23.3 Description of the Existing Environment

23.3.1 Coastal Environmental Setting in Mumbai

(1)General

The city of Mumbai was originally a group of islands separated by narrow tidal channels. The Principal islands were Salsette, Dharavi, Mumbai and Colaba. Through the last two centuries the process of reclaiming submerged grounds has developed these islands into the present Greater Mumbai, of which more than 50% is made up of reclaimed land. The topography of the area is generally flat except few hilly terrain existence.

(2)Geology and geomorphology

Mumbai was formed geologically through volcanic effusions and deposition of marine strata. The geological origin of rocks in the region is that of the Deccan Traps, a series of vast lava flows accompanied by volcanic eruptions at the close of Cretaceous period. Later deposition of marine strata has also occurred. The area also has tuffs, tuffaceous breccias and volcanic ashes which are all much softer than the basalt trap rock. The nature of the trap rocks means that they are often very weathered at surface and this has resulted in the formation of 'murrum'. The hardness and texture of these 'murrum' layers tend to vary depending upon the degree of disintegration of the original basalt. The complete disintegration results into formation of stiff yellow clay.

There is a strong evidence that the area was once a thickly wooded valley which subsided under the sea due to the tilting of the land mass. The discovery of a 'submerged forest', overlain by a thick stratum of clay, was made during the construction of Prince's Dock and this has been cited as clear evidence for such a theory.

(3)Soils

Mumbai soil essentially consists of clay with the particular nature of the top soil varying depending upon the location, since more than 50% of the area have been raised through reclamation and the surface material often reflects the fill material used. The overburden is soft marine clay having cohesion of 2 t/m^2. The pH of soil is below 8.5. In general, bore hole

logs show a 1-1.5 meters top soil/fill layer, overlaying a layer of clay of depth varying between about 3.5 meters to 7.0 meters. The clay layer is followed by a layer of 'murrum' which is supported in turn on weathered basalt rock, tuffs or tuffaceous breccias. In reclaimed areas, the top soil which may vary in depth from 1 meter to 3 meters generally comprises fill materials varying from loose boulders and pieces of weathered rock to well compacted clay. Soil in Mumbai is categorised as deep coastal alluvial soil (more than 50 cms depth), moderately deep black soil (25 to 50 cms depth), very deep saline and saline alkali soil (more than 50 cms), shallow to very shallow black soil (less than 25 cms depth).

(4)Ground water

A systematic hydrogeological survey of Greater Mumbai area was carried out by Central Ground Water Board (CGWB) in 1989-90, based on the measurement of the water levels in open wells in Greater Mumbai and the adjacent hinterland areas. During both pre and post monsoon periods it was observed that the water levels were between 0 and 2 meters deep in coastal areas (low lying tracts), 2 and 4 meters or more in the central elevated parts of Salsette, Trombay and southern tip of Mumbai island. In most of Greater Mumbai, the seasonal fluctuation was less than 2 meters and in 1989 it worked out to only 0.76 meters. Seasonal fluctuation of ground water table in the central elevated parts varied between 0 to 6.59 meters. Water samples tested from a well in Kurla show sulphate content as high as 2,678 mg/l with the acidic pH 5.1.

(5)Flooding spots

Flooding is believed to occur in the area due to rainfall alone, rainfall in conjunction with high tides and both in conjunction with inadequate storm sewer system, capacity or with a highly surcharged overflowing foul sewer. Flooding in Mumbai results in major disruptions of traffic which causes considerable inconvenience to the public in general, loss of production due to travel disruption and damage to road surfaces. The flood-prone areas are shown in Figure 23.3.1.

(6)Climate

The climate in the area shows a regular seasonal variation and the general character of the

weather is more strictly seasonal than most parts of the world. It is subject to both South-West (SW) and North-East (NE) monsoon winds, the former being more prominent. The latter, however, governs the fair weather period from late September to early June when the weather is generally sunny hot, sultry and humid as the conditions build up for the onset of SW monsoon. The SW monsoon wind, having blown across Indian Ocean and Arabian Sea, is warm and saturated with moisture. This results in the precipitation of very heavy rain as the winds reach the barrier of the Western Ghats, all along the Konkan Coast and commences in Mumbai about mid June. The break of the monsoon is generally violent and accompanied by heavy rain, often lasting for several days. For next two or three months the wind has almost constant SW direction and there are periods of heavy rains, interspersed with period of less of intensity. By the end of August the monsoon generally begins to slacken and recedes from Mumbai by the end of September. Another spell of sultry weather is thus experienced before the cooler days of December, January and February.

(7)Agriculture

Agriculture is not predominant in Mumbai region. Agriculture land is also decreasing due to steady pressure of housing and other constructional activities. The main crops in the area are rice, Nachni, Vani, Hanik, wheat and other few crops. The vegetables are tomato, chilly, Brinjal, palak, Bhindi, etc.

(8)Forest (Vegetation and wet lands)

Forest is also part of Eco system and natural resources. The forests have increased due to afforestation programmes in Mumbai area. The major type of trees are Mango, Teak, Raintree, Banyan Tree, Subobul, Eucalyptus, Bamboo, Peltphorrum, Cassia, Acasia, Jambul, Manogan, Muchkund, Caswrina and Gulmohar. There is no reserved forest within area of 20 km radius of the port. The major forest area lies in Borivali National Park. The Principle vegetation of the forest corresponds to the south India Moist Deciduous and semi evergreen. The majority of mangrove forests in the region are distributed along Thane Creek on the eastern portion and Malad/Manori Creek on the north Western side. The forests within this zone are dense and continuous. Small degraded patches of mangroves are found in the area of Mahim and Mahul Creeks. The Mangrove plantation/vegetation in Mumbai is mainly Aviannia marina. No thick

mangrove forests are observed along the sea shore except few patches at Bandra and Malad Creek. But by and large, there are not coastal forests at present in the inshore area of Mumbai region. The details are shown in Figure 23.3.2. The terrestrial flora and fauna information are presented in Figures 23.3.2a and 23.3.2b.

(9)Land use

The land use pattern in Mumbai is predominantly mixed-use. The other uses of land are commercial, industrial, harbour and air port, and residential. As per land use classification (1989), Mined land use 40%, Industrial use 5%, Harbour and Airport 3%, Agriculture activity 7%, Forest 14%, Scrub land and Out-crop 6%, Beaches 2 %, Coastal wet land 21% and Inland water bodies about 2%. The open space is very limited within Greater Mumbai Area. Presently industries are concentrated mainly in the Chembur-Sion area and Andheri-Sakinaka areas in suburbs. In Navi Mumbai Area, the important land uses are agriculture, forest, non-agriculture, settlement and water bodies. The present land is marshy, barren and uncultivated, low lying and use for salt evaporation pans. Much of the land is low lying coastal land, salt pans and marshy land with rural environment. The details of existing land use pattern are presented in Figure 23.3.3.

(10) Socio-economics

The density of population in Mumbai island is very high compared to the other urban area of Mumbai Metropolitan Region. The population in Mumbai City/suburban was 9,909,547 as per census of India, 1991. The population density is varying from 500/ha to 1000/ha in the Greater Mumbai area. About 50% of population of Mumbai resides in slums or squatters colonies. The residential population of Mumbai is now about 10.5 million. The projected population for Greater Mumbai by 2001 is 12.2 million. The population density is also shown in Figure 23.3.4. The population of island city zone is about 3.2 million and has become stabilised.

(11) Wet land

Wet lands are also one part of Eco-system and this plays a vital role in the conservation/ protection of environment. The city of Mumbai has wet lands of marsh, brackish and salty

water with static/stagnant and flowing water areas. Wet lands in Mumbai Eastern and Western suburbs are being decreased/reduced due to growth of urbanisation. The details of wet lands are shown in Figure 23.3.5.

(12) Fisheries

Fishery plays an important and vital role in socio-economic condition due to its contribution toward nutrition, employment and earning of foreign exchange. About 15 lakh people are directly and indirectly involved in fishing activities in the State. It contributes above 1,500 crores to the gross domestic product in the state economy. Recently export of prawns and marine fishes has contributed more than Rs. 350 crores and earned foreign exchange. Maharashtra State is one of the major marine states in India. It has 720 km long coastal line area spread all along the maritime districts. Yearly fish potential of state is 4.88 lakhs tons. More than forty varieties are found in marine fisheries. In Greater Mumbai, ven sand and sasson docks and Satpati and Uttan in Thane are the major landing centres in Mumbai Region. The Marine fish production of 95-96 is 4.26 lakh tons and inland fish production of 95-96 is 0.9 lakh tons. The marine fish landing is year 94-95 in Mumbai is 122,963 tonnes.

The catch was mainly contributed by sharks tuna, billfishes, barracuda, cat fish, ribbon fish, lizard fish, pomfret, perches etc. The Matsya Mohini and Matsya Nireeshani are the two stern trawler type vessels in Mumbai. The state is endowed with the prime exportable varieties of marine fish comprising of prawns, pomfrets, squids, sciarides, polnimidis, etc.

(13) Marine ecology

The biological microbial parameters, i.e. phytoplankton, zooplankton and benthos biomass are important parameter of water quality. The aquatic micro flora is reportedly rich depending on the location. Among the phyto plankton group, major occurrence of indicator groups is cyanophyaae in coastal water which signify contamination of coastal water due to higher organic pollution in terms of physiochemical and bacterial parameters.

Benthos biomass comprises of bottom dwelling organisers, i.e. polychaetes, bivalves, gastropodes, isopods, nematodes decapodes and amphipodis. Amongst zooplankton distribution, the copepoda is the most dominating group and no macrophyte, i.e. algae, is found. Zooplankton is more concentrated in this region except many common fishes and invertebrates

organism (shell fish). The ecological status of coastal water (Marine water) is poor due to indiscriminate discharge of untreated municipal waste water in the coastal area. No coral reefs are observed in the coastal area of Mumbai region.

(14) Fresh water supply and quality

The major sources of water supply to the region are located outside the limit of Greater Mumbai. The total water demand is 3,400 MLD and Agents supply of about 2,550 MLD. The sources of drinking water supply are various artificial lakes, i.e. Vihar, Tulsi, Tansa, Ulhas, Modak Sagar, Upper Vaitarna and Bhatsai river. Water quality observations on the lake used for potable water supply indicate high status of raw water quality. The physico-chemical parameters are observed to be well within tolerance limits (BIS 10500 -1983). The drinking water supply to domestic horizon is filtered and chlorinated at various treatment plants and various service reservoirs. Water supply was augmented by constructing dams on the rivers Vaitarna and Bhatsai. The treatment facility provided by MCGB for the potable water supply is adequate and treated water is of acceptable quality and fed to a total of 25 reservoirs and distributed over the region. Water quality at the consumer end is monitored as a routine. The surplus is collected and analysed by different municipal agencies. Domestic Sector receives about 80% of total water supply in Greater Mumbai, 20% is for industrial and commercial users.

The ground water potential of Greater Mumbai is limited. It is roughly calculated that the ground water can cater of 156 mid water demand. However, ground water is not suitable for drinking purpose but limited to non-potable users.

(15) Coastal water quality and beach water quality (Water fronts quality)

Water quality survey envisages that persistent waste water discharges deteriorate the coastal water quality of Mumbai region. Higher level of pollution is observed during ebb (Neap) tide in comparison with the spring tide. Total coliform varies from 104 to 105 per 100 ml, DO values ranges 2-4 mg/l during ebb tide, and concentration of BOD is less than tolerance limit 5 mg/l. The water quality of the water fronts as well as beaches plays a crucial role from recreational point as well as fishing. The average pH of beach water ranges from 6.0 to 7.9.

In July water quality is of acidic nature and in February water quality of alkaline side. The average DO values are low (2-3 mg/l) during May, June, July and October, November and December (95-96 data). Generally, beach water is characterised by high turbidity values. BOD values are less than 5 mg/l and frequently reach upto 10 mg/ l which exceeds the acceptable limit of BOD value 5 mg/l. Various coastal water qualities are shown in Figures 23.3.6 and 23.3.7 for low tide and high tide.

(16) Waste water and water reuse

The municipal waste water loads are generated from seven service area, i.e. Colaba, Love Grove (Worli), Bandra, Versova, Malad, Ghatkopar and Bhandup. A large portion of water supply turned into waste water (discharged mainly in coastal waters) after domestic, commercial and industrial use. The total municipal waste water generation is 1,550 MLD (1992 data) with 240 tonnes BOD/d and overall waste water treatment is very poor. Only 2% waste water is treated before disposal to coastal waters. A number of waste water treatment and disposal scheme have been planned by MCGB authority for environmental improvement. In the coastal region there is not such a need to reuse treated effluent and discharge may be directly to sea except few cultivation use. Treated effluent will meet IS 2490 part I, 1974 Marine Disposal standards. The waster water management system is being implemented for expected waste water flow in 2005. The plan envisages that the waste water will be treated and disposed of through marine outfalls mainly at Worli, Bandra, Malad and Colaba into Coastal waters. The waste water treatment plant and outfall location/points are shown in Figure 23.3.8.

(17) Historical interest and tourism

The Mumbai city is famous for its contribution to the Indian film industry. The international tourism tends to focus on cultural and historical interests whereas regional tourism seeks to attract visitors from different states for recreation and relaxation. The Coastal climate, civic amenities and infrastructure are also important factors for tourist/local tourist attraction. The National Park (Krishnagiri Upwan) at Borivali is a most popular tourist attraction. The city Mumbai with jostling crowd and rushing traffic has great industry, great wealth, great philanthropy, pop music and western manners cultural and religious traditions.

The places of interest and sightseeing are Gateway of India, Juhu Beach, Chowpaty, Prince of Wales Museum, Rajabai Clock Tower, Pawai lake, Tulsi Lake, Elephanta Caves, Haji Ali Mosque, Jain Temple, Mahalakshmi Temple, Nehru Planetorium, Hanging Garden, Essel Worlds, Kanheri Caves, Mahatma Gandhi Smarak, Crocodile park, and Lion Safari Park.

(18) Industrial areas

The distribution of industries in Mumbai is generally of mixed type, i.e. Textile, Chemical, Pharmaceutical, Engineering, Food processing and others. Five major industries located in the industrial zone are Bharat Petroleum Corporation Ltd. (BPCL), Hindustan Petroleum Corporation (HPCL), Oswal Petrochemicals Ltd., ILAC and Rashtriya Chemicals and Fertilisers Ltd. (RCF). These are the major water consuming industries in refining, petrochemical manufacturing and fertiliser sector. The location of various industries and volumetric load with organic value are shown in Figure 23.3.9. There are 208 industries in Greater Mumbai and water pollution load 557,778 m³/d with organic load of 19,956 kg/d and Air pollution SO_2, SPM and NOx are 21,819 kg/d, 6,012 kg/d, 4,050 kg/d. Textile and chemical industries are the major polluting sectors and chemical sector contribute about 60% of total organic pollution and about 90% of the total industrial effluents. In addition to organic load, industrial effluents also contain toxic chemicals and heavy metals. The total water requirement in the industrial sector is limited to about 170 MLD.

It is also noted by MPCB that 37 industries out of 208 industries have not provided the details of Effluent Treatment Plant (ETP). In the MBPT area, there are major industries like Mazgaon Dock Ltd, Digvijay Cement, Hindustan Lever, Tata Oils, Modistone Tyre Co., OK oils, Colgate-Palmolive Co., Vegetable Oils, Britannia Biscuits Co. contributing pollution in the Harbour water. The majority of industrial air pollution load is in south-eastern suburban followed by island city zone. The Marine Oil terminal (MOT) at Butcher Island (Jawahar Dweep) is also source of oil pollution in harbour water.

(19) Transport

The region benefits from a good transportation infrastructural network. There is also good road-link which provides feeder roads to access main highways and other link roads. The total length of surfaced road maintained by MCGB is 1,400 km. Greater Mumbai is well served by

the rail system for mass commuter movement. Currently there is commuter rail service between Greater Mumbai and Navi Mumbai and within Navi Mumbai. Except maritime transport in Mumbai, a regional (domestic) air port is located at Santacruz and an international air port is situated in Sahar area of North Mumbai. Two air ports, except Mumbai maritime Port and other inland water transport facility, serve a considerable number of passengers and materials. Due to increased traffic activity in Mumbai, the air quality is affected.

23.3.2 Overview on Existing Environmental Quality in and around The Port of Mumbai

(1) Introduction

Port and harbour development projects are usually associated with long term benefit due to trading activities in maritime transport services.

The Port of Mumbai with dynamic character is one of the best natural port of the world. The following multiple facilities due to shipping and harbour activities are arranged in Mumbai Port under MBPT.

- Loading and unloading operation/activity
- Storage and disposal of cargoes in the port
- Navigation of ships
- Berthing of ships approaching the port
- Anchorage in the mid stream of sea
- Communication facilities
- Integration of transport by land and sea
- Repair facility for maintenance.

As Maritime development usually generates local environmental problems, the feasible mitigative measure is to be taken to abate the pollution in surroundings.

The Prime Minister's directives for clearance of Nhava Sheva Port (Jawaharlal Nehru Port, JNP, commenced services in 1980) also included the clause and conditions for improvement in Environmental quality, environmental upgradation and decongestion of Mumbai with optimisation of land use to maintain the environmental balance of the port areas.

Mumbai Port Trust has about 14 contingency plans including chemical disasters, fire disasters, oil spill, ship accidents and pollution.

(2) Baseline Environmental Conditions

1) Baseline Conditions

In order to establish the existing environmental conditions in and around Mumbai Port, base line studies including field survey have been carried out in Feb. 97 and March 97 to cover the existing environmental attributes, i.e. water quality, Air quality, Meteorology, Noise, Marine Ecology, Socio-Economics and Demographic Status.

The following paragraphs summarise the results of main base line studies.

2) Water Quality

The results of water quality of various locations are presented in Tables 23.3.1 to 23.3.4 and locations are shown in Figure 23.3.10.

At Indira Dock, Prince's Dock and Victoria Dock, pH value of water is in the ranges of 6.44 - 8.12, BOD values in Indira Dock range 2-7 mg/l where as in Victoria Dock is 0-15.5 mg/l which is comparatively lower than tolerance limit of 100 mg/ l mentioned in standards for marine coastal area and no data analysed at Princes Dock. COD value is Princes Dock is ranging from 176 to 448, in Victoria Dock 48 - 432 mg/l and 16 - 512 mg/l in Indira Dock site and the values are frequently exceeding the permissible limit of 250 mg/l.

The oil and grease of docks water (Prince's & Victoria) have been varying from 1.2 to 18 mg/l and results are below the prescribed limit of 20 mg/l. No data are analysed for Indira Dock water. The oil may be derived due to shipping activities on berth. This affects generally the aesthetics of wet docks. Total nitrogen values are in the range of 4.0 - 13.6 mg/l. The nitrate is ranging from 0.05 - 4.21 mg/l whereas Nitrite values are less, i.e. 0.001 - 0.394 mg/l. The ammoniacal Nitrogen is also present in docks water upto 17.28 mg/l which is below the tolerance limit 50 mg/l prescribed for marine coastal area standards.

The chromium is also present, ranging from 0.001 to 2.4 mg/l, whereas cadmium was observed occasionally, copper content ranged from and the 0.046 to 1.037 mg/l, presence of iron, lead and zinc was also observed occasionally.

The bacterial quality and biological quality of dock water are not monitored by Pollution Control Cell, MBPT. The water qualities at Ballard Pier Extension, No.1 tanker Anchorage, NPP jetty, Sassoon dock and Fish Jetty Location are presented in Table 23.3.4.

pH values are ranging from 7.3 to 8.1, total suspended solids are 519-1042 mg/l, D.O. values are observed 2.7-5.8 mg/l in Sassoon dock area and 5.7 mg/l in Fish Jetty location.

C.O.D. values are 112 to 544 mg/l, indicating organic pollution for these locations as tolerance limit is 250mg/l. Heavy metals are not very significant in these sites. The higher chloride values are observed in these locations.

Ammoniacal Nitrogen values in Sassoon Dock and Fish Jetty site are observed 11.36 and 11.42 mg/l, respectively, and they are below the tolerance limit of 50 mg/l prescribed in marine coastal discharge standards. The total nitrogen varies from 6.5 to 44.04 mg/l, indicating putrefying organic pollution but within the tolerance limit of 100 mg/l. The oil and grease are varying from 2-12.2 mg/l in Sassoon dock site and 4.2 mg/l at Fish jetty site due to trawler/boats handling and fish processing. The bacteriological and biological parameters are not monitored in these locations.

National Institute of Oceanography (NIO) had studied the marine water quality within the port limits on Nov-Dec, 1996. Harbour (subtidal) water quality is presented in Tables 23.3.4a and 23.3.4b. During the extensive study of water quality in harbours and all Docks and Bunders their findings are described below:

a. The maximum temperature recorded is 28.5°C and minimum temperature 24.5°C. The high temperature is due to the influence of thermal discharges at the bay.
b. pH value of the bay ranged from 7.8 to 8.0 which is fairly constant. In some locations of docks and Bunders pH value is observed below 7.6.
c. Dissolved oxygen ranged from 0.6mg/l to 8.3 mg/l in the main bay and average value was above 3.5 mg/l. The DO values in the Docks and Bunders are less than 2.5 mg/l which indicates the organic pollution. The DO value in Timber Pond area is of 7.9 to 8.1 mg/l which appears high due to algal photosynthesis in the water.
d. Nitrate, Phosphate, Nitrite and Ammonia values are high with respect to standards for natural coastal water. This may be due to the indiscriminate discharge of waste water from fertilizer industries and spillage during unloading operations of fertilizers.
e. Concentration of nutrients is high in most of the docks and Bunders. The phosphate values, maximum is 1361µg/l, are abnormally high in Lakdi Bunder, Haji Bunder,Timber pond and Sewri mud flat area.
f. Petroleum Hydrocarbon value in the bay is higher (17.4 µg/ l) than standards for clean coastal waters and the values are high in most of the docks and Bunders, (34 µg/ l) but in

fish jetty the value is 49.1µg/l. The stations monitored by NIO are shown in Figure 23.3.10 a.

g. Harbour water qualities at monitoring stations (subtidal) are presented in fig 23.3.10b. The harbour water quality is relatively clean comparing the docks and bunders water quality.

3) Air Quality

The ambient air quality results are presented in Table 23.3.5. The monitoring results show that SO_2 concentration in designated industrial areas varied from 7.86 to 8.30 µg/m^3 and 2.62 to 135.98 µg/m^3 in Colaba and Sagar Darshan residential area whereas it was 24.56- 38.52 µg/m^3 in MBPT hospital area (sensitive area) and was observed to be high with respect to prescribed ambient air quality standards.

It is also noticed that NOx concentration ranges from 1.88 to 35.77 µg/m^3 at various industrial locations, and 7.52-35.72 µg/m^3 in residential use locations (Colaba and Sagar Darshan) and 6.44-7.54 µg/m^3 in MBPT hospital areas (sensitive locations). All the obtained values are found to meet the prescribed standards laid down by CPCB. The Air Quality Status '96-97' of various locations of 10 km radius area are also collected and presented in Table 23.3.6 to ascertain the surrounding air quality pollution in Mumbai Port. The air quality of most of locations is polluted with Suspended Particulate Matter (SPM) which shows concentration beyond permissible limits but $SO_2$and NOx concentrations are within prescribed standards in all locations except Khar area (96 µg/m^3 NOx value). The air quality locations of MBPT premises are shown in Figure 23.3.10 and air quality stations of about 10 km radius are shown in Figure 23.3.11.

4) Noise Pollution

Noise survey has been carried out by MCGB and observations on noise levels in Mumbai are limited to day time only. Majority of the observations are near the traffic islands. The observation data are tabulated in Table 23.3.7.

The observations indicate noise levels in the range of 70 to 88 dB(A) during peak traffic hours and residential area in 55-85 dB(A) and in commercial area the level 62-86 dB(A) which exceed CPCB prescribed standards. Traffic is the major contributor to the noise pollution in the city near the airport, where the noise level is in the ranges of 90-94 dB(A).

No data of Noise Survey is available within MBPT premises.

5) Marine Flora and Fauna

The average concentration of phytoplankton pigments inside the docks (Indira, Prince's and Victoria) is 2.0 mg/m^3 which is in the moderate range, whereas 22.3 mg/m^3 average concentration in other docks/bunders. In the main three docks phytoplankton cell is about 1.5 $\times 10^5$/litre whereas in other docks and bunders value 15×10^5/litre and Chaetocenos is predominant. The other major genera found are Penidium, Bacteniastrum, Biddulphia, Nitzschia, Rhizosolenia, Thalassiosina, and Skeletonema. The phytoplankton concentration range inside docks and bunders was collected Nov-Dec in 1996 and presented in Table 23.3.8. Zooplankton with macrobenthic information is presented in Table 23.3.8a.

Zooplankton biomass in the docks is 1.9 ml/100 m^3 and in bunder is 0.5 ml/100 m^3 which are very low. Zooplankton with macrobenthic concentration range in Harbour is presented in Table 23.3.8b.

The benthic potential in three major docks is very poor as average value observed is 0.3 g/ m^2 and benthic population is average 70 g/m^2 whereas in bunders and harbours (subtidal) the values are 7.9 g/m^2 with population 8000 1/m^2 and 7.4 g/m^2 with population 5000 1/m^2, respectively.

6) Fisheries.

The fisheries potential is moderate in the Mumbai harbour area and the average value of catch rate is 53 kg/hr. The catch rate near Butcher island (Jawahar Dweep) in Nov '96is 45.4 kg/hr, whereas in Harbour area the rate is 60.3 kg/hr. Eight types of fishes , two types of prawns and other types of species are found in the trawl catch. The detail information is presented in Table 23.3.9. Coilia, Shrimps and Sciaenids are predominant in the catch from harbour area. The fisherman house hold is 6,503 comprising 34,580 fisherman population and active fisherman 4,102 and allied workers 16,242. The number of non-mechanised boat is 1,011 and number of mechanised boat is 1,547 in Mumbai harbour area.

There is no fishery production zone/capture zone along the coast line of Mumbai region.

7) Microbial Population

The water and sediment quantity in the offshore Mumbai area have been analysed by NIO, GOA (Nov- Dec '96) and it is observed that the total viable count and pathogens are very high and indicate microbial contamination of water due to indiscriminate discharge of domestic waste waters in the harbour.

8) Terrestrial Ecology

There are no special identified site of sensitive ecological interest, rare and endangered species/habitats, protected and reserved forests within the immediate vicinity of Mumbai Port area. No nesting birds have been identified in the area. Most birds appears to be migratory and are found in the places of Timber Pond mangrove forest area.

9) Water Supply Status

The water requirement in the northern division area of Mumbai port for residential colonies and outline operational areas (Wadala, Fosbery, Sewree, Reyroad, Darukhana) is 14.6 MLD against supply of 9.1 MLD. The water requirement in south division area is 17.3 MLD against supply of 8.473 MLD only which caters to the requirement of the main docks, Sassoon dock, Colaba Quarters and Sassoon Fish Harbour.

10) Solid Waste Management

The solid waste accumulated is 68 m^3/day in the area Darukhana, Ship Breaking Yards, Road sweepings Mazgaon to Wadala, Wadala area, Grain Depot Sheds and Nadkarni park areas. The solid waste generation in MBPT Docks and surrounding areas is 126 m^3/day from the areas namely Sassoon Dock, Calicut street, Indira Dock, Prince's Dock, Bunder and road sections. The many Contractors are engaged in transportation to designated Vats of MCGB for final disposal.

11) Environmental Status Identification.

Various environmental problems are discussed and analysed in Table 23.3.10 to ascertain the existing environmental conditions on physical constraints, social, Aesthetics, physical and natural environment.

Table 23.3.1 Water Quality Results in Harbour Region of MBPT at Indira Dock (May 1996 to Feb. 1997)

Sl. No	Parameters	Units	May	June	July	August	September	October	November	December	January	February
1	pH		7.4 - 7.8	7.4-7.9	-	7.85-7.93	7.75-8.05	6.44-7.19	-	7.07-7.79	7.39-8.12	7.38-7.96
2	Total suspended solids	mg/ l	-	-	-	948-1283	767-1304	655-920	-	789-1038	480-745	544-669
3	Total Dissolved solids	mg/ l	-	-	-	42403-53907	41844-51308	33235-47715	-	39030-42694	45945-49170	40975-43061
4	BOD	5 days 20 C mg/ l	-	-	-	2.5-7.0	2.0-7.0	-	-	-	-	-
5	COD	mg/ l	-	-	-	-	240	84-169	-	156-284	16-208	96-512
6	Oil & Grease	mg/ l	-	-	-	-	-	-	-	-	-	-
7	Turbidity	N.T.U	-	-	-	21.5-31.5	15-35	ND-17.5	-	3.0-6.0	1.0-6.0	3.0-5.0
8	Chlorides	as Cl mg/ l	19494-23995	19890-22445	-	11000-25000	12000-15500	10000-26500	-	17485-20459	16461-22455	19461-24950
9	Chlorine Residual	as Cl mg/ l			-	-	-	-	-	3.56-6.37	2.127-6.735	2.127-3.899
10	Sulphate	as SO4 mg/ l	-	-	-	1561-1805	1787-2277	1466-2351	-	2163-2690	1787-3235	2897-4383
11	Sulphide	as S mg/ l	-	-	-	0.664-0.894	0.324-1.247	0.72-1.207	-	ND-1.39	0.07-1.15	ND-0.128
12	Phosphate	as PO4 mg/ l	0.07-0.15	0.03-0.12	-	0.395-0.662	0.181-0.35	0.046-0.977	-	0.018-0.044	0.03-0.15	0.092-0.722
13	Fluoride	as F mg/ l	-	-	-	-	-	ND-8.89	-	4.28-13.17	ND-9.833	1.77-8.22
14	Ammoniacal Nitrogen	as N mg/ l	-	17.28	-	-	-	2.41-5.98	-	0.403-4.412	ND-4.207	0.682-1.453
15	Total Nitrogen	asN mg/ l	-	-	-	5.771-6.607	4.53-5.729	-	-	7.46-12.09	-	10.36-12.76
16	Nitrate	as NO3 mg/ l	-	-	-	-	-	-	-	1.92-2.49	2.1-4.21	0.35-1.19
17	Nitrite	as NO2 mg/ l	-	-	-	-	-	-	-	ND-0.033	0.002-0.009	0.021-0.231
18	Acidity	mg/ l	-	-	-	-	-	-	-	10.0-20.0	14-24	14-26
19	Alkalinity	mg/ l	-	-	-	-	-	-	-	128-144	124-220	136-172
20	Arsenic	as As mg/ l	-	-	-	-	-	-	-	-	-	-
21	Cadmium	as Cd mg/ l	-	0.1-0.4	-	ND	ND-0.1	-	-	-	ND-0.4	ND
22	Chromium hexavalent	as Cr+6 mg/ l	2.0- 2.3	0-2.3	-	ND	ND	1.1-1.3	-	0.509-1.066	0.446-0.578	0.176-0.286
23	Copper	as Cu mg/ l	0.1- 0.2	0.08-0.185	-	0.104-0.157	0.104-0.109	0.278-0.403	-	ND-0.324	0.083-0.174	0.105-0.151
24	Iron	as Fe mg/ l	0-0.3	0-9.64	-	-	-	-	-	-	0.045-0.129	-
25	Lead	as Pb mg/ l	-	-	-	ND	-	-	-	ND-0.193	ND-0.3	ND-0.016
26	Zinc	as Zn mg/ l	0.1-0.2	0.1	-	0.2-0.7	0.2-0.3	-	-	-	ND-0.1	ND-0.01

Note : (1) '-' indicates parameter not monitored/ analysed.

(2) ND Means Not Detected

(3)

a Water Quality monitored in May '96	_Berth No.1,2,6
b. Water Quality monitored in June '96	_Berth No. 7,11,12,13,15,17
c. Water Quality monitored in July '96	_Not Monitored
d. Water Quality monitored in August '96	_Berth No.6,12
e. Water Quality monitored in September '96	_Berth No.12A,13A,13B,15
f. Water Quality monitored in October '96	_Berth No.12A,12B,13A,13B,17
g. Water Quality monitored in Novrmber '96	_Not Monitored
h. Water Quality monitored in December '96	_Berth No.5,6,13A,13B,15,17
i. Water Quality monitored in January '97	_Berth No.5,13A,13B,15,16, 17,18,20
j. Water Quality monitored February '97	_Berth No.2,6,7,12,13B,15

Source : Office of Pollution Control Cell, MBPT.

Table 23.3.2 Water Quality Results in Harbour Region of MBPT at Victoria Dock (May 1996 to Feb. 1997)

Sl. No	Parameters	Units	May	June	July	August	September	October	November	December	January	February
1	pH		7.89-7.95	7.4-7.6	7.3-7.8	7.2-7.7	7.07-7.73	6.98-7.4	7.35-7.9	7.44-7.97	7.16-7.44	7.06-7.27
2	Total suspended solids	mg/ l	-	-	-	-	109-1312	770-1010	745-1045	705-913	430-750	457-676
3	Total Dissolved solids	mg/ l	-	-	-	-	36815-5846	33450-41430	42000-46015	40339-64504	45455-48010	41030-42330
4	BOD	5 days 20C mg/ l	-	ND-7	ND-15.5	ND-9.5	6.5-9.5	-	-	-	-	-
5	COD	mg/ l	-	-	48-140	68-229	160	94-221	240-264	148-360	144-432	208-240
6	Oil & Grease	mg/ l	-	-	-	-	2.33	-	-	-	7.0-18	5.6-16.0
7	Turbidity	N.T.U	-	-	-	-	Sep-63	9.0-45	ND-4.7	5.0-10.0	2.0-5.0	1.0-5.0
8	Chlorides	as Cl mg/ l	21491-2898	12000-14500	9000-24000	9000-15000	13000-1700	14000-23500	23000-32000	17465-22954	18962-28942	19960-24950
9	Chlorine Residual	as Cl mg/ l		-	-	-			1.422-14.21	3.56-6.37	2.12-6.73	2.48-3.55
10	Sulphate	as SO4 mg/ l	2443-3080	2292-3480	1578-6702	1427-2270	1919-2520	2012.6-2822	1862-4232	2295-2277	2314-2052	2295-3040
11	Sulphide	as S mg/ l	-	.104-0.154	ND-2.06	0.52-2.75	ND-1.358	0.653-1.486	ND-0.26	ND-1.45	ND-0.81	ND-0.111
12	Phosphate	as PO4 mg/ l	ND-0.451	ND	ND-0.174	0.092-0.374	0.39-0.287	0.0497-0.464	ND-0.036	0.2-0.06	0.039-0.056	0.0085-0.712
13	Fluoride	as F mg/ l	-	9.88-13.83	ND-20.09	ND-5.929	-	5.92-15.81	4.61-12.51	3.62-16.79	0.805-4.19	3.24-4.15
14	Ammoniacal Nitrogen	as N mg/ l	-	4.447-4.794	1.32-8.74	1.7-3.99	-	4.656-5.812	0.169-0.925	0.417-6.68	ND-1.916	1.39-2.34
15	Total Nitrogen	asN mg/ l	-	-	-	-	4.014-5.98	-	6.47-12.83	7.52-13.6	-	10.47-11.7
16	Nitrate	as NO3 mg/ l	-	-	-	-	-	-	-	2.49-3.007	0.88-1.41	0.563-0.883
17	Nitrite	as NO2 mg/ l	-	-	-	-	-	-	-	0.394-0.48	0.001-0.031	0.011-0.022
18	Acidity	mg/ l	-	-	-	-	-	-	10.0-20	10.0-20.0	22-32	14-26
19	Alkalinity	mg/ l	-	-	-	-	-	-	108-140	133-193	124-148	124-140
20	Arsenic	as As mg/ l	-	-	-	-	-	-	-	-	-	-
21	Cadmium	as Cd mg/ l	ND	.5-1.1	ND-0.5	ND	ND	-	0.1	-	ND	ND-0.4
22	Chromium hexavalent	as Cr+6 mg/ l	2.4-2.88	0.417-0.685	ND-0.467	ND-0.71	ND	1.2-1.5	0.4-0.7	0.143-0.7	0.456-0.571	0.001-0.194
23	Copper	as Cu mg/ l	0.5-0.9	0.335-0.61	0.173-0.311	0.067-0.156	0.046-0.647	0.248-0.289	0.082-0.216	0.009-0.168	0.068-0.1	0.129-0.226
24	Iron	as Fe mg/ l	ND	ND-0.09	ND-0.34	0.01-0.37	-	-	ND-0.1	-	0.021-0.098	-
25	Lead	as Pb mg/ l	-	0.144-1.89	ND-1.31	ND	ND-1.4	-	ND-0.276	ND-0.045	ND	ND-0.196
26	Zinc	as Zn mg/ l	ND-0.1	0.1-0.6	ND	ND	0.1-0.8	-	0.1-0.3	-	ND	ND-0.2

Note : (1) '-' indicates parameter not monitored/ analysed.

(2) ND Means Not Detected

(3)

a. Water Quality monitored in May '96 _Berth No.12,15, B Shed

b. Water Quality monitored in June '96 _Berth No. 2,4,

c. Water Quality monitored in July '96 _Berth No. 2,4,6,9,12,15,C shed, F shed, M shed, P shed

d. Water Quality monitored in August '96 _Berth No. 6,9,12,15,C shed, F shed, M shed, P shed

e. Water Quality monitored in September '96 _Berth No.4,8,9,10,15

f. Water Quality monitored in October '96 _Berth No6,7,8,9,14

g. Water Quality monitored in November '96 _Berth No.2,4,6,8,12,14H, wall, 16

h. Water Quality monitored in December '96 _Berth No.9,10,12,14,15,B shed, M shed

i. Water Quality monitored in January '97 _Berth No.9,10,12,14,15

j. Water Quality monitored in February '97 _Berth No.8,13,14

Source : Office of the Pollution Control Cell, MBPT.

Table 23.3.3 Water Quality Results in Harbour Region of MBPT at Prince's Dock (May 1996 to Feb. 1997)

Sl. No	Parameters	Units	May	June	July	August	September	October	November	December	January	February
1	pH		7.55-7.81	7.6	-	-	-	-	7.3-7.8	7.75	7.29-7.7	7.2-7.45
2	Total suspended solids	mg/ l	-	-	-	-	-	-	720-1060	-	605-740	385-701
3	Total Dissolved solids	mg/ l	-	-	-	-	-	-	39260-4557	-	45845-48270	41070-43061
4	BOD	5 days 20 C mg/ l	-	-	-	-	-	-	-	-	-	-
5	COD	mg/ l	-	-	-	-	-	-	232-296	-	256-432	176-448
6	Oil & Grease	mg/ l	-	1.208	-	-	-	-	-	-	9.0-17	3.2-13.2
7	Turbidity	N.T.U	-	-	-	-	-	-	2.0-11.0	-	3.0-6.0	1.0-7.0
8	Chlorides	as Cl mg/ l	19992-2249	24492	-	-	-	-	18500-2900	18962	20958-21457	16966-29940
9	Chlorine Residual	as Cl mg/ l		-	-	-	-	-	4.26-14.22	-	2.836-3.545	2.12-3.19
10	Sulphate	as SO4 mg/ l	2832-2907	3221	-	-	-	-	2257-3574	2332	2276-2615	2264-2934
11	Sulphide	as S mg/ l	-	-	-	-	-	-	ND-1.36	0.35	ND	ND-0.30
12	Phosphate	as PO4 mg/ l	0.042-0.077	0.55	-	-	-	-	0.013-0.036	-	0.046-0.058	0.0205-0.624
13	Fluoride	as F mg/ l	-	-	-	-	-	-	2.63-16.47	5.27	ND-0.096	3.546-7.57
14	Ammoniacal Nitrogen	as N mg/ l	-	10.95	-	-	-	-	0.18-1.103	0.275	ND	1.078-2.343
15	Total Nitrogen	asN mg/ l	-	-	-	-	-	-	7.15-15.19	10.97	-	10.17-12.88
16	Nitrate	as NO3 mg/ l	-	-	-	-	-	-	-	-	1.23-1.83	0.054-0.8535
17	Nitrite	as NO2 mg/ l	-	-	-	-	-	-	-	-	0.008-0.022	0.0118-0.0673
18	Acidity	mg/ l	-	-	-	-	-	-	12.0-22.0	10	26-28	10.0-24.0
19	Alkalinity	mg/ l	-	-	-	-	-	-	120-164	195	140-144	120-149
20	Arsenic	as As mg/ l	-	-	-	-	-	-	-	-	-	-
21	Cadmium	as Cd mg/ l	-	ND	-	-	-	-	ND-0.1	-	ND	ND-0.3
22	Chromium hexavalent	as Cr+6 mg/ l	2.4	0.38	-	-	-	-	0.4-0.7	0.875	0.537-0.592	0.154-0.206
23	Copper	as Cu mg/ l	0.6-0.7	1.037	-	-	-	-	0.106-0.184	0.304	0.08-0.082	0.097-0.149
24	Iron	as Fe mg/ l	ND	1.2	-	-	-	-	ND-0.1	-	0.049-0.061	-
25	Lead	as Pb mg/ l	ND	-	-	-	-	-	ND-0.086	0.036	ND	ND-0.037
26	Zinc	as Zn mg/ l	0.1	-	-	-	-	-	0.1-0.2	-	ND	ND-0.2

Note : (1) '-' indicates parameter not monitored/ analysed.

(2) ND Means Not Detected

(3)

a.	Water Quality monitored in May '96	_B Shed, M shed
b.	Water Quality monitored in June '96	_M shed only
c.	Water Quality monitored in July '96	_Not Monitored
d.	Water Quality monitored in August '96	_Not Monitored
e.	Water Quality monitored in September '96	_Not Monitored
f.	Water Quality monitored in October '96	_Not Monitored
g.	Water Quality monitored in November '96	_B shed, C shed, D shed, E shed, P shed, F shed, M shed, U shed.
h.	Water Quality monitored in December '96	_C shed only
i.	Water Quality monitored in January '97	_B shed, M shed
j.	Water Quality monitored February '97	_B shed, C shed, F shed, Q shed

Source : Office of the pollution control cell MBPT

Table 23.3.4 Water Quality Results in Harbour Region at Other Locations

Sl. No	Parameters	Units	Ballard Pier Extension Feb 97	No. 1 Tanker Anchorage Dec 9	NPP Jetty Dec-96	Sassoon Dock Feb 97				Fish Jetty Feb 97
						Outer	Inner	Bot.Garden	Mukesh Mill	
1	pH		7.55	7.3	7.52	7.8	7.99	8.01	8.1	7.65
2	Total suspended solids	mg/ l	689	1042	784	824	1023	883	1034	519
3	Total Dissolved solids	mg/ l	40975	44629	45973	44355	45640	43265	44490	43790
4	DO	mg/ l	-	-	-	5.3	4.4	5.8	2.7	5.7
5	COD	mg/ l	480	-	384	192	544	464	400	112
6	Oil & Grease	mg/ l	-	-	-	-	12.2	-	2	4.2
7	Turbidity	N.T.U	-	55	9	9	20	19	18	8
8	Chlorides	as Cl mg/ l	22954	20958	19960	26946	25449	23952	24451	19451
9	Chlorine Residual	as Cl mg/ l	2.84	4.62	6.76	2.127	3.191	2.482	2.482	2.84
10	Sulphate	as SO4 mg/ l	2953	2539	2332	2803	2840	2724	2972	2784
11	Sulphide	as S mg/ l	0.089	1.68	ND	0.1	0.245	0.016	0.015	0.033
12	Phosphate	as PO4 mg/ l	0.247	0.181	0.159	0.4359	0.3391	0.1345	0.701	0.735
13	Fluoride	as F mg/ l	7.25	4.94	11.52	6.609	4.35	6.28	8.54	0.831
14	Ammoniacal Nitrogen	as N mg/ l	1.02	5.65	0.332	1.19	8.13	1.213	11.36	11.42
15	Total Nitrogen	asN mg/ l	11.96	12.95	12.64	6.511	44.04	-	34.23	-
16	Nitrate	as NO3 mg/ l	0.7709	2.643	2.62	0.188	0.785	0.138	0.861	0.3527
17	Nitrite	as NO2 mg/ l	0.0218	0.035	0.405	-	-	-	-	-
18	Acidity	mg/ l	20	14	22	10	22	26	20	28
19	Alkalinity	mg/ l	152	139	151	144	180	152	160	144
20	Arsenic	as As mg/ l	-	-	-	-	-	-	-	-
21	Cadmium	as Cd mg/ l	ND	-	-	ND	ND	ND	ND	ND
22	Chromium hexavalent	as Cr+6 mg/ l	0.206	0.663	0.663	0.282	0.0027	0.284	0.287	0.259
23	Copper	as Cu mg/ l	0.096	0.071	0.13	0.197	0.133	0.13	0.123	0.109
24	Iron	as Fe mg/ l	-	-	-	-	-	-	-	-
25	Lead	as Pb mg/ l	ND	ND	ND	0.02	0.026	0.023	ND	ND
26	Zinc	as Zn mg/ l	ND	-	-	0.1	ND	ND	ND	ND

Note : (1) '-' Parameter not monitored
(2) ' ND' Indicates Not Detectable.

Source : Office of Pollution Control Cell, MBPT.

Table 23.3.4a Water Quality Results in Harbour Region

Sl. No	Parameters			Location 1			Location 2			Location 3			Location 4			Location 5			Location 6		
				MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG
1	Temperature	^{0}C	S	29	27	28	27	27	27	27	27	27	28.0	26.8	27.5	29.0	26.5	27.4	28.8	26.5	27.4
			B	29	27	28	27	27	27	27	27	27	27.8	26.8	27.2	28.5	26.9	27.4	28	26.2	27
2	pH		S	8	8	8	8	8	8	8	8	8	7.8	7.6	7.7	7.9	7.7	7.8	7.7	7.7	7.7
			B	8	8	8	8	8	8	8	8	8	7.9	7.7	7.8	7.9	7.8	7.9	7.7	7.7	7.7
3	Total suspended solids	mg/l	S	36	26	31	56	56	56	35	35	35	88	23	56	57	31	59	34	31	33
			B	179	130	155	390	55	226	93	59	76	26	25	26	23	23	23	18	18	18
4	Salinity	ppt	S	33	32	32	33	33	33	33	32	33	35.4	34.2	34.9	35.2	34.5	35	38.7	33.5	35.6
			B	33	32	32	33	33	33	33	32	33	35.4	34.6	35	35.2	34.1	35	35.7	33.5	35
5	DO	mg/l	S	5	3	4	3	3	3	5	5	5	6.7	3.3	4.5	9.5	4.6	7.4	6	2.5	4.6
			B	5	4	5	5	4	5	4	3	4	5.7	1	3.9	9.5	4.3	7.5	6	4.1	4.6
6	BOD	mg/l	S	3	1	2	3	3	-	4	3	4	1.3	0.3	0.8	3.6	1	2.3	1.3	1.2	1.3
			B	2	2	2	4	3	-	3	3	-	0.6	0.3	0.5	1.3	1.2	1.2	0.6	0.3	0.5
7	Phosphate	μg/l	S	290	210	227	179	145	162	204	169	187	423	139	262	92	63	75	211	127	156
			B	254	213	234	211	200	206	201	155	178	428	166	281	88	53	70	163	76	126
8	Nitrate	μg/l	S	382	199	314	435	424	430	403	383	393	508	161	320	237	152	198	162	129	141
			B	297	226	254	467	458	463	393	305	349	424	152	295	257	196	214	215	109	152
9	Nitrite	μg/l	S	106	8	46	103	81	92	74	64	69	81	29	55	30	18	25	84	67	77
			B	23	2	7	71	62	67	69	66	68	52	18	29	13	6	10	99	56	73
10	Ammoniacal Nitrogen	μg/l	S	37	16	29	99	98	99	26	20	23	27	3	11	9	4	7	12	2	6
			B	40	23	29	98	22	60	33	26	30	13	1	6	11	7	9	16	10	13
11	Phenols	μg/l	S	39	12	26	61	61	61	32	32	32	34	34	34	81	41	61	24	11	18
12	Petroleum Hydrocarbon	μg/l	S	5.8	4.5	5.2	5.6	5.6	5.2	5.2	5.2	5.2	10.1	10.1	10.1	10.5	6.1	8.3	17.4	12.6	15

contd------

Table 23.3.4a2 Water Quality Results in Harbour Region

Location 7			Location 8			Location 9			Location 10			Location 11			Location 12			Location 13		
MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG
29	27	27.6	28	27	28	28.5	28	28.3	29.2	29	29.1	27	26	27	28.5	28.4	28.5	28.3	28	28.2
28.5	26.8	27.6	28	28	28	27.2	27	27.1	28.2	28.2	28.2	27	25.9	26.5	28.3	27.5	27.9	27.9	27	27.5
8	7.7	7.9	7.8	7.8	7.8	7.8	7.8	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.8	7.9
8.1	7.9	8	7.8	7.8	7.8	7.9	7.8	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9
26	25	26	23	23	23	18	18	18	31	31	31	97	97	97	29	29	29	42	42	42
20	20	20	32	32	32	19	19	19	93	93	93	110	110	110	48	48	48	271	271	271
35.6	34.5	35.1	35.2	34.1	34.7	35.2	34.8	35	34.8	34.8	34.8	35.4	35	35.2	34.6	34.2	34.4	34.6	33.9	34.3
35.9	34.8	35.3	35.2	34.8	35	35.2	34.8	35	34.5	34.1	34.3	35.4	35	35.2	35.4	34.6	35	34.2	33.9	34.1
7.7	5.4	6.5	3.5	1.9	2.7	4.4	3.2	3.8	3.9	3.6	3.8	3.6	3.3	4.5	5.9	4.3	5.1	5.6	2.6	4.1
8.3	5.4	6.9	5.7	3.2	4.5	5.4	4.7	5.1	3.6	2.9	3.3	5.6	5.3	5.5	5.9	5.9	4.9	6.3	5.9	6.1
3.8	2.6	3.2	0.3	0.3	-	1.3	1.3	-	-	-	-	2	2	2	2.6	2.6	2.6	2.3	2.3	2.3
3.2	3.2	3.2	2.5	2.5	2.3	1.6	1.6	1.6	-	-	-	2.6	2.6	2.6	2	2	2	1	1	1
85	30	65	114	110	112	133	130	132	89	89	89	197	155	176	114	110	112	110	96	103
44	26	36	93	77	85	111	104	108	92	91	92	165	159	162	130	120	125	119	102	111
166	84	135	167	159	163	16	12	14	157	139	148	202	193	198	232	144	188	190	185	188
149	77	120	230	217	224	77	50	64	169	168	169	282	236	259	261	198	230	208	205	207
7	4	5	22	21	22	6	6	6	10	10	10	4	3	4	5	5	5	4	4	4
7	5	6	17	13	15	6	5	6	10	10	10	4	4	4	5	5	5	5	4	5
15	9	13	11	11	11	12	9	11	10	9	10	11	10	11	7	6	7	10	9	10
15	9	12	11	11	11	17	14	16	11	9	10	10	9	10	9	8	9	9	9	9
19	19	19	34	34	34	43	43	43	49	49	49	ND	ND	ND	42	42	42	21	21	21
10.2	7.7	9	1.3	1.3	1.3	1.5	1.5	1.5	2.8	2.8	2.8	14.2	14.2	14.2	5	5	5	19.6	19.6	19.6

Note : 1. '-' indicates Not Monitored
2. ND Means Not Detectable
3. Water Quality parameters mentioned are analysed
Other parameters are not monitored.

Source : MBPT / NIO Report, April 1997.

Table 23.3.4b Water Quality Results in Docks and Bunders Region during Nov. - Dec 1996

Sl. No	Parameters			Indira Dock			Victoria Dock			Prince's Dock			Sasson Dock			Appolo Bunder			Naval Dock			Fish Jetty		
				MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG
1	Temperature	°C	S	29.5	27.8	28.2	28.5	27.8	28	28	27.5	27.8	27	26.3	26.7	27	24.5	25.8	26.9	26	26.5	28.5	26.5	27.5
			B	28.0	26.8	27.6	28	27.5	27.8	27.8	27	27.4	27.3	26.3	26.7	26.2	ND	-	26.9	26.5	26.7	28.1	26.6	27.4
2	pH		S	7.7	7.4	7.58	7.7	7.5	7.57	7.5	7.4	7.45	7.8	7.6	7.7	7.8	7.8	7.8	7.6	7.4	7.5	7.8	7.3	7.55
			B	7.7	7.6	7.68	7.6	7.6	7.6	7.6	7.5	7.55	7.7	7.6	7.65	7.9	-	-	7.8	7.6	7.7	7.7	7.5	7.6
3	Total suspended solids	mg/l	S	34	17	23	25	20	22.8	22	20	20.7	31	26	28.5	23	23	23	37	15	26	50	27	38.5
			B	37	19	27.5	127	17	46	30	17	22	32	31	31.5	30	-	-	45	28	36.5	110	19	64.5
4	Salinity	ppt	S	34.8	32.2	34	34.8	34.1	34.5	34.8	34.1	34.5	34.8	34.8	34.8	34.5	33.7	34.1	34.5	34.5	34.5	34.1	33.7	33.9
			B	34.8	32.9	33.9	34.8	34.1	34.5	35.2	34.5	34.8	34.8	34.1	34.5	34.5	-	-	35.6	34.5	35.1	34.1	33.7	33.9
5	DO	mg/l	S	4.7	3.7	4.1	4.7	3	3.92	2.7	1.3	2.2	4.1	2.9	3.5	3.5	2.9	3.2	3.8	2.3	3.05	2	1.7	1.85
			B	4.7	2.4	3.9	3.4	2	2.62	2.4	1.3	1.85	5.2	3.8	4.5	5.2	-	-	5.2	4.9	5.05	2	2	2
6	BOD	mg/l	S	3.2	0.7	1.78	2.7	1.6	1.96	-	-	-	2.9	-	-	-	-	-	-	-	-	-	-	-
			B	1.8	1.1	1.44	-	-	-	-	-	-	-	0.8	-	1.1	-	-	1.4	0.4	0.9	-	-	-
7	Phosphate	ug/l	S	175	146	164	189	178	185	205	164	186	240	160	200	204	184	194	392	215	304	283	246	265
			B	200	171	180	221	198	206	196	168	179	224	195	210	195	-	-	736	378	557	281	261	271
8	Nitrate	ug/l	S	204	140	179	403	230	290	493	163	336	185	167	176	235	141	188	399	343	371	404	373	389
			B	226	145	184	415	232	333	408	202	322	335	136	236	108	-	-	346	234	290	476	360	418
9	Nitrite	ug/l	S	35	11	24.1	112	107	109	115	105	110	127	94	111	124	123	124	128	111	120	130	126	128
			B	14	6	8.3	119	116	118	116	113	115	126	123	125	126	-	-	130	114	122	127	125	126
10	Ammoniacal Nitrogen	ug/l	S	51	9	22.6	83	22	61.5	105	53	69	43	15	29	41	32	36.5	56	8	32	93	90	91.5
			B	21	8	13.8	54	29	43.8	90	51	70.5	21	14	17.5	58	-	-	47	45	46	92	91	91.5
11	Phenols	ug/l	S	44	12	22.8	26	9	19.5	19	ND	15.7	ND	ND	ND	ND	-	-	-	ND	-	7	ND	3.5
12	Petroleum HydroCarbon	ug/l	S	34	7.2	16.5	29.5	18.5	24.4	14.8	7.7	9.85	9.6	8.6	9.1	8.8	8.7	8.75	11.5	9.1	10.3	49.1	-	49.1

*

a. At Indira dock Sampling done during Spring tide and surface depth varies from 9 to 10.5 m on 30.11.96
b. At Victoria dock Sampling done during Spring tide and surface depth varies from 5 to 6.5 m on 2.12.96
c. At Prince's dock Sampling done during Spring tide and surface depth varies from 6 to 6.5 m on 2.12.96
d. At Sassoon dock Sampling done during ebb tide and surface depth varies from 3.5 to 4 m on 5.12.96
e. At Appolo Bunder Sampling done during ebb tide and surface depth varies from 2 to 45 m on 5.12.96
f. At Naval dock Sampling done during ebb tide and surface depth varies from 9 to 10 m on 5.12.96
g. At Fish Jetty Sampling done during Spring/ebb tide and surface depth varies from 2 to 3.5 m on 3.12.96
h. At Mazgaon dock Sampling done during Spring/ebb tide and surface depth varies from 2 to 2.5 m on 3.12.96
i. At Darukhana dock Sampling done during Spring/ebb tide and surface depth varies from 1 to 5 m on 5.12.96
j. At Lakdi Bunder Sampling done during Spring/ebb tide and surface depth varies from 2 to 2.5 m on 3.12.96
k. At Coal Bunder Sampling done during Spring/ebb tide and surface depth varies from 1 to 1.5 m on 3.12.96
l. At Brick Bunder Sampling done during Spring/ebb tide and surface depth at 3 m on 3.12.96
m. At Haji Bunder Sampling done during ebb tide and surface depth varies from 0.5 to 1 m on 4.12.96
n. At Timber Pond Sampling done during ebb tide and surface depth varies from 1 to 1.5 m on 4.12.96
o. At Sewree Mud Flat Sampling done during ebb tide and surface depth varies from 1 to 10 m on 4.12.96

Note : 1. '-' indicates Not Monitored
2. ND Means Not Detectable
3. Water Quality parameters mentioned are analysed Other parameters are not monitored.
4. "S" for at Surface, "B" for at Bottom

Source : MBPT / NIO Report, April 1997.

Table 23.3.4b2 Water Quality Results in Docks and Bunders Region during Nov. - Dec 1996

Sl. No	Parameters			Mazgaon Dock			Darukhana			Lakdi Bunder			Coal Bunder		
				MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG
1	Temperatur	°C	S	28.5	26.5	27.5	26.7	25.5	26.1	28.5	28.1	28.3	28	27	27.5
			B	28	27	27.5	25.6	-	25.6	28	27.9	27.95	-	-	-
2	pH		S	7.5	7.3	7.4	7.1	6.9	7	7.2	6.8	7	7.4	7.4	7.4
			B	7.5	7.5	7.5	7.3	-	7.3	7.2	6.9	7.05	-	-	-
3	Total suspe	mg/l	S	19	17	18	30	16	23	32	13	22.5	17	17	17
			B	16	12	14	17	-	17	721	32	376.5	-	-	-
4	Salinity	ppt	S	34.5	34.1	34.3	37.5	34.1	35.8	34.8	34.1	34.45	34.8	34.5	34.65
			B	34.8	34.5	34.65	33.7	-	33.7	35.2	33.7	34.45	-	-	-
5	DO	mg/l	S	6.1	2	4.05	4.7	2.9	3.8	ND	ND	ND	4.4	3.4	3.9
			B	4.7	2.7	3.7	2.9	-	2.9	0.2	ND	0.1	-	-	-
6	BOD	mg/l	S	-	-	-	3.5	-	3.5	-	ND	ND	3.4	-	3.4
			B	-	-	-	-	-	-	-	ND	ND	-	-	-
7	Phosphate	µg/l	S	364	315	339.5	315	276	295.5	1090	463	776.5	416	383	399.5
			B	315	306	310.5	316	-	316	951	444	697.5	-	-	-
8	Nitrate	µg/l	S	438	320	379	550	347	448.5	383	124	253.5	346	277	311.5
			B	284	225	254.5	294	-	294	504	229	366.5	-	-	-
9	Nitrite	µg/l	S	130	126	128	127	126	126.5	15	10	12.5	127	127	127
			B	127	125	126	125	-	125	227	7	117	-	-	-
10	Ammoniac	µg/l	S	43	28	35.5	86	63	74.5	107	32	69.5	73	73	73
			B	57	41	49	125	-	125	135	99	117	-	-	-
11	Phenols	µg/l	S	12	ND	6	81	ND	40.05	11	11	11	ND	ND	ND
12	Petroleum	µg/l	S	24.1	ND	12.05	28.8	15.9	22.35	21.7	-	21.7	14.9	-	14.9

Sl. No	Parameters			Brick Bunder			Haji Bunder			Timber Pond			Sewree Mud Flat			Sewree Mud Flat		
				MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG	MAX	MIN	AVG
1	Temperatur	°C	S	28	26.6	27.3	27	26	26.5	27	27	27	27.5	27	27.25	27.5	27	27.25
			B	27.5	27	27.25	-	-	-	-	-	-	-	-	-	-	-	-
2	pH		S	7.4	7.2	7.3	7.7	7.3	7.5	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6
			B	7.5	7.4	7.45	-	-	-	-	-	-	-	-	-	-	-	-
3	Total suspe	mg/l	S	16	15	15.5	38	17	27.5	31	29	30	29	28	28.5	29	28	28.5
			B	18	15	16.5	-	-	-	-	-	-	-	-	-	-	-	-
4	Salinity	ppt	S	34.5	34.1	34.3	34.3	33.1	33.7	33.5	33.5	33.5	34.6	34.6	34.45	34.6	34.6	34.45
			B	34.1	33.3	33.7	-	-	-	-	-	-	-	-	-	-	-	-
5	DO	mg/l	S	3.7	1.4	2.55	5.5	2.9	4.2	8.1	7.9	8	7.6	7.3	7.45	7.6	7.3	7.45
			B	3	2.7	2.85	-	-	-	-	-	-	-	-	-	-	-	-
6	BOD	mg/l	S	-	-	-	2.9	2.2	2.55	3.9	3	3.45	2.9	0.6	1.75	2.9	0.6	1.75
			B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	Phosphate	µg/l	S	476	385	430.5	1361	429	895	1361	1150	1255.5	1361	1256	1308	1361	1256	1308
			B	357	322	339.5	-	-	-	-	-	-	-	-	-	-	-	-
8	Nitrate	µg/l	S	217	2.9	109.95	320	379	349.5	609	593	601	608	606	607	608	606	607
			B	355	96	225.5	-	-	-	-	-	-	-	-	-	-	-	-
9	Nitrite	µg/l	S	127	126	126.5	11	6	8.5	11	10	10.5	8	7	7.5	8	7	7.5
			B	127	126	126.5	-	-	-	-	-	-	-	-	-	-	-	-
10	Ammoniac	µg/l	S	110	83	96.5	57	1	29	4	1	2.5	68	165	66.5	68	165	66.5
			B	75	58	66.5	-	-	-	-	-	-	-	-	-	-	-	-
11	Phenols	µg/l	S	21	7	14	71	ND	35.5	ND	ND	ND	ND	ND	ND	ND	ND	ND
12	Petroleum	µg/l	S	42.56	-	42.56	14.2	5.3	9.75	9.7	7.7	8.7	16	5.8	10.9	16	5.8	10.9

Table 23.3.5 Analysis Report of Ambient Air Quality in MBPT Premises

Sl. No.	Name of sampling location	SO2 concentration in μ g/M3										NOx concentration in μ g/M3									
		Apr-96	May-96	Jun-96	Jul-96	Aug-96	Sep-96	Oct-96	Nov-96	Dec-96	Jan-97	Apr-96	May-96	Jun-96	Jul-96	Aug-96	Sep-96	Oct-96	Nov-96	Dec-96	Jan-97
*1	Fire float station (P.Dk)	346.62	9.17	830.54	36.68	8.38	-	-	-	-	-	15.04	8.46	15.66	16.92	15.85	-	-	-	-	-
**2	Sagar Darshan	-	42.70	-	135.98	2.62	-	54.36	85.58	36.15	43.23	-	13.72	-	17.39	15.04	-	-	28.51	7.52	10.57
*3	M-Shed P.Dk	-	-	41.92	202.78	27.06	-	62.88	96.54	-	-	-	13.16	14.57	15.04	15.03	-	19.97	33.18	-	-
*4	HDD P.S. (I.Dk)	-	-	-	259.82	-	-	-	-	-	-	-	-	-	14.57	-	-	-	-	-	-
*5	Fire float station	-	-	-	91.7	-	-	-	47.48	-	39.3	-	-	-	13.16	-	-	18.42	16.54	-	1.88
*6	MDD (P. Dk)	-	-	-	-	15.72	-	-	-	-	-	-	-	-	-	16.45	-	-	-	-	-
*7	Salvage Section (I Dk.)	-	-	-	-	7.86	-	-	-	-	44.54	-	-	-	-	15.51	-	-	-	-	5.64
*8	HDD (I. Dk)	-	-	-	-	21.62	53.17	32.75	-	36.75	29.94	-	-	-	-	19.27	15.92	18.93	-	7.97	5.64
*9	M.W. Dry Dock	-	-	-	-	-	-	43.36	-	-	-	-	-	-	-	-	26.7	23.96	-	-	-
*10	B.P.X.	-	-	-	-	-	-	-	99.56	49.78	38.32	-	-	-	-	-	-	-	35.77	-	11.28
*11	Ambedkar Bhavan	-	-	-	-	-	-	-	76.89	37.99	-	-	-	-	-	-	-	-	26.88	7.08	-
**12	Colaba Quarters (Sangam)	-	-	-	-	-	-	-	104.8	35.9	43.79	-	-	-	-	-	-	-	3572	-	11.28
***13	Mourtuary (MBPT) Hospital	-	-	-	-	-	-	-	-	-	38.52	-	-	-	-	-	-	-	-	-	7.65
***14	Shustrut (MBPT) Hospital	-	-	-	-	-	-	-	-	-	24.56	-	-	-	-	-	-	-	-	-	6.44

Note : (1) ---- Indicates No monitoring is carried out in the designated locations and MBPT Premises.

(2) * Indicates Industrial Area

** Indicates Residential and other Area

(3) ND - Not Detected

*** Indicates Sensitive Area.

Table 23.3.6 Ambient Air Quality Levels during September 1996 to February 1997 at about 10 km Radius Area

Sr. No.	Receptor Site	Code	SEPTEMBER 1996				OCTOBER 1996				NOVEMBER 1996				DECEMBER 1996			
			SO_2	NO_2	NH_3	SPM	SO_2	NO_2	NH_3	SPM	SO_2	NO_2	NH_3	SPM	SO_2	NO_2	NH_3	SPM
1	Colaba Transport House	AQ1	10	29	50	239	26	28	55	195	-	-	-	-	-	-	-	-
2	Worli Naka Municipal School	AQ2	12	53	24	-	16	35	61	191	32	66	88	275	-	-	-	-
3	Dadar Woolen Mill Lane	AQ3	8	42	37	-	13	22	90	206	-	-	-	-	36	55	97	366
4	Parel Nare Park Municipal School	AQ4	30	30	48	-	22	42	174	431	15	48	74	288	-	-	-	-
5	Sewree L.S.N. Engg. College	AQ5	7	10	24	-	-	-	-	-	34	31	87	210	-	-	-	-
6	Sion P.V.M.N. Sr. College	AQ6	7	37	68	-	11	26	70	294	36	66	97	323	-	-	-	-
7	Khar Municipal Dispensary	AQ7	15	29	39	264	29	47	64	304	24	54	80	326	38	96	87	505
8	Andheri N.M. Municipal School	AQ8	18	41	72	296	42	30	66	265	48	33	93	295	-	-	-	-
9	Chembur naka Municipal U.P. Scho	AQ9	17	22	67	-	22	16	99	258	21	44	102	219	63	75	100	497
10	Maravali Municipal School	AQ10	9	32	234	-	21	43	136	293	34	49	118	420	46	56	118	559
11	Anik Nagar Municipal School	AQ11	-	-	-	-	68	31	43	162	25	18	81	212	-	-	-	-
12	Mankhurd Municipal School	AQ12	6	20	34	169	13	16	40	175	9	30	57	186	-	-	-	-

Sr. No.	Receptor Site	Code	JANUARY								FEBRUARY							
			SO_2		NO_2		NH_3		SPM		SO_2		NO_2		NH_3		SPM	
			AV.	AX	AV.	AX	AV.	MAX.	AV.	MAX.	AV.	MAX.	AV.	MAX.	AV.	MAX.	AV.	MAX.
1	Colaba Transport House	AQ1	62	62	58	58	111	111	267	267	37	44	54	56	75	83	290	310
2	Worli Naka Municipal School	AQ2	62	105	60	94	134	201	392	595	57	140	70	117	118	182	334	496
3	Dadar Woolen Mill Lane	AQ3	30	42	63	77	98	110	260	351	26	35	37	45	89	115	343	445
4	Parel Nare Park Municipal School	AQ4	22	31	53	58	118	133	530	566	42	50	66	94	251	253	499	561
5	Sewree L.S.N. Engg. College	AQ5	47	48	62	65	87	94	288	304	58	62	54	54	104	107	381	454
6	Sion P.V.M.N. Sr. College	AQ6	49	67	59	102	103	116	398	486	49	67	48	66	100	116	439	581
7	Khar Municipal Dispensary	AQ7	33	50	62	96	89	103	413	610	34	48	45	64	94	123	428	589
8	Andheri N.M. Municipal School	AQ8	14	44	46	54	89	103	379	421	61	61	52	52	115	115	444	444
9	Chembur naka Municiapl U.P. Scho	AQ9	44	65	58	83	93	103	411	400	36	54	61	77	169	391	512	569
10	Maravali Municipal School	AQ10	14	18	52	58	118	131	478	525	52	52	77	77	169	169	579	579
11	Anik Nagar Municiapl School	AQ11	-	-	-	-	-	-	-	-	41	41	61	61	149	149	-	404
12	Mankhurd Municipal School	AQ12	29	38	37	47	106	123	406	511	13	13	41	41	45	45	317	322

Note :
1. Residential Zones : Colaba, Dadar, Khar
2. Industrial Zones : Rest of the Receptor oriented sites
3. Air Quality Monitoring equipment are established on the taraces of municipal schools.
4. '-' Indicates Air Quality Monitoring not carried out.
5. Frequency once in a WEEK
6. Units are in μ g/M^3

Source : Office of Dy. City Engineer (Civil) Environmental and Sanitation Projects, Municipal Corporation of Greater Mumbai

Table 23.3.7 Noise Level Survey at Different Places
at about 10 km Radius Area

Sr. No.	Name of the Monitoring Stations	Sound Level Reading in dB(A) in Daytime Nov. & December 1996
MUMBAI CITY REGION		
1	Navy Nagar Colaba	55-58
2	Colaba Bus Depot	60-62
3	Electric House	72-74
4	Lion Gate (Naval)	68-70
5	Fountain	80-82
6	Horniman Circle (Town Hall)	76-77
7	G.P.O.	75-80
8	V.T. Station	84-86
9	Patlon Road	85-88
10	Mohamad Ali Road	85-87
11	Byculla Bridge	72-76
12	Lalbaug	82-84
13	Metro Theater	74-76
14	marine Lines	78-80
15	Girgaon Chowpatty	70-76
16	Churchgate Station	70-76
17	Nariman Point	70-72
18	Jacob Circle	74-78
19	Bombay CentralJunction	84-86
20	Near Municipal Workshop	68-72
21	Tardeo (Ganga Jamuna)	75-80
22	Nana Chowk	82-84
23	Haji Ali	76-78
24	Breach Candy	70-74
25	Pedder Road	70-72
26	Worli Naka	78-80
27	Prabhadevi	80-82
28	Dadar (West)	80-82
29	Shivaji Park	60-72
30	Dadar Tilak Bridge	80-82
31	Dadar T.T.	80-84
32	Parel T.T.	75-80
33	Sewree	80-84
34	Reay Road	75-80
35	Mazgaon	68-70
36	Wadala	80-82

37	Hindu Colony	55-58
38	Five Garden	54-56
39	King's Circle	80-84
40	V.J.T.I.	70-72
41	Matunga (Central)	72-74
42	Dharavi	75-78
43	Elphinstone Bridge	78-82
44	Lower Parel Station	78-80
45	Mahim (J.T. Road)	78-78
46	Sion Hospital	85-87
47	Sion Station	75-85
48	Sion Circle	85-88
49	Sion Fort Road	68-70
50	Sion Koliwada Station Bridge	70-72
MUMBAI WESTERN SUBURBS		
1	Bandra (West) Bridge Junction	78-80
2	Near Bandra Theater	72-74
3	Linking Road	74-76
4	Khar S.V. Road	70-72
5	Santracruz (W), S.V. Road	74-78
6	Santacruz (W), S.V. Road	72-76
7	Near Air Port	82-86
8	Near Air Port with Aeroplane sound	90-94
MUMBAI EASTERN SUBURBS		
1	Chembur Naka	82-85
2	Chembur Colony	76-82
3	B.A.R.C.	75-80
4	Diamond Garden	68-75

Source : Office of Dy. City Engineer (Civil) Environmental & Sanitation Projects, Municipal Corporation of Greater Mumbai.

Table 23.3.8a Phytoplankton Information inside Mumbai Docks and Bunders NOV. - DEC. 1996

Location	Tide	Depths	Cell Count 10^3/lit	Total Genera	Major Genera	Pigments mg/ m^3	
						Chlorophyll	Phaeophytin
Indira Dock 1996/11/30	HL	S	30.8-225	5--9	*Bacteriastrum, Peridinium, Skeletonema Biddulphia, Rhizosolenia, Thalassiosira, Nitzschia,*	1.1-2.7	0.4-2.6
		B	9.7-39.1	3--8	*Thalassiosira, Bacteriastrum, Biddulphia, Nitzschia, Rhizosolenia, Peridinium, Coscinodiscus*	0.5-1.6	1.0-4.8
Victoria Dock 1996/12/2	HL	S	195.4-957	6--9	*Bacteriastrum, Peridinium, Skeletonema Nitzschia, Gyrosigma, Thalassiosira,*	2.1-10.7	0.5-2
		B	50.4-114.8	7--8	*Bacteriastrum, Peridinium, Skeletonema Rhizosolenia, Thalassiosira, Nitzschia*	0.5-1.6	0.3-3
Prince's Dock 1996/12/2	HL	S	89.3-206.8	7--9	*Bacteriastrum, Peridinium, Skeletonema Thalassiosira, Nitzschia*	0.5-2.7	0.7-3.0
		B	32-197.5	4--6	*Bacteriastrum, Peridinium, Skeletonema Thalassiosira, Nitzschia*	1.1	0.6-3.0
Sassoon Dock 1996/12/5	EB	S	85.2-92	6--10	*Bacteriastrum, Peridinium, Skeletonema Nitzschia*	0.5-1.6	5.4-6.9
		B	38.8-128	7--10	*Gyrosigma, Peridinium, Skeletonema Thalassiosira, Nitzschia*	1.1-1.6	1.4-1.5
Appolo Bunder 1996/12/5	EB	S	58.2-182.8	9	*Bacteriastrum, Peridinium, Skeletonema Coscinodiscus, Rhizosolenia, Thalassiosira,*	2.7-4.8	1.4-2.3
		B	27.2	11	*Peridinium, Skeletonema Nitzschia, Rhizosolenia*	1.1	1.5
Naval Dock 1996/12/5	EB	S	146.3-422.7	7--10	*Bacteriastrum, Peridinium, Skeletonema Coscinodiscus, Rhizosolenia*	7.5-15.5	0.6-0.7
		B	29.5-198	10--11	*Pleurosigma, Skeletonema, Chaetoceros Nitzschia, Rhizosolenia*	1.6	1.4-1.8

contd-------

Fish Jetty 1996/12/2	EB FL	S	119.2-284	9--12	*Bacteriastrum, Peridinium, Skeletonema Rhizosolenia, Nitzschia*	3.7-9.1	2.1-2.2
		B	168-204	8--12	*Bacteriastrum, Peridinium, Skeletonema Coscinosira, Rhizosolenia*	2.1-5.9	2.3
Mazagon Dock 1996/12/3	EB FL	S	133-844.8	7--9	*Bacteriastrum, Peridinium, Skeletonema Rhizosolenia, Nitzschia*	2.1-29.4	0.5-3.5
		B	268.8-343.6	8--11	*Bacteriastrum, Peridinium, Skeletonema Rhizosolenia, Oscillatoria*	3.7-9.6	0.2-1.5
Dharukhana 1996/12/5	EB FL	S	417.9-603.4	7--12	*Bacteriastrum, Chaetoceros, Skeletonema Rhizosolenia, Thalassiosira*	9.6-28.8	0.7-2.7
		B	370.2	8	*Bacteriastrum, Chaetoceros, Skeletonema Rhizosolenia,*	6.4	1.8
Lakdi Bunder 1996/12/3	EB FL	S	8.0-88	5--11	*Peridinium, Chaetoceros, Skeletonema Nitzschia, Pleurosigma*	1.6-2.1	1.2-5.1
		B	37.8-161.2	6--13	*Bacteriastrum, Nitzschia, Skeletonema Rhizosolenia, Thalassiosira, Navicula Stauroneis*	2.1-2.7	2.6-3.5
Coal Bunder 1996/12/3	EB FL	S	268-596	10--13	*Bacteriastrum, Nitzschia, Skeletonema Rhizosolenia, Thalassiosira, Chaetoceros*	6.9-8.0	0.6-2.0
Brick Bunder 1996/12/3	EB FL	S	139.2-184.8	8--12	*Peridinium, Rhizosolenia, Skeletonema Bacteriastrum, Nitzschia*	2.7-6.9	1.3-1.8
		B	114-310.8	10--13	*Oscillatoria, Nitzschia, Skeletonema Rhizosolenia, Thalassiosira*	2.1-5.9	0.9-2.7
Hay Bunder 1996/12/4	EB FL	S	319.7-6358	9--12	*Bacteriastrum, Skeletonema Rhizosolenia, Thalassiosira, Chaetoceros*	9.1-93.4	6.4-9.2
Haji Bunder 1996/12/4	EB	S	1858.6-10426	9--12	*Bacteriastrum, Skeletonema Rhizosolenia, Peridinium, Chaetoceros*	23-135.6	3.4-14.8
Timber Pond 1996/12/4	EB	S	4326-4342.8	11--12	*Bacteriastrum, Skeletonema Rhizosolenia, Anocystis, Chaetoceros*	53.4-61.9	8.3-10.2
Sewri mud flat 1996/12/4	EB	S	3321.2-4137	10--11	*Bacteriastrum, Skeletonema Rhizosolenia, Thalassioria, Chaetoceros Surirella*	42.7-48.1	5.8-12.2

Source : MBPT / NIO Report, April 1997

Table 23.3.8b Zooplankton and Macrobenthic Information inside Mumbai Docks and Bunders (Nov. - Dec. 1996)

Location	Zooplankton Information				Macrobenthic Information		
	Tide	Biomass ml/100m³	Total Groups	Population No./ 100m³	Biomass g/ml	Population No./ml	Total Groups
Indira Dock 1996/11/30	FL	0.09-0.5	3--10	52-1816	Nil-2.48	Nil-401	Nil-2
Victoria Dock 1996/12/2	FL	0.01-1.6	2--8	22-870	Nil-0.14	Nil-51	Nil-2
Prince's Dock 1996/12/2	FL	0.2-20.9	3--10	92-3823	0.01-0.70	13-250	1--2
Sassoon Dock 1996/12/5	EB	1.4-6.6	5--7	1220-1705	*	*	*
Appolo Bunder 1996/12/5	EB	0.2-0.7	8--13	734-1725	*	*	*
Naval Dock 1996/12/5	EB	0.2-0.8	8--9	302-559	*	*	*
Fish Jetty 1996/12/2	EB/FL	0.03	9	2815	8.57	1875	3
Mazagon Dock 1996/12/3	EB/FL	<0.01-0.03	1--4	1--34	4.59	1039	4
Dharukhana 1996/12/5	EB/FL	0.08-0.4	4--6	31-2473	*	*	*
Lakdi Bunder 1996/12/3	EB/FL	<0.01	1	5	0.08	3500	1
Coal Bunder 1996/12/3	EB/FL	<0.01-0.01	1--2	1--9	15.7	33588	2
Brick Bunder 1996/12/3	EB/FL	0.01-0.03	3--4	185-261	19.97	14526	2
Hay Bunder 1996/12/4	EB/FL	0.01-0.2	1--6	19-349	*	*	*
Haji Bunder 1996/12/4	EB	0.05-0.3	5--8	92-520	2.73	5838	3
Timber Pond 1996/12/4	EB	0.05-0.09	7	431-1414	6.59	2188	4
Sewri mud flat 1996/12/4	*	*	*	*	4.91	1675	4

Station	Zooplankton Information				Macrobenthic Information		
	Tide	Biomass ml/100m³	Total Groups	Population No./ 100m³	Biomass g/ml	Population No./ml	Total Groups
Location 1	FL	0.02-1.9	4--10	46-2135	*	*	*
	EB	2.7-10.5	9--11	522-2561			
Location 2	FL	*	*	*	5.2	3725	4
	EB	22.3--32	8--11	4556-7838			
Location 3	FL	39.4-69.6	9--12	2990-6625	0.32	563	5
	EB	*	*	*			
Location 4	FL	0.1-0.5	11--13	555-1882	0.49	351	3
	EB	6.6--11	10--13	1133-27766			
Location 5	FL	1.9-13.2	10--15	1109-7539	36.87	25689	6
	EB	3.8--39	14--16	9443-10849			
Location 6	FL	5.2	14	2770	6.5	800	1
	EB	10.3-33.8	12--17	3333-11205			
Location 7	FL	6.3	18	15465	9.25	7850	11
	EB	3.5-36.1	10--12	1977-22302			
Location 8	FL	*	*	*	*	*	*
	EB	16.7-18.2	15--16	69259-83649			
Location 9	FL	*	*	*	*	*	*
	EB	0.03-15	1--11	13-36568			
Location 10	FL	1.3-2.1	13--15	1685-2202	*	*	*
	EB	*	*	*			
Location 11	FL	*	*	*	*	*	*
	EB	7.2-10.2	12--13	12238-14594			
Location 12	FL	*	*	*	0.2	388	1
	EB	0.4-5.6	12--13	1543-3662			
Location 13	FL	4.2-6.4	13--14	7018-5949	0.26	438	2

Source : MBPT / NIO Report, April 1997

Note : * Indicates Sample not analysed by April 1997 by NIO

Table 23.3.9 Trawl Catch Data at Mumbai Harbour in Nov. - 1996

Area	Date	Tide	Catch kg/h	No. of Species	Species composition	Contribution (%)
Butcher Island	1996/11/16	spring	45.4	Fishes -8 Prawns-2 Others -2	Fishes: *Johnius glaucus, Johnius dussumeri, Lepturacanthus sacala Otolithus sp., Arius caelatus, Coilia dussumieri, Caranx para, Scomberomorus sp.* Prawns: *Parapenaeopsis stylifera, Penaus (Fenneropenaeus) indicus* Others: Squilla, Crabs.	Fish: Coilia (66.1) Sciaenids (22.0) Crabs (3.3) Prawns (1.1), Catfish (0.6) Prawns (1.1), Catfish (0.6)
Harbour	1996/11/27	spring	60.3	Fishes -8 Prawns-2 Others -2	Fishes: *Trichiurus haumela, Harpadon nehereus, Cynoglossus arel, Coilia dussumieri, Ilisha Sp., Pampus chinensis, Leiognathus splendens, Caranx sp., Clupea sp.* Prawns: *Parapenaeopsis stylefera, Parapenaeopsis sp., Solenocera crassicornis.* Others: *Polynemus polyphagus, Neptunus sanguinolentus, Squilla, Crabs.*	Prawns: (66.3) Crabs (24.9) Bombay Duck (1.7) Polynemid (1.7) Ribbon fish (0.5)

Source : MBPT/ NIO Report, April 1997

Table 23.3.10 Environmental Conditions in and around Port

Sr. No.	Area	Location/ Predominant Zone	Nature of Activity	Major Environmental problems	Mitigative Measures	Remarks
1.	Sassoon Dock Estate	Colaba (Industrial)	• Fishing harbour • Fish Storage • Ice Crushing • Fish processing • Non-fish activity Garages/godowns work	• Foul smell • Unhygienic conditions • solid waste generation • Dock area inadequate for 1200 trawlers/vessels • Heavy congestion & pollution • No traces of Green belt in the harbour estate • Unplanned out dated dilapidated building • Narrow gullies and Roads • Acute shortage of water supply	• Botanical Garden being developed as a buffer zone • Extension of fish harbour • Integrated development of old Sassoon dock and new reclaimed land • Widening of Roads • Provision of parking spaces • Removal of Non-fish based user to New fish harbour • Skiiming of dock water to reduce pollution • Stopping of fish processing to decrease solid waste generation	MBPT is taking action
2	Appollo Reclamation Estate	Colaba Estate (Residential) with commercial	Residential and commercial activities movement of motorised boat, launches. Tourist attraction for Gateway of India, Tajmahal Hotel as recreational facility.	• Land constraints • Poor state condition of ornamental garden • Inadequate landing facility for boat • Monumental building of Gateway of India likely to get damaged due to crowd and traffic	• Proper maintenance with trained horticulturist/Malis • Creation of new landing facility • Parking lot proposed • Development of ornamental garden as recreational ground	MBPT is looking into it.

Contd--------

Sr. No.	Area	Location/ Predominant Zone	Nature of Activity	Major Environmental problems	Mitigative Measures	Remarks
3.	Jamshedji Bunder	Residential	• Fishing harbour • slum dwellers' activities	• Unhygienic for poor sanitation • Unauthorised hutments (1000 Nos.) • Approach road encroachment	• Resettlement of slum dwellers proper sanitation • Reservation for public amenities • Slum Redevelopment scheme is to be taken	MBPT is looking into it
4.	Ballard Estate	Local Commercial	• Offices • Commercial	• No land potential • vacant plots occupied by slums • nuisance • Unauthorised parking	• Garden would be developed • Parking activity needs to be controlled • Recreational ground may be developed	MBPT has proposed in development plan.
5.	Mody Bay Estate	Local Commercial/ Mixed use	• Shipping • Commercial Offices • Hotels & Restaurants	• Need of essential amenity • Dilapidated condition of building • Solid waste generation • Acute shortage of water supply	• Provision of essential amenities	MCGB is looking into it.
6.	Main Docks	Indira Dock Princess Dock, Victoria Dock	• Maritime activity • Hazardous industrial activities storage/warehousing	• Air pollution/water pollution • Hindrance to the traffic • Congestion inside and outside the dock • Acute shortage of land for container handling	• Shifting of Godown of Custom Agents • Bufler area to be developed	Development Control Regulation is to be followed.

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Sr. No.	Area	Location/ Predominant Zone	Nature of Activity	Major Environmental problems	Mitigative Measures	Remarks
7.	Elphinstone Estate	Carnac Bunder (Commercial)	• Retail trade of iron - scrap • Godowns of grain merchants • Acute congestion due to narrow street • Transport operator garages • Wholesale market establishment	• Congestion and over crowding • Air pollution due to heavy traffic • Solid waste generation • Traffic Jams • Poor maintenance of Roads • Slum dwellers encroachment • Haphazardly parked trucks	• Shifting of wholesale godown • Proper maintenance of Roads • Shifting of transport operators garages • Proper Town planning scheme for elimination of traffic congestion	MRTP Act & D.C. Regulation are to be followed.
8.	Mallet Bunder Ferry Wharf	Bhaocha Dhakka (heavy industrial)	• Ferry wharf services • MBPT warehouse • CME's Workshop • Passenger Boar Services • Fishing activity • Container stuffing/ destuffing • Auction of uncleared cargo	• Heavy siltation problem • Limitation of space for fish - trawlers • Peeling of Prawn causes nuisance • Pollution due to fish pollution • Un-utilisation of vacant plot	• Avoid fish processing • Creation of cold storage • Buffer zone development • Open space is to be utilised in proper manner i.e. Dock/ fish traffic related activities etc.	Environment (Protections) Act is to be followed.
9.	Mazgaon Reclamation Estate	Brick Bunder Coal Bunder lakri Bunder Tank Bunder (heavy Industrial)	• Facilitate hardly up-country traffic of commodities wholesale iron and coal storage	• Air Pollution • Water Pollution • Poor Sanitation • Slum Development • Bunder are outdated for maritime trade • Untreated sewage discharg to Lakri Bunder	• Proper case to handle the commodities/ materials • Constructed wharf and water frontage is to be re-used potentially.	EPA rule/ D.C. Regulation are to be followed.

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Sr. No.	Area	Location/ Predominant Zone	Nature of Activity	Major Environmental problems	Mitigative Measures	Remarks
10.	Darukhana	Industrial / Residential	• Non-port based activities • Ship breaking • Iron scrap trading • Loading/ Unloading operation	• Hutments in footpath • Traffic jams by trucks/ forklifts cranes • Inadequate infrastructure facilities i.e. drainage water supply, sewage • Inadequate trading space causing spill over into narrow roads • Solid waste generation and disposal problem	• Slum redevelopment/ resettlement • Shifting of ship breaking yard and scrap iron trade • marine Park as recreational ground • proper Parking • Solid Waste disposal technique vats provision • Green belt development • Sewage Treatment Plant option.	Maharashtra Slum Act, MRTP and D.C. Regulation is to be followed.
11.	Cotton Depot/ Coal Depot/Grain Depot	Mazgaon Sewri reclamation estate (heavy industrial)	• Facilitate Truck traffic • Cotton trade export-import • Hinterland containers by railways • Grain loading/unloading • Charcoal storage • Storage of Grain	• Godowns in cotton Depot tenancies dilapidated condition • encroachment by hutments • Collapsed godown • large number of open/ vacant space • Solid waste generation	• Old godowns to be pulled down for safety • Use suitably collapsed godowns • Prevent encroachment of scattered vacant plots by local persons. • proper disposal of solid waste.	MRTP/D.C. Regulation and Slum Act are to be considered.

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Sr. No.	Area	Location/ Predominant Zone	Nature of Activity	Major Environmental problems	Mitigative Measures	Remarks
12.	Hindustan Lever and Ordinance depot	Mazgaon-Sewri (heavy industrial)	• Manufacturing of detergents/soaps • storage/mixing of chemicals/ inflammable materials	• Air pollution, water pollution due to effluents • Unsafe to handle the hazardous materials	• Enforcement for water/ Fir pollution control • Shifting of ordinance Depot • Ordinance depot use as container depot	Neither port based nor port related
13.	Digvijay Cement Mills	North of Sewri	• Cement production	• Emission of cement dust • Gaseous emission from	• Factory is to be removed out to protect residential zone	EPA rules is to be followed.
14.	Oil Installation	Wadala	• Storage of crude oil	• Oil leakage • Ugly surrounding due to lack of land scaping	• Buffer zone development • leakage control to avoid pollution • Recreation area proposed • Development of landscaping	D.C. Regulation, EPA rules are to be followed.
15.	Timber Pond	Sewree	• Marshy land • Existing mangrove vegetation affected by reclamation • Unloaded Container Yard	• Destruction of mangroves due to reclamation • Not fully improved as per C R Z rules	• Replanting of mangroves to keep ecological balance of harbour area.	Further Reclamation is prohibited.
16.	Incineration near cotton yard	Sewree	• Incineration for solid waster treatment	• Air pollution but presently not in operation	• Operate with Air Pollution Control equipments.	Dispute is yet to be resolved.

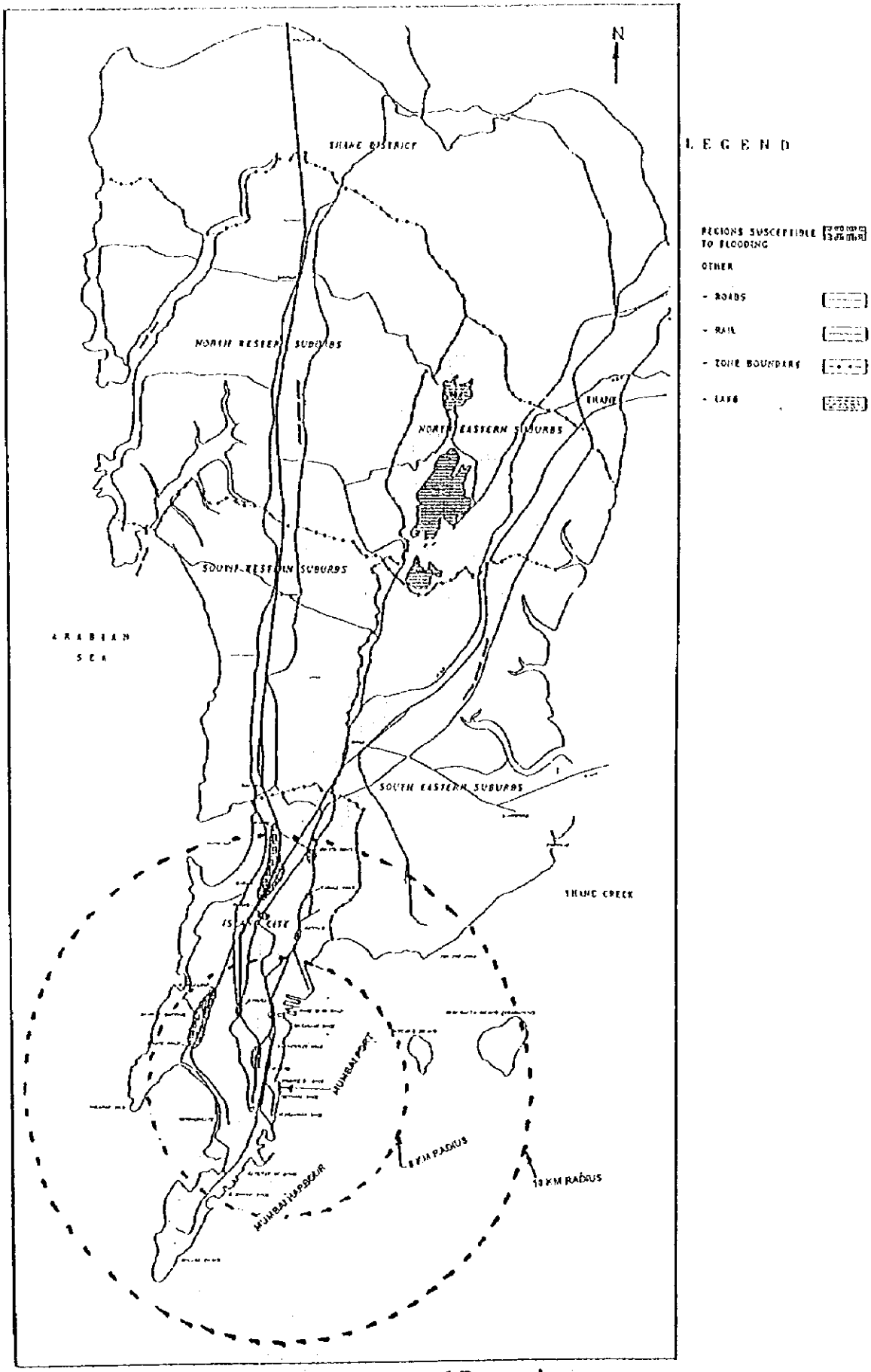

Figure 23.3.1 Major Flood Prone Areas

SOURCE : MCGB REPORT ENVIRONMENTAL STATUS OF GREATER MUMBAI 1995

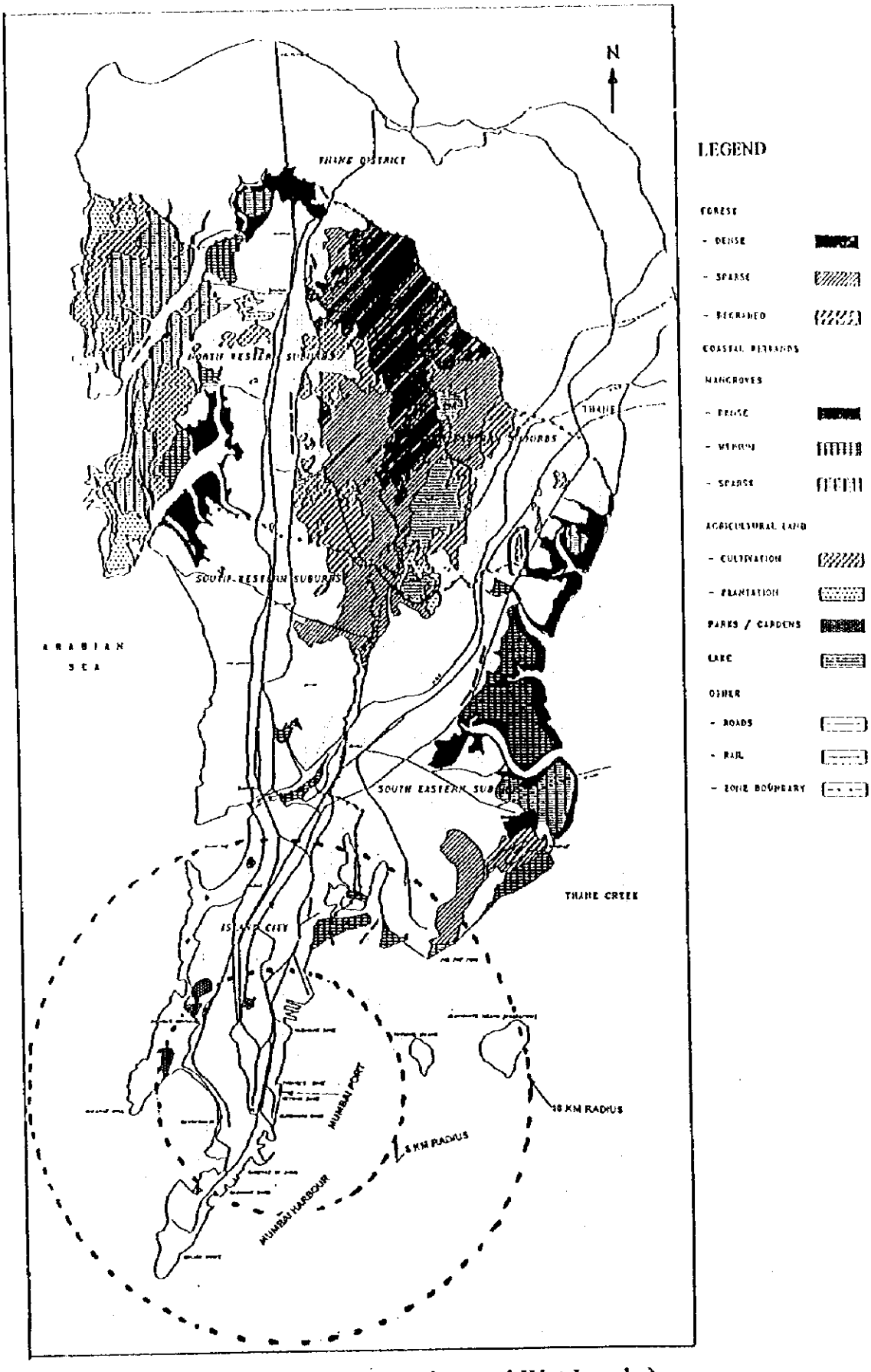

Figure 23.3.2 Forest (Vegetation and Wet Lands)

SOURCE : MCGB REPORT ENVIRONMENTAL STATUS OF GREATER MUMBAI 1995

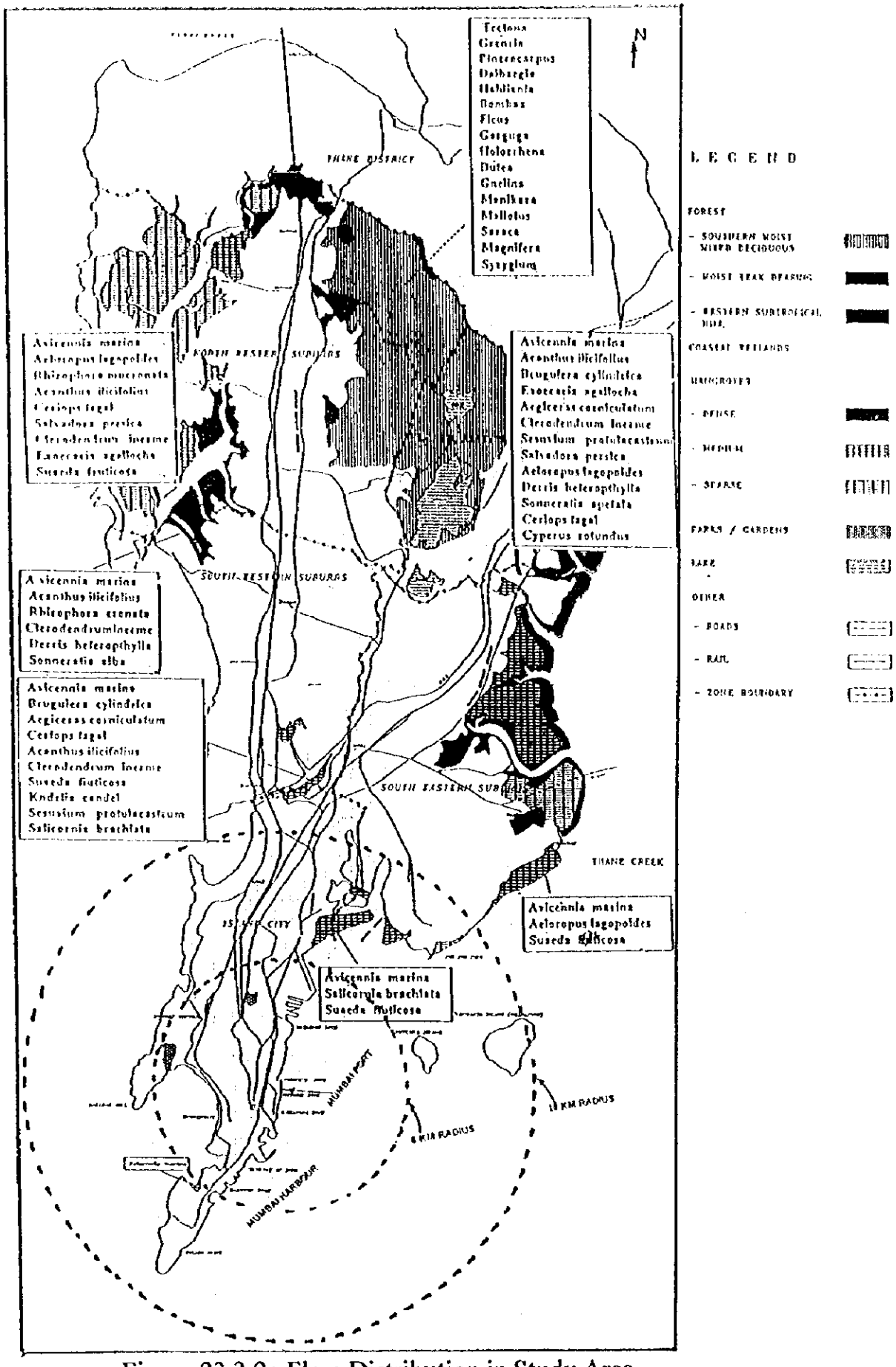

Figure 23.3.2a Flora Distribution in Study Area

SOURCE : MCGB REPORT ENVIRONMENTAL STATUS OF GREATER MUMBAI 1996

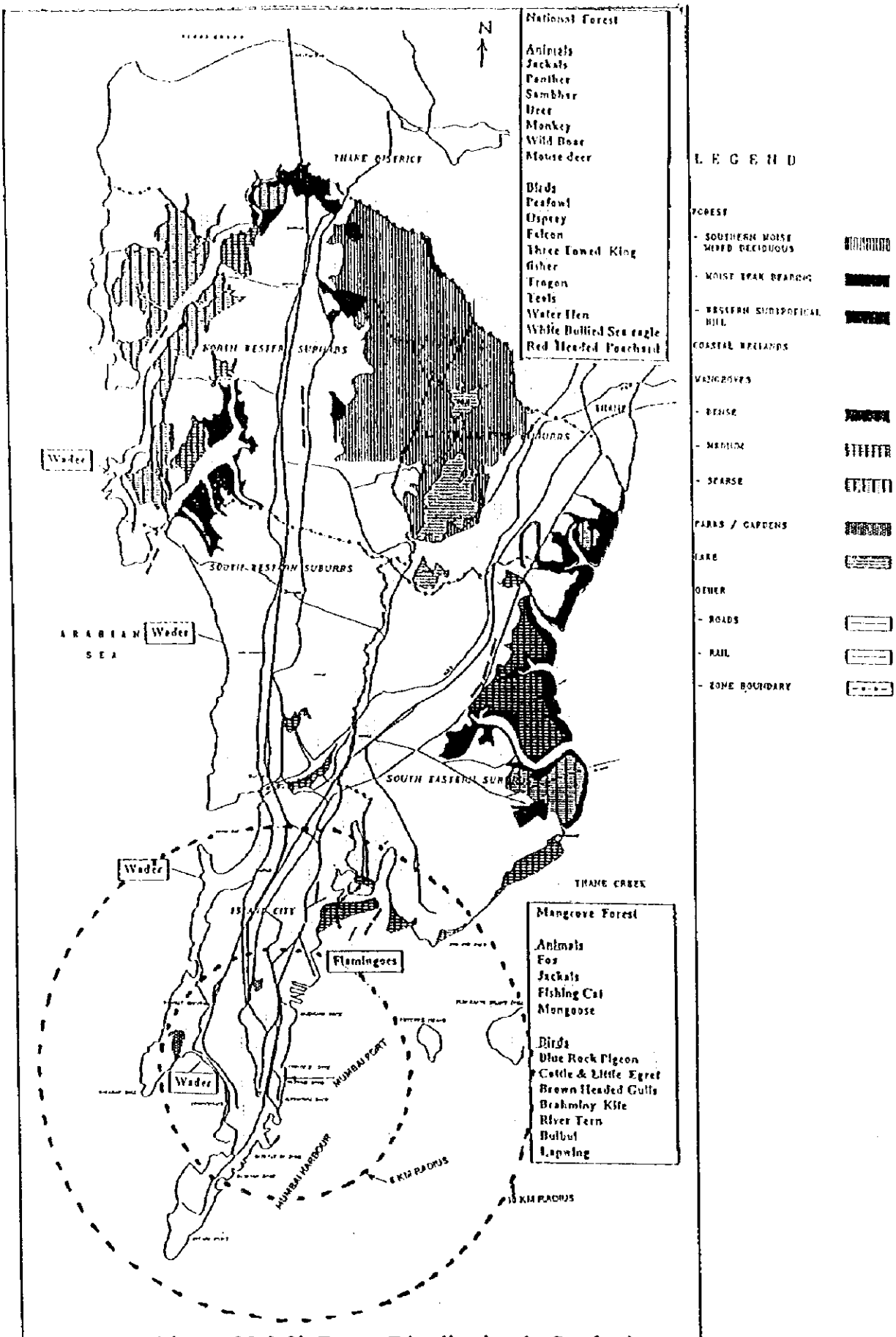

Figure 23.3.2b Fauna Distribution in Study Area

SOURCE : MCGB REPORT ENVIRONMENTAL STATUS OF GREATER MUMBAI 1995

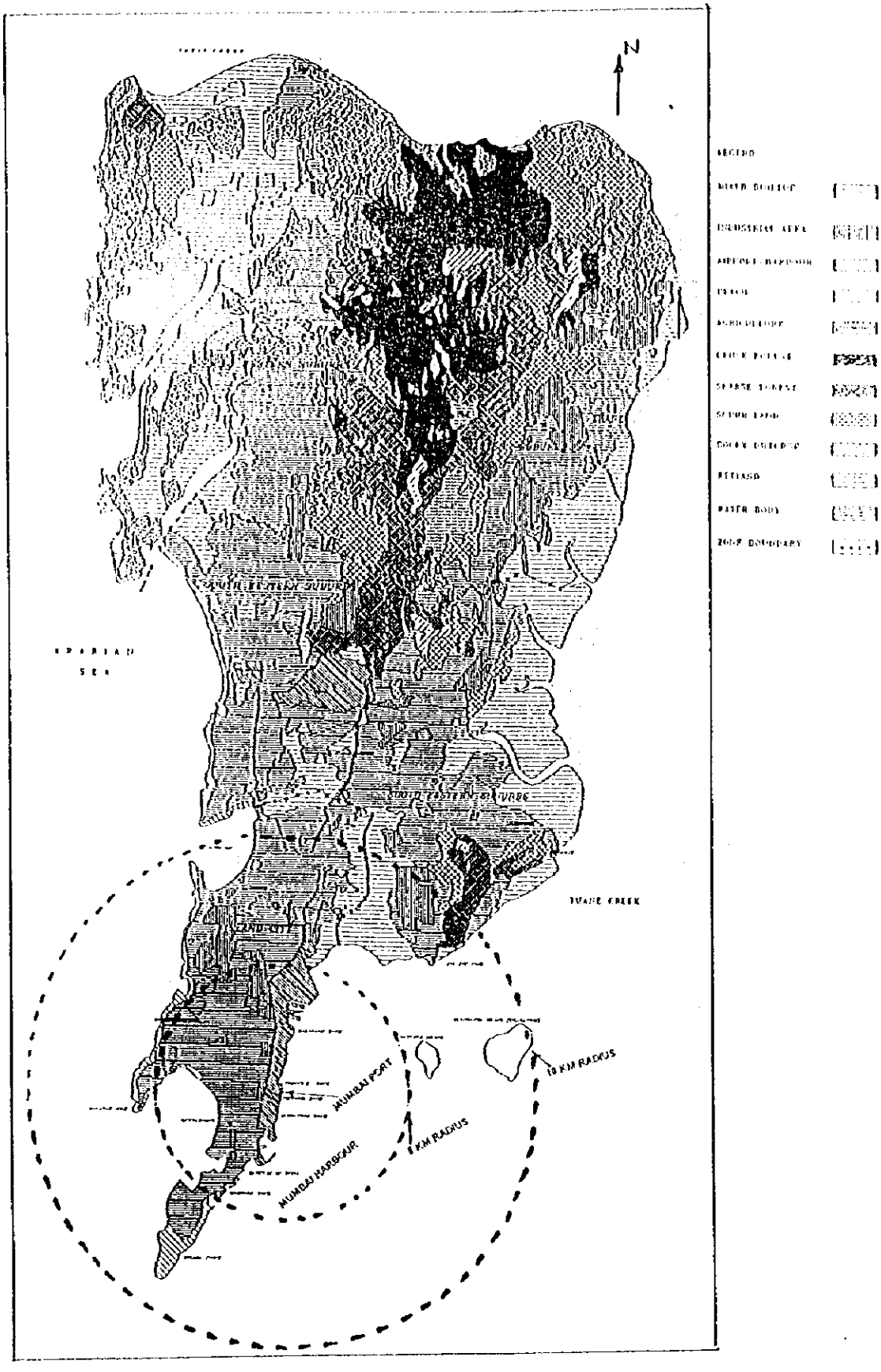

Figure 23.3.3 Existing Land Use in Study Area

SOURCE : MCGB REPORT ENVIRONMENTAL STATUS OF GREATER MUMBAI 1995

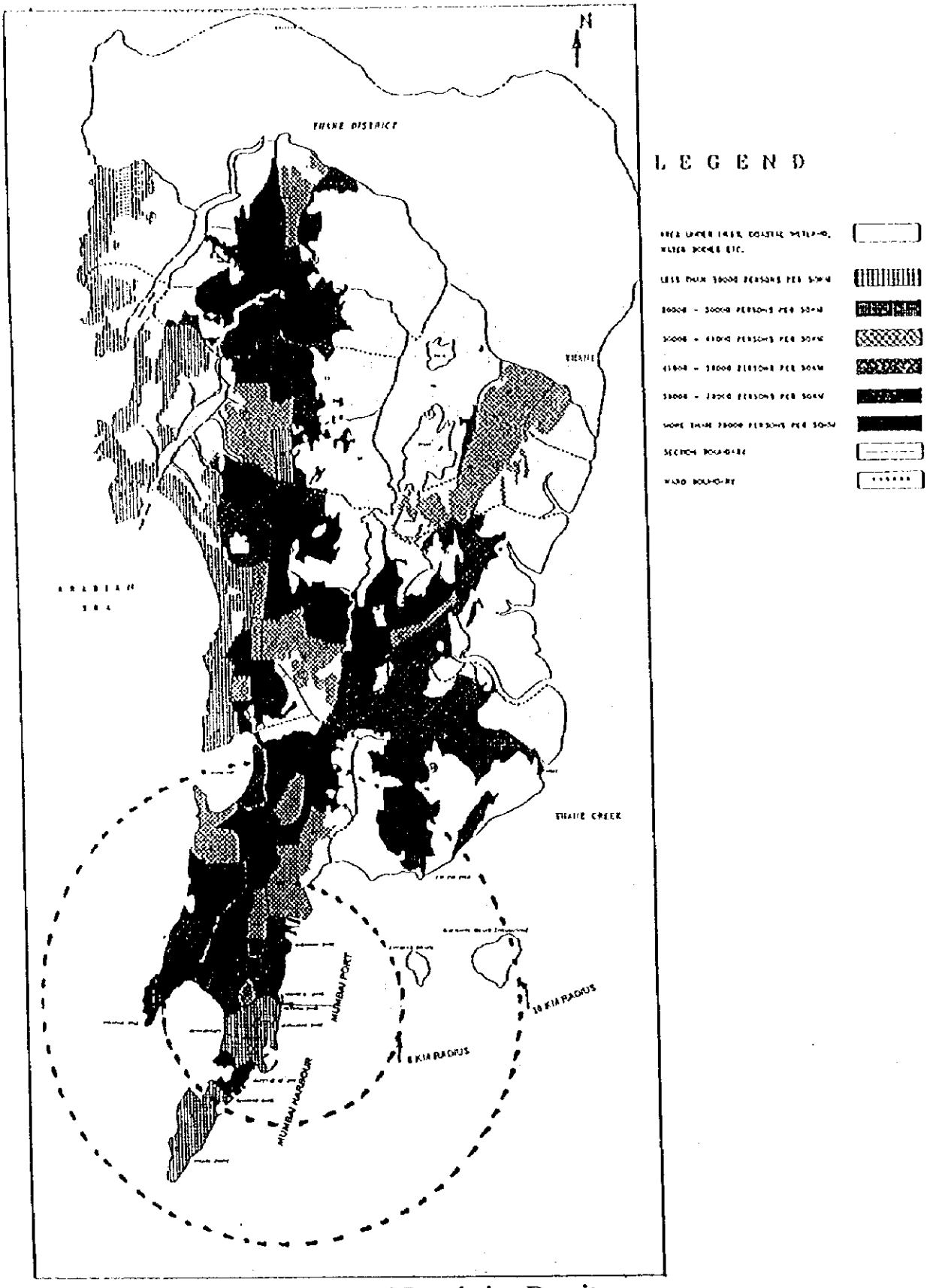

Figure 23.3.4 Population Density

SOURCE : MCGB REPORT ENVIRONMENTAL STATUS OF GREATER MUMBAI 1995

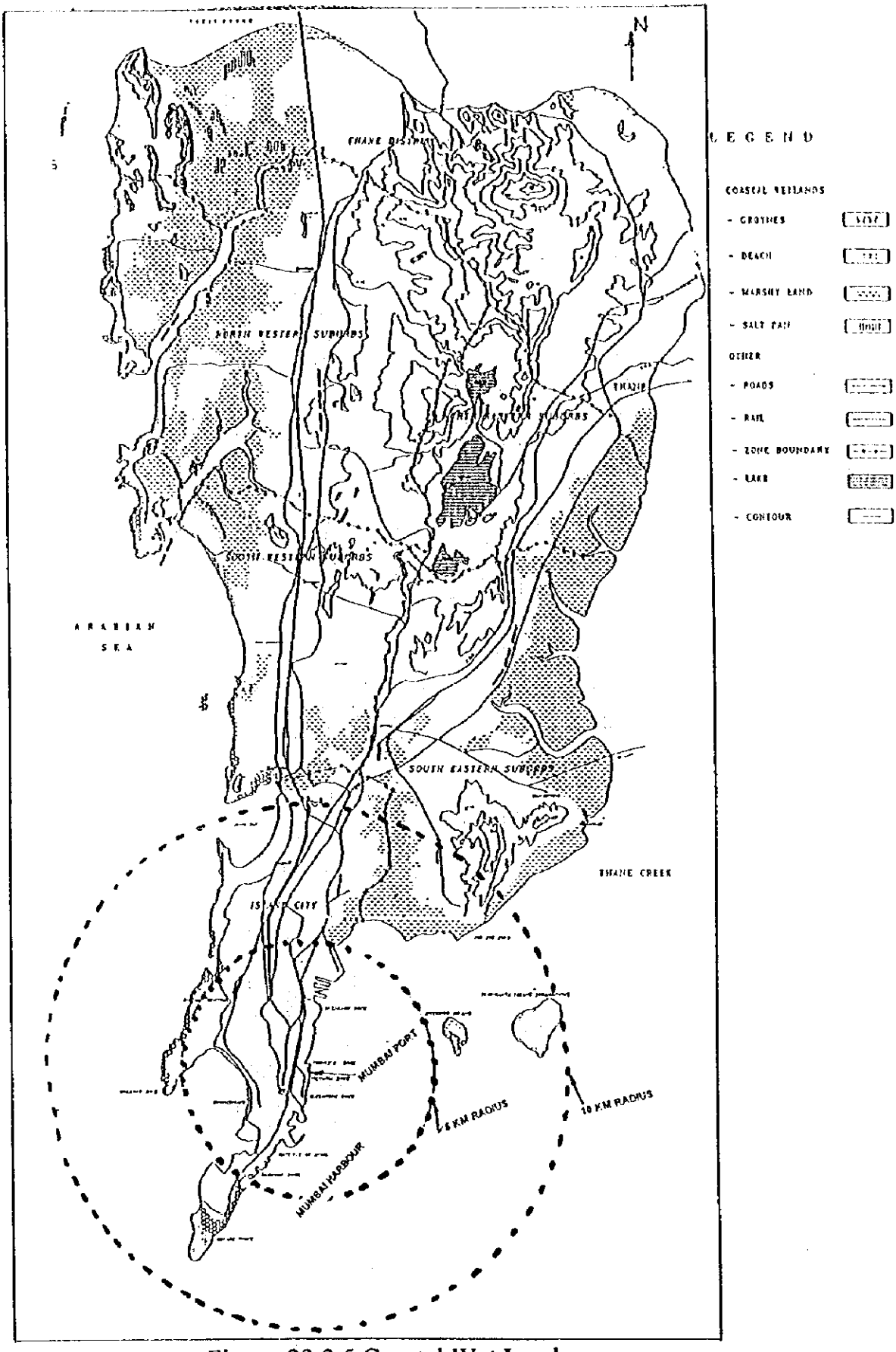

Figure 23.3.5 Coastal Wet Lands

SOURCE : MCGB REPORT ENVIRONMENTAL STATUS OF GREATER MUMBAI 1995

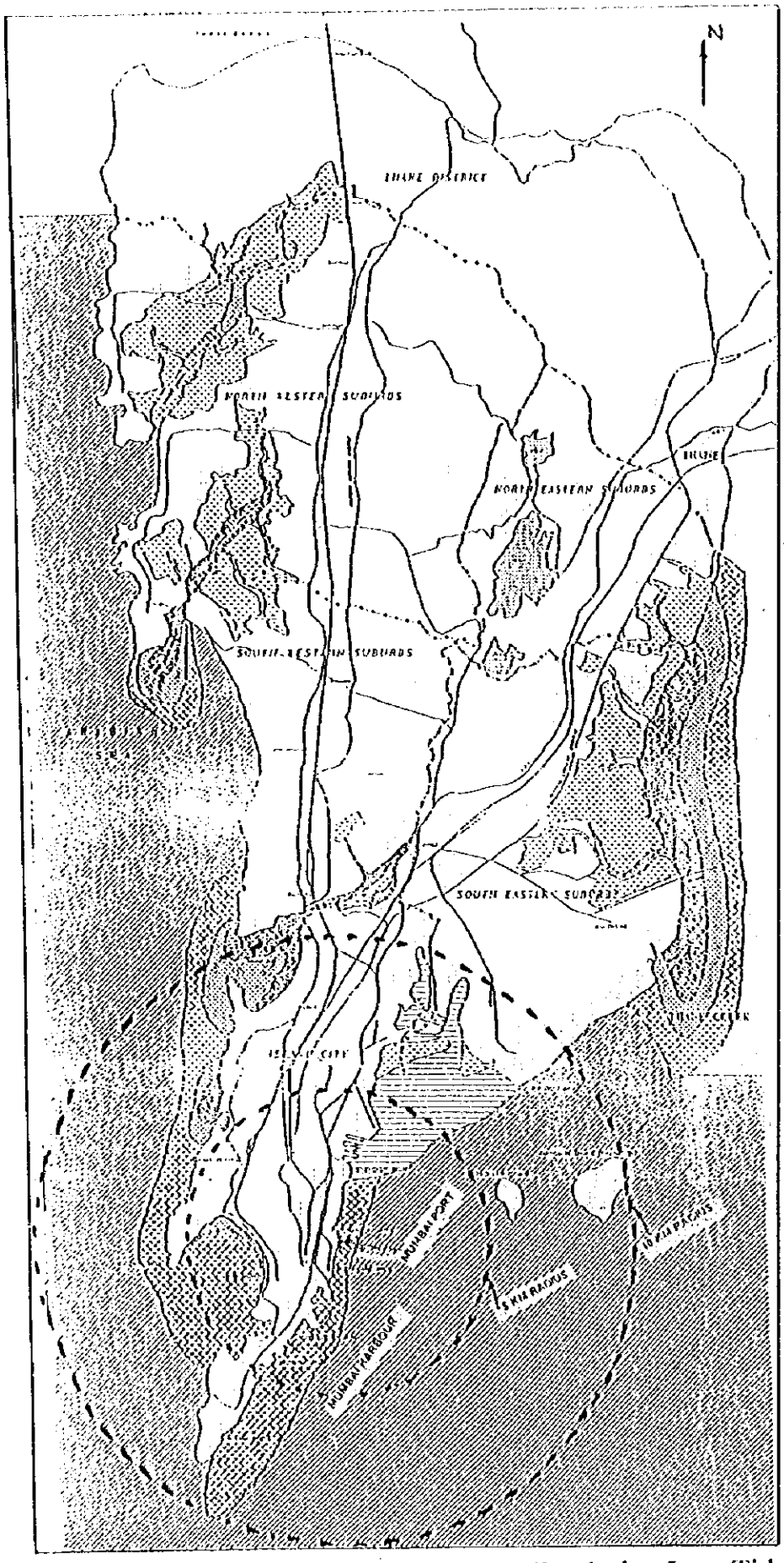

Figure 23.3.6 Coastal Water Quality during Low Tide

SOURCE : MCGB REPORT ENVIRONMENTAL STATUS OF GREATER MUMBAI 1996

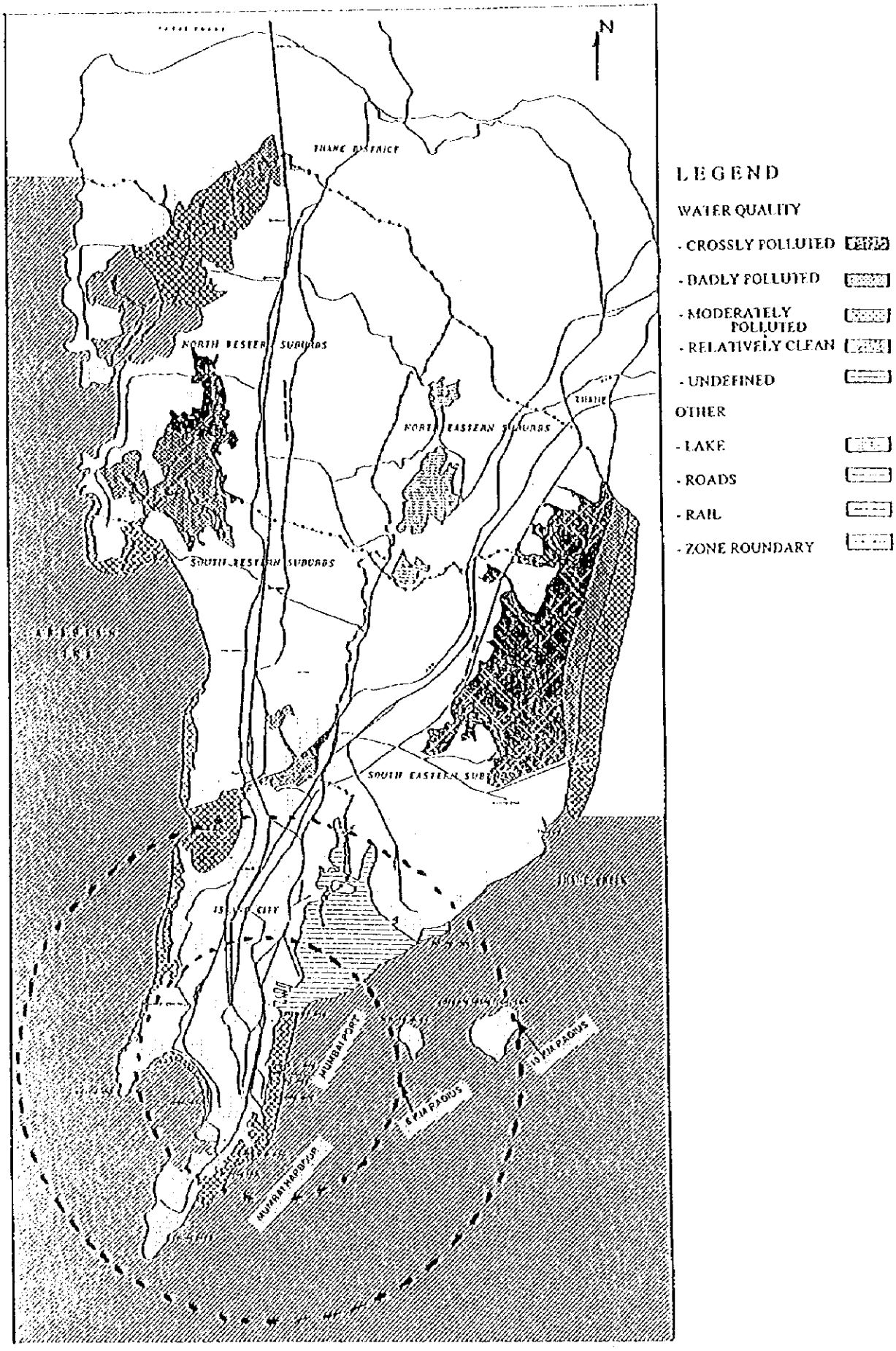

Figure 23.3.7 Coastal Water Quality during High Tide

SOURCE : MCGB REPORT ENVIRONMENTAL STATUS OF GREATER MUMBAI 1995

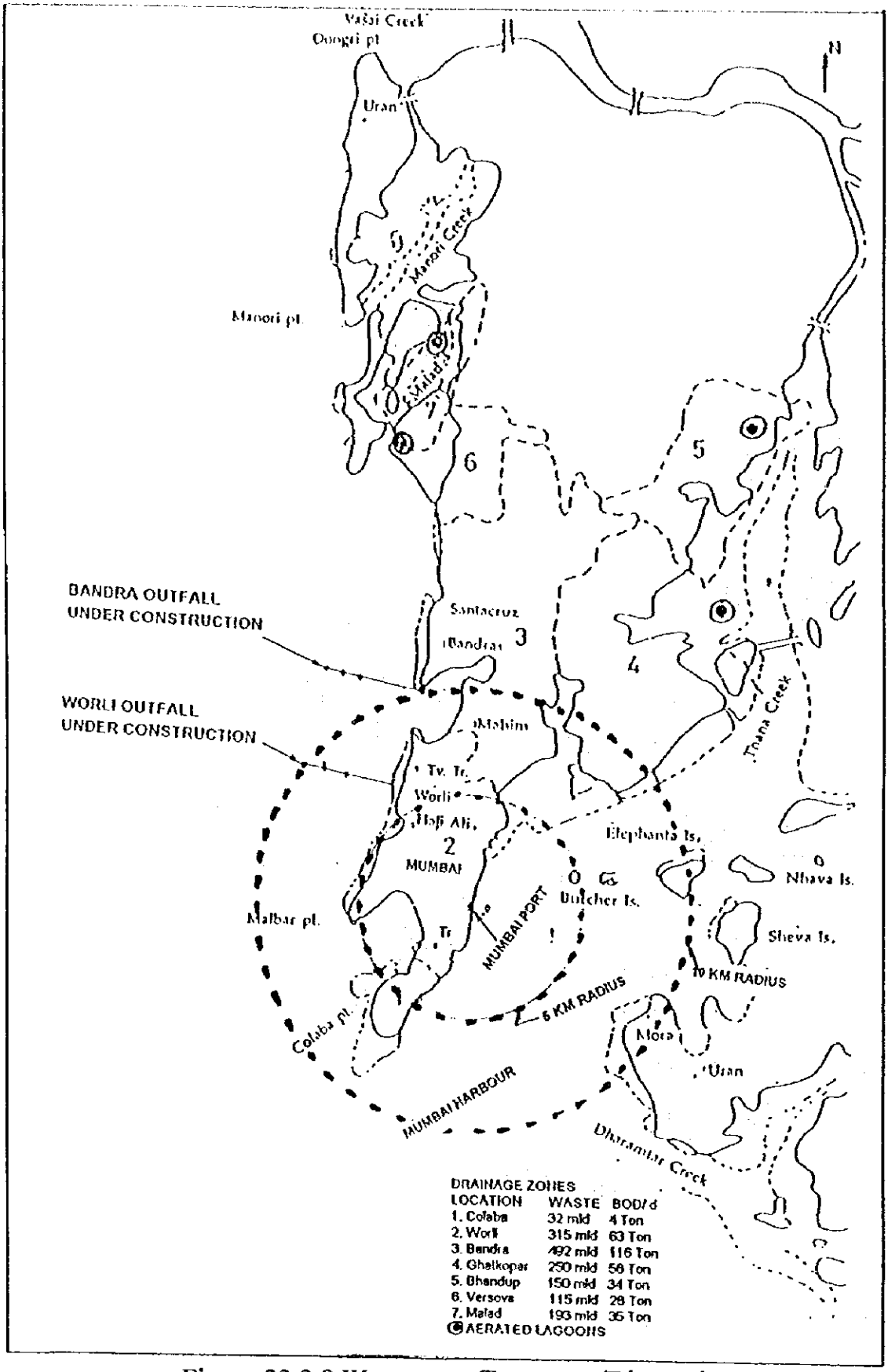

Figure 23.3.8 Wastewater Treatment/Disposal

SOURCE : MCGB REPORT ENVIRONMENTAL STATUS OF GREATER MUMBAI 1995

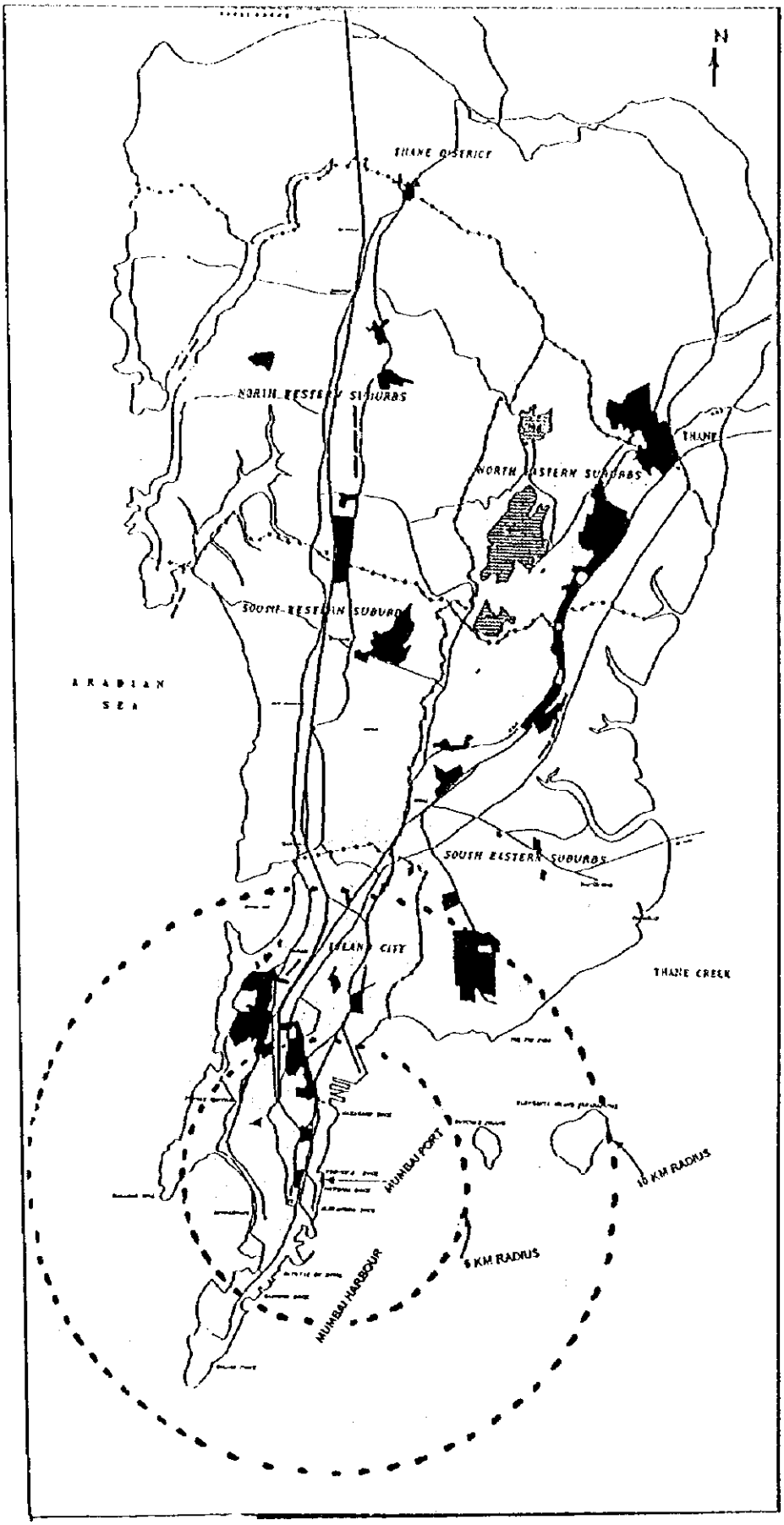

Figure 23.3.9 Location of Industrial Areas and Water Pollution Loads from Industries

SOURCE : MCGB REPORT ENVIRONMENTAL STATUS OF GREATER MUMBAI 1995

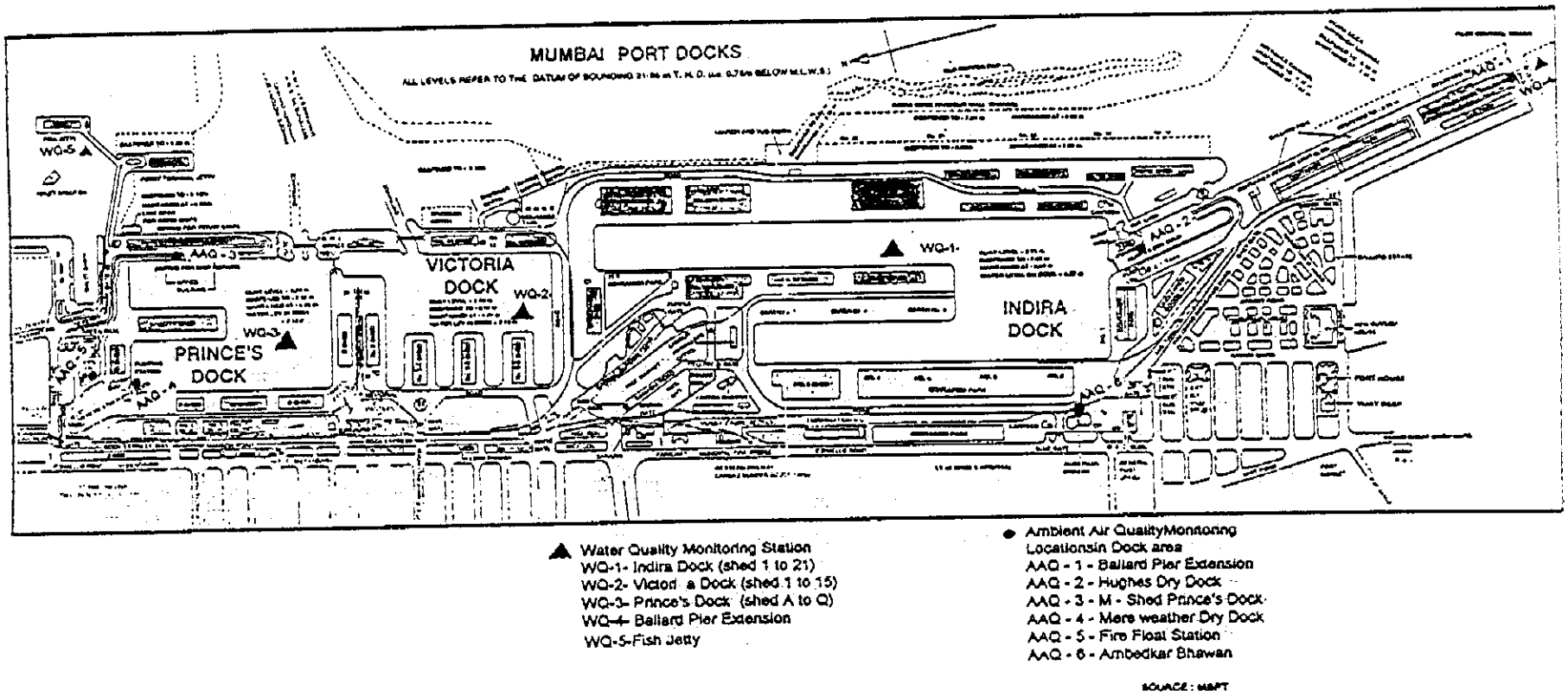

Figure 23.3.10 Location of Air Quality and Water Quality Monitoring

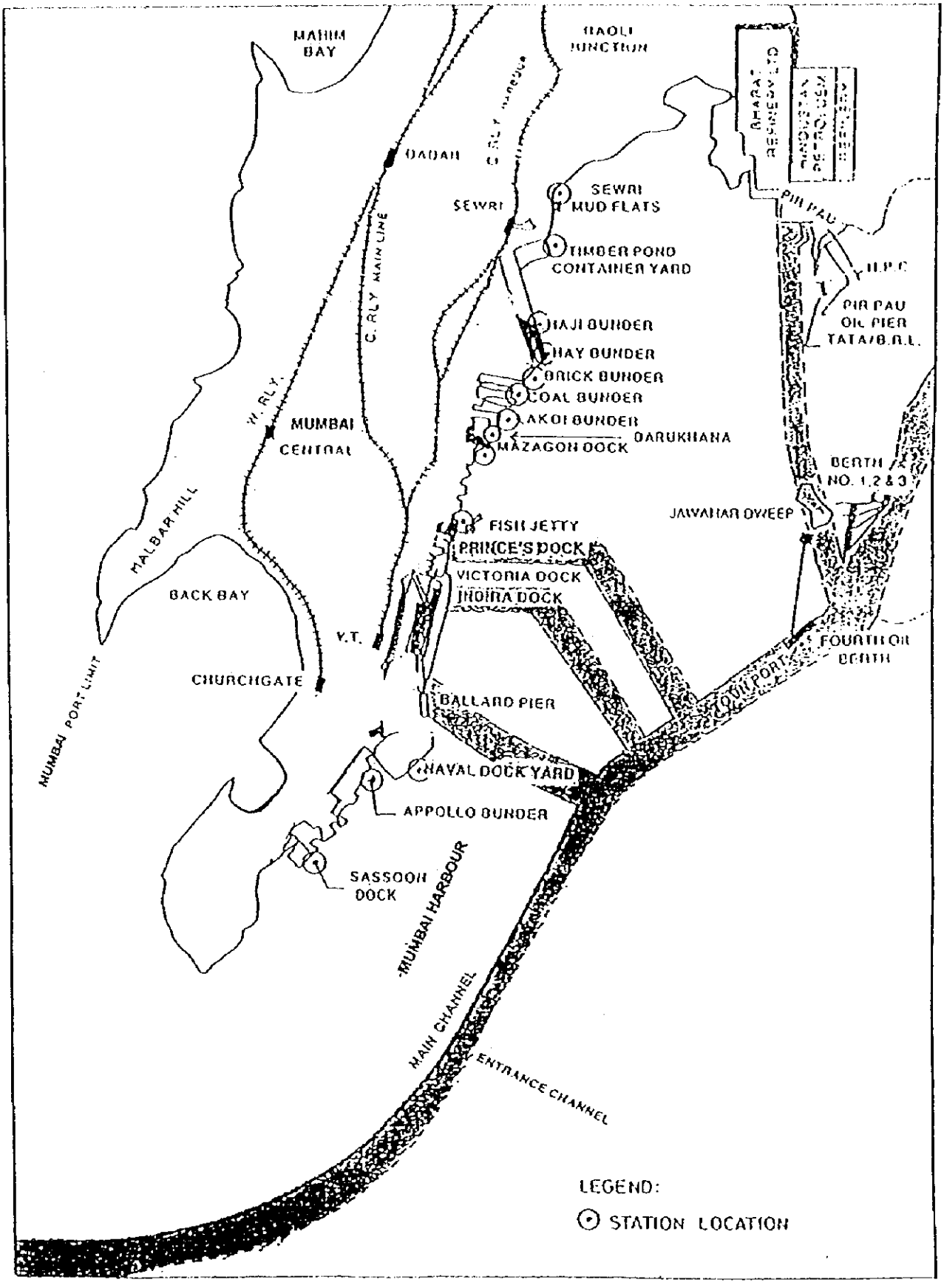

Figure 23.3.10a Location of Stations in Bunders & Docks

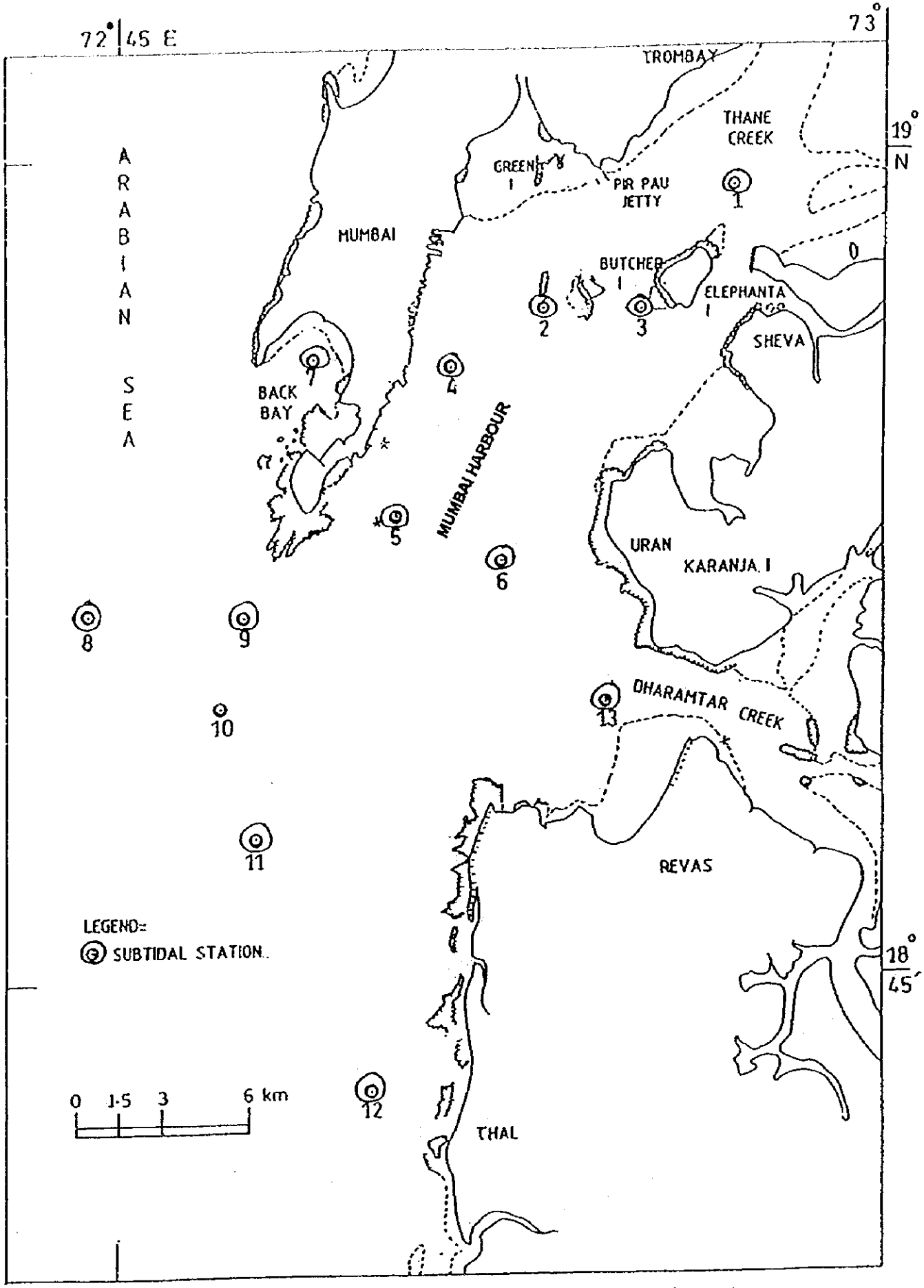

Figure 23.3.10b Location of Sampling Stations in Harbour Area of MBPT Premises

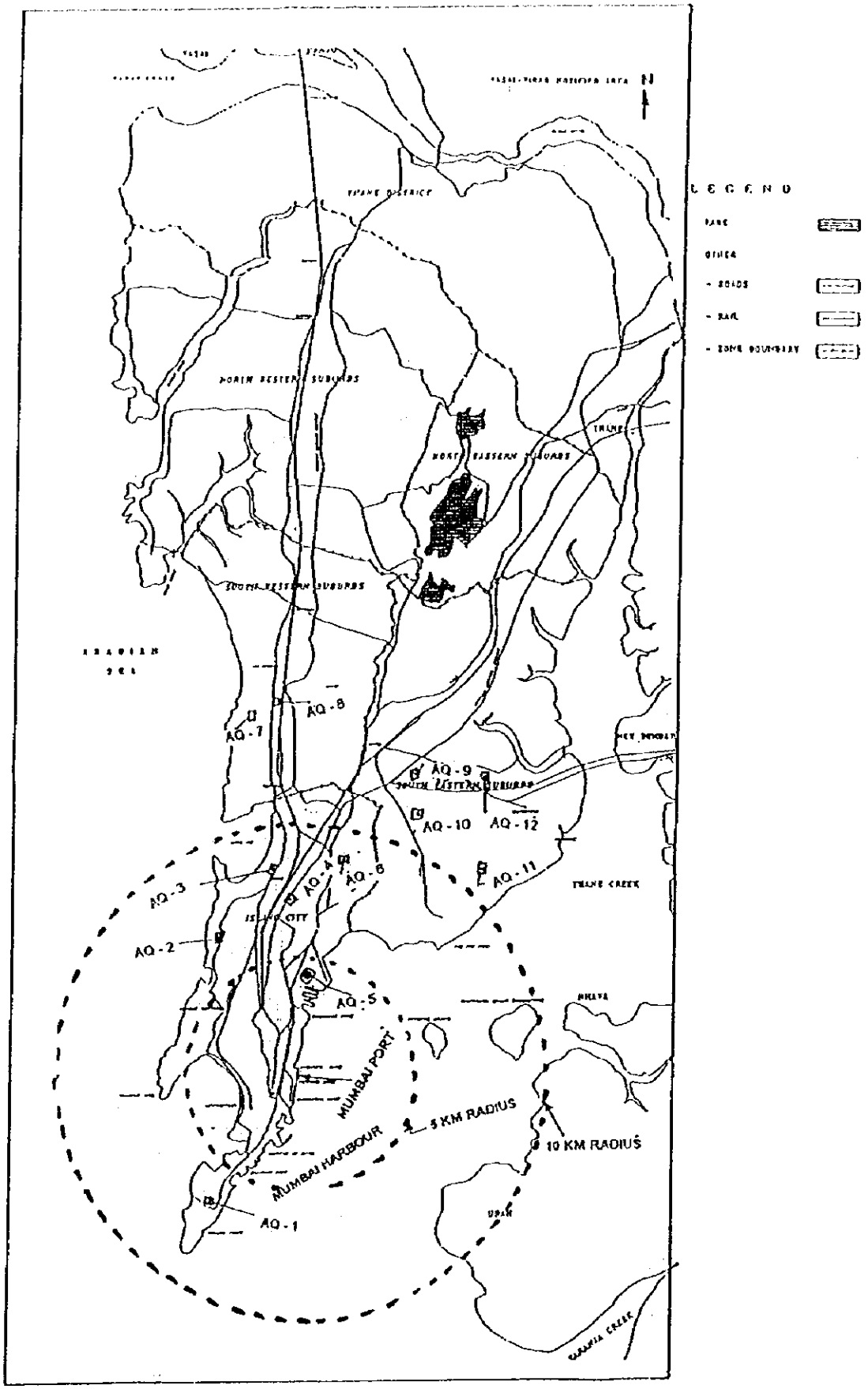

Figure 23.3.11 Air Quality Stations at 10 km Radius

SOURCE : MCGB

23.4 Baseline Environment Quality Survey*

23.4.1 Air Quality

(1) General

To establish the baseline conditions, ambient air quality survey was carried out in and around the Mumbai Port. The ambient air quality survey was conducted both on a weekday and on a holiday during the wet season (September 1987) and the dry season (October 1997).

(2) Selection of Sampling Points

As shown in Figure 23.4.1, following stations were selected for carrying out the survey in and around the Mumbai Port.

1) P.D'Mello Road (AQ-1)

The sampling point (AQ-1) was located at a distance of 500m away towards north from Orange Gate on P. D'Mello Road. This road remains congested due to the movement of city bound and general cargo traffic. It is envisaged in the short development plan that the general cargo traffic will be diverted to Dock Express way/Link Road. Due to this, the number of port bound traffic would be reduced on the P. D'Mello Road. Hence, the point AQ-1 was selected to assess the existing ambient air quality and to predict the air quality roads.

2) Link Road (AQ-2)

As it is envisaged that the traffic density along this road will be increased due to diversion of port bound traffic from P. D'Mello Road. The sampling point (AQ-2) was selected on Link Road to assess and predict the ambient air quality load.

3) Cotton Green Stations (AQ-3)

Container Freight Depot (CFD), where de-stuffing of the cargo takes place, is located in the vicinity of the sampling point AQ-3. The sampling station AQ-3 was selected to assess the existing ambient air quality and project air quality loads due to increased traffic movement.

4) Wadala Fly Over (AQ-4)

Presently, general cargo and containerized traffic are going to hinterlands through the Wadala Fly Over. Hence, the sampling point (AQ-4) was selected to assess the existing concentration of critical pollutants and future air quality loads due to short term development

plan.

5) Chembur-Near Priyadarshini (AQ-5):

The sampling point (AQ-5) was selected at Chembur near Priyadarshini building along the eastern expressway.

(3) Methodology

At each station monitoring was carried out continuously for 24 hours using the High Volume Sampler (HVS) for monitoring SPM, SO_2 and NOx. Samples for CO was collected using instantaneous sampling method

1) Sampling Procedure

In-situ sampling was adopted by passing a known volume of air through a trap and a collecting medium (Filter paper and bubbler). High volume samplers were used for the purpose.

Grab samples were collected in test bulbs for CO. Drager detector tubes were also exposed at site to know the instantaneous value of CO.

2) Analytical Methods.

a) Suspended Particulate Matter (SPM)

The samples for SPM were collected on filter paper by High Volume Sampler, operated at a rate of 1.1 m^3/min. and concentrations were determined gravimetrically on 24 hour basis.

b) Sulfur-dioxide

Sulfur-dioxide measurement was done by aspirating a measured volume of air through sodium-tetra-chloro-mercurate solution. It forms a stable di-chloro-sulphito-mercurate. The amount of SO_2 was estimated by using form spectrophotometer.

c) Nitrogen Oxides

Nitrogen oxides were estimated by bubbling air through 0.1 N sodium hydroxide (with sodium arsenite) solution to form a stable sodium nitrite. The nitrite ion produced during sampling was determined spectrophotometrically.

d) Carbon Monoxide (Gas Chromatography Method : Refer IS : 5182 Part (X) - 1976)

A sample of air containing carbon monoxide is injected into the gas chromatograph where it is carried from one end of the column to another. During its movement the constituents of the sample undergo distribution at different rates and get separated from another. Carbon Monoxide is converted to methane in the methanizer by a catalytic reduction resulting in a

peaked graph of carbon monoxide.

Drager detector tubes which indicate the CO levels by colour change on exposure were also used at site.

(4) Results and Discussion

The ambient air quality results are presented in Tables 23.4.1 (a) and (b), and described in the following section.

1) Suspended Particulate Matter (SPM)

a) Wet Season

The concentration of SPM is found to be high at all locations. The maximum concentration of SPM is found to be 1,112 $\mu g/m^3$ on weekday at the station AQ-3 (Cotton green station), while the minimum concentration (273.7 $\mu g/m^3$) is found at the location AQ -2 (Link Road) on holiday.

b) Dry Season

High concentration of SPM is found at all locations. Maximum concentration (863 $\mu g/m^3$) is found at the monitoring station AQ-3 (Cotton Green station), while the minimum concentration of SPM is found to be 313.5 $\mu g/m^3$ at the station AQ-2 (Link Road).

It is apparent from the ambient air quality results that the concentration of SPM found is exceeding the limits (200 $\mu g/m^3$) stipulated by CPCB.

2) Sulfur Dioxide (SO_2)

a) Wet season

The maximum concentration of SO_2 is found to be 51.9 $\mu g/m^3$ at monitoring station AQ-1(P. D'Mello Road) and AQ-5(Priyadarshini), while the minimum concentration (295 $\mu g/m^3$) is found at the station AQ-2(Link Road).

b) Dry Season

The concentration of SO_2 is found to be 64.2$\mu g/m^3$ at the air quality station AQ-3 (Cotton Green Station) during the weekday. The minimum concentration is found to be 30 $\mu g/m^3$ at the station AQ-2 (Link Road) during Holiday.

It is apparent that the concentration of SO_2 is found to be far below the limit (80 $\mu g/m^3$) prescribed by CPCB.

3) Oxides of Nitrogen (NOx)

a) Wet Season

The concentration of NOx is ranged between 11 $\mu g/m^3$ and 26 $\mu g/m^3$. The maximum concentration (25.5 $\mu g/m^3$) is reported at the station AQ-5 (Chember-Near Priyadarshini). The concentration of NOx is found to be 11 $\mu g/m^3$ (minimum) at the air quality stations AQ-2 (Link Road) during holiday.

b) Dry Season

The concentration of NOx is ranging between 16 $\mu g/m^3$ and 33 $\mu g/m^3$. The maximum concentration (32.5 $\mu g/m^3$) is found at the station AQ-5 (Chember-Near Priyadarshini) during Weekday, while the minimum concentration (16.4 $\mu g/m^3$) is reported at the station AQ-2 (Link Road)

The Concentration of NOx for both wet and dry seasons is found to be far below the limit (80 $\mu g/m^3$) prescribed by CPCB.

4) Carbon Monoxides (CO)

The concentration of CO is found to be not detectable at all monitoring station during wet and dry seasons.

23.4.2 Noise

(1) General

The noise quality survey was conducted during wet and dry seasons at the same location where the air quality monitoring was carried out. The noise quality survey was done during the course of air quality monitoring.

(2) Selection of Sampling points

As described in section 23.4.1, following sampling points were selected.

NQ -1	:	P.D.' Mello Road
NQ-1	:	Link Road
NQ-3	:	Cotton Green
NQ-4	:	Wadala Fly Over
NQ-5	:	Chember - Near Priyadarshini

(3) Methodology

The noise survey was carried out continuously for 24 hours using portable sound level meter. The noise level were recorded at 15 minutes interval at a height of 1.5 m from ground level.

(4) Results and Discussion

Based on the field investigation results, important statistical indications such as L_{10}, L_{50}, L_{90}, Leq, L_{max} and L_{min} computed are presented in Tables 23.4.2 (a) and (b) for the wet and the dry seasons, respectively. The results are discussed in the following sections.

1) Wet Season

Noise level (Leq) is ranged between 80 dB(A) and 96 dB (A). The maximum noise level (Leq) is found to be 96 dB(A) at Chember-near Priyadarshini (NQ-5). The minimum equipment noise level {80 dB(A)} is found at the station NQ-2 (Link Road) on a weekday, while same noise level is found at the station NQ-3 (Cotton Green Station) on holiday.

The maximum instantaneous noise level {106 dB(A)} is found at the station NQ-5 whereas the minimum instantaneous noise level {60 dB (A)} is found at the stations NQ-2 and NQ-3.

2) Dry Season

Noise level (Leq) is varying between 81 dB(A) and 88 dB(A) at the station NQ-4 (Wadala Fly Over), while the minimum noise level (Leq) is obtained to be 81 dB(A) at the station NQ-2 (Link Road). The maximum noise level - Lmax (instantaneous) is found to be 106 dB(A) at the station NQ-2 (Link Road). The minimum instantaneous noise level - Lmin is found to be 54 dB(A) at the station NQ-4 (Wadala Fly Over).

High Noise level is observed at all monitoring stations. It is attributed to the high traffic density and traffic congestion at all locations. The noise levels are exceeding the limit prescribed by CPCB.

23.4.3 Vibration

(1) General

Field survey pertaining to the vibrations was done on a weekday and a holiday for both the

dry and the wet season during the course of air quality monitoring.

(2) Selection of Sampling point

As described in Section 23.4.1, following sampling points were selected.

VQ-1	P. D'Mello Road
VQ-2	Link Road
VQ-3	Cotton Green Station
VQ-4	Wadala Fly Over
VQ-5	Chember - Near Priyadarshini.

The Vibration was measured at the same locations where the air quality survey was carried out.

(3) Methodology

The Vibration was recorded at 15 minutes intervals continuously for 24 hours.

(4) Results and Discussion

Based on the field investigation important statistical parameters such as L_{10}, L_{50}, L_{90} L_{min}, L_{max} computed are presented in Tables 24.4.3 (a) and (b) for the wet and the dry seasons, respectively

1) Wet Season

The maximum Vibration (Instantaneous) Lmax is found to be 186 micron at the station VQ-5 (Chember Priyadarshini), whereas the Vibration Level (Instantaneous) L_{min} is found to be 4 micron at the station VQ-4.

2) Dry Season

The maximum instantaneous vibration (L_{max}) is found to be 169 μ at the station VQ-5, while the minimum instantaneous vibrations ($L_{min.}$) is reported to be the station VQ-3 and instantaneous vibrations.

It is apparent from the results that the vibration level is high at VQ-5 during the wet season and the dry season. It is attributed to the high traffic density at VQ-5 (Chembur Priyadarshini).