514
DOMESTIC

EAST AFR. PROT.

No. 8360

C O
8360
Rec'd
6 MAY 07

(individual)

GB

907

Match

evious Paper.

452

(Subject)

Report on Townships of Nairobi Naivasha and Kisumu

Townships

(Minutes.)

See draft attached

BRANSBY WILLIAMS
CIVIL ENGINEER
5020 WESTMINSTER

39, VICTORIA STREET,
WESTMINSTER,
S.W.

March 5th. 1907.

The Under Secretary of State,
Colonial Office,
S.W.

Sir,

I enclose herewith two copies of my report on the East African townships, Naivasha, Nakuru & Kisumu, and am sending under separate cover two copies of the accompanying plan.

I have the honour to be,

Sir,

Your obedient servant,

Cecil Bransby Williams

BRANSBY WILLIAMS
CIVIL ENGINEER
5026 WESTMINSTER

515

39, VICTORIA STREET,
WESTMINSTER,
S.W.

March 5th. 1907.

The Under Secretary of State,
Colonial Office,
S.W.

Sir,

I enclose herewith two copies of my report on the East African townships, Naivaska, Nakuru & Kisumu, and am sending under separate cover two copies of the accompanying plan.

I have the honour to be,

Sir,

Your obedient servant,

C. Bransby Williams

516

REPORT ON THE TOWNSHIPS OF NAIVASHA NAKURU AND KISUMU.

[illegible] Victoria Street,

[illegible] Westminster, S.W.

March, 4th, 1907.

The Rt. Hon.
The Earl of Elgin & Kincardine K.G.
Secretary of State for the Colonies.

My Lord,

tions.

At the commencement of last October I was informed by H. M. Commissioner of the East Africa Protectorate that, in addition to the report on the sanitary condition of Nairobi on which I was at that time engaged, a supplementary report was required on the townships of Naivasha, Nakuru and Kisumu. I was instructed to proceed to these places as soon as possible in order to report upon them, and to spend a few days only at the two former towns, but to submit a more detailed report on Kisumu.

I accordingly left Nairobi on the 9th of October and arrived at Kisumu on the 18th, having visited and examined Naivasha and Nakuru, and the country surrounding them, en route, so far as the time at my disposal permitted.

I left Kisumu on the 9th of November, but this report has been delayed until now by the prior necessity of submitting my report on Nairobi as early as possible.

SECTION XI.
NAIVASHA.

osition of
ivasha.

The township of Naivasha is situated on the east side of Naivasha Lake. It is the headquarters of the Province of the same name and is a station on the Uganda Railway, 301 miles from Mombasa and 65 miles from Nairobi. The population is about 300 persons.

The lake is one of a series of lakes which extends along the bottom of the Rift Valley; it has a superficial area of about 20 square miles. Two rivers, the Gilgil and the Morendat flow into it, but there is no surface outlet.

Behind Naivasha the walls of the Rift Valley rise in a series of escarpments up to the Aberdare Range, and the Kinangop mountains, which attain a height of about 13000 feet above the sea.

ology.

The geological formations underlying Naivasha are either volcanic rocks or sedimentary deposits derived from their detrition.

The subsoil near the lake is a dusty porous earth. In places this deposit is quite 100 feet thick and it is occasionally interstratified with bands of volcanic ash and lapilli, which have doubtless been ejected during recent geological periods from Longonot or one of the other neighbouring extinct volcanoes. The rocks exposed in the escarpments, so far as I was able to observe them, were trachytes and lavas of varying degrees of hardness.

The earthy subsoil on the plains is covered with a very thin layer of top soil on which a thick rather coarse grass some 18 or 20 inches high grows. The porosity of the subsoil is shown by the way in which the streams flowing down from the neighbouring cliffs disappear before they reach the lake.

ight above the
s and Climate

The surface of the water in the lake is about 6350 feet above the sea and the highest point in the village is about 150 feet higher. It is nearly 1000 feet above Nairobi; thus the nights are rather colder and the climate is distinctly more bracing. It is an extremely windy place, a south easterly wind blows with great regularity every day during a certain portion of the year from about 9 or 10 o'Clock in the afternoon until midnight. Every evening during my stay in Naivasha it increased in strength until about ten p.m. when it was blowing nearly half a gale. This wind brings with it particles of fine dust and is a great disadvantage to what would otherwise be an attractive place. In addition to causing discomfort, the wind, combined with the great dryness of the soil, prevents trees from growing; but it appears to be possible to grow flowers, the geraniums are especially flourishing in the gardens.

nfall.

The rain-fall has only been recorded since 1904. It appears from a comparison of the results for 1904 and 1905, with the figures for the same years in other neighbouring places that the average annual rainfall is about 30 inches.

PRESENT CONDITION OF NAIVASHA.

dings
he
ahir.

At the present time Naivasha chiefly consists of government buildings. The Boma, a fortified enclosure surrounded by a stone wall and a moat, contains the Government offices, which are a row of white plastered stone buildings, a storeroom, the post office, and two officials bungalows made of mud and stones with thatched roofs. The Subcommissioner's house is built on the edge of the cliff, overlooking the lake. Behind the Boma are the hospital, consisting of a few

small stone huts with a store and dispensary, and a prison very roughly constructed of stone and mud. The police lines are a collection of mud huts higher up the hill. There are also the Collector's house the clerks' quarters and the Permanent way inspector's house. The Public Works Department has a yard and an office near the railway, about 500 yards to the north of the station.

Besides the official houses there are three private buildings, the Rift Valley Hotel, and two shops kept by Indian traders; all of them built of wood and corrugated iron.

itation.

The scavanging and night soil removal is under the management of the Collector. The contents of the buckets are removed each night and buried in trenches three quarters of a mile from the town on the east side; there was no appreciable nuisance from these trenches at the time of my visit.

Although I did not find any serious defects in the sanitary arrangements (so far as there are any,) they are in most cases of a primitive character.

There is no latrine accommodation for the hospital at all and the latrine for the prisoners is a long way from the prison. The police latrines are simply round pits dug near the lines. These pits are roofed over with a rough jungle wood framework covered with a few inches of soil, a small hole being left in the centre of the roof for [illegible]. The latrines are used for at least 12 months before being filled up and are at times very offensive.

The house refuse, which does not amount to a large quantity, is deposited in heaps which are collected from time to time and burned quite near the town.

SECTION I.

NAIVASHA.

Position of Naivasha.

The township of Naivasha is situated on the east side of Naivasha Lake. It is the headquarters of the Province of the same name and is a station on the [illegible] Railway, 291 miles from Mombasa and 69 miles from Nairobi. The population is about 300 persons.

The lake is one of a series of [illegible] which extends along the bottom of the Rift Valley; it has a superficial area of about 80 square miles. Two rivers, the Gilgil and the Morendat flow into it, but there is no surface outlet.

Behind Naivasha the walls of the Rift Valley rise in a series of escarpments up to the Aberdare Range, and the Kinangop mountains, which attain a height of about 13000 feet above the sea.

Geology.

The geological formations underlying Naivasha are either volcanic rocks or sedimentary deposits derived from their detrition.

The subsoil near the lake is a dusty porous earth. In places this deposit is quite 150 feet thick and it is occasionally interstratified with bands of volcanic ash and lapilli, which have doubtless been ejected during recent geological periods from Longonot or one of the other neighbouring extinct volcanoes. The rocks exposed in the escarpments, so far as I was able to observe them, were tuffs and lavas of varying degrees of hardness.

The earthy subsoil on the plains is covered with a very thin layer of top-soil on which a thick rather coarse grass some 12 or 16 inches high grows. The porosity of the subsoil is shown by the way in which the streams flowing down from the neighbouring cliffs disappear before they reach the lake.

ight above the
ea and Climate

The surface of the water in the lake is about 6350 feet above the sea and the highest point in the village is about 150 feet higher. It is nearly 1000 feet above Nairobi; thus the nights are rather colder and the climate is distinctly more bracing. It is an extremely windy place, a south easterly wind blows with great regularity every day during a certain portion of the year from about 3 or 4 O'Clock in the afternoon until midnight. Every evening during my stay in Naivasha it increased in strength until about ten p.m. when it was blowing nearly half a gale. This wind brings with it particles of fine dust and is a great disadvantage to what would otherwise be an attractive place. In addition to causing discomfort, the wind, combined with the great dryness of the soil, prevents trees from growing; but it appears to be possible to grow flowers, the geraniums are especially flourishing in the gardens.

ainfall.

The rain-fall has only been recorded since 1904. It appears from a comparison of the results for 1904 and 1905, with the figures for the same years in other neighbouring places that the average annual rainfall is about 30 inches.

PRESENT CONDITION OF NAIVASHA.

ildings
the
nshi

At the present time Naivasha chiefly consists of government buildings. The Boma, a fortified enclosure surrounded by a stone wall and a moat, contains the Government offices, which are a row of white plastered stone buildings, a storeroom, the post office, and two officials' bungalows made of mud and stones with thatched roofs. The Subcommissioner's house is built on the edge of the cliff, overlooking the lake. Behind the Boma are the hospital, consisting of a few

ight above the
s and climate

The surface of the water in the lake is about 6350 feet above the sea and the highest point in the village is about 150 feet higher. It is nearly 1000 feet above Nairobi; thus the nights are rather colder and the climate is distinctly more bracing. It is an extremely windy place, a south easterly wind blows with great regularity every day during a certain portion of the year from about 2 or 3 O'Clock in the afternoon until midnight. [illegible] during my stay in Naivasha it increased in strength until about ten p.m. when it was blowing nearly half a gale. This wind brings with it particles of fine dust and is a great disadvantage to what would otherwise be an attractive place. In addition to causing discomfort, the wind, combined with the great dryness of the soil, prevents trees from growing; but it appears to be possible to grow flowers, the geraniums are especially flourishing in the gardens.

nfall.

The rain-fall has only been recorded since 1904. It appears from a comparison of the results for 1904 and 1905, with the figures for the same years in other neighbouring places that the average annual rainfall is about 30 inches.

PRESENT CONDITION OF NAIVASHA.

ldings
the
nship.

At the present time Naivasha chiefly consists of government buildings. The Boma, a fortified enclosure surrounded by a stone wall and a moat, contains the Government offices, which are a row of white plastered stone buildings, a storeroom, the post office, and two officials bungalows made of mud and stones with thatched roofs. The Subcommissioner's house is built on the edge of the cliff, overlooking the lake. Behind the Boma are the hospital, consisting of a few

small stone huts with a store and dispensary, and a prison very roughly constructed of stone and mud. The police lines are a collection of mud huts higher up the hill. There are also the Collector's house the clerks' quarters and the Permanent way inspector's house. The Public Works Department has a yard and an office near the railway, about 200 yards to the north of the station.

Besides the official houses there are three private buildings, the Rift Valley Hotel, and two shops kept by Indian traders; all of them built of wood and corrugated iron.

anitation. The scavanging and night soil removal is under the management of the Collector. The contents of the buckets are removed each night and buried in trenches three quarters of a mile from the town on the east side; there was no appreciable nuisance from these trenches at the time of my visit.

Although I did not find any serious defects in the sanitary arrangements (so far as there are any,) they are in most cases of a primitive character.

There is no latrine accommodation for the hospital at all and the latrine for the prisoners is a long way from the prison. The police latrines are simply round pits dug near the lines. These pits are roofed over with a rough jungle wood framework covered with a few inches of soil, a small hole being left in the centre of the roof for defecation. The latrines are used for at least 12 months before being filled up and are at times very offensive.

The house refuse, which does not amount to a large quantity, is deposited in heaps which are collected from time to time, and burned quite near the town.

small stone huts with a store and dispensary, and a prison very roughly constructed of stone and mud. The police lines are a collection of mud huts higher up the hill. There are also the Collector's house the clerks' quarters and the Permanent way inspector's house. The Public Works Department has a yard and an office near the railway, about 200 yards to the north of the station.

Besides the official houses there are three private buildings, the Rift Valley Hotel, and two shops kept by Indian traders; all of them built of wood and corrugated iron.

The scavanging and night soil removal is under the management of the Collector. The contents of the buckets are removed each night and buried in trenches three quarters of a mile from the town on the east side; there was no appreciable nuisance from these trenches at the time of my visit.

Although I did not find any serious defects in the sanitary arrangements (so far as there are any,) they are in most cases of a primitive character.

There is no latrine accommodation for the hospital at all and the latrine for the prisoners is a long way from the prison. The police latrines are simply round pits dug near the lines. These pits are roofed over with a rough jungle wood framework covered with a few inches of soil, a small hole being left in the centre of the roof for defecation. The latrines are used for at least 12 months before being filled up and are at times very offensive.

The house refuse, which does not amount to a large quantity, is deposited in heaps which are collected from time to time, and burned quite near the town.

The drainage problem may be said not to exist at all at present. On the top of the hill near the lake the rock comes out to the surface of the ground but the slopes of the hill towards the station, on which the town buildings stand are covered with the porous earthy [illegible]. The trenches which have been dug alongside the roads to carry the surface water appear at first sight to be remarkably small for a tropical country. They amply serve their purpose however. Even in the heaviest rains the water disappears so rapidly that no trouble is ever experienced.

At present the drinking water is chiefly obtained from iron tanks, which catch the rain water from the roofs of the houses. Water for other purposes is fetched from the lake and carried up in kerosine tins fastened to the backs of donkeys. A boat goes out some half a mile in order to obtain this water. The lake water must in fact be very largely used for drinking purposes, for the tank storage is insufficient to provide for the requirements of the population throughout the year. Mr. Blain the Executive Engineer of the Public Works Department informed me that he proposed to [illegible] all the Government buildings by the construction of concrete tanks each with a capacity of 400 gallons for every inhabitant of the house supplied by the tank.

Private individuals at Naivasha have hitherto arranged for their own water supply.

FUTURE OF NAIVASHA.

Considerable difference of opinion exists as to the possibility of developing Naivasha to any great extent in the future. Mr. C. W. Jubby C.M.G. who was until recently sub-commissioner of Naivasha

Drainage.

The drainage problem may be said not to exist at all at present. On the top of the hill near the town the rock comes out to the surface of the ground but the slopes of the hill towards the station, on which the town buildings stand are covered with the porous earthy [illegible] through which have been dug alongside the [illegible] surface water may appear at first sight to be [illegible] for a tropical country. They amply serve their purpose however. Even in the heaviest rains the water disappears so rapidly that no trouble is ever experienced.

At present the drinking water is chiefly obtained from iron tanks, which catch the rain water from the roofs of the houses. Water for other purposes is fetched from the lake and carried up in kerosine tins fastened to the backs of donkeys. A boat goes out some half a mile in order to obtain this water. The lake water must in fact be very largely used for drinking purposes, for the tank storage is insufficient to provide for the requirements of the population throughout the year. Mr. Blain the Executive Engineer of the Public Works Department informed me that he proposed to increase the storage at all the Government buildings by the construction of concrete tanks each with a capacity of 450 gallons for every inhabitant of the house supplied by the tank.

Private individuals at Naivasha have hitherto arranged for their own water supply.

FUTURE OF NAIVASHA.

Considerable difference of opinion exists as to the possibility of developing Naivasha to any great extent in the future. Mr. C. W. Hobley C.M.G. who was until recently Sub-commissioner of Naivasha

Province believes that it will become a flourishing town On the other hand the present Subcommissioner Mr. J. Ainsworth C.M.G. is in favour of abandoning Naivasha and moving the centre of administration to Nakuru, making the latter town the capital of the Province.

Those who take an optimistic view expect development on two directions. In the first place as a health resort and sanatorium for the hotter and more unhealthy parts of East Africa, and secondly as the market for the sale of cattle from the grazing farms in the Rift Valley.

Present arrangement of town.

On the accompanying plan I have shown Naivasha as it at present exists. A new main street has been marked out up the hill in an easterly direction from the station. This is crossed at right angles by the existing Mowendat Road which is the main road from the Boma to the Government farm. It is intended to make another road parallel to the latter higher up the hill, and about 10 plots of land of two acres each have already been leased alongside it as residential sites. Between the Rift Valley Hotel and the existing Indian shops and along the south side of the main road from the station plots have been marked out for European shops and some of them apparently leased.

Position of new cattle saleyard

After the town had been arranged in this manner an area of 10 acres above the residential sites was set as a cattle sale yard. It is difficult to see what the object could have been in placing the sale yard here. By the proximity to the residential sites it will be a great nuisance to the owners of the houses, the cattle will bring with them innumerable flies, the sale yard drains naturally on to the plots in front, and the combination of noise dust, flies and smell will be intolerable.

-6-

Province believes that it will become a flourishing town. On the other hand the present Subcommissioner Mr. J. Hayworth C.M.G. is in favour of abandoning Naivasha and moving the centre of administration to Nakuru, making the latter town the capital of the Province.

Those who take an optimistic view expect development in two directions. In the first place as a health resort and sanitorium for the more wealthy parts of East Africa, and secondly as the market for the sale of cattle from the grazing farms in the Rift Valley.

Present arrangement of town.

On the accompanying plan I have shown Naivasha as it at present exists. A new main street has been marked out up the hill in an easterly direction from the station. This is crossed at right angles by the existing Mombasa Road which is the main road from the Boma to the Government farm. It is intended to make another road parallel to the latter higher up the hill, and about 10 plots of land of two acres each have already been leased alongside it as residential sites. Between the Rift Valley Hotel and the existing Indian shops and along the south side of the main road from the station plots have been marked out for European shops and some of them apparently leased.

Position of cattle yard.

After the town had been arranged in this manner an area of 10 acres above the residential sites was let as a cattle sale yard. It is difficult to see what the object could have been in placing the sale yard here. By the proximity to the residential sites it will be a great nuisance to the owners of the houses, the cattle will bring with them innumerable flies, the sale yard drains naturally on to the plots in front, and the combination of noise dust, flies and smell will be intolerable.

Proposed Cattle Yards

If it is not too late it would certainly be better to remove this yard to its natural place nearer the railway line. As the number of settlers in the country increases it will become more necessary to convey cattle by rail. It would therefore be better to have the cattle market as near the railway as possible in order to save trouble in entraining and detraining.

Alternative.

If it is decided to keep the cattle yard in its present position, persons who have taken plots near might be offered the choice of exchanging them for plots of equal area somewhere else. If Naivasha ever becomes a health resort I should expect the residential houses to be built on the hill to the south of the Boma, and I do not consider the plots which have been let are naturally in the most desirable position for good houses. This does not, however, affect the fact that the Land has been first of all let as plots for residential houses and afterwards spoiled ~~them~~ by placing a cattle sale yard in close proximity above. Such a policy on the part of the agent of a private owner ~~who proceeded in the manner~~, would be a very shortsighted one and by destroying confidence in himself would make the public very chary of taking land from him.

Indian Bazaar and Native Location.

It has been proposed to place the Indian Bazaar on the west side of the Morendat Road about 300 yards to the north of the junction with the new road from the station. A better place would be near the Public Works yard as shown on the accompanying plan. If a native location is afterwards required it could be placed further on in the same direction, and the land on the opposite side of the road reserved for cattle yards.

If it is not too late it would certainly be better to remove this yard to its natural place nearer the railway line. As the number of settlers in the county increases it will become more necessary to convey cattle by rail. It would therefore be better to have the cattle market as near the railway as possible in order to save trouble in transporting cattle backwards and forwards.

Alternative.

If it is decided to keep the cattle yard in its present position, persons who have taken plots near might be offered the choice of exchanging them for plots of equal area somewhere else. If Naivasha ever becomes a health resort I should expect the residential houses to be built on the hill to the south of the Boma, and I do not consider the plots which have been let are naturally in the most desirable position for good houses. This does not, however, affect the fact that the Land has been first of all let as plots for residential houses and afterwards spoiled them by placing a cattle sale yard in close proximity above. Such a policy on the part of the agent of a private owner who proceeded in like manner, would be a very shortsighted one and by destroying confidence in himself would make the public very chary of taking land from him.

Indian Bazaar & Native Location.

It has been proposed to place the Indian Bazaar on the west side of the Morendat Road about 300 yards to the north of the junction with the new road from the station. A better place would be near the Public Works yard as shown on the accompanying plan. If a native location is afterwards required it could be placed further on in the same direction, and the land on the opposite side of the railway reserved for cattle yards.

-4-

WATER SUPPLY.

r analyses.

In the Appendix the results of the analysis of a number of different waters are given. They are all very typical of surface waters in tropical climates, where the growth of vegetation takes place on a scale vastly greater than in the temperate zones. In these countries the amount of vegetable organic matter in the waters is consequently great, but on the other hand the amount of animal organic pollution in streams in thinly populated countries is small

etable taminat ion.

Of the two forms of contamination the animal organic matter is undoubtedly much the worst, but vegetable matter is exceedingly objectionable and in any large quantity may be dangerous. Diarrhoea and similar complaints may be caused, and as such water is enfeebling to the persons who drink it, it causes disease indirectly as well as directly; it is also extremely favourable to the multiplication of pathogenic bacteria if any get into it.

mal ta ination.

Although none of the waters analysed showed any very marked trace of sewage contamination, signs of it were not altogether absent from some of the samples, and in fact there are possibilities of animal contamination in most of the East African waters. In many cases there are farm-houses or native villages on the banks, and in addition the herds of cattle and the game are liable to convey internal parasites which may be communicated to the water of the streams and thence to the persons drinking it.

With the exception of the springs supplying Kahawa none of the waters analysed for me in East Africa would have been considered in England waters which could be drunk without filtration.

WATER SUPPLY.

r Analyses.

In the Appendix the results of the analysis of a number of different waters are given. They are all very typical of surface waters in tropical climates, where the growth of vegetation takes place on a scale vastly greater than in the temperate zones. In these countries the amount of vegetable organic matter in the waters is consequently great, but on the other hand the amount of animal organic pollution in streams in thinly populated countries is small

etable tamination.

Of the two forms of contamination the animal organic matter is undoubtedly much the worst, but vegetable matter is exceedingly objectionable and in any large quantity may be dangerous. Diarrhoea and similar complaints may be caused, and as such water is enfeebling to the persons who drink it, it causes disease indirectly as well as directly; it is also extremely favourable to the multiplication of pathogenic bacteria if any get into it.

mal mination.

Although none of the waters analysed showed any very marked trace of sewage contamination, signs of it were not altogether absent from some of the samples, and in fact there are possibilities of animal contamination in most of the East African waters. In many cases there are farm-houses or native villages on the banks, and in addition the herds of cattle and the game are liable to convey internal parasites which may be communicated to the water of the streams and thence to the persons drinking it.

With the exception of the springs supplying Nairobi none of the waters analysed for me in East Africa would have been considered in England waters which could be drunk without filtration.

Necessity for good supply.

A good potable water is especially necessary in a health resort, so if it is intended to make Naivasha a sanitorium a proper supply must be provided by some means.

Present Rain-water Supply.

The present supply is not at all satisfactory. The amount of rain-water stored is quite insufficient, and at the most even if all the water falling on the roofs of the houses were collected it would still be not more than two or three gallons perhead per day throughout the year for each of the inmates. Rain-water from roofs is not a good form of drinking water and is liable to all sorts of contamination both before and after reaching the tanks, especially if stored for a long time. If the corrugated iron roofs are painted the heat of the sun in course of time causes the paint to scale off; it is then washed into the tanks where it sometimes forms quite a large deposit and might in certain cases produce lead poisoning.

So long as it is necessary to drink rain-water it should be boiled and filtered in every house before drinking.

POSSIBLE SOURCES OF SUPPLY.

Quantity of water required.

There does not appear to be any probability of Naivasha becoming a large town even under the most favourable circumstancesfor a number of years, nor can I imagine any industry which is likely to be established there.

In estimating for a new water supply I have allowed for a population of 2000 persons with a daily consumption of 15 gallons per head each or a total of 30,000 gallons per day which unless the circumstances entirely alter should be sufficient for the next 20 or 25 years. The water mains will actually convey

sity for
supply.

A good potable water is especially necessary in a health resort, so if it is intended to make Naivasha a sanitorium a proper supply must be provided by some means.

sent Rain-
er Supply.

The present supply is not at all satisfactory. The amount of rain-water stored is quite insufficient, and at the best, even if all the water falling on the roofs of the houses were collected [illegible] would be not more than two or three gallons perhead per day throughout the year for each of the inmates. Rain-water from roofs is not a good form of drinking water and is liable to all sorts of contamination both before and after reaching the tanks, especially if stored for a long time. If the corrugated iron roofs are painted the heat of the sun in course of time causes the paint to scale off; it is then washed into the tanks where it sometimes forms quite a large deposit and might in certain cases produce lead poisoning.

So long as it is necessary to drink rain-water it should be boiled and filtered in every house before drinking.

POSSIBLE SOURCES OF SUPPLY.

of
quired.

There does not appear to be any probability of Naivasha becoming a large town even under the most favourable circumstances for a number of years, nor can I imagine any industry which is likely to be established there.

In estimating for a new water supply I have allowed for a population of 2000 persons with a daily consumption of 15 gallons per head each or a total of 30,000 gallons per day, which unless the circumstances entirely alter should be sufficient for the next 10 or 15 years. The water mains will naturally convey

more than this quantity for an allowance must be made for possible corrosion inside the pipes which would reduce their discharging capacity; they must therefore be of greater diameter than would be theoretically required.

In this and the following sections a number of alternative schemes of water supply will be discussed. Some of these which would require a larger outlay in the first instance, would be more economical in working than other schemes of which the first cost would not be so great but the working expenses would be higher. In order to obtain some basis of comparison I have given in each case the total cost of every 1000 gallons supplied, the figure being arrived at by adding to the cost of working and maintenance, interest at 5% per cent on the estimated capital with a sinking fund sufficient to repay the capital expenditure in 35 years and in the case of machinery an allowance for depreciation.

I have considered the possibility of supplying Naivasha with water from the following sources:-

(1) From Lake Naivasha.
  (a) by pumping by steam.
  (b) by pumping by a windmill.

(2) From the Maranguisha River on the Kinangop plateau.

(3) By means of a storage reservoir in the Maranguisha gorge in the lowest escarpment.

(4) By pumping from the Morendat River.
  (a) by steam pumps.
  (b) by water power pumps.

(5) From a stream above the nearest Syndicate farm.

(6) By gravitation from the upper waters of the Morendat.

(1), (a) The water in Lake Naivasha is decidedly bad. The lake is shallow on the East side for a considerable distance from the shore and the edges are very thickly overgrown with papyrus and reeds. The analysis of sample 1 in the Appendix, taken opposite Naivasha, shows how much the water is polluted with vegetable matter. It is also not free from the suspicion of sewage pollution.

The water improves towards the Southern end of the lake as is shown by the analysis of sample No. 3, taken in 10 feet of water. It is still bad water but could in my opinion be satisfactorily purified by filtration.

There is a suitable site for a pumping station about 2,700 yards to the south of the railway station. The intake pipe would have to be run out some 500 or 600 yards into the lake, and the outer end would be supported on a floating stage and protected from papyrus islands by fenderpiles. The water would be pumped by low lift pumps to the settling tanks, and would gravitate thence to the filters. After filtration the water would be pumped by high lift pumps to a service tank or reservoir, which would hold one day's supply, whence it would be distributed by service mains to various parts of the township.

I estimate the cost of this scheme at £5,600. The working expenses including pumping, filtration, maintenance of works, etc., would be comparatively heavy, for the staff of men required would be nearly as numerous as for a much larger supply. I estimate that the annual working expenses would be £305. Interest on capital expended, with the sinking fund and the depreciation come to £328 so that the total annual cost of the works would be £633, or 1/2½ per 1000 gallons supplied.

This is an expensive supply.

ill Pump. (b). As an alternative it might be possible to make use of the disused windmill pump at present standing near Naivasha station instead of erecting steam pumps. This pump is in good condition but would not be capable of pumping the water between enough that there was [illegible] time. Although there is the place in which one [illegible] windmill pump to be useful it would certainly be in Naivasha, I am nevertheless informed that at certain times of the year there is no wind at all for several days at a time. It would consequently be necessary to very greatly enlarge the capacity of the service reservoir and it would also be necessary to increase the size of the rising main, for the pumping would have to be done each day during a shorter time. Although the cost of the windmill pump would only be the expense of moving it from one place to another and re-erecting it the first cost of the works would be greater than for the steam pumping plant, and would amount to about £6,200. The working expenses would however be less and would be about £225 per annum. The total annual cost including interest and sinking fund would be £695 or 1/1 per 1000 gallons. I do not, however, recommend this scheme, for even with the increased capacity of the reservoir and the rising main there would be a constant risk of a failure and a consequent water famine through a long spell of insufficient wind, or a breakdown of the machinery.

kipisha (c). During my stay at Naivasha I was unable to visit the Kinangop plateau to see this possible source of supply. I have not yet any analysis of the water. Providing there is enough water available this is the most promising of the schemes and would be particularly so if it were possible to find springs from which a sufficiently pure water could be obtained without the

necessity of filtration.

It is apparently about 3½ miles from Naivasha to the stream from which it is suggested that the water should be taken. If there are no engineering difficulties to be overcome on the pipe line, the cost of this scheme would be about £ for filtration and £ for both. The working expenses would be £70 per annum without filtration. The total cost per annum would be £343 and £434 respectively and the cost per 1000 gallons supplied 7½d. and 9½d.

ing Reservoir Naivasha

(3). The Naivasha gorge offers opportunities for constructing a reservoir by building a dam across it. The cost of the work would be considerable, probably not less than £15,000.

at i

(4). (a). The water in the Moremat river is, as shown by the analysis somewhat less impure than that in the lake. It would be possible to erect a pumping station higher up the river than the Government farm and to pump the water to a height from which it could gravitate to Naivasha. The water could be purified by settlement and filtration. The cost of the scheme would be about £6,000 and the total annual cost on the same basis as before £818 per annum, or 1/5½ per 1000 gallons.

(b). The fall of the river is very small, not more than 8 feet per mile, and the works necessary for obtaining a volume and head of water sufficient to pump the town supply would consequently be expensive. The first cost of the scheme would probably be more than/the steam for pumps. If the scheme cost £8,000, the total annual cost would be about £719. 0. 0 about 1s. 3½d. per 1000 gallons supplied.

t Supply tion scheme.

(5). In order to get a supply from the upper waters of the Moremat, it would be necessary to lay a

necessity of filtration.

It is apparently about 6½ miles from Naivasha to the stream from which it is suggested that the water should be taken. If there are no engineering difficulties to be overcome on the pipe line, the cost of this scheme would be about £[illegible] without filtering and £[illegible] with. The working expenses would be £70 per annum without and £160 with filtration. The total cost per annum would be £343 and £434 respectively and the cost per 1000 gallons supplied 7½d. and 9½d.

(3). The Marungisha gorge offers opportunities for constructing a reservoir by building a dam across it. The cost of the work would be considerable, probably not less than £15,000.

(4). (a). The water in the Moremuat river is, as shown by the analysis somewhat less impure than that in the lake. It would be possible to erect a pumping station higher up the river than the Government farm and to pump the water to a height from which it could gravitate to Naivasha. The water could be purified by settlement and filtration. The cost of the scheme would be about £[illegible] and the total annual cost on the same basis as before £[illegible] per annum, or 1/[illegible]d. per 1000 gallons.

(b). The fall of the river is very small, not more than 8 feet per mile, and the works necessary for obtaining a volume and head of water sufficient to pump the town supply would consequently be expensive. The first cost of the scheme would probably be more than for the steam pumps. If the scheme cost £[illegible],000, the total annual cost would be about £700 or about 1s. 5½d. per 1000 gallons supplied.

(5). In order to get a supply from the Upper waters of the Moremuat, it would be necessary to lay a

main for about 12 miles. The total cost of this scheme would be quite £12,000.

[...] above Syndicate's [...]

(6). There is not sufficient water available in the stream above the Syndicate's farm to supply the needs of Naivasha, so that source need not be further considered.

[...] conclusions in regard to [...] water supply

[illegible] schemes, the most [illegible] probably be a gravitation supply from the Marenguishe or some other stream on the Kinangop Plateau. A careful series of gaugings of the streams in that district is necessary, with chemical and bacteriological analyses of the waters, and if sufficient water is available a survey of the pipe line would be required. If enough water cannot be obtained from that source, the question of the possibility of pumping by water power from the Morendat might be gone into, and if this is not possible at a reasonable cost the best alternative would be to pump the lake water. In any case with a possible exception of the water from the Kinangop Plateau, the water should be purified by efficient filtration.

DRAINAGE.

[...]inage.

8. There is no apparent prospect on any drainage scheme being required for Naivasha. If a separate foul water system is at any time required, the natural outlet will be into the lake at a point about a mile to the north-west of the railway station. This would be more than 2 miles away from the intake of the water supply if that is pumped from the lake, and with proper filtration of the water there should be no serious danger of contamination. The sewage could also possibly be purified by using it for irrigating the land near the lake.

GENERAL.

...ibilities of ...sha as a ...th resort.

In discussing the various possible methods of supplying Naivasha with water, I have endeavoured to show approximately what expenditure will be necessary on this work if it is proposed to develop the town. Whether Naivasha will ever be a very successful health resort is open to question, as the [illegible] bracing air and fine scenery, for the winds are decidedly sufficiently trying to make it unpopular with many persons. I am informed that the opposite shore of the lake is free from this objection, and it may be that the future health resort will be on that side with small steamers connecting it with Naivasha station. In any case further investigations and surveys are required before any scheme of water supply can be definitely decided upon, and in the meantime a decision will have been arrived at with regard to the proposed removal of the headquarters of the Province.

SECTION II.

NAKURU.

Nakuru Town and Lake.

Nakuru is 449 miles from Mombasa and 122 miles from Nairobi. It is at present almost entirely a railway town. It is the headquarters of the [illegible] district of the Uganda Railway, and has a population of about 500 persons. The height of the railway station above the sea-level is shown on the railway plans as being about 6,070 feet. The land on which the township stands has a gradual slope towards the lake Nakuru, the nearest point of which is about 2½ miles away in a south-westerly direction. The surface of the lake is shown on the published maps as 5,980 feet above the sea-level, or about 90 feet below the town. Some calculations which I made, from the results of some rough observations of the levels, made the difference more than this. The lake has an area of 23 square miles; the water in it is salt, and not fit for drinking.

Railway Buildings.

The railway authorities have reserved an area of 804 acres round the railway station for railway buildings and other purposes.

A corrugated iron fence encloses an area of 22 acres in the centre of the reserve containing the railway station, running shed, District Engineer's Office, [illegible] store etc. Outside the fence but on railway land are the District Engineer's and Medical Officer's houses, Subordinate's bungalows, dak bungalow, post office, police quarters, hospital, cemetery etc.

Private Houses.

The private houses are those in the Indian Bazaar and two small bungalows built by settlers. Nearly all

the buildings are of the usual corrugated iron type.

SANITARY CONDITION OF THE TOWNSHIP.

Soil and subsoil.

The sub-soil is of an exceedingly porous nature being formed of a considerable thickness of broken up pumice stone; the soil is not quite so porous as that of Nalvasha, but is apparently more fertile.

The [illegible] prevents any trouble being experienced from the surface water which soaks away rapidly even after the heaviest rains.

Sanitary condition of the Buildings.

The better class of houses are in a fairly sanitary condition but the back quarters of some of the subordinates' bungalows leave much to be desired in this direction. Some of the latrines were very offensive, particularly those set aside in the station for natives. The servants latrines at the back of the dak bungalows were also exceedingly filthy.

Hospital.

The Hospital is a long unlined corrugated iron barrack like structure, containing an office, dispensary, medical store, European ward, (which is only used in an emergency). and wards for natives. The building appeared to be likely to be hot and not particularly sanitary. There is no latrine accommodation for the Asiatic and African patients; a night commode is provided for Europeans.

Indian Bazaar.

The Indian bazaar consists of two rows of corrugated iron buildings, and contains on a small scale several of the offensive elements of the Nairobi bazaar. In some of the houses a single room is used for living, sleeping, working, baking and cooking in

the buildings are of the usual corrugated iron type.

Soil and subsoil.

The sub-soil is of an exceedingly porous nature being formed of a considerable thickness of broken up pumice stone; the soil is not quite so porous as that of Naivasha, but is apparently more fertile.

The nature of the subsoil prevents any trouble being experienced from the surface water, which runs away rapidly even after the heaviest rains.

Sanitary condition of the Buildings.

The better class of houses are in a fairly sanitary condition but the back quarters of some of the subordinates bungalows leave much to be desired in this direction. Some of the latrines were very offensive, particularly those set aside in the station for natives. The servants latrines at the back of the dak bungalows were also exceedingly filthy.

Hospital.

The Hospital is a long unlined corrugated iron barrack like structure, containing an office, dispensary, medical stores, European ward, (which is only used in an emergency). and wards for natives. The building appeared to be likely to be hot and not particularly sanitary. There is no latrine accommodation for the Asiatic and African patients; a night commode is provided for Europeans.

Indian Bazaar.

The Indian bazaar consists of two rows of corrugated iron buildings, and contains on a small scale several of the offensive elements of the Nairobi bazaar. In some of the houses a single room is used for living, sleeping, working, baking and cooking in

for storing a variety of different articles, and for fowl keeping. There is absolutely no ventilation in some of the rooms. The whole of the meat supply comes from this bazaar, and the conditions under which it is sold are very unsatisfactory. I understand that the occupiers have no agreements or leases for the land on which their houses are built, the bazaar only exists in its present place on sufferance. It is very desirable that it should be removed and rebuilt at the earliest opportunity.

rvancy. The conservancy of all the railway houses is looked after by a board consisting of the District Engineer, the Medical Officer, Station Master, Locomotive Foreman and Permanent Way Inspector. The night soil is regularly removed and buried in a spot about a mile away on the south west side of the town; a closed single bullock wagon being used for the purpose. The refuse is carried away and dumped at a spot nearer the town.

Latrines. The latrines for the lower class of railway servants, the police and the inhabitants of the Indian bazaar are deep open trenches. The subsoil is very suitable for this system and no offensive odours could be detected near any of those I visited.

EXISTING WATER SUPPLY.

e of supply. The present water supply is brought about 8½ miles from the Njoro river. A small concrete dam is built across the stream and a 2½ inch galvanised iron pipe conveys the water to Nakuru. About 33,000 gallons a day is made available in this way.

Arrangement of [illegible]

The water main delivers into four tanks each 8 ft. by 8 feet by 8 feet, holding together 18,000 gallons which supply the running shed and are fixed on columns 20 feet above the ground. These overflow into a second set on right, 8 feet by 8 feet by 8 feet tanks also holding 18,000 gallons which supply the water cranes in the station. From these the overflow in turn feeds four tanks each 4 feet by 4 feet by 4 feet holding together 1,600 gallons, which form the service tanks for the town supply, and overflow into a concrete tank below the station, used for washing clothes. Below this tank a marshy place is formed which might be a breeding place for anopheles mosquitos, and which it would be well to get rid of.

By this arrangement the tanks which supply the town only get water after the wants of the running shed and the engines have been satisfied.

Possibilities of present supply.

The average daily requirements of the locomotive department are at present 10,000 gallons, leaving a balance of 23,000 gallons for the inhabitants of the township. As the traffic on the railway increases the amount of water used by the locomotives will naturally increase also. I do not think that the present supply can be depended upon to do more in the future than provide water for railway purposes. The railway authorities have taken this view and are, I understand, not prepared to allow their water to be laid on to private premises.

Inconvenience of present arrangements.

If the inhabitants of the railway town continue to get their supply in this way they are likely to suffer some inconvenience from the method of distribu-

tion, unless some alteration is made in it, for with the increasing demands of the locomotive department, it may frequently happen that the upper tanks may be drawn down for some hours, so that during that time no water will overflow into the town tanks. The capacity of these tanks being small, they would be emptied, thus the railway houses would be liable to be left without water at the time when they most wanted it. In order to prevent this occurring it would only be necessary to increase the total capacity of the town tanks sufficiently, or to connect them to the water main above the upper tanks and to put a ball-cock at the lower end of the connecting pipe.

Quality of present water supply.

In the Appendix an analysis of the Njoro river water is given. It is an exceedingly soft water, and is apparently freer from vegetable contamination than many of the other waters examined. On the other hand there is considerable chance of animal contamination for there is a growing population on the banks of the streams above the intake of the pipe.

FUTURE WATER SUPPLY.

Quantity of new supply.

I have taken the quantity of water required by Nakuru in the near future as being the same as at Naivasha, that is 30,000 gallons per day. This quantity would however be sufficient for a larger population than at Naivasha. 15 gallons per head, which was the allowance in that case, would give a margin over what is actually required for domestic use. It would allow a limited amount for railway purposes if required or even a small quantity for

tion, unless some alteration is made in it, for with the increasing demands of the locomotive department, it may frequently happen that the upper tanks may be drawn down for some hours, so that during that time no water will overflow into the town tanks. The capacity of these tanks being small, they would be emptied, thus the railway houses would be liable to be left without water at the time when they most wanted it. In order to prevent this occurring it would only be necessary to increase the total capacity of the town tanks sufficiently, or to connect them to the water main above the upper tanks and to put a ball-cock at the lower end of the connecting pipe.

Quality of present water supply.

In the Appendix an analysis of the Njoro river water is given. It is an exceedingly soft water, and is apparently freer from vegetable contamination than many of the other waters examined. On the other hand there is considerable chance of animal contamination for there is a growing population on the banks of the streams above the intake of the pipe.

FUTURE WATER SUPPLY.

Quantity of water supply.

I have taken the quantity of water required by Nakuru in the near future as being the same as at Naivasha, that is 30,000 gallons per day. This quantity would however be sufficient for a larger population than at Naivasha. 15 gallons per head, which was the allowance in that case, would give a margin over what is actually required for domestic use. It would allow a limited amount for railway purposes if required or even a small quantity for

garden watering.

Suggestion that new supply should be laid to railway houses.

In Nakuru there is already the railway supply, but as the water they bring down is not of the best quality, I think that if it is decided to get an additional supply it would be better to lay the new supply on to all houses, including the railway houses, keeping the present supply for the engines, and utilising the overflow for clothes washing, garden watering, or any other purpose for which it may be required.

Water only required for purely domestic purposes.

If this is done there will be no need to supply more water per head than is actually required for purely domestic purposes; this would be about 10 gallons per head per day so that 30,000 gallons would be a sufficient supply for a population of 3000 persons.

Possible sources of supply.

There are so far as I am aware only three possible sources of supply,

1. The Mororoni river flowing into Lake Elmenteita.
2. A stream in the same district known as Costello's stream.
3. The existing source, the Njoro river.

Mororoni River scheme.

1. The results of an analysis of the water in the Mororoni river are given in the Appendix. Like the Njoro river water it is a very soft water. It shows more signs of vegetable contamination than the latter, but on the other hand there are less signs of animal contamination. By going far enough up stream a place could be chosen where the chances of

garden watering.

Suggestion that new supply should be laid to railway houses.

In Nakuru there is already the railway supply, but as the water they bring down is not of the best quality, I think that if it is decided to get an additional supply it would be better to lay the new supply on to all houses, including railway houses, keeping the present supply for the engines, and utilising the overflow for clothes washing, garden watering, or any other purpose for which it may be required.

Water only required for purely domestic purposes.

If this is done there will be no need to supply more water per head than is actually required for purely domestic purposes; this would be about 10 gallons per head per day so that 30,000 gallons would be a sufficient supply for a population of 3000 persons.

Possible sources of supply.

There are so far as I am aware only three possible sources of supply,

1. The Mororoni river flowing into Lake Elmenteita.
2. A stream in the same district known as Costello's stream.
3. The existing source, the Njoro river.

Mororoni River scheme.

1. The results of an analysis of the water in the Mororoni river are given in the Appendix. Like the Njoro river water it is a very soft water. It shows more signs of vegetable contamination than the latter, but on the other hand there are less signs of animal contamination. By going far enough up stream a place could be chosen where the chances of

sewage pollution would be reduced to a minimum, and if it were necessary to drink any water in the district in an unfiltered condition this is certainly the water I should choose. I have, however, included the cost of filtration in my estimate and would recommend that filters should be provided. I think the water could be satisfactorily purified either by the Candy process or by intermittent filtration through a sand filter. At the time of my visit I found that there was about 14,000,000 gallons a day flowing down this stream. From information obtained on the spot, I understand that the flow is never less than about 4,500,000 gallons a day, so that there is an ample supply. The distance to Nakuru from the intake on the Mereroni river is about 14,000 yards . It would be necessary as at Naivasha to construct a service reservoir at a highnpoint in the town and a system of distribution mains.

Cost. The total cost of the scheme would be about £9000 and the working expenses £160 per annum. The total cost including interest on capital and sinking fund works out to £654. per annum or 1/2¼ per 1000 gallons delivered.

Costello's stream 2. The water in Costello's stream does not appear to be of so good a quality as in the Mereroni river. The quantity is very much less and the stream finally disappears altogether about 3 miles from Lake Nakuru,into which it makes its way underground. I do not consider that a constant supply could be relied upon from this source and so I have not prepared an estimate of the cost of the scheme.

Njoro River. 3. The Njoro river at the point of the present intake was running at the rate of 2,700,000 gallons per

sewage pollution would be reduced to a minimum, and if it were necessary to drink any water in the district in an unfiltered condition this is certainly the water I should choose. I have, however, included the cost of filtration in my estimate and would recommend that filters should be provided. I think the water could be satisfactorily purified either by the Alum process or by intermittent filtration through a sand filter. At the time of my visit I found that there was about 14,000,000 gallons a day flowing down this stream. From information obtained on the spot, I understand that the flow is never less than about 4,500,000 gallons a day, so that there is an ample supply. The distance to Nakuru from the intake on the Mororoni river is about 14,000 yards . It would be necessary as at Naivasha to construct a service reservoir at a highpoint in the town and a system of distribution mains.

Cost. The total cost of the scheme would be about £9000 and the working expenses £160 per annum. The total cost including interest on capital and sinking fund works out to £654. per annum or 1/2¼ / per 1000 gallons delivered.

Costello's stream 2. The water in Costello's stream does not appear to be of so good a quality as in the Mororoni river. The quantity is very much less and the stream finally disappears altogether about 3 miles from Lake Nakuru, into which it makes its way underground. I do not consider that a constant supply could be relied upon from this source and so I have not prepared an estimate of the cost of the scheme.

Njoro River. 3. The Njoro river at the point of the present intake was running at the rate of 2,700,000 gallons per

day when I gauged it. I am informed that at certain times of the year the stream is low, but I do not believe that the flow is ever less than 500,000 gallons per day. The increasing population on the banks of the river above, in addition to causing a risk of pollution, use a certain amount of water, but 500,000 gallons a day should be sufficient both for them and for Nakuru if required.

scheme. The distance to Nakuru from the intake is rather more than from the Meroroni river, but owing to the greater amount of fall a smaller sized pipe can be used and the cost of the work will be less, about £8,000.

The working expenses will be about the same as in scheme No.1. the total cost will be £803. per annum, or 1/1½per 1000 gallons delivered.

parison with roroni scheme. If the water is properly filtered this scheme offers certain advantages over the Meroroni river scheme. It is somewhat cheaper, and it will be advantageous as far as maintenance and inspection are concerned to have the whole of the water supplied from one source instead of having two pipe lines in two opposite directions. The maintenance of the rail way water supply could be handed over to the municipal authorities, the railway contributing their share of the working expenses, and this would materially lighten the cost of maintaining the new works.

On the other hand it will be necessary to take a careful series of observations of the flow of the river in order to be assured that there is sufficient water at all times, and unless it is decided to filter the water I do not recommend this scheme. It

would be better in that case to go to the Meroroni river.

Wells. I have not prepared estimates of the cost of sinking wells either at Naivasha or Nakuru. The previous efforts in this direction in this district have been unsuccessful, the water obtained from the well at Naivasha appears to have been absolutely undrinkable. Comparatively shallow wells would no doubt obtain water both at Naivasha and Nakuru but the site would have to be carefully chosen, it would have to be some distance from the town to avoid pollution, and would in every case necessitate pumping, whilst there seems to be considerable probability of the water being naturally of an unsatisfactory quality.

DRAINAGE.

Provision for future sewage works. Although no works of drainage will be necessary at all events until the town is much larger than at present, still in laying out the township the possibility that a [illegible] sewage system will be required in the future should be considered. It would be quite easy to arrange for. A main outfall sewer along the central road leading southwards from the station could finally discharge into the lake, or the sewage would be used for irrigating some of the land between the town and the lake.

It would be well to reserve an area of land of from 50 to 100 acres about a mile and a half to the south of the town for this purpose.

would be better in that case to go to the Meroroni river.

Wells.

I have not prepared estimates of the cost of sinking wells [illegible] The previous efforts in this direction in this district have been unsuccessful; the water obtained from the well at Naivasha appears to have been absolutely undrinkable. Comparatively shallow wells would no doubt obtain water both at Naivasha and Nakuru but the site would have to be carefully chosen,it would have to be some distance from the town to avoid pollution,and would in every case necessitate pumping, whilst there seems to be considerable probability of the water being naturally of an unsatisfactory quality.

DRAINAGE.

Provision for future sewage works.

Although no works of drainage will be necessary, at all events until the town is much larger than at present,still in laying out the township the possibility that a scheme for water sewage system will be required in the future should be considered. It would be quite easy to arrange for. A main outfall sewer along the central road leading southwards from the station could finally discharge into the lake,or the sewage would be used for irrigating some of the land between the town and the lake.

It would be well to reserve an area of land of from 50 to 100 acres about a mile and a half to the south of the town for this purpose.

FUTURE ARRANGEMENT OF THE TOWN

Future arrangement of the town.

The Land Office have already divided the land on the low side of the railway property into plots and have let some of them. I think it would have been better to have arranged the town somewhat differently so as to have had the Indian bazaar on the West side instead of the East as at present. The Officials' houses would then have been placed on the hill above the railway on the east of the town which is the direction from which the prevailing winds blow. As it is too late to make this arrangement, the next best will be to put the Officials' bungalows on the hill side above the District Engineer's house, and the Indian bazaar somewhere near its present position, with the native quarter some distance beyond nearer to and below the railway. The business quarter will be in the centre of the town and the main streets the road running southwards from the railway station and the central cross road which intersects it at right angles. At the point of intersection a large central square could be arranged like in most of the South African towns. The accompanying plan illustrates this suggestion.

COMPARISON OF NAIVASHA WITH NAKURU.

Comparison of Naivasha and Nakuru.

So far as sanitary and engineering matters are concerned there is very little to choose between Naivasha and Nakuru. Both places are situated in a healthy climate amidst fine scenery, on a good subsoil which makes drainage a very easy matter. The climate of Naivasha is probably more bracing but on the other hand Nakuru is free from the objectionable wind

FUTURE ARRANGEMENT OF THE TOWN

Suggested arrangement of the town.

The Land Office have already divided the land on the East side of the railway property into plots and have let some of them. I think it would have been better to have developed the town [illegible] ently so as to have had the Indian bazaar on the West side instead of the East as at present. The Officials' houses would then have been placed on the hill above the railway on the east of the town which is the direction from which the prevailing winds blow. As it is too late to make this arrangement, the next best will be to put the Officials' bungalows on the hill side above the District Engineer's house, and the Indian bazaar somewhere near its present position, with the native quarter some distance beyond nearer to and below the railway. The business quarter will be in the centre of the town and the main streets the road running southwards from the railway station and the central cross road which intersects it at right angles. At the point of intersection a large central square could be arranged like in most of the South African towns. The accompanying plan illustrates this suggestion.

COMPARISON OF NAIVASHA WITH NAKURU.

Comparison of Naivasha and Nakuru.

So far as sanitary and engineering matters are concerned there is very little to choose between Naivasha and Nakuru. Both places are situated in a healthy climate amidst fine scenery, on a good subsoil which makes drainage a very easy matter. The climate of Naivasha is probably more bracing but on the other hand Nakuru is free from the objectionable wind

which is one of the chief characteristics of the former place. So far as the present arrangement of the two townships is concerned Naivasha has apparently suffered from the absence of any prearranged plan, for no clearly thought out scheme of arrangement could [illegible] have [illegible] a large [illegible] yard to be placed just [illegible] the chief [illegible] plots in the town. On the other [illegible] is doubtful if when the building plots were laid out and leased at Nakuru the question as to how the inhabitants were to get their water supply was ever considered.

As regards [illegible] water supply, if a sufficient quantity of good water can be obtained within a reasonable distance from the Kinangop plateau, Naivasha has the advantage, but unless this can be done Nakuru is in a slightly better position in this respect. On the whole I consider Nakuru the better site for a town but the difference between the two places is not sufficient to outweigh administrative considerations.

Suggested sites board to lay out [illegible] townships

I should suggest that a sites board should be appointed to lay out whichever town is chosen, consisting of the Subcommissioner of the Province, the Collector of the District, the [illegible] Medical Officer, the Executive [illegible] of the P.W.D., the District Engineer of the Railway [illegible] representative of the Land Office. The important points in laying out the town are, that the Indian and Native quarters should be separated from the European quarter; the building plots should be laid out in such a way as to give the Government or the Municipality the greatest possible advantage from the future in-

which is one of the chief characteristics of the former place. So far as the present arrangement of the two townships is concerned Naivasha has apparently suffered from the absence of any prearranged plan, for no clearly thought out scheme of arrangement could [illegible] which is one of the chief [illegible] plots in the town. On the other hand it is doubtful if [illegible] building plots were laid out and leased at Nakuru the question as to how the inhabitants were to get their [illegible] supply was ever considered.

With regard to a new water supply, if a sufficient quantity of good water can be obtained within a reasonable distance from the Kinangop plateau, Naivasha has the advantage, but unless this can be done Nakuru is in a slightly better position in this respect. On the whole I consider Nakuru the better site for a town but the difference between the two places is not sufficient to outweigh administrative considerations.

I should suggest that a sites board should be appointed to lay out whichever town is chosen, consisting of the Subcommissioner of the Province, the Collector of the District, the Local Medical Officer, the Executive Engineer of the P.W.D., the District Engineer of the Railway, a representative of the Land Office.

The important points in laying out the town are, (1) that European and Native quarters should be separated from the European quarter; (2) the building plots should be laid out in such a way as to give the Government the majority the greatest possible advantage from the future in-

crease in value of the land as the town becomes built over; and the large an area of land as possible should be reserved round the town, for it may be in the future a most valuable asset, and, if the town becomes an important one, the revenue from rents will enable municipal works to be carried out at the minimum cost to the ratepayers.

SECTION III.

KISUMU.

POSITION CLIMATE AND DEATHRATE.

Preliminary investigations.

I made a stay of about 3 weeks at Kisumu during which time I examined and partially surveyed the town and made some journeys into the surrounding country in order to look at possible sources of water supply. After my visit I prepared a plan showing my suggestions for the future arrangement of the township, a copy of which I sent to the acting Subcommissioner at Kisumu and another to the Commissioner of Lands. This plan was practically identical with that accompanying this report.

In the preliminary work I received much assistance from Mr. H. R. Tate the acting Subcommissioner and his staff, the local representatives of the railway and Dr. Henderson the Resident Medical Officer, and the Assistant Engineer P.W.D.

Position of Kisumu.

Kisumu or Port Florence is the terminus of the Uganda Railway on the Victoria Nyanza. It is about

crease in value of the land as the town becomes built over, and the large an area of land as possible should be reserved round the town, for it may be in the future a most valuable asset, and, if the town becomes an important one, the income from rents will enable municipal works to be carried out at the minimum cost to the ratepayers.

SECTION III.

KISUMU.

POSITION CLIMATE AND DEATHRATE.

Preliminary Investigations.

I made a stay of about 3 weeks at Kisumu during which time I examined and partially surveyed the town and made some journeys into the surrounding country in order to look at possible sources of water supply. After my visit I prepared a plan showing my suggestions for the future arrangement of the township, a copy of which I sent to the acting Subcommissioner at Kisumu and another to the Commissioner of Lands. This plan was practically identical with that accompanying this report.

In the preliminary work I received much assistance from Mr. H. R. Tate the acting Subcommissioner and his staff, the local representatives of the railway and Dr. Henderson the Resident Medical Officer, and the Assistant Engineer P.W.D.

Position of Kisumu.

Kisumu or Port Florence is the terminus of the Uganda Railway on the Victoria Nyanza. It is about

3,800 feet above the sea, and is built on a low saddle-backed hill on the South East side of Ugowe Bay.

Climate

The town is only a few miles south of the equator and the climate is tropical. The maximum shade temperature recorded within the last few years is 110° F. but that was more than high, the ordinary yearly maximum is under 100° F. on the other hand even in the coldest months the daily maximum is generally between 80° F. and 90° F. and the night temperature is considerably higher than in the more elevated parts of the Protectorate.

Rainfall.

The rainfall appears to average about 54 inches per annum and is therefore greater than at Nairobi; it is also more evenly distributed throughout the year. Between September 1902 and October 1906 there were only four months in which a total of less than one inch fell and only one month in which there was less than two thirds of an inch.

The rate of rainfall for short periods is sometimes very heavy, and falls at the rate of more than one inch an hour appear to be fairly common.

Prevailing Winds.

The winds blow with great regularity during part of each day from the South West and during part of each night from the north east, with a calm period in the early morning.

Geology.

In most parts of the town there is very little soil, on the top of the hill practically none. The underlying rocks are a black basalt and an iron stone of the same type range as the "murram" at Nairobi

3,800 feet above the sea, and is built on a low saddle-backed hill on the South East side of Ugowe Bay.

Climate

The town is only a few miles south of the equator and the climate is tropical. The maximum shade temperature recorded within the last few years is 110° F. but that was unusually high, the ordinary yearly maximum is under 100° F; on the other hand even in the coldest months the daily maximum is generally between 80° F. and 90° F. and the night temperature is considerably higher than in the more elevated parts of the Protectorate.

Rainfall.

The rainfall appears to average about 54 inches per annum and is therefore greater than at Nairobi; it is also more evenly distributed throughout the year. Between September 1902 and October 1906 there were only four months in which a total of less than one inch fell and only one month in which there was less than two thirds of an inch.

The rate of rainfall for short periods is sometimes very heavy, and falls at the rate of more than one inch an hour appear to be fairly common.

Prevailing Winds.

The winds blow with great regularity during part of each day from the South West and during part of each night from the north east, with a calm period in the early morning.

Geology.

In most parts of the town there is very little soil, on the top of the hill practically none. The underlying rocks are a black basalt and an iron-stone of the same type rocks as the "Kopjes" at Nairobi

but frequently much harder. It is in fact the stone with which many of the houses in Kisumu are built.

Municipal area and population.

The municipal area is enclosed in a imaginary circle of 2½ miles radius struck from the Collector's office as a centre. The population is supposed to be between 5000 and 6000 of which only about 50 persons are Europeans; the Indians number about 600.

Health of the town.

The town cannot under present conditions be considered a healthy one, malaria and blackwater fever are prevalent. Sleeping sickness appears at one time to have been common but by clearing the undergrowth along the lake side and thus getting rid of the Tsetse fly the disease has been eradicated so far as Kisumu itself is concerned, although cases occur along the shores of the lake within a comparatively short distance.

Death Rate.

The total number of deaths in the first 9 months of 1906 was returned at 71. The population is not known with sufficient accuracy to enable the total death rate to be accurately calculated, but the deaths amongst the Indians were 22, which would represent an annual death rate of nearly 50 per 1000; an exceptionally high figure, and one for which there must be some definite cause. The diseases causing the greatest number of deaths were pneumonia 23, and dysentery 12.

SANITARY CONDITION OF THE TOWN.

Buildings.

The most important buildings are the railway station, customs house, railway workshops, Collector's

but frequently much harder. It is in fact the stone with which many of the houses in Kisumu are built.

unicipal area
d population.

The municipal area is enclosed in a imaginary circle of 2½ miles radius struck from the Collector's office as a centre. The population is supposed to be between 5000 and 6000 of which only about 80 persons are Europeans; the Indians number about 600.

alth of the
own.

The town cannot under present conditions be considered a healthy one, malaria and blackwater fever are prevalent. Sleeping sickness appears at one time to have been common but by clearing the undergrowth along the lake side and thus getting rid of the Tsetse fly the disease has been eradicated so far as Kisumu itself is concerned, although cases occur along the shores of the lake within a comparatively short distance.

Death Rate.

The total number of deaths in the first 9 months of 1906 was returned at 71. The population is not known with sufficient accuracy to enable the total death rate to be accurately calculated, but the deaths amongst the Indians were 22, which would represent an annual death rate of nearly 50 per 1000; an exceptionally high figure, and one for which there must be some definite cause. The diseases causing the greatest number of deaths were pneumonia 13, and dysentery 12.

SANITARY CONDITION OF THE TOWN.

Buildings.

The most important buildings are the railway station, customs house, railway workshops, Collector's

office, Magistrate's Court, treasury, hospital, P.W.D. office and yard, market, gaol and police station. The official and railway bungalows are on the top of the hill on both sides of Victoria Road. The Indian bazaar is near the railway station and the native quarter is on the hill running north eastwards from the town.

Indian Bazaar.

The Indian bazaar consists of one main street containing the larger shops and a short cross street in which are some small shops. It is built on a slope on which there is practically no soil a thin layer of murram overlies the hard rock beneath. There is no difficulty about the surface water drainage; good sized drains are cut into the rock on each side of the road.

The houses in the bazaar are of corrugated iron and built on rough plinths of stones and mud, the floors being covered with a layer of cement which has peeled off in some places. Many of the houses have inside closets, the buckets being placed in 4 sunk recesses with a trap door opening out at the back of each. The condition of these recesses is filthy beyond description. Several of the houses have wash-in places from which the effluent flows out on to the adjoining ground. In some cases there were short lengths of cemented drains which had no proper outlets and were accordingly worse than no drain at all.

The stores and plinths harbour numerous rats which are attracted by the goods stored inside the houses, and it was not surprising to hear that there had recent-

offices, Magistrate's Court, treasury, hospital, P.W.D. office and yard, market, gaol and police station. The official and railway bungalows are on the top of the hill on both sides of Victoria Road. The Indian bazaar is near the railway station and the European quarter is on the hill running north eastwards/the town.

Indian Bazaar.

The Indian bazaar consists of one main street containing the larger shops and a short cross street in which are some small shops. It is built on a slope on which there is practically no soil a thin layer of murram overlies the hard rock beneath. There is no difficulty about the surface water drainage:good sized drains are cut into the rock on each side of the road.

The houses in the bazaar are of corrugated iron and built on rough plinths of stones and mud, the floors being covered with a layer of cement which has peeled off in some places. Many of the houses have inside closets,the buckets being placed in 4 sunk recesses with a trap door opening out at the back of each. The condition of these recesses is filthy beyond description. Several of the houses have washing places from which the effluent flows out on to the adjoining ground. In some cases there were short lengths of cemented drains which had no proper outlets and were accordingly worse than no drain at all.

The stones and plinths harbour numerous rats which are attracted by the goods stored inside the houses, and it was not surprising to hear that there had been an

ly been a serious epidemic of plague in the bazaar in which the deathrate was about 95 per cent.

The bazaar is not at present overcrowded but it suffers from the mistake which was made in the first instance of letting the land in such small plots that the buildings occupy the whole of each plot, leaving no courtyard space at all. The result of this has been that closets, kitchens and washing places are all inside the buildings, and I certainly did not come across any type of latrine in the Protectorate, amongst a large variety of offensive types, that was so objectionable as the closets in the houses of the Masaw bazaar.

At the back of the houses there are five public latrines, each containing 12 buckets, with cemented floors, which although of a primitive type and somewhat offensive on approaching near to them, did not appear to me to constitute any danger to the public health. There is no separation of the sexes in these latrines.

On the whole, there was no [illegible] in spite of the great efforts of the [illegible] medical officer the bazaar is in a thoroughly unsanitary condition.

Railway town.

There are a number of overcrowded and unhealthy landhies on the railway property. In some of these there are rows of small rooms about 9 feet square in each of which two men and two women sleep, whilst in others 30 or 40 people sleep in a one roomed building which should not be made to accomodate more than half that number. The latrines near these buildings are often filthy. The worst landhies and also

the most offensive latrines were those behind the lockyard. The better class of the railway subordinates live in corrugated iron bungalows higher up the hill. The conditions of their back quarters is not very satisfactory and the state of the servants latrines is very bad.

Official quarter.

The Officials' bungalows on the hill are nearly all substantially built of stone. The servants quarters, the kitchens, and the closets are detached from the main buildings. The general condition of these out-buildings is fairly satisfactory, but in the houses in which there are servants latrines they are generally in a filthy state. The Collector's office and the Magistrates Court are stone buildings, the Post Office is a corrugated iron building which has been condemned by the medical officer on account of the small accommodation available for the Post Office officials who inhabit it.

Jail.

The Jail consists of two stone built one roomed buildings each of which contained at the time of my visit 20 or 30 prisoners. There is no latrine accommodation; in the night time empty Kerosine tins are placed in the wards and used for defecating and uriniating.

Police Lines.

The police lines are about a quarter of a mile to the east of the Jail on the further slope of the hill on which Kieyum is built. They consist of 40 wall built round huts made of jungle wood framework filled in with mud and plastered with a

the most offensive latrines were those behind the dockyard. The better class of the railway subordinates live in corrugated iron bungalows higher up the hill. The conditions of their back quarters is not very satisfactory and [illegible] of the servants latrines is very bad.

Official quarter.

The Officials' bungalows on the hill are nearly all substantially built of stone. The servants quarters, the kitchens, and the closets are detached from the main buildings. The general condition of these out-buildings is fairly satisfactory but in the houses in which there are servants latrines they are generally in a filthy state. The Collector's office and the Magistrates Court are stone buildings, the Post Office is a corrugated iron building which has been condemned by the medical officer on account of the small accommodation available for the Post Office officials who inhabit it.

Gaol

The Gaol consists of [illegible] corrugated buildings each of which contained at the time of my visit 20 or 30 prisoners. There is no latrine accommodation; in the night time empty Kerosine tins are placed in the wards and used for defecating and urinating.

Police Lines.

The police lines are about a quarter of a mile to the east of the gaol on the further slope of the hill on which Kiaum is built. They consist of 40 well built round huts made of jungle wood frame-work filled in with mud and plastered with a

thin coating of lime. They are thatched with papyrus and grass, the interiors being divided up by partitions of papyrus reeds. This type of hut is supposed to have a life of four years and is inexpensive to build. These were certainly the best huts of their kind that I saw in the country.

Hospital. Before I left East Africa I was informed that a new hospital was shortly to be commenced at Kisumu. The accommodation in the present hospital is certainly inadequate. There are about 30 in patients and 140 out patients on an average every day. There are two wards which are used promiscuously for males and females and contain cases of pneumonia, sleeping sickness, dysentery, accidents etc., whilst patients suffering from infectious diseases such as small pox and measles are accommodated outside in tents.

The arrangements for operations and postmortems are of a very primitive nature.

Native Market. The native market is a new structure of corrugated iron. There is a central covered market with shops round, the meat sellers being at each end. The most objectionable part of the arrangements is the drain, which has no proper outlet and terminates in a small pool of sewage near the main road.

Slaughter Houses. There are two small slaughter houses near the edge of the lake, the floors and parts of the walls being cemented; they drain into the lake. There is practically no inspection of the meat slaughtered.

Dhobi Quarters. There are no regular dhobi quarters at present but the intention is to build some shortly. A Goanese who does the washing for the steamers and the dak bunga-

thin coating of lime. They are thatched with papyrus and grass, the interiors being divided up by partitions of papyrus reeds. This type of hut is supposed to have a life of four years and is inexpensive to build. These were certainly the best huts of their kind that I saw in the country.

Hospital. Before I left East Africa I was informed that a new hospital was shortly to be commenced at Kisumu. The accommodation in the present hospital is certainly inadequate. There are about 30 in patients and 140 out patients on an average every day. There are two wards which are used promiscuously for males and females and contain cases of pneumonia, sleeping sickness, dysentery, accidents etc., whilst patients suffering from infectious diseases such as small pox and measles are accommodated outside in tents.

The arrangements for operations and postmortems are of a very primitive nature.

Native Market. The native market is a new structure of corrugated iron. There is a central covered market with shops round, the meat sellers being at each end. The most objectionable part of the arrangements is the drain, which has no proper outlet and terminates in a small pool of sewage near the main road.

Slaughter houses. There are two small slaughter houses near the edge of the lake, the lower portions are of brickwork, the floors and parts of the walls being cemented; they drain into the lake. There is practically no inspection of the meat slaughtered.

Dhobi Quarters. There are no regular dhobi quarters at present but the intention is to build some shortly. A Goanese who does the washing for the steamers and the dak bunga-

low lives near the station. I found on visiting his house nothing to which I could take exception.

Native Quarter.

The native population of Kisumu is at the present time increasing with great rapidity and the area over which the native huts are now scattered must be quite a square mile. Separate portions of the native quarter are inhabited by Kavirondos, Baganda, Soudanese, Arabs, Swahilis and other native tribes. The huts vary in size and type. Those of the Arabs and Swahilis are the most pretentious, being large and square, and show considerable constructive skill. The Baganda have some small enclosed gardens in which they cultivate mealies. The area inhabited by the Arabs and the Swahilis has been marked out into small plots and the huts are being built in regular lines. The rest of the native quarter is an irregular collection of villages of various sizes scattered about the hill.

The huts are all built of mud and the roofs are thatched with papyrus and grass. The round hut which is the most common type, has some advantages from a sanitary point of view. There are no latrines, the natives make use of the waste land round their villages.

Municipal Committee.

CONSERVANCY.

The conservancy and refuse collection are undertaken by the municipal Committee.

The Committee was constituted by an Ordinance dated February 15th, 1904; the members are the Collector as Chairman, the Resident Medical Officer, the local Treasury Officer, the Railway Engineer, one European and one Indian civilian. Their duties and responsibilities appear

low lives near the station. I found on visiting his house nothing to which I could take exception.

Native

The native population of Kisumu is at the present time increasing with great rapidity and the area over which the native huts are now scattered must be quite a square mile. Separate portions of the native quarter are inhabited by Kavirondos, Baganda, Soudanese, Arabs, Swahilis and other native tribes. The huts vary in size and type. Those of the Arabs and Swahilis are the most pretentious, being large and square, and show considerable constructive skill. The Baganda have some small enclosed gardens in which they cultivate mealies. The area inhabited by the Arabs and the Swahilis has been marked out into small plots and the huts are being built in regular lines. The rest of the native quarter is an irregular collection of villages of various sizes scattered about the hill.

The huts are all built of mud and the roofs are thatched with papyrus and grass. The round hut which is the most common type, has some advantages from a sanitary point of view. There are no latrines, the natives make use of the waste land round their village.

CONSERVANCY.

Municipal Committee.

The conservancy and refuse collection are undertaken by the municipal Committee.

The Committee was constituted by an Ordinance dated February 13th, 1904; the members are the Collector as Chairman, the Resident Medical Officer, the local Treasury Officer, the Railway Engineer, one European and one Indian civilian. Their duties and responsibilities appear

to be much the same as those of the Nairobi Committee. In addition to the Conservancy the Municipality do some road making but on the other hand there is no street lighting. The rate levied is 7½ of the assessed annual

[illegible] was 641

[illegible] night soil is removed in the carts of the same pattern as at Nairobi, and is deposited amongst the bushes on the south side of the town. At the time of my arrival these operations were being carried on much [illegible] town, but the night soil was subsequently carried to a greater distance. There are no actual trenches, the contents of the buckets are simply spread about the ground. This cannot be said to be a satisfactory system for unless the night soil is covered up there is danger of infection being carried to the houses by flies.

The refuse has been for sometime tipped into a large borrow pit near the native market. It was undoubtedly necessary to get rid of this pit, for the bottom was full of water [illegible] great part of the year and anopheles mosquitos had an opportunity of breeding in it. On the other hand a better material could have been chosen to fill it up with than house refuse. It will now be quite impossible to build on the land near the pit for a number of years. The proper system for it would be for the house refuse to be taken away as far as possible and the combustible part burnt, as at Nairobi.

The night soil is removed from 170 buckets, and apparently about a tons of refuse a day is disposed of. Nearly the whole of this refuse comes from the Indian bazaar and the Native market.

to be much the same as those of the Nairobi Committee. In addition to the Conservancy the Municipality do some road making but on the other hand there is no street lighting. The rate levied is 7½d of the assessed annual

[illegible] night soil [illegible] manner as at Nairobi, and is deposited amongst the bushes to the south side of the town. At the time of my arrival these operations were being carried on much too close to the [illegible] but it will be subsequently carried to a greater distance. There are no actual trenches, the contents of the buckets are simply spread about the ground. This cannot be said to be a satisfactory system for unless the night soil is covered up there is danger of infection being carried to the houses by flies.

Refuse. The refuse has been sometimes tipped into a large borrow pit near the native market. It was undoubtedly necessary to get rid of this pit, for the bottom was full of water for a great part of the year and anopheles mosquitoes [illegible] breeding in it. On the other hand a better material could have been chosen to fill it up with than house refuse. It will now be quite impossible to build on the land near the pit for a number of years. The proper system for dealing with house refuse to be taken away as far as possible and the combustible part burnt, as at Nairobi.

Conservancy. The night soil is removed from 170 buckets, and approximately 300 tons of refuse a day is disposed of. Nearly the whole of this refuse comes from the Indian bazaar and the Native market.

The cost of conservancy and refuse removal is not very easy to get at from the municipal balance sheet, for it is difficult to find out how much of the labour paid for was employed on this work and how much on other municipal works. It appears to have cost about £250 in the year ending March 30th, 1908. This would make the work rather cheaper than at Nairobi, but the difference in cost ought really to be greater considering how much further the Nairobi night soil has to be carried. On the whole the work of conservancy appears to be less economically performed at Kisumu than at Nairobi.

WATER SUPPLY.

Present water supply. The present water supply comes partly from the private rainwater tanks and is partly pumped from the lake. The intake to the pumping station is close to the shipbuilding yard, the suction pipe extending about 50 yards into the lake. The analysis of a sample of the water of the lake taken at this point which is given in the appendix shews much vegetable contamination, and, although there is no obvious sign of animal pollution, it is hardly possible that pollution can be avoided from the pier, the boatmen, the dry dock and the shipbuilding yard, all of which are quite near. There can be no doubt that the water supplied is extremely bad.

Pumping machinery. The water is pumped by a set of four Barr Pumps, the steam being provided by two old locomotive boilers. The rising main is 2½ inches diameter and delivers into a steel riveted tank on the top of the hill near the gaol, whence it is distributed through a system of pipes to the standpipes in the town.

The cost of conservancy and refuse removal is not very easy to get at from the municipal balance sheet, for it is difficult to find out how much of the labour paid for was employed on this work and how much on other municipal works. It appears to have cost about £600 in the year ending March 30th, 1908. This would make the work rather cheaper than at Nairobi, but the difference in cost ought really to be greater considering how much further the Nairobi night soil has to be carried. On the whole the work of conservancy appears to be less economically performed at Kisumu than at Nairobi.

WATER SUPPLY.

Present water supply. The present water supply comes partly from the private rainwater tanks and is partly pumped from the lake. The intake to the pumping station is close to the shipbuilding yard, the suction pipe extending about 50 yards into the lake. A sample of the analysis of the water of the lake taken at this point, which is given in the appendix shews much vegetable contamination, and, although there is no obvious sign of animal pollution, it is hardly possible that pollution can be avoided from the jetty, the steamers, the dry dock and the shipbuilding yard, all of which are quite near. There can be no doubt that the water supplied is extremely bad.

Pumping machinery. The water is pumped by a set of four Barr Pumps, the steam being provided by two old locomotive boilers. The rising main is 2½ inches diameter and delivers into a steel riveted tank on the top of the hill near the gaol, whence it is distributed through a system of pipes to the standpipes in the town.

Consumption of water.

The consumption of water is 25,000 gallons a day in wet weather when the house tanks are full, but at the end of a dry period, when these tanks are partially empty, the consumption rises to nearly 40,000 gallons a day. Under normal conditions the pumps have to run for about 6 or 7 hours out of the 24. The diameter of the rising main is small and consequently the water has to be pumped through it at a high velocity with the result that there is a great loss of head from friction.

Cost of pumping.

The consumption of fuel is very high for the amount of work actually done. The total cost of pumping, including labour, fuel, stores etc., but exclusive of depreciation of plant or interest on capital expended is about £250 a year. The present system has certainly nothing to recommend it in the way of economy, for the cost of pumping is as much as it possibly could be under the circumstances. This is owing to the small size of the rising main and the unsuitability of the pumping machinery.

FUTURE POPULATION OF THE TOWN.

Probability of Kisumu remaining the chief East African Port on the Victoria Nyanza

The possibility of any great future increase in the population of the town depends largely upon whether it is to remain the chief East African Port on the Victoria Nyanza or not. If the railway is extended to Port Victoria the chief reason for the existence of Kisumu will to a great extent disappear. On the other hand if the railway gets as far as Port Victoria there appears to be no reason why it should not go further on or down the Nile.

Consumption of water.

The consumption of water is 25,000 gallons a day in wet weather when the house tanks are full, but at the end of a dry period, when these tanks are partially or quite empty, the consumption rises to nearly 40,000 gallons a day. Under normal conditions the pumps are working for 5 or 7 hours out of the 24. The diameter of the rising main is small and consequently the water has to be pumped through it at a high velocity with the result that there is a great loss of head from friction.

Cost of pumping.

The consumption of fuel is very high for the amount of work actually done. The total cost of pumping, including labour, fuel, stores etc., but exclusive of depreciation of plant or interest on capital expended is about £250 a year. The present system has certainly nothing to recommend it in the way of economy, for the cost of pumping is as much as it possibly could be under the circumstances. This is owing to the small size of the rising main and the unsuitability of the pumping machinery.

FUTURE POPULATION OF THE TOWN.

Probability of Kisumu remaining the chief East African Port on the Victoria Nyanza

The possibility of any great future increase in the population of the town depends largely upon whether it is to remain the chief East African Port on the Victoria Nyanza or not. If the railway is extended to Port Victoria the chief reason for the existence of Kisumu will to a great extent disappear. On the other hand if the railway gets as far as Port Victoria there appears to be no reason why it should not go further on or down the Nile.

Kisumu would then still be the natural port for the lake traffic on account of the shorter distance by rail to the coast.

The chief difficulty is the shallow entrance, but that will doubtless be overcome. From figures kindly supplied me by Commander R. Whitehouse R.N. I find that the level of the lake at the end of last November was 3 feet 6 inches above the lowest level known. If the lake were to go down to that extent it would be impossible for the larger ships to get in. The railway authorities have expended so much money on dry docks, pier, buildings etc., at Kisumu that they will probably find it worth while to dredge a channel out to the mouth of the bay deep enough to take their largest ships.

trading
e for the
ondo tribe.

Kisumu is the trading centre for the Kavirondo tribe. At present this tribe are naked savages and have very little need for manufactured articles, but as time goes on a demand may be created for certain classes of imported goods, which would be supplied by the Indian traders in the town. There is also a possibility of an increasing trade with Indian agricultural population who are settling near Kibos. It is therefore likely that there will be for some time at all events an increasing population of Asiatics and natives.

The town will not become a favourite residence for Europeans so long as it is so unhealthy and malarial as it is at present, but although it is not likely that it will even become an extremely healthy town it will probably become more so than it is now.

I think it is reasonable to suppose that the-

Kisumu would then still be the natural port for the lake traffic on account of the shorter distance by rail to the coast.

The chief difficulty is the shallow entrance, but that will doubtless be overcome. From figures kindly supplied me by Commander R. Whitehouse R.N. I find that the level of the lake at the end of last November was 3 feet 6 inches above the lowest level known. If the lake were to go down to that extent it would be impossible for the larger ships to get in. The railway authorities have expended so much money on dry docks, pier, buildings etc., at Kisumu that they will probably find it worth while to dredge a channel out to the mouth of the bay deep enough to take their largest ships.

of trading
re for the
ondo tribe.

Kisumu is the trading centre for the Kavirondo tribe. At present this tribe are naked savages and have very little need for manufactured articles, but as time goes on a demand may be created for certain classes of imported goods, which would be supplied by the Indian traders in the town. There is also a possibility of an increasing trade with Indian agricultural population who are settling near Kibos. It is therefore likely that there will be for some time at all events an increasing population of Asiatics and natives.

The town will not become a favourite residence for Europeans so long as it is so unhealthy and malarial as it is at present, but although it is not likely that it will even become an extremely healthy town it will probably become more so than it is now.

I think it is reasonable to suppose that the-

population within a few years may be about 12000 persons of whom probably 200 will be Europeans and 2000 Asiatics. Under present circumstances I do see any probability of its being very much more for a long time.

ARRANGEMENT OF THE TOWN.

rangement of
isting town.

In many aspects the present arrangement of the town so far as it has gone is a good one, especially of the European quarter on the hill.

roposal to
e the Indian
zaar.

The intention at the time of my arrival at Kisumu was to move the Indian Bazaar from its present position to another site at the end of Victoria Road near the Native Market. The occupants of the bazaar had been offered compensation for disturbance and removal, amounting I understand to Rs 800 for each house, and were to pull down their shops and rebuild them on the new site.

I took an early opportunity of informing the local authorities that in my opinion the scheme was not a good one. The proposed new site is one of the flattest pieces of land in Kisumu, and has the disadvantage that half drains in one direction and the other half in the opposite. Moreover the bazaar would have been inconveniently far from the station. The trade of Kisumu is always likely to be chiefly in the hands of the Indians, so that their shops should be near the station if possible. The present site is a very good one; the fault in the bazaar all lies with the houses which have been built and with the persons who inhabit them. The best result of the removal if it were carried out

population within a few years may be about 12000 persons of whom probably 200 will be Europeans and 2000 Asiatics. Under present circumstances I do see the probability of it being ever much more for a long time.

ARRANGEMENT OF THE TOWN.

rangement of isting town.

In many aspects the present arrangement of the town so far as it has gone is a good one, especially of the European quarter on the hill.

oposal to ve the Indian zaar.

The intention at the time of my arrival at Kisumu was to move the Indian Bazaar from its present position to another site at the end of Victoria Road near the Native Market. The occupants of the bazaar had been offered compensation for disturbance and removal, amounting I understand to Rs 800 for each house, and were to pull down their shops and rebuild them on the new site.

I took an early opportunity of informing the local authorities that in my opinion the scheme was not a good one. The proposed new site is one of the flattest pieces of land in Kisumu, and has the disadvantage that half drains in one direction and the other half in the opposite. Moreover the bazaar would have been inconveniently far from the station. The trade of Kisumu is always likely to be chiefly in the hands of the Indians, so that their shops should be near the station if possible. The present site is a very good one; the fault is the bazaar and lies with the houses have been built and with the persons who inhabit them. The net result of the removal if carried out

on the lines proposed would have been that these dilapidated houses would have been moved from a good site to a bad one and re-erected there with all their original defects.

best site is adjoining the present bazaar.

On the accompanying plan I have shewn a large area adjoining the present bazaar which should in my opinion be reserved for the Indian town. In the beginning one or two streets could be laid out as shewn. In my opinion the policy which should be adopted is not that of uprooting the whole bazaar and removing it bodily, but rather the more gradual process of improving it by the erection of a better class of buildings on or near the present site and taking in the meantime by/ immediate steps to put an end to the worst of the nuisances now existing.

The first step would be to condemn the whole of the present buildings as unsanitary and to prohibit their being inhabited unless certain structural alterations are made. I am doubtful whether any power exists under the Public Health Ordinances for the local authorities to make such an order, especially as the rules published in the Gazette of October 15th, 1905 for Nairobi do not appear to be applicable to Kisumu; but it is most essential that such power should be given. Any of the inhabitants who are in a position to do so should if possible be induced to build a better class of house in the new streets. Those who are not should be compelled to take steps to improve the condition of their houses. The plots on which the present shops are

on the lines proposed would have been that these dilapidated houses would have been moved from a good site to a bad one and re-erected there with all their original defects.

nt site is
joining the
esent bazaar.

On the accompanying plan I have shown a large area adjoining the present bazaar which should in my opinion be reserved for the Indian town. In the beginning one or two streets could be laid out as shewn. In my opinion the policy which should be adopted is not that of uprooting the whole bazaar and removing it bodily, but rather the more gradual process of improving it by the erection of a better class of buildings on or near the present site and taking in the meantime by/ immediate steps to put an end to the worst of the nuisances now existing.

The first step would be to condemn the whole of the present buildings as unsanitary and to prohibit their being inhabited unless certain structural alterations are made. I am doubtful whether any power exists under the Public Health Ordinances for the local authorities to make such an order, especially as the rules published in the Gazette of October 15th, 1905 for Nairobi do not appear to be applicable to Kisumu; but it is most essential that such power should be given. Any of the inhabitants who are in a position to do so should if possible be induced to build a better class of house in the new streets. Those who are not should be compelled to take steps to improve the condition of their houses. The plots on which the present shops are

built are 50 feet by 50 feet, which is too small an area; an additional 50 by 50 feet should be added to the back of each plot making the holdings 100 feet by 50 feet. The rent should not be increased on account of the larger holding but the lessees should be compelled to [illegible] that land. All washing places, kitchens, and latrines should be removed from the interior of the house and new ones erected in the courtyard at the back.

The stone plinths should be reconstructed as far as possible without disturbing the superstructure The mud and stones of which they are composed should be dug out to a depth of several inches and a layer of cement concrete should be put in and floated over at the top to a smooth surface. The joints on the outside of the plinths should also be raked out and pointed in proper mortar.

Whether the Government would be prepared to assist the occupiers financially in doing these works or not I do not know. The greater number of the Indian traders of Kisumu are poor men and the unsanitary condition of the bazaar is to some extent the fault of the officials who were responsible for letting the land in the first instance.

Special sanitary gang required.

These improvements will however be of little use in themselves unless the principle which I have recommended in the case of the Indian bazaar at Nairobi is adopted here also. A special district rate should be levied and expended on keeping a sanitary gang to scavenge and clean in the bazaar. The back premises must also be under constant and [illegible]

built are 50 feet by 50 feet, which is too small an area; an additional 50 by 50 feet should be added to the back of each plot making the holdings 100 feet by 50 feet. The rent should not be increased on account of the larger holding but the owners should be compelled to fence in their land. All washing places, kitchens, and latrines should be removed from the interior of the house and new ones erected in the courtyard at the back.

The stone plinths should be reconstructed as far as possible without disturbing the superstructure The mud and stones of which they are composed should be dug out to a depth of several inches and a layer of cement concrete should be put in and floated over at the top to a smooth surface. The joints on the outside of the plinths should also be raked out and pointed in proper mortar.

Whether the Government would be prepared to assist the occupiers financially in doing these works or not I do not know. The greater number of the Indian traders of Kisumu are poor men and the unsanitary condition of the bazaar is to some extent the fault of the officials who were responsible for letting the land in the first instance.

Special sanitary gang required.

These improvements will however be of little use in themselves unless the principle which I have recommended in the case of the Indian bazaar at Nairobi is adopted here also. A special district rate should be levied, and expended on keeping a sanitary gang to scavenge and clean in the bazaar. The back premises must also be under constant and

ful supervision.

Crusade against rats required.

I think much might be done in the way of prevention of plague by a vigorous crusade against the rats. The dead rats should also be frequently examined by the bacteriologist, for an epidemic of plague is generally, if not always preceded by an epidemic amongst the rats, from whom the disease is conveyed to human beings by fleas.

Native town.

On the plan the native town is shewn divided up into squares. I recommend that the native villages should only be erected on the alternate squares, leaving the intervening ones unoccupied. After a square has been built on for a certain time the mud huts could be pulled down, and the inhabitants could migrate to the adjoining one where they could build a fresh village, returning again to the first square after a further interval of time. In this way the ground would be prevented from becoming exceedingly foul. A large area of land will be required for 12,000 natives if this system be adopted probably nearly 200 acres, but much more than this is available.

Latrines.

The best type of latrines in the native town would be as in Nairobi a concrete trench with buckets in it. There will be no cemented drains in the native town so some receptacle for catching and holding the effluent from the buckets and the liquids from the trench would be required. This receptacle could be partly filled with earth and could be placed at the end of the trench in a square concrete recess, and

ful supervision.

Crusade against rats required.

I think much might be done in the way of prevention of plague by a vigorous crusade against the rats. The dead rats should also be frequently examined by the bacteriologist, for an epidemic of plague is generally, if not always preceded by an epidemic amongst the rats, from whom the disease is conveyed to human beings by fleas.

Native town.

On the plan the native town is shewn divided up into squares. I recommend that the native villages should only be erected on the alternate squares, leaving the intervening ones unoccupied. After a square has been built on for a certain time the mud huts could be pulled down, and the inhabitants could migrate to the adjoining one where they could build a fresh village, returning again to the first square after a further interval of time. In this way the ground would be prevented from becoming exceedingly foul. A large area of land will be required for 10,000 natives if this system be adopted, probably about 200 acres, but much more than this is available.

Latrines.

The best type of latrines in the native town would be as in Nairobi, a concrete trench with buckets in it. There will be no cemented drains in the native town so some receptacle for catching and holding the effluent from the buckets and the liquids from the trench would be required. This receptacle could be partly filled with earth and could be placed at the end of the trench in a square concrete recess, and

together with the buckets would be emptied daily and the whole properly disinfected. This process would doubtless cost some money but it is impossible to get rid of the excreta. of 10,000 persons without incurring some expense.

Public Gardens. In the middle of the town between the native and Indian town and the European quarter I have shown some large Public Gardens which separate the areas inhabited by the different races. It would not be wise to plant the shrubs and trees too closely in this garden for they might harbour the Tsetse fly, but a certain number could be planted and the gardens would improve the appearance of the town considerably.

European Quarter. The arrangement of the European Quarter shewn is an extension of the present plan. A new main road runs from the top of the Indian bazaar along the cliffs and several crescents follow the contours of the hill side, below the Subcommissioner's house. These offer the best sites for residences in Kisumu and will probably be taken up in course of time for bungalows, and possibly one or more hotels will be built.

Connaught Parade. The Connaught Parade will according to the present intention, when completed extend from the lime Kilns to the north east end of the bay. The land between the parade and the railway will furnish sites for warehouses if required.

European Bazaar. The European shops can be placed on the south west side of the Victoria Road near the markets and the Goanese shops could be lower down just above the Indian bazaar.

together with the buckets would be emptied daily and the whole properly disinfected. This process would doubtless cost some money but it is impossible to get rid of the excreta. of 10,000 persons without incurring some expense.

Public Gardens. In the middle of the town between the native Indian town and the European quarter I have shown some large Public Gardens which separate the areas inhabited by the different races. It would not be wise to plant the shrubs and trees too closely in this garden for they might harbour the tsetse fly, but a certain number could be planted and the gardens would improve the appearance of the town considerably.

European Quarter. The arrangement of the European Quarter shewn is an extension of the present plan. A new main road runs from the top of the Indian bazaar along the cliffs and several crescents follow the contours of the hill side, below the Subcommissioner's house. These offer the best sites for residences in Kisumu and will probably be taken up in course of time for bungalows; and possibly one or more hotels will be built.

Connaught Parade. The Connaught Parade will according to the present intention, when completed extend from the lime Kilns to the north east end of the bay. The land between the parade and the railway will furnish sites for warehouses if required.

European Bazaar. The European shops can be placed on the south west side of the Victoria Road near the markets and the Goanese shops could be lower down just above the Indian bazaar.

DRAINAGE.

Drainage of Indian Bazaar and Victoria Road.

The only portions of the town that at present require anything in the shape of masonry drains are the Indian Bazaar, the roads leading off from it to Victoria Road and part of Victoria Road. On the accompanying plan I have shewn the lines of the drains which I propose should be made. They would be open roadside drains and could be economically constructed of the local stone laid in lime mortar, the inside face being plastered over with cement. They would take the sullage and the surface water and should be capable of discharging the water flowing off the areas drained during a rainfall at the rate of one inch per hour. Some arrangements would be needed for flushing them. Small concrete tanks to hold about 1000 gallons each would be fixed at points A. and B. and could be filled with water from the mains during the night time the flushing being done when required.

Outlet into the lake.

The outlet is shewn into the lake at a point below the station. A 9 inch diameter cast iron pipe would take the dry weather flow and would be laid out into the lake for about 100 yards; there would also be an overflow channel to take the storm water in time of heavy rains. The amount of dry weather sewage discharged daily at the outfall would not be very large, but it would add to the pollution in the lake and I should not recommend that these drains should be laid until some different arrangement has been made for supplying the town with water.

DRAINAGE.

Drainage of Indian Bazaar and Victoria Road.

The only portions of the town that at present require anything in the shape of masonry drains are the Indian Bazaar, the roads leading up from it to Victoria Road and part of Victoria Road. On the accompanying plan I have shewn the lines of the drains which I propose should be made. They would be open roadside drains and could be economically constructed of the local stone laid in lime mortar, the inside face being plastered over with cement. They would take the sullage and the surface water and should be capable of discharging the water flowing off the areas drained during a rainfall at the rate of one inch per hour. Some arrangements would be needed for flushing them. Small concrete tanks to hold about 1000 gallons each would be fixed at points A. and B. and could be filled with water from the mains during the night time the flushing being done when required.

Outlet into the lake.

The outlet is shewn into the lake at a point below the station. A 9 inch diameter cast iron pipe would take the dry weather flow and would be laid out into the lake for about 100 yards; there would also be an overflow channel to take the storm water in time of heavy rains. The amount of dry weather sewage discharged daily at the outfall would not be very large, but it would add to the pollution in the lake and I should not recommend that these drains should be laid until some different arrangement has been made for supplying the town with water.

DRAINAGE.

Drainage of Indian Bazaar and Victoria Road.

The only portions of the town that at present require anything in the shape of masonry drains are the Indian bazaar, the roads leading to it from Victoria Road and part of Victoria Road. On the accompanying plan I have shewn the lines of the drains which I propose should be made. They would be open roadside drains and could be economically constructed of the local stone laid in lime mortar, the inside face being plastered over with cement. They would take the sullage and the surface water and should be capable of discharging the water flowing off the areas drained during a rainfall at the rate of one inch per hour. Some arrangements would be needed for flushing them. Small concrete tanks to hold about 1000 gallons each would be fixed at points A. and B. and could be filled with water from the mains during the night time the flushing being done when required.

Outlet into the lake.

The outlet is shewn into the lake at a point below the station. A 9 inch diameter cast iron pipe would take the dry weather flow and would be laid out into the lake for about 100 yards; there would also be an overflow channel to take the storm water in time of heavy rains. The amount of dry weather sewage discharged daily at the outfall would not be very large, but it could add to the pollution in the lake and I should not recommend that these drains should be laid until some different arrangement has been made for supplying the town with water.

Proposed main storm water and sewage disposal

In any case this sewage outfall could not be permanent if the town is going to become a large one and I have shown on the plan the line along which the [illegible] will probably eventually be laid. The drainage will gravitate to sewage disposal works about 300 yards beyond the lime kilns where the sewage will be purified and the effluent will flow into the lake. The storm water will be discharged direct into the lake at convenient places though storm water overflows. It is hardly necessary to say that this is looking some way ahead but it will be the proper method of draining the town if the sanitation is ever to be on proper and scientific lines; I recommend that land should be reserved in this place for future sewage works in case they are required.

Cost of works recommended.

I estimate the cost of the drains required in the bazaar and along Victoria Road together with the outlet into the lake at £3150.

NEW WATER SUPPLY.

Effect of the drinking water now supplied.

It is impossible to regard the present water supply with feelings of dismay. The argument was used except to me that it was not worth while expending any large sum of money on supplying Kisumu with good water because the number of Europeans was so small, there and also because the Europeans were all supposed to obtain their drinking water from the rainwater tanks. I have already in section I. of this report explained that the water in these tanks is usually not of good quality. It is also doubtful whether the water

ture main
SEWERAGE
DISPOSAL

In any case the sewage outfall could not be permanent if the town is going to become a large [illegible] the lines along which the main outfall sewer will probably eventually be laid. The dry weather sewage will [illegible] to sewage disposal works about 300 yards beyond the lime kilns where the sewage will be purified and the effluent will flow into the lake. The storm water will be discharged direct into the lake at convenient places though storm water overflows. It is hardly necessary to say that this is looking some way ahead but it will be the proper method of draining the town if the sanitation is ever to be on proper and scientific lines; I recommend that land should be reserved in this place for future sewage works in case they are required.

Cost of works recommended.

I estimate the cost of the drains required in the bazaar and along Victoria Road together with the outlet into the lake at £3150.

NEW WATER SUPPLY.

Effect of the drinking water now supplied.

It is impossible to regard the present water supply with feelings of disma except. The argument was used to me that it was not worth while expending any large sum of money on supplying Kisumu with good water because the number of Europeans there was so small, and also because the Europeans were all supposed to obtain their drinking water from the rainwater tanks. I have already in section I. of this report explained that the water in these tanks is usually not of good quality. It is also doubtful whether the water

drunk by Europeans is always obtained from the [illegible]. From native accounts it is pretty certain that the water will come from wherever it happens to be most convenient and it is quite clear that at certain times of the year people who have been in the habit of drinking lake water drink lake water. This is proved by the fact that after a spell of dry weather the consumption of lake water increases from 30,000 gallons a day to 40,000 gallons a day.

Whatever may be the case with the Europeans it is certain that the Indians drink it. I have not any doubt that the high death rate in the bazaar is largely owing to the bad water supplied. Dysentery, Diarrhoea, and possibly Cholera and Typhoid are the natural results of drinking such impure water as that now supplied. A supply of good water is a serious necessity for Kisumu.

I recommend that any new works should be designed for 15 gallons per head for 12,000 persons or a total of 180,000 gallons per day.

Of the [illegible] the most obvious [illegible] the Appendix analyses [illegible] of water taken at different [illegible] was the intake of the present water works. Sample 10 opposite the present waterworks about ½ mile from the shore, and sample 11 about 2 miles from Kisumu nearer the south of the bay. All these samples were distinctly bad but there is some improvement in quality in the case of sample 11. Although it would not be possible to get any water from the lake within a reasonable

drunk by Europeans is always obtained from the lake. [illegible] is pretty certain that the water will come from wherever it happens to be most convenient and it is quite clear that at certain times of the year people who have been in the habit of drinking tank water drink lake water. This is proved by the fact that after a spell of dry weather the consumption of lake water increases from 30,000 gallons a day to 40,000 gallons a day.

Whatever may be the case with the Europeans it is certain that the Indians drink it. I have no doubt that the high death rate in the bazaar is largely owing to the bad water supplied. Dysentery, Diarrhoea, and possibly Cholera and Typhoid are the natural results of drinking such impure water as that now supplied. A supply of good water is a serious necessity for Kisumu.

l Kumbi. timated for.

I recommend that any new works should be designed for the basic of 15 gallons per head for 12,000 persons or a total of 180,000 gallons per day.

r water.

Of the [illegible] samples [illegible] obviously [illegible] the lake. In the Appendix analyses [illegible] samples of water taken at different [illegible] and in the case of the intake of the present waterworks. Sample 10 opposite the present waterworks about ½ mile from the shore, and sample 11 about 2 miles from Kisumu nearer the south of the bay. All these samples were distinctly bad but there is some improvement in quality in the case of sample 11. Although it would not be possible to get any water from the lake within a reason-

able distance of Kisumu which could be safely drunk without filtration by going to the mouth of the bay it would be possible to get a water which would be better than that opposite the town and which it would be easier to pump.

Pumping station at mouth of Ugowe Bay.

At the mouth of the bay, about 2½ miles from Kisumu there is a promontory on which it would be possible to erect a pumping station. The intake pipe would be on the south side of the promontory and would be taken out for two or three hundred yards into the lake.

Service Reservoir.

The service reservoir should hold at least 180,000 gallons; its proper place is on the hill on which the native town stands. This is the highest point in Kisumu and by raising the reservoir a few feet above the ground every part of Kisumu could be supplied. The present tank is not sufficiently high to supply part of the native town. This is a matter of little importance at the present time, but in a new scheme it would be [illegible] to put the reservoir in the right place, also by so doing the length of the pumping main and consequently the cost of the works would be somewhat increased.

Distribution and pumping mains.

From the service reservoir a 7 inch diameter distribution main would be laid to Victoria Road and another 4 inch main to the Indian bazaar. In the rest of the town the existing distributing pipes could be used for some time but they will require to be replaced by larger pipes. A 7 inch rising main would connect the pumping station with the service reservoir.

able distance of Kisumu which could be safely drunk without filtration by going to the mouth of the bay it would be possible to get a water which would be better than that opposite the town and which it would be easier to pump.

Pumping station at mouth of Ugowe Bay.

At the mouth of the bay, about 2½ miles from Kisumu there is a promontory on which it would be possible to erect a pumping station. The intake pipe would be on the South side of the promontory and would be taken out for two or three hundred yards into the lake.

Service Reservoir.

The service reservoir should hold at least 150,000 gallons; its proper place is on the hill on which the native town stands. This is the highest point in Kisumu and by raising the reservoir a few feet above the ground every part of Kisumu could be supplied. The present tank is not sufficiently high to supply part of the native town. This is a matter of little importance at the present time, but in a new scheme it would be well to put the reservoir in the right place, although by so doing the length of the pumping main and consequently the cost of the works would be somewhat increased.

Distribution and pumping mains.

From the service reservoir a 7 inch diameter distribution main would be laid to Victoria Road and another 4 inch main to the Indian bazaar. In the rest of the town the existing distributing pipes could be used for some time but they will sooner or later have to be replaced by larger pipes. A 7 inch rising main would connect the pumping station with the service reservoir.

Filters would be absolutely necessary with this water and would be at the pumping station; some form of mechanical filter would probably be most suitable.

The pumping plant would consist of low lift pumps to pump the water from the lake to the filters and high lift pumps to pump to the service reservoir. Both pumps should be in duplicate in case of a breakdown.

ed Cost.

I estimate the total cost of the scheme including pumping station, filters, rising main, service reservoir, and distribution pipes at £16000. The working expenses would be about £440 per annum. The total cost including interest on capital, sinking fund and depreciation of machinery works out to £1396 per annum or 5d per 1000 gallons supplied.

ation
es.

The only three sources from which it appears to me to be possible to obtain a supply by gravity are (1) From the [illegible] of the River Kibos at the foot of the Nandi hills. (2) From the M'tewawi river on the north side of the bay; and (3) From a stream about 1½ miles further on in the same direction, near the Roman Catholic Mission Station.

r.

The source of the Kibos River supply would be a point in the Nandi hills just inside the Kibos gorge. There is an ample supply of water, an average of 10,000,000 gallons per day appears to flow down the stream at this point. The analysis of the water in the Appendix shows that it would be necessary to filter it. The settling tanks and filters could

Filters would be absolutely necessary with this water and would be at the pumping station; some form of mechanical filter would probably be most suitable.

The pumping plant would consist of low lift pumps to pump the water from the lake to the filters and high lift pumps to pump to the service reservoir. Both pumps should be in duplicate in case of a breakdown.

I estimate the total cost of the scheme including pumping station, filters, rising main, service reservoir, and distribution pipes at £16000. The working expenses would be about £440 per annum. The total cost including interest on capital, sinking fund and depreciation of machinery works out to £1396 per annum or 3d per 1000 gallons supplied.

The only three sources from which it appears to me to be possible to obtain a supply by gravity are (1) From the [illegible] of the River Kibos at the foot of the Nandi Hills. (2) From the M'towawi river on the North side of the bay; and (3) From a stream about 1½ miles further on in the same direction, near the Roman Catholic Mission Station.

The source of the Kibos River supply would be a point in the Nandi hills just inside the Kibos gorge. There is an ample supply of water, an average of 10,000,000 gallons per day appears to flow down the stream at this point. The analysis of the water in the Appendix shows that it would be necessary to filter it. The settling tanks and filters would

be placed near the intake and a 6 inch main would convey the water to the service reservoir, which would be in the same position as for the pumping scheme.

I estimate the total cost of these works including the distributing mains at £15800. The working expenses including filtration would be £210 per annum and the cost about 4d. per 1000 gallons supplied.

(2) The analysis of this water shows it to be slightly better than the Kibos water but not sufficiently good to drink without filtration. The total cost of this scheme would be about £17,500 and the cost of every 1000 gallons supplied 4½d.

This is the only water in the neighbourhood of Kisumu which in its natural condition approaches potability, but even this water is not really fit for drinking without filtration. Including filters the works would cost about £19500 and the cost of each 1000 gallons supplied would be about 4½d. There is a good supply of water in this stream quite sufficient for the requirements of Kisumu.

After my return from Kisumu and it was suggested to me by Mr. Currie the General Manager of the railway that water might be obtained from the gravel beds near Kibos station by sinking a well into them and using water power from the river to pump up the supply from the well to the town. Unfortunately I have not enough information to pronounce definitely on this scheme.

The chief advantage would be if the water could be used without filtration. For unless it could the first cost of the works would be nearly if not quite as great as the water gravitation scheme; the shorter

length of main would be made up for by the cost of the well, the pumping machinery and the channel alongside the river necessary in order to obtain the head of water required to work the pumps. These things should be gone into more fully, but I am disposed to look with suspicion upon a scheme for pumping unfiltered water from a shallow well near a river such as this flowing through the midst of a growing population. Under the most favourable circumstances I do not anticipate that the cost of this scheme without filters would be found to be much less than £14000.

In my opinion the ultimate source of the water supply for Kisumu will be the upper part of the Kibos river. If it were necessary to supply unfiltered water the Roman Catholic Mission Stream would be the only available source with the possible exception of the well at Kibos station but the water in that stream is by no means really good and the capital cost of the works without filtration would be more than the cost of the Kibos works with filtration.

A series of gaugings should be made of the Kibos river and also a series of analyses of the water in order to find out exactly how far the impurities vary during the different seasons of the year. This information would be necessary before deciding what type of filter would be necessary.

PROPOSED TEMPORARY SUBSTITUTE FOR NEW WATER SUPPLY.

Whatever source is chosen an expenditure of at least £14000 or £15000 must be contemplated if a good and permanent water supply is to be provided for Kisumu. At the present time the money available to the Protectorate for works of this kind is limited, and I have therefore considered whether it would not be possible to provide for the more immediate needs

length of main would be made up for by the cost of the well, the pumping machinery and the channel alongside the river necessary in order to obtain the head of water required to work the pumps. These things should be gone into more fully, but I am disposed to look with suspicion upon a scheme for pumping unfiltered water from a shallow well near a river such as this flowing through the midst of a growing population. Under the most favourable circumstances I do not anticipate that the cost of this scheme without filters would be found to be much less than £14000.

Kibos river most likely source of future supply.

In my opinion the ultimate source of the water supply for Kisumu will be the upper part of the Kibos river. If it were necessary to supply unfiltered water the Roman Catholic Mission Stream would be the only available source, with the possible exception of the well at Kibos station but the water in that stream is by no means really good and the capital cost of the works without filtration would be more than the cost of the Kibos works with filtration.

Gaugings and analyses required.

A series of gaugings should be made of the Kibos river and also a series of analyses of the water in order to find out exactly how far the impurities vary during the different seasons of the year. This information would be necessary before deciding what type of filter would be necessary.

PROPOSED TEMPORARY SUBSTITUTE FOR NEW WATER SUPPLY.

Temporary method of getting water difficulty.

Whatever source is chosen an expenditure of at least £14000 or £15000 must be contemplated if a good and permanent water supply is to be provided for Kisumu. At the present time the money available to the Protectorate for works of this kind is limited, and I have therefore considered whether it would not be possible to provide for the most immediate needs

of the town in a cheaper manner, postponing the larger work for a few years. The present system of pumping, is, as I have explained, very uneconomical. On the other hand the pumps are quite capable of delivering as much water as is now required and by working them for longer hours, they will be capable of meeting the demand for some years. It only needs a means of purifying the water drawn so that the present supply could be continued for some time.

New position for intake.

I am of opinion that this can be done without an extravagant outlay; and I recommend in the first place that, in order to lessen the danger of sewage contamination, the intake pipe at the pumping station should be extended along the Connaught Parade for some 400 or 500 yards and then as far as possible out into the lake.

Suggested removal of Nairobi purification plant.

In order to get rid of the vegetable organic matter I further recommend that the purification plant now lying idle at Nairobi should be removed from there, erected near the pumping station at Kisumu and made use of to filter the lake water.

The chief difficulty in the way of moving the purification plant is that the tanks connected with it furnish the greater part of the storage capacity which is available in Nairobi.

New service reservoir at Nairobi.

This storage is already too small, so if the tanks are removed it will be necessary to provide a new service reservoir at Nairobi. It will be very much cheaper to construct a new service reservoir at Nairobi than to obtain an entirely new water supply for Kisumu I therefore recommend that a concrete service reservoir to hold 100,000 gallons should be constructed at Nairobi and the Nairobi plant should be moved to Kisumu.

-Do-

of the town in a cheaper manner, postponing the larger work for a few years. The present system of pumping, is, as I have explained, very uneconomical. On the other hand the pumps are quite capable of delivering as much water as is now required and by working them for longer hours, they will be capable of meeting the demand for some years. If [illegible] of purifying the water could be arranged the present supply could be continued for some time.

New position for intake.

I am of opinion that this can be done without an extravagant outlay; and I recommend in the first place that, in order to lessen the danger of sewage contamination, the intake pipe at the pumping station should be extended along the Connaught Parade for some 400 or 500 yards and then as far as possible out into the lake.

Suggested removal of Nairobi purification plant.

In order to get rid of the vegetable organic matter I further recommend that the purification plant now lying idle at Nairobi should be removed from there, erected near the pumping station at Kisumu and made use of to filter the lake water.

The chief difficulty in the way of moving the purification plant is that the tanks connected with it furnish the greater part of the storage capacity which is available in Nairobi.

New service reservoir at Nairobi.

This storage is already too small, so if the tanks are removed it will be necessary to provide a new service reservoir at Nairobi. It will be very much cheaper to construct a new service reservoir at Nairobi than to obtain an entirely new water supply for Kisumu I therefore recommend that a concrete service reservoir to hold 100,000 gallons should be constructed at Nairobi and the Nairobi plant should be moved to Kisumu.

scription of
irobi plant.

The Nairobi water purification plant was designed to deal with water of a similar nature but not quite so impure as the lake water at Kisumu. It is a modification of the Anderson process. The water is passed through an Anderson Purifier and afterwards aerated by allowing it to flow out in fine jets from a series of small vents. It is then treated with aluminium sulphate and lime, and afterwards passed through a "Torrent" filter. The apparatus has never been worked at Nairobi, but there is reason to suppose that it would greatly improve the quality of the Victoria Nyanza water. It was apparently designed to purify 50,000 gallons a day so it should be capable of dealing with the Kisumu water for some time. The system will be an expensive one to work, and I am by no means convinced that anything so elaborate is really required, but the apparatus is now in the country and it would be better to use it than to let it lie idle at Nairobi; moreover the experience gained in working it will be useful in designing filters for water supplies in other places in the Protectorate.

angement of
purification
at
by.

The best arrangement of the Kisumu purification works would probably be to put in a new pump to lift the lake water to the filters, to construct a new clear water tank, and to use the existing pumps for lifting the filtered water from this tank to the town tank on the hill. An arrangement would also be necessary by which one or two of the Baume pumps could be used for pumping unfiltered water to the railway station.

mated cost
moval.

The total cost of these works including removing the purification plant and re-erecting it at Kisumu, laying a new suction main at the pumping station, providing and erecting a new pump at Kisumu, and also constructing a new service reservoir at Nairobi should be about £1300 so the cost should not

much
be more than about one tenth of what it would cost to provide Kisumu with a new supply.

MILK SUPPLY.

Before concluding this section there is another matter in connection with the public health of Kisumu that needs to be referred to. The milk supply is exceedingly unsatisfactory. It comes entirely from native milk sellers, and there is no inspection of the places from which it comes, the cows who give it, or the receptacles in which it is taken to Kisumu; nor is there any form of examination of the milk itself.

It is brought into the town by native women in large wooden vessels or old bottles, which generally have dirty pieces of rag as stoppers. On one occasion during my stay at Kisumu 150 of these women were paraded in front of the Collectors office with the milk which they were selling. I examined the vessels they were using and found that they were all extremely dirty whilst the milk in some of them had been so adulterated with urine as to present a disgusting appearance.

It would be well to consider if the system adopted by the German Government in the towns on the other side of the lake could not be introduced. The government there have purchased 200 cows, which they have handed over to a contractor, who is responsible for the whole of the milk supply of the town. The milk is inspected daily by the medical officer and any which is unsatisfactory is at once condemned and thrown away.

CAUSES OF MALARIA IN KISUMU.

In my opinion most if not all of the malarial mosquitos which affect Kisumu have their breeding places in the pools along the lake side and behind the papyrus

be more than about one tenth of what it would cost to provide Kisumu with a new supply.

MILK SUPPLY.

Before concluding this section there is another matter in connection with the public health of Kisumu that needs to be referred to. The milk supply is exceedingly unsatisfactory. It is entirely in the hands of native milk sellers, and there is no inspection of the places from which it comes, the cows who give it, or the receptacles in which it is taken to Kisumu; nor is there any form of examination of the milk itself.

It is brought into the town by native women in large wooden vessels or old bottles, which generally have dirty pieces of rag as stoppers. On one occasion during my stay at Kisumu 150 of these women were paraded in front of the Collectors office with the milk which they were selling. I examined the vessels they were using and found that they were all extremely dirty whilst the milk in some of them had been so adulterated with urine as to present a disgusting appearance.

It would be well to consider if the system adopted by the German Government in the towns on the other side of the lake could not be introduced. The government there have purchased 300 cows, which they have handed over to a contractor, who is responsible for the whole of the milk supply of the town. The milk is inspected daily by the medical officer and any which is unsatisfactory is at once condemned and thrown away.

CAUSES OF MALARIA IN KISUMU.

In my opinion most if not all of the malarial mosquitos which affect Kisumu have their breeding places in the pools along the lake side and behind the papyrus

which lines the shores. The work which has been already commenced of constructing the new Connaught Parade alongside the lake is therefore a very useful one, because it will fill up these pools and get rid of the Papyrus. It is unfortunate that the work should have been stopped, apparently for lack of funds. Otherwise much good has been done.

It has been suggested that the malaria is largely caused by the very large swamp to the south of Kisumu round the mouth of the river Kibos. I do not believe this has so much effect as has been supposed. The nearest point of the swamp is about 2 miles away and investigations in Italy have proved that the disease is not often carried so far as that. In fact Malaria is an eminently local disease and is only transmitted to a limited distance in any direction.

If the town is laid out on the lines I have suggested the pools and swamps in the immediate neighbourhood of Kisumu are got rid of, and a proper water supply is obtained, the health of the town will probably improve very much.

SUMMARY.

mary of commendations regard to mu.

For the reasons which I have given I have therefore the honour to make the following recommendations with regard to Kisumu.

1. The town should be laid out on the lines shewn on the accompanying plan.

2. The vital defects in the existing Indian Bazaar should as far as possible be got rid of by increasing the area of the holdings, fencing them in, and removing the latrines washing places and kitchens out of the houses into the backyards. The houses themselves to be structurally improved in the way I have suggested. The final object in view to be the substitution for the existing buildings of properly built

which lines the shores. The work which has been already commenced of constructing the new Connaught Parade alongside the lake is therefore a very useful one, because it will fill up these pools and get rid of the Papyrus. It is unfortunate that the work should have been stopped apparently for lack of funds before much good has been done.

It has been suggested that the malaria [illegible] caused by the very large swamp to the south of Kisumu round the mouth of the river Kibos. I do not believe this has so much effect as has been supposed. The nearest point of the swamp is about 2 miles away and investigations in Italy have proved that the disease is not often carried so far as that. In fact Malaria is an eminently local disease and is only transmitted to a limited distance in any direction.

If the town is laid out on the lines I have suggested the pools and swamps in the immediate neighbourhood of Kisumu are got rid of, and a proper water supply is obtained, the health of the town will probably improve very much.

SUMMARY.

[illegible] of recommendations with regard to Kisumu.

For the reasons which I have given I have therefore the honour to make the following recommendations with regard to Kisumu.

1. The town should be laid out on the lines shewn on the accompanying plan.

2. The vital defects in the existing Indian Bazaar should as far as possible be got rid of by increasing the area of the holdings, fencing them in, and removing the latrines washing places and kitchens out of the houses into the backyards. The houses themselves to be structurally improved in the way I have suggested. The final object in view to be the substitution for the existing buildings of properly built

-8b-

houses on or near the present site.

5. The native town should be laid out in squares, and every alternative square occupied by a native village. The inhabitants would subsequently migrate to the unoccupied squares when the ground on which they were living had become fouled.

The sanitary improvements in the native town to be of a simple kind.

4. The Connaught Parade should be completed as soon as the funds available will permit; and as far as possible all mosquito breeding holes in proximity to the town should be filled up.

5. The work of improving the water supply should be taken in hand at once. The intake to be moved and the Nairobi Purification plant transferred from Nairobi to Kisumu.

6. A system of drains to carry the surface water and sullage from the bazaar and part of Victoria Road should be laid; the temporary outlets will be into the lake below the bazaar.

7. The necessary preliminary investigations should be undertaken with a view to obtaining a permanent and sufficient supply of water either from the upper part of the Kibos River or from the well near Kibos station. An expenditure of from £14000 to £15000 will sooner or later be necessary on these works which however will probably not be required for the next three or four years.

8. Some radical improvement is necessary in the milk supply.

These recommendations do not require any large expenditure on money within the next two years.

The improvement in the water supply will cost about £1600 and I think the Government should be prepared to expend £600 on the Indian Bazaar during the

houses on or near the present site.

5. The native town should be laid out in squares, and every alternative square occupied by a native village. The inhabitants would subsequently migrate to the unoccupied squares when the ground on which they were living had become fouled.

The sanitary arrangements in the native town to be of a simple kind.

4. The Connaught Parade should be completed as soon as the funds available will permit; and as far as possible all mosquito breeding holes in proximity to the town should be filled up.

5. The work of improving the water supply should be taken in hand at once. The intake to be moved and the Nairobi Purification plant transferred from Nairobi to Kisumu.

6. A system of drains to carry the surface water and sullage from the bazaar and part of Victoria Road should be laid; the temporary outlets will be into the lake below the bazaar.

7. The necessary preliminary investigations should be undertaken with a view to obtaining a permanent and sufficient supply of water either from the upper part of the Kibos River or from the well near Kibos station. An expenditure of from £14000 to £15000 will sooner or later be necessary on these works which however will probably not be required for the next three or four years.

8. Some radical improvement is necessary in the milk supply.

These recommendations do not require any large expenditure on money within the next two years.

The improvement in the water supply will cost about £1300 and I think the Government should be prepared to expend £500 on the Indian bazaar during the

forthcoming financial year if required. The expenditure during 1907 should therefore be about £2100.

In 1908 the drains should be taken in hand they will cost about £5150. Another £500 may be required for the bazaar making a total of £3650 during 1908. These sums do not include anything for the cost of making the Connaught Parade for which estimates have be been prepared by the Director of Public Works.

SECTION IV.

CONCLUSION.

neral
grammes
gested.

In conclusion it is only necessary to say a few words on the subject of the general programme which I have suggested.

ivasha &
uru.

With regard to Naivasha and Nakuru I do not see the necessity for expending money on any important public works in these towns until it is clearly decided on what lines it is intended to proceed in developing them or if they are to be developed at all. In the first place it will be necessary to decide finally which is to be the capital of the Provinces; Administrative reasons must finally decide this question. It must also be decided whether the towns are intended to be health resorts or market towns or both. When these questions have been settled a sites board would be appointed to lay out either or both places. It is therefore unlikely that any large sum of money will be required during the next financial year for either of these places. During the following year an expenditure of from £6000 to £8000 will probably be necessary to provide either Naivasha or Nakuru with a proper water supply. In the meantime investigations on the lines I have suggested will have definitely decided where the water is to come from.

ivasha.

Kisumu is in a different position. In the first

place its future as the chief East African port on the Victoria Nyanza is fairly definitely assured, and in the second place its bad water supply and unsanitary bazaar are far more serious dangers than anything existing at Nairobi or Nakuru, and it is naturally an unhealthy place. It is therefore necessary to commence as soon as possible improving the unhealthy conditions and [illegible] should certainly be made during this year.

I have the honour to be, My Lord,

Your Lordship's

Most obedient

humble servant.

place its future as the chief East African port on the Victoria Nyanza is fairly definitely assured, and in the second place its bad water supply and unsanitary bazaar are far more serious dangers than anything existing at Nairobi or Nakuru, and it is naturally an unhealthy place. It is therefore necessary to commence as soon as possible improving the unhealthy conditions and a beginning should also be made during this year.

I have the honour to be, My Lord,

Your Lordships'

Most obedient

humble servant.

No. of Sample	Origin of Sample	Date 1906	Total Solids	Nitrogen as Free	Nitrogen as Albumenoid	Oxygen absorbed in 4 hrs. at 80° F.	Hardness Total	Hardness Temporary	Hardness Permanent	Chlorine	Nitrogen as Nitrates & Nitrites	Remarks
1	Nakuru Lake 2½ furlongs from shore	Oct 26th		015	0425	416	7	3	4	4.4	Faintest trace	Much vegetable contamination and signs of sewage contamination
2	Nakuru Lake 1 furlong South of town 200 yds from shore	Oct 26		0425	0325	216	7	3.5	3.5	1.4	Faintest trace	do
3	Molo River near Government farm	Oct 27		0025	0262	240	3	2	1	6	Faintest trace	Considerable vegetable contamination and some animal pollution
4	Stream near Syndicate farm Buildings 4 miles from Nakuru	Oct 27th		0025	0312	140	3	2	1	2.4	Faintest trace	Strong signs of animal pollution
5	Molo River near Freemans farm	Oct 27th		001	0190	300	15	1	5	8	Trace	Very soft water signs of vegetable contamination but not of animal pollution
6	Cobella's Stream	Nov 11th		0025	0337	170	1	1	0	31	Trace	Considerable vegetable contamination
7	R Njoro at intake of Water Supply Pipe	Oct 14th		005	0130	290	4	1	0	3.1	Faintest trace	Exceedingly soft water Slight signs of sewage pollution
28	R Ribbon at mouth of Kamal Gorge	Oct 26		005	0865	276	3	2.5	5	6	Trace	No appreciable mineral pollution
9	Victoria Nyanza at intake of water works	Oct 28th		0025	0418	1936	4.4	4.3	1	17	Trace	Much vegetable contamination
10	Victoria Nyanza 200 yds Kisumu ½ mile from shore	Oct 25		0010	0300	175	4.4	4.3	1	7	Faint trace	

No. of Sample	Origin of Sample	Date 1906	Total Solids	Ammonia Free	Ammonia Albuminoid	Oxygen absorbed in 4 hrs at 80°F	Hardness Total	Hardness Temporary	Hardness Permanent	Chlorine	Nitrogen as Nitrates Nitrites	Remarks
1	Naivasha Lake [illegible] township [illegible] shore	Oct 2nd		015	0425	416	7	3	4	1.5	Marked trace	Much vegetable contamination and signs of sewage contamination
2	Naivasha Lake [illegible] south of town 600 yds from shore	Oct 2		0025	0325	216	7	3.5	3.5	1.4	Marked trace	do
3	Nakendat River near Government farm	Oct 27		0025	0262	240	3	2	1	8	Marked trace	Considerable vegetable contamination and some animal pollution
4	Stream near [illegible] Farm Buildings 4 miles from Naivasha	Oct 27th		0025	0312	140	3	2	1	2.00	Marked trace	Some signs of animal pollution.
5	Meroroni River near Fleemers farm	Oct [illegible]		007	0190	300	1.5	1	.5	8	Trace	Very soft water signs of vegetable contamination but not of animal pollution
6	Costello's stream	Nov 11th		0025	0337	170	1	1	0	9	Trace	Considerable vegetable contamination
7	R. Njoro at intake of water supply pipe	Oct 14th		005	0130	290	1	1	0	8	Marked trace	Exceedingly soft water shows signs of sewage pollution
8	R. Hbas at mouth of Nandi Gorge	Oct 26th		005	0263	276	3	2.5	.5	6	Trace	No apparent animal pollution
9	Victoria Nyanza at intake of water works	Oct 28th		0025	0418	1936	4.4	4.3	.1	7	Trace	Much vegetable contamination
10	Victoria Nyanza opposite Kisumu ½ mile from shore	Oct 28		0016	0500	175	4.4	4.3	.1	[illegible]	Marked trace	

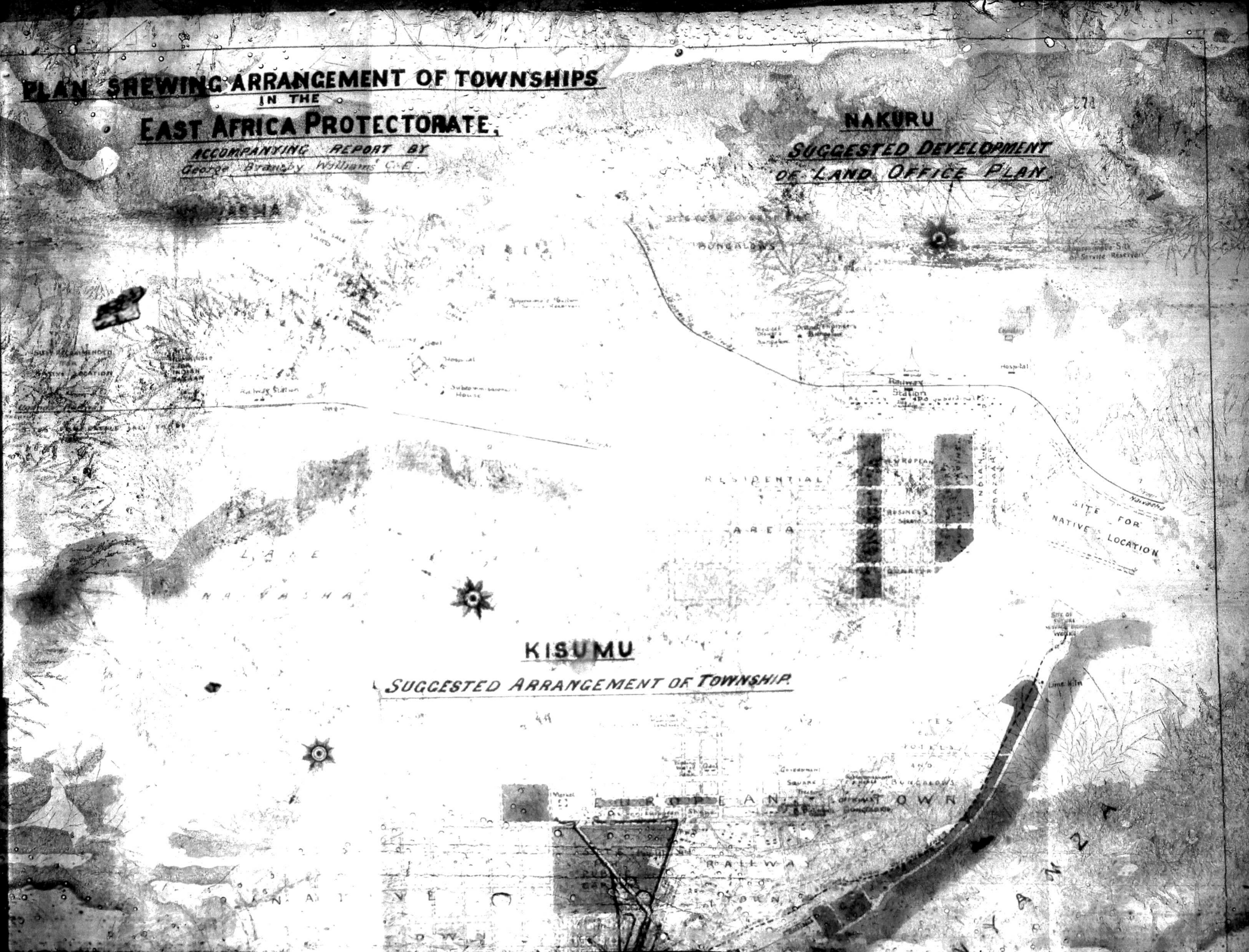
	Origin of Sample	Date 1936	Total Solids	Ammonia Free	Albuminoid	Oxygen absorbed at 80°		Hardness Temporary	Permanent	Chlorine	Nitrites and Nitrates	Remarks
	Victoria Nyanza 2 miles S. South of Jinja 50 yards from Shore	Oct		0028	035	148		43	2	7	Trace	Considerable vegetable contamination
	M Tanawi	Oct		0025	025	184		40	5	7	do	do
	Stream near Roman Catholic Mission	Oct		00125	02	144		45	15	5	do	not so much contamination but it is not a good drinking water

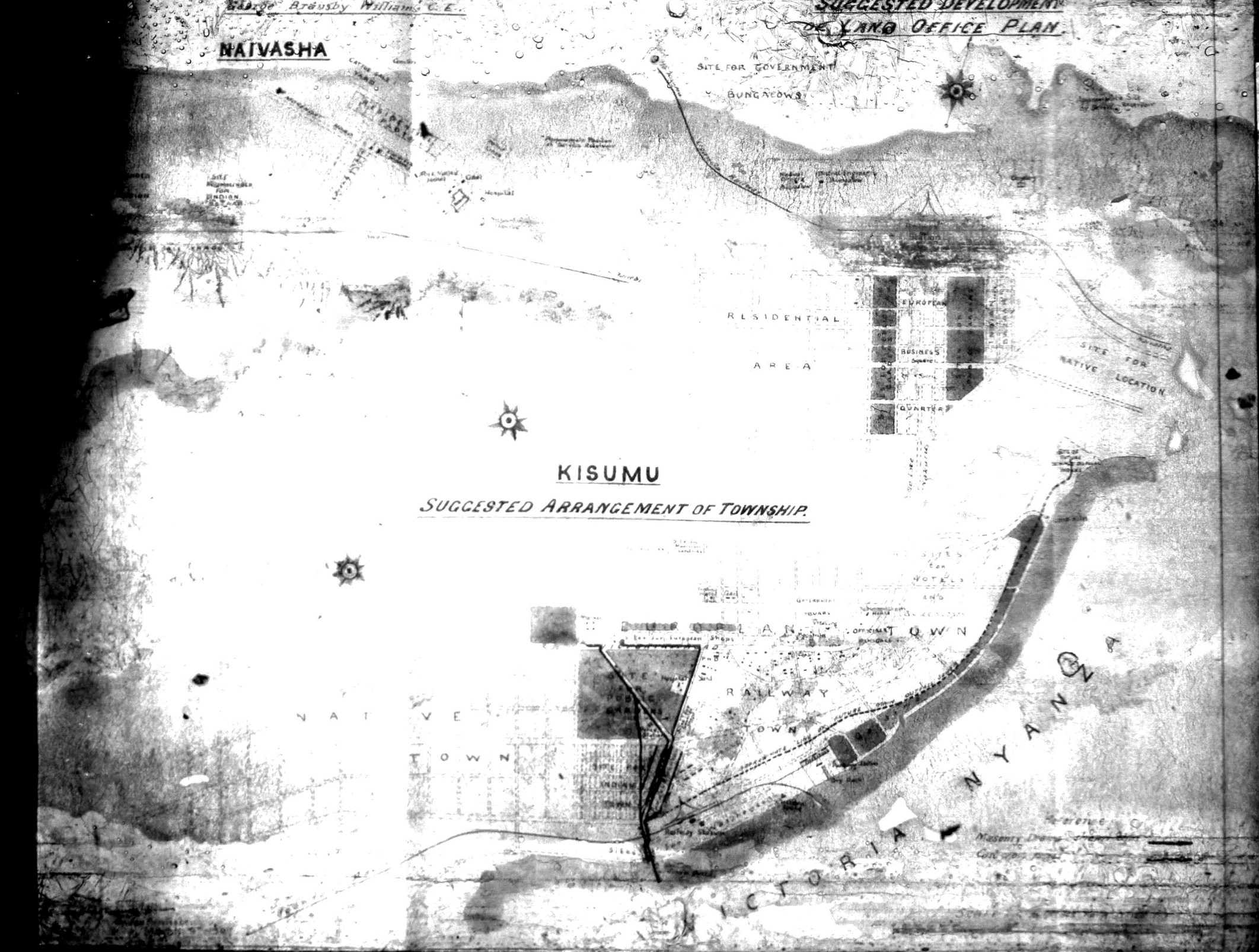
PLAN SHEWING ARRANGEMENT OF TOWNSHIPS IN THE EAST AFRICA PROTECTORATE.

ACCOMPANYING REPORT BY
George Bransby Williams C.E.

NAKURU

SUGGESTED DEVELOPMENT OF LAND OFFICE PLAN.




Geo. Brausby Williams C.E.
NAIVASHA
SUGGESTED DEVELOPMENT
OF LAND OFFICE PLAN.
SITE FOR GOVERNMENT
BUNGALOWS
RESIDENTIAL
AREA
EUROPEAN
BUSINESS
QUARTERS
SITE FOR
NATIVE LOCATION
KISUMU
SUGGESTED ARRANGEMENT OF TOWNSHIP.
RAILWAY
NATIVE
TOWN
VICTORIA
NYANZA

8360. East

DRAFT

The Crown Agents

MINUTE.

Mr. Scoffham 9/3

Mr. Read. ~~MR 9/3/07~~

Mr. Antrobus.

Mr. Cox.

Mr. Lucas.

Mr. Graham.

Sir M. Ommanney

Mr. Churchill.

The Earl of Elgin.

Copy given to Mr Engelbach 9/3.

Amd 14467

12 March 1907

Gentlemen,

With reference to the letter from this department of the 2nd instant, I am &c. to request that Mr G. B. Williams report on the townships of Naivasha, Nakuru and Kisumu in the E. Africa Prot., a copy of which was forwarded to you semi officially on the 7th instant, may be printed with Mr Williams report on Nairobi forwarded with the above mentioned letter.

I am

R L A