Sustainable City Strategy - Guntur

Sustainable Cities - Integrated Approach Pilot (SCIAP)

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SUBMITTED TO:

Guntur Municipal Corporation

PREPARED BY:

UN HABITAT
FOR A BETTER URBAN FUTURE

PROJECT DONORS:

UNIDO gef

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It documents the Sustainable City Strategies (SCS) which are intended to be targeted and cater to specifically identified issues for each of the five pilot cities - Bhopal, Guntur, Jaipur, Mysuru and Vijayawada during the City Profile and Diagnostic stage. The report is produced using data provided by the state and urban local bodies of the four participating states and additional geospatial data collected from the National Platform for Sustainable Cities, European Space Agency. Knowledge material published by UN-Habitat, The World Bank, other agencies are referred to formulate the Sustainable City Strategies. While UN-Habitat checks data, information to the fullest extent possible, the responsibility for the accuracy of the data, information lies with the original providers of the data. Information contained in this Report is provided without warranty of any kind, either express or implied, including, without limitation, warranties of merchantability, fitness for a particular purpose and non-infringement. UN-Habitat specifically does not make any warranties or representations as to the accuracy or completeness of any such data, information.

Cover Page: Conceptual view of proposed mixed use development at Amaravati Road–MG Inner Ring Road Intersection

SUSTAINABLE CITY STRATEGY- GUNTUR

Sustainable Cities Integrated Approach Pilot (SCIAP)
Component 1: Sustainable Urban Planning and Management

Acknowledgments

Authors:
Sajith Shaik, Urban Planner & City Project Coordinator; Maia Smillie, Urban Planner; Anastasia Ignatova, Urban Planner and Design Expert; Mansi Sachdev, Senior Urban Planner; Parul Agarwala, Country Programme Manager

Thematic Experts:
Swati Singh Sambyal, Waste Management Specialist; Sonal Shah, Gender Advisor; Sarga GS, Research Associate (Gender and Inclusion)

International Advisors:
Herman Jean Pienaar, Programme Management Officer; Srinivasa Popuri, Senior Human Settlements Officer

Administrative Support Team:
Jogesh Arora, Programme Specialist

Editorial Consultant:
Saon Bhattacharya

Report Design and Layout:
Roots Advertising Services Pvt. Ltd.

Ministry of Housing and Urban Affairs:
Roopa Mishra, Director; Mr Binay Kumar Jha, Former Director, Swachh Bharat Mission

UNIDO:
Katarina Barunica, Project Manager – SCIAP; Tomasz Pawelec and Mr NP Singh, Project Management Team – SCIAP

Guntur Municipal Corporation:
Kirthi Chekuri, IAS, Municipal Commissioner; Nishant Kumar, IAS, Former Municipal Commissioner; Challa Anuradha, Former Municipal Commissioner; Himabindu Katta, Former City Planner; Srinivasa Rao, Superintending Engineer; Departmental staff of Engineering, Town Planning, Public Health and Accounts Department

Andhra Pradesh Capital Region Development Authority:
Vivek Yadav, IAS, Commissioner; P. Lakshmi Narasimham, IAS, Former Commissioner; Manoj Kumar Mandapati, Associate Planner (Transportation Planning)

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List of Acronyms

ABD	Area Based Development
AFOLU	Agriculture Forestry and Other Land Use
AIIB	Asian Infrastructure Investment Bank
AMRDA	Amaravati Metropolitan Region Development Authority
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
APCRDA	Andhra Pradesh Capital Region Development Authority
APIIC	Andhra Pradesh Industrial Infrastructure Corporation
APPCB	Andhra Pradesh Pollution Control Board
APSRTC	Andhra Pradesh State Road Transport Corporation
APTIDCO	Andhra Pradesh Township and Infrastructure Development Corporation
ARHC	Affordable Rental Housing Complex
BRT	Bus Rapid Transit
CBD	Central Business District
CNG	Compressed Natural Gas
CPCB	Central Pollution Control Board
EV	Electric Vehicle
ETVM	Electronic Ticketing / Ticket Verification Machine
EWS	Economically Weaker Section
FAR	Floor Area Ratio
FSI	Floor Space Index
FTL	Flood Tank Level
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
GIS	Geographical Information System
GoAP	Government of Andhra Pradesh
GoI	Government of India
GMC	Guntur Municipal Corporation
GPSC	Global Platform for Sustainable Cities
ICF	Insulated Concrete Forms
INR	Indian Rupee
IPPU	Industrial Processes and Product Use
IPT	Intermediate Public Transport
LCCMP	Low Carbon Comprehensive Mobility Plan
LED	Light Emitting Diode
LIG	Low Income Group

MEPMA	Mission for Elimination of Poverty in Municipal Areas
MoHUA	Ministry of Housing and Urban Affairs
MRF	Material Recovery Facility
MSWM	Municipal Solid Waste Management
MTCO2-eq	Metric Tonnes of Carbon Dioxide Equivalent
NGO	Non-Governmental Organization
NH	National Highway
NIUA	National Institute of Urban Affairs
NMSH	National Mission on Sustainable Habitat
NMT	Non-Motorized Transport
NUP	National Urban Policy
PMAY-U	Pradhan Mantri Awas Yojana - Urban
PPH	Persons Per Hectare
PPP	Public Private Partnership
SAPCC	State Action Plan on Climate Change
SBM	Swachh Bharat Mission
SCIAP	Sustainable Cities Integrated Approach Pilot
SCS	Sustainable City Strategies
SH	State Highway
SHG	Self Help Group
SIPs	Structural Insulated Panels
SLIP	Service Level Improvement Plan
RoW	Right of Way
UDA	Urban Development Authority
UGN	Urban Growth Node
ULB	Urban Local Body
UN-HABITAT	United Nations Human Settlements Programme
UN-HABITAT ROAP	United Nations Human Settlements Programme Regional Office for Asia & the Pacific
UNIDO	United Nations Industrial Development Organization
UPHC	Urban Primary Health Centres
URDPFI	Urban and Regional Development Plans Formulation and Implementation
USAF	Urban Sustainability Assessment Framework
USIR	Urban Sustainability Indicators Report
WPR	Workforce Participation Rate
ZDP	Zonal Development Plan

Jinnah Tower

1 INTRODUCTION

1.1 Report Objectives

The Sustainable City Strategy (SCS) consitutes the final step of a three-step process under the Sustainable Cities Integrated Approach Pilot (SCIAP) Component 1 of the project. The first two steps being the application of the Urban Sustainability Assessment Framework (USAF) captured in Guntur's Urban Sustainability Indicators Report (USIR) and City Profile and Diagnostic Report. The City Profile and Diagnostic Report identified very specific diagnostic issues, which were essentially the key problem areas, obsctacles and developmental challenges faced by Guntur. These challenges were ascertained on the basis of evidence collected and assesed through the USAF[1]. As the third and final step, this report documents the SCS for Guntur, which is a spatial strategic plan with very specific actions and interventions designed to be targeted and impact-oriented on ground. These strategies will strengthen and enable city leadership and managers to drive future development based on quantifiable data and assessment using rationale decision making.

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

i) To identify strategic development opportunities for the city based on spatial evidence aligned with local, state and national policies and regulations.
ii) To design cross-sectoral and intra-sectoral strategies for an equitable, sustainable and resilient future development of the city, and contribute towards improving the city's climate emissions profile.
iii) To design and develop area-based, transformative interventions to demonstrate change on ground.
iv) To ascertain specific actions and interventions necessary for transformative impact over a five-year period.
v) Recommend convergence with national/ state missions for financing and technical resources.

1.2 Approach and Methodology

The foundation of the SCS is in the New Urban Agenda (NUA) with the following five pillars (except Pillar 1, since it is beyond the scope of SCIAP) of the NUA as the guiding document in framing the SCS.

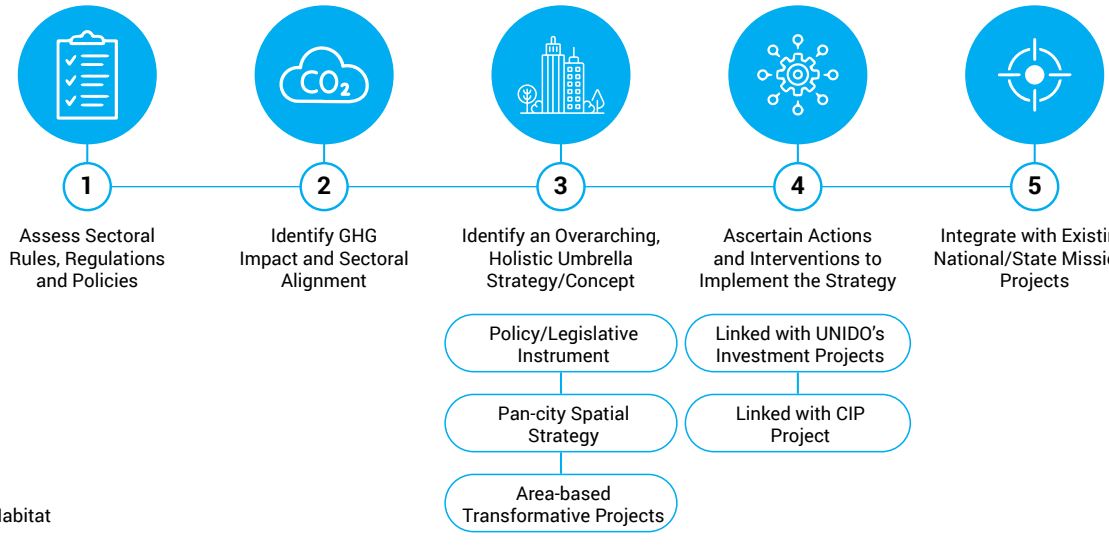
i) National Urban Policies (NUPs)
ii) Rules and Regulations
iii) Urban Planning and Design
iv) Financing Urbanization
v) Local Implementation

A detailed guidance note on the development of the SCS has been given in Annex 14.

The strategies could take the form of pan city intersectoral spatial interventions, area-based projects and even legislative/ policy-based intruments. Emphasis was given to the carbon footprint profile of sectors and their relationship with the intended strategic interventions to ensure that maximum carbon capturing is achieved. Significant effort was made to ensure convergence with projects and sectors covered by the national missions and state schemes/ policies with the recommended interventions.

The overarching steps followed for the development of the SCS have been illustrated in Figure 1.1.

FIGURE 1.1 Sustainable City Strategy (SCS) development process



Source: UN-Habitat

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.

1.3 Scope and Limitations

The SCS is intended to be very targeted and cater to specifically identified issues in the previous stage of the project. SCS would complement the city's master plan and development plans by synergising the proposed actions and interventions within the broad mandate and vision of these plans. SCS strengthens the implementation of the city's development vision by preparing specific actions and interventions for on-ground transformation and impact.

This SCS will help the municipal corporations to identify the following:[2]

1. What and where are the areas of growth?
2. Where should investments from various national and state missions/ schemes be made to maximize their impact on vulnerable social sections?
3. How can the existing natural and economic assets of the city be preserved and enhanced?
4. How can quality of life and equitable provision of urban amenities be enhanced?
5. How can interventions be prioritized to ensure practicality and maximum impact?

The following limitations need to be considered while assessing the strategic interventions:

1. The cost estimates have been calculated on block cost thumb rules derived from industry standards being used in the national missions. All assumptions have been listed out in detail for context building and understanding.
2. The concept designs and spatial location of proposed interventions are shown only for approach demonstration purposes, the interventions would require detailed planning and engineering studies to arrive at accurate costing and spatial design.
3. The savings on Greenhouse Gas (GHG) emissions shown for the strategic interventions are based on very high-level standards and metrics since they must be calculated at the detailed design stage with site specific inputs.
4. The analysis of legislations and policies is limited to the high-level implication of diagnostic issues. The SCS does not intend to provide detailed assessment of legislative frameworks and amendments to the policy and legislative framework.
5. The data and information used in the SCS are based on secondary sources available in the public domain. Primary data collection is limited to site visits and stakeholder consultations.
6. In some cases, latest spatial data, specifically land use and population density, was not available with the Urban Local Bodies (ULBs) and many assumptions had to be made by the teams, which have been mentioned.

2 https://unhabitat.org/sites/default/files/2014/07/A-guide-for-Municipalities-Inclusive-and-Sustainable-Urban-Development-Planning-Volume-1.pdf

Market Centre, GT Road

2 CITY DIAGNOSTICS

2.1 Climate Context and GHG Emission Profile

According to the Guntur City Disaster Management Plan, the city is highly vulnerable to heatwaves and is moderate to highly vulnerable to cyclones, urban flooding (pluvial flooding) and droughts. The State Action Plan on Climate Change for Andhra Pradesh (2012) projected Guntur District as one among three districts in coastal Andhra Pradesh that may experience maximum mean surface air-temperatures (>35°C) during summers (March, April and May) in the 2020s and would continue to increase in the 2050s and 2080s by more than 3°C. Another study (2019)[3] that estimated the potential future climate change scenarios for Amaravati and its surrounding areas,[4] has made the following observations regarding change in temperature and precipitation.[5]

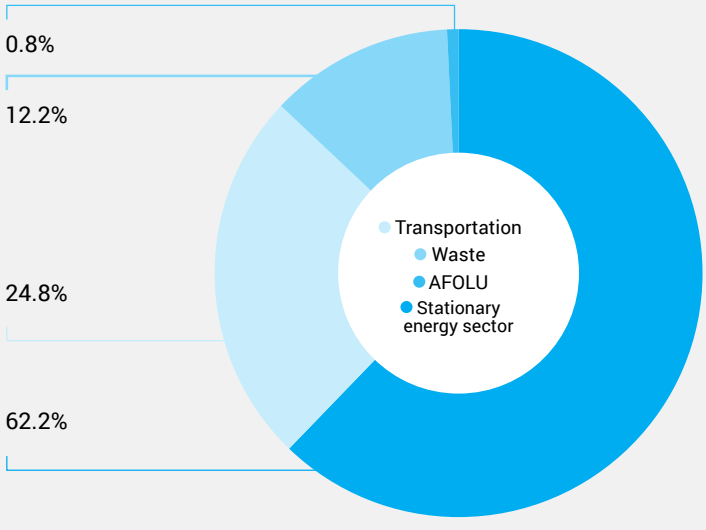
Temperature: More intense and more frequent high temperature extremes and longer duration of dry spells. Under a high-emissions scenario, temperatures are expected to rise by 3.7°C on average from 1981-2010 to 2071-2100. If emissions were to decrease rapidly, this rise could be limited to about 1°C on average.

Precipitation: Higher annual rainfalls and more frequent/ heavy rainfall events. Longer duration of dry periods. Under a high-emissions scenario, the total annual rainfall is expected to increase by about 13 per cent (about 125 mm) on average from 1981-2010 to 2071-2100. If emissions were to decrease rapidly, this rise could be limited to about 30mm on average.

According to a GEF-UNIDO-MoUD study (2017)[6], the GHG emissions in Guntur during 2015-16 were 1,122,848 Mt CO_2-eq, with total CO_2, CH_4 and N_2O of 977,232 Mt, 4,844 Mt, and 38 Mt, respectively, in the air. The annual GHG emissions per capita in 2015-16 was 1.44 Mt CO_2-eq.

As shown in Figure 2.1, the stationary energy sector/ energy use emitted 698,649 Mt of CO_2-eq (62 per cent of total emissions) during 2015-16 and is the largest contributor of GHG emissions. The transportation sector emitted 278,489 Mt of CO_2-eq (25 per cent) and is the second largest contributor, followed by the waste sector with 137,207 Mt CO_2-eq (12 per cent). The agriculture, forestry, and other land use (AFOLU) sector emitted 8,503 Mt CO_2-eq (1 per cent) during the period. In Guntur, no industry is classified under the industrial processes and product use (IPPU) sector. Hence, the emission of gases from the industrial sector was considered as zero. A few industrial activities in the city, such as road metal quarrying and stone crushing, cause only dust emissions.[7]

FIGURE 2.1 Sector-wise GHG emissions (Mt of CO_2-eq) in Guntur during 2015-16



Source: GEF-UNIDO-MoUD study (2017)

3 Amaravati: Building a Path Towards Climate Resilience. Report (May 2019) CEEW-UEA-Mott Macdonald.

4 Guntur is located about 35 kms from Amaravati.

5 Projections were made for two emissions scenarios (Representative Concentration Pathways [RCPs] – RCP 8.5: high end, business as usual scenario and RCP 2.5: low end, mitigation scenario), which span the range considered in the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC).

6 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).

7 GEF-UNIDO-MoUD Project Completion Report (2017).

2.2 Sectoral Assessment

Guntur was assessed over the 12 USAF sectors – namely, public space, urban form and safety, housing and property, water, sanitation, solid waste management (SWM), clean energy, disaster management, environment, transport, social facilities and services, governance and data management, finance and economy.

Of the total 131 indicators across the 12 sectors, 98 indicators were collected for Guntur, constituting 75 per cent of all indicators. The percentage of indicators collected for each sector is shown in Figure 2.2. The USAF assessment scored the city an overall "3", indicating medium performance. The score for each sector is shown in Figure 2.2. Environment and ecology, governance and data management, finance and economy, and SWM were the top performing sectors in Guntur city, while transportation, urban form, public space and safety, housing and property, were the lowest performing sectors.[8]

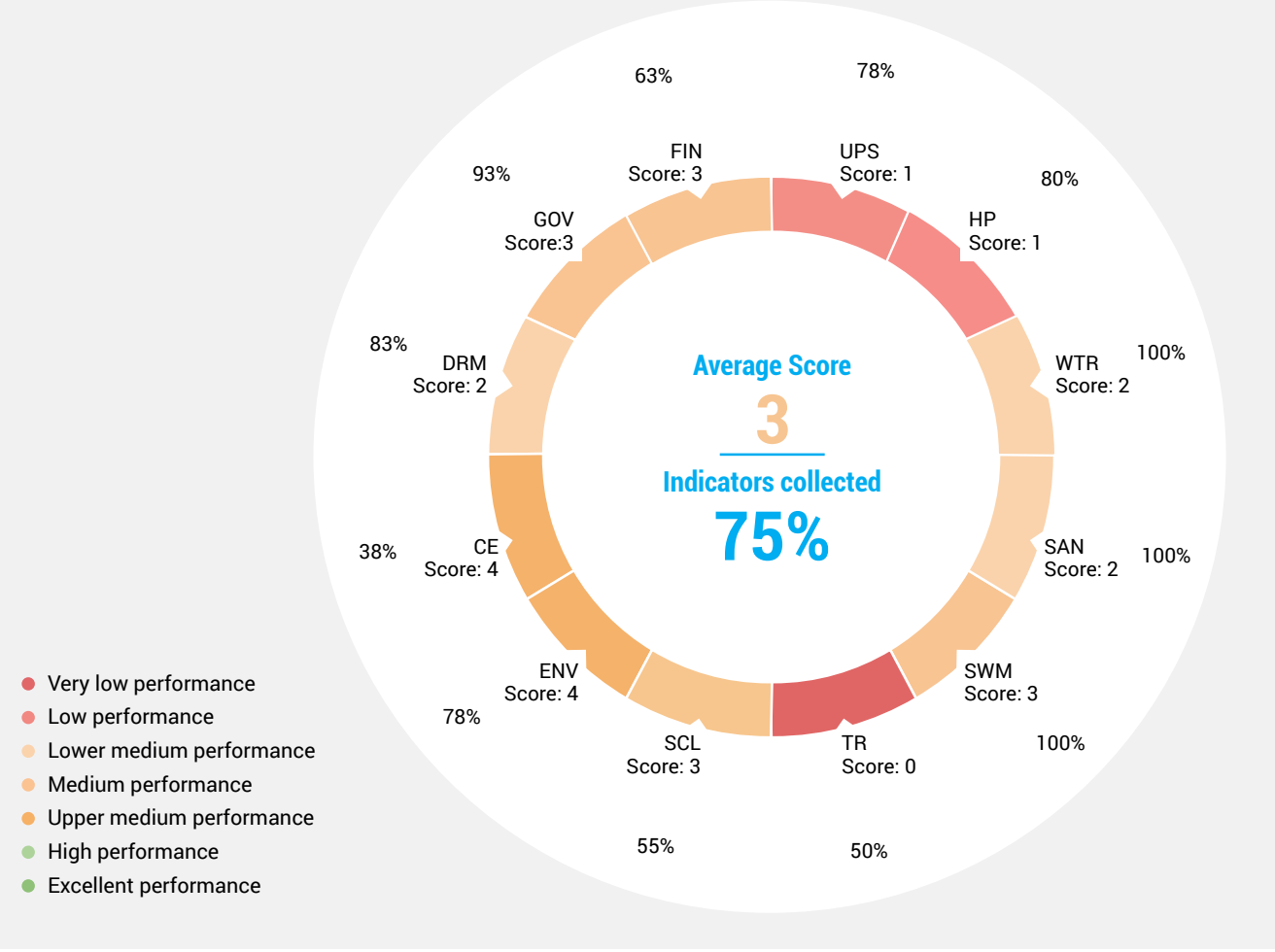
For the sector-wise indicator performance, refer to the Guntur USIR, and for the detailed, sector-wise inferences refer to the section on sectoral context (Chapter 4.4) of the Guntur City Profile and Diagnostic Report.

2.3 Key Issues Diagnosed

The city diagnostic study of Guntur has identified the following key spatial aspects, which are significant for identifying strategic issues and as well for developing sustainable city strategies.

Core city area: About 80 per cent of the city's households and population live within a 5-km radius of the city centre, or the 'Market Centre' near the Guntur Municipal Corporation (GMC) office on Grand Trunk Road. Most government offices, educational institutions, hospitals,

FIGURE 2.2 Average score, performance and percentage of indicators collected for the 12 USAF sectors



Source: UN-Habitat

8 The clean energy sector has not been considered among the top performing sectors in Guntur, since less than 50 per cent of the indicators were collected for it.

public transport hubs (bus terminals and railway stations), public parks, playgrounds, wholesale markets, cinema halls and theatres are within a 1.5-km radius of the city centre.

City suburbs: In 2012, 10 neighbouring villages, predominantly under agricultural land use, were added to GMC's jurisdiction, increasing the city limits to 128 sq. km. (12,800 Ha) from 45.71 sq. km. (4,571 Ha). These areas were underserved by basic infrastructure and civic services, such as water supply, sewerage network, stormwater drainage, roads, and parks.

Population density: The city's average population density in 2018 was 64 PPH.[9] The same usually varies between 9–344 PPH, with inner city precincts exhibiting a high density of 300–344 PPH and merged villages showing a density of 9 - 75 PPH. Areas with densities above 150 PPH occupy about 15 per cent (18.52 sq. km.) of the city's total area.

Proposed and existing land use: The Zonal Development Plan (ZDP) for Guntur and its surrounding zones (partly falling within the current GMC boundary) was prepared in 2006 for the horizon year 2021. The ZDP's proposed land use emphasized residential and industrial development in the city. Based on the existing land use draft (2017)[10] of Guntur, agriculture was the predominant land use, covering 55 per cent of the total area. Today, the city's urban growth has fallen short of the rate estimated by the ZDP. The proposed land use (2021) in comparison to the latest land use (2017) shows large sections of the city still under agricultural use or lying vacant, especially to the East and West, which had been proposed for residential and industrial use. For more details on these aspects, see Chapter 4 (Existing Urban Analysis) of the Guntur City Profile and Diagnostic Report.

From the three lowest performing USAF sectors in the city, four strategic issues were identified using the lowest performing indicators within their respective sectors (refer to Chapter 4.4 of the Guntur City Profile and Diagnostic Report). An inter-sectoral linkage was complemented by consultations with city officials to arrive at the following strategic issues:

- Inadequate public open spaces and conservation of water bodies.
- Sprawling and scattered development patterns.
- Poor/ unorganized public transport and non-motorized transport (NMT) infrastructure.
- Multiple deprivations in informal settlements.

The key concerns identified in each strategic issue are summarized below. For an in-depth analysis of the strategic issues, see Chapter 5, Strategic Diagnosis, in the Guntur City Profile and Diagnostic Report.

Inadequate public open spaces and conservation of water bodies

Guntur scored 'very low' in three indicators for the Urban Form Public Space and Safety sector that measured the accessibility and service level of public open spaces in the city.[11]

All the organized public open spaces in the city are within former municipal limits and the areas added to the city limits in 2012 have no provisions for organized public open spaces. Barring two parks, Manasasarovaram Park (22.25 Ha) and Gandhi Park (2.52 Ha), which constitute 85 per cent of the total park area, none of the other parks are of an area suitable for a community park (1–5 Ha) or neighbourhood park (0.5–1 Ha) as per URDPFI guidelines and AMRUT's Service Level Improvement Plan (SLIP) for green spaces and parks.[12] Further, the area percentage allocated for recreational use in the proposed land use for Guntur Zone for horizon year 2021 is only 0.92 per cent, which is far below the standard 12–14 per cent (for large cities[13]) of developable area for recreational use as per URDPFI guidelines.

45%

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

0.92 sq.m.

Open space recreational, organized green, 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)

9 Based on spatial analysis of World Pop 2020 open spatial demographic data sets.

10 While the jurisdiction area of GMC is 128 sq. km., the draft land use plan was prepared for a 174-sq. km. extent.

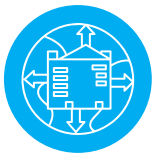
11 Open spaces generally serve the function of recreation (e.g., gardens and parks, community gardens, corridor links, amenity spaces, community use facilities, civic commons, or squares, which are for playing, socializing, exercising or celebrating) or sports (e.g., public playgrounds for formal structured sporting activities, such as team competitions, physical skill development and training); City-Wide Public Space Strategies: A Guidebook for City Leaders (2020), UN-Habitat.

12 AMRUT's SLIP template for green spaces and parks recommend ULBs to analyse their area proportion categorized for parks into five segments as per URDPFI guidelines, such as housing area parks (less than 0.5 Ha), neighbourhood parks (0.5–1.0 Ha), community parks (1–5 Ha), district parks (5–25 Ha), and sub-city parks (25 Ha and above).

13 URDPFI classifies a 'large city' as an urban settlement with a population of 5–10 lakh, governed by a Municipal Corporation (UDPFRI Vol I, p. 4).

The word 'Guntur' in Telugu translates into 'the village of tanks', referring to the many ponds dotting throughout the city. They are important elements of the city's historical, natural, and cultural ecosystems. According to GMC (2020), the city has about 50 ponds (as per revenue records) admeasuring 418.65 Ha and constituting 3.3 per cent of the total city area. Five of these have been regenerated as public open spaces and 41 have been encroached by urbanization, translating into approximately 30 per cent of the area under water bodies. Water body conservation buffer zones in the form of greenery, recreational areas and roads have been developed for some ponds. For a few others, especially in peripheral areas, only bunds/ embankments have been constructed. Almost all the ponds are disconnected from their original inflow sources and now rainwater is their only water source.

It was learnt that the ground water in the region is over-exploited. Guntur district falls among the 256 water-stressed districts in India selected by the Jal Shakti Abhiyan mission, a time-bound programme launched in 2019 for water conservation and water resource management.[14]



Sprawling and scattered development patterns

The Zonal Development Plan 2021 (ZDP 2021) proposed converting around 53 per cent of the agriculture land in the city (as of 2004) to various developable uses (USAF UPS 1.3). However, urban development in the city has not kept up the extent anticipated in the ZDP. Significant areas, especially to the East and West of the city, proposed for conversion from agriculture to various developable uses are still under agricultural use or lying vacant.

Between 2000 and 2018, there was no change in per capita built-up area in the city (USAF UPS 1.2) indicating that it had seen more spatial growth than population growth during the period. Factors such as merging neighbouring villages into municipal limits in 2012, the formation of Andhra Pradesh as a separate state in 2014, and the declaration of Amaravati as the new state capital in 2015, have significantly driven up the city's built-up area. Urban growth has spread out in all directions, away from the city core, largely in a scattered manner towards the northern micro-markets.

Large scale construction of high-rise buildings by private developers have come up in areas mainly covered by agricultural land, lacking adequate civic amenities such as water supply, sewerage network, public transport, organized parks, and open spaces. Similar growth has also taken place along the major road corridors towards the city's peripheral areas, forming an undesirable sprawling/ ribbon development. This sprawling and scattered development in the peripheral zone has led to significant conversion of agricultural land to vacant, residential, and other developable uses, with unequal access to existing facilities and services. This development trend has also seen significant increase in GMC's service area as well as to an increase in public commuting time to access various other services and facilities, causing more GHG emissions.

The new housing colonies proposed for construction in the peripheral zone and the city outskirts for housing the urban poor may further contribute to the urban sprawl and other associated impacts.

Poor/Unorganized public transport and NMT infrastructure

Public transportation is an essential component for building sustainable cities. Guntur does not have a formal public transport system and the city bus services are operated by both private and state government agencies with limited-service areas and supporting infrastructure, such as bus stops and public information system. Only 42 per cent of the city's population has access to public transport (bus stop) within 500 m. of their homes (USAF TR 6.1), while peripheral areas and neighbourhoods away from major roads have limited or no access to it. In the absence of organized public transport, the city is dependent on personal motor vehicles and shared auto-rickshaws. As of 2017, about 98 per cent of the total vehicles in the city were motor vehicles with motorcycles and auto-rickshaws driving 57 per cent and 29 per cent, respectively, of the total vehicular population. Most of the motor vehicles in the city run on fossil fuel, thus significantly contributing to air pollution. During 2015-16, emissions from the city's transportation sector stood at 2,78,489 Mt CO_2-eq, which constituted 24.8 per cent of the city's total emissions (USAF TR 8.9).[15]

NMT plays a crucial role as a mode for last-mile connectivity. As mentioned earlier, most of Guntur's government offices, public transportation nodes, commercial and recreation areas lie within 1.5 km of the city centre and 80 per cent of its population resides within 5 km of the city centre. These distances can be suitably covered on foot or by NMT. However, the city's existing

14 Districts with critical or over-exploited groundwater levels as per the Central Ground Water Board (CGWB), 2017.

15 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).

infrastructure supporting NMT is insufficient. Only a 9-km stretch of the main roads (13 per cent) have footpaths on either side wider than 1.2 m. (USAF TR 6.3) and it does not have dedicated cycle paths/ bike lanes (USAF TR 6.2). Most of the Ring Road and a few other roads have footpaths on one side, which are largely unutilized, lack maintenance, and are occupied by street hawkers and shops. Though sufficient road width is available along many stretches, the roads are unsafe for pedestrians and cyclists due to on-street vehicular parking, encroachment by street hawkers and absence of supporting infrastructure.

As Guntur is projected to become a city with a million-plus population in the next four or five years, immediate action on addressing the challenges of public transportation and NMT infrastructure assumes high priority.

Multiple deprivations in informal settlements

Further intensifying the issues discussed above on Guntur's unsustainable growth, 28 per cent of households reside in 173 informal settlements (USAF HP 2.1). All the slums are located within former city limits, constituting about 13.5 per cent of the former city area (5 per cent of current GMC jurisdiction) (USAF HP 2.2). Based on secondary data and a GIS database provided by GMC, a scoring-based assessment methodology was developed to assess the deprivations in slums for various parameters as shown in Table 2.1. The scores were assigned such that slums with low scores had more deficiencies and vice versa. The maximum score that could be assigned to a slum was '15'.

From the slum deprivation assessment study, it was found that 40 slums scored between '12' and '14' (23 per cent). About 106 slums (61 per cent) scored between '9' and '11', indicating that they lacked two or three aspects/ facilities. Provision of inadequate/ non-existent facilities could improve the living conditions of these settlements. Twenty-one slums (12 per cent) scored between '7' and '8', indicating multiple deficiencies. Six slums (three per cent) obtained the lowest score of '6', showing serious lack of facilities.

The city's informal settlements are densely populated with an average density of 305 PPH, while that in 25 slums is more than 500 PPH. Only less than one-fourth of the total slum dwelling units have access to organized open spaces and public transport (bus stops) within 500 m. In 50 per cent of the settlements, the dwellers have no rights to the land. These include all the 40 non-notified slums. About 53 per cent are on private land and 38 per cent are located on government land, including municipal land. In eight per cent of the slums, more than 10 dwelling units fall within the railway line or water body buffer zones.[16]

As per GMC records, there are no slums in the 10 villages merged into the city in 2012. These areas are currently experiencing or are characterized by urban growth mostly around transit corridors, large vacant lands, and proposed housing colonies for the homeless urban poor. These areas are also under-serviced by water supply, sewerage, and drainage services. Further, the ZDP 2021 had proposed the North, North-East and West of the city for developable uses, which might trigger the formation of new slums in the merged areas of the city. Hence, there is an immediate need for interventions to prevent the formation of any new informal settlements.

TABLE 2.1 Parameter-wise scoring criteria to assess the deprivations in informal settlements[17]

Parameter	Assigned Score		
	0	1	2
Nature of Slum	Non-notified	-	Notified
Population Density (PPH)	>500	301-500	<300
Accessibility Score	<2	3	4 or 5
Water Supply	No	-	Yes
Streetlighting	No	-	Yes
Location Vulnerability	Within buffer limits	-	No vulnerability
Ownership of Land	Religious agencies/ Private land	Private & Government	Government
Land Tenure	Patta land	B-Forms / Partly B-Forms	No rights

Source: UN-Habitat

16 Buffer zones are considered in line with AP Building Rules 2017 – 2 m. buffer for canals/ drains; 9 m. from the FTL boundary of a pond with area less than 10 Ha and 30 m. for railway tracks.

17 Methodology source: UN-Habitat; Data source: GMC

Amaravati Road

3 STRATEGIC RESPONSES

3.1 Core Planning Principles

In response to the challenges summarized above, the following key urban planning principles have been adopted, underpinning the strategic responses to the challenges and the proposed interventions.[18] These planning principles shall be considered and integrated into the Guntur masterplan (currently under revision), and other relevant plans and reports.

3.1.1 Principle 1: Low carbon development

Low carbon development is crucial to achieve green growth, reduce dependency on fossil fuels, and for efforts to mitigate climate change. Low carbon development concepts take a 'development first' approach over a 'climate first' approach and rethink development planning by proposing structural, policy solutions (such as alternative infrastructure, renewable energy dependency and spatial planning) with lower emission trajectories.[19] It focuses on addressing and integrating climate change with development objectives. In practice, the low carbon strategies and actions are tailored to local needs. The plans and designs are often combinations of new and existing elements, combined in a new way to address the intended development objectives along with the need to slow climate change and prepare for its impacts.[20]

3.1.2 Principle 2: Polycentric urban structure

A polycentric urban structure promotes distribution of economic, social, and administrative/ institutional functions across an urban area in contrast to a monocentric urban structure where all such activities are concentrated in the city core. The distribution of urban functions either as agglomerations of one type of use or a combination of uses provides many benefits in urban management, especially in cities with growth in both population and land area. Polycentric areas, both large and small, high-density areas offer best benefits if they can support essential facilities, provide public transport, foster lower car-dependence, and encourage productivity.[21]

3.1.3 Principle 3: Urban regeneration

Urban regeneration is a principle that responds to areas of a city that are in disrepair. Even small sites under disrepair may have exponential and wider scale negative impacts, which can be either spatial or non-spatial, such as employment, safety and social cohesion, among others. Urban regeneration helps to address the challenges of rising demand for land, particularly pockets of underused or disinvested land. It advocates turning around disinvested neighbourhoods to areas with uses or activities that help lower carbon emissions, reduce pollution, and contribute to increased resilience.[22]

3.1.4 Principle 4: Sponge city

The concept of 'sponge city' is an approach to manage flooding, water conservation, water quality improvement, natural ecosystem protection, reduce urban heat island effect and enhance the amenity value. The sponge cities concept proposes ecologically suitable alternatives to transform natural resources, urban green areas and urban infrastructures into green infrastructures that can capture, control and reuse rainwater in a useful and ecologically efficient manner.[23] The ongoing national programme, Jal Jeevan Mission (Urban) promotes 'sponge cities' for integrated urban water management.

In alignment with these key planning principles, and in response to the challenges found through the Guntur City Profile and Diagnostic Report, the following sections outline four strategic responses, with each proposing specific spatial or policy-based interventions.

3.2 Strategic Response 1: Sustainable Conservation and Development of Blue-Green Assets

The aim of this strategy is to guide optimum, efficient and sustainable use of the city's existing underutilized natural assets (water bodies) and resources (vacant

18 See Guntur City Profile and Diagnostic Report for detailed information on identified strategic issues.

19 UN SDG Knowledge Platform – Low Carbon Development; https://sustainabledevelopment.un.org/index.php?menu=1448 (accessed on 1 December 2021).

20 https://sustainabledevelopment.un.org/index.php?menu=1448 (accessed on 1 December 2021).

21 UN-Habitat. The Economics of Urban Form: A Literature Review; https://unhabitat.org/sites/default/files/download-manager-files/The%20Economics%20of%20Urban%20Form.pdf (accessed on 17 January 2022).

22 Sameh Wahba, Valerie-Joy Santos and Rodica Tomescu-olariu (10 May 2019). Urban regeneration – a catalyst for inclusive and sustainable cities. World Bank Blogs. https://blogs.worldbank.org/sustainablecities/urban-regeneration-catalyst-inclusive-and-sustainable-cities#comments (accessed on 17 January 2022).

23 UN Environment (January 2018). Early Warning, Emerging Issues and Futures: Emerging Sponge Cities. Foresight Brief; https://environmentlive.unep.org/media/docs/early_warning/foresight_brief_005.pdf (accessed on 1 December 2021).

land parcels), and to address its various challenges. The interventions proposed by this strategic response would primarily address the issues of inadequate public spaces, and conservation of water bodies. They would also address concerns of sprawling and scattered urban development, and the multiple deprivations of the city's informal settlements. The planning principle of 'Sponge Cities' has been adapted for developing one of the proposed interventions under this strategic response.

3.2.1 Proposed interventions within the strategic response

Five interventions are proposed under the strategic response for sustainable conservation and development of blue-green assets. These interventions are detailed as follows:

Intervention 1.1: Promoting public amenities on under-utilized vacant land

According to the existing land use map prepared for the Guntur Planning Zone[24] in 2017, approximately 10 per cent (12.8 sq. km.) of the GMC area[25] is vacant land. Earlier under agriculture use, these areas are proposed for residential and other developable uses by the ZDP 2021. As shown in Map 3.1, vacant land parcels can be found across the city with most of them located in the newly merged city areas. Vacant lands provide an opportunity to the city to address challenges such as inadequate green spaces and insufficient vehicular parking spaces, among others.

Aspects considered for formulating the intervention

- Presence of large extents of vacant land parcels in the city.
- Existing City problems including - inadequate public parks, recreational areas, vehicular parking, etc.
- City's vulnerability to heatwaves.
- Women WPR in the city (Census 2011) is only 25 per cent – far less than district and state average.
- Guntur is a major agricultural produce trade centre in the region.
- High proportion of urban poor population in the city.

The proposed intervention involves the GMC leasing the city's vacant land parcels from interested landowners, institutions, and other agencies to utilize them for various temporary uses. Such uses would primarily involve women self-help groups (SHGs) and the unemployed urban poor. Utilizing vacant land for urban agriculture would provide easy access to Guntur's agri-trading centre, which is the largest in the region. The Guntur district agriculture and horticulture departments can also provide necessary training. If required, GMC may integrate the groups involved in urban agriculture with existing *rythu bazaars*[26] to market the end produce.

Potential activities that can be taken up within vacant land parcels would depend on factors such as location, usability, availability of resources in the vicinity, duration of lease, and others. Vacant lands in predominantly commercial areas, along major road corridors, could be used for vehicular parking to decongest the streets and earn revenues. Vacant sites with long lease durations could also be used for renewable energy generation in a sustainable manner. GMC could also promote facilities such as temporary mini-parks, open air gyms, walking tracks and other recreational uses in vacant land parcels. Local employment opportunities could be generated too, by involving women SHGs and the urban poor in operating and maintaining such facilities (see Table 3.1 for more options).

This initiative will benefit various stakeholders in multiple ways, as follows:

- Women SHGs and unemployed urban poor: Employment/ livelihood opportunities
- City and its citizens: Increased service availability, increased green cover, reduced GHG emissions, improved air quality, availability of fresh local produce
- Landowners: Incentives of tax reduction, and safety from encroachments on their vacant land parcels
- GMC: Preventing squatter colonies and new slums from forming on vacant lands; improving service coverage to citizens; creating livelihood opportunities for unemployed urban poor, increasing city GDP, etc.

24 The existing land use plan was prepared for a 174-sq. km. extent.

25 GMC's jurisdiction extends over 128 sq. km.

26 Rythu bazaars are vegetable markets and farmers' markets run by the GoAP for smallholder farmers.

MAP 3.1 Vacant land parcels in city (2017)

Data source: Existing land use map - AP CRDA (2017)

Map source: UN-Habitat

IMAGE 3.1 Large extent of continuous vacant land parcel in northern area of the city

Source: UN-Habitat

TABLE 3.1 Options for potential activities in vacant land parcels

Vacant land category	Potential use / activity	Description
Small to moderate sized land parcels scattered across neighbourhoods	Vehicular parking	Off-street paid vehicular parking facilities
	Urban farming	Cultivation of green leafy vegetables, other vegetables, flowers, and other agri-products.
	Open air gyms	Providing open air gym equipment and walking tracks for neighbourhoods.
	Mini parks	Passive parks and small playgrounds for neighbourhoods.
	Nurseries	Selling a wide range of plant material and seedlings to citizens.
	Mini playgrounds	Small playgrounds with fencing nets for playing sports like tennis, badminton, volleyball, football, cricket, etc.
	Waste recycling and processing facilities	Material recovery facility (MRF), composting yard
Large land parcels in peripheral areas	Urban farming	Large scale agricultural activity with focus on commercial crops for more returns.
	Renewable energy	Renewable energy generation such as solar, wind, and others.

Source: UN-Habitat

IMAGE 3.2 A mini-play area at MG Inner Ring Road

Source: UN-Habitat

Effective implementation and monitoring are critical for undertaking this intervention. The key steps and departments responsible for executing the intervention are presented below:

1. Identifying, mapping of vacant land parcels; publishing list of identified vacant lands in GMC's website, office.

   Department responsible: Revenue Section, GMC; Mandal Revenue Office

2. Undertaking IEC activities with landowners, institutions, real estate agencies, other concerned groups. Communication with interested landowners, institutions.

   Department responsible: Town Planning Section, GMC

3. Executing lease agreements with interested landowners, institutions.

   Department responsible: Revenue Section, GMC

4. Preparing plan with list of activities to be conducted on vacant land parcels.

   Department responsible: Town Planning and Engineering Sections, GMC

5. Identifying eligible, relevant Women SHGs and unemployed urban poor groups to operate and maintain the land parcels for proposed/ approved activity/s.

   Department responsible: Urban Poverty Alleviation, GMC

6. Assistance in providing technical, capacity building support to the involved groups.

   Department responsible: Urban Poverty Alleviation, GMC

7. Monitoring overall implementation aspects of the intervention.

   Department responsible: Town Planning and Engineering Sections, GMC

CASE STUDIES

Pune: Community farming – placemaking

Under the Smart City Mission's area-based development component, the Pune Municipal Corporation has taken up 'place making' initiatives to transform dilapidated, limited use vacant sites in Wadgaonsheri and Bibwewadi into active areas through public participation. The project also involves urban farming and organic farming where citizens participate in cultivating the land.

Source: https://punesmartcity.in/project/community-farming-placemaking/

Quito, Ecuador: Integrating urban agriculture in land use plan

Urban agriculture was included in Quito's land use plan through a consultative process under a 'use of urban soil' initiative under the General Plan for Municipal Land Development 2000-2010, thus legitimizing it as an activity within city limits.

Source: https://www.fao.org/3/i3021e/i3021e.pdf

Rosario, Argentina: Provision of incentives, training for promoting urban agriculture

The Municipality of Rosario has created a participatory budgeting head in its budget framework for providing economic support to improve and provide inputs for urban agriculture. These include provisions for seeds, equipment, and training, in association with Argentina's National Agricultural Technology Institute. Tax reduction was also provided to landowners in the municipality who leased their plots to urban producers or used them for agricultural activities.

Source: https://www.fao.org/ag/agp/greenercities/en/ggclac/rosario.html

San Diego: The Urban Agriculture Incentive Zone

Property owners in the city of San Diego, who use or lease their vacant property for small-scale agricultural production for a minimum of five years, may be eligible for a property tax reduction through a lower land assessment value. Such land parcels must be vacant or unimproved and must meet the standards of the State Code and the City of San Diego ordinance.

Source: https://www.sandiego.gov/economic-development/business/starting/urban-agriculture

Intervention 1.2: Re-developing water bodies (ponds) as new recreational areas

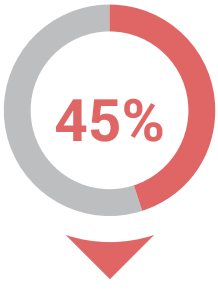
In 2020, about 45 per cent of the city's population lived within 500 m. of an organized park or open space. These spaces in Guntur include five water bodies with waterfront development (embankment/ bund), open air gyms and other community facilities. In 2021, GMC approved an action plan for developing four new neighbourhood parks[27] and five water bodies (including three with developed waterfronts and two new ones). This still leaves the North, North-East, North-West, and southern peripheral areas with limited or no access to organized parks or open spaces (see Map 3.2).

The proposed intervention involves developing five water bodies in the city as recreational areas (see Table 3.2 and Map 3.2). These water bodies are in the areas with less or no access to organized, open public spaces. Going forward, the city's population percentage with access to open spaces will gradually increase, since the water bodies proposed for development lie in areas experiencing growth, with their vicinities proposed for residential and other developable uses in ZDP 2021.

27 The four new neighbourhood parks have been proposed in Shantinagar, Postal Colony, RTC Colony and Etukuru.

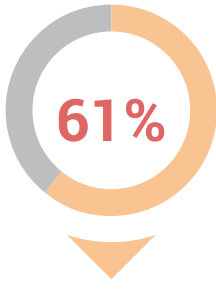
IMAGE 3.3 View of Gorantla Cheruvu – an ill maintained water body with no designated buffer zone

Source: UN-Habitat

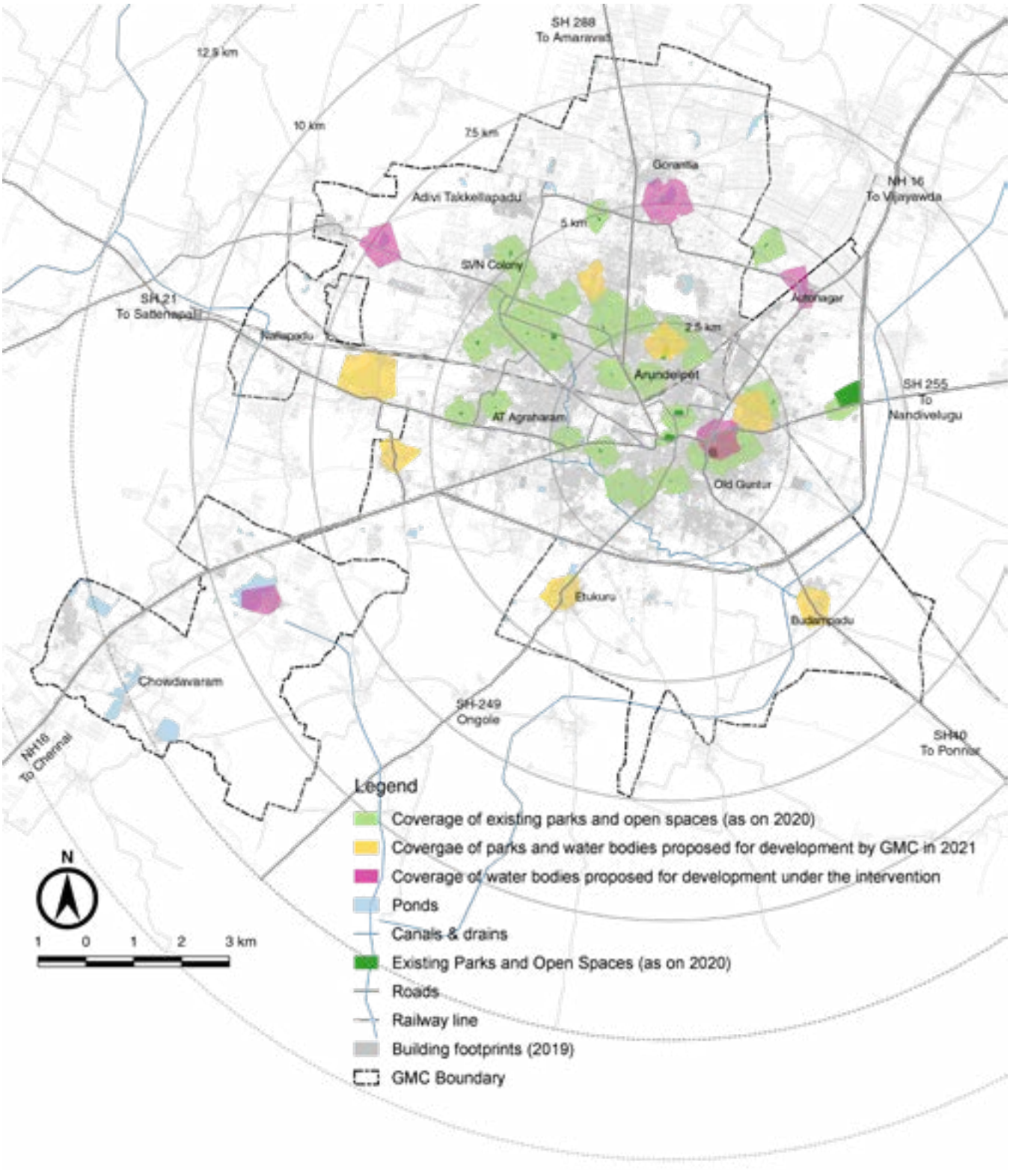


City's population percentage currently residing within 500 m. of an organized open space.

Population percentage living within 500 m. of an organized open space after the GMC-proposed open spaces are developed (3 water bodies and 4 parks).



Percentage of population living within 500 m. of an organized open space after the GMC-proposed open spaces and 5 water bodies are developed under the current intervention.



MAP 3.2 Coverage of existing and proposed organized open spaces by GMC in the city, as well as water bodies proposed for development as recreational areas under the intervention

Source: UN-Habitat

TABLE 3.2 List of water bodies developed and proposed for development by GMC as well as under the intervention

Category	Water body
Water bodies with waterfronts already developed by GMC	1) Koritepadu Cheruvu
	2) Gujjanagundla Cheruvu
	3) Brindavan Gardens Pond
	4) Chuttugunta Cheruvu
	5) Nallcheruvu
Water bodies proposed for development by GMC	6) Ankireddypalem Cheruvu
	7) Nallapadu Cheruvu
	8) Budampadu Cheruvu
Water bodies proposed for development as new recreational areas	9) Gorantla Cheruvu
	10) Gaddipadu Cheruvu
	11) Pothuru Cheruvu
	12) Chakali Cheruvu
	13) Pedapalakaluru Cheruvu

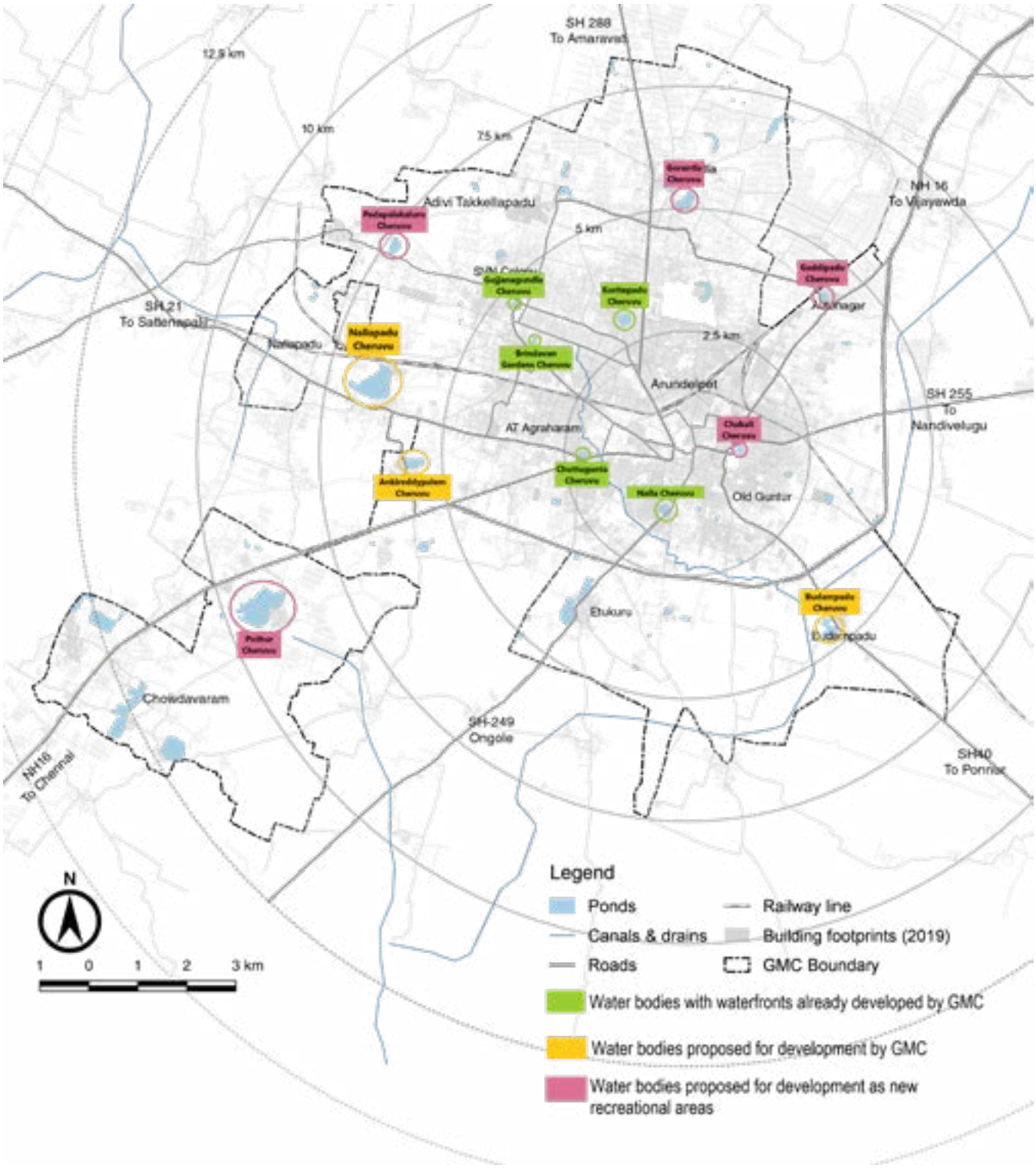
Source: GMC (2021), UN-Habitat

IMAGE 3.4 Gaddipadu Cheruvu – an unprotected water body along the Mahatma Gandhi Inner Ring Road near the railway crossing

Source: UN-Habitat

Aspects for identifying water bodies proposed for development as new recreational areas:

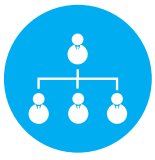
- Water bodies in areas with limited or no access to organized parks and open spaces.
- Ill maintained water bodies with no designated, developed buffer.
- Size of water body (Ha)
- Location of water body
- Existing road connectivity and proposed public transport connectivity.
- Proximity to proposed urban poor housing layouts (Pedalandariki illu colonies).



MAP 3.3 Location of water bodies developed and proposed for development by GMC as well as under the intervention

Source: UN-Habitat

Gender inclusive aspects such as ensuring visibility, provision of facilities for diverse age-gender, etc., shall be included while designing, developing open spaces. Refer to Annex 12 for Gender-inclusive development guidelines for public open spaces.



Intervention 1.3: Creating a hierarchy of organized public green spaces

The intervention is formulated in accordance with one of the reforms for green spaces and parks under the AMRUT mission, and in line with URDPFI's recommendation for organizing green spaces and parks in ULBs into five categories. In 2021, GMC initiated the redevelopment of the Manasasarovaram Park and Gandhi Park, the two largest parks in the city, as multi-utility recreational spaces. Accordingly, it approved the action plan to develop five water bodies with hardscape, softscape and recreational facilities. In addition, four locations were identified for developing new neighbourhood parks (see Annex 2 for the list of ongoing and proposed projects in the city). Considering GMC's ongoing and proposed initiatives to enhance urban greenery and the proposed Intervention 1.2 described earlier, this intervention proposes hierarchy of public green spaces. As shown in Table 3.3, the ongoing and proposed GMC initiatives have been categorized as per the norms of the AMRUT reforms for urban green spaces. The existing and proposed green areas developed/ to be developed by GMC fulfil the standard requirements of sub-city and district parks (see Table 3.3).

Currently, GMC is planning to develop four water bodies (excluding Nallapadu Cheruvu, which qualifies as a district park) and their buffer zones with recreational facilities. GMC shall provide the facilities required for a community park in these areas (see Annex 3 for facilities to be provided by the city's community parks). Four out of the five water bodies proposed for development as recreational areas in Intervention 1.2 shall also be developed as community parks (see Table 3.2). Large water bodies are also being considered as locations for community parks since substantial land used as protected buffer zones here could be utilized for providing facilities.

Aspects for identifying water bodies proposed for development as community parks include:

- Existing population density
- Location of water body
- Size of water body (Ha)

Further, GMC should consider providing a mini STP of capacity between 0.5–1.0 MLD (in accordance with the requirement) in each of the community parks. The recycled water can then be utilized as inflow for water bodies, watering plants, use in toilets, and other maintenance activities.

As shown in Table 3.3, the city should also develop neighbourhood parks. Pedapalakluru Cheruvu proposed to be developed as a recreational area under Intervention 1.2, for instance, will be developed as a neighbourhood park. Refer to Intervention 3.2 for developing green spaces in the city core. The revised master plan of Guntur shall emphasize the promotion of green spaces in the city.

TABLE 3.3 Proposed hierarchy of organized public green spaces in Guntur

Park category and area recommended	Population served per unit	Number of parks required in Guntur as per the standard	Number of existing parks in the city	Details of existing parks in the city	Number of parks required	Details of proposed parks in the city
Sub-City Park (25 Ha & above)	10 Lakh	1	1	Manasa sarovaram Park (22.25 Ha)	0	Not applicable
District Park (5–25 Ha)	5 Lakh	2	1	Gandhi Park (2.53 Ha)	1	Nallapadu Cheruvu (development proposed by GMC)
Community Park (1–5 Ha)	1 Lakh	8	0	NA	8	Koritepadu Cheruvu, Nalla Cheruvu, Ankireddypalem Cheruvu, Budampadu Cheruvu (proposed for development by GMC)
						Gorantla Cheruvu, Gaddipadu Cheruvu, Pothuru Cheruvu, Chakali Cheruvu (proposed for development in Intervention 1.2)
Neighbourhood Park (0.5–1 Ha)	15,000	55	28	(25 existing Parks (0.10 – 0.49 Ha) + 3 walking tracks (Gujjanagundla Cheruvu, Brindavan gardens Cheruvu, Chuttugunta Cheruvu)	27	Shantinagar, Postal Colony, RTC Colony and Etukuru areas (new parks proposed for development by GMC)
						Pedapalakluru Cheruvu (development proposed in Intervention 1.2) + parks in a few locations of reclaimed slum pockets (see Intervention 2 of Strategy 3).
Housing Area Park (less than 0.5 Ha)	5,000	Not assessed (5% area is mandatorily reserved in group housing layouts for landscaping)				

Note: The population of Guntur has been considered as 8.25 lakh; Data source: GMC (2021), AMRUT's SLIP template for green spaces Analysis/ recommendation.

Source: UN-Habitat

IMAGE 3.5 View of Chakali Cheruvu – an ill maintained water body in the old city area

Source: UN-Habitat

ALIGNMENT WITH NATIONAL PROGRAMMES

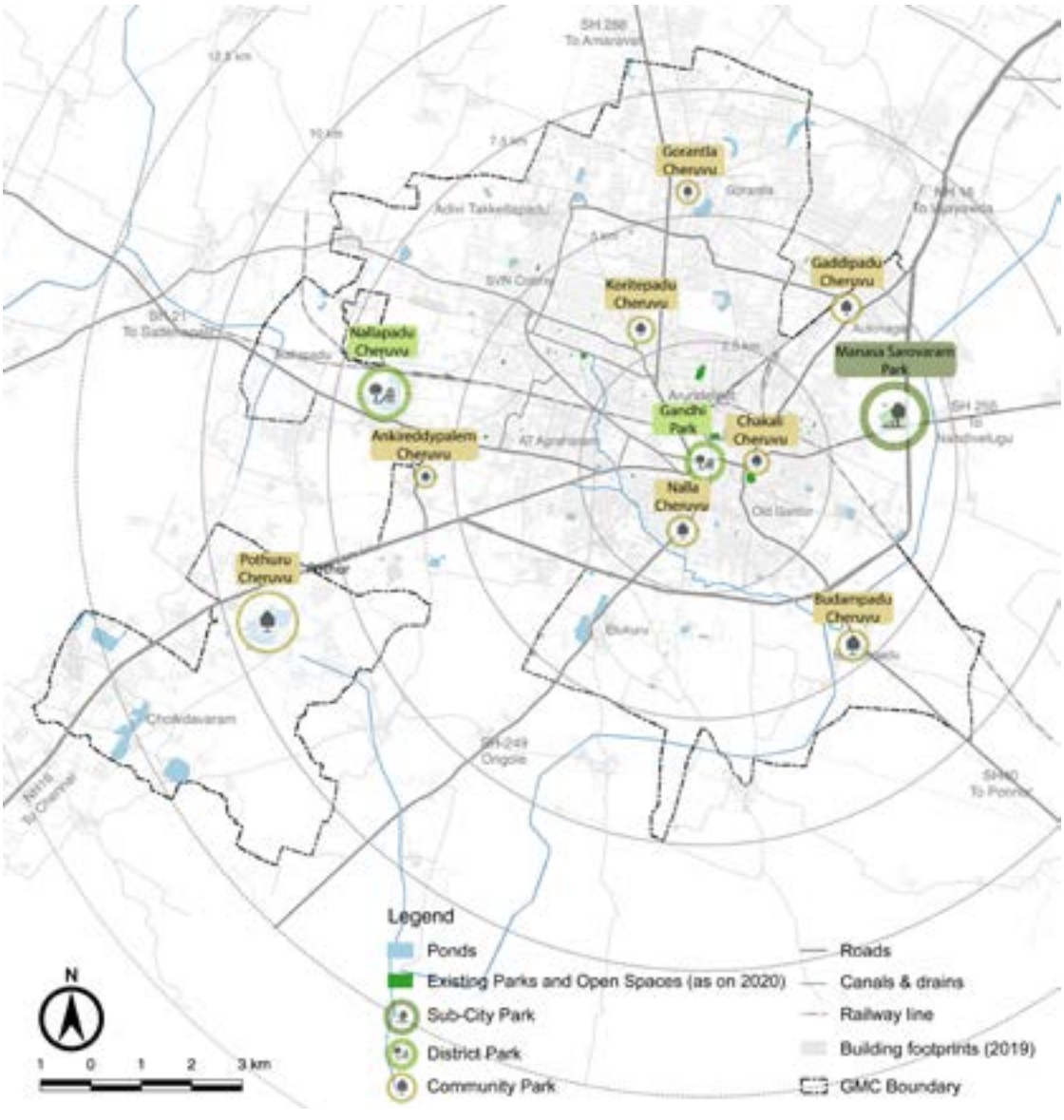
Proposed actions aligning with objectives of SBM U 2.0:

- Provision of mini STP to treat inflow into water body – at each proposed community park for treatment of used water coming from surrounding domestic, commercial and other establishments.
- Use of recycled water for water body rejuvenation – inflow into water body, watering plants, use in toilets, other maintenance activities.
- Construction of community toilets in 4 community parks.

Projects undertaken under SBM U 2.0 shall be planned in a manner that the envisioned Mission objective of no untreated used water discharged into water bodies are met in totality (Section 7.6.2 of SBM U 2.0 Operational Guidelines Document, October 2021).

Proposed actions aligning with objectives of AMRUT 2.0:

- Development of community green spaces linked to a clean water body.
- Provision of STP to treat inflow into water body.
- Strengthening/ rejuvenation of aquifers/ community wells.
- Harvesting rainwater through storm water drains into water body.



MAP 3.4 Location of open spaces in the city proposed to be developed as sub-city parks, district parks and community parks

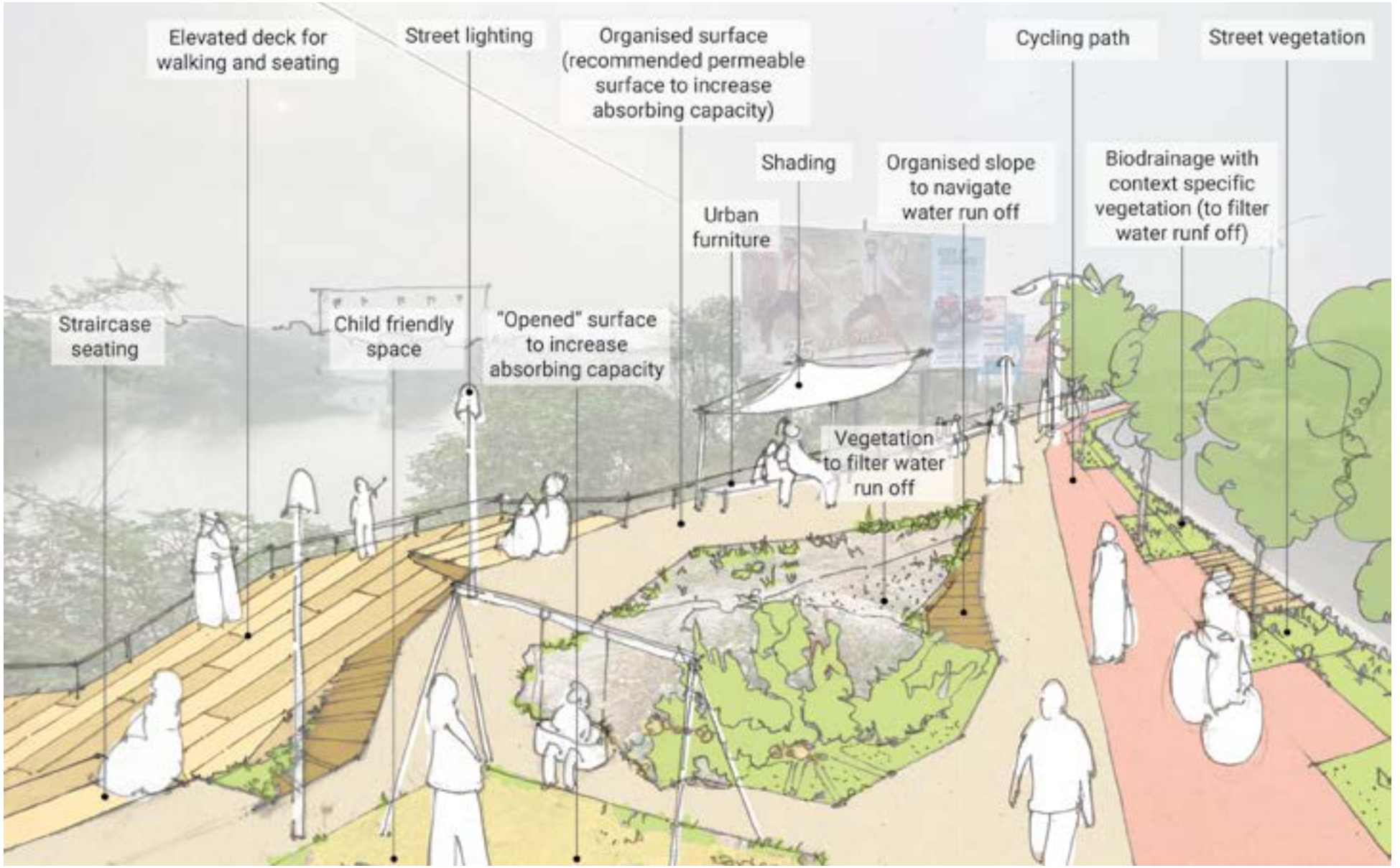
Source: UN-Habitat

It is recommended that the waterfront development plan be developed by collecting and assessing public space usage and behaviour data, disaggregated by gender, age, income (and religion, where relevant). Refer to Annex 13 for gender-inclusive waterfront development guidelines.

IMAGE 3.6 Existing View of Gaddipadu Cheruvu Bund

Source: UN-Habitat

FIGURE 3.1 Conceptual view of Gaddipadu Cheruvu: Various elements included in the Bund Area of the Pond



Source: UN-Habitat

Intervention 1.4: Protection and restoration of water bodies

This intervention addresses the issues of encroachment of water bodies and depletion of ground water levels in the city, which require immediate attention. The recommendation is to protect approximately 37 ponds (other than those proposed for development as new recreational areas and parks) and water channels, canals, and major storm water drains by creating conservation buffers in accordance with Andhra Pradesh Building Rules 2017 (see Annex 4) and restore them to act as sponges. Restoring and maintaining the water bodies by adopting the 'Sponge City' concept will help to recharge ground water, reduce flooding and urban heat islands, increase the holding capacity of water bodies and protect the city's ecological systems. The Jal Jeevan Mission (Urban)/ AMRUT 2.0 programmes launched by the Central Government in 2021 also emphasizes this concept to promote the circular economy of water – recycle/ reuse of treated sewage, rejuvenation of water bodies and water conservation.

A pilot intervention is detailed below with various technical aspects involved in restoring a water body (pond). The recommended key actions to protect the city's water bodies include:

Key agencies responsible: Mandal Revenue Office, Irrigation Department, GMC Town Planning Section	1 Undertake ground survey to define survey numbers of all water bodies within GMC limits. 2 Remove encroachments and define buffer area for every water body as per AP Building Rules 2017.
Key agencies responsible: GMC Administration, Accounts Section; GMC Council	3 Develop maintenance and long-term finance strategy. Create a budget allocation head in municipal budget.
Key agencies responsible: GMC town planning section, engineering section, horticulture wing, local communities, NGOs, and other interested groups.	4 Undertake studies and prepare detailed technical designs, vegetation plans for every water body. 5 Create conservation buffer, fencing. Engage local communities in design, maintanance of buffer area and waterbody. 6 Implement technical interventions to restore and conserve water bodies.

Pilot Intervention

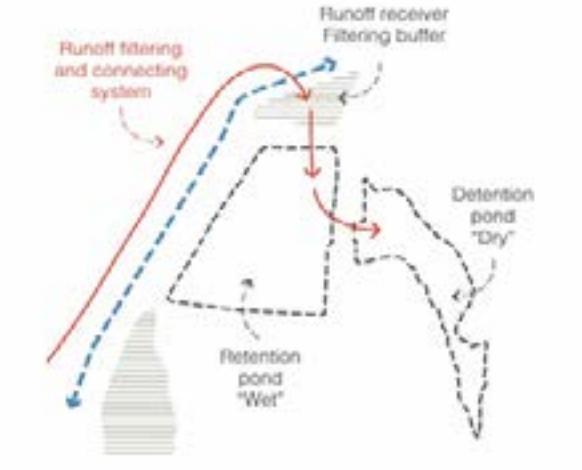
A water body (pond) at Adavitakkellapadu, behind Shilparamam, is proposed for development as a pilot project under the intervention.

Preliminary analysis has been undertaken to assess the existing condition of the water body and activities proposed in accordance with the sponge city concept.

IMAGE 3.7 View of water body (pond) in Adavitakkellapadu – identified for development as pilot intervention

Source: UN-Habitat

FIGURE 3.2 Assessing the current condition of the water body and its surroundings – satellite imagery of water body (left) and potential system connecting water bodies and filtration system (right)



Source: Google Earth imagery, dated 14 October 2021 (left); UN-Habitat analyis (right)

FIGURE 3.3 Proposed key steps (indicative) for protection and restoration of water bodies

1. Analyse existing systems and conditions

- Defining pond character – 'wet' and/or 'dry' water body and/or wetland – will define specific interventions applicable for each character.
- Defining the restoration strategy for the pond and its potential functionality (water harvesting reservoir, public space).
- Preparing the water body for technical interventions, such as cleaning up garbage from the pond and its adjacent areas to prevent water pollution.

2. Technical interventions

- Raising the bunds to prevent future encroachment and establishing proper water storage (for "wet" water bodies).
- Connecting water sources, as applicable, through landscaping, preservation of adjacent wetland to ensure filtration of runoff water.
- Planting trees of native species along bund to ensure increased green cover and shade (with context-specific vegetation).
- Removing invasive weeds.
- Connecting ponds/ canals, as applicable, for better storage capacity through filtration of wetlands.
- Installing water filtering structures and techniques prioritizing nature-based solutions such as small reed beds, infiltration strips, and swales.

3. Design and maintenance

- Defining buffer zone for protection and monitoring.
- Exploring potential design interventions and functions that promote the pond (e.g.: water body as public space) to inform/ plan future maintenance strategy (water control, cleaning, safety, etc.).
- Considering design interventions in line with sponge city concept such as rain gardens and permeable surfaces of sidewalks.
- Promoting community participation in maintaining water bodies.

Source: UN-Habitat

FIGURE 3.4 An indicative proposal with list of potential activities for restoration of water body (pond) in Adavitakkellapadu

Source: UN-Habitat

The restoration and protection of water bodies in Guntur could have several environmental benefits including improved biodiversity, clean and recharged water bodies, as well as new, well-designed public spaces. Potential social and economic benefits include increase in community engagement, collaboration, improved urban environment and aesthetics.

ALIGNMENT WITH NATIONAL PROGRAMMES

Proposed actions aligning with objectives of SBM U 2.0:

- Rejuvenation of water bodies by desilting (includes clearing garbage and measures to stop accumulation of garbage)
- Diverting polluting drains away from the water body.
- Creating/ strengthening storm water drains around the water body.

Proposed actions aligning with objectives of AMRUT 2.0:

- Rejuvenation of water bodies to augment water and enhance amenity value and development of green space.

CASE STUDIES

Restoration of Dharma Cheruvu, Nunna, Andhra Pradesh

The Dharma Cheruvu is a mid-sized lake in Nunna, a suburban neighbourhood of Vijayawada. With garbage dumping, invasive plants and shallow water holding capacity, the lake was fast losing its water holding characteristics. Various measures were undertaken between March and August 2021 to restore it, such as removing solid waste and weeds, desilting, constructing dual embankments, creating baby pond, fencing, and planting native tree species.

Dharma Cheruvu – Before (left) and after (right)
Source: https://efiblog.org/2021/09/20/the-nunna-regions-water-story-dharma-cheruvu/

Rejuvenation of an urban water body in Tiruppur, Tamil Nadu

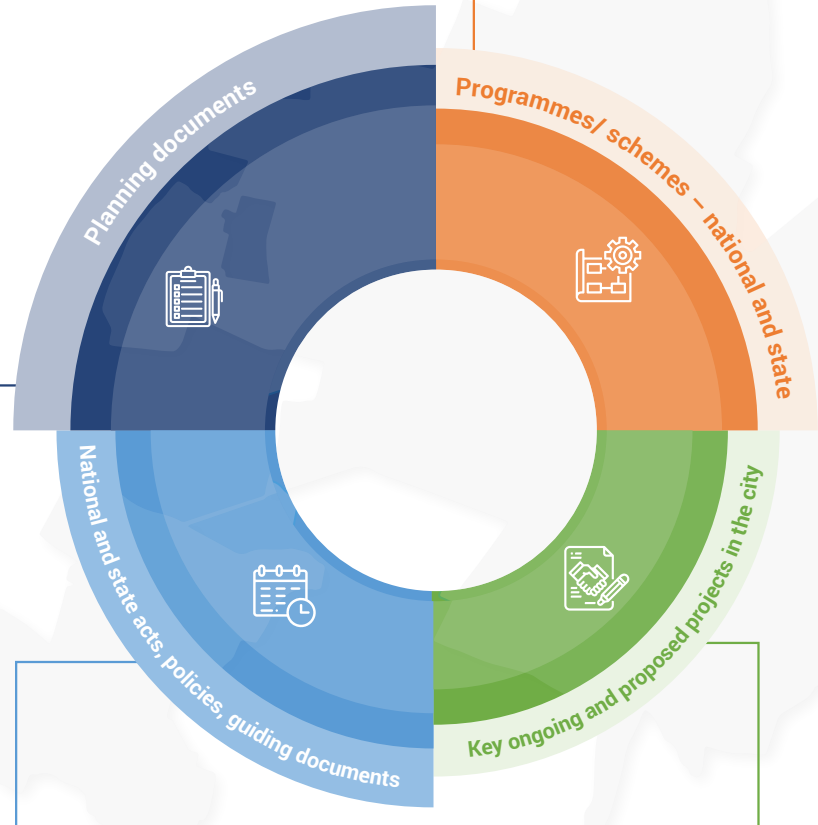
Mooli Kulam is a large lake of about 18 Ha in Tiruppur. The lake used to irrigate nearby agricultural fields and provide water for domestic purposes. Located in an urban pocket with no proper maintenance, the water body was polluted by solid waste from nearby residential complexes. Rejuvenation of the lake was undertaken between June and August 2021. The various measures included removing waste, desilting, constructing bunds and islands to improve the lake's biodiversity and provide secure grounds for resident birds, and water inlet and outlet regulation.

Mooli Kulam Lake – Before (left) and after (right)
Source: https://efiblog.org/2021/11/30/rejuvenation-of-an-urban-lake-in-the-textile-capital-mooli-kulam/

3.2.2 Alignment with national, state policies, programmes and ongoing, proposed capital projects in the city

- Zonal Development Plan 2021
- Guntur Clean Air Action Plan 2019
- Guntur City Disaster Management Plan

- AMRUT
- AMRUT 2.0/ Jal Jeevan Mission (Urban)
- Swachh Bharat Mission (Urban) 2.0
- Pradhan Mantri Awas Yojana – Urban
- Jagananna Pachathoranam
- Navaratnalu – Housing for All Poor



- National Mission on Sustainable Habitat 2021-2030
- Urban and Regional Development Plans Formulation and Implementation Guidelines (Volume 1) 2014
- Andhra Pradesh Water, Land and Trees Act, 2002
- Andhra Pradesh Building Rules 2017

- Guntur Master Plan/ ZDP (currently under revision)
- Re-development of Manasasarovaram Park and Gandhi Park
- Development of new neighbourhood parks in four locations
- Rejuvenation/ development of five ponds – Koritepadu Cheruvu, Nalla Cheruvu, Budampadu Pond, Ankireddypalam Cheruvu, and Nallapadu Cheruvu

3.2.3 Gender and inclusion

Conservation and development of blue green assets ensures creation of safe and secure public spaces for women and marginalised people where they can participate, interact and contribute to community. The strategic response offers scope for a gender transformative approach in all its interventions. In intervention 1.1, promoting public amenities encourage more women to access city and improve their choice of opting employment addressing low WPR of women in Guntur. Addressing the vacant land in the intervention as activity zones-such as playgrounds, nurseries, open air gyms etc., reduces unsafe corners/streets and improve overall safety, specifically for women and children. Gender inclusive public open space guidelines suggested to be followed for the same (refer to Annex 12 for details).

The involvement of Women SHGs recommended as prioritized groups for use of vacant land for multiple temporary purposes would be of high impact. More women as part of workforce acts as bouncing tool to promote further women to travel for work/leisure. The intervention also provides livelihood opportunities for the unemployed urban poor and low-income population, especially those from peripheral areas and proposed new urban poor housing layouts.

Enabling ecologically sensitive public spaces in diverse forms, scales and function as part of Intervention 1.3 would aid in creating gender inclusive recreational spaces (Ref annex 3 for indicative list of elements in community parks). It is recommended that the open space-green loop plan be developed by collecting and assessing public space usage and behaviour data, disaggregated by gender, age, income (and religion, where relevant). The waterfront development plan as part of Intervention 1.4 should consider gender-inclusive strategies (refer to Annex 13 for details).

All the interventions support in creating an inclusive economy by livelihood opportunities for unemployed urban poor also increasing city GDP.

3.2.4 Climate convergence

Developing water bodies as community parks can decrease the carbon storage potential of the site, due to construction of accessibility and recreational infrastructure (such as pathways, parking, social facilities). On the other hand, using sponge city techniques can improve the quality and quantity of water sources, reduce the impacts of flooding, increase nature-based solutions to water filtration and protect water bodies from pollution from human activities through natural buffers.

Not considering the additional green coverage created through the use of vacant land, the total savings potential through the implementation of conservation projects for both canal, main stormwater drains and 37 ponds, as well as the creation of community parks around four water bodies in the city, is approximately 320.32 tCO_2-eq per annum.

3.2.5 Estimated project costs

Cost estimates for this strategic response equal to a total of INR 1,719.33 lakh.

TABLE 3.4 Summary of Potential CO_2-eq savings for proposed projects in Strategic Response 1, Interventions 1.2 and 1.4

Intervention	Project	Potential GHG savings potential (CO_2-eq/annum)	Remarks
Intervention 1.2: Re-developing water bodies (ponds) as new recreational areas	Regeneration of 4 community parks[28]	50.25	This calculation uses an average park size of 2.5 Ha.
Intervention 1.4: Protecting and restoring water bodies	Conservation of neighbourhood park around water bodies	265.87	This calculation uses an approximate area of 47 Ha.
Intervention 1.4: Protecting and restoring water bodies	Conservation of canal/ major stormwater drains	4.20	This calculation uses an area of 8,400 m2 (21 km, 2 m buffer on either side of canal).

Source: Various sources have been used in the calculation of emissions savings potentials. Please see Annex 8 for Climate Savings Calculation Methodology for the calculation breakdown and assumptions made.

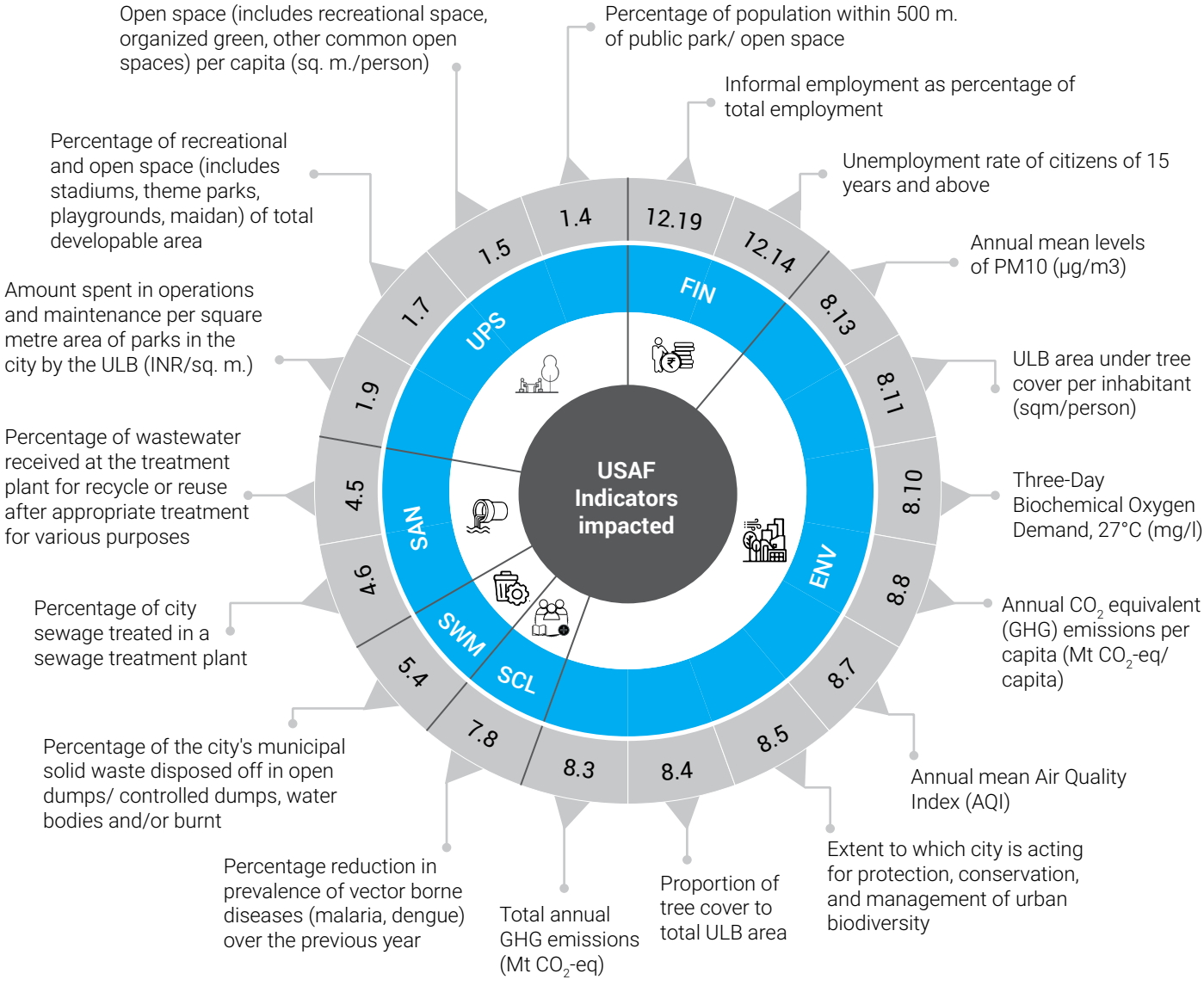
28 The definition of community parks and neighbourhood parks uses AMRUT's SLIP template for green spaces and parks, which uses five categories of parks as per URDPFI guidelines and includes housing area parks (less than 0.5 Ha), neighbourhood parks (0.5–1.0 Ha), community parks (1–5 Ha), district parks (5–25 Ha), and sub-city parks (25 Ha and above). This exercise assumes an average park size of 2.5 Ha in the creation of community parks around water bodies, using 75 per cent green coverage for park regeneration projects and a 100 per cent green coverage for conservation projects. The four parks considered for this intervention are Gorantla Cheruvu, Gaddipadu Cheruvu, Pothuru Cheruvu, and Chakali Cheruvu.

TABLE 3.5 Summary of estimated project costs for Strategic Response 1, Interventions 1.2 and 1.4

Intervention	Project [29]	Estimated Project Cost (in INR lakh)	Remarks
Intervention 1.2: Re-developing water bodies (ponds) as new recreational areas	Develop 4 water bodies and their buffer zones with hardscape, softscape and recreational facilities.	727.44	An additional cost may be considered for an STP of 0.5 MLD for each of the 4 parks in this intervention.[30]
Intervention 1.4: Protecting and restoring water bodies	Restoration and protection of 37 water bodies (ponds).	960.32	Includes 37 water bodies, using the sponge city concept, with a total buffer area of about 47 Ha.
Intervention 1.4: Protecting and restoring water bodies	Conservation of canals, major stormwater drains (activities include cleaning, waterbed treatment, strengthening bund, trench treatment and planting).	31.57	This calculation is based on a total area of 41 sq. km. (21-km length of the canal/ drain).

Source: Various sources have been used in the calculation of project costs. Please see Annex 9 for Cost Estimates Methodology for the calculation breakdown and assumptions made.

3.2.6 USAF Indicators impacted



29 Cost estimates for the creation of new parks does not include demolition or clearing, and park project costs do not include ongoing costs such as maintenance.

30 The cost estimate, including construction of an STP of 0.5 MLD is provided only for four community parks proposed under this intervention.

IMAGE 3.8 View of Shiva temple along the banks of Ankireddypalem Cheruvu

Source: UN-Habitat

3.3 Strategic Response 2: Re-densification of Areas Experiencing Growth

The overarching idea behind this strategic response is to promote and direct development in a sustainable manner in areas experiencing rapid growth. The interventions proposed here would primarily address the issue of sprawling and scattered development and address a few concerns identified in the two other strategic issues, such as poor/ unorganized public transportation and NMT infrastructure, and multiple deprivations in informal settlements. The planning principle, 'polycentric urban structure', has been adopted for formulating the proposed interventions under this strategic response.

3.3.1 Proposed interventions within the strategic response

Two interventions are proposed under this strategic response, which are detailed as follows:

Intervention 2.1: Development of urban growth nodes (UGN)

In Guntur, most workplaces, public transport hubs, commercial, leisure and public facilities are located within the core city.[31] In the recent decade, the city has grown in a scattered manner along its peripheral zones, largely towards the North, North-West, and South-West. The ZDP 2021 had proposed less population densities for these zones, added to the city limits in 2012 and currently experiencing scattered growth, than those within GMC's former limits. Given this scattered development trend, creating dedicated UGNs in strategic locations within municipal limits can lead to a sustainable approach for planning future growth and investments.

Three UGNs with a radius of 800 m. have been proposed from the following intersections/ junctions in the city (see Map 3.5). These growth nodes along arterial roads are well connected to the city core:

1) Amaravati Road–Mahatma Gandhi Inner Ring Road
2) Gujjanagundla Junction
3) Chuttugunta Junction

Aspects considered for formulating the intervention, Development of Urban Growth Nodes are as follows:

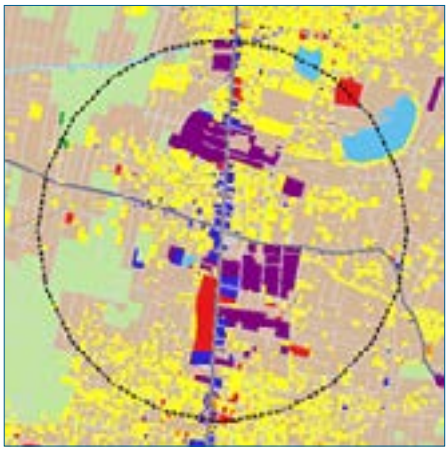
- Sprawling and scattered growth in the city's peripheral zones.
- Need to reduce dependency on the city core and decongest it.
- ZDP 2021 proposals are insufficient for current requirements.
- Several ongoing and proposed Infrastructure projects in the city.
- Proposed Urban Poor Housing Colonies both near and outside city limits.
- Master plan of city, which is currently under revision.

31 The 1.5-km (1,500-m) radius around the 'Market Centre Junction' (between the GMC office and Gandhi Park on Grand Trunk Road) is considered as the city core.

Existing characteristics of the proposed UGN

(Map: Existing land use, 2017)

UGN 1: Amaravati Road—MG Inner Ring Road Intersection – An area where the city is expanding and has potential for development through service provisions.

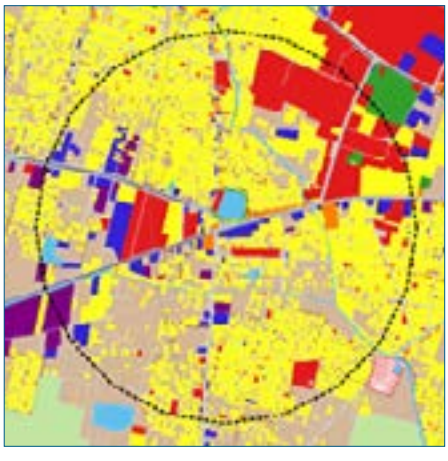


- Experiencing rapid residential and commercial development (along major transit corridors).
- Availability of vacant land parcels.
- Good road connectivity, connecting Gorantla, Reddypalem, and Adavitakkellapdu to city core via NH16.
- Construction of houses in urban poor housing layout at Lam area has started.
- Low coverage of city bus service.
- Absence of organized public parks and open spaces.
- Far (beyond 4 km) from fire stations.
- Water bodies are ill maintained and encroached upon.
- Presence of Industries (logistics, agro based related).

UGN 2: Gujjanagundla Junction — A well serviced area with potential for infill development and regeneration.

- Good coverage of city bus services.
- Located along the Ring Road.
- Currently experiencing high intensity commercial (shopping malls, restaurants) and mixed-use development.
- Average population density is more than 150 PPH (2018).
- No industrial development.
- Presence of informal settlements.
- Less vacant land parcels.

UGN 3: Chuttugunta Junction — An area with potential for densification and provision of services to cater to peripheral areas and proposed urban poor colonies in the South.



- Major traffic interchange.
- Provides connectivity to areas added to GMC's limits towards the city's West and South.
- Proximity to proposed urban poor housing colonies in the southern micro-markets.
- Rapid commercial development along transit corridors.
- Mirchi yard located in proximity.
- Low coverage of city bus service.
- Presence of informal settlements.

Map source: APCRDA, GMC; Analysis

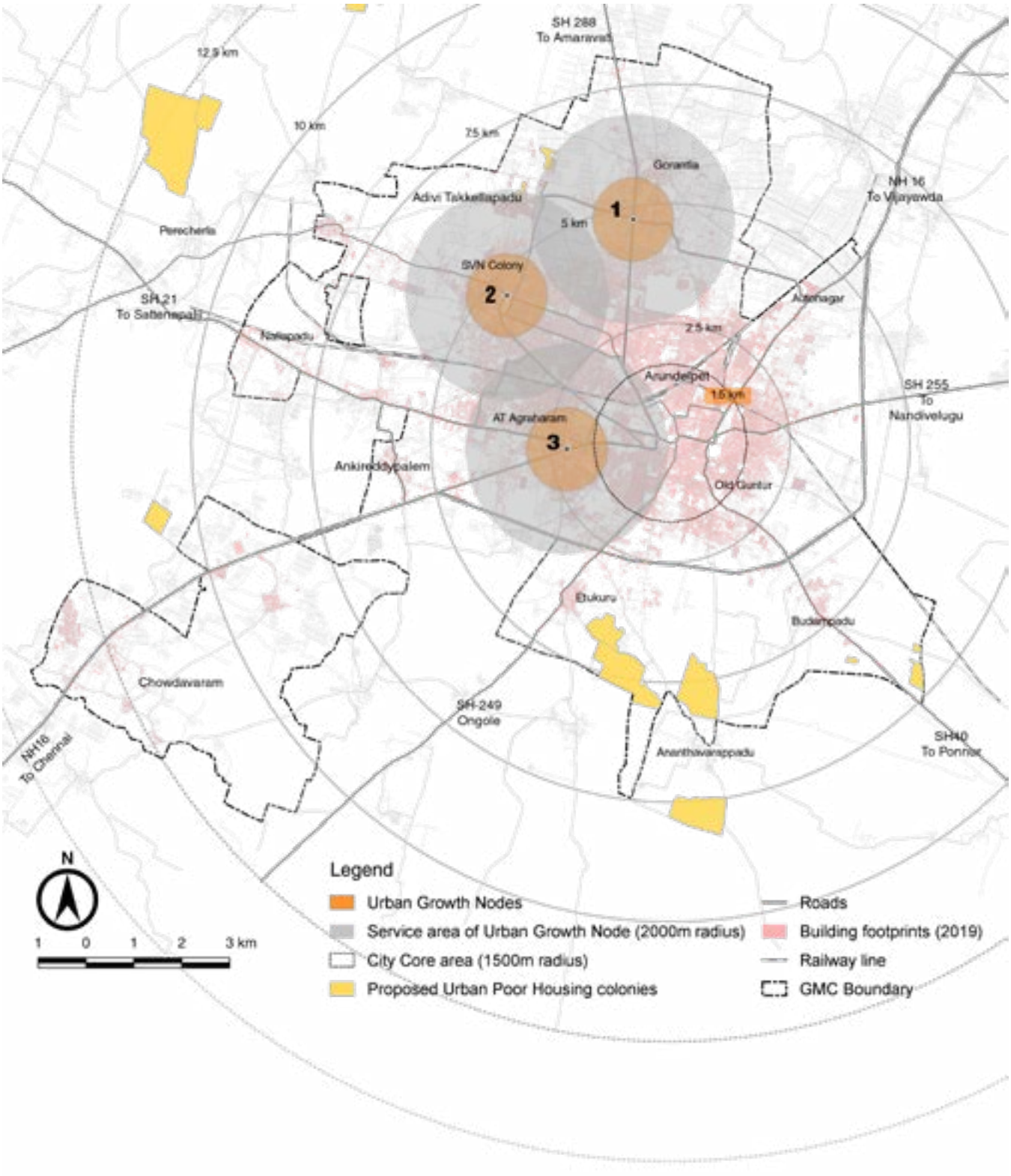
Source: UN-Habitat

IMAGE 3.9 View of Amaravati Road–MG Inner Ring Road Intersection (proposed UGN 1)

Source: UN-Habitat

IMAGE 3.10 View of Chuttugunta Junction (proposed UGN 3)

Source: UN-Habitat



MAP 3.5 Location of proposed UGNs and their service areas

Source: UN-Habitat

The following activities are proposed within the identified UGNs:

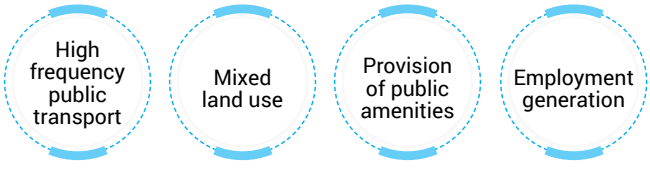
1) Introduce high frequency public transportation:
Provision of city bus services with high frequency (10-15 minutes) connecting the proposed UGNs to the core city. GMC has proposals for the construction of 20 e-bus bays across the city. Of these, two are planned for the intersections of UGNs 1 and 2. In view of the proposed intervention, it is recommended that provisions be made for a larger facility, accommodating two or three busses at any given point of time, based on space availability.

In addition, a minibus terminal is proposed at UGN 3 (Chuttugunta Junction), considering the prominence of the intersection. Each growth node is anticipated to function as an interchange for different directions with support infrastructure and a focus on NMT.

2) Mixed land use: The ZDP 2021 had proposed mono functional land use in areas currently experiencing growth. To increase service availability and population densities, the development plan, which is currently under revision, shall allocate mixed land use.

3) Provision of public amenities: The UGNs shall accommodate all necessary services and amenities catering to the daily needs of the public. A community shopping centre can be developed by GMC in partnership with landowners. Town planning instruments such as transfer of development rights, land pooling, land consolidation, and other initiatives can be explored for developing the commercial shopping complex.

FIGURE 3.5 Key activities proposed within the UGNs



The community centre should accommodate public amenities (hospitals, clinics, schools, etc.) currently absent within the UGN area (800 m.). Similarly, sub-city level government offices can also be accommodated. Such provisions will improve the access to affordable services for all socio-economic sections in the city, and reduce associated travel needs and GHG emissions. The community centre would also service nearby urban poor housing colonies.

Indicative list of amenities that could be accommodated in the community shopping complex:

- *Rythu* bazaar
- Medical shop
- Ward secretariat + other ward/ area level government offices
- Fire sub-station/ PHC/ other required service
- Skill development centre/ other uses
- Vehicle parking
- Commercial shops

4) Employment generation: The development of UGNs will create new employment opportunities. Emphasis is to be laid on creating livelihood opportunities for the urban poor (from proposed urban poor housing colonies) to participate in both the formal and informal sectors (through provision of vending zones) and reduce their travel needs to the city centre.

UGN service/ catchment areas are expected to be a 2-km (2,000-m) radius around the identified intersection/ junction (see Map 3.5). The population within these service areas are expected to benefit most from the development of such urban growth centres.

Anticipated benefits of the intervention:

1. Node-based development
Encouraging node-based development against ribbon development and balancing densities in the city.

2. Reducing GHG emissions
Increased access to facilities. Reducing travel to city centre, thus reducing GHG emissions.

3. Increased connectivity
Connecting peripheral zones and proposed urban poor housing colonies to the city centre.

4. Livelihood opportunities
Creating employment/ livelihood opportunities in new areas.

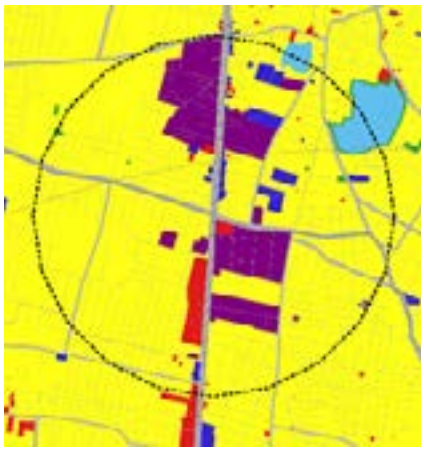
CASE STUDY

Community Centres in Delhi
Establishment of community centres was proposed in the first Master Plan of Delhi (MPD) 1961 and carried forward in the recent plan revised in 2021. A five-tiered commercial shopping plan was proposed in the MPD, which included Community Centres of 80–100 shops catering to groups of 40,000–50,000 residents, and District Centres of 200–350 shops for every 150,000–250,000 residents. The community and district centres were developed across the city to provide access to necessary social amenities. These are located near major transit corridors and transport networks to prevent unintended and unplanned ribbon development, as well as for better synergy between public transport and work centres.

A few activities proposed within the UGNs

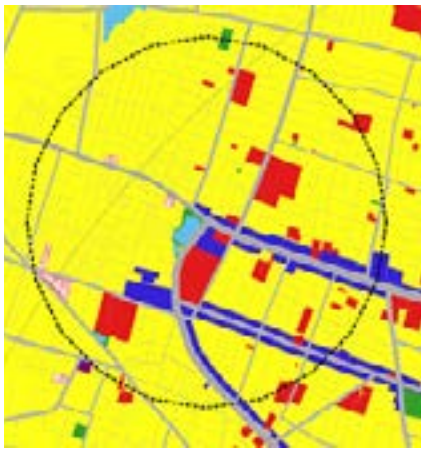
(Map: Proposed land use, ZDP 2021)

UGN 1: Amaravati Road—MG Inner Ring Road Intersection



- Change of land use from residential to mixed-use.
- Assess type and requirement of existing industries and revise the land use.
- Provide necessary trunk infrastructure and amenities.
- Protect water bodies through green buffer zones and develop Gorantla Cheruvu as a community park.
- Introduce high frequency (10-15 min) city bus services with support infrastructure, including NMT. Promotion of e-rickshaws/ vehicles for last-mile connectivity.
- Develop community shopping centre.
- Provide a fire sub-station in the vicinity.
- Create street vending zones.

UGN 2: Gujjanagundla Junction



- Change of land use from residential to mixed-use.
- Provide necessary trunk infrastructure and amenities.
- Develop new neighbourhood and community parks.
- Upgrade necessary facilities in informal settlements.
- Strengthen public transportation via high frequency (10-15 min) city bus service.
- Improve NMT infrastructure by creating pedestrian facilities and last-mile connectivity.
- Create street vending zones.
- Develop community shopping centre.
- Undertake traffic noise reduction measures.

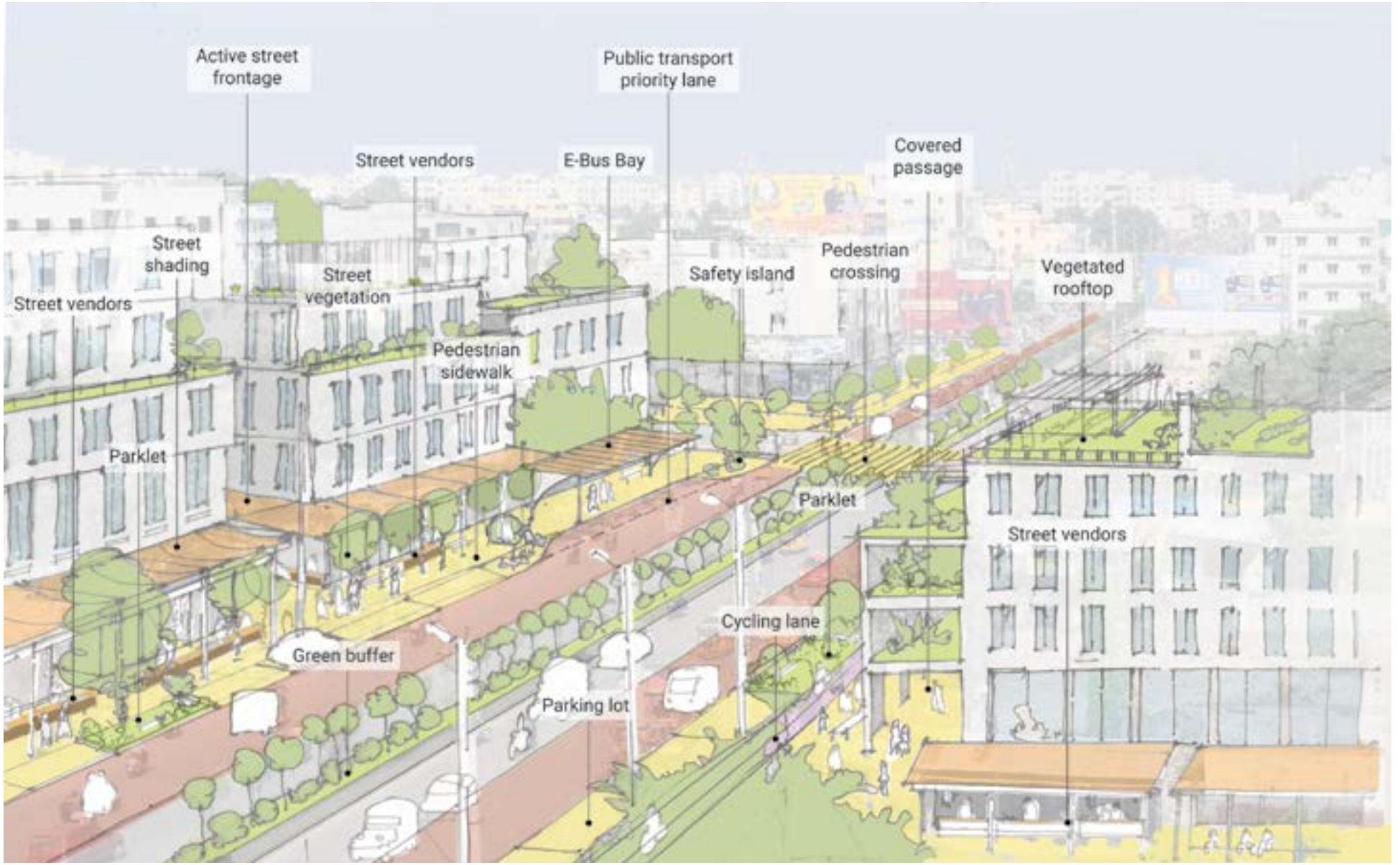
UGN 2: Gujjanagundla Junction

- Change of land use from residential to mixed-use.
- Provide necessary trunk infrastructure and amenities.
- Consider the option of shifting Mirchi yard to other feasible location.
- Construct minibus terminal, introduce high frequency (10-15 min) city bus service connecting peripheral zones and proposed urban poor housing colonies to the growth node.
- Develop new neighbourhood and community parks.
- Upgrade necessary facilities in informal settlements.
- Create street vending zones.
- Develop community shopping centre.

Map source: ZDP 2021; Analysis

Source: UN-Habitat

FIGURE 3.6 Conceptual view of a few proposed elements in UGN 1 (Amaravati Road–MG Inner Ring Road Intersection)



Source: UN-Habitat

Longer term intervention

Development of UGNs requires provisions for necessary amenities and trunk infrastructure to accommodate high density population and required infrastructure, amenities while realizing other anticipated benefits. This intervention will, hence, be a long-term action needing concerted cumulative steps by the GMC and APCRDA. The recommendations must be integrated into the master plan, which is currently under revision, and should also be complemented with a phased, infrastructure development plan for the proposed projects/ developments.

Once considerable trunk infrastructure and services are provided, a rise in property tax within the UGNs may be explored to provide value recapture for the government's investment. Land use regulations promoting mixed-use development, incentives for green buildings, high frequency public transportation with support infrastructure, ensuring provision for informal economic activity (e.g., designated vending zones) will support a vibrant and sustainable densification of the UGNs.

In the short-term, GMC shall focus on improving city bus service coverage, providing NMT infrastructure and developing community shopping complexes within the growth node. GMC shall consider the proposed UGNs as focal points for providing amenities planned under various ongoing and proposed initiatives, such as the construction of public health centres, secondary solid waste collection points, and establishing MRFs, among others. Treating these nodes as priority areas will aid in directing growth in a planned manner.

ALIGNMENT WITH NATIONAL PROGRAMMES

Proposed actions aligning with objectives of SBM U 2.0:

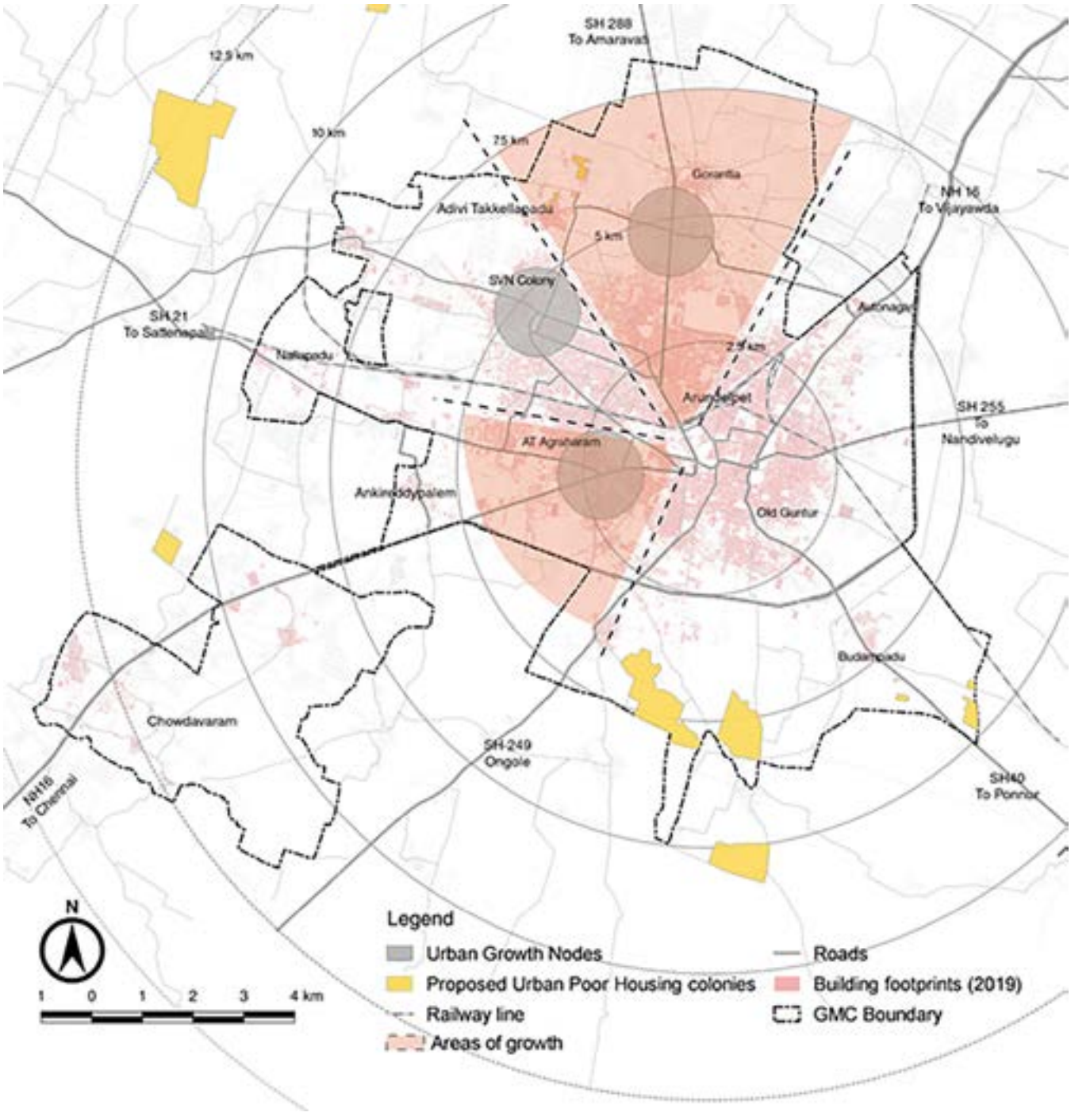
The intervention proposes provisions for processing facilities within/ near every UGN, including:

- Material recovery facility (MRF)
- Secondary waste transfer station
- Waste composting plant

The intervention's focus areas of waste collection and processing facilities are also eligible for funding under SBM 2.0.

Intervention 2.2: Prioritize development in areas experiencing growth)

As highlighted in the previous intervention, availability of required trunk infrastructure and amenities would be essential to promote and sustain development in any area. In Guntur, many large-scale projects for water supply, underground drainage, SWM, urban greenery, rejuvenation of water bodies, public health, housing for the urban poor, and transport infrastructure are ongoing and proposed (see Annex 2 for the list of ongoing and proposed projects in the city). A few ongoing and proposed projects are focused on providing infrastructure and services to the areas added to GMC's limits in 2012.



MAP 3.6 Major growth directions in the city

Source: UN-Habitat

This proposed intervention is a recommendation for GMC to focus on the areas currently experiencing rapid growth, while phasing the execution plan for ongoing and proposed large-scale, city-wide projects. As shown in Map 3.6, barring the city centre, the North and South-West micro-markets are expanding more rapidly than other zones. Further, the proposed urban poor housing layouts are located in these northern and southern zones (see Map 3.6).

Strengthening public transportation

Guntur should focus on strengthening its public transportation (city bus service) and creating associated infrastructure. As an immediate action, the city should focus on strengthening the city bus service along the major corridors that service most of the current city population (see Map 3.7 and Table 3.6). The focus should be on increasing the frequency (10-15 minutes) of city bus services supported by a real-time passenger information system. Along most of the identified corridors, GMC has proposed constructing 20 e-bus bays (see Map 3.7 and Table 3.6). These will be air-conditioned enclosures with facilities to accommodate approximately 50 passengers, along with free wi-fi services, first aid, toilets, mobile charging stations, automated teller machines (ATMs), and potable water.

Provisions for affordable public transportation to the city's peripheral areas and urban poor housing colonies are critical to ensure access to livelihood opportunities. Road corridors connecting these peripheral zones and proposed urban poor housing colonies to the UGNs and city core have been designated as other priority roads. These corridors are extension of routes identified in Phase 1. Bus stops are to be provided along Phase 2 routes with focus on urban poor housing colonies (see Table 3.6).

IMAGE 3.11 An e-Bus Bay at Lakshmipuran Main Road, constructed in 2017 by GMC in PPP mode

Source: UN-Habitat

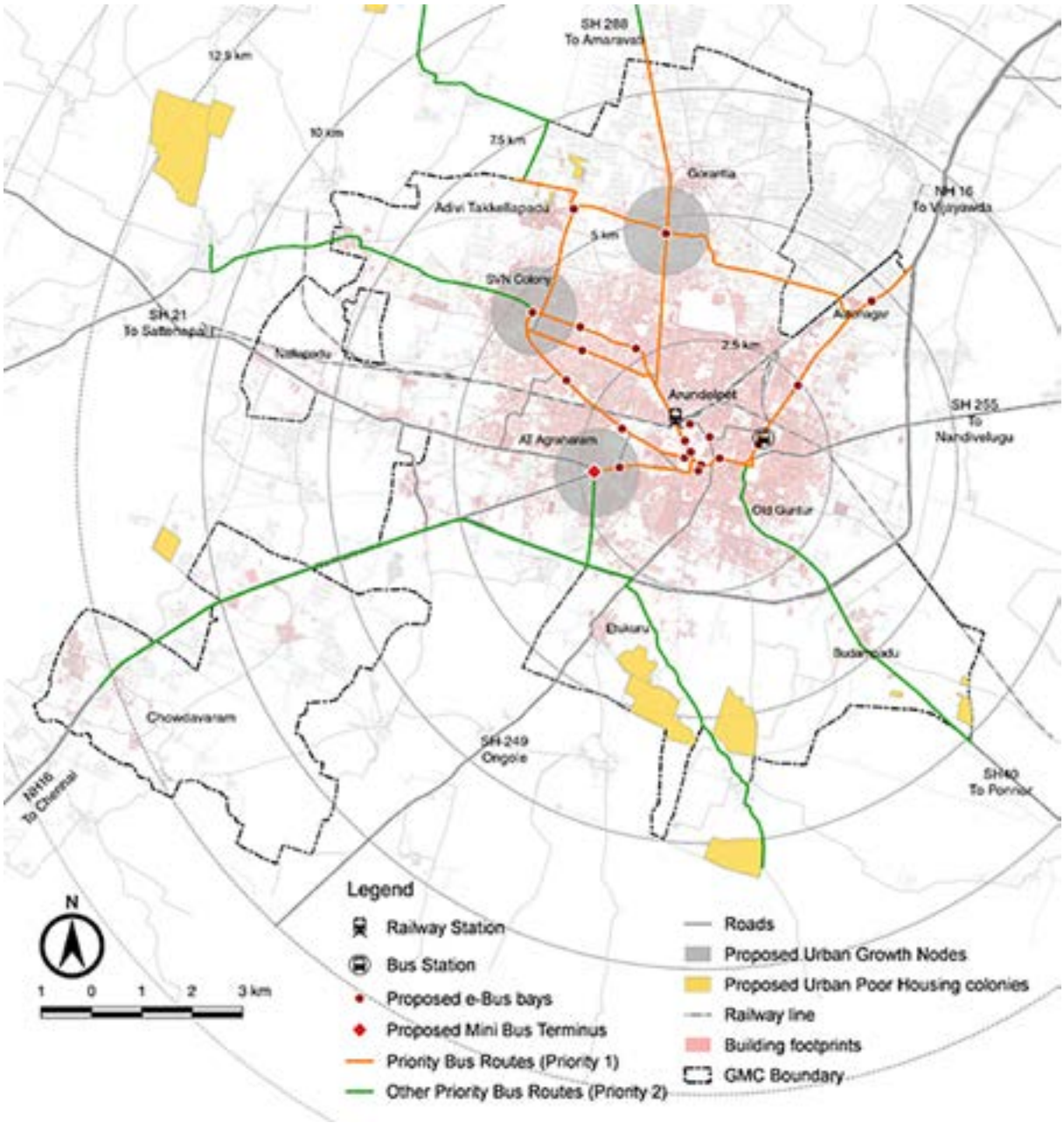
IMAGE 3.12 Urban poor housing complexes constructed by AP TIDCO in Adavitakkellapdu, which are not connected by any public transportation system

Source: UN-Habitat

TABLE 3.6 Corridors identified for introducing/ strengthening public transportation

Phase 1: Priority routes
• Ring Road (via Municipal Travellers Bungalow Center, Collector Office, Pattabhipuram, Gujjanagundla Junction, Vidyanagar, Koritepadu Road, Lodge Centre, Brodiepet Main Road, Sankarvilas Flyover)
• Lakshmipuram Main Road - Brindavan Gardens Main Road (connecting Ring Road at starting and ending points)
• Lodge Centre to Lam (via Chillies Dhaba, Gornatla Centre) – Amaravati Road
• Mahatma Gandhi Inner Ring Road (Reliance Petrol Bunk at GT road to Proposed Shilparamam near Adavitakkellapadu via Chillies Dhaba)
• Gujjanagundla Junction to Adavitakkellapadu TIDCO Housing (via JKC College)
• PVK Naidu Vegetable Market to Auto Nagar 'Y' Junction (via Jinnah Tower Centre, Bus Stand) – GT Road
• Chuttugunta Junction to PVK Naidu Vegetable Market – GT Road
• Bus Stand to PV Naidu Vegetable Market (via Old Club Road, Kothapeta Main Road, Naaz Centre, Women's College Road)
Phase 2: Other priority routes
• Y Junction near RTA office to Damarapalli
• Chuttugunta Junction to Chowdavaram
• Chuttugunta Junction to Ananthavarappadu
• Bus Stand/ NTR Circle to Budampadu
• Gujjanagundla Junction to Perecherla

Source: UN-Habitat



MAP 3.7 Major road corridors identified for introducing/ strengthening public transportation

Source: UN-Habitat

ALIGNMENT WITH NATIONAL PROGRAMMES

Key Findings from Transport4All Challenge Survey

In 2021, as part of the Ministry of Housing and Urban Affairs, Government of India initiative, Transport4All challenge, the GMC collected citizen feedback from over 7,200 participants through primary surveys. Their top three concerns were:

- Long waiting time and unreliable service,
- Non-availability of information about the city bus service timetable/ arrivals, and
- High fares

Among the survey respondents, commuters from low-income groups expressed long waiting time as a major concern. The absence of options for last-mile connectivity, and limited city bus service coverage were among the key concerns of citizens opting for personalized travel modes.

Source: GMC

3.3.2 Alignment with national, state policies, programmes and ongoing, proposed capital projects in the city

- Zonal Development Plan 2021
- Guntur Clean Air Action Plan 2019
- Guntur City Disaster Management Plan
- Guntur - Immediate Action Plan for Transport (Draft)

- AMRUT
- AMRUT 2.0/ Jal Jeevan Mission (Urban)
- Swachh Bharat Mission (Urban) 2.0
- Pradhan Mantri Awas Yojana – Urban
- Jagananna Pachathoranam
- Navaratnalu – Housing for All Poor

- National Urban Policy Framework 2018
- National Urban Transport Policy, 2014
- National Mission on Sustainable Habitat 2021-2030
- Urban and Regional Development Plans Formulation and Implementation Guidelines (Volume 1) 2014
- Andhra Pradesh Capital Region Development Authority Act, 2014

- Guntur Master Plan/ ZDP (currently under revision)
- Sanction of sites and construction of houses for the homeless urban poor under Navaratnalu - Housing for All Poor scheme
- Asian Infrastructure Investment Bank Funded Water Supply Project
- Integrated Secondary Waste Collection and Transportation points across the city
- Construction of 20 e-bus bays across the city

3.3.3 Gender and inclusion

This strategic response supports gender inclusive development in all its interventions and specifically in development of UGN. The seamless integration of multi-modal transport systems and improving coverage of urban amenities is in line with gender equitable development. Re-densification of areas experiencing growth promote a more equitable distribution of facilities for peripheral communities, including low-income groups and slum dwellers. Improving service provisions for the existing population and efficiently planning services for growth areas, will reduce access inequities and consequential social disparity.

The new mixed-use nodes and employment centres proposed as part of intervention 2.1-redenisification with all basic amenities in walking distance could address time poverty faced by women. Women in Guntur city were found to be opting for work opportunities 0-5 km from residence with 59 per cent of women in urban Guntur travelling to work by walking.

As part of the Intervention 2.2 additional social infrastructure is recommended to be provided (on assessment of existing shortage) for marginalised groups.

Safer travel in the night programme: Women perceive night travel unsafe in comparison to men. While mixed land uses can extend activities into the evening hours, a dedicated 'safer travel in the night programme' is recommended to improve women's access to education and economic opportunities, in the late evenings and night. Some components of safer travel are women led police patrols, streets vendors as street marshals, request stop service etc. (Refer to Annex 10 for activities recommended to be implemented under 'Safer travel in the night programme').

3.3.4 Climate convergence

There are no specific metrics that can be applied to these two interventions for the strategic response due to their scale and policy level changes involved. However, the proposed compact, nodal development can help reduce emissions from sprawling development patterns.

3.3.5 Estimated project costs

The estimated project costs for both interventions equal INR 2,197.21 lakh. Additional interventions, such as traffic noise quietening measures at Gujjanagundla Junction (GN2) through tree planting and developing Gorantla Cheruvu as a community park have been covered under Strategic Responses 4 and 1, respectively, and are not duplicated here.

TABLE 3.7 Summary of estimated project costs for Strategic Response 2, Interventions 2.1 and 2.2

Intervention	Project	Estimated project cost (INR lakh)	Remarks
Intervention 2.1: Development of Urban Growth Nodes	Growth Node 1	602.72	The estimated cost includes construction of a community centre, MRF, secondary transfer station, composting unit, NMT improvements, e-rickshaw and IPT stand, fire station, street vending zones, and additional bus stops.
	Growth Node 2	557.72	Community centre, MRF, secondary transfer station, composting unit, NMT improvements, e-rickshaw and IPT stand, street vending zones and additional bus stops.
	Growth Node 3	571.22	Community centre, MRF, secondary transfer station, composting unit, minibus terminal, e-rickshaw and IPT stand, street vending zones and additional bus stops.
Intervention 2.2: Prioritize development in areas experiencing growth	Bus stops (city-wide)	465.55	This includes bus stops at 800 m intervals along phases 1 and 2 routes (with 71 stops each).[32]

Source: Various sources have been used in the calculation of project costs. Please see Annex 9 for Cost Estimates Methodology for the calculation breakdown and assumptions made.

32 The lengths and names of all routes for phases 1 and 2, as well as the number of bus stops are indicated in Annex 9: Cost Estimates Methodology.

3.3.6 USAF indicators impacted

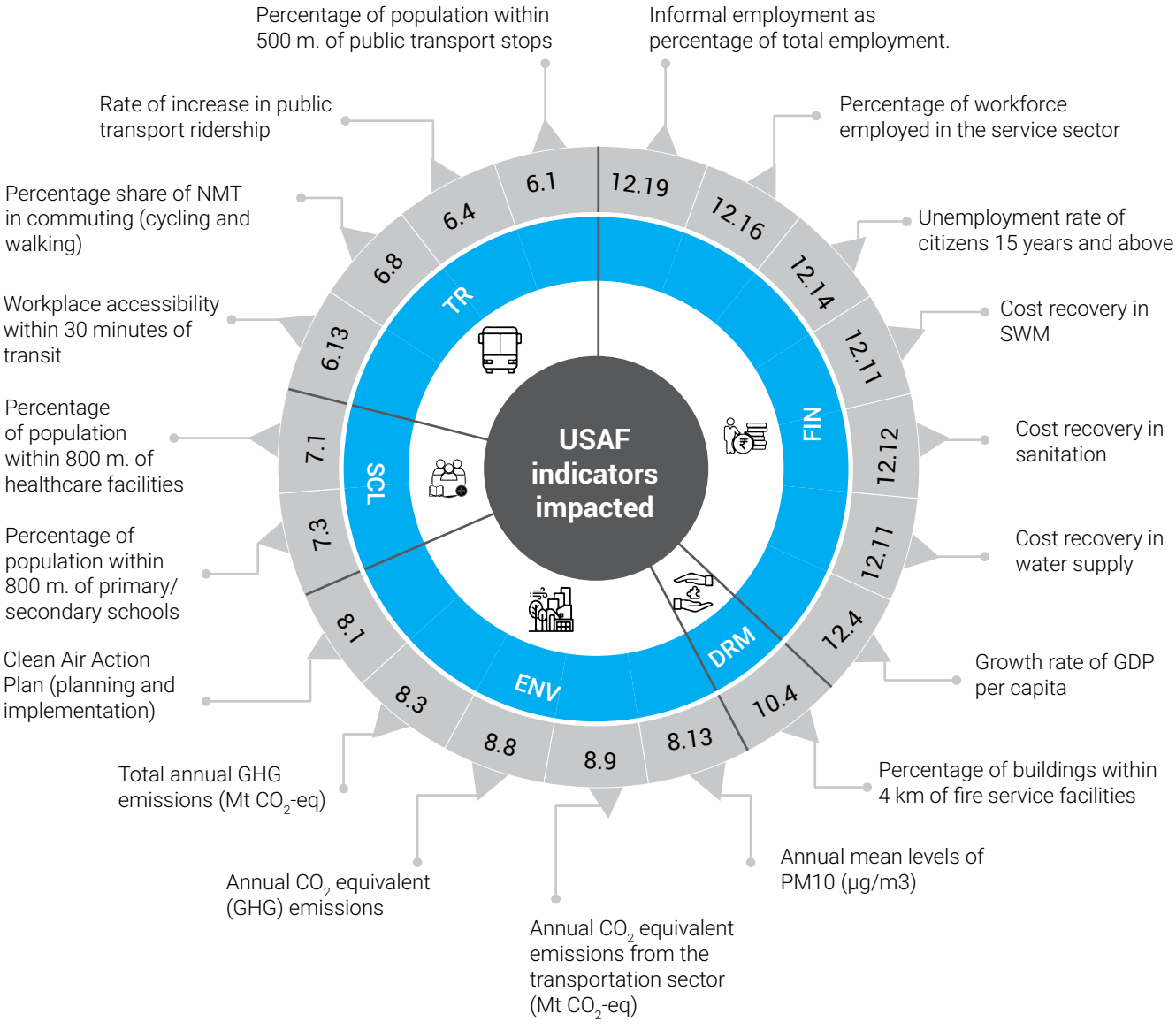


IMAGE 3.13 Multi-storied residential buildings along the MG Inner Ring Road section between Amaravati Road and JKC College Road

Source: UN-Habitat

3.4 Strategic Response 3: Rejuvenation of City Centre

This strategic response primarily addresses the problems of informal settlements and affordable housing within the former city limits. The interventions proposed would address the concerns identified in the strategic issues, multiple deprivations in informal settlements and inadequate public open spaces. The planning principle of 'urban regeneration' has been adopted as an overarching concept for formulating these interventions.

The state government's ongoing initiative, Navaratnalu - Pedalandariki Illu[33] (translates to Housing for All Urban Poor) (refer to Annex 1 for the list and description of ongoing programmes in the city) has been considered while formulating the interventions. Resettlement of people to peripheral areas (sanctioned housing layouts are to the North and South, as well as the outskirts) have undesirable results in some cases, in terms of environmental and socio-economic sustainability. However, the allocation of housing sites to the respective beneficiaries has been completed and construction is to begin.

3.4.1 Proposed interventions within the strategic response

The two interventions proposed under this strategic response include:

Intervention 3.1: Creation of affordable rental housing stock

The intervention is formulated in line with the recommendation of the National Urban Policy Framework 2018, which lays emphasis on creating affordable rental housing. The policy also states that rental housing can be cheaper for the government than subsidizing ownership. Guntur, as one of the major urban centres in the state, attracts migrant populations for employment and access to regional amenities/ services. Unavailability of rental housing close to workplaces, health facilities, education institutions, and other activity areas for low-income groups leads to formation of squatter colonies and informal settlements, forcing people to reside in peripheral areas. As a sub-scheme under PMAY (U), the Government of India is promoting Affordable Rental Housing Complexes (ARHCs), triggering many ULBs across India to take up initiatives to create RHCs under the scheme. For creating affordable rental housing stock, availability of well-accessed and serviced land is critical. However, as learned from the GMC Town Planning Section, GMC does not own any potential vacant lands for developing affordable rental housing.

Hence, the intervention recommends the creation of rental housing as a brownfield development in the city. Lands under industries and government-owned slums are proposed for developing ARHCs as detailed in the following sections.

a) Creation of ARHCs on reclaimed slum land

In accordance with the data received from GMC on slum settlements, 48 out of 173 slum settlements are situated on land parcels, fully or partially owned by the government. Among these, slum dwellers in many such settlements do not hold any property rights over the land. Assuming that a considerable number of urban poor households do not own any land property rights, they have been allocated sites in urban poor housing layouts in the city's periphery. Following the construction of the houses, these households have to be eventually relocated to these colonies. GMC shall reclaim such houses/plots in slums on government-owned land for the construction, operations and maintenance of dwelling units and dormitory beds in ARHCs and commercial areas (for financial viability) in line with the ARHC scheme's operational guidelines.[34] GMC may undertake this on its own or explore options for public–private partnership (PPP) modes. GMC may also consider utilizing the existing good quality houses from the reclaimed slum parcels as rental houses. As all slum settlements are located within the former city limits, with many located near major road corridors (see Map 3.8), strengthening city bus services with high-frequency coverage (see Intervention 2.2) will increase the ARHC's access to workplaces and other activity areas. The following actions are recommended for GMC in creating rental housing stock.

33 In Guntur, housing sites were provided to 66,300 houseless urban poor families (44.4 Sq. yd each) currently residing within the city. State Government would also undertake construction of houses in respective allocated sites. As of December 2021, construction of houses has been started in a few places.

34 Operational Guidelines for Affordable Rental Housing Complexes (ARHCs) - Ease of Living for Urban Migrants/ Poor (July 2020). http://arhc.mohua.gov.in/filesUpload/Operational-Guidelines-of-ARHCs.pdf (accessed on 6 January 2022).

1. Surveying slum inventory

Perform inventory survey in every slum settlement on government-owned land where slum dwellers have partial or no property rights. Prepare a record of households with site sanctioned in proposed urban poor housing colonies, land availability, condition of existing housing structures, condition of available trunk infrastructure and amenities in the settlement.

2. Preparing development plans

Prepare an area development plan for each slum settlement that includes existing situation assessment and activity plan for development of reclaimed land parcel. This includes developing ARHCs/ commercial areas or complexes/ public parks/ open public spaces/ any other community amenities, along with required trunk infrastructure and amenities to support the proposed development and its cost estimates.

3. Reclaiming land parcels

Reclaim identified land parcels, houses in slum settlements after shifting people to urban poor housing layouts. Demolish undesirable structures.

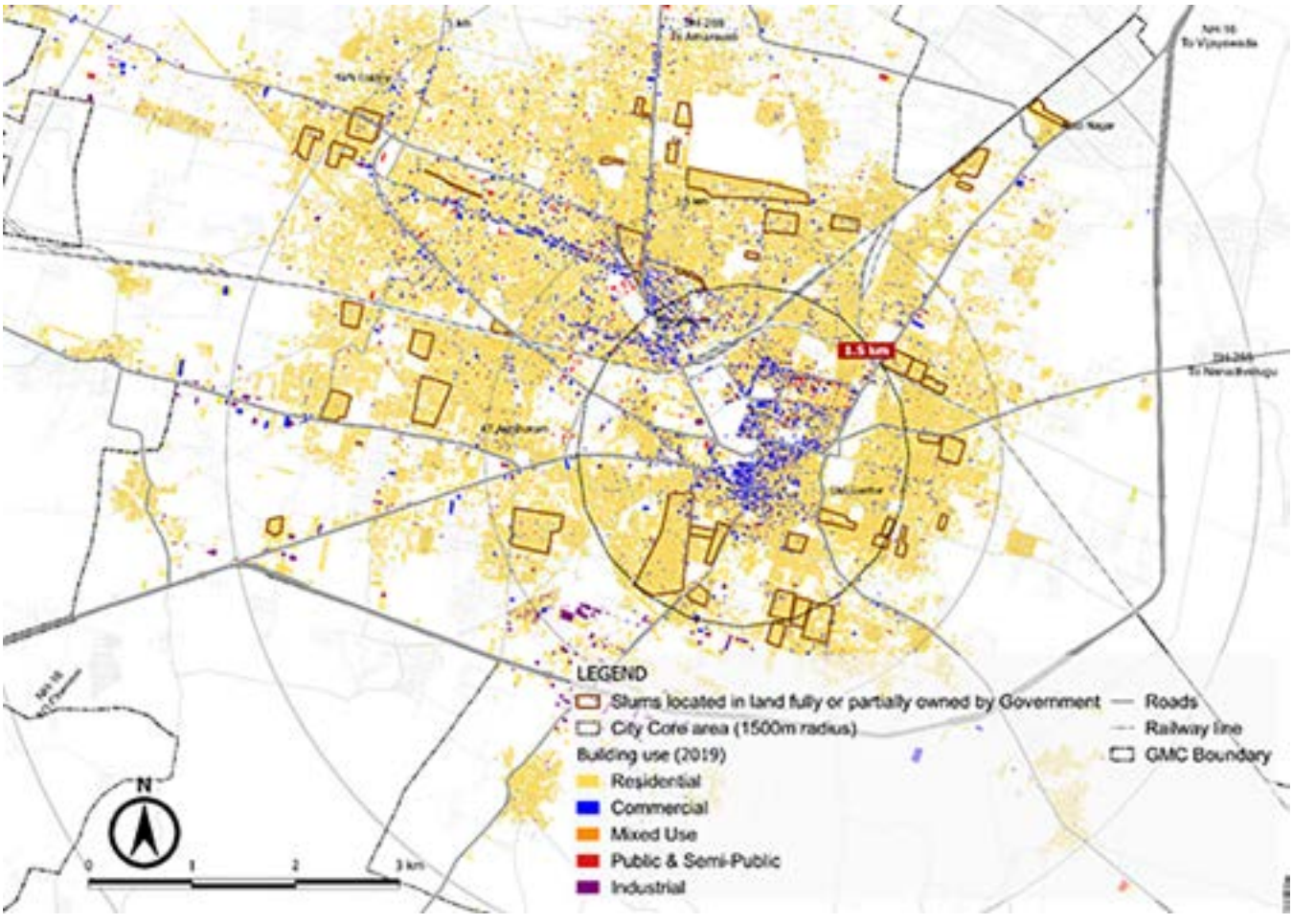
4. Preparing detailed project report

Prepare a detailed project report for provision of required trunk infrastructure, amenities, and development of planned activity within the designated land parcels.

5. Constructing planned activities

Construct planned infrastructure, amenities, and activity areas.

Key agencies responsible for undertaking the proposed intervention: GMC Town Planning and Engineering Sections.



MAP 3.8 Location of slum settlements on land fully or partially owned by Government

Source: UN-Habitat

ALIGNMENT WITH NATIONAL PROGRAMMES

Proposed Actions Aligning with Objectives of SBM U 2.0:

Construction of the following at each ARHC:

- Individual household latrines
- Community toilet at each ARHC
- On-site faecal sludge disposal system of a septic tank with soak pit

Provision of safe sanitation infrastructure, along with access to safe containment facilities is a major focus area under SBM 2.0.

b) Promote ARHCs within industrial layouts

The Guntur ZDP 2021 envisions developing the city as an international trade, commerce, and industrial hub. Accordingly, it gives more prominence to land allocation for industrial use over residential and transportation uses. Industrial land allocation in large continuous parcels is made along major corridors radiating out from the city (see Map 3.9). Workforce engaged in the secondary (industrial) sector constitutes a considerable share of the city's working population, with potential to increase further as most of the proposed industrial lands are yet to be occupied (see Map 3.9). Considering the fact that working population within EWS/ LIG groups face difficulties in finding houses for rent at affordable prices near their workplaces, industrial agencies should create ARHCs in feasible and safe vacant land within the industrial layout or in nearby vacant lands owned by respective industrial agencies.[35] Under the ARHC scheme, the Government of India provides various incentives to industrial and other private entities for the construction, operation and maintenance of ARHCs on their own vacant land. These incentives include provision of 'Use Permission' changes for housing, 50 per cent additional FAR/FSI over and above their existing FAR/FSI, free of cost, provision of necessary trunk infrastructure facilities up to the project site without any additional cost, single window approvals, among others.[36]

In collaboration with agencies such as the Guntur District Collectorate, Andhra Pradesh Pollution Control Board (APPCB), and Andhra Pradesh Industrial Infrastructure Corporation (APIIC), GMC shall conduct meetings with industrial entities in the city for constructing ARHCs. Consultations involving industrial associations, NGOs, and other relevant stakeholders shall be undertaken to plan the initiative.

This initiative benefits various stakeholders as listed below:

- EWS, LIG, students and other relevant groups: Rental housing at affordable price.
- GMC: Prevention of formation of new slums, and addition of revenue source.

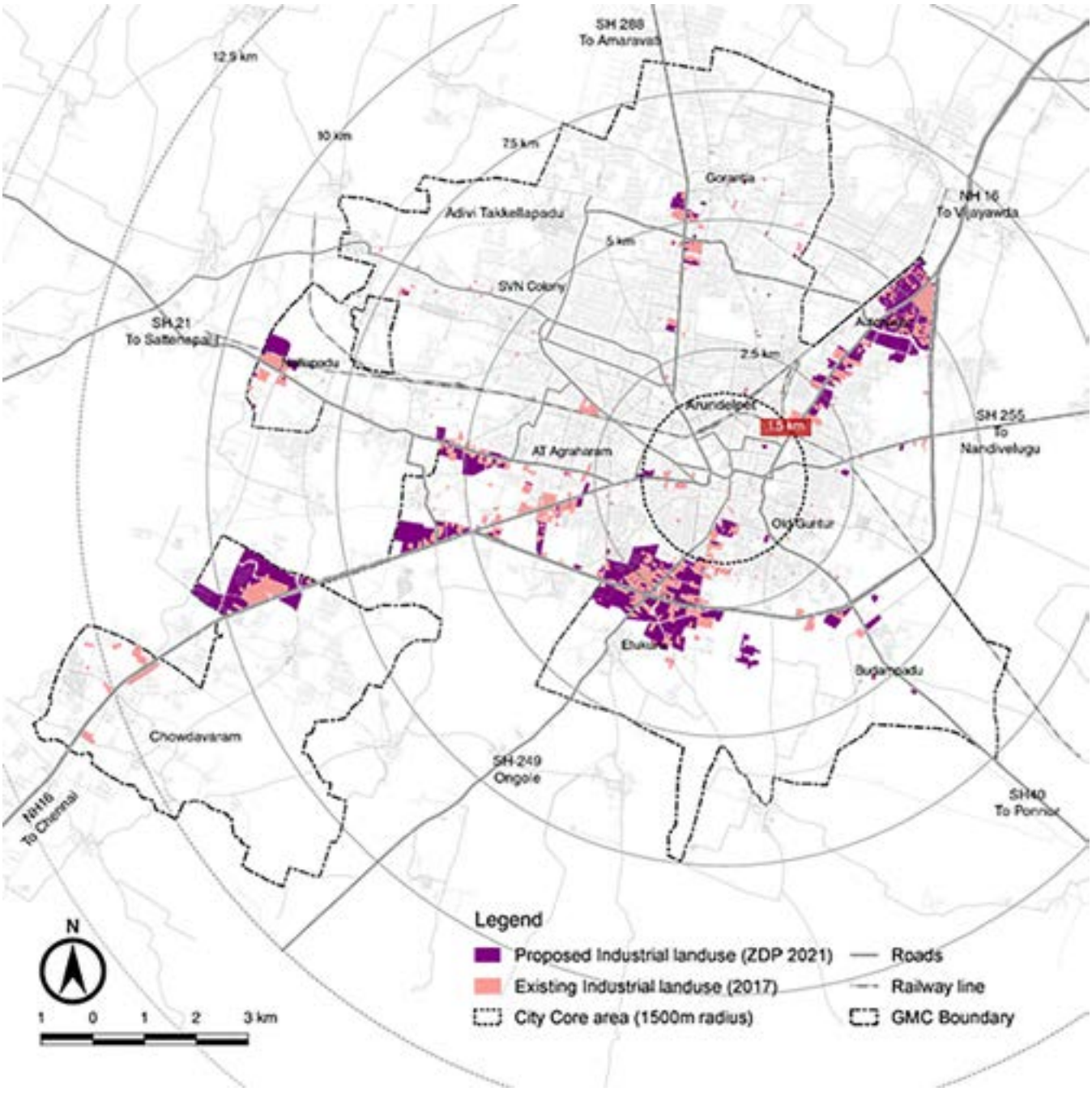
Intervention 3.2: Decongesting city core area

As detailed in the previous intervention, the reclaimed slum lands can also be utilized for developing community and neighbourhood parks based on the available land parcel size. This initiative will significantly help in decongesting the high-density city core and help provide access to organized green spaces to the population living in the city core, including slum settlements.

A few small and medium scale industries and workshops related to automobiles, vehicle service centres, printing, etc., are located in the highly dense city core area (1.5 km from Market Centre Junction) (see Map 3.9). Most of these industries have been functioning for more than three decades and add to the high intensity use of the land in the city core. These industries often attract undesired vehicular traffic and undermine the aesthetic appeal of the city centre. The ZDP 2021 has allocated land for industrial activity away from the core. GMC should consider relocating such industries to these designated industrial areas by providing appropriate incentives. A similar approach may be adopted to relocate wholesale markets, which attract a large number of goods carriers. The land parcels thus obtained could be used for multiple purposes,

35 Most of the industries located within GMC limits are non-hazardous. However, the type of industry and suitability for creating housing complexes shall be undertaken as a mandatory process by GMC during the building permission sanction stage.

36 Operational Guidelines for Affordable Rental Housing Complexes (ARHCs) - Ease of Living for Urban Migrants/ Poor (July 2020). http://arhc.mohua.gov.in/filesUpload/Operational-Guidelines-of-ARHCs.pdf (accessed on 6 January 2022).



MAP 3.9 Proposed (ZDP 2021) and existing (land use 2017) industrial land use in the city

Data source: GMC, ZDP 2021, APCRDA; Map source: UN-Habitat

such as vehicular parking facilities and public open spaces, social infrastructure, others contributing to a facelift of the urban core.

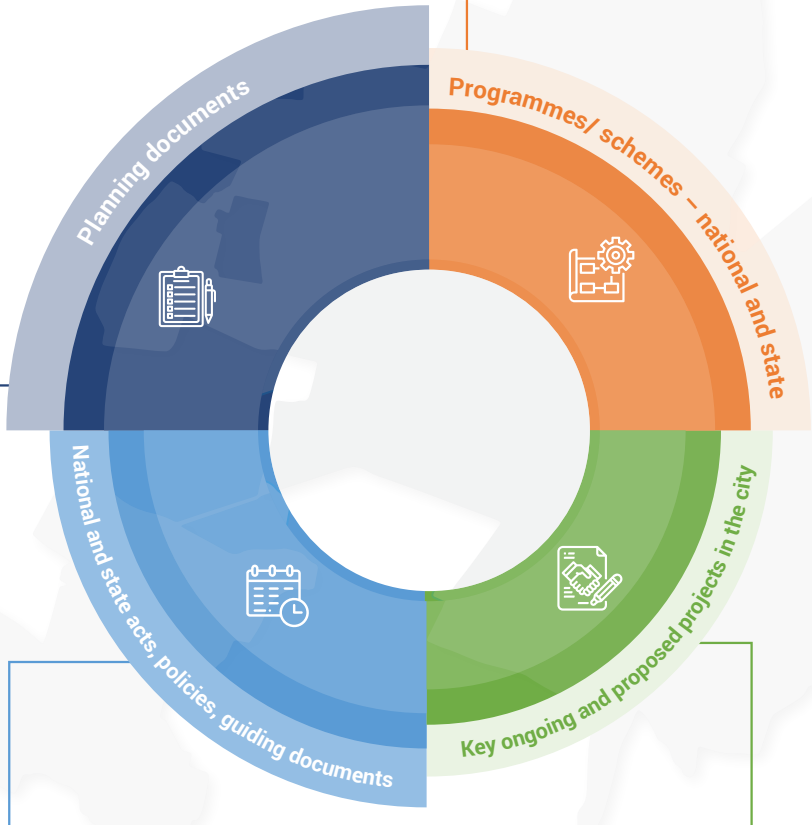
The relocation of above-mentioned activities impacts the people deriving livelihood in the area. Hence, the shifting of activities shall be undertaken in a gradual manner. It is essential to assess impact on livelihood and develop strategy to mitigate the same. Social protection, livelihood promotion, financial inclusion, social empowerment are key components to consider. Based on assessment and understanding of existing supply chain and livelihood, shifting allowance to beneficiaries shall be provided.

- A subsistence allowance be provided as social protection to enable beneficiaries to meet immediate needs
- Provide livelihood options matching previous employment.
- Economic inclusion: Improve financial literacy and access to savings and financial services
- Social support: Workshops and counselling for psychosocial support and to induce positive behaviour change among relocated communities.

3.4.2 Alignment with national, state policies, programmes and ongoing, proposed capital projects in the city

- Zonal Development Plan 2021
- Guntur City Disaster Management Plan

- Pradhan Mantri Awas Yojana - Urban
- Affordable Rental Housing Complexes sub-scheme
- Swachh Bharat Mission (Urban) 2.0
- Navaratnalu - Housing for All Poor
- Jagananna Pachathoranam



- National Urban Policy Framework 2018
- National Urban Housing Policy 2007
- AP Slum (Identification, Redevelopment, Rehabilitation and Prevention) Act, 2010
- Operational Guidelines for Affordable Rental Housing Complexes (ARHCs)

- Sanction of dwelling sites and construction of houses for the homeless urban poor under Navaratnalu - Housing for All Poor scheme
- Guntur Master Plan/ ZDP (currently under revision)

3.4.3 Gender and inclusion

This strategic response will improve the living conditions for slum dwellers through incremental slum upgrading processes as well as creating new housing. The access to services such as toilets, clinics, safe waste management would address the deprivation faced by people of informal settlements. The relocation is challenging in terms of socio-economic sustainability as it disrupts current pattern of employment. It is recommended to provide mobility subsidy (3-6 months) for people, specifically women who are been resettled to peripheral areas.

In the intervention 3.1- creation of affordable rental housing provides opportunities for single women, or those with a single income to access a home. The requirements of women, girls, gender minorities should be included in the ARHCs. The facilities may include shelters for survivors of domestic violence, shelters for homeless, counselling centres, working women's hostels, others. ARHS could also empower survivors with user sensitive design of domestic violence shelters.

It is recommended that in ARHS, floorspace to be reserved for vulnerable groups. Elderly women, single women, domestic abuse survivors could be some user groups to consider. Assessment of priority groups in the city should be conducted, and area planning suggested to be done accordingly.

- Units could be designed either by providing a whole women floor/ with majority (60-70 per cent) allotted for women.
- Planning of housing for women either in ground or first floor with commercial activities in ground floor.
- Reserved parking zones for women as per units, with safe accessibility.
- The other floor occupants in the building recommended to be families/couple with at least one-woman member.
- Amenities such as creches, clinics, day-care centres to be incorporated to promote women pursue employment opportunities.

Refer to Annex 11 for gender-inclusive development guidelines for affordable housing projects.

Creation of community and neighbourhood parks in vacant land as part of intervention 3.2-improves quality of living and safety in Guntur. The relocation of wholesale market recommended could impact existing livelihood. It is suggested to be done in graduation approach if identified mandatory. It would be helpful to assess impact on livelihood and develop strategy to mitigate the same. Based on assessment and understanding of existing supply chain and livelihood, shifting allowance suggested to be provided.

3.4.4 Climate convergence

Strategic Response 3 proposes developing new housing complexes. This may negatively impact the city's GHG emissions; however, several considerations may be applied to reduce these outcomes.

One housing layout, which forms part of the state government's 'Navaratnalu - Housing for All Poor' scheme, has been taken up to showcase a 'business as usual' approach to unit construction, as well as the increase in travel trips that this development may trigger.

TABLE 3.8 Project potential CO_2-eq emissions of a 'business as usual' scenario for one housing complex (with 1,666 units, 12.5 km from the city centre)[37]

Project	Details	Potential GHG savings potential (tCO2-eq/annum)
Urban Poor Housing Layout	Stationary sector	8,331.5
	Transport sector	3,476.9

Source: Various sources have been used in the calculation of emissions savings potentials. Please see Annex 8. For Climate Savings Calculation Methodology for the calculation breakdown and assumptions made.

37 The 'business as usual' construction method includes the use of materials such as concrete, cement, ceramic tiles and burnt clay bricks. The sustainable materials comparison detailed above includes the use of materials such as wood, cork and bamboo, as detailed in Annex 9.

This is compared with the proposed intervention for ARHCs to be constructed in the city's built-up area. It highlights the impact of GHG emissions on sustainable construction methods, and the reduction in private vehicular and public transport use by building residents with access to existing facilities and utility networks.

Each new affordable, EWS housing unit may emit up to 4.1 tCO_2-eq per annum, and each LIG unit may emit 5.48 tCO2-eq per annum. The largest housing layout, which is expected to hold 1,666 units, could emit around 8,331.5 tCO_2-eq per annum in total.

In addition, utility networks must be extended across large distances to reach isolated housing layouts compared to smaller scale expansion or increase in capacity for existing infrastructure within the city's former limits.

Furthermore, mobility emissions are exacerbated by longer travel distances to access employment and facilities. The distance travelled from the largest housing layout to the city centre could lead to an additional 4,998 trips a day.[38]As there are limited secondary economic nodes in Guntur, the distance from this housing layout to the city centre is approximately 12.5 km. This housing layout could, therefore, increase the transport sector's carbon emissions by 3,476.9 kg $C0_2$-eq per passenger per day.[39]

TABLE 3.9 Project CO_2-eq storage potential of a more sustainable housing construction method

Project	Details	Potential GHG savings potential (tCO_2-eq/annum)
Intervention 3.1: Creation of Affordable Rental Housing stock	Proposed ARHC (on government owned, freed-up slum land, or on industrial vacant or under-used land)	23,498.53[40]

Source: Various sources have been used in the calculation of emissions savings potentials. Please see Annex 8. For Climate Savings Calculation Methodology for the calculation breakdown and assumptions made.

Although indicative, this suggests that leveraging land, infrastructure and assets within the city can reduce the city's GHG emissions from new housing development. Maintaining green coverage through agricultural land uses at the city's periphery and using brownfield sites for new development can also aid in maintaining the city's carbon storage capacity. Using more sustainable construction materials can create a potential to store 23,498.53 tCO_2-eq per annum from the construction of 800 units.[41]

As proposed within this strategy, surveying existing housing stock that could be appropriate for retrofitting could be the least emitting way to increase housing stock. Not only are existing materials recycled and restored, but improvements such as insulation and ventilation can be made to the existing building to reduce emissions in the long-term. In addition, using vacant land for public and open spaces can increase green coverage and, consequently, the city's ability to store carbon (Intervention 3.2).

3.4.5 Estimated project costs

The total cost for the creation of ARHCs on government-owned slum land has been calculated below (see Table 3.10), assuming that only 50 per cent of slums are used for ARHCs, with one colony on each slum, and a total of 40 dwelling units per colony. The total cost for the construction of 800 housing units is approximately INR 7,670 lakh. With the addition of individual dwelling toilet facilities, septic tanks and community toilet facilities, the total project cost is approximately INR 8,303.6 lakh.

38 Based on the city's average trip rate of 0.6 trips per person per day and an average household size of 5.
39 This is based on the modal share for the city. However, it is likely that emissions would be higher as there is likely to be a higher dependency on private and public transport due to longer distances required to access facilities. India GHG Program. (2015) India Specific Road Transport Emission Factors. Available Online at [https://shaktifoundation.in/wp-content/uploads/2017/06/WRI-2015-India-Specific-Road-Transport-Emission-Factors.pdf].
40 This is based on a total of 280 EWS units, 520 LIG units, and uses materials such as fly ash, wood, cork and bamboo in place of cement, concrete and burnt clay bricks. See Annex 8 for more details on the break down in GHG emission calculations.
41 There are a total of 41 slums on government land. Assuming around 50 per cent, or 20 of these slums, are used for developing ARHCs with one colony per slum, this creates the potential to develop 40 dwelling units per complex. Therefore, a total of 800 housing units have been used for the calculation of GHG emissions and cost estimates.

TABLE 3.10 Summary of estimated project costs for Intervention 3.1

Project	Project	Estimated Project Cost (in INR lakh)	Remarks
Intervention 3.1: Creation of Affordable Rental Housing Stock	Create ARHCs on industrial land and government owned slum land, using green construction methods	8,303.6	As per SBM (U) 2.0 guidelines, in addition to housing units, one toilet per household, a community toilet facility and septic tank per housing complex has been included.

Source: Various sources have been used in the calculation of project costs. Please see Annex 9 for Cost Estimates Methodology for the calculation breakdown and assumptions made.

3.4.6 USAF indicators impacted

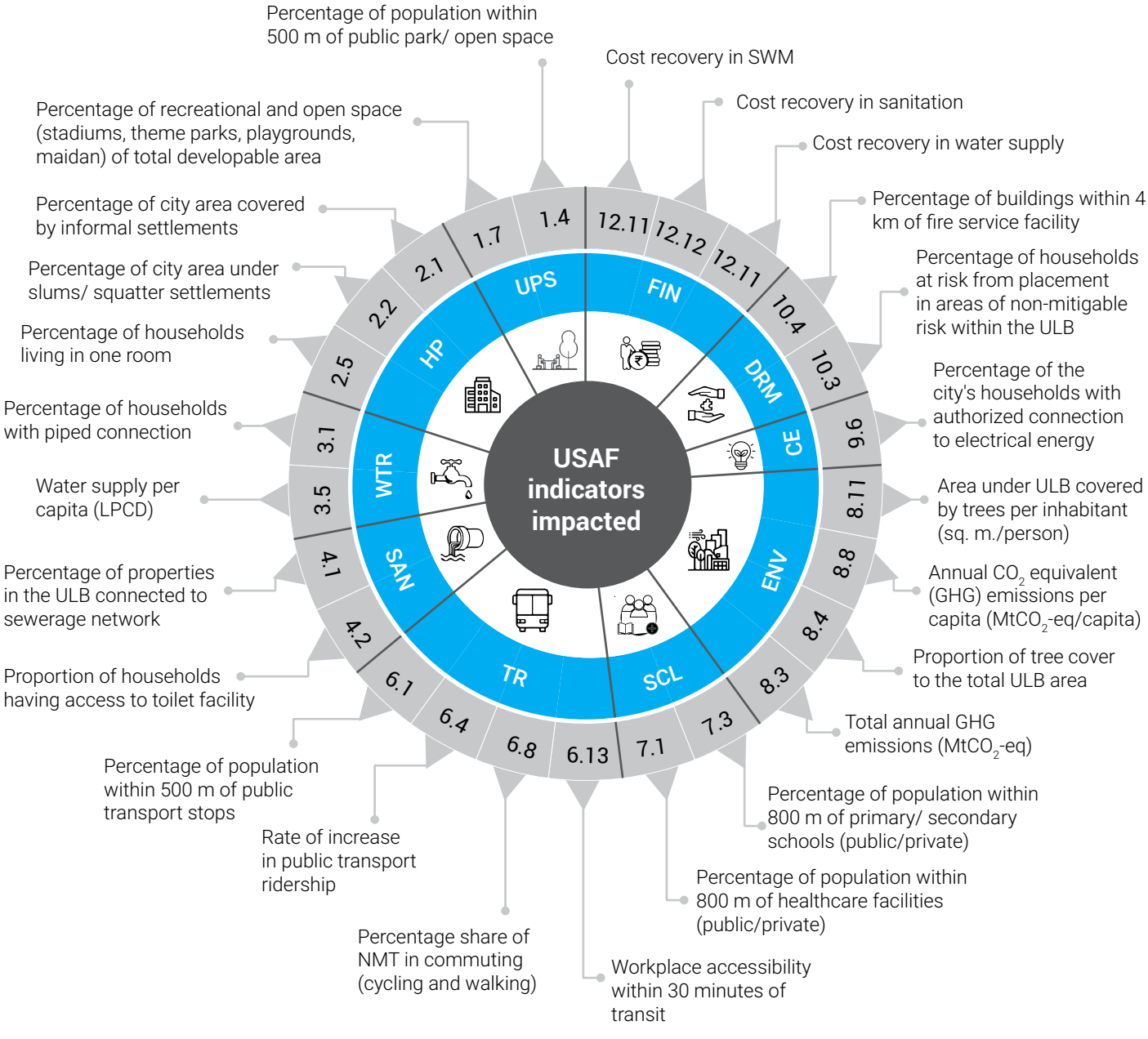


IMAGE 3.14 An urban poor housing complex (constructed by AP TIDCO) in Adavaitakkellapadu

Source: UN-Habitat

3.5 Strategic Response 4: Reinventing Liveable Streets

The strategic response addresses a few problems identified in the strategic issue, such as poor/ unorganized public transport and NMT infrastructure in the city. The principle of 'low carbon development' has been adopted for formulating the interventions under this strategic response.

3.5.1 Proposed interventions within the strategic response

Two interventions have been proposed under this strategic response as follows:

Intervention 4.1: Creating roads as multi-functional spaces

Roads are among the most important public assets in urban areas. They are critical for urban growth, economic development, and for access to social amenities. Guntur has an advantage of having most of its main roads (arterial and sub-arterial) with Right of Way (RoW) ranging between 60–120 ft. These main roads are mainly designed for vehicular traffic with rarely any space left for other street activities.

The footpaths provided along some of these major roads are poorly maintained and encroached by economic activities along the roadside. Absence of dedicated spaces for street vendors, vehicular parking, drop and pick-up points for city buses and auto-rickshaws create tremendous conflict. Except for the medians developed with greenery, the RoW is totally paved, leaving the roads impermeable. A few major roads in the city also experience water logging during heavy rains hindering traffic movement. Despite availability of four- and six-lane divided carriage ways along the major road encircling the city centre (Ring Road) and a few other major roads, lane discipline by vehicles is not followed and organizing various street activities is absent.

This intervention focuses on providing a solution to organize various street activities, thus transforming them into complete streets. The key objectives of the intervention are as follows:

- To transform major roads for efficient movement of various modes.
- To transform streets as multi-faceted spaces accommodating diverse uses.
- To promote greenery along streetways.
- To design street spaces to mitigate and adapt to impacts of climate change.

IMAGE 3.15 View of Brodiepet Main Road

Source: UN-Habitat

Guntur city core (1.5 km from Market Centre Junction) has been chosen to demonstrate the proposed intervention. As mentioned earlier, most government offices, colleges, hospitals, public transport hubs (bus terminus and railway station), playgrounds, wholesale markets, and cinema halls are in the city core. The distance between these facilities can be suitably covered on foot/ bicycle. As discussed earlier, the city core faces several issues (see Figure 3.8).

As shown in Figure 3.9, a few candidate road corridors (shown for illustrative purposes) in the city core have been mapped into three zones based on the existing predominant land use along the corridor. For example, in Zone 1, most of the city's medical facilities (including the Government General Hospital) are located along this corridor, which connects the bus terminal and railway station. The RoW of this identified corridor is 60 ft. Although it attracts huge pedestrian and vehicular traffic, it is not provided with any footpaths or adequate parking spaces. Similarly, Zone 3 houses a large informal sector as an extension of PVK Naidu Vegetable Market and Patnam Bazaar (wholesale commercial market), but it does not have any designated vending zones for street vendors.

As part of the intervention, the identified corridors in each zone are assigned with a character/ role based on the predominant street activity. This would translate into designing the street by accommodating the required components. The character/ role of 'movement' has been assigned to Zone 1, proposing facilities for efficient movement of pedestrian and vehicular traffic with footpaths, organized vehicular lanes, designated vehicular parking places, etc. Similarly, sufficient designated areas with support infrastructure need to be provided in Zone 3 for street vending activities along the corridors. Figure 3.10 shows the proposed predominant character of these identified corridors.

A similar exercise is proposed for the city's other major roads, as shown in Map 3.10. It is recommended that GMC prepare a detailed project report to redesign these major roads and develop these corridors accordingly.

FIGURE 3.7 A few roles of conventional and multi-functional streets

Source: UN-Habitat

FIGURE 3.8 A few problems in the city core

1 – Encroachment of road carriage way by street vendors along Guntur – Sattenapalli Road; 2 – Traffic congestion at the entry point of Shankarvilas Flyover; 3 – On-street vehicular parking and unorganized street activities on the road leading to Patnam Bazaar; 4 – Encroachment of footpaths at Collector Office Road; 5 – Water logging after a heavy rain in Brodiepet Main Road; 6 – On-street vehicular parking on a 60-ft road in Kothapeta

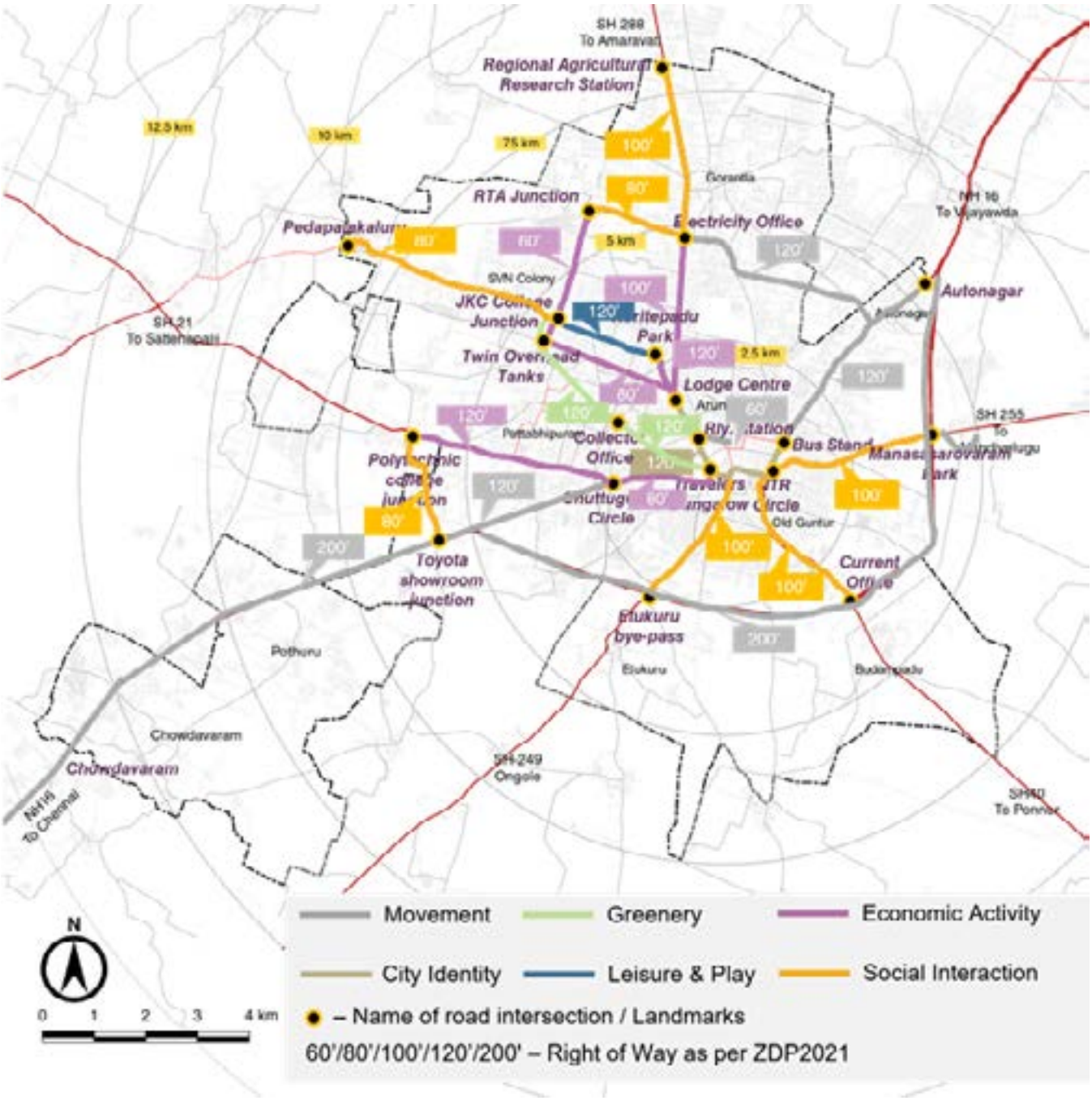
Source: UN-Habitat

FIGURE 3.9 A few major road corridors connection some prominent activities in the city core

Source: UN-Habitat

FIGURE 3.10 Proposed predominant character to a few major roads in the city core

Source: UN-Habitat



MAP 3.10 Proposed prominent character to major city roads

Source: UN-Habitat

Refer to Annex 5 for the parameters for assigning a prominent character to major city roads. To illustrate this proposed intervention, two road corridors connecting Market Centre Junction, i.e., Market Centre to Hindu College and Guntur–Sattenapalli Road, were selected. Detailed road cross section designs were also prepared for the two corridors (see Annex 6 for the designs).

A conceptual road cross section design has been prepared for the stretch between PVK Naidu Vegetable Market and Gandhi Park (see Figure 3.13). Various street design elements, as shown in Figure 3.12, have been included in the street cross section. The road being a prominent corridor in the city is proposed to develop as a 'city identity' corridor.

FIGURE 3.11 A few elements of a street

Bicycle Lane | Public Toilet | Bus Bay and Shelter | Urban Plaza

Tabletop Crossing | Street Vending Zones | Bloswale | On-Street Parking

FIGURE 3.12 Proposed cross section of the road with various street elements

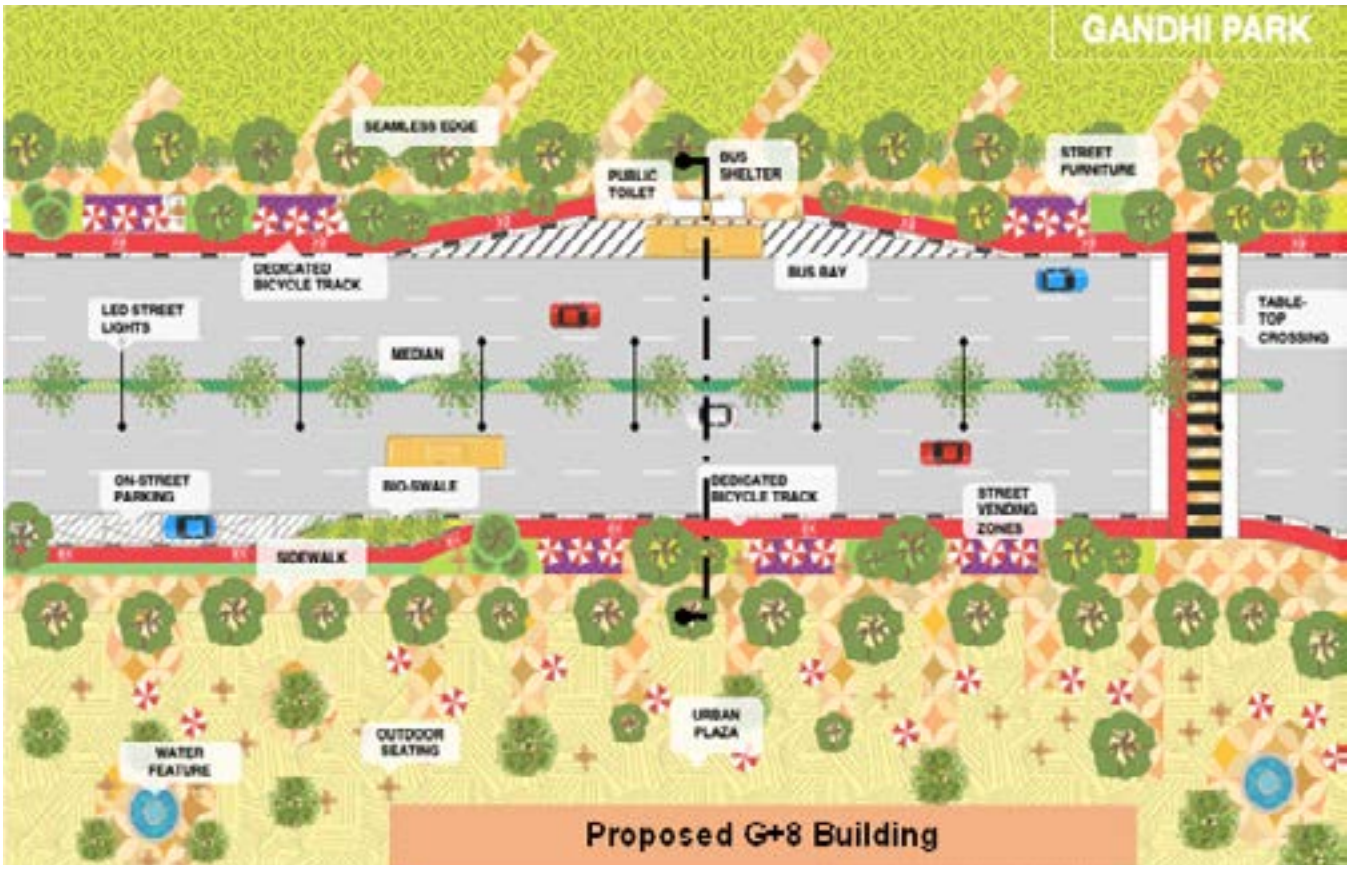
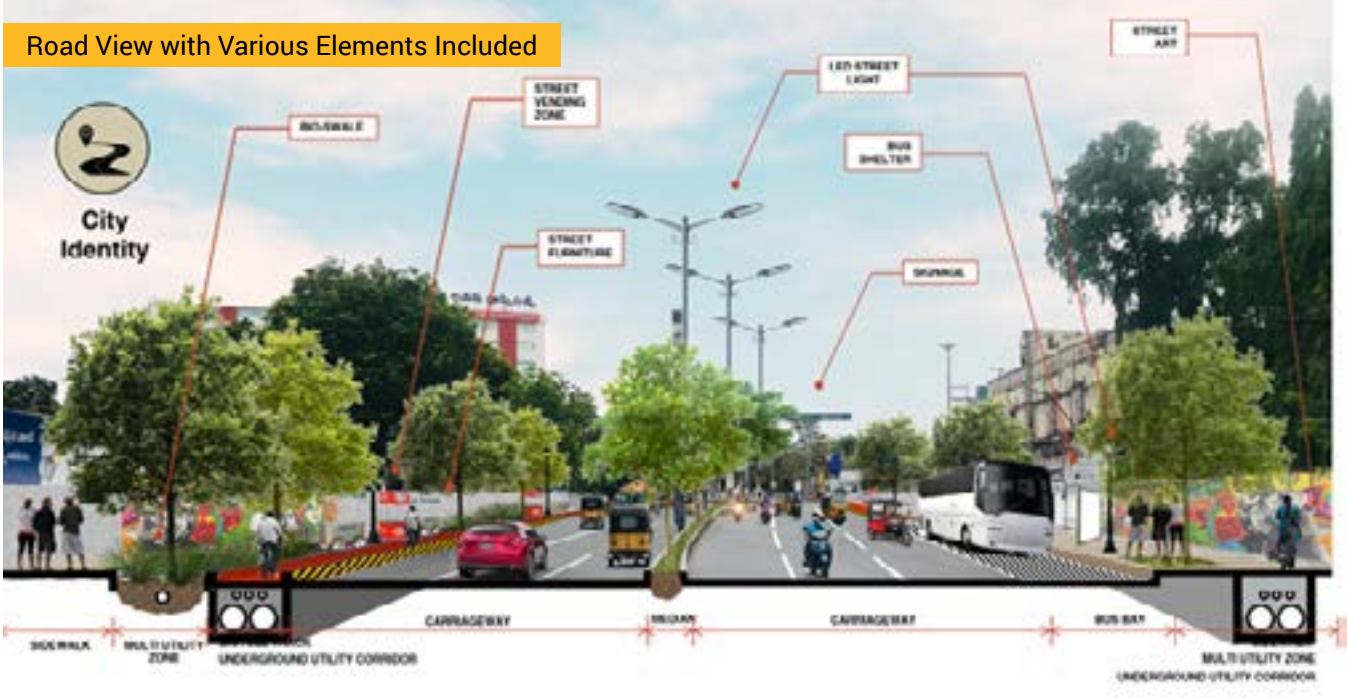


IMAGE 3.16 Existing view of PVK Naidu Vegetable Market to Hindu College Road corridor

FIGURE 3.13 Conceptual view of PVK Naidu Vegetable Market to Hindu College Road corridor with various street elements included



Source: UN-Habitat

With the proposed transformation, a 100-m road stretch of 120-ft. RoW would result in an 11 per cent increase in green cover and 27 per cent increase in permeable surface area.

IMAGE 3.17 View of road corridor between PVK Naidu Vegetable Market and Gandhi Park

Source: UN-Habitat

FIGURE 3.14 Conceptual view of proposed mixed use development at Amaravati Road–MG Inner Ring Road Intersection

Source: UN-Habitat

Intervention 4.2: Preparation of Low Carbon Comprehensive Mobility Plan (LCCMP)

As detailed earlier, Guntur does not have an organized public transportation system. Citizens mainly commute through private vehicles, followed by auto-rickshaws and privately operated city bus services, all of which use fossil fuels. Only a few major roads in the city have footpaths, most of which are encroached by street hawkers and adjacent shop keepers. Encroachment of carriageways by on-street vehicular parking and street vendors is seen across all major roads. There are no dedicated bicycle lanes in the city either.

The last comprehensive mobility plan for the city was prepared in 2004. Over the last one and half decades, the city has experienced significant population growth, area expansion and heightened economic activity. In the next four to five years, the city is estimated to become a million-plus city. There is an immediate need, therefore, for planning its urban transport system. In the last couple of years, a few plans were prepared with recommendations for some of the city's main mobility challenges. These plans include the Guntur City Clean Air Action Plan (2019) prepared by APPCB, and the Draft Guntur Immediate Action Plan for Transport prepared by APCRDA (see Table 3.11 for details).

APCRDA is also preparing a comprehensive mobility plan for the Andhra Pradesh Capital Region, including Guntur city. The master plan for Guntur is also currently under revision, wherein various transportation studies are to be conducted. It is necessary that these recommendations are integrated under the umbrella of reduced carbon emissions and green mobility. This intervention recommends the preparation of an LCCMP, detailing the required low carbon and green technologies needed for implementing the proposed projects/ developments. The plan shall also prepare detailed designs for roads to organize various elements, as detailed in Intervention 4.1 under this strategic response.

TABLE 3.11 List of select recommendations/ projects mentioned in City Clean Air Action Plan and Draft Immediate Action Plan for Transport

Guntur City Clean Air Action Plan (2019)
• Define routes, permits, fares, vehicle specification and safety standards for para-transit vehicles in the city.
• Ban and phase-out diesel auto-rickshaws. Introduce CNG, electric auto rickshaws.
• Assess and introduce city bus system of appropriate fleet size of small buses with GPS tracking, ETVMs for fare collection and passenger Information Systems. Develop route plan for bus operation.
• Develop pedestrian and cycling friendly street corridors. Prepare a plan for developing NMT infrastructure in the city.
• Identify and notify commercial areas with high footfall and create pedestrian plazas. Make encroachment of NMT lanes a publishable offence backing with legal provisions.
• Promote compact development in new developments (through promoting high density, mixed land use and mixed income developments) to reduce travel distances and improve access to facilities.
• Prepare and implement a parking demand management plan. The plan shall delineate parking in all major areas in the city based on land use, activity – demarcate parking areas for all modes and essential street amenities (vending zones, green open spaces, others) – Eliminate free vehicular parking; Equip parking areas with metering systems, signages, information system showing parking space availability, etc.
• Prepare traffic management plan for the city; monitor the performance and continuously update the plan. Enforce land driving through heavy fines
Draft Guntur Immediate Action Plan for Transport (December 2019)
• Road corridor improvements (Footpath, drainage, junction improvement, traffic management and streetscape improvements): total 3.3 km road stretch (Grand Trunk Road from NTR Bus Terminal to Mastan Darga Centre and Guntur-Sattenapalli Road).
• Construction and repair of footpaths, streetscape improvements in many major road corridors.
• Road safety measures (introducing appropriate speed limits, Road signs and markings, dividers and speed breakers) at various locations.
• Develop designated vehicle, auto rickshaw and truck parking spaces.
• Construct Bus shelters in various locations across the city and relocate some bus stops which are located near the intersections and causing traffic congestion.

Source: APPCB, APCRDA

The LCCMP of Guntur shall address the following aspects:

- Understand the present travel characteristics and forecast future travel demand.
- Estimate emissions from urban transport based on the future travel demand.
- Integrate impacts of transport on local air quality, emissions, safety, and social aspects.
- Assess the feasibility of a formal, organized public transport mode such as BRT/ buses, NMT and IPT.
- To provide a recognized and effective platform for integrating land use and transport planning.
- Formalize a vision and monitoring mechanism.
- Provide spatial, economic, and regulatory plans and interventions based on
  i. Urban Structure (land use)
  ii. Public Transport Strategies (city-wide and urban design)
  iii. NMT (using principles)
- Integrate the recommendations of Guntur Clean Air Action Plan (2019), Draft Guntur Immediate Action Plan for Urban Transport, Ongoing Transportation Plan for Andhra Pradesh Capital Region, Revised Master Plan for Guntur, and other relevant plans.

Refer to Annex 7 for the list of activities to be included in the scope of work for the LCCMP.

National Mission on Sustainable Habitat 2021-2030: Actions Recommended to ULBs

The National Mission on Sustainable Habitat 2021-2030 report recommended the ULBs to undertake the following action plans for the 'Urban Mobility and Air Quality' sector. Cities with a population of over a million and state capitals are recommended to prepare the plan between 2021–2024 and cities with a population more than 5 lakh are recommended to do the same between 2024–2027.

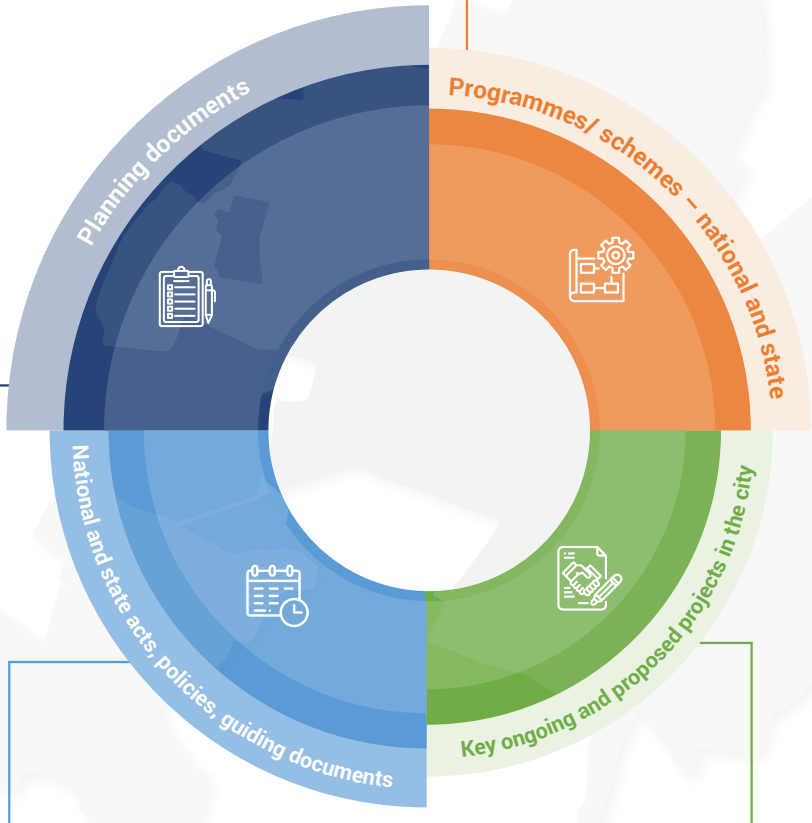
1) Action Plan for Clean Transportation
   Plan objective: Adoption of cleaner and environment friendly technologies, e.g., electric vehicles (EVs), compressed natural gas (CNG) and biofuels, as well as provisions for necessary infrastructure.
2) NMT Plan
   Plan objective: Promote mixed-use and NMT plans to facilitate walking/ cycling; Promote no-car zones, public bicycle sharing networks, etc. The plan shall emphasize safety aspects for pedestrians and cyclists.
3) Introduce strategies to decongest cities and discourage use of private vehicles.

Source: NMSH 2021-2030, MoHUA, GoI.

3.5.2 Alignment with national, state policies, programmes and ongoing, proposed capital projects in the city

- Zonal Development Plan 2021
- Guntur Clean Air Action Plan 2019
- Guntur City Disaster Management Plan
- Guntur - Immediate Action Plan for Transport (Draft)

- Transport4All Challenge
- Jagananna Pachthoranam
- Swachh Bharat Mission (Urban) 2.0



- National Urban Policy Framework 2018
- National Urban Transport Policy, 2014
- National Mission on Sustainable Habitat 2021-2030
- Non-Motorized Transport Guidance Document

- Guntur Master Plan/ ZDP (currently under revision)
- Andhra Pradesh Capital Region Transportation Plan (ongoing)
- Construction of 20 e-bus bays in across city

3.5.3 Gender and inclusion

Reinventing liveable streets and envisioning them as public spaces could encourage equitable access for women and marginalised groups. This strategic response in its interventions and additional establishment of Gender cell within GMC will be of high impact towards gender mainstreaming. The Intervention 1 specifically with creating roads as multi-functional space offers diverse uses, economic activity, community areas contributing to social inclusion. Women self-help groups may be employed in the street management as part of Intervention 4.1. In the designated vendor zones, it suggested to provide reservation for female vendors. Amenities for vendors and informal traders should be assessed and shortage of infrastructure such as restrooms/ changing rooms be provided.

Improving the safety and comfort of pedestrian routes through infrastructure, such as street lighting, public toilets (men, women and universally accessible), nursing rooms, drinking water facilities, street furniture etc can help marginalised groups and specifically women. Universal design codes are recommended to be followed in all interventions under the strategic response.

Intervention 4.2 does not have direct impact to GESI, however by the LCCMP affordable, efficient and accessible mobility systems could support more women to travel. The involvement of more women and gender minorities in the transportation sector could create safer mobility systems This would improve the WPR of women in Guntur.

Refer to Annex 10 for activities recommended to implement under 'Safer travel in the night programme'.

Recommendation: Establish Gender Cell within GMC

GMC shall consider establishing a gender cell to ensure action on gender-inclusive planning, implementation, capacity development and impact assessment. The suggested roles of the gender cell are below:

- Become a repository of gender (and where relevant age and income) disaggregated data across different sectors.
- Provide inputs to policies, programmes and projects undertaken by the GMC (and other agencies in the city), implement gender-focused initiatives in the city.
- Review, and create a gender budget with short, medium and long-term actions in partnership with departments such as Women and Child Welfare Department, Social Welfare Department, MEPMA, Police Department, APCRDA, other relevant departments; coordinate support, monitor implementation progress on a quarterly basis.
- Capacity Buildings within GMC staff.
- Create and implement communications and behaviour change programs for GMC
- Consult and disseminate information to civil society, academic institutes, self-help groups, membership-based and other organizations in the city.
- Create human resource policies for a gender-inclusive work environment in GMC. This includes but not limited to creating a gender-inclusive workplace policy, and annual sensitization of staff.
- Ensure representation and effective participation of women and gender minorities in development activities undertaking by GMC. Build capacities of women's self-help groups in the city to participate in the implementation, maintenance of interventions proposed in the Sustainable Development Strategies and as well in other development activities in the city.

3.5.4 Climate convergence

This strategic response includes the redesign of major streets in Guntur. Although we can quantify the GHG emission impact of greening interventions, additional impacts of Intervention 4.1 can aid in reducing GHG emissions. These include creating roads as multi-functional spaces, reducing road congestion, and increasing pedestrians and cyclists through organized traffic lanes, improving public transport and NMT infrastructure, etc.

The following emissions savings calculations are separated into two outcomes. The first shows the CO_2 storage potential of a 100-m stretch in the city centre (see row 1 in Table 3.12), and secondly. The second shows the impact of Intervention 4.1, creating roads and multi-functional spaces, at the city-wide scale, including all primary arterial and secondary sub-arterial roads (see row 2 in Table 3.12). Whereas the total GHG emissions savings for a 100-m stretch is -3.13 tCO_2 per annum, the total GHG emission savings potential for all primary and secondary roads is -1,747.56 tCO_2 per annum.

TABLE 3.12 Project CO_2-eq storage potential for Intervention 4.1

Classification & Intervention	Details	Potential GHG savings potential (tCO_2-eq/annum)
Intervention 4.1: Creating roads as multi-functional spaces	100-m stretch of road; City Identity - PVK Vegetable Market to Hindu College (near Market Centre) (120 ft RoW) road improvements	3.13
Intervention 4.1: Creating roads as multi-functional spaces	All primary arterial and secondary sub-arterial roads	1,747.56

Source: Various sources have been used in the calculation of emissions savings potentials. Please see Annex 8 for Climate Savings Calculation Methodology for the calculation breakdown and assumptions made.

3.5.5 Estimated project costs

The estimated project costs are based on the road stretch between PVK Vegetable Market and Hindu College (near Market Centre) (see Table 3.12 for details). The total estimated cost for the 100-m stretch is INR 202.43 lakh.

TABLE 3.13 Summary of estimated project costs for Intervention 4.1

Intervention	Project	Estimated project cost (INR lakh)	Remarks
Intervention 4.1: Creating roads as multi-functional spaces	PVK Vegetable Market to Hindu College (near Market Centre) (120 ft RoW)	202.43	Interventions include but are not limited to a tabletop crossing, toilets, bins, benches, lighting, median planting, bioswales, etc.

Source: Various sources have been used in the calculation of project costs. Please see Annex 9 for Cost Estimates Methodology for the calculation breakdown and assumptions made.

3.5.6 Indicators impacted

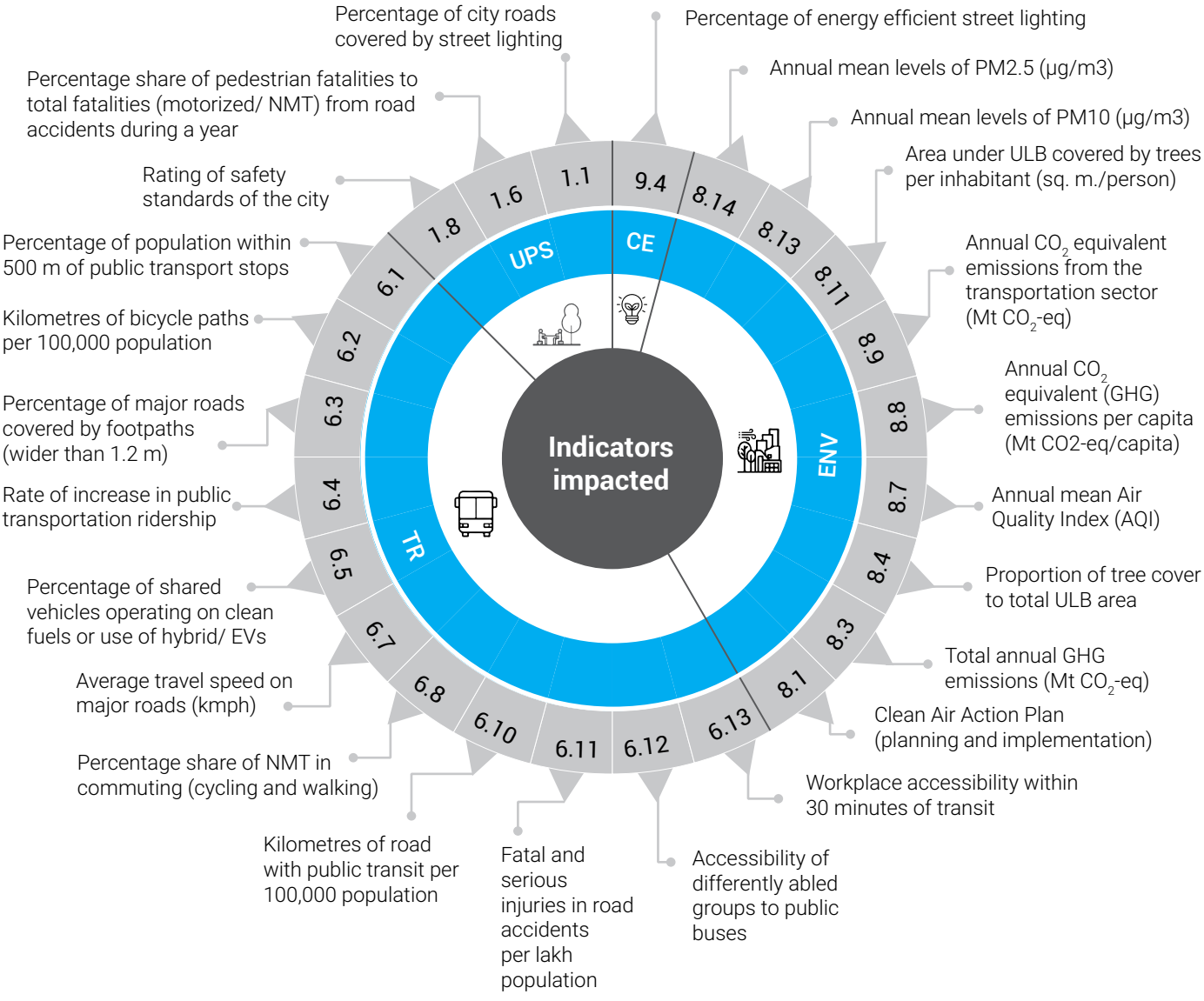


IMAGE 3.18 View of Ring Road section at Vidyanagar

Source: UN-Habitat

3.6 Transformative Project (ABD)

3.6.1 Scope of the area-based project

The area-based project showcases practical application of some of the proposed strategic interventions. The proposed UGN area in Guntur's northern micro-market, i.e., Amaravati Road–MG Inner Ring Road Intersection and its vicinity has been chosen as the demonstration area. This is among the areas experiencing rapid growth as well as concentration of various problems identified earlier by four strategic issues (see Section 3.3, Strategic Response 2).

Recommendations on the strategic densification around Amaravati Road–MG Inner Ring Road intersection will showcase key design principles at the neighbourhood scale, while illustrations of the block, public space, intersection, and street redesign will provide more detailed guidance in transforming the UGN into a compact and integrated neighbourhood with a safer street network and well-defined public spaces accessible to all.

The selected area provides vast opportunities to demonstrate pilot, city-wide strategies, and related design actions. The current availability of vacant land parcels provides opportunities to illustrate the design of new mixed-use blocks for infill development. The recommendations for public spaces and blue–green networks will tackle the lack of organized open spaces and parks. Introducing public transport routes and cycling infrastructure in response to low service coverage will be supported by street designs focused on safety and accessibility for all users (see Section 3.3, Strategic Response 2 for visual context details).

As an extension of the strategic recommendations, the area-based project will apply the UN-Habitat principles for sustainable neighbourhood planning[42], applicable for the Guntur context.

3.6.2 Urban design interventions

Transformation of the chosen area would require design interventions across different scales and elements. These include neighbourhoods, streets, and public spaces to illustrate strategic densification (see Figure 3.16) through infill development of compact neighbourhoods (see Figure 3.18), a snapshot of the street redesign illustrated by multi-modal intersection (see Figure 3.19) and design recommendations for water body design strategies (see Figure 3.20).

Table 3.14 shows the linkage between design interventions and strategic recommendations that address the identified challenges.

TABLE 3.14 Strategic issues and related strategic and design intervention

Strategic issue	Proposed intervention	Design intervention
Sprawling and scattered development patterns	Re-densification, infill development	Strategic densification through compact integrated neighbourhoods. (see Section 3.6.3)
Poor/ unorganized public transport and NMT infrastructure	Promotion of Non-Motorized Transport	Street redesign and multi-modal intersection (see Section 3. 6.4)
Inadequate public open spaces and conservation of water bodies	Protection of water bodies and development as recreational areas.	Water body as a public space (see Section 3.6.5)

3.6.3 Strategic densification through compact integrated neighbourhoods

The process of re-densification through infill development of the area-based project can be based on UN-Habitat's five principles for sustainable neighborhood planning, supporting three key features to a sustainable city, i.e., compact, integrated, connected.[43] This proposal uses these principles, and suggests that this approach should consider several steps/ principles (see Figure 3.17) to link the strategic recommendations and future vision of the city.

42 A New Strategy of Sustainable Neighbourhood Planning: five principles .2014. Discussion note 3, UN-Habitat. https://unhabitat.org/sites/default/files/documents/2019-05/five_principles_of_sustainable_neighborhood_planning.pdf.
43 Please note the five principles are currently being updated by UN-Habitat. Existing publications outlining these principles can be found online at: https://unhabitat.org/five-principles-of-neighbourhood-design.

These principles are:

1. **Building on the current potential:** The project is intended to leverage from the existing infrastructure (road network, open vegetated spaces) and build a more integrated environment through the targeted infill development and a set of connectivity strategies.
2. **Site selection for infill development considering the city-wide vision:** The plots for infill development can be selected on the basis of UN-Habitat principles for sustainable neighbourhood planning and the vacant land plots could be utilized for strategic densification along major arteries and areas with good road connectivity, ensuring adequate increase in density (to reach at least 150 PPH).[44]
3. **Retaining and enhancing the existing "green" and "blue" networks:** The site can benefit from the revitalization of existing land parcels with vegetation and water bodies, enabling transformation into a connected system of "green and blue" infrastructure, including integrated system of open public spaces with recreational and educational activities.
4. **Defining and "reserving" space for a pedestrian-priority network and public space:** The area-based project proposes a networked system of public spaces of various sizes, with different roles and characters. Most of the open green spaces were designed from scratch, right from the existing patches of vegetation and transformed into public spaces. The public space network emerged from connecting these scattered fragments to revitalize the existing green infrastructure and linking it to the overall urban system of public spaces with pedestrian avenues, streets, and pathways.
5. **Preserving agricultural assets:** To ensure the maximum impact of the proposed infill development, adjacent agricultural lands should be preserved from construction to meet the proposed vision for growth management, proposed as a unified outcome of the strategic responses. Apart from preventing the built-up area from forming a sprawl, agricultural lands can provide better food security and contribute to the local economy. It can also add to the area's distinct identity and character. For that purpose, the proposed neighbourhood suggests compact local markets that can also act as vibrant public spaces.

FIGURE 3.15 Strategic densification of the northern node

Source: UN-Habitat

44 Please note the five principles are currently being updated by UN-Habitat. Existing publications outlining these principles can be found online at: https://unhabitat.org/five-principlesof-neighbourhood-design.

FIGURE 3.16 Key steps in the process of strategic densification

1. Building on the current potential

2. Defining the most appropriate plots for infill development

3. Retaining and enhancing the current system of green open spaces

4. Defining the system of the pedestrian-priority network

5. Preserving agricultural assets

Source: UN-Habitat

Ensuring these five steps will allow for navigating densification in a sustainable manner. Strategic densification should be achieved by establishing compact neighbourhoods, planned in accordance with UN-Habitat's five principles for sustainable neighbourhood planning.[45] The potential neighbourhood design envisages the following components, aligned to these principles:

1. **Human-scale development:** Medium/ high population density ranging between 150–200 PPH (from existing 40–100 PPH) can be promoted through a compact built environment of human-scale housing blocks (3 - 5 storeys) allowing sufficient space between the units to be reserved for public space, vegetation, and parking. Such density achieved by human-scale development is positively perceived by local communities once sufficient public space is considered. For example, population densities of 150–200 PPH could be promoted in the existing residential areas with a scope for densification due to low-rise developments and availability of vacant lands (see Zoom 1 – Srirama Nagar Colony).
2. **Variety of housing typologies:** While promoting new mixed-use development, it is important to provide a variety of plot sizes and housing types for the diverse housing needs of the community at densities that can ultimately support the provision of local services. A mix of apartment types, sizes and tenures provide greater housing choices for a more diverse range of households. The housing options should include compact studios, one-bedroom apartments for younger/ smaller families, two or three-bedroom apartments for larger families, affordable rental housing for multiple tenants, housing units with direct access from the first floor with private community gardens for families with children, people with limited mobility, etc. The development of housing typologies should consider local ways of living and include comfortable spaces for women and youth, child-friendly spaces, areas at each floor of the block comprising various public and semi-public activities, communal gardens to grow own food, active block frontages ensuring passive surveillance for better street safety, etc.
3. **Green public spaces:** To ensure the vibrant environment of the neighbourhood, a variety of public spaces should be considered, adapted to the needs of all community members, according to universal design standards, prioritizing women and girls, the elderly, and the differently abled. The project proposes lively pedestrian-priority streets, marketplaces and areas with kiosks, child-friendly spaces and community gardens. In addition, such neighbourhoods support the 'sponge city' concept by providing more permeable open spaces that can act as rain gardens and bioswales.
4. **Vertical zoning:** To support the implementation of mixed-use neighbourhood concepts and ensure better resilience to climate change, vertical zoning should be applied to buildings to ensure the following:
    - Lower block levels should be reserved for economic activities, particularly at the street front, which will provide easy access to local employment opportunities and activate the street edge.
    - 'Green' roofs should be promoted where possible to increase vegetation cover to reduce heat islands, include community spaces for growing food and potential rainwater collection systems.
5. **Better connectivity:** The potential neighbourhood should provide an interconnected network of streets that facilitate safe, efficient, and pleasant walking, cycling, and driving experiences. The developed neighbourhood should demonstrate sustainable mobility patterns as a result of the street redevelopment, as described in Section 3.6.4.

45 Ibid.

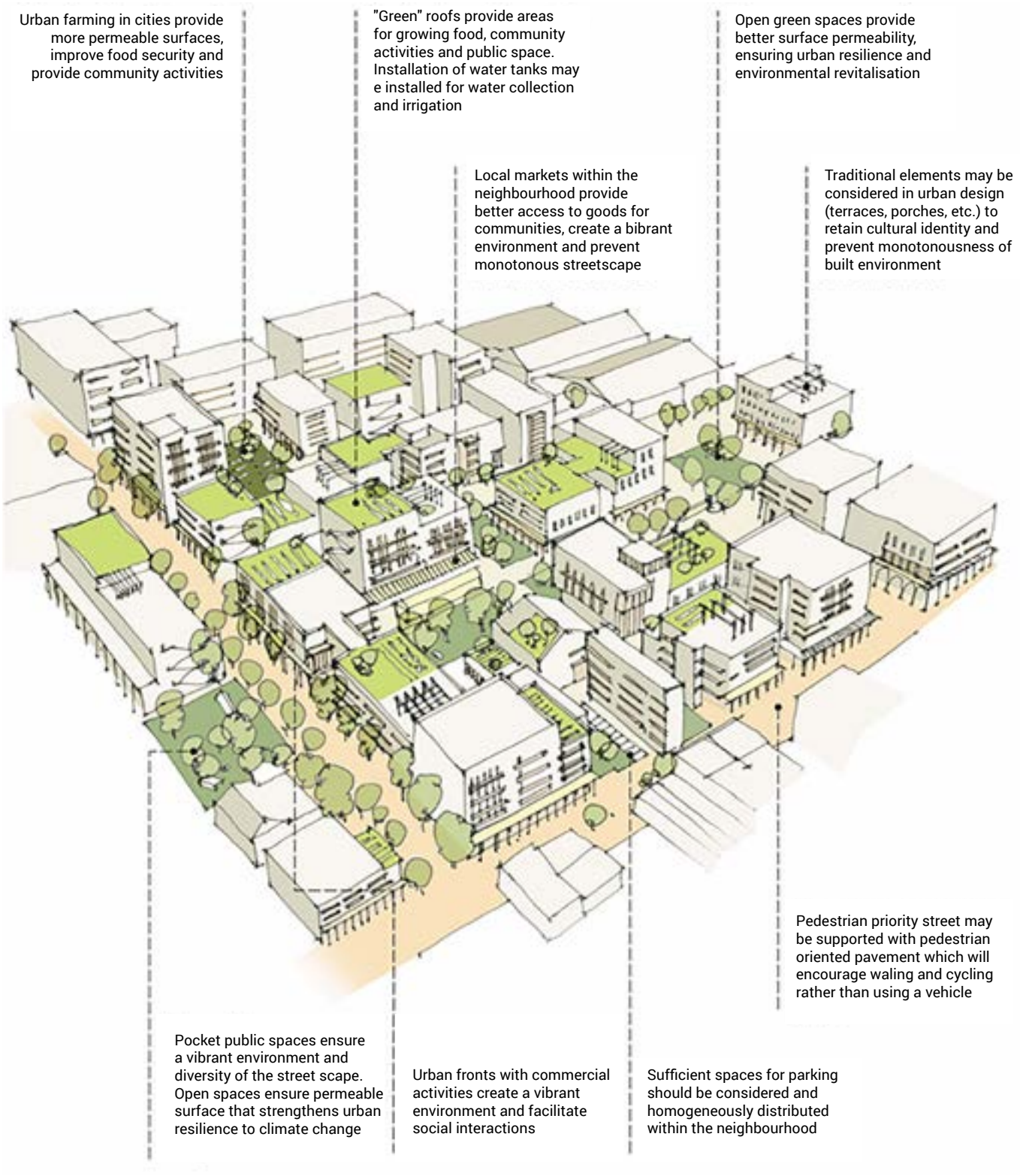
IMAGE 3.19 Street view (Srirama Nagar, 1st lane intersection) of an area at Zoom 1 in the ABD area

Source: UN-Habitat

FIGURE 3.17 Master plan of the potential neighbourhood (illustration)

Source: UN-Habitat

FIGURE 3.18 Vision of the potential neighbourhood (illustration)



Source: UN-Habitat

3.6.4 Street re-design and multi-modal intersections

The street strategies propose a set of interventions on street design to ensure the major streets of Guntur provide safe, accessible, and healthy travel experience for all users, including pedestrians, cyclists, and vehicles. As shown in Figure. 3.17, the current major streets of the northern node can be redesigned without disrupting or demolishing the existing structural elements, indicating the sufficient existing capacity of the street to accommodate the proposed interventions to promote NMT.

Urban design recommendations for the street network should include the following considerations:

- **Comfortable and inclusive environment for all street users:** The street redesign should ensure that streets provide an inclusive environment for use by all social groups, of all ages and abilities. That implies considering both technical aspects to make the streets more inclusive (tactile walking indicators, ramps and curb cuts, accessible pedestrian signals, etc.) and functional aspects (more vegetation to reduce noise and urban heat island, more child-friendly spaces close to social facilities, etc.).
- **Allocating efficient and comfortable space for cycling and walking:** Depending on the road classification, it is suggested that sufficient space be allocated for cycling lanes, addressing safety concerns by introducing green buffer zones and refuge islands between the transit lanes and cycle paths. To ensure that streets can act as public spaces, such elements like signage, street furniture, cycling facilities (bicycle parking, repair stations) and pedestrian infrastructure (crosswalks, ramps, central crossing islands, curb extensions, pinch points, etc.) should be designed and installed. These elements are particularly relevant for street type 'social interaction'.
- **Promoting comfortable environment to encourage use of public transport:** The city diagnosis identified the lack of public transport stops, which should be addressed at the stage of the detailed plan. To ensure a more comfortable operational experience for passengers, sheltered public transportation stops should be designed and constructed. Depending on the road classification, separate public transport lanes or public transport priority lanes may be introduced.

FIGURE 3.19 Concept proposal for the multi-modal intersection

Source: UN-Habitat

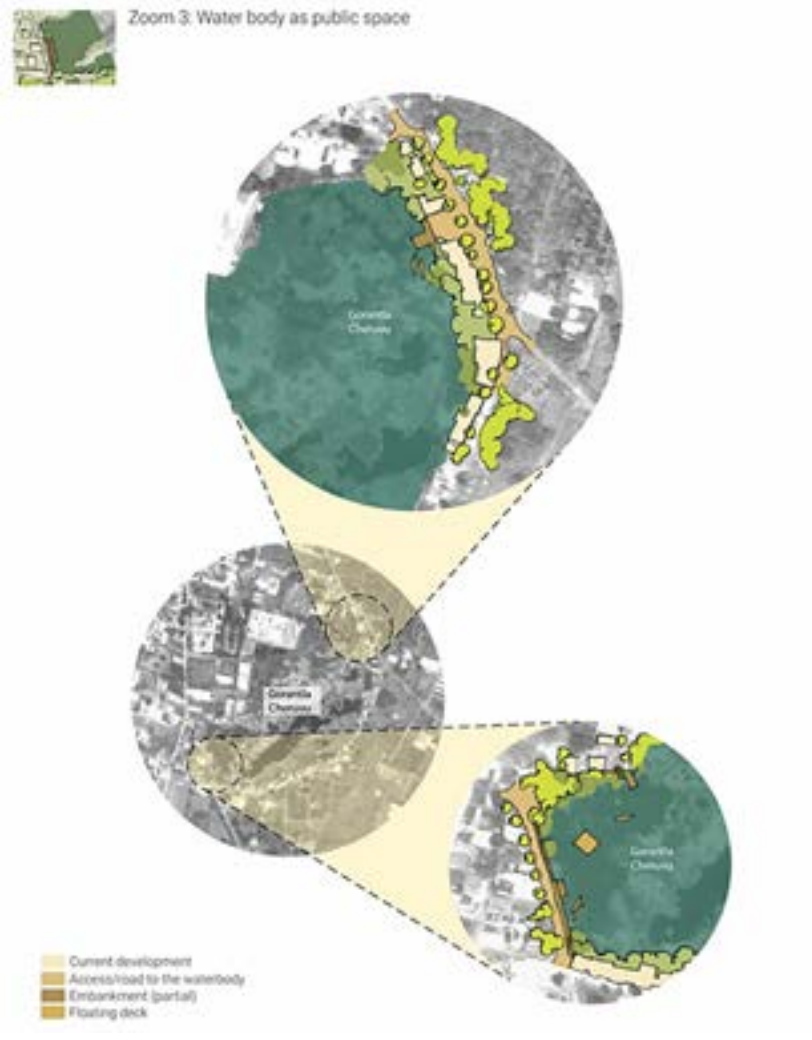
3.6.5 Water body as a public space

The encroachment of water bodies has resulted in challenges for communities to access water. To promote integration of the 'blue' network into the urban environment, detailed design solutions (potentially like the ones showcased in Figure 3.21) for water bodies should be developed, considering the current conditions of the water body and its adjacent areas. The project suggests enhancing and improving pedestrian linkages to water bodies through a system of paths/ trails. It also suggests preserving and designing access points to available water bodies that are currently free from construction. As illustrated in Figure 3.20, the water body has only two access points proposed for preservation and design interventions. Apart from mandatory technical recommendations (such as removal of invasive weeds and garbage), the key steps for the water body design are as follows:

Defining and preparing the water body for interventions: Due to encroachments, it is suggested that the current access points to the water body be identified and preserved. In addition, the water body buffer zone should be defined and spatially articulated through the promotion of context-specific vegetation, aligning with the 'sponge city' concept.

Defining design interventions: Design actions for the water body include improvements of the pedestrian linkages between the water body and urban areas (highlighting and improving the quality of the paths/ trails). Due to the limited space for a sidewalk/ path of appropriate width along the water body, embankment/ decks can be designed to provide communities with substantial, usable surfaces close to the water. Interventions such as small kiosks and water activities may be suggested to financially contribute to the maintenance of the area. Finally, the income generated may be used for managing and maintaining them.

FIGURE 3.20 Concept proposal for design of water body access point



Source: UN-Habitat

FIGURE 3.21 Prototypes of potential design solutions for the selected Gorantla water body

Source: UN-Habitat

1. Elevated deck adjacent to the water body, Northcountrydocks, USA,
2,3. Floating decks as a public space, Northcountrydocks and The Dock Doctors, USA
4. Elevated deck across the water body, Waterfront Park of Aiyi River, BLVD International, Yinchuan, China
5. Elevated deck as urban public space, Renmark Waterfront Park Observation Deck, Ingenia, Renmark, Australia
6. Floating wooden island in Copenhagen harbour, Fokstrot, Copenhagen, Denmark.

Therefore, the area-based project demonstrates the strategic densification of the northern node, providing guidelines for establishing a compact and efficient urban environment with diverse public spaces, multi-modal mobility patterns and consideration of contextual characters and local climate. Meanwhile, it meets the needs of a more compact, integrated, inclusive, and sustainable urban development model.

The snapshots of design recommendations provide practical guidance for targeted actions ensuring both short-term and long-term impact. For instance, while the infill development drives the process of densification for compact development, the street/intersection redesign can act as a "quick-win" initiative once implemented, providing immediate impact for communities such as better public space and safer streets. In addition, the targeted actions that are in line with a broader vision allow for more focused financing in a coordinated manner.

3.7 Actions and Interventions & Emissions Overview

The steps taken, the sources referenced, and the base metrics used to achieve the GHG potential savings and emissions, as well as the cost estimates for each intervention is included in Annex 8 and 9. Table 3.15 summarizes the key interventions and actions, the total GHG emissions and block cost estimates, the intervention duration, implementing agency and mission convergence.

TABLE 3.15 Summary actions and interventions

S. No	Strategic Response	Proposed Action / Project	Block Cost Estimate (in Lakh)	Climate Savings (in tCO2-eq) per annum	Location	Nature of Project	Duration (short, medium, long)	Implementing Agency	Sources of Finance	Convergence with National/ State Missions or Schemes
1	Sustainable Conservation and Development of Blue-Green Assets	Intervention 1.1: Promoting public amenities on under-utilized vacant land	N/A	N/A	Pan City	New Policy Guideline/Legal Instrument	Short / Medium (0-5 years)	GMC	PPP, GMC Funding	NA
2	Sustainable Conservation and Development of Blue-Green Assets	Intervention 1.2: Re-developing the water bodies (ponds) as new recreational areas (Developing four water bodies as Community parks)	727.44	50.25	Gorantla Cheruvu (Pond); Gaddipadu Cheruvu; Pothuru Cheruvu; Chakali Cheruvu;	Infrastructure Project	Short / Medium (0-5 years)	GMC	AMRUT 2.0, SBM 2.0, GMC Funding, Government Grants, PPP, CSR funding	AMRUT 2.0, SBM 2.0
3	Sustainable Conservation and Development of Blue-Green Assets	Intervention 1.3: Create a hierarchy of organized public green spaces	N/A	N/A	Pan City	Policy/Legal Reform or Amendment and Infrastructure Project	Short / Medium (0 - 5 years)	GMC	AMRUT 2.0, GMC Funding, Government Grants, PPP, CSR funding	AMRUT, AMRUT 2.0
4	Sustainable Conservation and Development of Blue-Green Assets	Intervention 1.4: Protection and restoration of water bodies	991.89	270.07	37 water bodies (Ponds) in the city; Along the stretch of Peekalavagu and Suddapallidonka stormwater drains Pilot project: Pond in Adavi Takkellapadu area (behind proposed Silparamam near RTA Office)	Infrastructure Project	Short / Medium term (0-5 years) Pilot Project: Short term (0-2 years)	GMC	AMRUT 2.0, GMC Funding, Government Grants, CSR funding	AMRUT 2.0 / Jal Jeevan Mission (Urban), Jagananna Pachathoranam
	Total Strategic Response 1. Sustainable Conservation and Development of Blue-Green Assets		1719.33	320.32						
5	Re-densification of areas experiencing growth	Intervention 2.1: Development of Urban Growth Nodes: Incorporating three Urban Growth Nodes in the revised Guntur Master Plan (2022-2035)	N/A	N/A	Three Urban Growth Nodes of 800 m radius from the following road intersection/ junction 1) MG Inner Ring Road - Amaravati Road Intersection 2) Gujjanagundla Junction 3) Chuttugunta Junction	Technical Study (Feasibility/ DPR/Plan)	Short (0 - 2 years)	APCRDA, GMC	APCRDA (In accordance with the APCRDA Act 2014)	NA

S. No	Strategic Response	Proposed Action / Project	Block Cost Estimate (in Lakh)	Climate Savings (in tCO2-eq) per annum	Location	Nature of Project	Duration (short, medium, long)	Implementing Agency	Sources of Finance	Convergence with National/ State Missions or Schemes
6	Re-densification of areas experiencing growth	Intervention 2.1: Development of Urban Growth Nodes: Preparation of Infrastructure Plan for Guntur city including the proposed Urban Growth Nodes (complementing the revised Master Plan)	N/A	N/A	Pan City	Technical Study (Feasibility/ DPR/Plan)	Short (0 - 2 years)	APCRDA, GMC	APCRDA (In accordance with the APCRDA Act 2014)	NA
7	Re-densification of areas experiencing growth	Intervention 2.2: Development of Urban Growth Nodes: Integrate and introduce regulatory measures to Change of land use (to Mixed land use) within the nodes, increase population density (150 - 200 PPH), others	N/A	N/A	Within the three proposed Urban Growth Nodes	Policy/Legal Reform or Amendment	Long (5 - 15 years)	APCRDA, GMC	NA	NA
8	Re-densification of areas experiencing growth	Intervention 2.1: Development of Urban Growth Nodes: Construction of Community Center, Satellite (mini) Bus Terminus and other node specific facilities/utilities (fire station, vending zones, improved NMT etc)	1731.66	N/A	Within the three proposed Growth Nodes (see annex 9 for component breakdown per Growth Node) - near the road intersection / main road	Infrastructure Project	Short / Medium (0-5 years)	GMC, APSRTC	APSRTC funding, GMC funding, PPP	NA
9	Re-densification of areas experiencing growth	Intervention 2.1: Development of Urban Growth Nodes: Introducing Urban Growth Node (zone) based shared paratransit services such as Electric Rickshaws and E-Auto rickshaws	N/A	N/A	The service area of Growth Node is considered as 2 km radius from the node Intersection point	New Policy Guideline/ Legal Instrument	Medium (3-5 years)	GMC, RTA	NA	NA
10	Re-densification of areas experiencing growth	Intervention 2.2: Prioritize development in areas experiencing growth: Prioritize the provision of ongoing, planned Infrastructure and services (Water supply, Sewerage network, secondary waste collection points, bus stops, Parks, others) in areas experiencing high growth	N/A	N/A	North and South-west parts of the city	Others	Short/ Medium/ Long (0-10 years)	GMC	SBM 2.0 / AMRUT 2.0 / CSR funding / GMC funding / Government Grants / Others	SBM 2.0 / AMRUT 2.0 / PMAY - U
11	Re-densification of areas experiencing growth	Intervention 2.2: Prioritize development in areas experiencing growth: Introduce / increase the Bus frequency of city bus services along the proposed priority routes (phase 1)	N/A	N/A	Ring Road, JKC College Road, Amaravati Road, MG Inner Ring Toad, GT Road	Others	Short (0 - 2 years)	GMC, APSRTC, RTA	NA	NA
12	Re-densification of areas experiencing growth	Intervention 2.2: Prioritize development in areas experiencing growth: Construction of new Bus stops (phase 1)	233.18	N/A	Ring Road, JKC College Road, Amaravati Road, MG Inner Ring Toad, GT Road	Infrastructure Project	Short / Medium (0-5 years)	GMC, APSRTC	GMC Funding, PPP	NA

S. No	Strategic Response	Proposed Action / Project	Block Cost Estimate (in Lakh)	Climate Savings (in tCO2-eq) per annum	Location	Nature of Project	Duration (short, medium, long)	Implementing Agency	Sources of Finance	Convergence with National/ State Missions or Schemes
13	Re-densification of areas experiencing growth	Intervention 2.2: Prioritize development in areas experiencing growth: Introduce / increase the Bus frequency of city bus services along the other proposed priority routes (phase 2)	N/A	N/A	Palakaluru Road, Etukuru Road, Ananthavarappadu Road, Damarapalli Road, Chowdavaram Road	Others	Medium / Long (3-10 years)	GMC, APSRTC, RTA	NA	NA
14	Re-densification of areas experiencing growth	Intervention 2.2: Prioritize development in areas experiencing growth: Construction of new Bus stops along the other proposed priority routes (phase 2)	232.37	N/A	Palakaluru Road, Etukuru Road, Ananthavarappadu Road, Damarapalli Road, Chowdavaram Road	Infrastructure Project	Medium / Long (3-10 years)	GMC, APSRTC	GMC Funding, PPP	NA
	Total Strategic Response 2. Re-densification of areas experiencing growth		2197.21	N/A						
15	Rejuvenation of City Centre	Intervention 3.1: Creation of Affordable Rental Housing stock: Undertake on-ground field survey in all the slum settlements located in Government owned land (where Patta / B-Forms to slum dwellers are not issued) to assess the land availability (for reclamation of land after the movement of people to allocated housing units in urban poor housing colonies) and condition of housing units	N/A	N/A	In all the slum settlements located in Government owned land where Patta / B-Forms to slum dwellers are not issued	Technical Study (Feasibility/ DPR/Plan)	Short (0 - 2 years)	GMC	GMC Funding	NA
16	Rejuvenation of City Centre	Intervention 3.1: Creation of Affordable Rental Housing stock: Utilizing the existing good quality housing stock in a few slum settlements located in Government owned land as Affordable Rental Houses for urban poor migrating to the city	N/A	N/A	In a portion of few slum settlements located within Government owned land (where Patta / B-Forms to slum dwellers are not issued)	Technical Study (Feasibility/ DPR/Plan)	Long (5-10 years)	GMC	GMC Funding	NA

S. No	Strategic Response	Proposed Action / Project	Block Cost Estimate (in Lakh)	Climate Savings (in tCO2-eq) per annum	Location	Nature of Project	Duration (short, medium, long)	Implementing Agency	Sources of Finance	Convergence with National/ State Missions or Schemes
17	Rejuvenation of City Centre	Intervention 3.1: Creation of Affordable Rental Housing stock in reclaimed land of a few slum settlements located in Government owned land	8303.60	23,498.53	In a portion of few slum settlements located within Government owned land (where Patta / B-Forms to slum dwellers are not issued)	Infrastructure Project	Long (5-10 years)	GMC	PPP, GMC funding	NA
18	Rejuvenation of City Centre	Intervention 3.1: Creation of Affordable Rental Housing stock: Create awareness, undertake discussions with Industrial unit owners to create Affordable Housing Rental Complexes in medium, large scale Industrial plot area	N/A	N/A	In medium, large scale Industrial unit plot areas. GMC, APPCB, APIIC to identify such Industries and encourage them to construct Affordable Housing Rental Complexes to accommodate Industrial workers	Policy/Legal Reform or Amendment	Short (0 - 2 years)	APIIC, APPCB, GMC (undertake discussions with Industry owners and provide necessary approvals, infrastructure); Industrial owners to construct and maintain affordable housing complexes	NA	ARHC Scheme / PMAY Urban
19	Rejuvenation of City Centre	Intervention 3.2: Decongesting the city core: Develop Organized Parks, Green spaces in reclaimed land of a few slum settlements located in Government owned land	N/A	N/A	In a portion of few slum settlements located within Government owned land (where Patta / B-Forms to slum dwellers are not issued)	Technical Study (Feasibility/ DPR/Plan)	Long (5-10 years)	GMC	GMC Funding, Government Grants	NA
		Total Strategic Response 3. Rejuvenation of City Centre	8303.60	23,498.53						
20	Re-inventing liveable streets	Intervention 4.1: Creating roads as multi-functional spaces: Prepare detailed street section designs in accordance with the assigned street character to the Major City Roads (to undertake as part of Low Carbon Mobility Plan)	N/A	N/A	All major Roads (Arterial and Sub-Arterial roads) in Guntur	Technical Study (Feasibility/ DPR/Plan)	Short / Medium (0-5 years)	GMC	GMC Funding	NA

S. No	Strategic Response	Proposed Action / Project	Block Cost Estimate (in Lakh)	Climate Savings (in tCO2-eq) per annum	Location	Nature of Project	Duration (short, medium, long)	Implementing Agency	Sources of Finance	Convergence with National/ State Missions or Schemes
21	Re-inventing liveable streets	Intervention 4.1: Creating roads as multi-functional spaces: Road Corridor improvements (design and construction of streets accommodating various activities in an organized manner with focus on NMT infrastructure, accommodating street vendors)	202.43[46]	1,750.69 [47]	All Major roads (Arterial and Sub-Arterial roads in the city. Pilot project: i) Market Centre Junction to Hindu College junction; Guntur – Sattenapalli Road (Road between GMC office and PVK Naidu Vegetable Market)	Technical Study (Feasibility/ DPR/Plan)	All city major roads: Long (0-10 years)			
				Pilot area: Short (0-2 years)	GMC, Traffic Police	GMC Funding	NA			
22	Re-inventing liveable streets	Intervention 4.2: Preparation of comprehensive Low Carbon Mobility Plan (Incorporating the suggestions from City Clean Air Action Plan 2019, Draft Immediate Action Plan for Urban Transport 2018-20, assigning street character and preparation of detailed road section sections designs for all major roads in the city in addition to the regular aspects covered under Low Carbon Mobility Plan)	N/A	N/A	Entire Guntur City and its immediate surrounding areas	Technical Study (Feasibility/ DPR/Plan)	Short / Medium (0-5 years)	GMC	GMC Funding	NA
		Total Strategic Response 3. Re-inventing liveable streets	202.43	1,750.69						

Source: UN-Habitat

46 This cost estimate only includes the pilot project (100m road stretch).
47 This total emission includes all primary and secondary roads in the city and includes the pilot project area (100m stretch).

Grand Trunk Road

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