

CHAPTER: 1 BACKGROUND

Preparation of Environmental Status Reports (ESRs) is mandated in the 74th constitutional Amendment Act and the 12th 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 city level. It does this through the identification of demographic, social and economic driving forces behind various issues that can pose risk to environment, 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 (appropriate resource allocation) to planners and policy makers.

- To communicate the status of the environment as well as proposed action plan to resolve identified issues for all stakeholders including citizens.

Aurangabad ESR

Aurangabad Municipal Council was established in 1936 and became a Municipal Corporation in 1982. Since 2001 ESR for the city have been prepared. The reports cover the state of natural resources in terms of air, soil, water and noise pollution, land management etc. and details of environmental infrastructure and services such as solid waste management, water supply sewerages and sanitation, transportation etc. The ESR ends with a presentation of the Environmental Action Plan, designed specifically to mitigate the various environmental issues brought to light in the report. The overall methodology followed for the preparation of this ESR is as explained in the following Figure1.

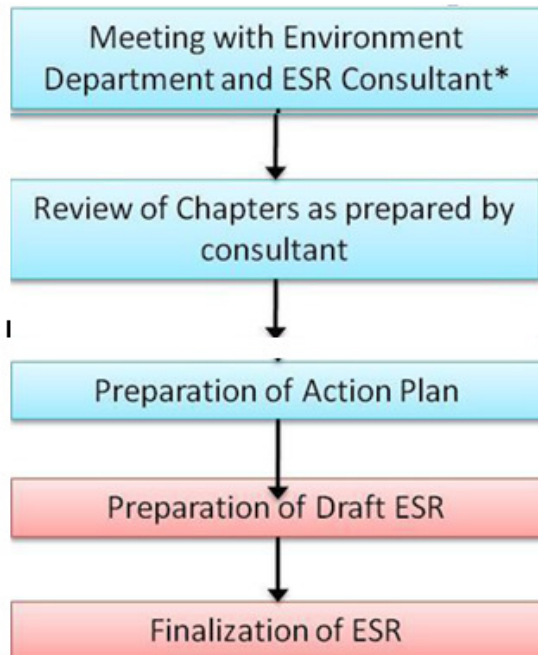


Figure1: Methodology Followed for Preparation of Aurangabad ESR

ESR 2017-18 has been prepared by **Dr. Geetanjali Kaushik** an Environmental Consultant.

ESR Preparation Process

ESR preparation process involves stakeholders as it is based on the participatory approach. As the name suggests, the primary objective of stakeholder consultation is to identify the city's needs through consultation with a range of stakeholders.

Review of existing ESRs

Consultant reviewed the previous ESRs for 2009-10, 2010-2011 and 2013-2014 to

understand the city, its environmental concerns and past as well as ongoing environmental initiatives undertaken by the authorities or the citizens. Wherever 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.

Purpose of Environmental Status Study:

The project envisages environmental improvement for the entire city including air quality management, development of open spaces, sewage treatment, environment monitoring and awareness program, etc. The action plan will cover the following:

- Improvement of physical infrastructure including water supply, sewerage, solid waste management, traffic and transportation etc;
- Protection and improvement of the green/open spaces
- Reduction of air, water, soil and noise pollution within city limits;
- Improved land use planning and management;

The basic premise of the project is to identify the environmental issues of the city and suggest measures to curb them.

Study Objective:

The aim of this research is to prepare an action plan for environmental improvement of Aurangabad city incorporating environmental planning and management tools to attain sustainable development.

The objectives of the project are as follows:

- To study the evolution and growth of the city, both in terms of physical and demographic growth and identify major growth centers in future;
- To understand the socio-economic pattern and other driving forces in city management;
- To develop integrated environmental strategies and policy instruments to ensure an environmentally sound development to protect environment and to steer sustainable development in the city
- To prepare sector specific short term and long term action plan to enable management of environmental issues in an integrated manner to ensure effective city management;

Process Adopted:

The mandate for achieving the above objectives is challenging. The task requires a dedicated inter-disciplinary team work for achieving the targets set by the concerned agencies. The action plan is to be formulated not only with visionary objective, but also developed involving environmentally sustainable, financially viable and institutionally acceptable strategies for effective city management. The sequence of the work includes:

- Collection of secondary data as available;
- Conduct public consultation;
- Perform baseline situation analysis including air and noise, water and soil
- Demand assessment and need for strategic interventions;
- Action plan for environment improvement.

CHAPTER 2: AURANGABAD CITY

Aurangabad city is situated in Maharashtra state of India it is the district headquarters. As per last census 2011, the total population of the city was 11,77,330. The current population of Aurangabad urban agglomerate is over 15.5 Lakh.

HISTORY:

Aurangabad ("Aurang City") is named after the Mughal emperor Aurangzeb. The city is a tourism hub, surrounded by many historical monuments including the Ajanta Caves and Ellora Caves, which are UNESCO World Heritage Sites. It is the administrative headquarters of Marathwada region. Aurangabad is titled as "The City of Gates" and the strong presence of these can be felt when one drives through the city. Recently, Aurangabad was declared "Tourism Capital of Maharashtra". By population it is the 5th largest city in Maharashtra after Mumbai, Pune, Nagpur and Nashik.

Khadki was the original name of the village which was made a capital city in 1610 A.D. by Malik Ambar, the Prime Minister of Murtaza Nizam, Shah of Ahmadnagar. Since ancient times, the city has played an important role due to its location on the famous Silk Route that traversed across the breadth of Asia to

Europe. Within a decade, Khadki grew into a populous and imposing city. Malik Ambar died in 1626. He was succeeded by his son Fateh Khan, who changed the name of Khadki to Fatehnagar. With the capture of Daulatabad by the imperial troops in 1633, the Nizam Shahi dominions, including Fatehnagar, came under the possession of Mughals. In 1653 when Mughal prince Aurangzeb was appointed the viceroy of the Deccan, he made Fatehnagar his capital and renamed it Aurangabad. Aurangabad is sometimes referred to as Khujista Bunyad by the Chronicles of Aurangzeb's regime.

By 1682 Khan Jahan Bahadur constructed a wall (about 6 miles in diameter) around Aurangabad to protect it against surprise attacks of Marathas. In 1692, he ordered to construct a magnificent palace near the great reservoir to the north of the city (viz. Subhedari).

Before the re-organization of state, i.e. prior to 1956 it was part of Hyderabad state and in the administrative set up of erstwhile Hyderabad state it was Subha (Region) established for five districts known as Marathwada. Aurangabad was then Subhedari head quarter.

After re-organization of states, Marathwada merged in Maharashtra state and Aurangabad became its divisional head quarter. The importance of the city increased with the passage of time. During 1961-71 MIDC developed industrial estate at Chikalhana.

The industries were setup with work force and it resulted in an appreciable demand for housing stock in the city. CIDCO was therefore, established as special planning authority and development for New Aurangabad took place.

During 1971-81 decade, Honorable High court of Bombay established a bench at Aurangabad. Thereafter city has commanded more and more area under its influence and in 1982 city reached the status of Municipal Corporation by further enlarging its dimensions with the inclusion of 18 villages in its campus. Waluj industrial area to the west of Aurangabad city consists of nearly 1600 Ha. of land which is developing rapidly with a large workforce.

Therefore, Aurangabad has shown tremendous potential in industrial development. It is also a historical city and occupies a significant position on the tourist's map of the world as it is surrounded all around with an amazing variety of monuments such as rock-cut temples in the mountain ravines of Ellora and Ajanta, strategic forts as the one at Daulatabad and mosques and mausoleums with their minarets and domes such as Bibi-Ka-Maqbara (AMC, 2016).

Aurangabad city was "A" class Municipal Council before December 1982 with an area of 54.4 Sq.Km. The Council was then converted into a Municipal Corporation (Figure 3). Additional 18 villages were merged in newly

Corporation area resulting in a total area of 138.50Sq.Km. The civic administration of Aurangabad Municipal Corporation area is managed by Aurangabad Municipal Corporation (AMC, 2016).

Geography:

Aurangabad has a strategic position on the Deccan Plateau. The city is surrounded by hills of the Vindhya ranges and river Kham passes through it. It stands in the Dudhana valley between Lakenvara range on the North and Satara hills on the south. Aurangabad is well connected by all means Air, Road, Railways. The city also has a very well developed and organized Industrial area which surrounds the city on all sides. Waluj, Waluj 2, Chikhalthana, Bidkin and a new Five Star Industrial Area Shendra are located in Aurangabad.

Location:

Aurangabad is situated on the banks of the River Kham a tributary of the Godavari River. The city is situated at the latitude of 19⁰ 53'50" N and longitude of 75⁰ 22' 46" E (Table 1, Fig 2). It is located 512 meters above sea level on Mumbai-Nagpur Highway (about 335 km from Mumbai and 475 km from Nagpur).

Geology and Soil:

The geological formations of the city are characterized by the Deccan traps (Upper cretaceous to lower Eocene). The granitic rocks have given rise to red as well as black cotton soils. Major part of the city has deep black soil derived from the trap rock. Certain variations occur due to exposure. A mixture of laterite and black soil, for example, is encountered in the eastern parts together with sandy soil along river banks. Most of the hill tops are bare or covered by coarse gravel while the low lying areas accumulate clay and loam.

There are mainly two types of rocks in this area:

i) Compact basalt which is almost free from gas cavities but contains sets of cooling joints (two vertical and one horizontal)

ii) Amygdaloidal basalt which is almost free from cooling joints but contains gas cavities which are filled by secondary minerals such as quartzite and calcites. In this area amygdaloidal basalt is more dominating rock type and compact basalt is comparatively rare.

There are about 21 dykes in and around Aurangabad city. Dykes were developed in the crust of the earth by tectonic forms. It is through these cracks lava outpoured on the surface of earth. By the cooling of the lava the rocks of

this area were formed. Weathering of basalt under dry and hot climate given rise to moorum first and then to black cotton soil. In the area of Aurangabad Municipal area, there is more black cotton soil. Sometimes during weathering process of basalt, lime (i.e. calcium carbonate) is also formed. This lime gets deposited in the soil in the form of partials imparting dirty white color to soil.

Climate:

The weather, in general, can be said to be hot and dry. Temperature of Aurangabad city varies between 9 °C and 41.8 °C. The average day temperature ranges from 27.7 °C to 38.0 °C while it falls between 26.9 °C and 20.0 °C during night. Similarly summer and winter temperatures also vary greatly. The highest during a summer day is around 41.8 °C while the lowest during winter nights falls to about 9.0 °C. Relative humidity is extremely low for major part of the year (between 29 to 77 %) while it is highest (95%) during monsoon. Rainy season is considered from middle of June to the end of September which is followed by a sultry period from the end of September to the middle of November. The winter season commences from the middle of November and ends by the end of January followed by a dry hot summer from February to middle of June. Summers are in general full of gusty winds. The normal average rainfall is about 72.50 cm but is rather variable from year to

year. It has decreased considerably in the recent years. The major portion of South West Monsoon precipitation is received on the West Coast of India due to the Sahyadris and only a small amount escapes through high hills, which is received by the Deccan Plateau. The total area under forest cover is about 557 km², which comprises of only 8.6% area of the total land area in Aurangabad (AMC, 2016).

Table 1: Basic information of Aurangabad city

Location	Latitude 19°53’N, Longitude 75°19’E
Land area (sq km)	139
Rainfall (mm)	734
GDP (billion \$)	6
Population	11,75,116
Annual Population growth (%)	3
Population density (people/ km ²)	365
Total vehicle population	9,46,093

(Source: AMC Report 2016)

Aurangabad has diverse economic activities ranging from industries, services, tourism and education. Due to the rapid industrialization and urbanization, the city has emerged as an educational hub, commercial center, and tourist attraction. There has been a drastic change in the city population and Aurangabad is emerging as the fastest growing city in the country. Recent census data revealed that the population of city is about 12 Lakhs (AMC, 2011). The city boasts of a large number of industrial units (small, medium and large-scale) (Kaushik et al, 2016).

From the above discussion it is evident that Aurangabad is a historical city with huge scope for industrial and commercial development, however, the climate is dry with low rainfall and poor forest cover therefore the winds during summer suspend the particulate matter and result in pollution. Even during winters low temperature coupled with low or no wind speeds prevent the dispersion of pollutants which is an alarming situation for a rapidly developing city.

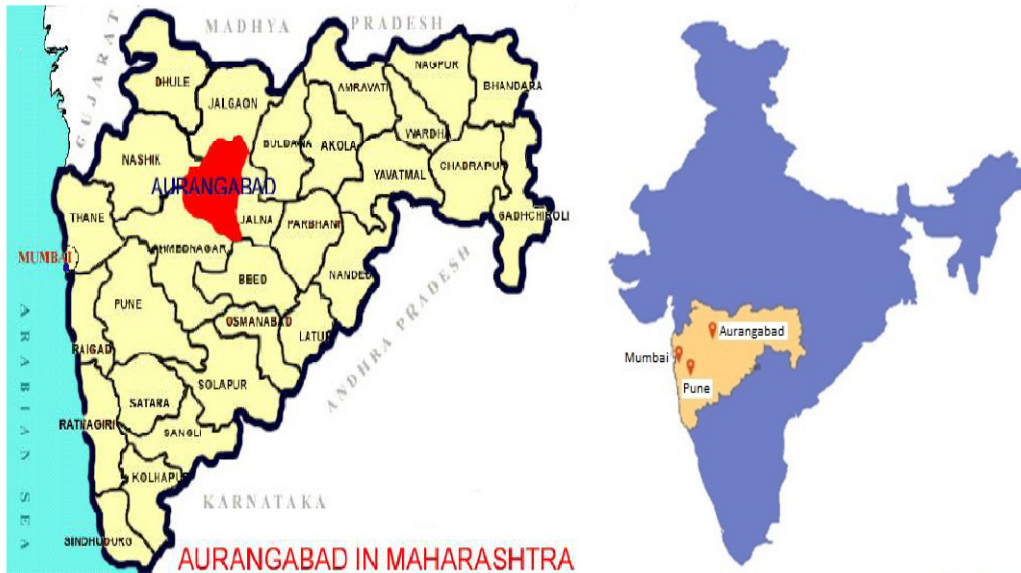


Fig. 2. Location of Aurangabad city

Source: Environment Status Report Aurangabad (2013-2014)

Main Features of City Development:

The Aurangabad Municipal Council was formed in 1936 when the geographical area of the town was 54.40 Sq.Km. In 1982 the Council was converted into a Municipal Corporation and 18 nearby villages were included in the city. The area of the Municipal Corporation at present is 138.5 Sq.Km. Since September 2006 the area planned by CIDCO has been included in the Municipal Limits.

Aurangabad has developed as an important city of the state with multiple functions as administrative headquarters, center for education, trade and commerce, industry and tourism. Historically too it has developed as a center for

administration and trade and commerce. The construction of the Meter Gauge Railway during the Nizam's rule gave further impetus to its development. After independence it also developed as an industrial center with pharmaceutical industries, automobile, engineering workshops, and silk mills and recently biotechnology has also emerged as a significant sector. Handloom and cottage industry and tourism also form important sectors shaping the city's development. The city is an important seat of education as it is the headquarters of the Dr. Babasaheb Ambedkar Marathwada University. Beside these there are a number engineering and medical colleges.

It is the seat of all the administrative functions of the district such as the Collectorate, Judiciary, Police and other government agencies. It is also the headquarter of Aurangabad Tehsil. The city has well developed road network. This connects it to the various urban centers in the district and the state. The meter gauge railway has been converted in to a broad gauge railway which now provides direct connectivity to different parts of the state and county.

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

Road Network:

The National highway No 211 Dhule-Solapur passes through Aurangabad. State highway SH -60 connects Pune and Mumbai. The major state highways MSH-5 and MSH- connect Nagpur and Nashik, MSH -8 connects Jalgaon at north. There are private as well as state transport for commuting between the nearby towns and cities. There are MSRTC (Maharashtra State Road Transport Corporation) buses from Aurangabad to Pune, Nasik, Indore and Mumbai. The MSRTC and MTDC also offer luxury overnight buses to Mumbai. For local transport and visit to heritages places in the region like Ajanta and Ellora there are buses run by MSRTC and intermediate transport such as auto rickshaws, taxis and local government buses.

Rail Network:

The city is connected by rail on Hyderabad- Mumbai railway corridor and has direct linkages to New Delhi, Pune and Hyderabad. There are 2 direct trains daily to /from Mumbai. There are 45 trains passing through city which include Express as well as Passenger trains.

Air Network:

The city has domestic airport located at the city which is well connected with the major urban centers Mumbai, Delhi, Hyderabad and other parts of the country.

The Airport is about 10 km east on the Jalna road.

CHAPTER 3: DEMOGRAPHIC CHARACTERISTICS

'Population growth' is an important indicator, with an objective to harmonize the annual growth of a city's population with its environment and the overall system of settlement. The urban population, similar to population density, is an indicator that measures the pressures on the environment including: exploitation of natural resources such as water and land; contamination of a city and its surroundings; air pollution by traffic and manufacturing industries, increased or decreased pressures on an urban environment illustrates population growth over time.

Population growth is one of the indicators of development. It has direct linkage with the environmental status of the city. Two components responsible for population growth are natural growth and in-migration. The increasing industrialization in the Aurangabad region has led to growth of urban population. The growth rate was highest in 1981 at 8% this could be due to the industrial development at Waluj which attracts significant populace for employment.

According to 2011 census total population recorded was 11, 75,116 (Table 2). The total population comprised of 51.84% males and 48.16% females. The sex ratio thus works out to 904 females per 1000 males.

Table 2. Demographic structure

Sr.No.	Year	Population
1	1981	2,84,807
2	1991	5,73,272
3	2001	8,80,740
4	2011	11,75,116

Source: AMC Report, 2016

From the available data the percentage of workers as Cultivators, Agricultural Labours, Household Industries, Manufacturing processing servicing and Repairs and others to total main workers are 1.38%, 1.66%, 2.32% & 85.32% respectively. Hence, the majority of workers are engaged in tertiary activities. As per 2011 census, the total workers in these two sectors comprise a whopping 85.32% (AMC Report 2016).

CHAPTER 4: LAND USE CHANGE

'Land-use Change' is an indicator; its objective is to reduce urban sprawl. Land, and the way it is managed, affects the entire environment. It is important to monitor changes in land use, especially rapid urbanization and urban sprawl. There is a continual need to reconcile the requirements for additional land for important uses, such as housing, industry, commerce and retailing with a desire to protect the countryside and agriculture (ESR Aurangabad, 2011-2012).

The study of existing Land Use pattern of the city is therefore of vital importance to understand the issues and to determine the optimum and most beneficial distribution of land use in the interest of community.

The major components of the existing land use include residential development, commercial, industrial, agricultural land and forest land. A comparison of existing land uses of 1991 with 2013 reveals that there is a substantial increase in residential and industrial areas. This is because Aurangabad city has developed as regional, educational and tourist center.

Proposed Land Use of Aurangabad for the year 2031:

The projected population of Aurangabad city is 19.93 Lakhs (by 2031). As can be seen from the density of population the comfortable density of population is between 250 -300 persons per hectare.

Comparing the density of wards it is observed that some wards are yet to achieve the comfortable density. The difference between existing and projected can be achieved by natural growth rate over the period in existing city and CIDCO area.

The underdeveloped area in the various land uses has to be developed on the lines of the planning standards of Urban Development Department, Government of India. The standards proposed for the densities of Population by the UDPIF guidelines are 250 to 300 persons per hectare on net residential land areas. The population projections by 2013 indicate that city will be 19.93 lakhs. The additional population to be accommodated is 9, 69,797 souls. The gross area required to accommodate the future population at the rate of average density of 125 persons per hectare is 7758 ha. The total area available presently is 7320 ha which is sufficient to accommodate the projected population within the existing low-density wards.

Land use Pattern (as per Guidelines):

a. **Residential land Use:** The UDPFI (Urban Development Plans Formulation and Implementation) guidelines suggest the residential areas for the cities having population above 10 lakhs range between 35 to 40%.

b. **Commercial land use:** Commercial activities are permitted in the residential area as well. Therefore, for pure commercial area 3.4% is proposed.

c. **Public-Semipublic use:** Aurangabad is the head quarter for Marathwada region, therefore regional offices are established in the city, it is also an educational center hence the land use under public semi-public is at the higher side which is proposed to be 13%

d. **Industrial land use:** two industrial areas are within Municipal Corporation boundary, other areas are located beyond the Municipal limits therefore no separate area is proposed within the city.

e. **Recreation space:** recreation spaces are deficient in the city; it is proposed to have more recreation spaces in proposed land use to compensate the deficiency.

f. **Traffic and transport:** width of the roads in the city is narrow therefore it is proposed to widen the existing roads and to keep the future roads with standard width.

Present Land Use Pattern

Industrial growth is also tremendous. There are industries in Waluj, Chikalthana and Shendra MIDC. However, it is important to note that the forest cover is close to 9% (largely includes sanctuary areas) which needs to be enhanced to tackle air and noise pollution. Still, it is considerably less as compared to the state average

of 20%. On the other hand, different parts of Marathwada have less than 5 % green cover.

The Eco Task Force (ETF) battalion is set to become reality in Aurangabad with an aim to improve the below-average green cover on a war-footing. The battalion, which is actually a part of Eco-Development Forces (EDF) scheme established in 1980s and implemented through the ministry of defence for ecological restoration of terrains rendered difficult either due to severe degradation, remote location or difficult law and order situation. It's proposed base camp is near Daulatabad Fort. It is believed that around 100 acres of area near the proposed camp would be brought under afforestation in phases with the help of ETP battalion through five-year planning (<https://timesofindia.indiatimes.com/city/aurangabad/force-ready-to-better-green-cover/articleshow/57363188.cms>). Since Aurangabad and the region as a whole have far less percentage of forest cover as compared to the state, it is expected that the ETF battalion would serve as an effective measure.

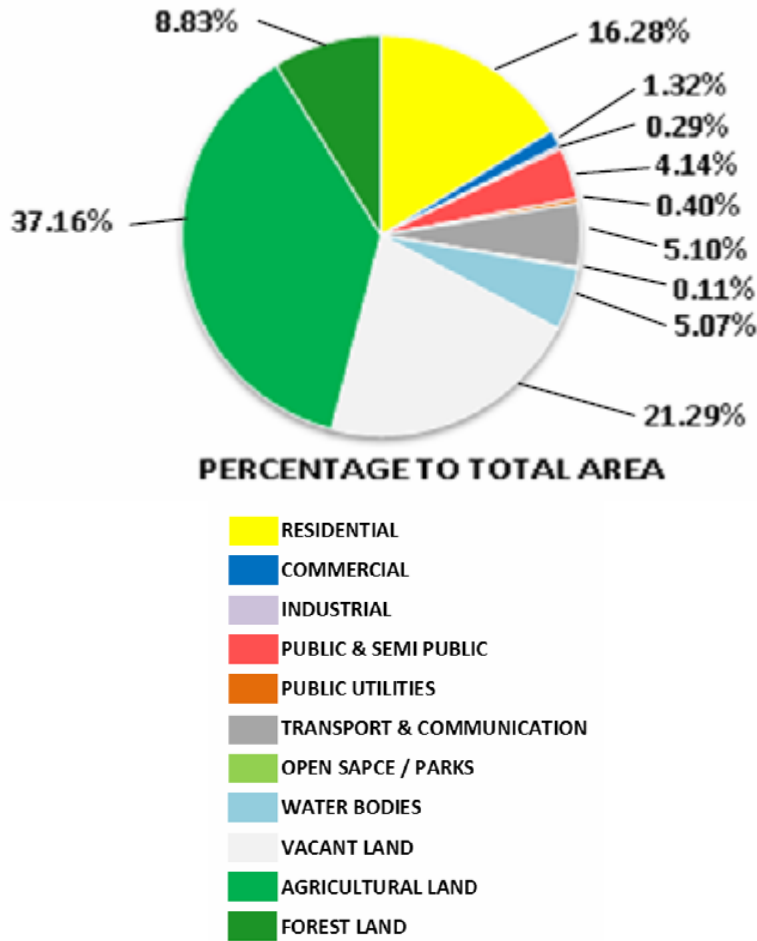


Fig. 3. Existing Land Use

(Source: AMC Report, 2016)

Growth Trend:-

The findings about growth trend are as follows:-

1. The existing land use plan indicates that the trend of development is mostly around villages. The planned residential development is more in villages Nakshtrawadi, Kanchanwadi, Itkheda, Satara, Padegoan, Mitmita, Bhavsingpura

and unauthorized residential development is in Harsul, Chikalhana, Mukundwadi and Garkheda along Beed bypass road.

2. It is seen from the existing land use plan that the most of the lands in village (Nakshtrawadi, Kanchanwadi, Itkheda, Satara, Padegoan, Mitmita, Bhavsingpura) have been laid out in to plots, however, all the plots have not yet been fully built up, are in the process of development.

3. Development is along the main traffic routes, Jalgaon, Jalana, Paithan road and Beed bypass, Nasik road. The interior lands are however in undeveloped condition for want of necessary infrastructure facilities and some lands are good agricultural lands.

4. There is proposed Shendra-Bidkin MIDC on Jalna road. This MIDC is just adjoining to fringe area on eastern side. The Shendra-Bidkin MIDC is developing rapidly.

5. The commercial activity is mainly located in core area, CIDCO area of the Corporation limits of Aurangabad (AMC Report, 2016).

Clearly construction activities would be a significant source of particulate matter in future so construction and demolition deserves attention by the municipalities. AMC must also focus on provision of roads in these newly developing areas to control pollution.

CHAPTER 5: BIODIVERSITY IN AURANGABAD

The climate of Aurangabad city is generally hot and dry. It receives low rainfall. However, the vegetation is diverse in nature. Common tree species observed in the city include Teak, Hardwickia, Banyan, sacred fig, yellow flame, Mango, Ashok, Peru, red date etc. Commonly occurring shrub here are Tantani, Neelpushpi, Aak, Bahava etc. These provide nesting, breeding or feeding habitats to several birds.

Common birds which are observed perennially include Pond heron, Cattle egret, White breasted kingfisher, Red wattled lapwing, Indian ring dove, Crow pheasant, Jungle babbler, Common myna, Rose ringed parakeet, Tailor bird, Purple rumped sunbird, Indian robin and Magpie robin. Some birds are seasonal like Black Ibis, European hoopoe and Coppersmith barbet. These are more frequently observed in winter. Grey hornbill and Tree pie are seen in beginning of the rainy season. In Aurangabad district, Gautala is a well known sanctuary, Jayakwadi is also famous for bird sanctuary. Theory scrub forests are having major trees such as Bor, Babul, Aloe-Vera etc. A variety of wild animals can be seen in the above said forests like wild boars, foxes, hares etc. Leopards are also seen but are rare in occurrence. There are many species of monkeys and Baboons within the city area.

The major agricultural crops are Cotton, Oil seeds, Bajra, Jowar, Groundnut, Wheat, Safflower and Sugarcane, which is an important irrigated crop. The other irrigated crops include Grapes, Bananas, Sweet Limes and Oranges. Variety of vegetables such as Brinjal, Tomato, Onion, Potato and Leafy vegetables are also grown. The Godavari is the main river in the Marathwada region. Table 3 presents the botanical names of common tree species found in the city.

Table 3 Common Tree species in the city

SNo.	Common name	Scientific name
1.	Mango	<i>Mangifera indica</i>
2.	Supota	<i>Achras zapotas</i>
3.	Almond	<i>Terminalia catoppa</i>
4.	Neem	<i>Azadirachta indica</i>
5.	Bottle brush	<i>Callistemon viminalis</i>
6.	Ashoka	<i>Saraca asoca</i>
7.	Banayan	<i>Ficus bengalensis</i>
8.	Sweet lemon	<i>Citrus sinensis</i>
9.	Ramphal	<i>Anona reticulata</i>
10.	Fig	<i>Ficus racemosa</i>
11.	Jamun	<i>Syzigium cumini</i>

12.	Coconut palm	<i>Cocos nucifera</i>
13.	Bamboo	<i>Bambusa vulgaris</i>
14.	Gulmohar	<i>Delonix regia</i>
15.	Indian rubber tree	<i>Ficus elastica</i>
16.	Guava	<i>Psidium guajava</i>
17.	Tamarind	<i>Tamarindus indica</i>
18.	Shoe flower	<i>Hibiscus rosa sinensis</i>
19.	Subabul	<i>Leuceana leucocephala</i>
20.	Bougainvillea	<i>Bougainvillea glabra</i>
21.	Sandalwood tree	<i>Santalum album</i>
22.	Custard apple	<i>Annona squamosa</i>
23.	Babul	<i>Acacia nilotica</i>
24.	Vilayati chinch	<i>Pithecellobium dulce</i>
25.	Karanj	<i>Pongamia pinnata</i>

Aurangabad zoo houses different animals such as jackals, leopards, macaque, langur, tiger, wolf, black buck, Indian porcupine, crocodile and tortoise.

However, despite the region being rich in biodiversity the pressure on biodiversity is immense from various associated sources, principally land use change (more land being brought under cultivation, residential and industrial areas), pollution and the introduction of alien species. It is expected that the area available for natural and semi natural habitats and indigenous species would decrease in the next decades, due to the ongoing spread of urban development.

Biodiversity Hotspots

The municipal limits of Aurangabad have sites such as Himayat Bagh, Harsul Lake, University campus and Salim Ali Lake that are rich in biodiversity and in need of conservation. Salim Ali lake is a rare and rich biodiversity spot within the city that hosts almost 16 tree species, 11 shrub types, 8 climbers, 32 terrestrial herbaceous plants, 10 varieties of algae, 12 of aquatic herbs, 16 aquatic insects, molluscs and crustaceans, nine varieties of fish, 15 species reptiles, seven types of rodents and mammals and 102 types of insects. More than 25 species of birds have been observed at the lake for breeding which include common coot, spot billed duck, purple moorhen, white breasted moorhen, water hen, common stilt, laughing dove, fan-tailed fry-catcher, Iora, peasant crow, egret and cormorant. It is known that legendary ornithologist Dr Salim Ali had visited this lake during his stay in Aurangabad in 1984 and recognized its rich and diverse birdlife. Since

then the lake was named after him. Under the enactments such as the Biological Diversity Act 2002, Rule 2004 and Maharashtra Biological Diversity Rules 2008, steps should be taken to invoke the provisions of these rules to declare the lake as a biodiversity hot spot. The beautification activities included cleaning and deepening of lake, fencing around it, construction of an effluent treatment plant and a bird watching tower and eradication of all aquatic vegetation as well as surrounding bushes and trees. These activities in and around the lake are threatening the biodiversity of the area and in particular adversely impact the roosting and nesting place of many bird species. Moreover, many among the visitors often indulge in unscrupulous activities such as pelting stones at the birds. Fishing activities are common, while the rising noise level is affecting the bird habitat," the high court had on October 17, 2013 directed the Aurangabad Municipal Corporation (AMC) not to carry out any development work detrimental to ecology of the lake without due permission of the biodiversity committee and the court (<https://timesofindia.indiatimes.com/city/aurangabad/Declare-Salim-Ali-lake-as-biodiversity-hot-spot-demand-environmentalists/articleshow/38948721.cms>).

The local civic body must form the mandatory Biodiversity Management Committee (BMC) after the tenure of earlier panel ended a few years back. The panel promotes conservation and proper documentation of biological diversity for

local self-governing institutions, as per the Biological Diversity Act, 2002. One of the key mandates for BMC is to collect data on various aspects of local biodiversity for preparing a people's biodiversity register (PBR). The desired panel is expected to consult with locals while preparing such PBR and validate it. It also shoulders the responsibility of collecting data related to natural habitats, conservation of landraces, folk varieties and cultivars, domesticated stocks, breeds of animals, micro-organisms and chronicling of knowledge relating to biological diversity (<https://timesofindia.indiatimes.com/city/aurangabad/amc-faces-flak-for-failing-to-name-biodiversity-panel/articleshow/62205276.cms>).

CHAPTER 6: AIR QUALITY

Currently, the air quality data available from the city is for Respirable Suspended Particulate Matter (RSPM) or PM10, NO₂, and SO₂ from three manual stations operated by the MPCB. From 2016, with the setting up of an automatic monitoring station in the city (Diggikar, 2016), more data has been made available.

Based on air quality results conducted by the MPCB, for the past five years, annual PM10 concentrations have been above the National Ambient Air Quality Standards (Table 4).

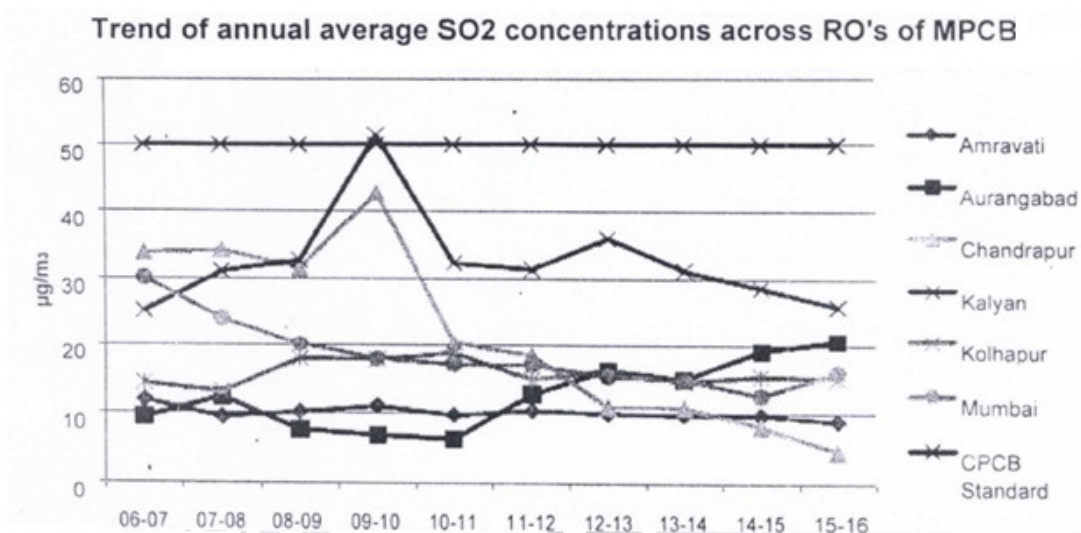


Fig. 4. Trends in SO₂ Concentrations from 2006-2016

Source: http://mpcb.gov.in/legal/pdf/Vardhaman_Kaushik_Union24062016.pdf

Table 4 a. Pollutant Concentrations in Aurangabad city ($\mu\text{g}/\text{m}^3$)

Sr.No.	Location	PM10	SO₂	NO₂
1.	CADA Office, Garkheda	80	15	41
2.	SBES College Campus	115	16	43
3.	Collector's Office	82	11	34

Source:[http://cpcbenviis.nic.in/airpollution/2016/National%20Ambient%20Air%20Quality%20Monitoring%20Programme%20\(NAMP\)%20Data%202016,%202007.11.2017.pdf](http://cpcbenviis.nic.in/airpollution/2016/National%20Ambient%20Air%20Quality%20Monitoring%20Programme%20(NAMP)%20Data%202016,%202007.11.2017.pdf).

Table 4 b. Monthly Air Quality Data, 2017-2018

(average of 3 locations)

Months	SO₂ $\mu\text{g}/\text{m}^3$	NO_x $\mu\text{g}/\text{m}^3$	RSPM $\mu\text{g}/\text{m}^3$
January, 2017	19.81	50.93	125.62
February, 2017	14.12	43.12	107.12
March, 2017	10.88	37.88	94.33
April, 2017	8.66	34.13	95.22
May, 2017	8.13	29.25	99.25
June, 2017	8.23	28.66	91.77
July, 2017	7.55	28.22	75.22
August, 2017	7.37	27.75	58.25

September, 2017	7.42	27.46	41.84
October, 2017	10.51	31.57	63.16
November, 2017	9.83	31.16	74
December,2017	14.5	39.55	84

On the other hand, annual SO₂ and NO_x concentrations in the city have been within the National Ambient Air Quality Standards (Figure 4 and 5).

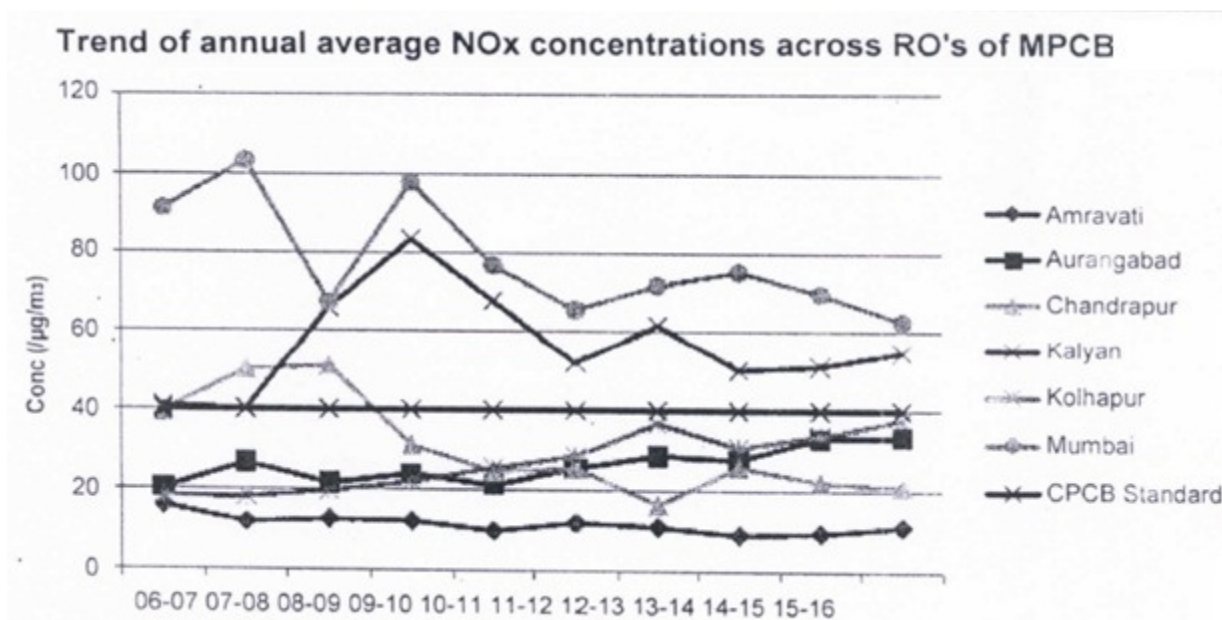


Fig. 5. Trend of NO_x concentrations

Source: http://mpcb.gov.in/legal/pdf/Vardhaman_Kaushik_Union24062016.pdf

Capacity to determine sources of air pollution and their contribution:

Emission inventory and source apportionment research for Aurangabad is in

progress and is expected to be completed. The MPCB has engaged NEERI and IIT Bombay to implement the Project “Air Quality Monitoring and Emission Source Apportionment

Air quality has been regularly monitored at three stations in Aurangabad funded under National Ambient Air Quality Monitoring Program since 1st December 2005 undertaken by the MPCB’s Regional Office. Ambient air quality monitoring is carried out twice a week at three locations, namely CADA office, SB College and Collector’s Office. The parameters monitored at these stations are SO₂, NO_X, SPM and RSPM (PM₁₀).

- **CADA Office:** is a Government office surrounded by a residential area. Heavy volume of all kinds of vehicles plies on this road. A big ground is located nearby on this ground various festive activities and exhibitions take place on a regular basis thereby adding to fluctuations in pollution levels.
- **S.B College:** is a residential area that has government employee apartments, government offices, schools, colleges etc. The Z.P ground located opposite this site is a parking facility for city buses, besides other seasonal activities.
- **Collector Office:** air quality monitoring station was installed at the terrace of the Collector’s Office w. e. f 18th Aug. 2008.

In addition to these monitoring stations which are predominantly located in the residential areas, a continuous monitoring station was installed in une2016 in the industrial area in Waluj, which will also monitor PM2.5, ozone, volatile organic compounds (VOCs), benzene, xylene, carbon monoxide (CO), nitrogen dioxide, ammonia, benzene, and toluene (Diggikar, 2016).

As per compliance report of CEPI Action plan Aurangabad (status as on 22 Jan, 2015) within 6 months 4 continuous AAQM stations were to be set up within the city by the implementing agency MPCB. The locations were M/s Orchid Chemicals & Pharmaceuticals Ltd. In MIDC Area Waluj, M/s Radico NV Distilleries Pvt. Ltd. MIDC Area Shendra and M/s United Spiritts Ltd MIDC Area Chikalhana for which the letters have been submitted to MPCB RO office. However, only the station at Waluj has been operational.

Based on the CPCB's Guidelines for Ambient Air Quality Monitoring, the recommended number of monitoring stations in a city is determined by (i) the size of the area to be covered, (ii) variability of pollutant concentration over the area, (iii) pollutants to be monitored, and (iv) city population (CPCB, 2003). Table 5 shows the recommended number of stations based on population size following US Environmental Protection Agency and the European Environment Agency recommendations compared with the actual number of stations per

pollutant in Aurangabad. Based on the guidelines, additional stations are needed to monitor Particulate Matter, Ozone and Carbon Monoxide.

Table 5. Air Quality Monitoring stations in Aurangabad

Monitoring stations	PM2.5	PM10	O₃	SO₂	NO₂	CO
Residential	-	3	-	3	3	-
Industrial (since 2016)	1	1	1	1	1	1
Total existing stations	1	4	1	4	4	1
Prescribed stations based on population	6	6	4	4	4	4

From Table 5, it is clear that more monitoring stations are needed for PM2.5, Ozone and CO estimation within the city in commercial, industrial and sensitive areas. Also, the city lacks display boards providing air quality information to public which may be taken up by Aurangabad industry forum.

Capacity to estimate impacts of air pollution: A comprehensive literature review revealed that a single dated study on the estimation of health impacts; few on environmental and scarce studies on impacts of air pollution to other sectors for Aurangabad have been conducted. However, there exist studies at the National level on the impact of air pollution on visibility, climate change,

agricultural productivity and long-range pollutant transport. The city needs to urgently undertake research studies on these themes, particularly relating to health, in order to have a better understanding of the impact of the air pollution experienced by the city residents.



Fig 6. City Awareness & Sensitization Workshop on Air Pollution

On 11th Jan, 2018 AMC, MPCB and CMIA organized a workshop on Air Pollution which was inaugurated by AMC Commissioner in presence of AMC Mayor and MPCB RO.

CHAPTER 7: STATUS OF NOISE

No one should be exposed to noise levels that endanger health or decrease the quality of life. Noise is an intense factor affecting human health both physiologically and psychologically. In large urban agglomerations, the effect of noise is further aggravated by high concentrations of people living together.

Noise can cause hearing impairment, hypertension, ischemic heart disease, annoyance, sleep disturbance, and decreased school performance (table 6). According to W.H.O guidelines optimum noise level is 45 dB by day and 35 dB by night; anything above 80 dB is hazardous.

Table 6: Impact of Noise levels on Human Body

Sr. No	Noise levels in dB	Health Hazards
1.	60	Annoying
2.	90	Hearing Damage (8 Hrs.)
3.	95	Very Annoying
4.	120	Pain Threshold
5.	140	Pain in Ear
6.	150	Significant change in heart pulse rate
7.	180	Major Permanent Damage to Ear

Increased number of vehicles in the city, manufacturing units, large scale festivals and cultural celebrations, construction operations, generators etc. has increased the ambient noise levels in the past few years in Aurangabad city. Poor urban planning may give rise to noise pollution, as industrial and residential buildings can result in noise pollution in the residential area.

Table 7. Average values of noise level (dB) at selected sites

SNo.	Monitoring Sites	Average noise level in dB	
		Morning (8:00-11:00 am)	Evening (5:00-8:00pm)
1.	Baba petrol pump	92	94
2.	Kranti Chowk	95	103
3.	CIDCO bus stand	83	90
4.	Railway Station	87	88
5.	Waluj Chowk	84	92
6.	Gulmandi Chowk	83	86

Data from table 7 clearly indicates that Kranti Chowk, Baba petro pump and CIDCO bus stand with high traffic density have high noise levels. Even Waluj industrial area has high levels of noise which are above the permissible levels.

Commercial areas such as Gulmandi frequented by people are also exposed to high levels even above the standards (table 8).

Table 8. Ambient Air Quality standards in respect of Noise

Area Code	Category of Area/Zone	<u>Limits in dB(A) Leq*</u>	
		Day Time	Night Time
(A)	Industrial area	75	70
(B)	Commercial area	65	55
(C)	Residential area	55	45
(D)	Silence Zone	50	40

It is advisable that AMC 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.

CHAPTER 8: WATER SUPPLY & QUALITY

Water requirement of AMC is expected to reach 300MLD at the end of 2031. At present, potable water in AMC area is supplied from Jaikwadi dam (table 9). After checking for residual chlorine, regularly chlorine is added in the storage tanks at various points to maintain the desired level (0.2 mg/l) of residual chlorine in the water. This water is distributed in AMC area. 130 MLD water is supplied to AMC from Jaikwadi. AMC supplies water to the households. AMC supplies water to slums through public stand posts. The coverage of water supply is 90%. Even though, water distribution system in AMC area is satisfactory the AMC is obliged to augment and improve the same. Schemes undertaken by AMC for improvement of water supply system include, construction of elevated service reservoir, replacement of old lines with ductile iron pipelines, system for re-chlorination of water, replacement of pumping machinery, installation of water meters for water audit at head works and master balance reservoir. Another major step of AMC to improve the performance and quality of water supply system as a whole is award of Comprehensive Operation and Maintenance of Water supply system based on performance. This has made water supply reliable, improved the quality of water, reduced water leakages and created energy conservation awareness. AMC has also started Abhay Yojna for avoiding misuse of water by

the consumers. During contingency, AMC can supply potable water from either of three sources.

Table 9. Aurangabad – Water Supply and Sewage Treatment Overview

Local Body	Water Consumption in MLD	Domestic Effluent Generation in MLD	Details of Existing STP
Aurangabad Municipal Corporation	130 (Jaikwadi Dam)	120	<p>2 STPs in operation.</p> <p>6.5MLD at CIDCO</p> <p>5.0 MLD is at Salim Ali lake.</p> <p>AMC has proposed 4 STPs with total capacity 216.0 MLD.</p> <p>Nakashtrawadi STP (161MLD) recently commissioned</p> <p>Zalta STP (35 MLD) 80% work completed.</p> <p>Padegaon STP (10MLD) work not yet started</p>

Water Treatment Plant:

Presently AMC has a water treatment plant located at Farola (table 10).

Table 10: Treated Water Quality at Farola Water Treatment Plant

Parameter	Summer	Monsoon	Winter
pH	7.35	7.25	7.82
Turbidity	1.12	1.31	1.16
Total Hardness	145	110	153
TDS	273	378	314
Chlorides	54	67	65
Nitrates	10.7	5.72	5.27
Nitrates	ND	ND	NT
Iron	0.16	0.12	0.13
Fluorides	0.26	0.39	0.36
Alkalinity	133	119	143
ND- Not Detectable, NT-Not Tested. Turbidity in N.T.U., All other except pH in Mg/l			

(Source: Testing reports from Reg. Public Health Laboratory)

Water Quality

AMC takes water samples from various locations to check their portability from Public Health Laboratories. The portability of water reduces at the user's end mainly due to unhygienic conditions of water tank and storage system at end user.

Water samples are sent to Public Health laboratory, Aurangabad for the analysis. All necessary quality control is taken in order to supply potable water to AMC. Water received is stored in ESR/GSR of AMC before being supplied to citizen. All ESR/GSR are cleaned regularly and water samples are sent to laboratory frequently for testing to Public Health laboratory, Aurangabad. AMC carries out remedial action in case of bad quality of potable water. To provide safe and clean water AMC tries to maintain the desire level of residual chlorine in ESR/GSR water.

Water Quality Analysis

Surface water is the main resource for drinking and domestic purposes.

However, its scarcity due to population growth and industrial development forces people to use groundwater for the portable and domestic uses in urban areas in Aurangabad. Further the establishment of numerous illegal wells and the lack of means to protect groundwater wells from different pollutants lead to reduction in groundwater storage and its pollution by pollutants coming from various sources like industrial effluent and sewage water of household.

Table 11a. Analysis of Water quality parameters in Drinking water samples

Sample	Location	Temp. (°C)	pH (6.5-8.5)	EC (400µs)	TDS (1000 ppm)	DO (above 5 mg/l)	Hardness (500 mg/l)	Chloride (250 mg/l)
1	Cidco	33	7.7	32.8	263	8.2	58	43.1
2	Pundlik nagar	32.2	6.9	32.5	240	7.9	46	41.7
3	Harsul T Point	32.4	7.1	37.8	328	6.2	78	47.4
4	TV centre	33.5	7	32.6	242	6.5	53	40.3
5	Garkheda	37.6	6.9	37.3	271	7.6	82	45.3
6	Paithan Gate	32.7	7.5	38.6	239	8.6	87	37.5
7	Begampura	33.1	7.2	32.5	269	7	92	51.6
8	Nandanvan colony	29.3	7.2	32.9	586	5.9	71	43.8
9	Chavani	31.6	7.3	36.0	126	6.6	96	41.7
10	Station road	32.5	7	47.8	821	7.1	128	90.6

Clearly the water quality parameters in the drinking water samples (table 11a) have been within the permissible limits.

Table 11 b. Monthly Drinking Water Quality Data, 2017-2018

(Average of 10 locations across the city)

Months	pH	EC	TDS	Hardness
January, 2017	7.3	31.0	195	119
February, 2017	7.2	33.0	210	140
March, 2017	7.3	34.5	225	142
April, 2017	7.3	36.0	235	145
May, 2017	7.1	37.4	270	143
June, 2017	6.9	29.8	170	90
July, 2017	6.8	27.8	172	95
August, 2017	6.9	27.5	169	99
September, 2017	7.0	28.0	165	97
October, 2017	7.0	31.2	175	110
November, 2017	7.1	35.3	181	120
December, 2017	7.2	32.0	190	115

However, before using groundwater we have to assess its quality to decide its suitability for drinking and domestic uses. Therefore, we have randomly selected samples from Aurangabad city to study physic-chemical parameters and comparing the obtained values with the standard value on the basis of BIS and WHO guidelines (table 11a, b and c).

L1:Chhavni weekly market

L2: Khadkeshwar

L3: Samarth arcadegate

L4: Harsul lake (surface water)

L5: Himayat Bagh

L6: Labor colony Harsh Nagar

L7: Shaha Bazar Bhoiwada

L8: Maratha High school

L9: Ambedkar hall Paithan gate

L10: Ganpati Mandir Sataraparisar

Table 11 c. Analysis of Water quality parameters in samples

Location	pH	EC	DO	COD	Cl ⁻	SO ₄	PO ₄	TDS	TH	NO ₃ ⁻
L1	7.5	759	5.3	125	121	16.5	0.14	455	359	20.2
L2	6.9	4522	6.5	131	211	25.5	0.15	2911	921	16.8
L3	6.9	3617	4.3	156	151	36	0.15	2307	1076	43.1
L4	7.1	773	4.6	113	155	24.5	0.14	397	379	30.7
L5	6.1	853	7.0	92	238	23	0.14	534	418	39.1
L6	6.2	4513	6.4	121	578	76	0.12	2778	1681	26.4
L7	6.8	1811	5.2	152	239	31.5	0.14	986	879	28.7

L8	6.9	1421	6.5	120	420	54.5	0.15	897	593	42.6
L9	6.6	1393	6.4	116	247	33	0.14	791	688	27.6
L10	7.0	2410	7.6	123	1211	32.5	0.13	1473	904	28.8

The obtained pH values of groundwater were in the range from 6.1 to 7.5, within the permissible limit 6.5 to 8.5 (WHO, 1996) and 6.5 to 9.0 as per Indian standard (BIS, 1991). Electrical Conductivity (EC) in this study ranged from 759 to 4522 $\mu\text{mhos/cm}$, so all the groundwater samples had EC values above the permissible limit (300 $\mu\text{mhos/cm}$) given by WHO and BIS.

Electrical conductivity is a measure of water's capacity to carry electrical current. Large measure of EC implies the presence of soluble ions indicating the presence of metals and chlorides. Dissolved Oxygen in the samples ranged from 4.3 to 7.6 mg/l. DO represents an important parameter and it is indicator of water quality where DO concentration controls distribution of animal and plants living in the water environment. Chemical oxygen demand COD is oxygen required for oxidation of organic and inorganic matter present in the water. In this study COD values varies from 92 to 156 mg/l, the higher values of COD means there is organic pollution. The high values of COD are on account of industrial and human activities where the contaminants and waste discharged on earth surface gradually pass into ground and mix with groundwater. Chloride values in this study are found in the range from 121 to 1211 and permissible limit is 1000 mg/l

as per BIS, location L10 shows high chloride levels. The high value of chloride means the water is not suitable for drinking and other domestic purposes and this water is saline needing special filtration for purification.

In this investigation, SO_4 concentrations were in range from 23 mg/l to 76 mg/l and all samples were below permissible limit 200 mg/l. Phosphate ions PO_4 contents in this study ranged from 0.12 to 0.151mg/l which are within the permissible limit which is 0.5 mg/l as per WHO.

Total dissolved solids TDS of ground water of selected samples are in the range from 397 mg/l to 2911 mg/l, permissible value of TDS in drinking water as per WHO and BIS is 1500 mg/l. High content of TDS in the samples may be due to weathering of rock and soil. Total Hardness TH ranged from 359 to 1681mg/l, above permissible limit 600 mg/l as per BIS. From the obtained results we can conclude that groundwater is polluted and would impact human health.

Measures to improve Water scenario in Aurangabad

With Aurangabad prone to drought-like situation Aurangabad Municipal Corporation may utilize over 100 public wells under its control to offer possible solution to the water woes in the city. Only 15 wells located in gardens civic gardens, burials grounds and crematoriums are used to draw water to meet the requirements. That apart, 15 other public wells are used only for the purpose of immersion of Ganesh idols during the Ganapati festival. Water scarcity is

gradually aggravating in the city with each passing day and residents have been demanding the municipal authorities to improve the supply system (<https://timesofindia.indiatimes.com/city/aurangabad/all-not-well-with-water-supply-plan/articleshow/58615638.cms>).

The cleaning the wells (desilting) and installing small water filtration plants along with overhead tanks near the wells could give some respite to citizens at least in some pockets.

In addition in to help raise the falling table level it is important to install rainwater harvesting system in the housing societies.

Rainwater generally runs off to the street leading to a lot of wastage besides flooding of the roads. Rainwater harvesting injects large quantities of water into the soil in order to sustain both the quality and quantity of ground water. At places where this is not possible, constructing percolation pit/recharge well and recharge bore pits or a combination of these two can solve the purpose. It is high time that rainwater harvesting is made mandatory for every property holder to combat water scarcity.

CHAPTER 9: SOIL

Soil is the most precious natural resource for crop production and it takes almost 1000 years to produce an inch of top soil (Chandra and Singh, 2009). Degradation of soil due to natural and manmade factors hampers the productivity. United Nations suggest that the world population by 2050 could reach 8.9 billion and at least one billion people will be chronically malnourished or starving. As human population continue to increase, human disturbance of the earth's ecosystem to produce food and fibre will place greater demand on soils to supply essential nutrients. The soils native ability to supply sufficient nutrients has decreased with higher plant productivity levels (Havlin et al, 2010). From the green revolution period agriculture is getting more dependent upon synthetic fertilizers which are product of fossil fuel. It has adversely affected the soil, causing decrease in organic carbon, reduction in microbial flora of soil, increasing acidity and hardening of soil (Jain, 2009).

Organic carbon, organic matter and microbial biomass are direct indicator of soil biological status of soil health. Intensive agriculture has caused extraction of 10 million tons soil nutrients every year, deficiencies of secondary and micronutrients, decreasing organic carbon content, and overall deterioration in soil health. The consumption of fertilizer of Maharashtra in kg/ha are N - 74.96, P-50.95 and K - 30.38, with NPK consumption ratio of 3.4: 2.3:1 in 2010 - 11.

Site specific nutrient management involving soil test based application of fertilizers is critical to efficient utilization (Compendium on Soil Health, 2012).

Soil pollution is caused by the addition of minerals to soils by man, from the use of agriculture chemicals such as fertilizers, herbicides, fungicides and insecticides, from the dustfall and contaminated water. Industrial pollution increases the toxicity levels of the soil. The soluble salt given out as pollutants damages the cultivated farms.

Soil pollution due to sewage is also very high. Several diseases are inflicted in human beings due to pathogenic forms present in the soil. It is the need of hour that we have to study the physico-chemical parameters of soil to know its quality. 15 representative soil samples were collected from the depth of 0-20 cm from the surface of soil from different parts of the city.

Soil Analysis

The pH range of soils of Aurangabad varied from 7.4 to 8.4 with mean value 7.89. This implies 95 per cent soils are moderately alkaline while 2.08 per cent soils are slightly alkaline. The electric conductivity of soils ranged from 0.2 to 1.70 dS/m with mean value of 0.74 dS/m in Aurangabad. There are 87.5 per cent soils with EC in range of 0.01 to 1.00dS/m which is considered as good.

The organic matter improves soil health by retention of mineral nutrients, improving soil structure and water holding capacity, water infiltration, aeration, drainage and root penetration (Havlin et al, 2010). It also helps to maintain large soil flora and fauna (Jain, 2009). The organic matter is obtained by estimation of organic carbon of soil. The organic carbon content of soils of Aurangabad ranged from 0.15 to 0.90 per cent with mean value of 0.39 %. Almost 50% of the soils have low organic carbon (> than 0.40%). The nitrogen forms cycle through various chains of reactions. Some free and few symbiotic bacteria fix atmospheric nitrogen in the available form of ammonium or nitrate ion, conversion of nitrogen containing compounds into humic acids, ammonification, nitrification, denitrification and nitrogen (Orlov, 1992). The available nitrogen varied from 74.32 to 271.36 kg/ha with mean of 158.39 kg/ha *i.e.* low nitrogen content. The soils with very low available nitrogen comprise 38.33 % and low available nitrogen comprises a whopping 61.67 %. Chalwade et al. (2006) also reported that soil samples from Marathwada are found low in available nitrogen. The phosphorus is important constituent in energy transfer and storage in plant, oils and amino acids (Tandon, 1997). The fixation of phosphorus in soils having alkaline soils is major cause of lower availability of phosphorus. Aurangabad soils are deficit in phosphorus in range of 6 to 22 kg/ha with a mean value of 9.10 kg/ha. The major portion of district *i.e.* 52.08% is very low in available

phosphorus having less than 7 kg/ha whereas 38.75% soils have low phosphorous which ranged from 8 to 13 kg/ha. The soils were found to be very rich in potassium in range of 336 to 448 kg/ha with a mean value of 443.60 kg/ha (Ajgaonkar & Patil, 2017).

The evaluation of soil health status revealed that the soil of Aurangabad district is moderately alkaline in nature with pH range 7.4 to 8.4. The soil is good, with EC ranging from 0.2 to 1.70 dS/m with mean of 0.74 dS/m.

The organic carbon content ranges from 0.15 to 0.90 per cent with mean value of 0.39 per cent. The half of the soil is having low organic carbon less than 0.40 per cent. The available nitrogen of soils is low with mean of 158.39 kg/ha. They are deficit in phosphorus in range of 6 to 22 kg/ha with a mean value of 9.10 kg/ha. The 52.08 per cent part is very low in available phosphorus whereas 38.75 per cent soils have low available phosphorus content. The soils are very rich in potassium with a mean value of 443.60 kg/ha.

To overcome the adverse effect of current cultivation practices, sustainable agricultural practices should be adopted. There is dire need of improvement in soil organic carbon and use of organic manures with intercropping, mixed cropping and adopting integrated nutrient management programme is need of hour.

CHAPTER 10: INDUSTRY

a. Aurangabad Industrial area:

MIDC, had foreseen the industrial potential of Aurangabad as early as 1963 and made a modest beginning by developing a small area (34 Ha.) near the Aurangabad railway station. The area today is well developed and has quite a few industries. Industrial units in this area are Nirlep Industries, Precision Engineers, Mahavir Paper Products, Ajantha Tiles and Marathwada Spun Pipe industries.

b. Chikalthana Industrial area:

After the success of Aurangabad Industrial Area, MIDC established Chikalthana as the industrial base in the vicinity of Aurangabad with a planned area of 724 Ha. The Chikalthana Industrial area established in 1965 and developed by MIDC has a total area of 719.68 hectares. Today this estate has renowned companies including Wockhardt, Maharashtra Distilleries Ltd., Lupin, Indo German Tool room, Greaves, Cosmo films, Hindustan Lever Ltd., HMT, Dagerfost and NRB.

c. Waluj Industrial area:

This industrial area developed after Aurangabad and Chikalhana is located 10 kms from Aurangabad with a planned area of 1,563 ha was established in 1982. The industrial area has already attracted many leading corporate houses of Indian industry and still continues to be favored location of entrepreneurs. The Industrial area has got a residential and commercial zone within the industrial area and hotels are already functioning in the commercial zone of the area. The area has got a water supply scheme with a capacity of 72,000 cubic meters a day and has a 132 KVA substation. The major industrial units at Waluj are Bajaj Auto, Colgate-Palmolive, Ceat tyres, Wipro, Kenstar, Garware, Wockhardt, Foster, Sterlite Industries Ltd., Franke and Johnson & Johnson.

d. Shendra Industrial area :

Shendra is the third industrial estate near Aurangabad having an area of 927 hectares. It is located on the Aurangabad-Jalna-Nagpur state highway. It is 8 km away from the Aurangabad airport and 19 kms from the Aurangabad Railway Station. Skoda has established its unit at Shendra. The area is at a developing stage.

e. Industrial Unit at Chitegaon:

Videocon has established a big industrial unit at Chitegaon along Paithan road. This has direct impact on Aurangabad City. The region is prospering largely because of the rapid growth in the automobile and pharmaceutical sectors. Important corporate players in Aurangabad are Bajaj Auto Limited. Garware, Varroc Engineering, Endurance Systems, Skoda Auto, Wockhardt, Shreya Life Science, Orchid, Lupin, Videocon, Nirlep, Siemens, Colgate Palmolive and Endress+ Hauser and Good year.

Special Economic zones:

Govt. of Maharashtra has declared to establish a Special Economic Zone at Aurangabad. This will lead to increase in employment opportunities in Aurangabad. Apart from SEZ from MIDC two more SEZ's are approved in the region.

There are four industrial clusters in the city (Table 12) namely MIDC (Maharashtra Industrial Development Corporation) Railway Station, MIDC Chikalthana, MIDC Waluj and MID Shendra (Kaushik et al, 2016). However, some scattered industrial development along the periphery of Aurangabad city

along Beed Road and Paithan road is also taking place. Renowned companies such as Wockhardt Ltd., United Spirits Ltd., Bajaj Auto Ltd., Orchid Chemicals & Pharmaceuticals Ltd., Skoda Ltd., Johnson & Johnson Ltd., Colgate Palmolive Ltd., Garware Polyesters Ltd., Sterlite Technologies Ltd., etc are in operation in Aurangabad (MPCB, 2013-14).

Table 12. Details of Industrial Cluster

S.No.	Name of Cluster	Distance from Aurangabad	Area in Hectares	Remarks
1.	Shendra MIDC	15 km	600	New developing area SEZ units
2.	Railway Station MIDC	Within AMC	20	Very small area with many sick Units
3.	Chikalhana MIDC	Within AMC	400	Old industrial area with mostly sick units
4.	Waluj MIDC	12 Km	1520	Major Ind. Area near city

Source : MPCB, 2013-14

The major air polluting industries (table 13) in Aurangabad are Bulk drug units, distilleries, breweries and electro plating industries.

Table 13. Highly Polluting industries

SNo.	Type of Industries	Shendra	Rly station	Chikalthana	Waluj	Total
1.	Basic Drug & Pharma Mfg	2		3	8	13
2.	Distilleries	1		1		2
3.	Thermal Power	1				1
	Total	4		4	8	16

Source: MPCB, 2013-14

In terms of air polluting industries there are 09 major source emission air polluting industries in Chikalthana MIDC, 07 in Shendra MIDC. There are 67 units of major source emission air polluting industries in MIDC Waluj. Most of the air pollutants, carcinogens are emitted due to improper facilities for solvent recovery and excess usage of solvent. All the chemical & Bulk Drug units have increased their efficiency of solvent recovery from 91% to 95% during the course

of implementation of Action Plan. M/s. United Spirit Ltd., MIDC Chikalhana, Abad has installed new Bio-digester and using their bio-gas for boiler as fuel. M/s. Radico NV Distillery, MIDC Shendra has installed evaporator for treatment of spent wash, thereby quantity of spent wash for further treatment by composting is reduced and the problem of water & air pollution is reduced.

As per compliance report of CEPI Action plan Aurangabad (status as on 22 Jan, 2015) within 3 months the industries in MIDC area Waluj and Chikalhana were required to upgrade the existing air pollution control systems. It was required to provide coal fired/briquette fired/bagaase fired burning equipments with wet scrubbers/ venture scrubber/bag filters which the individual industries complied within the deadline. Further 50 electroplating industries provided process emission control system. As per MPCB's directions to improve the efficiency of air pollution control systems 1 industry set up ESP and 1 provided wet scrubber. Board has also increased its vigilance. (Source: <http://mpcb.gov.in/CEPI/pdf/AurangabadCEPIpresentation.pdf>)

However, within a 2 year period the major air polluting industries were required to install continuous stack monitoring facilities which is still in progress. M/s. Harman industries and M/s. United sprits are installing continuous Stack monitoring facility. Industries were also instructed within 2 years to change the fuel pattern to clean fuel which has been initiated by most industries by altering

the use from coal/furnace oil to biomass, while few industries have made switch to biogas and LPG as fuel. As Aurangabad is a prominent industrial cluster its development is closely related to that of industry therefore, the industry must take adequate steps for control of air pollution as mandated by the MPCB.

Recently a project entitled “OXYGEN RICH MIDC” has been undertaken by industries in MIDC Chikalthana under which tree plantation has been done along side 12km stretch of road and it is expected to increase it to 70 km.

CHAPTER 11: TRANSPORT

Mobility plays an important role for faster development of an area. The inter-urban as well as intra-urban travel infrastructure needs to be carefully developed. This aspect is highly significant in planning and development of new cities. It provides accessibility to the spatially dispersed activities enables mobility of people and goods and integrates the different sectorial sub-systems. It is best to have an integrated transport plan for an area with regional linkages and hierarchical network for good intra-urban travel.

Road Connectivity

Aurangabad is well connected by road to various major cities of Maharashtra and other States. Road connectivity is excellent and roads connecting to Pune, Nagpur, Hyderabad, Beed, Mumbai, Jalna. Roads connecting to Hyderabad and Jalgaon are upgraded in to four-lane-highways. A new by pass for National Highway NH-211 is proposed towards south side of city. In addition to this, several major district roads like Paithan Road, Beed By pass etc. and village roads already exist.

Rail Connectivity

Aurangabad station is located on the Kachiguda-Manmad section of Nanded division of South-Central Railway (SCR). Aurangabad now comes under the

newly created Nanded (NED) Division of SCR. The Manmad-Kachiguda Broad gauge Railway line which emanates from the Mumbai- Bhusawal-Howrah trunk route at Manmad is an important artery of traffic in Aurangabad district. The importance of this line lies in the fact that it has opened for traffic the fertile agricultural tract in Marathwada region. It also serves as a link between Mumbai and Secundrabad in Andhra Pradesh. Aurangabad has more number of trains to Hyderabad than to any other city (AMC Report, 2016). Aurangabad has rail connectivity with Manmad, Aurangabad, Nandad, Nagpur, Parbhani, Parli-Vajinath, Latur, Osmanabad, Gangakhed, Mukhed, Adilabad, Nagpur, Basar, Nizamabad, Nasik, Mumbai, Pune, Daund, Mahebnagar, Kurnool, Kadapa, Renigunta, Tirupati, Katpadi, Erode, Madhurai and Kachiguda (KCG). Presently, three railway stations exist in the Aurangabad Municipal Corporation area. The major one is Aurangabad Railway Station. The other two are Mukundwadi Railway Station and Chikhalthana Railway Station.

Air Connectivity

Aurangabad City has domestic Airport. Aurangabad Airport has connecting flights to Delhi, Udaipur, Mumbai, Jaipur as well as Hyderabad. The airport is located in Aurangabad Municipal Corporation Area in Chikhalthana.

Roads

1. Aurangabad has a very good network of roads, connecting various parts of the region with National Highways, State highways and Major District Roads.
2. Dhule-Solapur is the only one National Highway No.211 which passes through the Aurangabad city. It enters the town on western side and after passing through the Aurangabad Municipal Corporation area it passes from eastern boundary towards Beed.
3. The Aurangabad –Jalgaon State Highway enters the Northern side at village Sawangi & Harsul and passes through the city area.
4. Aurangabad–Jalna Bypass road having existing width 30 m passes through Aurangabad Corporation area.
5. Aurangabad-Ahemadnagar-Pune State Highway passes through South-western side of Waluj Industrial Area and Waluj Mahanager are located on this state Highway.
6. Aurangabad-Paithan Road State Highway passes through Aurangabad Corporation area through Nakshtrawadi area on southern side (AMC Report, 2016).

7. Aurangabad–Nasik State Highway passes through the city area and passes on western side.

8. A new Bypass road has been constructed by PWD.

General Conditions of Roads

All State Highways are asphalted. All these roads are provided with central street lights and divider are put up and width of two traffic lane is developed on these roads except Aurangabad-Jalgaon state highway, Paithan road and Nasik road.

Major District Roads

Nagar–Aurangabad-Jalna Road divides the city in two parts Northern and Southern. Due to heavy burden of traffic on this road, the demand of alternative roads was under consideration from long period. The Government has proposed a by-pass road (Beed Bypass) in Southern side of Aurangabad and implemented it.

On Northern Side, Public Works Department has proposed a new Ring Road of 60 meter width passing through partly Chikhalthana & fringe area and also 60 meter wide road is proposed through Mitmita, Bhavsingpura area to join Pune road and Nasik road (AMC Report, 2016).

Local Roads

Existing conditions of local roads is not up to the mark. In March, 2017 various proposals have been approved. Wankatesh Nagar tar roads will be resurfaced at a cost of Rs 32.36 lakhs. Similarly, proposals of roads in Asefiya Colony, Builders Housing Society, Kiradpura, Chikhalthana and Raj Nagar among other localities were also approved. A concrete road will be constructed in Rohidaspora at a cost of Rs 25-35 lakhs (<http://smartcity.eletsonline.com/developmental-projects-worth-rs-93-crore-sanctioned-for-aurangabad/>).

Within 3 years the local body had begin work on road widening, AMC has started the work of widening of the roads and square for avoiding vehicle congestion. Over 41 km of roads have been re-laid and three flyovers have also been constructed to ease traffic congestion (AMC, 2015; TOI, 2016).

The mass transport system for Aurangabad includes Bus System & Intermediate Public Transport (sharing Autos, Auto rickshaws). Two wheelers clearly (table 14) comprise a major proportion of Aurangabad city vehicle population. During the period between 2015 and 2016 vehicles have shown a growth rate of 8% from 1020021 to 1102444.

Table14. Vehicle Population

S.No.	Category	Number
1.	Motorcycles	735794
2.	Scooters	84168
3.	Mopeds	46939
4.	Total 2 wheelers	866901
5.	Motor cars	55123
6.	Jeeps	29314
7.	Station Wagons	452
8.	Taxi metre fitted	21
9.	Taxi tourist cabs	2596
10.	Autorickshaws	26529
11.	Stage Carriages	5614
12.	Contract Carriages	1375
13.	School Buses	1008
14.	Pvt.Service.Veh.	1989
15.	Ambulances	490
16.	Trucks & Lorries	13119
17.	Tankers	4712
18.	Del. Van(4 Wh.)	24888
19.	Del. Van(3 wh.)	29960
20.	Tractors	23285

21.	Trailers	14689
22.	Others.	379
	Total Number of Vehicles	1102444

Source: Transport Maharashtra, 2016

Public Transport

The public transport comprises passenger transportation services. In 2006 civic body initiated city bus service with a private contractor, APMS which introduced 70 buses. However, due to issues the service shut down in 2010. Subsequently the Maharashtra State Road Transport Corporation (MSRTC) took up the responsibility of public transport.

- Civic body started city bus service in 2006 in association with a private contractor, Akola Pravasi Va Malwahtuk Sanstha (APMS).
- **Fleet of over 70 buses introduced in 2006.**
- After successfully running for 1 year, service started facing issues and was shut down in 2010.
- **AMT defaulted on bank loan of over Rs 3crore post 2010. The buses were seized and sold to recover the dues.**
- Presently **29 city buses ply on 11 routes** and are incurring losses running into crores.

Fig. 7. Aurangabad City buses (Source: TOI, 2016)

The MSRTC started the service with 29 buses on 11 routes but that fared poorly due to a variety of reasons. In the absence of proper public transport facilities in the city, thousands of school and college students, traders, office-goers and

commoners have to rely on the 26,000-odd autorickshaws or private vehicles plying in the city.

This has drastically increased the number of vehicles on city roads and ultimately put a burden on the infrastructure. The city buses face great inconvenience in plying in about 40% of the old city area due to traffic congestion. Moreover, the aggressive and unruly behaviour of autorickshaw drivers has also contributed in terminating the services in many areas. MSRTC officials have maintained that since the inception of the city bus service, the MSRTC has incurred a loss of around Rs 4 crore in the past three years.

(<http://timesofindia.indiatimes.com/city/aurangabad/AMC-still-reluctant-to-restart-public-transport-service/articleshow/46965382.cms>).

As per the city population the requirement of buses is 560 in number, but Aurangabad has less than 30 running. While buses are running on 12 to 13 routes winding through prominent areas in the city, residents of Satara, Devlai, Naregaon, Mukundwadi, Mitmita, Padegaon and many other places having sizeable population have to rely on auto rickshaws or their own vehicles. Over 150 different bus routes have been left unattended. Under the union government's Smart City mission, the Aurangabad Municipal

Corporation has been eyeing on the creating a Bus Rapid Transit System (BRTS) on a select stretch besides planning to operate a public transport system under built operate and transfer (BOT) model.

Recently, the standing committee chairman had asked the municipal administration to prepare a fresh proposal of launching a public transport facility under BOT model. The committee had also asked the administration to study similar projects launched by local bodies in Mumbai, Nagpur and Pune.

In Jan 2018 during a city level workshop on air pollution awareness and sensitization organized by AMC, MPCB and CMIA the Commissioner informed that air quality is being tackled on a war footing basis. He said soon dust cleaners will be engaged to clean major roads. Further AMC will start 5 electric buses in the city on a pilot basis which will be increased to 150.

Intermediate Public Transport

Recently with the withdrawal of the restriction on the number of permits for autorickshaws and taxis i.e. kaali peelis public is all set to benefit. Despite Aurangabad having 26,000 registered auto-rickshaws, the parking stands are limited to only around 150 across city limits which need to be increased to 500. This initiative would lead to minimizing the use of private vehicles within the

city (<http://timesofindia.indiatimes.com/city/aurangabad/no-cap-on-permits-for-autos-kaali-peelis-state-govt/articleshow/59241082.cms>).

E-Rickshaw

E-rickshaws have been successfully experimented in Delhi, Kolkata and Nagpur. These auto-rickshaws are available at reasonable rates and work on electrical battery. In this regard very recently in Oct 2017 Mayor of AMC inaugurated city's first e-rickshaw along with e-rickshaw charging and training centre. 50 e-rickshaws have also been booked. It is expected that these would provide a cheap means of transport to Aurangabad residents at very nominal rates in addition to reducing air pollution.

Terminal Facilities

Truck Terminal Facility in the form of truck terminus for heavy vehicles is not in existence. Trucks are being parked along Highways and Major Road near Hotels, Dhaba's etc. Considering the large Industrial Area and Traffic of heavy vehicles it is very necessary to have a well developed truck terminus of larger area on the National Highway and State Highway so as to ease the traffic problems.

Clean Fuel

With rapidly growing vehicle numbers, smart city tag and the removal of limits on permits for autos and taxis Aurangabad is set for high vehicular growth. However, despite huge demand for Compressed Natural Gas (CNG) from different quarters, the city still does not have supply of the green fuel. On the contrary, relatively smaller cities from Marathwada like Osmanabad and Latur have been already considered for licence bid by PNGRB Petroleum and Natural Gas Regulatory Board (PNGRB). Considered as an eco-friendly fuel as it reduces vehicular exhaust emissions, the CNG has been considered as viable alternative to traditional fuels such as diesel and petrol due to its cost-effectiveness. The Regional Transport Office (RTO) does not register CNG-run vehicles as there is no facility for supply of such fuel (<http://timesofindia.indiatimes.com/city/aurangabad/citys-wait-for-cng-continues/articleshow/58900777.cms>). It has been proposed that any petrol pump having space over 6,000 square feet available may be allowed to supply CNG after the necessary network of pipeline has been laid.

Biofuels

Biofuels provide a low cost, readily available alternative to conventional fossil fuels. The use of Bio-ethanol and Bio-diesel in vehicles also lowers harmful

particulate matter emissions. The fuel can be used in cars, buses and commercial vehicles, industrial vehicles, tractors, power generators that use regular diesel. Through various retail outlets within six months, Aurangabad city has consumed impressive one lakh litres of biodiesel a month blended with diesel (<https://timesofindia.indiatimes.com/city/aurangabad/bio-fuel-to-lead-the-way-in-clean-energy-in-india/articleshow/61800534.cms>).

CHAPTER 12: WASTE MANAGEMENT

Central Government enacted Municipal Solid Waste (Management and Handling) (MSW) Rules, 2000 and prescribed a time limit as well as method to dispose Municipal Solid Waste. The Central Government later on revamped the MSW Rules 2000 and notified Solid Waste Management (SWM) Rules, 2016. Time limits are prescribed and directives have been given to all urban local bodies for disposal of solid waste in dry and wet condition.

AMC estimates that per capita solid waste generation in the area is over 450 grams per person per day. In 1996, AMC introduced —Ghanta Gadi for door to door collection of waste.

Quantity of Solid Waste: About 450 tons per day of waste is generated in the city

Source and type of Solid Waste: The main source of municipal solid waste in the city are the residential areas (about 2.5 to 3 lakhs housing units), commercial areas, vegetable markets, guesthouses, restaurants, hospitals and health centre and Mangal Karyalayas (marriage halls). Besides these, street sweepings drain cleanings and construction debris also forms a significant component. Out of the 393 tones 363 tons is collected daily which gives a collection efficiency of 92%.

Out of 393 tons of waste nearly 40% is biodegradable (wet waste). The break-up of the waste generated from different source is given below in table 15:

Table 15: Physical characteristics of solid waste of Aurangabad City

Sr. No.	Constituents	Percentage of waste
1	Organic Waste (Food Waste, Landscape & Trimming)	51 %
2	Recyclable Waste (Paper, Card Board, Plastic, Glass & Metal)	17.5 %
3	Inert Waste (Stones & Slit, Bones & other inorganic Material)	31.5 %
	Total	100 %

Existing Solid Waste Management System:

AMC is responsible for the collection and management of the municipal solid waste in Aurangabad. The city is divided into 122 wards for waste collection and management. 145 vehicles collecting waste from different parts of city through door to door collection by bell ringing. Both AMC and private agency undertake waste collection.

Table 16: Waste Management Statistics

Service Level Indicator for Solid Waste in Aurangabad Town	
Particulars	Values
Quantity of waste generated per day	450-500 tons (Approx)
Waste collected per day	450 tons
Collection efficiency	90%
Length of roads	1400 km
Length swept daily	85-90 %
House to House collection	90%
Vehicles	145
Segregation at source	Nil
Landfill sites	At dumping site Naregaon
Area of landfill and location	20 acres, 10 km from the city

Transportation of solid waste:

The waste is collected by Ghanta Gadis at collection points and the community bins is collected in tractors and dumpers. Further it is transferred to the Municipal Solid Waste (MSW) dumping site at Naregaon (table 16).

Processing & Disposal of MSW

Close to 450 MT of waste is generated there are 3 dry waste sorting centres (capacity 20T). And currently 18 composting (pit and windrow) sites from which 134 MT of compost has been produced and provided to farmers in past 2 years.

The Central Naka dry waste sorting centre has recycled 1000MT of waste (AMC, 2018).

In 2016 AMC introduced windrow composting facilities in 12 civic wards for effective processing of the waste. Experts said the system can efficiently handle large quantities of waste in comparison to vermicomposting and also help sanitary workers manage the problem of flies and odour while handling municipal solid waste. The 12 wards generate a total of 100 tonnes of waste. About 60% of this, or 60 tonnes, of waste is expected to be processed at the windrow composting centres (<https://timesofindia.indiatimes.com/city/aurangabad/Civic-body-to-start-windrow-composting-in-12-wards/articleshow/51033519.cms>).

The need for Aurangabad city is a community based solid waste management system involving recycling and windrow composting in conjunction with sanitary land filling with possible provision for transfer station to account for long distance of landfill sites, the possible way out of the current inefficient system. Increase the use of GIS and Remote sensing data to analyze solid waste and preparation of thematic maps. Environmental awareness programme must be implemented among the masses regarding waste segregation at source.

WASTE BURNING, CONSTRUCTION & DEMOLITION WASTE

Biomass burning on open land and garbage burning in open areas is another key issue which contributes towards poor air quality in Aurangabad. As per compliance report of CEPI Action plan Aurangabad (status as on 22 Jan, 2015) within a year AMC was instructed to act and penalize the defaulters but it has not been complied so far.

However, most of the major construction projects have started demolishing and undertaking new construction activities in a closed manner by providing dust arresting facility at the boundary. But AMC has not been able to submit any communication regarding the compliance of the same.

SMART CITY INITIATIVES

Aurangabad has also been selected as one of the 100 cities which the Government of India wishes to develop as Smart City. With the short listing of Aurangabad for the Smart Cities project, the AMC initiated ambitious three day cleanliness drive termed “Smart city-I am also ready”. This drive was aggressively promoted by the cleaning of different areas by involving citizens, politicians and civic authorities (Chinchkhede, 2015). The AMC also proposed a revised Smart City plan worth Rs.1,730 crores to the Central Government in June 2016. In the plan, the top priority has been accorded to the Smart Urban characteristics proposed in the development plan areas follows:

- Planned and organized public places
- Public-squares, assembly-plazas, neighborhood central plaza, etc. interspersed with built up forms
- Innovative, ‘smart’, intermittent recreational areas with Wi-Fi zones, safety and security surveillance, real-time-display-boards, etc.
- Open spaces, gardens and landscaping
- Proposed Built form to open space ratio: 30:70; green space centric development
- 70 acres of open land for the hospitality and tourism hub

- Approximately 4 lakh plantations along the utility corridor, intersections etc.
- Central parks, gardens, playgrounds etc. integrated in all clusters
- Mixed-use development
- Planned, efficient integration of retail, office, residential, hotel, recreation and other functions following the principles of ‘green urbanism’
- Street malls, dedicated hawker zones, convenient shopping proposed within residential neighborhoods, etc.
- Easy pedestrian movement and non- motorized zones
- Pedestrian-oriented development based on ‘filtered permeability’
- 15-km network of pedestrian sidewalks and 31 km cycle tracks on both sides of the carriage way, each track measuring 3 m; automatic boom barriers
- Designed ‘promenade’
- Dedicated service corridor
- Utility corridor (3 m) and storm water section (3 m) on both sides of the roads
- Organic grid iron pattern of roads with decentralized parking approach
- Green buildings (90% of all buildings)
- Differently-abled design features

- Barrier-free design, including ramps for all approaches, specific pavement design for the visually-impaired, indicators for level changes, etc.
- Signage and street amenities
- Smart displays and interactive signage
- Smart street amenities: light poles with sensors, garbage bins with RFID tags, etc.
- Urban design norms
- Well-designed urban design norms for built forms, common area, elevation features, etc.

From the plan, it is evident that at this stage, various initiatives and measures have been planned under the Smart City project (Sustainable urban transport, walkability, cycling). Full implementation of these initiatives will be vital towards achieving better air quality as well as better standard of living in the city.

CONCLUSION

The Preparation of Environmental Status Reports (ESRs) is mandated in the 74th constitutional Amendment Act and the 12th Schedule. ESR attempts to identify current and emerging environmental concerns as well as opportunities at the city level. It does this through the identification of demographic, social and economic driving forces behind various issues that can pose risk to environment, 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). Aurangabad is the administrative headquarters of Marathwada region. City is a tourism hub, surrounded by many historical monuments including the Ajanta Caves and Ellora Caves. By population it is the 5th largest city in Maharashtra after Mumbai, Pune, Nagpur and Nashik. Aurangabad has a strategic position on the Deccan Plateau. The city is surrounded by hills of the Vindhya ranges and river Kham passes through it. The city also has a very well developed and organized Industrial area which surrounds the city on all sides. Waluj, Waluj 2, Chikhalthana, Bidkin and a new Five Star Industrial Area Shendra are located in Aurangabad. The geological formations of the city are characterized by the Deccan traps. Major part of the city has deep black soil derived from the trap rock. The weather is hot and dry with low rainfall and poor

forest cover therefore the winds during summer suspend the particulate matter and result in pollution. Even during winters low temperature coupled with low or no wind speeds prevent the dispersion of pollutants which is an alarming situation for a rapidly developing city.

The increasing industrialization in the Aurangabad region has led to growth of urban population. According to 2011 census total population recorded was 11,75,116. The majority of workers are engaged in tertiary activities, the total workers in these two sectors comprise a whopping 85.32%. Study of existing Land Use pattern of the city is therefore of vital importance to understand the issues and to determine the optimum and most beneficial distribution of land use in the interest of community.

The population projections by 2013 indicate that city will be 19.93 lakhs. The additional population to be accommodated is 9,69,797 souls. The gross area required to accommodate the future population at the rate of average density of 125 persons per hectare is 7758 ha. The total area available presently is 7320 ha which is sufficient to accommodate the projected population within the existing low-density wards.

Since Aurangabad has far less percentage of forest cover (8.83%) it is expected that the ETF battalion would be effective in bringing 100 acres of area near the proposed camp under afforestation in phases.

Lands in village (Nakshtrawadi, Kanchanwadi, Itkheda, Satara, Padegoan, Mitmita, Bhavsingpura) have been laid out in to plots, however, all the plots have not yet been fully built up, are in the process of development and necessary infrastructure facilities. Clearly construction activities would be a significant source of particulate matter in future so construction and demolition deserves attention by the municipalities. AMC must also focus on provision of roads in these newly developing areas to control pollution.

Though flora and fauna are highly diverse in nature the pressure on biodiversity is immense from various associated sources, principally land use change (more land being brought under cultivation, residential and industrial areas), pollution and the introduction of alien species. A balance has to be maintained between land brought under use and the impact on the local biodiversity. The municipal limits of Aurangabad have sites such as Himayat Bagh, Harsul Lake, University campus and Salim Ali Lake that are rich in biodiversity and in need of conservation. The local civic body must form the mandatory Biodiversity Management Committee (BMC) with a mandate to collect data on various aspects of local biodiversity for preparing a people's biodiversity register (PBR).

The desired panel is expected to consult with locals while preparing such PBR and validate it.

Based on air quality results conducted by the MPCB, for the past five years, annual PM10 concentrations have been above the National Ambient Air Quality Standards. Annual SO₂ and NO_x concentrations in the city have been within the National Ambient Air Quality Standards, though NO_x levels are rapidly growing.

Emission inventory and source apportionment research for Aurangabad must be completed at the earliest. More monitoring stations are needed for PM2.5, Ozone and CO estimation within the city in commercial, industrial and sensitive areas. Also, the city lacks display boards providing air quality information to public which may be taken up by Aurangabad industry forum. The city needs to urgently undertake research studies particularly relating to health, in order to have a better understanding of the impact of the air pollution experienced by the city residents.

Data clearly indicates that Kranti Chowk, Baba petro pump and CIDCO bus stand with high traffic density have high noise levels. Even Waluj industrial area has high levels of noise which are above the permissible levels. Commercial areas such as Gulmandi frequented by people are also exposed to high levels even above the standards. AMC 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. Surface water is the main resource for drinking and domestic purposes. However, its scarcity due to population growth and industrial development is forcing people to use groundwater for domestic uses in Aurangabad. From the obtained results we can conclude that groundwater is polluted and would impact human health. With Aurangabad prone to drought-like situation Aurangabad Municipal Corporation may utilize over 100 public wells cleaning the wells (desilting) and installing small water filtration plants along with overhead tanks near the wells. In addition in to help raise the falling table level it is important to install rainwater harvesting system in the housing societies.

The evaluation of soil health status revealed that the soil of Aurangabad district is moderately alkaline in nature with pH range 7.4 to 8.4. The soil is good, with EC ranging from 0.2 to 1.70 dS/m with mean of 0.74 dS/m. The organic carbon content ranges from 0.15 to 0.90 per cent with mean value of 0.39 per cent. The half of the soil is having low organic carbon less than 0.40 per cent. The available nitrogen of soils is low with mean of 158.39 kg/ha. They are deficit in phosphorus in range of 6 to 22 kg/ha with a mean value of 9.10 kg/ha. The 52.08 per cent part is very low in available phosphorus whereas 38.75 per cent soils

have low available phosphorus content. The soils are very rich in potassium with a mean value of 443.60 kg/ha.

To overcome the adverse effect of current cultivation practices, sustainable agricultural practices should be adopted. There is dire need of improvement in soil organic carbon and use of organic manures with intercropping, mixed cropping and adopting integrated nutrient management programme is need of hour.

There are four industrial clusters in the city namely MIDC (Maharashtra Industrial Development Corporation) Railway Station, MIDC Chikalthana, MIDC Waluj and MID Shendra. In terms of air polluting industries there are 09 major source emission air polluting industries in Chikalthana MIDC, 07 in Shendra MIDC. There are 67 units of major source emission air polluting industries in MIDC Waluj. As Aurangabad is a prominent industrial cluster its development is closely related to that of industry therefore, the industry must take adequate steps for control of air pollution as mandated by the MPCB. Existing conditions of local roads is not up to the mark. In March, 2017 various proposals have been approved for widening, resurfacing and construction of roads as well as flyovers. Over 41 km of roads have been re-laid and three flyovers have also been constructed to ease traffic congestion. During the period between 2015 and 2016 vehicles have shown a growth rate of 8% from 1020021 in 2015 to 1102444

in 2016. Two wheelers clearly comprise a major proportion of Aurangabad city vehicle population (78%).

The number of cars is 55123 and that of autorickshaws is 26529. As per the city population the requirement of buses is 560 in number, but Aurangabad has less than 30 running. While buses are running on 12 to 13 routes winding through prominent areas in the city, residents of Satara, Devlai, Naregaon, Mukundwadi, Mitmita, Padegaon and many other places having sizeable population have to rely on auto rickshaws or their own vehicles. Over 150 different bus routes have been left unattended. Soon AMC will start 5 electric buses in the city on a pilot basis which will be increased to 150. Also dust cleaners will be engaged to clean major roads. Recently with the withdrawal of the restriction on the number of permits for autorickshaws and taxis i.e. kaali peelis public is all set to benefit. Despite Aurangabad having 26,000 registered auto-rickshaws, the parking stands are limited to only around 150 across city limits which need to be increased to 500. This initiative would lead to minimizing the use of private vehicles within the city.

in Oct 2017 Mayor of AMC inaugurated city's first e-rickshaw along with e-rickshaw charging and training centre. 50 e-rickshaws have also been booked. It is expected that these would provide a cheap means of transport to Aurangabad residents at very nominal rates in addition to reducing air pollution.

It has been proposed that any petrol pump having space over 6,000 square feet available may be allowed to supply CNG after the necessary network of pipeline has been laid. Through various retail outlets within six months, Aurangabad city has consumed impressive one lakh litres of biodiesel a month blended with diesel.

About 450 tons per day of waste is generated in the city, collection efficiency is 92%. Nearly 40% waste is biodegradable (wet waste). The city is divided into 122 wards for waste collection and management. Vehicles collect waste from different parts of city through door to door collection by bell ringing. The waste is collected by Ghanta Gadis at collection points and the community bins is collected in tractors and dumpers. Further that it is transferred to the dumping site at Naregaon.

In 2016 AMC introduced windrow composting facilities in 12 civic wards for effective processing of the waste. Experts said the system can efficiently handle large quantities of waste in comparison to vermicomposting and also help sanitary workers manage the problem of flies and odour while handling municipal solid waste. The need for Aurangabad city is a community based solid waste management system involving recycling and windrow composting in conjunction with sanitary land filling with possible provision for transfer station to account for long distance of landfill sites, the possible way out of the current

inefficient system. Increase the use of GIS and Remote sensing data to analyze solid waste and preparation of thematic maps. Environmental awareness programme must be implemented among the masses regarding waste segregation at source.

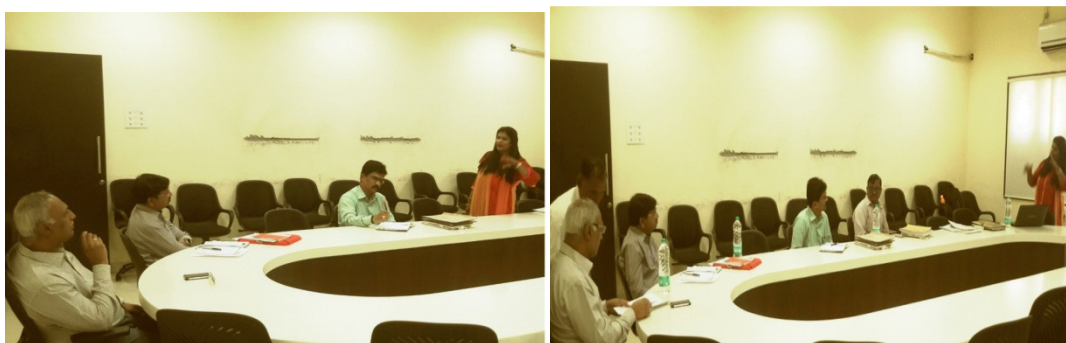
Biomass burning on open land and garbage burning in open areas is another key issue which contributes towards poor air quality in Aurangabad. As per compliance report of CEPI Action plan Aurangabad (status as on 22 Jan, 2015) within a year AMC was instructed to act and penalize the defaulters but it has not been complied so far. Most of the major construction projects have started demolishing and undertaking new construction activities in a closed manner by providing dust arresting facility at the boundary. But AMC has not been able to submit any communication regarding the compliance of the same.

Various initiatives and measures have been planned under the Smart City project (Sustainable urban transport, walkability, cycling). Full implementation of these initiatives will be vital towards achieving better air quality as well as better standard of living in the city.

ANNEXURE

Aurangabad's Clean Air Action Plan 2017

On 25th Oct, 2017 a presentation on City's clean air action plan was given to Aurangabad Municipal Corporation Commissioner Mr. D.M. Muglikar along with Dr. Vijay Patil (garden superintendent) including other city officials in Ambedkar Research Centre.



AMC Commissioner took keen interest in the presentation and commented that various initiatives are in place within the city and hoped that within a few years the city would be able to control its pollutant levels.



Presentation of Ist draft of ESR during meeting of City's Environment Committee members on 7th May, 2018.



Aurangabad Municipal Corporation Zoo

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No/AMC/ZOO/ /2017

Date-

Siddharth Garden Zoo

Aurangabad Municipal Corporation (M.S.)

INVENTORY FORM 2017-2018

SCH-1 & SCH-2 (WILD LIFE PROTECTION ACT.)F.NO.21-03/2001 SM

Sr. No.	Species	Stock as on 1/1/2018				Quarter ending Mar 2018												Stock as on 31/3/2018					
		M	F	U	T	Birth			Acquisition			Disposal			Death			M	F	U	T		
						M	F	T	M	F	T	M	F	T	M	F	T						
1	Black Buck (Antelope Cervicapra)	22	20	-	42	--	2	2	--	-	-	-	-	-	-	-	1	-	1	21	22	-	43
2	Common Palm Civet (Paradoxurus hermaphroditus)	01	02	--	03	--	--	--	--	--	--	--	--	--	--	--	-	-	-	01	02	--	03
3	Jackal (Canis aureus)	2	0	--	2	--	--	--	--	--	--	--	--	--	--	--	-	-	-	2	0	--	2
4	Leopard (Panthera Pardus)	1	2	--	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2	--	3
5	Macaque rhesus (Macaca mulatta)	3	2	--	5	--	--	--	--	2	2	-	--	-	-	-	-	-	-	3	4	--	7
6	The Common Langur (Presbytis entellus)	01	01	--	02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	01	01	--	02
7	Tiger (White) (Panthera tigris)	02	00	--	02	-	--	--	--	--	--	--	--	--	--	--	-	-	-	02	00	--	02
8																							
9	Wolf (Canis lupus)	--	01	--	01	--	--	--	--	--	--	--	--	--	--	--	1	1	--	--	00	--	00
10	Indian Porcupine (Hystrix indica)	01	01	--	02	--	--	--	--	--	--	--	--	--	--	--	-	-	-	01	01	--	02
	Total Mammals	33	29	--	62	--	2	2	--	2	2	-	--	--	--	1	1	2	32	32	--	64	
1	Crocodile (CrocodylusPalustris)	1	01	3	05	--	--	--	--	--	--	--	--	--	--	--	-	-	-	1	01	3	05
2	Star tortoise	--	--	43	43	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	43	43
	Total Reptiles	1	01	46	48	--	--	--	--	--	--	--	--	--	--	--	-	-	-	1	01	46	48
	Total Animals	34	30	46	110	--	2	2	--	2	2	-	--	--	--	1	1	2	34	30	46	110	

Inventory of animals in Aurangabad Zoo