter beds water-tight will have a permanent effect.

11. The Water Engineer has submitted plans and estimates and made an exhaustive report on this, and it only remains now for this very necessary work to be carried out.

On 25th September 1906 the Municipal Commissioner in his No. 20507 wrote to the Health Officer asking him to take steps to prevent the breeding of mosquitoes at Hornby Vellard.

On 26th September 1906 the Divisional Health Officer No. 2 in his No. 17622 reports that as a temporary measure he is treating the pools with kerosine, and requests that the Drainage Engineer be requested to pump the water into the sewer.

On 24th October 1906 the Divisional Health Officer reported that the Drainage Department had cut channels and drained the water off. There was no further need for complaint.

On 1st October 1906 Resolution No. 4307 from the Corporation to the Municipal Commissioner:

“That the attention of the Municipal Commissioner be drawn to the serious nuisance caused by the large collection of water full of vegetable and other growths situated at the junction of Nepean Sea Road and Warden Road, and he be requested to report to whom the land belongs and whether in the interest of the health of the neighbourhood it is not desirable to have the ground filled in or drained.”

The Divisional Health Officer in his No. 20175 of 26th October 1906 reported that the collection of water belonged to Mr. Chabildass Lalloobhoy as to $\frac{2}{3}$ and $\frac{1}{3}$ to Dr. Edulji Nusserwanji.

The Health Officer requested filling in. Refused.

On 11th July 1907 the Corporation resolved (Resolution No. 2265) that the letter of the Municipal Commissioner dated 23rd May 1907 No. 4605 regarding the nuisance alleged to have been caused by the accumulation of water at the junction of Nepean Sea Road and Warden Road be recorded and the Municipal Commissioner be required to be so good as to take such measures from time to time as he deems fit for the removal of green scum accumulating on the surface of the tank and for preventing the breeding of mosquitoes.

Letter, in the “Times of India” of 19th August 1907 regarding anopheles mosquitoes in the Elphinstone Garden.

Divisional Health Officer reports in his No. 20678 of 1st October 1907: “no mosquito larvæ found on the fountain.”

3rd October 1907.—The Health Officer calls for expedition of report from the Divisional Health Officer No. 1 regarding Malaria in St. George's Hospital.

On 5th October 1907 the Divisional Health Officer No. 1 writes to the Health Officer asking for letters to be sent to the Port Trust Engineer, Messrs. Price Wills & Reeves, G. I. P. Railway, B. B. & C. I. Railway, and the Standard Oil Co., to remove all rank vegetation, to fill up all pools of water, to pesterine or kerosine the water tanks, and to provide covers to the Storage tanks.

On 14th October 1907, by appointment, the Divisional Health Officer No. 1 met a representative of the G. I. P. Railway and showed him exactly what was to be done.

On 4th October 1907 the Divisional Health Officer No. 1 reported that he had that day inspected the European General Hospital and found the compound full of rank vegetation and the storm water drains blocked with leaves, causing pools to form; also many garden tubs containing anopheles larvæ, also barrels containing water with anopheles larvæ in them. The tanks in connection with the Dhobi Ghat also had larvæ. (Copy was forwarded to Dr. Collie).

On 11th October 1907 another letter to the Executive Health Officer from the Divisional Health Officer stating that the rank vegetation had not been properly removed. Letter on 12th October 1907 to Dr. Collie.

On 5th December 1907 Corporation Resolution No. 5602 :

“In view of an epidemic of a virulent type prevalent among the residents of Frere Road since August last, the Municipal Commissioner be requested to report as to the cause thereof, and submit estimates of the probable cost of measures necessary for efficiently carrying off the storm water at the points in that locality where the road is annually flooded during the monsoon or for removing such causes.”

On 9th October 1907 and on *8th January 1908* the Health Officer reported on this area, stating that in large compounds like the European General Hospital, the yards of the G. I. P. and B. B. & C. I. Railway Companies and the New Docks collections of water and rank vegetation are to be found in which the larvæ of mosquito are present in large numbers, and stating that letters had been addressed to all the abovementioned bodies, and that a more efficient method of carrying off storm water from this locality would be a great boon to the neighbourhood and, that the system adopted by the Drainage Engineer in closing the storm water entrances directly after the monsoon would remove one source of the propagation of the mosquito.

On 5th October 1907 letter from Mr. D. E. Wacha regarding Malaria to Municipal Commissioner sent to Health Officer.

On 9th October 1907 the Health Officer reported to the Municipal Commissioner that before receiving Mr. Wacha's letter the Health Department Staff had been enquiring into the outbreak of Malaria in Frere Road.

On 11th October 1907 Dr. N. N. H. E. Sukhia wrote to the Municipal Commissioner stating that the street water entrances were not yet covered, and asking the Health Officer's opinion as to the desirability of converting the present syphon like arrangements into ordinary drains without compartments wherein water remains collected acting as a breeding ground for mosquitoes.

This question was referred to the Deputy Executive Engineer, who on 21st December 1907, replied that the covering of the drains had been taken in hand and point out that as the work could not be commenced earlier than October 15th and as some thousands have to be covered, some delay must occur, and added that Dr. Sukhia's proposal regarding catchpits hardly required answering; as such a system is entirely opposed to the most elementary principles of Sanitary Engineering.

The Health Officer agreed in his letter of 24th October 1907 that no entrance to a storm water drain in this City should be directly connected with the drain without a proper trap, and recommended an air-tight cover which it was understood the Drainage Department were doing.

On 4th November 1907 the Acting Municipal Commissioner requested the Health Officer to examine the water of some of the storm water entrances with a view to ascertain whether it is likely to be the source of fevers.

On 12th November 1907 the Health Officer replied, on personal inspection, that he had found some culex larvæ in the water of these catchpits, and in view of the great nuisance and annoyance to the neighbourhood orders had been given to treat all storm water entrances that have not yet been covered up with pesterine and adding that in the past this had been done, and requesting the Deputy Executive Engineer, Drainage, to expedite the work and to use thicker plates for the purpose.

12. With regard to items (a), (b), (c) and (d) of the Corporation Resolution, I beg to report as under :

(a) The reasons that could be assigned for the extraordinarily large number of mosquitoes this year are: (1) in many of the compounds there were cesspits and fountains used by the mallees for watering the garden. There were also cesspits for bath water and house drainage, and these, if not properly attended to and kept free from accumulation of water, will become the breeding places for mosquitoes. We have for some time been paying much attention to the presence of mosquitoes on the Hill, and our staff visit and treat with Pesterine all likely places; but it is not possible to treat them all in this way, and we have issued every year instructions to the houseowners asking them to instruct their servants, and many tenants do attempt this, but if some are slack or forgetful, breeding places escape and become a nuisance and mosquitoes breed and infect other bungalows where strict precautions are taken. (2) Besides these local spots there has been added a new and very large breeding place on the site of the septic tank. (3) Leakage of the reservoir and filter beds. (4) There is also the large tank at Walkeshwar which affords a good breeding place for mosquitoes.

(b) The steps taken by the Health Department to get rid of mosquitoes are to :—

- (1) Fill up all places where water may collect.
- (2) Pesterine as many places as they could or that come to their notice.
- (3) Issue leaflets on the preventive measures of Malaria.
- (4) I have already submitted many reports pointing out that the leakages of the reservoir are constant cause of the unhealthiness of the locality.

In January last I submitted the following report :—

The malarial condition of Malabar Hill in the proximity of the ravine and reservoir has been the subject of much correspondence but with very little result.

The cause of the accumulation of water is so well known to the Commissioner and the permanent remedies suggested are under consideration but will take a considerable time.

To temporarily get rid of this nuisance presents no great engineering difficulty; it only requires the application of a certain amount of attention to this apparently small cause but very serious danger to the health of the neighbourhood.

Remedies have been suggested but only partially carried out and have to be repeated every year. The area should be considered a dangerously unhealthy one and treated accordingly. When science has taught us how to compete against disease it is hardly right not to accept that knowledge and take advantage of it.

It is apparently not possible at once to prevent the leakage from the reservoir, but it is quite possible to confine these leakages to well made and cemented channels to collect and carry the water to the sea a short distance away, so that the water cannot remain and form pools for the breeding of mosquitoes. As part of the south side of the hill belongs to the Municipality and part to the Improvement Trust, I would suggest that the Executive Engineer and the Engineer of the Improvement Trust be requested to draw up a scheme to effectually deal with this water and the undergrowth on the hill. It is possible that the onus of the work may properly be the duty of the Municipality as the nuisance is caused by the leaking from the reservoir. However this may be, the matter should be dealt with seriously and the whole hillside so treated either by laying it out in terraces and making it a garden, private or otherwise, or by so channelling and draining the area and constant

attention to the channels that water cannot form suitable places for mosquitoes to breed. I need hardly remind the Commissioner that for many years this subject is coming up both with regard to east side of the hill and to the other side, but no proper measures have been taken to deal with the water leaking from the reservoir.

- (c) The planting of Eucalyptus trees in large number as a preventive against Malaria has not been tried here so far as I am aware. It might be tried, but while the breeding places remain, there will be little chance of success.
- (d) I have already said in my reply to the query raised in item (a) that the septic tank installation has become an additional source or cause of the spread of Malaria in the neighbourhood, and I wrote to the Drainage Engineer in the following terms on 3rd April 1908 :—

On making an inspection of the locality known as Lands End Road, Narayan Dabholkar Road, Malabar Hill, and inquiring into complaints about mosquitoes, I inspected the septic tank amongst other places.

The Inspection Chambers were all open and hundreds of mosquitoes were to be seen coming out. In the filter bed which was in use and in which sewage was present to about two or three feet over the filtering materials innumerable mosquito larvæ were present.

There was also a large quantity of water (sub-soil) in the channels on the sides of the filter beds which also forms a breeding place for mosquitoes.

Although there are other places in this locality where mosquitoes breed, these septic tanks and filter beds form a new and very large increase to the existing number of places, and unless steps can be taken to prevent mosquito breeding here the presence of this tank will always be a nuisance. The remedies I would suggest are :

- (1) To keep the covers of the tank permanently.
- (2) To put in Pesterine or oil on the top of the sewage. The oil would remain at the top and would not interfere with the action of the Bacteria and would reduce the smell.
- (3) To only allow the sewage to be discharged into the filter beds to within two inches of the top of the layer of filtering materials or to cover them with mosquito-proof gauze so that no mosquitoes can gain access to the water. It is possible that when more solid matter is discharged into the tank mosquitoes will not breed when a scum is formed of sufficient thickness.

I am about to issue the circular to the residents on the Malabar Hill with reference to the connection of the houses to the sewers. But before doing so I shall be glad to see you in this matter.

In a further letter I said :

“ The covers of the Inspection Chambers have been kept on and the amount of sewage in the filter beds reduced, wire gauze has not been used, nor has the tank been treated with Pesterine. The tank is itself far from free of mosquitoes, although they appear to be more localized. The tank has been kept under observation and the drains and cess-pits near the tank and compounds of the houses on Malabar Hill frequently visited and treated with Pesterine. I again visited the septic tank installation on Saturday 18th and found large numbers of mosquitoes in the tank and issuing from the vent pipes and inlet chamber and in the discharge channels and in the filter beds. Larvæ were found in the tank and in the side channels and in the effluent.

I would again urge that this tank be dealt with; that its presence be no longer a nuisance and a breeding place for mosquitoes.

All possible inlets and outlets must be made mosquito proof.

Pesterine should be used in the tank, the side channels filled in and the ovoid channels and effluent channels treated with pesterine.

It is possible that larvæ and eggs may be brought into the tank with the sullage water as well as deposited there by mosquitoes, and I see no alternative but to treat the sewage with oil regularly. The effluent is not required for manurial purposes but is discharged into the sea, and I do not apprehend any objection to the oil floating on the top of the sewage in the tank as far as bacterial action goes, and unless these measures are taken the tank will be a nuisance."

On 29th June 1908 the Corporation by Resolution No. 2206 recorded the report and requested the Municipal Commissioner to submit a further report after the monsoon.

The Health Officer in his No. 17283 of 15th October 1908 addressed a letter to the Deputy Executive Engineer, Drainage, regarding sewage tanks as follows :—

"I have the honour to inform you that on the morning of the 9th instant, on inspecting the Bacteriological Septic Tanks on Malabar Hill the Deputy Health Officer D Ward found that the effluent discharged on to the metal beds was almost like crude sewage, and it gave out an offensive odour. As such an occurrence is likely to give rise to complaints, I request the favour of your taking the necessary action at an early date to abate the nuisance."

The Health Officer wrote to the Municipal Commissioner under his No. 18105 of 27th October 1908 as under :

"With reference to your No. 10966 of 11th July 1908 forwarding copy of Corporation Resolution No. 2206 of 29th June 1908, I have the honour to report that in conjunction with the Drainage Engineer, the metal beds of the Septic Tank at Malabar Hill were regularly and systematically treated with pesterine and kerosine oil, with the result that very few mosquitoes are now noticed at this Biological Installation. As this measure has served the purpose of getting rid of mosquitoes from this source on Malabar Hill, it will be continued.

It only remains for me to add that at present the nuisance due to mosquitoes is reduced to a great extent, and several of the measures indicated by me in this office No. 3038 of 1st May 1908 are being carried out."

Under the Health Officer's No. 17769 of 21st October 1908 the Deputy Health Officer was addressed as follows :—

"The Deputy Health Officer D Ward is requested to take the necessary steps to remove the rank vegetation from Malabar Hill and Chowpaty, and to treat the water coming from the hill on both the sides. Please look up the file of last year and previous years and you will find what we did. The same procedure should be followed at once and the different authorities written to. The Hill should be visited at least twice a week by the Deputy Health Officer and the compounds of bungalows on the hills should be systematically inspected for water and mosquitoes and regularly treated with oil or pesterine with the permission of the owners.

The leaflets on Malaria should be freely distributed. These have been already sent to the Deputy Health Officer from this office. The Deputy Health Officer and Chief Inspector Ringrow are responsible for carrying out these orders.

Please reply in ten days as to what action has been taken in the matter."

Report of Assistant to Health Officer, Sanitary, to the Executive Health Officer :

"I have the honour to make the following report on my examination of Malabar Hill in regard to the means necessary for the prevention of Malaria.

The breeding places that exist are very numerous and for that reason difficult to combat.

On both sides of the hill (east and west) much water escapes from the reservoir and flows down the hill side. In some parts of the hill this waste water is conducted in properly constructed open half channel pipes, but at other places these pipes have fallen into disrepair, and do not properly perform their function of carrying away the water as expeditiously as possible. This is the case on both sides of the hill.

Furthermore, in certain places, more especially near the Body Guard Lines, new points of leakage have made themselves visible, and for these the existing channels are inadequate, with the result that the water accumulates in pools, thereby facilitating the breeding of mosquitoes.

On the western slope of the hill in the ravine which runs down to sea level there is a drain, which, in part of its course, is an open one, and in the rest closed. It was originally intended for the conveyance of the water used in the sand washing tanks, but the natural configuration of this portion of the hill causes it to be one of the main channels by which the surplus rain water drains off the hill. The bed of the ravine is very irregular and readily lends itself to the formation of pools, and the existing drain which is broken in several places is quite inadequate to properly conduct the water away.

There is much rank vegetation and undergrowth in the ravine which still further impede free drainage. At the time of my last inspection this was in process of being cut down as was also the undergrowth on the eastern slope.

In my opinion the existing drain is insufficient to deal properly with the amount of water which flows down, and it should be replaced by an open channel drain with sloping sides. This drain should be at least three feet from edge to edge and $1\frac{1}{2}$ feet deep.

The vegetation should be cut down at regular intervals of time so as to prevent free drainage being blocked. The waste water at present flowing here affords quite sufficient moisture for a luxuriant growth of vegetation.

Nothing short of a well constructed open drain will satisfactorily deal with this ravine. The drain should be of considerable size, and should have side channels flowing into it at frequent intervals to carry off surface water during the monsoon.

The very numerous wells and garden tubs that are to be found in the gardens of bungalows on the hill form a constant source of potential danger. Much has been written on this subject and it is unnecessary to labour it.

The accumulations of water lying in and around the various dhobi ghats on the western side of the hill were examined and larvæ (anopheles) found.

Larvæ were also found in the Banganga Temple Tank, though their number was but few.

The pools on the seashore (formed partly by the sea water and partly by house sullage water) were also found by Mr. Ringrow to contain larvæ a few days prior to my visit.

The Septic Tank installation was visited by Mr. Ringrow on 15th November 1908. No larvæ or mosquitoes were found. (The place was locked on my visit).

Recommendations.

- (1) The entire remodelling of the existing drain in the ravine on the west of the hill.
- (2) The construction of fresh open channels where necessary, and the repair of existing channels in places where such is necessary on both sides of the hill.
- (3) The regular and systematic cutting of rank grass and undergrowth where such is necessary. This should not be less than 3 times per year.
- (4) The appointment of an intelligent Inspector in charge of a special gang of five men at least whose sole duty is to consist in systematically road by road inspecting the compounds of bungalows, for uncovered cisterns, wells, garden tubs, tins, chattis, damaged drains, old barrels, etc., and dealing in the most suitable manner with such when found. The Inspector should make it his duty to draw the attention of some responsible member of the household to any source of danger as regards Malaria, that may be found and ask his or her permission to deal with the matter at once, and to point out how a recurrence may be avoided.

Malabar Hill in itself offers sufficient work for an Inspector and a gang working whole time in this particular direction; he should, therefore, confine his attention to Malabar Hill only.

At the office of the Sanitary Inspector on the hill a quantity of quinine should be stocked and a special circular might be addressed to all residents on the Hill urging them to encourage their servants, malis, etc., to apply for free doses of quinine at the Hill office, both as a prophylactic and a curative measure.

A letter might be addressed to the Trustees of the Banganga Temple asking for a personal interview in the Head Office, when the Health Officer could point out the danger of such open areas of water and ask for their co-operation in the matter in so far as the treatment of the unfrequented edges of the pond are concerned.

The treatment of the Septic Tank with pesterine should be continued, as it appears to have effected much good. Wells proved to contain larvæ of anopheles mosquitoes should be covered. This could be done by means of a suitable wire gauze cover or by a permanent wooden cover. In either case a trap door can be left if necessary and the householder specially warned to keep this closed at such times as the well is not in use.

Section 381 says, if in the opinion of the Municipal Commissioner any pool, ditch, pond, well, quarry-hole, low ground or stagnant water is, or is likely to become a nuisance the Commissioner may, with the approval of the Standing Committee by notice in writing require the owner thereof to cleanse, fill up, drain off or remove the same or to take such other order as the Commissioner shall deem necessary. In view of the prevalence of Malaria, I consider, a well, which can be proved to be breeding anopheles mosquitoes can reasonably be held to be a nuisance to the neighbourhood, and an order to cover is quite reasonable under the circumstances. The views of the Standing Committee might be obtained in this matter by a test case, should occasion arise.

Localised Areas.

II.—BODY GUARD LINES, CHOWPATI.

Dr. Cogill under his No. 30 of 15th December 1907, wrote to the Municipal Commissioner as under:—

“I have the honour to draw your attention to the marked prevalence of Malarial fever in the Body Guard Lines, Chowpati. Out of a total strength of about 200 there have been 40 cases already: and these go on steadily increasing, and it may be confidently expected that by the end of the season but few will have escaped, in spite of quinine prophylaxis.

To try and prevent this enormous incidence work is at present being undertaken to make the lines mosquito proof by protecting living rooms with wire gauze.

My object in writing to you is to find out whether it be not possible to obviate the necessity for those precautions by dealing with the mosquitoes, the source of all the mischief.

From what is known of the life history of the malaria bearing mosquito, it may be stated that the only possible breeding places for them must arise from leakages from the reservoir.

It is understood that steps are to be taken to prevent this leakage. This must of necessity take a long time. Might I request that some steps be taken as a temporary measure, to try and mitigate the nuisance.

In any steps you may think fit to suggest you may be assured of my active co-operation."

The Executive Health Officer under his No. 17749 of 20th December 1907 wrote to the Municipal Commissioner as under :—

"In continuation of this office No. 17636, dated the 10th instant, I have the honour to report that with reference to Dr. Cogill's letter concerning cases of Malaria amongst the Body Guards and their relatives, similar complaints had been made on previous occasions and the cause was ascribed to leakages from the reservoir and accumulations at the bottom of the hill. Diligent search was made many times along the edge of the cliff of Malabar Hill and Chowpati with a view to ascertain whether there were any accumulations of water likely to provide breeding places for mosquitoes and whether any anopheles larvæ could be found. A great deal has been done to render the particular site free from the accumulations of water, drain and carrier have been made and the Improvement Trust was asked to keep the slope of the Hill free from rank vegetation. The locality was thoroughly inspected by Dr. Turkhud and no trace of anopheles mosquitoes could be found and this is due to the attention given to the particular locality by draining and the use of pesterine.

The compound of the Body Guards Lines had not however received the same attention the reason being, I understand, that the staff of the Health Department have not been allowed to enter the compound and examine the surroundings. This morning I inspected the place with the staff of "D" Ward and Dr. Turkhud. Several patients were examined in the Hospital including a baby not in hospital, and samples of bloods taken and examined with the following result :—

No.	Name.	Chemical features.	REMARKS. Examination of blood films.
1	Lance Duffadar Fattah Mahomed Khan.	Enlarged spleen, suffering from fever of tertian type.	Malarial parasites.
2	Sowar Met Singh	Chrono enlarged spleen, suffers from fever occasionally.	Malarial parasites, a large number of eosinophils.
3	Lance Duffadar Mumtas Ali Khan.	Fever every day with shivering ...	Malarial parasites.
4	Lance Duffadar Udesing's child.	Suffering from fever for sometime.	Malarial parasites.

It will be seen from this that the majority of the patients were chronic Malarial subjects.

I was informed by the Hospital Assistant in charge that the men of the Body Guard and their families always suffered from Malaria when they came to Bombay and occupied these lines, and I also gathered that when they camped outside on the Chowpati Estate they were free ; and in Poona they rarely suffered.

This naturally led me to assume that although these men previous to their residence in these lines had suffered from Malaria a local re-infection was taking place. On searching the compound several likely places for the breeding of mosquitoes were found and in particular the large tank placed to catch the water leaking from the Hill and used for bathing purposes overflowing all round contained anopheles larvæ in large numbers.

This tank is partly covered with bamboo matting broken in places and I found anopheles larvæ in it.

The presence of this tank and the leakage from the Hill into the cups formed at the roots of trees is the cause of the prevalence of the mosquito, and thus the cause of Malaria amongst the occupants of these lines. Had this particular spot been examined the presence of these mosquito larvæ would have been discovered and the cause of the disease would have been apparent. The remedy therefore is to clean out the tank and to properly protect it with an impervious cover to prevent the leakage from the service pipes leading from it and to thoroughly render the immediate surroundings in cement so that no water can accumulate. To examine all the cups or places under trees and fill them up and to cut down all rank vegetation and to treat all the leakage and places with pesterine twice weekly. This has been done with great success in all such places on Malabar Hill.

In order however to properly complete this campaign against Malaria, intelligent Officers and the Hospital Assistant should be instructed in the life history of the mosquito and its connection with Malaria so that no breeding place be allowed to remain. If such measures are properly carried out it is our experience that the Malaria bearing mosquito disappears and with it the attack of fever due to re-infection. At the same time I would point out that it must not be forgotten that amongst the large body of men with their families there are many cases of chronic Malaria which frequently develop fever without a necessary re-infection."

Letter from the Executive Health Officer under his No. 18623 of 8th January 1908, addressed to the Municipal Commissioner, runs thus :—

"In continuation of this office No. 17749, dated 20th December 1907, I have the honour to state that the malarial condition of Malabar Hill in the proximity of the ravine and reservoir has been the subject of much correspondence but with very little result.

The cause of the accumulation of water is so well-known to the Commissioner and the permanent remedies suggested are under consideration but will take a considerable time.

To temporarily get rid of this nuisance presents no great engineering difficulty. It only requires the application of a certain amount of attention to this apparently small cause but very serious danger to the health of the neighbourhood.

Remedies have been suggested but only partially carried out and have to be repeated every year. The area should be considered a dangerously unhealthy one and treated accordingly. When science has taught us how to compete against disease it is hardly right not to accept that knowledge and take advantage of it.

It is apparently not possible at once to prevent the leakage from the reservoir but it is quite possible to confine these leakages to well-made and cemented channels to collect and to carry the water to the Sea a short distance away so that the water cannot remain and form pools for the breeding of mosquitoes. As part of the south side of the hill belongs to

the Municipality and part to the Improvement Trust, I would suggest that the Executive Engineer and the Engineer, Improvement Trust, be requested to draw up a scheme to effectually deal with this water and the undergrowth on the hill. It is possible that the onus of the work may be properly the duty of the Municipality as the nuisance is caused by the leaking from the reservoir. However this may be, the matter should be dealt with seriously and the whole hillside so treated either by laying it out in terraces and making it a garden private or otherwise, or by so channelling and draining the area and constant attention to the channels that water cannot form suitable places for mosquitoes to breed. I need hardly remind the Commissioner that for many years this subject is coming up both with regard to east side of the hill and to the other side but no proper measures have been taken to deal with the water leaking from the reservoir."

The Municipal Commissioner was written to under the Executive Health Officer's No. 18526 of 7th January 1908, as under :—

"With reference to your No. 30245 of 23rd December 1907, I have the honour to report that at our meeting on the Body Guard Lines at Chowpati this Department was asked to carry out the following work to prevent the breeding of mosquitoes in the neighbourhood :

1. To open out the outlet of the masonry tank and to see that it is kept open and water allowed to pass off freely.
2. To have the ground round about the tank cleaned up and the rank vegetation removed.
3. To clean and open to sunlight the kutchra water channels and cause the water to discharge into the masonry tank.
4. To prevent people from using the water in the masonry tank and to have a notice board put up to that effect.
5. To treat the water in the masonry tank and all the streams from the slope of the hill with pesterine.
6. All this has been done by this Department and a ramosi has been posted for a few days to prevent the people from using the water in the tank.

I visited this spot on Friday, the 3rd instant. With the exception of the Notice Board all the work the Health Department had to do has been done. The Improvement Trust are cutting away the brushwood; the drain which the Drainage Engineer was to have laid was not completed. There were still places where mosquitoes could freely breed and I am writing to you fully on the question."

III.—NEW DOCKS AND EUROPEAN GENERAL HOSPITAL.

A letter was addressed to the Municipal Commissioner by Mr. F. R. Joshi and others on the 9th May 1908, as under :—

"We, the residents and houseowners of Frere Road, Fort, beg to lay before you the following grievances with a hope that they will meet with favourable consideration.

As the Corporation had called for a report with regard to an epidemic of Malaria of a virulent type prevalent amongst the residents of this locality, we had patiently waited with a hope that active steps would be taken by the Corporation to exterminate the epidemic after the report was made, but to our great disappointment we find that a responsible body like the Corporation has merely shelved the report of the Health Officer and the Executive Engineer, instead of taking stringent measures for the extermination of this epidemic, and of thus putting the locality in a healthy condition as before.

Some of us have been residing on the Frere Road for the last ten years, and have never heard of the malady prevailing in this locality, but since the extensive operations of the New Docks were taken in hand, the epidemic still prevails in our locality most of the houses have been vacated, specially between the Fort Street and the Alibag Street, and the owners thereof have been put to a serious loss. It is a sore sight, indeed, to see the locality so desolate.

On account of the virulence of this epidemic, and not keeping good health some of us have been compelled to remove our families from Bombay and reside in the suburbs. This has put us into the double expense of house rent not to speak of the inconvenience and annoyance caused thereby.

We may add that the collection of water in the New Docks and rank vegetation around the Frere Road in the monsoon are the chief causes of the epidemic, and we have, therefore, the honour to request that, in view of the approaching monsoon, you will kindly issue such orders that the marshy grounds and the water pools complained of may be put right.

We have also to bring to your notice that the buffalo stables belonging to the European General Hospital which were at the southern end of the old compound have now been removed owing to the new Post Office buildings and they are to be rebuilt in the new compound of the hospital quite close to the dwelling houses on the road, which will be a great nuisance to and the means of spreading the malady amongst us. We have, therefore, to request you to kindly arrange for the same being built at the northern end of the compound where there are no dwelling houses, and we hope this will not inconvenience the authorities concerned.

By your enforcing the Municipal law, the sanitary condition of this locality will be greatly improved, for which we shall feel ever grateful."

Deputy Health Officer's (A Ward) No. 2721 of 1st June 1908 to the Executive Health Officer.

"Reference is requested to the Executive Health Officer's Nos. 18625 of 8th January 1908 and 12494 of 9th October 1907 to the Municipal Commissioner on the same subject.

Measures have since been kept up to pesterine all the storm water catchpits in the locality as well as pesterine the side-walls of gullies so as not to afford a resting place for mosquitoes. This has been repeated at frequent intervals. Stagnant pools in the New Dock compound were also pesterined.

The same precautions as were taken last year will be repeated this year to remove rank vegetation in the compound of the New Dock premises, the B. B. & C. I. Railway and G. I. P. Railway compounds and that of the St. George's Hospital and also to pesterine stagnant pools or to remove such as could be removed."

The Acting Executive Health Officer reported to the Municipal Commissioner under his No. 7208 of 15th June 1908 as follows:—

"As to the probable cause of the prevalence of Malaria in Frere Road, I have the honour to refer the Commissioner to the Executive Health Officer's reports No. 12494 of 9th October 1907 and No. 18625 of 8th January 1908, from which it will be seen that that Officer attributes the prevalence of Malaria in this District to the excavation going on in connection with the New Dock.

After a careful examination of the whole locality, I entirely agree with that opinion. The following action has been taken by this Department to meet the circumstances:—

All stagnant pools in the New Dock compound have been treated with pesterine frequently.

All house gullies in the infected neighbourhood have been regularly and systematically pesterined and the house walls on either side to the height of 2 feet or more. This has resulted in a marked diminution in the number of mosquitoes found there.

The catchpits of the storm water drains in this locality have regularly been pesterined.

The same measures as were taken last year will be repeated to deal with any rank vegetation in the compound of the New Dock premises, the B. B. & C. I. and the G. I. P. Railway compounds and also that of St. George's Hospital.

As the monsoon is rapidly approaching it is to be feared that during the breaks thereof large quantities of water will accumulate in the excavations and facilitate the breeding of mosquitoes. In view of this threatened source of danger, I am of opinion that the Port Trust should be written to and urged to take every precaution.

At present the Municipality treat the accumulations of water in their compound, but during the monsoon the amount of water to be treated will greatly increase and I consider the Port Trustees should bear the burden of the cost.

The best method of treatment would be by petroleum or pesterine. This should be regularly applied to every pool.

I have the honour to request the favour of the Commissioner approaching the Port Trust on this subject and urging on them the necessity of extensive, prompt and regular action on these lines.

The Municipal Commissioner under his No. 8292 of 19th June 1908 addressed a letter to the Secretary, Bombay Port Trust, as under :—

“I have the honour to state that a complaint has been received from the residents of Frere Road regarding the prevalence of Malaria in their neighbourhood and the Health Officer attributes this to the excavations going on in connection with the operations of the New Dock. During the breaks in the rains large quantities of water will accumulate in these excavations and thus facilitate the breeding of mosquitoes, the source of infection. The Municipality have up to this time been treating the accumulations of water on the Port Trust Estate with pesterine but during the monsoon the quantity of water to be dealt with will be enormous and I am of opinion that the Trustees should carry out this work. The best method of treatment would be by Petroleum or Pesterine which should be regularly applied to every pool.

I have the honour, therefore, to urge on the Port Trustees the necessity of extensive prompt and regular action in the matter.”

Corporation Resolution No. 1795 of 15th June 1908 runs thus :—

“That copy of the letter, dated the 1st June 1908 from Mr. S. D'Mello and others, praying for measures being taken for controlling malarial fever prevalent on Frere Road, be forwarded to the Commissioner for favour of remarks.”

The Acting Executive Health Officer under his No. 9816 of 14th July 1908, wrote to the Municipal Commissioner as under :—

“I met the various gentlemen mentioned in the Port Trust acting Secretary's letter No. 3444 of 4th July 1908 and pointed out what steps were desirable and they expressed their intention to do everything in their power to assist us in the matter.”

The Secretary, Bombay Port Trust, under his No. 3559 of 13th July 1908, wrote to the Municipal Commissioner as under :—

“In continuation of my letter No. 3444 of the 4th instant I am directed to say the Chief Engineer met the Executive Health Officer on the 10th idem and went over a portion of

New Dock Works with him, accompanied by Messrs. Price, Wills and Reeves' Agent and the Deputy Engineer. The Health Officer explained that he did not wish anything done to the pools while the rain lasted but during the breaks and in the fair weather he wished all pools of standing water to be treated with pesterine and all rank vegetation to be cut down. The Chief Engineer pointed out to him that all the water in the trenches and the bottom of the dock would be pumped out by the contractors in order to get on with the work. The contractors' agent agreed to drain off or fill in as many of the pools on the high ground as possible and treat the few remaining ones with pesterine and also to cut down the grass when long enough. The Health Officer seemed satisfied with this undertaking and suggested that a supply of quinine should be kept on the works and the men induced to take it.

"The contractors' agent promised to consult their Medical Officer about this."

The Acting Executive Health Officer under his No. 10238 of 18th July 1908, wrote to the Presidency Executive Engineer as under :—

"I have the honour to draw your attention to a large pool of water that has collected in the eastern portion of the new Post Office buildings at the junction of Fort Street and Frere Road, owing to the excavations of the foundations of a portion of these buildings on that side. Such an accumulation of water is likely to breed mosquitoes which not only cause nuisance and annoyance to the neighbouring residents, but may prove the means of spreading malarial fever among them. I would, therefore, request the favour of your filling up these excavations by expediting the building work, or treating the pools that already exist with kerosine oil or pesterine once a week.

This matter is urgent as numerous complaints have been made to the Corporation regarding the prevalence of Malaria in the Fort, and it is absolutely necessary that all causes that may contribute to the breeding of mosquitoes should be removed. I trust, therefore, you will be good enough to take prompt measures in the matter."

"P. S.—I personally found several larvæ of anopheles in this part on 17th July 1908."

The Acting Executive Health Officer under his No. 10262 of 18th July 1908 addressed a letter to the Engineer, G. I. P. Railway Co., as under :—

"I have the honour to inform you that when the yard and sidings of the G. I. P. Railway on Frere Road were inspected by me on the 17th instant I found several pools of water containing the larvæ of malarial mosquitoes. I also found some quarry holes filled with stagnant water in which stable refuse was deposited.

As complaints have been received regarding Malaria in this District, I request the favour of your filling in with good earth these pools and quarry holes without delay. This matter is very urgent as an extreme amount of Malaria is reported to prevail in this District.

In this connection I would request your attention to this office letter No. 12320 of 7th October 1907 in which similar insanitary condition of the yard, etc., was brought to your notice."

The Engineer, G.I. P. Railway, was addressed by the Executive Health Officer under his No. 12254 of 13th August 1908, thus:—

"I have the honour to invite your attention to this office No. 10262 of 18th July 1908 regarding pools of water containing the larvæ of malarial mosquitoes in the yard of the G. I. P. Railway Co. on Frere Road and to request the favour of your taking immediate steps to obviate the nuisance referred to.

I may also mention that the rank vegetation which abounds in the yard compound is an insanitary feature and is a resting place for mosquitoes and I therefore request the favour of your taking action for the same without any further delay."

The Acting Executive Health Officer under his No. 12255 of 13th August 1908 wrote a letter to the Physician in Charge, St. George's Hospital, as under:—

“I have the honour to draw your attention to the rank vegetation that has grown in the hospital compound. As this grass affords a resting place for mosquitoes I would request the favour of your taking action for the removal of the same.”

Under the Acting Executive Health Officer's No. 12613 of 17th August 1908 the Chief Engineer, B. B. and C. I. Railway, was addressed thus:—

“I have the honour to inform you that there are several pools of water containing the larvæ of malarial mosquitoes in the yard and sidings of the Railway Company on Frere Road and there are also some quarry holes filled with stagnant water in which stable refuse is deposited from the horse-box. I have also to bring to your notice the growth of rank vegetation in the yard compound. As these are very insanitary features and tend to breed malarial mosquitoes, I request the favour of your having the quarry holes and pools of water filled with good earth and the rank vegetation removed.

As complaints have been received regarding prevalence of malaria in this District I request the favour of your very early attention to this matter.

I may mention that last year this office had to draw your attention to similar insanitary conditions of the yard, etc., under this office No. 12321 of 10th October 1907.”

Corporation Resolution No. 2342 of 2nd July 1908 runs thus:—

“That the Commissioner be requested to report whether action under Section 377 or any other Section of the Municipal Act cannot be taken against those whose premises in Frere Road, Fort, have been known to be in such unwholesome or filthy condition as has proved dangerous to the health of the inhabitants of that locality and especially the Port Trustees in respect of the large area of marshy land near the New Docks, which is in the opinion of the Health Officer and the Executive Engineer the cause of the prevalence of malarial fever on Frere Road, and if so to take the necessary action and to report the result to the Corporation.”

The Acting Executive Health Officer wrote a letter to the Physician in Charge, St. George's Hospital, under his No. 13587 of 28th August 1908, as under:—

“In continuation of my No. 12255 of 13th August 1908 and others I have the honour to again invite your attention to the state of affairs at present existing in the compound of St. George's Hospital. Numerous representations have been made in the past with, I regret to-add, practically no results.

In continuation of the usual practice the compound was minutely examined by me to-day. I was accompanied by the Assistant to Health Officer and the Deputy Health Officer of the ward.

In practically every corner of the compound, breeding places were found and I have no hesitation in saying that I destroyed *many thousands of mosquito larvæ* (both *Culices* and *Anopheles*) to-day alone.

Frequent representations have been made by the Hospital authorities that Malaria is rampant in the Hospital. I have the honour to point out that such a condition of affairs as found by me to-day and on many previous occasions does not appear to me to be likely to conduce to a lessening of the number of cases.

What is required to be done to combat such a condition has been specified in previous correspondence.

In order to assist you in any measures you may deem it necessary to take, I will briefly enumerate the various places in which larvæ were found, though at the same time it is necessary to point out that the whole compound is practically a vast breeding ground.

1. The open channel storm water drain leading from the entrance into St. George's Road is overgrown with weeds and in consequence large pools of water form. These pools contained numerous larvæ. The obvious remedy is to clean out the weeds and silt.

2. Very many tubs situated under water taps at various places throughout the compound contained larvæ, both culices and anopheles.

3. A very large number of barrels were found lying about indiscriminately. The majority were so placed as to collect a maximum of rain water. *Nearly all contained larvæ.* I would suggest that whether the barrel be open or closed it should be laid on its side, and not placed on end as then, whether open or closed, larvæ breed freely in the accumulations of water.

4. There were a large number of iron basins lying about the compound, nearly all of these were placed in such a manner as to catch and retain rain water. *All contained larvæ.* If it is necessary to have such vessels about (and I fail to see the necessity, as they were lying about in utter confusion), I would suggest that they be turned upside down so as not to retain rain water.

5. Many score of old tins were found, *nearly all were full of water and such as were all contained larvæ, mostly anopheles.* These tins have simply been thrown away and allowed to accumulate. Many of them were almost hidden by the rank grass. I did not attempt to count them as such a proceeding would have occupied me too long.

6. Many pools bordering on Frere Road and quite close to the Frere Road entrance contained countless larvæ, *nearly all anopheles.*

7. A considerable portion of the compound is overgrown with rank vegetation, in which old tins collect and where rain water is bound to be retained in small pools.

Further I have the honour to point out that many of these breeding places were found within a few feet of bungalows and presumably under daily observation. It is the more inexplicable, therefore, how such a condition of affairs can exist.

The tins referred to above were found chiefly in the neighbourhood of the Servants' Quarters in the north-east corner of the compound. The water in some of the receptacles above complained of was simply teeming with larvæ.

In the interests of those compelled by circumstances to reside either temporarily or permanently in this area I have to again request your urgent co-operation.

I would suggest as a measure of relief that—

- (1) The rank grass be immediately cut.
- (2) The storm water drain be cleared of weeds and silt.
- (3) Every old tin be collected and removed from the premises. (Many thousands of larvæ were found in these tins).
- (4) If it is necessary to have barrels lying about the premises, these barrels should be laid on their side.

(5) The large iron basins scattered promiscuously over the compound be placed upside down so as to prevent the accumulation of water therein, failing their removal.

(6) The pools referred to near Frere Road be filled in.

(7) The various vessels (earthen) found in various places (and apparently unused) be collected and removed from the premises.

(8) An intelligent subordinate be deputed to inspect the whole compound systematically twice weekly and destroy any larvæ found.

I have the honour, in conclusion, to express the opinion that so long as existing conditions are permitted to continue it is not possible to hope for much diminution in the plague of mosquitoes complained of. Moreover, such a vast breeding ground in the Fort stultifies the efforts of this Department so admirably supported by the Port Trust authorities in the direction of combating Malaria in Fort North. A copy of this has been forwarded to the Municipal Commissioner for information."

Reply from the Physician in Charge under his No. F 609 of 5th September 1908, to the Acting Executive Health Officer through the Municipal Commissioner, runs thus :

"I have the honour to acknowledge your letter No. 13587, dated 28th August 1908, and to state that the suggestions made by you have received attention.

2. You appear to have the impression that I have full control of the compound in which this hospital is located, but I would point out that the Public Works Department has a certain sphere which it controls, *e. g.*, the cutting of grass, general drainage arrangements, their own store rooms, etc., none of these I can interfere with. I can only write and suggest that attention should be paid to them, as mentioned in the case of grass in this office No. F 948, dated 15th August 1908.

3. You imply that this compound is responsible in a great measure for the breeding of mosquitoes and the propagation of Malaria, but I would point out that Malaria was for a long time prevalent in the Frere Road and adjacent neighbourhood before this compound became affected. Admitting your statement that mosquitoes do breed here, I think that you have still to find the centre which infects the neighbourhood, and until you can prove that this hospital is that centre I am not prepared to admit what you imply. In the concluding para. of your letter you also imply that the Port Trust has enabled you to combat Malaria by what they have done, but I can state on most reliable authority that after the date of your letter prolific mosquito breeding grounds were found within the dock area to the east of this hospital.

4. I must say that your letter appears to me to exaggerate. For example :

(a) In your first para. you refer to "numerous representations". Will you be kind enough to quote the numbers and dates of these numerous representations? To the best of my recollection I received only one letter and that was written after a visit of an Assistant to the Health Officer who spent a short time in the compound, and after stirring some water with a bunch of twigs said they were swarming with larvæ, he did not even remove the water for inspection.

(b) You refer to the collections of "large pools of water" in the storm water drain. I consider that this is absolutely impossible; the drain is an open one and after even an ordinary shower it is filled and flushed; I have fre-

quently seen it absolutely dry an hour after heavy rain, and beyond very small collections, where the surface is uneven, and which are speedily dried by the sun, it is impossible for water to collect. Moreover, in a monsoon such as we have had, little opportunity is given for mosquitoes to breed in this drain, for, after ordinary rain, a large volume of water speedily flushes the whole channel out. It is impossible to prevent silt getting in. I am positive that under no circumstances can this drain be considered a breeding-place.

(c) I went round the whole compound on receipt of your letter and I certainly did not see a "large number of iron basins" nor "many score of old tins."

5. You consider it is inexplicable how such a condition of affairs can exist, but when I state that about 500 persons occupy this compound—that many live in quarters with grounds which they have a right to consider more or less private—that many (*e.g.*, private servants and irresponsible work people) are not under my control, that the staff of this hospital have other and more important duties to perform—and that there is a dual control—you will perhaps recognise that the duty of mosquito hunting presents some difficulties. On the other hand, I take it that it is the duty of the Health Department of the City to find out and combat dangers to the health of the community, and when definite suggestions are made, I shall be most happy to second the efforts of your Department as far as lies in my power."

The Acting Executive Health Officer under his No. 14559 of 10th September 1908 replied to the above letter thus:

"I have the honour to acknowledge the receipt of your letter No. F/609, dated 5th September 1908. I propose to discuss your remarks *seriatim*.

In reference to para. 2. A very extensive experience of hospitals, both Military and Civil (including the control thereof), has resulted in my being in the position to appreciate the difficulties of a dual control of which you complain in para. 2, under reference. I may be permitted to point out, however, that the usual custom throughout the world is to make the Superintendent of the Hospital (usually the Physician in Charge) responsible for the sanitary condition of the hospital, and on him devolves the duty of making such representations to the proper authorities as he may deem necessary. My personal experience has always been that such representations have been immediately attended to, the responsibility of neglect thereof being too great.

My letter of the 28th ultimo was addressed to you in recognition of the merits of that universal custom and not, as you suggest, as the result of any misconception as to the exact position of the Physician in Charge in the St. George's Hospital.

Para. 3 of your letter. The fact that Malaria was for a long time prevalent in the Frere Road and adjacent neighbourhood before the compound of St. George's Hospital became affected in no way alters the fact stated in my letter dated 28th August 1908: the statement contained therein was to the effect that I had on that date personally destroyed many thousands of mosquito larvæ (both *Culices* and *Anopheles*). It is safe to assume that their presence does not in any way lessen the risk of the patients and others becoming infected at some future date when full development has occurred.

Nor can I for a moment admit the suggestion that I, in my letter, implied that the St. George's Hospital compound was *the centre* which infects the neighbourhood. For your

convenience I quote the exact words used by me. 'Such a condition of affairs as found by me to-day and on many previous occasions does not appear to me to be likely to conduce to a lessening of the number of cases.'

To that opinion I must adhere. In the concluding portion of my letter I stated that the Port Trust authorities were admirably supporting the Health authorities in their endeavour to destroy breeding-places. I see no reason to modify that opinion.

In the absence of more definite information I am unable to express my opinion on the subject of the prolific mosquito breeding grounds stated to have been found within the Dock area subsequent to my letter of the 28th.

Para. 4 A. The representations made by this Department are enumerated below :

- (1) Letter from Divisional Health Officer, No. 1 Division, to Presidency Executive Engineer, dated 28th September 1907.
- (2) Letter No. 12208 of 4th October 1907, to the Physician in Charge, St. George's Hospital.
- (3) Letter No. 12774 of 12th October 1907, to the Physician in Charge, St. George's Hospital.
- (4) Verbal representation on or about the end of September to Major King, the Resident Surgeon, by the Sanitary Inspector, Mr. McAfee.
- (5) Verbal representation to, and demonstration of, the source of complaint made by the Acting Divisional Health Officer to Mr. Smith, the Steward.
- (6) Letter No. 12255 of 13th August 1908 to the Physician in Charge, St. George's Hospital.
- (7) The letter under reference No. 13587 of 28th August 1908.

I may point out in reference to the concluding portion of this para. that it is quite unnecessary to remove any water in order to demonstrate the mere presence of larvæ of mosquitoes.

Para. 4 B. In reference to your remarks regarding the collection of water in the 'Storm Water Drain.'

Circumstances do not permit my entering into an academic discussion as to the possibility or otherwise of such a drain affording facilities for mosquitoes to breed. You appear to consider such a thing impossible, and definitely state that '*it is absolutely impossible for large pools of water to collect in this drain*', and further add '*I am positive that under no circumstances can this drain be considered a breeding place.*'

I regret that I must meet this definite expression of opinion with the statement that the impossible has apparently been accomplished. Not only were there several large pools but also there were many hundreds of mosquito larvæ in these pools. I deeply regret that you have seen fit to so flatly contradict my statement, more especially as I am under the necessity of pointing out that four other individuals were witnesses of the existence both of the pools and larvæ.

Para 4 C. I am quite prepared to accept your statement that on receipt of my letter you went round the whole compound and that you did not see a 'large number of iron

'basins nor many score of old tins'. That is quite possible, but I must still adhere to my original statement for to do otherwise would necessitate my admitting that I imagined, *firstly*, that I saw them, *secondly*, that I treated with pesterine all those that contained larvæ, *thirdly*, that such as did not contain larvæ were overturned by me in imagination, and *lastly*, it involves the necessity of concluding that I was joined in my flights of imagination by the following:—(1) Dr. Sorab C. Hormusjee, (2) Dr. Malegaunwalla, (3) Mr. McAfee, the Sanitary Inspector of the Ward, and (4) the Assistant Sanitary Inspector, Mr. Parekh. All the abovementioned are of long experience in this City, two of them are qualified Medicalmen, the other two have had many years' service in this Department, and all helped me in searching for them and dealing with them when found.

In view of this I cannot believe that you are seriously prepared to dispute the existence of these tins.

Further, if such be the case it will be necessary for you to explain from whence came the 4 or 5 cart loads of old tins removed from St. George's Hospital compound on or about the 5th September 1908.

Para. 5. I may be permitted to point out that no one, whether living in private quarters or not, ought to allow conditions which are a nuisance and even a danger to health to exist in his immediate vicinity. Whether the Hospital compound contains 500 or 5,000 in no way lessens the responsibility of seeing that no nuisance exists. The condition of affairs was considered inexplicable by me owing to the fact that it is common knowledge that the inmates of St. George's Hospital are much troubled by mosquitoes. It is reasonable to suppose, therefore, that due search would have been made in the vicinity to ascertain a cause. A search may have been made, but judging from results it can hardly be deemed to have been a very exhaustive one.

As to the 'other and more important duties that the staff of the hospital have to perform,' I must refrain from expressing an opinion other than to say that anything that conduces to the comfort and improvement in health of the inmates of the hospital forms a very essential item on the list of duties.

The prevention of annoyance and danger from mosquitoes is, in my opinion, an item.

With reference to your concluding remark, as the officer temporarily responsible for the health of this City, I am fully alive to my duties and cares, but you will pardon me if I point out that among the duties delegated to me by the Commissioner in terms of the Municipal Act, I cannot find that of cutting grass, collecting old tins, and cleaning storm water drains, etc. My duty is to ascertain the existence of such things and invite the attention of those responsible for the premises wherein found. In my No. 13587 of 28th August 1908 I performed that duty.

I have to thank you for the efforts recently made by you to assist me in discharging my public duties, and to inform you that I visited the Hospital premises on the 8th instant and found a very much more satisfactory state of affairs. I would, however, again invite your attention to the pools in the immediate vicinity of the gani situated near the Frere Road entrance (near the Small-pox Hospital). I again had to treat these pools with pesterine on the 8th instant. It would be much more satisfactory if the depressions were filled in."

The Acting Chief Engineer, G. I. P. Railway, was addressed thus by the Executive Health Officer under his No. 14871 of 15th September 1908:

"With reference to your letter No. D-10068/C-108 of the 11th instant, I have the honour to inform you that in this office letter No. 10262 of 18th July 1908 I requested you

to take action for the removal of grass and pools in the Railway Yard to the east of the Victoria Terminus, whereas your letter under reply refers to the insanitary condition of the yard at Wari Bunder. I therefore request the favour of your attention to the yard to the east of Victoria Terminus as requested in my previous letter. I trust that you will at the same time carry out the steps mentioned in yours under reply, as such are very necessary."

Number of wells examined in the Fort	...	...	...	...	123
Number in which Anopheles were found	...	...	...	...	65
Number in which Culices were found	...	...	...	...	30
Number in which mixed Anopheles and Culices were found	...	...	...	...	25

Circular to the Deputy Health Officer, "A" Ward, No. 15008 of 17th September 1908 :

"As increased trouble is to be expected from mosquitoes this month I desire the Deputy Health Officer, "A" Ward, to depute Assistant Inspector Mr. Parekh with 4 men under him to spend their working day in searching for accumulations of water in building foundations, etc., and treating such accumulations when found with pesterine. Mr. Parekh should treat all roadside wells and catchpits, and should specially search for old tins containing water and uncovered cisterns, etc., in fact, for everything likely to afford any breeding ground for mosquitoes. This special duty will be terminated by a subsequent order.

I specially desire also that Sanitary Inspector Mr. Mc.Afee will continue to exercise the vigilance displayed by him in the past, as the appointment of Mr. Parekh on this special work is not intended in any way to lessen the responsibility devolving on the Sanitary Staff of Ward "A," but rather to augment the value of their work.

Mr. Parekh should commence his duties as soon as the Deputy Health Officer can arrange for it."

Circular to the Deputy Health Officers "B," "D," and "E" Wards.

"The Deputy Health Officer, Ward is requested to depute Sub-Inspector Mr. for special anti-malarial work. Mr. should be provided with four bigaries who are to be under his immediate orders.

The Sub-Inspector's duty will be to regularly and systematically search his Ward for all breeding places for mosquitoes and, when found, to there and then superintend his bigaries' work of treating the pools with pesterine. This should be done at the time of discovery and not deferred to some later period.

A concise statement of places visited and treated each day to be submitted through the Deputy Health Officer. This work is in no way to be interpreted as lessening the responsibility of the usual Sanitary staff in their duty of destroying breeding places. It is intended to supplement that work in a systematic way.

The Deputy Health Officer will please arrange to put four bigaries at the disposal of the Sub-Inspector and let him start this work as early as possible.

The whole of the Sub-Inspector's working day is to be devoted to this purpose only.

For the present the work of disinfection must be supervised by the Sub-Registrar.

This order may be revised, should Plague, etc., necessitate such a step."

A WARD.

Table showing the sections, their areas, and population since 1881.

SECTIONS.	Area in sq. miles.	POPULATION BY THE CENSUS OF —			
		1881	1891	1901	1906
Upper Colaba	·22	2,867	4,835	3,956	3,775
Middle and Lower Colaba	·42	14,265	13,622	13,023	15,310
Fort, South	·21	3,515	3,951	3,809	3,944
Fort, North	·21	33,828	32,847	22,956	28,778
Esplanade	1·04	13,080	10,064	10,398	11,015
Total ...	2·10	67,555	64,319	53,642	62,822

B WARD.

Table showing the sections, their areas, and population since 1881.

SECTIONS.	Area in sq. miles.	POPULATION BY THE CENSUS OF —			
		1881	1891	1901	1906
Mandvi	·26	42,351	37,295	31,402	38,158
Chakla	·08	37,058	32,197	24,384	29,862
Umerkhadi	·16	54,656	52,466	48,481	53,610
Dongri	·45	33,290	30,317	25,778	32,663
Total ...	·95	167,345	152,275	130,045	153,793

C WARD.*Table showing the sections, their areas and population since 1881.*

SECTIONS.	Area in sq. miles.	POPULATION BY THE CENSUS OF —			
		1881	1891	1901	1906
Market	·14	49,130	44,751	28,415	35,305
Dhobi Talao	·16	39,409	39,945	29,553	36,594
Fanaswadi	·20	23,218	24,069	16,354	29,240
Bhuleshwar	·12	38,106	38,363	30,229	38,129
Khara Talao	·07	28,691	27,035	28,161	26,935
Kumbharwada... ..	·07	34,990	32,209	27,544	32,784
Total	·76	2,13,544	2,06,372	1,55,256	1,98,987

F WARD.*Table showing the sections, their areas and population since 1881.*

SECTIONS.	Area in sq. miles.	POPULATION BY THE CENSUS OF —			
		1881	1891	1901	1906
Parel	·86	18,560	28,740	33,390	46,960
Sewri	·70	5,555	6,063	9,294	15,985
Sion	6·66	17,237	19,601	25,443	30,515
Total	8·22	41,352	54,404	68,127	93,460

E WARD.*Table showing the sections, their areas and population since 1881.*

SECTIONS.	Area in sq. miles.	POPULATION BY THE CENSUS OF —			
		1881	1891	1901	1906.
Mazagaon	·96	27,904	33,640	27,933	30,872
Tarwadi	·75	14,542	21,298	18,460	26,278
2nd Nagpada	·05	15,922	18,768	18,591	22,016
Kamathipura	·10	28,455	29,203	26,706	36,484
Tardeo... ..	·86	20,281	18,980	20,958	28,193
Byculla... ..	·80	26,842	47,403	57,646	76,290
1st Nagpada	·05	9,372	11,133	10,577	3,335
Total	8·07	1,43,818	1,80,425	1,80,871	22,3,458

D WARD.

Table showing the Sections, their areas and population since 1881.

SECTIONS.	Area in Sq. mile.	POPULATION BY THE CENSUS OF :—			
		1881.	1891.	1901.	1906.
Khetwady	·27	29,486	28,814	27,160	33,579
Girgaum	·20	25,319	26,999	14,866	28,449
Chowpati	·17	10,975	11,512	6,729	13,033
Walkeshwar	·85	11,303	12,990	10,563	12,685
Mahaluxmi	1·00	6,232	17,014	18,092	24,650
Total ...	2·49	83,265	97,329	77,410	112,396

G WARD.

Table showing the Sections, their areas and population since 1881.

SECTIONS.	Area in Sq. mile.	POPULATION BY THE CENSUS OF :—			
		1881.	1891.	1901.	1906.
Mahim... ..	2·01	17,309	18,505	27,386	31,178
Worli	2·84	14,621	25,493	45,588	69,488
Total ...	4·85	31,930	43,998	72,974	100,666

Table showing the Density of Population in the Wards, per square mile.

WARD.	ACCORDING TO THE CENSUS OF :—			
	1881.	1891.	1901.	1906.
A	32,121	30,866	25,543	29,915
B	176,152	160,289	1,36,889	1,61,887
C	280,979	271,542	204,284	261,825
D	33,439	39,088	31,088	45,138
E	46,683	58,770	58,915	72,787
F	5,030	6,618	8,263	11,369
G	6,583	9,071	15,046	20,755

A WARD.

Table showing Total Mortality and Fever Mortality.

YEAR.									Total Mortality.	Fever Mortality.
1880	...	...	...	...	...	...	...	...	1,427	443
1881	...	...	...	...	...	...	...	...	1,530	434
1882	...	...	...	...	...	...	...	...	1,359	410
1883	...	...	...	...	...	...	...	...	1,456	362
1884	...	...	...	...	...	...	...	...	1,479	458
1885	...	...	...	...	...	...	...	...	1,456	410
1886	...	...	...	...	...	...	...	...	1,323	362
1887	...	...	...	...	...	...	...	...	1,352	344
1888	...	...	...	...	...	...	...	...	1,415	339
1889	...	...	...	...	...	...	...	...	1,530	451
1890	...	...	...	...	...	...	...	...	1,347	399
1891	...	...	...	...	...	...	...	...	1,440	418
1892	...	...	...	...	...	...	...	...	1,686	539
1893	...	...	...	...	...	...	...	...	1,448	394
1894	...	...	...	...	...	...	...	...	1,466	387
1895	...	...	...	...	...	...	...	...	1,430	390
1896	...	...	...	...	...	...	...	...	1,927	552
1897	...	...	...	...	...	...	...	...	2,172	321
1898	...	...	...	...	...	...	...	...	2,962	193
1899	...	...	...	...	...	...	...	...	3,309	243
1900	...	...	...	...	...	...	...	...	4,329	315
1901	...	...	...	...	...	...	...	...	3,256	264
1902	...	...	...	...	...	...	...	...	2,647	231
1903	...	...	...	...	...	...	...	...	2,624	184
1904	...	...	...	...	...	...	...	...	2,341	145
1905	...	...	...	...	...	...	...	...	2,720	195
1906	...	...	...	...	...	...	...	...	3,004	283

B WARD.

Table showing Total Mortality and Fever Mortality.

YEAR.									Total Mortality.	Fever Mortality.
1880	...	...	...	...	...	...	...	...	5,354	2,077
1881	...	...	...	...	...	...	...	...	5,500	1,642
1882	...	...	...	...	...	...	...	...	5,218	1,288
1883	...	...	...	...	...	...	...	...	5,869	1,388
1884	...	...	...	...	...	...	...	...	5,555	6,916
1885	...	...	...	...	...	...	...	...	5,440	1,738
1886	...	...	...	...	...	...	...	...	4,953	1,574
1887	...	...	...	...	...	...	...	...	5,018	1,485
1888	...	...	...	...	...	...	...	...	5,196	1,669
1889	...	...	...	...	...	...	...	...	5,216	1,722
1890	...	...	...	...	...	...	...	...	4,564	1,519
1891	...	...	...	...	...	...	...	...	5,410	1,574
1892	...	...	...	...	...	...	...	...	6,116	1,829
1893	...	...	...	...	...	...	...	...	5,041	1,486
1894	...	...	...	...	...	...	...	...	5,784	1,545
1895	...	...	...	...	...	...	...	...	5,260	1,417
1896	...	...	...	...	...	...	...	...	7,371	1,940
1897	...	...	...	...	...	...	...	...	8,907	1,266
1898	...	...	...	...	...	...	...	...	9,985	793
1899	...	...	...	...	...	...	...	...	10,753	985
1900	...	...	...	...	...	...	...	...	15,735	1,628
1901	...	...	...	...	...	...	...	...	12,152	1,689
1902	...	...	...	...	...	...	...	...	9,871	730
1903	...	...	...	...	...	...	...	...	9,265	647
1904	...	...	...	...	...	...	...	...	8,330	663
1905	...	...	...	...	...	...	...	...	8,565	587
1906	...	...	...	...	...	...	...	...	9,314	817

C WARD.

Table showing Total Mortality and Fever Mortality.

YEAR.									Total Mortality.	Fever Mortality.
1880	...	...	...	...	...	...	...	...	6,079	2,270
1881	...	...	...	...	...	...	...	...	6,266	1,767
1882	...	...	...	...	...	...	...	...	5,734	1,401
1883	...	...	...	...	...	...	...	...	6,482	1,423
1884	...	...	...	...	...	...	...	...	6,249	1,787
1885	...	...	...	...	...	...	...	...	6,075	1,798
1886	...	...	...	...	...	...	...	...	5,521	1,603
1887	...	...	...	...	...	...	...	...	5,386	1,474
1888	...	...	...	...	...	...	...	...	5,673	1,586
1889	...	...	...	...	...	...	...	...	6,130	1,829
1890	...	...	...	...	...	...	...	...	5,892	1,707
1891	...	...	...	...	...	...	...	...	5,951	1,687
1892	...	...	...	...	...	...	...	...	6,518	1,921
1893	...	...	...	...	...	...	...	...	5,740	1,537
1894	...	...	...	...	...	...	...	...	6,330	1,613
1895	...	...	...	...	...	...	...	...	6,083	1,636
1896	...	...	...	...	...	...	...	...	8,256	2,215
1897	...	...	...	...	...	...	...	...	9,139	1,469
1898	...	...	...	...	...	...	...	...	12,351	966
1899	...	...	...	...	...	...	...	...	11,621	898
1900	...	...	...	...	...	...	...	...	16,726	1,306
1901	...	...	...	...	...	...	...	...	13,701	1,298
1902	...	...	...	...	...	...	...	...	10,614	890
1903	...	...	...	...	...	...	...	...	11,089	470
1904	...	...	...	...	...	...	...	...	9,701	410
1905	...	...	...	...	...	...	...	...	9,852	546
1906	...	...	...	...	...	...	...	...	9,990	814

D WARD.

Table showing Total Mortality and Fever Mortality.

YEAR.	Total Mortality.	Fever Mortality.
1880	2,009	669
1881	2,092	583
1882	1,832	464
1883	2,259	546
1884	2,231	648
1885	2,024	579
1886	1,922	580
1887	2,063	563
1888	2,171	595
1889	2,329	704
1890	2,076	630
1891	2,204	658
1892	2,368	674
1893	2,133	540
1894	2,530	658
1895	2,381	628
1896	2,865	741
1897	3,895	647
1898	4,787	386
1899	5,277	412
1900	7,044	641
1901	5,486	604
1902	4,468	376
1903	4,773	218
1904	3,904	226
1905	4,232	249
1906	4,211	371

E WARD.

Table showing Total Mortality and Fever Mortality.

YEAR.	Total Mortality.	Fever Mortality.
1880	4,447	1,363
1881	4,319	1,221
1882	4,284	1,114
1883	5,101	1,841
1884	4,640	1,380
1885	4,653	1,333
1886	4,337	1,168
1887	4,593	1,147
1888	5,115	1,541
1889	5,406	1,551
1890	4,780	1,398
1891	5,684	1,448
1892	6,379	1,681
1893	5,595	1,122
1894	7,265	1,853
1895	6,640	1,462
1896	8,879	2,217
1897	13,754	2,000
1898	14,042	1,039
1899	16,644	1,569
1900	23,142	2,633
1901	16,108	2,726
1902	12,886	1,342
1903	13,650	535
1904	11,657	726
1905	13,465	965
1906	15,932	1,864

F WARD.

Table showing Total Mortality and Fever Mortality.

YEAR.	Total Mortality.	Fever Mortality.
1880	997	436
1881	1,148	489
1882	1,101	425
1883	1,222	463
1884	1,209	511
1885	1,031	435
1886	1,000	321
1887	1,081	360
1888	1,431	505
1889	1,529	619
1890	1,343	541
1891	1,693	660
1892	1,991	741
1893	1,643	477
1894	1,886	500
1895	1,451	447
1896	1,635	571
1897	4,103	720
1898	3,325	377
1899	4,318	490
1900	6,051	766
1901	4,331	833
1902	3,726	437
1903	4,079	113
1904	3,181	127
1905	4,038	160
1906	4,895	314

G WARD.

Table showing Total Mortality and Fever Mortality.

YEAR,	Total Mortality.	Fever Mortality.
1880	587	223
1881	702	244
1882	676	303
1883	859	340
1884	900	308
1885	854	314
1886	741	184
1887	754	202
1888	1,087	374
1889	792	324
1890	649	242
1891	922	352
1892	941	315
1893	913	224
1894	1,382	325
1895	1,206	349
1896	1,663	465
1897	2,909	426
1898	2,663	304
1899	4,284	502
1900	6,203	634
1901	4,296	496
1902	4,108	501
1903	4,911	156
1904	3,435	111
1905	4,750	163
1906	5,378	387

A WARD.

Tables showing the total number and the number of Fever cases treated in the
Municipal Dispensaries.

Frere Road Dispensary.

Year.	Total Number of cases treated.	Number of fever cases.	Percentage of fever cases.
1902 (from May)	2,212	833	37·65
1903	5,014	2,074	41·36
1904	6,605	2,984	45·17
1905	8,367	4,086	48·53
1906	10,160	4,852	47·75

Colaba Dispensary.

1902	6,344	1,850	28·84
1903	7,993	2,676	33·48
1904	7,123	2,958	41·52
1905	7,244	2,559	35·32
1906	10,146	4,357	42·94

B WARD.

Kolsa Moholla Dispensary.

Year.	Total Number of cases treated.	Number of fever cases.	Percentage of fever cases.
1902	1,232	377	30·6
1903	4,266	1,132	26·5
1904	5,495	1,346	24·5
1905	4,220	1,193	25·9
1906	4,002	1,034	25·8

Jail Road Dispensary.

Year.	Total Number of cases treated.	Number of fever cases.	Percentage of fever cases.
1902	11,554	3,152	27·3
1903	11,575	3,322	28·6
1904	13,134	2,916	22·2
1905	13,075	3,426	26·2
1906	12,773	4,123	32·3

C WARD.**Bapu Khote Street Dispensary.**

Year.	Total Number of cases treated.	Number of fever cases.	Percentage of fever cases.
1902	1,081	216	19·98
1903	2,016	390	19·34
1904	2,807	509	18·13
1905	2,078	454	21·85
1906	3,057	635	20·77

Grant Road Dispensary.

1902	11,883	1,835	15·4
1903	10,104	1,580	15·5
1904	9,372	1,356	14·4
1905	10,142	1,284	12·6
1906	8,744	1,473	16·8

D WARD.

Kandewady Dispensary.

Year.	Total Number of cases treated.	Number of fever cases.	Percentage of fever cases.
1902	2,380	919	38·6
1903	3,768	1,242	32·9
1904	4,135	1,290	31·1
1905	3,948	1,425	36·09
1906	4,042	1,526	38·2

E WARD.

Ripon Road Dispensary.

Year.	Total Number of cases treated.	Number of fever cases.	Percentage of fever cases.
1902	12,906	3,549	27·5
1903	15,502	2,754	17·7
1904	17,826	2,159	12·1
1905	15,925	1,472	9·2
1906	15,898	1,014	6·3

Foras Road Dispensary.

1902	5,985	1,148	19·18
1903	11,006	1,278	11·61
1904	10,044	749	7·45
1905	11,501	2,138	18·58
1906	10,744	2,301	21·41

F WARD.

Naigaon Dispensary.

Year.	Total Number of cases treated.	Number of fever cases.	Percentage of fever cases.
1902	4,076	285	6.99
1903	5,271	319	6.05
1904	5,000	403	8.06
1905	5,380	274	5.09
1906	5,664	358	6.32

G WARD.

De Lisle Road Dispensary.

Year.	Total Number of cases treated.	Number of fever cases.	Percentage of fever cases.
1902	19,124	2,566	13.41
1903	16,286	2,522	15.43
1904	15,013	2,644	17.61
1905	15,050	2,543	16.89
1906	13,625	2,161	15.86

A WARD.

This ward is composed of the following Sections :—

Upper Colaba,
Lower and Middle Colaba,
Fort North,
Fort South, and
Esplanade.

The following localities are noted for fever in the ward :—

- (1) Fort North,
- (2) Colaba Village,
- (3) Victoria Bander.

We will take *Fort North* first. It consists of two portions :—

- (a) The portion that was included within the ramparts of the old Fort St. George of Bombay, and
- (b) The portion to the east of Mint Road, between it and the harbour.

Taken as a whole area the greater portion of Northern Fort is very insanitary. The houses are generally old, high, densely packed together, and devoid of any open air spaces around them either for ventilation or for drainage purposes; the drains, consequently are found to run through the basements of some of the houses. The roads run chiefly North and South, and even these are not wide and are flanked by high houses on both sides. The cross streets intersecting the roads are very narrow and tortuous. On this account the houses, with the exception probably of the front rooms, are dark and ill-ventilated, and the ground floors as a rule damp. Even where "Chowks" or open spaces are provided, they are not large enough for admitting sufficient light and air.

The southern portion of Fort North is inhabited chiefly by Parsees, and the northern portion by better class Hindoos.

The portion of the Fort North which lies to the east of Mint Road, although only of about thirty years' growth, has been built upon with very narrow sweepers' passages between the houses which are large tenement dwellings and very high. Consequently all the back rooms of these houses are dark and ill-ventilated.

This area is inhabited by a miscellaneous class of people, and low caste Hindoos, and the houses occupied by the better class show considerable over-crowding.

Fort North is noted chiefly for Malarial fever, and shows occasional cases of Enteric. There is a Charitable Municipal Dispensary in Frere Road, and statistics (already submitted to the Fever Committee) show that during the last five years from 87-65 to 48-83 per cent. of the cases treated in the Dispensary were suffering from Malarial fever. Blood specimens taken from six patients attending the Dispensary, and living in different parts of Fort North, were examined by me and all found to contain Malarial Parasites.

The following table shows the total number and the number of Malarial fever cases treated in the Frere Road Dispensary during each month in 1906 :—

1906.	Total No. of cases treated.	No. of Malarial fever cases.	Percentage of fever cases.
January	764	350	45.95
February	776	339	43.68
March	862	402	46.63
April	759	306	40.31
May	680	259	38.08
June	700	277	39.56
July	900	397	44.11
August	1,102	555	50.36
September	899	480	53.28
October	958	512	53.32
November	982	571	58.14
December	778	404	51.92
TOTAL ...	10,160	4,852	47.75

It will be seen from the above figures that the percentage of Malarial fever cases coming for treatment in this Dispensary is very high, and that the percentage goes much higher during the rainy season, reaching as high as 58.14 during the month of November.

The figures from the same Dispensary for the year 1907 show practically the same thing, but the ratio shows a considerable increase of Malarial cases throughout the year and reached the abnormally high figure of 65.95 per cent. during the month of October.

1907.	Total No. of cases treated.	No. of Malarial fever cases.	Percentage of fever cases.
January	772	379	49.04
February	638	268	42.00
March	712	356	50.00
April	688	329	47.67
May	808	457	56.55
June	868	531	61.17
July	979	606	61.90
August	1,255	806	64.22
September	1,211	759	62.67
October	1,504	992	65.95
November	1,074	578	53.81

Another area in A Ward which is very unhealthy is known as the Colaba Village. It is contained in Lower Colaba a little to the south of the "Cotton Green," bounded on the north by Thomas Street, west by Colaba Road, south by the Gun Carriage Factory and east by Thomas and Nowroji Streets. The village itself occupies a very small area and is very thickly packed with houses which are old and very much overcrowded; the ground floors are generally damp, and rooms small, dark and ill-ventilated. The streets are very narrow and tortuous.

The village is peopled mostly by poor working classes, chiefly Maratha labourers, employed in the adjacent Cotton presses or go-downs or on the "Cotton Green." A few fishermen also live in this locality.

A little to the south of the Colaba Village is another unhealthy locality consisting of a group of estate, and known as the Victoria Bunder. Notwithstanding the fact that these chawls have been recently built, and in accordance with Municipal requirements, the rooms are all extremely overcrowded being occupied not only by the Mill-hands working in the adjoining Mill but also by their families, relatives and friends. This arrangement makes each room practically a boarding house and the resulting overcrowding is very much in evidence at night time when every available space in the rooms and on the verandahs is utilised for sleeping purposes. All this overcrowding is the result of high rents and also from want of more living accommodation in this neighbourhood.

The privy arrangement for these chawls is a detached row of latrines away from the chawls. As a result of this and also of overcrowding, a number of residents, instead of making use of these latrines in the mornings, foul the open spaces around the chawls. This nuisance, however, has been considerably lessened under a stricter supervision on the part of the Land Company authorities, as a result of constant complaints from the Health Department.

The following statistics for the year 1906 from the Colaba Dispensary, which is situated in the Colaba Village, show that there is a good deal of Malarial fever prevalent in these localities, and that the number of fever cases goes up considerably during and after the rainy season :—

1906.	Total No. of cases treated.	No. of Malarial fever cases.	Percentage of Fever cases.
January	722	204	28.25
February	578	188	32.52
March	785	230	29.29
April	842	288	34.20
May	801	277	34.58
June	698	272	39.24
July	1,081	654	60.49
August	1,226	664	54.12
September	974	464	47.63
October	899	471	52.50
November	848	390	45.99
December	697	255	36.48
Total	10,146	43,570	42.94

It has been already stated that the whole of Fort North is chiefly noted for Malarial fevers, and fevers of Remittent types. Among the poorer residents of Frere Road, Relapsing fever also is very prevalent when it is epidemic. In Colaba Village and Victoria Bunder also Relapsing Fever is very common among the residents in addition to Malaria. All these localities are generally badly affected with plague.

Malarial mosquitoes have been in a number of places in these localities. *Anopheles* larvæ have been found from time to time in the basins of various fountains, in drinking troughs, in buckets and tubs where water is stored as a precautionary measure against fire, in open cisterns, in pools of water formed from overflow from stand-pipes, and in collections of water formed during rains.

Culex larvæ have been found chiefly in wells, gullies, storm-water catchpits, chiefly in the places with stagnant water.

The following are some of the specific instances where *Anopheles* larvæ have been detected some time or another in A Ward :—

They have been found in the Wellington Fountain Basin.

They have been found in the basin of the Floral Fountain, sometimes in abundance.

The late Dr. Cayley found them only once in the Elphinstone Circle Garden Fountain. Even at times when they are abundant in the Floral Fountain, they are not to be found in this Fountain owing to presence of fish.

They have been found in an unused well in Marine Lines.

They have been found in the basin of the Zoroastrian fountain, Parsi Bazar Street.

They have been found in the buckets and tubs kept as a precautionary measure against fire in the Goculdas Tejpal Health Camp and in the Modikhana, and Parsi Camps at Mody Bay. These camps have now been demolished.

They have been found on the Cooperage in pools formed by the overflow of water from a small stand-pipe.

They have been found in a garden off Hummum Street in depressions in the ground and in surface drains.

They have been found in tubs and buckets kept at the Colaba Health Camp.

They have been found in the Wodehouse Bridge Camp in pools of water.

They have been found in pools of water on the "Cotton Green".

Anopheles have been never found in the Mint Tank.

Many of the wells on the Esplanade and also inside houses have been examined from time to time, but in no cases (with the exception of one unused well in Marine Lines) have *anopheles* larvæ been detected, although in many of these *culex* larvæ have been found in abundance.

Outbreak of Malaria in 1907.

Early in October 1907 it was reported that a number of cases of Malarial fever of a severe type had occurred in St. George's Hospital, and in the adjacent houses on Frere Road. The District Registrar No. 1 who was in charge of the Municipal Dispensary at Frere Road reports that prevalence of fever was in no way peculiar to Frere Road, as it was prevalent all over Fort North as was seen from the attendance at the Dispensary, where the percentage of fever cases had risen during the previous months of July, August and September to 61·90, 64·22, and 62·67, respectively.

The Acting Divisional Health Officer was then instructed to inspect the neighbourhood. He visited the St. George's Hospital, where in almost all the garden tubs provided for the separate gardens in connection with the several detached quarters in the Hospital compound, and in shrubs in close proximity to these, he discovered anopheles mosquitoes and anopheles larvæ. He also discovered anopheles larvæ in some barrels containing water, in buckets provided at the servants' quarters, and in two tanks in connection with the Dhobis' watering place. The seal of one trap also showed larvæ and anopheles were about. The G. I. P. Railway Yard to the west of the Hospital and all the open places to the east of Frere Road were also examined but no anopheles or pools or breeding places were discovered. All the places where larvæ were found were treated with Pesterine.

In reporting on this outbreak of fever, the Health Officer says: "An increase in fever cases is always anticipated after the rains, but the present epidemic is rather exceptional. For Malarial fever to spread certain chief factors are necessary: the parasite in the blood of the animal or man, and the Malarial bearing mosquito which conveys the parasite, and collections of water for the mosquito to breed. Unfortunately all these are present in Bombay at present.

"In large compounds like the European General Hospital the goods and rail yards of the G. I. P. and B. B. & C. I. Railways and the New Docks, collections of water and rank vegetation are present in large numbers. The workmen at the New Docks and in the excavations suffering from Malaria contain the parasite in their blood which is readily conveyed to other persons living in houses in the vicinity.

"The mosquito when fully developed from the larvæ on these collections of water, searches for blood and finds it in the cooly exposed to its attacks. The cooly's blood contains the Malaria parasite. The mosquito thus containing the parasite is carried away by wind to other parts of the neighbourhood, enters houses at night, and attacks susceptible people, after which it seeks the nearest collection of water to lay its eggs. This water may be an open cistern on top of the house, a garden tub, or old pot or can, or even the tins containing water put under the feet of cupboards in houses, or wherever water collects and is allowed to remain undisturbed there will the mosquitoes breed. Larvæ have been found at all the places mentioned above, and even in open drains and gully traps which are not disturbed.

"The Health Department some months ago issued a caution against Malaria and suggested how to prevent it, and issued notices to all concerned.

"In the present instance and wherever pools of water are found they are treated with Pesterine or kerosine. But the ubiquitous mosquito is hard to deal with, and in addition to measures for the prevention of breeding, measures against its attacks should be adopted by taking quinine, and the use of Mosquito curtain."

Letters were addressed to Messrs. Price, Wills and Reaves, Dock Contractors, to Port Trust Engineer, and Engineers of the G. I. P. and B. B. & C. I. Railways requesting these authorities to take the necessary measures to prevent the breeding of mosquitoes in their compounds, and have pesterined all the collections of water in the neighbourhood.

On inspecting this locality again early in December, a few culex larvæ only were discovered on a gully trap of a house in Frere Road and also in a long channel of brackish water in an excavation in the New Dock.

B. WARD.

This ward comprises the following sections :—

Mandvi, Chakla, Umarkhadi and Dongri.

Of these sections, Mandvi has now acquired unenviable notoriety on account of Plague, and it is in this locality that Plague is supposed to have first started in this City.

Taken generally most of the houses in Mandvi are high and overcrowded, and the ground floors are utilised as godowns or stores for storing grain, sugar, spices or gunny bags. In some parts, *viz.*, in the vicinity of DeSouza Street, the streets are very narrow, and the houses in consequence are ill-ventilated and dark. The habits of the people who are chiefly Baniyas and Lohanas are insanitary, food and refuse is generally thrown into gullies where it decomposes and renders the air of the locality very offensive. In fact this is an ideal section for attracting and sheltering rats and for the dissemination of plague.

But Mandvi, although a hot bed of plague, is by no means a locality where Malarial fevers can be said to be prevalent. This is because this locality is peculiarly free from any open areas where fresh water can accumulate in pools or puddles and form suitable breeding places for anopheles mosquitoes. The culex mosquito, however, exists, and culex larvæ have been sometimes found in drinking troughs for cattle in Mandvi, and in the basin of the fountain in Dongri Street.

Umarkhadi.—The whole of this section is very congested. Most of the houses are dark, damp, old, ill-ventilated and overcrowded. Some of the public streets are narrow and tortuous. A part of this District will be considerably opened up by the City Improvement Trust new Road ; but the remaining portion will still need great alterations. Umarmkhadi Section, in spite of these defects, cannot be put down as malarial. There is one large Tank in this section, *viz.*, the Baboola Tank ; it has been partially filled in, but no anopheles larvæ have been ever detected in it.

Two of the most insanitary areas in Umarmkhadi are situated in the immediate neighbourhood of this tank, the one to the west is known as Pathanwadi and the chawls in this locality are low, without plinth, damp in all seasons and very badly ventilated. Rooms are small and greatly overcrowded.

The other unhealthy locality in this section lies to the east of the tank and in the immediate vicinity of the Municipal Health Department Stable at Jail Road. In this locality, which is chiefly occupied by low caste Hindoos, Relapsing fever is very common when it is epidemic. In this connection it is interesting to note that Relapsing fever has also frequently broken out in an epidemic form among the convicts of the Common Jail which is in close proximity to this area, although isolated from it by a very high wall.

Dongri.—The whole of Dongri to the west of the Railway line is insanitary, and the west portion of it known as the Nowroji Hill is to be demolished under the City Improvement Trust Scheme.

To the north of Nowroji Hill and separated by Chinchbunder Road is a small, insanitary area known as Walpakhadi. It is bounded on the north and east by G. I. P. Railway yard, on the west by Mazagaon Road and south by Chinchbunder Road. A greater portion of this area is below the level of the sewers in the Mazagaon and Chinchbunder Roads, and consequently very damp and water logged in the monsoon. This area has been acquired as a site for chawls for the Health Department Halalkhores, and has been recently considerably improved by demolishing the bullock sheds which before saturated the ground with dung and filth, and by filling up the low-lying parts.

Vandekar's Lane is another insanitary area in this section. It is a small bifurcating lane situated at the foot of Nowroji Hill at its southern extremity. The houses are closely aggregated, overcrowded, low, without plinth, damp, dark and ill-ventilated. The lane is hardly 4 feet in width in some places and very dirty. The drainage is defective, and gully traps and pipe lines are constantly choked.

These localities are noted for plague and Relapsing fever, while cases of Malarial fever also are met with in Walpakhadi.

B ward contains two Municipal Dispensaries : one at Kolsa Mohalla, near Pydhoni, at the North-west corner of Chukla section, and the other at Dongri, at the north end of Jail Road east where it joins Chinchbunder Road.

The following table shows the number of Malaria cases treated in Kolsa Mohalla Dispensary during the various months in the year 1906 :—

1906.	Total No. of cases treated.	No. of Malarial fever cases.	Percentage of fever cases.
January	280	79	28.25
February	314	85	27.8
March	336	99	29.5
April	299	67	22.4
May	316	77	24.3
June	227	69	30.4
July	300	98	32.7
August	404	109	27.
September	345	99	28.8
October	482	100	20.2
November	367	84	22.9
December	332	68	20.5
TOTAL	4,002	1,034	25.8

The percentage of fever cases as shown in the above figures is rather high for B ward, but the Dispensary is situated close to the boundary of C ward, and treats a number of cases from the neighbourhood of Mumbadevi Temple, Telwady and Ghogari Moholla which are all in C ward. The actual number of fever cases treated is very small.

The following table shows the number of Malaria cases treated in the Jail Road Dispensary during the same period :—

1906.	Total No. of cases treated.	No. of Malarial fever cases.	Percentage of fever cases.
January	1,004	340	33.7
February	916	310	33.8
March	1,200	327	27.2
April	1,037	292	28.1
May	969	303	31.2
June	885	318	35.9
July	1,063	320	30.1
August	1,255	428	34.1
September	1,178	336	28.5
October	1,150	449	39.0
November	1,170	393	33.5
December	946	307	31.4

The percentage of Malarial cases in this Dispensary is rather high, and the actual number of Malarial fever cases treated is also large. Although these figures also include a few cases from the adjoining E Ward they give a more or less correct idea of the prevalence of Malaria which exists in Walpakhadi and its neighbourhood and parts of Nowroji Hill.

Anopheles have been discovered in very few places in B ward. Their larvæ have been found in the G. I. P. Railway yards at Wari Bunder during the rains and also in some buckets and iron cisterns in the Government Telegraph Stores. They most probably come from the neighbouring Bhandarwada Hill where they are generally found in large numberse.

As stated before culex larvæ have been sometimes found in drinking troughs for cattle in Mandvi and in the basin of the fountain in Dongri Street.

C WARD.

This ward contains the following Sections:—

Market, Dhobi Talao, Fanaswadi, Bhuleshwar, Khara Talao and Kumbharwada.

This is the most densely populated ward and situated in the very heart of the City, and although it is usually badly affected with plague, small-pox, cholera and other infectious diseases when these are epidemic in the City, and although it contains a large number of areas that are insanitary on account of density of houses, overcrowding, imperfect ventilation and unsatisfactory drainage, still it cannot be said that any particular locality in this ward is noted for Malaria fevers. Relapsing fever is very common in certain chawls inhabited by lower classes, and cases of Typhoid fever are occasionally come across in the ward.

Market.—The southern portion of this Section contained a number of insanitary areas which in previous years were hot-beds of plague and every epidemic disease; but they have been all pulled down by the City Improvement Trust.

In the northern portion of it, there still exists a small insanitary area, situated to the north of Vithalwady and known as Telwady. This locality is traversed by narrow and irregular lanes, flanked by many old rickety and insanitary houses and chawls with no adequate means of obtaining light and ventilation. Many of the chawls are overcrowded, and Plague, Phthisis, Remittent fevers and epidemic diseases generally are common. The Executive Engineer has proposed that a new street should be run through the centre of this area which would prove sufficient to admit light and fresh air "where now both these are all too rare."

Dhobi Talao.—The whole of this Section is more or less unsatisfactory and contains a number of insanitary areas:—

There is an insanitary locality to the north and west of the Dhobi Talao Tank. It is bounded on the north by Lohar Street, on the west by Wellington Street and Dhuswady, south by 1st Marine Street, and east by Girgaum Road. The houses are densely packed together in this area, and are in most cases attached to each other, and back to back with a long range of gullies between. In many instances the drainage passes through the houses. A great number of the houses are high, give accommodation to a large number of people, and consequently there is considerable overcrowding; the ventilation is imperfect, and the air in the houses highly charged with organic matter. Relapsing fever, and fevers of intermittent and remittent types and plague are common in this locality.

A little eastward and situated near the southern end of Kalbadevi Road, is a small blind area known as Kolbhatwady. The houses here are irregular and densely huddled together with narrow winding gullies between, and are dark, damp, and ill-ventilated; the rooms are small and overcrowded and inhabited by poor and low-class people. The whole of Kolbhatwady is surrounded by high houses which effectually prevent thorough ventilation. Unfortunately this area abuts upon, but does not form part of the City Improvement Trust Scheme No. II, and will remain insanitary unless specially dealt with. Plague and Relapsing fever are common here.

Further northward is another insanitary area known as Cavel. It is bounded on the north by Agiary Street, on the west by Girgaum Road, South by Kolbhat Street, and east by Kalbadevi Road. This is a large area chiefly inhabited by Hindoos and Christians, and surrounded by high houses which effectually stop free circulation of air. The streets are narrow and tortuous and the houses show a considerable overcrowding. The height of some of the houses is three times the width of the street, and the Deputy Health Officer of the ward remarks that he is "curious to know what law controls the height of houses in this particular area."

Fanaswadi.—There is an insanitary area in this section noted for plague and Relapsing fever. It is bounded on the north by Burrows Lane, west by Queen's Road, south by Old Sonapur Lane, and east by Girgaum Road. The houses in this area are mostly dark, damp and ill-ventilated; the rooms are small and show considerable overcrowding. The locality is inhabited chiefly by Hindoos of lower class, Christians, Mahomedans and a few Parsees, and contains Allibhoy Karimji's chawls, Battliwala's chawls, Tadwady, Dukerwady and Nana's wady, which are all noted for Relapsing fever and plague. In Nana's Wady there are a number of upper storey chawls situated between two large stables.

A little northward and to the east of Girgaum Road, there is another insanitary locality chiefly inhabited by Hindoos, and known as Zaoba's Wady. The place is low-lying, densely packed with houses, and shows considerable overcrowding. Fevers of remittent and intermittent types are prevalent in this area.

Bhuleshwar.—There are two unhealthy localities in this section, viz. :—Bhoiwada and Ghogari Moholla.

The former comprises the 1st, 2nd and 3rd Bhoiwada Streets, and the 3rd Bhoiwada Cross Lane. This area shows a great density of houses, which are all with two or three and even four storeys, and fully tenanted. The houses are back to back with long gullies between. They are attached to one another, and the drains of the majority of them pass through the houses. There is considerable overcrowding; each house may be considered a miniature village.

The second unhealthy area is known as Ghogari Moholla. It is bounded on the north by Erskine Road, on the west by Alli Umar Street, east by Parel Road (Bhendy Bazar) and on the south by Banian Street. This area is inhabited chiefly by Mahomedans. The streets are narrow and the houses are old, lofty, densely packed together, dark, ill-ventilated and in some cases damp. The houses are attached to one another with a long range of gullies common to them at the back.

In both these areas, plague and fevers both remittent and intermittent are commonly prevalent.

Khara Talao.—This is a very congested section occupied chiefly by Mahomedans. Most of the houses are dark, ill-ventilated and overcrowded. Phthisis and continued fevers are commonly prevalent in this District. A portion of this locality will be considerably opened up and improved by the City Improvement Trust New Road passing through it, but the remaining portion will still require much attention.

Kumbharwada.—A large portion of Kumbharwada has now been demolished, and considerably improved by the construction of new roads by the City Improvement Trust. This locality used to be very much congested, very unhealthy and always notorious for Relapsing fever and plague.

The portion of this section in the vicinity of the North Brook Garden and known as Durgadevi is still overcrowded. Relapsing fever is common in this area, and Malaria is frequently prevalent about the monsoon time on account of the puddles and pools formed in the neighbouring burial grounds acting as suitable breeding places for mosquitoes.

C Ward contains two Municipal dispensaries—one in Bapoo Khote Street and the other in Grant Road.

The following table shows the number of Malarial cases treated in the Bapoo Khote Street Dispensary during the various months in the year 1906 :—

1906.	Total No. of cases treated.	No. of Malarial fever cases.	Percentage of fever cases.
January	269	60	22·31
February	214	45	21·02
March	243	54	22·22
April	225	44	19·56
May	258	28	10·85
June	185	42	22·70
July	245	48	19·59
August	270	59	21·85
September	293	66	22·53
October	314	54	17·20
November	278	65	23·38
December... ..	267	70	26·22
TOTAL ...	3,057	635	20·77

Continued fevers are common in the vicinity of this Dispensary, viz., Bhuleshwar, Bhoiwadas, Mumbadevi and Telwady, and some of the patients in the latter districts seek medical relief, as already stated, in Kolsa Moholla Dispensary in B Ward.

The other Municipal Dispensary in this ward is situated in Grant Road, near the corner of Kumbharwada section. It was originally located in this section, and the following table shows the number of Malarial fever cases treated in it in the various months in 1906 :—

1906.	Total No. of cases treated.	No. of Malarial fever cases.	Percentage of fever cases.
January	755	144	19.07
February	605	126	28.8
March	799	143	17.8
April	736	131	17.7
May	698	100	14.3
June	630	98	15.7
July	597	102	17.08
August	809	99	12.2
September	851	109	12.8
October	782	118	15.1
November	758	147	19.3
December	724	156	21.5
TOTAL ...	8,744	1,473	16.8

It will be seen from the above figures that Malarial fever is not common in the neighbourhood of this Dispensary.

Malarial mosquitoes have been found in very few places in this ward. Anopheles larvæ have been often discovered in a well in No. 80, 3rd Bhoiwada Street, but this well has now been filled in.

On the 16th of December 1907 I examined the water in the large tank in the compound of Bhuleshwar Temple. The water was found to contain green algae in large quantities, and was swarming with Anopheles larvæ. So far as I am aware, Anopheles larvæ have not been looked for or detected in this tank which is considered sacred, and I have been given to understand that the water is not used for bathing or washing purposes. The Deputy Health Officer informs me that the presence of Anopheles larvæ in this tank most probably accounts for the Malarial and Remittent fevers which are common more or less in the vicinity.

The larvæ when hatched out turned out to be Anopheles Rossii.

In the Mumbadevi Temple tank close by no mosquito larvæ were detected. This tank is largely utilised for washing and bathing purposes.

E WARD.

This is a large ward and consists of the following seven sections :—

Mazagaon, Tarwadi, 2nd Nagpada, Kamatipura, Tardeo, Byculla, and 1st Nagpada.

Out of these sections the whole of the 1st Nagpada has been newly laid out and re-constructed after demolishing all the old houses. Before it was pulled down it was a notoriously unhealthy section, but has become the cleanest, the healthiest and the most sanitary section in the ward.

The number of insanitary areas and localities in E ward is very large. There are two whole sections in it which are quite insanitary, *viz.*, Kamatipura and 2nd Nagpada. In Byculla section there are four insanitary localities, *viz.*, Madanpura, Kalapani, Tankpakhadi, and Guzri Bazar. In Mazagaon section Bhundarwada Hill and its neighbourhood is unhealthy on account of the prevalence of Malaria in the locality.

Kamatipura is the largest of these insanitary areas; it is bounded on the north by Bellasis Road, on the west by Suklaji Street, south by Grant Road and on the east by Upper Duncan Road.

The streets in Kamatipura are well arranged and fairly numerous, there being sixteen running across it from east to west, and five from north to south. There is no uniformity about the houses and they vary much in shape and size, most of them are sublet in separate tenants, and are occupied by persons of the poorer classes. Many of these chawls are unfit for human habitation either wholly or in part, owing to radically defective construction.

Overcrowding is undoubtedly the chief cause of the unhealthiness of Kamatipura. This term is applied to two distinct conditions, which, however, are invariably associated together. The one has reference to land upon which the houses are situated in such close approximation, that the provision of air, light and space is reduced to quantity below the standard requirements of health, the other to houses in which the inhabitants exceed in number the accommodation. Both these conditions obtain in an exceptional degree in Kamatipura. The houses are built almost back to back, there being only a narrow passage between the row of houses in one street and that in the next. The depth of houses from front to back is excessive, and, as usually, the whole of the available space behind the street frontage is occupied by the building itself, the privies in many cases are not properly detached, and the air of the dwelling is continually charged with the most noisome odours. There is rarely a gully at the sides of houses, and when one exists it is generally not more than 2 feet in width. As a result of this the buildings, as a whole, are deficient in light and ventilation, the centre rooms being often in absolute darkness and dependent for ventilation upon the passages within the houses. Speaking generally the gullies are open channels for carrying off sullage, but usually they are so imperfectly paved as not to be water-tight, and sometimes they are not laid with a proper fall towards the street drain. Many of them serve as passages for sweepers and are flanked on either side by a long row of privy shafts. In such cases the trap doors of the shafts abut immediately on the gully and when the receptacles get full and overflow as they frequently do, the liquid filth is discharged on the surface of the gully. Refuse of all kinds is also thrown into the gullies by the people living in the adjoining houses. For these reasons the gullies though repeatedly cleaned are generally in a dirty and foul condition, and windows which overlook them have to be kept closed to exclude the smell. Such gullies are, therefore, of little use for purposes of ventilation. Moreover, owing to structural defects pointed out above, liquid filth is not carried out but stagnates in the gullies, and the foundations of the houses and the soil around them are continually receiving what to all intents and purposes is the soakage of sewage. In this way the soil and sub-soil are fouled and rendered damp, and the level of the ground water is raised. Throughout Kamatipura this dampness of the soil can be observed, and water is to be found within a few feet of the surface. As a result, dampness of ground floors is a noticeable feature in nearly all the houses, even in those with substantial plinths and paved or cemented floors.

The next largest insanitary area is 2nd Nagpada. Its boundaries are :—

North—Bellasis Junction Road.

South—Grant Road.

East—Parel Road.

West—Upper Duncan Road.

Undria Street, running from south to north, divides it into two almost equal parts as regards area and population.

The sanitary defects of 2nd Nagpada are exactly the same as those of Kamatipura. The streets, however, are not well arranged as in Kamatipura, and there are only five streets of any size in the whole area, and they run from north to south. There are no streets running from east to west, but only a few narrow cross lanes. Thus most of the houses receive the direct rays of the sun only for an hour or two in the day. The overcrowding within dwellings and the dense aggregation of houses on area are greater than in Kamatipura, and the dampness of the soil and sub-soil is also more marked. In other respects the description given of Kamatipura applies equally well to 2nd Nagpada. It must be pointed out, however, that the inhabitants of 2nd Nagpada are, for the most part, Mahomedans, and that it is the custom amongst them to seclude their women. The evil effects of overcrowding and want of ventilation are therefore greatly aggravated, and, as might be expected, phthisis and diseases of the respiratory organs are more prevalent in this area than in any other part of Bombay.

Byculla section has a number of insanitary areas, the chief of these is Madanpura situated between Ripon and Morland Roads.

There are only two streets in Madanpura, *viz.*, Ghellabhoy Street and Mahomedan Street. The area is low-lying and storm water does not readily flow off, and as the streets and cross passages are not metalled, they are in an almost impassable plight during the monsoon from wet and dirt. The house property generally is of poor kind, many of the dwellings being old and dilapidated. The houses are closely packed together and are very insufficiently lighted and ventilated, and dampness of ground floors is general. There are underground drains in Madanpura and most of the houses are connected to them.

By far the largest insanitary area in this section lies between Ripon and Haine's Roads and to the north of Sankli Street, the Dhobis' washing place and Khatav Mankanji Mills. This area is known as Tankpakhadi and Kalapani.

The house accommodation in Kalapani is of the most wretched description, and many of the dwellings are absolutely unfit for human habitation. The dampness of the site is excessive, the whole area being below the level of Ripon Road. Indeed, the area is so low-lying that in the rainy season a great part of it is under water, and the inhabitants have then to wade when leaving or returning to their homes. The Agripada kutchra drain, which is practically an open sewer, runs through a portion of Kalapani and skirts a number of the houses. The foundations of these dwellings on the soil around them are therefore continually soaked in sewage, and the inmates of the houses are continually inhaling the offensive emanations from the sewage. In the rainy season, when the drain is running full, the sewage sometimes floods the ground floors of some of the houses. With the above exception there are no drains in Kalapani.

A little to the south-east of the G. I. P. Railway Byoulla Station and lying between the Railway line and Parel Road is another insanitary area known as Guzri Bazar. Its boundaries are :—

North.—Junction of Chamber Lane and Parel Road.

South.—Narrow Lane north of "Gold Mohur Castle."

East.—Parel Road.

West.—G. I. P. Railway Line.

Except in Chamber Lane the houses are arranged in a haphazard way without regard to order or regularity. Most of them are old and dilapidated and some are mere sheds. The air space around buildings is in many cases insufficient, and the rooms on the ground floors are generally dark and damp. In the neighbourhood of the market (where fish, meat and vegetables are sold) the houses are thickly grouped. The area is drained and most of the houses are connected to the underground drain.

The inhabitants of Madanpura and Kalapani are Julai Mahomedans and are very poor ; hence the overcrowding.

The defects in the areas described above may be grouped under two or more of the following heads:—

- (1) Overcrowding within dwellings.
- (2) Dense aggregation of houses upon area, and, as a result, inadequate open space about dwellings and insufficient light and ventilation within them.
- (3) Dampness of soil.
- (4) Want of drainage or imperfect drainage leading to pollution of the soil.

Such insanitary conditions are, as is well known, powerful predisposing causes in the production of phthisis, pulmonary diseases, fevers and epidemic diseases generally and a reference to the statistical tables published in the Health Officer's Annual Reports will show that in the areas described above, the general and infantile death-rate are both very high, and that the rates of mortality from the abovementioned diseases are considerably above the average. Of the total influence which the insanitary conditions exert upon the health of the people exposed to them, no exact statement can however be given. That they produce certain diseases and a considerable amount of physical suffering and disablement is undoubted, but it is only so far as the diseases kill that the effect can be represented in numbers.

In some of these insanitary areas, notably in Kamatipura and 2nd Nagpada, certain houses have been improved to a slight extent at the instance of the Engineering Department, and in a few cases buildings have been marked "U. H. H." and their use as dwellings prohibited. These minor effects have, however, had little or no effect in reducing the general unhealthiness of the areas, and the only measure which will prove of any avail in this direction is demolition of nearly all the buildings upon the areas and rebuilding on sanitary principles. If such a scheme were undertaken, special provision would have to be made for the housing of the population displaced. The areas are at present overcrowded, and the new streets and buildings which would be constructed upon them after they were cleared would, of course, have to comply with the dictates of sanitary science. It is certain, therefore, that new house accommodation on the cleared area could be provided for only a portion of the persons displaced, and that for the remainder of the population it would be necessary to erect suitable dwellings elsewhere.

The Agripada kutchra drain which has been referred to above, is formed by the junction of the different branch drains. One of these comes from the direction of the Victoria Gardens, and crossing the G. L. P. Railway line a little to the north of the Byculla Station, passes under DeLisle and Haine's Roads to a spot a little to the north of the Municipal stables for E Ward (East) at Agripada. Here it is joined by an old underground drain from the direction of Guzri Bazar, which in its turn receives an open drain running northwards from the Khatav Mill. The drain thus formed by the junction of the three branches afterwards remains open throughout its entire course, passing westward through the low-lying district of Kalapani, under Ripon Road by the side of the New Agripada Chawls, and under Gilder Street, Arthur Road and the B. B. & C. I. Railway line to the Flats.

This drain, which is kutchra, and meant for carrying only storm water, is never dry. In its course the water receives a certain amount of sewage also, and the flow being sluggish, it is always in a very stagnant condition. A portion of this drain water is diverted and utilized in fair weather for irrigating a considerable area of land to the north of Kalapani between Ripon and Haines Roads.

Mazagaon section contains an unhealthy area which is noted on account of Malarial fevers. It is Bhandarwada Hill and its neighbourhood. A reservoir was built on this Hill and completed about the year 1884. The leakages taking place from this reservoir through the sides of the Hill, gradually saturated the ground in the neighbourhood. The pools and puddles formed by these leaks, as well as the open filter beds themselves, afforded suitable breeding places for Malarial mosquitoes, and Malarial fevers thus became very prevalent in this neighbourhood.

The residents of Mazagaon Road and Wari Bunder Road, DeLima Street, Dockyard Road and Belvedere Road, and even of Walpakhadi to the south and Matharpakhadi to the north, suffered badly from Malarial fevers, for which these fevers acquired an unenviable notoriety.

In March 1906 Microscopical Examination was made of specimens of blood taken from the children from two of the institutions in the neighbourhood, *viz.*, "St. Joseph's Home and Foundling Hospital," at Mazagaon Road, and "St. Peter's Boys' School" at Dockyard Road. These tests, it must be remembered, were carried out at a time when Malaria is generally less prevalent, and when the Rev. Father Nicholson, the Principal of St. Peter's Boys' School, was "fighting the fever systematically by the use of Quinine." In spite of this the following results will show that Malarial index was very high among these children:—

Name of Institution.	Number examined.	Malarial Parasites in blood.	Percentage of Malarial Parasites.
St. Joseph's Home and Foundling Hospital.	25	15	60.00
St. Peter's Boys' School	28	15	53.57

By means of systematic use of Kerosine to destroy anopheles larvæ; by constructing suitable pucca channels to drain away the water from the leakages from the Reservoir, so as to prevent it from soaking into ground; and by filling up all hollows and depressions in the ground, so as to do away with all breeding places for mosquitoes, a considerable improvement has taken place in the health of the locality. Father Nicholson informs me that very few of his school children now appear to suffer from Malaria.

A leak taking place at the back of the Bombay Electric Co.'s station at Wari Bunder Road, has, I have been given to understand, not yet been located.

There are two Municipal Dispensaries in the ward ; one at No. 8, Ripon Road, and the other at Foras Road. The following tables show the number of Malarial cases treated in them during 1906 :—

Ripon Road Dispensary.

1906.	Total No. of cases treated.	No. of Malarial fever cases.	Percentage of fever cases.
January	1,195	116	9·7
February	1,200	67	5·5
March	1,536	130	8·4
April	1,364	125	9·1
May	1,391	117	8·4
June	1,074	54	5·0
July	1,288	59	4·6
August	1,446	46	3·1
September	1,445	57	3·9
October... ..	1,520	84	5·5
November	1,308	86	6·6
December	1,136	73	6·4
Total ...	15,898	1,014	6·3

Foras Road Dispensary.

1906.	Total No. of cases treated.	No. of Malarial fever cases.	Percentage of fever cases.
January	827	150	18·13
February	764	146	19·10
March	1,039	266	25·60
April	966	239	24·74
May	898	181	20·15
June	770	158	20·51
July	825	138	16·10
August	1,140	220	19·29
September	971	191	19·64
October	983	205	21·97
November	898	264	29·39
December	713	143	20·05
Total ...	10,744	2,301	21·41

It will be seen that the number of Malarial fever cases treated in the Ripon Road Dispensary is very small. The reason is that the poorer residents of the Malarious district of Bhandarwada and its neighbourhood resort for medical treatment to the dispensaries at the J. J. Hospital and Jail Road which are nearer to them. Moreover the number of poor people residing in the neighbourhood of Bhandarwada is comparatively small the locality being inhabited by a number of well-to-do residents.

Aroopheles larvæ have been detected from time to time practically all over this ward. These larvæ have been found in the filter beds of the reservoir, and in pools at the foot of the Bhandarwada Hill; in a ditch in Belvedere Road; in storm water drains opposite houses Nos. 10 and 53 Mazavarpakhadi; in a fountain and tank in Victoria Road; in an open drain in Mount Road; in pools and puddles off Matharpakhadi Road, and in Anjirwadi off Mount Road.

They have been detected in the fountain reservoir in the Victoria Gardens, and also in pools under water-taps; in a tank in Morland Road; in a tank on the Tank Bunder; Hindu Burning ground; in a tank and pools and puddles in the compound of the Jewish Synagogue in Parel Road, and in pools and puddles near the Byculla Club.

They have been detected in wooden tubs in the Kamatipura Night-soil depôt; in a chawl in Foras Road, and in pools and puddles near a fountain near the Falkland Road Dharamsalla; in a pool of water near house No. 109-111 Tank Street; in Mustan Tank and in a small ditch in Bellasis Road near Mustan Tank; in Foras Road Health Camp; and in a tank between Ripon Road and Morland Road.

It will be seen from above how extensive the distribution of the Malarial mosquito is in this ward.

F. WARD.

This is the largest of the wards and comprises three sections, viz :—

Parel, Sewri, and Sion.

Of these, Parel is the most congested section showing a population of 54,604 per square mile according to the Census of 1906.

Practically the whole of F Ward is noted for Malarial fever, and with the exception of Parel section it is still undrained. Portions of it are hilly, while in other parts the ground is low-lying and utilized for cultivation. There are a number of large tanks in this ward and quarrying operations on an extensive scale are being carried on in all the three sections, but especially in Sewri.

There is a Municipal Dispensary at Naigaum and from the table given below it will be seen that the percentage of fever cases treated is very small. I have been given to understand that this is due to the fact that this ward occupies a very large area, nearly $8\frac{1}{2}$ miles, and the inhabitants on account of the distance do not avail themselves of the Dispensary,

but try their own country remedies. The number of patients treated in this Dispensary is therefore comparatively small. The following table gives the figures for the year 1906 :—

1906.	Total No. of cases treated.	No. of Malarial fever cases.	Percentage of Fever cases.
January	462	30	6.4
February... ..	443	31	6.9
March	510	15	2.9
April	448	28	6.2
May	385	34	8.8
June	419	32	7.5
July	521	40	7.6
August	617	29	4.7
September	519	28	5.5
October	418	32	7.6
November	502	29	5.7
December	420	30	7.1
Total ...	5,664	358	6.32

The localities from which these cases came were as follows :—

Sion	249
Sewri	44
Parel	35
G ward	20
E ward	10
Total ...	358

Anopheles have been found in F Ward in rain water puddles and pools in the compound of the old Government House, Parel; in pools on Dadar Road opposite the ward stables; in pools in some of the rice fields in Vincent Road; in quarry holes on Sewri Road, Parel Tank Road, and in the neighbourhood of the Naigaum Night Soil Depot; in a well in the compound of Moon Mills; in pools on Antop Hill, and in small pools in the trenches by the side of the G. I. P. Railway line near Dadar and Matunga Stations.

D WARD.

The ward contains the following sections :—

Khetwadi, Girgaum, Chowpatti, Walkeshwar and Mahaluxmi.

In this ward the locality most noted for Malarial fevers is the vicinity of the Malabar Hill Reservoir.

This Reservoir is built on the top of the Malabar Hill near the junction of Ridge and Gibbs Roads. The Hill, which is composed of basaltic trap rock, is continued north side ward as Cumballa Hill, Love Grove and Worli Hill, has a slope on the east or Chowpatti and a ravine on the west.

The neighbourhood of the Malabar Hill Reservoir has been known for a long time to be a malarious locality; and the bungalows that were situated at the foot of the Hill at Chowpatti, acquired such a notoriety for fever that it became impossible to find tenants for them. On this side of the Hill may be seen a number of springs coming down the slope like so many waterfalls. The water soaked into the ground and made the surrounding area extremely damp, and this dampness was supposed to be the cause of the fevers prevailing in the locality. This was, of course, in the days before the researches of Manson and Ross. The adjoining areas in the neighbourhood of Gaumdevi and Gowalia Tank were also noted for the prevalence of remittent and intermittent fevers. All the locality has now been considerably improved by opening it up by the construction of the new Road, and by draining the water-logged areas at the foot of the Hill.

On the west side of the Reservoir there is a ravine which takes away not only the storm water from that side of the Hill, but also the water from the leakages taking place from the Reservoir on that side and numerous complaints have been received from time to time from the residents on that side also as regards the prevalence of fevers among their families and servants.

The immediate neighbourhood of the Reservoir itself acquired an unenviable notoriety on account of sickness among the staff working in connection with the Reservoir. The residential quarters erected near the Reservoir for the Water Inspector became notoriously unhealthy on account of Malaria, and the matter assumed crisis when the Inspector who was occupying these quarters in June 1905 reported to the Water Engineer "that his youngest daughter died of Malaria and that he himself and two other children were suffering from fever. He was therefore obliged to shift from the quarters". Reporting upon this the Water Engineer stated that "the Inspector was allowed to remove from the quarters at once." He further reported that "the quarters were very unhealthy and malarious and had been known to be so for some years past." He therefore recommends that new quarters should be provided within easy reach of the Reservoir.

In commenting upon this Mr. Hall, Executive Engineer, Bombay Municipality, stated:—"Complaints have been made for the Fire Brigade men who reside near Gowalia Tank in consequence of their suffering from Malaria whilst living on the hill."

"It is however well known absolute protection from Malaria can be obtained by excluding mosquitoes. The celebrated case of two young men residing for a considerable period on the Campagna in Italy without suffering when all other persons around them without protection were constantly being attacked, and no one could live one night without an attack of Malaria, leads me to think that similar protection may be found to be effective at the quarters in question."

"I have, therefore, consulted Drs. Cayley and Venis, Divisional Health Officers, and Dr. Gibson of the Government Laboratory at Parel; and they are of opinion that under the circumstances wire gauze would probably have the desired effect. I accordingly beg to suggest that the verandahs and windows be covered with a fine mesh brass wire gauze of a size that would exclude mosquitoes, and yet permit the free passage of air. This and double doors affording access to the quarters will cost Rs. 792, and if successful will avoid the necessity of building new quarters and enable the Inspector in charge to reside on the premises with safety to himself and his family."

Dr. Turner, to whom this matter was referred, reported upon the proposed experiment as follows:—

"The experiment proposed by the Executive Engineer may be tried, but the conditions under which the experiments were carried out in Italy are not comparable. In order to come to practical conclusion the person inhabiting the house should be malaria free from the

beginning, and this condition will be difficult to fulfil. They should also be able to understand the objects for which the house is rendered mosquito-proof, and have a knowledge of the various mosquitoes as without care and attention the experiment would prove abortive."

The experiment was tried and the windows, doors and verandahs of the quarters in question were covered with fine wire gauze and made mosquito-proof.

In June 1907 the Water Engineer reported upon the experiment as follows :—

" It appears that covering the verandahs, windows and doors of the Inspector's quarters with mosquito-proof wire gauze has not proved to be quite satisfactory in preventing malarial fever."

"People who have lived in these quarters since the alterations were made are stated to have suffered from malarial fever and I understand that mosquitoes are still found in the rooms."

"It is difficult to account for the presence of mosquitoes within the rooms and I am not altogether sure that the mosquito guards have always been kept closed."

"I am informed that the wire gauze had the effect of preventing a free current of air into the rooms and I am inclined to think the wire mosquito guards have been kept open at night when the weather has been warm and oppressive."

"Mr. Pinto, who occupied these quarters for sometime after the experimental measures were completed, undoubtedly contracted malarial fever and at present is absent on sick leave"

"The prevailing opinion is that the quarters are still unhealthy"

An experiment carried on in this manner without proper care and attention was bound to prove a failure.

On account of the prevalence of Malaria the Fire Brigade Lascars had to be removed from the Malabar Hill Station. The Chief of the Fire Brigade reports that this had to be done "owing to all or most of the men doing duty there having contracted fever of a malarious nature, which has constantly placed them off duty, and in several cases men have been invalided through the deadly effects of this fever."

The Water Engineer has calculated that about 500,000 gallons of water are lost every 24 hours from the Malabar Hill Reservoir through the leakage, and under the circumstances it is not strange that the reservoir should seriously affect the health of the locality in its vicinity.

In reporting upon the cause of the unhealthiness of the houses in the neighbourhood of the Malabar Hill Reservoir, and the remedy for the removal of the cause, the Health Officer (Dr. Turner) says: "Fever cases amongst the servants in the bungalows on Malabar Hill are very common after the monsoon in good many houses, and this is, I believe, due, no doubt, to the mosquito breeding places in the ravine. Although there is a good deal of improvement since the construction of the pucca drain below the reservoir there are places by the side of the drain where water oozes out from the ground and forms regular puddles in which anopheles and culex mosquitoes breed. Several reports have been made as to the condition of the ravine and the incidence of fever in the neighbourhood, and these have dealt with the pools of water collected in the ravine and the presence of anopheles mosquitoes. An open channel has been laid along the bottom of the ravine. This was found to be insufficient and was extended. Collections of water still occur and to make a radical cure much larger operations must be undertaken."

Dr. Turner attributes the persistence of Malaria in the neighbourhood to the following causes :—

1. The presence of the Reservoir and filtering tanks.
2. The leaking of the Reservoir and Receiving tanks.
3. The water from the washing of the sand from the filter.
4. The collection of pools along side the open channel.
5. The presence of dhobis in the ravine.
6. The collection of water in the compound of the bungalows.
7. The extensive growth of grass and shrubs.

Although search has been made for the anopheles larvæ in the Reservoir, tank, and filter, they have never been found, and it is asserted that they do not exist. Dr. Turner, however, is of opinion that "in the dark covered places inaccessible to the searcher, the mosquito may gain access and breed, and nothing but mosquito-proof netting can keep them out."

The leakage of the Reservoir, tank and filters is very great on both sides of the Hill. There is an immense thick growth of jungle on the/Chowpatti side, hiding the pools of water and favouring the breeding of mosquitoes. This should be cut down and kept down. To prevent the leaking the whole of the Reservoir will have to be made water-tight. The Water Engineer reports that "the leakage is undoubtedly spoiling the portions of the structure, but the stability of the walls is not affected. No measures likely to be permanently effective can be carried out except at considerable cost. Half measures are objectionable and should be avoided." The value of the water lost from leakage amounts to Rupees 34,310 per year and by making the Reservoir water-tight, not only will this waste be saved but the present unhealthiness of the locality will be remedied to a very large extent.

The open channel should be covered and continued high up, and all the places where water oozes out should be drained and filled in.

The washing places used by the dhobis should be abolished.

Instructions should be issued from time to time to the occupiers of the neighbouring houses stating how to prevent the breeding of mosquitoes, as much depends upon the supervision of the compounds by the occupiers themselves.

Leaflets have been printed by the Health Department giving hints for the prevention of Malarial Fevers, and are distributed amongst residents when Malarial fevers are prevalent.

The health of the locality in the neighbourhood of the Malabar Hill Reservoir has much improved with the construction of the pucca channels on both sides of the hill to carry away the leakage water without allowing it to soak into ground. But unless strict attention is paid to see that they are kept perfectly clear, any slight obstruction causes an overflow and stagnation of water in the adjoining ground. In monsoon vegetation grows wild, and if not attended to will obstruct the flow of water with consequent overflow and formation of stagnant pools and swamps which soon become suitable breeding grounds for anopheles mosquitoes and malarial fevers. But with great vigil, constant removal of rank vegetation, proper drainage and judicious use of Kerosine or Pesterine much may be done towards prevention of Malaria.

In Khetwady, Chowpatti and Girgaum Sections of this ward also, Malarial fevers are commonly prevalent. These sections still retain in some parts the remnants of cocoanut groves of old days, which are still watered from wells as in olden times.

In Khetwady there is an old drain which passes under Falkland Road and is the remains of an open ditch which in olden times passed from where the Crawford Market now stands to the flats where it emptied itself into a Tidal Estuary. No attempts were made to arch over any portion of this drain until 1824, and it was not until 1845 that it was covered even as far as Paidhoni, and by 1856 the arching had been completed up to Bellasis Road. Mr. Carkeet James says that "This old main drain exists even to this day, though much improved by being repaired and in parts rebuilt. It is perhaps needless to add that it is now used for storm water only." This drain which is never dry is said to attain a width of twenty feet while passing under Falkland Road, and may very probably be responsible for the dampness of the localities on both sides of Falkland Road.

There is a Municipal Dispensary in this ward at Kandewady in Girgaum Section. The following table shows the number of Malarial fever cases treated in the Dispensary in the year 1906 :—

1906.	Total No. of cases treated.	No. of Malarial fever cases.	Percentage of fever cases.
January	299	121	40.4
February	235	89	37.8
March	273	99	36.2
April	197	76	38.5
May	299	90	30.1
June	311	133	42.7
July	398	127	31.9
August	449	156	34.7
September	446	164	36.7
October	420	166	39.5
November	425	203	47.7
December	290	102	35.1
TOTAL ...	4,042	1,526	38.2

Anopheles larvæ have been detected from time to time at the following places in this Ward :—

They have been found in the ravine on the west side of the Malabar Hill Reservoir and also in small pools and rivulets at the foot of the Hill on Chowpatty side; in very large numbers in collections of water by the side and near the commencement of the channel in the ravine; also in fresh water pools formed along the Nepean Sea Road foreshore near the Petit Hall.

They have been found in a water cistern in Mount Pleasant Road, and also at Walkeshwar to the west of Banganga in pools of water on the foreshore.

They have been found in a compound in Warden Road, in a storm water catch-pit in Winter Road, and in a garden fountain at 34, Walkeshwar Road.

They have been recently detected in a reservoir in H. E. the Governor's Body Guard Lines at Chowpatti, where Malaria is generally prevalent. Microscopical examination of

lood taken from four persons, showed malarial parasites in all the specimens. Three of the cases were suffering from fever off and on for some time, and had enlarged spleens.

In Girgaum Section, *Anopheles* larvæ have been found in a well at 75-77 Girgaum Back Road, and also in a well at 51 Kandewady Lane.

G WARD.

This ward contains two sections:—

Worli and Mahim.

Worli.—This is a large section and occupies an area of 2·84 square miles. For descriptive purposes it may be divided into three parts:—

(1) A portion that occupies the north and west corner—the west portion is hilly with a few small villages or “pakhadees,” and the northerly portion with a few scattered houses in low-lying “wadees” or gardens with cocoanut plantations.

(2) A middle portion, which is low-lying but more or less open, and industrial in character being occupied by Mills with a few chawls for Mill-hands.

(3) The remaining portion which is situated towards the south-east corner of the section, near Jacob's Circle, and along DeLisle Road. This part shows a number of large chawls which are overcrowded being occupied by labouring classes chiefly Mill-hands and Railway workmen. Relapsing fever is very common in this locality.

Malaria is prevalent all over this section, which with the exception of the hilly portion along the western foreshore, is generally low-lying. Various storm water drains as well as the newly constructed channels for the removal of subsoil water pass through this section before they empty themselves out into the sea.

Mahim forms the remaining section of this ward, and occupies an area of 2·01 square miles. The houses in this section generally speaking are scattered, and situated in large gardens full of cocoanut groves and watered from wells or tanks of which there is a very large number in this section. These tanks which constitute a striking feature in this locality are large and very old and were constructed when Mahim was a prosperous town. There are also a few old quarry holes which are generally full of water. The large Tuls watermain also passes through this District by the side of the B. B. & C. I. Ry. line.

This section is low lying generally, and is not drained, and during the monsoon is very much under water.

The soil is chiefly sandy; but the presence of the large number of tanks and wells, gardens and cocoanut plantations, and the absence of drainage together with the low lying character of the locality, make this district damp and unhealthy. Malarial fever is prevalent all over this section.

Mosquitoes, both *Culex* and *Anopheles*, have been found breeding in tanks, wells, quarry holes and in low-lying places in this section in abundance especially after the rains.

All these factors combine to make this district extremely unhealthy and insanitary, when it should be one of the coolest and healthiest suburbs of Bombay, being exposed along the whole extent of the great Mahim or Salvacao Bay to the westerly breezes from the Arabian Sea.

But this district is still in a primitive condition, and with the help of modern sanitary science and the application of the laws of sanitation there is no reason why it should not develop into an extremely healthy suburb of Bombay.

The District should be first intersected with large wide roads which should open it out and help the circulation of fresh air into it.

The drainage of the district, both surface and sub-soil, requires to be suitably carried out, so as to prevent the ground from remaining submerged in the rains and to remedy the dampness owing to high sub soil.

The large public tanks and those in connection with the temples should be stocked with fish, and systematically and regularly examined to see that the fish are alive, and that the water is not breeding mosquitoes.

All low lying areas will have to be raised, quarry holes filled in and also the ditches and depressions by the side of the railway line and the Tulsi Water Main.

The cocoanut groves, though picturesque looking, interfere with sunlight, and the circulation of fresh air, and should therefore be done away with. Land irrigation and rice cultivation should be prohibited.

The new houses should be built in the form of detached villas so as to admit of plenty of sun-shine and fresh air, and constructed with the strictest attention as regards drainage and sanitary arrangements and prevention of overcrowding. Chawls and "Flats" (which are but glorified chawls) should not be tolerated.

The drainage scheme of the section will have to be carefully studied. The drainage will have to be carried either to Worli or Love Grove and discharged into the sea at a good distance from the land, so as to prevent the fouling of the foreshore of the Salvacao Bay.

There is only one Free Municipal Dispensary in this section, at the junction of DeLisle and Curry Roads.

The District Registrar who is in charge of this Dispensary while reporting upon the prevalence of Malaria in his District puts it tersely as follows :—

"Malarial fevers are mostly prevalent in the whole G Ward. Special insanitary features responsible for this are large plots of undrained fields, and building of new houses which disturb the soil. Anopheles may be found in all parts of Mahim section and also in houses near low lying and vacant ground all over this ward.

The following table shows the Number of Malarial fever cases treated at the DeLisle Road Dispensary during the year 1906 :—

1906.	Total No. of cases treated.	No. of Malarial fever cases.	Percentage of fever cases.
January	1,204	161	13.37
February	1,060	151	14.30
March	1,123	181	16.09
April	1,128	197	17.5
May	1,148	196	17.07
June	1,141	138	12.09
July	1,186	146	12.13
August	1,370	215	15.69
September	1,224	183	14.95
October	1,163	196	16.85
November	961	204	21.22
December	917	193	21.04
Total ...	13,625	2,161	15.86

The Anopheles mosquito is very largely distributed all over G Ward. During the campaign against mosquitoes in 1902, anopheles larvæ were discovered in Worli section in 54 places within 5 weeks, and in Mahim section in 187 places within 2 months.

They have been found near the B. B. & C. I. Railway Dadar Station ; in puddles on the west side of Mahim Station ; and in a pool on the east side of Mahaluxmi Station. They have been found in a kutchra drain on the north side of Fergusson Road, and in a storm water channel at the culvert of the same road.

They have been found in a puddle in Elphinstone Road, and in a kutchra drain in Agar Bazar receiving waste water from a stand pipe.

They have been found in a quarry hole at Portuguese Church Road, Mahim Agar.

The Divisional Health Officer has reported that he has failed to find anopheles larvæ in the several large tanks at Mahim and Purbhadevi, but on December 12th, they were discovered by me in the "Ganapati Tank" and also in the adjacent "Sawli Tank," both on the Purbhadevi Road.
