Model Environmental Status Report (ESR) For Thane Municipal Corporation
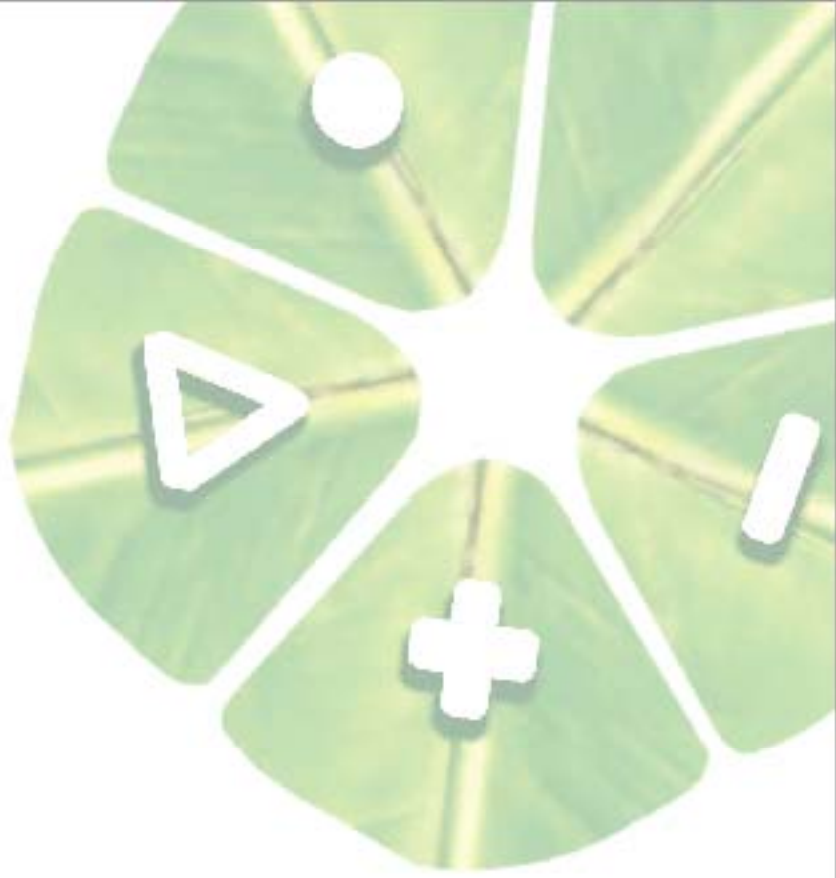
For
Maharashtra Pollution Control Board

March 2010

emc

Acknowledgement

The Environmental Status Report (ESR) is not just about the fulfillment of the need for a report, rather, it is a continuous process of measurement of environmental indicators and assessment of their condition. The results are not just compiled but are analyzed with deep study and discussion, on the basis of which the Thane Municipal Corporation will take steps for the mitigation of identified environmental issues and strive towards better environmental management. We consider this as one of our most important duties and it is for these reasons we make intensive efforts to prepare this report annually.

It is a matter of immense pride to be part of a team trying to develop the city in an eco-friendly manner. Through our combined efforts, we are striving to constantly improve the status of Thane city at all levels – social, environmental or economic.

I would like to acknowledge the support and advice of the Maharashtra Pollution Control Board (MPCB). I would like to thank M/s Ultra Tech, Environmental Consultancy and Laboratory for their efforts towards information collection and compilation for this report. Special thanks are due to the Environmental Management Centre (EMC) for its technical assistance in data assessment for and re-structuring of the report as per MPCB's guidelines for preparation of ESR and serve as a model to other cities.

Finally I would also like to record my appreciation and thanks to all individuals and departments for their valuable inputs to this report.

Shri Nandakumar Jantre (IAS)
Municipal Commissioner
Thane Municipal Corporation

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Preface

Thane Municipal Council (TMC) has been preparing Environmental Status Reports (ESRs) since 1996. We take pleasure in presenting the ESR for 2008-09.

In order to standardize the ESR development process and enhance the quality of ESRs, a more comprehensive ESR preparation methodology has been developed by the Maharashtra Pollution Control Board (MPCB). It is necessary that this methodology be demonstrated to create a Model ESR that will serve as a guide for other Urban Local Bodies (ULBs).

For this purpose, the TMC has developed the ESR for 2008-09 using the methodology developed by MPCB. In doing so, it presents this ESR as a Model ESR, and hopes to start a trend for the development of such ESR at other ULBs.

Mr. K. D. Lalla
City Engineer
Thane Municipal Corporation

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Abbreviations

AC	Air conditioning
API	Air Pollution Index
BMW	Bio-Medical Waste
BOD	Biochemical Oxygen Demand
C & D	Construction and Demolition
Cd	Cadmium
CH_4	Methane
CIDCO	City Industrial Development Corporation
Cl^-	Chlorides
CO	Carbon monoxide
CPCB	Central Pollution Control Board
Cr	Chromium
Cu	Copper
dB	Decibel
DO	Dissolved Oxygen
DP	Development Plan
DPSIR	Driving forces – Pressure – State – Impacts – Responses
E & S	Environmental and Social
ESR	Environmental Status Reports
H_2S	Hydrogen sulphide
ICU	Intensive Care Unit
IT	Information Technology
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
Leq	Level equivalent
LPCD	Liters Per Capita per Day
MCGM	Brihan Mumbai Municipal Corporation
MIDC	Maharashtra Industrial Development Corporation
MLD	Million Liters per Day
MoEF	Ministry of Environment and Forests
MPCB	Maharashtra Pollution Control Board
MSEDCL	Maharashtra State Electricity Distribution Company Ltd.
MSL	Mean Sea Level
MT	Metric Tonnes
NAAQS	National Ambient Air Quality Standards
NH	National Highway
NH_3	Ammonia
NMMC	Navi Mumbai Municipal Corporation
NO_3	Nitrate
NOx	Nitrogen Oxides
Pd	Lead
PHC	Primary Health Centres

PO_4^{2-}	Phosphates
PPP	Public Private Partneship
PS	Pumping Station
RSPM	Respirable Suspended Particulate Matter
SATIS	Station Area Traffic Improvement Scheme
SCADA	Supervisory Control And Data Acquisition
SH	State Highway
SO_2	Sulphur Dioxide
SOx	Sulphur Oxides
SPM	Suspended Particulate Matter
STP	Sewage Treatment Plant
TBIA	Thane Belapur Industrial Association
TDS	Total Dissolved Solids
TKN	Total Kjeldhal's Nitrogen
TMC	Thane Municipal Corporation
TMT	Thane Municipal Transportation
ULB	Urban Local Body
URL	Universal Resource Locator (i.e. website address)
WTP	Water Treatment Plant

1. Background of ESRs

> This chapter provides an introduction to ESRs. It introduces a short history of ESR preparation at TMC.

Preparation of Environmental Status Reports (ESRs) is mandated in the 74th Constitutional Amendment Act and the Twelfth Schedule. Some cities of Maharashtra have been publishing ESRs since 1997.

The ESR is a comprehensive document that serves as an information resource base for identification of critical issues and also as an input for new city / town Development Plans (DPs) or even revisions in them. The ESR attempts to identify current and emerging environmental concerns as well as opportunities at the town level. It does this through the identification of demographic, social and economic driving forces behind various issues that can pose risk to environment and health and safety of citizens. The ESR also encourages the Urban Local Bodies (ULBs) to formulate and adopt an overarching Environmental Policy, which would ultimately help in planning and implementation of the Action Plan (a product of the ESR).

Thus, the objectives of preparing an ESR may be listed as below -

- To assist in drawing meaningful inferences about the status of the environment for a city / town
- To provide a logical decision making structure for responses (including appropriate resource allocation) to planners and policy makers
- To communicate the status of the environment as well as proposed actions to resolve identified issues to all stakeholders including citizens

1.1. Thane ESR

The Thane Municipal Council (TMC) was established in 1863 and became a Municipal Corporation in 1982. It has been preparing ESRs since 1996. The reports cover the state of natural resources in terms of air, water and noise pollution, land management etc. and details of environmental infrastructure and services such as solid waste management, water supply, sewerage and sanitation, education and health care facilities, transportation etc.

The ESR for 2008-09 has been revised as per MPCB's guidelines for ESR Preparation. This ESR uses the data from ESR 2008-09 and is restructured as per the D-P-S-I-R Framework (Driving forces – Pressure – State – Impacts – Responses) endorsed in MPCB's ESR preparation guidelines. This ESR ends with a presentation of the Environmental Action Plan, designed specifically to mitigate the various environmental issues brought to light in this ESR.

2. ESR Preparation Process

> This chapter details the ideal process of ESR preparation along the lines stipulated by the Maharashtra Pollution Control Board (MPCB).

Model ESR preparation process involves stakeholders as it is based on the participatory approach. This most important element - stakeholder participation and consultation - remained weak in formulating past ESRs, has been incorporated in MPCB's guidelines for Model ESR. As the name suggests, the primary objective of stakeholder consultation is to identify the city's needs through consultations with a range of stakeholders.

In the case of ESR for TMC, stakeholders' participation workshops were not conducted as the ESR for 2008-09 had been already developed by an external Consultant (Ultratech Consultants). Thus, the same report has been restructured here in the format of the Model ESR for demonstration purposes.

The overall methodology followed for the preparation of this Model ESR is as explained in **Figure 1.**
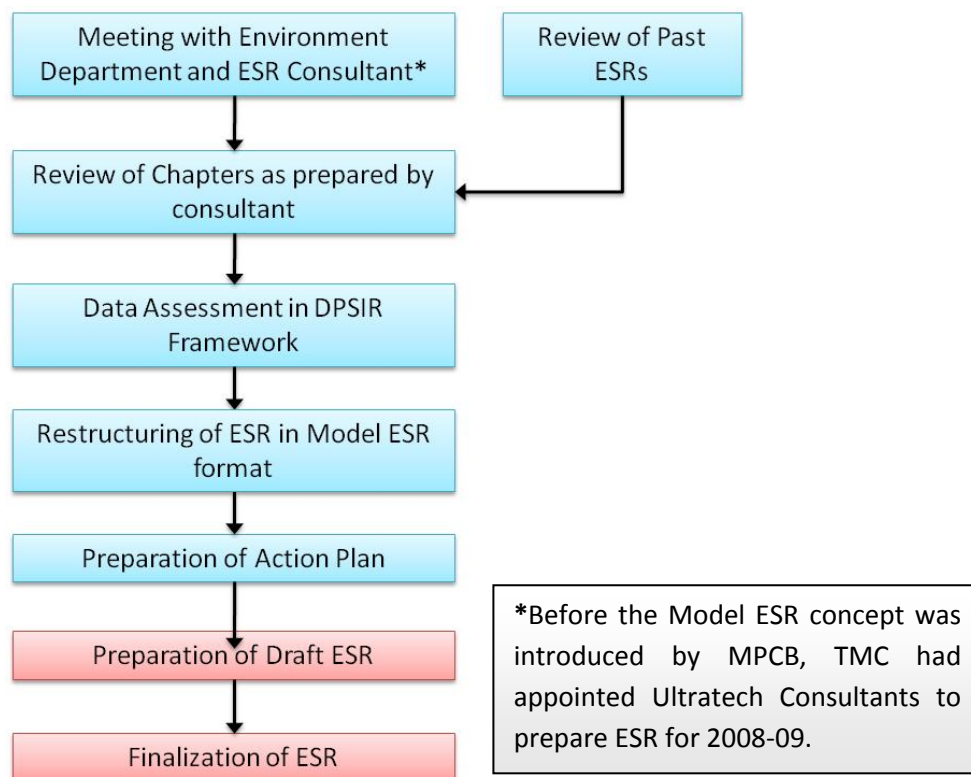
Figure 1.   Methodology Followed for Preparation of Thane ESR

*Before the Model ESR concept was introduced by MPCB, TMC had appointed Ultratech Consultants to prepare ESR for 2008-09.

A meeting with the Environment Department of TMC and representatives from Ultratech Consultants was organized on 4th November 2009. The agenda of this meeting was to explain the Model ESR structure and report restructuring process to these participants.

The web-based tool for community participation 'EkoVoices' was demonstrated during this meeting.

Two ESRs (2004-05 and 2007-08) were shared by TMC for review. Findings from past ESRs are given in **Chapter 3**.

The draft version of ESR 2008-09 was prepared by Ultratech Consultants. The data presented in this draft version has been restructured and analyzed using the D-P-S-I-R framework. The entire report was then restructured as per the Model Table of Contents prescribed by MPCB.

3. Review of Past ESRs

EMC reviewed the ESRs for 2004-05 and 2007-08 to understand the city, its environmental concerns, and past and ongoing environmental initiatives by the authorities as well as the citizens.

The reviewed ESRs cover following sections on status reporting –

- About the City
- Social Environment
- Water Environment
- Air Environment
- Noise Environment
- Solid Waste Management
- Green Environment
- Non-Governmental Organizations' (NGOs) in Thane
- Important findings

Where applicable, information from these sections has been incorporated under relevant sub-sections of this report. Data and observations from environmental monitoring have been compared with the respective standards to assess compliance.

3.1. Issues identified in the Past ESRs

The issues identified from the past ESRs can be listed as:

a. **Water Quality**

- Water quality of certain public bore wells and open wells used as a source of water for TMC below potable limits

b. **Water Supply**

- Water supply shortage in newly developed areas
- 20% unaccounted water supply (mainly through leakages)

c. **Water Bodies**

- Disturbances in the lake ecology due to ingress of sewage and effluent, dumping of solid waste, storm water runoff, idol immersion etc.
- Heavily polluted state of Thane Creek

d. **Sewerage system**

- Flowing of sewage through open drains
- Overloaded sewer networks leading to overflowing and flooding

- Overloading of sewage treatment plants and poor quality of discharged effluent
- Sewage disposal directly into Thane creek

e.   Sanitation

- Poor maintenance of public toilets

f.   Noise Levels

- Noise levels beyond permissible limits along roads and during festivals

g.   Solid Waste

- Dumping of solid waste in and around the creek obstructing water flow to the creek and affecting the creek ecology
- Absence of a secured scientific landfill

h.   Mangroves

- Damage to mangroves due to solid waste dumping, construction activities, agriculture activities, etc.

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4. Situation Analysis

This Chapter aims to provide an understanding of the present state of affairs in the city. The analytical distillation of information demonstrates a roadmap towards action planning. The purpose of this analysis is to enable the effective mapping of external environmental challenges. DPSIR framework has been used for analysis and drawing out an Action Plan.

This chapter is based on the data collected from secondary sources. The information sources are past ESRs, city DPs and monitoring records. Information has also been collected from personal interviews / discussions with TMC staff.

4.1. Introduction to Thane

Thane city is a part of the Mumbai Metropolitan Region and is one of the 18 Urban Centers therein. It is the administrative headquarters of Thane District, in Maharashtra. Thane is the first urban Center on the periphery of the Greater Mumbai and hence occupies a unique position in the region.   Refer to **Figure 2** for its location.
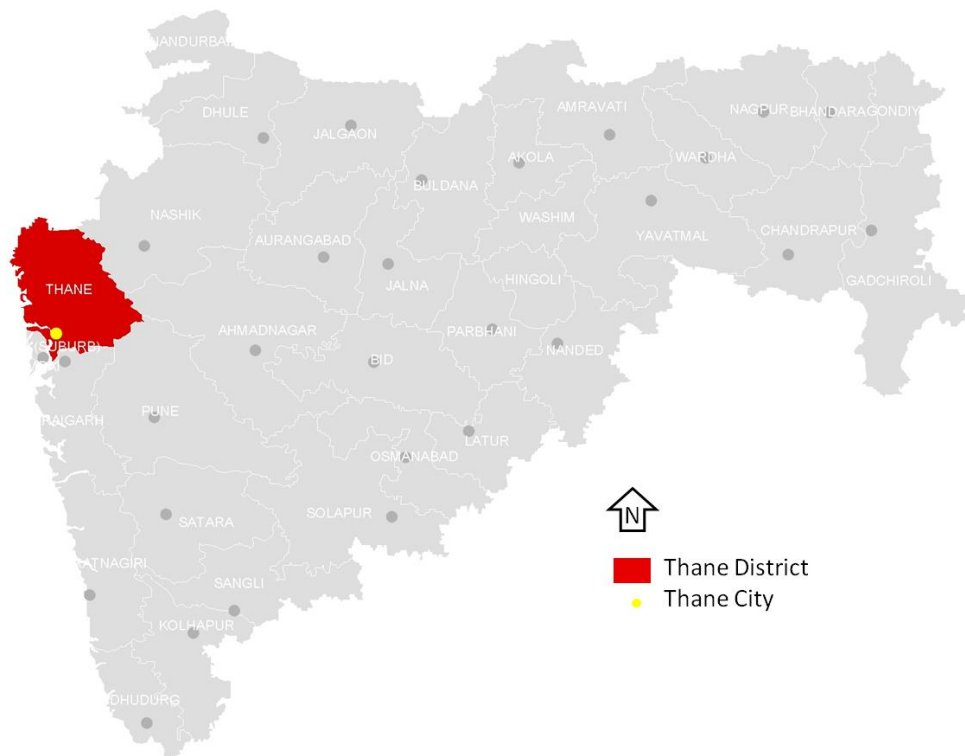
Figure 2.   Location Map for Thane District and Thane City

Topographically Thane is separated from the mainland by the Ulhas estuary and the Thane creek and it is connected through reclaimed land with the island city of Mumbai. The city is surrounded by hills as seen in **Figure 3.**

Figure 3.   Thane City and surrounding

Because of the topography, there are many lakes in and around the city. The city is known for its lakes and has around 30 lakes within city limits. The most beautiful of them is the *Masunda Talao*, also known as *Talao Pali*. Refer to **Figure 4** for locations of some of the more prominent lakes in Thane city.
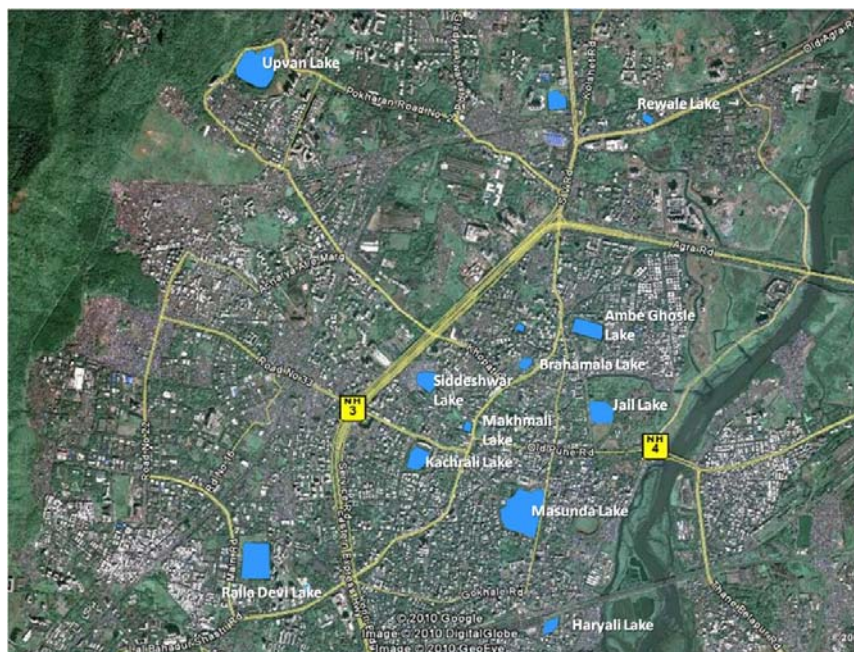
Figure 4.   Location of Lakes in Thane City

4.1.1.　Geographical Features and climatic conditions

- Latitude and longitude – 19° 12' N and 73° 02' E [1]
- Altitude (from mean sea level – MSL) – 7 m
- Terrain – high hills towards the west and submersible marsh land along the Thane Creek on the south-east and Ulhas River bank towards the north
- Climate – Coastal, hot and humid
- Annual average rainfall – 2500 mm
- Maximum temperature– 35^0C to 40^0C
- Minimum temperature – 25^0C to 35^0C

4.1.2.　Administrative set-up

- Area of town – 128.23 sq.km.
- Population – 1,261,517 (Census 2001)
- Number of wards – 9

4.1.3.　Connectivity

Thane city is well connected with all major cities of India by road, rail and air network.

- **Road Network:** There are two important National Highways which pass through the city viz. Mumbai-Agra National Highway (NH)-3 and Mumbai-Bangalore (NH-4). Refer to **Figure 5** for the highway network in Thane.
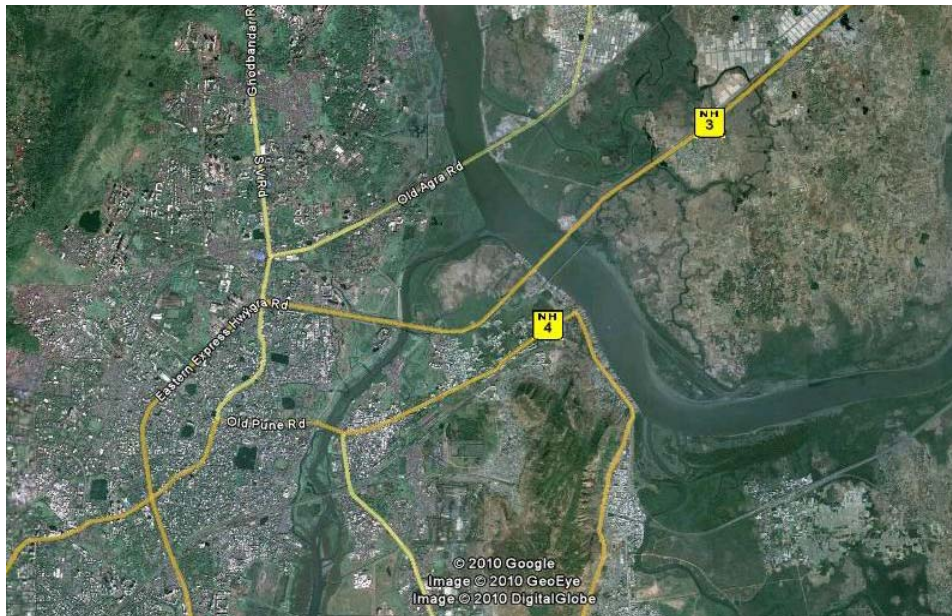
Figure 5.　　Road network in Thane city

- **Rail Network:** The central railway's main and local lines pass through the city, which connect the city to all parts of India. Thane city is connected to Mumbai

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[1] Source of information: www.mapsofindia.com

and Navi Mumbai through the local rail network. Refer to **Figure 6** for Railway lines in Thane.
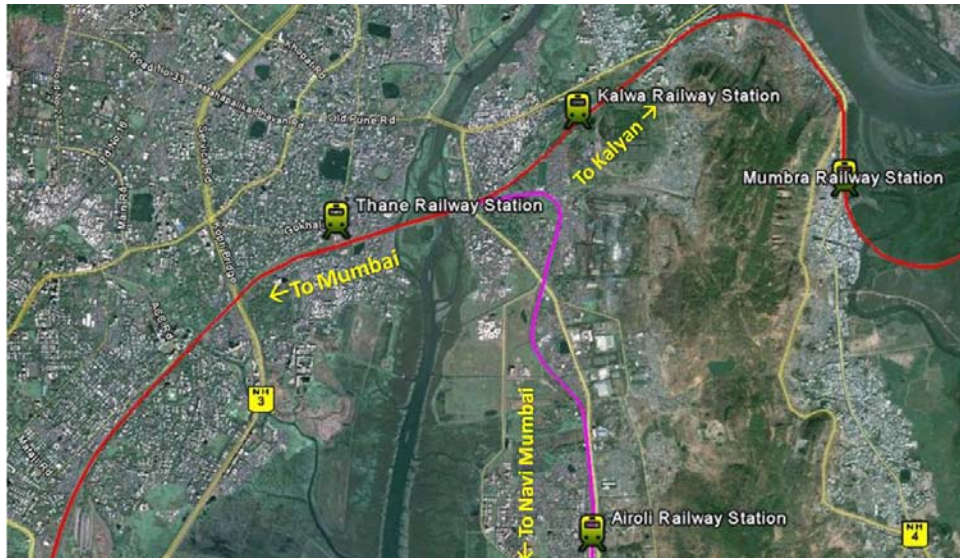
Figure 6.   Railway lines in Thane city

- **Water ways:** The important national port of Mumbai and Navi Mumbai are at about 25-30 km from the city.

- **Air ways:** The domestic as well as international air ports are at the distance of about 15-20 km from Thane.

4.1.4.   Land use

Major land use category in TMC is under forest and green zone. They together occupy 52% of the total within administrative boundaries. This distribution is as proposed in DP for Thane. The percentage land use distribution across the town is explained **Figure 7.**
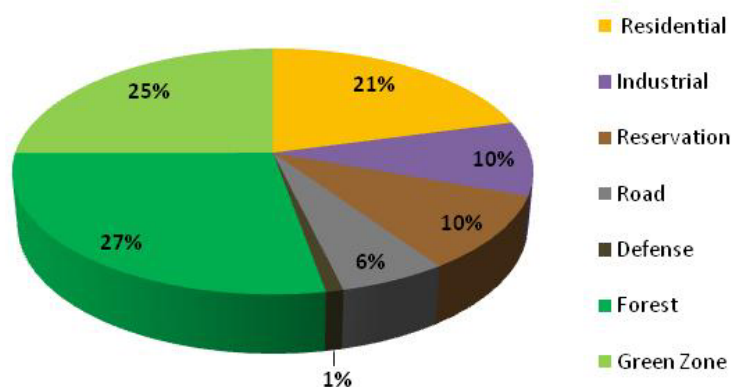
Figure 7.   Percentage land use Distribution in Thane City

Mangroves also fall under the green zone. As per DP, the key features[2] of land use pattern in Thane are as follows:

- The total area under the corporation is 12,823 Ha out of which 5,930.23 Ha is developable, 3,682 Ha is non-developable while 3,211.77 Ha falls under the green zone.
- There are 11 planning sectors and a total of 804 reserved sites covering an area of 1,267.65 Ha. Out of these reserved plots 67 were developed.
- By end of June 2007, 10% reservations were acquired by TMC under reservations for entertainment facilities.

4.2. DPSIR Framework

The DPSIR framework used in this situation analysis, assumes cause-effect relationships between interacting components of environmental, social and economic systems. This framework attempts to effectively report the complex interrelationship between the causes of environmental impacts and their effects. As a result, the DPSIR framework leads the way towards Strategic Action Planning.

Figure 8 shows the relationship between Strategic Action Planning and the DPSIR framework.
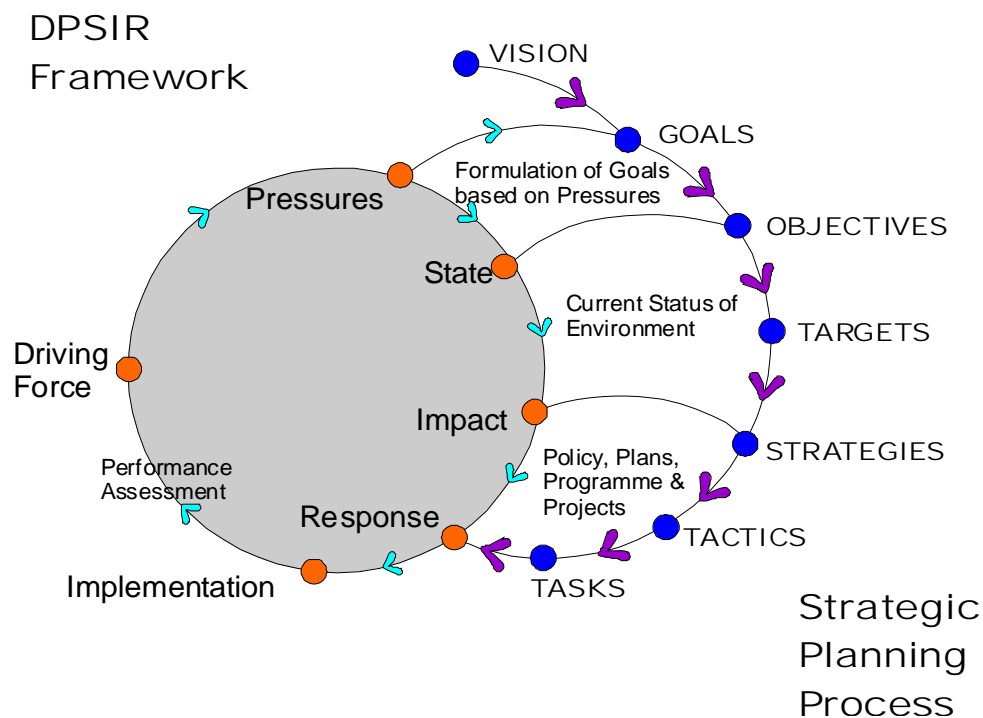
Figure 8.   Relationship between Strategic Action Planning and the DPSIR framework

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[2] As per information given by TMC

The DPSIR framework attempts to answer the following questions that are essential towards understanding the inter linkages between causative factors and resulting environmental impacts:

- What is happening to the environment and what are the reasons for the pressures exerted on it?
- What are the consequences for / impacts on the environment and public health?
- What is being done about it and how effective are these actions?
- What other / alternative actions may be taken?

Some of the key terms used in the DPSIR framework are outlined in **Annexure 1**.

4.3. Driving Forces

A driving force is a human activity that is generated to satisfy a 'need'. This section discusses the most significant driving forces contributing to the maximum pressures on the environment in Thane namely:

- Population growth
- Industrialization
- Construction
- Tourism

4.3.1. Population Growth

Population growth is one of the indicators of development. It has direct linkages with the environmental status of the city. Two components responsible for population growth are natural growth and in-migration. This section explains the population status in Thane and the growth trends.

As per Census 2001, population of Thane city is about 12.6 lakh. The population of Thane has been increasing consistently since 1951, with an average decadal growth rate of 65%. Total estimated population in the year 2008 was 17,00,000[3].

Refer **Figure 9** for population growth trend in Thane.

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[3] As projected for DP by TMC
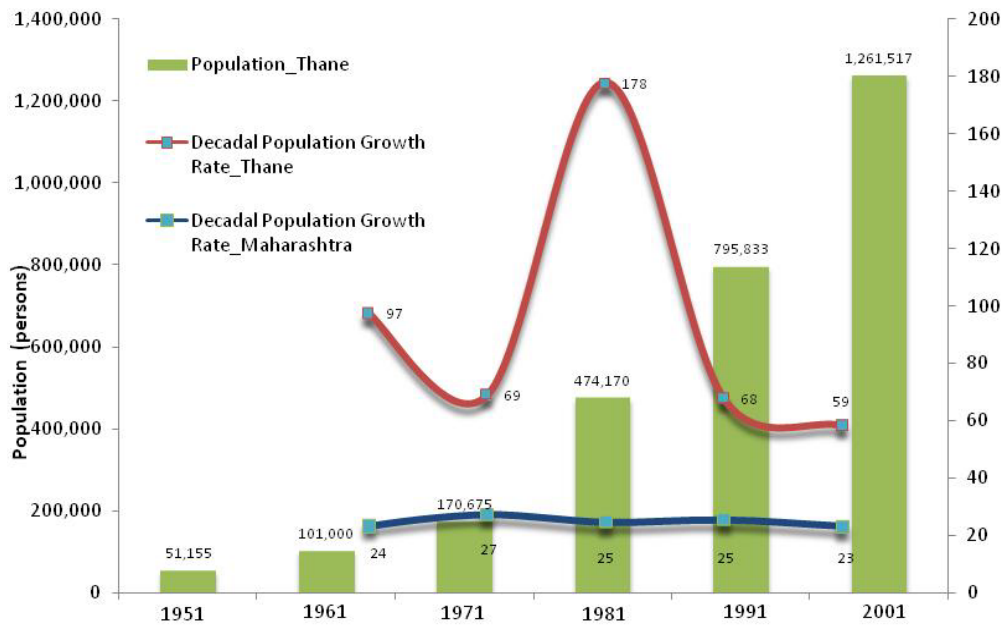
Figure 9.   Population Growth Trend in Thane

The sudden increase in population between 1971 and 81 could be accounted to formation of TMC in 1982, which included the then Thane Municipal Council and around 32 other settlements including the Kolshet-Balkum Industrial Complex and other villages along the Thane-Ghodbunder Road. As seen in above graph, the growth rate of Thane over 50 years is almost double than that of Maharashtra State. It may thus be concluded that in-migration (rather than natural growth of the population) is the causative factor for population growth of the city.

a.   Literacy

The city recorded a literacy rate of 80.67% as per the 2001 Census. Males have a higher literacy rate of 87.06% compared to 73.10% for females. However, as seen in **Table 1**, the gap between literacy rates between males and females has narrowed compared to that prevailing in 1991.

Table 1 -   Literacy Rate in Thane city

Category	Census 1991	Census 2001
Male	73.10 %	87.06 %
Female	60.28 %	77.56 %
Average literacy rate	66.69 %	82.31 %

b.   Slums

There are a total 210 slums within city limits. The total slum population is estimated to be 30-35% of total population[4]. Some of the major slum areas are:

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[4] As per data given by TMC

- Uthalsar
- Mumbra Divashil
- Owle Manpada Kolshet

- Naupada
- Wagle Estate

- Kopari
- Raila Devi

- Kalwa
- Vartak Nagar

4.3.2. Industrialization

The manufacturing belt has been the economic driver of the city since 1961. However due to a change in classification of industrial areas in TMC to Zone I, Thane has seen a steady decline of manufacturing units and the trend is moving towards establishment of service industries and IT parks instead.

TMC industrial area consists of Wagle Estate, Balkum and Kolshet industrial areas. These industrial areas house mostly chemical, engineering, textile and electrical industries. Refer to **Figure 10** for location of industrial areas.

Figure 10.   Location map of Industrial estates in Thane

4.3.3. Construction

The concept of conversion of industrial areas into residential areas in recent years has given rise to the real estate industry in Thane. Given the strategic advantage in terms of its location and with the TMC focusing its attention to the basic development of the city, there has been a large-scale construction in the city. Some of the biggest players in the real estate industry have set up their projects in Thane viz. Rustomjee, Lodha, Kalpataru, Runwal, Hiranandani, and Akruti developers. The booming IT and BPO sector has also boosted the real estate industry. In this scenario the disposal of Construction and Demolition (C&D) waste becomes an important element for consideration.

4.4. State and Pressures - Natural Resources

The state of the environment is represented by the qualitative and quantitative indicators of environmental resources as well as the quality of services it offers. Environmental monitoring data for air and water quality, and the extent of land contamination are some typical quantitative indicators.

This section explains the state of following resources:

- Air quality
- Noise
- Water quality
- Green areas
- Flora and fauna

It also includes a briefing for the state of services including:

- Water supply
- Sewage and sanitation
- Solid waste management
- Transportation
- Power supply

4.4.1. Air Quality

Air quality mainly gets affected due to industrial activities, vehicular movements and construction activities. In Thane, there is no distinct buffer between industrial and residential areas. TMC and MPCB together are monitoring the air environment for Thane.

Ambient air quality monitoring has been carried out at main road junctions and at the TMC dumping ground. The ambient air quality is also monitored by MPCB at four locations in Thane city – Kolshet, Balkum, Naupada and Kopri. The Kolshet and Balkum are industrial areas while the other two are residential locations. This monitoring data has been analyzed for this report. The National Ambient Air Quality Standards, 2009 have been used for assessing compliance.

a.   Ambient Air Quality Monitoring by MPCB

The four air monitoring stations of MPCB are shown in **Figure 11**. The analysis has been carried out for three seasons represented by data for the months of May, September and January. The sulphur dioxides (SOx) and nitrogen oxides (NOx) concentrations are quite low in comparison to the standards[5] for all three seasons. Refer **Figure 12** and **Figure 13** for SOx and NOx concentrations. The Suspended Particulate Matters (SPM) levels in May 2008 record high levels when compared to

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[5] http://mpcb.gov.in/envtdata/demoPage1.php

2009 levels, but are still well within permissible limits. Refer **Figure 14** for SPM levels. The Respirable Suspended Particulate Matters (RSPM) levels, though within limits, are quite high. Refer **Figure 15** for RSPM levels. The percentage of RSPM in SPM is almost 60% which is an alarming situation. Refer to **Figure 16** for the ratio of RSPM in SPM.
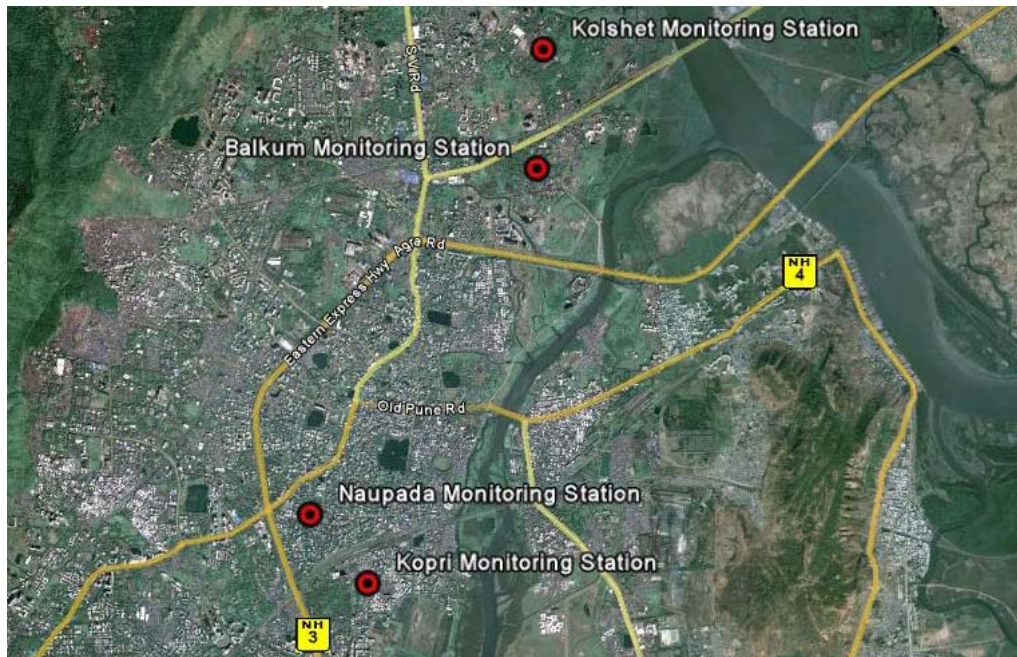
Figure 11.   Air Quality Monitoring locations in Thane city
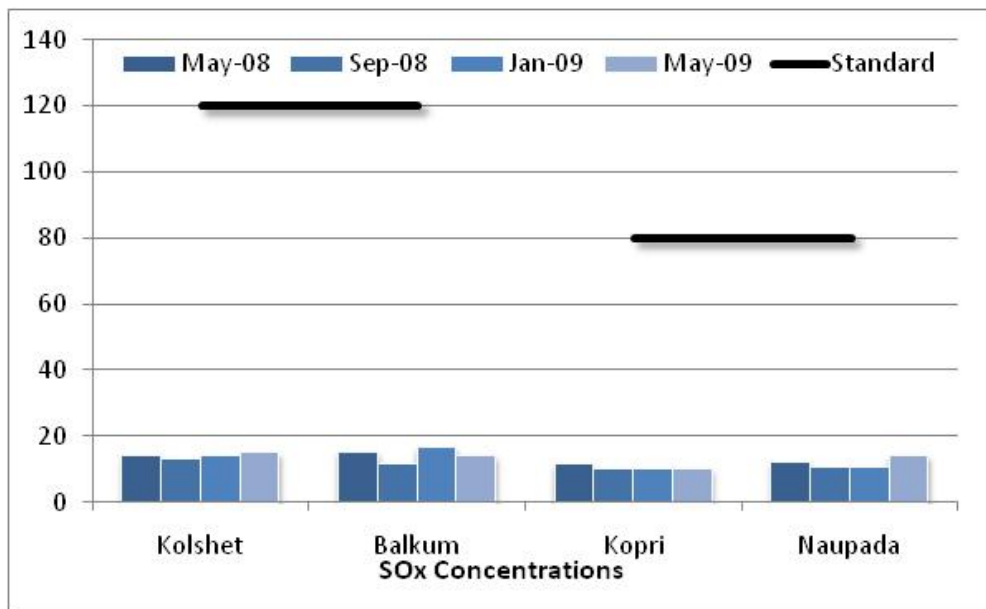
Figure 12.   Ambient air quality – SOx (µg/m³)

Ambient air quality standard for SOx in industrial area is 120 µg/m³ and for residential area is 80 µg/m³
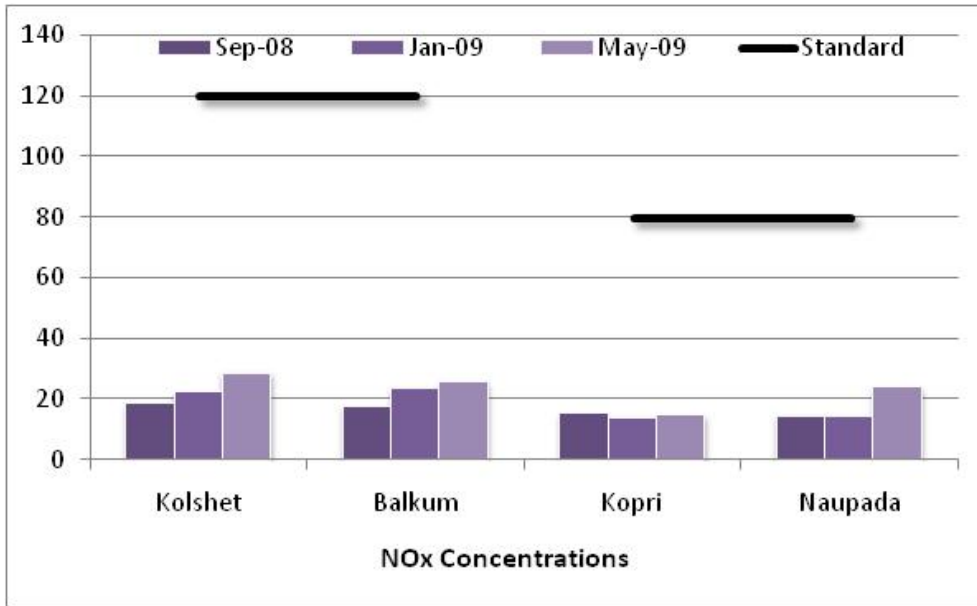
Figure 13.   Ambient air quality – NOx (µg/m³)

Ambient air quality standard for NOx in industrial area is 120 µg/m³ and for residential area is 80 µg/m³

For SOx and NOx concentrations, it can be clearly seen that concentrations at Kolshet and Balkum are higher compared to Kopri and Naupada. As mentioned earlier, Kolshet and Balkum are industrial areas.
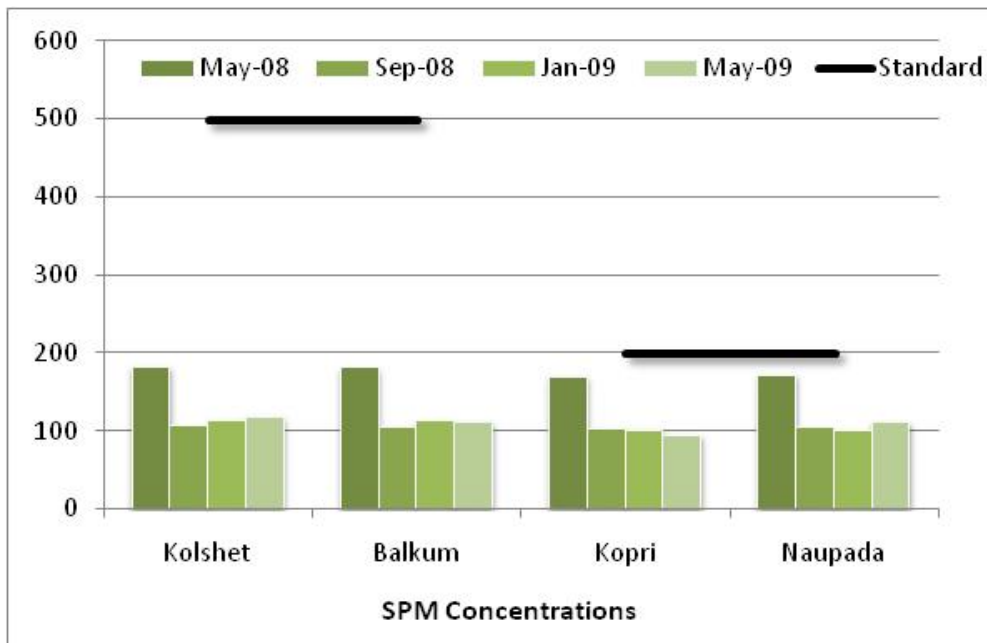
Figure 14.   Ambient air quality – SPM (µg/m³)

Ambient air quality standard for SPM in industrial area is 500µg/m³ and for residential area is 200 µg/m³

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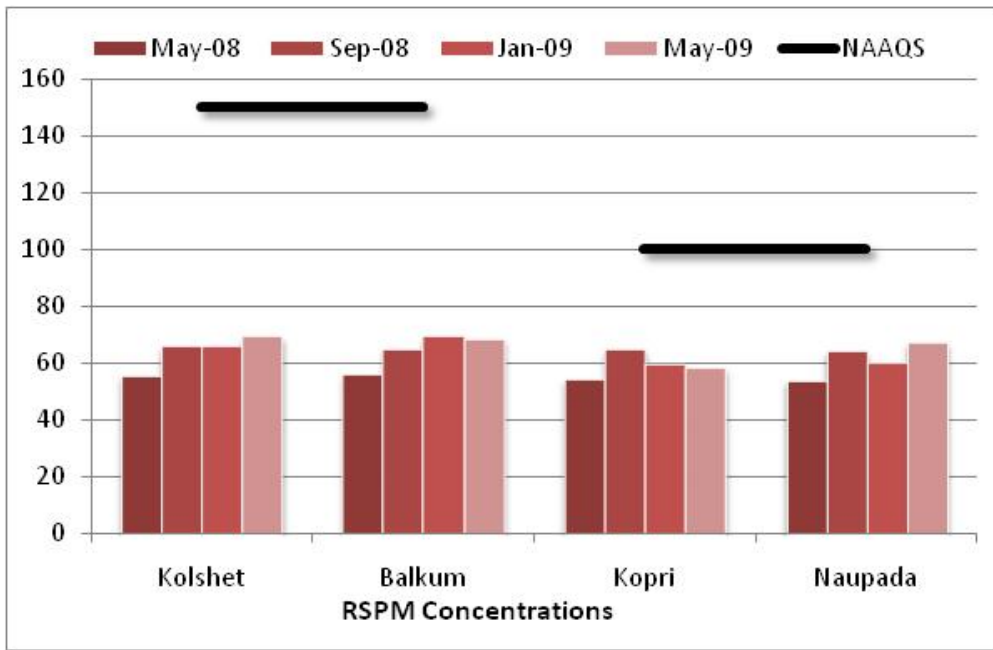
Figure 15.   Ambient air quality – RSPM (µg/m^3)

Ambient air quality standard for RSPM in industrial area is 120 µg/m^3 and for residential area is 100 µg/m^3
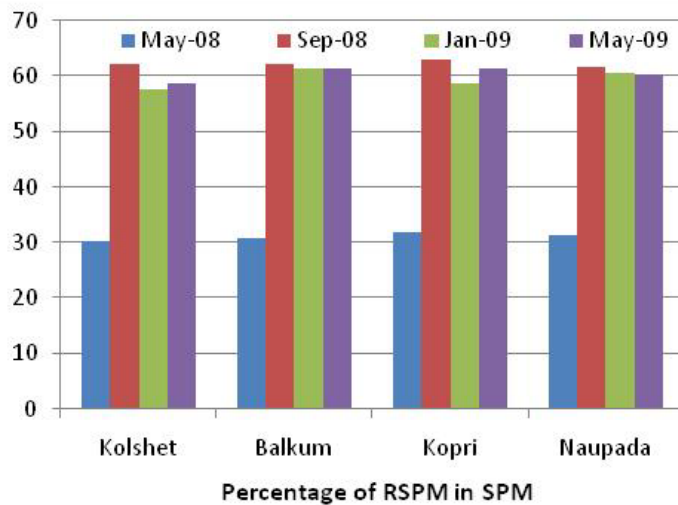
Figure 16.   Air Quality – Percentage of RSPM to SPM

SPM levels in May 08 are substantially higher than other monitoring periods. This may due to the weather conditions at that particular timing of monitoring.

b.   Ambient Air Quality Monitoring at Junctions by TMC

The ambient air quality has been monitored at ten main junctions in the city viz. Kopri, Panch Pakhadi, Gandhi Udyan, Sant Gajanan Maharaj Chowk, Manpada, Mulund Check Naka, Cadbury, Nitin Company Naka, Majiwada and Gavdevi. Refer to **Figure 17** for location of these monitoring locations. The parameters monitored are

SOx, NOx, RSPM, ammonia (NH_3) and hydrogen sulphide (H_2S). Once again, the SOx and NOx concentrations are quite low while the RSPM levels exceed the National Ambient Air Quality Standards (NAAQS). Refer to **Figure 18** for SOx, NOx and RSPM comparison with standards.

Refer to **Annexure 2** for ambient air quality monitoring conducted at junctions.
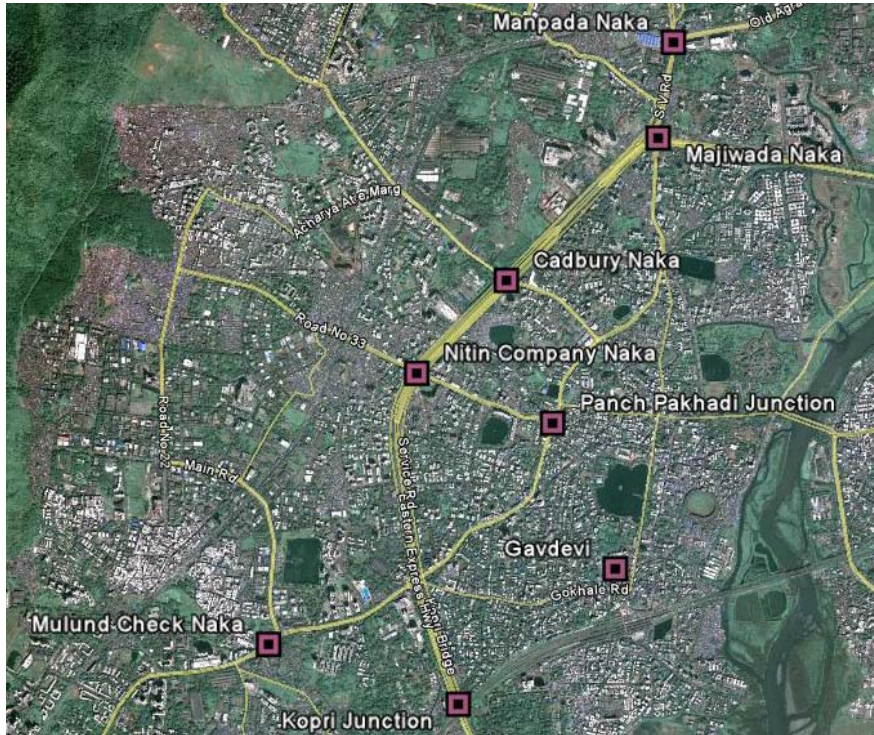
Figure 17.   Air Quality Monitoring Locations - Road Junctions in Thane
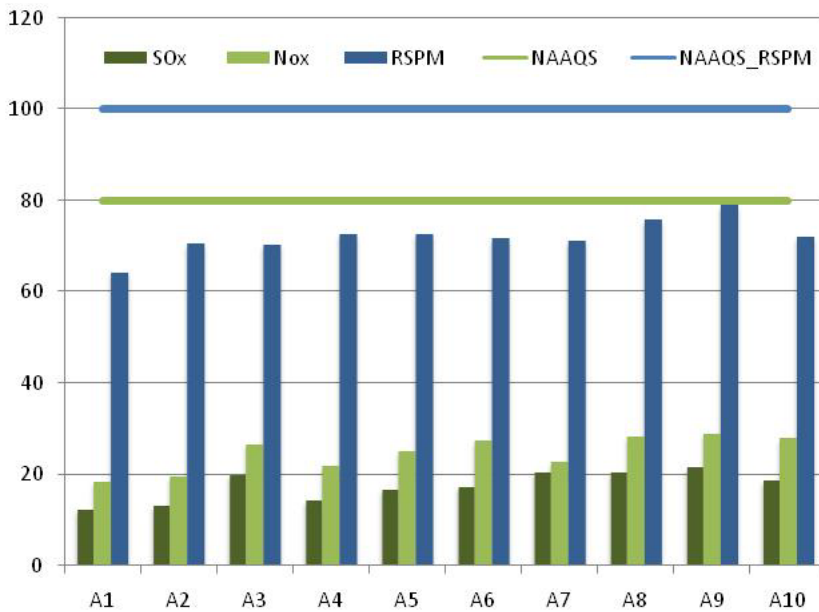
Figure 18.   Air Quality at Junctions – SOx, NOx, RSPM Concentrations (µg/m³)

The ambient air quality at the TMC dumping ground located at Gaimukh Ghodbunder Road is also monitored. The parameters monitored are NOx, SO_2, NH_3, H_2S, carbon monoxide (CO), methane (CH_4) and SPM. Refer to **Annexure 3** for ambient air quality monitoring conducted at the TMC dumping ground.

c.   Air Pollution Index

Previous ESRs (2006-07 and 2007-08) included observations from ambient air quality monitoring. Based on these readings, Air Pollution Index (API) was calculated for a pollutant as well as a location using following equations:

$$\text{API for each pollutant} = \frac{Observed\ value\ of\ the\ pollutant}{Standard\ limit\ as\ per\ CPCB} \times 100$$

API for location = Average of all APIs for each pollutant at given location

In general, the greater the API, the more is the pollution. A lower API therefore is beneficial for human health and the environment.

Monitoring data used for calculating API was reported by the Environmental Lab, TMC. Calculation of API is recommended. But the data used for calculation purposes should be given in Annexure.

Refer to **Table 2** for APIs calculated for various locations for the years 2006-07, 2007-08 and 2008-09.

Table 2 -   APIs

Location	API		
	2006-2007	2007-2008	2008-2009
Maziwada	30	32	35.8
Kolshet	18.8	25	37.15
Kalwa	25.2	28	33
Wartak Nagar	16.98	18.37	22.9
Mumbra	20.2	22	24.9
Pokhran Road	26.3	27.8	29.2
Kopri	17.8	25.3	29
Shahu Market	18.1	26.3	28.6
Balkum	18.3	30.3	32.6
Uthalsar Prabhag Samiti	22.9	26.4	31.5

It can be clearly seen from the above table that there is an increase in API every year. In 2006-07 and 2007-08, Maziwada area recorded the highest API levels. In year 2008-09 Kolshet, a rapidly growing area, recorded the maximum API as 37.15.

Also refer to **Figure 19** for a graphical comparison of APIs for the above-mentioned years.
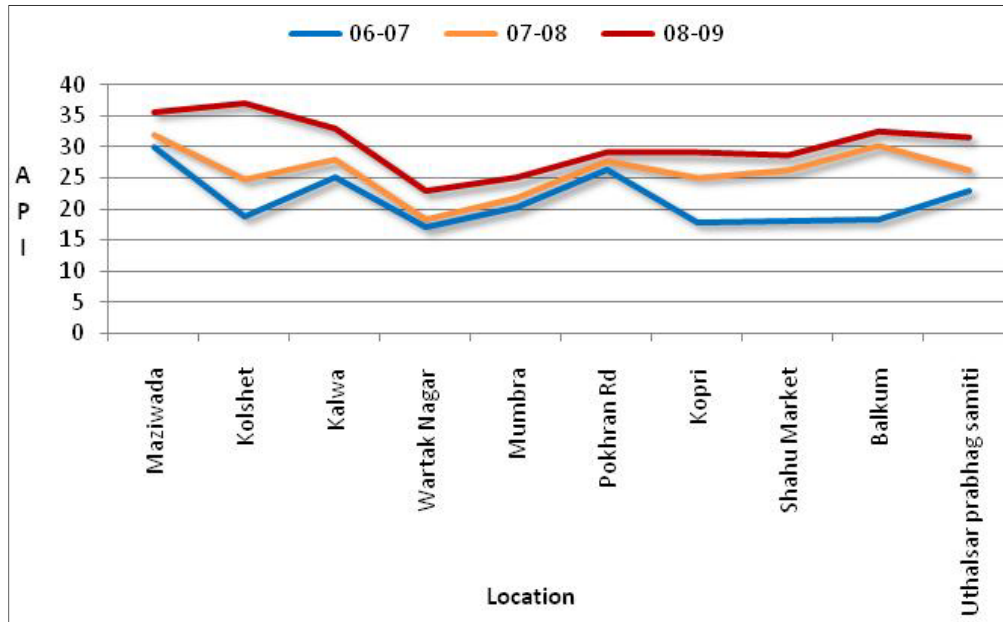
Figure 19.   API Comparison across locations and years

It can be clearly seen from Figure 19, Balkum and Kolshet are the locations where API has increasd substantially.

d.   Ambient Air Quality monitoring during Diwali

The Diwali festival is one of the most important festivals and is celebrated with great pomp all over the city. This is the festival of lights and typically includes bursting fire crackers. This has led to serious concerns about rising air pollution levels. Typical air pollutants emitted as a result of bursting fire crackers are SO_2, NOx and smoke/ dust including RSPM. Experience has shown that the enforcement of rules governing air pollution is very difficult and may not always suffice. It is best to tackle this issue by continuing to create public awareness about it.

In order to ascertain the levels of air and noise pollution during the festival, air quality monitoring was carried out by TMC city at 9 different locations. Using this data API for these 9 locations has been calculated.[6]

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[6] Monitoring has been conducted by TMC and analyzed by the TMC's Consultant. API has been calculated. But raw data is not provided in report or annexure.

e. Ambient Air Quality for the Station Area Traffic Improvement Scheme (SATIS)

The major transit point of Thane city is its railway station which required specific improvement. A two-level transport system called Station Area Traffic Improvement Scheme (SATIS) was planned for Thane station in previous years, to segregate movement of buses and private vehicles. This would ensure quick dispersal of traffic and thereby reduce congestion as well as air pollution levels.

Ambient air quality was monitored during the construction and operation phases of SATIS. Refer to **Table 3** for observations.[7]

Table 3 -   Ambient Air Quality during and post construction of SATIS

Location	SOx (µg/m³)		NOx (µg/m³)		RSPM (µg/m³)		SPM (µg/m³)	
	C	O	C	O	C	O	C	O
Standard	80	80	80	80	100	100	200	200
B-Cabin	25.2	13	10.2	21	190.0	155	328	213
Railway Station	23.7	16	13.3	19	178.6	150	253.6	202
Jambil Naka	30.2	22	19.5	33	178.6	129	250.9	178
Gandhi Garden	53	18	18.9	50	202	174	260.2	239

C – During construction phase   O – During operation phase

Concentrations of SOx, SPM and RSPM have reduced after the construction activities are over. However, the concentrations of NOx have increased (though within permissible limits) even after in operational phase.

4.4.2. Noise

Ambient air noise levels have been monitored at seven locations in residential areas and compared with the applicable standards. Standards used for comparison are those stated in the Ambient Air Quality Standards for Noise specified by the Central Pollution Control Board (CPCB). Refer **Table 4** for day time averages for these 7 locations.

Table 4 -   Ambient air Noise Monitoring observations at residential area

Location	Day time Average dB(A) Standard – 55 dB(A)
Raila devi Prabhag Samitee	61
Kalwa Prabhag Samitee	64
Kopri Prabhag Samitee	66
Utalsav Prabhag Samitee	74
Raila Devi Prabhag Samitee	74

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[7] Monitoring results are as provided by TMC Consultant

Location	Day time Average dB(A) Standard – 55 dB(A)
Pokharan 2 Gandhi Nagar	73
Kalwa Prabhag Samitee	69

Refer to **Annexure 4** for hourly observations during these monitoring periods.

The monitoring results show that the noise levels during the day[8] exceeded the permissible limits significantly. Residential areas in Railadevi Prabhag and Utalsav Prabhag have more noise pollution among the monitored.

a.	Noise monitoring in silence zones

Noise monitoring was carried out in silence zones at the following locations:

- Mental Hospital
- Civil Hospital, Temby Naka
- Chatrapati Shivaji Maharaj Hospital, Kalwa
- Kaushalya Hospital Pachpakhadi
- Lok Hospital, Vasant Vihar
- Bedekar Hospital
- Chirangivi Hospital
- Saraswati High School
- Bedekar School
- Holly Cross High School K villa
- District Court, Court Naka

The permissible noise limits for silence zones are 50 dB(A) Leq during day-time and 40 dB(A) Leq during night-time. Refer to **Figure 20** for data. It may be observed that none of the monitored locations meet the prescribed standard.

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[8] Night time data is not made available by TMC or Consultant.
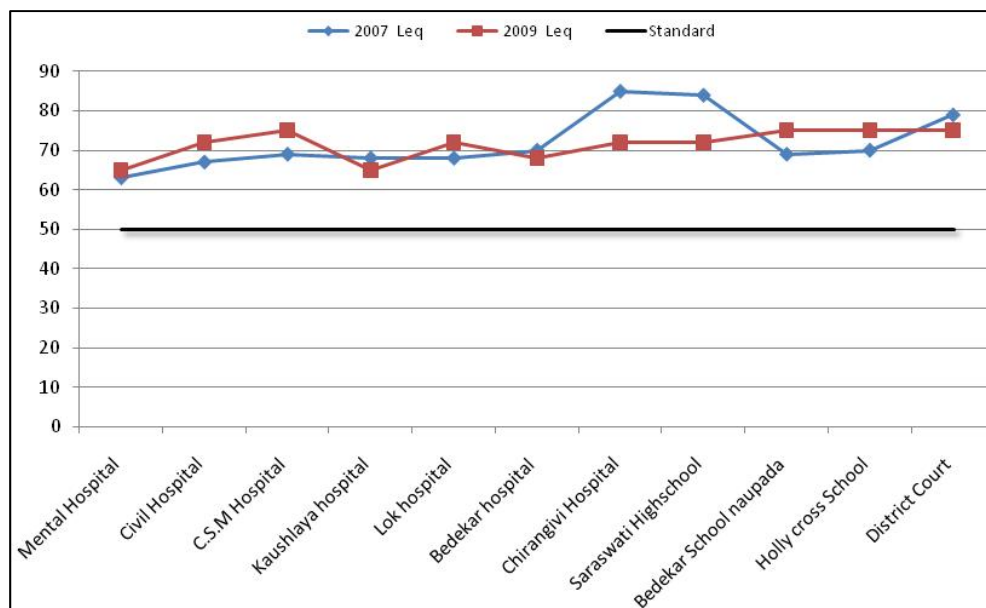
Figure 20. Noise levels in silence zone [dB(A) Leq]

It can be seen from the graph above (figure 20) that, some of the locations show increase in noise levels in 2009 compared to 2007, e.g. Civil Hospital, CSM Hospital, Bedekar School, Lok Hospital and Holy Cross School. Remaining locations show the decrease in noise levels, may be as a result of measures taken to minimize noise pollution.

> If noise levels have dropped due to initiatives undertaken by Corporation or institutes then these should be explained in the report.
>
> Also, as the standards for day time and night time are different, noise assessment should be done separately.

b.   Noise monitoring during festivals

Noise monitoring was also carried out during major festivals viz. Ganpati and Diwali. Readings taken at various locations of Ganesh idol immersions show very high levels of noise i.e. ranging between 75–90 dB(A). Noise levels at Ganesh Visarjan Ghat have been monitored and compared for last 3 years. Refer to **Table 5** for observed noise levels on the immersion day at visarjan ghats. As compared to standards[9], the observations are exceeding the permissible limits.

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[9] As per Noise Pollution (Regulation and Control) (Amendment) Rules 2010, the noise levels shall be maintained at boundary of public places shall not be more than 10 dB(A) above the permissible limit of specified area or 75 dB(A) whichever is lower.

The noise levels monitored during Diwali too have recorded values which exceed the standards.

Table 5 -   Noise level at Ganesh Visarjan Ghats

Ganesh Visarjan Ghat	2007 dB(A)	2008 dB(A)	2009 dB(A)
Kopari Ghat	77	80	78.5
Kalwa Ghat	78	77.5	79.12
Kharegaon Ghat	78	85	79.12
Reti Bandar Ghat	78	77.5	81.7
Upavan Lake (artificial pond)	81	86	81.6
Raila devi Lake (artificial pond)	82	85	80.7
Masuda Lake (artificial pond)	82	85	81.6
On selected roads	95	93	96.06

c.   Noise Monitoring at Yeoor Tekadi

Yeoor Tekadi is one of the tourists' attraction spot in Thane. It is also famous spot for parties, especially New Year parties. On account of the High Court order prohibiting vehicles at Yeoor Hills on New Year's Eve in 2009, there was a remarkable reduction in noise levels (Refer to **Table 6**).

Table 6 -   Noise Monitoring on 31st December 2008 and 2009 at Yeoor Tekadi

Monitored Location	Leq 2008	Leq 2009
Shradha Restaurant	108	40
Yeoor Village	98	52
Sharma Farm House	100	41
Exotica	102	41
Golden Swan Club	98	43

4.4.3. Water Quality

Water is one of the basic building blocks of life. Changes in physical, chemical and biological characteristics of water – i.e. water pollution – can cause harmful effects on living organisms. The water quality for Thane city was monitored for various types of water bodies viz. creek, lake, *nallah* and ground water.

Creek Water Quality

Thane Creek is part of the estuary of the Ulhas River opening into Mumbai Harbour. It covers an area stretching from Mumbra Retibunder to the Mankhurd-Vashi Bridge. Thane Creek receives a variety of pollutants from the domestic and industrial waste water treatment facility of the Brihan Mumbai Municipal Corporation (MCGM),

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TMC, Navi Mumbai Municipal Corporation (NMMC), Thane Belapur Industrial Association (TBIA), Maharashtra Industrial Development Corporation (MIDC), City Industrial Development Corporation (CIDCO) and several large scale industries.

Water quality was tested at six locations in Thane creek. Refer to **Figure 21** for these locations. Physico-chemical parameters such as pH, Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Chlorides (Cl^-), Phosphates (PO_4^{2-}), Nitrate (NO_3), and Total Kjeldhal's Nitrogen (TKN) were monitored. Refer to **Table 7** for their concentrations. Water Quality Standards for best designated usages prescribed by MPCB have been used for assessing compliance. [10]
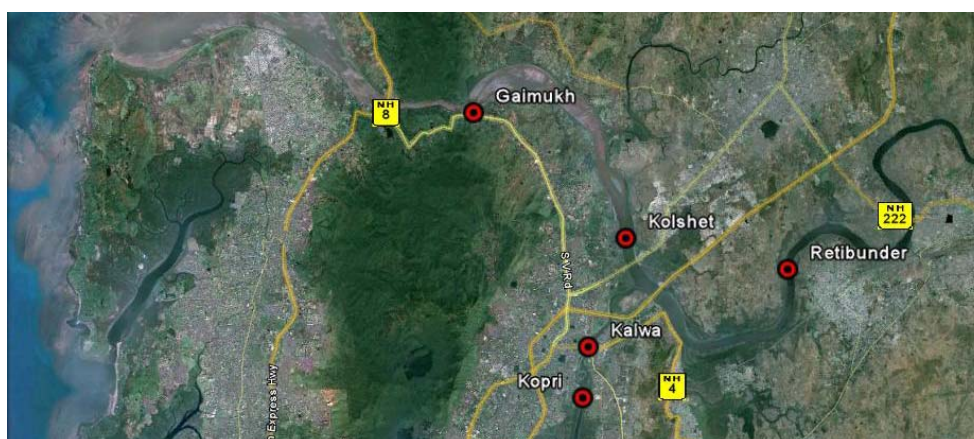
Figure 21.   Monitoring Locations for Thane Creek Water Quality

Table 7 -   Thane Creek Water quality

Monitoring Location	pH	DO mg/lit	BOD mg/lit	Cl^- mg/lit	PO_4^{2-} mg/lit	NO_3 mg/lit	TKN mg/lit
Kopri Creek	7.2	4.3	35	14,180	0.262	0.2	0.82
Gaimukh	7.2	4.2	25	10,224	0.308	0.166	0.078
Kolshet	7.4	4.8	39	12,354	0.056	0.1	0.051
Saket	7.5	2.6	42	14,200	0.252	0.066	0.05
Retibander	7.5	1	39	14,889	0.18	0.314	0.068
Kalwa	7.2	4.8	40	13,967	0.326	0.22	0.072

a.   pH and other pollutants

The pH level is close to being neutral (i.e. 7) and is within the specified range. The phosphate, nitrate and TKN concentrations too are quite low compared to the standards. The chloride concentration is extremely high and affects aquatic life adversely. The concentrations of chloride recorded here are known to be toxic to fishes.

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[10] http://mpcb.gov.in/envtdata/waterquality41.php
http://www.cpcb.nic.in/Water_Quality_Criteria.php

b.　　　　**Dissolved Oxygen**

The amount of DO in a water body is one of the most commonly used indicators of its health. The DO level of most monitored locations meet the prescribed limit (i.e. greator than or equal to 4mg/lit)[11], with the exception of Saket and Retibander (2.6mg/lit and 1.0mg/lit). A comparison with DO data for the previous year shows that levels have decreased slightly for this year, an indicator of worsening water quality for Thane creek.

c.　　　　**Biochemical Oxygen Demand**

BOD is a measure of the uptake rate of DO by biological organisms in a body of water. It has been observed that all monitored water bodies tend to have very high BOD values (exceeding the prescribed limits) and are thus heavily polluted. It implies that these water bodies are suffering from large amounts of organic pollution. High temperatures can also contribute to high BOD levels. Refer to **Figure 22** for a comparison of important monitored parameters with the standards.
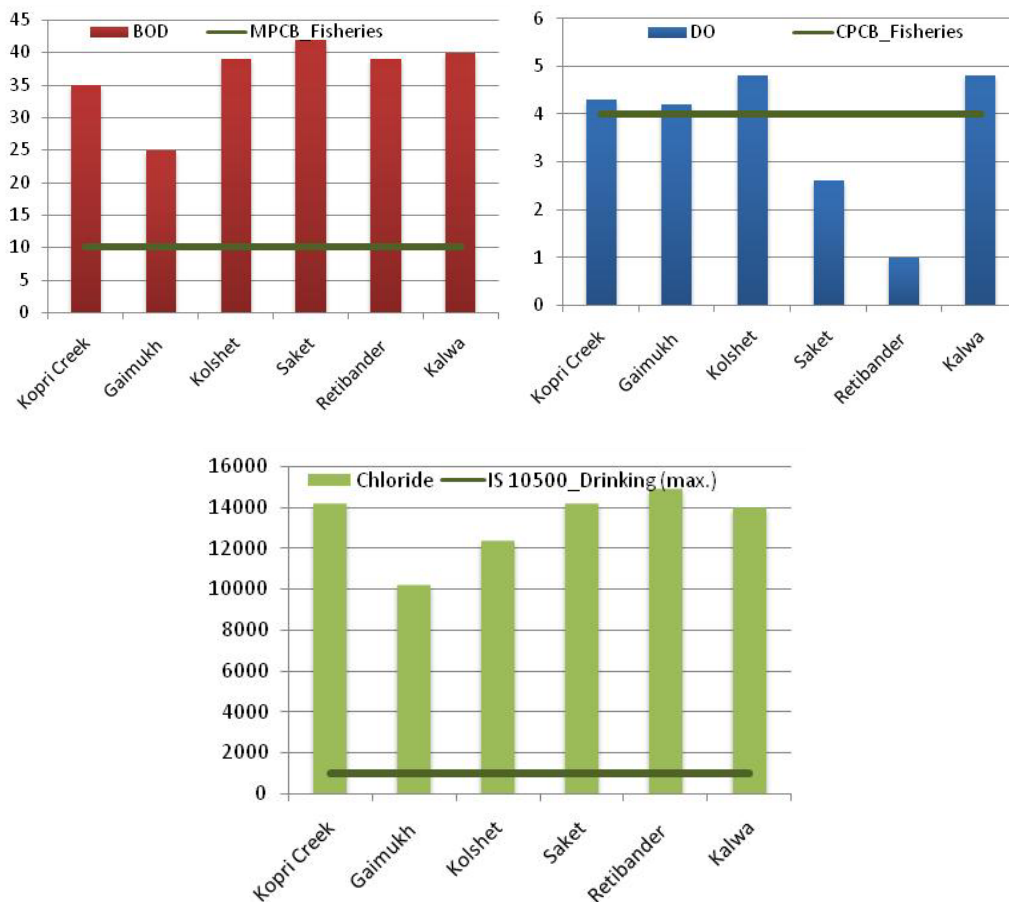
Figure 22.　Comparison of parameters with standards for Thane Creek Water Quality

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[11] Unlike standards for other parameters, high DO is positive indicator of water quality.

Lake Water Quality

The water quality of 19 lakes was tested for physicochemical parameters such as pH, BOD, COD, nitrates and phosphates. DO levels were monitored for the benthic as well as pelagic zones. Refer to **Figure 23** for monitoring locations for lake water quality.
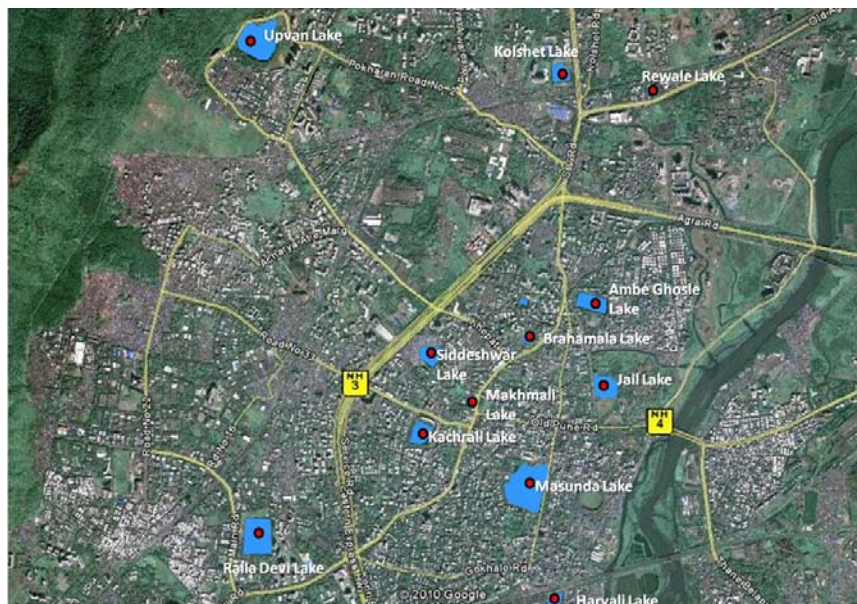
Figure 23. Monitoring Locations for Thane Lake Water Quality

The standards used for compliance assessment for the monitored levels are IS: 10500 and Water Quality Standards for Best Designated Usages by MPCB. The DO levels are very good when compared with drinking water standards. DO is monitored at Pelagic and Benthic levels. Pelagic level is near to shore or at the water surface level. As the water is in contact with ambient air, DO levels are higher than the benthic level. Benthic samples are collected from the bottom of the water body.

Considering the DO as an indicator for good health of lake, Masunda and Kausa lakes are performing better. Kalwa and Railadevi lakes are worst among the samples, though within the permissible limit as mentioned above.

In normal circumstance, high DO results into low BOD levels. Such cases indicate the low level of organic and inorganic pollution levels. However, here in these lakes, the BOD levels are higher than that permissible for drinking water and hence make it unfit for use as potable water. If BOD levels are compared with the MPCB standards for fisheries, then Kolbad, Upavan and Siddheshwar are beyond permissible limits for fisheries, indicating low sustainability of aquatic life. Kalwa and Railadevi lakes have low BOD and comparitivly high DO indicating good aquatic life. Kausa lake shows high DO as well as high BOD values, which needs to checked.

The pH levels were found to vary from neutral (pH = 7) towards increasing alkalinity (pH > 7). Refer to **Figure 24** for DO levels and **Figure 25** for BOD concentrations and their comparison with the standards.
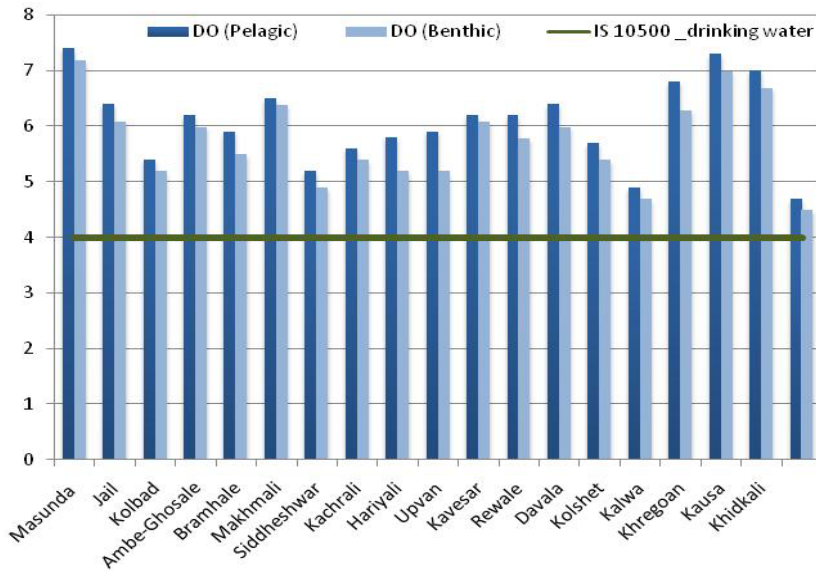
Figure 24.   Comparison of DO (mg/l) with standards for Thane Lakes Water Quality
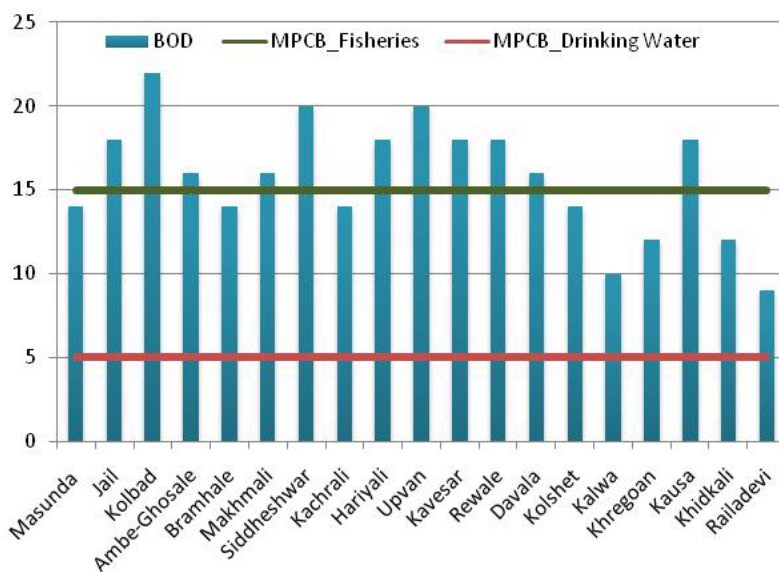
Figure 25.   Comparison of BOD (mg/l) with standards for Thane Lakes Water Quality

Immersion of Ganesh Idols in Lakes

TMC implemented a project for eco-friendly Ganesh idol immersion this year. It embarked upon a novel idea of creating an artificial immersion pond within the lake itself. About 60,000 Ganesh idols are immersed in local water bodies every year. On an average, an idol is eight to ten inches tall and weighs 250 gm. Around a ton and

half of plaster of paris used for in the preparation of idol mixes contributes a huge pollution load to the water body within the short span of 10 days which make up the Ganesh Festival.

Analysis for receiving water bodies with the contained artificial immersion pond was conducted before, during and after the festival. TMC also initiated mitigatory measures such as aeration of the artificial immersion pond, and addition of alum and potassium permanganate before, during and after the immersion. It was noted that the water quality of the artificial immersion pond did not deteriorate on account of the immersions. Rather, due to this pre-emptive treatment, the quality of water was satisfactory enough to meet the prescribed standards for inland surface water. Refer to **Annexure 5** for the above-mentioned observations.

Nallah **Water Quality**

Nallahs or drains are intended to serve as conduits for stormwater. However, given the poor state of sewage infrastructure, there are chances that water in *nallahs* may contaminate with sewage and hence water quality of *nallahs* also needs to be monitored. It has been observed that *nallahs* are recipients of industrial discharges and domestic effluent arising from slums. This has given rise to the growth of certain weeds like water hyacinth, lpomea etc.

Nallah water quality was tested at eleven locations in Thane city. Refer to **Figure 26** for these monitoring locations. The parameters monitored were pH, suspended solids, BOD, COD, phosphates, nitrates, ammoniacal nitrogen and sulphides. The pH levels were found to be in the neutral range. The BOD and COD concentrations are high indicating organic as well as inorganic pollution. The level of suspended solids in Rabodi *Nallah* was found to be the highest of all tested *nallahs*. Refer to **Annexure 6** for observations.
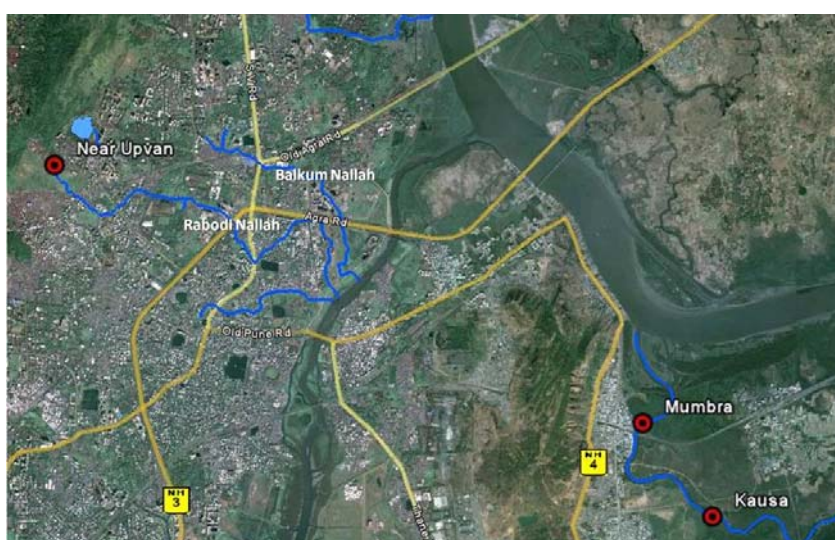
Figure 26.   Monitoring Locations for Nallah Water Quality

Ground Water Quality

The ground water quality has been tested for each ward in Thane city. Refer **Figure 27** for monitoring locations. The monitoring has been conducted at open wells and bore wells which are in use in the city. The parameters monitored are total hardness, chlorides, pH, total dissolved solids, COD, BOD, suspended solids and chlorine demand. The standards used for comparative analysis is IS:10500 and MPCB standards for drinking water.

The water quality of borewells is more contaminated as compared to open wells. The monitoring results show general high concentration of contaminants in Manpada and Mumbra ward. The BOD levels are high at all locations of bore wells, the highest being at Railadevi, Wagle Estate, Mumbra and Manpada. The hardness measured for borewells is beyond the standards specified at all locations and is highest at Kopri and Uthalsar wards. The borewell water in Kopri and Uthalsar wards are not fit for consumption considering the high contaminant levels. Similarly the well water is unfit for consumption in Mumbra and Manpada wards. Refer **Figure 28** for comparison of monitored ground water parameters with standards.
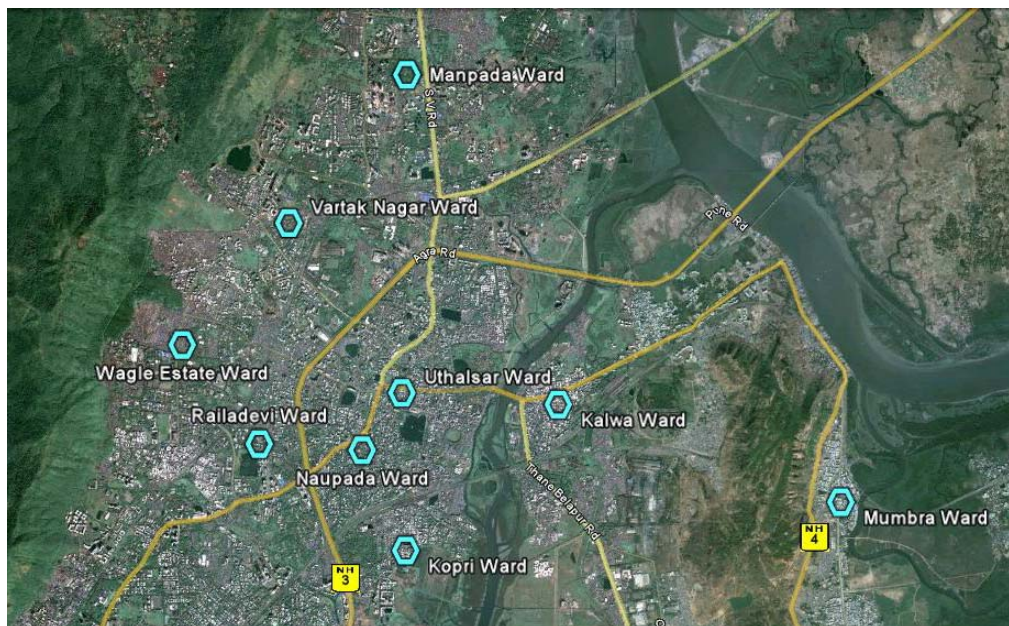
Figure 27.   Monitoring Locations for Ground Water Quality

Well water Samples	Borewell Samples

GW1-Railadevi, GW2-Wagle Estate, GW3-Mumbra, GW4-Manpada, GW5-Kopri, GW6-Uthalsar, GW7-Naupada, GW8-Kalwa, GW9-Vartak nagar
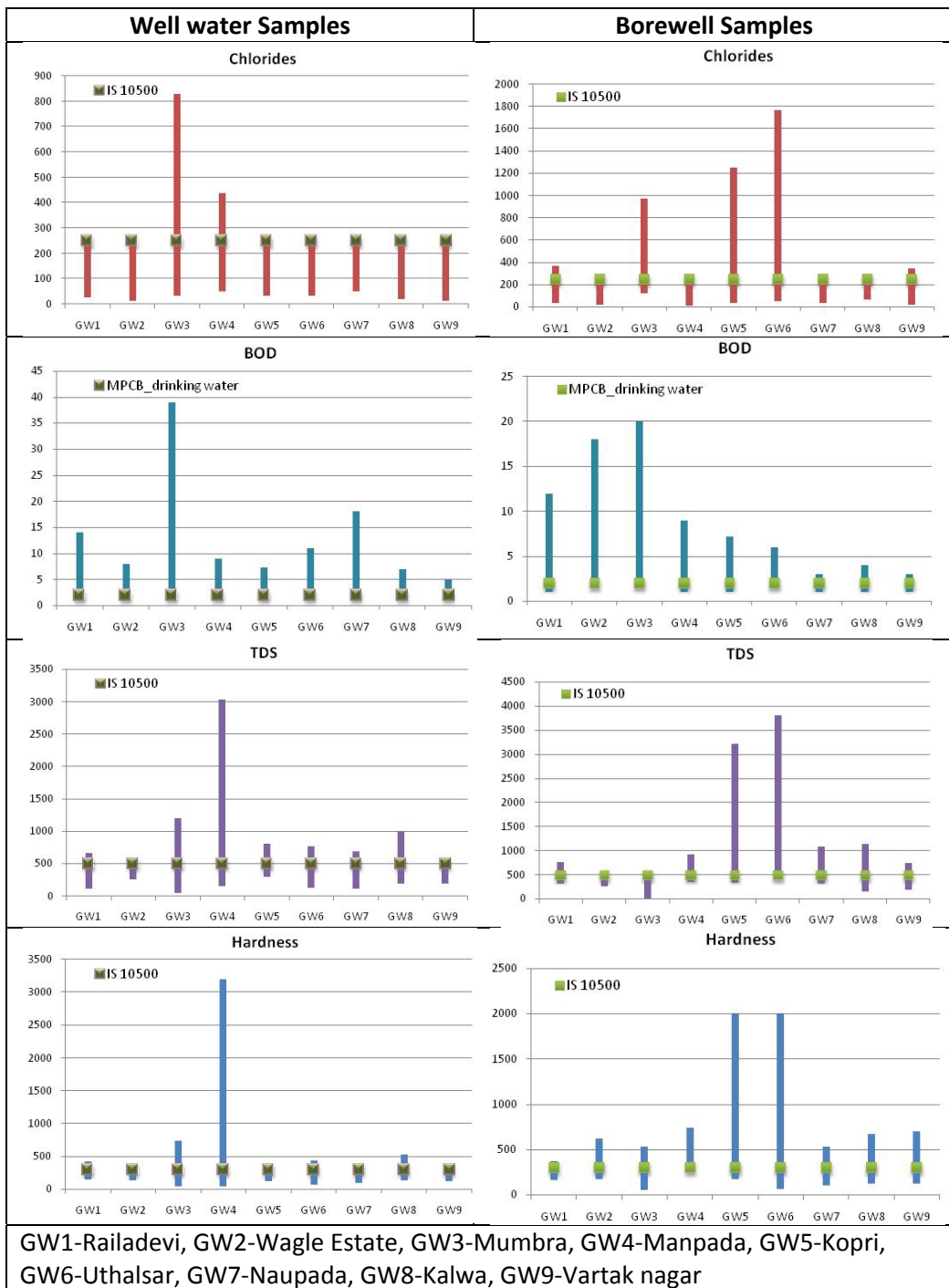
Figure 28.   Ground Water Monitoring Parameters Concentrations – wells and bore wells

4.4.4. Land

Green spaces act as the lungs of the city. Gardens, open spaces with greenery, hilly area, mangroves area etc. are considered as green areas.

Out of total TMC area of 128.33 sq.km. 48.72 sq.km. (Approx. 36%) area comes under green spaces. It includes 28 sq. km. of forest area, 10 sq. km. of mangroves

area and 10.72 km of tree green cover. TMC has also been implementing arboriculture and mass plantation drives every year with the help of some NGOs. Gardens in Thane

The Garden Department of TMC in collaboration with the Tree Authority is responsible for maintaining and increasing open and green spaces within the city. Thane has about 72 gardens occupying a total area of 19.02 sq. km. These gardens are home to a variety of species of flora and birds. Refer to **Table 8** for information about gardens in various wards of the city.

Table 8 -   Information about gardens in various wards of the city

Wards	Total area of gardens in Ha	No. of Gardens
Naupada	20,107	17
Uthalsar	34,341	10
Kopari	4,191	5
Railadevi	2,779	4
Wagale Estate	14,335	4
Vartak Nagar	17,192	11
Chitalsar Manpada	60,739	6
Kalawa	32,162	6
Mumbra	4,436	4
Total	1,90,482	67

According to the Tree Census (2002), TMC has a total of 3,31,500 trees under its jurisdiction. 294 species have been identified in the municipal notified area, of which 85 are exotic.

4.4.5. Flora and Fauna

Thane city is surrounded by Sanjay Gandhi National Park and Yeoor hills to the west and mangroves of Thane creek to the east. Refer **Figure 29**

Sanjay Gandhi National Park: The Park is a large Protected Area notified by the Forest Authority. An estimated 800 types of flowering plants, 284 kinds of birds, 5,000 species of insects, 36 types of mammals, 62 reptiles and 150 species of butterfly are home to the forest. The park has also many endangered species of plants and animals. The world's largest moth, the Atlas moth, was discovered here. *Karvi* or *Karvy,* also known as *Strobilanthes Callosa* to botanists, a flowering plant which blooms once in 8 years, can be found here. The park is also home to a small population of leopards.

Yeeor Hills: The Yeoor hills are a part of the Sanjay Gandhi National Park and lie alongside Thane city near Upvan Lake. Yeoor Hills is home to about 78 known species of birds and about 12 different species of animals. It also has the highest

density of leopards in India. The prime attraction here is the 150-year-old holy shrine of *Mama Bhanja.*

Mangroves: As per the study conducted by Kothari and Singh in 1998, there were 14 species of true mangroves, 12 species of mangrove associates, and 8 species of non-mangrove halophytes. The mangroves of Thane creek are under serious threat from anthropogenic activity. They are regularly cut for fuel or for acquiring land for aquaculture ponds. In many places, serious damage has been caused by solid waste dumping, including waste material arising from C&D activities in the city. Reclamation of mudflats for building roads, bridges, etc. is also a contributory factor for their destruction.
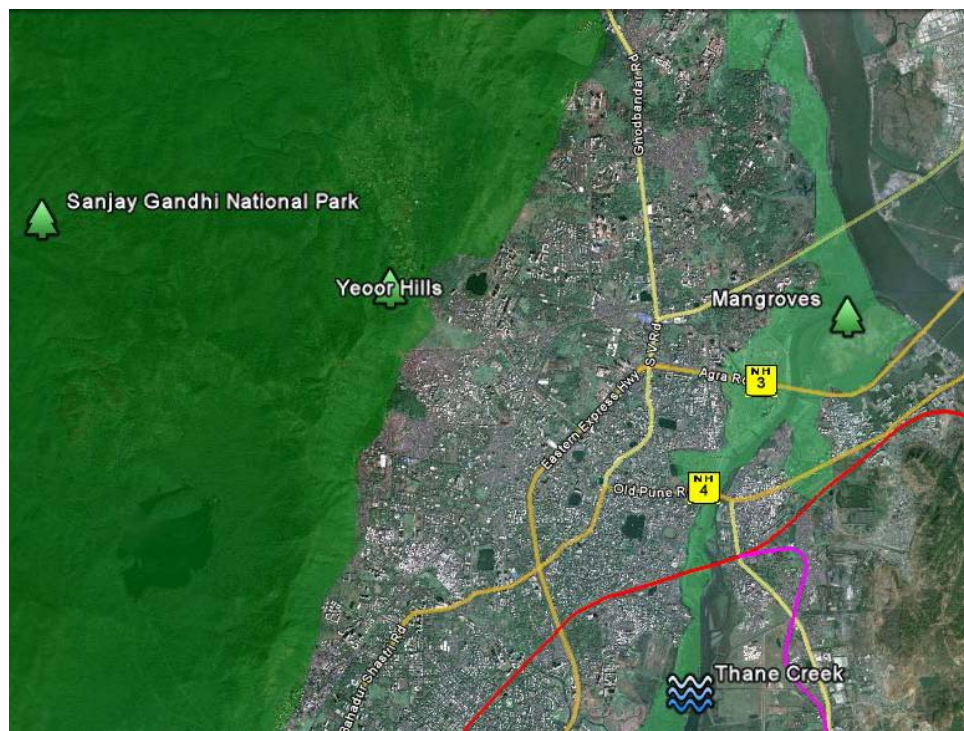
Figure 29.   Location of Green Spaces in Thane city

The destruction of mangroves and the steady encroachments on the forested side of Yeoor Hills and certain fractions of Sanjay Gandhi National Park are major causes for concern, as is the conflict for space between man and leopards in Yeoor Hills.

4.5. State and Pressures - Urban Infrastructure

Urban or municipal infrastructure refers to systems generally owned and operated by municipalities, such as transportation, water supply, sewers, etc. Indian cities and towns face serious challenges of growth and its management. Across geographies, the issues of urbanization manifest in the form of overcrowding, congestion, insufficient infrastructure, inadequate service provisioning—mainly in terms of drinking water, sanitation, energy, transport, solid waste management, environmental degradation, and pollution, etc. These, along with the poor

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management of rapid growth, affect the socioeconomic development of the area. Deficient infrastructure and increasing demand impacts the status of natural resources. This section explains the existing urban infrastructure facilities in Thane.

4.5.1. Water Supply

TMC supplies 422 Million Litres per Day (MLD) to the City. Thane receives water from Bhatsa river through supply by TMC (160MLD), MIDC - 80MLD, Shahad-Temghar Water Supply Project (STEM- 122MLD) and MCGM- 60 MLD. The water is treated at Temghar treatment and supply plant. Refer **Table 9**

Table 9 -   Water Supply Sources in TMC

Scheme	Quantity of water sourced (2009)	Quantity of water sourced (2008)
Independent water supply scheme	160 MLD	100 MLD
BMC	60 MLD	60 MLD
MIDC	80 MLD	75 MLD
STEM	122 MLD	127 MLD
Total	**422 MLD**	**362 MLD**

Considering distribution losses 20%, tanker supply 1.2 MLD, the available quantity of water for total population is 337.60 MLD. Of the total available quantity of water, about 104.22 MLD is supplied to slum areas and 9 MLD is supplied to commercial areas. The per capita water supplied is 135 litres per capita per day (lpcd) for slum areas, 211 lpcd in commercial areas and for the rest of the city

a. Water Supply Infrastructure

Components of water supply system are explained as follows –

- **Water Treatment Plant:** TMC requires purification treatment only for water from Independent Water Supply Scheme and 60 MLD from MCGM. Presently TMC has a water treatment plant of 280MLD capacity located at Temghar.

Distribution Network: For effective water distribution TMC has formed 3 zones which are further divided into 44 water districts. The city is supplied with piped water and the domestic connections are unmetered. Total length of water supply pipe line measured 610.83 km in 2008-09; and in the year 2009-10 115 km pipeline has been laid. Total number of domestic connections within city limits is 85, 093 and 69 stand posts. Refer **Table 10**

Table 10 -   Water Districts

Zone	Source	Water District	Demand (MLD)
Central	BMC + STEM + TMC	13	206.50
Northern	BMC + STEM + TMC	14	102.50
Eastern	MIDC + TMC	17	113

- **Elevated Storage Reservoirs :** There are a total of 47 ESR/GSR in the city and construction of 37 new ESRs have been proposed. Of the 37 proposed ESR 30 have been commissioned amounting to approximately 97 MLD increase in capacity.

Quality of water supplied: TMC took water samples from 9749 locations to check their potability. Out of the total 9351 samples were found to be good for drinking purpose i.e. 95.91% the potability at source of treatment is above the WHO standards ie 95%. The potability of water reduces at the user's end mainly due to unhygienic conditions of water tank and storage system at end user.

Other Sources of water: There are around 455 dug wells, 678 tube wells in TMC being used for potable water use.

b.   Measures undertaken by TMC to augment water supply in the city

Automation of water supply system: To reduce water distribution losses caused by manual operation and to provide quality drinking water to the citizens, TMC has automated water supply system network. The automation is based on data received from Supervisory Control And Data Acquisition (SCADA) system. This system has been deployed from sources i.e. head works on Bhatsa River at Pise Village upto service reservoirs in Thane city. This system comprises of field instruments and sensors for pressure flow level, turbidity, dissolved oxygen, residual chlorine and other analytical parameters for water treatment. The system updates the data automatically.

TMC's water supply system right from lifting raw water at Pise upto distribution ESR is automated based on data received from SCADA system.

Water Supply augmentation: A 110 MLD water supply project was completed and commissioned in August 2009. The project was funded by the state and central governments to the extent of 40 percent under the central government Jawaharlal Nehru National Urban Renewal Mission (JNNURM)

c.   Pressure on Water Supply

With the continuous in-migration of people in the residential sector, there is a growing demand for potable water. TMC is dependent on other sources of water for about 37% of its daily requirement. The additional capacity augmentation of 110 MLD would reduce this dependency. Also measures need to be undertaken to ensure the potability of water for the end user.

4.5.2. Sanitation, sewerage and sewage treatment

About 17% of TMC notified area is covered by underground sewerage network. The remaining sewage is collected by nallahs running across the city and draining into the creek. Refer **Figure 26** for location of nallahs.

Components of sewerage system are explained as follows –

a.   **Sewage Treatment Plant (STP):**

Thane city generates about 329 MLD of sewage, of which only 54 MLD is treated in the Sewage Treatment Plant (STP) located at Kopri, rest of the sewage goes through septic tank and soak pit. There are three proposed STPs and their details are as follows

- Phase –I Kopari Thane city area, Capacity-120 MLD, Completion March 2011. (10%work is completed)
- Phase –II Kalwa, Cap-100 MLD, Completion March 2011, (Land acquisition is in process)
- Phase-III Mumbra, Capacity-32 MLD, Completion Dec 2011, (3% work is completed)

The STPs are designed to achieve the following effluent quality

- pH - 6 to 8
- BOD - < 20mg/lit
- COD - < 250 mg/lit
- SS - < 30 mg/lit

b.   **Sewerage Network:**

It is proposed that approximately 108.9 sq.km. area will be covered by underground sewage network, which accounts to 85% of total notified area of TMC. TMC has divided the city into four major sewerage zones.

1. Zone under phase I: Thane city area
2. Zone under phase II: Ghodbandar & Kalwa
3. Zone under phase III: Mumbra
4. Zone under phase IV: North Ghodbandar

Existing Sewerage Network

Total length of sewer line	69.2 km
Pumping stations	8
STP capacity	54 MLD
Method of Treatment	Activated Sludge Method
Total numbers of manholes	2174
Mode of disposal	Creek

Sewerage Network for Area under PS 1

The catchments area under this pumping station includes Kopri area, covering ward 12, 13 and 14. The roads and area within this sewerage zone are Kopri police station road, Rambhau, Mahali, road Mith Bandar road Jianmatha road, Bara bungalow

road, Guru Nanak road, Lokmanya Tilak marg, S Vaswani road Kopri Gaon marg, The areas covered in this zone are Parshiwadi area, Daulat nagar, Kopri colony road, Kaniya nagar, and Patil wadi.

Sewerage Network for Area under PS 2

This catchment includes Naupada covering wards 28, part of 29 and 36 wards, The roads and areas within this sewerage zone are Gavani road Naupada Road, B.V Road, Gokale Road, Sane Guruji road, part of M.G. road from Sambhaji road to Gokhale road, Baji Prabhu road, Bhaskar colony area, Brahamin Wadi area which also cover the Vrindhavan society & Bhakti Mandir area.

Sewerage Network for Area under PS 3

This sewerage zone covers part of 37th ward and part of 36th ward. The roads within this sewerage zone are Ghantali road, Gadkari road, Veer Saavarkar road, and part of Almeda road. LBS road from Shah and Sanghi to Almeda Junction, Baki Mandar to Harinivas circle. Part of M.G road from Subhash Path to Harinivas circle. Aradhana Cinema road, Tikedi bungalow area.

Sewerage Network for Area under PS 5

This sewerage zone consists of the following roads viz: Shahid Mangal Pandey Marg, Sant Guruji road, Gokhale road & Prabhu road.

Sewerage Network for Area under PS 6

This sewerage zone consists of the Shahid Mangal Pandey Road and Abhiruchi talau.

Sewerage Network for Area under PS 7

This sewerage zone consists of a part of Hanuman Nagar Road, Bhavani Nagar Road, Kisan Nagar Road and Shahid Mangal Pandey Marg.

c.   Pumping Stations:

There are a total of eight pumping stations in the city. The pumping station at Kopri (PSI) has a capacity 17.09 MLD and pumping station at Naupada (PS2) has a capacity of 7.85 MLD. The total flow coming to PS1 is around 24.94 MLD, which then gets pumped to the existing Kopri Sewage Treatment Plant. The flow of the Cadbury pumping station (PS7), having capacity 15.87 MLD is transferred to the Dyanasadhana College pumping station (PS8). The capacity of PS8 is 18.22 MLD. The flow going to the Kopri STP from PS7 and PS8 is 52.59 MLD. The flow PS6, having capacity 9.86 MLD and PS3 having capacity 2.77 MLD joins the pumping station PS5 having 29.80 MLD, located at Dadoji Konddev Stadium. The total flow being pumped from PS5 to the Kopri STP is 42.73 MLD.

d.   **Works under Sewerage**

Under phase-I, it is proposed to lay down 120 km length of sewerage line and construction of 7 pumping stations. Out of which 20 km line has been laid down.. Upgradation of Kopari STP to 120 MLD Capacity is in progress.

Under phase-II, it is proposed to lay down 120 km length of sewerage line and construction of 7 pumping stations.

Under phase-III, it is proposed to lay down 25 km length of sewerage line and 3 pumping stations.

The work under all three phases is in progress.

e.   **Private STPs for Sewage Treatment**

Currently there are about 20 STPs operating in private residential complexes, multiplex and shopping complexes like Pride Park, Pakruti Park, Nilkanth park, Kores, Nakshtra etc. These complexes are reusing the treated sewage in their own premises thus reducing the water demand.

f.   **Low Cost Sanitation**

A total number of 24 villages located at the boundary towards the north and east of the city are proposed to be covered by low cost sanitation works. The project includes the construction of community latrines.

The reorganization survey done at time of preparation of the feasibility study showed that approximately 1471 household latrines and 80 community toilets (603 seats) existed in these villages. A total of 5340 toilets with septic tanks and soak pits are proposed to be constructed in two phases to cover the project population of year 2021.

The proposed project has been designed to also provide access to the urban poor, for which TMC has identified a total of 211 slums. About 11 slums are presently covered by the existing sewerage network. In the remaining slums, while a few households may have individual toilets, most households largely depend on public toilets.

g.   **Pressure on Sanitation and Sewage**

Major portion of the sewage generated in the city flows through open nallahs causing unhygienic conditions. The present STP capacity is significantly insufficient, with only 15% of the sewage generated being treated. The treatment facility for sewage is under augmentation as also the sewerage network. Considering the ongoing practice, decentralized treatment of sewage generated should be encouraged to reduce the load on the existing sewerage network.

4.5.3. Solid Waste Management

a.   Municipal Solid Waste

The total solid waste generated in TMC is around 704 metric tonnes per day, with a per capita generation of 380 grams. The waste dumped is 679 metric tonnes per day. Refer **Table 11**

Table 11 -   Current Infrastructure for Solid Waste

Sr.No.	Designation	Numbers
1	Deputy Municipal Commissioner	1
2	Medical Officer (SWM)	1
3	Assistant Municipal Commissioner	1
4	Chief Sanitary inspector	1
5	Additional Chief Sanitary Inspector	1
6	Dy. Chief Sanitary Inspector	16
7	Sanitary Inspector M P W	38
8	Clerk	6
9	Head Mukadam	5
10	Mukadam	50
11	Drivers	65
12	Drivers (Contract Basis)	28
13	JCB Operators	2
14	Sweeepers (Permanent+Contract basis)	2300

Waste Collection efficiency of TMC is about 96%. For effective Primary collection of solid waste TMC provides door-to-door collection and uses collection vehicles like dumper placers, ghanta gadi and rickshaw. The solid waste from each collection point is brought to the dumper placers and other collection vehicles. From here the waste is moved to specified areas, weighed and lastly disposed off at open dumping site. Deodorants and insecticides are sprayed to address flies and for odour control. The various types of collection vehicles used and their numbers is given in **Table 12**

Table 12 -   Collection Vehicles for Municipal Solid Waste

Infrastructure	2008	2009
Dumper placer	23	16
Dumper	29	28
Rikshaw	2	2
Minidoor	10	10
Trolly	-	1
Tractor	1	1
Chaindoser	2	3
J.C.B	2	3

Infrastructure	2008	2009
Ghanta gadi	131	135
Dumper (Contractor basis)	27	26
10 wheeler large capacity dumper	-	10
Sweeper	2300	3502

The wet waste from vegetables-fruit market, hotels and segregated wet waste from municipal solid waste accounting to 25 MT/day is treated by TMC in collaboration with Enviro-Vigil organization through bio-methanation process.

It is proposed to create a scientifically designed landfill site at Diaghar. On this site only that part of non bio-degradable Municipal solid waste which cannot be recycled such as inerts shall be dumped. The proposed plant at Diaghar would ensure that only 20% of the entire Municipal solid waste goes to the scientific dumping site.

b.   Biomedical Waste (BMW)

Thane Municipal Corporation has provided bio medical waste facility through M/s. ENVIRO-VIGIL, Thane. The city produces approximately 164766 kg of BMW annually.

The bio medical waste is treated and disposed through incinerator with a capacity of 50 kg/hour. Disposal site is located at Chatrapati Shivaji Maharaj Hospital, Kalwa. This disposal facility is certified with ISO 9001:2000.

The number of institutions registered with the bio medical waste treatment facility have been on a rise in 2008-09 as compared to 2007-08. In 2007-08, registered members were 451 whereas in 2008-09 those were 1022. Refer **Annexure 7** for category-wise number of registered members. This fact reflects the overall increased awareness towards sanitation and social well being and also indicates adequacy of the BMW Management network in city.

c.   Construction and Demolition Waste

With a spur in the industrial areas conversion to residential colonies, recycling and disposal of construction and demolition (C&D) waste becomes important. At present it is dumped alongside the creek

d.   Pressure on waste disposal

The municipal solid waste is dumped near the creek impacting the creek ecology. Recycling and disposal of C&D waste is an urgent issue in Thane as no facility is available in the current scenario.

4.5.4. Power Supply

The Government of Maharashtra has designated Maharashtra State Electricity Distribution Company Ltd. (MSEDCL) as a licensee to distribute the electric power in

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TMC notified area. Main sources of electric power are MSEDCL and Tata Power. MSEDCL supplies 575 MVA of power whereas Tata Power contributes 150 MVA.

The city presently faces 4 hour daily load shedding. TMC has planned to implement two strategies in achieving self sufficiency in power, a) Energy saving measure for reduction in consumption of power and b) Generation of power through renewable energy sources and utilization of same for various municipal utilities.

Energy saving Measures adopted by TMC are:

- Installation of micro-processor based cyclic almanac timer in control panel, to reduce energy losses due to unscheduled operations of street lights.
- Installation of tri-phosphor T-8 tube lights with electronic ballasts voltage variable frequency drives, to avoid energy losses in water pumps and motors.
- Compulsion of solar water heater system to all new construction proposals developing in municipal notified area.
- Use of solar energy of 180 tonnes in AC plant project at Chatrapati Shivaji Maharaj Hospital
- Production of methane gas from wet solid waste
- Up- gradation of centralized AC with the use of refrigerant system at Ram Ganesh Gadakari Rangyatan.

4.5.5. Transportation

The number of vehicles plying on the roads have consistently been on the rise. The proportion of two wheelers among the private vehicles is the highest. Of the total number of vehicles registered in 2008-09 (11.5 lakhs), 52% are two wheelers (6 lakhs).

Transport modes in Thane city

a. Railway:

The central railway's main north-south corridor passes through Thane city, providing daily commuter services to Mumbai and neighbouring suburbs as well as long distance train services. There are four railway stations in TMC notified area – Thane, Kalwa, Mumbra and Diva. Thane has also become a junction for connectivity to Navi Mumbai due to the Thane-Vashi rail link.

b. Public Transport:

Thane Municipal Transportation (TMT) operates a fleet of about 325 buses on 25 routes. TMT has been undertaking special efforts to reduce pollution by introducing 50 CNG buses. TMT has proposed to buy 223 new buses, out of which 200 busses

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are under JNNURM scheme. Type of these busses will be- 80 CNG, 80 Diesel (less air polluting) and 10 AC busses for travelers comfort. Refer **Annexure 8** for public transport infrastructure made available by TMC.

c.   Roads

TMC has increased length of concrete roads from 12 percent to 16 percent, to reduce repair cost and control accidents caused by poor condition of roads.

To avoid traffic congestion in the vicinity of Thane railway station, TMC has initiated SATIS for two level transport system.

The project involves two levels of transportation; one for buses while other for private vehicles. The first phase of SATIS Project from Thane station to Jambli Naka junction near Talaopali has been completed. Second phase of the proposed SATIS project seeks to extend the Jambli Naka arm to the edge of the Meenatai Thackeray Chowk. This extension would be in the form of a four-lane road in roughly 1.5-kilometre distance between Jambli Naka and the start of the proposed Meenatai Thackeray Flyover.

Growth of vehicular population in Thane has assumed extraordinary proportions. Increasing two wheelers has gained a sudden impetus between 2002 and 2009; has doubled. Following figures show the trend over the last seven years[12]. Total 11, 56,038 vehicles are registered; of which 6, 01,742 are two wheelers, accounting for 52% share, in 2009. The growth in number of vehicles (total) is approximately 125%. Refer **Figure 30.** Refer **Annexure 8** for category wise number of vehicles registered each year.
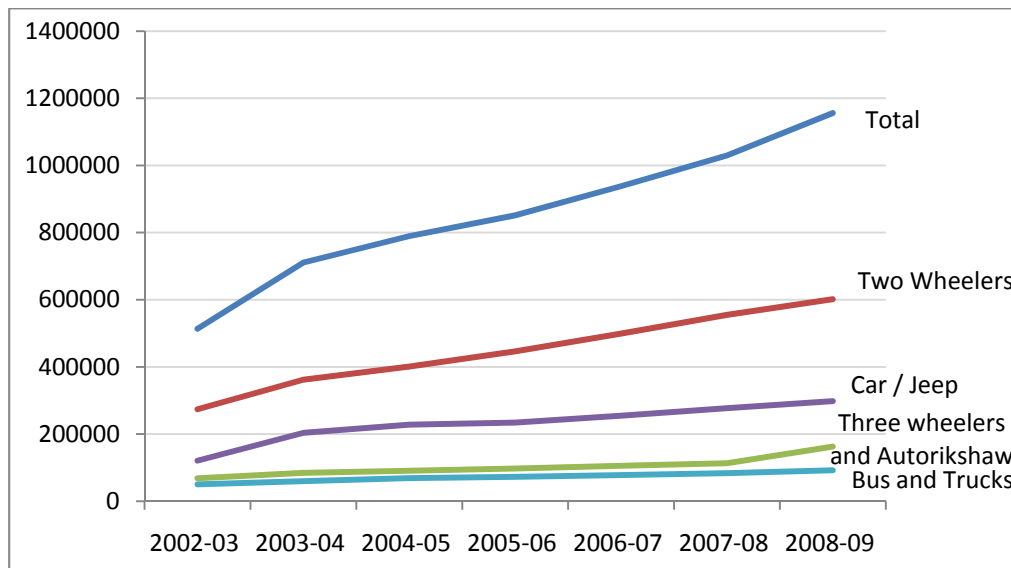
Figure 30.   Growth in number of vehicles in Thane

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[12] **Source: -Regional Transport Office, Thane**

d.   Fuel Consumption

Success of TMC's policy to promote use of cleaner fuels can be clearly seen from below table. In year 2006-07, there was no registered vehicle running on cleaner fuel; but numbers have increased constantly, which can be seen from figures of year 2008-09. Refer **Table 13**[13]

Table 13 -   Fuel Consumption pattern in Thane Region

Year	Diesel	Petrol	LPG	CNG
2006-07	296104	729490	0	0
2008-09	245425	918273	11275	21251

Number of registered vehicles and fuel consumption data are for Thane Region under RTO. This does not give clear picture of vehicles running in the city, hence, assessment of relationship between number of vehicles and air pollution is not carried out. If city level number of vehicles' data as on the roads is available then such assessment is recommended.

4.5.6. Social Infrastructure

Social infrastructure consists of education facilities, hospitals, recreational spaces etc. This section discusses the social infrastructure facilities available in Thane city.

a.   Educational Facilities

Thane city has good education facilities starting from kinder garten to higher education. Technical, agricultural and vocational education facilities are also available. There are a total of 201 primary schools, including aided and non-aided private schools and government schools. **Table 14** below gives details of schools

Table 14 -   Academic institutions in Thane

Schools	Primary Education (1st-4th)	Secondary Education (5th-7th)	Total
Private Non Aided	40	143	**183**
Private Aided	33	76	**109**
TMC	128	08	**136**
Total	**201**	**227**	**428**

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[13] **Regional Transport Office, Thane**

Environment Awareness Center: TMC has started this center to create awareness about environmental issues among the general public.

b.　　Health Care Facilities

TMC provides public health services through 25 dispensaries and primary health care centre, one domestic centre, five maternity homes; one periodic hospital and 500 bedded Chatrapati Shivaji Maharaj Hospital. In addition it implements national health programs such as polio vaccination, family planning and welfare vitamin and booster dosage to children. The corporation also runs a medical college and nursing training center.

TMC carries out health surveys for controlling infectious disease and family planning, woman and health care issues etc. The most commonly surveyed infectious diseases found, which are spread by mosquitoes.

TMC has setup special facility for controlling mosquitoes that are

- Weekly mosquito control sprays
- Spraying of pesticides
- Biological control of larvae
- Public awareness campaign

In addition to the government health facilities, there are a number of private hospitals and also multi specialty and gynecology hospitals.

4.6. Impacts and Risks

For the purposes of this ESR, environmental impacts have been identified based on the status of resources such as water, land, etc. as well as the services provided by TMC to the public. A review of past ESRs has also helped towards this exercise. Typically, environmental impacts are not standalone – they tend to be interlinked and hence, are cumulative in nature. Thus, the Action Plan for alleviating the various environmental issues identified through this ESR tries to take these circumstances into account.

4.6.1.　Impacts of Air Pollution

Studies carried out to monitor the ambient air quality of Thane city show high levels of RSPM. This could be attributed to the increasing number of vehicles plying on the road as well as industries located within the city adjacent to residential areas.

RSPM includes particles less than 10 micrometers in diameter that pose severe health impacts as they can get deep into the lungs, and some may even get into the bloodstream.

People with heart or lung diseases, children and older adults are the most likely to be affected by RSPM exposure. In healthy persons also, exposure to elevated levels of RSPM could cause asthma.

At present there is no statistical information available for number of people affected by air pollution and suffering from respiratory diseases. It is proposed to track such information for use in future ESRs. Also, given the presence of high levels of RSPM, monitoring for $PM_{2.5}$ (i.e. particles less than 2.5 micrometers in diameter[14]) is advisable.

Air quality near the industrial areas such as Balkum and Kolshet is poor compared to other areas. Also there is no buffer between industrial estates and residential areas in Balkum and Kolshet. Thus the industrial air pollution may directly impact the residents around these estates (Sainath Nagar, Lodha Paradise near Balkum and Sandoz Baug near Kolshet) depending on the emissions.

4.6.2. Impacts of Noise Pollution

Elevated workplace or other noise can cause hearing impairment, hypertension, ischemic heart disease, annoyance, sleep disturbance, and decreased school performance.

In Thane, noise levels at silence zones are also very high. This is non-compliant as well as affecting the health of community.

The noise levels monitored across the city during festivals as well have exceeded the prescribed standards.

It is advisable that TMC step up enforcement of the prescribed standards with the help of the Police, in addition to organizing continuous awareness campaigns among the citizens about the effects of noise pollution.

4.6.3. Impacts of Surface and Ground Water Pollution

Water pollution affects plants and organisms living in these bodies of water; in almost all cases, the effect is damaging not just to individual species and populations, but also to entire natural biological ecosystems. The consumption of polluted water also affects human health.

Contamination of water (surface and ground) may take place due to various reasons such as discharge of untreated sewage, discharge of industrial effluent, solid waste dumping etc.

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[14] Sources of fine particles include all types of combustion, including motor vehicles, power plants, residential wood burning, forest fires, agricultural burning, and some industrial processes.

In Thane creek, the water quality monitoring revealed high BOD and chloride values alongside a steadily reducing DO content. Previous sections of the report also noted that a major portion of the sewage generated in the city is directly disposed into Thane creek. Therefore, the sewage treatment capacity of TMC needs to be urgently augmented. Special efforts also need to be taken for a clean-up of Thane creek.

The lake water quality indicates that it cannot be used for drinking but is favourable for propagation of fisheries. TMC should take measures (such as through the use of appropriate signages) to ensure that these lakes are not used as a source of drinking water.

The results of ground water quality monitoring reveal the presence of heavy metals which may be attributed to the geological formations of Thane city. However, further investigation would be required to pinpoint exactly the cause of high concentrations of heavy metals in ground water.

4.6.4.   Impacts on Flora and Fauna

Disposal of untreated sewage and solid waste into / along Thane creek have damaged the mangrove ecosystem. In such a scenario, the DP should allocate areas for scientific management of solid waste as well as sewage treatment plants. It may also be worthwhile to begin monitoring for phytoplanktons and zooplanktons as part of water quality studies, so as to be able to understand the effects of the proposed changes on the creek's ecosystem over time.

The steady encroachment of illegal slums into some sections of the Sanjay Gandhi National Park and Yeoor Hills has also been a cause for concern. Ideally, the DP should make provisions for maintaining a buffer for these areas. This would also lessen the man-leopard conflicts which have become fairly frequent in the past two years.

5. Action Plan

The Action Plan is prepared as a response to the issues identified in assessment and is in line with the Environmental Policy of Thane. Prioritization of issues and respective actions are based on logical criteria such as severity of issues, geographical extent, temporal patterns, etc. An attempt has also been made to link proposed activities in the Action Plan with past initiatives of the TMC, so that they may be carried forward. Each action is detailed out in Action Sheets to include:

- **Action** (title)
- **Type of Action** (Project / Program / Plan / Policy) Refer **Annexure 1**.
- **Objective** (to give the basis of the action, denote which issues will be resolved with this action or what opportunities will be stimulated on the basis of which the action is planned)
- **Location / geographical extent of application / targeted beneficiaries** (mainly in case of programs and policies)
- **Tasks** (delineating a roadmap for implementation)
- **Implementation Plan** (as per the priority, implementation period shall be defined for each action. For example, high priority actions shall start immediately. Tentative completion dates or duration of action will also be stated wherever possible)
- **Responsibility allocation** (responsibilities may be assigned to relevant departments in the Corporation, also highlighting outsourcing requirements wherever relevant)
- **Budgetary requirements** (in terms of broad level estimates for implementation)
- **Recommendations** (if a particular action needs additional studies or surveys to be carried out or pilots to be implemented)
- **Illustrations** (examples of particular interventions that have been implemented elsewhere.

5.1. Environmental Policy

Thane's Environmental Policy was framed in readiness for ESR preparation for the year 2008-09. The various details of the Vision, Policy, Objectives and Targets of the TMC are as enumerated below.

5.1.1. Vision

TMC has initiated the preparation of VISION 2031 for the city in the process of preparing the City Development Plan for Thane. The same has been adopted for the ESR as well.

VISION 2031 is to make Thane a global metropolis and a world class city, where the people of Thane can experience growth in their standard of living and improved qualities of life in a sustainable environment.

5.1.2. Environmental Policy

Thane Municipal Corporation is driven by its Vision to make Thane a global metropolis in a sustainable environment.

The Environmental Policy is founded on the concept of Sustainable Development and thereby recognizes Environmental and Social (E&S) considerations in its business activities. The Policy aims for minimizing impacts on natural resources along with health and risks to the Urban Infrastructure. TMC strives to conserve natural resources, protect the environment and improve standards of living for present populations and provide a favourable environment to future generations.

The Environmental Policy applies to all Departments under TMC.

TMC is committed to comply with its Environmental Policy, applicable laws of the land and be responsive to existing and emerging global E&S concerns on a proactive basis.

5.1.3. Targets

- To improve ambient air quality by reducing emissions as well as by controlling noise levels.
- To improve water quality of lakes and creek
- To provide sufficient breathing spaces (green cover and open spaces) within the city
- To improve the sewerage network in the city
- To provide adequate sewage treatment facilities
- To reduce conventional energy consumption of the city
- To set up infrastructure for the scientific treatment and disposal of solid waste and C&D waste
- To improve transportation network and facilities in the city.
- To explore options for reducing dependency on external sources for water supply to Thane city

5.2. Past Initiatives by TMC

TMC has initiated the program of development of social infrastructure for the city by invoking Public-Private-Partnership instruments. The program comprises of 57 projects. TMC has formulated strategy of holistic and sustainable development of the city by planning and initiating projects through PPP in the sphere of education, health, housing, sports, entertainment and art.

- Education: 9 projects - school building, boy's hostel , nursing college and hostel

- Health : 4 projects - Primary Health Centres (PHC), Dispensary, Maternity home
- Housing: 6 projects
- Welfare: 12 projects costing - Community center, Library, Mahila Udyog Kendra, Multipurpose hall
- Administrative: 6 projects - Ward offices, fire station , administrative building
- Commercial :8 projects - Shopping center, Market
- Traffic and Transport: 3 projects - Parking plaza, Parking Zones
- Art and Environment: 3 projects - Art gallery, drama theater, convention center, art center
- Sport and recreation: 6 projects - Sports complex, play ground, garden, and parks

Under JNNURM Thane had submitted the CDP with prioritization of infrastructure projects.[15]

- Underground Sewerage System
- Integrated Nalla Development Project
- Station Areas Transport Improvement Scheme
- Additional 100 MLD water supply scheme
- Road Connectivity & Linkages
- Area Level Improvement Schemes (Subways, Flyovers)
- Road Concretization
- Slum Redevelopment
- Slum Improvement Schemes
- Lake and Creek conservation program
- Development of Recreational Places

Some of the projects which already have been approved and either ongoing or completed are explained below.

5.2.1. Lake Restoration Project

In the past, TMC initiated the Lakes Restoration Project under the National Lake Conservation Program. In 2002 alone, work was initiated to revive 10 lakes using bioremediation technology under this program. Since then, every year TMC has continued to revive new lakes using their own funds. Details of some of these projects are provided in this sub-section.

a.   Masunda Lake

- Restoration and beautification was completed last year.

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[15] http://jnnurm.nic.in/nurmudweb/toolkit/ThaneCdp/EXECUTIVE_SUMMARY.pdf

- The technique of restoration used here was done so for the very first time in India. It includes the use of wetland vegetation around the periphery wall and the construction of filter and grease trap around the lake. The results were highly appreciated by the Ministry of Environment and Forests (MoEF).

b.   Brahamala Lake

- Area: 0.5173 ha
- Location: Uthalsar ward office
- Geology: Floodplains
- Type of settlement: Urbanized
- Impact of development: Unorganized *tabela* next to lake leads to contamination. Oil &grease surrounding the lake enters the lake
- TMC Initiative: Dredging of lake, Construction of RCC retaining wall around the lake, Jogging track around the lake, Landscaping around the lake, Bioremediation of the lake and Maintenance of lake.

c.   Ambe Ghosale lake

- Area:-2.7725 ha.
- Location:-Uthalsar Ward office, Meenatai Thakare Chawk
- Geology:-Floodplains
- Type of settlement:-Completely urbanized water body.
- TMC Initiative: - Physical cleaning & Bioremediation of the lake, Landscaping
- Ambe- Ghosale lake was completely filled with water hyacinth in 2003.

d.   Gokul nagar lake

- **Area**:-0.3250 ha.
- **Location**:-Uthalsar Ward office It is a small lake situated in the heart of the city in the midst of Gokulnagar slums
- **Type of settlement**:-Completely urbanized water body.
- **TMC Initiative**: - Dredging & Construction of RCC retaining wall around the lake was completed last year. Bioremediation & Metal grill around the lake carried out this year.

e.   Hariyali lake

- Area:-0.7939 ha.
- Location:-Kopari Ward office
- Geology:-Floodplains
- Type of settlement:-Completely urbanized water body.
- Impact of Development:-

- TMC Initiative:- Physical cleaning of lake, Landscaping around the lake, Bioremediation of the lake,
- Maintenance of lake.

f. Kacharali lake

- Area:-2.000 ha.
- Location:-Naupada Ward office
- Geology:-Floodplains
- Type of settlement:-Completely urbanized water body.
- TMC Initiative:- Physical cleaning & Construction of RCC retaining wall around the lake, Jogging track & Landscaping around the lake, Bioremediation of the lake.

g. Kausa lake

- Area:-1.5173h.
- Location:-Mumbra Ward office ,Kausa
- Geology:-Man made Depression
- Type of settlement:-Completely urbanized densly developed area.
- TMC Initiative:- Dredging & Construction of RCC retaining wall around the lake, Bioremediation, Beautification & Landscaping around the lake.

h. Kharegaon lake

- Area:-0.7377 ha.
- Location:-Kalwa Ward office
- Geology:-Floodplains
- Type of settlement:-Completely urbanized water body.
- TMC Initiative: - Physical Cleaning & Bioremediation of lake, Landscaping & Jogging track around the lake

i. Kolbad lake

- Area:-1 ha.
- Location:-Uthalsar Ward office .
- Geology:-Flood plain
- Type of settlement:-. High-rise residential development has sprung up in the immediate vicinity of the lake
- TMC Initiative:- Dredging & Construction of RCC retaining wall, Bioremediation

j. Kalwa Lake

- Area- 2 ha.
- Location:-Kalwa Ward office. Located close to railway station.
- Geology:-Floodplains

- Type of settlement:-Completely urbanized water body.
- TMC Initiative:- Physical cleaning & construction of RCC retaining wall around the lake, Bioremediation, and landscaping around the lake

k.   Siddheshwar lake

- Area:-3.0 ha.
- Location:-Uthalsar Ward office
- Geology:-Floodplains
- Type of settlement:-Completely urbanized water body.
- TMC Initiative:- Dredging and Bioremediation of the lake

l.   Upwan lake

- Area:- 6 ha.
- Location:- foothills of Yeoor
- Geology:-Rocky bed
- TMC Initiative:- Dredging & Construction of RCC retaining wall around lake, Bioremediation, Landscaping & jogging track around the lake

5.2.2. Creek Conservation

In the past, TMC conducted a survey for depth measurement at various locations along the creek stretch. It was observed that, the depth has reduced due to unauthorized dumping of C&D waste around the bridges constructed over the creek, thus obstructing the natural flow. A total seven bridges have been constructed over the creek within TMC's area of jurisdiction. To overcome the issues posed by these activities, TMC initiated Creek Conservation Program.

Phase I of the Creek Conservation Program included the following activities:

- Removal of debris by dredging at Saket bridge (Thane and Kalwa sides) was done on a priority basis. About 10,628 m^3 of debris was removed from these locations.
- In order to reduce pollution levels along the creek stretch near the Gaimukh dumping site, TMC constructed soak pits to reduce leachate percolation into the creek. It sprayed bio-sanitizer enzymes to tackle bad odors and also initiated plantation along this stretch. About one lakh trees were planted. Debris removal and plantation were also carried out at Mahagiri Koliwada (Kalwa side of the creek).

5.2.3. Low-Cost Sanitation Project

The low-cost sanitation project includes construction of community and individual latrines. TMC has identified a total of 211 slums to be covered under the proposed project, which should alleviate a part of the problems currently posed by open defecation and diversion of sewage to open *nallahs*.

5.2.4. Water Quality Monitoring

Lakes, creeks, *nallahs* are currently being tested for water quality. However, it is suggested that the parameters being monitored should follow the parameters specified in the standards as per designated water use to enable true assessment of the system.

5.3. Actions

Based on the targets and the issues identified in situation analysis, actions identified for ESR 2008-09 are:

- Design and construction of sewers in areas not covered by underground sewerage through centralized and decentralized options: **High Priority**
- Design and construction of STP: **High Priority**
- Design and construction of a scientific solid waste treatment and disposal facility: **High Priority**
- Treatment and disposal facility for C&D waste: **High Priority**
- Clean-up of city *nallahs*: **High Priority**
- Protection of mangroves within TMC's jurisdiction through regular monitoring/ patrolling along the creek and ecological restoration of degraded mangroves: **High Priority**
- Provision of public sanitation facilities in slum areas (including their maintenance): **Medium Priority**
- Improvement in Environmental Monitoring Program for water quality: **Medium Priority**
- Improvement of ambient air quality by reducing the industrial air pollution near Balkum and Kolshet industrial areas. – **Medium Priority**

Additional studies and surveys to be done:
- Detailed study of ground water quality to identify the causative factors for high heavy metals concentrations
- Monitoring of phytoplanktons and zooplanktons in Thane Creek

Details about High Priority actions are provided below.

5.3.1. Design and Construction of Sewers

a.   Action

Design and construction of sewers; centralized and decentralized options

b.   Type of Action

Project with High Priority

c.   Objectives

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- To provide well-planned sewers
- To improve hygiene and reduce health impacts of open gutters
- To arrest the sewage pollution in city *nallahs*

d.   Past Interventions

A low-cost sanitation project has been proposed by TMC for construction of community and individual latrines in slum areas.

e.   Location

Implementation shall be undertaken for the remaining area not covered by underground sewerage.

Depending on the population density and sewage discharge volumes, centralized and decentralized options can be evaluated.

f.   Tasks

- Define zones depending on population density
- Estimate sewage load for each zone
- Evaluate centralized and decentralized options for each zone
- Prepare Detailed Project Report

g.   Budgetary requirements

- Decentralized option: Septic tanks – Rs. 6,000 to 15,000
- Conventional sewers: Approximately Rs.50,000 for $1m^3$/day flow. Low to medium investment costs if population density is high, number of connections is large, and three to four households share one connection.
- Small bore sewage: Approximately Rs. 28,000/- per unit

h.   Responsibility

- Primary responsibility: Water and Sanitation Department
- Tasks such as need assessment and identification of suitable locations can be outsourced

i.   Recommendations

- Suitable option should be identified based on population density, sewage volume and space availability
- Future population should be considered at the planning and design stage

j.   Illustration

Refer to "A Guide to Decision Making Technology Options for Urban Sanitation in India" published by the Government of India in September 2008.

URL: www.wsp.org/UserFiles/file/Urban_Sanitation.pdf

5.3.2. Design and Construction of STP

a.   Action

Design and construction of STP

b.   Type of Action

Project with High Priority

c.   Objectives

- To prevent sewage disposal into Thane creek
- To improve the creek ecosystem impacted by sewage pollution

d.   Past Interventions

About 15% of the sewage generated in Thane is treated in the STP located at Kopri

e.   Location

At present untreated sewage is discharged into Thane Creek. The STP can be located in the vicinity of the existing STP subject to availability of land.

f.   Tasks

- Estimate sewage load for treatment
- Identify suitable location
- Bidding process for construction contract
- Construction phase
- Operation and maintenance phase

g.   Budgetary Requirements

Activated sludge process: Capital cost of Rs 4.2–4.8 million/MLD. Approximately 55% of the total cost covers civil works and the balance covers electrical and mechanical works. Operating costs work out to Rs 0.43–0.52 million/year/MLD[16]

h.   Responsibility

- Primary responsibility: Water and Sanitation Department
- Tasks such as need assessment, identification of suitable locations, and preparation of Detailed Project Report can be outsourced

i.   Recommendations

- Suitable options should be identified based on population density, sewage volume and availability of space
- Future population scenarios should be considered during the planning and design stage

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[16] Source - Technology Options for Urban Sanitation in India (2008), Water and Sanitation Program, Government of India

j.   Illustrations

Refer to the findings of a community-based Waste Water Treatment Plant which has been constructed in Madhyapur Thimi Municipal Council area.

URL: www.unwac.org/new_unwac/pdf/.../CWTP_Thimi_Municipality.pdf

5.3.3.   Design and Construction of Solid Waste Treatment and Disposal Facility

a.   Action

Design and construction of solid waste treatment plant and sanitary landfill

b.   Type of Action

Project with High Priority

c.   Objectives

- To control the impact on creek areas due to solid waste dumping
- To prevent ground water and pollution due to leachate from solid waste dumping
- To improve hygiene and reduce health impacts

d.   Past Interventions

At present 20 MT of waste is treated at the Biomethanation plant in Chhatrapati Shivaji Hospital at Kalwa. The gas released is then utilized for providing electricity to the hospital. There have been no other interventions in the past for the scientific disposal of solid waste.

e.   Location

A suitable location for the landfill and biomethanation plant should be identified complying with Municipal Solid Waste (Management and Handling) Rules, 2000.

f.   Tasks

- Estimate waste load for treatment and landfilling
- Prepare Detailed Project Report
- Identify suitable locations
- Bidding process for construction contract
- Construction phase
- Operation and maintenance phase

g.   Responsibility

- Primary responsibility: Health Department
- Tasks such as need assessment, identification of suitable locations, and preparation of Detailed Project Report can be outsourced

h.   Recommendations

- Future population should be considered at the planning and design stage
- Suitable option for waste treatment should be identified based on population density, waste volume and space availability
- Future solid waste generation scenarios should be considered while designing the landfill

i.   Illustration

Refer to "A Guide to Decision making Technology Options for Urban Sanitation in India" published by the Government of India in September 2008.

URL: www.wsp.org/UserFiles/file/Urban_Sanitation.pdf

5.3.4.   Treatment and Disposal Facility for C&D Waste

a.   Action

Creation of collection depots, recycling and disposal facility for C&D waste

b.   Type of Action

Project with High Priority

c.   Objectives

- To control the impact on creek areas due to C&D waste dump
- To reduce the waste load through recycling
- To improve hygiene and reduce health impacts

d.   Past Interventions

There have been no interventions in the past for recycling and disposal of C&D waste.

e.   Location

Suitable locations for collection of C&D waste would have to be identified. Siting criteria should consider surrounding land use and suitable buffer area.

f.   Tasks

- Estimate waste load for collection at depots, reduction of waste through recycling and for disposal to landfill
- Identify suitable location for collection depots
- Identify suitable recycling options
- Prepare Detailed Project Report
- Bidding process for construction of depots and recycling plant
- Construction Phase
- Operation and maintenance of depots and recycling plant

g.   Responsibility

- Primary responsibility: Health Department
- Tasks such as need assessment, identification of suitable locations, preparation of detailed project report can be outsourced

h.   Recommendations

- Future scenarios involving the growth in real estate market and construction sector should be considered at the planning and design stage
- Suitable option for waste recycling should be identified based on secondary use
- Future C&D waste loads should also be considered while designing the landfill for Municipal Solid Waste

i.   Illustration

Refer to "Environmental Building Guidelines for the city of Hyderabad". The document includes information regarding the management of C&D waste.

URL: http://www.hmda.gov.in/EBRG/site/the%20guidelines/images/pdfs/Retrofit-%20step%206.pdf

5.3.5.   Design and construction of *Nallah* gardens

a.   Action

Restoration of city *nallahs* by designing and constructing *Nallah* gardens

b.   Type of Action

Project with High Priority

c.   Objectives

- To control the impact on creek areas due to waste load from *nallahs*
- To improve hygiene and reduce health impacts due to waste water flowing in open *nallahs*

d.   Past Interventions

There have been no interventions in the past for clean-up of *nallahs*

e.   Location

All the main *nallahs,* especially those traversing through slum areas

f.   Tasks

- Identification of pollution sources
- Dredging of *nallahs*
- Designing and constructing *nallah* gardens
- Maintenance of *nallah* gardens

g.   Budgetary requirements

Nallah Gardens: Construction costs – Rs. 5 lakhs/ km[17]

h.   Responsibility

- Primary responsibility: Water and Sanitation Department in cooperation with Garden Department
- Tasks such as survey of *nallah*, technology assessment, identification of suitable locations, and preparation of Detailed Project Report can be outsourced

i.   Recommendations

Identify the points of sewage disposal into the *nallahs* and treat them locally before discharge into the *nallahs*. A suitable technology should be identified and adopted for improving the water quality of *nallahs*.

j.   Illustration

Pune city has beautified its *nallahs*. For more details refer to the documentation prepared by Mrs. Almitra H. Patel, Member, Supreme Court Committee for Solid Waste Management.

URLs: http://www.almitrapatel.com/docs/088.doc   and http://www.almitrapatel.com/docs/192.doc

5.3.6.   Budget allocations by TMC

Apart from these actions, actions identified by TMC and budgets allocations are as explained in **Table 15.**

Status of proposed activities in terms of approved by TMC and funds have been allocated, ongoing activity, etc should be given in ESR.

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[17] Source - http://www.almitrapatel.com/docs/192.doc

Table 15 -　Actions and budget allocations by TMC

Key Issue	Suggested Measures	Budgetory Provision
Land Usage	Provide adequate open spaces and recreational areas	Sports Complex at Kausa- 6 Crores
		Drama Theatre- 6 Crores
		Planatorium - 3.5 Crores
		Mini Stadium - 1.75 Crores
		Development of Play ground- 1 Crore
		Aquarium - 2 Crore
		Nana-Nani Park - 1 Crore
		Joggers Track - 2 Crore
		Gymnasium - 1 Crore
Housing and slums	Survey of Unauthorised Consructions & Its Regulation. Undertake measures for rehabilitation of the existing slums and improvement of living conditions in the low income areas.	3 Crore Rs. 142.2 Crore under BSUP Project
	Rehabilitation of residents from dilapidated Buildings so as to prevent mishap	Under PPP Construction of 5 Buildings at Saket - Kolshet area

Key Issue	Suggested Measures	Budgetory Provision
Public Health & Hygiene	Upgradation of facilities at health centres, Hospitals	Renovation of Hospitals and health centres - 4 Crore under PPP, Construction of Hostel at medical hospital, nursing college
	Implement national programme for public health	Pulse Polio Programme - 30 Lakhs Aids Prohibition Programme- 50,000 RCH Programme- 60 Lakhs Senior Citizen health plan- 50 lakhs Disinfectant and machinery procurement for filaria dept. - 65 lakhs
Water Supply & Sanitation	Develop water distribution network	28 Crores Water Purification Machinery - 14 Lakhs
	Identify leakages of distribution network and implement majors to prevent it	40 Lakhs
	Rain water harvesting and water consrvation programme	Water conservation programme for TMC Dept.
	Survey for ground water pollution and remedial measures	Survey of well and borewell - 50 lakhs Well cleaning, repairing - 30 lakhs Bore well repairing - 30 lakhs Bore well cleaning - 25 lakhs
	Monitoring water quality at source and endusers	Purchase of required chemicals and glass wares - 10 lakhs

Key Issue	Suggested Measures	Budgetory Provision
Sewerage & Sewage Treatment	Undertake long term plan for the collection, treatment and disposal oi sewage from all areas of the city,	Rs. 159.29 crores for sewerage projects under phase-I, II & III
Solid Waste Management	Take measures to ensure that the collection, transportation and disposal of all the solid waste confirms to statutory standards, including sanitary landfill, etc	Procurement of Ghanta gadi and other vehicles - 6.5 crores Bio-gas plant - 1 crore Training to conservancy staff-5 lakhs Sant Gadge Baba Swacchhata Abhiyan - 7 lakhs Hospital Waste Management-5 lakhs Slotter house at Rabodi with T.P. - 1.5 crores
		Total Solid waste management provisions - 25 crores
Enhancement in green area	Development of garden Plantaion Drive	Garden - 1.5 crore Nature park Manpada- 1 crore
	Afforastation Programme	Rutuchakra Nisarga Park- 1 crore Saplings - 10 lakhs Tree Greibition - 12 lakh
		Plantation - 75 lakh
		Senior Citizen Amusement Centre
		- 25 lakhs
Air Pollution	Remedial measures to control vehicular pollution	Construction of new roads-10 crores
	Ambient Air Quality Monitoring	8 lakhs

Key Issue	Suggested Measures	Budgetory Provision
Transportation	Widening of roads, construction of fly-overs to reduce congestion	SATIS Project - 10 crores widening of road VTWT Method-35 crores
		Concretisation of roads - 30 crores
		Chowk Beautification - 3 crores
		Parking Plaza - 1 crore
		Eco friendly buses for TMT-56 cores
		Flyover subway bridge- 14 crores
Energy Conservation	Promote use of non-conventional and environment-friendly energy resources	Solar power project- 3 crores
		A.C. system of solar power for CSM hospitals - 3 crores
Water Pollution	Environmental friendly conservation and beautification of lakes	Lake cleaning - 3 crores lake beautification - 4 crores
	Undertake programme in order to minimise pollutants ingress in water bodies	Creek conservation programme-25 lakhs Mangroves plantation - 10 lakhs
Noise Pollution	Implement Government Regulation	Pollution Control & Survey- 5 lakhs
	Public awareness during festivals with the help of NGO to reduce noise pollution	Public awareness - 10 lakhs

Annexure 1 -   DPSIR Framework

Driving Forces (D)

A driving force is a human activity that is generated to satisfy a 'need'. Driving forces can be of two types - *primary driving forces* which are related to activities to fulfill the needs for shelter, food and water, and *secondary driving forces* which are activities to satisfy the need for mobility, entertainment and culture. The following are some of the typical driving forces:

- Population growth
- Industrialization (resource extraction and processing)
- Urbanization
- (Lack of adequate) Infrastructure
- Intermittent driving forces such as religious- or leisure-based tourism

Pressures (P)

The driving forces exert a stress on the available environmental resources which in turn induce pressures on the environment. These pressures can be divided into two main types, namely:

- **Depleting pressures**, which are induced by driving forces that extract environmental resources, such as declining forest cover and reduced levels of groundwater table, etc.
- **Degrading pressures**, which are induced by driving forces that discharge pollutants into the environment such as air pollution, water pollution and soil erosion.

State (S)

As a consequence of the pressures, the state of the environment – its quality and quantity - gets affected. The state of the environment is represented by the following:

- Air quality
- Water quality and reserves
- Soil quality
- Productivity of land

Impacts (I)

The physical, chemical or biological changes in the state of the environment impact the quality of environmental resources, including biodiversity and health and welfare of humans. Polluted environmental resources have health and/or economic

impacts, threatening the sustainability of all economic activities. The following are some typical impacts:

- Status of biodiversity
- Human health

Response (R)

Due to an undesired impact, a response is triggered to address the change(s) in the environment. A response is directed specifically towards regulating driving forces, pressures or impacts to mitigate environmental pollution. A response should ideally be a part of the larger Action Plan. Response measures under an Action Plan can be categorized under four heads, namely:

- **Policy** – A Policy is a definite course or method of action that guides and determines present and future decisions. It is the overall framework that embraces the general goals and procedures of an institution (in this case BMC)[18]. A Policy is usually directed towards regulating the Driving Forces (D)
- **Plan** – A Plan is defined as a detailed formulation of a program of action. It can be described as intent to carry out an action[19]. A Plan targets to regulate the Driving Forces (D) and Pressures (P).
- **Program** - A Program is a system of projects and services[20]. A Program, like the Plan, targets to regulate the Driving Forces (D) and Pressures (P).
- **Project** - A Project is the most location-specific response that may be planned under a Program. A Project targets to change the State (S) of the Environment.

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[18]*Merriam-Webster Online Dictionary Definition Search*. Available at: http://www.m-w.com/cgi-bin/dictionary?book=Dictionary&va=policy&x=12&y=14
[19]*Merriam-Webster Online Dictionary Definition Search*.Availableat:http://www.m-w.com/cgi-bin/dictionary?book=Dictionary&va=plan
[20]*Princeton University WordNet Search 2.1*. Available at:www.cogsci.princeton.edu/cgi-bin/webwn2.1

Annexure 2 -   Ambient Air Quality Monitoring at Junctions

Location	SOx µg/m3	NOx µg/m3	H2S mg/m3	RSPM µg/m3	NH3 mg/m3	API %	Air Quality
Standard	80	80	-	100	0.4	-	
Kopri	12.4	18.4	8.4	64.4	5.2	34.3	Moderate
Khandelwal Panchpakhadi	13.2	19.6	8.4	70.6	5.6	37.2	Moderate
Gandhi Udyan	20	26.75	7	70.5	5.5	42.97	Moderate
Sant Gajanan Maharaj Chowk	14.4	22	9.6	72.8	6.4	39.16	Moderate
Manpada Naka	16.8	25.2	7.8	72.8	5.4	41.76	Moderate
Mulund check Naka	17.4	27.4	6.8	71.8	4.8	42.6	Moderate
Cadbury Naka	20.6	22.8	8.4	71.2	5.8	41.81	Moderate
Nitin Company	20.6	28.4	8.8	75.8	6.4	45.68	Moderate
Majiwada Naka	21.6	29	7.4	79	6.2	47.41	Moderate
Gavdevi	18.8	28	7	72.2	5	43.5	Moderate

Annexure 3 - Ambient Air Quality Monitoring at dumping ground

Sr. no	Parameter	12to14 2 Hr	14to18 4 Hr	Average	Acceptable level at landfill site
1	NOx	35	34	34.5	120µg/m3
2	SO2	12.6	14.3	13.5	120µg/m3
3	NH3	3.2	3.2	3.2	400 µg/m3
4	H2S	3.2	4.9	4.5	150 µg/m3
5	CO	6.27	6.23	6.25	2 mg/m3
6	Methane	3.3	3.7	3.5	3.5 mg/m3
7	SPM	270	272	272	500 µg/m3

Annexure 4 -   **Noise Monitoring**

Locations	Hourly observations dB(A)																Avg.
	6	7	8	9	10	11	12	13	14	15	16	18	19	20	21	22	
Raila devi Prabhag Samitee	-	-	-	57	58	56	56	62	65	66	65	-	-	-	-	-	61
Kalwa Prabhag Samitee	-	-	-	60	62	68	66	66	64	62	64	-	-	-	-	-	64
Kopri Prabhag Samitee	60	62	63	63	64	-	-	-	-	-	-	68	62	71	74	68	66
Utalsav Prabhag Samitee	72	70	73	72	-	-	-	-	-	-	-	74	76	78	78	77	74
Raila Devi Prabhag Samitee	68	70	72	70	70	-	-	-	-	-	-	78	76	84	74	78	74
Pokharan 2 Gandhi Nagar	68	70	72	76	70	-	-	-	-	-	-	78	75	76			73
Kalwa Prabhag Samitee	58	60	61	65	76	-	-	-	-	-	-	68	70	74	78	78	69

Annexure 5 - Analysis of lake Physico-Chemical parameter and Heavy metal during and after Ganeshotsav

Parameters	pH	TDSmg/lit	DO mg/lit	COD mg/lit	BODmg/lit	Fe mg/lit	Cd mg/lit	Crmg/lit	Cumg/lit	Znmg/lit	Pbmg/lit	Hgmg/lit	Nimg/lit
CPCB Std	5.5-9.0	NS	NS	250	100	-	2	2	3	5	0.1	-	-
Location-: Gandhinager													
Bf 11 days Af 1 1/2 days	7.6	314	5.2	36	13	0.017	0.02	0.01	T	0.009	0.2	T	T
Af 7 days	6.5	306	7.2	24	9		0.017	T	T	0.07	0.08	T	T
Af 11 days	7.2	304	9.2	16	4	T	T	0.021	0.009	0.004	0.17	T	0.032
Location-New Shivaji Lake													
Bf 11 days Af 1 1/2 days	7.3	402	5	42	12	0.008	0.015	0.003	0.01	0.011	0.05	T	0.04
Af 7 days	7.5	466	8.3	40	12	0.007	0.035	0.09	T	0.023	0.11	T	0.003
Af 11 days	7.2	408	6	49	17	0.013	0.021	0.021	T	0.09	0.4	T	T
Location –Ghosale													
Bf 11 days Af 1 1/2 days	7.5	248	5.6	29	4	0.02	0.025	0.006	0.008	0.012	0.01	T	T
zAf 7 days	6.7	262	8	20	7	T	0.03	0.016	T	0.012	0.02	T	0.011
Af 11 days	7.3	280	8.3	20	6	0.014	0.003	0.031	T	0.014	0.14	T	0.016
Location Masunda Datta Ghat													
Bf 11 days Af 1 1/2 days	7.1	504	5.9	28	8	0.013	0.16	0.019	T	0.08	0.06	T	0.016
Af 7 days	7.2	402	7.2	34	12	T	0.07	0.015	T	0.079	T	T	T
Af 11 days	7.4	352	7.7	28	9	T	0.01	0.021	T	0.013	0.07	T	0.03

Parameters	pH	TDSmg/lit	DO mg/lit	COD mg/lit	BODmg/lit	Fe mg/lit	Cd mg/lit	Crmg/lit	Cumg/lit	Znmg/lit	Pbmg/lit	Hgmg/lit	Nimg/lit
CPCB Std	5.5-9.0	1000	>0.4 mg/l	250	100	-	2	2	3	5	0.1	-	-
Location-: Railadevi(Artificial Pond)													
Bf 11 days Af 1 1/2 days	7	326	4.7	32	9	T	T	0.08	T	0.05	T	T	0.04
Af 7 days	7.2	598	8.2	20	6	T	0.009	T	T	0.07	T	T	0.016
Af 11 days	6.8	578	3.7	32	11	0.012	0.003	0.064	T	0.016	T	T	T
Location-Hariom Nagar Pandurang bhorv lake													
Bf 11 days Af 1 1/2 days	7.2	568	4	58	17	0.016	T	0.009	0.009	0.005	0.02	T	0.01
Af 7 days	6.3	590	6.3	28	12	0.008	T	T	T	0.05	0.014	T	0.02
Af 11 days	7.5	508	6	12	3	0.017	0.01	0.01	0.01	0.026	0.011	T	T
Location –Kharegoan													
Bf 11 days Af 1 1/2 days	7.5	378	3.9	48	11	0.03	0.013	0.03	0.02	0.06	0.03	T	T
Af 7 days	7.6	376	7.8	32	10	T	0.02	0.024	0.02	0.057	T	T	T
Af 11 days	7.1	402	10.1	28	10	T	0.017	0.03	T	T	0.037	T	0.03
Location – Nilkant Woods(Artificial Pond)													
Bf 11 days Af 1 1/2 days	7.1	232	4.6	30	7	0.08	0.02	0.02	0.018	T	0.08	T	T
Af 7 days	-	-	-	-	-	-	-	-	-	-	-	-	-
Af 11 days	6.7	118	9	20	6	0.08	0.007	0.01	T	0.021	0.02	T	T

Annexure 6 - Water Quality testing at Nalla

Location	pH	S.S.m g/l	BOD mg/l	COD mg/l	PO$_4$ mg/l	NO$_3$ mg/l	NH3-N mg/l	Sulphide mg/l
Rabodi Nallah	6.8	320	44	128	0.24	0.12	3.5	T
Saket Nallah	6.5	250	44	132	0.199	0.295	5.6	T
Thane College Nallah	7.13	290	42	112	0.228	0.157	4.2	T
Balkum Nallah	7.1	230	30	88	0.43	0.1	6.7	2.3
Clarient	6.8	300	49	136	0.72	0.2	5.3	4.5
Saket	6.9	160	52	144	0.308	0.2	13.5	6.2
Upvan	7.5	220	-48	-160	-0.4	0.8	-4.2	-T
Thane College Nallah 2	7.2	-210	-52	150	0.56	0.3	5.6	T
Mumbra Station	7.5	-230	-56	210	0.68	0.21	6.2	T
Amrit Nagar	6.9	-240	-50	230	0.51	0.17	6.8	T
Kausa	7.2	-210	-50	226	0.71	0.32	6.5	T

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Annexure 7 -　　　　**Category – wise Registered Members for BMW Management**

Category	No. of centers	
	2007-08	**2008-09**
Blood bank	6	7
Corporate	15	15
Dentist	97	175
E. N. T.	12	31
General hospital	146	173
General Practitioner	64	421
Maternity Homes	11	95
Pathological Lab	38	105
Total	**451**	**1022**

Annexure 8 -   Transportation Infrastructure

Public Transportation infrastructure

Item	2007-08	2008-09
No. of Buses	286	325/288
Rental Buses	25	25
No. of Depots.	2	2
No. of Routes	60	60/46
No. of passengers traveling per day	2.64 Lakh	2.01/3.1 Lakh
Distance traveled per bus per day (Km)	192	185
Diesel consumed per day (litre)	10,743	8,900
CNG Buses	0	50

Category – wise number of Registered vehicles under RTO, Thane

Type	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09
Two Wheelers	273848	362104	400796	446111	499344	554921	601742
Three Wheelers	58197	68514	70688	73822	77335	79845	81472
Autorikshaw	10112	15827	20119	23727	27903	33339	81381
Car / Jeep	120580	203700	228190	234292	254683	276886	298145
Bus	2753	3538	5538	5581	5827	6583	6639
Trucks	47512	56083	63300	66905	72147	76936	85476
Other	720	920	987	996	1136	1171	1183
Total	513722	710686	789618	851434	938375	1029681	1156038

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