

ANNUAL REPORT OF THE SANITARY BOARD FOR THE OFFICIAL YEAR ENDING 31st MARCH 1931.

The Sanitary Board came into existence in the early nineties at the instance of the Army Sanitary Commission for the purpose of advising Local Bodies on general sanitary improvements. It consisted of the Director of Public Health, then known as the Sanitary Commissioner, and a senior Engineer Officer who came to be styled in 1892 the Sanitary Engineer and who subsequently became *ex-officio* Secretary of the Board. These officers toured round the Presidency and inspected and advised the Local Bodies with respect to sanitary improvements. The Sanitary Board's functions as developed to date are briefly as follows:—

(i) Consideration of measures for effecting progress in sanitation in the Presidency and giving help and advice to Local Bodies on Public Health matters;

(ii) Scrutiny of Public Health improvement schemes and of their financial aspect, with a view to recommending their being undertaken by or on behalf of Local Bodies with or without help from Government;

(iii) Distribution of grants for minor sanitary schemes to the poorer Municipalities whenever Government places funds for the purpose at the Board's disposal.

These functions the Board discharges at meetings held at intervals during the year—any specially urgent questions being dealt with by circulation.

2. The Board is now constituted as follows:—

The Commissioner, Central Division, as President, with the Sanitary Engineer to Government (now designated Superintending Engineer, Public Health, Bombay) as Secretary; the Secretary to Government, General Department; the Chief Engineer and Secretary (or Joint Secretary) to Government, Public Works Department (Roads and Buildings Branch); the Director of Public Health for the Government of Bombay, and one non-official member.

3. The personnel as it stood during the year under report is as follows:—

President.

The Commissioner, Central Division—A. W. W. Mackie, Esq., M.A., I.C.S.

Members.

The Secretary to Government, General Department—R. B. Ewbank, Esq., C.I.E., B.A. (Oxon.), I.C.S., J.P.

The Chief Engineer and Secretary to Government, Public Works Department—

A. X. Moraes, Esq., L.C.E., M.I.E. (Ind.) (Joint Secretary)—from 5th April to 5th December 1930.

D. R. H. Browne, Esq., O.B.E., A.K.C. (Lond.)—from 1st April to 4th April and from 6th December 1930 to date.

The Director of Public Health for the Government of Bombay—
Dr. Accacio da Gama, L.M. & S. (Bom.), D.P.H., D.T.M. & H.
(Cantab.).

Non-official Member.

Diwan Bahadur K. R. Godbole, M.C.E. (Bom.), C.B.E.

Member and Secretary.

The Superintending Engineer, Public Health, Bombay—A. P. Maddocks,
Esq., B.Sc. (Birm.), M.Inst.C.E., M.Inst.W.E., M.I.E. (Ind.),
F.R.San.I.

The Board's executive functions are chiefly carried out by the Superintending Engineer, Public Health, Bombay, who advises upon the engineering and financial aspects of the proposed schemes of Public Health Improvements and prepares and carries out the majority of such projects.

During the greater part of the year under report,—until 1st March 1931,—the Public Health Branch was constituted as follows :—

(i) A Division for preparing projects, keeping accounts, etc. with an Executive Engineer and staff at Poona.

(ii) Six Sub-Divisions distributed all over the Presidency, with a Sub-Divisional Officer and a small staff for each for the investigation and execution of Public Health schemes, three of which are working directly under the Superintending Engineer, Public Health, and the other three under the Executive Engineer, Poona Drainage Construction Division.

(iii) An Executive Division for Poona Water Works (for its maintenance and capital works) and the maintenance of the Poona Drainage Works under an Executive Engineer and staff at Poona.

(iv) An Executive Division for the carrying out of the Poona Drainage Improvement Project under an Executive Engineer and staff at Poona.

(v) A Boring Division for “ deep and shallow trial bores as sources of supplies ” throughout the Presidency with an Executive Engineer and staff with headquarters at Nasik.

From 1st March 1931, in consequence of the current financial stringency, two of the Divisions, viz. the Project Division and Poona Drainage Construction Division were amalgamated to form a new Division called the Public Health Works Division, and the Boring Division was abolished. The Branch as reconstituted stands as under :—

(i) The Public Health Works Division with six Sub-Divisions distributed over the Presidency (including Sind), each with a Sub-Divisional Officer for the investigation and execution of Public Health schemes.

(ii) The Poona Water Works Division for carrying out the new capital and maintenance and repairs works in connection with Poona Water

Works and the Kirkee Water Works and the maintenance and repairs of the pumping stations and outfall disposal works of the Poona Drainage Works.

(iii) The Government Central Workshops, constituting another Division, for carrying out repairs to and the upkeep of Government plant and machinery, the manufacture of special castings, etc., etc.

4. From January 1927, the Superintending Engineer, Public Health, had been carrying on the duties of the Mechanical Engineer to Government in addition to his other duties, having under him a small Mechanical staff to assist him in the design, erection and inspection of pumping plant for Water Supply and Drainage projects. Information regarding the working of sewage and water supply pumping plants throughout the Presidency is being collected by the Superintending Engineer, in order that the Municipalities concerned may be advised with respect to their maintenance expenses and the efficient working of the plants.

5. A meeting of the Sanitary Board was held in Bombay on the 30th of January 1931, when, amongst other important questions, a communication from Government imposing restrictions on the undertaking of new Public Health projects on account of the prevailing financial stringency was considered. The Sanitary Board after full consideration resolved to recommend Government to adopt the following general policy in respect of giving grants-in-aid to local bodies in respect of centage charges :—

(1) full remission of centage charges should be given in the case of—

(a) Underground drainage projects, and

(b) the Maintenance and Repairs of completed works which involve the maintenance of Pumping Stations ;

(2) 18 per cent. grant in-aid out of the 28 per cent. charges should be given in cases of improvements and extensions to existing water supply schemes.

In spite of the fact that Government was unable during the year to afford substantial help by way of subventions to local bodies for public health works, the local bodies continued to evince a lively interest in the Public Health works and to find funds for them on a considerable scale from their own resources.

WATER SUPPLIES.

6. The works in progress during the year under report were as follows :—

Ahmedabad.—The city of Ahmedabad had a population of 277,007 according to the 1921 census. The source of supply is the Sabarmati river. The supply derived from infiltration wells, sunk in the bed of the river about 2 miles upstream of the city at Dudheshwar is conveyed through pipes into pumping sumps on the river bank. Thence the water is pumped into elevated service reservoirs from which it is distributed through supply mains to the town. For some years past the water supply has been inadequate and the Superintending Engineer, Public Health, has been

advising the Municipality as to the most suitable methods of augmenting the same. During the year under review the erection of a new elevated service reservoir of one million gallons capacity was completed with the necessary rearrangement of inlet and outlet pipes. This reservoir is 120 feet square and 12 feet deep, built up of pressed-steel plates, with its bottom 50' above ground level. The work was carried out by the staff of the Public Health Branch. The laying of 200 feet of porous pipe infiltration gallery in the river bed was also in progress. The net expenditure incurred during the year was Rs. 2,72,129. Side by side with this, improvements to the supply mains and pumping plant as well as the usual maintenance and repairs of the Water Works were carried out by the Municipal staff at a net cost of Rs. 63,826.

Alandi.—The scheme for supplying water to the pilgrims at Alandi during Fairs, estimated to cost Rs. 84,990 net, was practically completed. The source of supply is the Indrayani River; the pumping plant consists of a crude oil engine and centrifugal pump in duplicate. The water pumped is conveyed to four service cisterns through C. I. Rising mains. These service cisterns are situated at points near the different camping grounds and supply water to horizontal service pipes placed round the cisterns and provided with push cocks. The pumping plant is capable of pumping 250,000 gallons in 12 hours, i.e. $2\frac{1}{2}$ gallons per head for one lakh of pilgrims.

The following items of work were executed during the year:—

Approach road to the pumping station, Engine House, chlorinating shed with two reinforced cement concrete platforms, and erection of pumping machinery consisting of two National Oil Engines of 14 B.H.P., each driving Mather and Platt Vertical Medivane centrifugal pumps. The net expenditure incurred on this work during the year was Rs. 31,348.

Hyderabad.—The town of Hyderabad (including Gidu, Transfuleli and other suburbs) has a population of approximately 95,930 according to the census of 1931. Its daily consumption ranges between 1·6 M.gls. per day in the winter and 2·9 M.gls. in the hot weather.

(a) *Bazar Main.*—Owing to the increased consumption and to the growth during the last decade of a big suburb on the plateau known as the Hirabad quarters between the old town and the Central Jail, the existing distribution mains were found to be extremely inadequate, both the supply of water and the pressures available having become unsatisfactory. The new main from the reservoirs in the Fort to the north end of the plateau has been designed to provide a supply of 40 gallons per head per day for a prospective population of 72,000. The estimated net cost of the scheme is about Rs. 1,70,000. The scheme is divided into two stages,—the first consisting of laying large new mains from the reservoir to the market, and the second of taking out the old mains in the above area and relaying them in the Hirabad quarters. The Bazar main has now been completely laid, and the extension of the same towards the Hirabad quarters will now be taken in hand. The capacity of the present pumping plant at the Fort Lift Pumping Station

having become insufficient when pumping to the High Service Reservoir (from which the supply is to be given to the new bazar main) it was decided to instal new pumping machinery consisting of electrically operated centrifugal pumps. The work of erecting the new pumps and motors was taken in hand and is in progress. This work is all being carried out by the Public Health Branch staff. The net expenditure incurred during the year was Rs. 60,433.

(b) *Gidu Water Supply*.—Gidu is a small “Bunder” on the river Indus, 3 miles to the west of Hyderabad adjoining the intake works of the City Water Supply, and within the Hyderabad Municipal limits. The distribution system is designed to provide a supply of 30 gallons per head per day for a prospective population of 2,000. For the present the supply will be drawn from the masonry settling tanks of the Hyderabad Water Works. After the construction of the proposed rapid-filtration plant, the distribution system will be connected with the elevated wash-water tank (containing filtered water for cleaning the filter beds). The estimated net cost of the scheme was Rs. 19,900. The scheme has been completed at a total cost of Rs. 16,838 net and the service started. The work was carried out by the Public Health Branch staff. The net expenditure incurred during the year was Rs. 3,876.

(c) *Transfuleli Water Supply*.—The inhabited area fast developing on the eastern side of the Fuleli Canal near Hyderabad within the Hyderabad Municipal limits is known as the Transfuleli quarter. The distribution system has been designed to provide a supply of 30 gallons per head per day for a population of 5,000. The supply is given from the low level reservoir in the Fort at Hyderabad. The estimated net cost of the scheme amounted to Rs. 77,000. The work has been completed at a cost of Rs. 63,705 net and the service started. The net expenditure during the year was Rs. 13,017.

Jacobabad.—The sub-soil water at Jacobabad is mostly brackish and the town has been in great need of a supply of sweet water. The project is divided into two stages, the first stage,—estimated to cost Rs. 2,15,000 net,—providing for a supply of 5 gallons per head to a population of 12,000. Two infiltration wells near the Nurwah Canal flowing through the area known as Dickenson’s forest are to be the sources of supply. The flow of the Wah percolates through the neighbouring sub-soil and helps to drive down the salt in the sub-soil and to render the sub-soil water potable. The water from the infiltration wells is pumped after chlorination through a 6” C.I. main 14,600’ long into a covered elevated service tank in the town from which standposts are served. The construction of the first stage of the scheme has been in progress since January 1928. The following works were completed during the year under review :—

Engine house (including pumping machinery), and minor works such as fencing and erecting a bund round the head works; distribution system and construction of an elevated pressed steel tank.

The Water Works were opened by His Excellency the Governor of Bombay on 21st November 1930. Extensions of the distribution system have subsequently been taken in hand at the request of the

Municipality. This work is being carried out by the Public Health Branch staff. The net expenditure during the year was Rs. 68,000.

Kapadwanj.—Kapadwanj had a population of 18,784 according to the 1921 census. The scheme for water supply under execution estimated to cost Rs. 2,69,280 net is for supplying the town from the Varachhi river. A duplicate set of pumping machinery to raise 20,000 gallons per hour to a total lift of 180' is installed in the pumping station. The supply is raised through a 9" rising main 5,415' long, to a reinforced concrete elevated service reservoir of 1 lakh gallons capacity from which the town is served through a distribution system. This work is now practically complete. An additional inspection chamber was constructed on the line of the intake pipe. The maintenance and repairs of the work has for the present been entrusted to the Public Health Branch. The net expenditure incurred during the year was Rs. 2,234.

Karachi.—The town of Karachi has a population of 260,639 according to the census of 1931. It derives its water supply from the sub-soil flow in the basin of the Malir river, near Dumlottee. A long infiltration gallery in the bed of this river discharges into a gravitation masonry conduit about 17 miles long between Dumlottee and Karachi, conveying the supply to the service reservoirs. The supply so obtained from gravitation is supplemented when necessary by pumping water into the same conduit from infiltration wells in the basin of the river below the site of the infiltration gallery. From the service reservoirs the water is distributed through an ever-growing distribution system to the different parts of the town.

For some years past Karachi has been going through a period of severe drought. As a result, the sub-soil water has fallen considerably and the yield of the wells has consequently been reduced. The existing sources of supply in the basin of the Malir river have therefore to be increased or supplemented. At the request of the Municipality an underground survey of the river bed for a distance of about 4 miles above the gallery has been made by the Public Health Branch staff by means of borings, in order to determine the level of the impervious river bed and the practicability of increasing the gravitation supply from the Malir river. These investigations were continued during the year under review. Extensive improvements to the water supply distribution system were carried out by the engineering staff of the Municipality at a net cost of Rs. 84,364.

Jalgaon.—The execution of a scheme estimated to cost Rs. 5,50,350 net prepared by the Superintending Engineer, Public Health, has been in full swing, the source of supply being the river Girna, about 4 miles from Jalgaon, near the village of Saokhera. The supply is drawn from a porous pipe infiltration gallery in the river bed, connected with a sump of the pumping station on the river bank. A duplicate set of engines and pumps raises the supply through a 12" rising main, 3 miles long, to a service reservoir situated on high ground near the Collector's bungalow. From this a 15" main conveys the supply to the existing

city distribution system. This scheme was completed during the year and handed over to the Municipality for maintenance. The net expenditure incurred during the year was Rs. 72,242.

Nandurbar.—Nandurbar has a population of 15,750 according to the 1931 census. A scheme for water supply estimated to cost Rs. 3,22,000 has been in progress during the year. At a distance of about 4 to 5 miles from the town there is a narrow gorge through which flows a perennial stream locally known as the Tokartala Nala, the flow of which is believed to be maintained by a large silted up basin behind the gorge which absorbs and stores a considerable part of the rain water falling in it. The flow as gauged during successive years was found to measure not less than 130,000 gallons a day in the hottest part of the year. It should thus afford under the most unfavourable conditions a gravitation supply of between 8 and 9 gallons per head. This flow is being diverted into a gravitation main 12,000' in length supplying a service reservoir of 4 lakhs gallons capacity located on the hill overlooking the town known as the Mortuary Hill, from which the supply will be distributed to the town. The laying of the gravitation main and the construction of the service reservoir have been completed; work on the pick-up-weir and the town distribution was in progress. This work is being carried out by the Public Health Branch staff. The net expenditure during the year was Rs. 41,522.

Nasik Road Central Prison.—This scheme, estimated to cost Rs. 1,79,900 net, which has been in progress since March 1927 provides for a jail population of 2,500 at the rate of 40 gallons per head. This project is an extension of the scheme already in operation for the supply of the Distillery. The source of supply is the Darna river. An intake pipe conveys the pipe water to a sump, from which electrically driven pumps raise it to steel coagulating tanks. The water is then filtered by Jewel filters, chlorinated and pumped to a pure water reservoir, from which the Distillery is served through a distribution system. An additional coagulating tank and filter unit and an extra compartment of the pure water reservoir have now been provided. The filtered water for the prison is raised by an electrically driven pump through a 6" rising main about 5,600' long to a reinforced concrete elevated service reservoir of 100,000 gallons capacity near the Prison from which the necessary distribution system takes off. This work is being carried out by the Public Health Branch staff. During the year distribution pipes to the Factory and Chakki shed were laid, two fire hydrants constructed and storage tanks for the staff quarters fixed. All the works in connection with the water supply arrangements have now been completed and handed over for maintenance. The net expenditure during the year was Rs. 6,700.

Nipani.—Nipani had a population of 11,878 according to the 1921 census. The main source of supply is an infiltration gallery about a couple of miles distant from the town. From this gallery a gravitation main leads to a service reservoir, from which the existing distribution system is supplied. The works which are very old are now inadequate

and certain improvements have been undertaken at the cost of the Municipality. A new covered service reservoir of 50,000 gallons capacity has been constructed on the site of part of the open service reservoir, and it is proposed to replace the existing gravitation main from the gallery to the service reservoir by a pipe of larger diameter. The works of constructing the service reservoir and laying a 6" C.I. service main having been completed last year, some improvements to the distribution system were taken in hand and completed during the year under report at a net cost of Rs. 2,918. This work was carried out by the Public Health Branch staff.

Poona—(a) Poona Cantonment Water Works.—These Water Works supply the Cantonment and Suburban Municipal areas with water. The source of supply is the Mutha Right Bank Canal. The raw water is pumped into settling tanks with a capacity of 5.9 M. gallons. These tanks are drawn down during the periodical canal closures for repairs and the removal of weeds; the prolonged period of storage normally provided by them serves to reduce the dose of alum required. From these tanks the settled water passes on to coagulating tanks, where the necessary dose of hydrate of alumina (normally about $\frac{1}{4}$ grain per gallon) is usually given. The settled water with its fine "floc" of alum is passed on to the ten rapid-filter units, each with a capacity of approximately 300,000 gallons per day. The filtered water after the addition of a dose of about 0.3 parts of chlorine per million parts of water is passed into covered pure water reservoir with a capacity of approximately $1\frac{1}{2}$ million gallons, from which the supply passes by gravitation to the Low Service Zone or is pumped into one or other of four covered service reservoirs serving the Elevated Service, High Service and Middle Service zones. The pumping and distribution mains range from 21" to 3" in diameter, the total length being approximately 51 miles. Extensive improvements have been in progress during the past few years; during the year under review, an additional Paterson Filter unit with a capacity of one million gallons per day was provided and brought into use, bringing the filter capacity up to 4 M. gallons per day. In addition, a new coagulating tank, mixing troughs and filter house extension suitable for a future *additional* pure water supply of 3 M. gallons per day, or 7 M. gallons per day in all, were constructed. To meet the increasing demand of water in the Middle Service zone, a new Worthington Simpson Horizontal Triplex Expansion Surface condensing steam engine is being installed. Extensive improvements to the distribution system in the Low Service Zone were also carried out during the year—the total length of C.I. pipes laid being 8,800 feet of diameters varying from 12" to 4". The consumption of water in the bazar area of Poona Cantonment being found to be out of proportion to the revenue realised, it was found expedient to meter the supply, and about 950 meters were fixed during the year under report. The total net expenditure incurred during the year was Rs. 1,63,818.

Besides these new works, the usual maintenance and repairs work was carried out at a cost of Rs. 1,84,579.

(b) *Kirkee Water Supply*.—The Kirkee Water Works was purchased by the Bombay Government from the Military Authorities at a cost of Rs. 5 lakhs and the works were taken over by the Executive Engineer, Poona Water Works Division, on 1st April 1930. The maintenance and repairs work was carried out as usual at a cost of Rs. 43,233. Extensive necessary improvements were also carried out during the year. The laying of a new 15" gravitation main for supplying raw water from the Mutha Right Bank Canal to the purification works at Holkar's Bridge was in progress, a total length of 16,000 feet of reinforced concrete Hume pipes being laid complete. The work of erecting two sets of Ruston-Hornsby Cold Starting Vertical Crude-Oil Engines of 112 B.H.P. at the Holkar's Bridge Water Works was in progress. This machinery is designed to pump 1.4 M. gallons of filtered water in 24 hours into an elevated service reservoir to be constructed near the Ammunition Factory. The water from this reservoir will be distributed to the Kirkee Cantonment area and Government House, Ganeshkhind. The net expenditure incurred during the year was Rs. 1,92,853.

Shingnapur.—Shingnapur is an important pilgrim centre in the Satara District, the pilgrim population being estimated at 40,000. The only source of supply is an existing tank which covers an area of nearly 40 acres. The arrangements for water supply have been found unsatisfactory and since 1916 the question of improving them has been under consideration. A scheme estimated to cost Rs. 50,000 net has been prepared, the supply being drawn from the tank, conveyed by gravitation to the jack well of a small pumping station, chlorinated and pumped through a rising main 4" in diameter into a service cistern and to standposts on the pilgrim camping grounds. The work was started last year and the construction of the supply well, jack well and engine house with chlorinating shed and pumping plant, the laying of the 6" connecting pipe and of the rising main 1,865 feet long and the construction of the service reservoir and the distribution system were completed during the year under report, and the works opened for the supply of water to the pilgrims. This work was carried out by the Public Health Branch staff. The net expenditure during the year amounted to Rs. 30,878.

Sholapur.—The city of Sholapur has a population of 135,632 according to the 1931 census. Its source of supply is the tank known as the Ekruk Tank, about 6 miles from the city. Gravitation mains, on which Venturi meters to measure the supply have been provided, lead the water to small settling tanks near the pumping station on the north side of the town. From the pumping station the water is raised through a rising main partly 15" and partly 12" in diameter to service reservoirs serving the different zones of the city. Both the quantity of water supplied and the pressures in the mains have proved inadequate and considerable improvements and enlargements of water works are urgently needed. The first and most urgent stage of the scheme of improvements, costing Rs. 1,98,000 net including the replacing of the 12" section of the rising main by pipes of 24" diameter and the provision of an additional pumping unit capable of pumping 2½ M. gallons per day, was undertaken by the Public Health

Branch staff during the year. The Municipality proposes to carry out further urgent improvements at an early date and the preparation of plans and estimates for the same has been taken in hand. The net expenditure during the year amounted to Rs. 1,11,477.

Surat.—The city of Surat with a population of 117,434 in 1921 derives its water supply from the river Tapti, which flows past the town. The Head works are situated at Warachha, five miles upstream, above normal tidal reach. From a number of interconnected infiltration wells sunk in the bed of the river, two C. I. mains 24" and 22" in diameter convey the water to the pumping sump of the pumping station situated on the river bank. From here three sets of steam engines and pumps raise the water to two elevated steel tanks near the engine house. From these tanks a 22" supply main, 3 miles long, conveys the supply to the town distribution mains. The supply has been proving inadequate both in quantity and in pressure. To increase the yield additional infiltration works consisting of 24" porous concrete percolation pipes have been constructed by the Superintending Engineer, Public Health. The work of laying a 4" rider main along the main bazar road was completed and 300 house connections transferred from the trunk main to the new rider main. The work of laying a new trunk main was in progress, about 6,770 Rft. of C. I. pipes of large diameter being laid and jointed. The net expenditure incurred during the year was Rs. 1,30,802.

Besides carrying out these works, the Public Health Branch has also been entrusted with the maintenance and repairs works of the Uran Water Works, the Matheran Water Works, the Jalgaon Water Works (up to 31st December 1930), the Kapadwanj Water Works, the Karad Water Works, the Satara Camp Water Works and the Pandharpur Water Works. The net expenditure on account of the maintenance of these works during the year amounted to Rs. 86,517.

BORING OPERATIONS.

7. The question of the continuance of the boring operations has been for a considerable time under the consideration of Government. Government finally decided to close down the Boring Division with effect from 1st March 1931. No new deep borings were undertaken during the year under review. The two bores at Bagodra and Derwala, work on which was not finished last year, were completed, the expenditure incurred on account of these being Rs. 26,289 net.

A number of shallow borings were taken at several places with a view to augment the yield of existing wells, the expenditure incurred being Rs. 21,213.

DRAINAGE WORKS.

Ahmedabad.—This city is sewered by underground drains on the water-carriage system, the sewage gravitating to a pumping station outside the Jamalpur Gate, whence duplicate sets of engines and pumps raise the sewage through a rising main to a sewage farm, for disposal by irrigation. Extensive improvements in the shape of additional

main and branch sewers, a Hume pipe outfall sewer, etc., were carried out by the engineering staff of the Municipality at a net cost of Rs. 1,80,972.

Belgaum.—This town is not at present provided with any piped water supply, but is dependent on wells distributed throughout the town. A main drainage scheme has, however, been found necessary and a scheme has accordingly been drawn up for providing new surface drains and three main collecting drains conveying the sullage to settling tanks, the effluent from which will be disposed of by irrigation. The surface drains forming the first stage of the works having been completed, the second stage consisting of the outfall sewer, settling tank and sewage-disposal works was started. The work of laying 12" stoneware pipes and constructing manholes, etc., are in progress. A length of 1,500 Rft. of 12" stoneware piping being completed. The net expenditure incurred during the year under report was Rs. 24,604.

Dhulia.—A partial drainage scheme for conveying the sullage by gravitation from the existing surface drains of the town through underground pipe drains to a common outfall and thence to a settling tank has been prepared by the Superintending Engineer, Public Health, and is now under construction by his staff. Two main underground drains, one running alongside of the natural drainage channel known as the Hagra Nala and the other along the west side of the town, join at the north-east corner of the town, and from this junction the outfall main conveys the sullage to settling tanks on the right bank of the Hagra Nala below the town. A stoneware pipe main will convey the effluent to the irrigation farm. The third stage of the scheme consisting of the construction of a settling tank in two compartments (capacity 90,000 gallons) was carried out and brought into operation. The remaining works, viz., effluent carrier and sewage farm could not be undertaken owing to delay in land acquisition. The net expenditure incurred during the year was Rs. 19,177.

Gadag-Bettigeri.—An extensive surface drainage improvement scheme has been in progress. Most of the sullage flows into a nala known as the Javal Nala. Suitable V shaped surface drains to take the sullage and storm water at the rate of $\frac{1}{4}$ " run off per hour are being provided and the existing main drain in the nala has been improved and extended to below the railway bridge. In subsequent stages it is proposed to divert the sullage flow from the nala into an underground pipe drain and to lead it by gravitation to the effluent irrigation area. The estimated cost of the scheme amounts to Rs. 1,40,783 net. Works of the second stage (providing additional surface drains) were in progress during the year and 14,399 Rft. of different types of drains laid complete. The net expenditure incurred during the year was Rs. 26,484.

Kapadwanj.—Underground pipe drains are being provided to convey the sullage from all houses which are given water connections and the waste-weir from the public standposts to a common outfall outside the town. The effluent, after passing through settling tanks, is disposed of on a small sewage farm. The original project, estimated to cost

Rs. 70,000 net, is already complete and the second stage of the scheme for the provision of sewers along the bye-lanes is now in hand. The work of laying pipe sewers in these bye-lanes was in progress. The net expenditure during the year amounted to Rs. 13,632.

Karachi.—The city is served by the water-carriage system of underground drainage. The town area is flat and numerous Ejector stations are provided. The sewage is lifted through a common rising main to a municipal sewage farm 210 acres in extent, where it is disposed of by irrigation. The net revenue from the farm amounts approximately to Rs. 30,000 per annum. Extensive improvements to the drainage works were carried out during the year by the engineering staff of the Municipality at a total net cost of Rs. 1,36,297.

Nasik Road Central Prison.—A drainage scheme consisting of a modern water carriage system with suitable internal sanitary fittings, underground pipe drains, settling tanks and sewage farm has been in progress. The estimated net cost of the scheme is Rs. 1,65,300 and the work is being carried out by the Public Health Branch staff. The connection of water closets and urinals in the factory and chakki sheds and the laying of sewer lines, construction of manholes, etc., were completed, the net expenditure during the year amounting to Rs. 9,378.

Poona.—The Poona Drainage Improvement scheme has been in progress during the year under review. For purposes of administration and finance, the improvement project under execution estimated to cost Rs. 41,25,016 net is divided into two sections. The *first section* includes the following works:—

- (1) Completion of branch and lateral sewers in the City area;
- (2) the reconstruction of the Low Level Pumping Station;
- (3) the construction of an egg shaped outfall sewer 18,675 feet long, varying in sizes from 3' × 2' to 5' × 3' from Daruwala Bridge along the right bank of the Mutha and Mutha-Mula rivers to an outfall pumping station near the junction of the Bahiroba Nala and the Mutha-Mula river. (Provision is made for reception *en route* into this of the sewage of the Poona Cantonment Authority, the Railway Authorities and the Poona Suburban Municipality);
- (4) Settling and Balancing Tanks with screens and *grit* elevators.

The *second section* includes—

- (1) the Outfall Pumping Station,
- (2) the Rising Mains, and
- (3) the necessary works in the effluent irrigation area.

The items of works that were in progress during the year under report are described below :

First Section.—S. W. pipe sewers, 15" to 6" in size and 3,857 feet in length were laid complete with house connections and pail depots in District No. 3 (Nana and Bhavani Peths) of Poona City. The construction of the Low Level Pumping Station was in progress. Net expenditure during the year Rs. 2,89,222.

Second Section.—The work of providing a third pumping unit in the Bahiroba Pumping Station was in progress. A "Lea Recorder" was installed for measuring the flow in the outfall sewer. The work of laying 33" and 30" Hume pipes for effluent irrigation under Outlet 27 and Distributary 6 was completed with the necessary drinking water supply arrangements to the vasties in the effluent area. The works for effluent irrigation under Distributaries 3 and 4 were also completed. The laying of a 15" branch to Distributary 3 from the 30" rising main was taken in hand and completed. The following urgent works for disposal of surplus effluent during the winter months were executed and brought into use during the year under report:—

- (a) A Hume concrete pipe line from the Effluent Farm to the Winter Disposal area.
- (b) Feeder channels.
- (c) Trenches in the acquired area of 207 acres.

The net expenditure on all these works amounted to Rs. 2,22,136.

Poona Suburban Municipal Internal Drainage.—The Poona Suburban Municipality has entrusted the execution of its internal drainage works in part of District 10 to the Public Health Branch. These works were completed during the year at a total net expenditure of Rs. 90,431, the net expenditure incurred during the year amounting to Rs. 38,081. The local body has made available additional funds to the extent of Rs. 90,000 towards their works in Districts 11-C and 11-D and arrangements for starting the work are in progress.

The *maintenance and repairs work* of the *Sewage Outfall works*, the Bahiroba Pumping Station, pumping main, etc., was carried out at a net cost of Rs. 45,437.

Shikarpur.—The town of Shikarpur has a population of 62,000 according to the 1931 census. The sullage water collects in cess pits constructed on the road edges from which it is removed by carts and emptied into the existing surface drains, along which it flows to local depressions known as the Gulamshah Hollow, Aminshah Hollow and the Sarwar Tank. These hollows become very insanitary and offensive. At the request of the Municipality, the Superintending Engineer, Public Health, has drawn up a partial scheme of drainage with underground main sewers. For convenience of financing, the scheme is divided into suitable stages and it is now proposed to carry out the first stage of the project which is estimated to cost Rs. 2,20,000 net. This consists of western and north-eastern main intercepting sewers, balancing well with screen and grit chamber, pump well and engine house, 18" rising main leading to a sewage farm and disposal works at the sewage farm. A commencement has been made with this work, the work being carried out by the Public Health Branch staff. The net expenditure incurred during the year was Rs. 18,434.

Sholapur.—This city requires an up-to-date drainage system and the Municipality is gradually undertaking the construction of a comprehensive drainage scheme. A commencement has been made by laying

underground sewers to serve the most insanitary areas of the city along the Upper and Lower Lendki Nalas. The city is fortunately so situated that it can be provided with underground sewers which will convey the sewage to the irrigation outfall by gravitation. The works under construction are all designed to form part of the comprehensive scheme which the Municipality intends to carry out. Branch internal sewers will be constructed and connected to the main sewer as funds are made available for the purpose. Progress on the main drainage works for the city was continued during the year, minor improvements to the already constructed Upper and Lower Lendki sewers were carried out and surface drains constructed in the Tiregaon area. The total net expenditure incurred during the year on all these items amounted to Rs. 41,447.

Surat.—A progressive scheme of complete underground drainage is waiting to be financed. In the meantime, certain improvements of the sanitary conditions of the thickly populated area through which the main natural drainage channel known as the Makai Creek runs are considered urgent, the cost of these works being estimated at Rs. 81,000 net. Funds for this urgent improvements are being provided by the local body, and work will be taken in hand next year. The local body is anxious to undertake a comprehensive drainage scheme and plans and estimates for the same are being revised by the Superintending Engineer, Public Health.

Tando Adam.—This is a small town with a population of 12,996 according to the 1921 census. The first stage of the surface drainage scheme (for the western catchment), cut up into suitable stages, has been constructed by the Public Health Branch staff. Estimates for providing a main surface drain for the eastern catchment of the town were prepared and the necessary funds having been provided by the Municipality, the work was taken in hand and is nearing completion. The net expenditure incurred during the year amounted to Rs. 21,897.

In addition to the several construction works in progress in the Public Health Branch, the staff was engaged during the year on *survey and project work*. About 43 schemes were investigated during the year, the more important of them being the following:—

- (1) Improvements to Karachi Water Supply.
- (2) Karachi Artillery Maidan Water Supply and Drainage.
- (3) Hyderabad Drainage.
- (4) Improvements to Hyderabad Water Supply—Rapid Filtration Scheme.
- (5) Mahmudpura Water Supply.
- (6) Surat Water Supply Improvements.
- (7) Surat Drainage.
- (8) Dakor Water Supply.
- (9) Gogha Water Supply.
- (10) Nasik Drainage Improvements.
- (11) Nasik Police Head Quarters Drainage.
- (12) Yeola Drainage.

- (13) Bhusaval Water Supply.
- (14) Alibag Water Supply.
- (15) Khed Water Supply.
- (16) Pen Water Supply.
- (17) Nagothna Water Supply.
- (18) Roha Ashtami Water Supply.
- (19) Panvel Water Supply.
- (20) Dombivli Water Supply.
- (21) Uran Water Supply.
- (22) Kurla Water Supply.
- (23) Thana Water Supply.
- (24) Kalyan Drainage.
- (25) Kurla Drainage.
- (26) Ahmednagar Water Supply.
- (27) Barsi Water Supply.
- (28) Jejuri Water Supply Improvements.

The post of Superintending Engineer, Public Health, Bombay, continued to be held by Mr. A. P. Maddocks, B.Sc., M.Inst.C.E., M.Inst.W.E., M.I.E.(Ind.), F.R.San.I. The charge of the Sanitary Project Office was held by Mr. N. K. Joglekar, L.C.E., up to 5th November 1930 and from 6th November 1930 to 1st March 1931,—the date of its amalgamation with the Poona Drainage Construction Division,—by Rao Bahadur B. P. Jagtap, L.C.E., M.R.San.I., A.M.I.E.(Ind.); the Poona Water Works Division by Mr. Paul Braganza, L.C.E., M.I.E.(Ind.), up to 10th October 1930 and from 11th October 1930 to date by Mr. R. A. Collett, A.M.I.E.; the Boring Works Division by Mr. Wm. C. Dooris, up to 3rd February 1931 and from 4th February to 1st March 1931,—the date of its abolition,—by Mr. E. L. Young, Assoc. Inst.M.&M.; the Poona Drainage Construction Division by Mr. V. G. Shete, L.C.E., M.I.E.(Ind.), M.R.San.I., A.M. I.San.E. The charge of Dapuri Government Central Store and Workshop was held by Mr. R. A. Collett, A.M.I.E., up to 10th October 1930 and from 11th October 1930 to date by Mr. C. Holliman, A.M.I. Mech.E.

A. P. MADDOCKS,

Secretary, Sanitary Board,
Bombay Presidency.