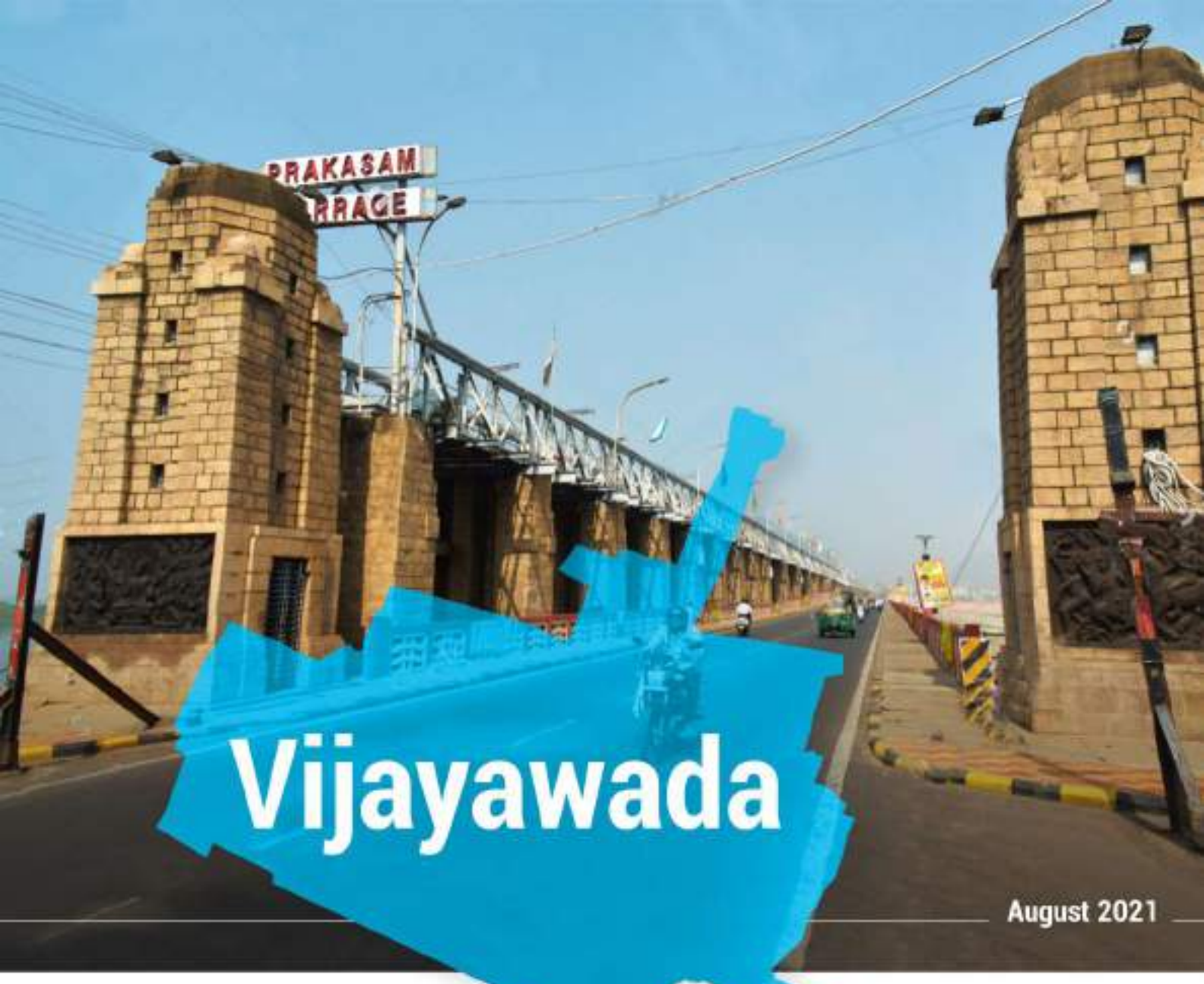

Vijayawada

August 2021

CITY PROFILE AND DIAGNOSTIC REPORT

Sustainable Cities Integrated Approach Pilot (SCIAP)

UN-HABITAT
FOR A BETTER URBAN FUTURE

UNIDO

vijayawada
Municipal Corporation

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SUBMITTED TO:

Vijayawada Municipal Corporation

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UN-HABITAT
FOR A BETTER URBAN FUTURE

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CITY PROFILE AND DIAGNOSTIC REPORT

Sustainable Cities Integrated Approach Pilot (SCIAP)

Component 1: Sustainable Urban Planning And Management

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VIJAYAWADA

City Profile and Diagnostic Report

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List of Acronyms

AFOLU	Agriculture, Forestry and Other Land Use
AMRDA	Amaravati Metropolitan Region Development Authority
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
APCPDCL	Andhra Pradesh Central Power Corporation Distribution Limited
APCRDA	Andhra Pradesh Capital Region Development Authority
APG&BC	Andhra Pradesh Greening and Beautification Corporation
APIIC	Andhra Pradesh Industrial Infrastructure Corporation
APPCB	Andhra Pradesh Pollution Control Board
APSDRFS	Andhra Pradesh State Disaster Response and Fire Services
APSDMA	Andhra Pradesh State Disaster Management Authority
APSRTC	Andhra Pradesh State Road Transport Corporation
APUIAML	Andhra Pradesh Urban Infrastructure Asset Management Limited
AQI	Air Quality Index
ATL	Average Trip Length
CAA	Constitutional Amendment Act
CDMA	Commissioner and Directorate of Municipal Administration
CDMP	City Disaster Management Plan
COVID	Coronavirus Disease
CPCB	Central Pollution Control Board
DCR	Development Control Regulations
DDMP	District Disaster Management Plan
DEM	Digital Elevation Model
DTCP	Directorate of Town and Country Planning
EESL	Energy Efficiency Services Limited
ELSR	Elevated Level Service Reservoirs
EOL	Ease of Living Index
EWS	Early Warning Systems
FSSM	Faecal Sludge and Septage Management
GDP	Gross Domestic Product
GoAP	Government of Andhra Pradesh
GEF	Global Environment Facility
GHG	Greenhouse Gas
GGH	Government General Hospital
GIS	Geographical Information System
GPSC	Global Platform for Sustainable Cities
GRIHA	Green Rating for Integrated Habitat Assessment
GVP	Garbage Vulnerable Points
IALA	Industrial Area Local Authority
IBEF	India Brand Equity Foundation
IGBC	Indian Green Building Council
INR	Indian Rupee
IRR	Inner Ring Road
JICA	Japan International Cooperation Agency
JnNURM	Jawaharlal Nehru National Urban Renewal Mission

LPCD	Litres per Capita per Day
MA&UD	Municipal Administration and Urban Development Department
MEPMA	Mission for Elimination of Poverty in Municipal Areas
MoHUA	Ministry of Housing and Urban Affairs
MNRE	Ministry of New and Renewable Energy
MPI	Municipal Performance Index
MSWM	Municipal Solid Waste Management
MTCO2e	Metric Tonnes of Carbon Dioxide Equivalent
MTD	Metric Tonnes per Day
NAAQS	National Ambient Air Quality Standards
NAQMP	National Air Quality Monitoring Programme
NH	National Highway
NIUA	National Institute of Urban Affairs
NMT	Non-Motorised Transport
NPC	National Productivity Council
NREDCAP	New & Renewable Energy Development Corporation of AP Ltd.
NRW	Non-Revenue Water
ODF	Open Defecation Free
ORR	Outer Ring Road
PCTR	Per Capita Travel Trip Rate
PHMED	Public Health & Municipal Engineering Department
PMAY-U	Pradhan Mantri Awas Yojana - Urban
PPH	Persons per Hectare
SBM	Swachh Bharat Mission
SCADA	Supervisory Control and Data Acquisition
SCIAP	Sustainable Cities – Integrated Approach Pilot
SCR	South Central Railway
SCS	Sustainable City Strategies
SEZ	Special Economic Zone
SH	State Highway
SPA V	School of Planning and Architecture Vijayawada
STP	Sewage Treatment Plant
TERI	The Energy and Resources Institute
UDA	Urban Development Authority
ULB	Urban Local Body
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UN-HABITAT	United Nations Human Settlements Programme
UNIDO	United Nations Industrial Development Organization
URDPFI	Urban and Regional Development Plans Formulation and Implementation
USAF	Urban Sustainability Assessment Framework
VMC	Vijayawada Municipal Corporation
WPR	Workforce Participation Rate
WTP	Water Treatment Plant
ZDP	Zonal Development Plan

01

Introduction

1.1 Report Objectives

The city profile and diagnostic report situates Vijaywada 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.

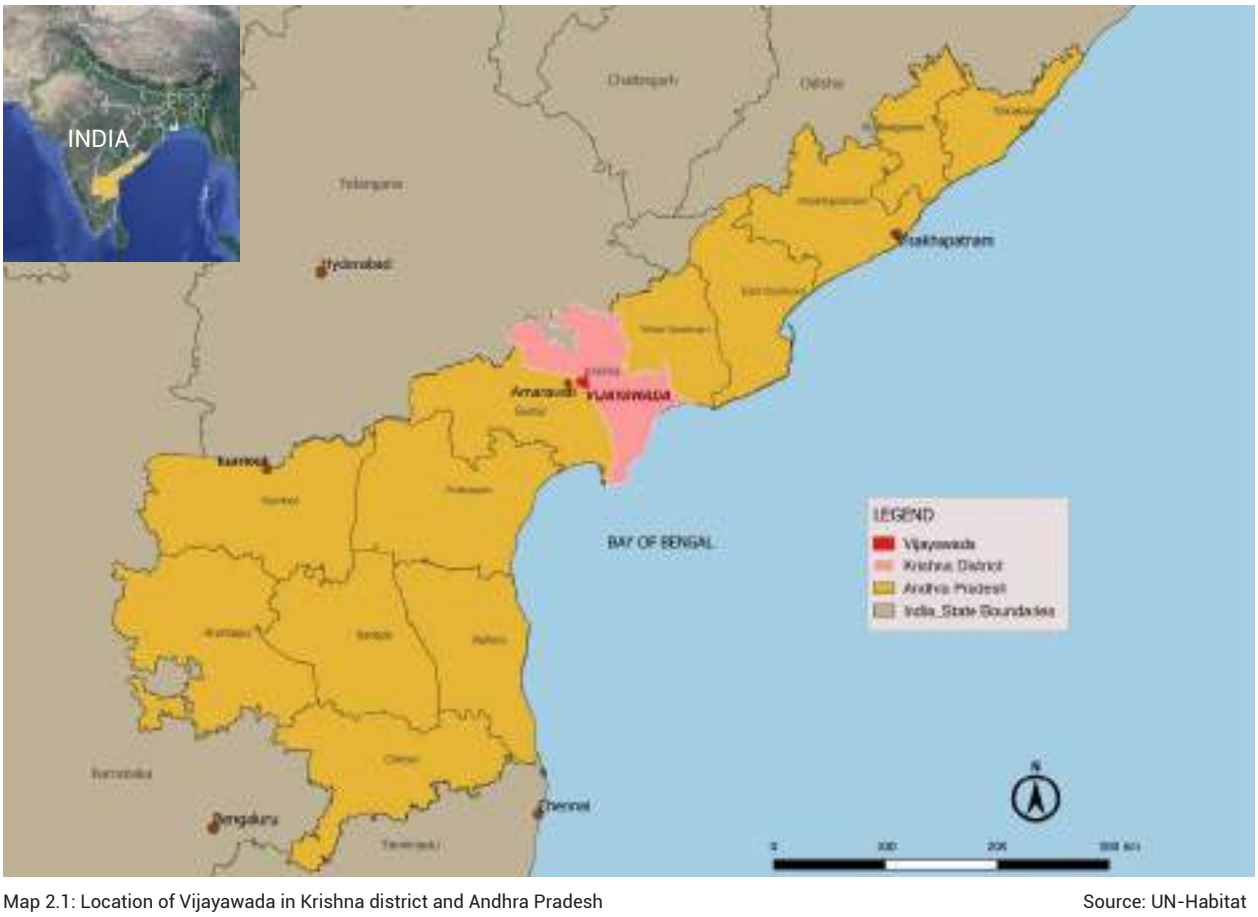
[1] The Urban Sustainability Assessment Framework was developed by UN-Habitat India as a part of the SCIAP project. Further details are available in the Urban Sustainability Assessment Framework Report.

02

Regional Context

2.1 GEOGRAPHY AND LOCATION

Vijayawada is the second most populous city in the state of Andhra Pradesh. There are 13 districts in Andhra Pradesh, and Vijayawada is part of the Krishna district. The city lies about 70 km to the West of the Bay of Bengal along the eastern coast of India. Amaravati, the state capital, stands about 15 km to the West of Vijayawada, as indicated in Map 2.1. The Krishna River running through the state, divides Krishna district from Guntur district.



Map 2.1: Location of Vijayawada in Krishna district and Andhra Pradesh

Source: UN-Habitat

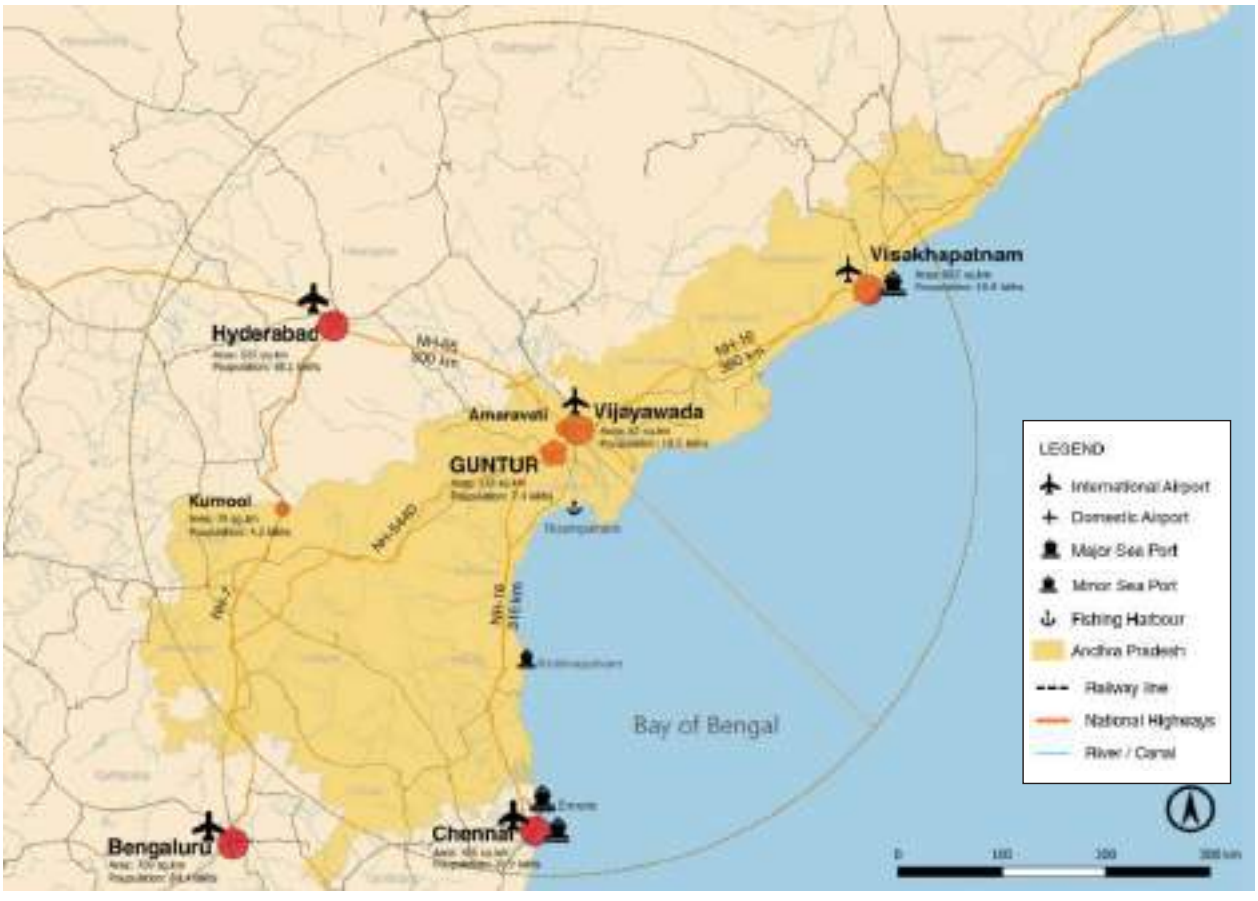
2.2 REGIONAL CONNECTIVITY

Vijayawada enjoys a locational advantage in terms of its regional connectivity. Regional and urban centres are connected to Vijayawada by road, rail, and air, enabling the city to function as one of the key commercial and economic centres of Andhra Pradesh.

Road Connectivity

The road network forms the backbone of public transport in Vijayawada with intercity as well as intra-city connectivity. The city is well-connected to key urban centres like Hyderabad, Guntur, Gannavaram, Eluru, Jaggayyapeta, Mangalagiri, Machalipatnam, and Visakhapatnam through the region's primary road network. As shown in Map 2.2, Vijayawada is connected through National Highway 16 (NH 16) to Chennai in the South and Visakhapatnam to the North; and through NH 65 to Hyderabad in the West and Machilipatnam to the East. State Highway 236 (SH 236) is another important road linkage connecting Vijayawada with Nuzvid to the North.

The Andhra Pradesh State Road Transport Corporation (APSRTC) operates intercity as well as intra-city public bus routes in Vijayawada.



Map 2.2: Regional connectivity of Vijayawada with major urban centres within 400 km. Source: Capital Region Draft Perspective Plan, 2050

Image 2.1: View of the Vijayawada railway station façade

Source: UN-Habitat

Rail Connectivity

Constructed in 1888, Vijayawada is one of the busiest railway stations in India, with Vijayawada junction forming one of the six divisions of the South Central Railway (SCR) zone. The station is a major junction along the two main railway lines that run from New Delhi to Chennai and from Howrah to Chennai. More than 250 express and 150 freight trains pass through the city daily. It serves over 50 million passengers every year, as per the Draft Perspective Plan, Andhra Pradesh Capital Region Development Authority (APCRDA) 2050.

Air Connectivity

Vijayawada is served by the Vijayawada International Airport at Gannavaram, which stands along NH 16, about 20 km from the city. During the establishment of Amaravati as the state capital in 2015, the Vijayawada Airport served as the key linkage to the region for domestic and international passengers.

2.3 REGIONAL URBAN FUNCTION

As the second most populous city in the state, barring Guntur, there are no other large cities (in terms of population) within 200 km of Vijayawada. Within a 400-km radius of the city, however, there lie the three metropolitan[2] cities of Hyderabad (to the West), Visakhapatnam (to the North) and Chennai (to the South). Following the bifurcation of the former state of Andhra Pradesh, Vijayawada gained significance as an important growth centre for the region. Due to its proximity to Amaravati, and presence of the many government departments in the city, Vijayawada functions as a de-facto capital. As per the URPDFI hierarchy of urban settlements, Vijayawada is the only metropolitan urban settlement within the state's capital region (see Map 2.2).

2.4 SOCIO-ECONOMIC CONTEXT

2.4.1 Demographic profile

Population

Vijayawada Municipal Corporation (VMC) covers an area of 61.88 sq. km. with a total population of 10,34,358, as per Census 2011. Vijayawada constituted only 0.73 per cent of the total area and 23 per cent to the total area of the of the Krishna district, as per Census 2011. Vijayawada drove 56 per cent of the district's urban population and seven per cent of the urban population of the state. The decadal population growth rate between 2011 and 2001 was 9.8 per cent. Between 1981 and 2011, Vijayawada experienced higher decadal population growth than that of Krishna district as well as of Andhra Pradesh. However, the city's decadal population growth during 2001–2011 was slightly less than that of the state (see Table 2.1).

Table 2.1: Population and decadal growth rates (1981–2011)

	Vijayawada		Krishna District		Andhra Pradesh	
Year	Population (lakh)	Decadal growth rate (%)	Population (lakh)	Decadal growth rate (%)	Population (lakh)	Decadal growth rate (%)
1981	4.62	-	30.48	-	535.49	-
1991	7.08	53.2	36.99	21.4	665.08	24.2
2001	9.42	33.1	41.88	13.2	762.1	14.6
2011	10.34	9.8	45.17	7.9	845.8	11.0

Source: Census of India and Krishna District Census Handbook

With the bifurcation of Andhra Pradesh in 2014, Vijayawada became the second most populated city in the newly reorganized state, following Visakhapatnam (17.28 lakh), as per Census 2011.

[2] As per the Urban and Regional Development Plans Formulation and Implementation (URDPFI) classification of urban settlements, metropolitan cities are those with a population of more than 10 lakh.

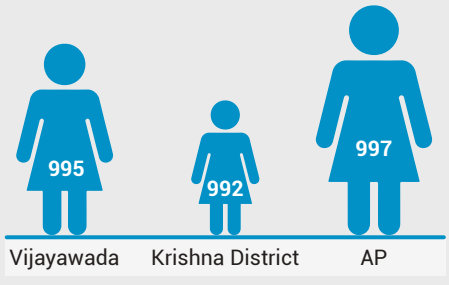
Sex Ratio

In 2011, Vijayawada's sex ratio was 995 females for every thousand males, which was slightly higher than the district's sex ratio of 992. The city's sex ratio was lower than the state average of 997, but six per cent higher than the national average of 940 females for every 1,000 males.

Age Cohort

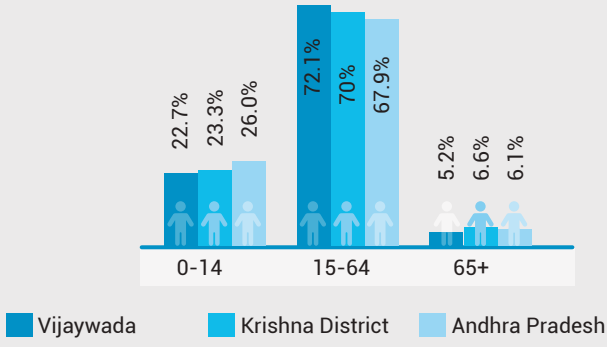
In 2011, Vijayawada's working age population (15–64 years) constituted 72 per cent of the total population, which was slightly higher than the district and state average (see Figure 2.2). About 28.32 per cent of the city's population constituted its dependent population (0-14 years and above 65 years).

Figure 2.1: Sex ratio in Vijayawada in comparison to Krishna District and Andhra Pradesh



Source: Census of India 2011

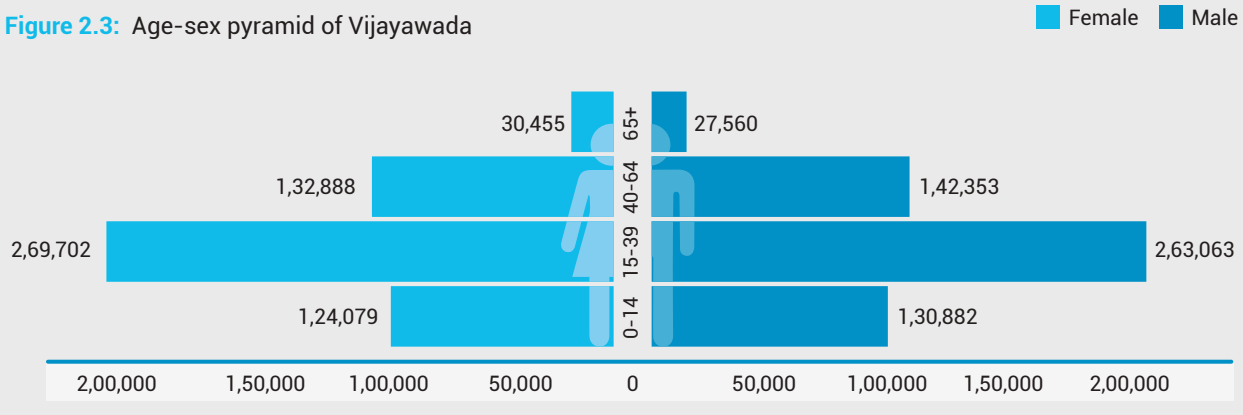
Figure 2.2: Percentage of working age and dependant age populations



Source: Table C-14 Andhra Pradesh – Population in five-year age group by residence and sex, Census 2011

The city's dependent population, however, was slightly lower than that of Krishna district and of the state. In 2011, Vijayawada's youth (15-34 years)[3] constituted 39.2 per cent of its total population, while the same in Krishna district and the state constituted 36.9 per cent and 36.5 per cent, respectively. The population in the age group of 35-64 years (working population other than youth) constituted 32.9 per cent of Vijayawada's total population (see Figure 2.3).

Figure 2.3: Age-sex pyramid of Vijayawada



Source: Table C-14 City – Population in five-year age group by residence and sex, Census 2011

[3] The 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.

2.4.2 Social context

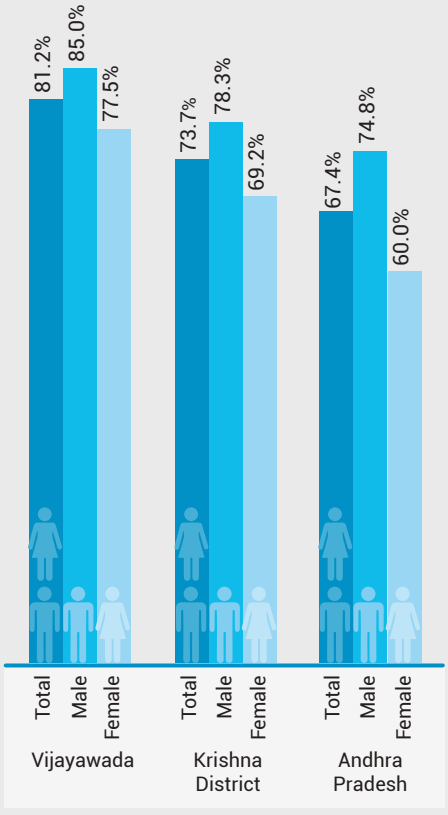
Literacy Rate

In 2011, the literacy rate in Vijayawada was 81 per cent, driven by a literate population of 7,57,667 among a total population of 9,32,659 over the age of six. The female literacy rate was 77 per cent, which was slightly less than the national urban average of 83 per cent. The city's total literacy rate, as well as its literacy rates by gender were higher than that of Krishna district and the state (see Figure 2.4). Details of the city's schools and their accessibility to its citizens are covered in Section 4.7.7.

Work Participation Rate

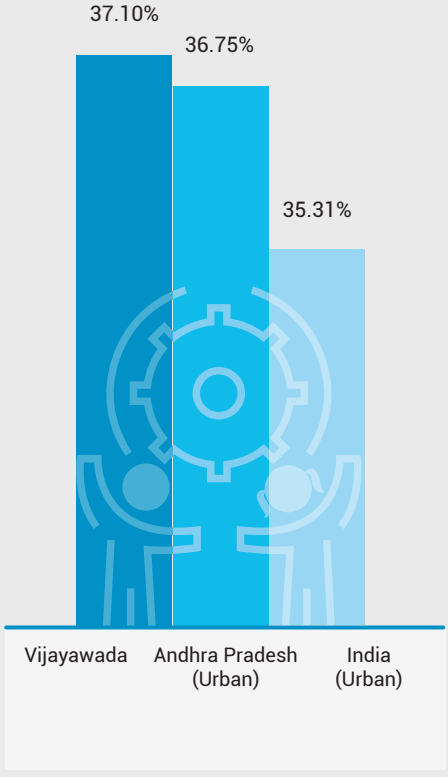
In 2011, the total Work Participation Rate (WPR)[4] in Vijayawada was 37.10 per cent, representing 3,83,705 workers. The city had 3,36,661 main workers, who constituted 88 per cent of its total workforce, and 47,044 marginal workers who made up the rest (12 per cent). As per Census 2011, Vijayawada's WPR was higher than the total urban workforce of Andhra Pradesh (36.7 per cent) as well as of the country (see Figure 2.5). The city's female workforce of 87,972 made up about 23 per cent of its total working population in 2011.

Figure 2.4: Total, male, and female literacy rates in Vijayawada, Krishna district and the state



Source: Census of India 2011

Figure 2.5: Work participation rate in Vijayawada compared to urban areas in the state and India



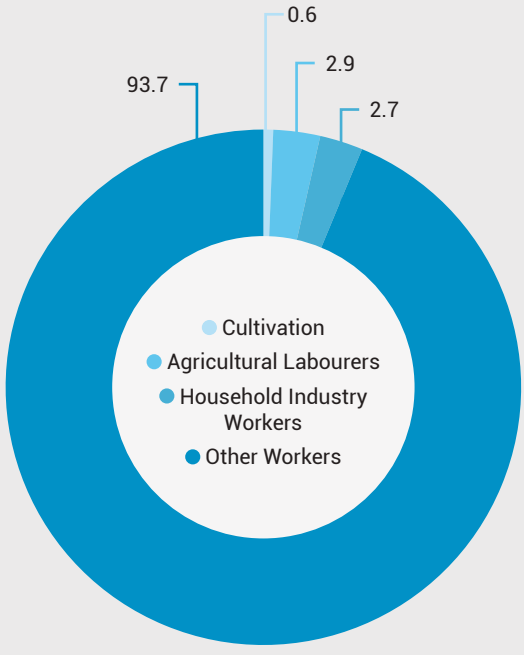
Source: Census of India 2011

[4] According to the Census of India, WPR is defined as the percentage of total workers to the total population.

As there are no agricultural lands in the city, it is evident that the Census 2011 data reflected around 3.5 per cent of the total workforce were engaged in cultivation activities or were engaged as agricultural labourers.

Of the city's total workforce of 3.83 lakh, nearly 93 per cent were engaged in 'other' work, which included working in the service/ tertiary sector (see Figure 2.6).

Figure 2.6: Distribution of workforce by occupation in Vijayawada (in percentages)



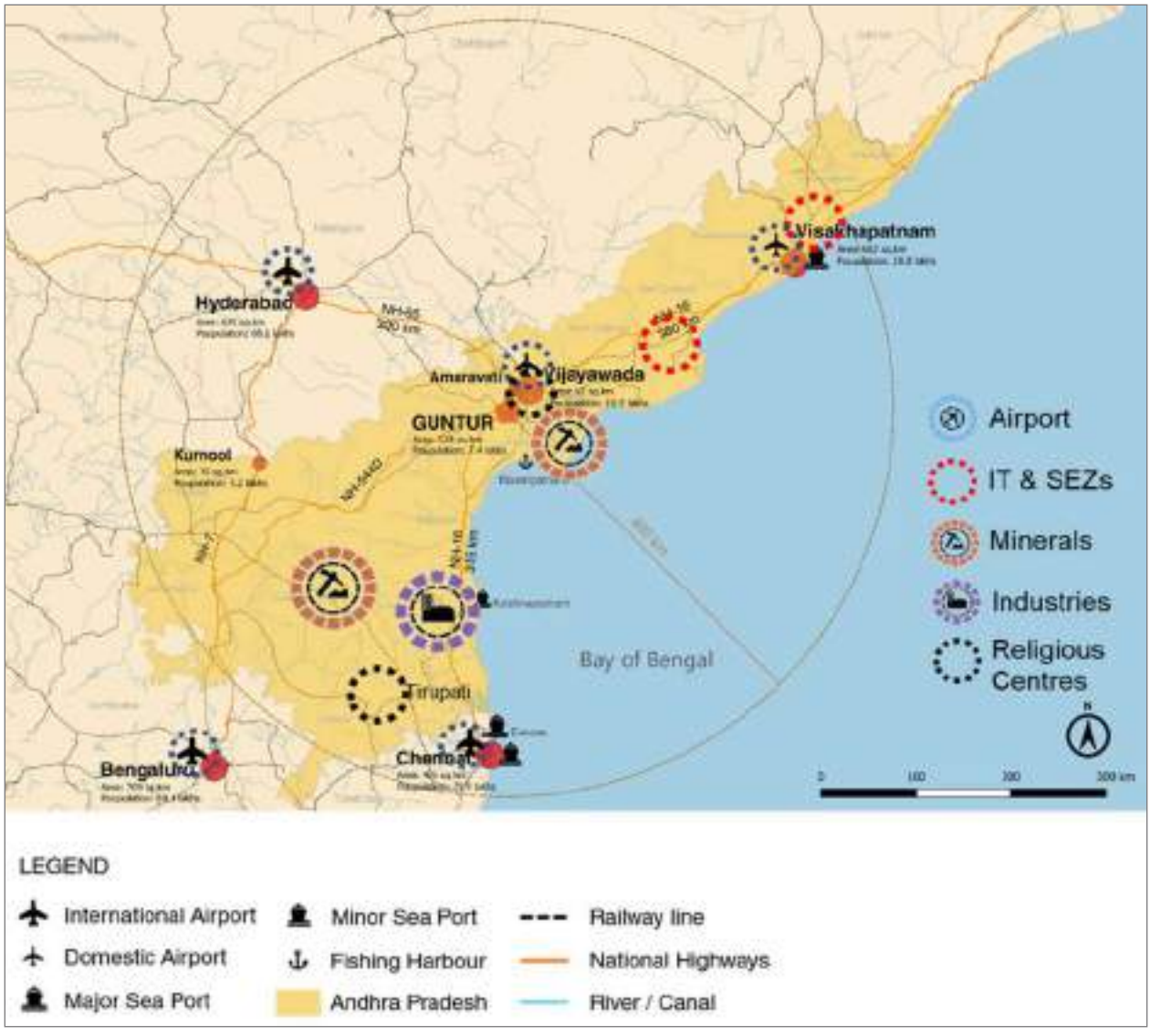
Source: Census of India 2011

2.4.3 City economy

Vijayawada is the largest commercial centre in Krishna district, bustling with commercial, trade, automobile, agricultural and allied activities. Some of the key economic sectors of Vijayawada are agricultural and allied activities, trade, tourism, automobile spare parts, and transportation. Vijayawada is famous for processing agricultural products, automobile body building, hardware, textiles, consumer goods, and small-scale industries. As shown in Map 2.3, Special Economic Zones (SEZs) and IT parks are located near Visakhapatnam to the city's North and near Nellore to the South. Auto Nagar is the city's main industrial area, which serves as a trade centre for automobiles as well as for agricultural and allied marketing activities. The Industrial Area Local Authority (IALA) is responsible for all services and maintenance of this industrial area.

Vijayawada is categorized as a B-1[5] grade city by the India Brand Equity Foundation (IBEF)[6]. The declaration of Amaravati as the state capital in 2015, its strong implications were reflected in the sudden increase in property prices, commercial and construction activities in the city.

[5] Urban areas are classified into eight SEC categories, with category B accounting for an urban population segment of high-class consumers.
[6] https://www.ibef.org/download/URBAN_DEVELOPMENT.pdf

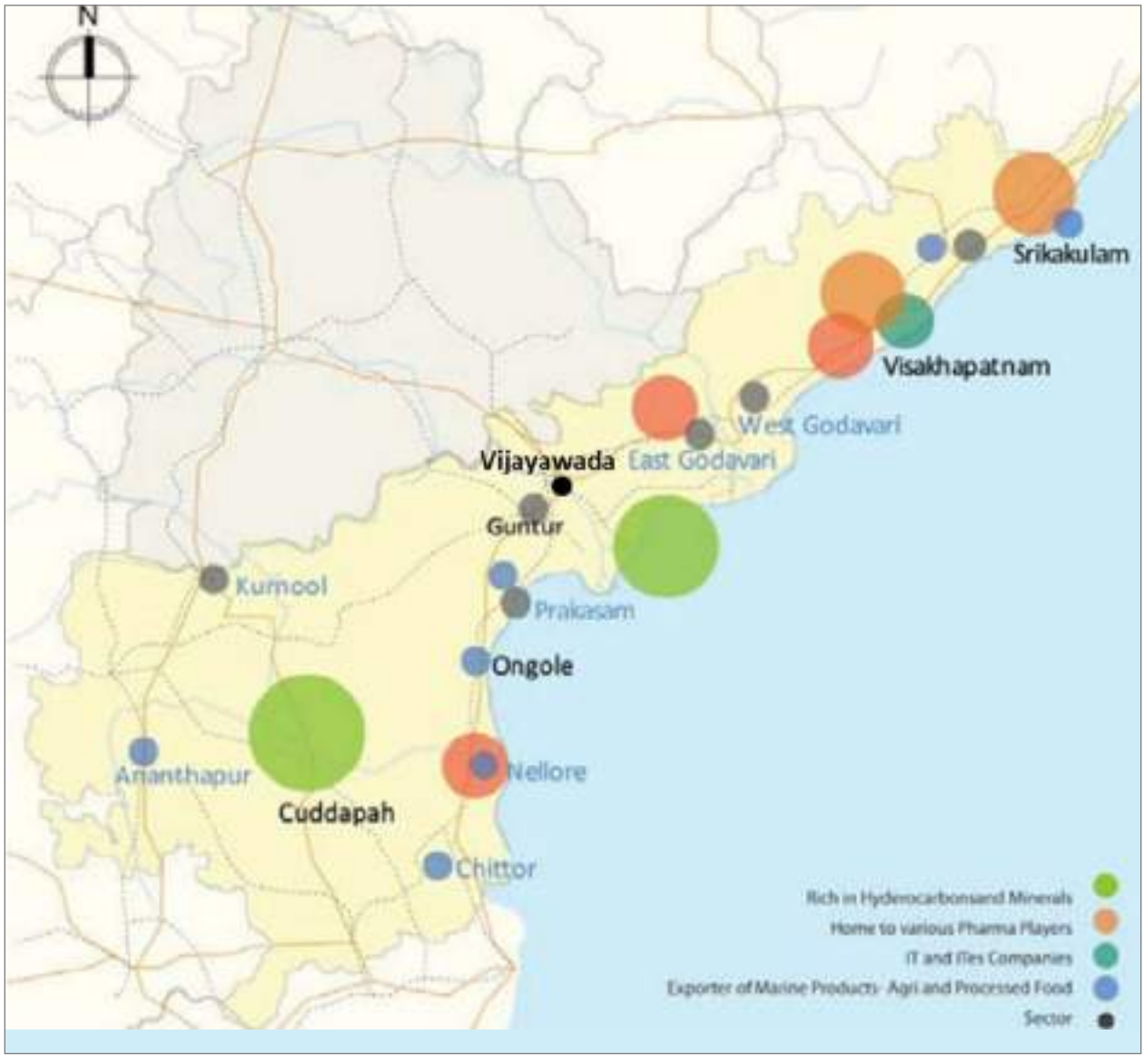


Map 2.3: Key regional functions around Vijayawada

Source: Capital Region Draft Perspective Plan, 2050

Image 2.2: View of K.R. Market

Source: UN-Habitat



Map 2.4: Existing regional economic diversity

Source: Draft APCRDA Perspective Plan 2050

Cultural Significance

The state of Andhra Pradesh owes much to the common cultural heritage of the nation, while retaining its own distinct character and flavour. Down the ages, the traditions and practices of various groups of people have contributed to the cultural development in the state. The rich cultural heritage of the city of Vijayawada may be experienced through its social and religious events, its literature, music, performing arts and crafts, as well as in the daily lives of its people.

The Kanaka Durga Temple in Vijayawada is a famous pilgrimage site and the annual Krishna Pushkaram festival, dedicated to worshipping rivers, attracts visitors from across the state. As shown in Map 2.5, major historic sites near Vijayawada include the Kondapalli Fort (1360 AD), the Undavalli Caves (420 AD) and the Moghalarajpuram Caves. Kondapalli, 25 km from Vijayawada, is the second most visited destination around the city, next to the Kanaka Durga Temple. Kondapalli's wooden toys are renowned for their fine workmanship.

Map 2.5: Heritage sites near Vijayawada

Source: UN-Habitat

Image 2.3: View of Bapu Museum

Source: UN-Habitat

Image 2.4: View of recently installed city logo by VMC

Source: UN-Habitat

03

Urban Governance

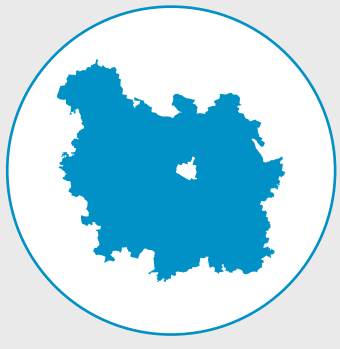
This chapter will cover the legal, institutional, regulatory, and administrative framework of the city's municipal authorities, and the key responsibilities of various urban local bodies (ULBs) in Vijayawada. Like most states in India, the responsibility of urban development planning and regulatory control in Andhra Pradesh are separately managed by two agencies at the city level. The Urban Development Authority (UDA) prepares the master plan, also referred to as the zonal or development plan, and provides a comprehensive guideline for land use, zoning, and long-term vision for the city's development. The master plan often covers areas beyond the municipal boundary. The Municipal Corporation, on the other hand, is responsible for all civic administration, service delivery, building use regulation enforcement, infrastructure provisions and maintenance of public assets.

3.1 LEGAL CONTEXT

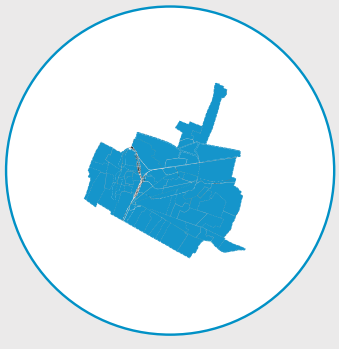
In Andhra Pradesh, the development plans and town planning schemes are prepared under the Andhra Pradesh Town Planning Act, 1920, and Andhra Pradesh Metropolitan Region and Urban Development Authorities (APMR & UDA) Act, 2016. The relevant urban development authority is required to prepare a regional level vision document called the Perspective Plan with a long-term timeframe, of preferably more than 30 years. It is complemented by a conforming, detailed city/ zonal level development plan, with a medium-term timeframe of (preferably) not less than 10 years.

Vijayawada falls within the Amaravati Metropolitan Region Development Authority (AMRDA), which also

Andhra Pradesh (State)



AMRDA (Urban Development Authority)



Vijayawada Municipal Corporation (Urban Local Body)

includes the cities of Guntur and Amaravati, the new legislative capital of the state. The AMRDA region covers a jurisdictional area of 8,603.32 sq. km. In 2011, the population of the region was 58.65 lakh. The draft Perspective Plan for the region was prepared in 2015 for the horizon year 2050. The enforced Zonal Development Plan for Vijayawada was notified in 2006 for the horizon year 2021. The revised Zonal Development Plan for 2035 is under preparation.

The Andhra Pradesh Building Rules, 2017 (including its amendments), provide standards for regulating building requirements. These rules are applicable to all ULBs and UDAs in Andhra Pradesh.

3.1.1 Planning instruments and procedures

Hierarchy of Plans

As per the APMR & UDA Act, respective UDAs are required to prepare a regional level Perspective Plan with a long-term timeframe of, preferably, more than 30 years. This is complemented by a detailed city/ zonal level development plan, with a medium-term timeframe of (preferably) not less than 10 years.

Draft Perspective Plan for AMRDA

The Draft Perspective Plan for the AMRDA region was prepared in 2015 for the horizon year 2050. The entire region was categorized under six land use zones – viz., agricultural, urban, industrial, development corridor, infrastructure, and protection (water bodies, hills, and forests) zones – and accorded uses that were permissible for each zone. Further, the entire region was sub-divided into eight administration zones with a regional centre identified for each zone. Vijayawada city was identified as the regional centre for the Central zone. The Draft Perspective Plan for AMRDA plan proposals for Vijayawada included development of the Amravati the capital city together with Vijayawada and Mangalagiri as a mega city and Amaravati and Vijayawada as twin cities in the region. The Central zone included Vijayawada and Mangalagiri as urban agglomerations to be developed as high-density compact neighbourhoods with average gross population densities of 500 persons per sq. km. Other proposals included the development of the Vijayawada Bypass (VB), Inner Ring Road (IRR) and Outer Ring Road (ORR). This plan is pending approval and further notification from the state government.

Zonal Development Plan – 2021

The Zonal Development Plan (ZDP) for Vijayawada was notified in 2006 for the horizon year 2021. The jurisdiction area under the Vijayawada Municipal Corporation (VMC) was considered as the total planning area for the ZDP, covering 61.88 sq. km. and a base population of 8,45,217, as per Census 2001.

The population projected by the Vijayawada ZDP for 2021 was 16.4 lakh, with a projected population density norm of 265 persons per hectare. The entire extent of the then existing vacant land and total land within city limits was demarcated as developable land and proposed for future urban development, with emphasis on industrial development. An industrial area (Auto Nagar Industrial Estate) was also notified within city limits.

The Vijayawada ZDP 2021 envisions the development of the city as:

- A national transport node
- A sub national commercial and service centre
- A tourism and cultural heritage centre
- An educational hub and knowledge city

The revised Development Plan for the city for the horizon year 2035 is currently under preparation.

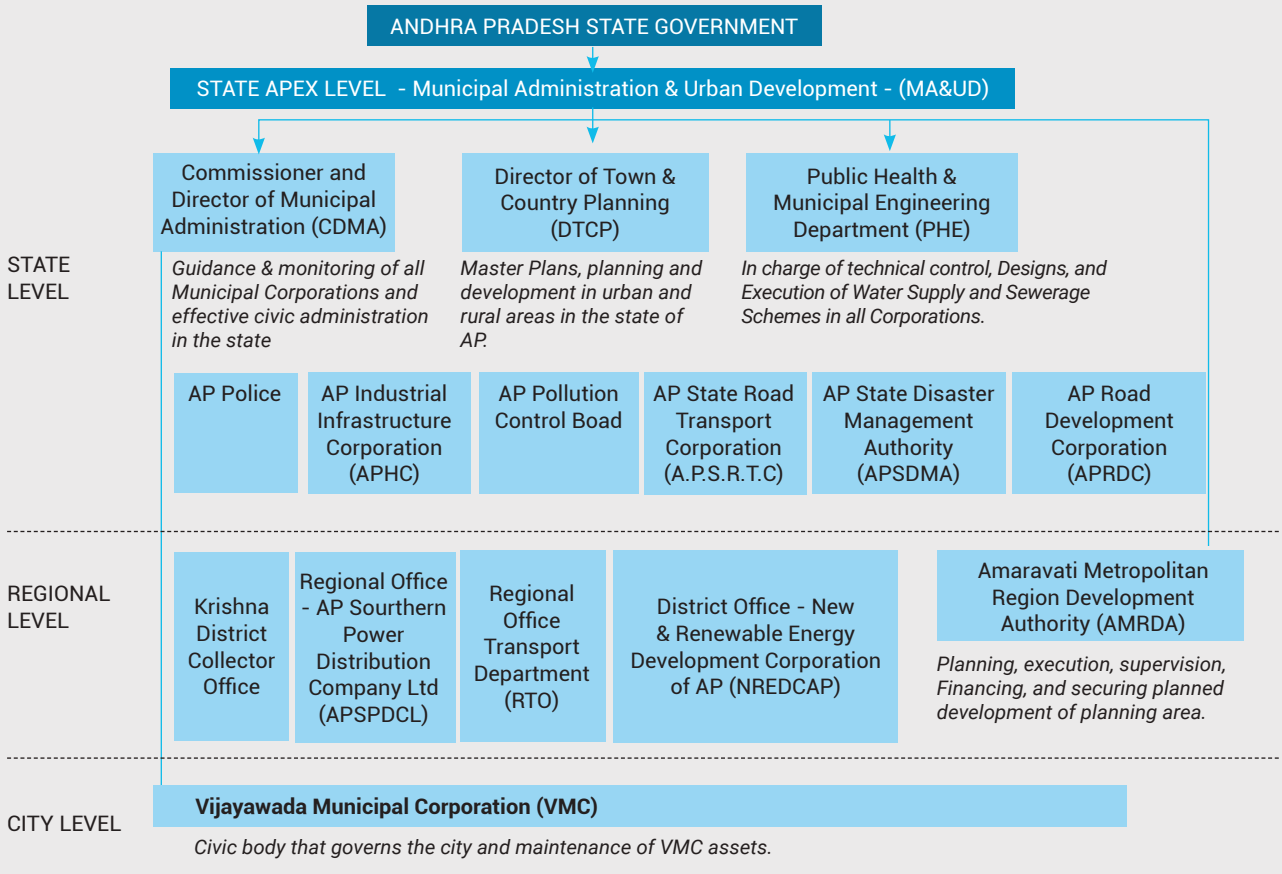
3.2 INSTITUTIONAL CONTEXT

State and Regional Level

The Municipal Administration and Urban Development (MA&UD) Department, Government of Andhra Pradesh (GoAP), is the apex body for urban development related activities in the state. The Commissioner and Directorate of Municipal Administration (CDMA) is the nodal agency for ULB administration under the MA&UD Department.

The Directorate of Town and Country Planning (DTCP) looks after planning and development in urban and rural areas of the state, except for areas that fall within UDA limits. However, DTCP provides technical advisory assistance to UDAs and ULBs in various planning and development matters, including change of land use proposals and alienation of lands. DTCP has four regional offices in the state and 13 District Town and Country Planning Offices. AMRDA is the planning authority for Vijayawada and plays a key role in change of land use and development promotion in the city.

Figure 3.1: Major stakeholder departments relevant for the SCIAP project in Vijayawada



Source: UN-Habitat

At the state level, several departments under the administration of the MA&UD, such as the Public Health & Municipal Engineering Department (PHMED), Mission for Elimination of Poverty in Municipal Areas (MEPMA), and the Andhra Pradesh Greening and Beautification Corporation (APG&BC), provide support to the ULBs for urban service delivery. These include infrastructure development, skill development, and urban greenery. The hierarchical key stakeholders at the state, regional and city levels are indicated in Figure 3.1. Table 3.1 below indicates the roles and responsibilities of various other agencies in Vijayawada city.

Table 3.1: Roles and responsibilities of key stakeholder departments in Vijayawada

S. No	Organization	Key roles and responsibilities in Vijayawada
1	Krishna District Collectorate	Key role in Disaster Management, public distribution, civil supplies, monitoring and implementation of various social welfare programmes. Krishna District Collector is also the Special Officer of VMC.
2	Vijayawada Urban Police	Maintains law and order, and public safety. 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.
3	PHMED	Responsible for investigation, designs and execution of water supply and sewerage schemes in ULBs across the state. In Vijayawada, PHMED is currently overseeing projects related to water supply and underground drainage.
4	MEPMA	Deals with issues related to empowerment of urban poor women, especially those residing in slums. It works with VMC's Urban Community Development (UCD) cell to enhance access to credit, financial freedom, skill development, employment creation and health.
5	APG&BC	Responsible for improving urban green cover by conserving and preserving existing green areas. Also responsible for scaling up urban landscapes by creating parks and green zones in all ULBs of the state. It supports VMC in preparing development designs for various parks and open spaces.
6	Andhra Pradesh State Disaster Response and Fire Services (APSDRFS)	The department's Krishna District Office is responsible for fire prevention, firefighting, community safety, rescue activities and disaster response in the city. Vijayawada has five fire stations. The Regional Fire Officer (RFO) from VMC is responsible for all fire response services in the ULB's jurisdiction.
7	Andhra Pradesh Pollution Control Board (APPCB)	Responsible for the prevention, control and monitoring of various forms of pollution and improvement of the quality of the environment in the state by effective implementation of environmental laws. APPCB's Vijayawada regional office works in coordination with VMC for air quality improvement, wastewater management, SWM and the environment.
8	Andhra Pradesh State Disaster Management Authority (APSDMA)	Apex body in the state for disaster management. Provides support to districts and ULBs in the state for hazard monitoring, hazard mapping, disaster management planning, scientific data analysis, emergency operations, response communications, capacity building, etc. VMC's Disaster Cell is responsible for all disaster response activities.
9	Andhra Pradesh State Road Transport Corporation (APSRTC)	Responsible for public bus transport service in the state. Vijayawada is one of the 12 APSRTC regional centres headed by a Regional Manager. Vijayawada intra-city bus service is operated by the APSRTC. The city bus stand is the largest in the state and handles regional public transport services.
10	Andhra Pradesh Road Development Corporation (APRDC)	Responsible for developing, maintaining and managing state highways, roads, bridges and flyovers, as entrusted by the state government. Some roads and flyovers in Vijayawada city were constructed by the department.
11	Andhra Pradesh Industrial Infrastructure Corporation (APIIC)	Nodal agency for all industrial promotions in the state. APIIC has a zonal office in Auto Nagar, Vijayawada. The Industrial Area Local Authority (IALA) was established by APIIC to maintain and monitor the Auto Nagar Industrial Estate
12	Andhra Pradesh Central Power Corporation Distribution Limited (APCPDCL)	Provides electricity to Vijayawada. The city has a regional circle office headed by a Superintending Engineer.
13	New & Renewable Energy Development Corporation of Andhra Pradesh Ltd., (NREDCAP)	Works towards promotion and implementation of non-conventional/ renewable energy projects in the state. NREDCAP Krishna District office provides advisory and technical assistance to VMC, other government and private institutions in Vijayawada for implementing renewable energy projects.

Source: UN-Habitat

Local Level

The municipality of Vijayawada was constituted on 1st April 1888 and was upgraded to a selection grade municipality in 1960 and, subsequently, to a corporation in 1981. VMC was constituted within the legal framework of the Vijayawada Municipal Corporation Act, 1981. Its departments include administration, accounts, revenue, engineering, public health, town planning and urban poverty alleviation to monitor and provide civic services to citizens. The municipal council is formed by 64 elected ward representatives and is headed by the Mayor.

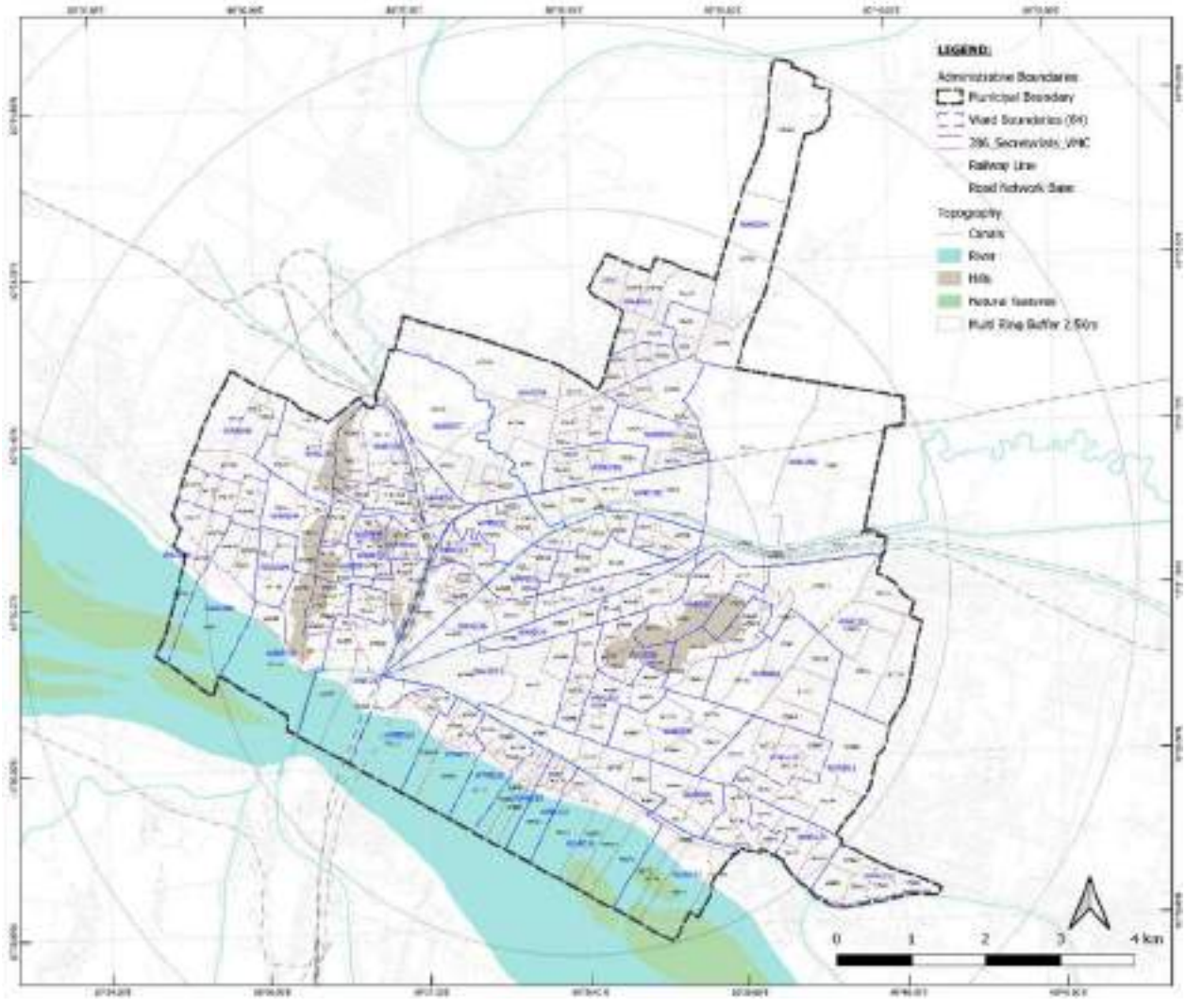
In 2019, in line with the state government's ward secretariat system initiative, the city was divided into ward secretariat units with a secretariat office for each unit. Ten secretaries were appointed by the state government of Andhra Pradesh (GoAP) for administration, amenities, sanitation and environment, education and data processing, planning and regulation, welfare and development, energy, health, revenue and women's protection *(Mahila Samrakshana Karyadarsi)* for each ward unit. Based on the number of households, the secretariats are constituted by the ULB for delivery of the GoAP's schemes and municipal services to residents. In addition, a ward volunteer is appointed for every 1,200-1,500 households within a secretariat unit. This system is meant for effective service delivery at the grassroots level and efficient response to public grievances.

Image 3.1: View of Vijayawada Municipal Corporation office building

Source: UN-Habitat

3.3 ADMINISTRATIVE BOUNDARIES

VMC's jurisdiction covers 64 wards spread across 61.88 sq. km. (6,188 Ha). These wards are divided into 286 ward secretariats for servicing 1,200-1,500 households in the city (see Map 3.1).



Map 3.1: Municipal administrative and ward secretariat boundaries, Vijayawada

Data Source: VMC
Map Source: UN-Habitat

Image 3.2: View of Ward Secretariat 211 in Mutyalampadu, Vijayawada

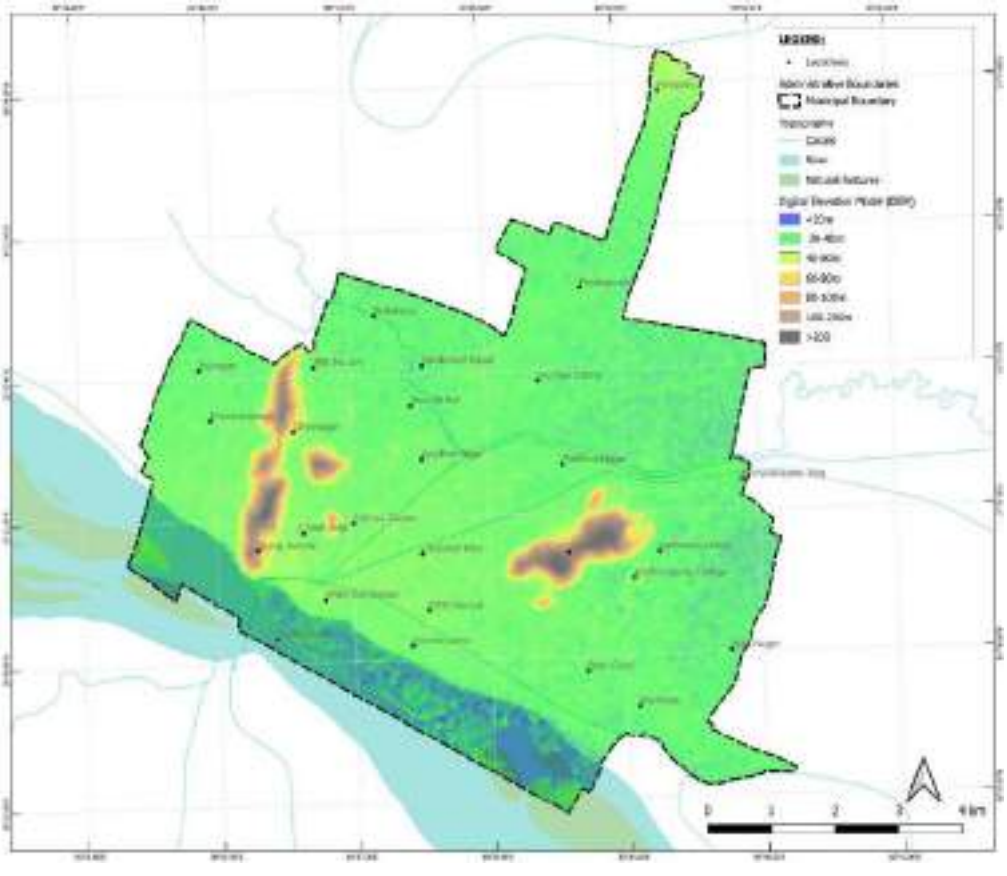
Source: UN-Habitat

04

Existing Urban Analysis

4.1 NATURAL TOPOGRAPHY

The Krishna River, the hills and canals are Vijayawada's three key natural topographical features that have structured its urban development. Most of the city is flat with a mean sea level (MSL) of +19.35 m and contours ranging between 10–216 m. The Krishna River's embankments, Budameu and Nandamuri Nagar, are some of the city's key low-lying areas with slopes lower than the MSL. Map 4.1 below shows the Digital Elevation Model (DEM) of Vijayawada.



Map 4.1: Digital Elevation Model (DEM), Vijayawada

Data Source: VMC
Map Source: UN-Habitat

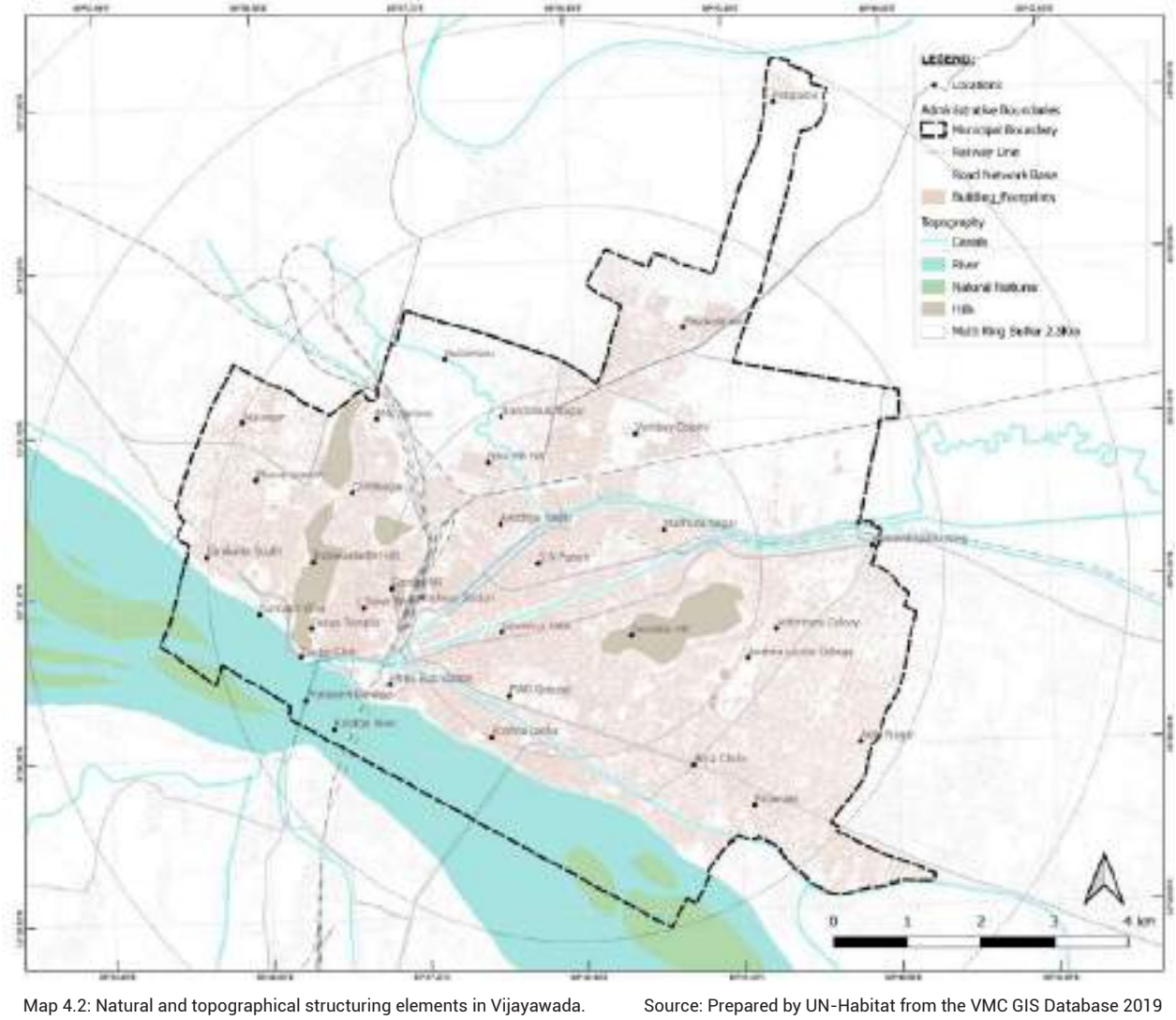
4.1.1 Significant natural features

Water Bodies

Krishna River flows along the city's southern boundary, with three canals diverging from the river – viz., the Rvyes Canal, Eluru Canal and Bandar Canal – along an approximately 23-km stretch. The river is the city's major source of water supply and also adds an aesthetic feature. The banks of the river, such as the Punnami Ghat and Durga Ghat, are used for religious purposes. The riverine Bhavani islands are an important tourist destination, while Prakasam barrage forms the main link connecting Vijayawada to Guntur district.

Hills and Terrain

A low range of hills covers the northern, north-western, and south-western parts of the city. The topography of Vijayawada is largely flat, however, with small to medium-sized hills of the Eastern Ghats standing to the East and West of the city. These natural topographical features have impacted the city's spatial growth, leading to a fan-shaped expansion in the North-East.



Map 4.2: Natural and topographical structuring elements in Vijayawada. Source: Prepared by UN-Habitat from the VMC GIS Database 2019

The city's climate is tropical with hot summers and moderate winters. The city receives an average annual rainfall of 974 mm and its average annual temperature is 28.2°C[7]. The peak temperature reaches 45°C in May-June, while the winter months see a temperature of 17-25°C. Vijayawada receives rainfall from both the South-West and North-East monsoons.[8]

Image 4.1: View of Prakasam Barrage, Indrakeeladri Hill and river ghat for religious activities

Source: Drone photo, facilitated by VMC Nodal Officer

Image 4.2: View of the Bandar Canal flowing through the city

Source: UN-Habitat

[7] https://en.climate-data.org/asia/india/andhra-pradesh/vijayawada-715084
[8] City Disaster Management Plan, 2015, Vijayawada

Image 4.3: View of Prakasam Barrage, the city's most iconic landmark Source: UN-Habitat

4.2 URBANISATION AND LAND USE PATTERNS

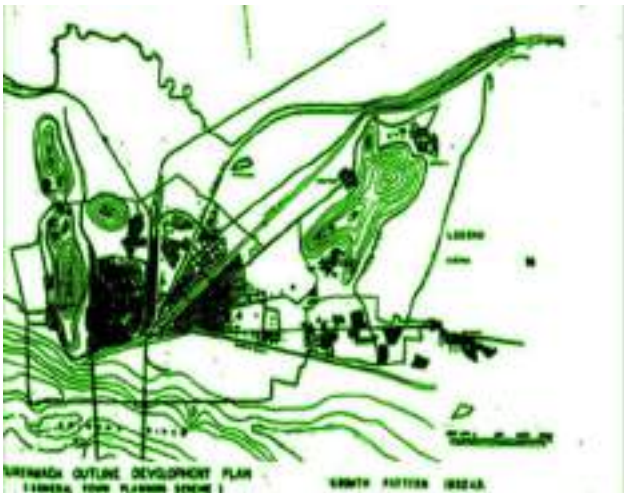
4.2.1 Significant natural features

The city evolved along the foothills of the Kanaka Durga Temple as ancillary religious events started evolving near the temple town around 1855, spreading spatially along the major connectivity spines (see Map 4.3). The construction of a check dam (anicut) in 1854 and a railway bridge across the Krishna River (connecting the present Krishna and Guntur districts) had enabled intense cultivation on the fertile river delta. This provided economic opportunities for the development of the region through trade and led to the migration of populations to the settlements of Guntur, Vijayawada, and Tenali.

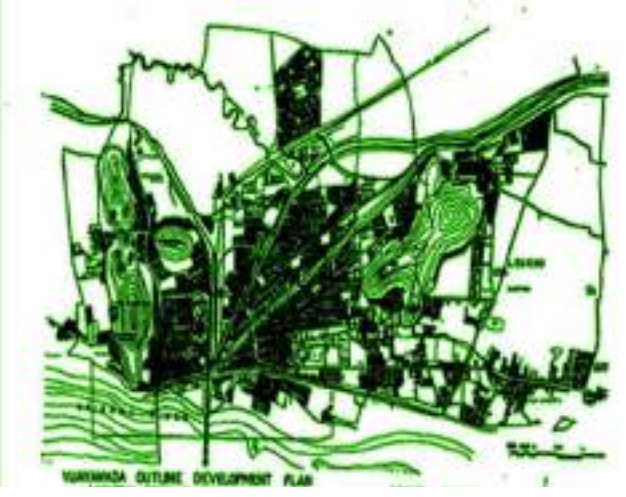
1855

1905

1935



1965



Map 4.3: City evolution and spatial growth of Vijayawada

Source: VMC

Constituted on 1st April 1888, the municipality of Vijayawada was upgraded to a selection grade municipality in 1960, and eventually to a corporation in 1981. With the merger of the Gunadala, Patamata, and Bhavanipuram village panchayats, as well as the two villages of Payakapuram and Kundavari Kandrika in 1985, the jurisdiction area of the municipal corporation increased to 61.88 sq. km. (6,188 Ha). After 1985, the municipal area under VMC did not witness any changes.

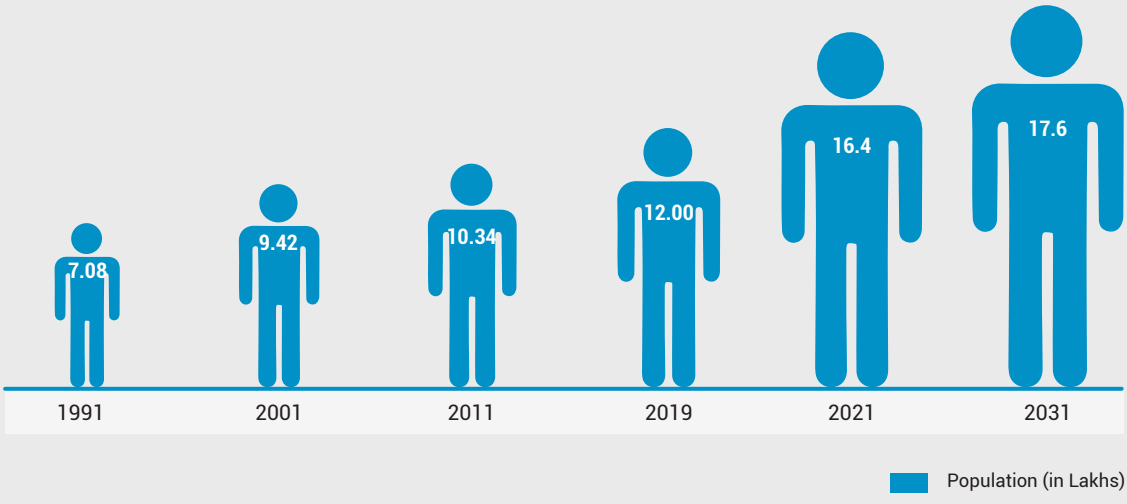
With the bifurcation of the state of Andhra Pradesh in 2014 and Vijayawada's proximity to the new capital of Amaravati, the city's annual population growth rate is estimated to be three per cent between 2019-2034[9] against that of Andhra Pradesh at 0.25 per cent. The significance of Vijayawada as a major pilgrimage centre in the region, and its various educational institutions attract a floating population from various parts of the state. Data on the city's floating population or population migration, however, is not available.

Table 4.1: Population growth rate in Vijayawada over the decades

Year	Population (lakh)	Decadal growth (%)	VMC Area (Ha)	Population Density/ Ha
1991	7.08	-	6188	114
2001	9.42	33.1	6188	152
2011	10.34	9.8	6188	167
2019[10]	12.00	-	6188	193
2021[11]	16.40	58.6	6188	265

Source: Census of India, VMC

Figure 4.1: Vijayawada decadal population growth (1991–2031[12])



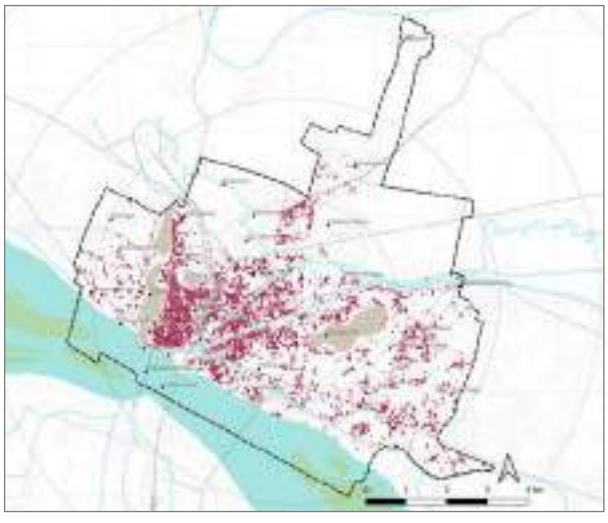
Source: Census of India, ZDP 2021 and VMC

[9] Strategic Report – Vijayawada Urban Infrastructure Corporation Limited, 2017
[10] As per its Service Level Benchmarking (SLB) 2018-19, VMC estimated the city's population as 12 lakh in 2019
[11] Projected population as per Vijayawada ZDP 2021
[12] Projected population as per the SWM Detailed Project Report prepared by TATA Consulting in 2016

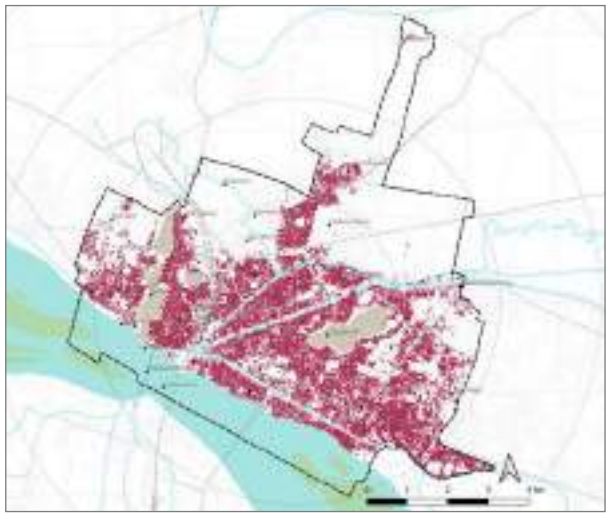
The population of Vijayawada in 1991 was 7.08 lakh due to the upgradation of the municipality and the merger of nearby villages into the municipal area. With rural migration to the city and establishment of the Estate Association of Andhra Pradesh Industrial Infrastructure Corporation (APIIC) in 1995, increased economic opportunities led to a decadal population growth of 33 per cent between 1991–2001.

The 2001-2011 decade, however, did not see any significant population growth, possibly because of the lack of any planned economic development in the city during the period. Thereafter, the declaration of Amaravati, located about 15 km from Vijayawada, as the new state capital in 2015 might have led to the nearly two per cent annual population growth during 2011–2019.

1975

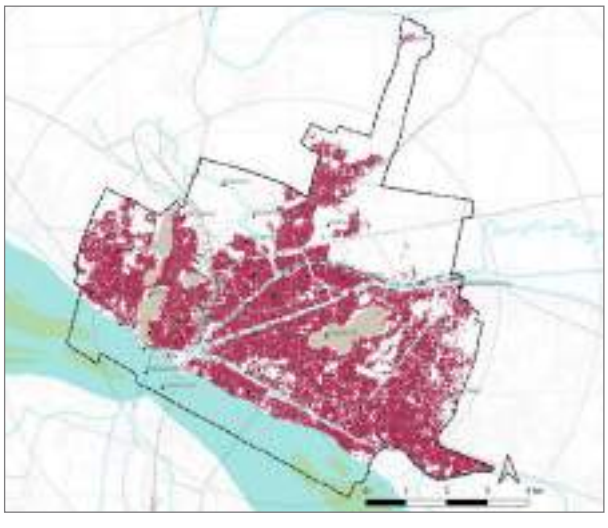


1990



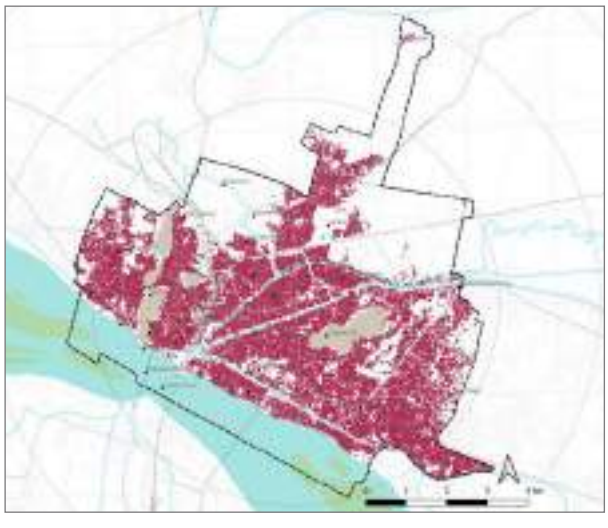
Area: 22.70 sq. km.
Population: 7.1 lakh (Census1991)

2000



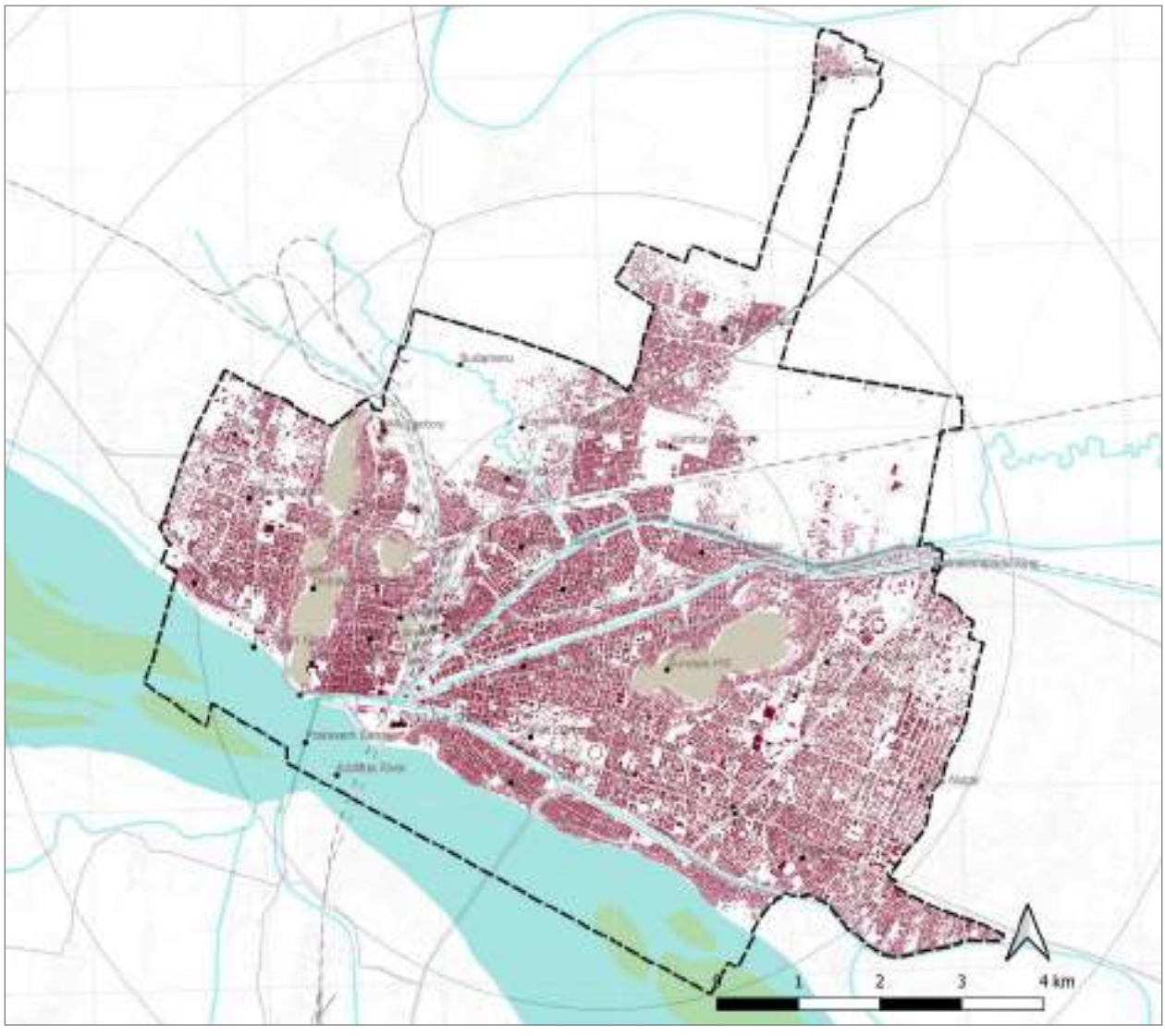
Area: 61.88 sq. km.
Population: 9.4 lakh (Census 2001)

2014



Area: 61.88 sq. km.
Population: 10.3 lakh (Census 2011)

2019



Area: 61.88 sq. km.
Population: 12 lakh (SLB estimate)

Map 4.4: Change in built-up area over 1997–2019 in Vijayawada

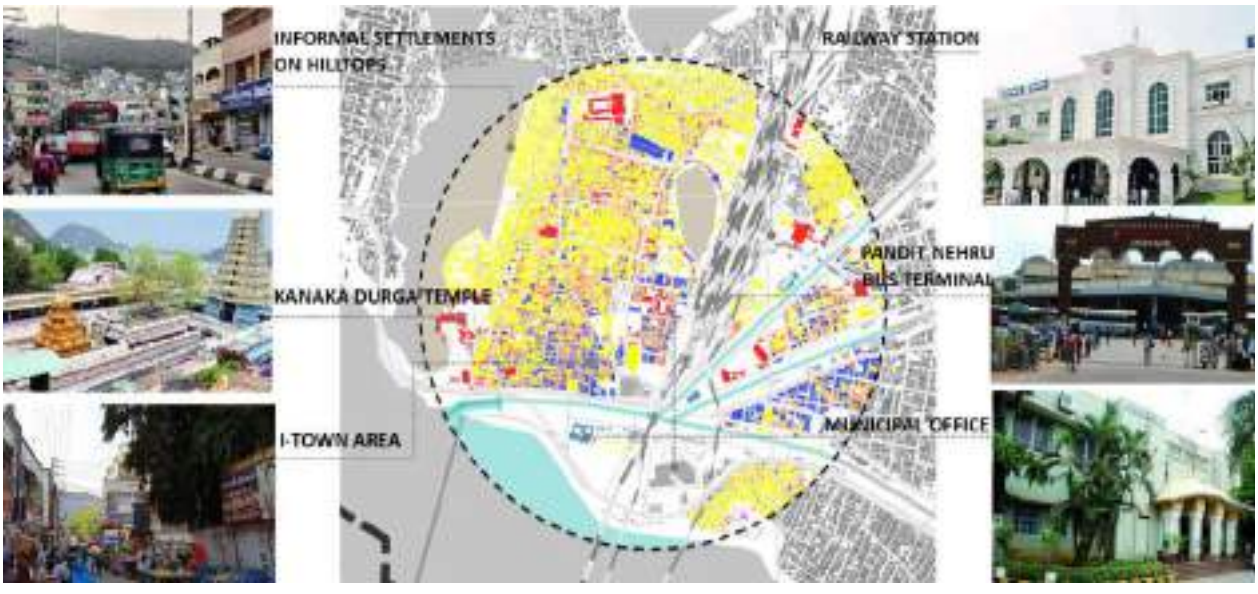
Source: Multitemporal information layer on built-up presence as derived from Landsat image collections (GLS1975, GLS1990, GLS2000, and ad-hoc Landsat 8 collection 2013/2014, GHSL (10m) Sentinel-2 imagery (2018)

Owing to its proximity to Amaravati, the city of Vijayawada was established as a key administrative and economic centre with various government offices and private entities. The two national highways of NH 16 (connecting Chennai to Kolkata) and NH 65 (connecting Machilipatnam to Pune) acted as catalysts for the city's growth as a regional commercial and transport node. The Pandit Nehru Bus Station, inaugurated in 1990, is the country's fourth largest and among its busiest bus terminals, next only to those in Delhi, Chennai and Hyderabad. The city's distinct urban character, its economic and employment opportunities, and its well-established transport connectivity have enabled people to migrate to Vijayawada.

4.2.2 Spatial development pattern

City Core Area

The old city centre was established as a business hub for trade activities with a mix of commercial and residential buildings amid a narrow network of roads and alleyways. Vijayawada's growth into a key urban centre and the state's second most populous city led to increased economic growth and development in the city. Some of the key development features of Vijayawada include the Pandit Nehru Bus Station (PNBS), the Vijayawada Junction railway station, the Indira Gandhi International Stadium (IGI), I-Town, Besant Road, and the city's many educational institutions, wholesale markets, PWD grounds, and state government departments. Map 4.5 illustrates the key built forms around the city centre, about 1 km from I-Town, with its old residential developments, mixed-use developments, commercial establishments, informal settlements on hilltops, the railway station, the city bus terminal, the Kanaka Durga Temple, the VMC Office and other government offices.



Map 4.5: Key activities located within 1.0 km radius from city core area (I-Town area) Source: UN-Habitat

Currently, the city is expanding to the surrounding hill tops, which is a significant ecological concern.

Image 4.4: View of built form of city core I-Town area and the Indrakeeladri Hill. Source: Drone photo, facilitated by VMC Nodal Officer

Impact of Amaravati as Capital City

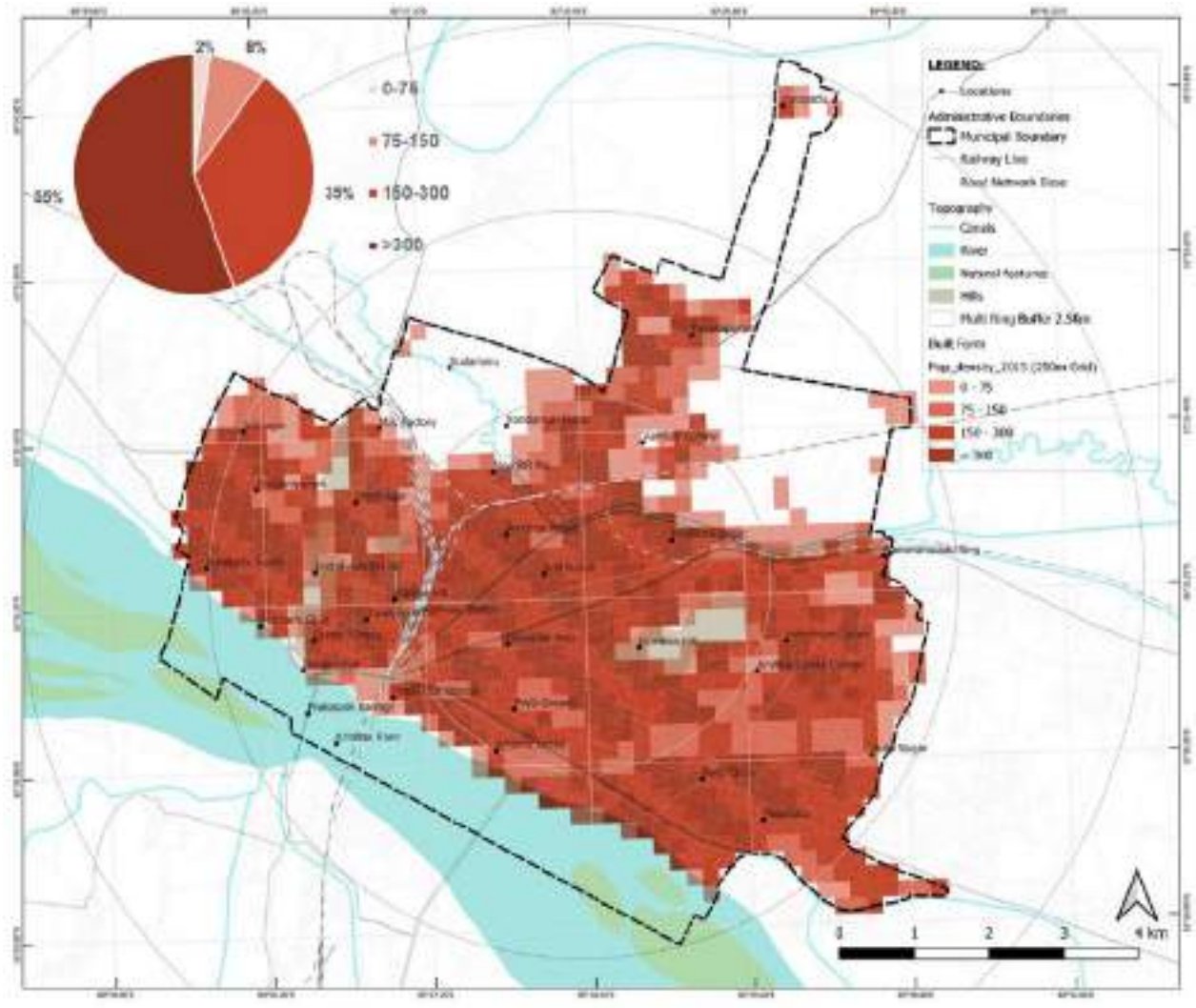
The declaration of Amaravati as the new capital city led to increased land values and commercial developments in the city after 2015, including new construction activities in Vijayawada's peripheral areas. The city's urban growth was noted primarily in the western micro-markets along NH 65 with intense commercial developments like shopping malls and complexes along M.G. Road and Eluru Road. The city's de-facto capital status is reflected by the location of new government offices, including state departments, in Vijayawada. In 2020, the GoAP announced Amaravati as the legislative capital of the state, while making Visakhapatnam the executive capital and Kurnool the judiciary capital. This decision may impact the city's growth once the executive and judicial activities are shifted from Amaravati.

Image 4.5: View of fragmented development in the city peripheral areas near IRR

Source: Drone photo, facilitated by VMC Nodal Officer

4.2.3 Urban density

Settlements near the Durga Temple, I-Town, and precincts to the West of the railway station form the city centre with densities higher than 150 PPH. The zone is characterized by narrow streets, haphazard residential sprawl and informal settlements along adjoining hillsides, on-street parking and lack of open public or green spaces. Commercial developments are concentrated in the I-Town area and along the three major road networks of M.G. Road, Eluru Road and NH 16. Most of the institutional and administrative uses are concentrated near M.G. Road and Eluru Road within a radius of 2.5 km of the city centre. The city's intercity railway lines impact its spatial growth and infrastructure development in the East and North-East micro-markets. In 2019, the estimated population of Vijayawada was 12 lakh, residing within an area of 61.88 sq. km. with a population density of 193 PPH. Ninety per cent of its population was concentrated in areas with density greater than 150 PPH in the central business district (CBD; within 2.5 km of the city centre) as well as along Vijayawada's primary road network (see Map 4.6).



Map 4.6: Population density estimates (2015) Source: Multitemporal information layer derived from Landsat image collections

The CBD has a population density of 150–300 PPH, sometimes even higher, which is reflective of the micro-market's overall character, marked by intense activities and concentration of built structures over decades.

Image 4.6: View of S.N. Puram, with a population density of more than 150 PPH Source: Drone photo, facilitated by VMC Nodal Officer

4.2.4 Existing and proposed land patterns

Zonal Development Plan

The proposed land use plan for Vijayawada was prepared in 2006 for the horizon year 2021, as part of the ZDP. The Vijayawada ZDP was part of 27 zonal development plans prepared for the Vijayawada–Guntur–Tenali–Mangalagiri (VGTM) Urban Region. Prior to the formation of AMRDA, the VGTM UDA functioned as the department responsible for the planning and enforcement of the region's land use plan. The Vijayawada ZDP considered the municipal boundaries to encircle 61.88 sq. km. The ZDP 2021 indicated the permitted land uses as well as the uses permissible for nine categories of land areas in the city.

Proposed Land Use

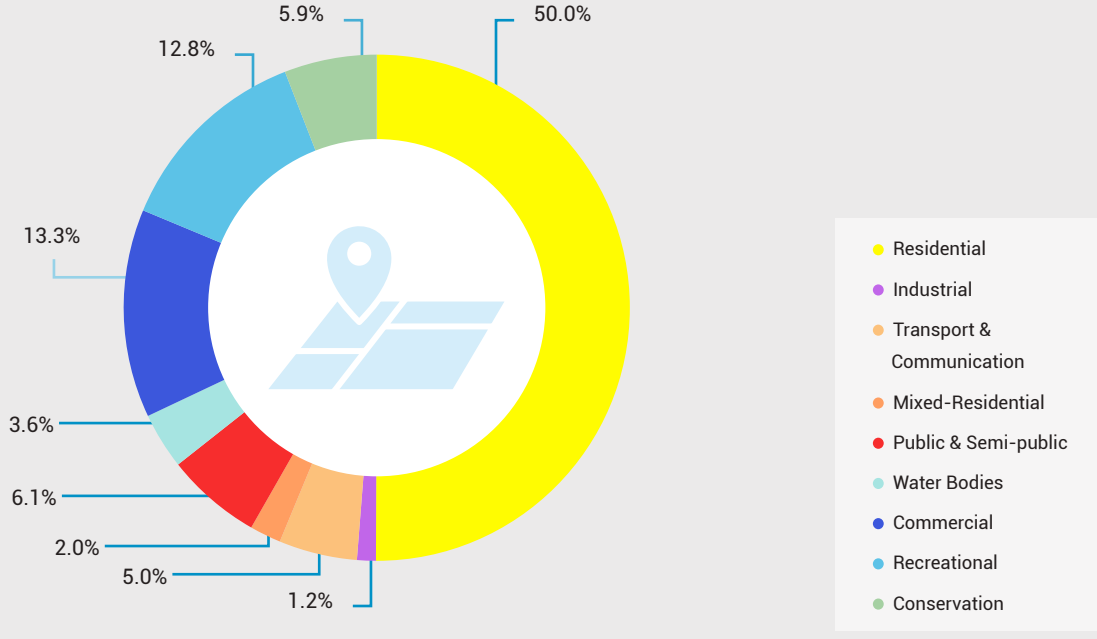
The Vijayawada ZDP projected a population of 16.40 lakh for 2021, but its provisions did not indicate the spatial density allocation in the land use plan, except for demarcating available land for residential use. As per the ZDP's projected population for the ULB's 61.88 sq. km. area in 2021, the proposed population density was 265 PPH. According to Census 2011, the decadal population growth by 2021 was estimated at 58 per cent. The Andhra Pradesh Building Rules, 2017 (including its amendments), provide standards for regulating building requirements to monitor and enforce the ZDP's land use provisions; while the VMC is responsible for building permissions in accordance with the provisions in the ZDP proposed land use and the enforced building byelaws and the AMRDA monitors implementation of proposed land use and violations of the ZDP's provisions.

Map 4.7: Proposed land use 2021, Vijayawada

Source: Zonal Development Plan, 2021

As per Vijayawada ZDP 2021, the existing land use in 2004 comprised 37.53 sq. km. of developed area and 24.35 sq. km. of undeveloped area (see Map 4.7 for the proposed land use for 2021). Residential, commercial, industrial, public and semi-public, institutional, recreational, transit zones, canals and vacant lands were considered developable components, while the river, the water bodies, agricultural lands and hills were considered non-developable. The percentages for recreational land use (3.56 per cent) and public/ semi-public use (6.09 per cent), as proposed by the ZDP 2021, were much lower than the URDPFI guidelines of 14-16 per cent and 10-12 per cent, respectively. Strategic planning interventions were needed to develop and utilize vacant land in the city. The suggested standards for open spaces in large and metropolitan cities are 1.2–1.4 ha per 1,000 persons, but the proposed land use in the ZDP assigned open spaces of only 0.18 ha per 1,000 persons in the city.

Figure 4.2: Proposed land use distribution as per Vijayawada ZDP 2021(in percentage)



Source: Vijayawada ZDP 2021

Existing Building Use (2019)

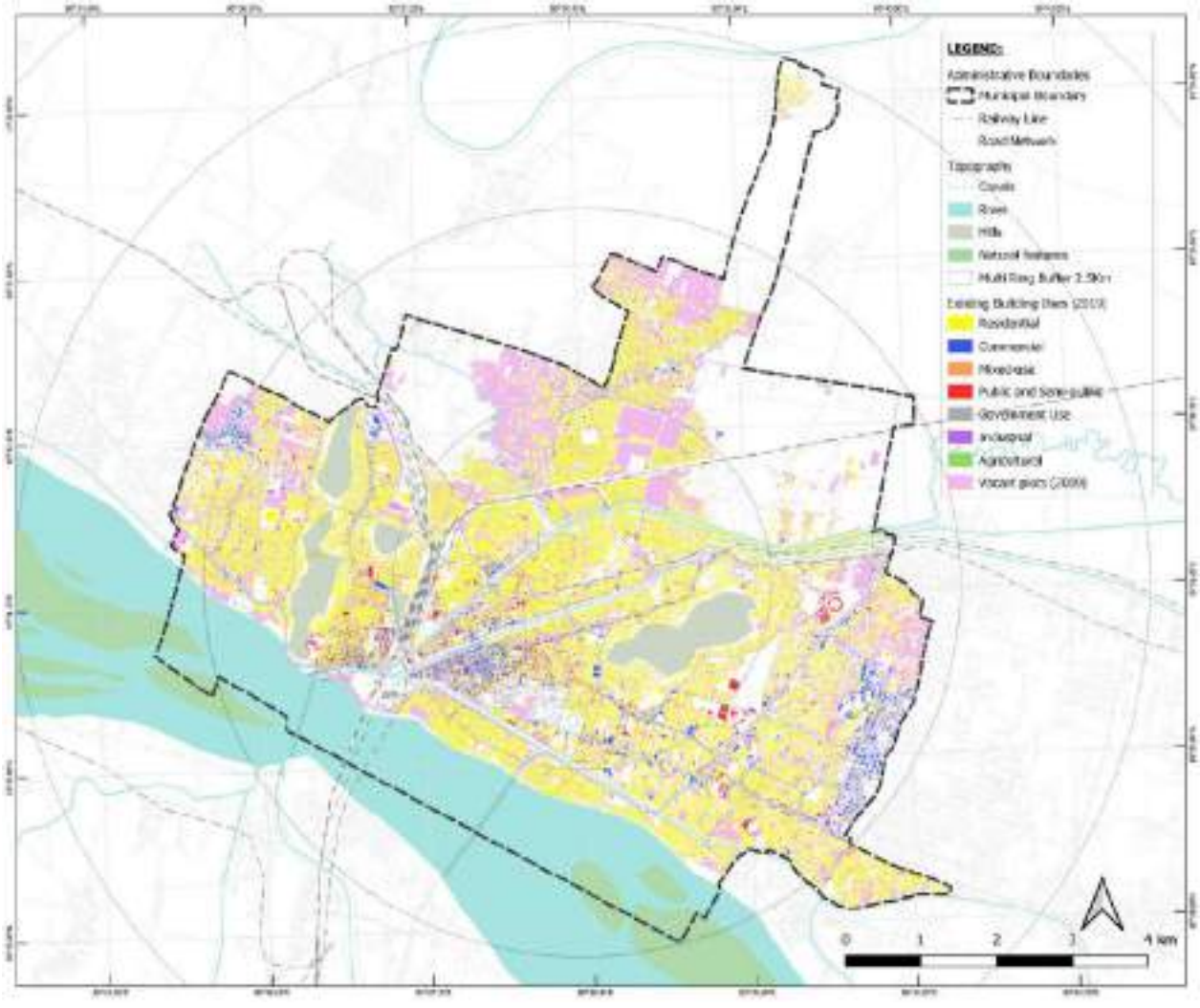
As the city's revised Development Plan for 2035 is under preparation, the city's existing land use map is not available. However, the VMC could facilitate the existing building use data that was prepared in 2019, as part of a state level initiative (see Map 4.8). In 2019, residential, commercial, mixed-use, and public/ semi-public buildings made up 93 per cent of the total built environment of Vijayawada. A comparison of the proposed land use in ZDP 2021 and the city's existing built form in 2019 reveals that most of the city's peripheral areas were vacant despite the ZDP indicating them for residential use to decongest the CBD. Hundred per cent of the city area is developable, of which 20 per cent covers natural features. The spatial extent reaming the same and the city's population growth may be the key factors for the decrease in the built-up area per capita. As most of the civic facilities, infrastructure and economic opportunities are concentrated in the CBD, there is a tendency for fragmented development in peripheral areas like Nandamuri Nagar in the North-West, Nunna in the North, and Ajith Singh

Nagar in the North-East, along the city's major transit corridors. Auto Nagar in Ward 11 is the city's industrial zone, which serves as a trading hub for the automobile, agricultural and allied sectors. Auto Nagar falls under the separate jurisdiction of the Industrial Area Local Authority (IALA), the ULB responsible for all services and maintenance in the area.

Table 4.2: Existing building use distribution in Vijayawada (2019)

Existing building footprint	sq. km.	% contribution
Total residential building footprint	9.1	70.5
Total Commercial building footprint	1.4	10.9
Total Mixed-use building footprint	1	7.8
Total PSP building footprint	0.5	3.9
Total building footprint	12.9	-

Source: VMC GIS Database, 2019



Map 4.8: Existing building uses (2019), Vijayawada

Source: GIS Database, VMC. (Requires ground verification of the database including Auto Nagar Industrial area)

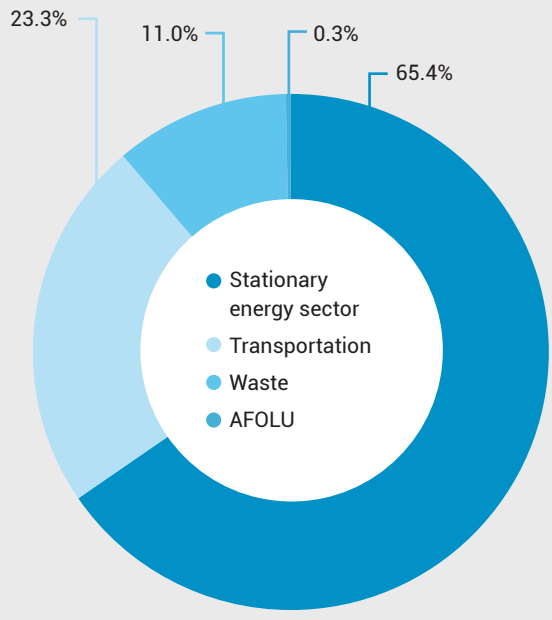
4.3 GREENHOUSE GAS EMISSIONS PROFILE

According to a GEF-UNIDO-MoUD study (2017)[13], **the GHG emission in Vijayawada during 2015-16 was 1,888,582 Mt CO_2-eq, with total CO_2, CH_4 and N_2O of 1,675,863 Mt, 7,093 Mt, and 53 Mt, respectively in the air.** There are no GHG emissions from combustion of materials of biogenic origin-CO_2 (b) (e.g., biomass and biofuel, since carbon neutral fuel is considered zero emission) within the city boundary.

As shown in Figure 4.3, the stationary energy sector/ energy use emitted 12,35,184 Mt of CO_2-eq., accounting for 65% of the total GHG emissions during year 2015-16. The transportation sector emitted 4,40,679 Mt of CO_2-eq., which was 24 per cent of the total GHG emissions. The waste sector emitted 2,06,962 Mt of CO_2-eq., which was 11 per cent of the total GHG emissions. The Agriculture, Forestry, and Other Land Use (AFOLU) sector emitted 5,757 Mt of CO_2-eq., which was 0.3 per cent of the total GHG emissions.

In Vijayawada, there is no industry classified under Industrial Processes & Product use (IPPU) sector. Hence the emission of gases from the industry sector is considered as zero. A few types of industrial activities in the city such as spare parts manufacturing, road metal quarries, contributed only to dust emissions. **The annual CO_2 equivalent (GHG) emissions per capita in 2015-16 was 1.73 Mt CO_2-eq/capita.**[14]

Figure 4.3: Sector-wise GHG emissions (Mt of CO_2-eq.) in Vijayawada during 2015-16



Source: GEF-UNIDO-MoUD Project completion report (2017)

4.4 SECTORAL CONTEXT

This section covers Vijayawada's assessment over 12 USAF sectors – namely, governance and data management, finance and economy, housing and property, water, sanitation, waste management, clean energy, disaster management, environment, public space, urban form and safety, transport, and social facilities and services.

For Vijayawada, 79 per cent of all indicators (103 out of the 131 indicators), were collected (refer Figure 4.4). Ninety-four per cent of all primary indicators were collected (51 out of the 54 indicators). As shown in Figure 4.5, the overall average city score is 4. The detailed performance of sectors is provided in the Vijayawada Urban Sustainability Indicators Report.

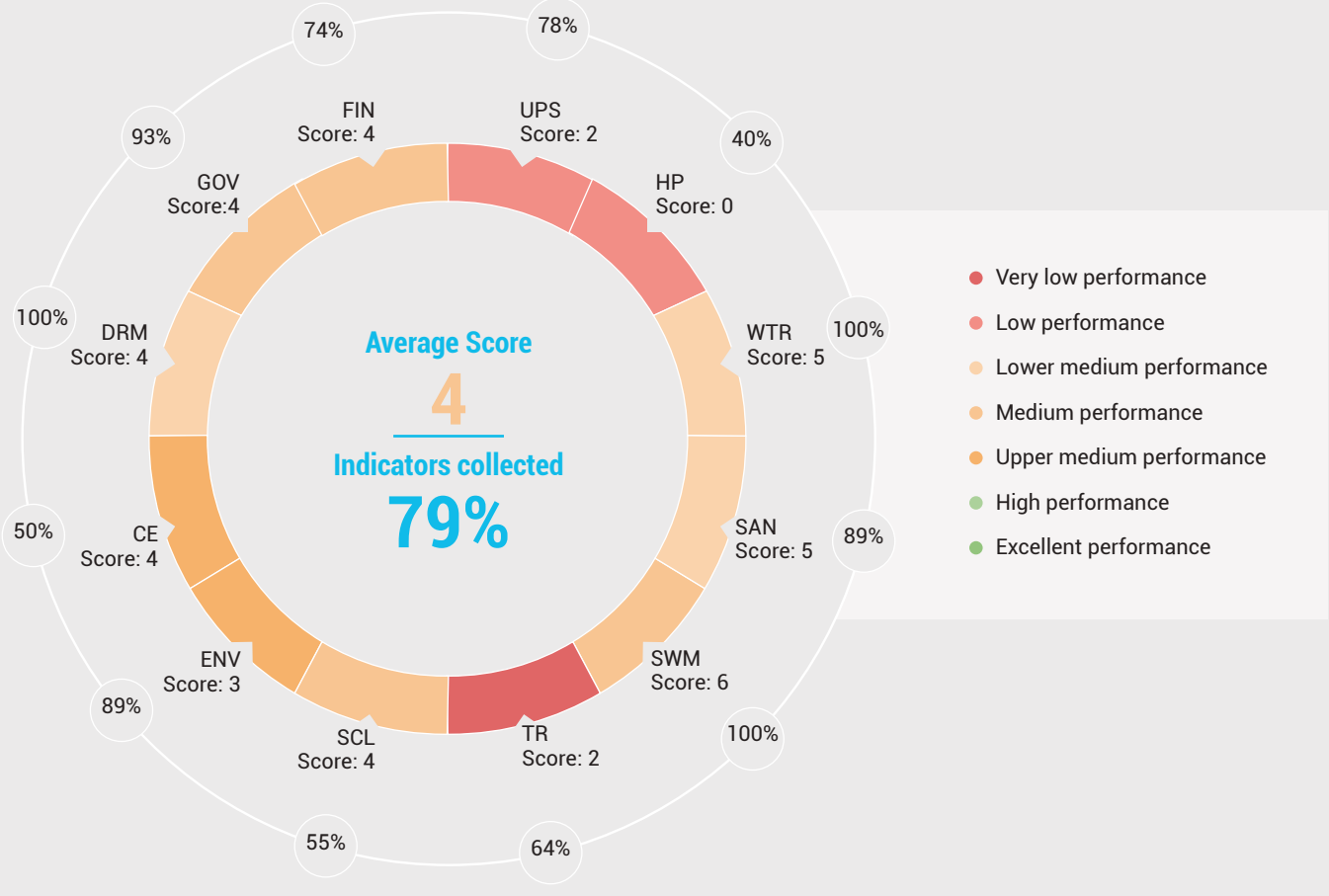
The proceeding sub-sections present an in-depth evaluation of each of the sectors based on the USAF parameters.

[13] GHG Accounting and Capacity Building for the Cities of Jaipur, Bhopal, Mysore, Vijayawada and Guntur' as a first step under the GEF-UNIDO-MoUD Project (2017)
[14] GHG Accounting and Capacity Building for the Cities of Jaipur, Bhopal, Mysore, Vijayawada and Guntur' as a first step under the GEF-UNIDO-MoUD Project (2017)

Figure 4.4: USAF primary, secondary and tertiary indicators data collection status

Source: UN-Habitat

Figure 4.5: Average performance and percentage of indicators collected for all sectors



Source: UN-Habitat

Refer Annexure 4.1 for overall performance of Vijayawada across all USAF sectors

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 to public and open spaces in the city. For Vijayawada, data was collected for seven of the nine indicators. The city's overall performance in this sector was 'lower medium'.

Public Space

In Vijayawada, open space (including recreational space, organized green, and other common open spaces) per capita (sq. m./person) is 3.83 sq. m. per person, against a URDPFI benchmark and AMRUT guidelines of 12 sq. m. per person. The city scored 'very low' on open public spaces for its citizens.

The VMC maintains around 174 parks in the city, covering 4.59 sq. km. of open spaces (including recreational space, organized green and other common open spaces, as well as flood plains and forest cover) in the city. In 2019, only 63 per cent of the city's population had access to parks and open spaces within a walking distance of 500 m. (see Map 4.9). In Vijayawada, although 0.42 sq. km. is covered by parks and open public spaces, only one per cent of the total developable area is dedicated to recreational use (including stadiums, theme parks, playgrounds, etc.).

These recreational facilities are used by residents for walks, open gym exercises and children's play area. The city scored 'very low' for open space per capita (sq. m./person). In 2018-19, VMC had spent an average of INR 65 per sq. m. towards operations and maintenance of parks in the city. Existing parks, green cover on hill tops and canals are the key sources of carbon sinks in the city.

Image 4.7: View of K.L. Rao Park, an area level park and recreation space

Source: UN-Habitat

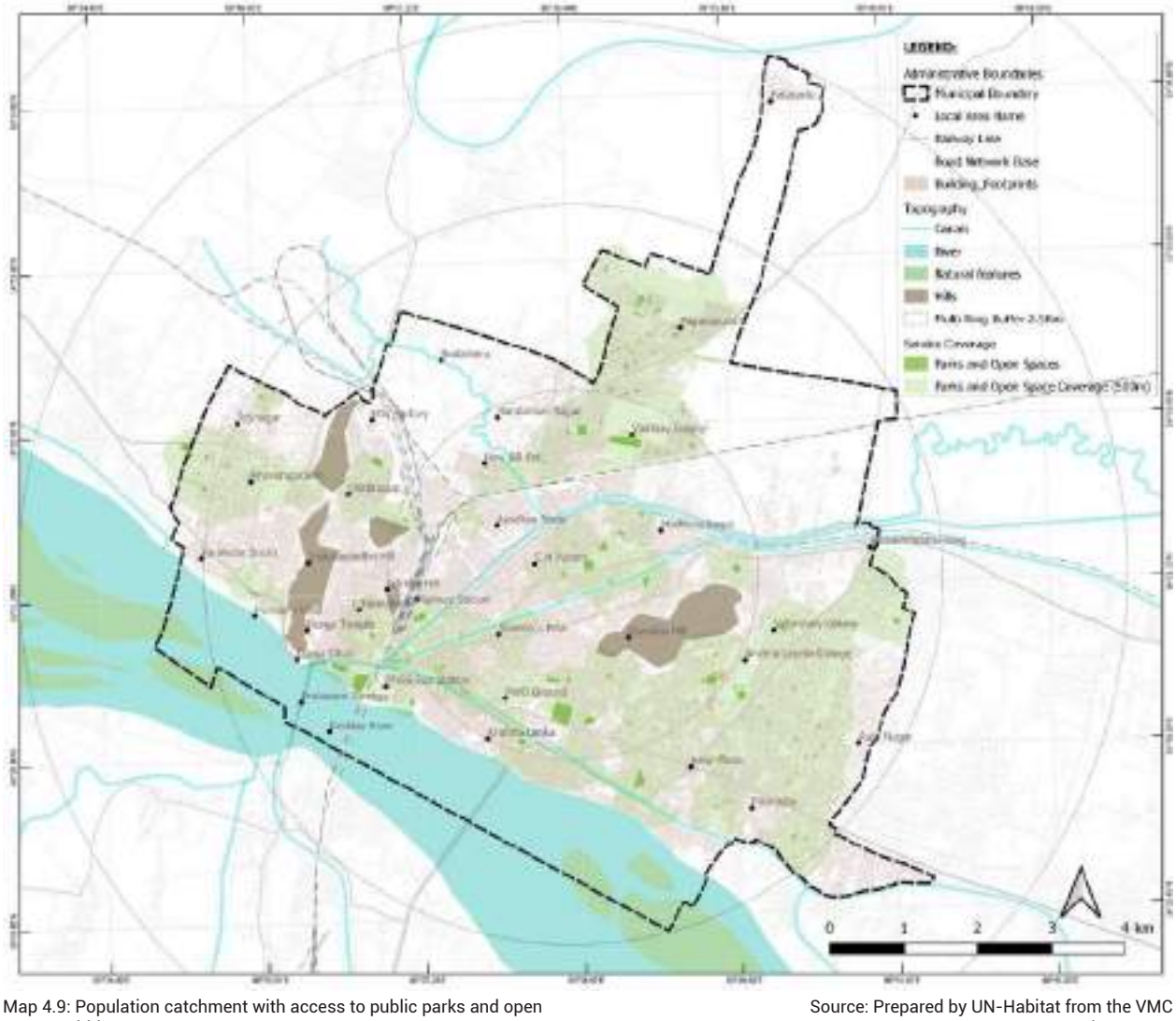
Image 4.8: View of children's play area and open gym at K.L. Rao Park Source: UN-Habitat

Image 4.9: View of Ayyapa Park developed along National Highway and Bandar Canal Source: UN-Habitat

The development of parks and urban greenery is one of the priority areas of VMC. VMC is exploring alternative strategies, such as canal embankments, boundary-free parks, and eco-parks in remediated lands, to increase open public spaces in the city, while old parks are being renovated with innovative concepts.

Image 4.10: View of ongoing eco-park development at Ajith Singh Nagar

Source: Drone photo, facilitated by VMC Nodal Officer



Map 4.9: Population catchment with access to public parks and open spaces within 500 m.

Source: Prepared by UN-Habitat from the VMC GIS Database 2019

Image 4.11: View of F1 H2O Park developed under flyover by VMC

Source: UN-Habitat

Proposed Agricultural Land Use Conversion

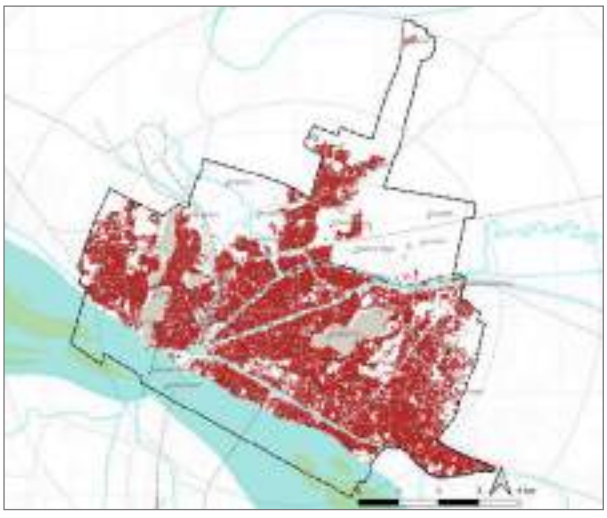
There are no existing or proposed agricultural lands and most of the vacant land (refer Image 4.12) is either plotted real estate development, or privately-owned vacant land, or government.

Image 4.12: View of plotted lands for residential development near the Bypass Road Source: UN-Habitat

Change in Built-up Area Over Time

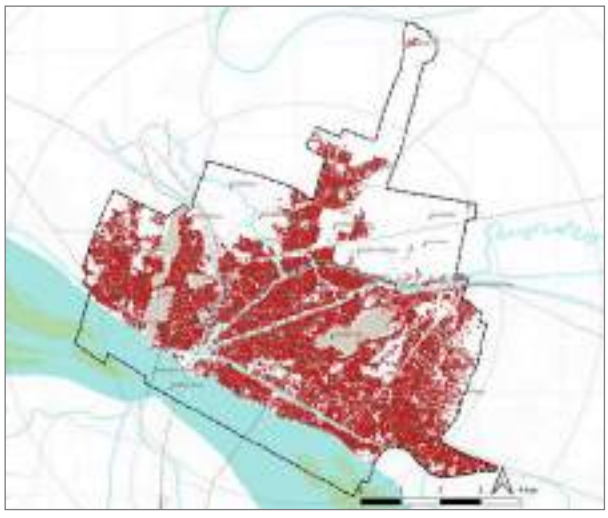
The total built-up footprint in Vijayawada increased by three per cent to stand at 26.4 sq. km. in 2014 from 25.7 sq. km. in 2000. However, built-up area per capita in the city decreased by 11 per cent to 25 m./ person in 2014 from 27 m./ person in 2000, with an increase in population even as the developable land remained the same. The scarcity of vacant land available for development in Vijayawada may be one of the key factors for fragmented expansion due to its natural topographical features in the North-East and along its major transit corridors.

2000



Area: 61.88 sq. km.,
Population: 9.4 lakh (2001)

2014



Area: 61.88 sq. km.,
Population: 10.3 lakh (2011)

Map 4.10: Built-up area in the city in 2000 and 2014

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)

As per the Vijayawada ZDP 2021, 100 per cent of the city area is developable and the natural features like river, hills, and canals occupy around 35 per cent of the total land in the city. High population density may be the key factor for the decrease in built-up area per capita and per capita open spaces.

100 per cent of city roads are covered with 34,589 streetlights. The city scored 'excellent' for its coverage of street lighting.

Data for the indicator of safety standards in the city is not available for Vijayawada. The Vijayawada Urban Police monitor on-street activities through CCTV surveillance and the police command control centre. VMC has also embedded live feed from its own cameras from its command control centre, which supplements the existing surveillance in the city. The city has traffic signals and, surveillance systems installed in all major road cross-sections. Zebra crossing lanes are not evident in many locations and most footpaths are occupied by shops, street vendors and vehicular parking.

Image 4.13: View of pole mounted surveillance cameras on Eluru Road

Source: UN-Habitat

4.4.2 Housing and property

There are five indicators for measuring the status of informal settlements/ slums and housing demand in the city. Data for four of these indicators was collected for Vijayawada. The overall performance of the city in this sector was 'very low'.

Housing

In 2011, the total number of households in Vijayawada was 2.79 lakh, increasing to 2.83 lakh in 2019[15]; while the average household size increased from 3.7 in 2011 to 4.2 in 2019[16]. Some of the city's important government housing colonies include H.B. Colony, VAMBAY Colony and New R.R. Pet. In 2019[17], 70 per cent of the total built-up area was driven by residential buildings, which covered 9.1 sq. km. of the city's built environment.

Natural topographical features like hills and water bodies resulted in fragmented housing distribution in the city. Vijayawada's housing typology is predominantly that of plotted, low-rise buildings in the city centre, haphazard, informal residential sprawls along the hillsides, or high-rise buildings in the peripheral areas.

[15] VMC SLB Signed statement, 2019
[16] VMC SLB Signed statement, 2019
[17] VMC SLB Signed statement, 2019

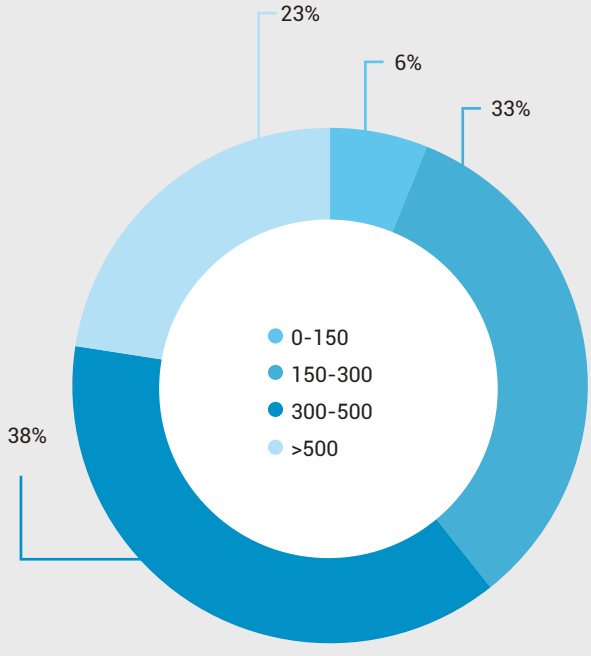
Image 4.14: Various housing typologies in the city

Source: UN-Habitat

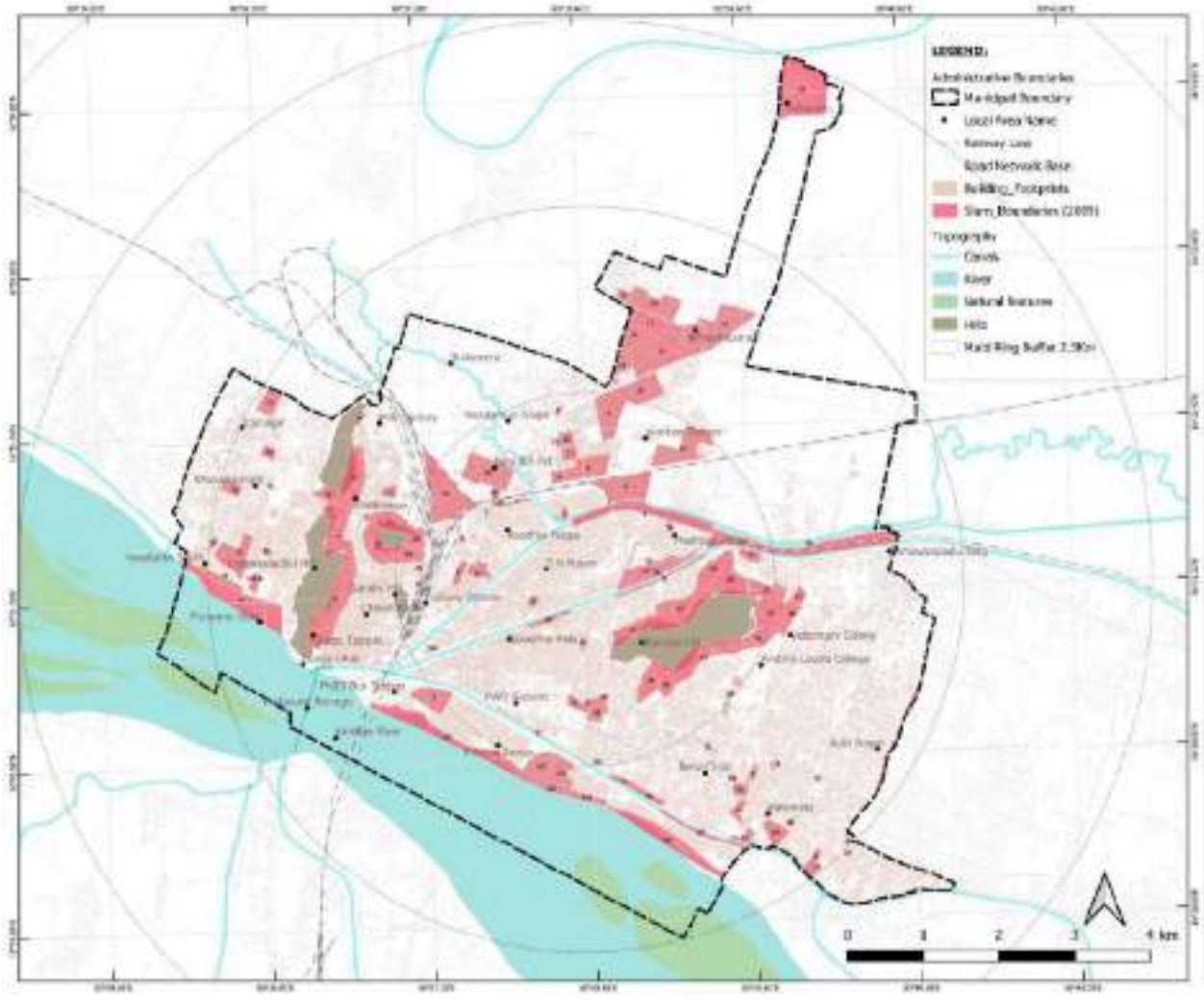
Informal Settlements

There are 111 informal settlements occupying 15 per cent (9 sq. km.) of the VMC's total jurisdiction area. There are around 82,115 households in these areas, constituting 29 per cent of the city's urban households who live in informal settlements. In 2019, a population of about 2,87,983 resided in 111 such settlements (refer Map 4.11), with most of them concentrated on hilltops that are prone to landslides, or in flood-prone areas along the Krishna River. Figure 4.6 indicates that informal settlements are densely populated, with only six per cent of their population residing in areas with a density of less than 150 PPH and 94 per cent residing in areas with a density greater than 150 PPH.

Figure 4.6: Percentage of population density distribution in Vijayawada's informal settlements



Source: UN-Habitat



Map 4.11: Location of informal settlements in Vijayawada

Source: Prepared by UN-Habitat from the VMC GIS Database 2019

The key development challenges of the city's informal settlements are overcrowding, their location in vulnerable areas, challenges in civic service provisions, difficulty in emergency operations, land scarcity for new housing development and removal of illegal encroachments. As per MPI 2019, under PMAY, 55,800 dwelling units have been sanctioned for VMC, but only 15,112 sanction letters have been issued and only 55 per cent of these sanctioned applicants have been allotted housing units. About 6,576 PMAY housing units are under construction in Jakkampudi. Areas demarcated as conservation zones by the Vijayawada ZDP 2021 see a proliferation of informal settlements on hill tops and hazard prone areas, due to the lack of strict enforcement measures. There are no provisions for the redevelopment of informal settlements or their relocation in the ZDP.

Image 4.15: Karkatta South slum near Punnami Ghat along NH-65 Source: UN-Habitat

4.4.3 Water supply

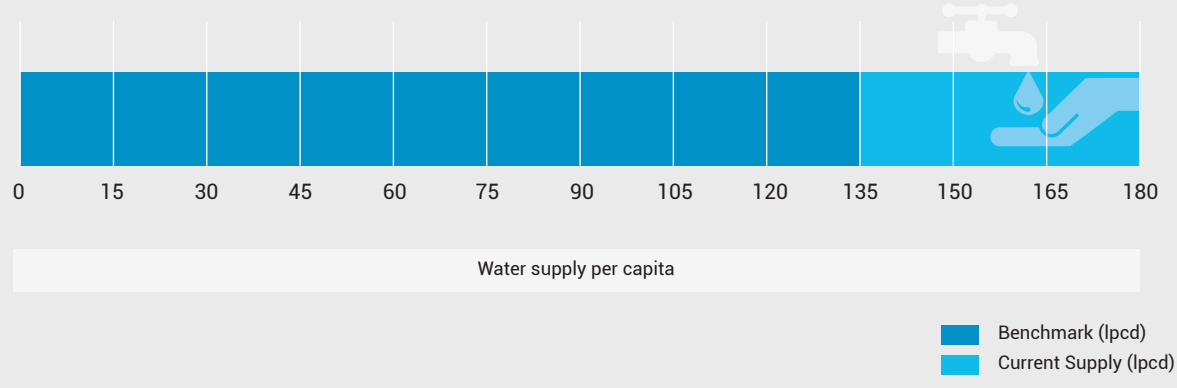
There are six indicators to gauge water resource management, including service coverage and efficiency in mapping households with piped connections, metered connections, and measuring the extent of non-revenue water in a city. For Vijayawada, data was collected for all the six indicators.

The Krishna River is the city's main source of water. VMC's Head Water Works is responsible for supplying potable water to the entire city, and the ULB meets its water supply requirements through surface and sub-surface sources.

Water Supply and Service Coverage

The water treatment plant at K.L. Rao Head Water Works utilizes 248 million litres per day (MLD) of water. After treatment, 216 MLD of water is put into the transmission and distribution system, with 27 per cent of Non-Revenue Water (NRW). The city earned an 'upper medium' score for supplying 180 Litres per Capita per Day (LPCD) of water per capita. The Krishna River enables VMC to supply more than the benchmark of 135 LPCD, earning the city an 'excellent' score for the water supply per capita indicator. The Krishna River offers the city a capacity of 246.95 MLD of water from a surface source. The city's sub-surface water source from infiltration galleries has a capacity of 9.77 MLD, and its groundwater capacity from bore wells is 279.45 MLD.

Figure 4.7: Water supply per capita (lpcd) in the city compared to benchmark for water supply



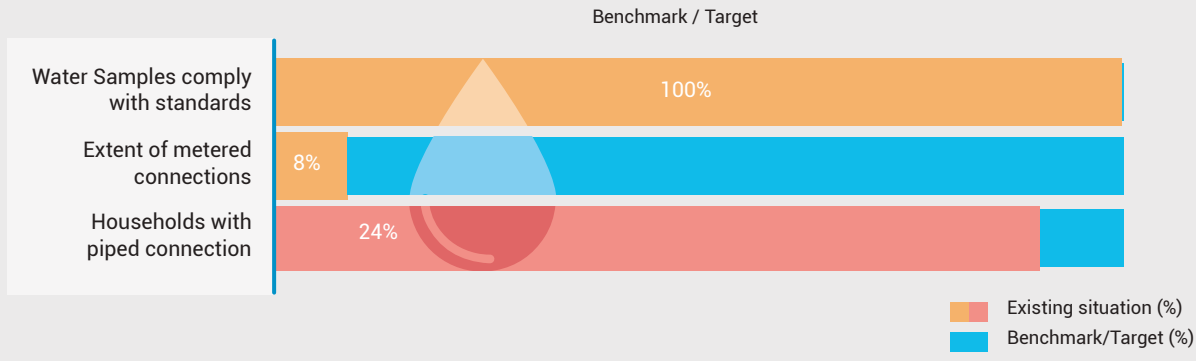
Source: UN-Habitat

As per SLB 2019, the percentage of households with piped water supply connections in Vijayawada is 90 per cent (2,54,989 HH), earning it a 'high' score against this parameter. As per the 2019 GIS database, Vijayawada has a total water supply pipeline network of 748 km. The database also indicates that Wards 01, 30, 57, 58 and 64 under VMC are not covered by a water supply network (refer Map 4.12), while the Auto Nagar Industrial Estate (Ward 11) is served by IALA. The water supply division is one of the major revenue contributors of VMC. Water supply, transmission and management is carried out through Supervisory Control and Data Acquisition (SCADA) systems established in Vijayawada.

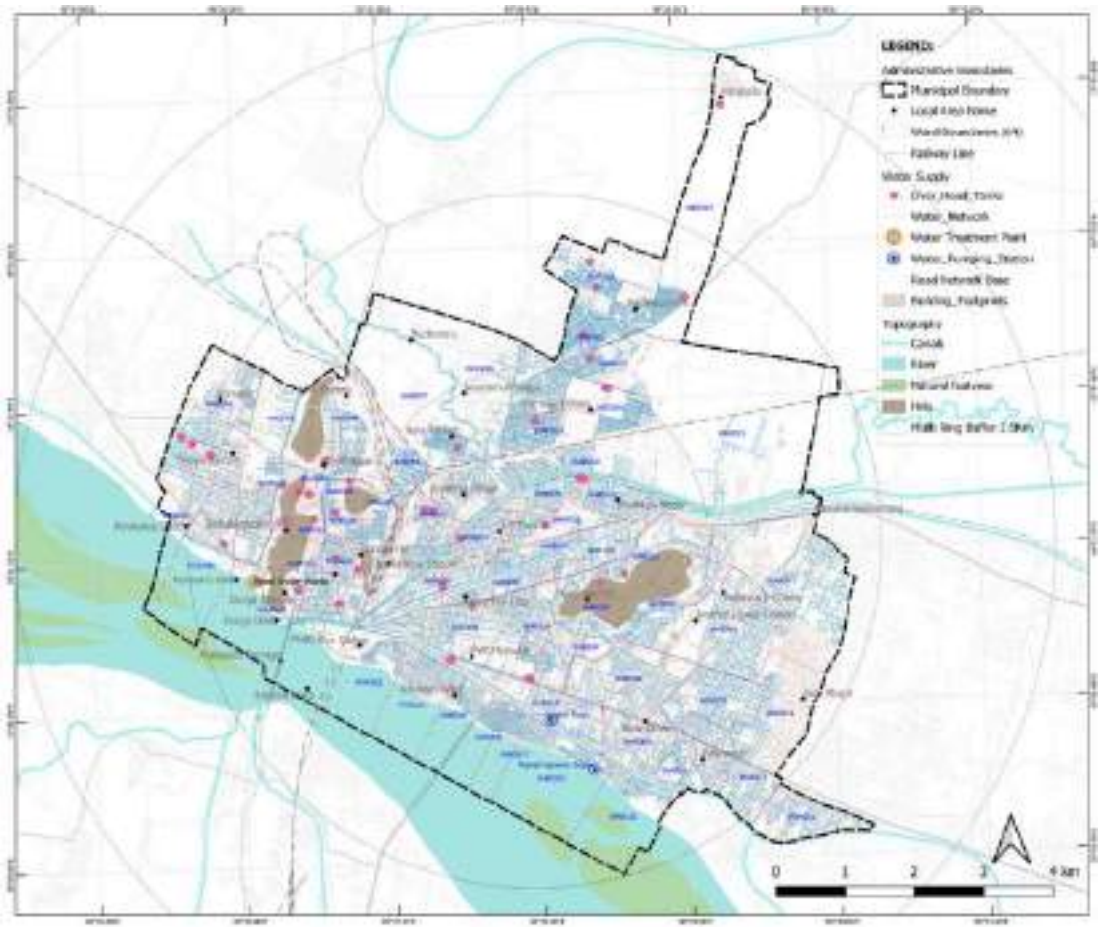
Water Quality

In 2018-19, 100 per cent of the water samples collected from the city complied with the national potable water quality standards of 100 per cent, as prescribed by the Central Pollution Control Board. The city, therefore, scored 'excellent' for its water quality.

Figure 4.8: Water supply and services management in Vijayawada



Source: UN-Habitat



Map 4.12: Water supply network and location of overhead tanks in Vijayawada

Source: Prepared by UN-Habitat from the VMC GIS Database 2019

Image 4.16: Head Water Works intake well and treatment plant in Krishna River Source: UN-Habitat

To address the existing gaps in the water supply system, VMC is undertaking various activities. Under the national AMRUT mission, provision of water supply for house service connections and strengthening of the existing water supply system is being undertaken. VMC is also in the process of providing new house service connections along with water meters for improvement in billing and collection systems.

A strategic project report for water supply was prepared for Vijayawada by Andhra Pradesh Urban Infrastructure Asset Management Limited (APUIAML) in 2017 for water resource assessment and management for the horizon year 2034. As per the strategic project report, water demand of 238 MLD is projected for 2034. As of 2020, VMC was already treating 248 MLD and distributing 216 MLD. VMC is also in the process of formulating a summer action plan to ensure water supply in areas that have transmission losses due to damaged pipelines.

4.4.4 Sanitation

There are nine indicators for assessing the performance of a city's coverage of sewerage network, toilet facilities, compliance with wastewater treatment norms and guidelines. For Vijayawada, data for eight indicators were collected. The overall performance of the city in this sector was 'high'.

Coverage of Sewage Network Services

The total length of the sewerage network in the city is 798 km (as per the GIS database), with 92 per cent of city households enjoying access to sewerage network service connections, which includes 1,85,809 properties with direct connection to the network (including residential, commercial, industrial, and institutional categories). The city scored a 'lower medium' for this parameter (see Map 4.13 for the distribution of the sewerage network).

Wastewater Treatment

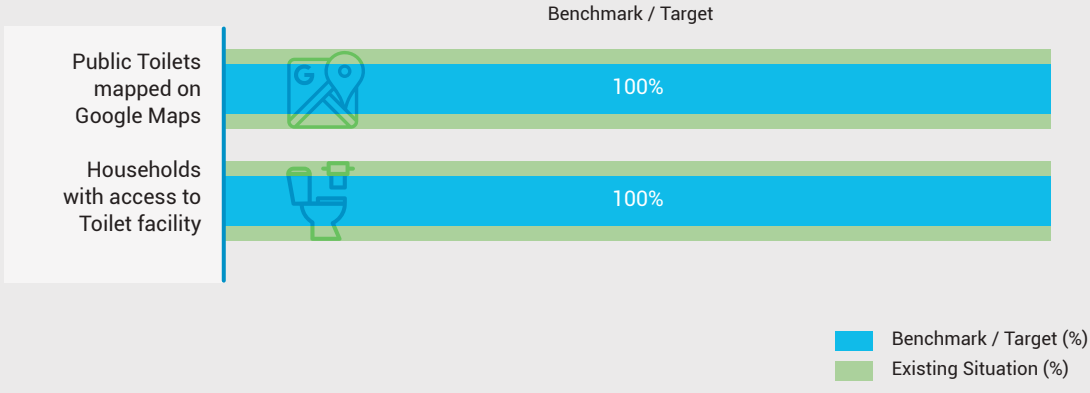
There are seven Sewage Treatment Plants (STPs) in the city with an installed capacity of 140 MLD at Ajith Singh Nagar (two plants), Auto Nagar Industrial Estate (two), Jakkampudi and Ramlingeswara Nagar (two). A total sewage of 149 MLD is generated in the ULB, with 85 per cent (127.7 MLD) of wastewater treated before discharge, earning the city a 'high' score against this parameter. Of the total treated wastewater, 22 per cent is reused for road cleaning, watering greenery and the remaining is let into canals, again earning the city a 'high' score for its performance. As per SLB 2019, the city scored 'excellent' with 100 per cent of the total wastewater samples collected in a year by the VMC passing the specified secondary treatment standards.

Access to Toilets

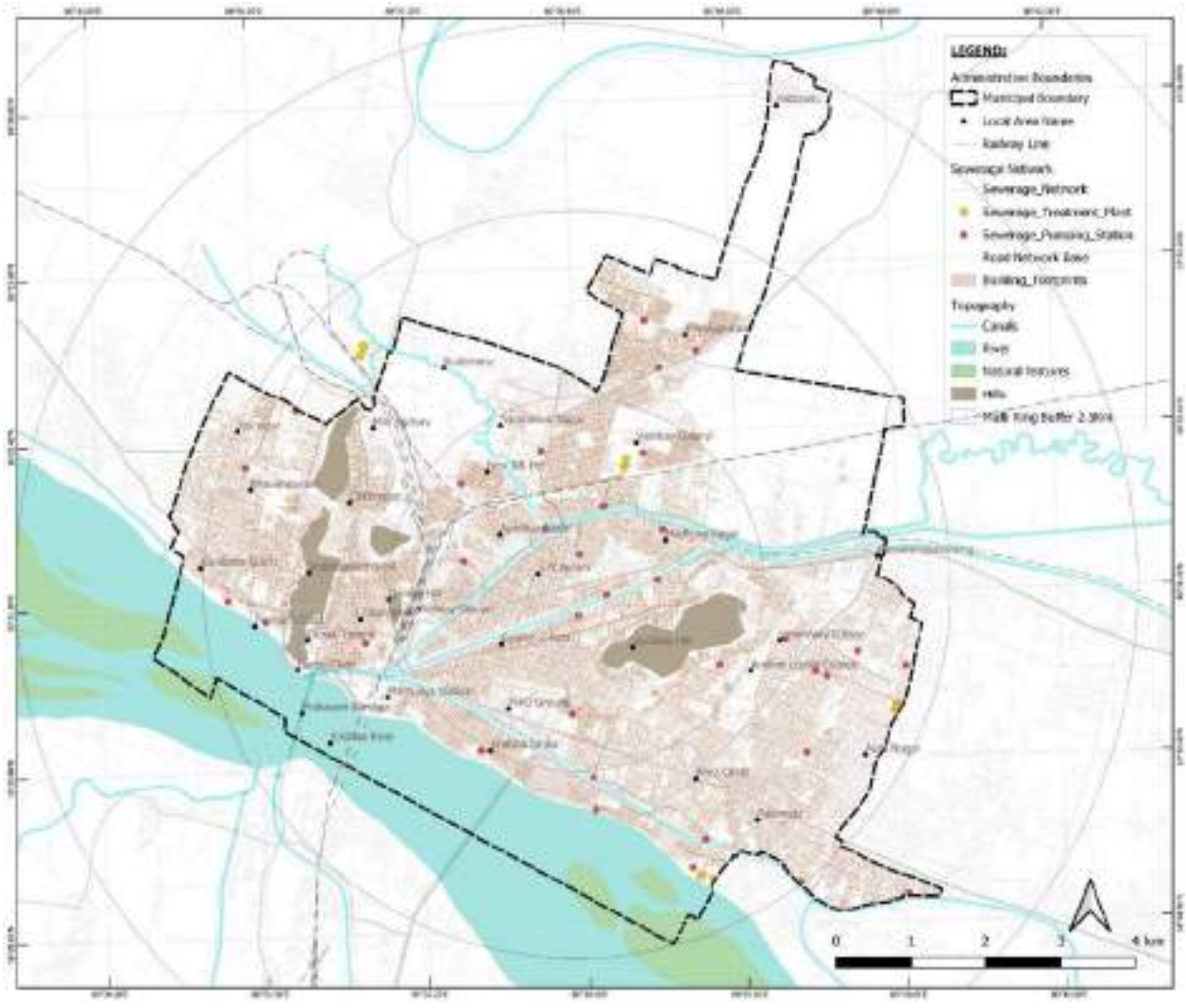
Vijayawada was declared as Open Defecation Free (ODF++) under the Swachh Bharat Mission (SBM) norms, and under the Swachh Survekshan 2020 mission, Vijayawada was awarded as the cleanest, big city in India. All of the total 2,83,275 households in the city have access to a toilet facility, with 2,63,446 households enjoying access to individual toilets and 19,829 households access to community toilets.

There are 50 public toilets and 15 community toilets in Vijayawada. All households have access to private toilet and public toilet (PT) facilities, as indicated by Google Maps (refer Figure 4.9), earning the city an 'excellent' score for these indicators.

Figure 4.9: Households with access to private and public toilets marked on Google Maps



Source: Swachh Bharat Mission data, VMC (2020)



Map 4.13: Sewerage network and location of treatment plants in Vijayawada

Source: Prepared by UN-Habitat from the VMC GIS Database 2019

Percentage of industries complying with wastewater treatment as per the Central Pollution Control Board (CPCB) norms is yet to be collected for Vijayawada.

Central and eastern Vijayawada were already covered with Under Ground Drainage (UGD) facility before the Jawaharlal Nehru National Urban Renewal Mission (JNNURM). Under the JNNURM and AMRUT missions, VMC undertook the laying down of underground drainage facilities for all unserved areas of the city by constructing and installing a sewer collection network, pumping mains, pumping stations and transformers.

With funds of Rs. 39.88 crore approved under AMRUT, VMC is developing a new sewerage network and addressing network gaps. Three sewage pumping stations are proposed at BRTS Road near the Municipal Circle Office, at Satyanarayanpuram and at APIIC Colony. United Nations Industrial Development Organization (UNIDO) is funding the STP upgradation on a pilot intervention through the SCIAP project.

Faecal Sludge and Septage Management (FSSM) Action Plan

Vijayawada has a FSSM action plan or notified San-benchmarks, byelaws/ guidelines, thus earning it an 'excellent' score for its existing guidelines and its target to achieve a clean city.

Image 4.17: View of Ajith Singh Nagar STP (40 MLD)

Source: Drone photo, facilitated by VMC Nodal Officer

4.4.5 Solid waste management

There are 12 indicators to assess solid waste management (SWM), which includes the efficiency of waste collection, extent of waste processing and remediation of legacy waste in the city. Data for all the indicators were collected for Vijayawada. The overall performance of the city in this sector was 'excellent'.

SWM is one of the topmost priority sectors of VMC, which collects, transports and manages the solid waste generated by households, commercial establishments and public places.

Waste Collection and Processing Efficiency

The city generates a waste of approximately 550 tonnes per day (TPD) and VMC collects 90 per cent of this total waste, including 265 TPD of wet waste and 229 TPD of dry waste. Of the 265 TPD of wet waste, VMC processes 91 per cent (240 TPD) through centralized composting, vermicomposting, bio-methanation and windrow composting. Of the city's 229 TPD of dry waste, 77 per cent is separated and classified for recycling/ material recovery (refer Figure 4.10).

Figure 4.10: Solid waste collection and processing in Vijayawada

Source: Swachh Bharat Mission data, VMC (2020) and USAF Indicators

Wards Practicing Source Segregation

All the 64 wards under VMC's jurisdiction practice source segregation of waste, which is maintained till the processing/ disposal site, with 52 wards having been notified as bin-free wards. The city scored 'excellent' for all indicators for the city's wet waste processing, dry waste separation and classification for recycling/ material recovery, as well as for wards practicing source segregation of waste.

Other Solid Waste Processing

The city's total solid waste generation per capita per day is 0.4 kg/capita/day, which is higher than the national average of 0.11 kg/capita/day, earning the city an 'upper medium' score for this parameter. The city scored 'high' for 24 per cent of the municipal solid waste being disposed of in open dumps / controlled dumps. Vijayawada fulfils 100 per cent for the following indicators, scoring excellent on the parameter:

- 100 per cent of the legacy waste dump site has been remediated through a bio-mining plant
- 100 per cent of the Construction and Demolition (C&D) waste is collected and processed through wet process technology
- 100 per cent of the city's hazardous waste is processed by VMC through established agencies

Legacy Solid Waste

There are two transfer stations under VMC, one at Ajith Singh Nagar and another at Auto Nagar. The garbage from the city is transferred to these transfer stations through autos, small tippers, compactors, dumper placers and tractors. The same is further transported to the Pathapadu landfill through hook loaders, big compactors, and big tippers. In Ajith Singh Nagar, 45 acres of the land was covered with 3.05 lakh MT of mixed municipal legacy solid waste. VMC remediated this dumpsite through a bio-mining process. The project started in 2018 and involved the design, construction, operation and maintenance of the bio-mining and reclamation of existing solid waste dumpsite in a scientific process. During 2015-16, the stationary energy sector use emitted 1,235,184 Mt of CO_2-eq, accounting for 65.40 per cent of the total Green House Gases (GHG), of which the waste sector emitted 206,962 Mt CO_2-eq, which was 10.95 per cent of the city's total GHG emissions.[18]

Energy Recovery from Solid Waste Processing

At present no solid waste is used for energy recovery (incineration) or co-processing in the city, earning it an 'excellent' score for this indicator. The first regional cluster-based Waste-to-Energy plant is currently under construction near the Naidupet dumping yard in Guntur. About 1,200 MT of waste generated by Vijayawada and eight other ULBs daily will be used to generate 15 MW of electricity. As per the Waste-to-Energy plant government agreement, VMC is scheduled to send more than 550 MT waste per day to the plant for the project period of 25 years. The plant is scheduled to commence operation from 2021.

[18] GHG Accounting and Capacity Building for the Cities of Jaipur, Bhopal, Mysore, Vijayawada and Guntur' as a first step under the GEF-UNIDO-MoUD Project (2017)

Image 4.18: Regional Waste-to-Energy plant (under construction) near Naidupet, Guntur

Source: City Coordinator, UN-Habitat

ICT-based Monitoring System

Through its Command Control Centre, VMC has an ICT-based monitoring mechanism in place for – ward-wise collection and transportation (C&T); monitoring of Garbage Vulnerable Points (GVPs); and attendance of sanitation staff. The city scored 'excellent' for this parameter.

As per SBM 2020, VCM has identified 135 informal waste pickers in the city and 100 per cent of them have been integrated into the city's sustainable SWM system. The city scored 'excellent' for integrating all identified informal waste pickers into formal employment.

SWM Initiatives by VMC

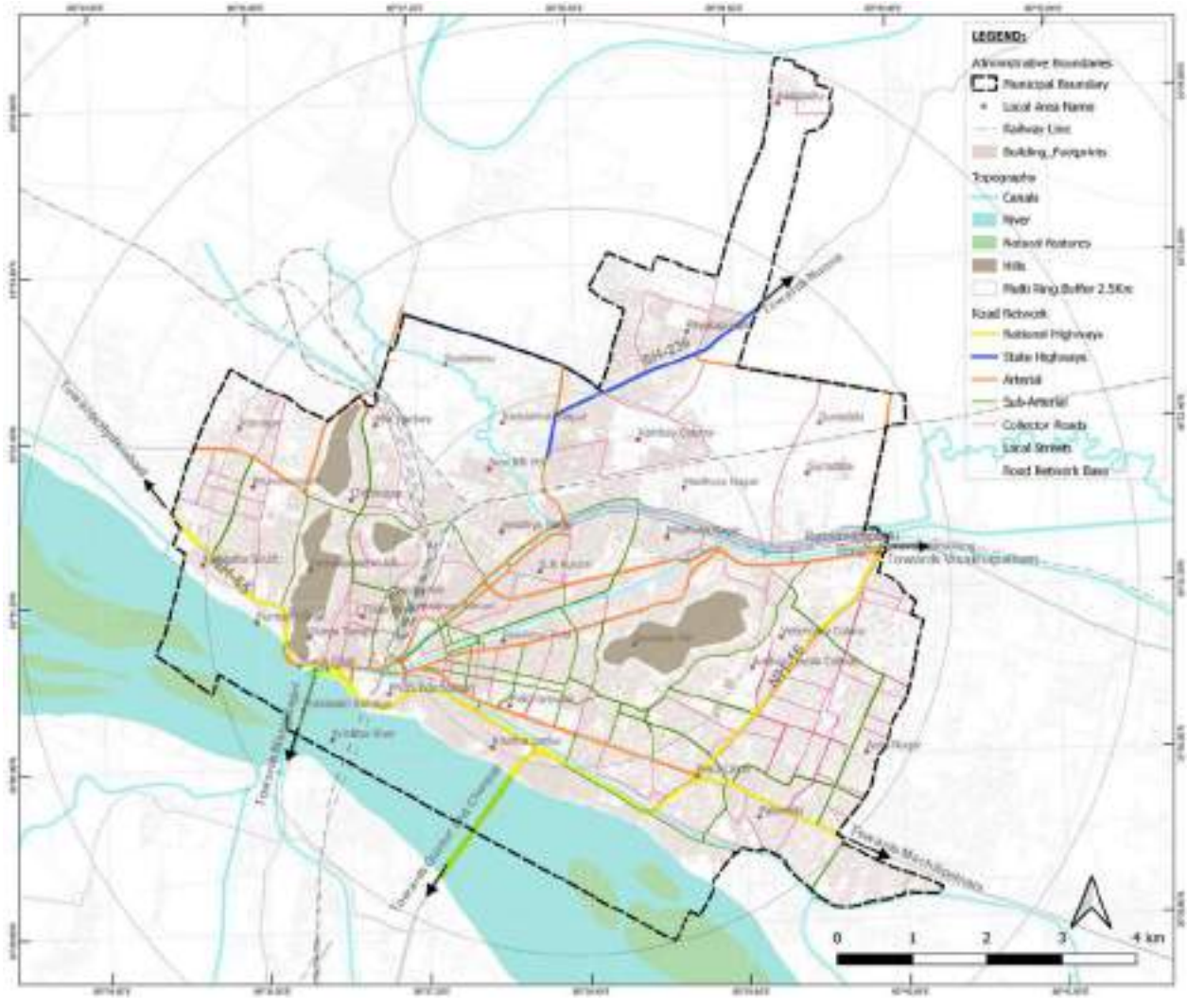
VMC implemented initiatives to improve the existing SWM practices in the city, such as a scientific landfill, wet waste processing through composting, a plastic waste collection and recycling centre, the construction and demolition (C&D) waste processing plant through advanced wet process technology, single-use plastic ban, door-to-door waste collection, etc.

4.4.6 Transportation

There are 14 indicators to assess the status of public transport coverage, quality, safety, and investments made towards environmentally friendly infrastructure in a city. Data for nine indicators were collected for Vijayawada.

Road Network

Transportation is one of the key development sectors in Vijayawada. The total road length in the city is 1,260 km with intense development of commercial and mixed-use activities along the stretches. Most of the development is concentrated along NH 16, NH 65, M.G. Road, Eluru Road, BRTS Road (3.3 km), Ring Road and the Vijayawada Bypass Tunnel. Out of the total road network length, 216 km is constituted by NH 16 and NH 65, arterial and sub-arterial roads (refer Map 4.14). Vijayawada is one of the key junction stations of the South Central Railways (SCR) and a railway track of nearly 19 km traverses the city, dividing it into four parts. The railway tracks also creates disruptions in traffic movement and issues of accessibility across the city (refer Map 4.14).



Map 4.14: Existing road network in Vijayawada

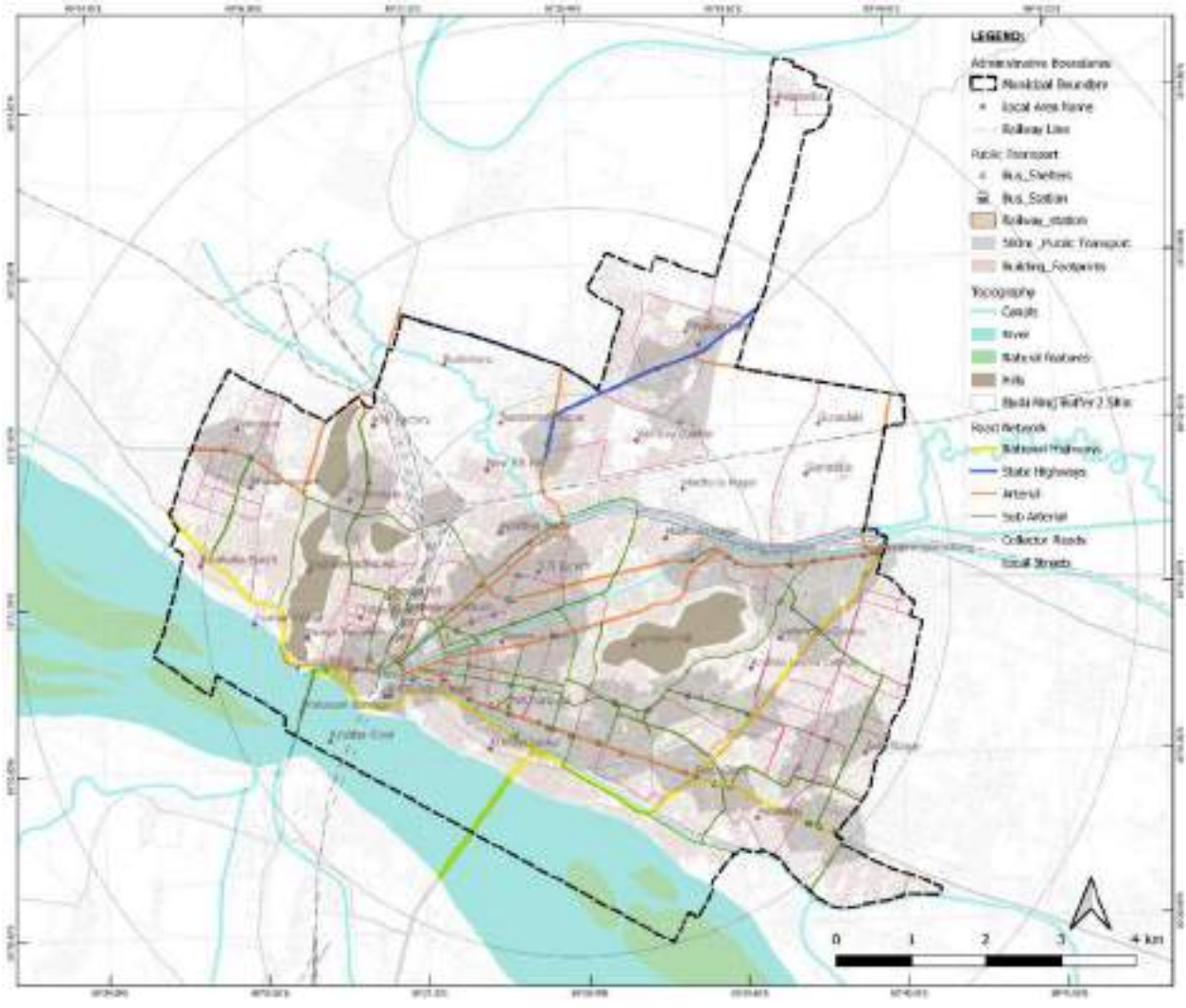
Source: Prepared by UN-Habitat from the VMC GIS Database 2019

The percentage of total area allocated to transportation in the city is 16 per cent, which is well below the norm (30 per cent) suggested by URDPFI guidelines. Thus, the city scores 'low' for this parameter. Road density is just 1.2 m. per person, whereas the road density in terms of the area is 20.35 km per sq. km.

Public Transport Coverage

APSRTC is the state-owned road transport corporation responsible for intercity and intra-city public transport in Vijayawada. Only 22 per cent (286 km) of the total road length has public transport routes. As per the GIS database, there are 77 bus stops concentrated along the primary road network and only 39 per cent of the population has access to public transport within 500 m. of a bus stop (see Map 4.15). Consequently, the city scored 'very low' on the public transport accessibility parameter.

Only 23.8 km of road exists with public transit per 100,000 people (km), whereas the prescribed standard is above 40 km per 100,000 people. In 2019, the ULB's total public transit stretch was 286 km, with a fleet of 457 public transport buses. Of the ULB's total public buses, 53 per cent were vehicles that ran on clean fuel like CNG and PNG, earning the city a 'high' score. As per the data shared by APSRTC, the total public transport ridership in 2019 was 3.6 lakh, and no change was noted from 2018 to 2019. The city scored 'medium' on this parameter since there was no change in ridership during the review period.



Map 4.15: Population catchment with access to public transportation stops within 500 m.

Source: Prepared by UN-Habitat from the VMC GIS Database 2019

As per the GIS database, absence of bus shelters in the northern, north-eastern and north-western parts of the city led to reduced intra-city access to public transportation. About 23.83 km of roads in Vijayawada are serviced by public transit per 100,000 population (km). The city scored 'medium' for this indicator on comparing with the benchmark of 40 km.

Major Transportation Modes in the City

Private transport is the primary means of mobility in Vijayawada, followed by paratransit modes, such as shared auto (running along major corridors), cab operators, autorickshaws and cycle rickshaws. As per the 2018 Urban Commute Report by CSE[19], two-wheelers (53 per cent), public transport (29 per cent), and intermediate public transport (IPT; 15 per cent) like autos and cars (four per cent) constitute majority of the city's vehicular composition.

As per the 2018 Urban Commute Report by CSE, Per Capita Travel Trip Rate (PCTR) value for Vijayawada is 1.3[20] and the Average Trip Length (ATL) of IPT like taxis or autorickshaws is around 5.5 km, while that of two-wheelers is 7 km and that of cars is 13 km.

Image 4.19: Non-functional BRTS Road near Satyanarayana Puram Source: UN-Habitat

Image 4.20: Auto stand (IPT transport mode) near city police control room Source: UN-Habitat

[19] The Urban Commute Report by CSE, analysis and ranking of 14 cities in India, 2018.
[20] The Urban Commute Report by CSE, analysis and ranking of 14 cities in India, 2018.

Non-Motorized Transport (NMT) and NMT Facilities

The city lacks infrastructure for pedestrians and NMT in its design for transport facilities, and there are no dedicated bicycle lanes or bikeways in the city. Only nine per cent of the road length in Vijayawada have footpaths with a width of more than 1.2 m. on either side of the road, earning a 'very low' score for this indicator. The carriageway and footpaths along the major roads are encroached by street vendors and on-street parking activities. As the city does not have dedicated bicycle lanes, it scored 'very low' on this indicator.

Image 4.21: Encroachment of medians by street vendors

Source: UN-Habitat

VMC is undertaking improvement of urban road corridors for a stretch of 38.11 km to incorporate standard lane width, pedestrian facilities, road geometry, junction improvements, parking facilities, bus stops/ bays, IPT stands, road markings and signages, and landscaping. Through the existing gaps in the indicators performance and assessing the indicators with performance, USAF can assess the spatial distribution of existing main road corridors and analyse planned corridor improvements with population access to public transport and NMT facilities to improve accessibility as a city strategy.

Image 4.22: View of NH-65 and Kanaka Durga Temple flyover near VMC Office

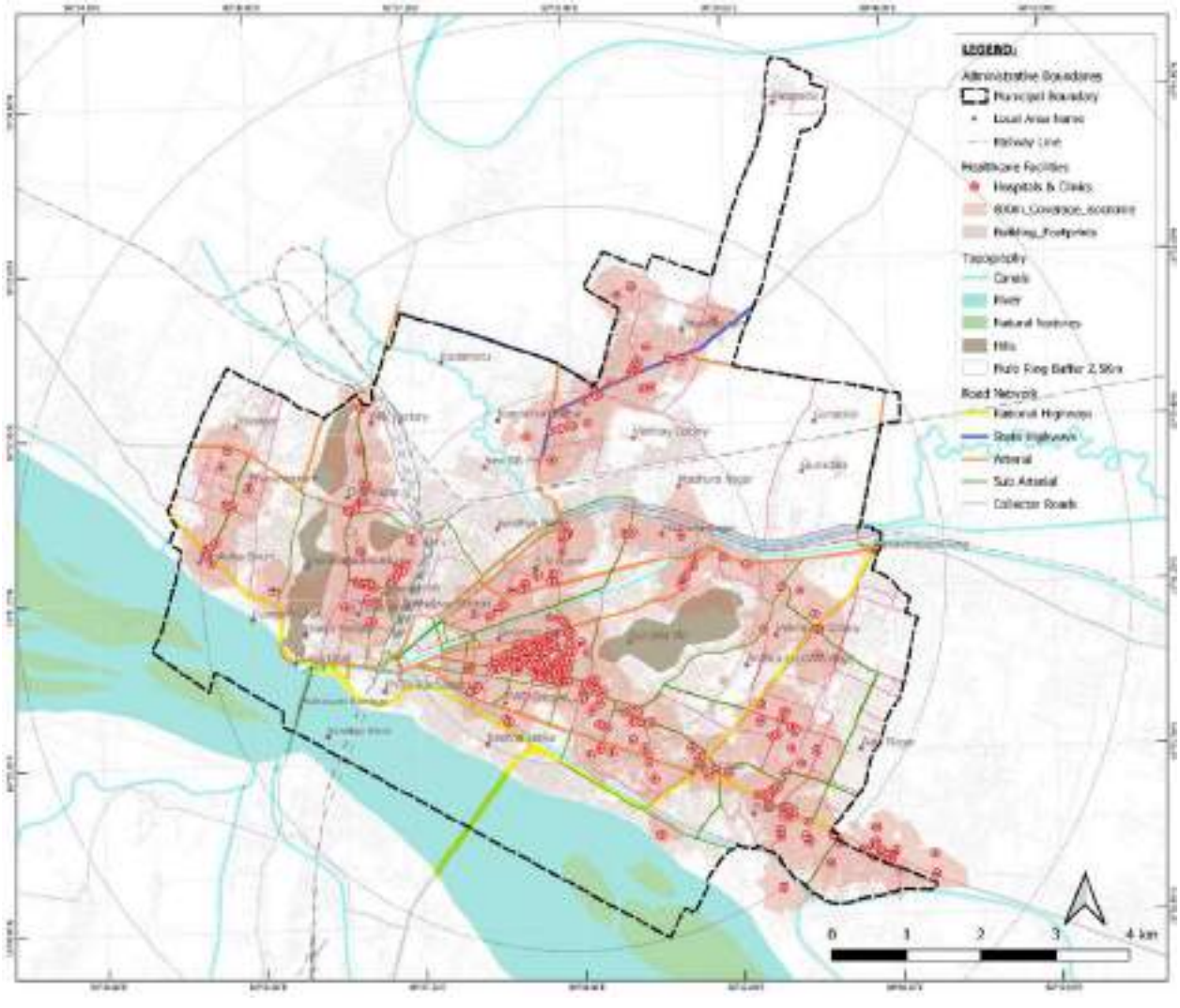
Source: Drone photo, facilitated by VMC Nodal Officer

4.4.7 Social facilities and services

There are 11 indicators for assessing social infrastructure in a city, including two related to demography, five related to health, one on ICT, and three about the status of education in the city. Data was collected for six indicators in Vijayawada. The decadal population growth rate in Vijayawada decreased by 23 per cent between 1991-2001 and 2001-2011. Data for City Level Dependency Ratio was not collected.

Healthcare

Vijayawada is known for its multi-speciality hospitals, healthcare facilities, urban primary healthcare, and other medical facilities. Hospital bed density in public and private (beds per 10,000 residents) hospitals is 27 beds per 10,000 people, which is higher than the standard of 25 beds per 10,000 people. Hence, the city scored 'excellent' on this indicator. Though the bed density is high, 59 per cent of the population have access to healthcare facilities within 800 m. (within 5-15 minutes) of their residences, 800m is generally considered as the standard proximity to a community facility. With low percentage of population with access to healthcare facilities the city scored 'very low' on this parameter (refer Map 4.16).



Map 4.16: Population catchment with access to healthcare facilities within 800 m.

Source: Prepared by UN-Habitat from the VMC GIS Database 2019

There are about 340 government and private healthcare facilities in Vijayawada, but most of them are concentrated in centralized nodes within a 2.5 km radius from the city core or only along with the primary road network. Data for indicators such as under-five mortality rate per 1,000 births, prevalence of water borne diseases and vector borne diseases was not collected.

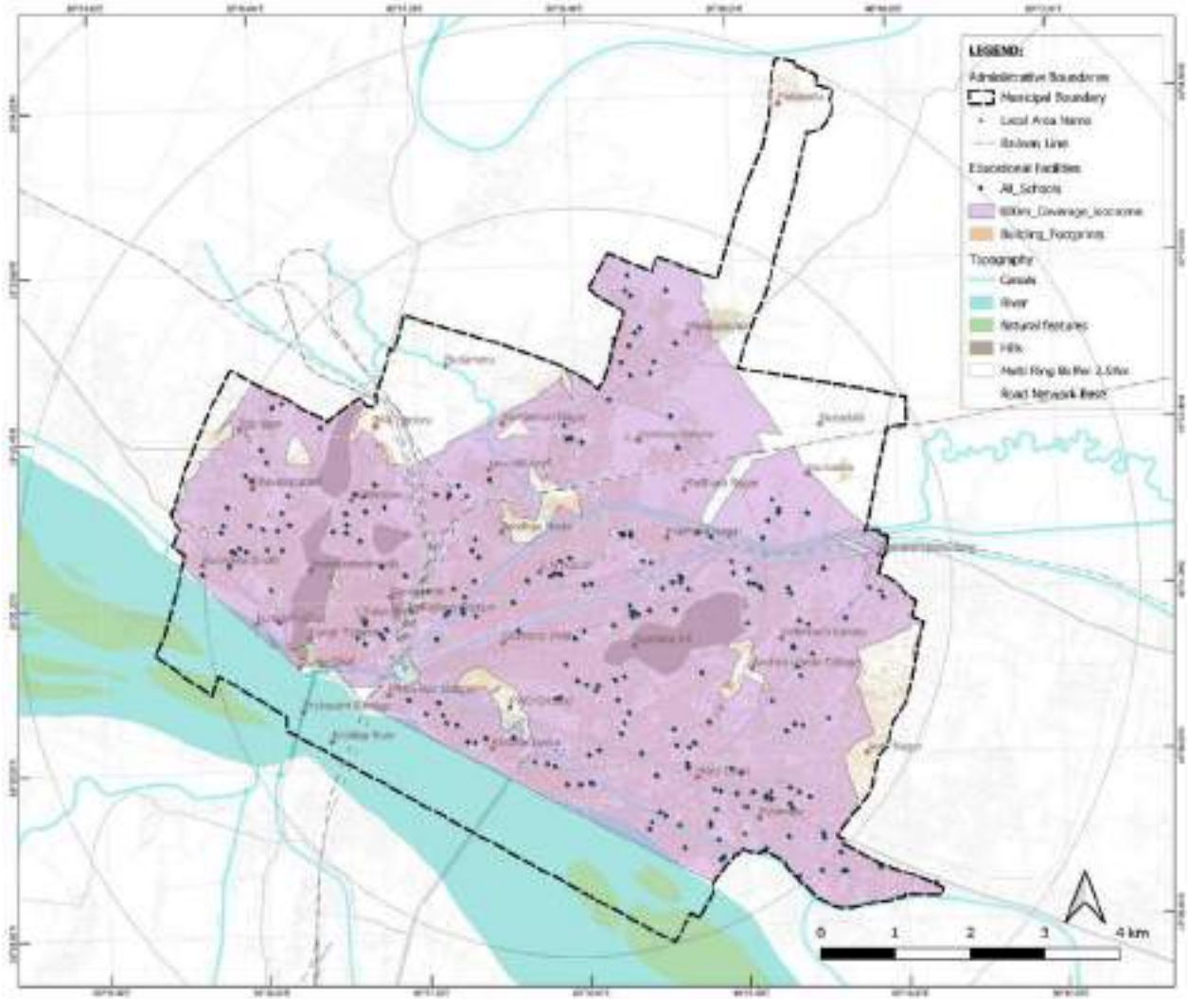
Image 4.23: View of Government General Hospital (GGH), Vijayawada

Source: UN-Habitat

Education

Vijayawada is an important educational hub in the region. As per the Ease of Living Index (EOL) 2019, there are 549 primary and secondary schools in the city, of which 430 are private schools. Ninety-five per cent of the population has access to primary and secondary schools (private or government) within 800 m. from their residences. The city earned an 'excellent' score for the high proportion of its population with access to educational facilities (refer Map 4.17). As an established educational hub, Vijayawada's citizens enjoy high access to educational facilities.

In 2011, the total literacy rate in Vijayawada was 81 per cent, contributed by a literate population of 7,57,667 among a total population of 9,32,659 above six years. In 2011, the female literacy rate in Vijayawada was 77 per cent, slightly less than the national urban average of 83 per cent. The city scored 'medium' for its performance on this indicator. As per EOL 2019 report, 100 per cent of the city's schools had access to digital education.



Map 4.17: Population catchment with access to schools within 800 m.

Source: Prepared by UN-Habitat from the VMC GIS Database 2019

Image 4.24: View of Municipal Corporation High School, Durgapuram Source: UN-Habitat

Image 4.25: View of Ghantasala Venkateswara Rao Government Music College Source: UN-Habitat

4.4.8 Environment and ecology

With 18 indicators to examine whether ULBs have a clean air action plan, measure major pollutants, and disaggregate emissions data to specific sectors, environment and ecology is one of the most important sectors of the USAF. There are four indicators for annual CO_2 equivalent (GHG) emissions, annual CO_2 equivalent emissions from the transportation sector and total annual methane emissions. Five aspirational indicators are associated with annual CO_2 and methane emissions, its change over time and its sector-wise bifurcation. Data was collected for 16 indicators in Vijayawada.

Clean Air Action Plan

In 2019, Vijayawada was identified as one of the non-attainment cities[21] in India, because of the respirable suspended particulate matter (PM10) in its ambient air. CPCB has identified a list of 124 cities where the prescribed National Ambient Air Quality Standards (NAAQS) are violated[22]. These cities have been identified based on the ambient air quality data (2008-2010) under the National Air Quality Monitoring Programme (NAMP). A comprehensive action plan for clean air for Vijayawada was formulated to control air pollution.

The Andhra Pradesh Pollution Control Board (APPCB) regularly monitors the ambient air quality of Vijayawada at 10 locations using nine manual ambient air quality monitoring stations under NAMP and one continuous ambient air quality monitoring station on real time basis. An action plan for clean air has been prepared by APPBC for the city. Road dust, vehicular emissions, and construction activities were identified as major contributors to air pollution, particularly PM10 in the city. The city scores 'medium' on this indicator, because it has a Clean Air Action Plan and has identified the source of pollutants.

Measuring GHG Emissions

APPCB in Vijayawada currently does not have systems in place to measure GHG and CO_2 emissions. **The city scores 'very low' with regard to the existence of a GHG emissions measurement and monitoring system.**

Air Quality

As per the data shared by APPCB, the annual mean levels of PM10 (µg/m^3) recorded in Vijayawada was 55 µg/m^3 in 2020, less than the standard CPCB of 60 µg/m^3, but with significant improvement from 92 µg/m^3 recorded in 2017. The annual standard for PM2.5 (µg/m3) as per CPCB is 40 µg/m^3, the annual mean levels of PM2.5 (µg/m^3) recorded for Vijayawada were 21 µg/m^3, 27 µg/m^3, 30 µg/m^3 and 38 µg/m^3 for 2020, 2019, 2018 and 2017, respectively. This indicates that there was substantial improvement in the values of PM2.5 over the years. The annual concentration of NO_2 (µg/m^3) recorded in Vijayawada in 2020 was 17.2 µg/m^3, which is half the prescribed annual standard of 40 µg/m^3 as per CPCB. The average daily concentration of SO_2 (µg/m^3) recorded in Vijayawada was 4.6 µg/m^3, which was much lower than the prescribed 24-hour standard of 50 µg/m^3 by CPCB. (refer Table 4.3).

In 2019, the Air Quality Index (AQI) of Vijayawada was 51/100, indicating satisfactory levels as per CPCB standards. All the parameters of ambient air quality, i.e., particulate matter 2.5 (PM2.5), Sulphur Dioxide (SO_2), Oxides of Nitrogen (NOx) and Ammonia (NH3) recorded relatively less than their respective annual average standards. However, there is a need to enhance urban green cover for improving the environment, enhancing the physical and mental health of the local community, and increasing access to recreational facilities.

[21] Central Pollution Control Board (CPCB) has identified 124 towns and cities in India as non-attainment for not meeting the National Ambient Air Quality Standards (NAAQ) between 2014-2018.
[22] https://cpcb.nic.in/uploads/Non-Attainment_Cities.pdf

Table 4.3: Ambient air quality monitoring data, Vijayawada

Year	PM 10 (µg/m3)	PM 2.5 (µg/m3)	NO_2 (in µg/m3)	SO_2 (in µg/m3)
2017	92	38	32	7.1
2018	80	30	23.5	6
2019	71	27	19	5.2
2020	55	21	17.2	4.6
Average Standard	**60**	**40**	**40**	**50**

Source: APPCB (2021)

Noise Pollution

APPCB's Vijayawada Regional Office measures and monitor noise pollution levels in the city, earning the city an 'excellent' score for measuring and monitoring noise pollution.

Tree Cover

In Vijayawada, 1.63 sq. km. is under tree cover. Only three per cent of the total area under the ULB has tree cover, earning the city a 'very low' score against the 10 per cent benchmark. At present, as there is no local biodiversity strategy and action plan, the city scored 'very low'. However, VMC has formulated a local Bio-diversity Management Committee (BMC) and is in the process of formulating a local biodiversity strategy and action plan for the city. As the tree cover under the ULB for every inhabitant (sq. m. per person) is just 1.36 sq. m. per person, the city scored 'very low' against the benchmark of 15 sq. m. per person.

Incentives for Green Buildings

Andhra Pradesh Building Rules, 2017, has provisions for promoting green buildings across all the ULBs in the state. Financial incentives are provided for Green Building plans that have been rated by the Indian Green Building Council (IGBC), LEED India, The Energy and Resources Institute (TERI) or Green Rating for Integrated Habitat Assessment (GRIHA). The financial incentives include 20 per cent reduction on building permit fees, one-time reduction of 20 per cent on Duty on Transfer of Property (surcharge on Stamp Duty) in case the property is sold within three years of construction, and incentives towards development charges. All green buildings with plot sizes above 300 sq. m. are required to comply with green norms, such as solar energy utilization, energy efficiency (lighting of common areas by solar energy/ LED devices), water conservation and management, waste management provisions, etc. Vijayawada scores 'medium' for providing financial incentives for promoting green buildings.

As per the EOL 2019 report, there are two GRIHA certified green buildings in Vijayawada, one is the School of Planning and Architecture (SPA V) Vijayawada, and the other is the I.T. Towers (VICINITY) for Software Technology Parks of India. Both buildings cover 48,020 sq.ft.

Demarcated Conservation Zones

The Vijayawada ZDP's proposed land use plan includes zoning with environmental protection and conservation zones on hill tops, earning the city an 'excellent' score for this parameter. The ZDP 2021 proposed embankments to be conserved through development of parks along the canals.

Key Environment Concerns

Some of the key environment issues in the city are discharge of sewage water into the canals and water bodies, solid waste dumping in canals, encroachment of canals, proliferation on hill tops impacting their biodiversity, high air pollution levels due to vehicular pollution, ground water pollution at some locations, and increase in temperatures.

Image 4.26: View of Budameru canal with drainage outlet pipes and solid waste dump Source: UN-Habitat

Image 4.27: View of air pollution from burning dump near Nehru Nagar Source: UN-Habitat

The data on biochemical oxygen demand in surface water bodies in the city was not collected.

Image 4.28: View of Continuous Ambient Air Quality Monitoring Station near Polyclinic Road Source: UN-Habitat

4.4.9 Clean energy

There are eight indicators to assesses the current electrical energy consumption, access to renewable energy, energy efficiency, coverage and stability, accessibility of households to natural gas for cooking, and current per capita consumption. There is an indicator related to energy use per capita, and an aspirational indicator related to the proportion of the city's population with access to renewable energy. Data for four of these indicators were collected for Vijayawada.

Renewable Energy

As per CSAF 2.0, the total energy consumption in the ULB was 119 crore kilowatt hour (kWh) in 2020, but the renewable energy share in the total energy consumption was just 0.8 per cent (1,08,87,726 kWh). As this is much lower than the benchmark of 15 per cent, the city scored 'very low' on this indicator. Energy use per capita in residential areas (kWh) of Vijayawada was 992.1 kWh, which is slightly higher than the national average of 910 kWh per capita as per the International Energy Agency, 2018. Emissions from the stationary energy sector was 1,235,184 Mt CO_2-eq, forming the largest contributor to the city's total GHG emissions during 2015-16. Through its building byelaws, VMC promotes solar energy utilisation by the installation of solar water heating systems, sola lighting for buildings with plot areas more than 300 sq. m. and through rainwater harvesting systems.

Energy Compliance Building Codes

As per the Andhra Pradesh Building Rules, 2017, the New & Renewable Energy Development Corporation of Andhra Pradesh Ltd. (NREDCAP) acts as a nodal agency to guide ULBs, institutions, applicants to install appropriate solar roof top systems depending on the size and usage of the buildings on a gross or net metre. The NREDCAP facilitates and processes all proposals for availing subsidy, if any, for solar rooftop systems as per the Ministry of New and Renewable Energy (MNRE) guidelines. Through its building byelaws, VMC is promoting solar energy utilisation by installing solar water heating systems and solar lighting for buildings.

Through the Andhra Pradesh Building Rules, 2017, VMC is promoting Energy Compliance Building Codes. All buildings with plot sizes above 300 sq. m. have provisions for complying with norms for solar energy utilization, energy efficiency (lighting of common areas by solar energy/ LED devices, water conservation and management, waste management provisions, etc. The city scored 'excellent' for promoting eco-friendly techniques and/ or the use of local/ renewable materials through building codes.

Street Lighting

There are about 34,589 streetlights in the city under the jurisdiction of VMC, which ensures that 100 per cent of the streetlights are energy efficient. Vijayawada scored 'excellent' for the 100 per cent efficient street lighting in the city. Through a joint venture between NREDCAP and VMC, there is proposal for installing 1,000 solar streetlights in the city. Streetlighting accounts for 75 per cent of the total energy consumption for VMC municipal services, and an annual expenditure of about INR 7 crore.

Other Initiatives by VMC

To emphasize more on renewable energy-based initiatives, VMC established the following:

- Solar roof panelling on its buildings to consume direct energy for office operations,
- Utilization of electric cars for municipal staff transportation,
- CNG-based 'Custom Designed Solid Waste Collection Vehicles' (25) purchased, which has improved door-to-door collection to 98 per cent

VMC is collaborating with NREDCAP to explore opportunities for solar rooftop on municipal buildings and installation of a solar power plant to enable municipal services to be operated on renewable energy and reduce CO_2 displacement.

Image 4.29: EV charging stations and electric cars on lease at VMC Office

Source: UN-Habitat

4.4.10 Disaster risk management

There are six indicators to analyze the state of preparedness of a city in an event of natural disasters (flood, earthquakes, and cyclones, etc.) and manmade disasters (incidences of fire). Data for all six indicators were collected for Vijayawada. The overall performance of the city in this sector was 'upper medium' with an average score of four.

City Disaster Management Plan (CDMP) and Vulnerability Mapping

Vijayawada is prone to various disasters like cyclones, floods, rockslides, earthquakes, heatwaves, and fire incidents. Vijayawada is a multi-hazard risk city, with an emergent need to formulate a city level disaster management plan and risk vulnerability assessment.

As part of the project for "Developing Resilient Cities through Risk Reduction in the Context of Disaster and Climate Change" (undertaken in partnership with MHA-USAID-UNDP), the United Nations Development Program (UNDP) partnered with VMC to prepare a City Disaster Management Plan (CDMP) in 2015 and an Urban Resilience Baseline Study Report in 2017.

As per the Krishna District Disaster Management Plan 2017, the city is prone seven major types of hazards and various levels of hazard vulnerabilities (refer Table 4.4).

Table 4.4: Level of hazard vulnerability, Vijayawada

Cyclone	Flood	Drought	Landslide	Earthquake	Heat Waves	Fire Accidents
M	H	L	M	M	H	H

*L: Low; M: Medium / Moderate; H: High

Source: Krishna District Disaster Management Plan

The city scored a 'medium' due to the availability of a CDMP, which was prepared/ updated before 2016. However, the plan has hazard vulnerability maps/ risk maps for the main hazards threatening the city. City level maps were also prepared as part of the other studies mentioned above. Due to the Urban Resilience Baseline Study Report (2017) and the UNDP's detailed hazard vulnerability maps/ risk maps (2016), the city scored 'excellent' on this parameter.

Early Warning Systems (EWS)

In addition to the Early Warning System (EWS) linked to VMC's Command Control Centre, the Krishna District Collectorate has a command control centre linked to hazard EWS. The collectorate office communicates information to VMC in case of an early warning. During an emergency warning and/or pandemic situations, the District Collector declares an emergency. Through the established City Emergency Operation Centre with the Commissioner, VMC oversees the evacuation, operations and relocations during disasters and extreme weather incidents, as the Incident Commander. A similar setup was functional during the COVID-19 pandemic in 2020. The city scored 'excellent' in this aspect as it has access to information from a hazard EWS with direct linkage with the city's Command Control system.

UNDP assisted VMC in preparing its Hazard Risk and Vulnerability Analysis (HRVA) in 2014, City Disaster Management Plan (CDMP) in 2015 and Urban Resilience Baseline Study Report in 2017. As the city rarely experiences urban floods / water stagnation, it does have a flood risk assessment and management plan. The city scores 'excellent' for conducting urban flood / water stagnation risk assessment / plan in the last five years.

Vulnerable Population

As per the CDMP, 48 per cent (1,34,965) of the city's households are at risk due to placement in areas of non-mitigable risk within the ULB. In Vijayawada, 17 wards out of 64 wards are prone to landslides due to the presence of hills, and 11 wards are flood prone due to the Krishna River in the South. There are 111 informal settlements in the city, including 14 that fall under flood prone areas and 28 that fall under landslide risk areas. Vijayawada falls in a high cyclone risk zone. The city scored 'very low' in this aspect as the proportion of households at risk due to placement in areas of non-mitigable risk is very high in the ULB.

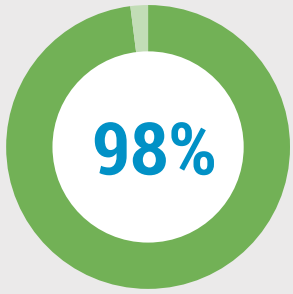
The city's risk assessment study[23] estimates that the entire city is prone to severe cyclonic storm (89 mph) at a 50-year return period. As per the District Disaster Management Plan (DDMP), a population of

[23] UNDP Hazard Risk and Vulnerability Analysis (HRVA) for the City of Vijayawada, 2014.

4,34,313 is vulnerable to cyclones, 89,557 to either flooding or waterlogging and the city is in a Zone III earthquake risk location, indicating moderate damage from earthquakes. The city is not in a high-risk zone, but the quality of construction and location of existing buildings may add to the vulnerability of the region.

Flooding of the Krishna River is common and almost every monsoon people living in the flood plains of the river are affected. Floods are mainly caused by the release of water from the Nagarjuna Sagar (NS) Dam. The primary reason for flood vulnerability is the unauthorized settlements along the river, which is a result of the lack of planning and enforcement.

Access to Fire Services

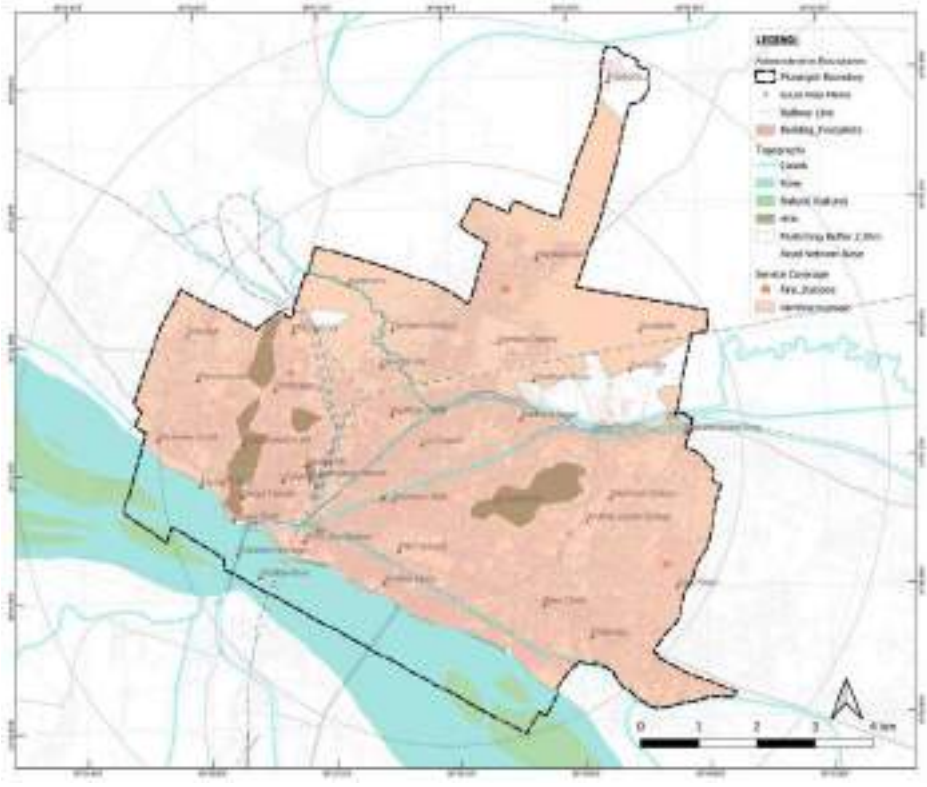


Vijayawada has five fire stations. About 98 per cent buildings in the city are located within 4 km of these fire stations, as shown in the Map 4.18.

Other Initiatives

Some of the other disaster mitigation initiatives undertaken by VMC are as follows:

- With the support of Andhra Pradesh State Disaster Management Authority (APSDMA), it inaugurated a retaining wall along the Krishna River.
- UNDP is preparing 18 ward level disaster management plans, exclusively for eight flood prone wards and 10 wards that are prone to landslides



Map 4.18: Catchment of buildings with access to fire service facilities within 4 km

Source: Prepared by UN-Habitat from the VMC GIS Database 2019

The emergent need from VMC is the preparation of detailed risk assessment and mitigation plans with a real-time database. ZDP 2021 had earmarked areas on hill tops for conservation, but the area is proliferated by informal settlements with no enforcement for removing illegal encroachments from these areas. The key challenges relating to disaster management include accessing vulnerable properties, difficulty in emergency operations on hill tops, or overcrowded, informal settlements with narrow streets. Enforcement of conservation zone encroachments on hill tops and persuading the public to relocate are also key development challenges.

Image 4.30: Informal settlement affected by floods in 2020 and rescue operations by VMC and NDRF

Source: Drone photo, facilitated by VMC Nodal Officer

4.4.11 Governance and data management

There are 14 indicators to analyse the extent to which ULBs are effectively directing the planning and management of a city. Data was collected for 13 indicators in Vijayawada. The overall performance of the city in this sector was 'upper medium with an average score of four.

VMC's elected body is headed by the Mayor who administers the municipal corporation. The Commissioner acts as the executive head and oversees the day-to-day functioning of the local body. Local body elections in the city were last conducted in March 2021 and a Council was formed with ward councillors as the elected representatives, headed by the Mayor. The proportion of women councillors in the municipal council stood at 53 per cent, earning the city an 'excellent' score for having more than 50 per cent women in its municipal council.

VMC performs activities in the city in line with the 74th Constitutional Amendment Act (CAA) and the Andhra Pradesh State Municipal Corporations Act, 1994. Out of the 18 items stipulated in the Twelfth Schedule (Article 243W) of the Indian constitution, VMC implements all 18 functions. The responsibility of fire service in the city is undertaken by the State Disaster Response and Fire Services Department and there is an assigned fire officer in VMC.

In 2019, GoAP initiated the Ward Secretariat system and a total of 286 ward secretariats were established for every 1,200-1,500 households in Vijayawada as a step towards decentralized governance. For monitoring and implementing town planning related activities at the grassroots level, a 'Ward Planning and Regulation Secretary' was appointed for each of the secretariat units in the city. In 2020, there were three town planning staff in the city for every 14,000 people, higher than the URDPFI recommendation. The city scored 'excellent' for the number of planners per capita.

VMC is implementing e-governance initiatives for online public service delivery and monitors the services through the Command Control Centre in the VMC office. 'Spandana' is one of the most important governance initiatives of the GoAP. It is a one-stop public grievance redressal platform for citizens where grievances can be registered from various sources like ULB offices, 1,902 call centres, mobile app, web application, and every Monday at government offices. VMC has been effectively implementing many local-level reforms and initiatives recommended by JNNURM, AMRUT, central and state finance commissions in areas of e-governance, devolution of funds, double-entry accounting, municipal tax improvement, energy and water, Swachh Bharat Mission, building byelaws, urban planning, and city-level plans.

The enforced development plan of Vijayawada was approved in 2006 for the horizon year 2021. Periodic reviews, plan updates with spatial growth, and infrastructure provisions were not undertaken during the implementation period, hence the city scored 'very low' on this indicator. However, the preparation of a master plan for the horizon year 2035 is underway. The enforced ZDP of the city and Development Control Regulations (DCR) are accessible to the public through the AMRDA website, thus earning the city an 'excellent' score for the initiative. Though the GIS database for the city was prepared in 2019, VMC's usage of the database for decision making and analysis remains limited. The ZDP was not prepared with GIS data, thus earning the city a 'very low' score.

The city scored 'excellent' in implementing various e-governance initiatives by the ULB, such as availability of a ULB website, online public service delivery and grievance redressal through both website and mobile application. VMC already has an established command and control system where 12 municipal services are monitored. Therefore, the city scored 'excellent' for the high number of municipal services managed through the command and control system.

VMC has citizen charter and appeal mechanisms in place for the public to avail services and make both offline and online appeals, thus scoring 'excellent'. VMC has an open data portal website and has an appointed city data officer. VMC has also adopted an e-filing system for office file approvals and tracking. Thus, the city scored 'excellent' for both these indicators. Details of staff who received training in the ULB's functionary domains were not available.

VMC has also constituted various committees, such as the Municipal Committee/Council, Project Advisory Committee, Ward Committee, Town Vending Committee, and Project Coordination Committees. Town Level Federation (TLFs) for Self-Help Groups (SHGs) as per the recommendations of the 74th CAA and Street

Vending Act, 2014; and the District Planning Committee as per the recommendations of the 74th CAA were constituted at the district level. However, as there is no significant heritage component in Vijayawada, and no established heritage committee, thus the city scored 'medium' on this parameter.

In the last three years, the city has not prepared any environmental status report with action plans, thus earning it a 'very low' score.

Image 4.31: View of VMC Command Control and Communication Centre (Non-Smart City) Source: UN-Habitat

4.4.12 Finance and economy

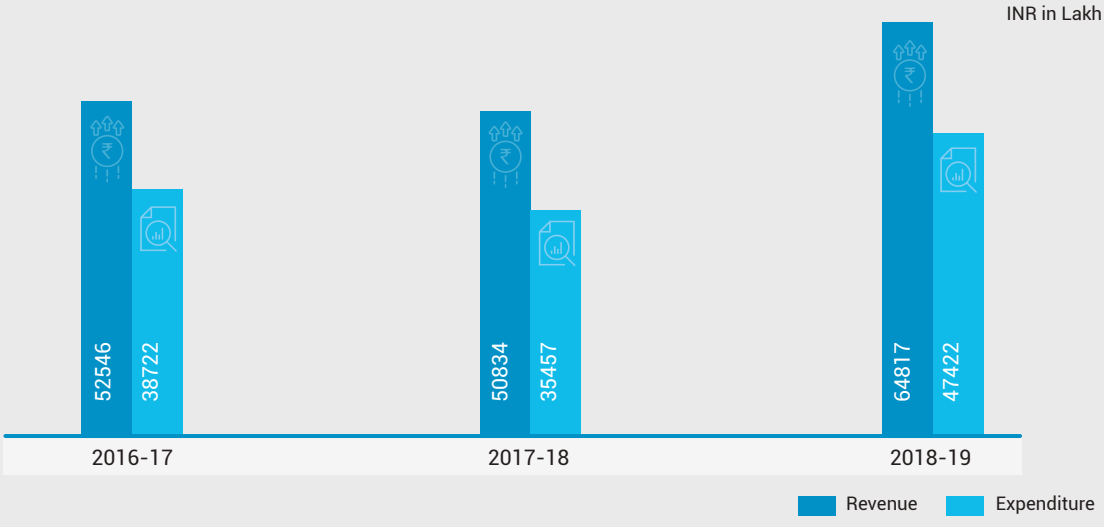
Out of the total 19 indicators in this sector, 13 indicators are related to the status of municipal finance in the city and the remaining six indicate the performance of the economic factors. Data was collected for 12 indicators in Vijayawada. The overall performance of the city in this sector was 'upper medium'.

Financial Performance

The input values for the financial performance of VMC have been considered from the signed financials statement from the accounts department of VMC and the values for the total expenditure for 2016-17 and 201-18 have been considered from the Municipal Performance Index (MPI). The total annual revenue of VMC has been increasing over the last three financial years (2016 to 2019). VMC's total annual revenue decreased slightly from INR 52,546 lakh in 2016-17 to INR 50,834 lakh in 2018-19 (refer Figure 4.11) and the corresponding total annual expenditure also decreased over the same period. The total annual expenditure in 2016-17 was INR 38,722 lakh and in 2018-19 it was INR 47,422 lakh, indicating an increase of 22 per cent in VMC's total expenditure in 2016-17.

VMC recorded a surplus budget in all the financial years between 2016-17 and 2018-19 (refer Figure 4.11), thus scoring 'excellent' for its performance. Thirty-six per cent the of ULB's total annual revenue being generated by state and central government grants may be one of the reasons for the surplus budget in 2018-19.

Figure 4.11: Revenue and expenditure of VMC during three financial years (2016-17 to 2018-19)



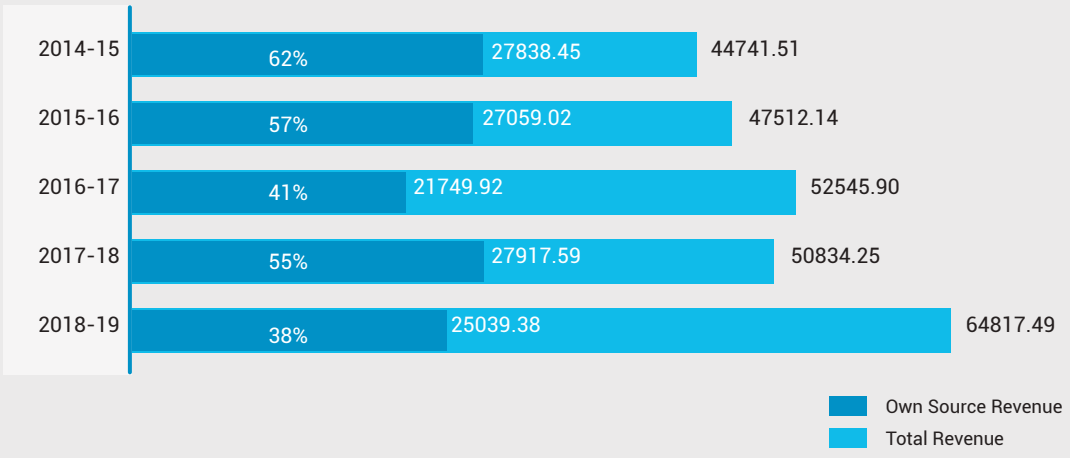
Source: Signed financials statement and values for total expenditure for 2016-17 and 201-18 from VMC Municipal Performance Index, 2019 data.

Own Source Revenue

The average contribution from own source revenues (tax and non-tax revenues) to its total revenues in the last five financial years (2014-15 to 2018-19) was 51 per cent as per the signed financials statement received from the accounts department of VMC. Refer to Figure 4.12 for the share of VMC's own source revenue. The city scored 'excellent' for its financial independency from external revenue sources.

Figure 4.12: Share of VMC's own source revenue to total revenue in last five financial years

INR in Lakh



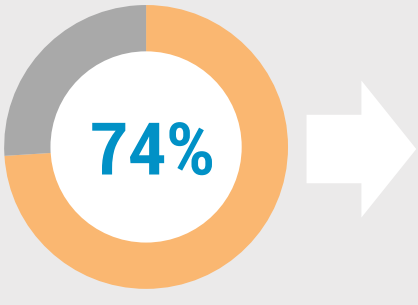
Source: VMC

Change in Own Source Revenue (OSR) of the ULB

As per the signed financials statement received from the accounts department of VMC, in Vijayawada the financial years from 2014-15 to 2018-19 observed percentages greater than 20 per cent all the five financial years. The performance of change in Own Source Revenue (OSR) of the ULB indicator thus scored 'excellent'.

Property Tax Collection Efficiency

Over the last three financial years, property tax has been VMC's major revenue earner, followed by surcharge on stamp duties, and consolidated other non-tax revenues, user charges, building licence fees, penalisation charges, and hoarding fees.



As per the MPI, VMC collected property tax of INR 9,441 lakh against the total billed property tax of INR 12,825 lakh in the same financial year 2018-19. The city scored 'upper medium' for its property tax collection efficiency. VMC's property tax collection efficiency in 2018-19 was only 74 per cent.

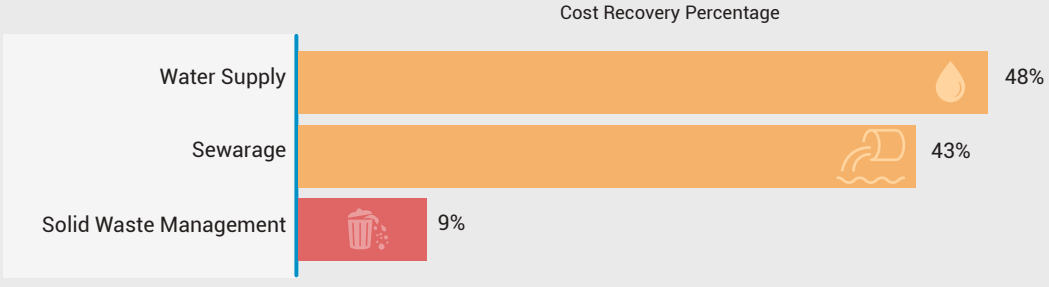
Financial Dependency

Total grants received by VMC in 2018-19 from state and central governments under various schemes constituted only 36 per cent of its total revenue. The city scored 'medium' for its high financial dependency on grants.

Cost Recovery of Services

In 2018-19, the total operating revenues of VMC towards water supply services, sewerage and SWM services against their total operating expenses were 48 per cent, 43 per cent and nine per cent, respectively (refer Figure 4.13). The city scored 'medium' for cost recovery in water supply, 'lower medium' in sewerage services and 'very low' for SWM.

Figure 4.13: Cost recovery in water supply, sewerage and SWM in 2018-19



Source: SLB 2018-19, VMC

Credit Rating

VMC received a long-term outstanding credit rating of [ICRA]A- from ICRA in July 2018. The city scored 'medium' due to its average credit rating, which was also one of the financial reforms that ULBs need to comply with, as per the AMRUT mission.

Economy

Vijayawada, like many cities in India, does not have a system for measuring Gross Domestic Product (GDP). Data for indicators such as unemployment rate of persons of 15 years and above, Inequality Index based on Consumption Expenditure (Gini Coefficient), percentage of workforce employed in the service sector, informal employment as percentage of total employment, GDP density as a percentage of the built-up area of the local government, etc., are not available.

05

Strategic Diagnosis

5.1 IN-DEPTH ANALYSIS 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 urban service delivery, such as water supply, sanitation, and solid waste management related services, city governance and management. There are areas where significant improvement is warranted. The city is vulnerable to multiple disasters and the presence of slums in vulnerable locations is a concern. The three canals passing through the city are also the sources of environmental pollution, thus impacting the city's resilience. Further, considering the high population densities and spatial development patterns, the city needs more focussed attention on improving its existing public transportation.

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. Vulnerable informal settlements
2. Sub-optimal urban mobility
3. Sprawling and scattered development patterns
4. Inadequate public green spaces and fragmented blue–green network

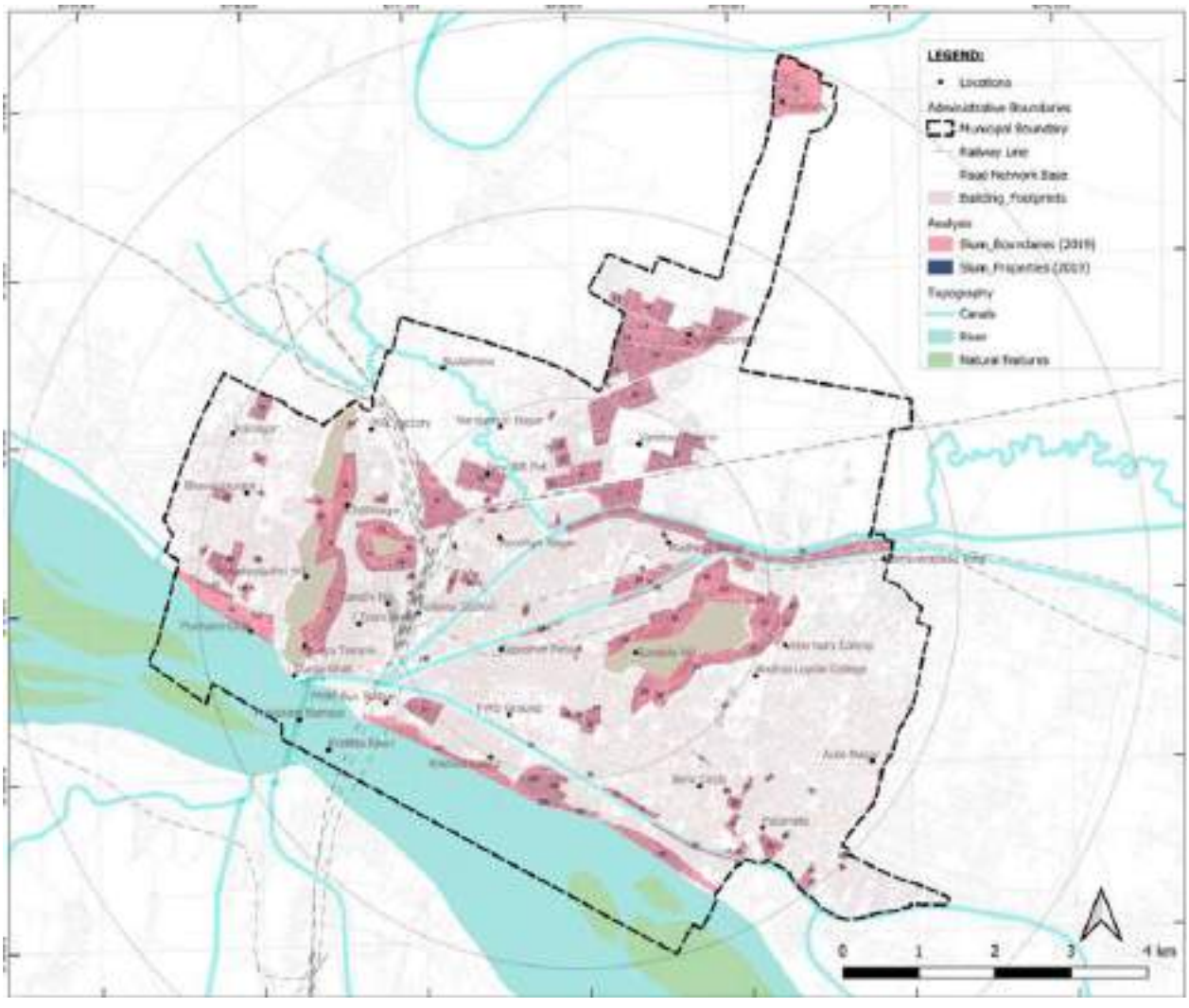
5.1.1 Strategic issue 1: Vulnerable informal settlements

Vulnerable informal settlements emerged as one of the foremost issues in Vijayawada, based on findings of the urban sectoral assessment[24], consultations with municipal corporation, the development authority, grassroots organizations like Margam Foundation, Urban Community Development (UCD), and parastatal organizations like New & Renewable Energy Development Corporation of Andhra Pradesh Ltd. (NREDCAP), Andhra Pradesh State Disaster Management Authority (APSDMA), Road Transport Corporation and RTOs, among others.[25]

As mentioned in Section 4.4.2 earlier, there are 111 slums occupying 15 per cent (9 sq. km.) of the total city area under VMC.

[24] USAF was applied to 12 sectors integrated with a spatial tool and USAF benchmarks/ thresholds were drawn on the synergies of other frameworks.

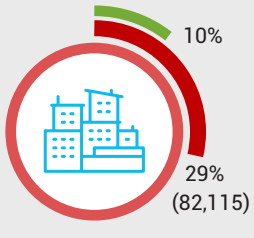
[25] Details of stakeholders are provided in the Vijayawada stakeholder mapping and consultation report.



Map 5.1: Location of informal settlements in Vijayawada

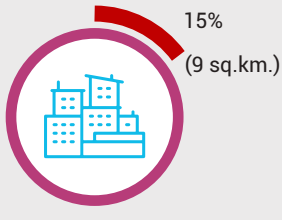
Source: UN-Habitat

HP 2.1 Urban households living in slums



BM CIV CIS

HP 2.2 City area under slums/ squatter settlements

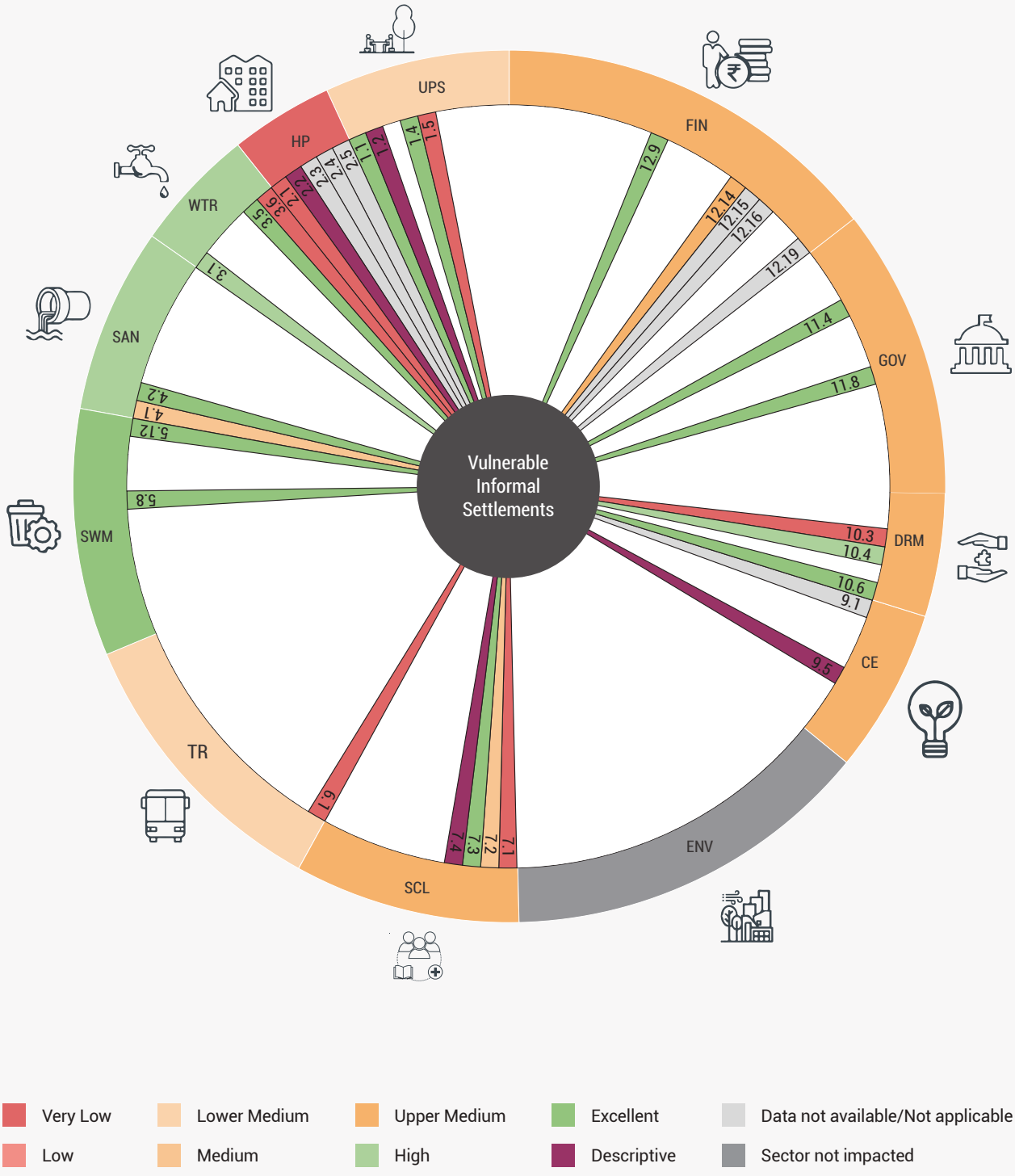


BM: USAF Benchmark
CIV: City Indicator Value
CIS: City Indicator Score

There are around 82,115 (as per VMC 2019 data) slum households **constituting 29% of the urban households in** Vijayawada. Thus, the indicator scores **'0'** against the suggested USAF benchmark of 10%. About **94% of the slum population resides in areas with density greater than 150 PPH.**

As most urban development challenges, the city's vulnerable informal settlements are linked to many other housing, economic and environmental factors (see Annexure 5.1). There are 33 indicators (either direct or indirect) across 11 sectors (see Figure 5.1) that are related to this diagnostic issue.

Figure 5.1: Interlinkage of the issue of slums with indicators across USAF sectors.



Source: UN-Habitat

Key Challenges in Informal Settlements

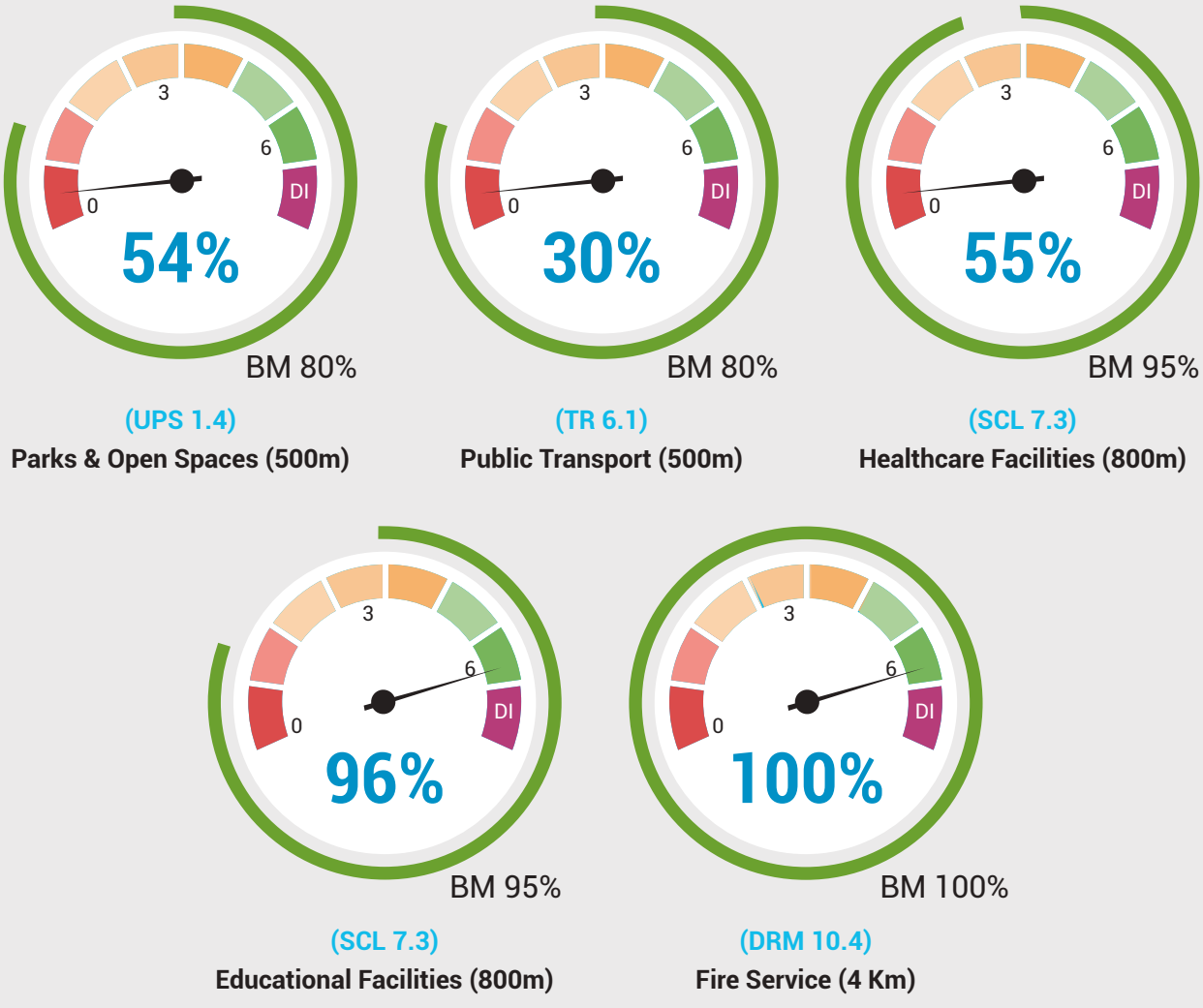
The broad key challenges relating to slums in the city are overcrowding, location of slum properties in vulnerable areas, challenges to VMC in service provisions, difficulty in emergency operations during hazards and disasters, and removal of illegal encroachments. Analysis of the strategic issue of informal settlements was categorized into the following broad sections.

I. Application of USAF service coverage analysis

As mentioned in the Urban Sustainability Indicators (USI) Report, five service coverage indicators were assessed for a scoring on a 7-point scale, wherein '0' (or very low) is awarded for performances below the minimum threshold and '6' (or excellent) is awarded for performances that meet or exceed the benchmark.

Informal settlements in the city were assessed on the service coverage access indicators dealing with the percentage of the population within a 500-m. distance of public parks/ open spaces, and of public transportation stops; within 800 m. of healthcare facilities, and primary/ secondary schools; and the percentage of buildings within 4 km. of fire service facilities.

Figure 5.2: Application of USAF service coverage indicators to slums



Source: UN-Habitat

Key inferences from the application of USAF service coverage analysis are shared below (see Figure 5.2 and Map 5.2).

SCORING

Slums with access to **parks and open spaces, public transport and healthcare facilities** are very **low performing with a score of '0'.**

The city, being an educational hub and with five fire stations, scores **excellent** on **educational facilities and fire services** with a **score of '6'.**

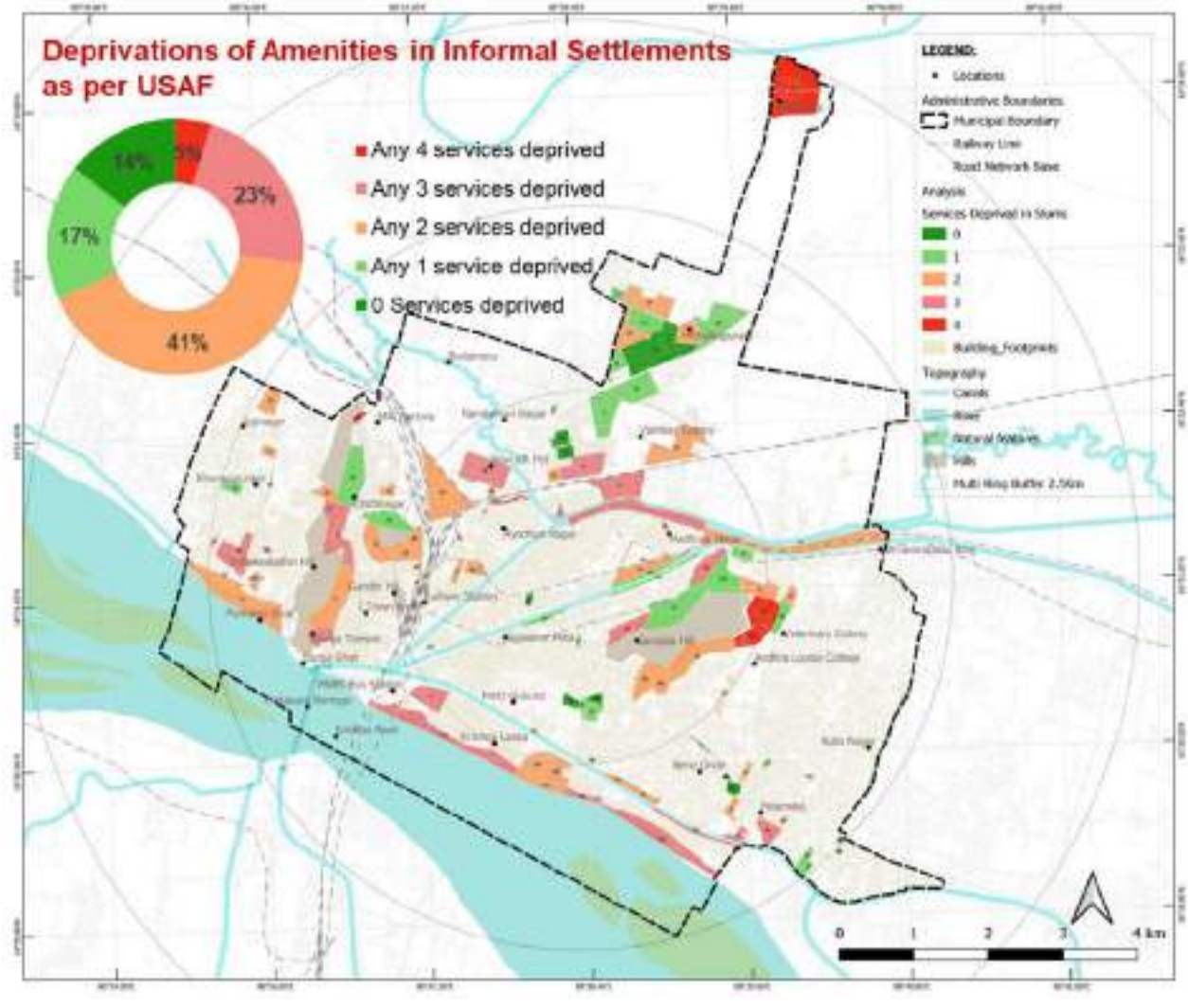
SERVICE COVERAGE

Of the five service coverages assessed in informal settlements, about **69%** of the slums are **deprived** of any **two or more services.**

This raises key service accessibility concerns and merits a **relook at this strategic issue on priority** for development.

SPATIAL DISTRIBUTION

Most of the slum settlements, deprived of access to services, are located either along **hazard prone areas,** such as Indrakeeladri Hills, Krishna River, or near Pathapadu.



Map 5.2: Deprivations of amenities in informal settlements as per USAF

Source: UN-Habitat

II. Encroachment of conservation zone by informal settlements

The ZDP 2021 prepared in 2006 has clearly demarcated a conservation zone on the hills and green spaces along the canals. The spatial analysis indicates that approximately nine per cent (23,780) of the slum population and approximately 11 per cent (7,052) of the slum buildings are in the demarcated conservation zone. Three canals add value to the city as natural structuring elements and 12 slums exist along these canals (see Map 5.3).

As the issue of encroachment is directly related to planning and enforcement, there is a strong need for the VMC, AMRDA and other relevant stakeholders to come together and address this by creating synergies of slum improvement with urban planning, land management and land use, infrastructure development, and environmental safeguards.

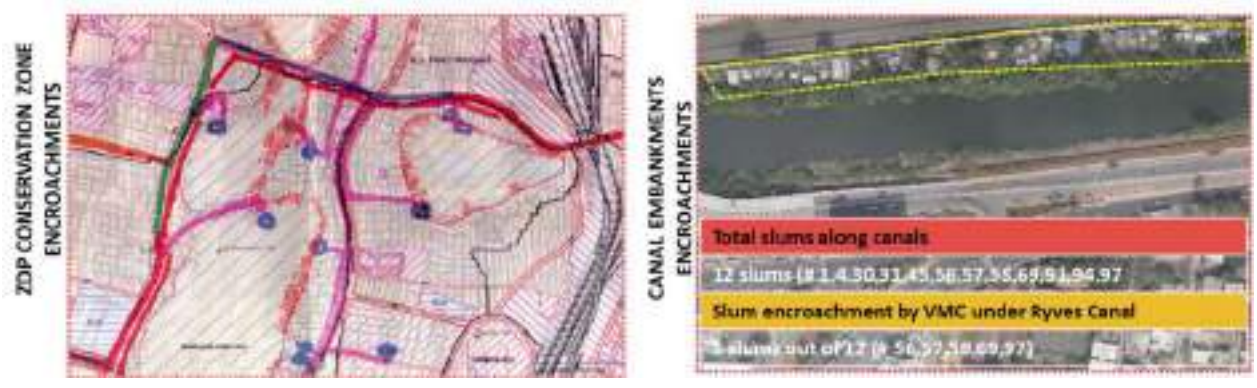
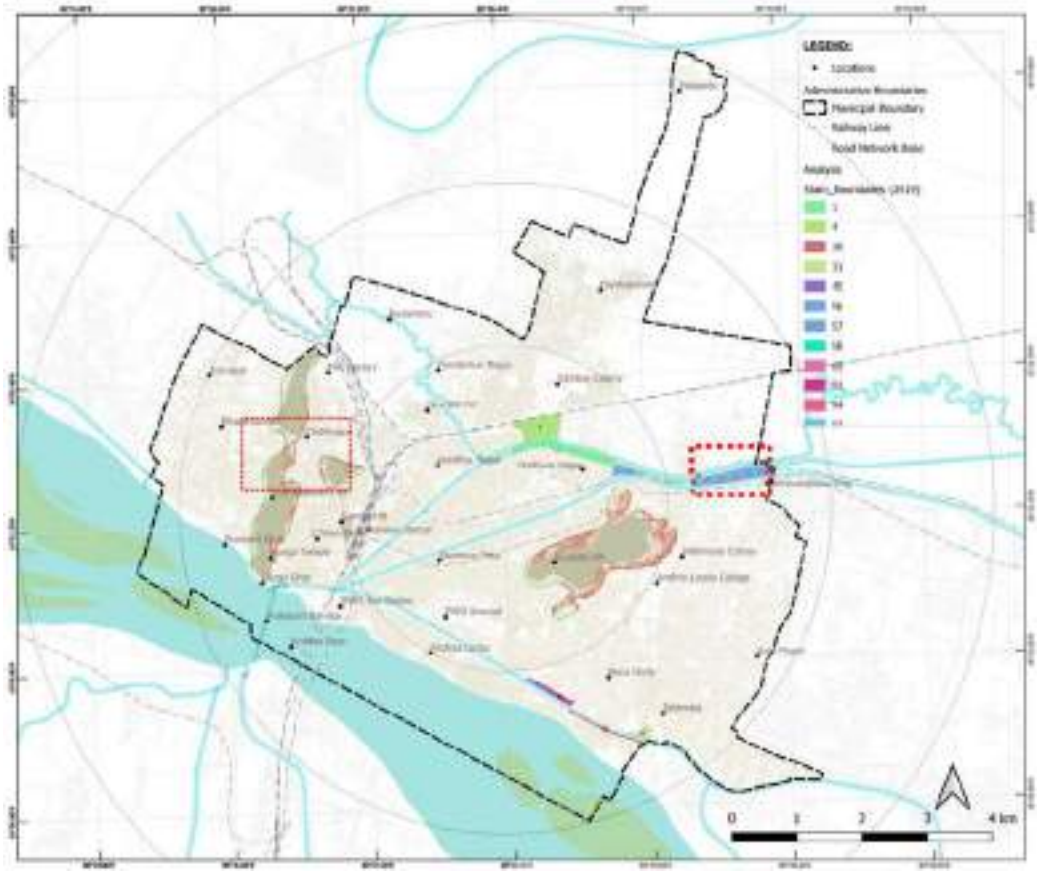


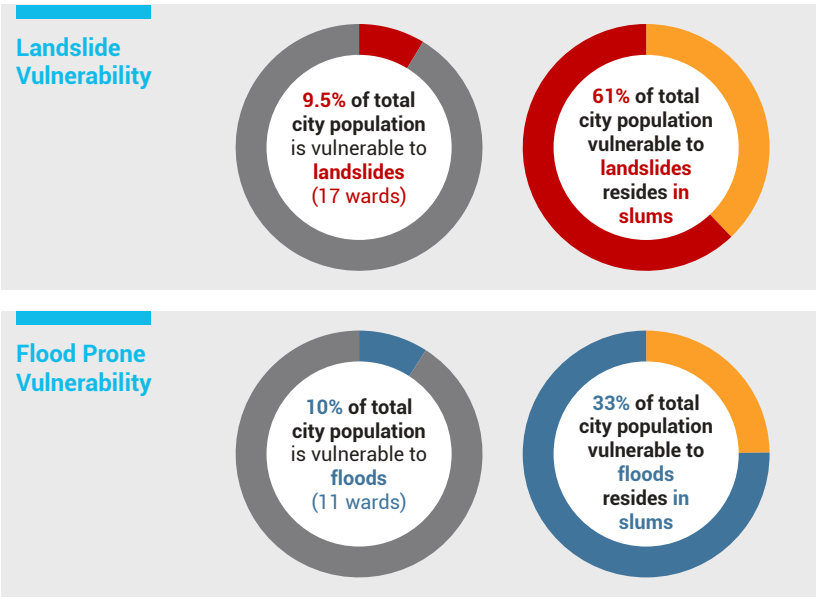
Figure 5.3: Encroachment of slums on conservation zone and along the canals Source: UN-Habitat

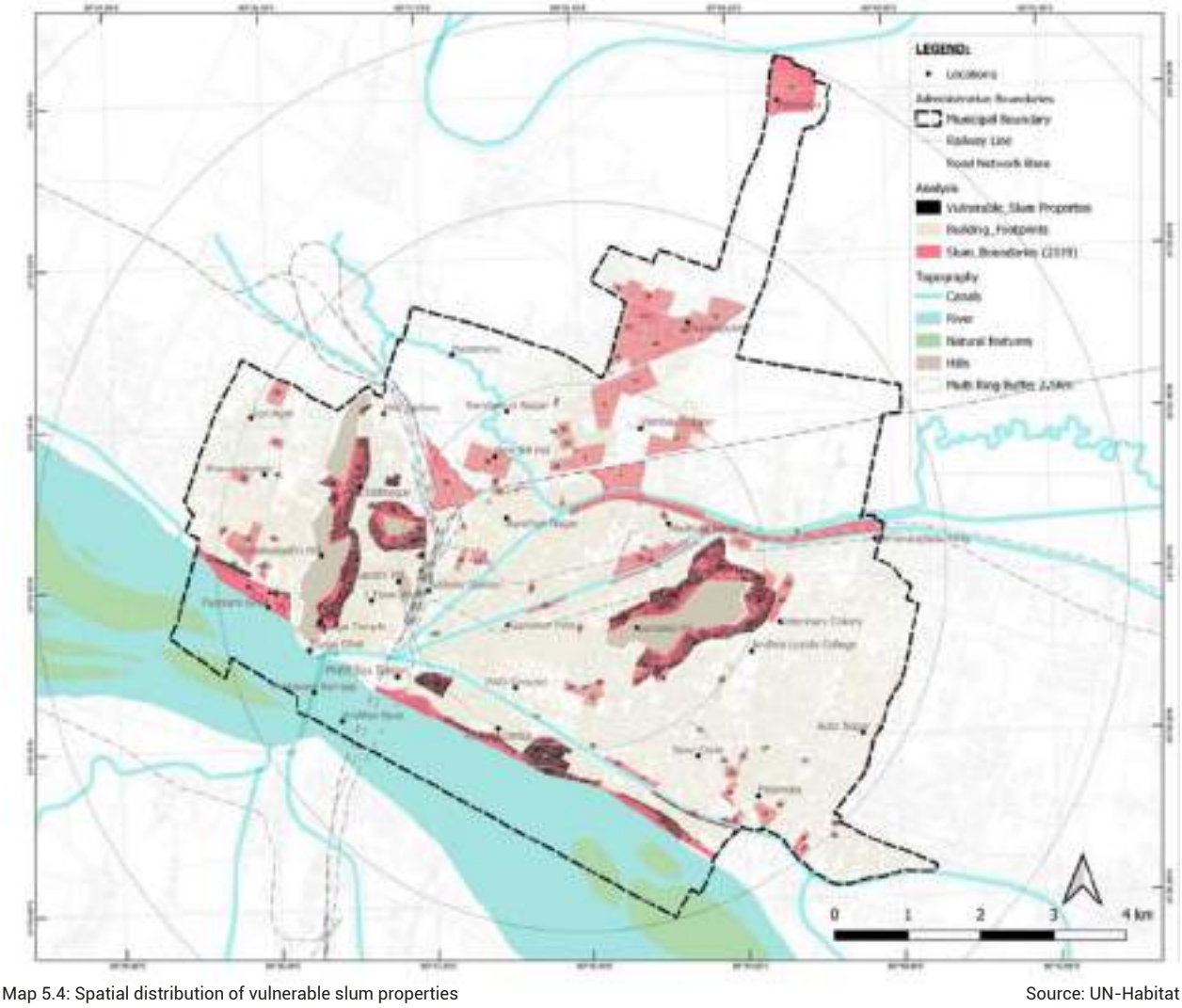


Map 5.3: Spatial distribution of encroachment of slums on conservation zone and along canals Source: UN-Habitat

III. Locational vulnerability

As explained in the earlier section on disaster risk management, Vijayawada is prone to various disasters like cyclones, floods, rockslides, earthquakes, heatwaves and fire incidents. As Vijayawada is a multi-hazard risk city, there is an emergent need to assess the risk of informal settlements.





Map 5.4: Spatial distribution of vulnerable slum properties

Source: UN-Habitat

As per the City Disaster Management Plan (CDMP) prepared in 2015, 44 per cent of the households are at risk (see Figure 5.3),[26] while 17 wards are prone to landslides and 11 are flood prone. The spatial analysis reveals that 9.5 per cent of the city's population is vulnerable to landslides and 10% to floods (see Map 5.4). Of the total city population vulnerable to landslides and floods, 61 per cent and 33 per cent, respectively, reside in slums.

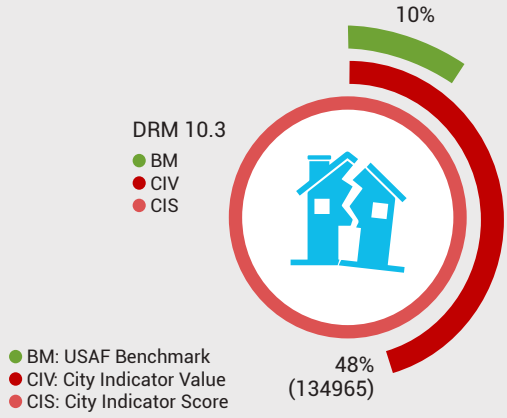
[26] This indicator scores 'very low' as it is 38% more than the suggested USAF benchmark of 10%.

About 61% of the city's total population **vulnerable to landslides** resides in slums and **33%** of the population vulnerable to **floods** resides in slums.

Slums with Multi-deprivations

Slums needing urgent intervention were identified by assigning weightages of '0', '1' and '2' from the outcomes of the USAF service coverage analysis, encroachment of conservation zones by slums, and the location of informal settlements in vulnerable areas. This distribution of the critical slums is shown in Table 5.1. For the detailed analysis of these slums, see Annex 5.2 and 5.3.

Figure 5.4 Households at risk due to their location in areas of non-mitigable risk



Source: UN-Habitat

Table 5.1: Critical informal settlements analysis outcomes

	Total Slums	Percentage
Most Critical Slums		
Total Grading Score: =>4	8	7%
Moderate Critical Slums		
Total Grading Score: 3	16	14%
Low Critical Slums		
Total Grading Score: 1 or 2	28	25%
Slums Not Critical		
Total Grading Score: 0	59	53%
Total	111	100%

Source: UN-Habitat

Grading Critical Slums

With deprived USAF service access	Landslide prone slums	Flood prone slums	ZDP Conservation Zone (CZ)
4 services deprived: Score 2	100% pop prone: Score 2	100% pop prone: Score 2	>50% pop on ZDP CZ: Score 2
3 services deprived: Score 1	Prone: Score 1	Prone: Score 1	>0 to <50% pop on ZDP CZ: Score 1
<3 services deprived: Score 0	Not prone: Score 0	Not prone: Score 0	No encrochment: Score 0

Image 5.4: Representation of challenges and anticipated outcomes in slums

Source: UN-Habitat

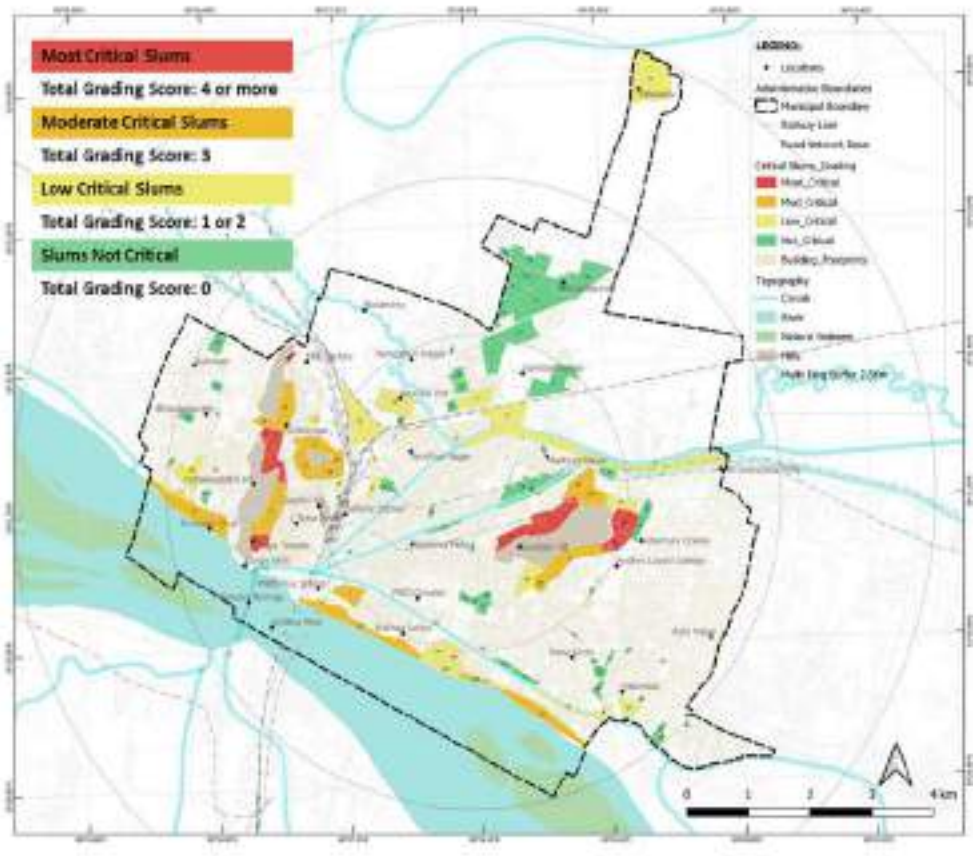
The eight most critical slums and the spatial distribution of those needing urgent intervention are shown in Table 5.2 and Map 5.5. They require immediate attention from the ULB and other relevant stakeholders to formulate development strategies for addressing the challenge of slums and informal settlements at the city as well as local levels. Some of the key challenges and anticipated outcomes are represented in image 5.5

Table 5.2: Outcomes of critical informal settlements analysis

Slum Number	USAF Services Deprived	Critical Slums Deprived Services	Critical Slums Prone to LS	Critical Slums Prone to FP	Critical Slums ZDP Cons	Most Critical Slums
62	4	2	2	0	2	6
44	4	2	2	0	1	5
63	3	1	2	0	2	5
77	3	2	2	0	1	5
46	3	1	2	0	1	4
67	3	1	2	0	1	4
75	3	1	2	0	1	4
87	3	1	2	0	1	4
17	3	1	0	2	0	3
41	3	1	1	1	0	3
43	0	0	2	0	1	3
64	2	0	1	0	2	3
68	1	0	2	0	1	3
72	2	0	2	0	1	3
73	2	0	2	0	1	3
74	3	1	1	0	1	3
76	2	0	2	0	1	3
84	2	0	2	0	1	3
86	2	0	2	0	1	3
88	1	0	1	0	2	3
100	3	1	0	2	0	3
101	3	1	0	2	0	3
103	3	1	0	2	0	3
107	2	0	1	0	2	3

0, 1, 2 are assigned weightages

Source: UN-Habitat



Map 5.5: Spatial distribution of slums based on critical analysis Source: UN-Habitat

5.1.2 Strategic issue 2: Sub-optimal urban mobility

Sub-optimal urban mobility emerged as one of the key strategic issues in Vijayawada from the findings of the urban assessment[27], consultations with VMC and multiple stakeholders.

Transportation is one of the key development sectors in Vijayawada. The total road length in the city is 1,260 km. with intense commercial and mixed-use activities along the roads. Most of the development is concentrated along

NH 16, NH 65, MG Road, Eluru Road, BRTS Road (3.3 km.), Ring Road and Vijayawada Bypass Tunnel. Of the 14 indicators in the transportation sector, data was collected for nine indicators in case of Vijayawada.

Sub-optimal Urban Mobility Analysis

I. Existing city level key mobility challenges

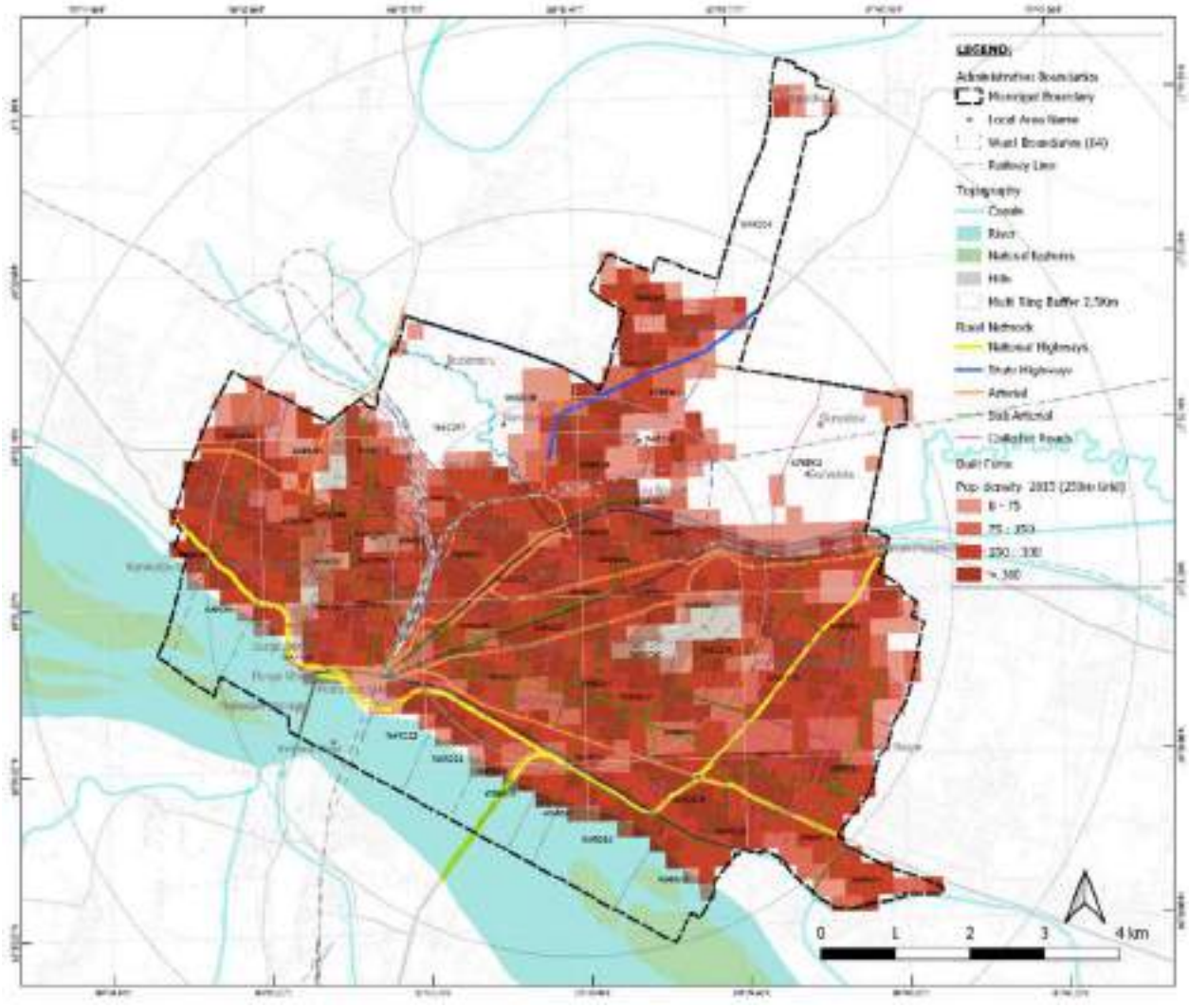
An overview of the city's existing road network is discussed in greater detail in Section 4.4.6. The key mobility challenges in the city include absence of designated pedestrian facilities, encroachment of footpaths by informal vendors, under serviced public transport connectivity in the peripheral areas, on-street parking, low public transport coverage access within 500 m. (USAF TR 6.1), pedestrian and traffic conflicts and non-implementation of development plan proposals. Some of the key mobility challenges are shown in Image 5.1.

[27] The USAF was applied to 12 sectors integrated with spatial tools, while USAF benchmarks/ thresholds were drawn on the synergies of other frameworks.

The overall average score of Vijayawada in the transportation sector is **'2'**, assessed from **64% of the total data collected.**

Image 5.1: Snapshots of mobility challenges in the city

Source: UN-Habitat



Map 5.6: Primary road network on density estimates (2015) Source: UN-Habitat

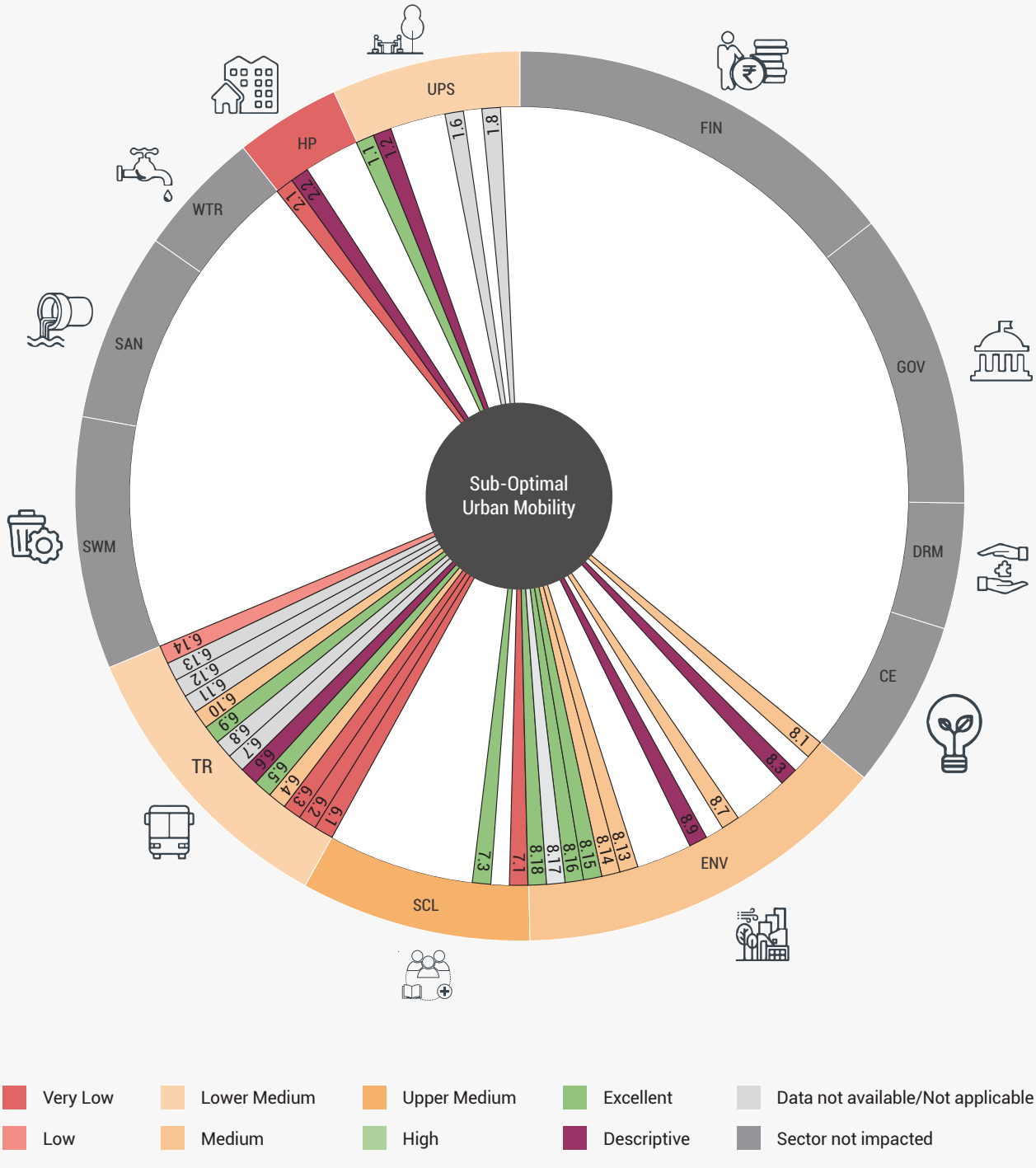
On superimposing the primary road network on the residential population density estimates (2015) it is evident that linear spatial development is spread **along the city's primary road corridors.**

Existing intercity railway lines impact spatial growth in the **North, North-East** and **North-West** parts of the city.

II. Interlinking strategic issue of sub-optimal mobility across USAF sectors

Our USAF analysis found that there are 32 indicators across five sectors (see Figure 5.5) with strong linkages to transportation, environment and ecology, and social facilities and services. The detailed indicator-wise interlinkage with their respective scoring is shown in Annexure 5.4.

Figure 5.5: Interlinkage of issue of mobility with indicators across USAF sectors

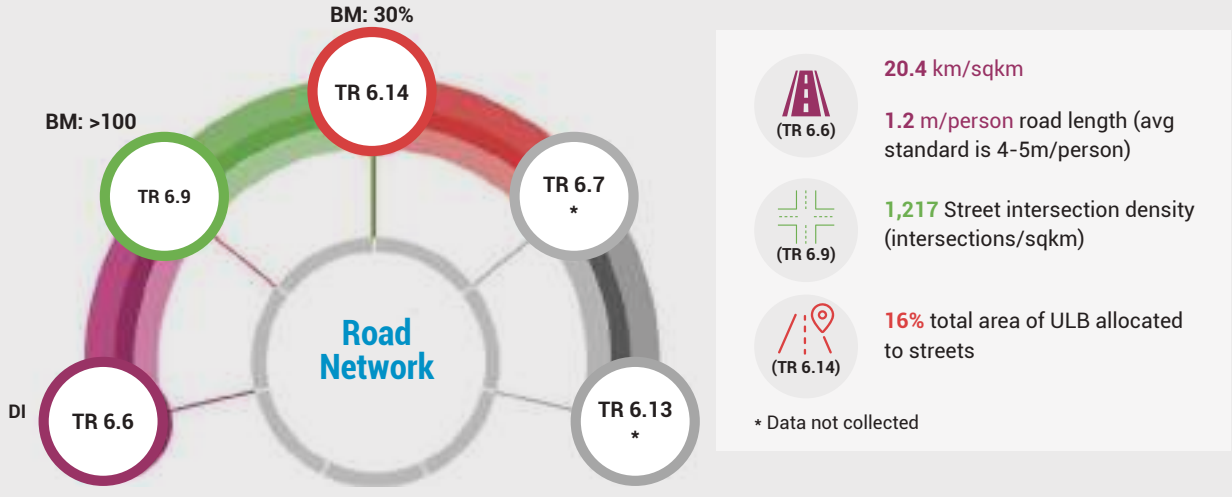


Source: UN-Habitat

III. Application of USAF service coverage analysis

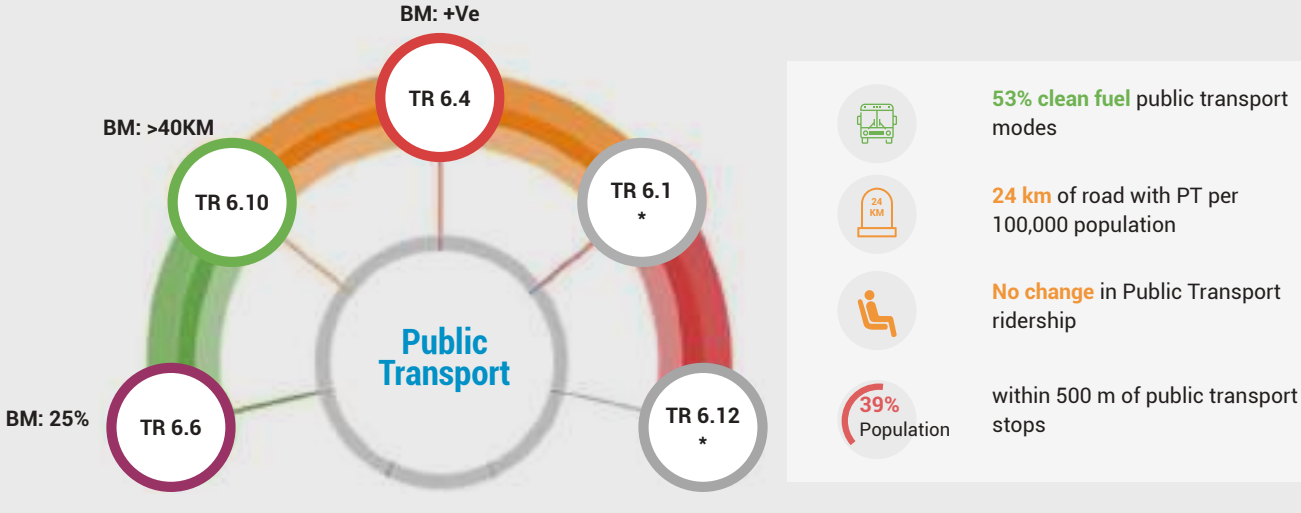
There are 77 bus stops in Vijayawada[28] and APSRTC operates 457 intracity Public Transit buses, of which 53 per cent are clean fuel vehicles. Bus ridership remained static at 3.6 lakh for 2019 and 2020, as per APSRTC. Performance of the USAF transport sector indicators and suggested benchmarks are illustrated in Figure 5.6 and Figure 5.7 below.

Figure 5.6: Performance of USAF transportation sector indicators for Road Network



Source: UN-Habitat

Figure 5.7: USAF transportation sector indicators performance for Public Transport

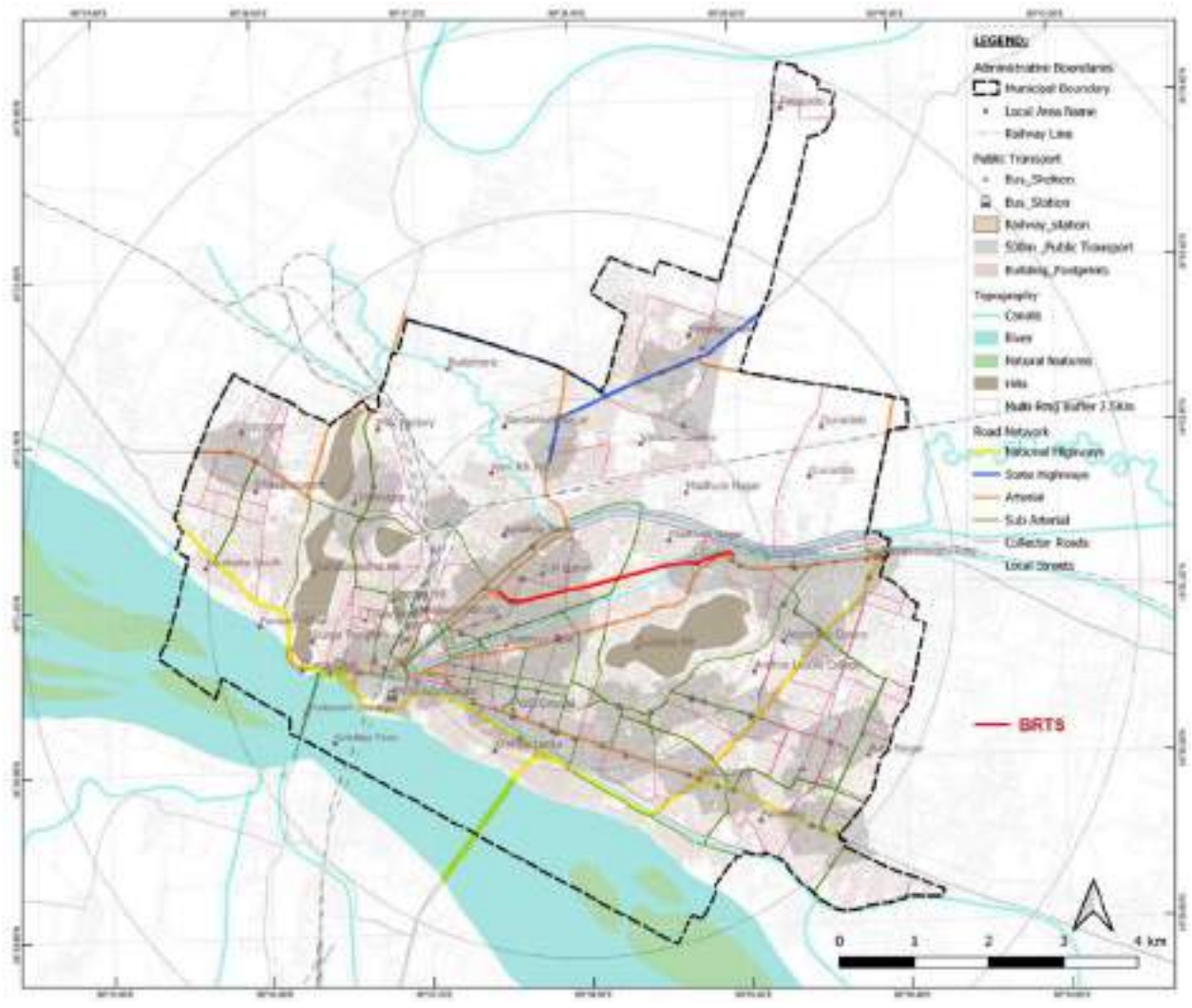


Source: UN-Habitat

Street coverage is inadequate in Vijaywada (16 per cent) and **lack pedestrian facilities. Public transport is not very accessible to the public with only 39 per cent living within 500 m. of a public transit stop. There are limited facilities for NMT, such as footpaths, and there are, moreover, no cycle tracks or bike lanes in the city.**

These key concerns require immediate attention from the ULB and other relevant stakeholders for improving mobility in the city. Significant features of the existing transportation system in the city that are working well are the contribution of clean fuel operated buses (53 per cent), the bus ridership, and the high intersection density (1,217 street intersections/ sq. km.) as the total road length of 1,260 km is concentrated in 61.88 sq. km.

[28] As per the 2019 GIS database shared by VMC

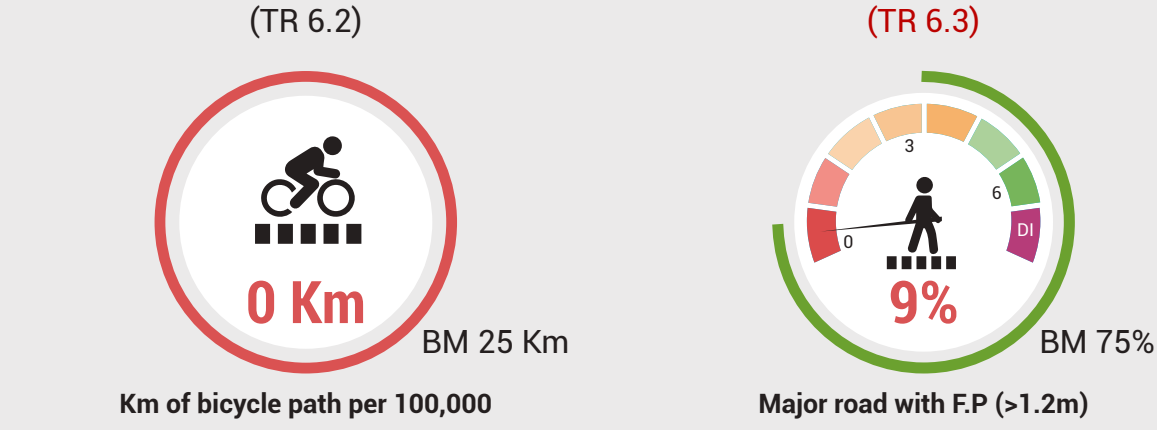


Map 5.7: Primary road network and public transport coverage within a 500 m. distance

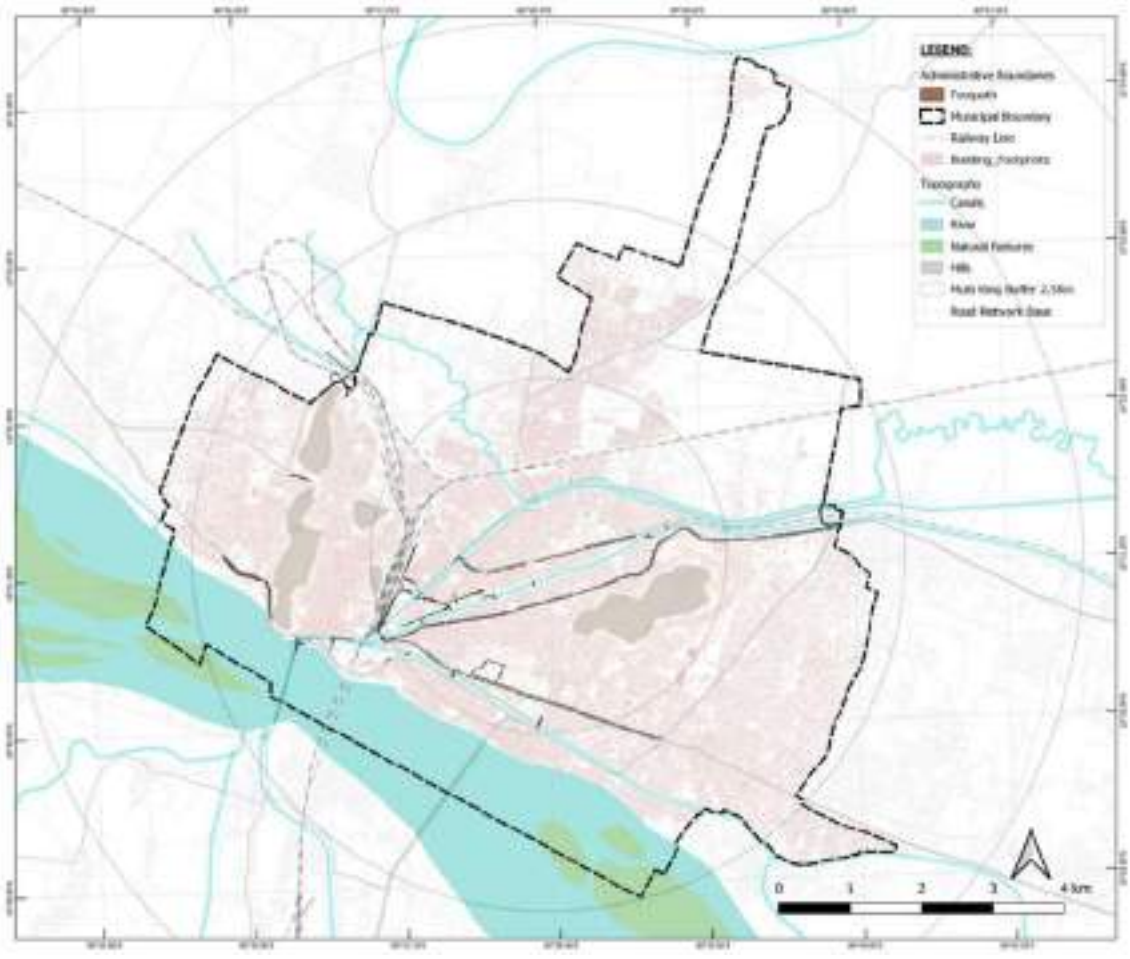
Source: UN-Habitat

The city has been trying to explore alternative strategies to create a pedestrian-friendly environment and promote pedestrian facilities through street scaping and redesigning streets in Vijayawada.

Figure 5.8: Performance of USAF walkability and NMT indicators



Source: UN-Habitat



Map 5.8: Existing footpaths in Vijayawada Source: UN-Habitat

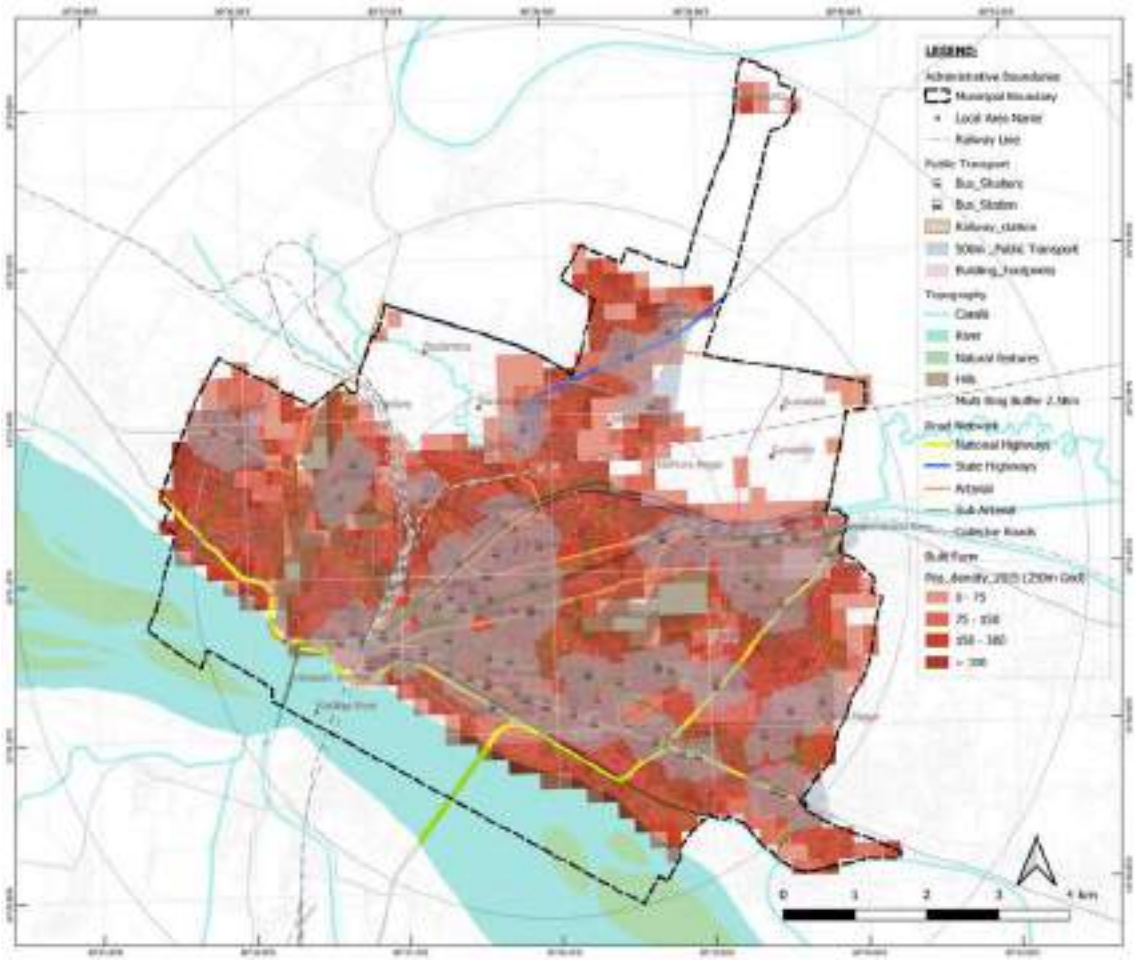
Population Density and Public Transport Access

Population Density and Public Transport Access
Ninety per cent of the city's population resides in areas with densities greater than 150 PPH. Bus stops are concentrated mainly along the primary road networks and in the city core of about 2.5 km. (For high density population distribution areas in the city see Map 5.9).

The GIS data for the spatial distribution of bus stops reveals that Ajith Singh Nagar and Gundala in the North-East, Budameru in the North-West and Pathapadu in the North (see Map 5.7) are not connected with designated bus stops, reducing their access to public transport. In addition, narrow carriage ways are one of the primary reasons for reduced public transport access in Vijayawada.

The railway track trifurcates the city into fragmented areas, reducing direct access to peripheral areas through the road network (see Map 5.9).

Image 5.2: Bus bay at MG Road Source: UN-Habitat



Map 5.9: Existing public transport coverage super-imposed on residential density estimates Source: UN-Habitat

IV. Implications of city priority projects on USAF indicators

For strategic interventions, existing city priorities were also considered. VMC is undertaking improvement of **urban road corridors of 38.11** km. Under the project, VMC is integrating urban street design elements to emphasise walkability through pedestrian friendly initiatives. Corridor improvement design elements focus on safety, comfort, utility, landscape design and innovative elements. Representations of some of the draft road corridor improvement design ideas are shared in Image 5.3 below.

(Only for reference, design/proposal is in draft stage. To use this, approval is required from VMC)

Image 5.3: Snapshots of urban road corridor draft design proposals Source: VMC

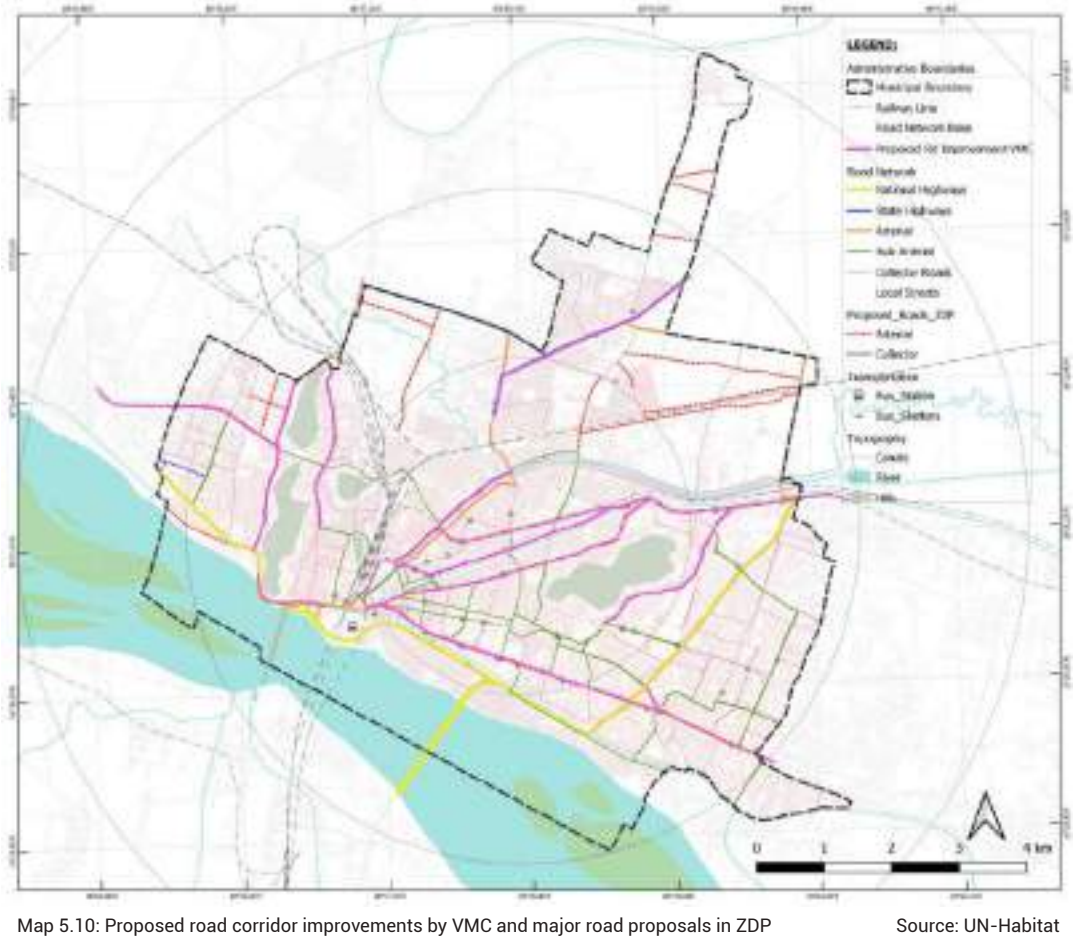
Implications of Proposed Project on USAF Transportation Indicators

USAF can assist cities in assessing the performance of the indicators and enable city administrators to analyse the indicative implications of the proposed and ongoing development projects. This city development project will have direct linkages with the transportation indicators identified in the USAF. Some of the key proposed development projects and their indicative implications on indicator performances are shown in Table 5.3 below.

Table 5.3: Indicative implications of proposed project on USAF transportation indicators

USAF Indicator	Existing	Implications of Proposed Project
Percentage of main roads covered with 1.2-m. footpath [USAF Benchmark: 75%]	9% (38 km)	If VMC completes improvement of 38 km road corridor then this indicator value will increase to 17% (76 km) If VMC completes improvement of 38 km road corridor and implements 19 km of major ZDP proposed roads (60ft & 80ft), then this indicator value will increase to 26% (114 km)
Road density (km/ sq.km)	20 (km/ sq.km)	If 19 km of major ZDP proposed roads (60ft & 80ft) are executed, then this indicator value will increase to 21 (km/ sq.km)

Source: UN-Habitat



Map 5.10: Proposed road corridor improvements by VMC and major road proposals in ZDP Source: UN-Habitat

Key Takeaways from USAF Application

1. **Public Transport:** Only 39 per cent of the population has linear access to existing bus stops within 500 m. of their homes. This can lead to increased dependency on private transport and increased GHG emissions.
   - Northern parts of the city are under serviced by public transport access.
   - Increasing public transport access and interlinking public transport coverage with population density would decrease dependency on private transport.
   - Clean fuel technologies in public transportation would reduce overall GHG emissions.
2. **Road Network:** Constraints of land availability and topographical features led to only 16 per cent of total ULB area being allocated to roads.
3. **NMT:** Lack of pedestrian and NMT facilities paves way for a strong need to formulate integrated city level and local level urban mobility strategies.

Opportunities for Formulation of Sustainable Urban Mobility City Strategies

Action Plan for Transportation for Vijayawada[29], funded by Japan International Cooperation Agency (JICA), is in the draft stage with final approval expected in two months. Key interventions suggested in the action plan report and the key strategic issues identified for the transportation sector through USAF application can be considered for formulating sustainable urban mobility city strategies. In addition, recommendations from the report can be incorporated into the ongoing ZDP revision.

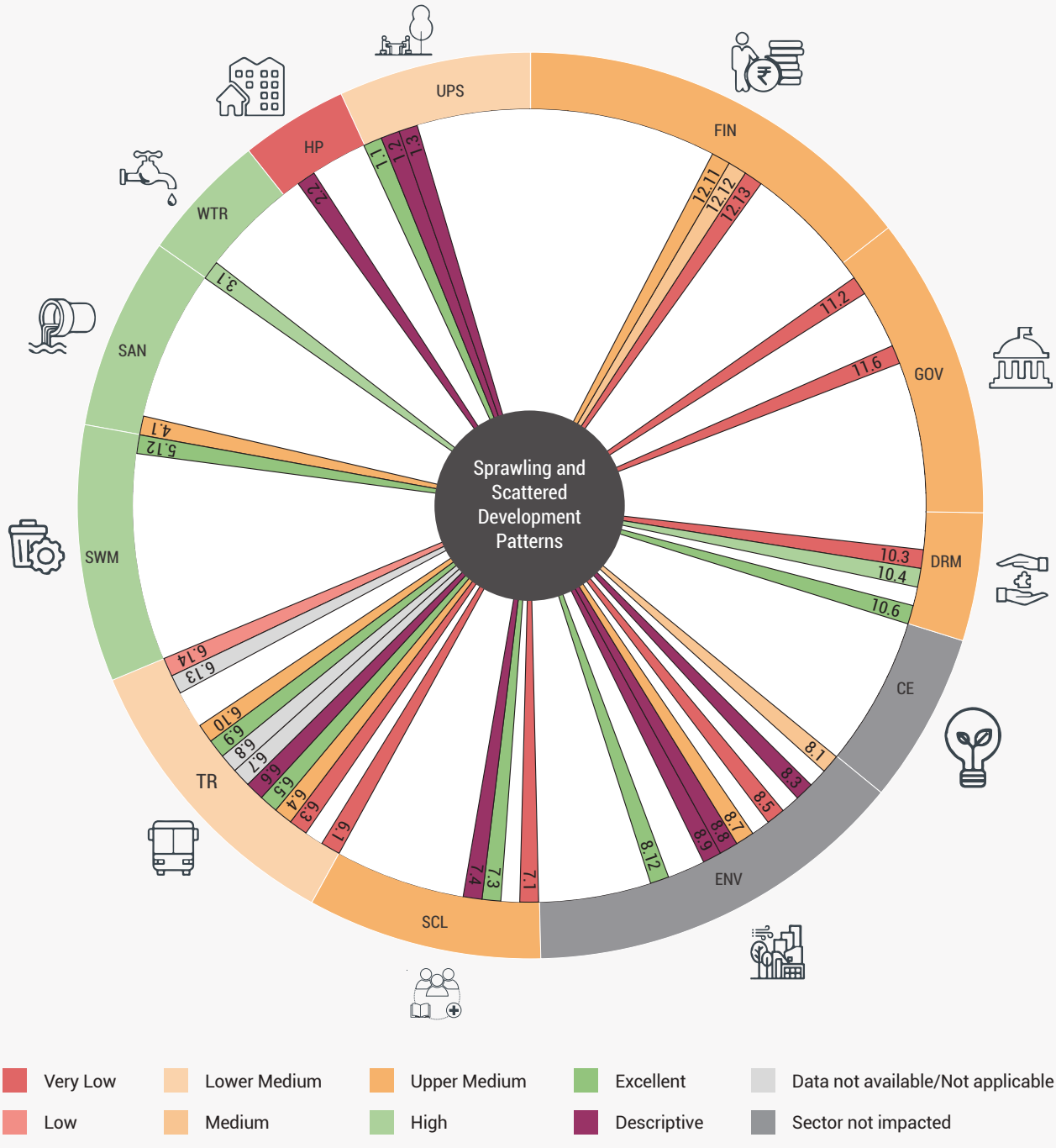
5.1.3 Strategic issue 3: Sprawling and scattered development patterns

Vijayawada experiences unplanned and unregulated development patterns with increase in population, but no increase in developable land. Undesirable urban development patterns result in low density, scattered habitations, increased travel time, high automobile dependency, loss of natural habitations along the canals and consequent higher GHG emissions. These concerns have been identified by examining spatial growth patterns in Vijayawada during the last two decades through spatial analysis, reviewing documents such as the ZDP 2021, Clean Air Action Plan (2019), City Disaster Management Plan (2015) and consultations with VMC and AMRDA. The application of urban sectoral assessment has highlighted various other interlinked factors/ development sectors that ascertains the issue (see Annexure 5.5).

Addressing urban sprawl and development patterns is of paramount importance for Vijayawada. Timely identification of spatial development issues through the application of USAF and spatial city strategies can be incorporated in the revised ZDP, which is under preparation. City development priorities like transport action plans, Clean Air Action Plan, Andhra Pradesh Building Bye Laws (2017), etc., can promote planned spatial development and integrate spatial development with transport linked infrastructure to improve access and reduce GHG emissions.

[29] Information received during the city diagnostics draft presentation to AMRDA.

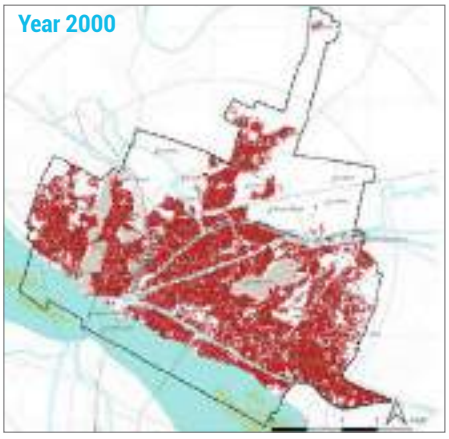
Figure 5.9: Interlinkage of issue of urban sprawl across USAF sectors

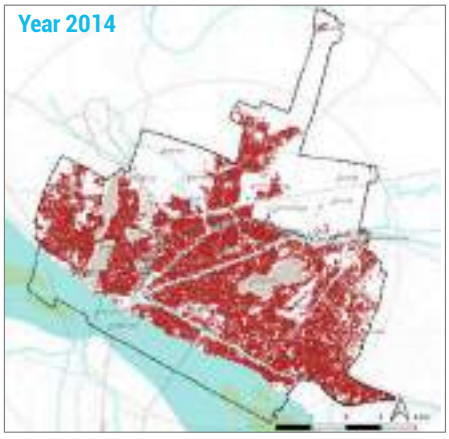


Source: UN-Habitat

Sprawl Development

As discussed in Section 4.2.1 in greater detail, between 2000 and 2014, the total built-up footprint increased by three per cent to 26.4 sq. km. in 2014 from 25.7 sq. km in 2000 (see Map 5.11), while the population increased from approximately 9.4 lakh to 10.8 lakh. The city witnessed rapid increase in built-up area after 2014. However, built-up area per capita in the city decreased by 11 per cent from 27m/person in 2000 to 25m/person in 2014, while the increase in population and developable land remained stable.





11% decrease in per capita built-up area in the city between 2000 and 2014 (USAF UPS 1.2)

Map 5.11: Built-up area of the city in 2000 and 2014

Source: UN-Habitat

The spatial extent of built-up area is mainly spread up to a maximum of 5 km from the city core (see Map 5.11). There is scope for further densification in this area and along the road corridors (see Map 5.12). Factors, such as the formation of Andhra Pradesh as a separate state in 2014, the declaration of Amaravati as the new capital in 2015 and Vijayawada functioning as a de-facto capital, have significantly contributed to the rapid increase of built-up area in the city.

As per the ZDP 2021, Vijayawada has 100 per cent developable land without any proposed agricultural use. The spatial growth has primarily spread to the northern parts of the city, away from the city core, in a scattered manner and along the road corridors.

City Core: High density and compact developments — 2.5 KM

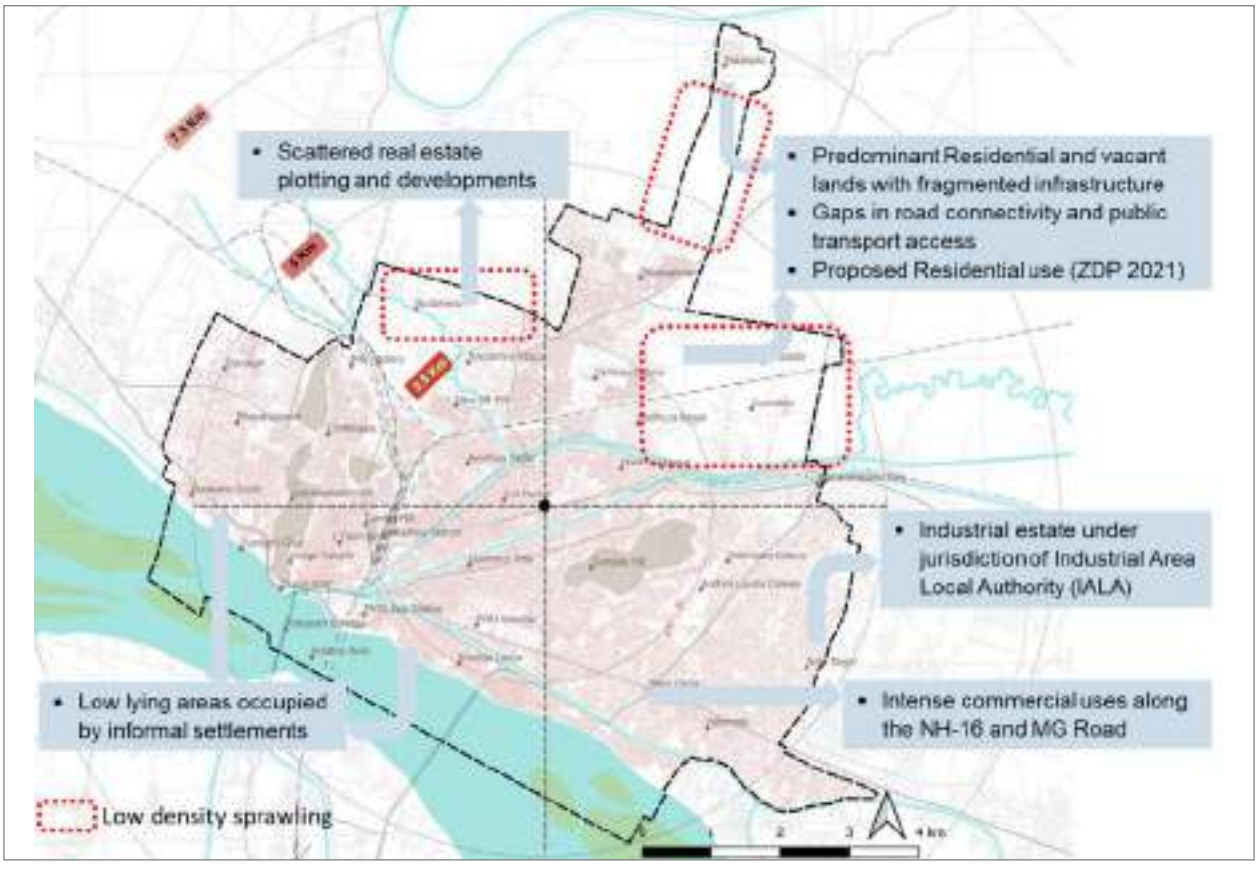
- Residential • Commercial
- Transport nodes • Government offices

Peripheral Areas: Scattered development — 5 KM

- Predominantly residential
- Vacant lands with fragmented infrastructure
- Road connectivity and public transport connectivity gaps

Outward growth along road corridors — >5 KM

- Towards North, North-East & North-West



Map 5.12: Localities experiencing sprawling and scattered development in the city

Source: UN-Habitat

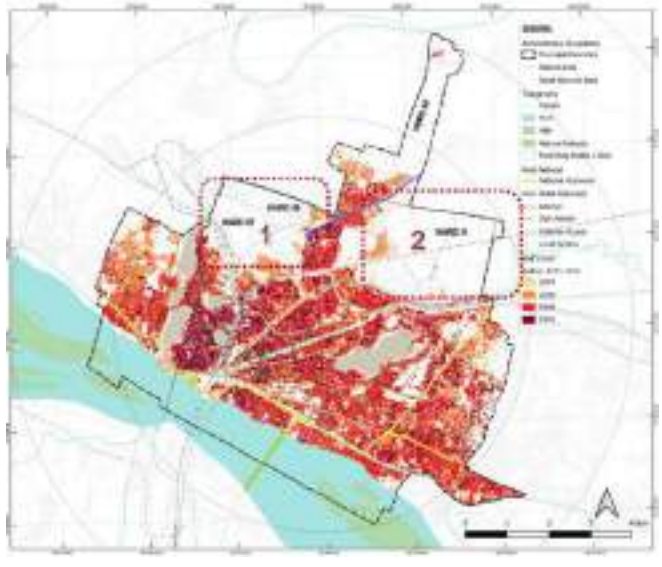
With rise in land values and demand for developable lands in Vijayawada, large scale construction of high-rise buildings and real estate plotting by private developers (see Map 5.12) have been undertaken in the northern areas. These areas are characterized by predominantly agricultural activities, vacant plots, and lack of adequate physical trunk infrastructure, such as water supply, sewerage, public transport, organised parks and open green spaces to accommodate the rapid growth.

Further, growth has taken place along the major road corridors in the North, North-East and North-West parts of the city, often forming linear and mostly scattered development patterns (see Map 5.12).

The southern part of the city experienced lesser growth as it is already densely packed with scarce availability of vacant lands, natural topographical features like hills and vulnerable low lying or hazard prone areas.

Key Inferences

1. **High density** development within urban core **(90% of population** reside in areas with **greater than 150 PPH).**
2. **Outward growth** with **scattered and low-density** development, rapidly expanding away from urban core.
3. **Ribbon development** (along transit corridors) significantly noted along corridors to **North, North-East & North-West.**



Map 5.13: Locations with real estate plotting and scattered developments in the city

Source: UN-Habitat

Urban Morphology Analysis

The scarcity of vacant land for development and natural topographical features (see Image 5.4) in Vijayawada are the key factors for fragmented city expansion to the North-East and along major road corridors.

Image 5.4: Aerial view of built-up and natural structuring elements around city core area

Source: Drone photo capture facilitated by VMC

An urban morphology analysis (see Figure 5.10) was conducted by examining three swatches of land (1 sq. km. each). The first swatch from the urban core (city swatch), the second from a partially developed settlement (partially developed swatch) and the third from a peripheral area, but within municipal limits (peripheral swatch). All the three swatches were measured in terms of road density and built footprint ratio. A comparison of the **road density revealed that the peripheral swatch had four times higher road density than the city swatch,** while **built footprint for the city swatch was 48 per cent higher than the peripheral swatch.** It can be inferred that the per person cost of building and providing physical and social infrastructure increases significantly towards the outer edges of the city. In addition, maintaining service levels of higher quality and reliability is challenging in these areas, as well as in under-developed/ partially developed wards of the city (see Figure 5.10).

	1. City Swatch	2. Partially Developed Swatch	3. Peripheral Swatch
Patch Area (sq.km)	1 Sq. Km	1 Sq. Km	1 Sq. Km
Built Footprint (sq.km)	0.48 Sq. Km	0.13 Sq. Km	0.01 Sq. Km
Built Footprint Ratio	48%	13%	0.01 %
Road Length (km)	24.5 Km	21.4 Km	6.8 Km
Road Density (km/sq.km)	24.5	21.4	6.8
Water supply network(Km)	23 Km	10.5 Km	0 Km

Figure 5.10: Urban morphology analysis

Source: UN-Habitat

Proposed Agricultural Land

0% agricultural land use in ZDP

Percentage of agricultural land use area proposed for future developable uses in the Master Plan (USAF UPS 1.3)

Considering the high density and scarcity of land for development in Vijayawada, the ZDP 2021 has proposed 100 per cent city area (61.88 sq. km.) as developable with no provision for agricultural land.

Being a highly 'urban' city, there is no farming within city limits. However, agricultural products are traded from the hinterlands, as Vijayawada is an established commercial centre in the district.

Scattered development in the peripheral areas significantly **increased the serviceable area of VMC** and in turn the **capital investment** on provision of additional **infrastructure services,** as well as increase in **operation and maintenance costs,** thus impacting the **municipal budget.** These would also have implications on the **overall GHG emissions.**

Demarcating available lands for residential and other developable uses in the ZDP 2021 is both an opportunity for accommodating the city's growing population as well as a risk, **facilitating the possibility of urban sprawls and increasing the burden** on VMC.

Land Carrying Capacity Analysis

As discussed in Section 4.2.3, an estimated population of 12 lakh (2019) reside in an area of 61.88 sq. km., with a population density of 193 PPH. Ninety per cent of Vijayawada's population lives in areas with greater than 150 PPH, concentrated in the city core of about 2.5 km and along the city's primary road network. See Table 5.4 for the city's projected population.

Table 5.4: Population growth pattern in Vijayawada over the decades

Year	Population (lakh)	Decadal growth (%)	VMC Area (in Ha)	Population Density/ Ha
2011	10.34	9.8	6188	167
2019[30]	12.00	-	6188	193
2021[31]	16.40	58.6	6188	265
2031[32]	17.60	7.3	6188	284

Source: Census of India, ZDP 2021 and VMC

UN-Habitat's five principles for Sustainable Urban Development state that compact cities should aim at the recommended density of 150 PPH. According to this parameter, if UN-Habitat's density norm is applied to the present conditions of the city's available vacant land, the current expanse of vacant land within VMC limits could inhabit up to 1,93,000 people, which is about 16 per cent of the city's existing population (2019) as per VMC's SLB data.

Table 5.5: Indicative land carrying capacity in Vijayawada

Population of Vijayawad,a (2019)[30]	12,00,000
Current gross population density in PPH (2019) within 61.88 sq. km.	193
Total land available (approx.) (in Ha)[33]	1,000
Additional population (approx.) that can be accommodated as per suggested UN standard of 150 PPH	1,50,000
Additional population (approx.) that can be accommodated as per existing population density of 193 PPH	1,93,000

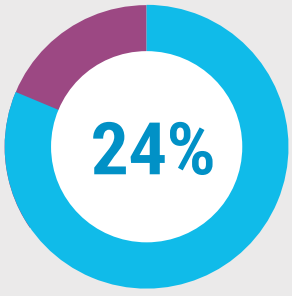
Source: VMC's SLB data and GIS database 2019

High Automobile Dependency

Sprawling development patterns create the need to travel large distances for work and to access various services/ facilities. The residents of Vijayawada also rely mostly on personal motorized vehicles and auto-rickshaws.

As per the Urban Commute Report by CSE, 2018[34] two-wheelers (53 per cent), public transport (29 per cent), intermediate public transport (15 per cent) like autos, and cars (four per cent) constitute most of the city's vehicular composition. Due to sprawling development, the use of personalized motor vehicles tends to increase further, causing more GHG emissions. The absence of integrated public transportation with development in the city also leads to increase in use of personal motor vehicles and fossil fuels.

[30] VMC estimated the city's population at 12 lakh in SLB 2018-19.
[31] Projected population as per Vijayawada ZDP 2021
[32] Projected in VMC SWM DPR by Tata Consulting Engineers Limited in 2016
[33] Approximate vacant lands (private + Govt.) calculation in wards 01, 57, 58, 64 and in other wards as per GIS database 2019
[34] The Urban Commute Report by CSE, analysis and ranking of 14 cities in India, 2018



Transport sector contribution out of total city emissions during 2015-16. Annual CO_2-eq emissions from the transportation sector in the city is 4,40,679 Mt CO_2-eq

5.1.4 Strategic issue 4: Inadequate public green spaces and fragmented blue–green network

Inadequate public green spaces emerged as one of the foremost issues in Vijayawada, according to the findings of the urban assessment[35], consultations with VMC as well as with multiple stakeholders. Moreover, it aligns with the topmost development priority of VMC. The city scored 'very low' on two indicators, and 'medium' on one indicator of the urban sustainability assessment report on the urban form public space and safety sector that measured accessibility and service level of public open spaces[36] in the city.

On interlinking the strategic issue of inadequate public green spaces and fragmented blue–green network across USAF sectoral indicators, 20 indicators across six sectors (see Figure 5.11) were found to have strong linkage to urban form and environment.

63%

City population with access to organized public open space within 500 m.

(USAF UPS 1.4)

3.83 sq.m.

Open space (recreational space, organized green space, other common open spaces) per capita

(USAF UPS 1.5)

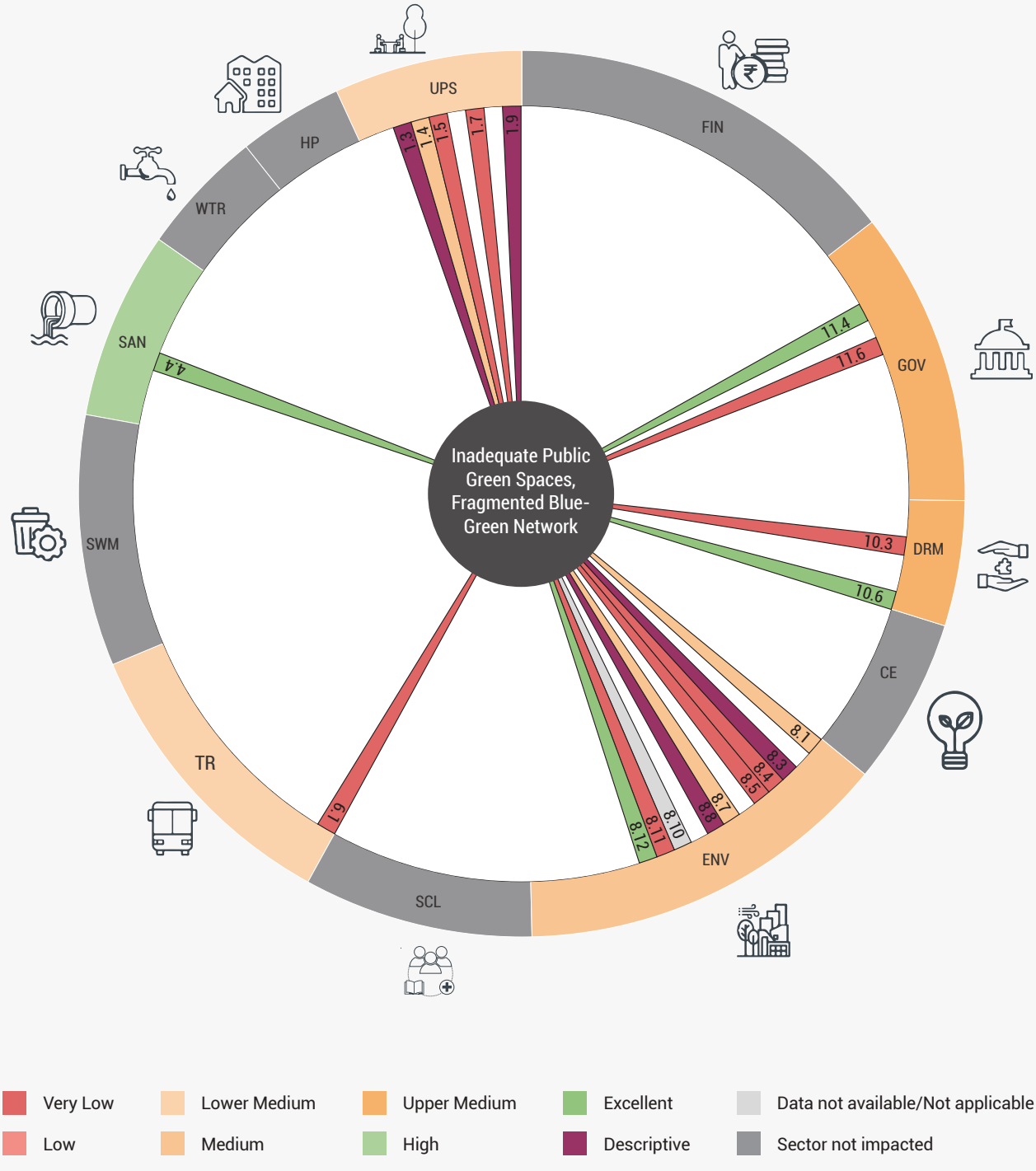
1%

Recreational and open space area out of total developable area in the city

(USAF UPS 1.7)

[35] USAF was applied to 12 sectors integrated with spatial tools and USAF benchmarks/ thresholds were drawn on the synergies of other frameworks.
[36] Open spaces generally serve the function of recreation (e.g., gardens and parks, community gardens, corridor links) or sports (e.g., public playgrounds for formal structured sporting activities, such as team competitions, physical skill development and trainings. City-Wide Public Space Strategies: A Guidebook for City Leaders (2020), UN-Habitat

Figure 5.11: Interlinkage of issue of green spaces and blue network across USAF sectors



Source: UN-Habitat

Public open spaces play a significant role in the reduction of GHGs, mitigation of the urban heat island effect, water conservation and overall public well-being and quality of life. As most urban development challenges, that of inadequate public open spaces and conservation of water bodies are also linked to many other development and environment factors (see Annexure 5.6).

Inadequate Open Public Spaces

Development of parks and greenery in the city has been a priority area of VMC. Many area level parks were developed by VMC in the last decade through general funds and under programmes like AMRUT. However, the new parks and other open spaces are not proportional to the city's increasing population. Lack of vacant government land within the available small city size of 61.88 sq. km. is one of the primary reasons for inadequate public open spaces. Even historically, the city focused more on the River Krishna and associated religious fairs, such as Pushkar, and never on equitable open space distribution. There are 174 parks[37] in the city and the total open space (including recreational space, organized green space and other common open spaces, such as vacant lands/ open spaces) in the city is 4.59 sq. km.

As discussed in Section 4.4.1 in greater detail, 37 per cent of the city's population does not have access to any organized open space within 500 m. of their homes (see Map 5.14). With only 3.83 sq. m. of accessible open space per person (2019)[38] against a benchmark of 10-12 sq. m. per person. In addition, the percentage of area allocated for recreational use in the proposed land use of Vijayawada for 2021 is 2.2 sq. km. (3.56 per cent) of the total city area. Even if this is fully implemented, it would still not meet the standard of 12–14 per cent of developable area for recreational land use, as per URDPFI guidelines.

63%

City population with access to organized public park, open space within 500m (USAF UPS 1.4)

3.83 sqm/person
open space per capita (USAF UPS 1.5)

Benchmark: 10-12 sqm (URDPFI)

1% Recreational and open space area out of total developable area (USAF UPS 1.7)

Benchmark: 35%

3% Proportion of tree cover to the total ULB area (USAF ENV 8.4)

Benchmark: 10%

Map 5.14: Overview of USAF with indicators for parks and open spaces, and access coverage

Source: UN-Habitat

Image 5.5: Existing developed parks and green spaces by VMC. Source: UN-Habitat

Although various alternative strategies have been adopted by VMC (see Image 5.5), the city still lacks government-owned vacant lands in appropriate places for developing new parks and other organized open spaces.[39]

Lack of Conservation along Water Bodies

Three canals—Bandar, Ryves and Eluru—with an approximate length of 23 km. flow through Vijayawada. In addition, the Budameru canal (8 km.) is one of the most flooded rivulets (see Map 5.14). Rejuvenation of these canals is one of the top priorities of the city.

Image 5.6: Discharge of waste into canals despite fencing walls in place. Source: UN-Habitat

[39] Stakeholder consultation interactions with VMC during USAF draft demonstration.

Image 5.7: Unauthorized constructions along Budameru canal to the North-West of the city. Source: Drone photo capture facilitated by VMC

Rajiv Gandhi Park and Raghaviah Park are two of the city's key parks. VMC is in the process of converting a remediated dumpsite into an eco-park in Ajith Singh Nagar (see Map 5.15). See Table 5.6 for the population served and the approximate ward-wise gaps, as per URDPFI guidelines.

Despite various initiatives for cleaning the canals and removing encroachments on the embankments or unauthorized constructions along the canals, there are still proliferation of construction activities at these vulnerable areas (see Image 5.6).

While existing local green spaces are spatially fragmented, the city lacks accessible parks and open spaces in the North near Pathapadu, the North-East near Ajith Singh Nagar and the North-West near Budameru (see Map 5.15).

Ward-wise gaps were identified by assessing Vijayawada's existing parks and open spaces, as per standard URDPFI guidelines. VMC can take these into account to plan for spatial and integrated development of accessible parks and open spaces for the city's residents.

Key Inferences

1

3.83 sq. m. of open space **per capita** is just **one-third** of the suggested benchmark of **10-12 sq. m**. per person.

City lacks government owned vacant lands

2

Only 63% of the city's population has **access to open space within 500 m. of their hom**es.

3

Blue network: **Encroachment of embankments** and **unauthorized constructions along canals** are the major areas of concern.

4

Percentage of area proposed for **recreational use** in Vijayawada **ZDP 2021** is only **3.56%** of the total ULB area.

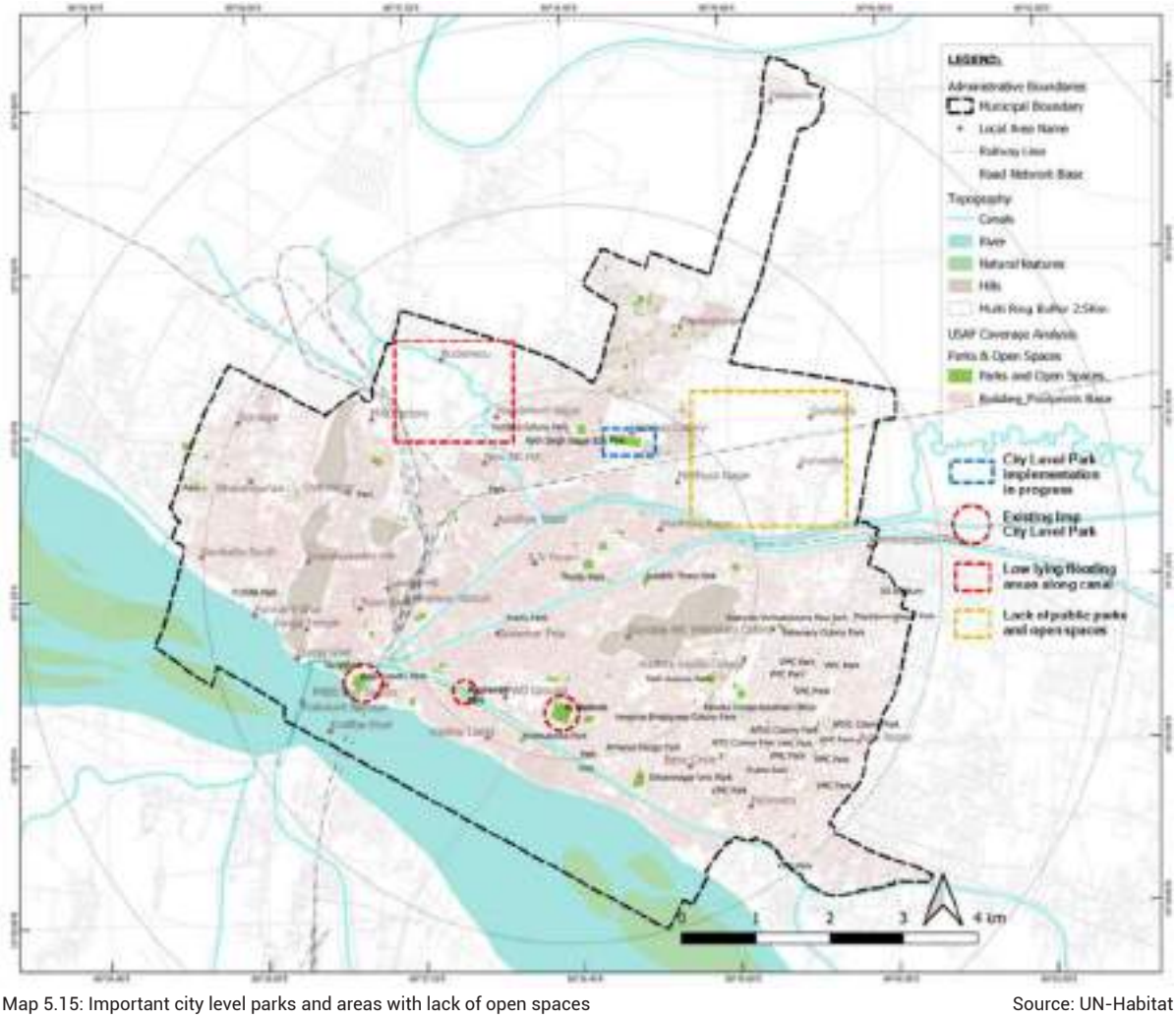
Table 5.6: URDPFI suggested area for population served and approximate ward-wise gaps.

Gaps in Quantities (approx.)

S. No.	Category	Population served per unit	Area Requirement (Ha)
1.	Housing Area Park	5000	0.50 Source URDPFI

WARD	Population	W_Area (in Ha)	URDPFI Norm (in Ha)	Existing Open Spaces (in Ha)	Gaps in Ha
WARD01	18501	590.2	1.85		1.85
WARD02	14218	90.0	1.42	1.13	0.29
WARD03	53724	301.5	5.37	1.15	4.22
WARD04	50509	181.1	5.05	5.71	-0.65
WARD05	19999	81.8	2.00	0.09	1.91
WARD06	11461	58.9	1.15		1.15
WARD07	25872	65.7	2.59	1.44	1.15
WARD08	50119	130.7	5.01	0.72	4.29
WARD09	26339	65.5	2.63	0.11	2.53
WARD10	35383	97.7	3.54	1.84	1.70
WARD11	29846	152.4	2.98	1.25	1.73
WARD12	32722	70.4	3.27	0.00	3.27
WARD13	25724	66.7	2.57	0.84	1.73
WARD14	19291	48.9	1.93	0.47	1.46
WARD15	11544	138.6	1.15		1.15
WARD16	13943	183.3	1.39	0.82	0.57
WARD17	8598	51.9	0.86	1.08	-0.22
WARD18	5887	55.8	0.59	0.53	0.06
WARD19	32556	93.2	3.26	2.50	0.75
WARD20	13705	76.7	1.37	1.87	-0.50

Source: UN-Habitat



Map 5.15: Important city level parks and areas with lack of open spaces

Source: UN-Habitat

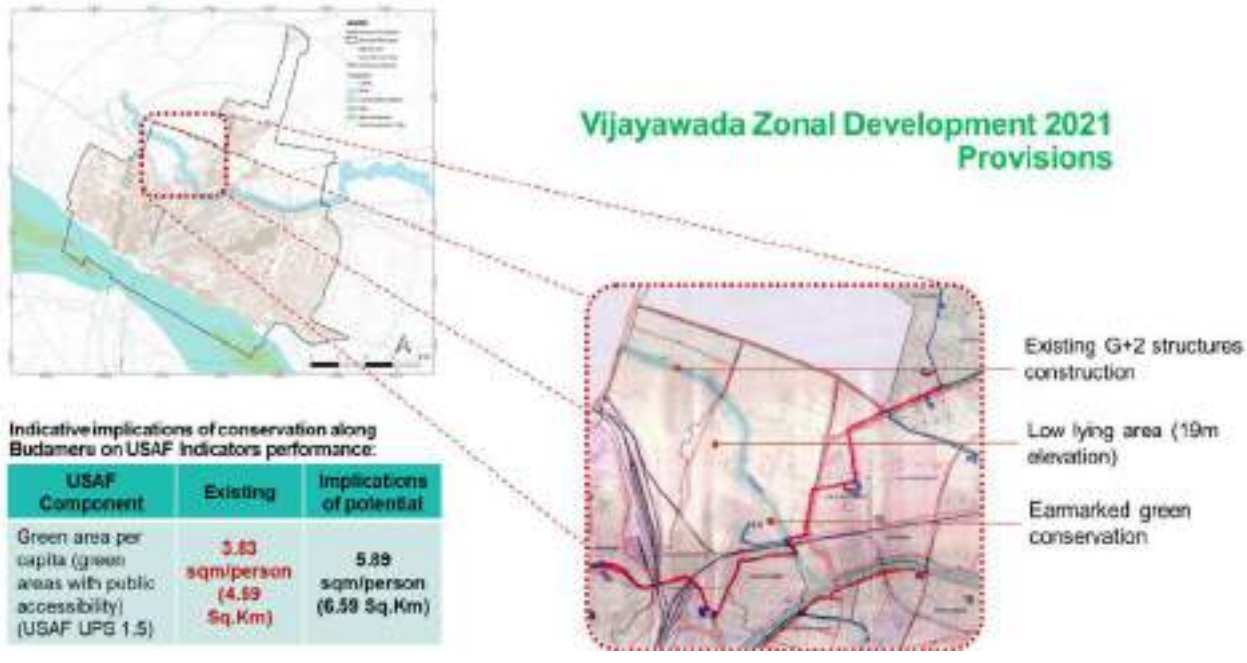
As per Andhra Pradesh Building Rules 2017, no building/ development activity is allowed on the bed of water bodies and at the Full Tank Level (FTL). A buffer zone, as listed in Table 5.7, has to be maintained as a recreational/ green buffer zone, with no building activity allowed (barring a few relaxations for conservation).

Table 5.7: Suggested buffer zone from FTL boundary of water bodies

Sn	Required buffer zone from the FTL boundary of water bodies	Approx. area of water body
1	Buffer zone of 30 m.	10 Ha and above
2	Buffer zone of 9 m.	less than 10 Ha

Source: Andhra Pradesh Building Rules 2017

VMC has developed green zones along canal embankments for recreational use and to minimize encroachments. For many water bodies, especially in peripheral areas, only bunds/ embankments have been constructed. There is a strong need to integrate passive open spaces with the blue network to increase access to public parks/ open spaces within walkable distance of residents. See Map 5.16 for the indicative conservation implications of ZDP 2021 along Budameru canal.



Map 5.16: Indicative conservation implications of ZDP 2021 on USAF indicator performance

Source: UN-Habitat

Addressing the issue of inadequate public green spaces and fragmented blue–green network would have greater implications on reducing GHG emissions in the city.

ANNEXURE

Annexure 4.1: Overall performance of Vijayawada across all USAF sectors

Annexure 5.1: Interlinkage of issue of sub-optimal urban mobility with indicators across USAF sectors.

Annexure 5.2: Slum-wise percentage of population with access to USAF service coverage, hazard vulnerable areas and conservation zones

Slum Number	Slum Name	%PWA to PT	%PWA to POS	%PWA to HC	%PWA to Edu	%PWA to FS	S_Pop_ LS_V	S_Pop_ FP_V	S_Pop_ ZDP_
62	Arul Nagar (Gunadala)	0%	39%	77%	63%	100%	100%	0%	83%
44	Slum behind SAS College	0%	0%	59%	79%	100%	100%	0%	19%
63	Ayyappa Nagar Quarry (Vijay and Uma Nagar)	63%	15%	76%	100%	100%	100%	0%	86%
77	Turnel South Hill area	12%	22%	40%	100%	100%	100%	0%	35%
46	Mallikharjunapet	0%	0%	3%	100%	100%	100%	0%	9%
67	Machavaram Down, Karmika Nagar	7%	14%	55%	100%	100%	100%	0%	40%
75	Kothapet hill area from Srinivasa Mahal to Tunnel South	37%	5%	70%	100%	100%	100%	0%	22%
87	Machavaram Hill slope down Harijana Wada	0%	0%	19%	100%	100%	100%	0%	44%
17	Saw Mill Hutting	56%	40%	0%	100%	100%	0%	100%	0%
41	Karakatta Down South	0%	60%	83%	99%	100%	63%	99%	0%
43	Lambadipet Chittinagar Hill area	86%	71%	100%	100%	100%	100%	0%	18%
64	Christurajapuram	27%	88%	0%	99%	100%	99%	0%	77%
68	Machavaram upto Quarry Hill area	98%	10%	100%	100%	100%	100%	0%	13%
72	Tailorpet Hill area	17%	0%	100%	100%	100%	100%	0%	17%
73	Frizerpet Hill area	61%	99%	71%	100%	100%	100%	0%	12%
74	Kothapet Hill area up to Srinivasa Mahal	0%	0%	83%	95%	100%	99%	0%	17%
76	Turnel North Hill area	5%	97%	17%	100%	100%	100%	0%	42%
84	Wynchipet Hill Area	0%	2%	100%	100%	100%	100%	0%	1%
86	Chinthalamala Palli	0%	64%	90%	100%	100%	100%	0%	11%
88	Mogalrajupuram Hill area East	92%	74%	18%	100%	100%	36%	0%	80%
100	Bramarambapuram River Bund Burial Ground	2%	18%	0%	100%	100%	0%	100%	0%
101	River Bank Rpakalu Bramarambapuram	0%	46%	34%	100%	100%	0%	100%	0%
103	River Bund Ranigarithota Nehru Nagar	0%	49%	0%	100%	100%	0%	100%	0%
107	Bethlaham Nagar	79%	61%	84%	100%	100%	98%	0%	59%
8	New Ayodhyanagar Donka	0%	0%	0%	72%	100%	0%	0%	0%
13	Kundavari Kandrika Rural	0%	0%	0%	0%	100%	0%	0%	0%
30	Ramalingeswara Nagar Canal Hutting	0%	39%	44%	100%	100%	0%	86%	0%
42	Karakatta Down North	0%	20%	95%	100%	100%	0%	100%	0%
61	Autonagar Area	0%	0%	0%	0%	100%	0%	0%	0%
65	Lurd Nagar	87%	57%	57%	100%	100%	59%	0%	23%
71	K.L. Rao Nagar	100%	100%	100%	100%	100%	100%	0%	0%
78	New Raj Rajeswari Pet	0%	27%	0%	100%	100%	0%	0%	0%
81	Abbothu Appanna Pakalu	0%	0%	100%	100%	100%	100%	0%	0%
85	Wynchipet Railway Station	0%	0%	100%	100%	100%	100%	0%	0%
89	Mogalrajupuram Hill area West	47%	81%	44%	100%	100%	53%	0%	22%

Slum Number	Slum Name	%PWA to PT	%PWA to POS	%PWA to HC	%PWA to Edu	%PWA to FS	S_Pop_ LS_V	S_Pop_ FP_V	S_Pop_ ZDP_
102	River Bund low level North Ranigarithota	0%	98%	0%	100%	100%	0%	100%	0%
104	Chalasani Nagar Ranigarithota	0%	100%	0%	100%	100%	0%	100%	0%
105	Ranigarithota Bhaskara Raopet	0%	100%	0%	100%	100%	0%	100%	0%
1	Ambedkar Nagar Canal Hutting up to Madhura Nagar	0%	17%	65%	100%	100%	0%	0%	0%
3	Budameru Flood Bank Ramakrishnapuram	6%	0%	41%	95%	100%	0%	0%	0%
4	Devi Nagar	0%	0%	0%	100%	100%	0%	0%	0%
6	Kuddushnagar Kadareswaripet	0%	0%	0%	100%	100%	0%	0%	0%
9	Yerukala area near UP School	1%	42%	49%	100%	100%	0%	0%	0%
15	Nandamuri Taraka Rama Nagar	0%	0%	0%	96%	100%	0%	0%	0%
31	Malapalli Canal Hutting (Patamata Ambedkar Nagar)	0%	77%	0%	100%	100%	0%	17%	0%
39	Santhinagar Patamata	0%	30%	70%	100%	100%	0%	0%	0%
51	Sanjay Gandhi Labour Colony	0%	0%	0%	100%	100%	0%	0%	0%
55	Nulakapet Bhavanipuram	0%	2%	79%	100%	100%	0%	0%	0%
56	Ryves Canal Hutting North & South from Dal Mill	64%	0%	33%	94%	100%	0%	0%	0%
79	Raj Rajeswari Pet	79%	0%	0%	99%	100%	1%	0%	0%
83	Heart Pet	73%	0%	0%	100%	100%	0%	0%	0%
94	Slum South & West of Montissori College	100%	75%	100%	25%	100%	0%	75%	0%
2	Warehouse Road	100%	0%	0%	100%	100%	0%	0%	0%
5	East K.L. Rao Road in 23rd Division	0%	99%	100%	100%	100%	0%	0%	0%
7	Nandamuri Basavathraka Nagar	67%	0%	100%	100%	100%	0%	0%	0%
10	Area near 1 & 2 Blocks of A.S. Nagar	36%	100%	100%	66%	100%	0%	0%	0%
11	Cement Factory Hutting	0%	66%	0%	100%	100%	0%	0%	0%
12	Area near Block Nos. 37 & 40 of A.S. Nagar	93%	100%	100%	100%	100%	0%	0%	0%
14	L.B.S. Nagar Payakapuram	0%	98%	100%	100%	100%	0%	0%	0%
16	N.S.C. Bose Nagar Kandrika	60%	100%	100%	33%	100%	0%	0%	0%
18	Rajiv Nagar Colony	0%	100%	62%	100%	100%	0%	0%	0%
19	Sundaraiah Nagar	2%	100%	76%	100%	100%	0%	0%	0%
20	Vaddera Colony 23rd Division	100%	100%	100%	100%	100%	0%	0%	0%
21	Vaddera Colony, Rajiv Nagar Extn	0%	100%	100%	100%	100%	0%	0%	0%
22	Vambey Colony	3%	100%	0%	100%	100%	0%	0%	0%
23	P.S. Nagar behind Burma Colony	52%	100%	62%	100%	100%	0%	0%	0%
24	Prakash Nagar	66%	100%	98%	100%	100%	0%	0%	0%
25	Santhi Nagar Payakapuram	27%	100%	100%	100%	100%	0%	0%	0%
26	Seetharama Puram	100%	0%	100%	100%	100%	0%	0%	0%
27	Interior parts of RTC Colony Patamata	0%	100%	86%	100%	100%	0%	0%	0%
28	J.D. Nagar	0%	100%	98%	100%	100%	0%	0%	0%
29	New Giripuram	72%	100%	100%	100%	100%	0%	0%	0%
32	Sanjay Gandhi Nagar Patamata	100%	79%	100%	100%	100%	0%	0%	0%
33	Venkateswara Manyam Hutting	100%	56%	100%	100%	100%	0%	0%	0%
34	Badava Woodpet	54%	100%	100%	100%	100%	0%	0%	0%
35	DarsipetI	100%	100%	86%	100%	100%	0%	0%	0%

Slum Number	Slum Name	%PWA to PT	%PWA to POS	%PWA to HC	%PWA to Edu	%PWA to FS	S_Pop_ LS_V	S_Pop_ FP_V	S_Pop_ ZDP_
36	DarsipetII	54%	100%	0%	100%	100%	0%	0%	0%
37	High School Road, Patamata Scavengers Colony	100%	100%	100%	100%	100%	0%	0%	0%
38	Nehru Nagar (Giripuram)	3%	100%	100%	100%	100%	0%	0%	0%
40	Thotavari Street, Patamata	24%	0%	100%	100%	100%	0%	0%	0%
45	Canal Hutting Greenlands Hotal	14%	97%	32%	100%	100%	0%	0%	0%
47	RTC Workshop, Gorila Doddi	0%	100%	0%	100%	100%	0%	0%	0%
48	RTC Workshop Rama Nagar	Data not available							
49	Priyadarsini Colony	23%	100%	92%	100%	100%	0%	0%	0%
50	Singhnagar Road Side Hutting	100%	100%	100%	100%	100%	0%	0%	0%
52	Urmila Subba Rao Nagar	0%	100%	0%	100%	100%	0%	0%	0%
53	Joji Nagar Colony	99%	36%	14%	100%	100%	0%	0%	0%
54	K.R. Dall Mil Area (warehouse)	0%	23%	100%	100%	100%	0%	0%	0%
57	Eluru Road Hutting (Ring Road East Extn)	100%	73%	100%	100%	100%	0%	0%	0%
58	Canal Hutting up to Cabin end	27%	92%	8%	100%	100%	0%	0%	0%
59	Harizanawada (Gunadala)	100%	5%	100%	100%	100%	0%	0%	0%
60	Christianpet (Gunadala)	99%	62%	100%	100%	100%	0%	0%	0%
66	Varalakshmi Nagar	100%	100%	0%	82%	100%	0%	0%	0%
69	Kothavanthena Canal Hutting West Side	100%	40%	100%	100%	100%	0%	0%	0%
70	Maruthinagar Canal Hutting	26%	84%	30%	100%	100%	0%	0%	0%
80	T. Subbaraju Nagar	0%	100%	0%	100%	100%	0%	0%	0%
82	Dhall Mill Area	100%	0%	0%	100%	100%	0%	0%	0%
90	Mogalrajupuram Prajashakti Nagar	93%	83%	100%	100%	100%	0%	0%	0%
91	Pakeer Gudeam	0%	100%	30%	100%	100%	0%	0%	0%
92	Pettingul Pet	88%	86%	100%	100%	100%	0%	0%	0%
93	Workment Pet	100%	100%	100%	100%	100%	0%	0%	0%
95	Slum Kapu Kalyan Mandapam	100%	100%	100%	100%	100%	0%	0%	0%
96	Atchamma Bazar	98%	46%	41%	100%	100%	0%	0%	0%
97	Gulabhi Thota area	7%	100%	0%	97%	100%	0%	0%	0%
98	Madhura Nagar Revenue Layout	0%	20%	100%	100%	100%	0%	0%	0%
99	Madhura Nagar Donka Road and Track	20%	92%	0%	100%	100%	0%	0%	0%
106	Namburi Gopal Rao Street	0%	100%	0%	100%	100%	0%	0%	0%
108	Ambedkar Nagar (Krishana Nagar)	100%	89%	100%	100%	100%	0%	0%	0%
109	Off Lorry Stand, Vidyadharapuram	0%	100%	0%	100%	100%	0%	0%	0%
110	L.M.B. Colony, Maruthi Nagar	0%	100%	83%	100%	100%	0%	0%	0%
111	Rajeev Nagar Katta	4%	100%	84%	100%	100%	0%	0%	0%
Grand Total		**30%**	**54%**	**55%**	**96%**	**100%**	**27%**	**14%**	**9%**

Annexure 5.3: Slum-wise percentage of population with access to USAF service coverages, hazard vulnerable areas and conservation zones

Slum Number	Slum Name	USAF Services Deprived (out of 5)	Assigned weightages (0,1 and 2)				Most Critical Slums
			Critical Slums Deprived Services	Critical Slums Prone to LS	Critical Slums Prone to FP	Critical Slums ZDP Cons	
62	Arul Nagar (Gunadala)	4	2	2		2	6
44	Slum behind SAS College	4	2	2		1	5
63	Ayyappa Nagar Quarry (Vijay and Uma Nagar)	3	1	2		2	5
77	Turnel South Hill area	3	1	2		1	4
46	Mallikharjunapet	3	1	2		1	4
67	Machavaram Down, Karmika Nagar	3	1	2		1	4
75	Kothapet Hill area from Srinivasa Mahal to Tunnel South	3	1	2		1	4
87	Machavaram Hill slope down Harijana Wada	3	1	2		1	4
17	Saw Mill Hutting	3	1		2		3
41	Karakatta Down South	3	1	1	1		3
43	Lambadipet Chittinagar Hill area	0		2		1	3
64	Christurajapuram	2		1		2	3
68	Machavaram up to Quarry Hill area	1		2		1	3
72	Tailorpet Hill area	2		2		1	3
73	Frizerpet Hill area	2		2		1	3
74	Kothapet Hill area up to Srinivasa Mahal	3	1	1		1	3
76	Turnel North Hill area	2		2		1	3
84	Wynchipet Hill area	2		2		1	3
86	Chinthalamala Palli	2		2		1	3
88	Mogalrajupuram Hill Area East	1		1		2	3
100	Bramarambapuram River Bund Burial Ground	3	1		2		3
101	River Bank Rpakalu Bramarambapuram	3	1		2		3
103	River Bund Ranigarithota Nehru Nagar	3	1		2		3
107	Bethlaham Nagar	2		1		2	3
8	New Ayodhyanagar Donka	4	2				2
13	Kundavari Kandrika Rural	4	2				2
30	Ramalingeswara Nagar Canal Hutting	3	1		1		2
42	Karakatta Down North	2			2		2
61	Autonagar area	4	2				2
65	Lurd Nagar	1		1		1	2
71	K.L. Rao Nagar	0		2			2
78	New Raj Rajeswari Pet	3	1				1
81	Abbothu Appanna Pakalu	2		2			2

Slum Number	Slum Name	USAF Services Deprived (out of 5)	Assigned weightages (0,1 and 2)				Most Critical Slums
85	Wynchipet Railway Station	2		2			2
89	Mogalrajupuram Hill area West	2		1		1	2
102	River Bund low level North Ranigarithota	2			2		2
104	Chalasani Nagar Ranigarithota	2			2		2
105	Ranigarithota Bhaskara Raopet	2			2		2
1	Ambedkar Nagar Canal Hutting up to Madhura Nagar	3	1				1
3	Budameru Flood Bank Ramakrishnapuram	3	1				1
4	Devi Nagar	3	1				1
6	Kuddushnagar Kadareswaripet	3	1				1
9	Yerukala area near UP School	3	1				1
15	Nandamuri Taraka Rama Nagar	3	1				1
31	Malapalli Canal Hutting (Patamata Ambedkar Nagar)	2			1		1
39	Santhinagar Patamata	3	1				1
51	Sanjay Gandhi Labour Colony	3	1				1
55	Nulakapet Bhavanipuram	3	1				1
56	Ryves Canal Hutting North & South from Dal Mill	3	1				1
79	Raj Rajeswari Pet	2		1			1
83	Heart Pet	3	1				1
94	Slum South & West of Montissori College	1			1		1
2	Warehouse Road	2					0
5	East K.L. Rao Road in 23rd Division	1					0
7	Nandamuri Basavathraka Nagar	2					0
10	Area near 1 & 2 Blocks, A.S. Nagar	2					0
11	Cement Factory Hutting	2					0
12	Area near Block No. 37 & 40 A.S. Nagar	0					0
14	L.B.S. Nagar Payakapuram	1					0
16	N.S.C. Bose Nagar Kandrika	2					0
18	Rajiv Nagar Colony	2					0
19	Sundaraiah Nagar	2					0
20	Vaddera Colony 23rd Division	0					0
21	Vaddera Colony, Rajiv Nagar Extn	1					0
22	Vambey Colony	2					0
23	P.S. Nagar behind Burma Colony	2					0
24	Prakash Nagar	1					0
25	Santhi Nagar Payakapuram	1					0
26	Seetharama Puram	1					0
27	Interior parts of RTC Colony Patamata	1					0
28	J.D. Nagar	1					0
29	New Giripuram	0					0
32	Sanjay Gandhi Nagar, Patamata	0					0
33	Venkateswara Manyam Hutting	1					0
34	Badava Woodpet	1					0

Slum Number	Slum Name	USAF Services Deprived (out of 5)	Assigned weightages (0,1 and 2)	Most Critical Slums
35	DarsipetI	0		0
36	DarsipetII	2		0
37	High School Road, Patamata Scavengers Colony	0		0
38	Nehru Nagar (Giripuram)	1		0
40	Thotavari Street Patamata	2		0
45	Canal Hutting Greenlands Hotal	2		0
47	RTC Workshop Gorila Doddi	2		0
48	RTC Workshop Rama Nagar	Data not available		
49	Priyadarsini Colony	1		0
50	Singhnagar Road Side Hutting	0		0
52	Urmila Subba Rao Nagar	2		0
53	Joji Nagar Colony	2		0
54	K.R. Dall Mil Area (Warehouse)	2		0
57	Eluru Road Hutting (Ring Road East Extn)	0		0
58	Canal Hutting up to Cabin end	2		0
59	Harizanawada (Gunadala)	1		0
60	Christianpet (Gunadala)	1		0
66	Varalakshmi Nagar	2		0
69	KothavanthenaCanal Hutting West Side	1		0
70	Maruthinagar Canal Hutting	2		0
80	T.Subbaraju Nagar	2		0
82	Dhall Mill area	2		0
90	Mogalrajupuram Prajashakti Nagar	0		0
91	Pakeer Gudam	2		0
92	Pettingul Pet	0		0
93	Workment Pet	0		0
95	Slum Kapu Kalyan Mandapam	0		0
96	Atchamma Bazar	2		0
97	Gulabhi Thota area	2		0
98	Madhura Nagar Revenue Layout	2		0
99	Madhura Nagar Donka Road and Track	2		0
106	Namburi Gopal Rao Street	2		0
108	Ambedkar Nagar (Krishana Nagar)	0		0
109	Off Lorry Stand, Vidyadharapuram	2		0
110	L.M.B. Colony, Maruthi Nagar	2		0
111	Rajeev Nagar Katta	2		0

Annexure 5.4: Interlinkage of issue of sub-optimal urban mobility with indicators across USAF sectors.

Annexure 5.5: Interlinkage of issue of sprawling and scattered development patterns with indicators across USAF sectors

Annexure 5.6: Interlinkage of issue of inadequate public green spaces and fragmented blue–green network with indicators across USAF

Notes:


DON'T
OVER SPEED
DON'T
DRUNK & DRIVE
WEAR A SEAT BELT
Engineered for Concrete
POLICE

UN HABITAT
FOR A BETTER URBAN FUTURE

UNIDO

vijayawada
Municipal Corporation

gef