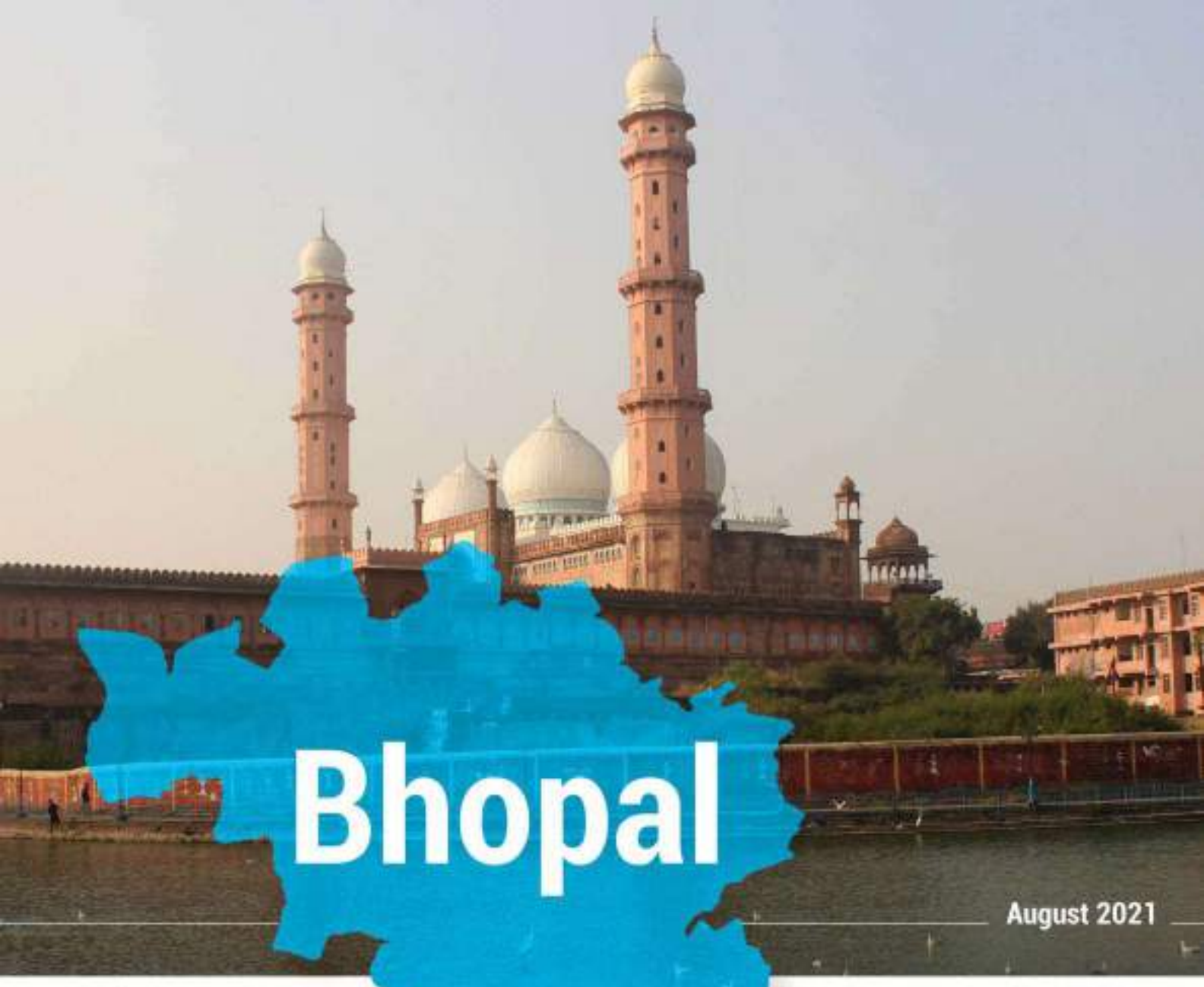

# Bhopal

August 2021

## CITY PROFILE AND DIAGNOSTIC REPORT

Sustainable Cities Integrated Approach Pilot (SCIAP)

UN-HABITAT
FOR A BETTER URBAN FUTURE

UNIDO

Bhopal Municipal Corporation

gef

**PREPARED FOR:**

Bhopal Municipal Corporation

**PREPARED BY:**

UN HABITAT
FOR A BETTER URBAN FUTURE

**PROJECT DONORS:**

UNIDO gef

**August 2021**



This report has been prepared under the Sustainable Cities Integrated Approach Pilot (SCIAP) project funded by the Global Environment Facility (GEF-6). It documents the findings from the application of the Urban Sustainability Assessment Framework (USAF), which was developed under SCIAP for five pilot cities – Bhopal, Guntur, Jaipur, Mysore and Vijayawada. The report is produced using data provided by the state and municipal authorities of the four participating states and additional geospatial data collected from the National Platform for Sustainable Cities, European Space Agency. 

**Cover Page:** Taj-ul-Masajid (Crown of Mosques) built by Nawab Shah Jahan Begum of Bhopal, is one of the largest mosque complexes in India.

# Bhopal

# CITY PROFILE AND DIAGNOSTIC REPORT

Sustainable Cities Integrated Approach Pilot (SCIAP)

Component 1: Sustainable Urban Planning And Management

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# Bhopal

## City Profile and Diagnostic Report

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# List of Acronyms

| | |
|---|---|
| AFOLU | Agriculture, Forestry and Other Land Use |
| BCLL | Bhopal City Link Limited |
| BMC | Bhopal Municipal Corporation |
| COVID-19 | Coronavirus Disease-2019 |
| CSR | Corporate Social Responsibility |
| GEF | Global Environment Facility |
| GIS | Geographical Information System |
| GPSC | Global Platform for Sustainable Cities |
| IPPU | Industrial Processes and Product Use |
| MoEFCC | Ministry of Environment, Forests and Climate Change |
| MoHUA | Ministry of Housing and Urban Affairs |
| MUDA | Mysuru Urban Development Authority |
| NGT | National Green Tribunal |
| NIUA | National Institute of Urban Affairs |
| NPC | National Productivity Council |
| PWD | Public Works Department |
| SBM | Swachh Bharat Mission |
| SAPCC | State Action Plan on Climate Change |
| SCIAP | Sustainable Cities – Integrated Approach Pilot |
| SCS | Sustainable City Strategies |
| TNCP | Town & Country Planning Department |
| ULB | Urban Local Body |
| UNDP | United Nations Development Programme |
| UNEP | United Nations Environment Programme |
| UN-HABITAT | United Nations Human Settlements Programme |
| UN-HABITAT ROAP | United Nations Human Settlements Programme Regional Office for Asia & the Pacific |
| UNICEF | United Nations Children's Fund |
| UNIDO | United Nations Industrial Development Organization |
| USAF | Urban Sustainability Assessment Framework |
| WHO | World Health Organization |

# 01

# Introduction

## 1.1 REPORT OBJECTIVES

The city profile and diagnostic report situates Bhopal in its regional context and provides a comprehensive outlook of the city's performance by applying the Urban Sustainability Assessment Framework (USAF)[1]. In addition, it builds on the desk review of existing plans, policy documents and development proposals by the state and local government to present a complete picture of each sector of the city. It also puts forth a cross-sectoral analysis to arrive at key issues and challenges that the city currently faces.

In this context, the main objectives of this report are:

- To build an understanding of the city's current performance across 12 sectors
- To assess intra-city spatial equity for each sector
- To employ an evidence-based approach to ascertain key cross-sectoral challenges and strategic opportunities
- To inform sectoral priorities, a strategic development plan and resource allocation for the sustainable and resilient development of the city

## 1.2 APPROACH AND METHODOLOGY

The evidence-based planning approach creates an all-encompassing, rich understanding of the spatial dynamics of an urban area. This is achieved by combining and comparing urban datasets such as demography, land use, natural features, accessibility analysis and service delivery parameters. The evidence (data) is collected as inputs for the USAF indicators, which are assessed against best practices, as well as global and national benchmarks for sustainable urban development. This brings to light the main developmental issues by sometimes quantifying them, and at other times by recording the availability of effective planning tools and instruments, presence of legal and institutional mechanisms and the financial soundness of the city. Such an approach can also help to assess future development projects by feeding their information as inputs to the indicators applied in the analysis.

The following elements are used in this evidence-based approach:

- Review of relevant existing plans, policies, and development proposals
- USAF performance by the city (indicator assessment)
- Spatial analyses of indicators to conduct granular, cross-sectoral analysis to investigate trends, causes and effects

The methodology adopted analyses the interplay of socio-economic, spatial and environmental factors, first at a city scale and then at a more granular, ward-level scale to understand the degrees of influence. This helps to decipher the interdependencies within the city's physical development pattern and seeks the reasons for such interdependence to improve the functioning of that city.

[1] The Urban Sustainability Assessment Framework wad developed by UN-Habitat India as a part of the SCIAP project. Further details are available in the Urban Sustainability Assessment Framework Report.

# 02

# Regional Context

## 2.1 GEOGRAPHY AND LOCATION

The Bhopal region stands along the Malwa Plateau, flanked by the Vindhyachal and Satpura mountain ranges. A large part of the city sits on jagged ground as a rolling landscape of hillocks shape the undulating terrain. The ridges are green, mostly protected under national/ state institutions or developed as high-income housing. Valleys are watersheds for storm water reservoirs, lakes, and streams. The city is nestled between an intricate lake system and a rolling typology that facilitates the collection of rainwater in the lakes.

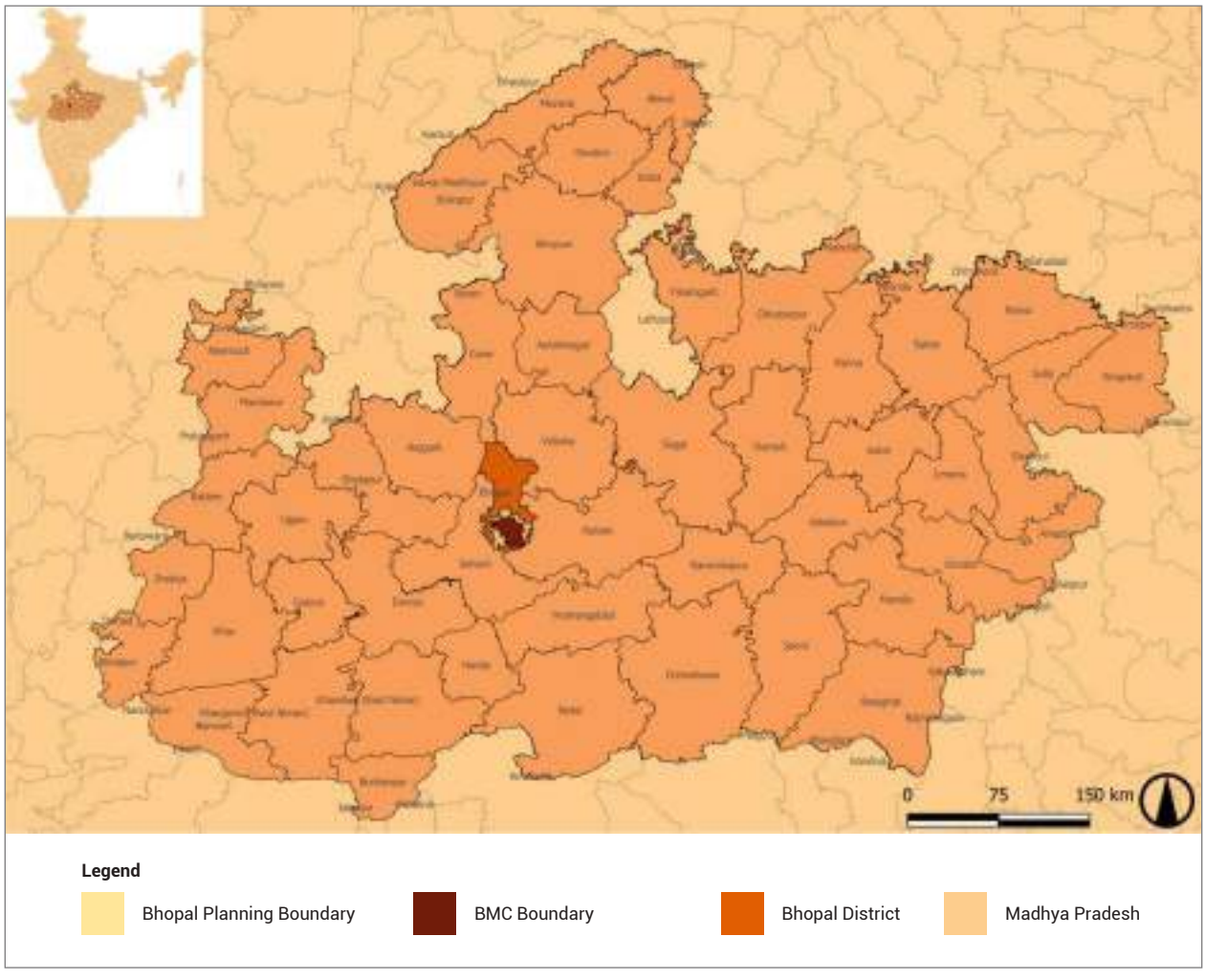
Image 2.1: Upper Lake and Bhopal city skyline with the under-construction Mahatma Gandhi Medical College on the north-eastern banks of the lake

Source: UN-Habitat

Bhopal (23.2599° N, 77.4126° E) is the capital of the state of Madhya Pradesh and is situated 790 km South of the national capital, New Delhi. Madhya Pradesh consists of 52 districts, which are grouped into 10 administrative divisions. Bhopal district sits at the centre of the state, with a population of 23.8 lakh as per Census 2011. The district has three tehsils (or sub-districts)—Berasia, Huzur, and Kolar—and is divided into two community development blocks (CD block)[1] —Berasia and Phanda. The administrative area of the Bhopal Municipal Corporation (BMC) comprises parts of Huzur and Kolar tehsils and falls within the Phanda CD block.

The 'Nawabs of Bhopal' ruled the city from 1707 to 1949 and constructed most of the city's heritage structures. The old city was earlier known as 'Shehr-e-Khaas' (unique city) and was accessed through 14 historic gates. Shahjahanabad and Jehangirabad, the extensions of Shehr-e-Khas developed by successive nawabs, form the core old city area, which is the densest part of Bhopal city at present.

The natural and panoramic setting of hills, lakes, and the abundance of rare flora and fauna in the region, lend a unique topographic character to Bhopal. Around 17 per cent of the city area is forested and has natural grasslands that play a vital role as carbon sinks. Ratapani Tiger Reserve (wildlife sanctuary), which shelters around 45 tigers[2], surround the eastern and southern parts of the city. Van Vihar National Park (4.45 sq. km.) along the southern banks of Upper Lake has been developed as a zoological garden, wildlife conservation centre and ecotourism destination.




Map 2.1: Location of Bhopal District and Bhopal City in Madhya Pradesh

Source: UN-Habitat

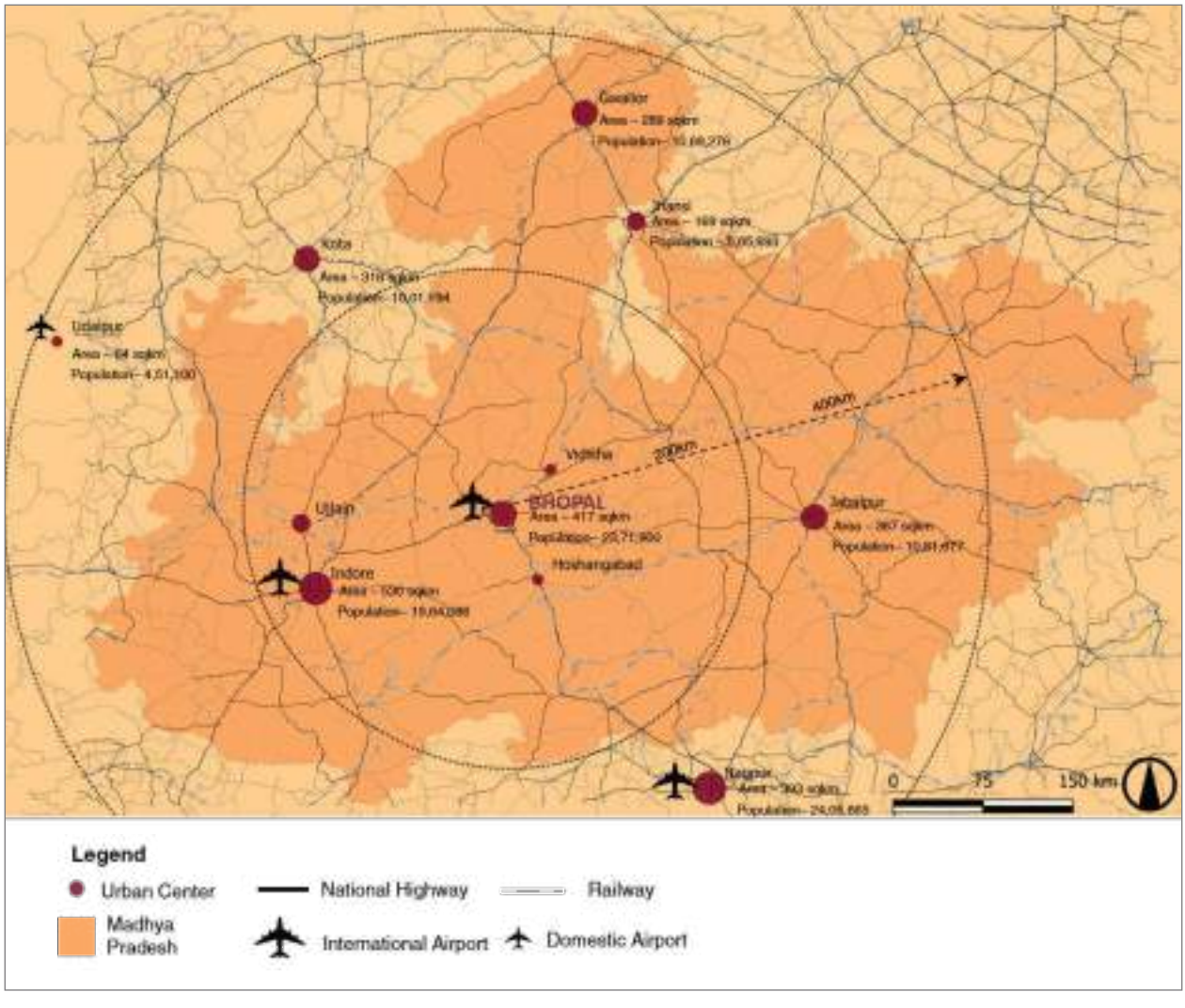
[1] CD blocks are rural areas that are administratively grouped and earmarked for planning and development.
[2] Status of Tigers, Copredators and Prey in India 2018, p. 81.

## 2.2 REGIONAL CONNECTIVITY

### Regional Road Connectivity

Bhopal is well connected to major cities across the country and the state through a network of national and state highways. National Highway 12 (NH 12) connects Bhopal with Jabalpur to the East and Jaipur to the West. NH 86 connects Bhopal with Sagar to the East and Dewas to the West. State Highway 17 (SH 17; the Sehore Bypass Road) connects Bhopal with Indore to the West. SH 23 connects Bhopal with Berasia to the North and further to Sanchi, a UNESCO World Heritage Site, through Vidisha Road.

The city's major bus terminals are the Interstate Bus Terminal (ISBT) near Chetak Bridge, Nadra Bus Stand, Jawahar Bus Stand, Halalpur, and Putlighar Bus Stand. Madhya Pradesh does not have a public regional bus service. In 2010, to augment the need for regional bus services and improve connectivity, the state allowed private operators to run a bus service under the Madhya Pradesh State Transport Policy, 2010. Currently, private operators provide regional bus transport services in the state.




Map 2.2: Regional connectivity of Bhopal

Source: UN-Habitat

## Regional Rail Connectivity

Bhopal is well connected through railways with major cities and towns in India. Bhopal is the second-largest division of the West Central Railway zone, after Jabalpur, in terms of route kilometres operated, employee strength and freight earnings. The city has six railway stations, of which Habibganj Station is one of the few privatized railway stations in the country.

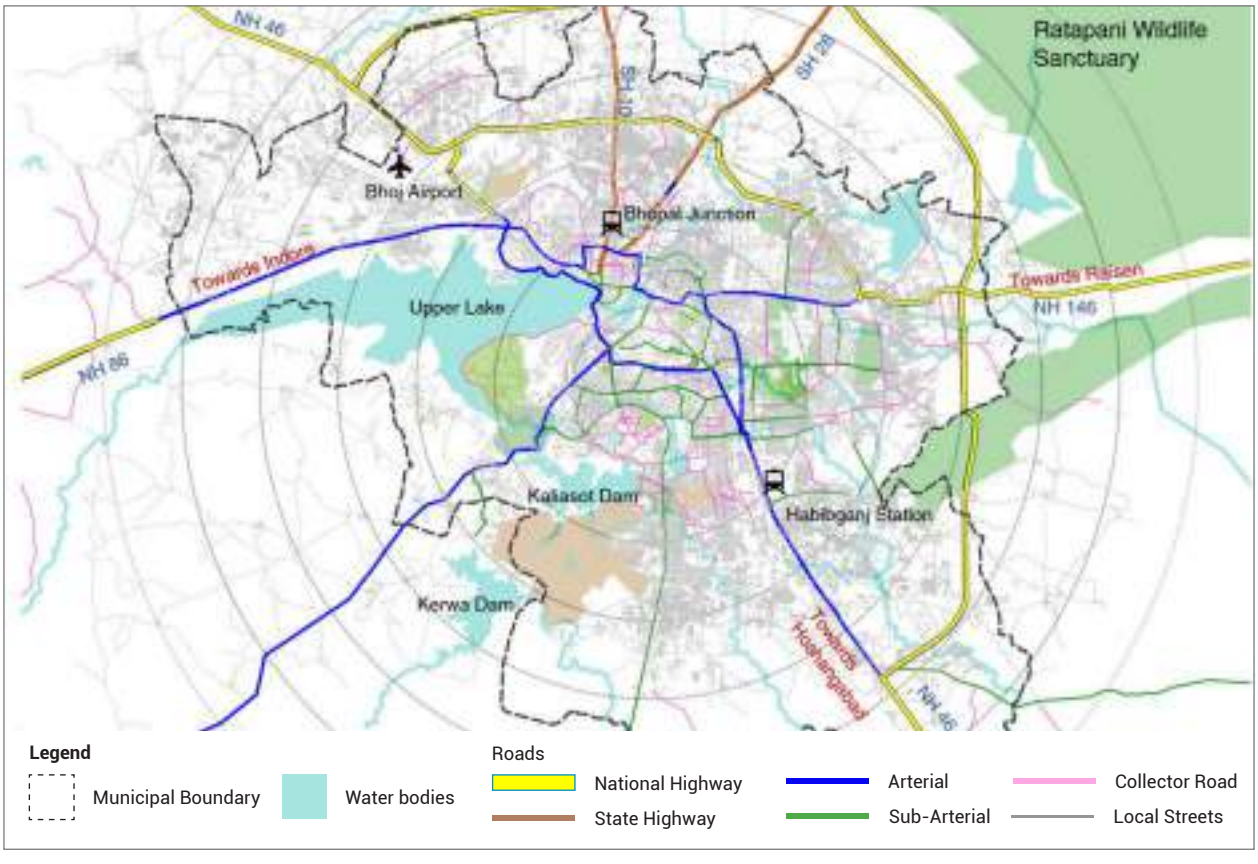
## Regional Air Connectivity

Raja Bhoj International Airport is the nearest airport, situated 20 km North-West of the city along the Bhopal–Narsingarh Road. Bhopal is connected with India's six major cities (New Delhi, Mumbai, Bengaluru, Ahmedabad, Hyderabad, and Lucknow)[3] through direct flights.

# 2.3 REGIONAL URBAN FUNCTION

Bhopal is the second-most populated city in the state after Indore, and acts as a centre of trade and commerce of regional importance. Small and medium-sized towns, such as Hoshangabad, Sehore, Obedullaganj, Mandideep, Itarsi, and Vidisha, are largely dependent on Bhopal for economic opportunities and improved social services.

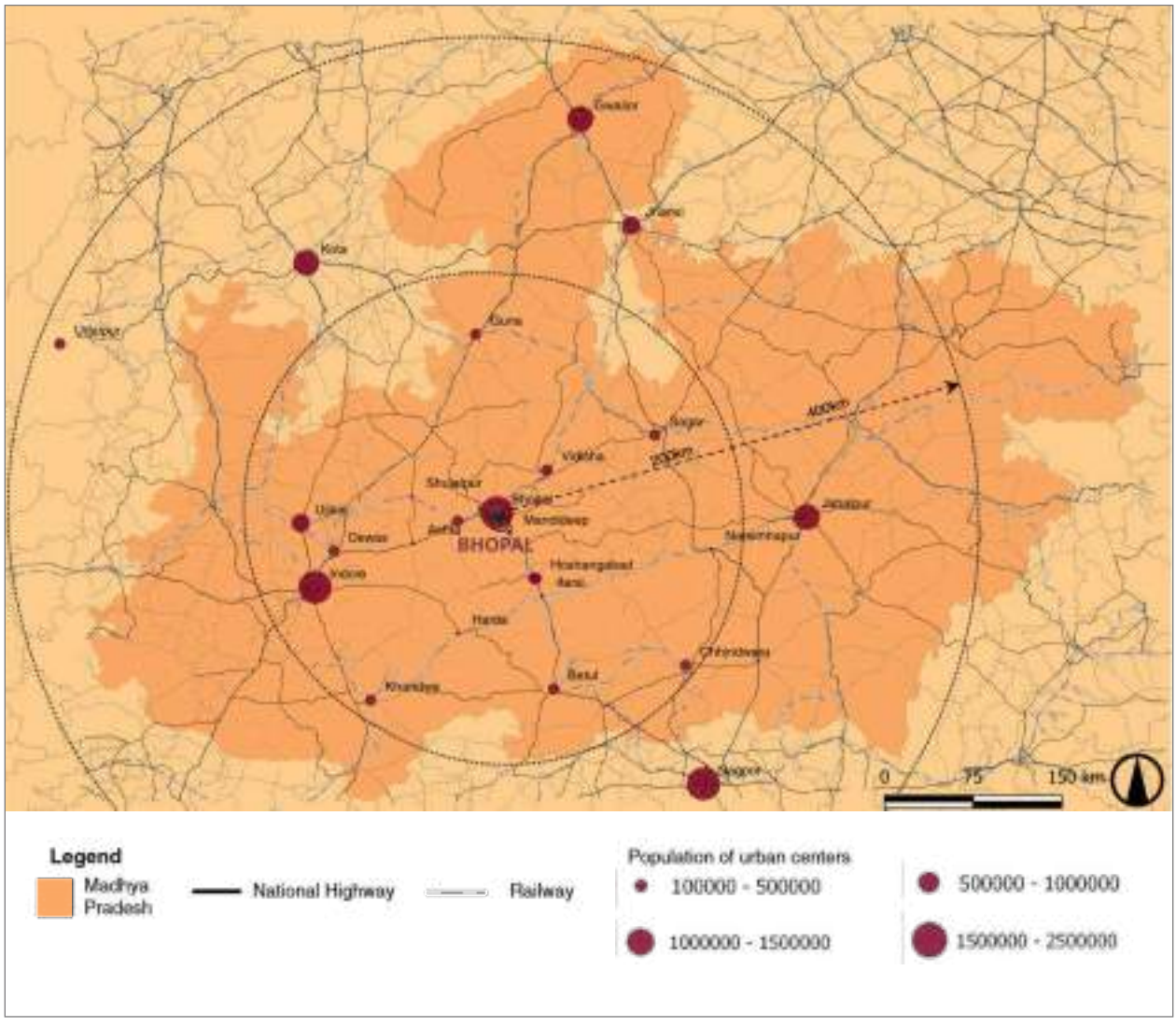
Bhopal began as a guardian settlement along the Upper Lake in the 11th century and has witnessed numerous phases of destruction before growing into the multi-functional city that it is today. The old city has retained several of its heritage structures, which are representative of successive historical eras. Bhopal is the centre of administrative, educational and commercial activities in Madhya Pradesh. It is also an important transit node.




Map 2.3: Inter-city connectivity in Bhopal

Source: UN-Habitat

[3] https://www.bhopalairport.com/arrivals.php as on 02/03/2021




Map 2.4: Regional urban centres within 400 km radius

Source: Census of India 2011

# 2.4 SOCIO-ECONOMIC CONTEXT

## 2.4.1 Demographic profile

### Population

Madhya Pradesh is the second-largest state by area and the fifth-largest by population in the country, home to over 725 lakh people as per Census 2011. The state government implemented the Madhya Pradesh Population Policy in 2000, which aimed to reduce the fertility rate, as well as maternal and child mortality rates in the state, and improve block-level healthcare facilities Similarly, in 2001-2011, a greater impact of the population policy was witnessed in urban Bhopal as the population growth rate reduced by 11 per cent. Other factors like the division of Madhya Pradesh State and migration of people to the newly formed state played a vital role in the reduction of the population growth rate.

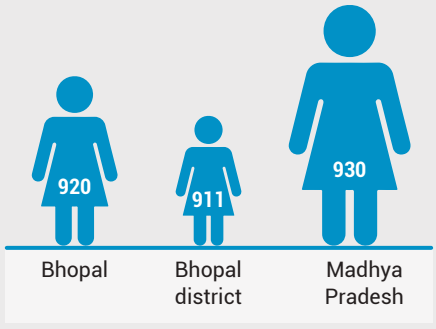
**Table 2.1:** Population and decadal growth rates of Bhopal city, Bhopal District and Madhya Pradesh between 1981 and 2011

| | Bhopal City | | Bhopal District | | Madhya Pradesh | |
|---|---|---|---|---|---|---|
| Year | Population (in Lakh) | Decadal Growth rate (%) | Population (in Lakh) | Decadal Growth rate (%) | Population (in Lakh) | Decadal Growth rate (%) |
| 1981 | 6.71 | 74% | 8.94 | 56% | 381.68 | 28% |
| 1991 | 10.62 | 58% | 13.51 | 51% | 485.66 | 27% |
| 2001 | 14.58 | 37% | 18.43 | 36% | 603.48 | 24% |
| 2011 | 17.98 | 23% | 23.71 | 28% | 725.97 | 20% |

Source: Census of India 2011

## Sex Ratio

**Figure 2.1:** Sex ratio in Bhopal compared to Bhopal District and Madhya Pradesh

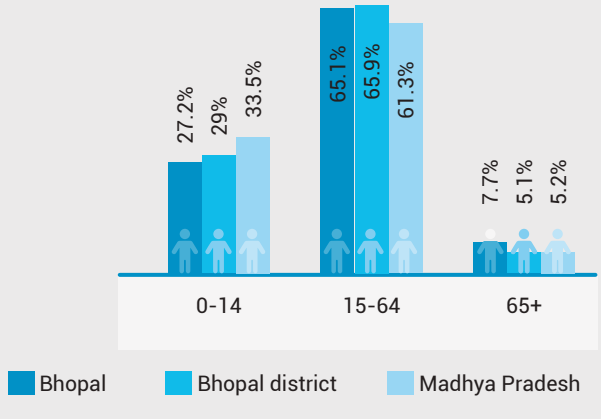



Source: Census of India 2011

As per Figure 2.1 above, the sex ratio of Bhopal city in 2011 was 920, which was higher than the sex ratio of Bhopal District. The sex ratio of the city was lower, however, than that of the state as well as the national average of 940.

## Age Cohort

**Figure 2.2:** Percentage of working age (15-64 years) and dependant age (0-14 years and above 65 years) populations in Bhopal, Bhopal District, and Madhya Pradesh

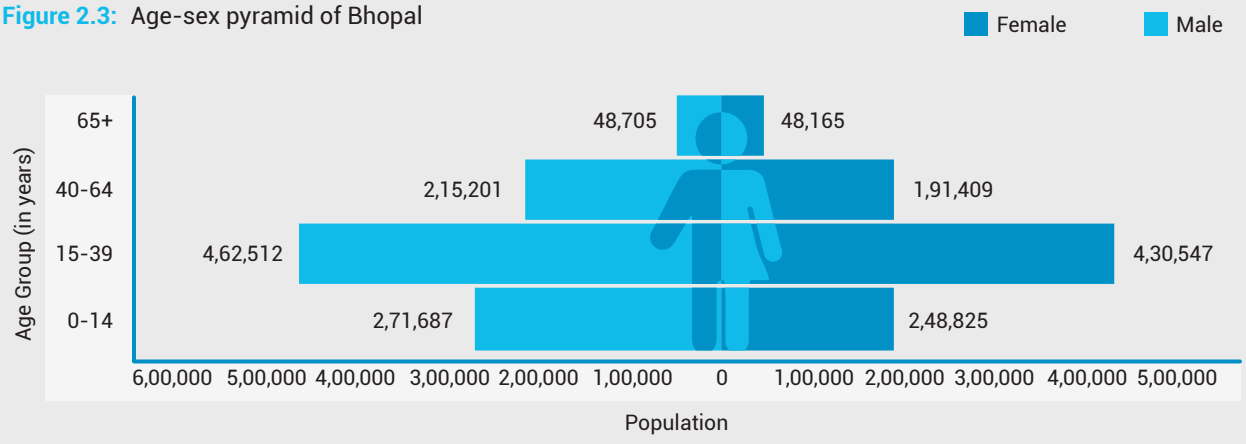



Source: Table C-14 Madhya Pradesh – Population in five-year age group by Residence and Sex, Census 2011

As per Census 2011, the working age population (15-64 years) in Bhopal constituted 65 per cent of its total population, which was lower than that of Bhopal District and Madhya Pradesh. About 35 per cent of the city's population made up its dependent population (0-14 years and above 65 years).

As per Census 2011, the youth population (15-34 years)[4] constituted 39.1 per cent of the city's total population, which was higher than that of Bhopal District (38.2 per cent) and Madhya Pradesh (34.7 per cent). The population group between the ages of 35-64 years (working population other than youth) in Bhopal city constituted 36.8 per cent of its total population (see Figure 2.3).

**Figure 2.3:** Age-sex pyramid of Bhopal




Source: Census of India 2011

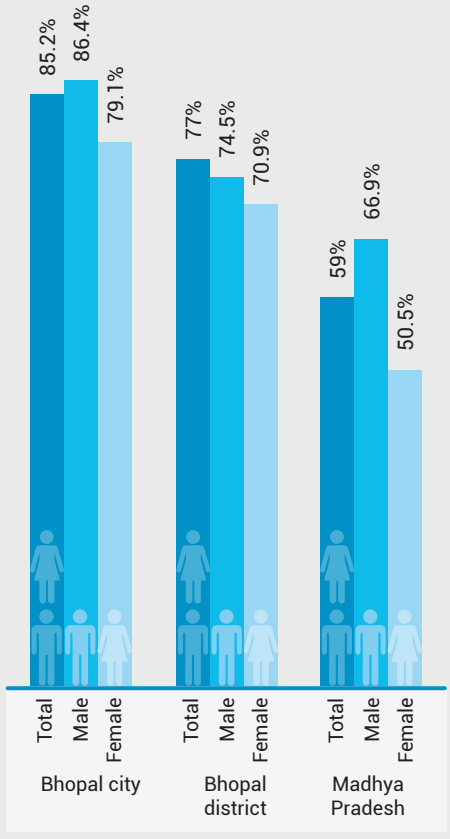
## 2.4.2 Social context

### Literacy Rate

The literacy rate of Madhya Pradesh improved from 63.7 per cent in 2001 to 70.6 per cent in 2011. The female literacy of the state in 2011 is 60 per cent, which is lesser than the national average of 65.4 per cent. The literacy rate of the city increased from 78 per cent in 2001 to 85.2 per cent in 2011.

The literacy rate of Bhopal city was higher than that of Bhopal District and Madhya Pradesh (see Figure 2.4). Similarly, the city's female literacy rate of 79.1 per cent in 2011 was higher than that of the state level as well as the national average. This may be owing to access to better educational facilities in urban areas like Bhopal.

**Figure 2.4:** Comparison of literacy rates in Bhopal, Bhopal District and Madhya Pradesh




Source: Census of India 2011

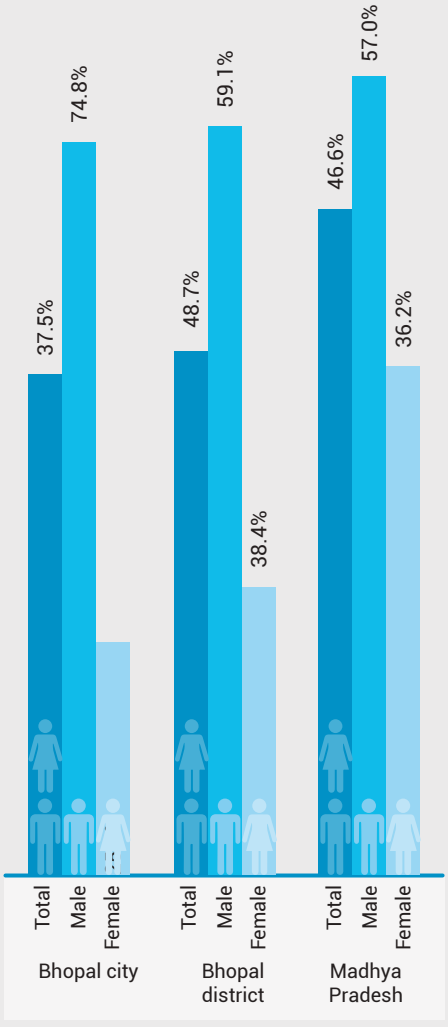
[4] Central Statistics Office (CSO), Ministry of Statistics and Programme Implementation (MoSPI), GoI (2017), considered the youth category as the population group between 15-34 years.

## Workforce Participation Rate

The Work Participation Rate (WPR) of Bhopal in 2001 was 29.6 per cent, which increased to 34.2 per cent in 2011. As per Census 2011, the WPR of the city was considerably lower than that of Bhopal District and the state (see Figure 2.5). Bhopal's low WPR was due to its low female participation, of merely 18.4 per cent, in the workforce; while that of Bhopal District and Madhya Pradesh were 22.4 per cent and 38.5 per cent, respectively.

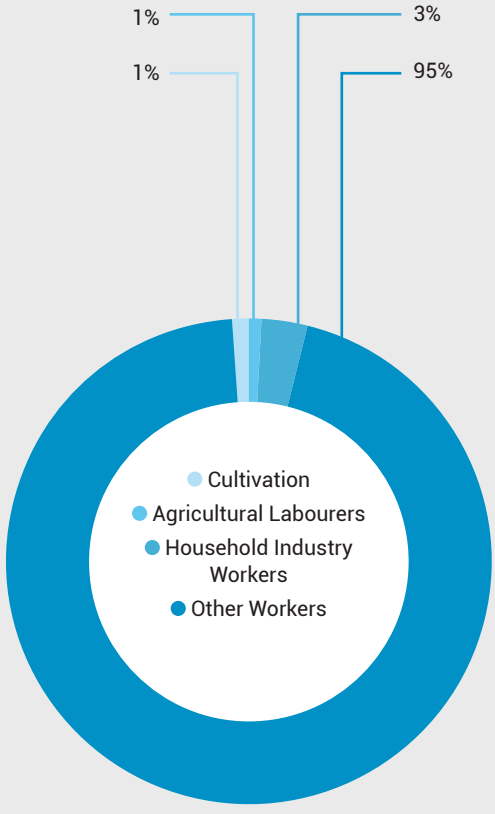
The city's main workers constituted 85.4 per cent and its marginal workers comprised the remaining 14.6 per cent of its total workforce. Bhopal city's total workforce in 2011 was over 6.31 lakh. Of this, nearly 95.4 per cent was engaged in the service/ tertiary sector. The distribution of the workforce in Bhopal is shown in Figure 2.6.

**Figure 2.5:** Comparison of workforce participation rates in Bhopal, Bhopal District and Madhya Pradesh




Source: Census of India 2011

**Figure 2.6:** Distribution of workforce by occupation in Bhopal




Source: Census of India 2011

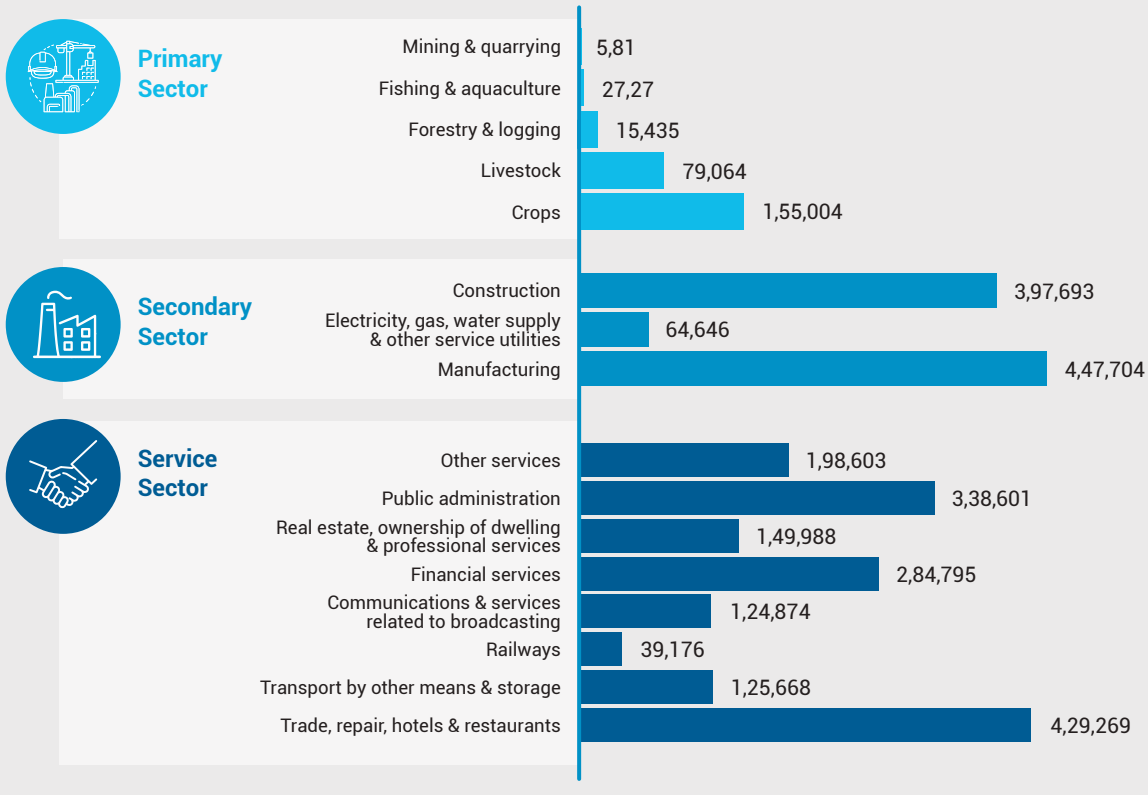
## 2.4.3 City economy

As per the Estimates of District Domestic Product, Madhya Pradesh, 2019, issued by the Directorate of Economics & Statistics, the Gross Value Added (GVA) for Bhopal District in 2015-16 was INR 16,77,425 lakh at current prices. The per capita income of the district was INR 96,055 in 2015-16. The GVA for Bhopal District in the primary sector (agriculture and allied) in 2016-17 was INR 2,52,811 lakh, which was 6.2 per cent of the combined GVA. As per Census 2011, around seven per cent of Bhopal city's total population was employed in agriculture and allied activities, which was significantly lower than the percentage share of employment in the agricultural sector (65 per cent) at the state level.

As per the District Economic Profile of Bhopal, issued by the Ministry of Micro, Small and Medium Enterprises, Government of India, in 2015-16, the district had 10,989 registered industrial units. Around 1,170 units (10 per cent) of these were situated in the city. The industrial area of Govindpura in the city is the biggest industrial estate in Bhopal, home to prominent enterprises such as Hindustan Electro Graphite (HEG), Eicher Tractor, Action Group of Companies, and Bharat Heavy Electricals Limited (BHEL). The GVA for Bhopal District in the secondary sector (manufacturing and household industries) was INR 9,10,043 lakh in 2015-16, which was 22.6 per cent of the total GVA.[5]

Bhopal is a regional hub with prominent education and healthcare institutions. The city has several financial institutions and family-led commercial and retail businesses. In 2015-16, the district level GVA in the tertiary sector (service provider and public administration) was INR 28,53,828 lakh, driving 71 per cent of the total GVA with a major share in the district economy.[6]

**Figure 2.7:** Sector-wise GVA (in INR lakh) of Bhopal District at current prices (2016-17)




Source: Estimates of District Domestic Product, Madhya Pradesh, 2019

[5] Estimates of District Domestic Product for Madhya Pradesh, 2019, p. 50
[6] Estimates of District Domestic Product for Madhya Pradesh, 2019, p. 53


Image 2.2: Hawkers Corner developed by BMC under NULM to organize street vending in Number 07 Market Source: UN-Habitat

## Urban Poverty and Slum Settlements

As per the Madhya Pradesh Millennium Development Goals (MDG) report 2015, the state registered a Gross State Domestic Product (GSDP) growth of 11.1 per cent in 2013-14, one of the highest in the country, when the Indian economy grew at 4.5 per cent. However, the human development indicators in the state did not follow a similar trend. For instance, while the poverty headcount in India between 1993- 94 and 2011-12 declined by 23.4 per cent, the decline in Madhya Pradesh was only about 13 per cent. In 2011-12, 31.65 per cent of people in Madhya Pradesh lived below the poverty line and the MDG target of reducing the poverty level to 22.3 per cent by 2015 was not achieved. As per the Global Multi-Dimensional Poverty Index Report published by UNDP in 2018, Madhya Pradesh was ranked the fourth poorest state in the country.

In 2005, the city had an urban poverty ratio of 48.4 per cent (1,99,394), the highest among all urban centers in India, when around 209 slum locations were mapped.[7] In 2019, as per the Housing for All (HfA) survey[8], the urban poverty ratio decreased by 23 percentage points and, currently, 25 per cent of the city's population live in slums. The number of Bhopal's citizens living in slums increased by 2.8 times between 2005 and 2019; in 2019, around 5.68 lakh people resided in slums.

[7] UN-Habitat in collaboration with BMC published the report, Poverty Mapping – A Situation Analysis of Poverty Pockets in Bhopal.
[8] The HfA survey is a demand analysis of housing shortage in urban areas to be carried out by ULBs under the national flagship mission, Pradhan Mantri Awas Yojana (PMAY).

# 03

# Urban Governance

At the national level, the 74th Constitutional amendment mandates the District and Metropolitan Development Agencies to carry out spatial planning and empowers the urban local bodies (ULBs) to self-govern. The responsibility of urban development planning and regulatory control are separated and managed by two agencies in Bhopal. The parastatal agency the Directorate of Town and Country Planning (TNCP)), crafts the master plans, also known as zonal or development plans, and provides a comprehensive guideline for land use, zoning, and long-term vision of the city as well as the metropolitan region beyond municipal boundaries. TNCP is responsible for developing and ratifying the master plans within the stipulated time frame required by the Madhya Pradesh Nagar Tatha Gram Nivesh Niyam, 1973and can range from 10 to 20 years. The Bhopal Municipal Corporation, headed by the Municipal Commissioner, is the city-level administrative agency that enforces land and building use regulations, as per the master plans, and ensures service delivery. It is divided into zones and wards for administrative convenience.

While there is no common overarching framework, the Ministry of Housing and Urban Affairs (MoHUA) issued the Urban and Regional Development Plans Formulation and Implementation (URDPFI) Guidelines 2014 for spatial planning, which is adopted at the state level. MoHUA has also formulated a National Transit Oriented Development Policy, 2017, with incentives for a Metro Policy and a Green Urban Mobility Scheme to curb urban sprawl, encourage non-motorized transport (NMT) planning, and reduce pollution. Other noteworthy, sector-specific and project-oriented national-level missions are summarized in Table 3.1.

**Table 3.1:** MoHUA Missions and Schemes

| MoHUA Mission | Objective |
|---|---|
| Smart City Mission 2015 | To incorporate technological solutions for governance and developing model areas in cities |
| Pradhan Mantri Awas Yojana (PMAY) 2015 | To provide housing for all by 2022 by meeting the housing shortage in urban areas |
| Atal Mission for Rejuvenation and Urban Transformation (AMRUT) 2015 | To improve service level benchmarks in water, sanitation, public transportation, and green and open spaces in urban areas |
| Heritage City Development and Augmentation Scheme (HRIDAY) 2015 | To integrate urban planning, economic development, and heritage conservation to preserve the built heritage of cities |
| Swachh Bharat Mission (SBM) – Urban 2014 | To achieve open defecation free status and scientific waste management in all urban areas |
| DAY – National Urban Livelihood Mission (NULM) 2013 | To enhance access to employment opportunities, credit, entrepreneurship skills upgradation, and a market for the urban poor |

Source: https://mohua.gov.in

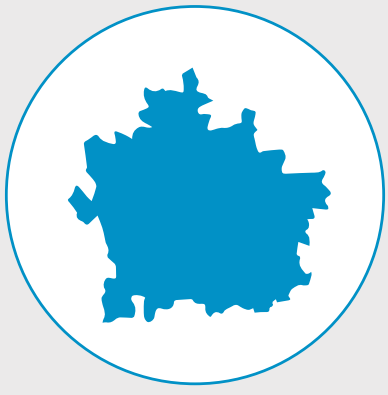
## 3.1 LEGAL CONTEXT

The municipal corporations in large urban areas in the state are set up under the Madhya Pradesh Municipal Corporation Act, 1956, and municipalities in small urban areas under the provisions of the Madhya Pradesh Municipalities Act, 1961. Bhopal was identified as the state capital in 1956 and the Bhopal town municipality obtained the status of a municipal corporation in 1983.

Madhya Pradesh Nagar Tatha Gram Nivesh Niyam, 1973, is the guiding policy for the state government to constitute the Directorate of Town and Country Planning (TNCP), the parastatal agency that develops planning documents for regions and settlements in the state.

Madhya Pradesh Bhumi Vikas Niyam, 2012, is the policy guideline for building bylaws crafted by TNCP, providing development standards and control regulations for land development in the state, including guidelines for building use, FARs, and ground coverage. A city-specific development control regulation has been prepared as part of the Draft Bhopal Development Plan 2031.

Madhya Pradesh (State)



Directorate of Town and Country Planning

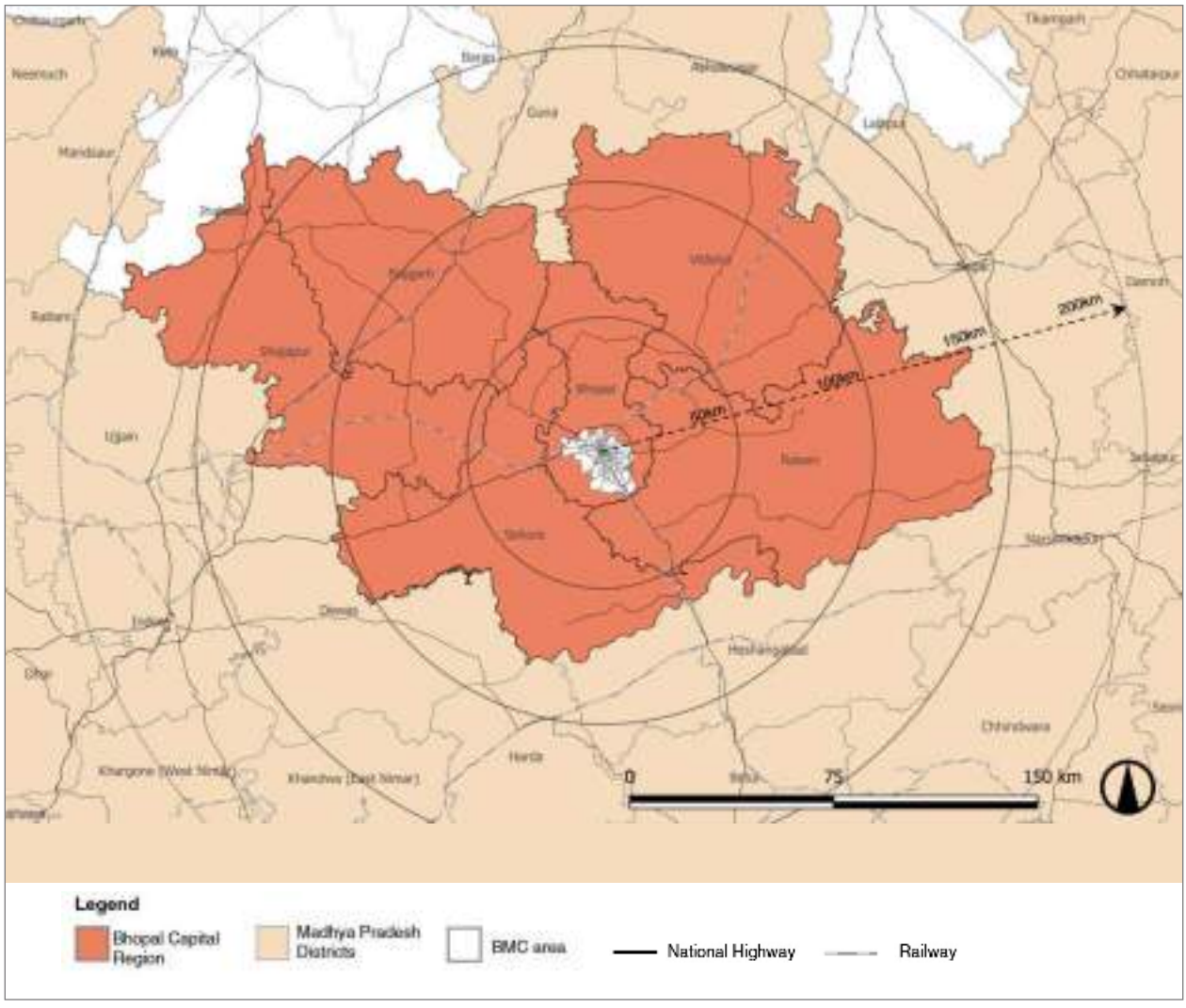
Bhopal Municipal Corporation (ULB)

### 3.1.1 Planning instruments and procedures

Under the provisions of the Madhya Pradesh Nagar Tatha Gram Nivesh Niyam, 1973, the regional offices of TNCP are responsible for preparing planning documents for the development of identified regions, agglomerations and settlements by the state.

**Regional Plans** are prepared for a special region created by state notification and aggregation of several villages, urban centres and districts that have similar development characteristics. At present, there are eight notified regions in the state. Bhopal lies in the Bhopal Capital Region, which includes Bhopal, Raisen, Sehore, Shajapur, and Rajgad Districts. The area of the Bhopal Capital Region is 30,144.8 sq. km., whose Draft Regional Plan is under preparation.

**Development Plans** are prepared for planning areas constituted by the state government, which may include an urban agglomeration and adjoining villages. The current Bhopal Development Plan (BDP) was prepared in 1999 for the horizon year 2005. The total area of the Bhopal planning area is 601 sq. km., which includes the BMC area and 146 adjoining villages. Since then, Draft Development Plans have been formulated for the horizon year 2021, but has not been approved by the state government. Currently, the Draft BDP 2031 has been prepared for an area of 1,016 sq. km. and submitted to the state government, pending approval.




Map 3.1: Bhopal Capital Region

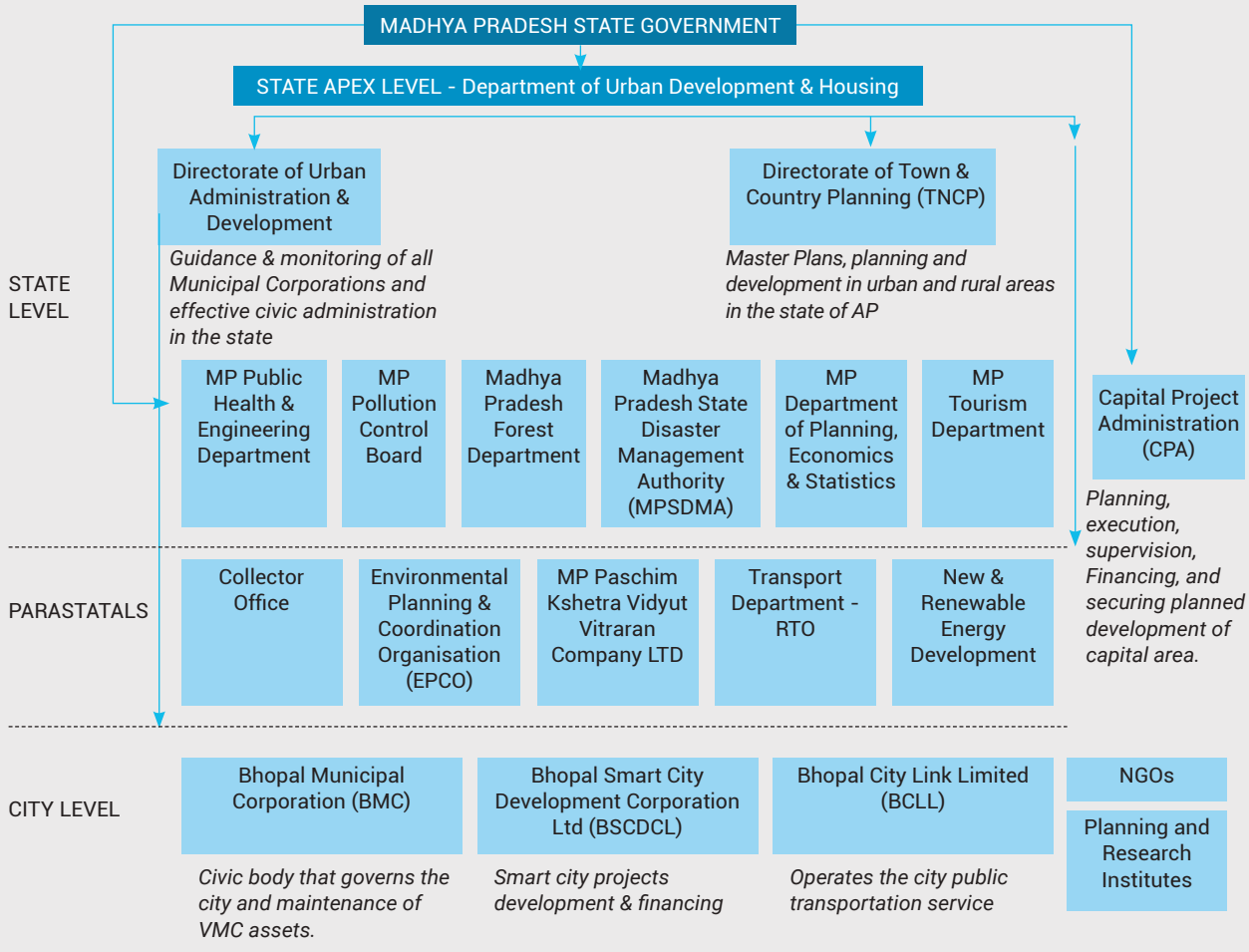
Source: UN-Habitat

## 3.2 INSTITUTIONAL CONTEXT

The Department of Urban Development & Housing, under the State Government of Madhya Pradesh, is responsible for the administration of all ULBs, urban planning, infrastructure development, and financing of urban projects in the state. The Directorate of Municipal Administration & Urban Development is the nodal agency for ULB administration under the Department of Urban Development & Housing in the state and is responsible for the administration and monitoring of municipal corporations and town municipalities. TNCP is the state agency for developing master plans, layout formation, land development, and implementing all zoning and Development Control Regulations (DCRs). For Bhopal city, the TNCP Bhopal and Sehore Regional Office are responsible for the preparation and revision of master plans and zonal development plans. The plans are notified after the approval of the Department of Urban Development and Housing.

The Bhopal Municipal Corporation (BMC) is the urban local body set up under the provisions of the Madhya Pradesh Municipal Corporation Act, 1956. The city is divided into 17 administrative zones and 85 wards. It is administered by the Municipal Commissioner, appointed by the Directorate of Municipal Administration & Urban Development. The administrative staff includes the Additional Commissioners, zonal officers, water and sanitation engineers, health officers, and urban planners. The municipal staff is appointed by the state's Department of Urban Development and Housing, selected under the Madhya Pradesh Public Service. The city council is the governing body that is constituted by elected ward representatives, headed by the Mayor. The city council has various committees headed by elected ward representatives to deliver specific functions. For instance, the health committee is responsible for governing projects and investments in public health, while the finance committee is responsible for governing BMC's budgets and accounts.

**Figure 3.1:** Government institutional structure in Bhopal




Source: UN-Habitat

BMC's functions can be broadly classified into regulatory, service delivery, and coordination.

**Regulatory functions** include enforcement of the Madhya Pradesh Bhumi Vikas Niyam, 2012; enforcement of Waste Management Rules 2016; collection and regulation of taxes, user charges, fees, and levy; conservation of the city's natural and built heritage; and regulation of encroachment and parking.

**Service delivery functions** include the provision of basic civic services like drinking water supply; safe sanitation services; solid waste management; provision of social facilities like parks, sports facilities, fire emergency services, and vaccination; and implementation of state and central schemes for the improvement of livelihoods and urban services.

**Coordination functions** include coordination with state departments and agencies involved in city development. For instance, supporting the district collectorate to conduct elections and census activities.

The mandate of preparing planning documents lies with TNCP, whereas the responsibility of implementing the plans lies with BMC. The Buildings Permission Department of BMC is responsible for issuing building licenses, occupancy certificates and issue permissions for construction and demolition works in the city.

Some functions overlap with the mandates of state departments or para-statal departments. For instance, the mandate of providing safe sanitation services is shared between BMC and the Department of Public Health and Engineering. The responsibility of provisioning and operating education and healthcare facilities in the city lies entirely with the Department of School Education and Directorate of Health Services, respectively.

The Bhopal Smart City Development Corporation Limited (BSCDCL) and Bhopal City Link Limited (BCLL) are two utilities instituted under BMC to carry out specific functions. In 2015, Bhopal was selected as a Smart City and BSCDCL was institutionalized as

a special purpose vehicle (SPV) to implement and finance the smart city projects. The city's Municipal Commissioner is the chairman of the SPV and BSCDCL's primary responsibility is to implement the Bhopal Smart City Plan, which is an investment plan of INR 3,440 crore, to develop area-based projects and pan city development projects. An integrated control and command centre (IOCC) was set up at the BSCDCL office in Govindpura. IOCC integrates several functions like monitoring the city through CCTV cameras installed in public spaces, provisioning open Wi-Fi at public spaces, managing data for solid waste management vehicles, smart traffic and parking management, and citizen grievance redressal through city apps into a centralized command centre.

The BCLL is an SPV headed by the Additional Commissioner, BMC, established with the mandate of operating and managing public bus transportation. BCLL maintains the city bus terminals and transit stops; and operates the bus depot and workshops for the maintenance of public buses.

**Table 3.2:** Roles and responsibilities of key stakeholder departments in Bhopal

| S. No | Organization | Key roles and responsibilities in Bhopal |
|---|---|---|
| 1 | Bhopal Smart City Development Corporation Limited (BSCDCL) | An SPV created to develop, finance, and implement the Bhopal Smart City projects. Under smart city projects, various area-based development projects and pan city development projects are being developed. Public bicycle sharing, free Wi-Fi in public spaces, and smart traffic management are some of the key activities. |
| 2 | Bhopal City Link Limited (BCLL) | Responsible for managing the public transportation fleet in the city. BCLL maintains the city bus terminals and transit stops; and operates the bus depot and workshops for maintenance of the buses. |
| 3 | Capital Project Administration (CPA) | A parastatal body set up to implement and monitor projects in the administrative capital area of the city, which includes maintenance of government buildings, and maintenance of gardens and parks in the area. |
| 4 | Bhopal District Collectorate | Plays a key role in disaster management, public distribution, and civil supplies, monitoring, and implementation of various social welfare programmes. |
| 5 | Madhya Pradesh Police Department | Maintains law and order enforcement, and public safety in the city. Besides police stations, the city has special branches for women, traffic control, cyber security, crime records and intelligence gathering. The traffic wing handles road safety, vehicular traffic regulation and management. |
| 6 | Public Health Engineering Department (PHED) | Responsible for the investigation, design, and execution of sewerage schemes in ULBs across the state. In Bhopal, PHED jointly executes projects related to underground sewerage with BMC. |
| 7 | Madhya Pradesh Urban Development & Housing Department (MPUDH) | Nodal agency for urban development and monitoring ULBs in the state. |
| 8 | Madhya Pradesh State Disaster Management Authority (MPSDMA) | A statutory body created under the provisions of the Disaster Management Act, 2005, responsible for activities related to community safety, rescue activities, developing SOPs, multi-hazard risk management, and disaster response in the city. |
| 9 | Madhya Pradesh Pollution Control Board (MPPCB) | Responsible for prevention, control, and monitoring of various forms of pollution, such as air, water, land and noise, to improve the quality of the environment in the state by effective implementation of environmental laws. The MPPCB Bhopal regional office works in tandem with BMC in various aspects related to waste management and environmental improvement. |
| 10 | Environment Planning and Coordination Organisation (EPCO) | An autonomous organisation set up to advance the capacity of environmental management and protection in the state. EPCO assists and advises the State Government on environmental policy and planning. Appraisal of development projects, environment and sustainability research, and capacity building are the main mandates of the organisation. |
| 11 | Madhya Pradesh Forest Department | Responsible for the preservation and monitoring of state forests, national parks, and wildlife sanctuaries in the state. |
| 12 | Madhya Pradesh Metro Rail Corporation (MPMRC) | Responsible for the construction of the Bhopal Metro. The construction of phase-1 of the project is ongoing. |
| 13 | Madhya Pradesh State Industrial Development Corporation (MPSIDC) | The nodal agency for all industrial promotional activities in the state. Planning and managing all industrial estates in the state is a major mandate. |
| 14 | Madhya Pradesh Madhya Kshetra Vidyut Vitaran Company Limited (MPMKVVCL) | Provides electricity supply for the central region of the state, including Bhopal. Implements national and state flagship missions to promote alternative sources of energy in the city. |

# 04

# Existing Urban Analysis

## 4.1 STRUCTURING ELEMENTS

### 4.1.1 Natural elements

#### Lakes and Forests

Bhopal lies on a rugged tableland flanked by the Satpura and Vindhyachal mountain ranges of Central India. The forested mountains of the Ratapani Tiger Reserve lie mainly to the southern and eastern ends of the city. Bhopal city stands on a hilly terrain that slopes downwards to the South-East. The old city lies along the north-eastern banks of Upper Lake, nestled between the Idgah Hills and the Shamla Hills. The eastern and southern parts of the city are flatlands. The Govindpura Industrial Estate was developed on the eastern flatlands; while Mandideep, another important industrial hub, lies 15 km to the South of the city.

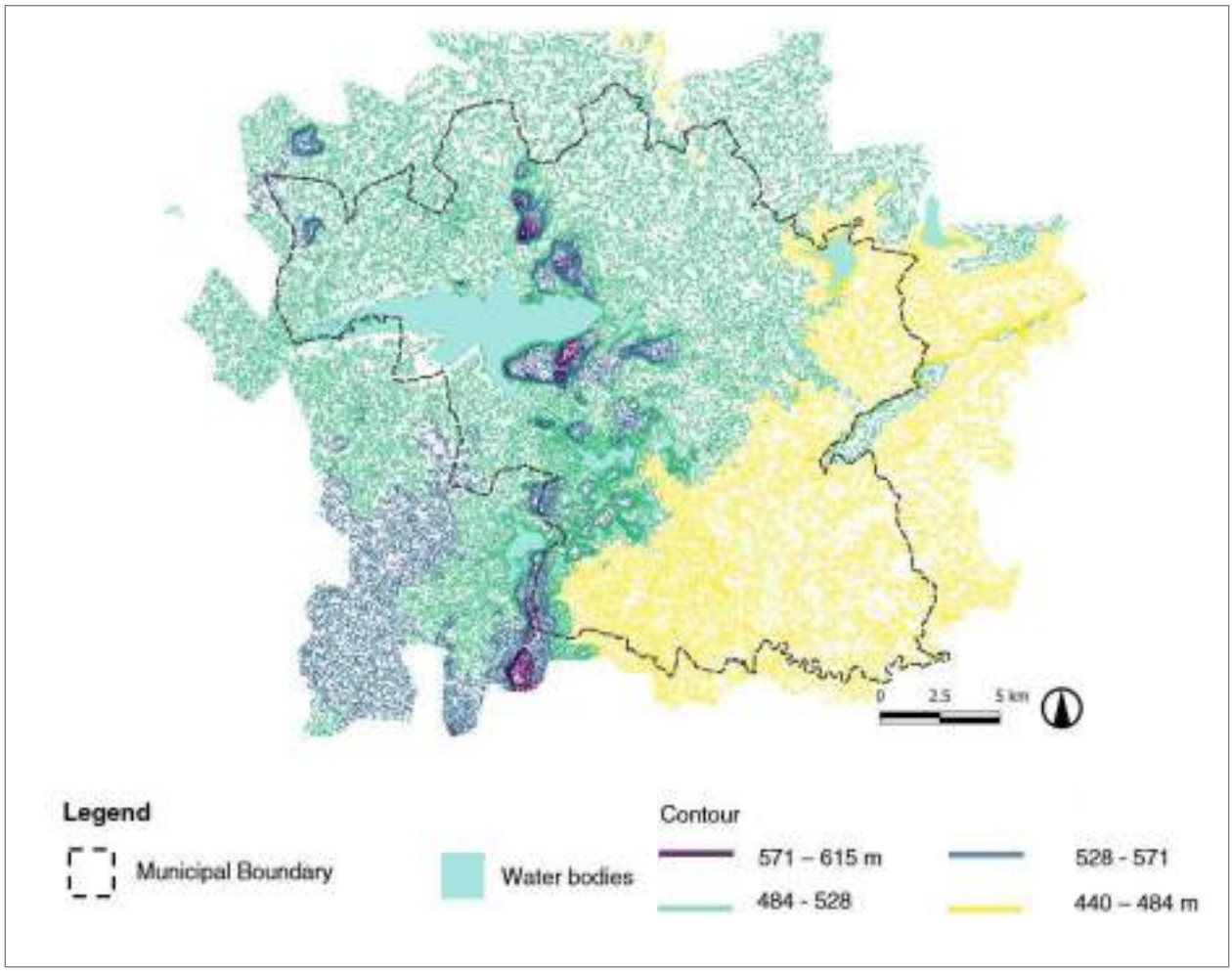
Bhopal is popularly known as the 'City of Lakes' and the Bhopal planning region constitutes 18 water bodies. The total area under water bodies—including lakes, rivers and streams—is around 54.95 sq. km. (13 per cent of the city area). Bhojtal or Upper Lake is one of the largest urban lakes in the country, spread over 34.84 sq. km. and rising to 508.17 m. at full tank level. Upper Lake's catchment area is spread across 361 sq. km., with nearly 80 per cent of the area currently exhibiting rural characteristics with agriculture as the predominant activity.

The Halali River provides drainage along the north-eastern end of Bhopal city, while the Kaliyasot River provides the same along the south-eastern end. Both rivers drain storm water into the Betwa River, a tributary of the Yamuna River.

The natural elements of the city provide panoramic views and its beautiful, natural landscape offers immense possibilities for developing public recreational spaces by capitalizing on the rolling highlands, lakes and rivers surrounding Bhopal city. The Boat Club and the lakefront development along the banks of Upper Lake are popular recreational spaces and tourist spots.

Image 4.1: Boat Club developed along the southern banks of Upper Lake Source: UN-Habitat

Image 4.2: Lakefront development along Upper Lake Source: UN-Habitat




Map 4.1: Topography of Bhopal

Source: UN-Habitat

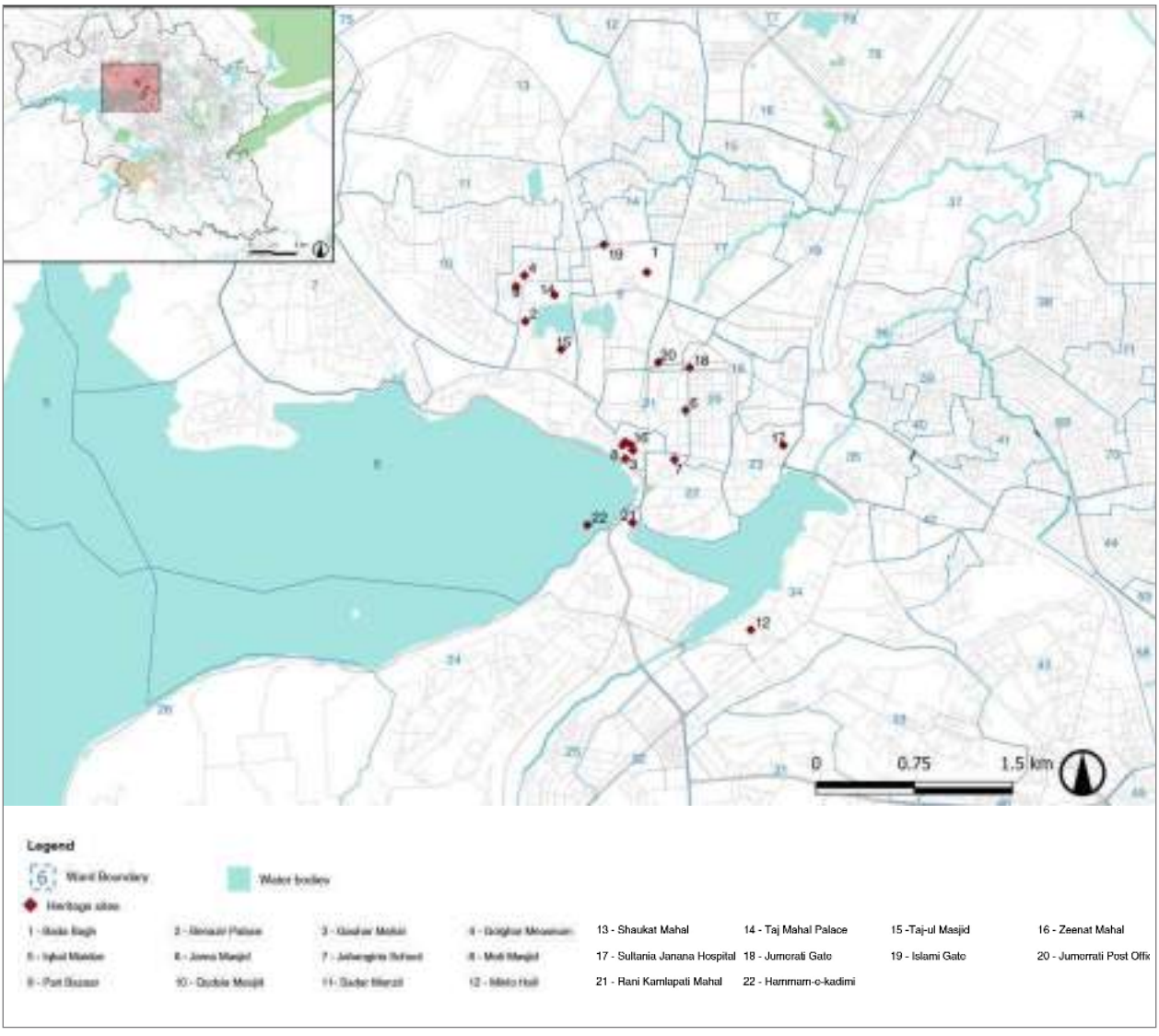
## 4.1.2 Built heritage

According to folklore, Bhopal was founded by the Paramara King, Raja Bhoj, who ruled from his capital at Dhar in the 11th century. In the early 18th century, Bhopal was a small village in the Gond Kingdom of Central India till Dost Mohammad Khan established the Bhopal State after annexing land from several local chieftains of the Malwa region. He founded the modern city and ruled as the Nawab of Bhopal. In 1818, a treaty was signed between the British East India Company and the Nawab of Bhopal to form the princely state of Bhopal. Down the years, between 1819 and 1926, the princely state was ruled by four women heads of state, famously known as the Begums of Bhopal. During their rule, Bhopal saw extensive cultural and developmental projects being successfully implemented.

The Taj-ul-Masajid (meaning the crown of all mosques), is one such architectural landmark of Bhopal city. Several other historic structures, such as the Taj Mahal of Bhopal, Gauhar Mahal, Sadar Manzil, and Moti Masjid were built during this period. The 14 historic gates, which once formed the entrances to the fortified city of Bhopal, are other prominent heritage features of the modern city.

These heritage structures, however, stand in a dilapidated condition. The Taj Mahal complex[9] of Bhopal, Shaukat Mahal[10] and Teen Mohre Gate[11] are instances of such heritage structures that require immediate restoration. Under the heritage conservation component of the national Smart City Mission, restoration of the Sadar Manzil Complex is ongoing.

[9] UN https://www.hindustantimes.com/india/a-ruined-taj-mahal-in-madhya-pradesh/story-KgLWIeAGPxmm2t3pOFzXeJ.html
[10] https://www.hindustantimes.com/bhopal/bhopal-s-180-year-old-architectural-marvel-shaukat-mahal-in-a-shambles/story-0HY8lI3cxE2JBCKJ5yUKmK.html
[11] https://timesofindia.indiatimes.com/city/bhopal/victim-of-neglect-teen-mohre-gate-on-the-brink-of-collapse/articleshow/67032924.cms




Map 4.2: Major heritage sites in Bhopal

Source: UN-Habitat

Image 4.3: Shaukat Mahal, a dilapidated heritage structure in the old city

Source: UN-Habitat

# 4.2 URBANIZATION AND LAND USE PATTERNS

## 4.2.1 City development pattern

Bhopal was made the capital of Madhya Pradesh in 1956. During the same period, Bharat Heavy Electricals Limited (BHEL), a public sector manufacturing company, was established to augment the employment opportunities in the city.

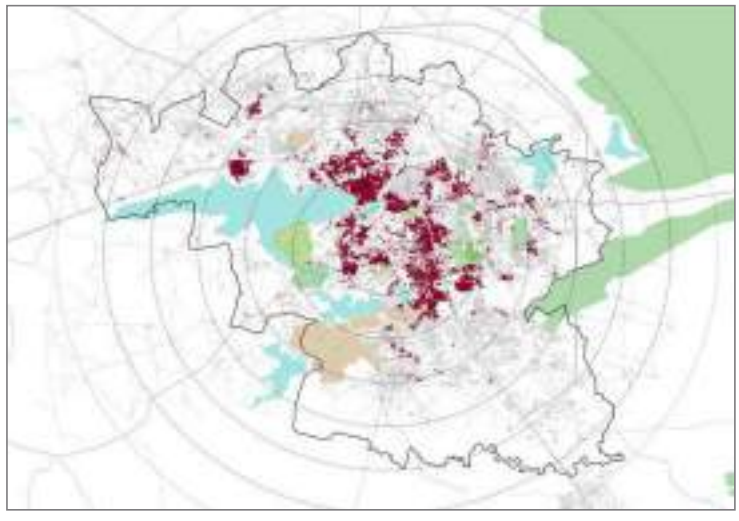
The public offices and newly set up industries prompted rapid population growth in the city, resulting in around 120 per cent growth of the decadal population during 1951-61[12]. The city, in 1956, was limited to the old walled city, which later expanded to accommodate increasing urbanization. A new capital region was developed to accommodate public offices and housing. The region was later incorporated as TT Nagar growth centre in the BDP 1991.

In 1971-1981, the city boundary was increased to accommodate BHEL Township and Bairagarh as growth centres. Bairagarh, to the city's West, is a refugee settlement of the Sindhi community. Over the years, the community has established family-led retail and commercial enterprises and is currently one of the major commercial hubs in the city. An industrial area was established at Mandideep, along with the Bhopal–Hoshangabad transit corridor to the South of the city. Due to the consolidation of the industrial and commercial activities, and expansion of public services, the decade of 1971-81 witnessed 74 per cent growth in the city's decadal population.

In 2000, a new state, Chhattisgarh, was carved out of Madhya Pradesh, leading to the migration of government employees from Bhopal to the newly formed state. Bairagarh, Old Bhopal, TT Nagar, BHEL and New BHEL Extension were the five existing growth centres during the period.[13] Kolar town municipality was later merged with BMC in 2014 to increase the ULB's area to the current 417 sq. km.

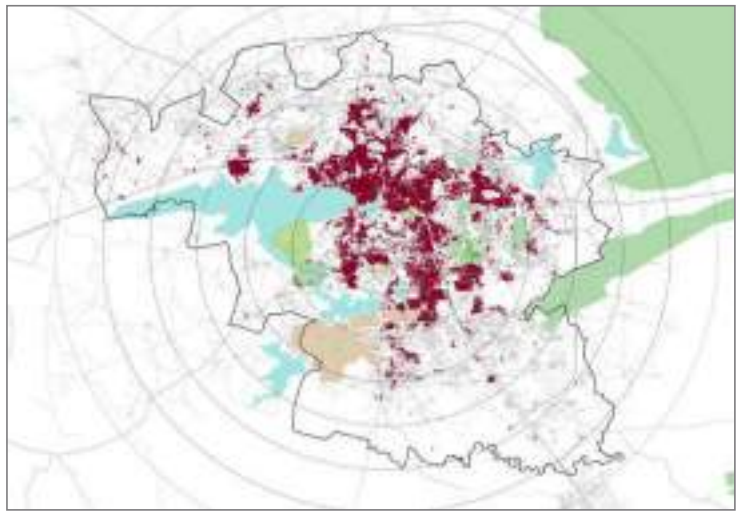
In 2020, the city had a population of 23.7 lakh and is currently being developed as one of the 100 smart cities under the flagship Smart City Mission of the Government of India.

**1975**



Area: 26.3 sq. km.
Population: 3.84 lakh

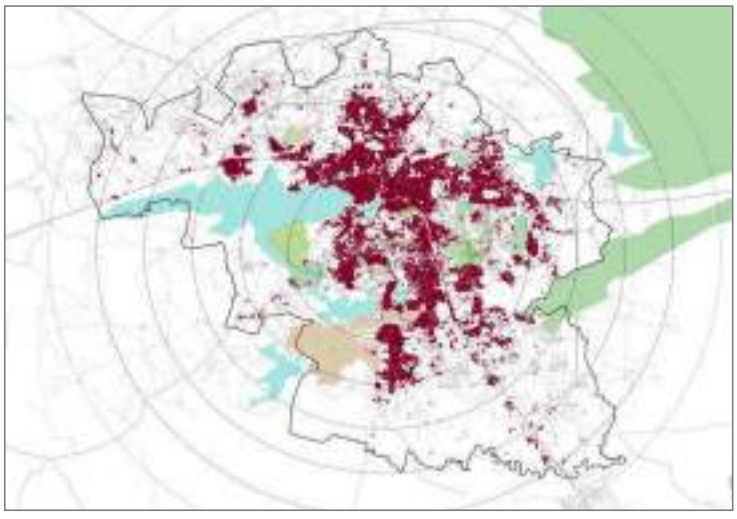
**1990**



Area: 44.5 sq. km.
Population: 10.62 lakh

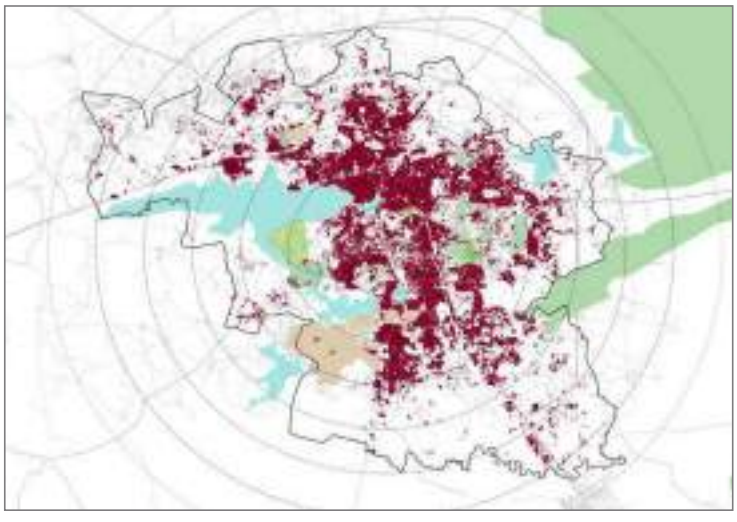
[12] Census of India, Archive
[13] Bhopal Development Plan, 2005

**2000**



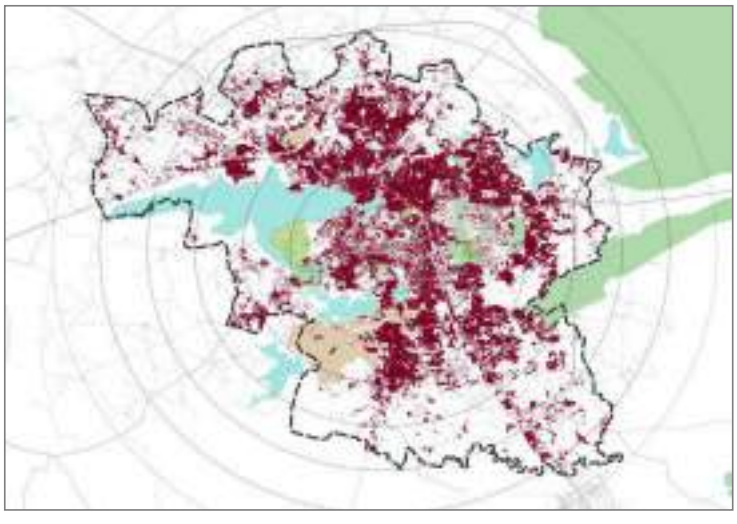
Area: 68.6 sq. km.
Population: 14.5 lakh

**2014**



Area: 86.7 sq. km.
Population: 17.9 lakh

**2018**



Area: 107.8 sq. km.
Population: 19.23 lakh

Map 4.3: Change in built-up area in Bhopal over the years

Source: Multitemporal information layer on built-up presence as derived from Landsat image collections (GLS1975, GLS1990, GLS2000, and ad-hoc Landsat 8 collection 2013/2014, GHSL (10m) Sentinel-2 imagery 2018).

## 4.2.2 Spatial development pattern

### Core City and Growth Centres

The BDP 1991, prepared in 1973-75, laid the foundation for the development of the newly formed state capital. The plan proposed to integrate the newly formed capital area, referred to as the TT Nagar growth centre, with the existing core (old) city and focussed on mixed-use development. However, separate zones for the industrial area were created and developed as BHEL and New BHEL growth centres on the city's eastern flatlands.

The Bairagarh growth centre was developed in the city's north-western micro-market with a mix of commercial and residential developments. The extensive network of lakes, rivulets and hillocks, however, provided limited scope for development in the city's western micro-market. The Van Vihar National Park, Indira Gandhi Manav Sangrahalaya, and various state and central institutions like the Indian Institute of Forest Management (1978) and National Law University (1997) were developed here. In the late 1970s, Mandideep town, 23 km to the South of Bhopal city, was proposed to be developed as an industrial township, eventually becoming a major pull factor for development in the city's southern micro-market.

In 1984, the historic gas leak at the Union Carbide India Limited pesticide factory led to a major industrial disaster, killing around 3,787 people and causing permanent injuries to 5,58,125 (more than 60 per cent of the population of the city in 1984), as per official reports.14 The gas leak polluted the surrounding land, restricting growth in the city's northern micro-market.

The BDP 2005, prepared in 1999, focused on developing the city's existing growth centres and proposed two new growth centres—Neori to the North and Misrod to the South. The plan proposed the construction of transport corridors to the South, connecting Hoshangabad. Owing to the flatland and its proximity to transit infrastructure, the city saw development in its southern micro-markets.

## 4.2.3 Administrative boundaries

The current administrative area of BMC is 417 sq. km. and is divided into 85 electoral wards (see Map 4.5). In 2014, the boundary was extended from 285 sq. km. to 417 sq. km. by merging Kolar town, to the city's South, into the BMC boundary. The Bhopal planning region includes the BMC area and 146 adjoining villages. The area planning region was increased from 240 sq. km. in 1975 to 601 sq. m. in 1995 and the BDP 2005 was prepared to guide the development of this new area. The draft BDP 2031 proposes to further extend the planning area to 1,016 sq. km.

## 4.2.4 Urban density

The net population density of BMC in 2020 was 56.8 persons per hectare (PPH). The low net population density is mainly because of the city's natural elements, such as hills, forest areas and water bodies occupying a large tract of land, thus reducing the effective land area available for habitation. Around 98 sq. km. is occupied by these protected natural features. Considering the developable area of 319 sq. km., the average population density of the city is 60.2 PPH.

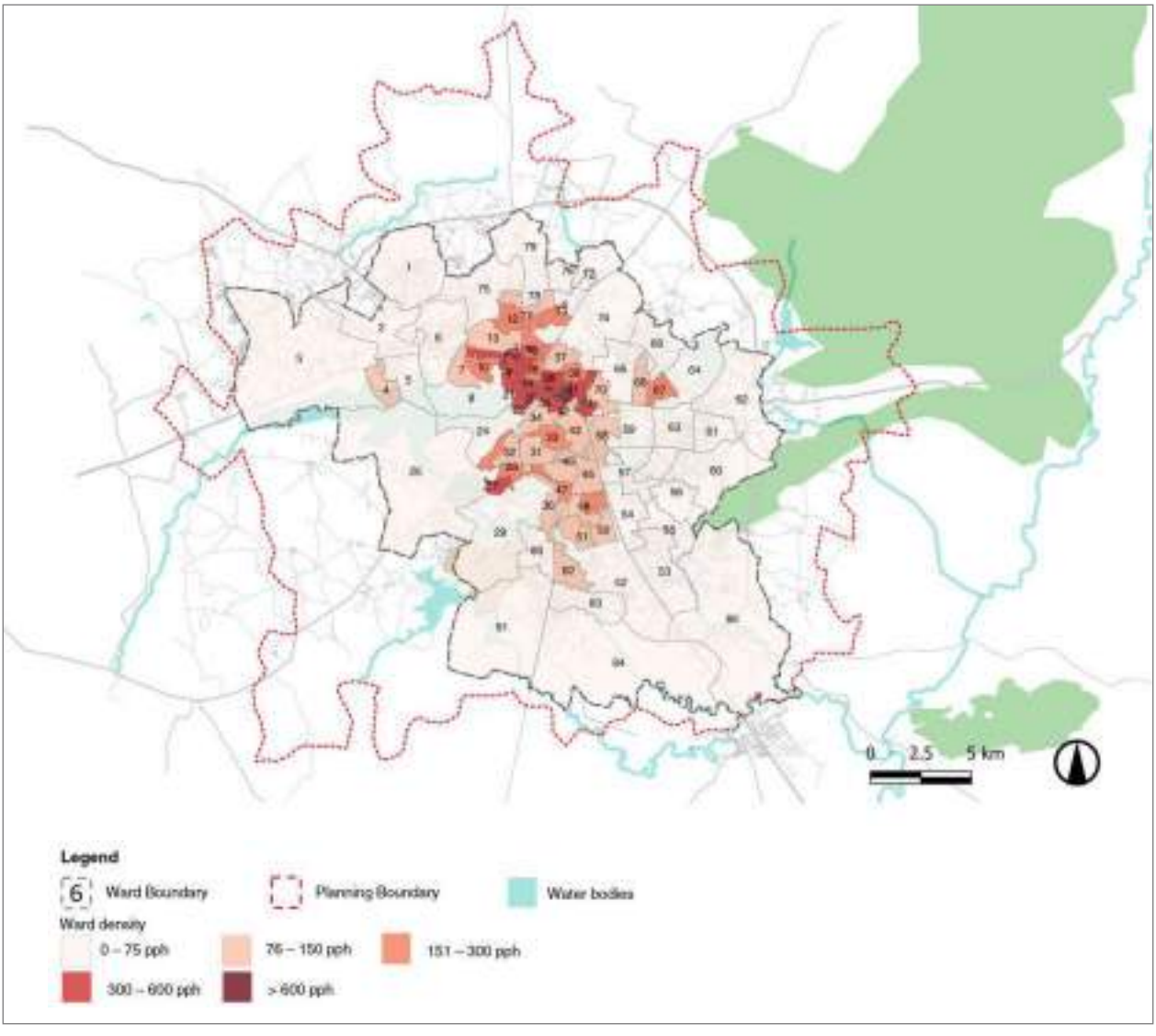
As per Census 2011, the wards falling in the old city are the densest pockets of Bhopal city. Ward No. 14 has the highest density of 1,003 PPH. As per Map 4.5, the density is concentrated in the core city area. Around 52 wards (60 per cent) have a density of less than 150 PPH.

[14] https://www.indiatoday.in/india/story/bhopal-gas-tragedy-what-had-happened-this-day-33-years-ago-that-killed-thousands-1099247-2017-12-03

**Table 4.1:** Population growth and density of Bhopal

| Year | Population (lakh) | Decadal growth (%) | BMC Area (Ha) | Population Density/Ha |
|---|---|---|---|---|
| 1971 | 3.84 | - | 7,123 | 54 |
| 1981 | 6.71 | 74.3 | 7,123 | 94.2 |
| 1991 | 10.62 | 57.7 | 7,123 | 149.2 |
| 2001 | 14.58 | 37.2 | 28,500 | 51.1 |
| 2011 | 17.98 | 23.3 | 28,500 | 63 |
| 2020 | 23.71 | 31.8 | 4,1700 | 56.8 |

Source: Census 2011




Map 4.4: Ward-wise density distribution of Bhopal

Source: UN-Habitat

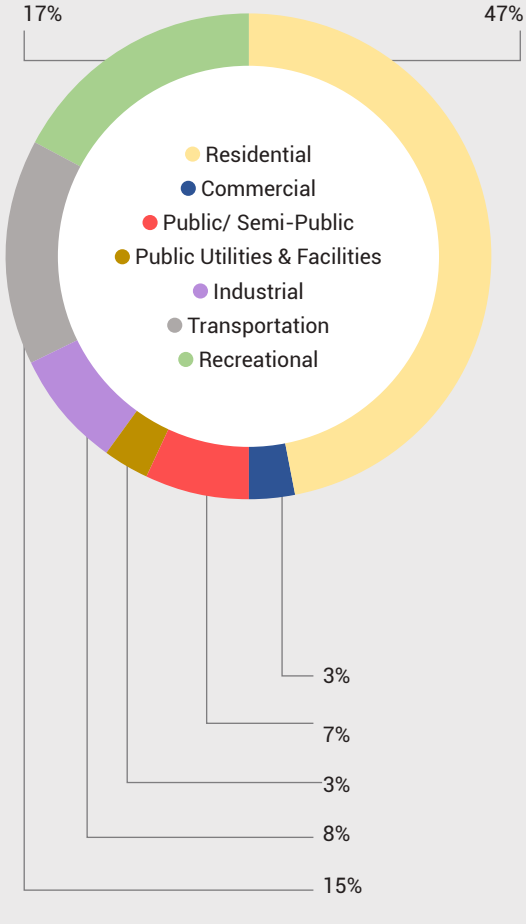
## 4.2.5 Existing land use analysis

BDP 2005 envisaged development of 601.06 sq. km. of planning area, including 146 villages. The total developable area under different land uses was 225 sq. km. As per the Draft BDP 2031, however, only 128.3 sq. km. (47 per cent) has been developed.

As per Figure 4.1, 17 per cent of the total land (601. sq. km. of planning area) is allocated for recreational use, which includes lakefront development (Upper Lake, Shahpura Lake, Laharpur Lake), protected forests (Van Vihar National Park), and city and neighbourhood parks. Considerable land is allocated for the improvement of transportation facilities for constructing a new railway station at Habibganj, Grade separators over railway lines, new Link Roads along the southern and northern parts of the city, expansion of existing roads, and development of three Transport Nagars at different locations. Currently, none of these three Transport Nagars have been developed.

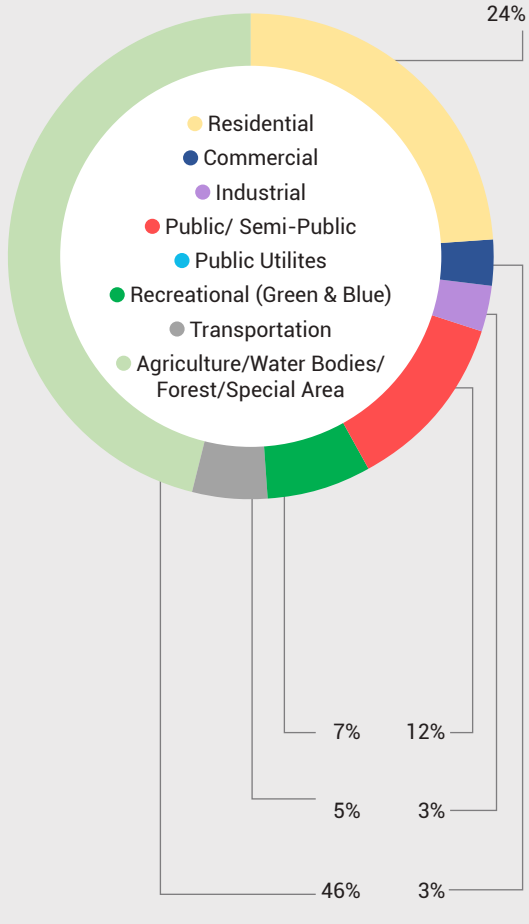
The plan has allocated seven per cent of land to public and semi-public space, which includes national and state educational institutions. School of Planning and Architecture-Bhopal, Indian Institute of Science Education and Reserach, National Institute of Fashion Technology, Indian Institute of Forest Management, and Atal Institute of Good Governance are some of them. Proposed educational institutes have not been developed at Chandanpur and on the land near the Kerwa–Kalisot ridge due to the presence of dense vegetation, and many institutions are still currently under construction. As per the Draft BDP 2031, the land use categorization is summarized in Figure 4.2.

**Figure 4.1:** Proposed land use as per BDP 2005




Source: Census of India 2011

**Figure 4.2:** Existing land use as per Draft BDP 2031




Source: Census of India 2011

The gaps identified in the implementation of BDP 2005, and current land use analysis are summarized in Table 4.2

**Table 4.2:** Sector-wise gaps in implementation of BDP 2005

| Sector | Status |
|---|---|
| Target Population | The projected population for 2005 was 25 lakh, but the projection was not achieved even in 2019 |
| Urban Expansion & Development | The proposed growth centres at Neori, BHEL, Misrod and Kolar (2012 amendment) are not developed yet. Unplanned commercial development in residential areas |
| Heritage | No heritage precinct development plan developed. Smart City Mission took up conservation and development of the Jama Masjid and Sadar Manzil precincts |
| Transportation | • None of the Transport Nagars have been developed<br>• Only 53 km out of 241 km of roads have been developed |
| Eco-sensitive Areas | • Buffer of 50-100 m not developed along the banks of lakes<br>• Public and semi-public uses in Kerwa and Kaliasot region not implemented<br>• No monitoring of pollution in the lakes |
| Industrial Area | Industrial estates not developed in Adampur |
| Social Infrastructure | • Schools and educational institutions not developed in Chandanpur due to its forested typology<br>• Several institutions are still developing their allotted land (NIFT) |

Source: Draft BDP 2031

Image 4.4: Agriculture land enclave near Bawadia Flyover

Source: UN-Habitat

Under the Earth Observation for Sustainable Development[15] initiative by Earth Space Agency (ESA) analysis of satellite imagery for 2005 and 2017 was carried out. The Land Use Land Classification (LULC) analysis showed that in 2005, the most dominant LULC classes occurring was Agriculture land use (48.77 per cent of the total area), Residential (15.77 per cent of the total area), Natural areas (9.37 per cent of the total area) and Forest areas (8.51per cent of the total area).

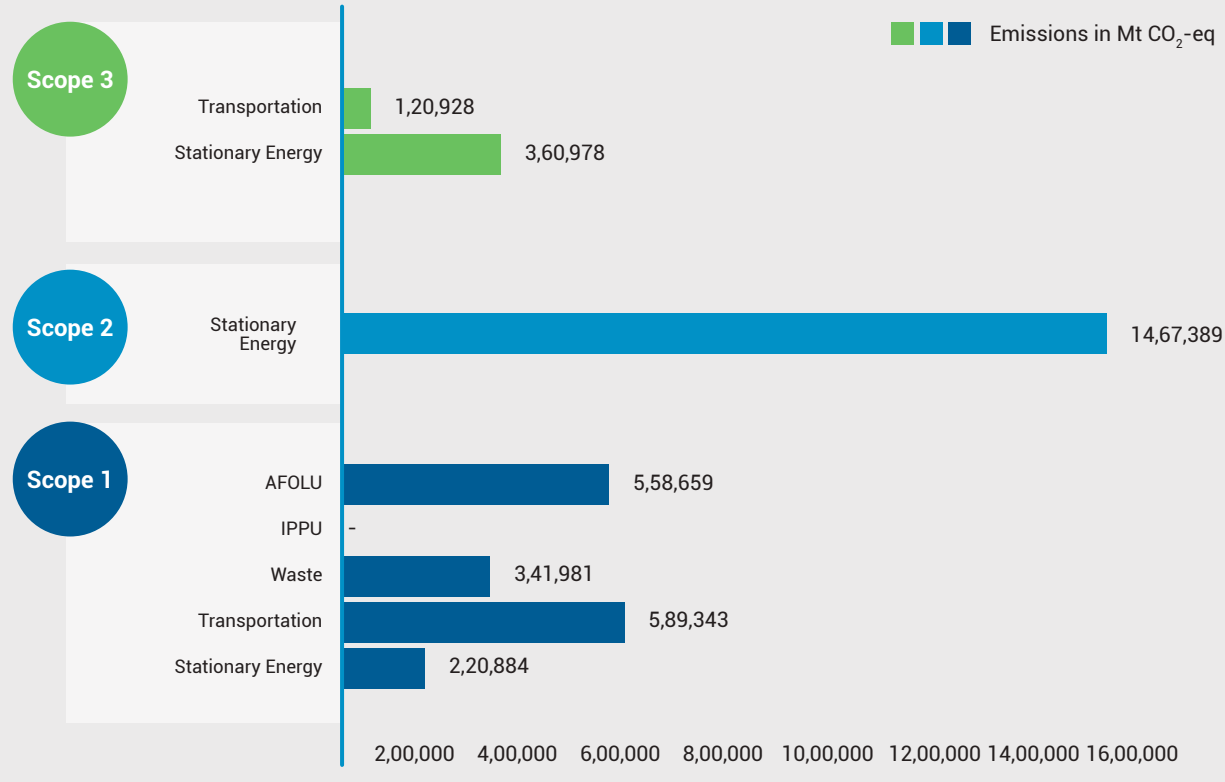
The agriculture class decreased by 6.76 per cent for the 2005–2017 period, effectively losing 38.71 sq. km. from the initial area of 279.21 sq. km. in 2005. The residential class, which represented 15.77 per cent (90.31 sq. km.) of the overall area in 2005, increased by 6.45 per cent, thus accounting for 127.2 sq. km. of the overall area by 2017.

## 4.3 GREENHOUSE GAS EMISSIONS PROFILE

In 2015-16, Bhopal emitted a total of 36,60,161 Mt $CO_2$-eq from stationary energy, transportation, waste, Industrial Processes and Product Use (IPPU), agriculture, forestry and other land use (AFOLU) sectors. The total $CO_2$, $CH_4$, and $N_2O$ emitted were 27,67,923 Mt, 27,286 Mt, and 484 Mt, respectively. Emissions under Scopes 1, 2, and 3 are summarized in Figure 4.3.

Emissions from stationary energy were the highest contributors of GHGs, accounting for 56 per cent of Bhopal city's total emissions. The transportation sector emitted 19 per cent and the AFOLU sector 15 per cent of the total GHG emissions in the city. Emissions from the IPPU sector were zero as there are no industries that can be classified as such in Bhopal.

**Figure 4.3:** GHG emission profile of Bhopal for 2015-16




Source: Estimates of District Domestic Product, Madhya Pradesh, 2019

[15] EO4SD-Urban Project: Bhopal City Report, Earth Observation for Sustainable Development, 2019, p - 23

## 4.4 SECTORAL CONTEXT

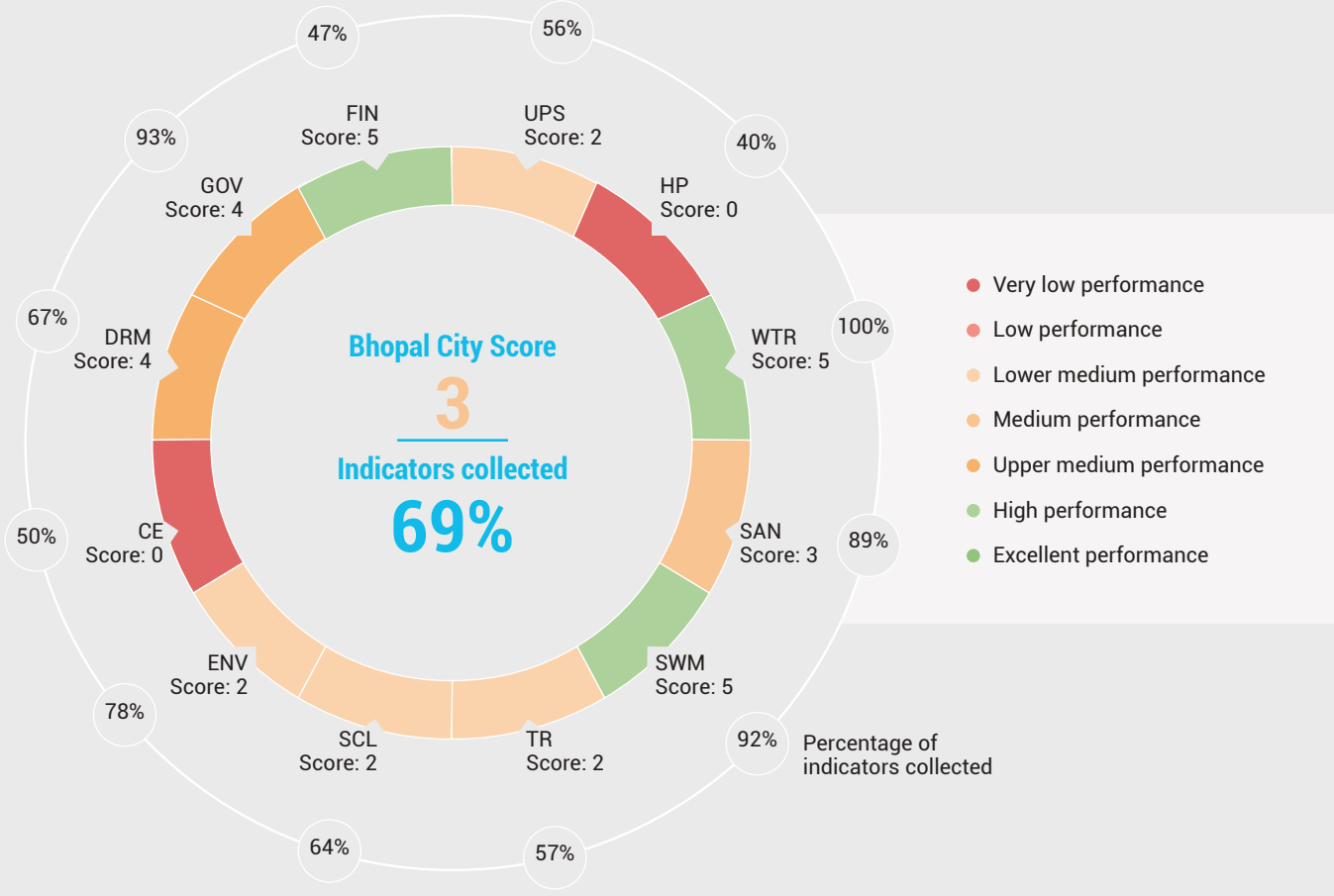
This section presents the key findings of Bhopal across 12 USAF sectors.

This section discusses the assessment of Bhopal over 12 USAF sectors – namely, public space, urban form and safety, housing and property, water, sanitation, solid waste management, clean energy, disaster management, environment, transport, social facilities and services, governance and data management, finance, and economy.

The overall performance of Bhopal is rated as three (medium performance) based on the data collected. Data for 69 per cent of indicators (91 out of the 131 indicators) have been collected and 83 per cent of all primary indicators have been collected. Water, Solid Waste Management, Finance and Economy, scoring highest, and Housing and Property, and Clean Energy, scoring lowest. The average performance of each sector is represented using the 7-point colour gradient as illustrated in Figure 4.4.

For the detailed performances of these sectors, refer to the Bhopal Urban Sustainability Indicators Report. The following sections present an in-depth evaluation of each of the sectors based on the USAF sustainability indicators.

**Figure 4.4:** Average performance and percentage of indicators collected for all sectors




Source: UN-Habitat

## 4.4.1 Public space, urban form, and safety

There are nine indicators in this sector, three of which are related to safety, two to urban form and the rest are related to public and open spaces in the city. Data for five out of nine indicators were collected for Bhopal.

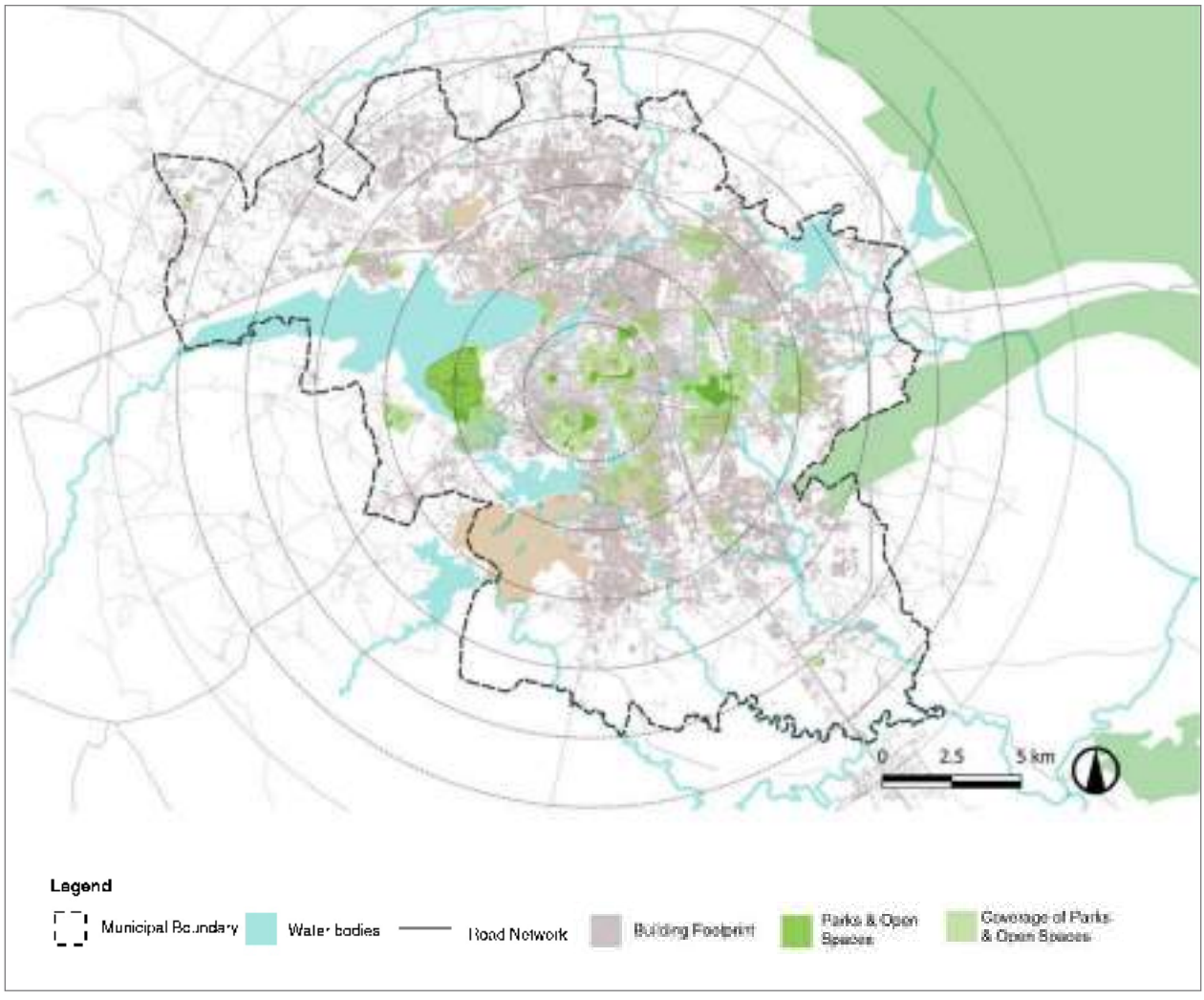
### Change in Built-up per Area over the Years

The built-up footprint increased to 86.6 sq. km. in 2014 over 68.6 sq. km. in 2000 (see Map 4.3). Built-up area per capita increased by three per cent from 47.3 sq. m. per person in 2000 to 48.7 sq. m. per person in 2014. As per the existing land use analysis in the Draft BDP 2031, around 87.63 sq. km. of land (20 per cent of the city area) is undeveloped as per the proposals notified under BDP 2005.

### Parks and Open Spaces

Bhopal is known for its Upper Lake lakefront development, which is a major tourist attraction. Lakefront developments on Lower Lake, Bhadbhada Lake and Shahpura Lake are iconic public space developments along with the water bodies. The Madhya Pradesh Tribal Museum, Indira Gandhi Manav Sangrahalaya and Van Vihar National Park are other major tourist attractions in the city. The total area of accessible, publicly managed parks is 5.3 sq. km. (1.3 per cent of the total city area). Around 25 per cent of the city's population have access to parks and open spaces within a 500 m. radius, which is lower than the URDPFI recommended accessibility of green spaces to 80 per cent of an urban population. The city offers 11.67 sq. m. of open space per person, which is at par with the URDPFI recommendation of 12 sq. m. open space per person.

Image 4.5: Boat Club, a major tourist attraction, is part of the lakefront development along Upper Lake Source: UN-Habitat




Map 4.5: Access to public parks and open spaces within a 500 m. radius

Source: UN-Habitat

## Safety

Around 83 per cent of the city roads have streetlights, which is lower than the benchmark of 100 per cent coverage of streetlights. BSCDCL and the Bhopal Police Department have installed CCTV cameras at major junctions and public spaces, which are monitored through the respective control and command centres.

## 4.4.2 Housing and property

There are five indicators in this sector for measuring the status of informal settlements and slums, as well as housing demand in the city. Data for two of these five indicators were collected for Bhopal.

In 2019, Bhopal accommodated around 4.3 lakh households across residential developments spread over 97 sq. km. (23 per cent of total city area). The city's residential sector is predominantly characterized by standalone bungalows with low density, low rise development; except for the old city and slum settlements, which are marked by high-density, low-rise development. The city has also been witnessing steady increase in high-rise, residential development along the transit corridors. The Draft BDP 2031 has proposed increasing the Floor Area Ratio (FAR) to 4.0 along the city's metro lines to promote high-rise, compact housing development.

## Ownership and Condition of Housing

As per Census 2011 (see Figure 4.5), around 68 per cent of households lived in their own residences and 66 per cent of such housing units were classified as being in good condition.

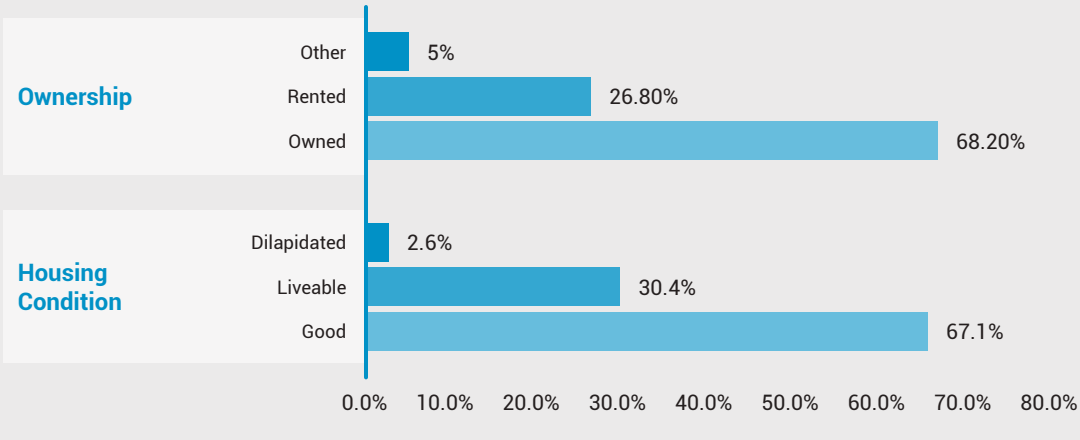
## Slums and Informal Settlements

Around 5.68 lakh citizens (30 per cent of the city population) from 1.56 lakh households (36 per cent of total households) in Bhopal reside in slums. Around 11 per cent of the city is covered by slums and informal settlements.

As per Map 4.6, Bhopal's slums are concentrated along the periphery of the old city near Idgah Hills, Jehangirabad and Shahjanabad; and near Ban Ganga, Pul Bogda and Ashoka Garden in the TT Nagar growth centre.

National housing schemes like the Pradhan Mantri Awas Yojana and Smart City Mission, as well as state housing schemes like the Chief Minister Awas Yojana, aim at providing houses to the urban poor. The city aims to provide 1.06 lakh housing units by 2022.

**Figure 4.5:** Housing characteristics in Bhopal

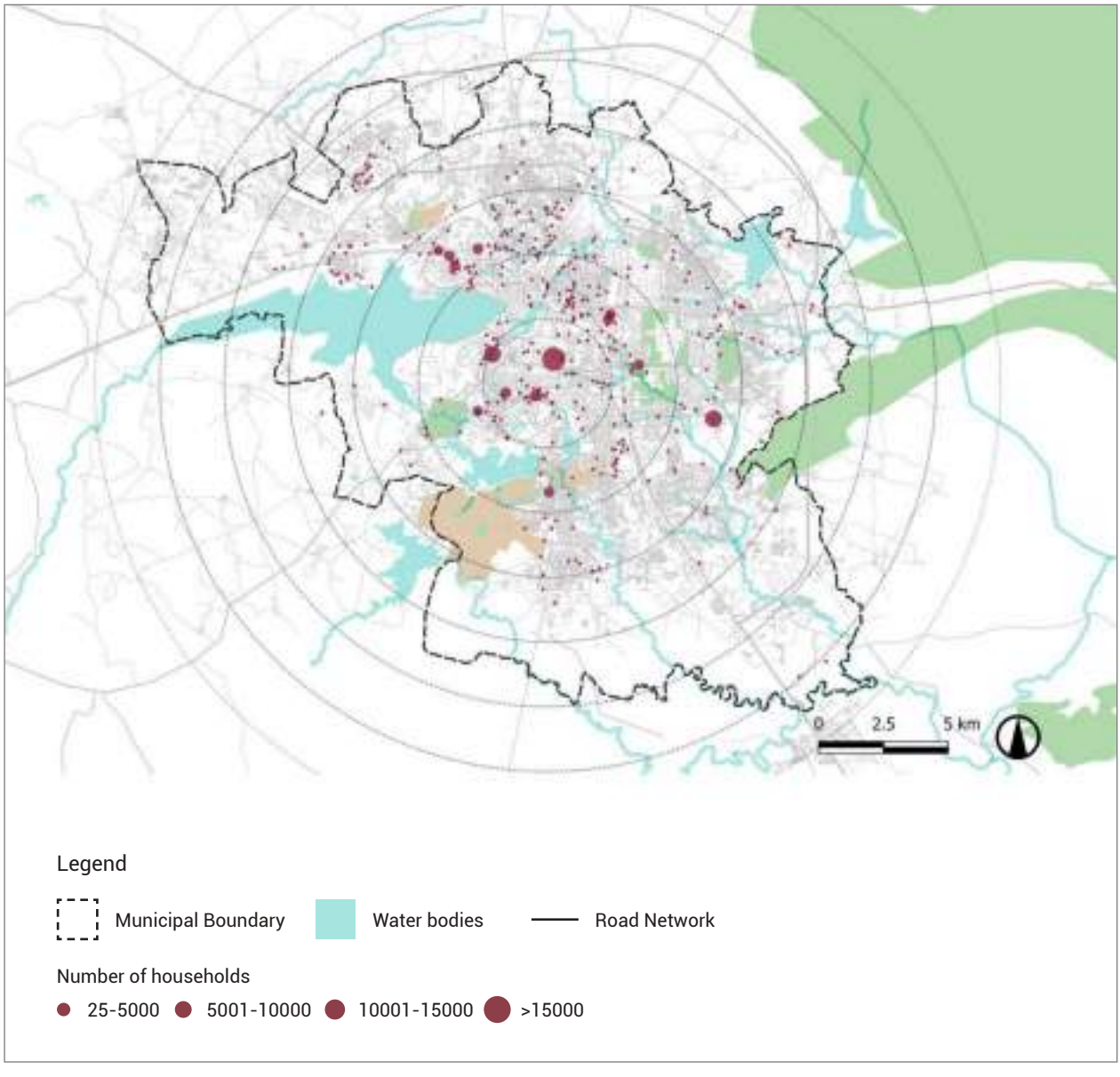



Source: Census 2011

**Table 4.3:** Growth of Bhopal's slum population

| Year | City Population | Slum Population | Slum Population % |
|---|---|---|---|
| 1961 | 2,22,948 | 9,000 | 4.0% |
| 1971 | 3,84,859 | 19,059 | 5.0% |
| 1981 | 6,71,018 | 14,763 | 2.2% |
| 1991 | 10,62,771 | 2,50,000 | 23.5% |
| 2001 | 14,58,416 | 4,80,000 | 32.9% |
| 2011 | 17,98,218 | 4,79,764 | 26.7% |
| 2019 | 19,23,000 | 5,68,424 | 29.6% |

Source: Census 2011 and BMC Housing




Map 4.6: Location of slums in Bhopal

Source: UN-Habitat

Note: The size of the slum marker corresponds to the number of households in the slum

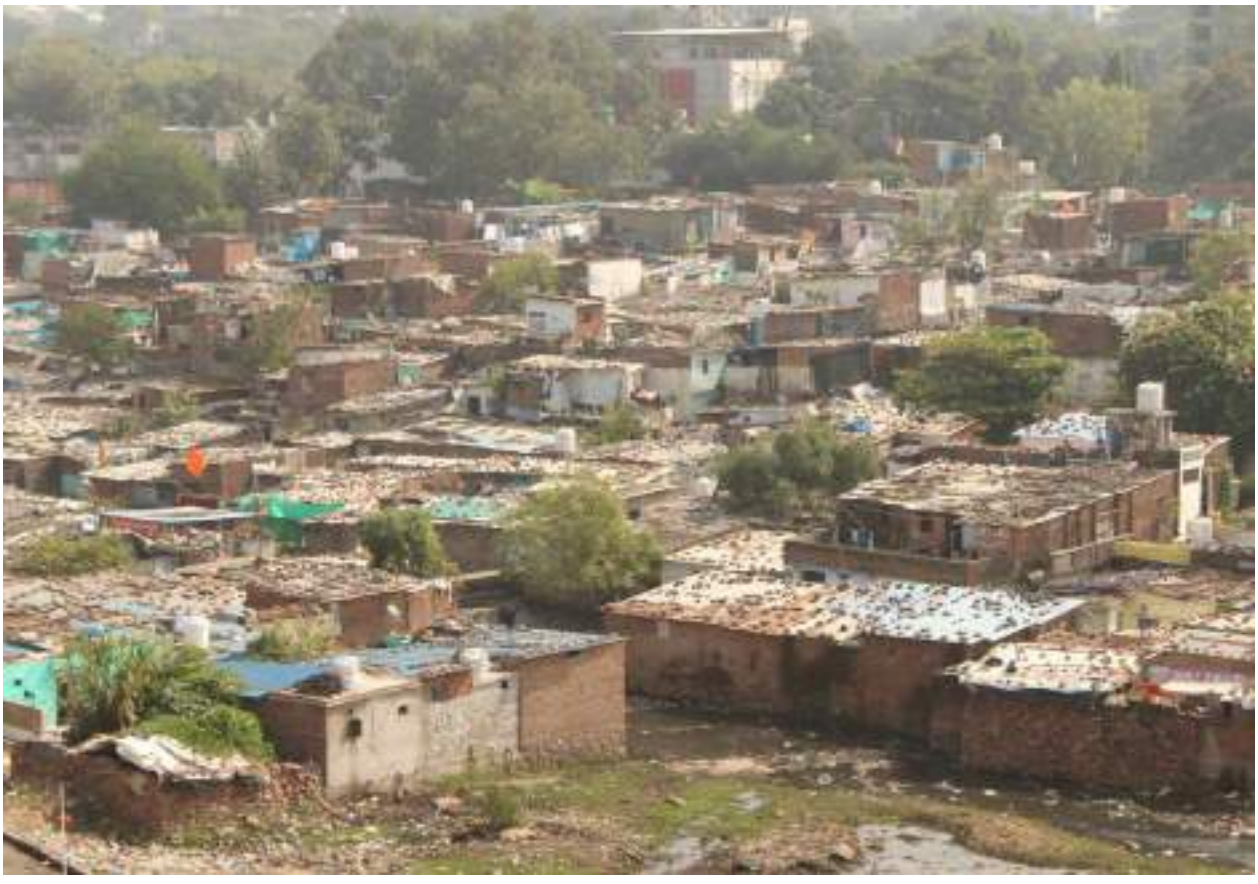


Image 4.6: Banganga Slum Settlement lies in the valley between Upper Lake and Lower Lake Source: UN-Habitat

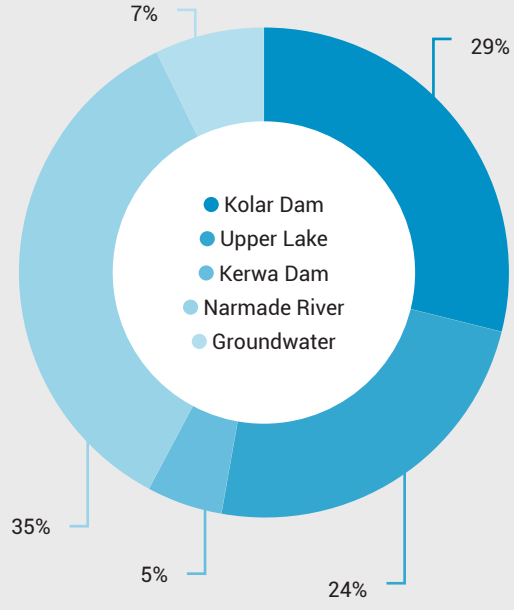
Image 4.7: EWS housing blocks under the RAY scheme in Nehru Nagar on the banks of Upper Lake Source: UN-Habitat

## 4.4.3 Water supply

There are six indicators to gauge water resource management in a city, including service coverage and efficiency in mapping households with piped connections, metered connections, and measuring the extent of non-revenue water in the city. Data for all six indicators were collected for Bhopal.

In 2019, the per day water supply requirement in Bhopal city was 530 MLD. As per Figure 4.6, 35 per cent of the city's water requirement is met by the Narmada River, which lies around 65 km away from Bhopal.

**Figure 4.6:** Different sources of water supply in Bhopal




Source: Draft BDP 2031

About 94 per cent of city's households have access to piped drinking water connections. The city supplies around 230 litres of potable water per capita, which is higher than the prescribed quantity of 135 litres per capita as per URDPFI guidelines.

Only five per cent of households in the city have metered piped drinking water connections, which is lower than the SLB 2018-19 target of achieving 100 per cent metering. Under Smart City Mission, smart metering of household water supply connections will be carried out. The extent of non-revenue water is 16 per cent, which is lower than the SLB 2018-19 target of 20 per cent. To further monitor wastage of water through transmission and operation, moreover, the Supervisory Control and Data Acquisition (SCADA) system is proposed under the Smart City Mission.

As per Madhya Pradesh Bhumi Vikas Niyam, 2012, to institutionalize rooftop rainwater harvesting systems, BMC charges rainwater harvesting fees, which may be refunded if the applicant effectively includes rainwater harvesting systems in the new development.

The city does not have a recent comprehensive water resource management report that maps the existing water resources, projects the future demand, and rationalizes the use of water.

## 4.4.4 Sanitation

There are nine indicators in the sanitation sector for assessing the performance of cities on coverage of sewerage network and toilet facilities, and industry compliance with wastewater treatment norms and guidelines. Data for eight of these nine indicators were collected for Bhopal.

Bhopal has a composite sanitation system, with both onsite and underground sewerage facilities for treating the liquid waste generated by the city. The topography of the city poses challenges for constructing a centralized city-wide sewerage network.

Around 14 per cent of the properties in the city are connected to underground sewerage and 60 per cent of households use septic tanks or twin-pit systems for disposing liquid waste. The older developments in the old city and areas adjoining the Upper Lake and Lower Lake are connected to the underground sewerage network. The informal settlements and new development along the periphery of the city are connected to onsite facilities.

The city generates around 308 MLD of wastewater, while it has a treatment capacity for 80 MLD (26 per cent of total sewage produced). Around 220 MLD (74 per cent) of wastewater is not treated and flows in the city's lakes and waterbodies.

The city has developed 156 public toilets and around 98 per cent of them are mapped. The city is currently augmenting the existing sewerage network under the Madhya Pradesh Urban Water Supply and

Environmental Improvement Project funded by the Asian Development Bank (ADB). The city also has ongoing projects to increase the sewerage network coverage and construct new treatment plants and pump stations at a project cost of INR 160 crore under AMRUT. Around 45–50 per cent of Bhopal city's properties will be connected to the underground sewerage network by 2022 after the implementation of both projects.

Image 4.8: Sewage inlet to Shahpura Lake for retention and oxidation

Source: UN-Habitat


Image 4.9: Flow of sewage into storm water drain near ISBT, Habibganj

Source: UN-Habitat

Image 4.10: Vacuum tanker emptying faecal sludge collected from onsite sanitation facilities at Kotra STP Source: UN-Habitat

## 4.4.5 Solid waste management

There are 12 indicators for assessing the state of solid waste management in a city, including the extent of scientific landfill sites, provision for treating hazardous waste and remediation of legacy waste in the city. Data for 11 out of the 12 indicators were collected for Bhopal.

Bhopal has been faring well in solid waste management, reflected in the Swachh Survekshan 2019 programme, when the city was awarded the 'Cleanest State Capital' in the country. The city generates around 980 tonnes of waste every day. The city uses 450 tipper autos for the door-to-door collection of waste and the coverage of this door-to-door service is close to 96 per cent, which is an excellent performance. Around 60 per cent of waste is segregated at source, before being further segregated and sent to respective treatment sites from six intermediate transfer stations across the city. Issued in 2018, the Bhopal Municipal Corporation Solid Waste bylaws govern the waste management operations in the city.

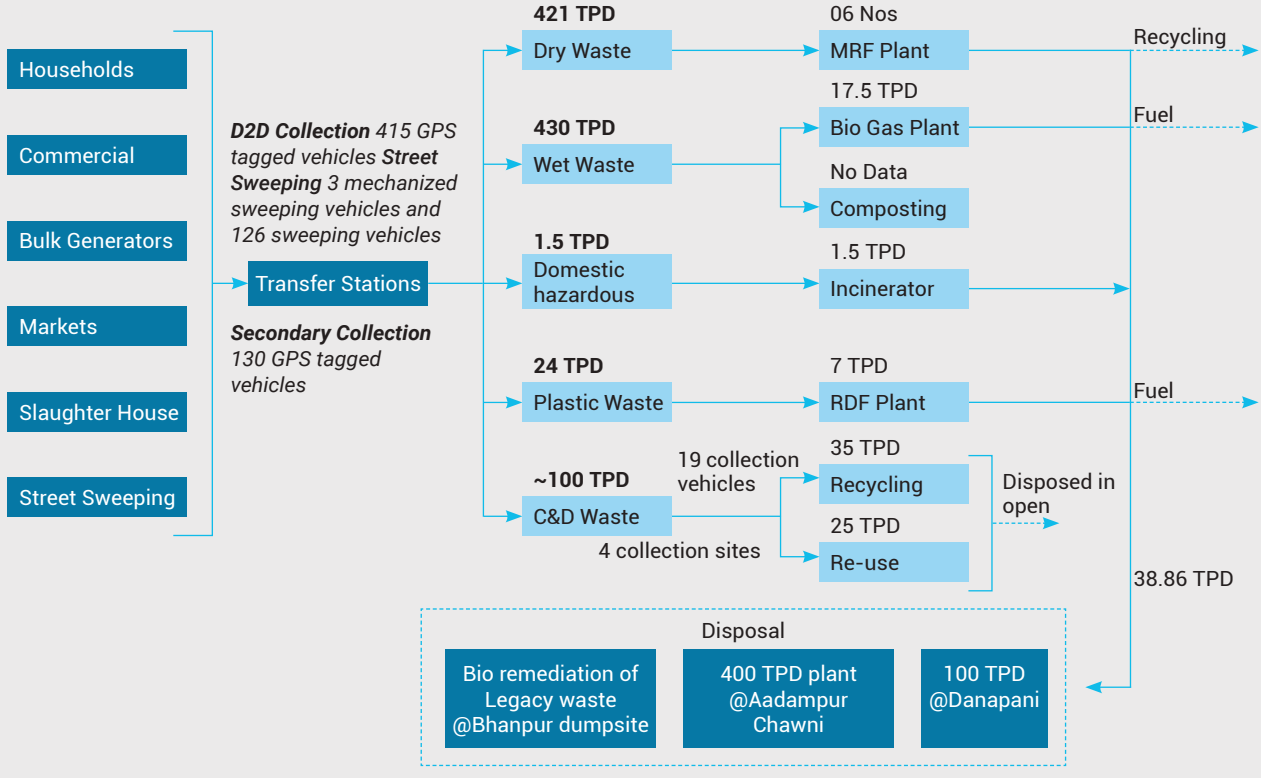
### Wet Waste Treatment

The city generates around 430 tonnes of wet waste, which is thoroughly segregated in transfer stations and sent to composting or bio-gas plants. The city has a total treatment capacity of 390 tonnes/day of compost at four different locations. There are also decentralized biogas plants with a total processing capacity of 67.5 tonnes/day at six locations. The biogas plant at Sukh Sevania has the highest processing capacity of 50 tonnes/day. BMC has also set up several onsite leaf composters at parks to treat waste and encourage home composting.

## Dry Waste Processing

The city generates around 420 tonnes of dry waste every day. The segregated dry waste from transfer stations reaches the Material Recovery Facility (MRF) where it is further segregated on the basis of the type of waste material, like plastic, glass, paper, tin, etc. There are nine MRF plants across the city with a current processing capacity of 580 tonnes/day. After segregating various kinds of dry waste, those with a high recycle value is sold while those with high calorific value are sent to Refuse-Derived Fuel (RDF) plants.

**Figure 4.7:** Flow chart of solid waste management process in Bhopal




Source: Swachh Bharat Mission Cell, BMC (2019)

## Domestic Hazardous Waste Treatment

The city generates around 1.5 tonnes of hazardous domestic waste. This is treated at a common bio-medical waste treatment facility.

Image 4.11: Scientific remediation of landfill site at Bhanpur

Source: BMC

## 4.4.6 Transportation

There are 15 indicators in the transportation sector to assess the status of public transport coverage, quality, safety features, and investments in environmentally friendly infrastructure by a ULB. Data for eight of these indicators were collected for Bhopal.

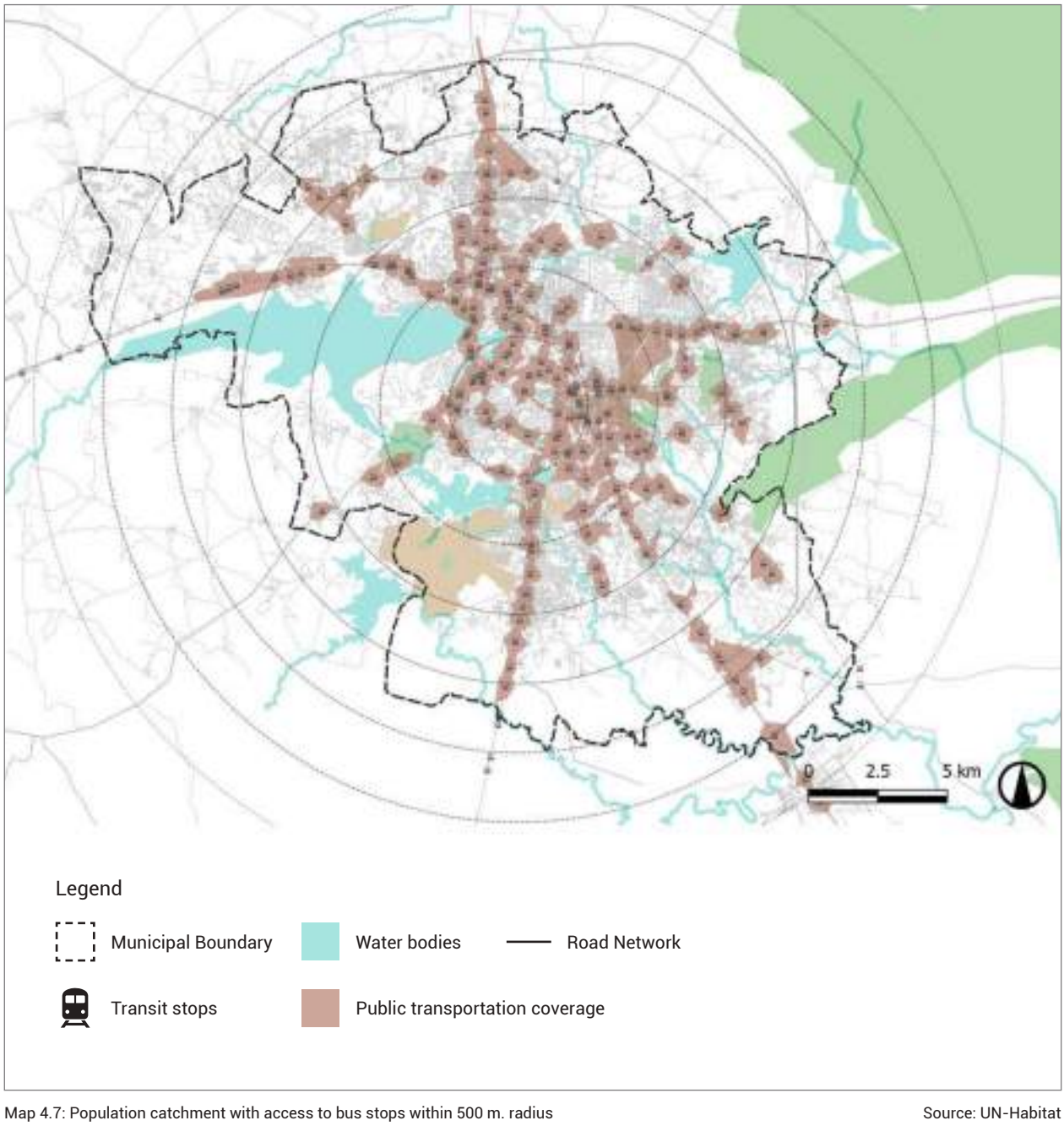
Bhopal is the educational and healthcare hub of the region. Intercity and intra-city transportation plays a vital role in connecting people with these facilities. The city has developed around 3,600 km of roads. The old city has narrow roads, while new areas have relatively broad roads, flanked by footpaths and landscaping.

**Around 54 per cent of the city's roads have footpaths wider than 1.2 m., which is lower than the benchmark of 75 per cent as per the Urban Transportation SLB.** Several ongoing developments, such as the construction of metro lines and augmentation of underground sewerage network projects create traffic blockades and detours. As a result, traffic congestion and commuting delays are prevalent in several parts of the city.

## Public Transportation

The city is developed along three transit corridors—the Bhopal–Indore Road to the West, the Bhopal–Raisen Road to the East, and the Bhopal–Hoshangabad Road to the South East. These transit corridors are the arteries of the city.

The city is fairly connected by a city bus transportation network, with 115 buses operating on 11 identified bus routes that span over 401 km. A dedicated 24-km lanes have been developed as a Bus Rapid Transit System (BRTS) corridor along the Bhopal–Indore and Bhopal–Hoshangabad roads. The city has around 11.26 km of public transit per 100,000 population, which earns it a 'medium' score on the benchmark of 40 km. The current public transport facilities provide 74 per cent of the city's population with access to transit stops within a 500 m. radius, earning it an 'upper medium' score in this sector.




Map 4.7: Population catchment with access to bus stops within 500 m. radius

Source: UN-Habitat

Magic vans or mini vans, a private transport service, are a major mode of intermediate public transport (IPT) in the city that operate on most bus routes. As per the Regional Transport Office (RTO), Bhopal Division, around 800 magic vans were operating in the city in 2018.

Under AMRUT, 600 new buses have been proposed to cater to the city's future demand for public transportation. About 50 per cent of these buses will operate on CNG; and the city is exploring the feasibility of including 100 new electric buses in its public transportation fleet.


Image 4.12: BRTS corridor near Ravindra Bhavan. The gates are manually operated to prevent entry of other vehicles

Source: UN-Habitat

Image 4.13: Magic vans or mini vans with diesel engines are a major mode of IPT in Bhopal

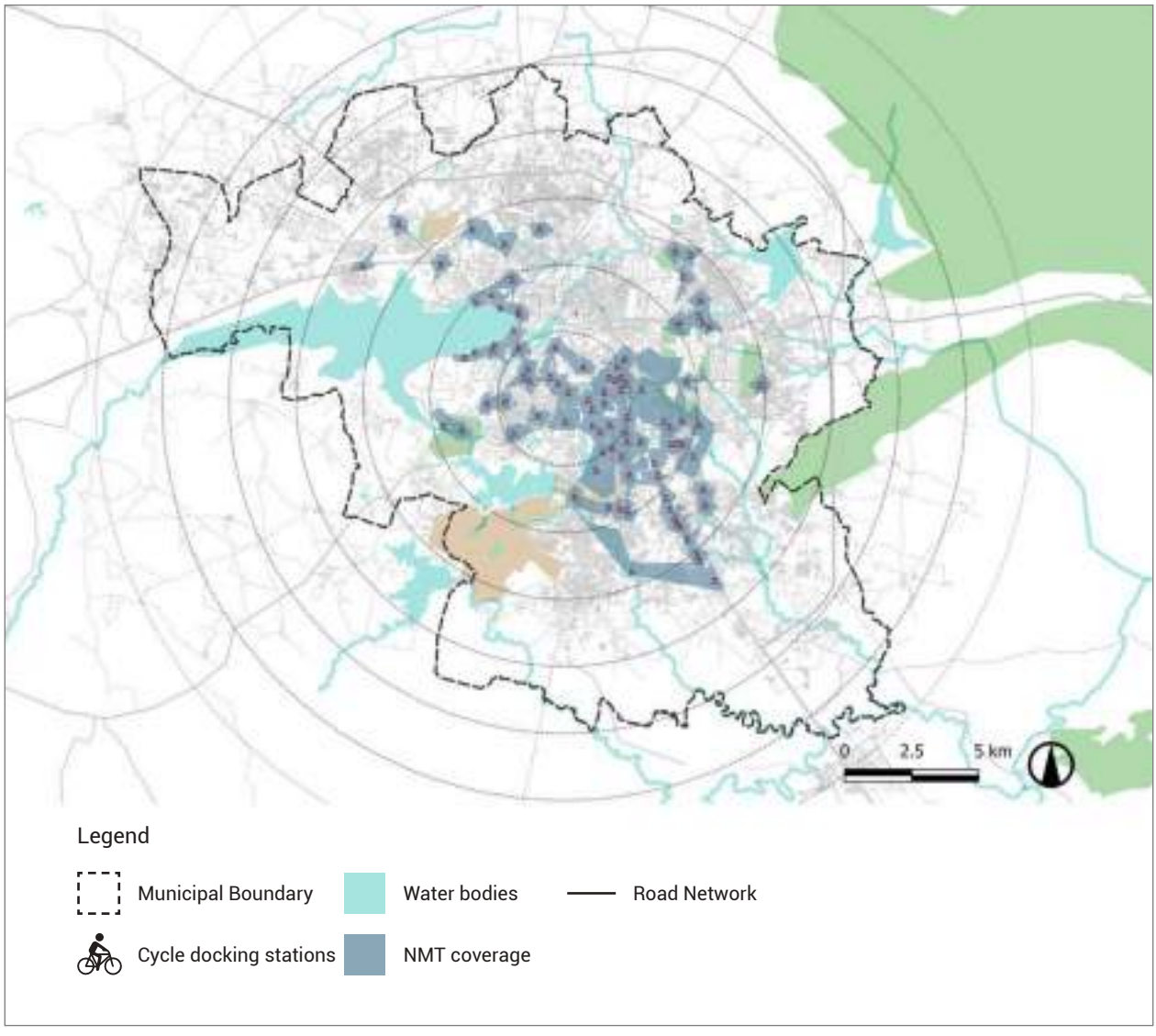
Source: UN-Habitat

## Non-motorized Transportation

Under the Smart Cities Mission, BSCDCL has constructed 22 km of a dedicated cycle track, which translates to 0.93 km of cycle tracks for every 100,000 people. This is very low for an urban area. Bhopal has implemented a public bike-sharing initiative called, 'Chartered Bike', implemented under a public–private partnership (PPP). There are around 500 GPS tagged cycles, accessible through smart cards, at 98 cycle docking stations across the city.


Image 4.14: Pilot electric vehicle charging points in ISBT, Habibganj

Source: UN-Habitat




Map 4.8: Population catchment with access to NMT docking stations within 500 m.

Source: UN-Habitat

Image 4.15: Designated cycle track on Science Centre Road near Smart City Hospital Source: UN-Habitat


Image 4.16: Chartered cycle docking station on Boat Club Road Source: UN-Habitat

## Metro Rail

There is a proposed metro rail system in Bhopal, which is being implemented by the MP Metro Rail Corporation Limited. The Central and state governments provide 20 per cent of funding each, while the remaining 60 per cent is procured as loans from international financial institutions like the European Investment Bank. Phase-1 of the development (Red and Blue lines), spanning over 28 km, is currently being constructed. The Red Line connects Karond Circle in North Bhopal to AIIMS in the East, and the Blue Line connects Bhadbhada Square in West Bhopal to Ratnagiri Tiraha in the East. Phase 1 is expected to be operational by 2023.[16]

## 4.4.7 Social facilities and services

There are 11 indicators for assessing a city's social facilities and services sector. Four relate to the demography, five to health and three to the status of education in the city. Data for seven of these indicators were collected for Bhopal.

## Demography

As per Census 2011, the decadal population growth rate of the city reduced by 14 per cent between 1991-2001 and 2001-2011. Moreover, the city had a dependant population of 48 per cent in the age groups of 0–14 years and above 65 years.

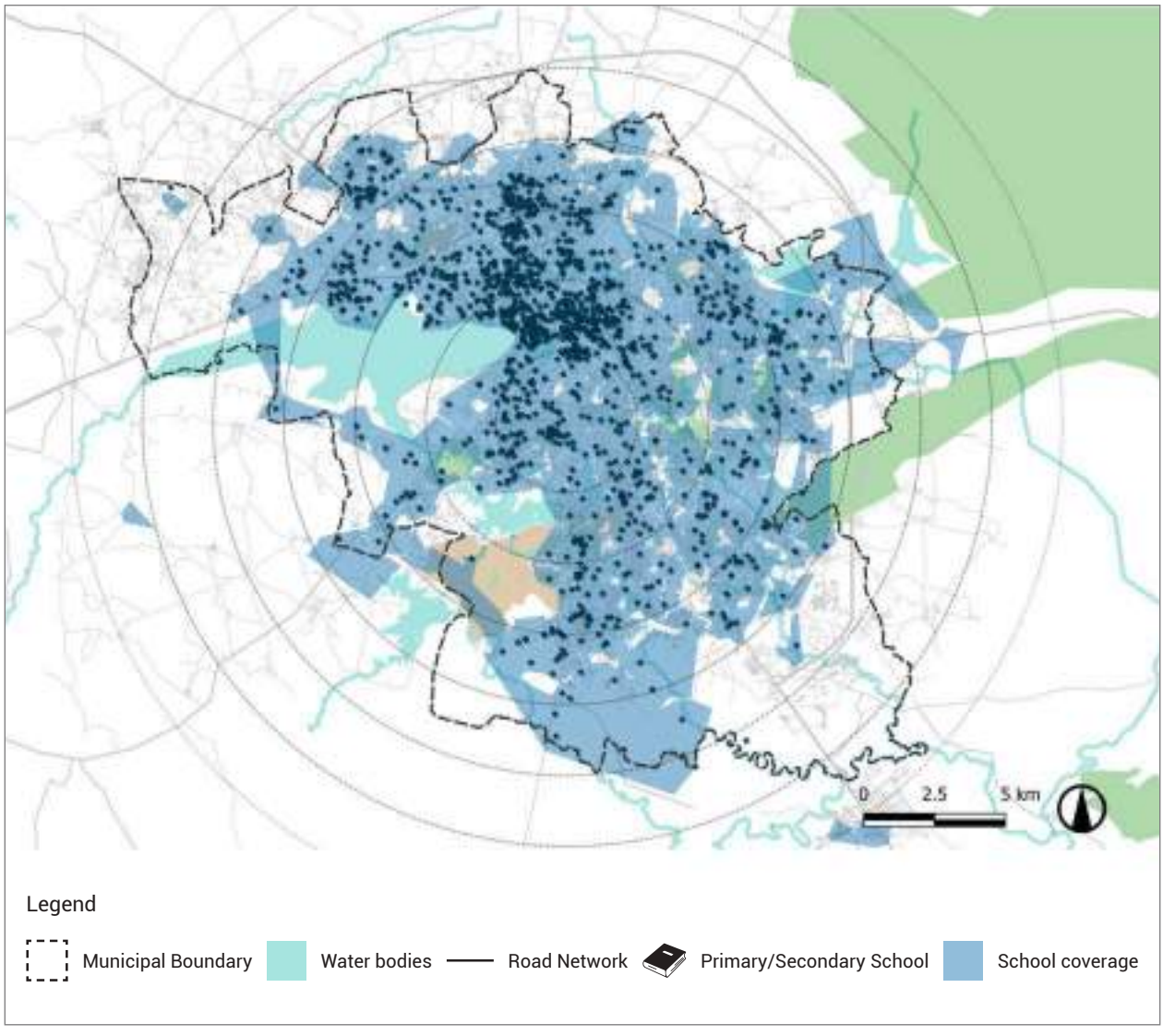
## Education

As per Census 2011, the city's female literacy rate was 79 per cent, which was lower than the national average of 82.8 per cent. There are around 1,600 public and private schools across the city, with around 92 per cent of Bhopal's residents enjoying accessing to them within an 800-m. radius of their homes. This earns the city an 'upper medium' score against the benchmark of 95 per cent of citizens having access to primary or secondary schools within walking distance of their residences.

The city is a higher education hub in the region and is home to institutions of national importance, viz., the Indian Institute for Science Education and Research (IISER), the Indian Institute of Forest Management (IIFM), the School of Planning and Architecture – Bhopal (SPAB), and the National Law Institute University (NLIU) to name a few. Barkatullah University and Madhya Pradesh Bhoj Open University are some of the state-level higher education institutes in the city.

The Department of School Education and the Department of Higher Education are the agencies responsible for provisioning and sustaining education facilities in Bhopal city.

[16] https://www.livemint.com/news/india/bhopal-indore-metro-state-government-signs-mou-1566298463293.html




Map 4.9: Population with access to schools with a 800 m. radius

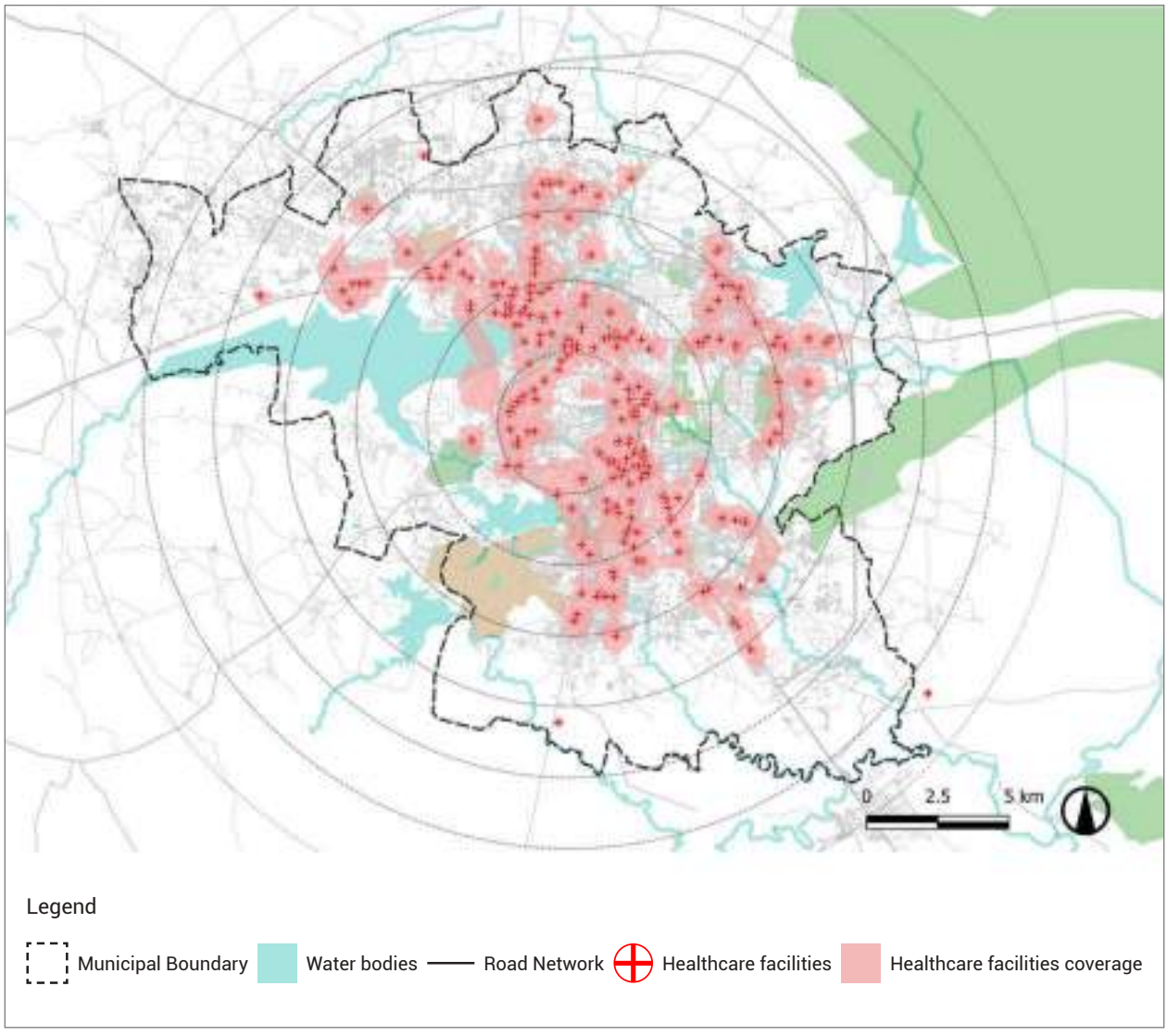
Source: UN-Habitat

## Healthcare

Bhopal has around 260 healthcare institutions, including primary healthcare centres and hospitals. The All India Institute of Medical Sciences (AIIMS), Bhopal, and Hamidia Hospital are major government-operated institutions in the city. Private sector participation is greater in the healthcare segment. Chirayu Hospital and Bansal Hospital are some of the major privately operated hospitals in Bhopal.

Around 82 per cent of citizens have access to healthcare facilities within an 800-m. radius of their homes. This earns Bhopal a 'low' score against the benchmark of 95 per cent of citizens enjoying access to the same, as per the Ease of Living Index 2018. The availability of hospital beds currently stands at 4.7 beds per 100,000 population, which is 'very low' compared to the benchmark of 25 beds per 100,000, as per the Ease of Living Index 2018.

Moreover, the city is prone to dengue and malaria outbursts during the dry season; around 1,008 cases of vector-borne diseases were reported in 2019. The Department of Public Health and Family Welfare is the primary agency responsible for providing healthcare services in the city.




Map 4.10: Population with access to healthcare facilities with 800-m. radius

Source: UN-Habitat

## 4.4.8 Environment and ecology

There are 18 indicators to examine whether a ULB has a clean air action plan, is equipped to measure major pollutants, and disaggregate emissions data to specific sectors. This is one of the most important USAF sectors. Data for 14 out of 18 indicators were collected for Bhopal.

As per the Project Completion Report for city-wise GHG Inventory by UNIDO, Bhopal's total emissions in 2015-16 stood at 36,60,161 Mt $CO_2$-eq from various sectors, such as stationary energy, transportation, waste, IPPU, and AFOLU. The total $CO_2$, $CH_4$, and $N_2O$ emitted by the city stood at 27,67,923 Mt, 27,286 Mt, and 484 Mt, respectively, equalling 36,60,181 Mt $CO_2$-eq.

The ambient air quality of Bhopal is monitored regularly by the Madhya Pradesh Pollution Control Board (MPPCB) under the National Ambient Air Quality Monitoring Programme (NAMP) at six locations in the city. Five stations are in residential and commercial areas, while one is in an industrial area. in this sector, mainly three parameters are monitored on a regular basis, i.e., Respirable Dust (RSPM), Sulphur Di-oxide ($SO_2$) and Oxides of Nitrogen ($No_X$).

In 2019, the annual mean air quality index of the city was 137.6, which was poor on the standard gradation (101-200) for ambient air quality. The annual mean level of PM10 was 113 µg/m$^3$, which was higher than the Central Pollution Control Board (CPCB) standard of 60 µg/m$^3$. The annual mean levels of PM2.5 was 51.8 µg/m$^3$, which was also higher that the CPCB standard of 40. Bhopal has been identified as a non-attainment

city for the pollutant PM10 parameter, exceeding the prescribed emission standards in 2019. As per the directions from CPCB and the National Green Tribunal, Central Bench, MPPCB has prepared a Clean-Air Action Plan for the city.

BDP 2005 includes conservation zones along the green–blue network in the city. At present, the conservation zones are not completely implemented or notified in the city as per BDP 2005. The Bhopal region is rich in biodiversity; and the MP Biodiversity Board is currently preparing the People's Biodiversity Register, through which the unique biodiverse species of the region can be accounted for and conserved. As per BDP 2005 and the Madhya Pradesh Bhumi Vikas Niyam, 2012, there are no incentives for promoting green building development in the city.

## 4.4.9 Clean energy

There are eight indicators to assess a city's current energy distribution network, coverage and stability, accessibility of households to natural gas for cooking, and current per capita energy consumption. Data for four of these indicators were collected for Bhopal.

**The city's stationary energy sector/ energy use emitted 16,88,273 Mt $CO_2$-eq, accounting for 56 per cent of the total GHG emissions in the city during 2015-16. The city's main source of energy is fossil fuels.** The percentage of total electrical energy in the city from renewable sources was less than one per cent (exact data was unavailable/ not collected). BMC has installed solar panels by the banks of Upper Lake, along VIP Road.

Under the Smart City Mission, 37 per cent of the city's conventional streetlights were replaced by energy efficient LED streetlights. The rest will be replaced under the Street Lights National Programme and convergence with the Smart City Mission.

Currently, the Madhya Pradesh Bhumi Vikas Niyam, 2012, does not have any provisions for promoting eco-friendly techniques and/or the use of local/ renewable materials through building codes/ bylaws.

Data for indicators such as energy use per capita (kWh), percentage of households with an authorized connection to electrical energy, and system average interruption frequency index were unavailable/ not collected.

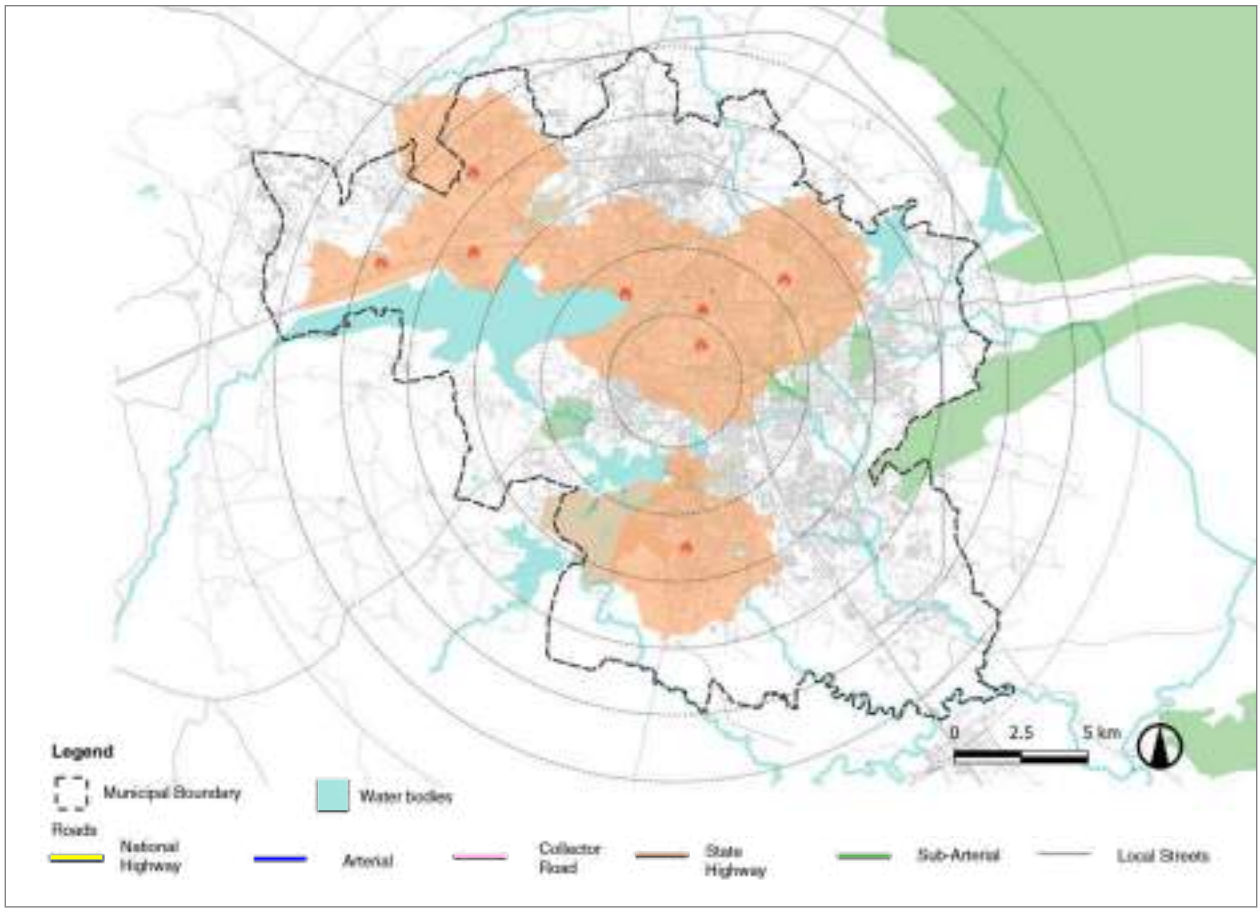
## 4.4.10 Disaster risk management

The Bhopal Gas Tragedy, an industrial disaster that struck the city on the night of 2 December 1984, killed more than 3,787 people and caused injuries to 5,58,125 more. The leak of the poisonous chemical, methyl isocyanate, from the Union Carbide India Limited pesticide factory caused a major industrial disaster in the country's history.

Bhopal is situated on the Malwa plateau and as per the Bureau of Indian Standards, Bhopal district is classified as a seismic Zone II or low damage risk zone. There have been no reported major earthquake events near the region and Madhya Pradesh Bhumi Niyam, 2012, includes required guidelines for earthquake-resistant development.

Bhopal receives around 1120 mm of average rainfall annually and the undulating topography of the city creates natural water channels, which drain the storm water into water bodies. Due to urbanization and encroachment of natural channels, the storm water builds up, unable to drain off, and causes urban floods in low lying areas. As per BMC, Gautam Nagar, Jamalpura, Indiranagar, Jagjivan Colony, Dharmapuri, Mahamai Bagh, Rajendra Nagar, Shahpura Lake's surrounding areas, Munshi Hussain's pond, and Motia Talab in North Bhopal are some of the areas affected by floods.

Bhopal District Collectorate is the nodal agency for disaster management at the district level and the District Collector is the nodal officer. BMC provides fire emergency services in the city through six fire brigade stations across the city. Around 67 per cent of the city's area has access to fire stations within a 4-km radius or a 10-minute drive. The city-level disaster management plan, prepared in 2018, has documented standard operating procedures during emergency, as well as guidelines for setting up early hazard warning systems. The city has not undertaken any hazard vulnerability and risk assessment mapping exercise. Although it has hazard early warning systems at the district disaster management centre, the warning systems are not integrated with the ULB command centre.




Map 4.11: Coverage of fire services within 4-km radius

Source: UN-Habitat

## 4.4.11 Governance and data management

There are 14 indicators to analyse the extent to which a ULB is effectively directing the planning and management of a city. Data for 13 of these indicators were collected for Bhopal.

The Bhopal city council is made up of 85 elected ward representatives, of whom 41 are women representatives (48 per cent).

As discussed earlier, BDP 2005 was prepared in 1999. In 2012, a Draft Development Plan 2021 was prepared, but was not approved by the Department of Urban Development and Housing. In 2019, as per AMRUT recommendations, TNCP prepared a GIS-based Draft Development Plan 2031. The approval and acceptance of the draft plan is pending. The development plan and building bylaws for the city are available online on the TNCP website at: http://mptownplan.gov.in/plan_bhopal.html.

Fifteen urban planners, working in the city, are associated with different organizations like BMC, TNCP, and BSCDCL. As per URDPFI guidelines, the city should have at least one planner per 14,000 population, whereas Bhopal has only 0.11 planners.

Under the Smart City Mission, a City Data Officer was appointed, and a command-and-control centre was set up for integrating various online services through the 'Bhopal Plus' mobile application. Services like property tax payment, water tax payment, request for birth and death certificates, citizen collaboration platforms, and citizen grievance redressal are integrated to the command centre.

Under the Smart Cities initiative, a draft city Data Policy was prepared whereby data is regularly shared on an open data portal hosted by the Ministry of Housing and Urban Development. The same can be accessed at: https://smartcities.data.gov.in/cities/Bhopal?filters%5Bogpl_module_domain_access%5D=3&filters%5Bfield smartcity%3Aname%5D=Bhopal&format=json&offset=0&limit=9&sort%5Bcreated%5D=desc.

Image 4.17: Control and Command Centre (IOCC) set up under the Smart City Mission at BSCDCL Office in Govindpura

Source: UN-Habitat

## 4.4.12 Finance and economy

There are 19 indicators for analysing this sector, with 13 indicators related to the status of municipal finance in the city and the remaining six indicators for assessing the performance of various economic factors. Data for nine of these 19 indicators were collected for Bhopal.

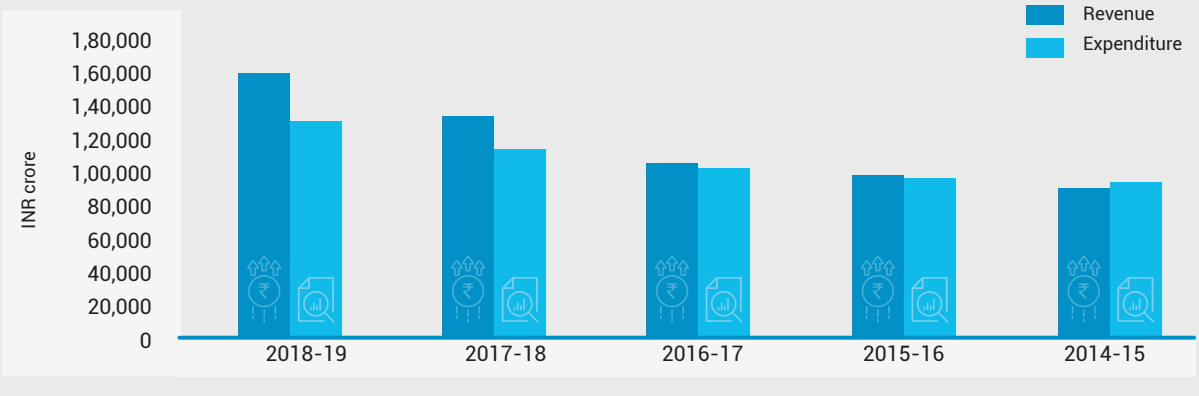
BMC was accredited with a 'AA' credit rating in 2019, which signifies stable and robust financial flow in the ULB. As per Figure 4.8 below, BMC's total revenue has followed a rising curve over the 2014-15 to 2018-19 period.

The total revenue of BMC in 2018-19 was INR 1,31,960 crore, which increased by 14 per cent over 2017-18.

For five years starting 2014-15, on an average, BMC has been generating 30 per cent of its own source revenue (OSR) annually. The tax collection efficiency of the ULB was 64 per cent in 2019, when INR 10,784 crore was collected as taxes. The total loans availed during 2018-19 was INR 32,443 crore, which was 25 per cent of the total revenues generated during the same period. Around 24 per cent of this total revenue was received as development grants from Central and state governments.

Madhya Pradesh does not currently practice estimating city level gross domestic product (GDP). Only the district level GVA is estimated, which constitutes sector-wise value added by the district. This is summarized in detail in Section 2.4.3.

**Figure 4.8:** Five-year comparison of total receipts and expenditure of BMC




Source: BMC Financial Statements

# 05

# Strategic Diagnosis

## 5.1 IDENTIFICATION OF KEY STRATEGIC ISSUES

Through the application of the USAF, subsequent exhaustive analysis of the results, secondary information gathered and stakeholder consultation, a few patterns, development trajectories and trends were identified. As illustrated in Section 4.2 earlier, strengths were observed in strong city governance and financial management which effectively provides improved basic civic services. The waste management initiatives in the city help to scientifically treat and dispose the waste and keep it clean. These initiatives collectively help Bhopal to achieve its higher goal of becoming a sustainable and resilient city. There are also areas where Bhopal is lagging behind and significant improvement is warranted. These include improvements in sanitation and sewerage infrastructure, which has a direct impact on underground pollution and that of surface water bodies. Further, the city needs more focussed attention in protecting its immediate ecosystem by applying disaster risk management tools.

There were other multi-sectoral issues as well that were deduced after careful analysis of the data. These are listed below and discussed in detail in the next section.

1. Sprawling urban development pattern
2. Endangered natural assets
3. Vulnerability in informal settlements
4. High dependence on fossil fuels and sub-optimal use of NMT

## 5.2 IN-DEPTH ANALYSIS OF KEY STRATEGIC ISSUES

### 5.2.1 Strategic issue 1: Sprawling urban development pattern

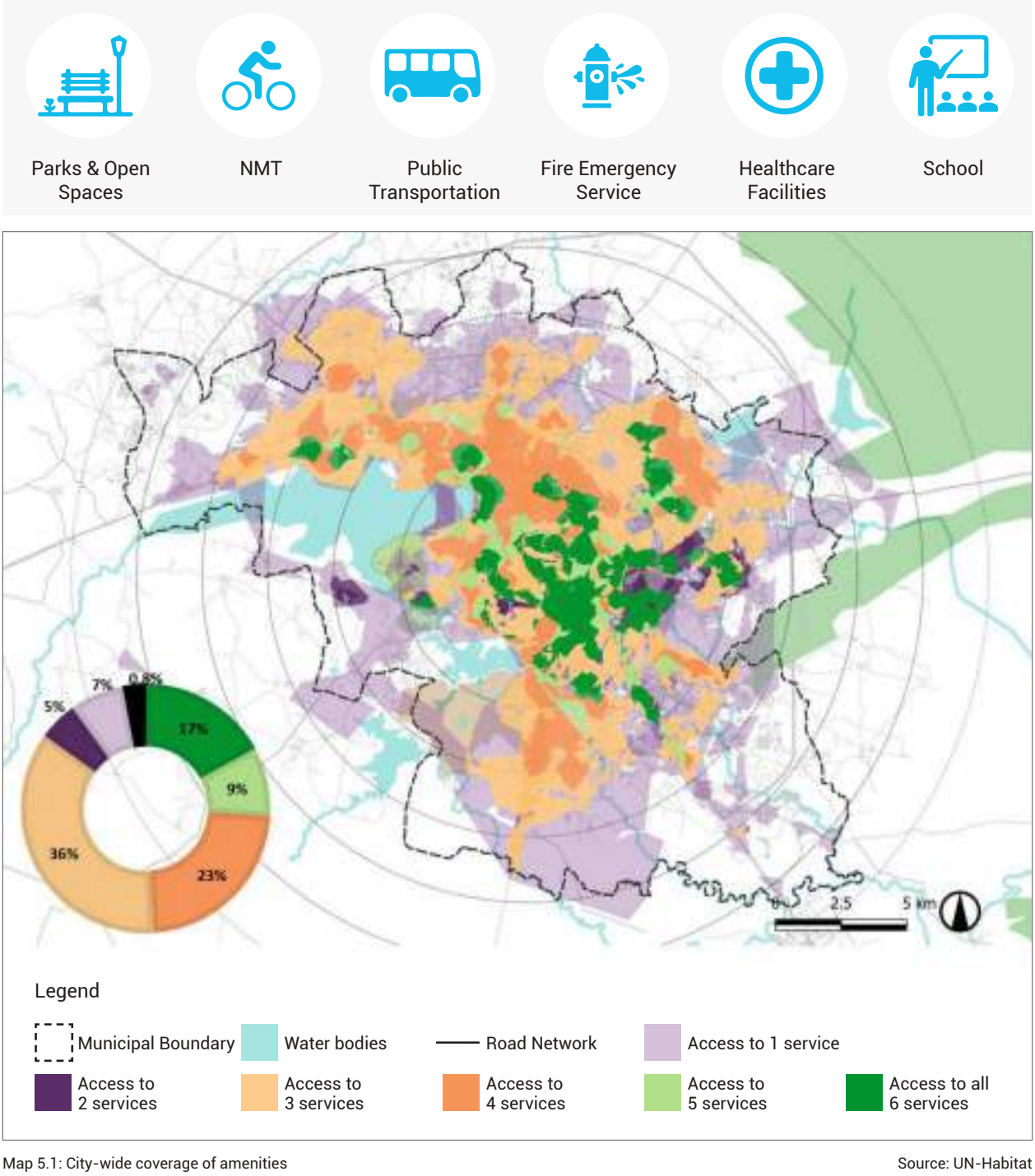
Bhopal is experiencing sprawling urban development resulting in low-rise, low density habitation, with loss of agricultural land along the fringes and high dependence on automobiles. The BDP 2005 has not been updated or revised for the last 15 years, which may have led to unchecked development in the city. The low population growth rate and increasing built-up area per capita during the 2001-2011 period are key indicators of the urban sprawl in the city. Frequent expansion of the administrative boundaries and opening of agricultural land along the city's fringes for development are the major concerns. Urban sprawl has emerged as the foremost issue based on findings of the urban sectoral assessment[17] and consultations with the municipal corporation, planning agencies, and grassroots organizations.[18]

[17] Urban Sustainability Assessment Framework was applied to 12 sectors integrated with spatial tools and USAF benchmarks/ thresholds along the synergies of other frameworks.
[18] Refer to the Stakeholder Consultation Report on City Profile and Diagnostics

Sprawling development patterns impact the access and coverage of infrastructure services, such as water supply, sanitation, solid waste management, public transportation, and housing. The services are concentrated in the city centre and gradually reduce towards the peripheries. Meanwhile, accessibility to social facilities like health and education is good across the city, including the peripheral zones.

With less population density along the periphery, the per capita cost of providing services also increases. Furthermore, according to draft BDP 2031, the land value at the centre of the city is at least 2.5 times higher than the land value in the peripheral areas, thus propelling the city to grow outwards in search of affordable housing by compromising on better access to services that are available near the core area.

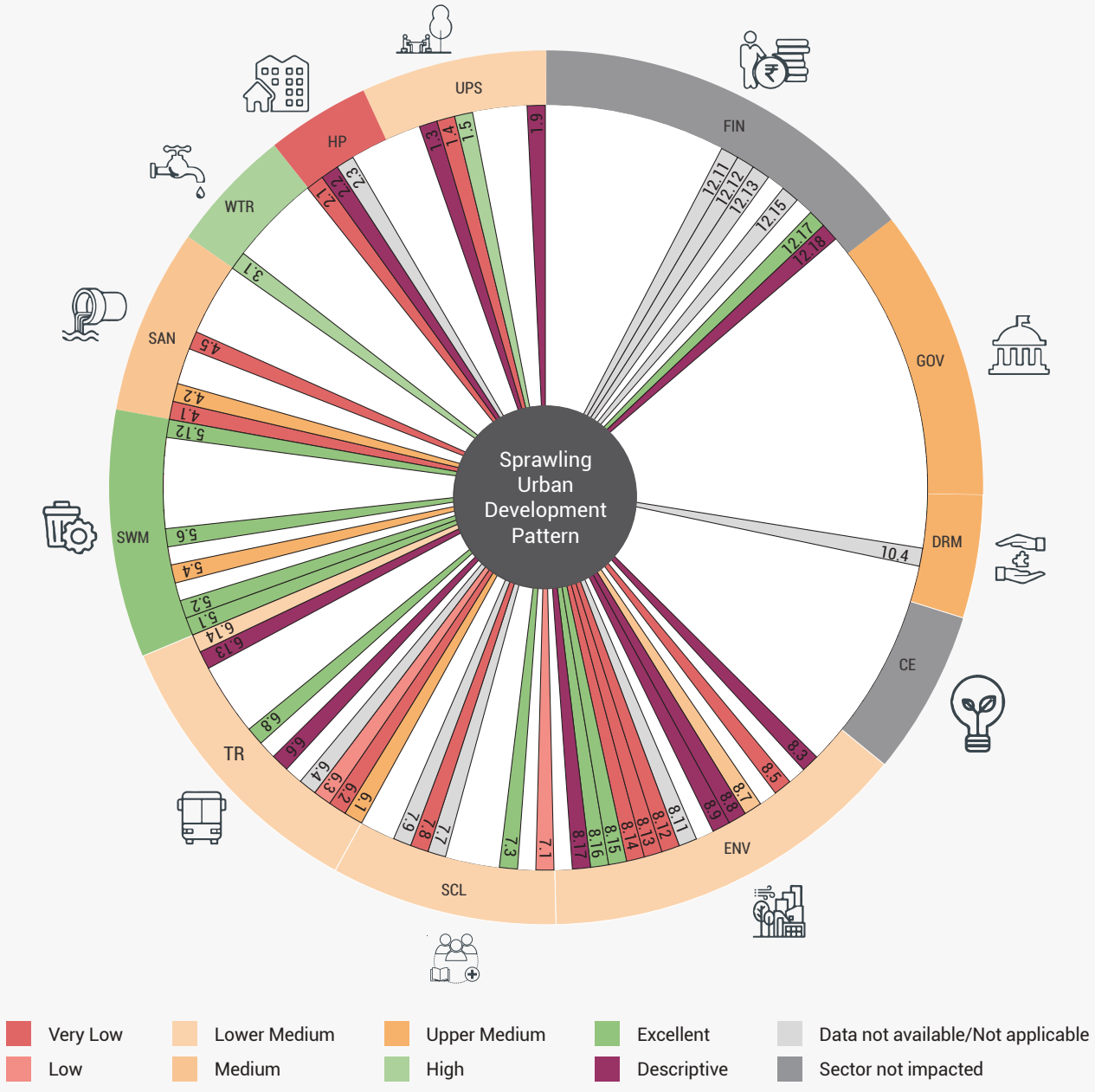
Urban sprawl is a complex issue that influences all the 12 sectors of the USAF. Mapping the interlinkages of the USAF sectors with the issue and the performance of 44 indicators across the 10 linked USAF sectors (see Figure 5.1), indicate that the city's performance in the transportation sector has the most influence on the issue, followed by the urban form, public space, and safety sector. See Annexure 5.1 for the application of urban sectoral assessment and impact across all indicators.




Map 5.1: City-wide coverage of amenities

Source: UN-Habitat

**Figure 5.1:** Interlinkage of urban sprawl issue with USAF indicators




Source: UN-Habitat

## Key Inferences

- High density core; low density growth rapidly expanding away from core
- Increase in administrative boundary does not correspond with population growth
- Services are concentrated in the core and the accessibility reduces as the distance from the core increases
- Significant ribbon development along transit corridors in North (Ayodhya Byepass), South (Hoshangabad Road) and East (Raisen Road)

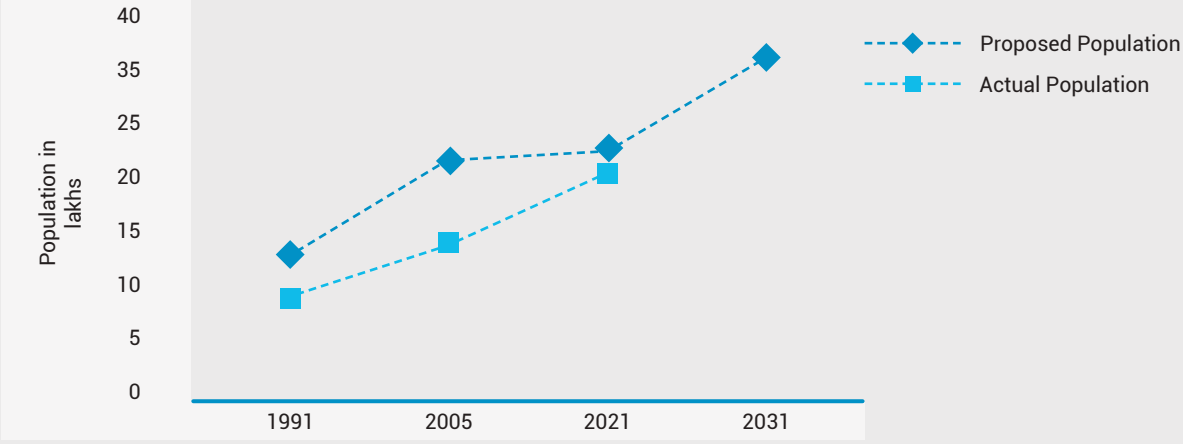
## Unmatched Population Growth with City Boundary/ Area

The city has witnessed a declining trend in decadal population growth. The highest recorded decadal growth rate was 74 per cent in 1971-81 and the average population density was 94.2 PPH. BDP 2005, prepared in 1995, expected 58 per cent growth in the city's decadal population, with a population of 25 lakh by 2005.[19]

The city witnessed a decline in decadal population growth by 14 per cent between 2001-2011 and 1991-2001 (SCL 7.4). In 2011, the city's population was 19.98 lakh with an average population density of 63 PPH.

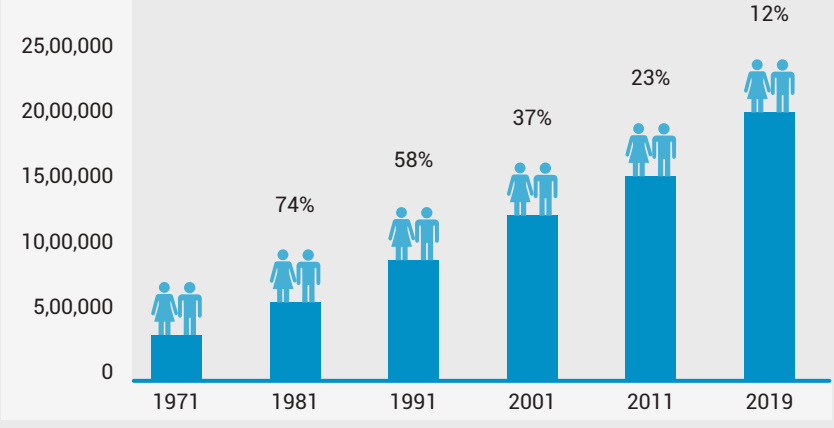
By 2005, the area of BMC increased four times to 285 sq. km. from 71.23 sq. km., to accommodate the additional population growth, which did not occur. In 2014, the city's boundary was again increased to 417 sq. km. to include Kolar Census town within BMC's administrative area.

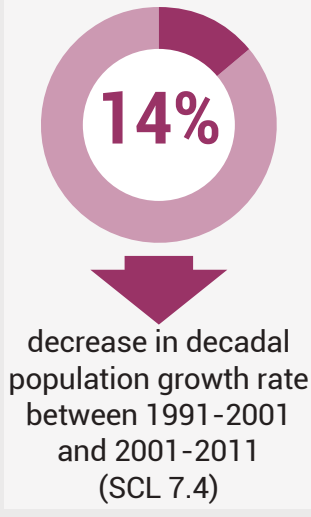
**Figure 5.2:** Comparison between proposed and actual population




Source: UN-Habitat

**Figure 5.3:** Change in decadal population growth rate




Source: UN-Habitat

[19] The BDP 2005 was prepared for a total planning area of 601 sq. km., while BMC's area is 417 sq. km. Draft BDP 2031 has proposed increasing the planning area to 1,016 sq. km.

Image 5.1: Dense built form in Koh-e-Fiza, situated on the northwestern banks of Upper Lake Source: UN-Habitat

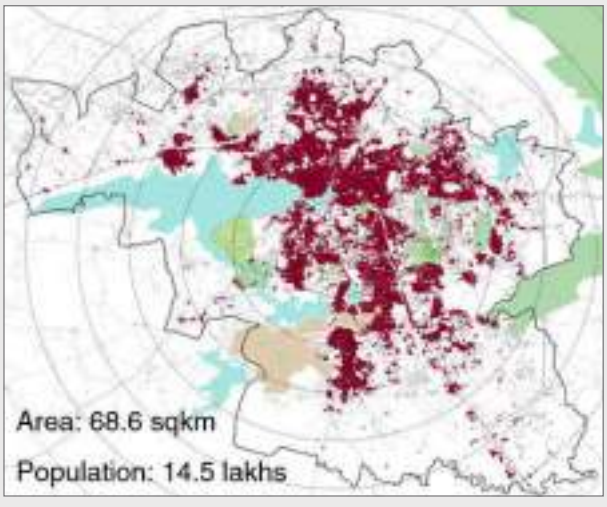
## Built Footprint Expansion

The built footprint analysis of Bhopal reveals a wave-like pattern in urban expansion, defining the spatial growth of the city. The first wave of urban expansion took place during 1975–2000 when the average annual growth rate of Bhopal city's built-up footprint was 10.4 per cent. The rate of expansion of the city declined during 2001–2005 due to the division of the state. The second wave of spatial expansion was during 2005–2018 when the average annual growth rate of the city's built-up area was 12.1 per cent.

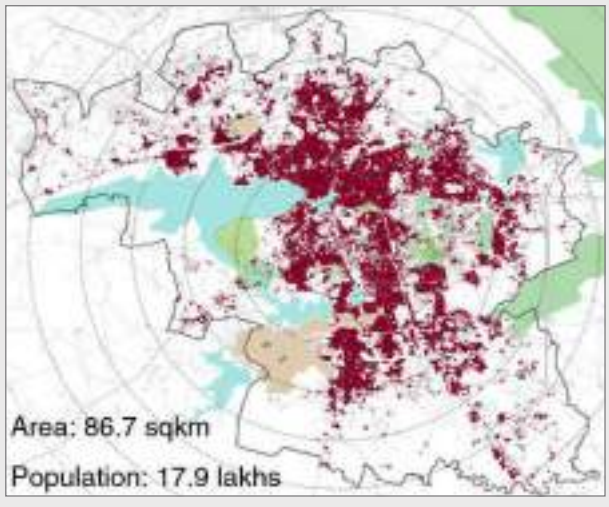
New development in the city is predominantly in the southern micro-market, along the Hoshangabad Road corridor. Factors like proximity to industrial estates, flatlands, and improved transit corridors provide an apt location for residential development. Large-scale construction of high-rise residential buildings by private developers is prevalent in the region, developed on land marked for predominantly agricultural use. These hinterlands lack adequate physical trunk infrastructure, public transport connectivity, and organized public spaces. Similar development is prevalent along the Ayodhya Byepass Road in North Bhopal, and Raisen Road in the East, resulting in ribbon development along the city's transit corridors. Growth in the south-western micro-market is limited by natural features. However, low density development, along Kaliasot Dam, Kaliasot River and Kerwa Dam like bungalows and farmhouses, is increasing in recent years, challenging the balance of eco-sensitive assets in the city.

**Figure 5.4:** Built-up area analysis of Bhopal

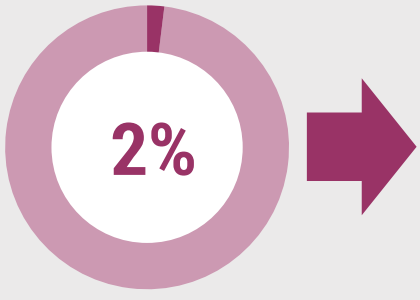
**Built-up in 2000**




**Built-up in 2014**




Source: UN-Habitat



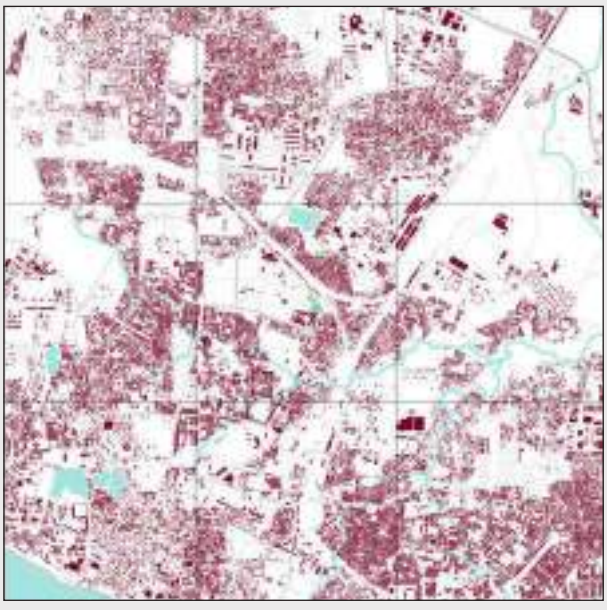

increase in built-up per capita between year 2000 and 2014 (UPS 1.2)

## Urban Morphology Analysis

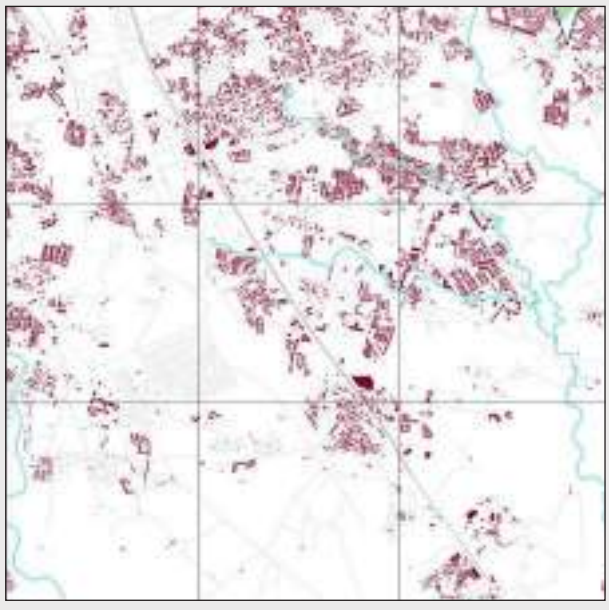
An urban morphology analysis was conducted by examining two area swatches (9 sq. km. each), one from the old city (city swatch) and the other from Bhopal's peripheral zone (peripheral swatch). Both these swatches were measured in terms of road density and built footprint ratio, which revealed the road density to be 2.2 times higher and the built footprint to be five times higher for the city swatch than the peripheral swatch.

**Figure 5.5:** Urban morphology analysis to understand the distribution of built footprint in the city

City Swatch



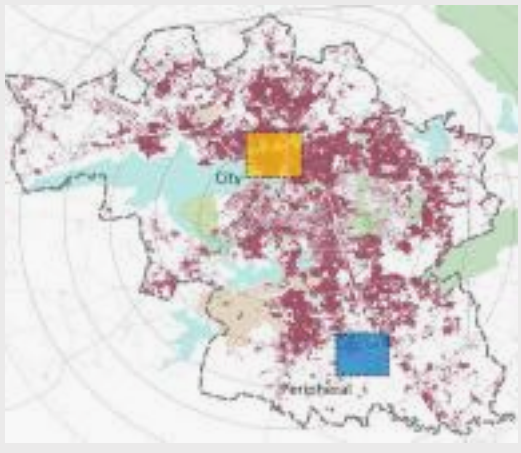
Peripheral Swatch



Source: UN-Habitat

**Table 5.1:** Comparison of city swatch and peripheral swatch

| | City Swatch | Periphery Swatch |
|---|---|---|
| Area (sq. km.) | 9 | 9 |
| Road Length (km) | 257 | 116 |
| Road Density (km/sq. km.) | 28.5 | 12.9 |
| Built Footprint (sq. km.) | 3.8 | 0.8 |
| Built Footprint Ratio | 42.2% | 8.8% |



Source: UN-Habitat

## Land Carrying Capacity

As discussed in Section 4.2.4 above, the old city is Bhopal's densest area, where around 60 per cent of the wards have a population density of less than 150 PPH, with scope for further densification. According to UN-Habitat's five Principles for Sustainable Urban Development, the recommended density for developing compact cities is 150 PPH. If UN-Habitat's recommendation is applied to the present conditions of Bhopal's low density, built environment and available vacant land, it can accommodate an additional population of 10 lakh.

**Table 5.2:** Land carrying capacity of Bhopal

| Population of the city in 2019-20 | 23,71,000 |
|---|---|
| Area of the city in sq. km. | 417 |
| Current gross population density (PPH) | 56.8 |
| Area of protected land as per BDP 2005 (sq. km.) | 192 |
| Net land available for development (sq. km.) | 225 |
| Current net population density (PPH) | 105.37 |
| Additional population required to reach 150 PPH | 10,04,000 |

Source: UN-Habitat

## Proposed Spatial Development as per Draft BDP 2031

Draft BDP 2031 was prepared for the city, anticipating an urban population of 36 lakh in 2031 at a 36 per cent decadal growth rate. The plan proposes the development of the city with a gross population density of 100 PPH. To accommodate an additional 13 lakh, around 70 sq. km. of existing agricultural land within the municipal limits of the southern and western micro-markets were proposed for residential land use. As per the existing land use analysis, only 65 per cent of the proposed land under residential use were developed. The existing land under residential use is 97.19 sq. km. The total residential land use proposed in the Draft BDP 2031 is 365.8 sq. km., which is 3.7 times higher than the residential land use under BDP 2005.

## High Automobile Dependency and Poor Air Quality

With increasing sprawl in the city, the newly developed areas have low or no access to public transportation. Bhopal has experienced tremendous growth in the number of private vehicles registered in the city from 2005 to 2015, when the average rate of vehicular growth has been 10 per cent per year. The city has around 835 diesel-operated minivans or magic autos, which offer feeder services and augment access to the city's public transportation network in the peripheral zones. With increasing dependence on private vehicles and the burning of fossil fuels, the concentration of PM10 is increasing in the ambient air.

The Central Pollution Control Board has classified Bhopal as one of the 100 non-attainment cities under the National Clean Air Programme, due to high concentrations of PM10. PM10 residue arises mainly through emissions from automobiles, burning of fossil fuels, and infrastructure development activities in the city. The Madhya Pradesh State Pollution Board has prepared a Clean Air Action Plan and has strategized projects to reduce PM10 emissions in the city.

## 5.2.2 Strategic issue 2: Endangered natural assets

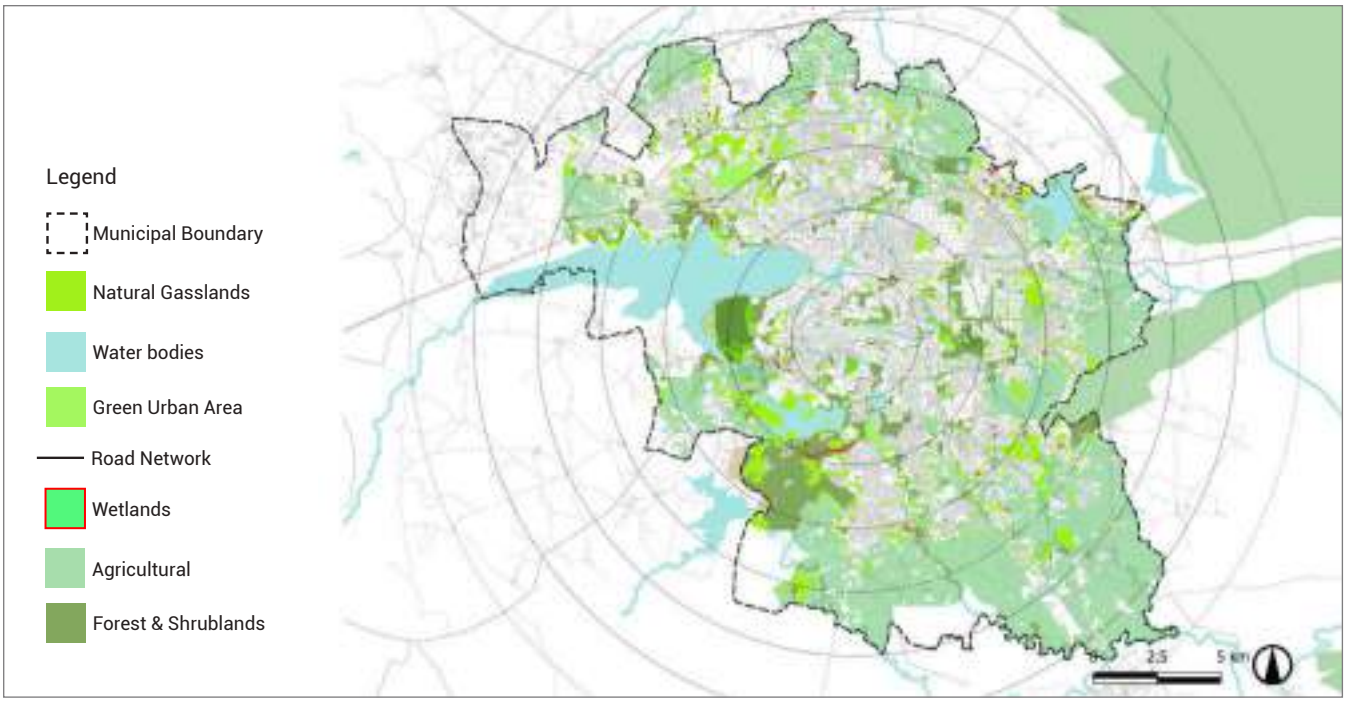
As discussed, Bhopal is endowed with natural assets like lakes, rivulets, forest reserves, and wetlands. The city's increasing urbanization poses challenges to the delicate balance of its eco-sensitive natural assets. Factors like unchecked urban development, urban sprawl, lack of formalization of forest typology, and lack of action for the preservation of local biodiversity have resulted in the endangered status of natural assets. This stress on the environment was highlighted during the USAF sectoral assessment, stakeholder consultations[20], review of newspaper articles and legal case proceedings by the National Green Tribunal (NGT).

As per the Land Use and Land Cover (LULC) analysis of the satellite imagery obtained for Bhopal from the Earth Observation for Sustainable Development Project, European Space Agency (see Map 5.2), around 216 sq. km. of eco-sensitive green area is present in the city. Agricultural landforms are a major component, forming 33 per cent of the city area (see Table 5.3). Similarly, around 10 per cent of the ULB area is covered by forests and shrublands.

**Table 5.3:** Summary of green area in Bhopal

| Land use | Area in sq km | % of Green area | % of City area |
|---|---|---|---|
| Agriculture Land | 136.15 | 62.8% | 33.0% |
| Forest & Shrublands | 41.71 | 19.3% | 10.1% |
| Green urban area(accessible) | 5.31 | 2.5% | 1.3% |
| Natural grasslands | 29.65 | 13.7% | 7.2% |
| Sports & leisure | 2.34 | 1.1% | 0.6% |
| Wetlands | 1.51 | 0.7% | 0.4% |
| Total green area | **216.67** | | |

Source: UN-Habitat

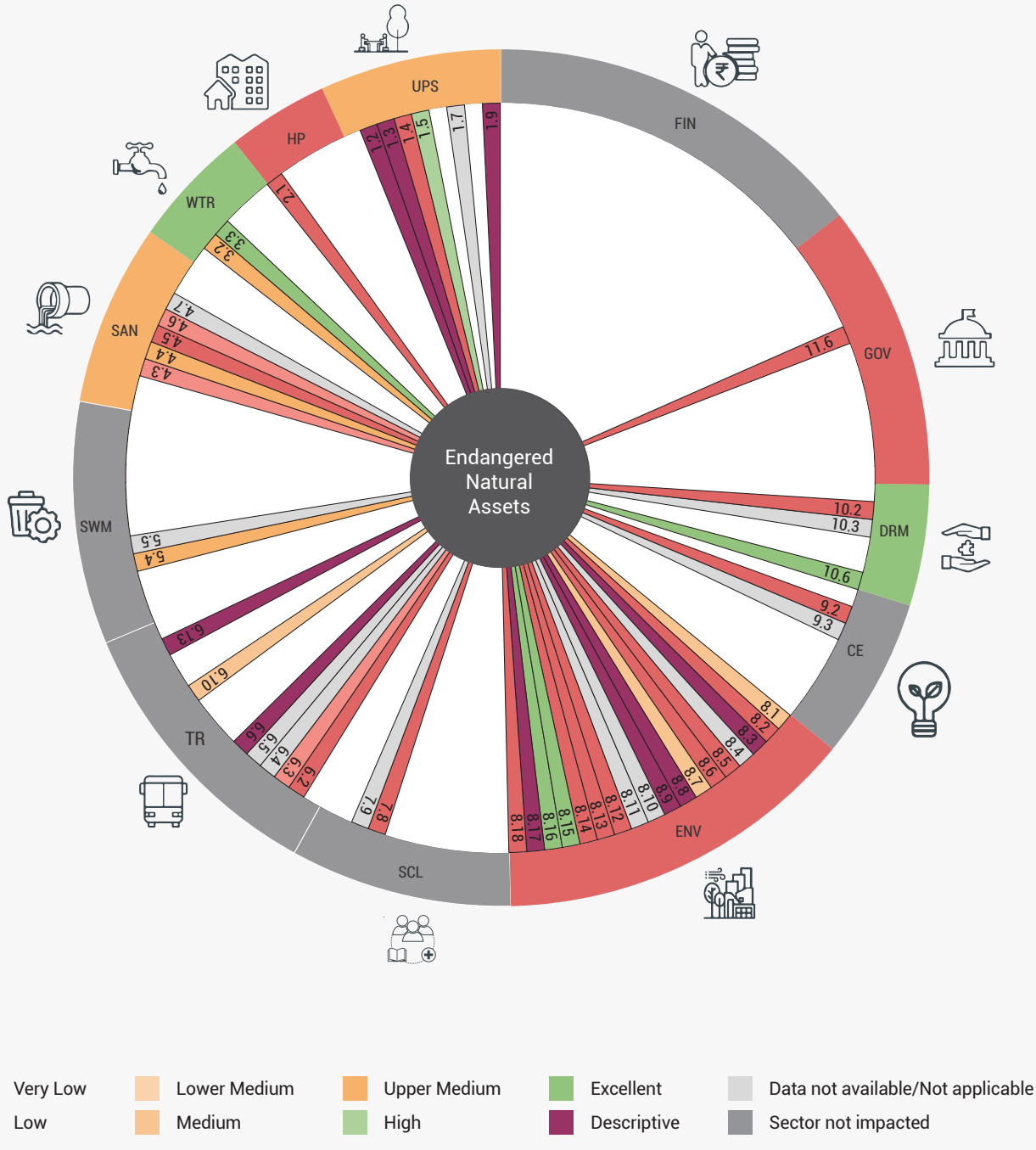



Map 5.2: LULC classification of green areas in Bhopal

Source: European Space Agency

[20] Refer to the Stakeholder Consultation Report on City Profile and Diagnostics

**Figure 5.6:** Interlinkage of the issue with indicators across USAF sectors




Source: UN-Habitat

As per USAF sectoral assessment, the issue has interlinkages with 21 indicators across seven sectors with strong linkage with the environment and ecology sector, as well as the urban form, public space and safety sector (see Figure 5.6). The performance of interlinking 21 indicators is summarized in Annexure 5.2.

## Key Inferences

Limited implementation of preservation zones proposed under BDP 2005 along the water bodies with dense plantation to protect from pollution, silting and stress due to development

Tropical Dry Deciduous forests have seasonal transitional nature; challenging to realise the typology

Urban expansion in the south-western and north-eastern parts of the city creating animal-human conflicts and loss of biodiversity

## Limited Implementation of Preservation Zones

The lakes and water bodies are the lifelines of the city and due consideration in terms of management and preservation should be provided to them. As per BDP 2005, a green buffer of 50-100 m. with a dense plantation of indigenous trees was proposed to check the pollution of water bodies and create additional recreational space. The plan proposed strategies to prevent silt from entering the water bodies, efficient solid and liquid waste management, and restricting agricultural practice along the city's water bodies.

Consultations with city planning officials and site visits revealed that the implementation rate of these proposed, preventive strategies has been limited. The buffer zones and plantations are not developed uniformly, exposing the city's natural assets to the adverse effects of urbanization.

**15 Years**

Years since enforced master plan/ development plan was last reviewed and updated.

(Gov 11.2)

**No**

Is there a land use plan that includes zoning with environmental protection and preservation zones?

(ENV 8.12)

**10%**

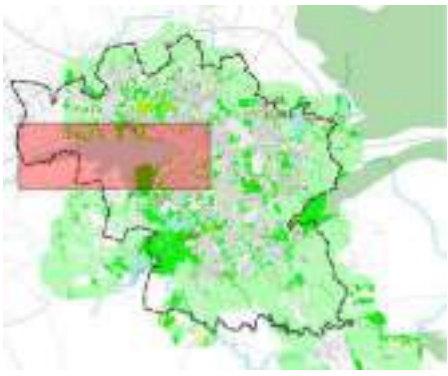
Share of recreational & open green space in total developable area.

(USAF UPS 1.7)

## Land Use Incompatibility along Bhoj Wetland and Water Bodies

The Bhoj wetland consists of two lakes, Upper Lake and Lower Lake, which are the city's lifelines. Upper Lake is the oldest of Central India's large artificial lakes, while Lower Lake was constructed nearly 200 years ago, mostly from the seepage from the Upper Lake. Bhoj Wetland was recognized as a wetland of international importance under the Ramsar Convention of 1971 in 2002. Various threats to them include soil erosion of the catchment area, the inflow of untreated wastewater from surrounding human settlements, and encroachment of catchment areas by informal settlements, agricultural activities, and tourism.

A study of the aerial imagery of Bhoj Wetland reveals that the preservation zones proposed by BDP 2005 were not implemented completely, and the extent of land use incompatibility and encroachment.




Map 5.3: Key map of Bhoj wetland system

Source: Google Earth imagery


Map 5.4: Aerial imagery of Upper Lake and Lower Lake

Source: Google Earth imagery


Map 5.5: Aerial imagery of northern banks of Upper Lake along with SH 28

Source: Google Earth imagery

Image 5.2: Encroachment by hospitals along the northern banks of Noor Mahal Talab, one of the three historical cascading lakes of Bhopal

Source: UN-Habitat

Lower Lake is within the urban area and subjected to many negative anthropogenic stresses and, consequently, the water quality degradation here is much more than in Upper Lake. It is evident from Map 5.4 that the implementation of the preservation zone along Lower Lake has been very limited. Ward numbers 23, 34, and 41, with a population density higher than 600 PPH, are situated along the north-western and north-eastern banks of Lower Lake. The inflow of sewage, solid waste, and encroachment by religious buildings and informal settlements are major concerns. As per a report by the Centre for Science and Environment, the extent of Lower Lake reduced from 8.0 sq. km. to 2.0 sq. km. by 2009.

The northern and eastern banks of Upper Lake have urban characteristics, while the southern and western banks have agricultural and rural characteristics. The dense, old city is situated on the lake's eastern and north-eastern banks with a population density reaching 1,003 PPH in ward number 14. SH 28 connecting Bhopal and Indore, an important development corridor, lies along the lake's northern banks. High-rise buildings and large-scale construction activities are prevalent along the corridor. As illustrated in Map 5.5, private and public buildings have encroached on the eco-sensitive lakebed. Chirayu Medical Hospital (bio-medical waste generator) and BCLL Bus Depot (industrial waste generator) were constructed on watersheds and wetlands. Agriculture is practiced along the flood plains of the lake. Water intensive crops like water chestnuts, wheat, and soya beans are grown here, further contributing to the chemical pollution of the lake. Unchecked development and incompatible land uses have stressed the water bodies in the city.

## Realizing Forest Typology

Madhya Pradesh is rich in natural resources, including bio-diverse forest lands. Forests in the state cover about 30.72 per cent of its total area.[21] As per the Champion & Seth Forest Classification, the state's 18 forests can be categorized into three main types, viz., tropical moist deciduous, tropical dry deciduous, and tropical thorn forests. Among these, tropical dry deciduous forests[22] make up 88 per cent of the state's total forest typology.

[21] http://mpenvis.nic.in/index1.aspx?lid=266&mid=1&langid=1&linkid=206

[22] Tropical dry deciduous forests occur in the region with very low rainfall of 100-150 cm during the dry season (Singh and Chaturvedi 2017). The trees are transitional in nature, as the forest is deciduous during rainy months and degenerates into thorns/ shed leaves during the dry season.

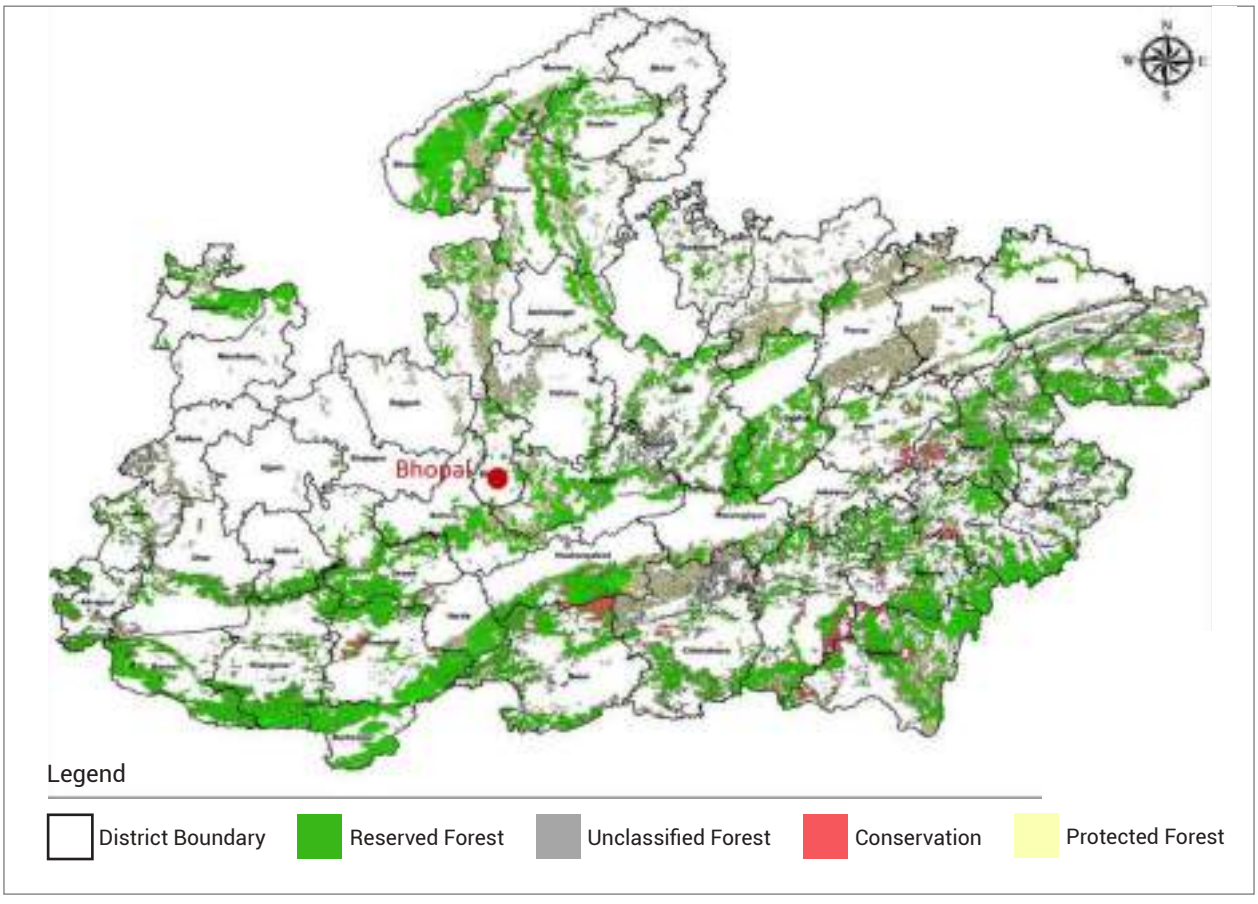
[23] https://timesofindia.indiatimes.com/city/bhopal/ngt-orders-fresh-mapping-of-kaliasot-kerwa-stretch/articleshow/73993202.cms

As shown in Map 5.6, Bhopal district is surrounded by the Ratapani Forest Reserve to the East and South, and by the forest reserves of the Betwa River Valley to the North. The 4.45-sq. km. Van Vihar National Park is a major forest area and tourist destination on the southern banks of Upper Lake. Similarly, as per the LULC analysis, around 40 sq. km. of forests and shrublands are present within BMC limits. In February 2020, while disposing of applicant Rashid Noor's petition seeking a ban on non-forest activity in the Kalisot–Kerwa region, NGT ordered the Madhya Pradesh State Forest Department to map out the area and notify the region as a 'state forest' under the provisions of the India Forest Act, 1972.[23]

The issues that led to the NGT's orders are discussed below.

## Land Use Overlap of Forest and Urban Land

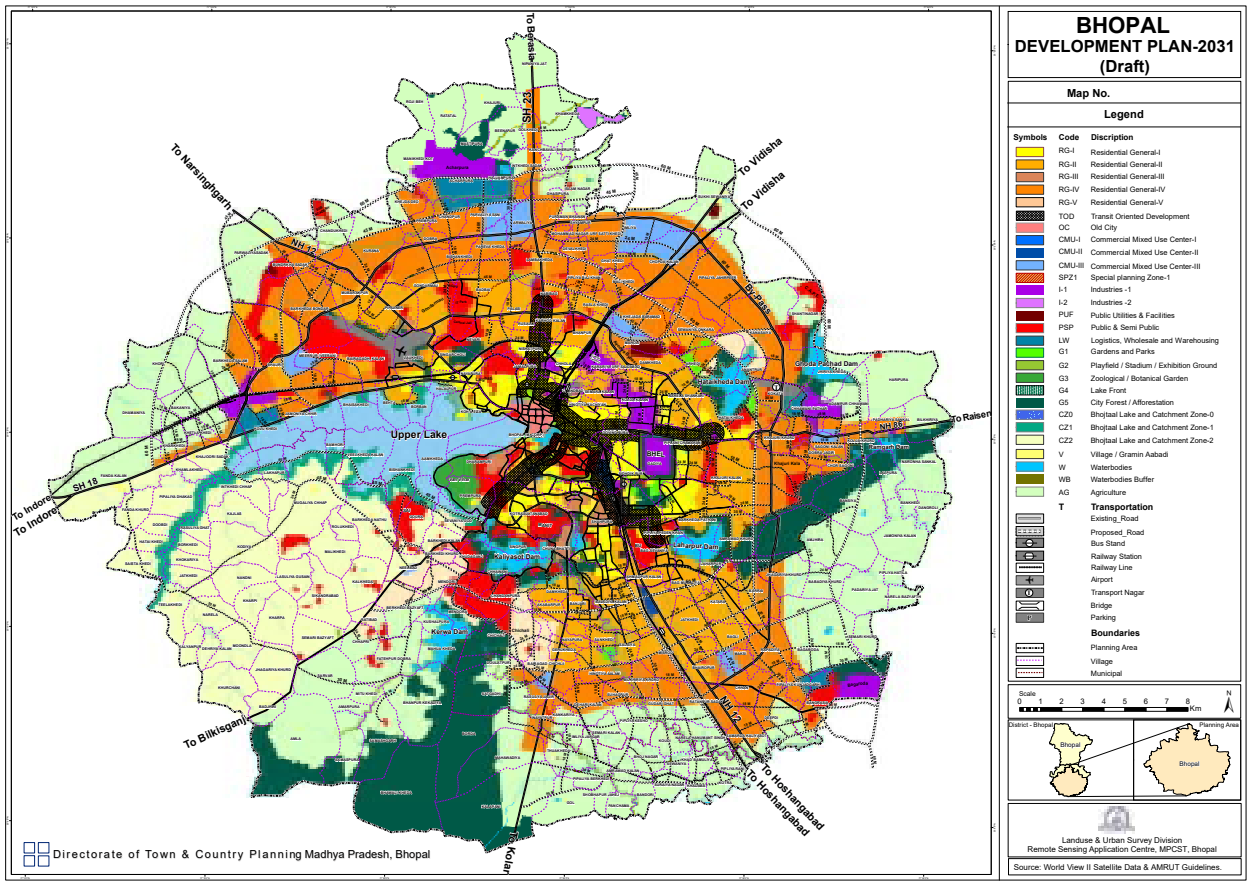
The region has characteristics of a tropical dry deciduous forest and the transitional nature of the forest makes it challenging to realize the typology for the city. Several developments like the Sanskar Valley School, state government research facilities, farmhouses, and educational institutions, which do not comply with provisions of the India Forest Act 1972, have come up here. The confusion in land ownership between the State Revenue Department and Forest Department has given rise to such developments.




Map 5.6: Madhya Pradesh forest map

Source: ENVIS Centre of Madhya Pradesh's State of Environment; http://mpenvis.nic.in/index1.aspx?lid=266&mid=1&langid=1&linkid=206

[23] https://timesofindia.indiatimes.com/city/bhopal/ngt-orders-fresh-mapping-of-kaliasot-kerwa-stretch/articleshow/73993202.cms




Map 5.7: Land use plan proposed under Draft BDP 2031

Source: Draft Bhopal Development Plan 2031; http://mptownplan.gov.in/LU-panel/Bhopal/Amrut/Maps/BDP-2031.pdf


Map 5.8 - Mapping adjoining land use along the forest patch near Kaliasot-Kerwa Ridge

Source: UN-Habitat

## Draft BDP 2031 Proposed the Entire Region as Public–Semi-Public Land Use

The Draft BDP 2031 does not recognise the forest resources of the Kaliasot–Kerwa region and, consequently, has not proposed any preservation measures for the area. Instead, it has proposed public and semi-public land use to promote large-scale institutional, administrative, educational, health, and social-cultural activities in the region.

## Conservation of Active Tiger Corridor

Historically, the Kerwa–Kaliasot region may have been part of the Ratapani Forest Reserve and several patches of forest exist even today, forming a forest trail. Several newspaper articles have indicated the increasing frequency of tiger (and other predators, such as leopard) sightings in the region. Recent urban development has increased traffic movement in the area, creating human–animal conflicts.

Image 5.3: Warning sign boards cautioning commuters about tiger movement

Source: UN-Habitat


Image 5.4: Existing state research facilities and educational institutions in the region

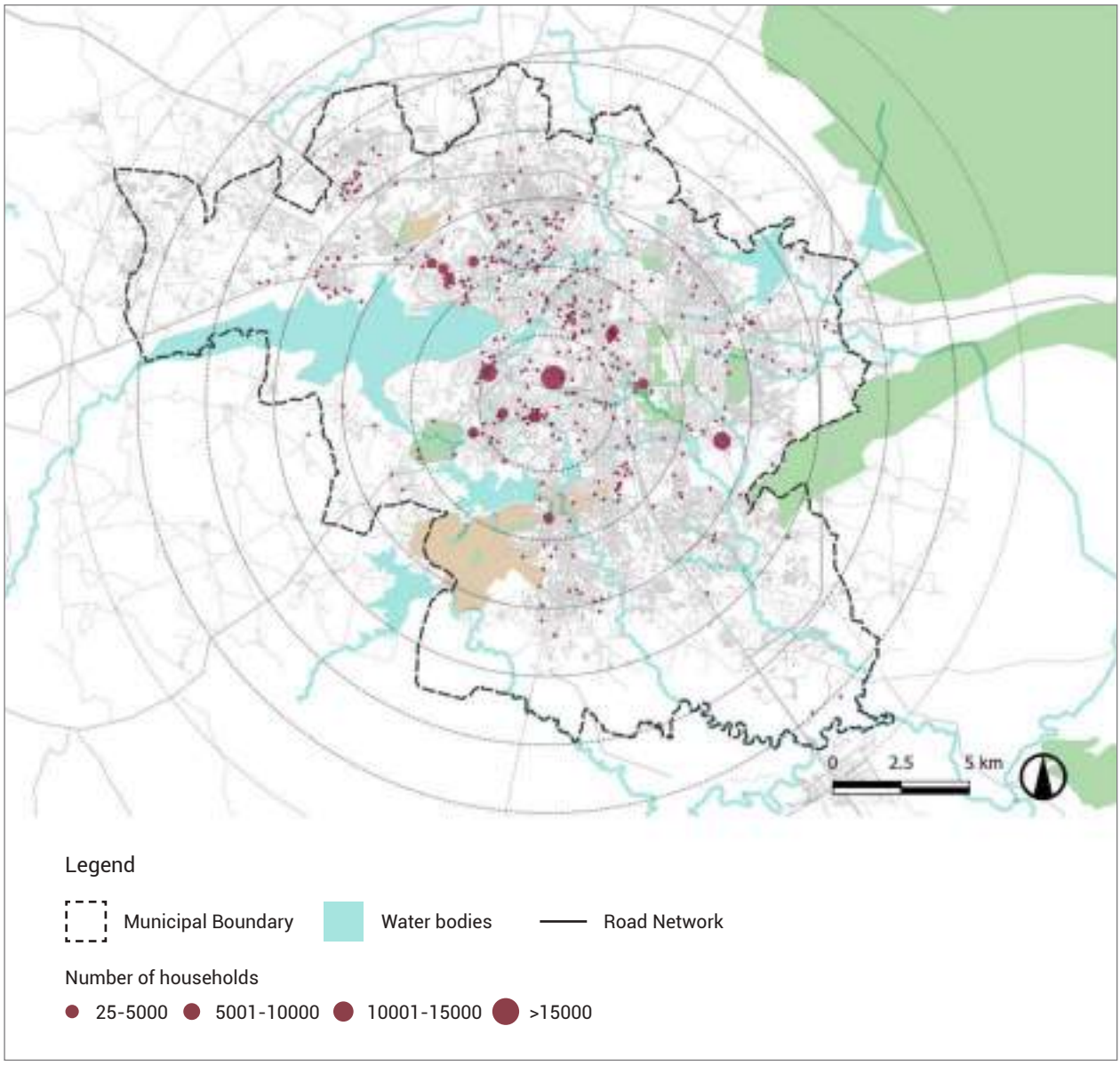
Source: UN-Habitat

[24] https://www.indiatoday.in/magazine/environment/story/20170123-tigers-bhopal-big-cats-985572-2017-01-14https://www.hindustantimes.com/bhopal/bhopal-no-plan-to-manage-tigers-in-kerwa-only-stop-gap-arrangements/story-Uo64dycQUJsE4foE6ctXcN.html

## 5.2.3 Strategic issue 3: Vulnerability of informal settlements

Vulnerable informal settlements emerged as one of the foremost issues in Bhopal based on the findings from the urban sectoral assessment, consultations with BMC, planning agencies, and grassroots organizations.[25] Multidimensional urban expansion has put enormous stress on various resources like affordable housing, and access to basic services. As discussed in Section 4.4.2, Bhopal has witnessed mushrooming informal settlements in the last 20 years, many of which are the most vulnerable or infrastructure deficient pockets of the city.

The key challenges facing informal settlements in the city are the **location of such households in vulnerable areas marked by basic civic service deprivation, illegal encroachments, overcrowding and associated health risks.** The vulnerability of informal settlements is a complex issue, strongly linked to USAF sectors like housing and property, environmental and ecology, and disaster risk management. There are 23 indicators across seven sectors (see Figure 5.7), which highlight the multi-deprivations of informal settlements. The performance of the interlinking 21 indicators is summarized in Annexure 5.3.

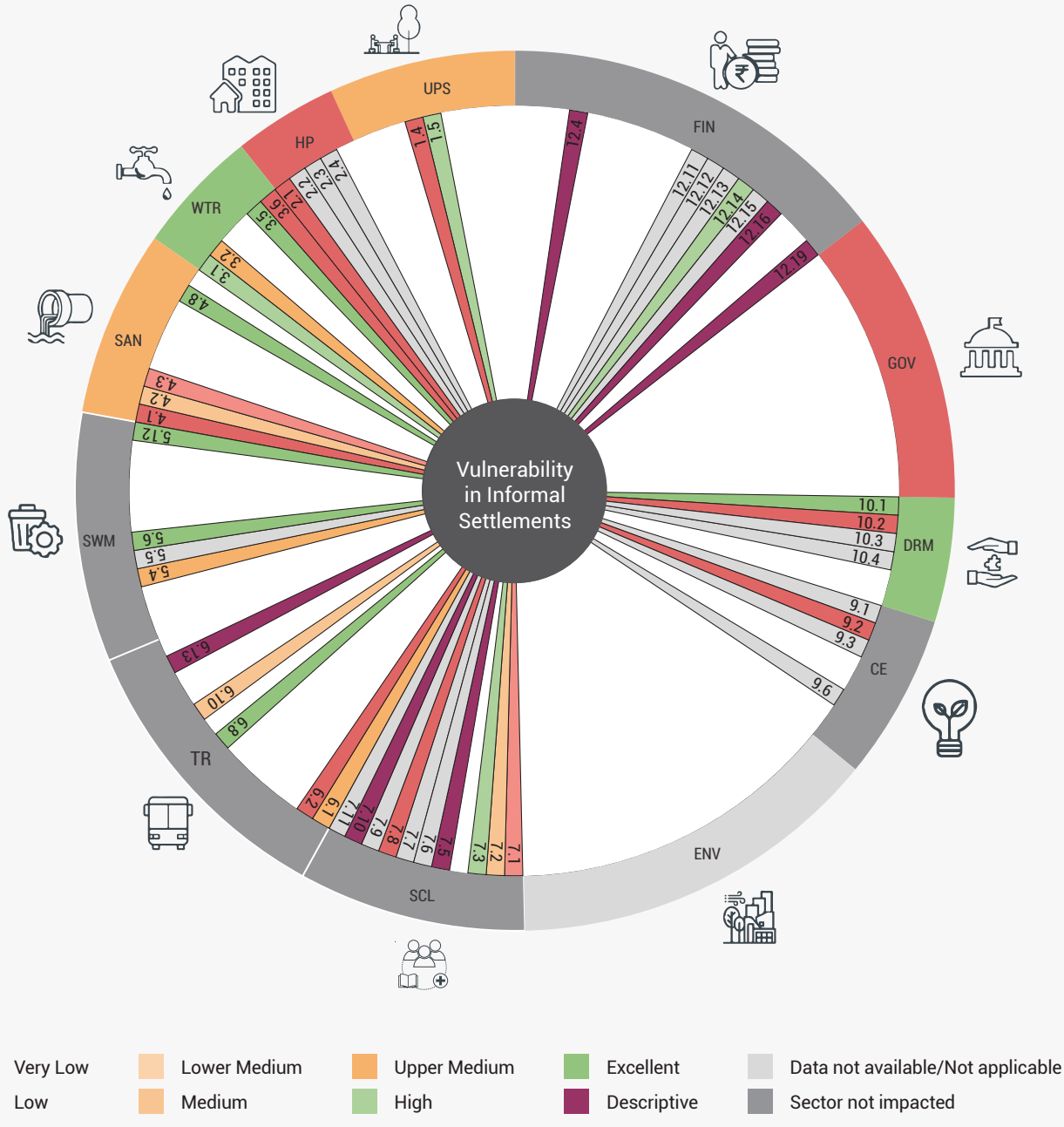



Map 5.9: Location of informal settlements in Bhopal

Source: UN-Habitat

[25] Refer to the Stakeholder Consultation Report on City Profile and Diagnostics

**Figure 5.7:** Interlinkages of the issue with USAF sectors




Source: UN-Habitat

## Key Inferences

Around 36% of the city's households live in slums. The 388 identified slums are situated in just 8% of the city area forming the dense and vulnerable pockets

Around 90 slums are situated on eco-sensitive areas near water bodies and slopes. During wet months, these slums are prone to land slides and floods

Due to overcrowding and proximity to water bodies, slums are prone to water-borne diseases and other health risks

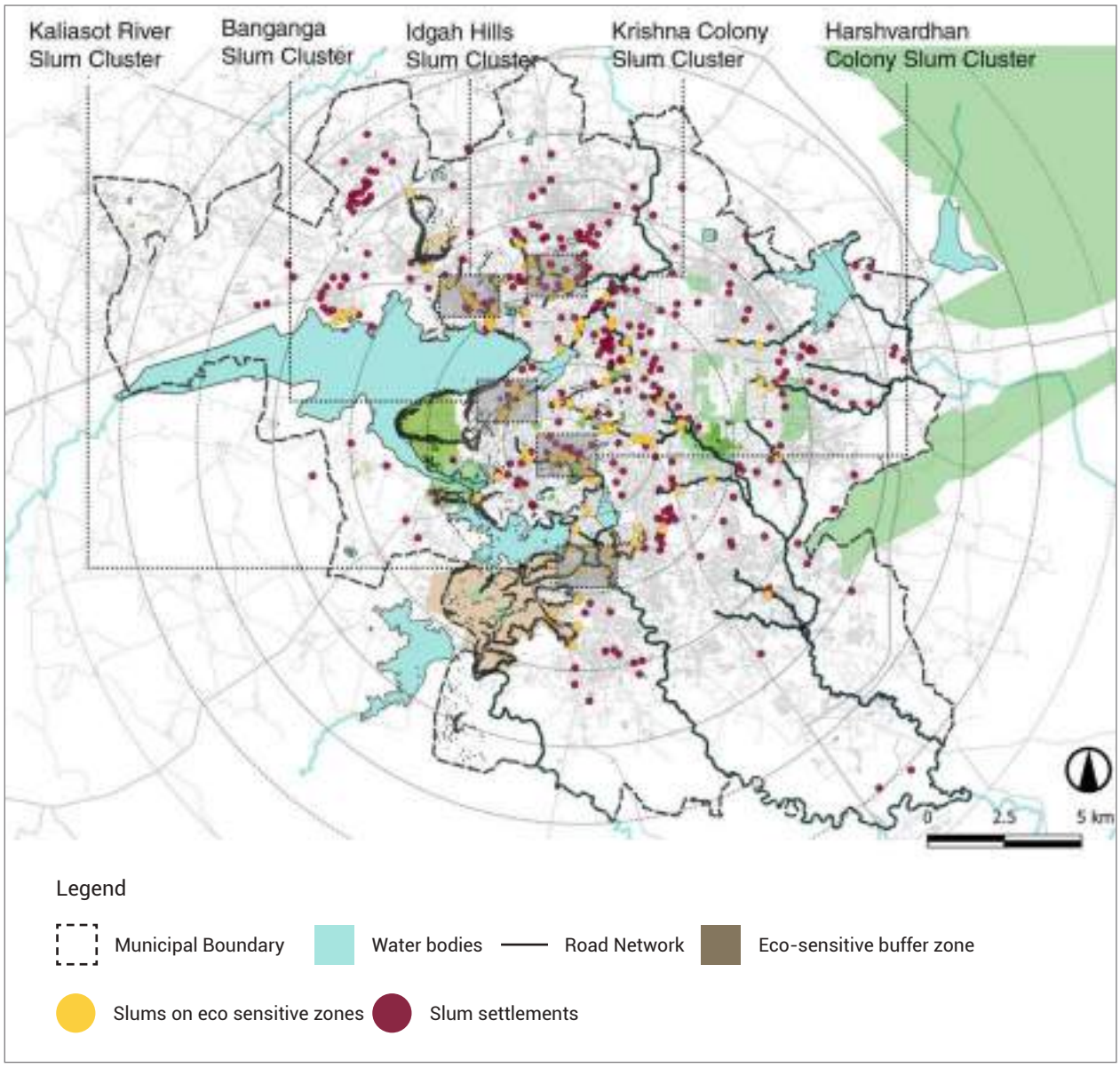
## Topographical Vulnerability: Encroachment of Proposed Conservation Zones

Rapid urbanization and climate change together increase the vulnerability of poor urban communities to natural hazards, undermining urban resilience. The Draft BDP 2031 has proposed conservation zones along water bodies like lakes, streams, and wetlands. Around 20 sq. km. is proposed as conservation zones. Similarly, the plan has proposed no development zone in hilly areas with slopes greater than eight degrees.

Dense plantation of native plant species is proposed in areas where no development is allowed.

The spatial overlay of the natural topography and human settlements (see Map 5.9) identifies the location of informal settlements at vulnerable and eco-sensitive zones.

As per the spatial analysis, around 90 informal settlements (23 per cent of total slums in the city) with a population of 1,64,029 and 44,123 households are located on eco-sensitive buffer zones. Households residing in areas with slopes greater than eight degrees, such as the Idgah Hills slum clusters are prone to landslides. In formal settlements along the streams and wetlands, viz., the Kaliasot River slum cluster and Harshvardhan Colony slum cluster are prone to flooding and water-borne diseases.




Map 5.10: Eco-sensitive buffer zones and location of informal settlements

Source: UN-Habitat

Image 5.5: Slums along the banks of Kaliasot River

Source: UN-Habitat

## Vulnerability due to Deprivation of Services

In the past three decades, the urban slum population in Bhopal has increased by 2.5 times. With increasing density in slum settlements, there is a contention for land and basic amenities in the city as well as within the slum settlements.

The assessment of access to basic services was carried out under the USAF service coverage analysis. Six services—schools, healthcare centres, parks and open spaces, public transit stops, and bicycle sharing facilities—were considered for the analysis.

The assessment of informal settlements (see Map 5.10 and Table 5.4) shows that around 300 households in three settlements do not have access to any of the six services. Around 194 settlements (50 per cent of total slums) have access to three or fewer services; while around 59 informal settlements, mainly in the core city area, have access to all six services.

Parks & Open Spaces

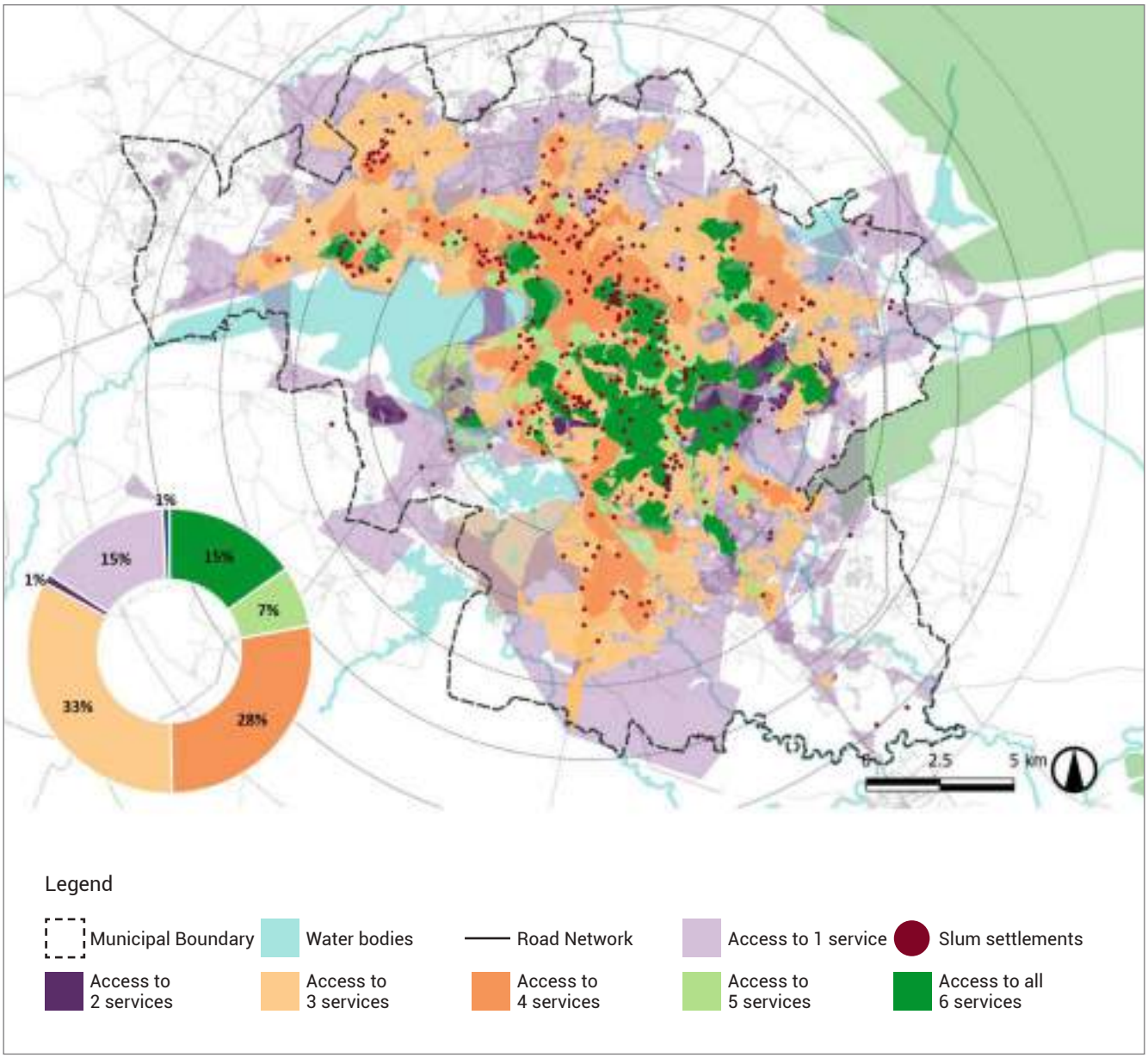
NMT

Public Transportation

Fire Emergency Service

Healthcare Facilities

School




Map 5.11: Access to services and location of slums

Source: UN-Habitat

**Table 5.4:** Summary of slums with level of access to services

| Access to number of Services | Number of slums covered | % of total number of slums | Population | Households |
|---|---|---|---|---|
| All Services | 59 | 15% | 86,585 | 24,203 |
| Five services | 27 | 7% | 48,693 | 13,611 |
| Four services | 108 | 27% | 1,60,869 | 44,141 |
| Three services | 128 | 33% | 1,84,496 | 50,124 |
| Two services | 4 | 1% | 4,896 | 1,296 |
| One service | 59 | 15% | 81,461 | 22,571 |
| No services | **3** | 0.90% | 1,424 | 300 |

Source: UN-Habitat

## Vulnerability of Health: Overcrowding

Urban growth in Bhopal has outpaced the development of appropriate housing and infrastructure, resulting in overcrowded informal settlements. Crowding occurs when the population exceeds the space available. Together with a lack of basic infrastructure, informal settlements can be hotspots for the transmission of infectious diseases.

The 388 informal settlements identified by BMC, are home to around 36 per cent of the total households in the city, which are located on just eight per cent of the city area. These slums settlements are the densest and most overcrowded pockets in the city (see Map 5.11). The 90 slums, which are located in eco-sensitive zones are more prone to health risks. As discussed in Section 5.2.2, the flow of untreated sewerage and greywater into the city's water bodies increases the health risk of informal settlements. In 2019, Bhopal had reported more than 1,008 cases of malaria and dengue, which was the highest among the five SCIAP pilot cities.

**36%**

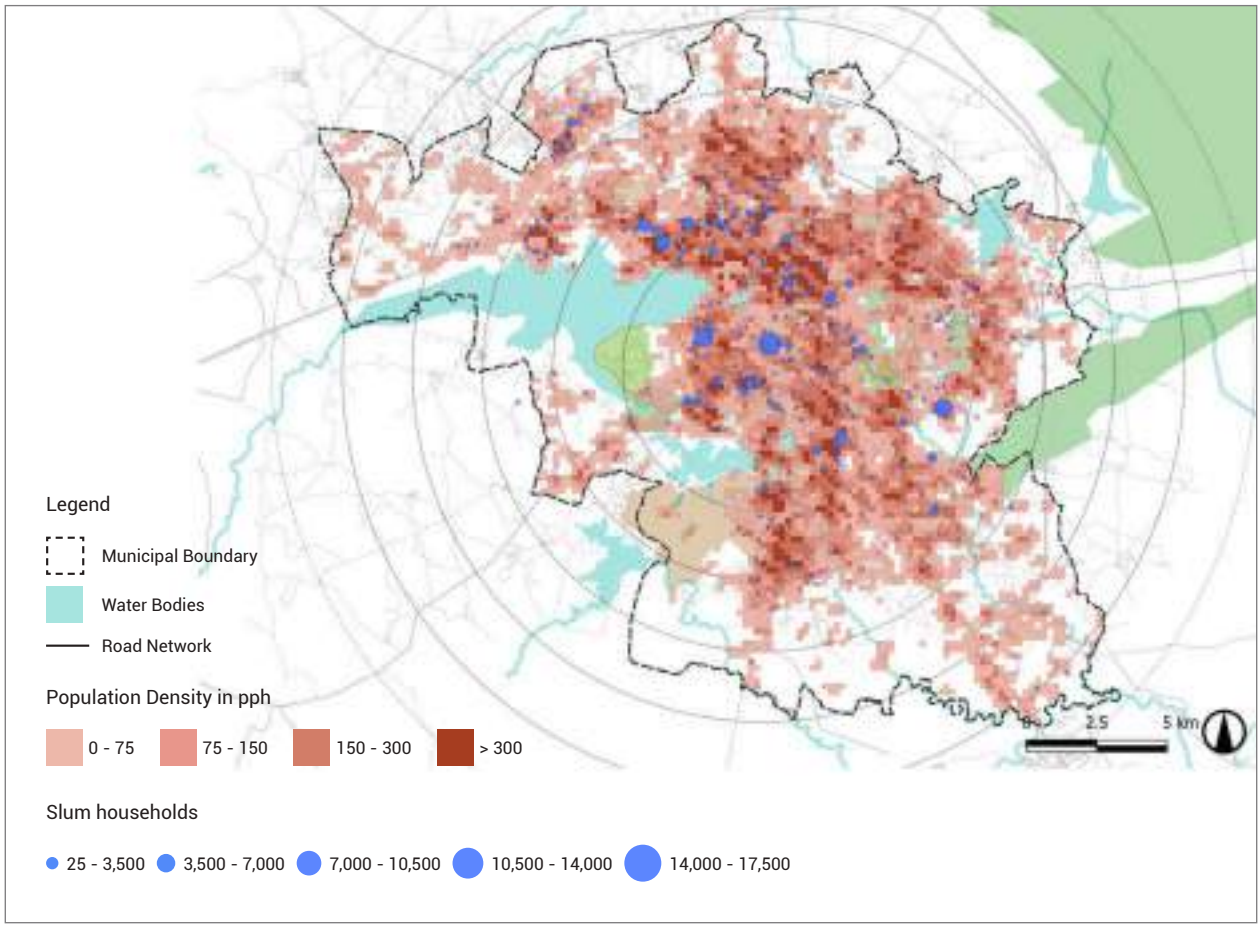
Percentage of urban households living in slums/squatter settlements

(HP 2.1)

**8%**

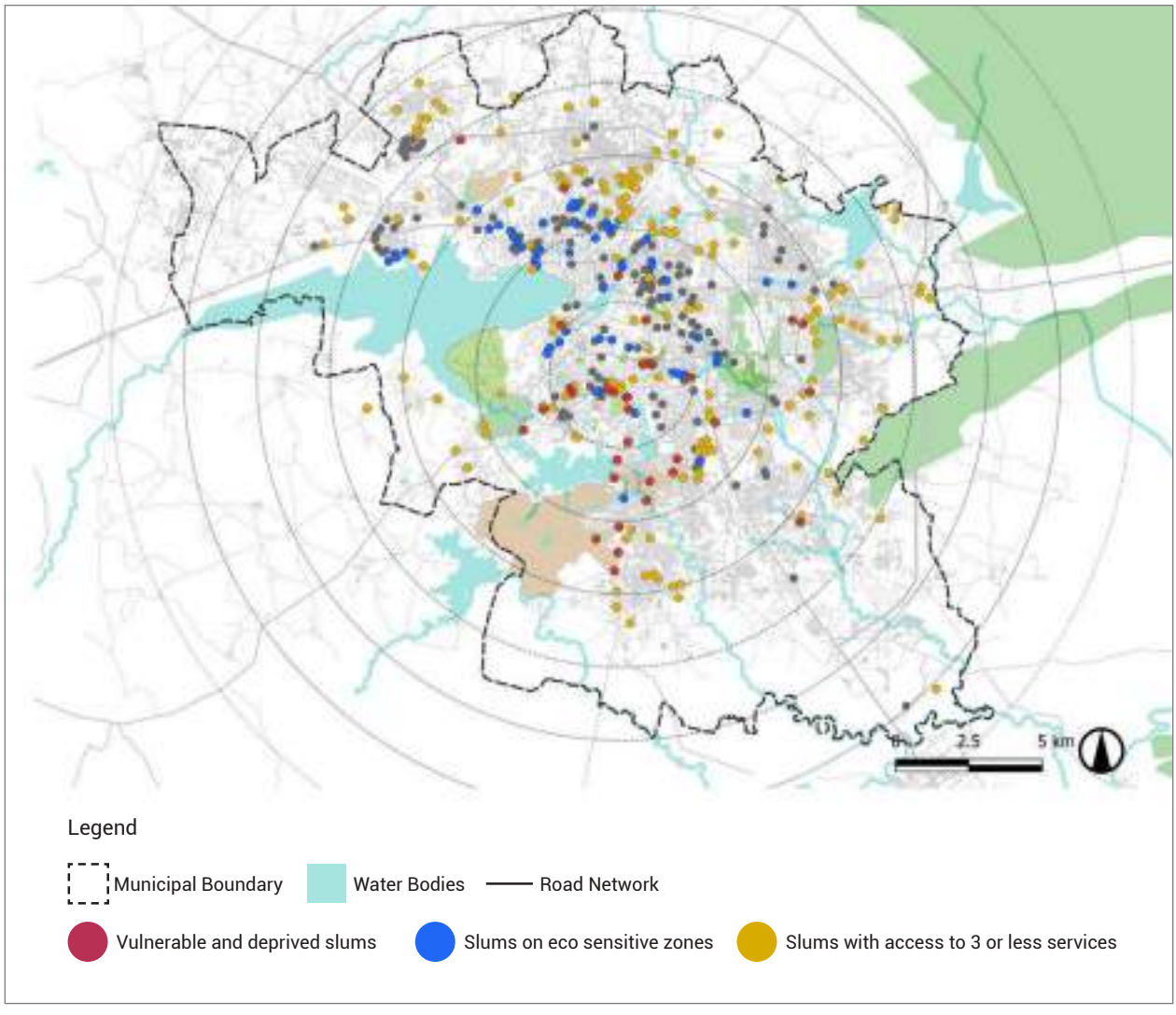
Percentage of city area under slum/squatter settlements

(HP 2.2)




Map 5.12: Population density of Bhopal and location of slums

Source: UN-Habitat




Map 5.13: Classification of slums based on location at eco-sensitive zones and deprivation of services

Source: UN-Habitat

**Table 5.5:** Classification of slums based on vulnerability and deprivation

| | Number of slums | Population | Households |
|---|---|---|---|
| Critically vulnerable slums | 34 | 41,397 | 10,966 |
| Slums on eco-sensitive zones | 56 | 1,22,632 | 33,157 |
| Slums with access to three or less services | 160 | 2,30,494 | 63,255 |

Source: UN-Habitat

Informal settlements that require urgent intervention were identified through a spatial analysis of the encroachment of conservation zones and service coverage analysis. The distribution of critical slums is indicated in Table 5.5 above. The critically vulnerable 34 informal settlements identified by the analysis need urgent intervention from the ULB. These informal settlements may be prioritized in government housing and redevelopment schemes, as well as infrastructure development programmes. The details of these vulnerable informal settlements are indicated in Annexure 5.4.

## 5.2.4 Strategic issue 4: High dependence on fossil fuel and suboptimal use of NMT

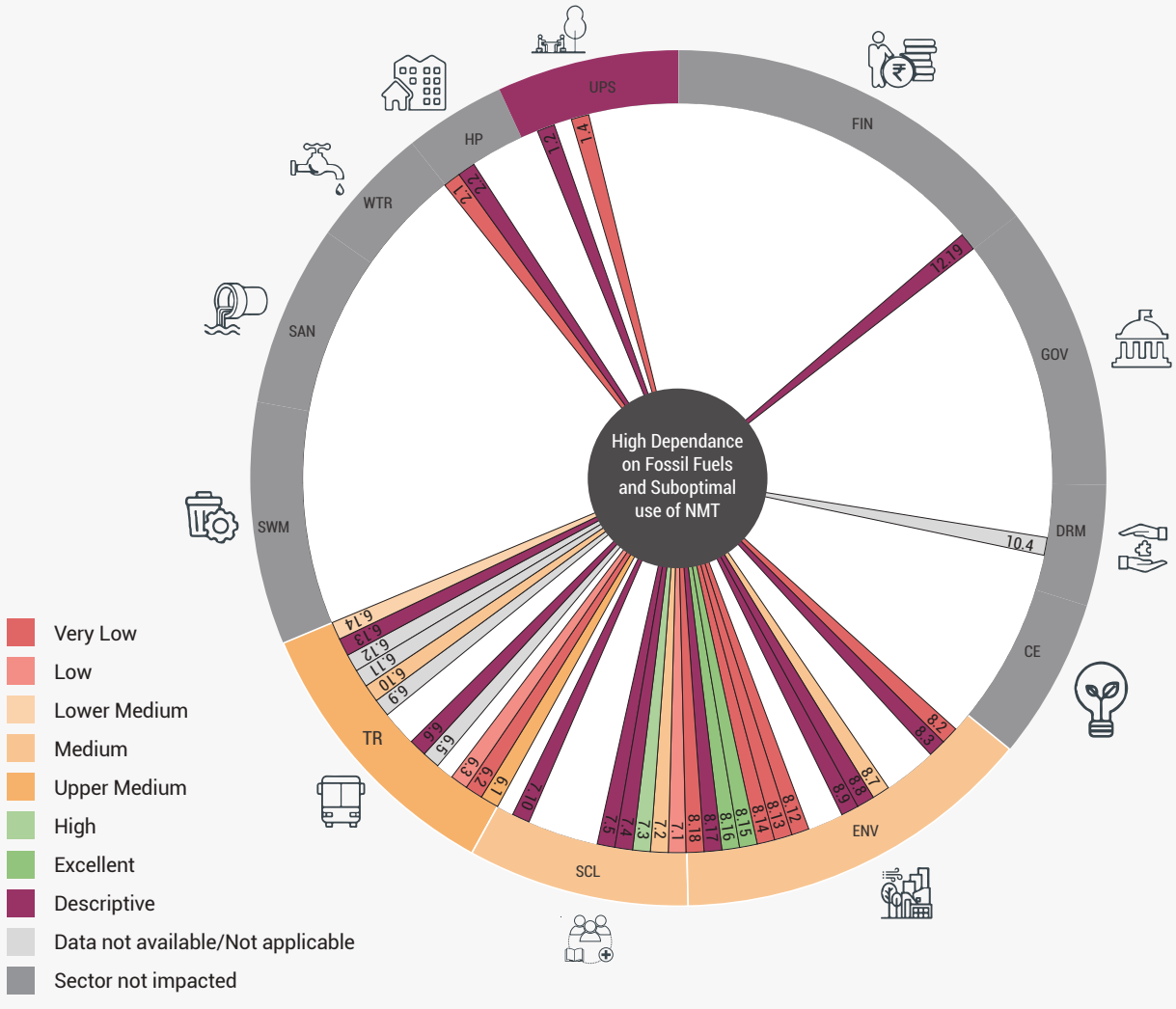
Urban mobility is the key development sector in Bhopal. The city has undertaken several projects to improve connectivity. A BRTS corridor was implemented in 2013 along a 24-km stretch from Sant Hirdaram Nagar in the West to Misrod in South Bhopal. Under the Smart City Mission, the city has constructed 22 km of a dedicated bicycle lane, and has been a torchbearer city in India in terms of promoting NMT. At present, the Bhopal Metro Rail is under construction with Phase I of the project, spanning over 28 km, to be completed by 2027.

**With the increase in urban sprawl and the number of vehicles in recent decades there is an increase in traffic, which has resulted in traffic-related problems, such as air pollution, increase in on-street parking, frequent traffic congestions, and increase in travel time.**

Based on the findings from the USAF sectoral assessment and stakeholder consultations, it was evident that the city's dependence on fossil fuel is high, leading to high GHG emissions. Bhopal was classified as one of India's 100 non-attainment cities by the Central Pollution Control Board in 2019, due to high concentrations of residual particulate matter (PM10) in ambient air. Similarly, the suboptimal use of NMT in the city emerged as a concurrent strategic issue.

The interlinking of 22 relevant indicators across four USAF sectors (see Figure 5.8) indicates the strong linkages of the issue with transportation, as well as environment and ecology sectors. The performance of the interlinking 22 indicators is summarized in Annexure 5.5.

**Figure 5.8:** Interlinkage of the issue with indicators across USAF sectors




Source: UN-Habitat

## Key Inferences

- Increasing dependance on privately owned vehicles and less reliance on public transportation
- High PM10 concentration in the ambient air due to burning of fossil fuels, reducing green cover and dust due to development projects
- NMT infrastucture is not well integrated even with a high modal share of NMT at 47%
- Opportunity to transit to clean fuels and incentivise conversion of IPT vehicles to have hybrid engines

## Limited Access to Public Transport at Neighbourhood Level

The public transportation fleet in Bhopal comprises both BRTS and city bus services. The city has around 222 buses operating along a total route length of 401 km across the city. The average daily ridership remained static at 1.45 lakh in 2018 and 2019.

The spatial coverage of transit stops within a radius of 500 m. in Bhopal is 72 per cent, which earns it an 'upper medium' performance as per the USAF analysis. It is notable that the transit stops are situated along the city's major transit corridors (see Map 5.13). **Neighbourhood accessibility to transit stops decreases as the distance from the core city area increases. Households in the northern and south-eastern parts of the city have poor access to transit stops.** To augment the gap in access to public transportation, several IPT modes are present in Bhopal. Diesel-operated magic autos or minivans are popular modes of IPT. Magic autos act as a feeder service to public transportation in the core city and operate along all major bus routes connecting under-serviced areas in the city's peripheral zones.

**72%**

Percentage of population within 500 m. of public transport stops

(TR 6.1)

**0%**

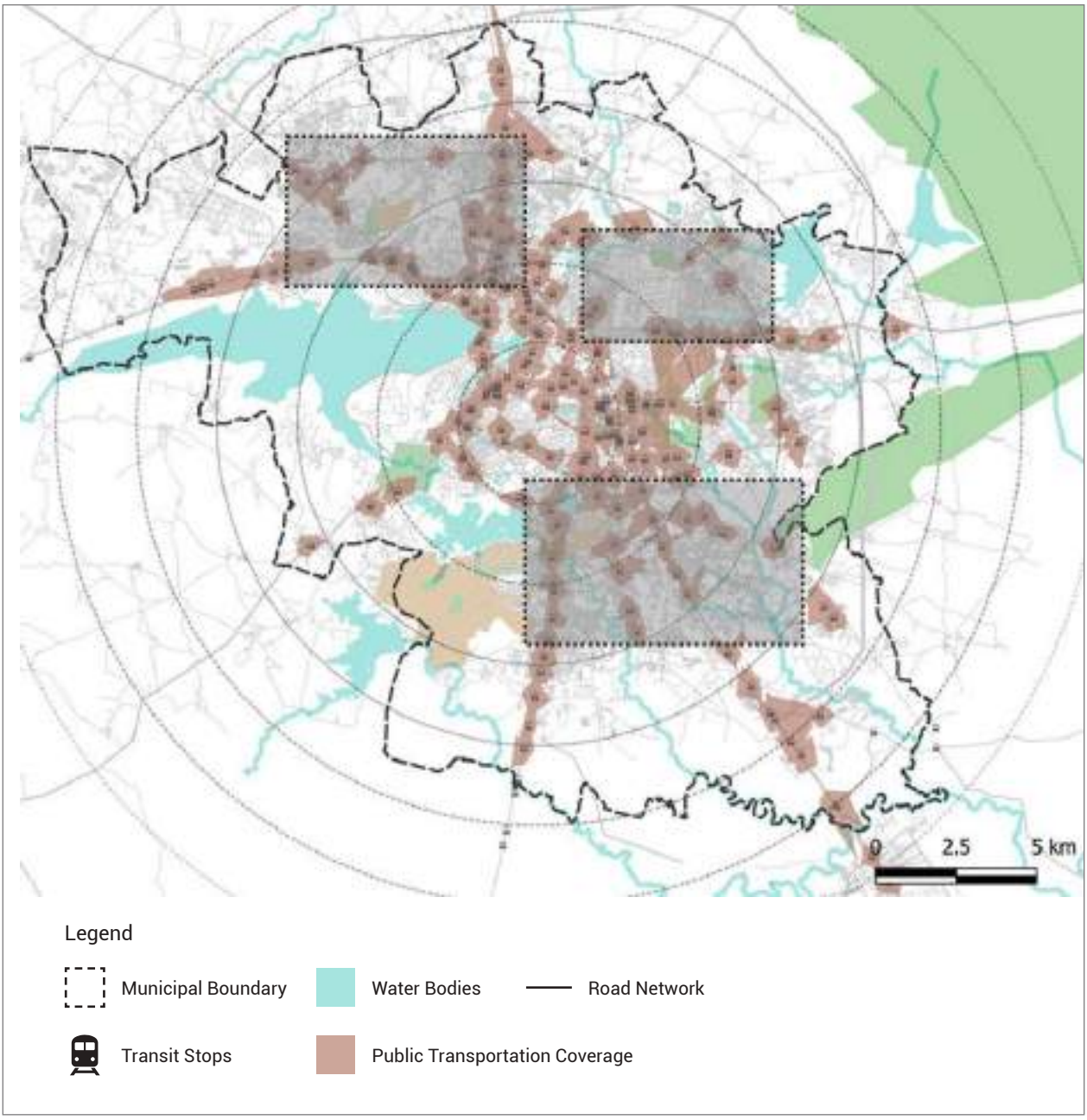
Rate of increase in public transportation ridership

(TR 6.4)

**11.2%**

Kilometres of road with public transit per 100,000 population

(TR 6.10)



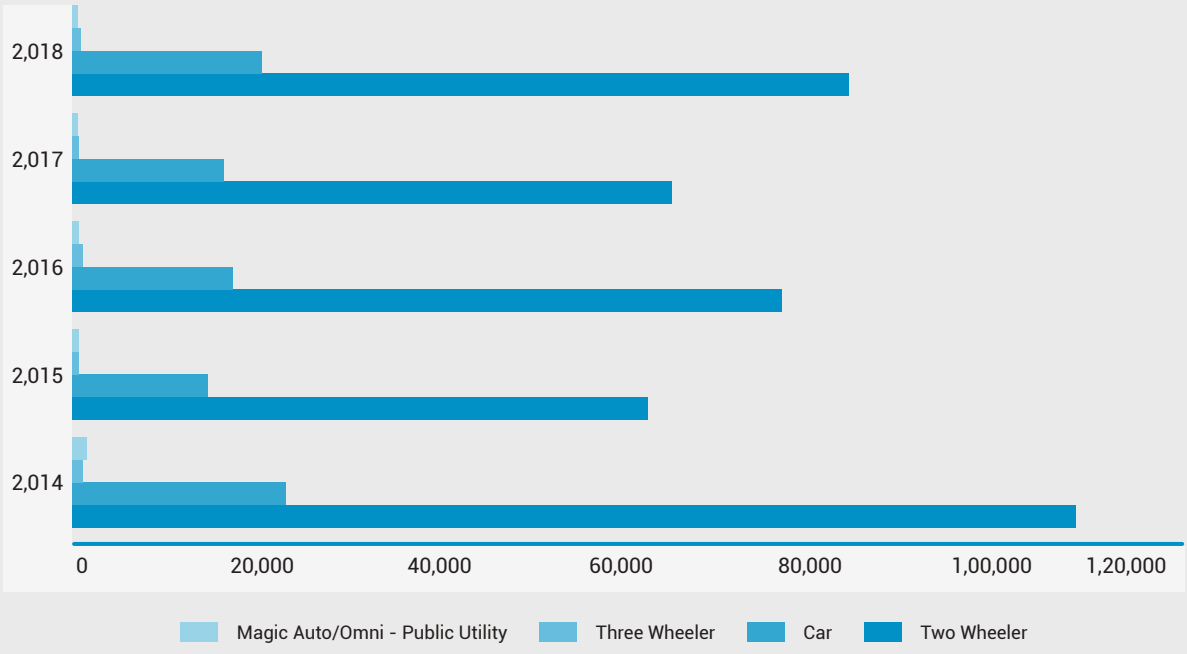

Map 5.14: Population catchment with access to bus stops within 500 m.

Source: UN-Habitat

## Increase in Number of Privately Owned Vehicles

The data of vehicle registrations from the Bhopal RTO reveal that the growth of two-wheelers has been tremendous in recent years. In 2018, the total registered vehicles were 1,18,920, of which 85,387 were two-wheelers. The increase in the number of private vehicles (see Figure 5.9) indicates the preference for owning a private vehicle among Bhopal's residents, than relying on public transport.

**Figure 5.9:** Registration of vehicles from 2014 to 2018 in Bhopal

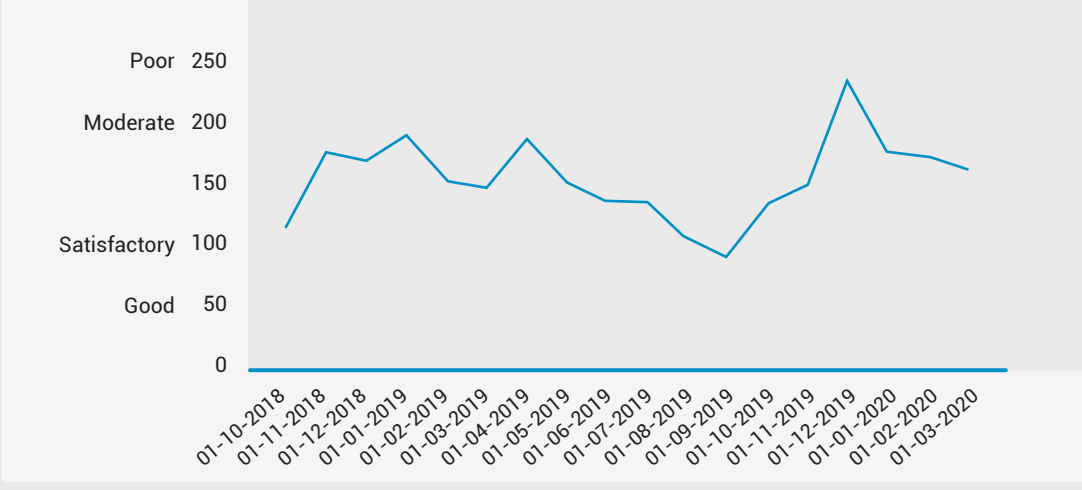



Source: UN-Habitat

## Non-attainment City and Increase in Air Pollution

The transportation sector is a major contributor to GHG emissions in the city. In 2015 -16, the total emissions in the city were 36,60,161 Mt $CO_2$-eq and the transportation sector emitted 7,10,271 Mt $CO_2$-eq, which is 19 per cent of the total emissions.

**Figure 5.10:** Monthly average AQI from October 2018 to March 2020 in Bhopal

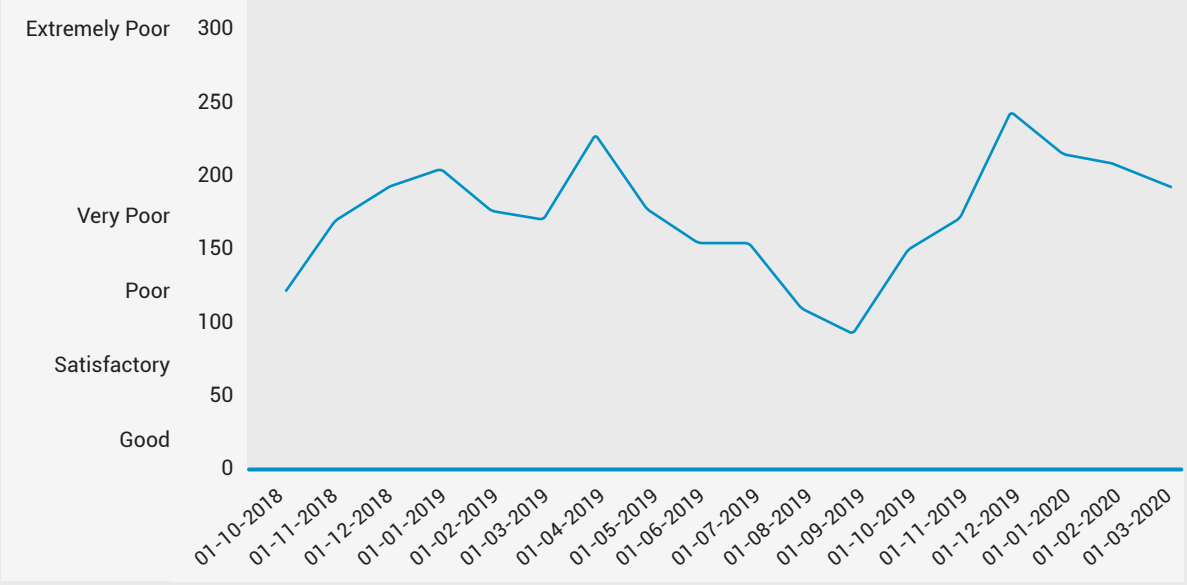



Source: UN-Habitat

The vehicular traffic in Bhopal is increasing at a rate of 10 per cent each year. The pollution in the city is increasing[26] due to use of fossil fuels, felling of trees[27] and dust from development activities. As per Figure 5.10, the AQI in 2018-2020 was in the range of 'Moderate to Poor', which may cause breathing difficulties in sensitive populations. The AQI in Bhopal varies seasonally and the poorest air quality is during the winter months from November to February. The AQI during the monsoons (June–September) is comparatively lower than in the winters.

Residual particulate matter of size 10 microns (PM10) is mainly produced by burning fossil fuel and dust from development activities. As per Figure 5.11, the PM10 for Bhopal during 2018-2020 ranged from 'Poor to Extremely Poor', which can cause breathing discomfort and respiratory ailments.

**Figure 5.11:** Variation of PM10 concentration from 2018 to 2020




Source: UN-Habitat

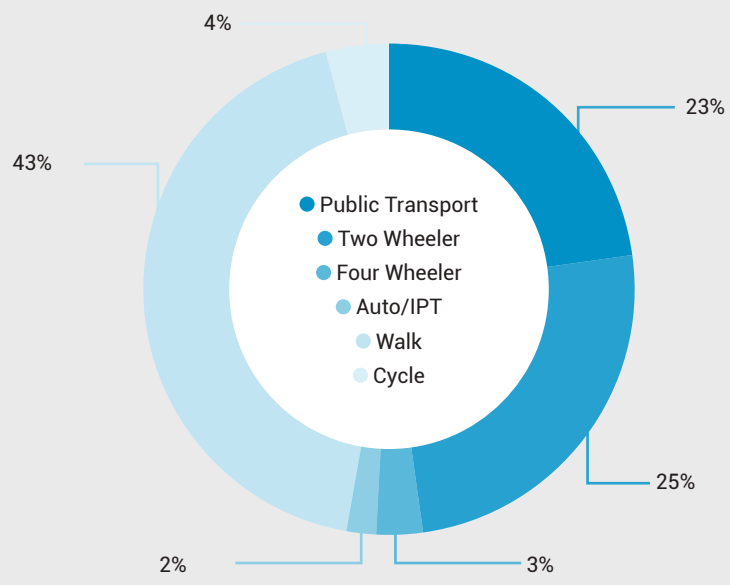
## Modal Share for Work Trips in Bhopal

As per the Sustainable Urban Transport Index Report for Bhopal (UNESCAP, 2019), two-wheelers are a popular transportation mode, accounting for 25 per cent of trips in the city. On the other hand, the share of public transport is only 23 per cent. Significantly, the share of NMT (walking and cycling) is high at 47 per cent of the total work trips in the city. The high NMT share may be due to mixed-use development proposed under BDP 2005 and the high rate of the city's urban poor population.

The average trip length of pedestrians is 1.41 km and the average trip length for a bicyclist is 3.64 km. It was observed that the average trip length by public transport is around 5.81 km, followed by four-wheelers, which have a trip length of 5.35 km.

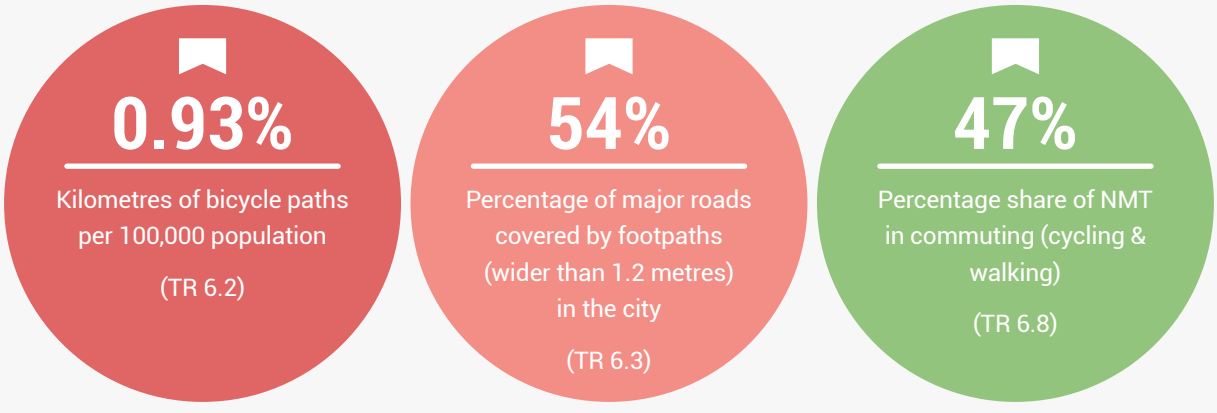
[26] https://timesofindia.indiatimes.com/city/bhopal/bhopal-chokes-with-poor-air-quality-index/articleshow/72282917.cms
[27] https://timesofindia.indiatimes.com/city/bhopal/toxic-times-air-in-major-mp-cities-not-fit-for-breathing/articleshow/80657174.cms

**Figure 5.12:** Modal share of Bhopal in 2015-16



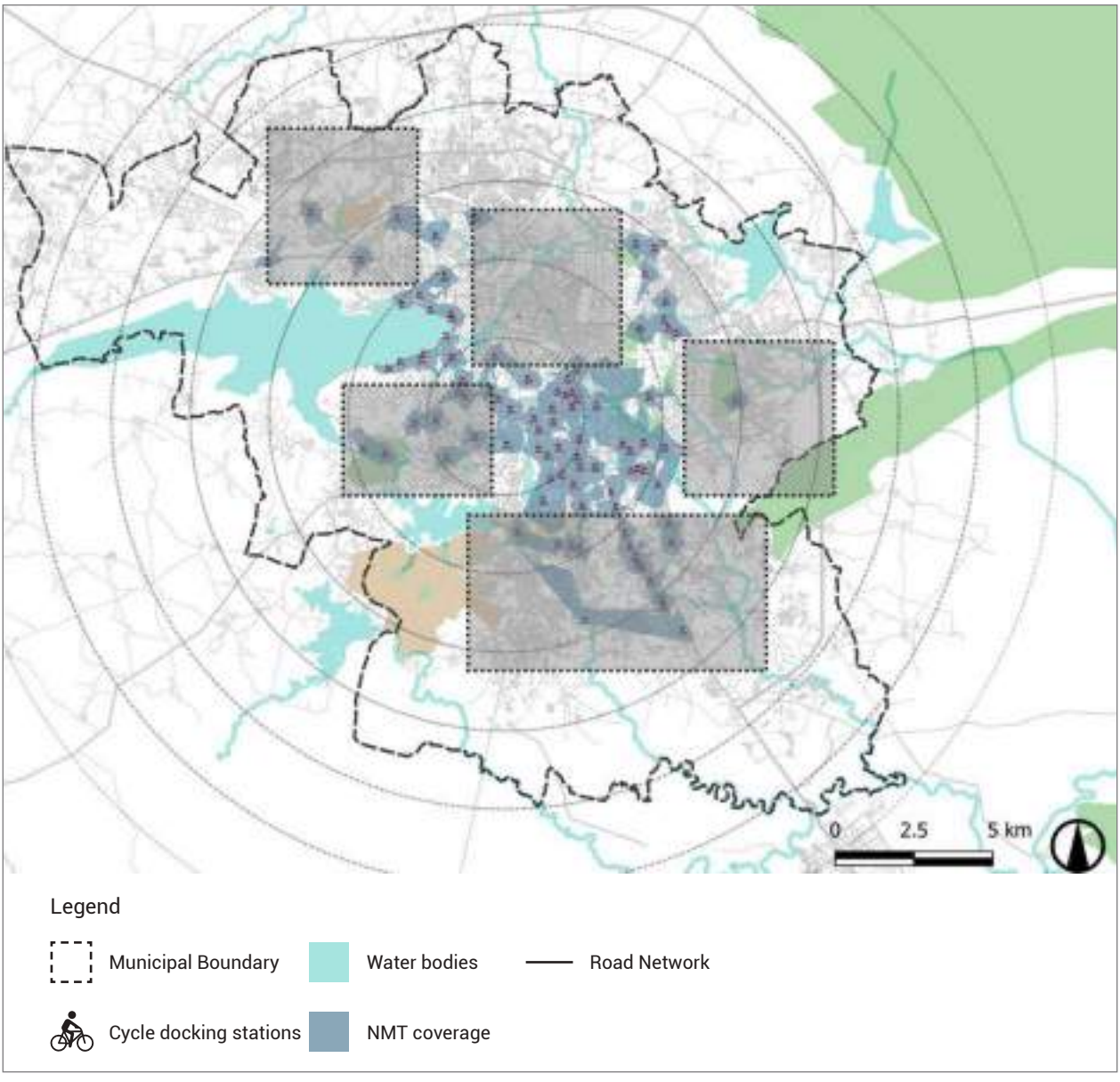

Source: Sustainable Urban Transport Index for Bhopal, UNESCAP, 2019; https://www.unescap.org/sites/default/d8files/knowledge-products/Bhopal_%20India.pdf

## Suboptimal Use of NMT




NMT is often a key element of successfully encouraging clean urban transport. It is a highly cost-effective transportation strategy and brings about large health, economic and social co-benefits, particularly for the urban poor.[28] The 22-km cycle track is constructed in fragments and is not well integrated to provide seamless/ continuous access to cyclists in the city. At present, the city has only 0.93 km of cycle track for every 1,00,000 of its citizens, which is a 'very low' performance as per USAF. The spatial coverage of 'Chartered' cycle docking stations in the city (see Map 5.14) reveals that the facility is concentrated in the core city area, where access to public transportation is high. The peripheral zones in the city are deprived of access to cycle docking stations and cycle tracks.

[28] http://mohua.gov.in/upload/uploadfiles/files/NMTGuidanceFINAL.pdf




Map 5.15: Population catchment with access to NMT docking stations within 500 m. Source: UN-Habitat

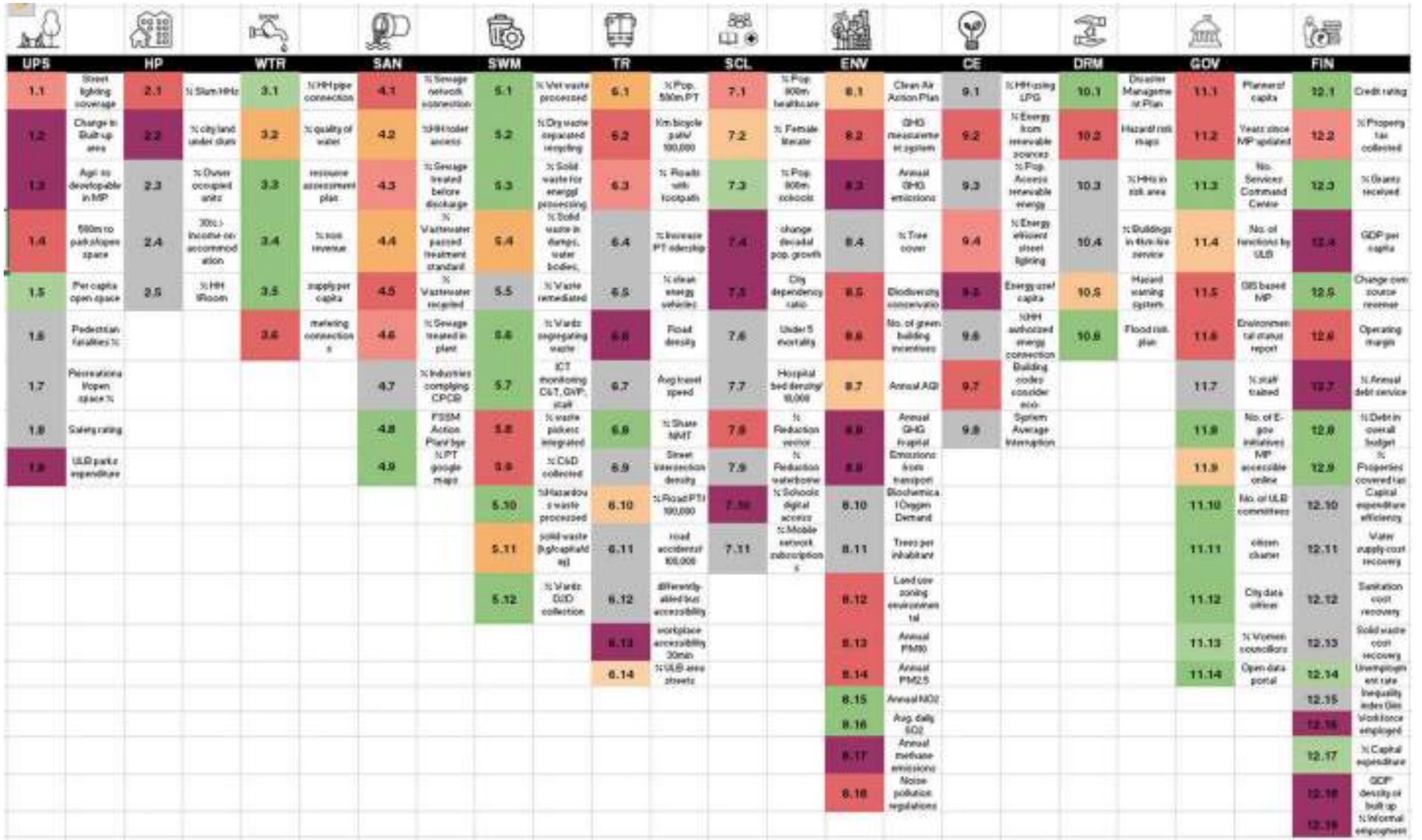
Only 54 per cent of the city's roads are flanked by footpaths wider than 1.2 m., which is a 'low' performance as per USAF. Haphazard on-street parking, increasing encroachment by street vendors, and undeveloped footpaths have created despair for pedestrians in the city. Bhopal's pedestrians face more challenges in commercial areas such as the Old City, MP Nagar Zones 1 and 2, Number 10 Market, and Bairagarh, due to high on-street parking, encroachment of footpaths by hawkers and street vendors, and poor integration of different modes of transit at the junctions. Despite the allocation of space, most footpaths lack continuity. Development projects like the Metro rail construction, laying of an underground sewer network, and other utility works pose serious challenges to pedestrians, decreasing the ease of walkability in the city.


Image 5.6: Haphazard parking on the footpath in Bhopal's Number 10 Market Source: UN-Habitat

Image 5.7: Encroachment of footpath by hawkers and shopkeepers near Number 10 Market Source: UN-Habitat

# ANNEXURE

## Annexure 4.1: Indicator-wise scoring (overall performance) of Bhopal across USAF sectors



# Annexure 5.1: Interlinkage of issue 1 – 'Sprawling Urban Development' – with indicators across the urban assessment sectors

| UPS | | HP | | WTR | | SAN | | SWM | | TR | | SCL | | ENV | | CE | | DRM | | GOV | | FIN | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.1 | Street lighting coverage | 2.1 | % Slum HHs | 3.1 | % HH pipe connection | 4.1 | % Sewage network connection | 5.1 | % Wet waste processed | 6.1 | % Pop. 500m PT | 7.1 | % Pop. 800m healthcare | 8.1 | Clean Air Action Plan | 9.1 | % HH using LPG | 10.1 | Disaster Management Plan | 11.1 | Planners/ capita | 12.1 | Credit rating |
| 1.2 | Change in Built-up area | 2.2 | % city land under slum | 3.2 | % quality of water | 4.2 | %HH toilet access | 5.2 | % City waste separated recycling | 6.2 | Km bicycle path/ 100,000 | 7.2 | % Female literate | 8.2 | GHG measureme nt system | 9.2 | % Energy from renewable sources | 10.2 | Hazard risk maps | 11.2 | Years since MP updated | 12.2 | % Property tax collected |
| 1.3 | Agri to developable in MP | 2.3 | % Owner occupied units | 3.3 | resource assessment plan | 4.3 | % Sewage treated before discharge | 5.3 | % Solid waste for energy/ processing | 6.3 | % Roads with footpath | 7.3 | % Pop. 800m schools | 8.3 | Annual GHG emissions | 9.3 | % Pop. Access renewable energy | 10.3 | % HHs in risk area | 11.3 | No. Services Commissed Centre | 12.3 | % Grants received |
| 1.4 | 500m to park/open space | 2.4 | 20% x livelihood on accommod ation | 3.4 | % non revenue | 4.4 | % Wastewater passed treatment standard | 5.4 | % Solid waste in dumps, water bodies, | 6.4 | % Increase PT ridership | 7.4 | change decadal pop. growth | 8.4 | % Tree cover | 9.4 | % Energy efficient street lighting | 10.4 | % Buildings in 4km fire service | 11.4 | No. of functions by ULB | 12.4 | GDP per capita |
| 1.5 | Per capita open space | 2.5 | % HH Room | 3.5 | supply per capita | 4.5 | % Wastewater recycled | 5.5 | % Waste remediated | 6.5 | % clean energy vehicles | 7.5 | City dependency ratio | 8.5 | Biodiversity conservatio | 9.5 | Energy use/ capita | 10.5 | Hazard warning system | 11.5 | GIS based MP | 12.5 | Change own source revenue |
| 1.6 | Pedestrian fatalities % | | | 3.6 | metering connection s | 4.6 | % Sewage treated in plant | 5.6 | % Wards segregating waste | 6.6 | Road density | 7.6 | Under 5 mortality | 8.6 | No. of green building incentives | 9.6 | %HH authorized energy connection | 10.6 | Flood risk plan | 11.6 | Environmen tal status report | 12.6 | Operating margin |
| 1.7 | Recreationa l/open space % | | | | | 4.7 | % Industries complying CPCB | 5.7 | ICT monitoring C&T, GVP, staff | 6.7 | Avg travel speed | 7.7 | Hospital bed density/ 10,000 | 8.7 | Annual AQI | 9.7 | Building codes consider eco- | | | 11.7 | % staff trained | 12.7 | % Annual debt service |
| 1.8 | Safety rating | | | | | 4.8 | FSSM Action Plan/ bye | 5.8 | % waste pickers integrated | 6.8 | % Share NMT | 7.8 | % Reduction vector | 8.8 | Annual GHG /capital | 9.8 | Spoms Average Interruption | | | 11.8 | No. of E-gov initiatives | 12.8 | % Debt in overall budget |
| 1.9 | ULB parks expenditure | | | | | 4.9 | % PT google maps | 5.9 | % O&D collected | 6.9 | Street intersection density | 7.9 | % Reduction waterborne | 8.9 | Emissions from transport | | | | | 11.9 | MP accessible online | 12.9 | % Properties covered tax |
| | | | | | | | | 5.10 | %Hazardou s waste processed | 6.10 | % RoadEPTA 100,000 | 7.10 | % Schools digital access | 8.10 | Biochemica l Oxygen Demand | | | | | 11.10 | No. of ULB committees | 12.10 | Capital expenditure efficiency |
| | | | | | | | | 5.11 | solid waste (kg/capita/d ay) | 6.11 | road accidents/ 100,000 | 7.11 | % Mobile network subscription s | 8.11 | Trees per inhabitant | | | | | 11.11 | citizen charter | 12.11 | Water supply cost recovery |
| | | | | | | | | 5.12 | % Wards O&D collection | 6.12 | differently abled bus accessibility | | | 8.12 | Land use zoning environmen tal | | | | | 11.12 | City data officer | 12.12 | Sanitation cost recovery |
| | | | | | | | | | | 6.13 | workplace accessibility 20min | | | 8.13 | Annual PM10 | | | | | 11.13 | % Women councillors | 12.13 | Solid waste cost recovery |
| | | | | | | | | | | 6.14 | % ULB area streets | | | 8.14 | Annual PM2.5 | | | | | 11.14 | Open data portal | 12.14 | Unemployment rate |
| | | | | | | | | | | | | | | 8.15 | Annual NO2 | | | | | | | 12.15 | Inequality index Gini |
| | | | | | | | | | | | | | | 8.16 | Avg. daily SO2 | | | | | | | 12.16 | Workforce employed |
| | | | | | | | | | | | | | | 8.17 | Annual methane emissions | | | | | | | 12.17 | % Capital expenditure |
| | | | | | | | | | | | | | | 8.18 | Noise pollution regulations | | | | | | | 12.18 | GDP density of built up |
| | | | | | | | | | | | | | | | | | | | | | | 12.19 | % Informal employment |

# Annexure 5.2: Interlinkage of Issue 2 – 'Endangered Natural Assets' with indicators across the urban assessment sectors

| UPS | | HP | | WTR | | SAN | | SWM | | TR | | SCL | | ENV | | CE | | DRM | | GOV | | FIN | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.1 | Street lighting coverage | 2.1 | % Slum HHs | 3.1 | % HH pipe connection | 4.1 | % Sewage network connection | 5.1 | % Wet waste processed | 6.1 | % Pop. 500m PT | 7.1 | % Pop. 800m healthcare | 8.1 | Clean Air Action Plan | 9.1 | % HH using LPG | 10.1 | Disaster Management Plan | 11.1 | Planners/ capita | 12.1 | Credit rating |
| 1.2 | Change in Built-up area | 2.2 | % city land under slum | 3.2 | % quality of water | 4.2 | HH toilet access | 5.2 | % Dry waste segregated recycled | 6.2 | Km bicycle path/ 100,000 | 7.2 | % Female literate | 8.2 | GHG measurement system | 9.2 | % Energy from renewable sources | 10.2 | Hazard risk maps | 11.2 | Years since MP updated | 12.2 | % Property tax collected |
| 1.3 | Agri to developable in MP | 2.3 | % Owner occupied units | 3.3 | resource assessment plan | 4.3 | % Sewage treated before discharge | 5.3 | % Solid waste for energy/ processing | 6.3 | % Roads with footpath | 7.3 | % Pop. 800m schools | 8.3 | Annual GHG emissions | 9.3 | % Pop. Access renewable energy | 10.3 | % HHs in risk area | 11.3 | No. Services Command Centre | 12.3 | % Grants received |
| 1.4 | 500m to park/open space | 2.4 | 30x Income on accommodation | 3.4 | % non revenue | 4.4 | % Wastewater passed treatment standard | 5.4 | % Solid waste in dumps, water bodies, | 6.4 | % Increase PT ridership | 7.4 | change decadal pop. growth | 8.4 | % Tree cover | 9.4 | % Energy efficient street lighting | 10.4 | % Buildings in 4km line service | 11.4 | No. of functions by ULB | 12.4 | GDP per capita |
| 1.5 | Per capita open space | 2.5 | % HH Slums | 3.5 | supply per capita | 4.5 | % Wastewater recycled | 5.5 | % Waste remediated | 6.5 | % clean energy vehicles | 7.5 | City dependency ratio | 8.5 | Biodiversity conservatio | 9.5 | Energy use/ capita | 10.5 | Hazard warning system | 11.5 | GIS based MP | 12.5 | Change-over source revenue |
| 1.6 | Pedestrian fatalities % | | | 3.6 | metering connection s | 4.6 | % Sewage treated in plant | 5.6 | % Wards segregating waste | 6.6 | Road density | 7.6 | Under 5 mortality | 8.6 | No. of green building incentives | 9.6 | HH authorized energy connection | 10.6 | Flood risk plan | 11.6 | Environmental status report | 12.6 | Operating margin |
| 1.7 | Recreational/ open space % | | | | | 4.7 | % Industries complying CPCB | 5.7 | ICT monitoring C&T, GWP, staff | 6.7 | Avg travel speed | 7.7 | Hospital bed density/ 10,000 | 8.7 | Annual AQI | 9.7 | Building codes consider eco- | | | 11.7 | % staff trained | 12.7 | % Annual debt service |
| 1.8 | Safety rating | | | | | 4.8 | FSSM Action Plan/ bgs | 5.8 | % waste pickers integrated | 6.8 | % Share NMT | 7.8 | % Reduction vector | 8.8 | Annual GHG /capital | 9.8 | System Average Interruption | | | 11.8 | No. of E-gov initiatives | 12.8 | % Debt in overall budget |
| 1.9 | ULB parks expenditure | | | | | 4.9 | % PT google maps | 5.9 | % CSD collected | 6.9 | Street intersection density | 7.9 | % Reduction waterborne | 8.9 | Emissions from transport | | | | | 11.9 | MP accessible online | 12.9 | % Properties covered tax |
| | | | | | | | | 5.10 | % Hazardous waste processed | 6.10 | % Road PT/ 100,000 | 7.10 | % Schools digital access | 8.10 | Biochemical Oxygen Demand | | | | | 11.10 | No. of ULB committees | 12.10 | Capital expenditure efficiency |
| | | | | | | | | 5.11 | solid waste (kg/capita/day) | 6.11 | road accidents/ 100,000 | 7.11 | % Mobile network subscription s | 8.11 | Trees per inhabitant | | | | | 11.11 | citizen charter | 12.11 | Water supply cost recovery |
| | | | | | | | | 5.12 | % Wards D2D collection | 6.12 | differently-abled bus accessibility | | | 8.12 | Land use zoning environmental | | | | | 11.12 | City data officer | 12.12 | Sanitation cost recovery |
| | | | | | | | | | | 6.13 | workplace accessibility 20min | | | 8.13 | Annual PM10 | | | | | 11.13 | % Women councillors | 12.13 | Solid waste cost recovery |
| | | | | | | | | | | 6.14 | % ULB area streets | | | 8.14 | Annual PM2.5 | | | | | 11.14 | Open data portal | 12.14 | Unemployment rate |
| | | | | | | | | | | | | | | 8.15 | Annual NO2 | | | | | | | 12.15 | Inequality index Gini |
| | | | | | | | | | | | | | | 8.16 | Avg. daily SO2 | | | | | | | 12.16 | Workforce employed |
| | | | | | | | | | | | | | | 8.17 | Annual methane emissions | | | | | | | 12.17 | % Capital expenditure |
| | | | | | | | | | | | | | | 8.18 | Noise pollution regulations | | | | | | | 12.18 | GDP density of built up |
| | | | | | | | | | | | | | | | | | | | | | | 12.19 | % Industrial employment |

# Annexure 5.3: Interlinkage of Issue 3 – 'Vulnerability of Informal Settlements' with indicators across the urban assessment sectors

| UPS | | HP | | WTR | | SAN | | SWM | | TR | | SCL | | ENV | | CE | | DRM | | GOV | | FIN | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.1 | Street lighting coverage | 2.1 | % Slum HHs | 3.1 | % HH pipe connection | 4.1 | % Sewage network connection | 5.1 | % Wet waste processed | 6.1 | % Pop. 500m PT | 7.1 | % Pop. 800m healthcare | 8.1 | Clean Air Action Plan | 9.1 | % HH using LPG | 10.1 | Disaster Management Plan | 11.1 | Planners/ capita | 12.1 | Credit rating |
| 1.2 | Change in Built-up area | 2.2 | % city land under slum | 3.2 | % quality of water | 4.2 | %HH toilet access | 5.2 | % City waste separated recycling | 6.2 | Km bicycle path/ 100,000 | 7.2 | % Female literate | 8.2 | GHG measurement system | 9.2 | % Energy from renewable sources | 10.2 | Hazard risk maps | 11.2 | Years since MP updated | 12.2 | % Property tax collected |
| 1.3 | Agri to developable in MP | 2.3 | % Owner occupied units | 3.3 | resource assessment plan | 4.3 | % Sewage treated before discharge | 5.3 | % Solid waste for energy/ processing | 6.3 | % Roads with footpath | 7.3 | % Pop. 800m schools | 8.3 | Annual GHG emissions | 9.3 | % Pop. Access renewable energy | 10.3 | % HHs in risk area | 11.3 | No. Services Command Centre | 12.3 | % Grants received |
| 1.4 | 500m to park/open space | 2.4 | 30% > Income on accommodation | 3.4 | % non revenue | 4.4 | % Wastewater passed treatment standard | 5.4 | % Solid waste in dumps, water bodies, | 6.4 | % Increase PT ridership | 7.4 | change decadal pop. growth | 8.4 | % Tree cover | 9.4 | % Energy efficient street lighting | 10.4 | % Buildings in 4km fire service | 11.4 | No. of functions by ULB | 12.4 | GDP per capita |
| 1.5 | Per capita open space | 2.5 | % HH Room | 3.5 | supply per capita | 4.5 | % Wastewater recycled | 5.5 | % Waste remediated | 6.5 | % clean energy vehicles | 7.5 | City dependency ratio | 8.5 | Biodiversity conservatio | 9.5 | Energy use/ capita | 10.5 | Hazard warning system | 11.5 | GIS based MP | 12.5 | Change own source revenue |
| 1.6 | Pedestrian fatalities/ % | | | 3.6 | metering connection s | 4.6 | % Sewage treated in plant | 5.6 | % Wards segregating waste | 6.6 | Road density | 7.6 | Under 5 mortality | 8.6 | No. of green building incentives | 9.6 | %HH authorized energy connection | 10.6 | Flood risk plan | 11.6 | Environmental status report | 12.6 | Operating margin |
| 1.7 | Recreational open space % | | | | | 4.7 | % Industries complying CPCB | 5.7 | ICT monitoring C&T, GWP, staff | 6.7 | Avg travel speed | 7.7 | Hospital bed density/ 10,000 | 8.7 | Annual AQI | 9.7 | Building codes consider eco- | | | 11.7 | % staff trained | 12.7 | % Annual debt service |
| 1.8 | Safety rating | | | | | 4.8 | FSSM Action Plan/ typ | 5.8 | % waste pickers integrated | 6.8 | % Share NMT | 7.8 | % Reduction vector | 8.8 | Annual GHG /capital | 9.8 | System Average Interruption | | | 11.8 | No. of E-gov initiatives | 12.8 | % Debt in overall budget |
| 1.9 | ULB parks expenditure | | | | | 4.9 | % PT google maps | 5.9 | % C&D collected | 6.9 | Street intersection density | 7.9 | % Reduction waterborne | 8.9 | Emissions from transport | | | | | 11.9 | MP accessible online | 12.9 | % Properties covered tax |
| | | | | | | | | 5.10 | %Hazardous waste processed | 6.10 | % Road PT/ 100,000 | 7.10 | % Schools digital access | 8.10 | Biochemical Oxygen Demand | | | | | 11.10 | No. of ULB committees | 12.10 | Capital expenditure efficiency |
| | | | | | | | | 5.11 | solid waste (kg/c/a/d at sl) | 6.11 | road accidents/ 100,000 | 7.11 | % Mobile network subscription s | 8.11 | Trees per inhabitant | | | | | 11.11 | citizen charter | 12.11 | Water supply cost recovery |
| | | | | | | | | 5.12 | % Wards D2D collection | 6.12 | differently-abled bus accessibility | | | 8.12 | Land use zoning environmental | | | | | 11.12 | City data officer | 12.12 | Sanitation cost recovery |
| | | | | | | | | | | 6.13 | workplace accessibility 30min | | | 8.13 | Annual PM10 | | | | | 11.13 | % Women councillors | 12.13 | Solid waste cost recovery |
| | | | | | | | | | | 6.14 | % ULB area streets | | | 8.14 | Annual PM2.5 | | | | | 11.14 | Open data portal | 12.14 | Unemployment rate |
| | | | | | | | | | | | | | | 8.15 | Annual NO2 | | | | | | | 12.15 | Inequality index Gini |
| | | | | | | | | | | | | | | 8.16 | Avg. daily SO2 | | | | | | | 12.16 | Workforce employed |
| | | | | | | | | | | | | | | 8.17 | Annual methane emissions | | | | | | | 12.17 | % Capital expenditure |
| | | | | | | | | | | | | | | 8.18 | Noise pollution regulations | | | | | | | 12.18 | GDP density of built up |
| | | | | | | | | | | | | | | | | | | | | | | 12.19 | % Informal employment |

# Annexure 5.4 – Details of Vulnerable Informal Settlements

| Classification of slums | # as per BMC records | Name of the Slum | Ward | Zone | Households | Population |
|---|---|---|---|---|---|---|
| Critical Slums | 269 | Durga Nagar-3 | 55 | 12 | 575 | 2340 |
| | 311 | Nehru Nagar | 60 | 13 | 380 | 1143 |
| | 226 | Durga Nagar_1 | 45 | 10 | 118 | 389 |
| | 257 | Jatkhedi | 52 | 11 | 880 | 3747 |
| | 228 | Durga Nagar_3 | 45 | 10 | 36 | 120 |
| | 227 | Durga Nagar_2 | 45 | 10 | 91 | 288 |
| | 380 | Gareeb Nagar | 81 | 19 | 87 | 512 |
| | 379 | Bhopa Nagari Basti | 81 | 19 | 95 | 450 |
| | 127 | Balmiki Nagar | 25 | 6 | 278 | 1015 |
| | 381 | Kanha Kunj Phase-2 | 81 | 19 | 102 | 510 |
| | 371 | Damkhera B Sector | 82 | 18 | 421 | 1626 |
| | 368 | Ambedkar Nagar | 80 | 18 | 452 | 2040 |
| | 106 | Dharampuri | 22 | 5 | 133 | 485 |
| | 343 | Gondipura | 68 | 14 | 488 | 1484 |
| | 150 | Ekta Nagar or Ishwar Nagar | 46 | 6 | 133 | 461 |
| | 71 | Lathif Nagar | 10 | 3 | 61 | 236 |
| | 130 | Aradhna Nagar | 26 | 6 | 599 | 1989 |
| | 141 | Ishwar Nagar | 28 | 6 | 119 | 433 |
| | 135 | Bhadbada Nagar | 27 | 6 | 313 | 1145 |
| | 132 | Sudama Nagar | 26 | 6 | 365 | 1293 |
| | 154 | Panchil Nagar | 46 | 6 | 1516 | 5644 |
| | 152 | Joytiba Fhule | 46 | 6 | 221 | 732 |
| | 147 | 8 Dukan Ke Piche | 46 | 6 | 50 | 172 |
| | 145 | Shivaji Nagar | 28 | 6 | 59 | 212 |
| | 251 | Baba Nagar | 51 | 11 | 783 | 2919 |
| | 250 | Sahapura Gaon | 50 | 11 | 1135 | 4751 |
| | 222 | Shankar Nagar | 44 | 10 | 92 | 240 |
| | 252 | Rahul Nagar Chavani | 51 | 11 | 32 | 142 |
| | 166 | Dhobi Ghat | 34 | 7 | 185 | 565 |
| | 171 | C.I. Colony | 42 | 8 | 35 | 146 |
| | 138 | Durga Nagar | 28 | 6 | 285 | 1065 |
| | 137 | Chuna Bhatti | 28 | 6 | 586 | 2167 |
| | 312 | Piplani Thane Ke Samne Ki Jhugi | 60 | 13 | 60 | 156 |
| | 288 | Indra Nagar | 58 | 12 | 201 | 780 |

| Classification of slums | # as per BMC records | Name of the Slum | Ward | Zone | Households | Population |
|---|---|---|---|---|---|---|
| Slums on eco-sensitive zones | 92 | Bag Munshi Khan | 7 | 4 | 1220 | 4634 |
| | 79 | Tila Jamalpura Gaon | 11 | 3 | 366 | 1327 |
| | 139 | Harshwardhan Nagar Slum_01_ | 28 | 6 | 42 | 158 |
| | 85 | Chouksey Nagar Nale Ke Pas | 13 | 3 | 62 | 231 |
| | 142 | Kolar Colony | 28 | 6 | 1066 | 3691 |
| | 143 | Pampapur Nagar | 28 | 6 | 266 | 886 |
| | 113 | Hansnath Prat-ap Nagar | 23 | 5 | 1239 | 4728 |
| | 114 | Rahul Nagar (Vishthapit) | 23 | 5 | 477 | 1742 |
| | 158 | Om Nagar - 3 | 31 | 7 | 262 | 864 |
| | 157 | Bhim Nagar | 31 | 7 | 4908 | 17164 |
| | 189 | Nav Vihar Colony | 35 | 9 | 28 | 85 |
| | 178 | Padnabh Nagar | 43 | 8 | 47 | 187 |
| | 52 | Sahid Nagar Behind Rto | 6 | 2 | 619 | 2296 |
| | 180 | Aazad Nagar | 64 | 8 | 24 | 96 |
| | 51 | R.T.O Ke Piche Ki Jhuggi | 5 | 2 | 37 | 194 |
| | 262 | Saket Nagar | 53 | 11 | 397 | 1338 |
| | 191 | Roshan Bagh Dhobi Ghat | 35 | 9 | 174 | 750 |
| | 192 | S.B.I. Colony | 35 | 9 | 30 | 103 |
| | 194 | Sankrachary Nagar | 35 | 9 | 52 | 178 |
| | 200 | Vijay Nagar Kapda Mill Ki Chal | 36 | 9 | 966 | 3781 |
| | 201 | Bismillah Colony | 37 | 9 | 337 | 912 |
| | 218 | Om Nagar-2 | 29 | 10 | 613 | 1970 |
| | 220 | Ankur School Ke Pass Ki Juggi | 44 | 10 | 198 | 733 |
| | 221 | Rajeev Nagar | 44 | 10 | 59 | 220 |
| | 63 | S.B.I. Colony | 8 | 2 | 135 | 540 |
| | 64 | Water Filter Plant | 8 | 2 | 111 | 450 |
| | 246 | Railway Colony | 50 | 11 | 37 | 180 |
| | 28 | Railway Fatak Slum Lalghati | 2 | 1 | 84 | 312 |
| | 38 | Behta Gaon | 4 | 1 | 707 | 3456 |
| | 43 | Manjhi Nagar | 4 | 1 | 250 | 1050 |
| | 44 | Old Dairy Form | 4 | 1 | 225 | 900 |
| | 45 | Rahul Nagar | 4 | 1 | 266 | 811 |
| | 58 | Ekta Nagar | 8 | 2 | 125 | 375 |
| | 276 | Durga Chouk | 56 | 12 | 89 | 409 |
| | 55 | Bajpayi Nagar | 8 | 2 | 1476 | 5904 |
| | 275 | Anna Nagar And Puliya | 56 | 12 | 239 | 1109 |

| Classification of slums | # as per BMC records | Name of the Slum | Ward | Zone | Households | Population |
|---|---|---|---|---|---|---|
| Slums on eco-sensitive zones | 277 | Goutam Nagar Pani Ki Tanki Ke Pass | 56 | 12 | 66 | 456 |
| | 61 | Police Line Colony | 8 | 2 | 92 | 460 |
| | 223 | Santi Nagar | 44 | 10 | 237 | 624 |
| | 60 | Mother India | 8 | 2 | 2745 | 8235 |
| | 325 | Satnami Nagar | 63 | 13 | 520 | 2286 |
| | 111 | Banganga | 23 | 5 | 3275 | 11770 |
| | 66 | Sanjay Nagar Lendiya Talab Ka Slum | 9 | 2 | 1854 | 7083 |
| | 320 | Labour Colony | 62 | 13 | 830 | 2681 |
| | 76 | Basor Basti | 11 | 3 | 325 | 1245 |
| | 77 | Krishna Colony | 11 | 3 | 715 | 2569 |
| | 82 | Indra Nagar | 12 | 3 | 738 | 2737 |
| | 378 | Damkheda A Sector | 80 | 18 | 1350 | 6117 |
| | 47 | Barela Gaon | 5 | 2 | 2000 | 8000 |
| | 50 | Lalghati Chora-ha Slum | 5 | 2 | 90 | 360 |
| | 96 | Ibrahim Khan Ki Babdi | 15 | 4 | 18 | 56 |
| | 97 | Shain Colony | 15 | 4 | 96 | 248 |
| | 99 | Dulichand Ka Baag | 16 | 4 | 189 | 844 |
| | 100 | Ekta Nagar | 16 | 4 | 253 | 1078 |
| | 112 | Babu Lal Gour Nagar | 23 | 5 | 95 | 384 |
| | 103 | Bhoi Mohalla | 21 | 5 | 436 | 1635 |
| Slums with access to three or less services | 248 | Sai Baba Nagar E- 6 | 50 | 11 | 1076 | 4518 |
| | 254 | Baagmugaliya | 52 | 11 | 785 | 2949 |
| | 252 | Rahul Nagar Chavani | 51 | 11 | 32 | 142 |
| | 259 | Baagmugaliya | 53 | 11 | 1080 | 4137 |
| | 257 | Jatkhedi | 52 | 11 | 880 | 3747 |
| | 261 | Laharpur | 53 | 11 | 180 | 404 |
| | 260 | Mp Housing Bord Slum | 53 | 11 | 190 | 573 |
| | 238 | Ishwar Nagar 1 Railway Line Ke Pass | 50 | 11 | 426 | 1781 |
| | 232 | Samrat Ashok Nagar | 45 | 10 | 120 | 421 |
| | 240 | Rose Convent School Ke Pass Janta Quartes | 50 | 11 | 307 | 1388 |
| | 239 | Ishwar Nagar 2 Gulmohar Colo-ny Ke Pass E-8 Ishwar Nagar Shiv Mandi Ke Pass | 50 | 11 | 524 | 2176 |
| | 243 | Meera Bai Nagar E-6, Arera Colony | 50 | 11 | 280 | 1351 |

| Classification of slums | # as per BMC records | Name of the Slum | Ward | Zone | Households | Population |
|---|---|---|---|---|---|---|
| Slums with access to three or less services | 242 | Laxman Nagar | 50 | 11 | 169 | 779 |
| | 245 | Priyadarshini Nagar | 50 | 11 | 34 | 141 |
| | 244 | P.C. Nagar E-6 | 50 | 11 | 155 | 661 |
| | 18 | Adarsh Nagar New Colony | 2 | 1 | 390 | 1600 |
| | 10 | Pipalner | 1 | 1 | 129 | 715 |
| | 20 | Bhesha Khedi Old | 2 | 1 | 410 | 1540 |
| | 19 | Beragad Kala | 2 | 1 | 503 | 1700 |
| | 39 | Borband Gao | 4 | 1 | 80 | 310 |
| | 24 | Laukhedi | 2 | 1 | 403 | 1499 |
| | 70 | Harijan Basti Nariyal Kheda | 10 | 3 | 192 | 905 |
| | 53 | Sajida Nagar Behind Rto | 6 | 2 | 564 | 2042 |
| | 2 | Arjun Ward Gandhi Nagar | 1 | 1 | 583 | 2027 |
| | 1 | Abbas Nagar | 1 | 1 | 1022 | 4202 |
| | 4 | Gond Basti | 1 | 1 | 463 | 2144 |
| | 3 | Banjara Basti | 1 | 1 | 178 | 764 |
| | 6 | Hari Om Nagar | 1 | 1 | 189 | 482 |
| | 5 | Goundher Mao | 1 | 1 | 791 | 2363 |
| | 8 | Nai Basti | 1 | 1 | 976 | 4500 |
| | 7 | Mahaveer Basti | 1 | 1 | 328 | 879 |
| | 117 | Beelkheda | 24 | 5 | 190 | 821 |
| | 116 | Barkhedi Khurd | 24 | 5 | 464 | 1796 |
| | 119 | Sevaniya Gond | 24 | 5 | 907 | 3082 |
| | 118 | Bishankhedi | 24 | 5 | 136 | 552 |
| | 121 | Prempura Ghat | 24 | 5 | 606 | 2319 |
| | 120 | Gore Gao | 24 | 5 | 353 | 1245 |
| | 124 | Naya Basera | 25 | 6 | 1793 | 6087 |
| | 122 | Suraj Nagar | 24 | 5 | 344 | 1095 |
| | 72 | Nagar Nigam Colony | 10 | 3 | 235 | 872 |
| | 71 | Lathif Nagar | 10 | 3 | 61 | 236 |
| | 105 | Ahata Rustam Kha | 22 | 5 | 972 | 3132 |
| | 73 | Nariyal Kheda | 10 | 3 | 147 | 547 |
| | 108 | Kaccha Bangla | 22 | 5 | 174 | 541 |
| | 106 | Dharampuri | 22 | 5 | 133 | 485 |
| | 115 | Barkhedi Kala | 24 | 5 | 396 | 980 |
| | 109 | Krishna Nagar | 22 | 5 | 283 | 1046 |
| | 334 | Samera Kala | 66 | 14 | 63 | 133 |
| | 333 | Samera Gaon | 66 | 14 | 202 | 834 |
| | 336 | Udiya Basti | 66 | 14 | 214 | 952 |
| | 335 | Shankar Nagar | 66 | 14 | 191 | 903 |
| | 339 | Daam Khera | 67 | 14 | 176 | 794 |
| | 337 | Ayodhya Nagar | 67 | 14 | 26 | 119 |
| | 341 | Khejda | 67 | 14 | 252 | 1109 |
| | 340 | Gaon Mohali | 67 | 14 | 142 | 650 |
| | 319 | Gotam Nagar Govindpura | 62 | 13 | 260 | 817 |

| Classification of slums | # as per BMC records | Name of the Slum | Ward | Zone | Households | Population |
|---|---|---|---|---|---|---|
| Slums with access to three or less services | 318 | Adarsh Nagar Govindpura | 62 | 13 | 510 | 1866 |
| | 328 | Garib Nagar | 66 | 14 | 333 | 790 |
| | 327 | Bhanpur Gaon Vidisha Road | 66 | 14 | 151 | 609 |
| | 330 | Kariya Farm | 66 | 14 | 487 | 1394 |
| | 329 | Kolua Kala | 66 | 14 | 400 | 1573 |
| | 332 | Rasla Khedi | 66 | 14 | 133 | 525 |
| | 331 | Rajeev Nagar | 66 | 14 | 202 | 877 |
| | 352 | Kanchi Chola | 69 | 14 | 1094 | 3881 |
| | 351 | Kamal Colony | 69 | 14 | 89 | 373 |
| | 356 | Preet Nagar | 69 | 14 | 148 | 498 |
| | 355 | Nevari | 69 | 14 | 191 | 546 |
| | 358 | Shankar Nagar | 69 | 14 | 366 | 1396 |
| | 357 | Prem Nagar | 69 | 14 | 799 | 2863 |
| | 360 | Shindhi Visthapit | 69 | 14 | 53 | 219 |
| | 359 | Shiv Shakti Nagar | 69 | 14 | 782 | 2875 |
| | 343 | Gondipura | 68 | 14 | 488 | 1484 |
| | 342 | Badvai Gao | 68 | 14 | 437 | 1201 |
| | 345 | Palasi Gao | 68 | 14 | 460 | 1254 |
| | 344 | Nayapura | 68 | 14 | 216 | 608 |
| | 348 | Chand Badi Jhuggi | 69 | 14 | 604 | 2446 |
| | 346 | Annu Nagar | 69 | 14 | 675 | 2932 |
| | 350 | Kanjar Mohalla (Grib Nagar) | 69 | 14 | 62 | 222 |
| | 349 | Chandbadi_01 Kachichola | 69 | 14 | 99 | 338 |
| | 292 | Amritpuri Nan-digram | 59 | 13 | 98 | 310 |
| | 291 | Pakshi Vihar Ajad Nagar | 58 | 12 | 174 | 678 |
| | 294 | Bal Bihar | 59 | 13 | 510 | 1420 |
| | 293 | Annandpura Village | 59 | 13 | 170 | 428 |
| | 296 | Doulatpura | 59 | 13 | 450 | 1453 |
| | 295 | Balaji Nagar | 59 | 13 | 199 | 612 |
| | 298 | Guthan | 59 | 13 | 260 | 727 |
| | 297 | Gadiya Basti | 59 | 13 | 668 | 1719 |
| | 264 | Barkheda Pathani | 54 | 12 | 3115 | 10775 |
| | 263 | Amrawat Khurd | 54 | 12 | 166 | 610 |
| | 266 | Pipliya Pende Khan | 54 | 12 | 982 | 4200 |
| | 265 | Bda Colony | 54 | 12 | 706 | 1970 |
| | 287 | Purana Nagar | 57 | 12 | 426 | 1870 |
| | 271 | Padma Nagar | 55 | 12 | 604 | 2218 |
| | 289 | Jai Hind Nagar | 58 | 12 | 247 | 900 |
| | 288 | Indra Nagar | 58 | 12 | 201 | 780 |
| | 308 | 60 Quarters | 60 | 13 | 501 | 1742 |
| | 307 | 40 Quarters | 60 | 13 | 430 | 1738 |
| | 310 | Milk Dairy Slum | 60 | 13 | 101 | 321 |

| Classification of slums | # as per BMC records | Name of the Slum | Ward | Zone | Households | Population |
|---|---|---|---|---|---|---|
| Slums with access to three or less services | 309 | Chand Badi | 60 | 13 | 570 | 2553 |
| | 312 | Piplani Thane Ke Samne Ki Jhugi | 60 | 13 | 60 | 156 |
| | 311 | Nehru Nagar | 60 | 13 | 380 | 1143 |
| | 316 | Hathaikheda Pathar | 61 | 13 | 456 | 1658 |
| | 314 | Shiv Nagar | 60 | 13 | 860 | 3343 |
| | 300 | Harijan Basti Anand Nagar | 59 | 13 | 180 | 460 |
| | 299 | Harijan Basti | 59 | 13 | 302 | 987 |
| | 302 | Kocta Village | 59 | 13 | 171 | 470 |
| | 301 | Khajuri Kalan | 59 | 13 | 446 | 1400 |
| | 304 | Sonpur_1 | 59 | 13 | 124 | 406 |
| | 303 | Krishna Nagar | 59 | 13 | 156 | 535 |
| | 306 | 100 Quarters | 60 | 13 | 705 | 2386 |
| | 305 | Sonpur_2 | 59 | 13 | 133 | 421 |
| | 383 | Amrai Basti | 81 | 19 | 65 | 425 |
| | 381 | Kanha Kunj Phase-2 | 81 | 19 | 102 | 510 |
| | 386 | Tola Jhuggi | 85 | 19 | 70 | 395 |
| | 385 | Dhouli Khadan Jhuggi | 84 | 19 | 70 | 490 |
| | 388 | Dipdi | 85 | 19 | 40 | 208 |
| | 387 | Barrai | 85 | 19 | 330 | 1650 |
| | 362 | Timber Market | 69 | 14 | 82 | 244 |
| | 361 | Sundar Nagar | 69 | 14 | 689 | 2209 |
| | 366 | Karond Rusali | 70 | 14 | 158 | 439 |
| | 364 | Nvibag | 70 | 14 | 228 | 692 |
| | 368 | Ambedkar Nagar | 80 | 18 | 452 | 2040 |
| | 367 | Bhagwati Nagar | 55 | 13 | 65 | 305 |
| | 379 | Bhopa Nagari Basti | 81 | 19 | 95 | 450 |
| | 377 | Om Nagar | 83 | 18 | 490 | 2380 |
| | 156 | Sewa Sadan | 46 | 6 | 99 | 338 |
| | 155 | Patha Mohalla | 46 | 6 | 57 | 268 |
| | 186 | Govind Pura | 65 | 8 | 31 | 84 |
| | 185 | Durga Basti | 65 | 8 | 179 | 683 |
| | 198 | Krariya Gaon | 36 | 9 | 62 | 251 |
| | 196 | Khushi Pura | 36 | 9 | 428 | 1532 |
| | 229 | Priyadarshani Nagar | 45 | 10 | 785 | 468 |
| | 204 | Afkar Colony | 38 | 9 | 336 | 1038 |
| | 130 | Aradhna Nagar | 26 | 6 | 599 | 1989 |
| | 127 | Balmiki Nagar | 25 | 6 | 278 | 1015 |
| | 135 | Bhadbada Nagar | 27 | 6 | 313 | 1145 |
| | 132 | Sudama Nagar | 26 | 6 | 365 | 1293 |
| | 148 | Durga Nagar | 46 | 6 | 143 | 389 |
| | 141 | Ishwar Nagar | 28 | 6 | 119 | 433 |
| | 151 | Jai Bhim Nagar | 46 | 6 | 95 | 284 |
| | 149 | Goutam Nagar | 46 | 6 | 418 | 1262 |
| | 250 | Sahapura Gaon | 50 | 11 | 1135 | 4751 |

# Annexure 5.5: Interlinkage of issue 4 – 'High Dependence on Fossil Fuels and Sub-optimal use of NMT' with indicators across the urban assessment sectors

| UPS | | HP | | WTR | | SAN | | SWM | | TR | | SCL | | ENV | | CE | | DRM | | GOV | | FIN | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.1 | Street lighting coverage | 2.1 | % Slum HHs | 3.1 | % HH pipe connection | 4.1 | % Sewage network connection | 5.1 | % Wet waste processed | 6.1 | % Pop. 500m PT | 7.1 | % Pop. 800m healthcare | 8.1 | Clean Air Action Plan | 9.1 | % HH using LPG | 10.1 | Disaster Management Plan | 11.1 | Planners/ capita | 12.1 | Credit rating |
| 1.2 | Change in Built up area | 2.2 | % city land under slum | 3.2 | % quality of water | 4.2 | HH toilet access | 5.2 | % Dry waste separated recycling | 6.2 | Km bicycle path/ 100,000 | 7.2 | % Female literate | 8.2 | GHG measurement system | 9.2 | % Energy from renewable sources | 10.2 | Hazard risk maps | 11.2 | Years since MP updated | 12.2 | % Property tax collected |
| 1.3 | Agri to developable in MP | 2.3 | % Owner occupied units | 3.3 | resource assessment plan | 4.3 | % Sewage treated before discharge | 5.3 | % Solid waste for energy/ processing | 6.3 | % Roads with footpath | 7.3 | % Pop. 800m schools | 8.3 | Annual GHG emissions | 9.3 | % Pop. Access renewable energy | 10.3 | % HHs in risk area | 11.3 | No. Services Command Centre | 12.3 | % Grants received |
| 1.4 | 500m to park/open space | 2.4 | 30% income on accommodation | 3.4 | % non revenue | 4.4 | % Wastewater passed treatment standard | 5.4 | % Solid waste in dumps, water bodies, | 6.4 | % Increase PT ridership | 7.4 | change decadal pop. growth | 8.4 | % Tree cover | 9.4 | % Energy efficient street lighting | 10.4 | % Buildings in risk/ no service | 11.4 | No. of functions by ULB | 12.4 | GDP per capita |
| 1.5 | Per capita open space | 2.5 | % HH 1Room | 3.5 | supply per capita | 4.5 | % Wastewater recycled | 5.5 | % Waste remediated | 6.5 | % clean energy vehicles | 7.5 | City dependency ratio | 8.5 | Biodiversity conservatio | 9.5 | Energy use/ capita | 10.5 | Hazard warning system | 11.5 | BIS based MP | 12.5 | Change own source revenue |
| 1.6 | Pedestrian fatalities % | | | 3.6 | metering connection s | 4.6 | % Sewage treated in plant | 5.6 | % Wards segregating waste | 6.6 | Road density | 7.6 | Under 5 mortality | 8.6 | No. of green building incentives | 9.6 | HH authorized energy connection | 10.6 | Flood risk plan | 11.6 | Environmental status report | 12.6 | Operating margin |
| 1.7 | Recreational/open space % | | | | | 4.7 | % Industries complying CPCB | 5.7 | ICT monitoring C&T, GWP, staff | 6.7 | Avg travel speed | 7.7 | Hospital bed density/ 10,000 | 8.7 | Annual AQI | 9.7 | Building codes consider eco- | | | 11.7 | % staff trained | 12.7 | % Annual debt service |
| 1.8 | Safety rating | | | | | 4.8 | FSSM Action Plan/ bye | 5.8 | % waste pickers integrated | 6.8 | % Share NMT | 7.8 | % Reduction sensor | 8.8 | Annual GHG/ capital | 9.8 | System Average Interruption | | | 11.8 | No. of E-gov initiatives | 12.8 | % Debt in overall budget |
| 1.9 | ULB parks expenditure | | | | | 4.9 | % PT google maps | 5.9 | % C&D collected | 6.9 | Street intersection density | 7.9 | % Reduction waterborne | 8.9 | Emissions from transport | | | | | 11.9 | MP accessible online | 12.9 | % Properties covered tax |
| | | | | | | | | 5.10 | %Hazardous waste processed | 6.10 | % Road PTI 100,000 | 7.10 | % Schools digital access | 8.10 | Biochemical Oxygen Demand | | | | | 11.10 | No. of ULB committees | 12.10 | Capital expenditure efficiency |
| | | | | | | | | 5.11 | solid waste (kg/capita/day) | 6.11 | road accidents/ 100,000 | 7.11 | % Mobile network subscriptions | 8.11 | Trees per inhabitant | | | | | 11.11 | slides charter | 12.11 | Water supply cost recovery |
| | | | | | | | | 5.12 | % Wards D2D collection | 6.12 | differently-abled bus accessibility | | | 8.12 | Land use zoning environmental | | | | | 11.12 | City data officer | 12.12 | Sanitation cost recovery |
| | | | | | | | | | | 6.13 | workplace accessibility (time) | | | 8.13 | Annual PM10 | | | | | 11.13 | % Women councillors | 12.13 | Solid waste cost recovery |
| | | | | | | | | | | 6.14 | % ULB area streets | | | 8.14 | Annual PM2.5 | | | | | 11.14 | Open data portal | 12.14 | Unemployment rate |
| | | | | | | | | | | | | | | 8.15 | Annual NO2 | | | | | | | 12.15 | Inequality index (Gini |
| | | | | | | | | | | | | | | 8.16 | Avg. daily SO2 | | | | | | | 12.16 | Workforce employed |
| | | | | | | | | | | | | | | 8.17 | Annual methane emissions | | | | | | | 12.17 | % Capital expenditure |
| | | | | | | | | | | | | | | 8.18 | Noise pollution regulations | | | | | | | 12.18 | GDP density of built up |
| | | | | | | | | | | | | | | | | | | | | | | 12.19 | % Informal employment |

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