Government of Maharashtra
Environment and Climate Change Department

Majhi Vasundhara Abhiyan

सोलापूर वातावरण बदल कृती आराखडा २०२४ माहितीपत्रक

Photo credit: Pravin Gaikwad

सोलापूर शहराचे ध्येय

नैसर्गिक संसाधनांचे जतन करून शहराचा जल संवेदनशील, सर्वसमावेशक आणि कमी-कार्बन विकास करणे, व त्यासोबत नागरिक, निसर्ग आणि व्यवसायांची वातावरण बदला संदर्भातील अनुकूलन क्षमता वृद्धीकरण करणे आणि महाराष्ट्राच्या निव्वळ शून्य कार्बन उत्सर्जनाचे उद्दिष्ट साध्य करण्यासाठी योगदान देणे हे आहे.

Prepared and compiled by WRI India

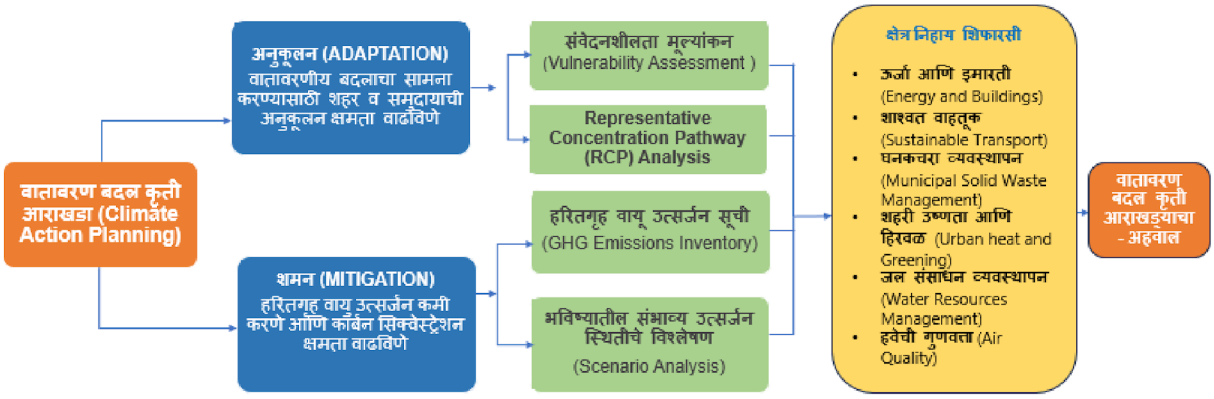
पार्श्वभूमी

महाराष्ट्र राज्य शासनाच्या मार्गदर्शनाखाली, वर्ल्ड रिसोर्सेस इंस्टीट्यूट इंडिया (डब्ल्यूआरआय इंडिया - WRI India) ह्या संस्थेने, सोलापूर महानगरपालिकेसोबत सोलापूर शहरासाठीचा वातावरणीय बदल कृती आराखडा म्हणजेच Climate Action Plan (CAP) तयार केलेला आहे. महाराष्ट्र राज्यातील शहरे आणि नागरी समूहांसमवेत शाश्वत विकास आणि वातावरणीय बदलावर काम करण्याच्या अनुषंगाने महाराष्ट्र शासनाच्या एकत्रित प्रयत्नांचा हा एक भाग आहे.

हा आराखडा तयार करण्याच्या व्यापक प्रक्रिये मध्ये, सन २०२२ पासून विविध विभाग आणि संस्थांकडून संबंधित माहिती गोळा करण्यात आली, त्यानंतर त्याचे विस्तृत विश्लेषण आणि अभ्यास करण्यात आला. तसेच विविध भागधारकांशी अनेक वेळी व्यापक सल्लामसलत करण्यात आलेले आहे.

वातावरणीय बदल कृती आराखड्याचे मुख्य घटक

ह्या आराखडयाचे मुख्य घटक आणि तो तयार करण्याची व्यापक कार्यपद्धती खाली दर्शविण्यात आलेली आहे:



ह्या आराखडया अंतर्गत खालील दोन विषयांचे अवलोकन हे महत्वाचे आहे

१. हरितगृह वायू उत्सर्जन सूची (greenhouse gas emissions inventory or GHG emissions inventory)

२. संवेदनशीलता मूल्यांकन (Vulnerability Assessment or VA)

संवेदनशीलता मूल्यांकन (Vulnerability Assessment or VA) अंतर्गत वातावरणीय बदलासंदर्भातील धोक्यांचा शहरातील रहिवासी, उपजीविका आणि पायाभूत सुविधांवर होणारा परिणाम याविषयी सविस्तर भौगोलिक विश्लेषण (spatial analysis) देखील करण्यात आले आहे.

सोलापूर - वातावरणीय बदलाचे धोके

ह्या वातावरणीय बदल कृती आराखड्या अंतर्गत सोलापूर शहराशी संबंधित वातावरणीय बदलांमुळे होऊ शकणाऱ्या धोक्यांबद्दलचे विश्लेषण करण्यात आले आहे. सोलापूर शहरात विशेषत: चार वातावरणीय बदलासंदर्भातील धोके संभवतात :

शहरी उष्णता अर्थात अर्बन हीट
(Urban heat)

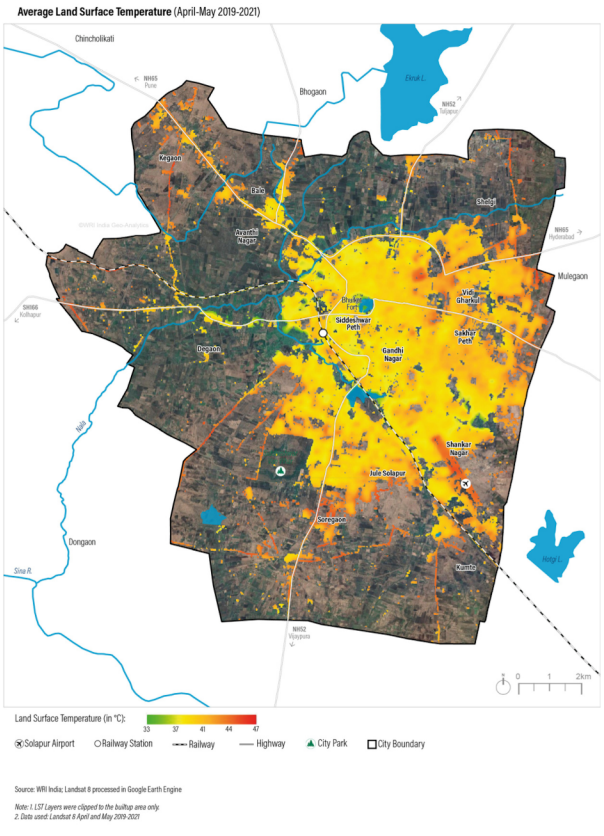
वायू प्रदूषण
(Air pollution)

प्रादेशिक पातळीवर पर्जन्यमानातील व्यापक बदल (rainfall variability) व जल संसाधनावरील ताण
(Water stress)

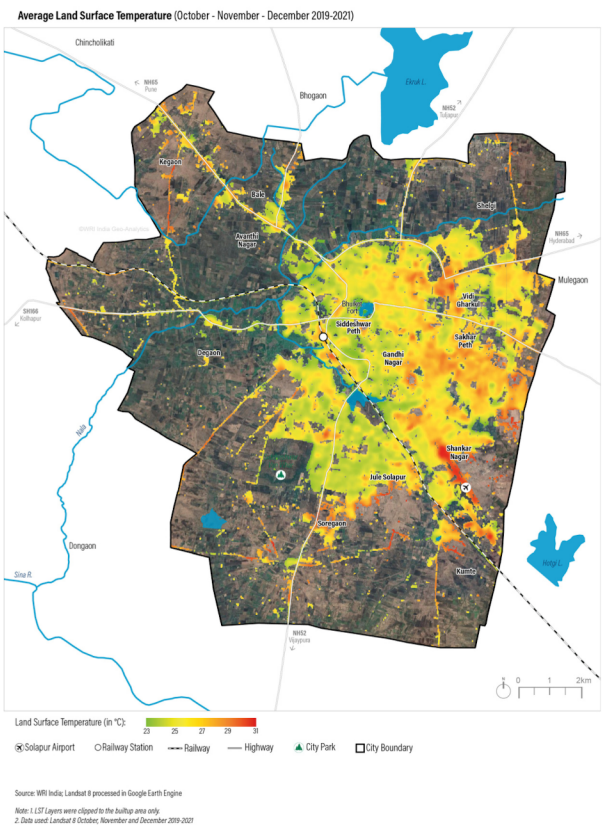
भूजल पातळी खालावणे अर्थात भूजलाचा ऱ्हास
(depletion of groundwater)

Mean Land Surface Temperature (LST) for pre and post monsoon (2019-2021)

अ) मान्सूनपूर्व उन्हाळी महिने
(एप्रिल आणि मे)
(Pre monsoon summer months April and May)

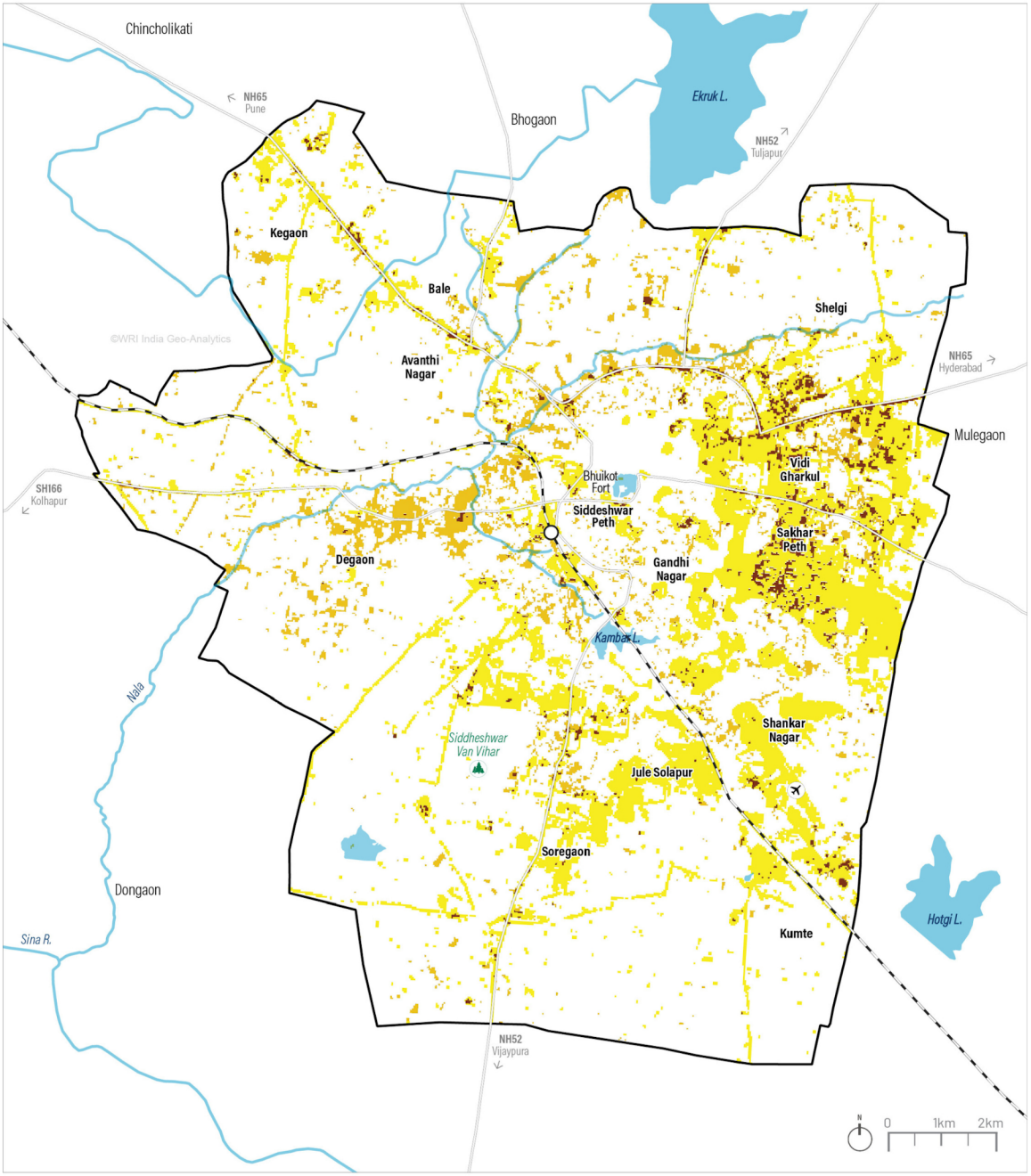


ब) मान्सून नंतरचे हिवाळी महिने
(ऑक्टोबर – डिसेंबर)
Post monsoon winter months (October – December)



Multi-hazard analysis- Land Surface Temperature (LST) and decreased Groundwater Recharge Potential.

Settlements and Areas exposed to LST levels above the city average and decreased Ground Water Recharge Potential respectively



Settlements exposed to LST levels above the City Average
Areas within decreased Ground Water Recharge Potential
Settlements and areas exposed to both increased LST levels and decreased Ground Water Pontential
Public Toilet
Solapur Airport
Railway Station
Railway
Highway
Waterbody
Ward Boundary
City Boundary

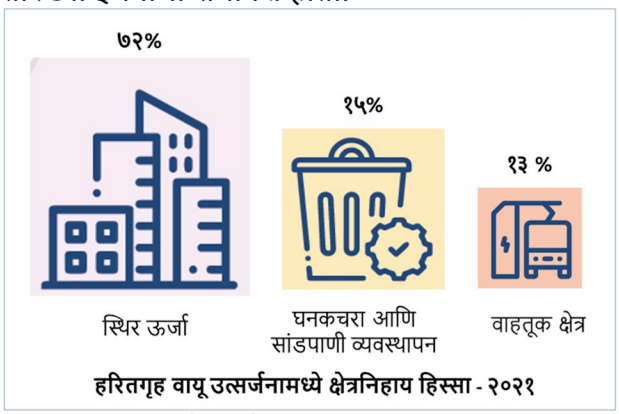
Source: Solapur Municipal Corporation; WRI India 2022

Note: Average distance covered in 5 minutes in Indian condition is 400-500 metres for an adult (Bernard van Leer Foundation, 2018)

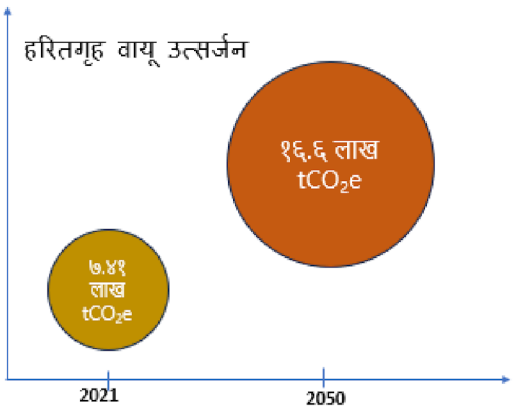
Stakeholder Consultation at SMC
Photo credit: WRI India

सोलापुरातील हरितगृह वायू उत्सर्जन (Greenhouse gas emissions)

सोलापूर वातावरण कृती आराखड्या अंतर्गत, सोलापूर शहराची पहिली हरितगृह वायू उत्सर्जन सूची म्हणजेच GHG emissions inventory तयार करण्यात आली असून विविध हरितगृह वायूंच्या स्रोतांचेही विश्लेषण करण्यात आले आहे. ही उत्सर्जन सूची वर्ष २०२१ हे वर्ष आधारभूत मानून तयार करण्यात आलेली आहे. या सूची प्रमाणे, २०२१ मध्ये, सोलापूर महानगरपालिका क्षेत्राचे अंदाजे हरितगृहवायूंचे (GHG) उत्सर्जन हे ७.४१ लाख टन कार्बन डाय ऑक्साईड समतुल्य (tCO2e) इतके असून त्यामध्ये स्थिर ऊर्जा क्षेत्राचा हिस्सा सर्वात जास्त म्हणजे ७२% आहे. स्थिर ऊर्जा क्षेत्रा मध्ये वीज, आणि घरगुती/ व्यावसायिक/ औद्योगिक क्षेत्रासाठी साठी वापरल्या जाणाऱ्या एलपीजी सारख्या इंधनांचा समावेश होतो.



Source: WRI India analysis



Source: WRI India analysis

भविष्यात सोलापूर शहराचा विकास होत राहणार असून, इतर शहरांच्या बाबतीत पाहिल्याप्रमाणे, खाजगी वाहतूक पद्धतीचे वर्चस्व कायम राहिल्यास हरितगृह वायू (GHG) उत्सर्जनातील वाहतुकीचा वाटा सध्याच्या १३% पेक्षा जास्त वाढू शकेल. तसेच घनकचरा आणि घरगुती सांडपाण्यासंदर्भातील हरितगृह वायू (GHG) उत्सर्जनाचा वाटा सध्याच्या १५% पेक्षा जास्त वाढण्याची शक्यता आहे.
भविष्यातील संभाव्य स्थितीचे विश्लेषण असे दर्शविते की हरितगृह वायू (GHG) उत्सर्जन सध्याच्या ७.४१ लाख tCO2e प्रतिवर्ष वरून २०५० पर्यंत १६.६ लाख tCO2e प्रतिवर्ष पर्यंत वाढेल.

क्षेत्रनिहाय शिफारसी

या सर्व तपशीलवार विश्लेषणाच्या आधारे आणि मुख्य भागधारकांशी व्यापक सल्लामसलत करून, सहा प्राधान्य क्षेत्रांमध्ये धोरणे आणि कृतींची शिफारस करण्यात आली आहे. ही सहा प्रमुख क्षेत्रे आहेत –

- शहरी उष्णता आणि हिरवळ (urban heat and greening)
- वायू गुणवत्ता (air quality)
- शाश्वत वाहतूक (sustainable transport)
- घनकचरा व्यवस्थापन (municipal solid waste management)
- जल संसाधन व्यवस्थापन (water resources management)
- ऊर्जा आणि इमारती (energy and buildings)

Photo credit: Abhi Dulange

Source: WRI India analysis, SMC

सोलापूर महानगरपालिका व इतर संबंधित संस्था व विभाग यांनी शहराच्या शाश्वत विकासाच्या माध्यमातून वातावरणीय बदलाचा सामना करण्यासाठी आराखड्या अंतर्गत सुचविण्यात आलेल्या आवश्यक उपाययोजना करणे अपेक्षित आहे.

ह्या आराखड्याची यशस्वीपणे अंमलबजावणी करण्यासाठी, सोलापूर महानगर पालिके सोबत शहरातील विविध घटक जसे की नागरिक, सरकारी संस्था, खाजगी संस्था व उद्योग, आणि गैर-सरकारी संस्था या सर्वांची महत्वाची भूमिका आहे.

उद्योग व व्यावसायिक आस्थापने वातावरण बदल कृतीत खालील प्रमाणे योगदान देऊ शकतात -

औद्योगिक प्रक्रियाव वाणिज्यिक उपयोगासाठी स्वच्छ इंधनाचा वापर करणे

रूफटॉप सोलरचा वापर करणे

पाण्याचे संवर्धन करणे, सांडपाण्यावर प्रक्रिया व पुनर्वापर करणे

Corporate Social Responsibility (CSR) निधीचा वापर शहरी हिरवाई, भूजल पुनर्भरण सारख्या अनुकूलन उपक्रमांसाठी करणे

भूजल पुनर्भरण आणि पावसाच्या पाण्याची साठवण करणे

कर्मचाऱ्यांना सार्वजनिक वाहतूक वापरण्यासाठी प्रोत्साहन देणे, वाहतुकीसाठी स्वच्छ इंधनावर आधारित (CNG व इलेक्ट्रिक) वाहनांचा वापर करणे

महानगरपालिका, शासकीय संस्था, एनजीओज वातावरण बदल कृतीत खालील प्रमाणे योगदान देऊ शकतात -

रूफटॉप सोलरचा वापर करणे

पाण्याचे संवर्धन करणे

स्वच्छ इंधनाचा वापर करणे

शहरी हिरवळ आणि उष्णता शमन करणे

सार्वजनिक वाहतुकीचा वापर, वाहतुकीसाठी स्वच्छ इंधनाचा वापर

भूजल पुनर्भरण आणि पावसाच्या पाण्याची साठवण

सांडपाणी प्रक्रिया आणि पुनर्वापर करणे

बायोमिथेनेशन आणि कंपोस्टिंग प्रकल्पांची उभारणी आणि अंमलबजावणी सुलभ करणे

विद्यार्थी आणि शिक्षक वातावरण कृतीत खालील प्रमाणे योगदान देऊ शकतात -

शालेय उपक्रमात वातावरण बदला संदर्भात जागरूकता करणे

कॅम्पसमध्ये वातावरण बदल क्रिया संबंधित प्रकल्प राबविणे - भूजल पुनर्भरण, हिरवळ आणि उष्णता शमन, रूफटॉप सोलर

सार्वजनिक वाहतुक व सायकलचा वापर करणे

शून्य कचरा, प्रदूषण मुक्त, व जल संवर्धन - शाश्वत परिसर विकास करणे

Prepared and compiled by
WRI India

REACH OUT TO US
Leona Nunes |
leona.nunes@wri.org
Anshula Menon |
anshula.menon@wri.org

Government of Maharashtra
Environment and Climate Change Department

CHILDREN'S INVESTMENT FUND FOUNDATION

SOLAPUR

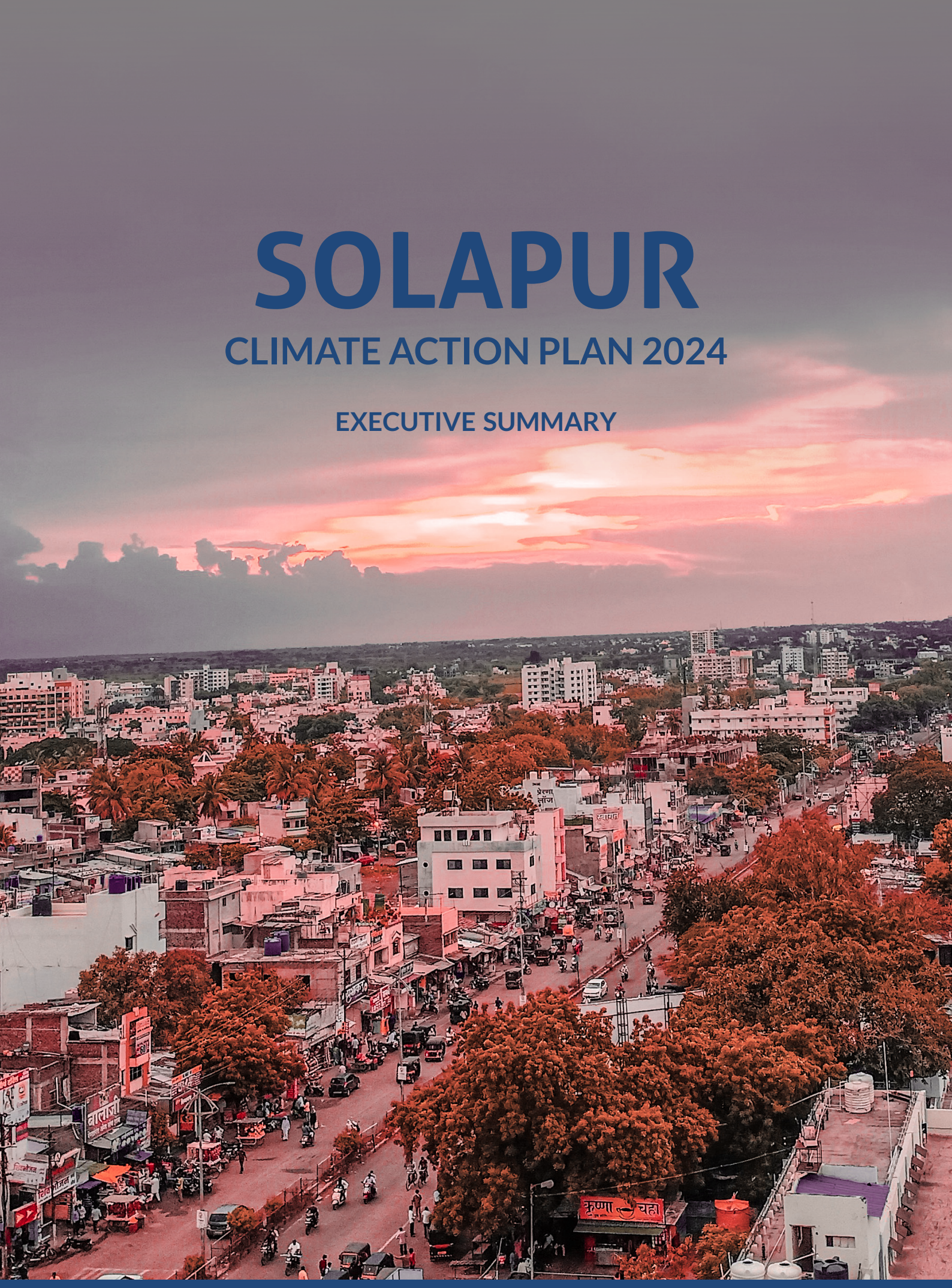
CLIMATE ACTION PLAN 2024

Prepared and compiled by WRI India

SOLAPUR

CLIMATE ACTION PLAN 2024

EXECUTIVE SUMMARY



Prepared and compiled by WRI India

TABLE OF CONTENTS

SOLAPUR CLIMATE ACTION PLAN EXECUTIVE SUMMARY

KAMBAR TALAV

Photo credits - Kambar Talav, Pravin Gaikwad

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

AMRUT	Atal Mission for Rejuvenation and Urban Transformation
BAU	Business as Usual
CAAQMS	Continuous Ambient Air Quality Monitoring System
CAP	Climate Action Plan
CDP	City Development Plan
CCRA	Climate Change Risk Assessment
CHVA	Climate Hazard Vulnerability Assessment
CIRIS	City Inventory Reporting and Information System
CMP	Comprehensive Mobility Plan
CNG	Compressed Natural Gas
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
CPCB	Central Pollution Control Board
CSCAF	Climate Smart Cities Assessment Framework
CURB	Climate Action for Urban Sustainability
DMC	Deputy Municipal Commissioner
E&B	Energy & Buildings
E&P	Existing and Planned
ECAC	Environment and Climate Action Cell
GHG	Greenhouse Gas
GIS	Geographic Information System
GOI	Government of India
GPC	Global Protocol for Community–Scale Greenhouse Gas Emission Inventories
GPS	Global Positioning System
GSDA	Groundwater Surveys and Development Agency
GW	Groundwater
GWRP	Groundwater Recharge Potential
ha	hectare
HH	Households
IMD	Indian Meteorological Department
IPCC	Intergovernmental Panel on Climate Change
IPT	Intermediate Public Transport
km	Kilometre
kmph	Kilometre Per Hour
KPI	Key Performance Indicators
KW	Kilowatt
LPG	Liquefied Petroleum Gas
LST	Land Surface Temperature
MER	Monitoring, Evaluation, Reporting

MLD	Million Litres Per Day
MPCB	Maharashtra Pollution Control Board
MSAAPC	Maharashtra State Adaptation Action Plan on Climate Change
MSEDCL	Maharashtra State Electricity Distribution Company Limited
MSW	Municipal Solid Waste
MVA	Majhi Vasundhara Abhiyan
MW	Megawatt
NAAQ	National Ambient Air Quality
NBS	Nature-based Solutions
NCAP	National Clean Air Programme
NCEI	National Centers for Environmental Information
NGO	Non-Governmental Organization
NMT	Non-Motorized Transport
NOx	Nitrogen Oxides
O_3	Ozone
PM	Particulate Matter
PNG	Piped Natural Gas
RCP	Representative Concentration Pathways
RE	Renewable Energy
RSPM	Respirable Suspended Particulate Matter
SM	Sustainable Mobility
SMC	Solapur Municipal Corporation
SO_2	Sulphur Dioxide
SPM	Suspended Particulate Matter
STP	Sewage Treatment Plant
SW	Solid Waste
SWM	Solid Waste Management
TPD	Tonnes Per Day
UG	Urban Greening
UHI	Urban Heat Island
WRI	World Resources Institute
WR	Wastewater recycling and reuse
WS	Water Supply System
WW	Waste Water

PREFACE

SHRI. PRAVIN DARADE, IAS

Principal Secretary,
Department of Environment and Climate Change,
Government of Maharashtra

It gives me an immense pleasure and a profound sense of accomplishment to acknowledge Solapur is leading the way forward in tackling the climate crisis by adopting the Solapur Climate Action Plan.

The increasing number of extreme weather events worldwide that directly affect our local communities has made it more urgent to address the climate crisis. During the COP26 summit in Glasgow, Hon. Prime Minister of India announced a target to achieve net-zero emissions by 2070. Hon. Prime Minister of India also introduced a new concept called "Lifestyle for the Environment (LiFE)" during the COP on 1st November 2021. This initiative encourages people to adopt mindful and deliberate practices to protect and preserve the environment rather than mindless and destructive consumption. The program is people-centric and aims to tackle climate change while also calling for global action.

Maharashtra is leading India's efforts to combat the imminent climate crisis by implementing policy reforms and encouraging climate action culture within society. The state has a history of pioneering initiatives such as the 'Sant Gadge Baba Gram Swacchata Abhiyan' and 'Swachh Bharat Abhiyan' and is now spearheading the 'Majhi Vasundhara Abhiyan' in Urban Local Bodies and Panchayati Raj Institutions. While India is working towards achieving its Nationally Determined Contributions, Maharashtra's commitment to the cause sets an example for the nation.

Climate change requires tailored solutions that address the environmental concerns of our diverse urban landscapes. The Solapur Climate Action Plan is aligned with the Paris Agreement's goal of limiting global warming to 1.5°C. Additionally, formation of the Climate Action Cell at the state level inspires the city to establish its own city-level Climate Action Cell within the Solapur Municipal Corporation.

I personally congratulate the Solapur Municipal Corporation and WRI India for their leadership in advancing the ambitious climate agenda for a 'Climate Forward Maharashtra'.

FOREWORD

SHRI. ABHIJIT GHORPADE

Director, State Climate Action Cell, Department of Environment and Climate Change, Government of Maharashtra

Climate Change is the greatest challenge faced by man in this century. In the pursuit of a sustainable and resilient future, acting on climate change has never been more crucial. With its dynamic communities and diverse landscapes, Maharashtra stands at the centre stage of this global challenge. I am proud to share that Solapur city is actively contributing to the effort of tackling the climate crisis by adopting its own Solapur Climate Action Plan. This plan adheres to a global standard, highlighting the significant role the city plays in addressing the pressing issue of climate change.

Maharashtra, the third most urbanized state in India, has around 45% of its population living in urban areas. As cities continue to grow and offer education, healthcare and job opportunities, they also present a unique challenge to climate adaptation and mitigation due to their diverse landscapes. Cities therefore, should not only be at the centre of climate change, but also at the forefront of climate action. In recent decades, the Government of Maharashtra has increased its focus on climate resilience to address the rising heatwaves, changing rainfall patterns, cyclones, and other extreme weather events.

Solapur has a unique opportunity to shape its future urban development while considering the impact of climate change. The newly created Solapur Climate Action Plan (CAP) is designed to align with important government schemes and policies, such as the National Clean-Air Action Plan (NCAP), the Swachh Bharat Mission, Majhi Vasundhara Abhiyan targets, and the Climate Smart Cities guidelines. The city should prioritise climate actions by utilizing funds from these schemes and missions.

The Government of Maharashtra aims to expedite localized measures to achieve the objectives of the Paris Agreement, which seeks to limit global warming to 1.5°C. The creation and release of the Solapur CAP marks a significant achievement for the city, encouraging other AMRUT cities to emulate its example and attain the ambitious target of achieving Net Zero emissions by 2050.

As the Director of the Maharashtra State Climate Action Cell, I extend my heartfelt gratitude and appreciation to the administrative leadership of the Solapur Municipal Corporation and WRI India's team for their unwavering commitment to combating climate change by implementing the ambitious climate action plan. As the city of Solapur is working towards the goal of climate resilience, I urge all cities and towns in Maharashtra to tread the path towards a sustainable and resilient future for our urban communities and realize the dream of a 'Climate-Forward Maharashtra'.

PLEDGE

SMT. SHEETAL BASAVARAJ TELI UGALE, IAS

Commissioner and Administrator, Solapur Municipal Corporation

I feel incredibly proud and fortunate to present the Solapur Climate Action Plan (CAP) on behalf of the Solapur Municipal Corporation (SMC) in our pursuit of progressing towards a sustainable future. This milestone is a testament to the unyielding support of the Department of Environment and Climate Change, Government of Maharashtra, in making the CAP a reality.

I would like to congratulate the Additional Municipal Commissioner, the Deputy Municipal Commissioner (Environment), the City Engineer, the Environment Officer, and the SMC team for their tireless efforts in developing the CAP. I extend my heartfelt thanks to our knowledge partners, WRI India. This CAP is our initial contribution towards making 'Climate Forward Maharashtra'.

The city of Solapur faces significant crisis in terms of water stress and increasing urban heat. Climate change expedites these crisis, leaving the city with more challenges. The CAP document provides a baseline assessment of Solapur's preparedness for climate risks. The document carefully charts out recommendations to address Solapur's climate vulnerabilities. The plan has been diligently formulated after extensive data collection, critical analysis, and extensive consultations with multiple stakeholder groups, including departments from the SMC. The plan highlights areas of concern through the spatial mapping exercise grounded in rigorous scientific analysis and ground truthing.

This is probably the first time Solapur City has prepared its comprehensive Greenhouse Gas (GHG) emissions inventory. To implement the CAP, SMC is looking forward to strengthening the environment mandate by creating a climate action cell within SMC. We will focus on implementing various actions recommended under the CAP and mainstreaming climate actions in our plans, programs, and projects. Increasing urban greening, mitigating urban heat and air pollution hotspots, recharging groundwater, recycling and reusing wastewater, etc., are our top priorities going forward. All the stakeholders, including government and non-government organisations and citizens, play essential roles in this endeavour.

Solapur CAP aims to guide the city towards achieving net zero emissions in the future through inclusive low-carbon, green, and water-sensitive development. I humbly request all citizens, government agencies, and civil society to support SMC's efforts to successfully implement the CAP.

PLEDGE

SHRI. MACCHINDRA GHOLAP

Deputy Municipal Commissioner, Solapur Municipal Corporation

I appreciate the visionary leadership of the Environment and Climate Change Department of the State Government of Maharashtra for their progressive vision. Thanks to their efforts, the Solapur Climate Action Plan (CAP) has become a reality.

I feel honoured to have been given the opportunity to head the team of the Solapur Municipal Corporation (SMC) in the preparation of the CAP. I would like to express my sincere gratitude to all the departments of SMC, various parastatal agencies, and Shri. Swapnil Solankar for their support in providing data and their insights, coordination, and assistance towards this initiative. Furthermore, I deeply appreciate our knowledge partners, WRI India, for their technical guidance and support in preparing and compiling the Solapur CAP.

Cities like Solapur, which are classified as Tier-II cities, are becoming increasingly important as emerging growth centres in the next few decades. It is crucial that these cities adopt sustainable practices in their development trajectory. The Solapur CAP is vital for ensuring climate-resilient urban development in Solapur, and it is centred around the needs of its citizens. The Solapur CAP focuses on six critical sectors that are closely aligned with India's commitments to the Sustainable Development Goals (SDGs). Through ongoing initiatives such as increasing green cover, implementing sustainable waste management practices, promoting sustainable mobility, creating accessible footpaths, and building cycling infrastructure, the Solapur Municipal Corporation (SMC) is making efforts to align with climate goals.

I am highly confident that Solapur CAP will make significant contributions to SMC's efforts in addressing the causes and effects of climate change and improving the quality of life for people in Solapur.

MESSAGE

SHRI. MADHAV PAI

CEO, WRI India

Tier II cities are crucial to India's growth, and the Solapur Climate Action Plan (CAP) is a pivotal tool in ensuring this growth is sustainable and resilient to climate impact; along with meeting the needs of the city's residents. The Plan's six key areas of action – energy and buildings, sustainable mobility, sustainable solid waste management, urban greening and heat mitigation, water resource management and air quality – are closely aligned with the Sustainable Development Goals (SDGs). The Plan is also in line with India's commitments to chart decarbonization pathways for the energy and transport sector.

Working with the Solapur Municipal Corporation's team in shaping the city's first every climate action plan brings me immense joy, and I extend my heartfelt thanks to all departments and agencies for their invaluable contributions. I also want to acknowledge Children's Investment Fund Foundation (CIFF) for their unwavering support towards climate-centric development which fosters positive change for children and other communities across India.

I am excited about the Solapur Climate Action Plan's transformative potential, not only for the city, but also for other Tier II cities that could take forward these learnings to create their own climate action plan. This is an opportunity for the city to build capacity across multiple sectors paving the way for sustainable, equitable and resilient development.

As we witness the Plan unfold, WRI India looks forward to working with local authorities, communities, and other stakeholders to shape Solapur into becoming a more resilient city that fosters innovative thinking and sustainable practices.

STATION ROAD, RAILWAY LINES
Photo credit: Pravin Gaikwad

ACKNOWLEDGEMENTS

WRI India prepared and compiled the Solapur Climate Action Plan under the leadership and direction of the Department of Environment and Climate Change, Government of Maharashtra, and Solapur Municipal Corporation (SMC).

We extend our heartfelt gratitude to the following individuals for their invaluable support and remarkable contributions to the Solapur Climate Action Plan (Solapur CAP).

GOVERNMENT OF MAHARASHTRA:

Shri. Eknath Shinde, Chief Minister of Maharashtra and Minister of Environment and Climate Change Department

Shri. Pravin Darade, IAS, Principal Secretary, Environment and Climate Change Department

Shri. Abhijit Ghorpade, Director, State Climate Action Cell, Environment and Climate Change Department Shri. Sudhakar Bobade, Mission Director, Majhi Vasundhara Abhiyan, Environment and Climate Change Department

SOLAPUR MUNICIPAL CORPORATION (SMC):

Smt. Sheetal Basavaraj Teli Ugale IAS, Municipal Commissioner of Solapur, SMC

Shri. P Siva Sankar IAS, Ex-Municipal Commissioner of Solapur

Shri. Sandip Karanje, Additional Municipal Commissioner, SMC

Shri. Macchindra Gholap, Deputy Municipal Commissioner (Environment), SMC

Shri. Dhanraj Pandey, Ex-Deputy Municipal Commissioner of Solapur, SMC

Shri. Vikramsinh Patil, Ex-Assistant Municipal Commissioner, Department of Gardens and Tree Authority, Department of Sports and Culture, Department of Public Health/ Solid Waste Management Department

Shri. Dhayarshil Patil, Deputy Conservator of Forest, District Forest Department Office

Shri. Laxman Chalwadi, City Engineer, SMC

Shri. Vijaykumar Rathod, Public Health Engineer, SMC

Shri. Neelkanth Mathpati, Dy. Engineer Water Supply, SMC

Shri. Vyanktesh Choube, Asst. Engineer, Water Supply, SMC

Shri. Santosh Yalgulwar, Asst. Engineer, Mechanical, SMC

Shri. Rajesh Pardeshi, Executive Engineer, Electrical, SMC

Shri. Sambhaji Kamable, Assistant Director, Town Planning Department, SMC

Shri. Mahesh Kshirsagar, Asst. Engineer, Town Planning Department, SMC

Shri. Anil Charate, CS, Solid Waste Management, SMC

Shri. Nagesh Mendgule, CCS, Solid Waste Management, SMC

Shri. Nagnath Birajdar, CCS, Solid waste management, SMC

Shri. Girish Antad, Solapur Municipal Transport

Shri. Tapan Danke, AE (Roads), SMC

Shri. Rahul Shinde, Engineer, Sewage Treatment Plant

Shri. Tejas Shaha, City co-ordinator, SWM, SMC

Shri. Pravesh Kasare, Computer dept, SMC

Shri. Swapnil Solankar, Environment Officer, SMC

STAKEHOLDER AGENCIES:

Shri. Sudhir Harhare, Meteorologist, India Meteorological Department

Shri. Shitalkumar P Kumbhar, Dy. Regional Transport Office, Solapur

Shri. Anil Vipat, National Highways Authority of India

Shri. Prashant Kuthe, Sr. Manager, I.M.C Ltd

Shri. Nikil More, SRO, Maharashtra Pollution Control Board

Shri. Bhagavan Karande, GM, Solapur Bio-Energy Systems Private Limited

Shri. Prafull Patil, Sub Divisional Engg, Hydrology Project Sub Division, Solapur

Pratik Bavi, Climate Fellow - Department of Environment and Climate Change, Government of Maharashtra (former)

WRI INDIA:

Authors:

Leona Nunes, Senior Program Associate – Urban Development

Anshula Menon, Senior Program Associate – Urban Development

Mukta Salunkhe, Program Associate – Urban Development

Tanvi Ghaisas, Junior Program Associate – Urban Development

Prasad Lad, Junior Program Associate – Urban Development

Mehul Patel, Lead - Climate Program

Mahesh Harhare, Program Head – Climate Action Plan

Walter Samuel, Project Manager

Paulami De, Junior Program Associate – Geo Analytics

Janhavi, Program Associate – Geo Analytics

Aditya Khare, Program Associate – Geo Analytics

Nakul Markandey, Senior Program Associate – Geo Analytics

Bhanu Khanna, Program Manager – Geo Analytics

Mentors:

Lubaina Rangwala, Program Head – Urban Development

Prerna Mehta, Associate Director – Urban Development

Jaya Dhindaw, Executive Program Director, Sustainable Cities, Director, WRI India Ross Center

Madhav Pai, CEO, WRI India

Data and Geo Analytics team:

Jyoti, Program Associate – Geo Analytics

Raj Bhagat, Senior Program Manager, Geo Analytics

Kanwal Nayan Singh, Manager – Geo Analytics

Sri Pujitha Pukkella, Program Associate – Geo Analytics

Abhimanyu S, Program Associate – Geo Analytics

Harsha K, Junior Program Associate - Geo Analytics

Arsh Doda, Senior Program Associate - Geo Analytics (Former employee)

Reviewers:

Energy and Buildings: **Dhilon Subramanian,** Manager – Energy Program

Sustainable Mobility: **Vishal Ramprasad,** Senior Program Manager - Electric Mobility

Sustainable Solid Waste Management: **Avni Agarwal,** Senior Program Associate – Urban Development

Urban Greening: **Priya Narayanan,** Senior Program Manager – Urban Development

Urban Greening: **Linda Regi,** Program Associate, Geo Analytics

Water and Wastewater: **Vjiay Anadkat,** Program Senior Fellow – Sustainable Cities & Transport

Air Quality: **Ajay Nagpure,** Ex-Program Director, Air Quality

Air Quality: **Bhavay Sharma,** Senior Program Manager – Air Quality

Air Quality: **Kishore Wankhade,** Program Manager – Air Quality

Design & Communications:

Rama Thoopal, Program Manager – Communications

Anhad Imaan, Senior Program Communications Associate

Abhinand Gopal, Senior Program Communications Associate – Geo Analytics

Nileena S, Senior Communications Associate – Geo Analytics

C40 CITIES:

Shruti Narayan, Regional Director, South and West Asia

Raina Singh, Deputy Regional Director, South and West Asia

Nikhil Kulkarni, Senior Manager- Climate Implementation

Kirsty Griffin, Senior Technical Manager, Adaptation Planning

Ryan Green, Senior Technical Manager

Sanjana Acharya, Regional Officer, South and West Asia

Solapur Municipal Corporation expresses its gratitude to all the advisors and reviewers from WRI India, as well as all Assistant Commissioners, Deputy/Joint Municipal Commissioners, Engineers, Officers at the ward level and Zonal Officers, stakeholders, and external agencies who actively participated in the stakeholder consultations for the Solapur Climate Action Plan. Your contributions and efforts are greatly appreciated.

CONTACTS FOR THIS REPORT:

1. Environment Dept., SMC – env.smc@gmail.com
2. Leona Nunes – leona.nunes@wri.org
3. Mahesh Harhare – mahesh.harhare@wri.org

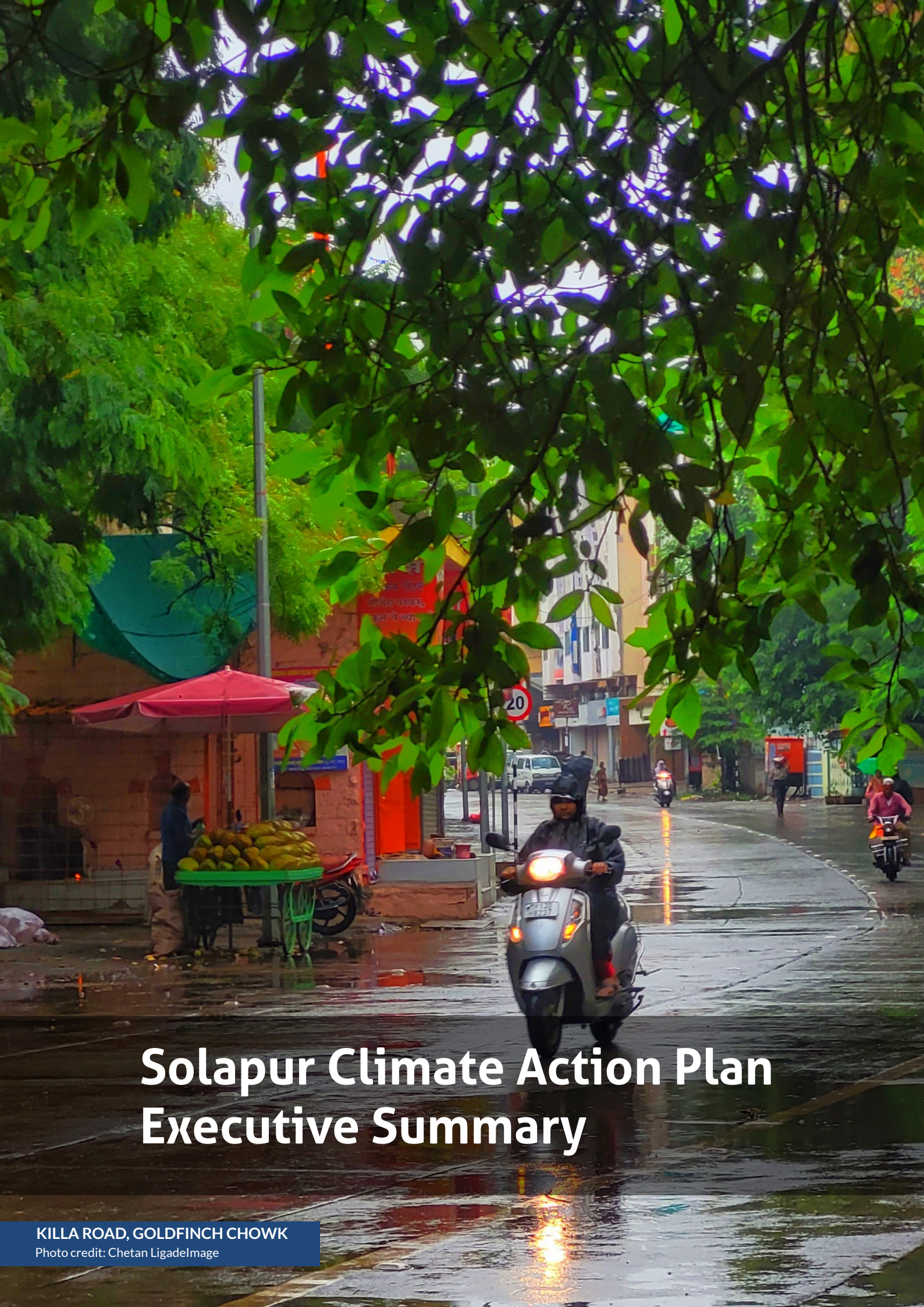
All maps in this report are intended as visualizations to communicate city-wide data analysis for information purposes only and are not to scale.

This report should be referred to as the 'Solapur Climate Action Plan, 2024'

Edited by **Chandni Nair**

Report designed by **Simijaison Designs**

Cover page Photo credit: **Pravin Gaikwad**



Solapur Climate Action Plan Executive Summary

KILLA ROAD, GOLDFINCH CHOWK
Photo credit: Chetan LigadeImage

1. BACKGROUND

Metros and large cities in India have begun focussing on the causes and impacts of climate change with adaptation and mitigation strategies. However, Tier II Indian cities (with a million-plus population but smaller than metro cities) continue to lack the capacity and capability to apprehend and focus on climate-related risks. To address these challenges, the Government of Maharashtra and Children's Investment Fund Foundation (CIFF) shortlisted three Ties II cities (project cities) in Maharashtra — Solapur, Nashik, and Chhatrapati Sambhajinagar (Aurangabad) — to work on the Climate Action Plan (CAP), one for each city. The project is also supported by C40 Cities.

WRI India has been appointed to develop the CAPs for Solapur, Nashik, and Chhatrapati Sambhajinagar (Aurangabad) and support priority actions and interventions until June 2024. The handholding will enable the local governments in these cities to integrate climate change actions with their urban development initiatives.

2. CLIMATE ACTION PLANNING PROCESS – APPROACH AND METHODOLOGY

a. Approach

The Solapur CAP adopts an inclusive and consultative process and comprises of the following stages:

Project inception
Setting up of a core team, signing the Letter of Intent with Solapur Municipal Corporation, setting the context, mapping stakeholders, and conducting initial discussions with city officials and parastatal agencies.

1

Baseline Assessment
Data collection, data validation and identification of data gaps, and addressing the same

2

Stakeholder consultations
Stakeholder consultations - Data validation and mapping of vulnerable areas, identification of waterlogging and air pollution hotspots, etc.

3

Developing Climate Profile
Developing Vulnerability Assessment (VA) and Greenhouse Gas (GHG) Emissions Inventory, identifying climate risks, identifying key sectors

4

Stakeholder consultations
Capacity building workshop on VA and GHG emissions inventory

5

Scenario Analysis and RCP Analysis
Carrying out future scenario analysis and Representative Concentration Pathways (RCP) Analysis

6

Stakeholder Consultations
Validate various assumptions under the Scenario Analysis

7

Sectoral analysis
Develop sectoral goals, strategies, and actions, review with WRI India's sectoral experts

8

Finalisation of draft CAP
Compilation of the VA, GHG Emissions Inventory, sectoral assessment, recommendations, and sectoral strategies; developing the structure of the Climate Action Cell, development of the Monitoring, Evaluation, and Reporting (MER) framework, acceleration of plans to projects, stakeholder consultation and presentation of the draft Solapur Climate Action Plan

9

Stakeholder consultations
Inputs and feedback on the draft Solapur Climate Action Plan

10

Finalisation of the CAP
Finalise Solapur CAP addressing comments from various stakeholders

11

Launch of the CAP
Launch of the CAP

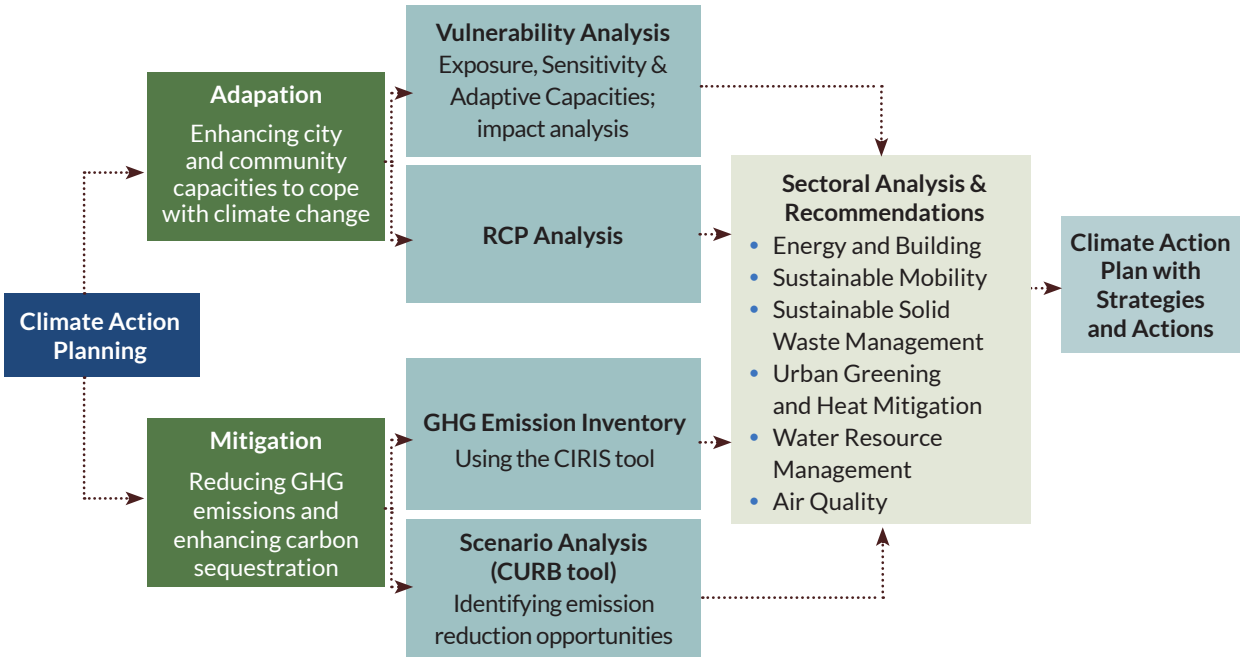
12

The CAP consists of two key strategies:

- The adaptation strategy focuses on the impacts of climate change and sectoral sub-strategies and actions to enhance the capacities of the city and community to cope with climate change.

- The mitigation strategy focuses on the causes of climate change, i.e., assessing GHG emissions and their sectoral contribution, likely scenarios of future GHG emissions and sectoral sub-strategies and actions to reduce the emissions.

Figure E-1: Climate Action Plan – strategies



Source: WRI India Analysis

These strategies are powerful tools for monitoring progress towards the climate goal as they allow cities to formulate evidence-based adaptation and mitigation goals and actions.

b. Methodologies and Tools Used

The Climate Change Risk Assessment (CCRA) guidance document developed by C40 Cities and the Climate Hazard Vulnerability Assessment (CHVA) Framework developed by WRI India were used to assess risk from climate-induced and environmental hazards. The C40 Cities Climate Action Planning Framework and Mumbai Climate Action Plan prepared by WRI India were also referred to during the assessment.

The GHG emissions inventory for the SMC boundary is developed based on the Global Protocol for Community-scale Greenhouse Gas Emission Inventories (GPC) using the CIRIS tool. The CAP uses the inclusive planning framework developed by C40 Cities and WRI to address equity and inclusivity.

The base year is 2021, and the horizon is for 2050, with 2030 and 2040 as intermediate years.

The project area for the Solapur CAP is defined as the boundary of Solapur Municipal Corporation (SMC). However, a regional approach is adopted for certain aspects like rainfall variability.

The assessment included various data sources such as government departments, published data of central government agencies such as Census 2011, meteorological data, satellite imageries, etc.

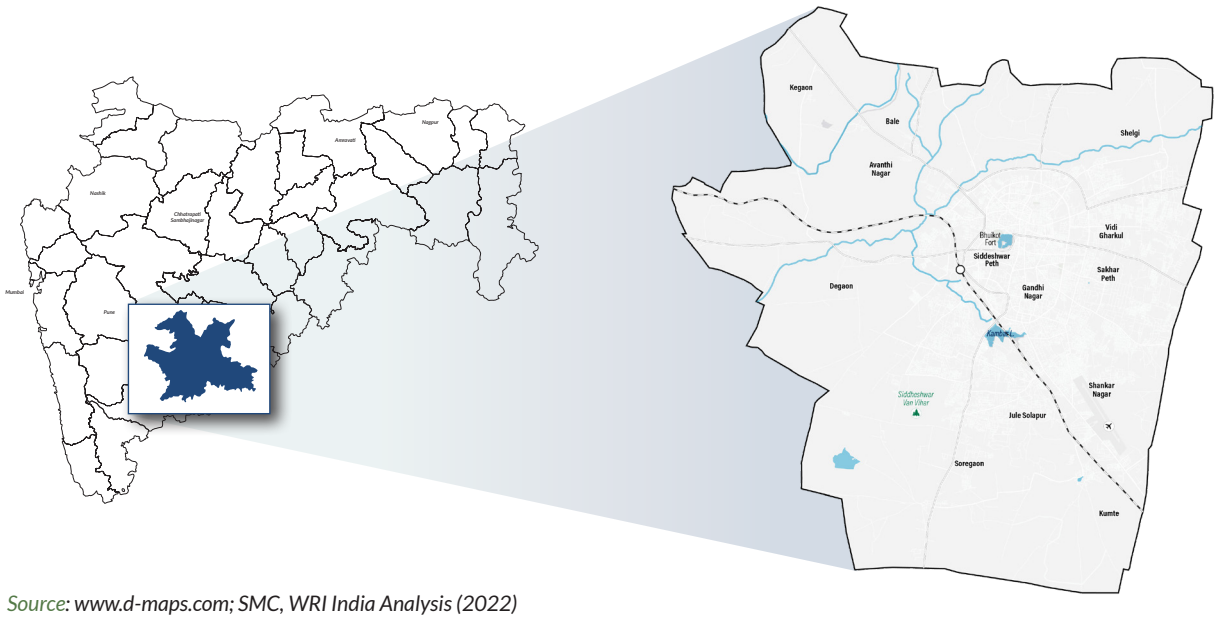
Scope for reporting GHG emissions and future emission pathways:BASIC level (as per GPC reporting framework), which includes the sectors of Stationary Energy, Transportation and Waste.

STAKEHOLDER CONSULTATION AT SMC
Photo credit: WRI India

3. CITY PROFILE

Solapur is historically regarded as an industrial city, with prominent textile units that originated with establishment of the railways in 1860. The city of Solapur is in the southwest region of Maharashtra. It is an important node, mainly because of its connectivity to major cities (Ahmednagar, Gulbarga, Osmanabad, Satara, Sangli).

Figure E-2 : Regional setting of Solapur City

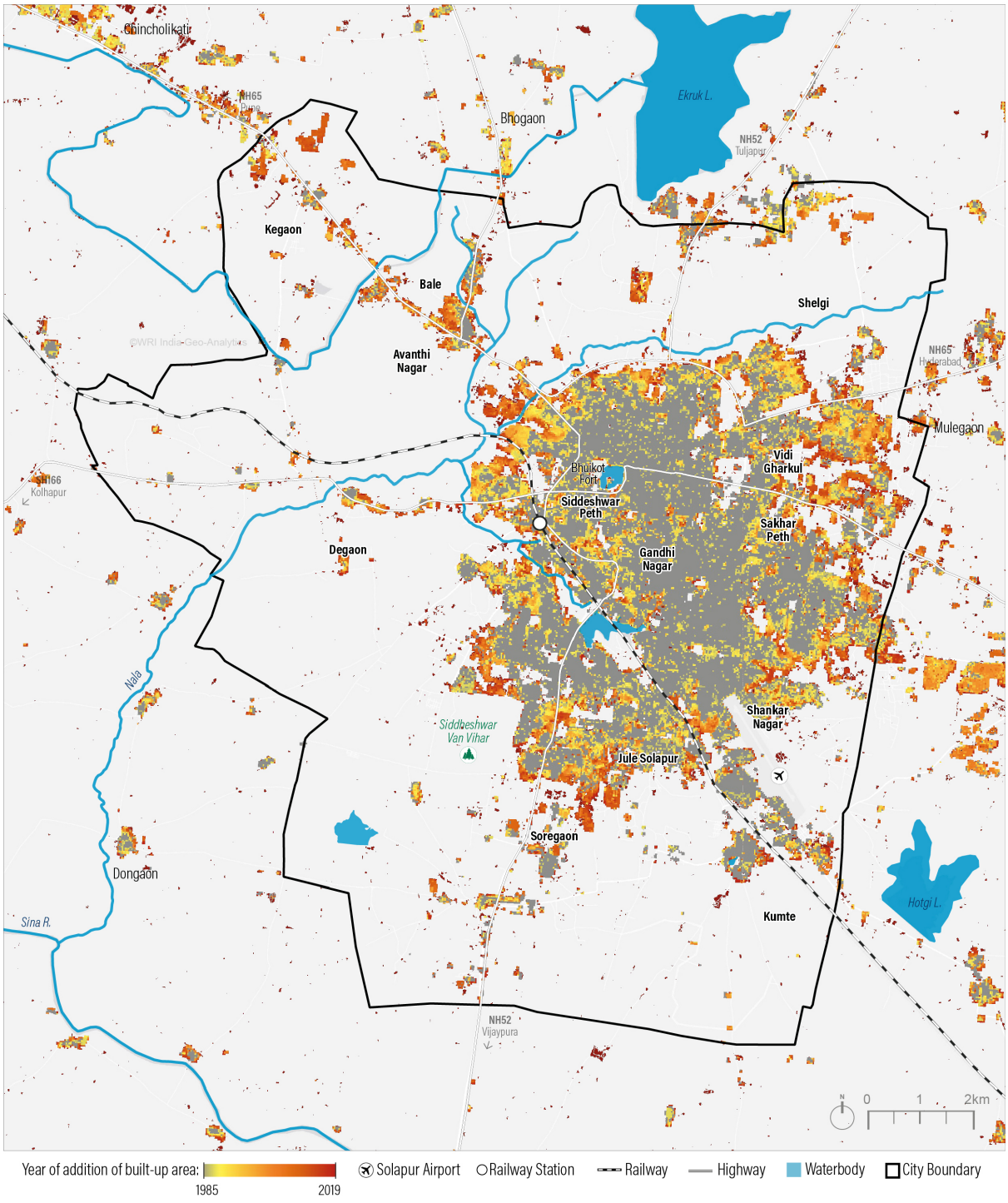


Source: www.d-maps.com; SMC, WRI India Analysis (2022)

Solapur is the major regional centre in the district for trade, commerce, and health and education infrastructure. The primary economic sector is agriculture, particularly sugarcane cultivation. The city has several sugar-based industries. In terms of secondary sectors, the city is known for its textiles (powerloom and handweaving) industry, beedi industry, cement grinding units, and building and construction units.

Presently, the jurisdiction of SMC encompasses an area of 178.57 sq. km, with a population of 12.27 lakh (estimated for the year 2021), which was 951,118 as per Census of India 2011. The city is divided into 8 administrative zones, 26 election wards, and 98 Census wards.

Figure E-3 : Map of SMC area showing urban expansion



Source: WRI India Analysis based on World Settlement Footprint Evolution (DLR, ESA, GEE)

4. CLIMATE OVERVIEW

Temperature and humidity: Based on the analysis of the NCEI data (from 1975 to 2021), since 2011, the hourly air temperature in the summers (from March to May) has ranged from 25°C to 41°C. In the summer of 1976, temperatures as high as 47°C were recorded. Winters in Solapur commence in November and end in February, with the air temperature occasionally dropping as low as 11°C and rising to 38°C.

Rainfall analysis: The average annual rainfall in the area is around 725 mm, and the monsoon season lasts about one-and-a-half months (18 - 55 days in a year). The maximum rain the city received was 1300 mm in 1999, and the driest year with rainfall of 300 mm was 1972.

Rainfall during June-September amounts to about 74% of the annual rainfall, with September being the wettest month for the city, while 17% of the rainfall is received during the post-monsoon months.

5. CLIMATE RISKS

Solapur city faces three significant climate challenges – heat risk, air pollution risk, and drought and groundwater depletion.

On analysing rainfall variability as a part of the VA, urban flooding was not found to be a critical risk for Solapur City. However, because the region and the district are prone to drought, the city might face drought-like situations in terms of water resource availability, causing severe water stress.

The increase in temperatures in and around Solapur City is making the summer months (March–May) hotter, which has also been reported in the media. Moreover, less rainfall and groundwater depletion have led to severe water shortages in the city.

a. Urban heat risk

An assessment of urban heat risk was done by analysing non-spatial and spatial parameters.

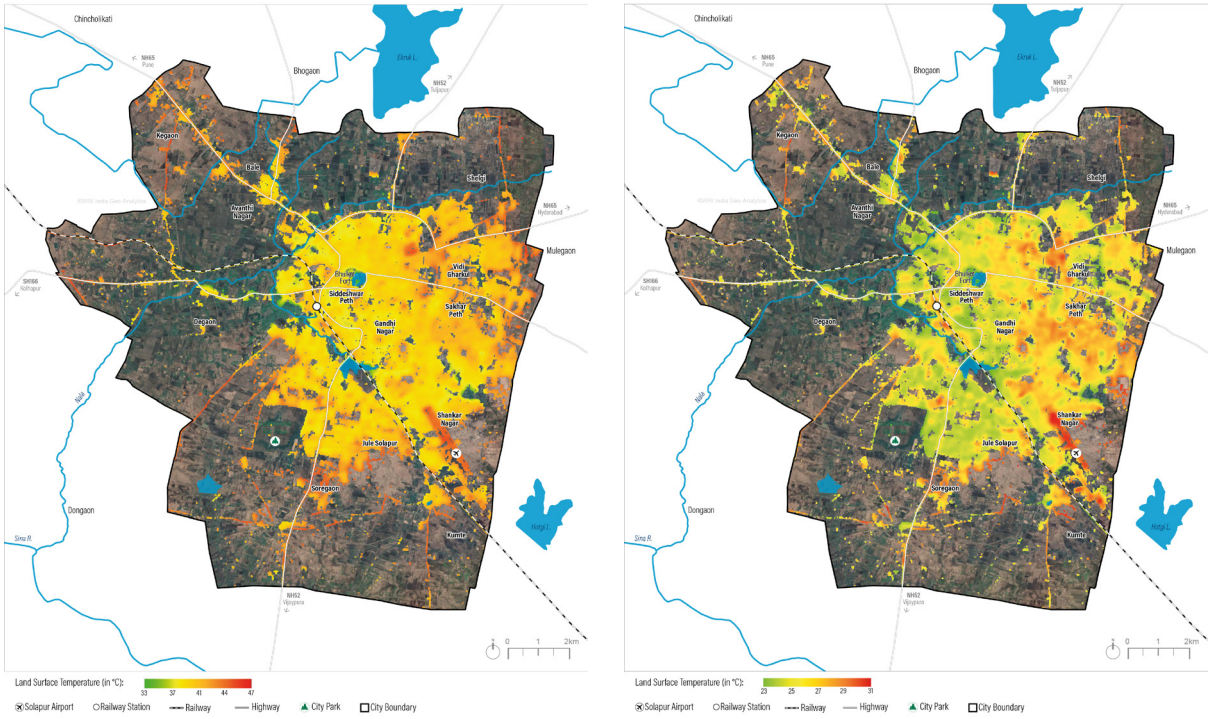
- Annual mean temperatures were calculated for Solapur city from 1975 to 2021 using data from NCEI. The trend analysis shows annual mean air temperatures rose by 0.1°C per decade between 1975 and 2021.
- Heatwave and extreme heat wave incidents in Solapur are analysed from 1975-2022. An increasing trend of 8.7 hours added yearly to the time the city spends in extreme heatwave conditions was observed.
- Heat index classification is analysed to consider air temperature and relative humidity and indicate the perceived temperature. As the air's moisture content increases, the human body's cooling capacity decreases. The number of 'caution' and 'extreme caution' days are increasing at the rate of almost one day per year.

- On analysing the city Land Surface Temperature (LST) spatially, it was observed that pre-monsoon months the average LST within the city built-up areas ranges between 33°C and 37°C and ranges from 23°C to 31°C during the post-monsoon months. During summers, LST in and around the airport can reach 45° C.

Figure E-4 : Mean Land Surface Temperature for pre and post monsoon (2019-2021)

a) Pre monsoon summer months (April & May)

b) Post monsoon winter months (October – December)



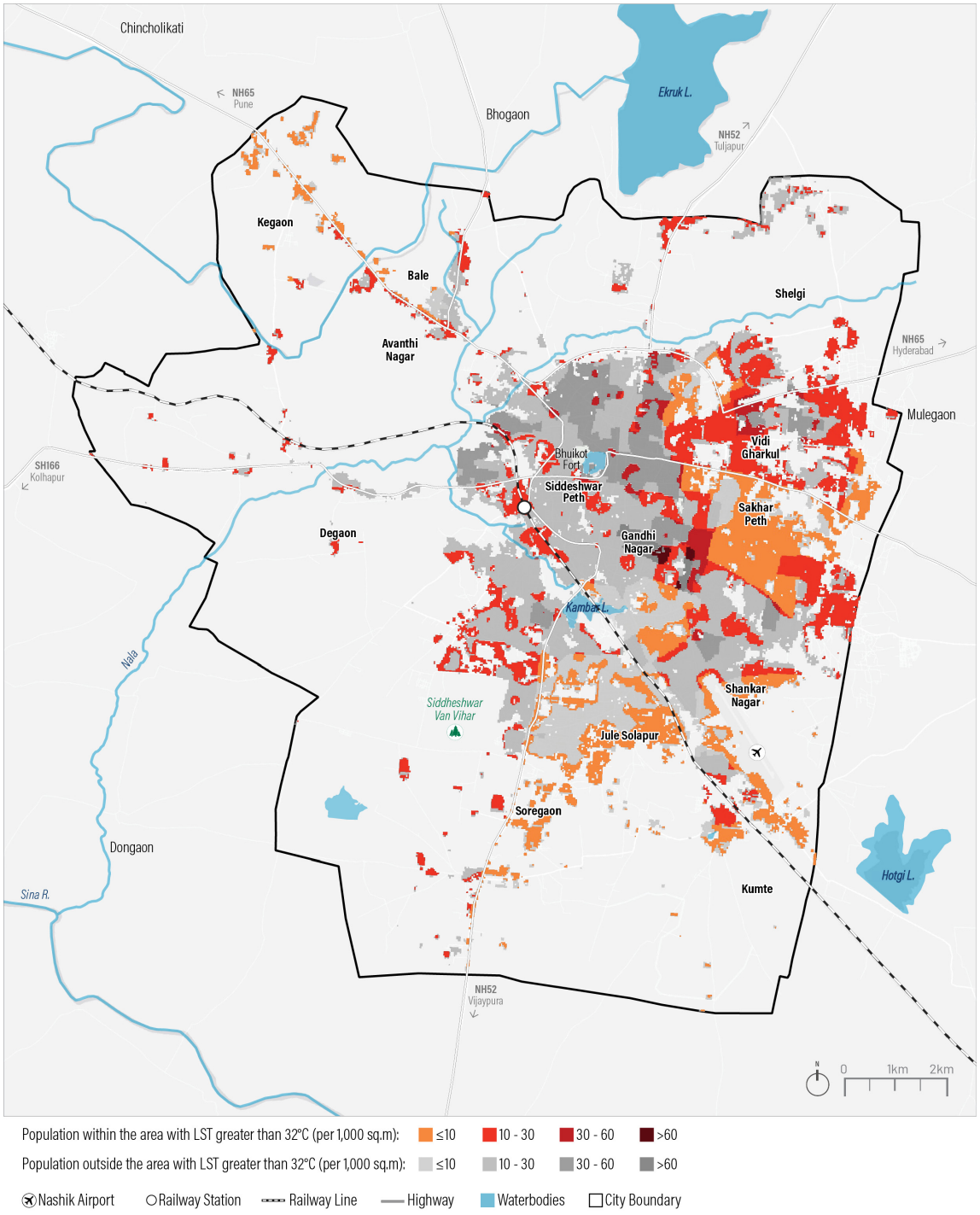
Source: WRI India analysis using Landsat 8, USGS, 2022; Left: Pre-monsoon summer months (April & May), Right: Post-monsoon winter months (October – December)

Impact of heat

- The annual average LST within the city ranges between 25°C and 39°C for the built-up area which during summer, can go up to 46°C. Solapur has 50.63 sq. km of built-up area, some of which act as heat hotspots, contributing to the vulnerability to heat. The heat threshold LST for Solapur has been considered 33°C. Given that, 33% of the city population is at a higher risk due to heat. Areas such as Shastri Nagar near the inner ring road and Vijay Nagar are vulnerable and have a higher population density.
- On analysing the spatial distribution of jobs, it was observed that 58.1% of formal jobs within the city are at risk due to heat. 70.9% of the establishments belong to the manufacturing category, with 68.47% of the job share within the high heat risk area.

- Slum areas experience higher temperatures and are more susceptible to heat due to the densely packed built form and roofing material. Solapur has 220 slums, of which 159 are notified, and the rest are unnotified slums. On analysing the impact of heat on slums, 108 of the slums appear as clear hotspots, with LST higher than the average compared to the surrounding area.

Figure E-5 : Areas within the city above city annual average LST



Source: WRI India analysis

b. Air pollution risk

Air pollution risk assessment includes temporal analysis using data from the Continuous Ambient Air Quality Monitoring Stations (CAAQMS) and manual stations established in the city and spatial analysis based on satellite imagery. Based on the temporal analysis, the following pollutant levels are observed:

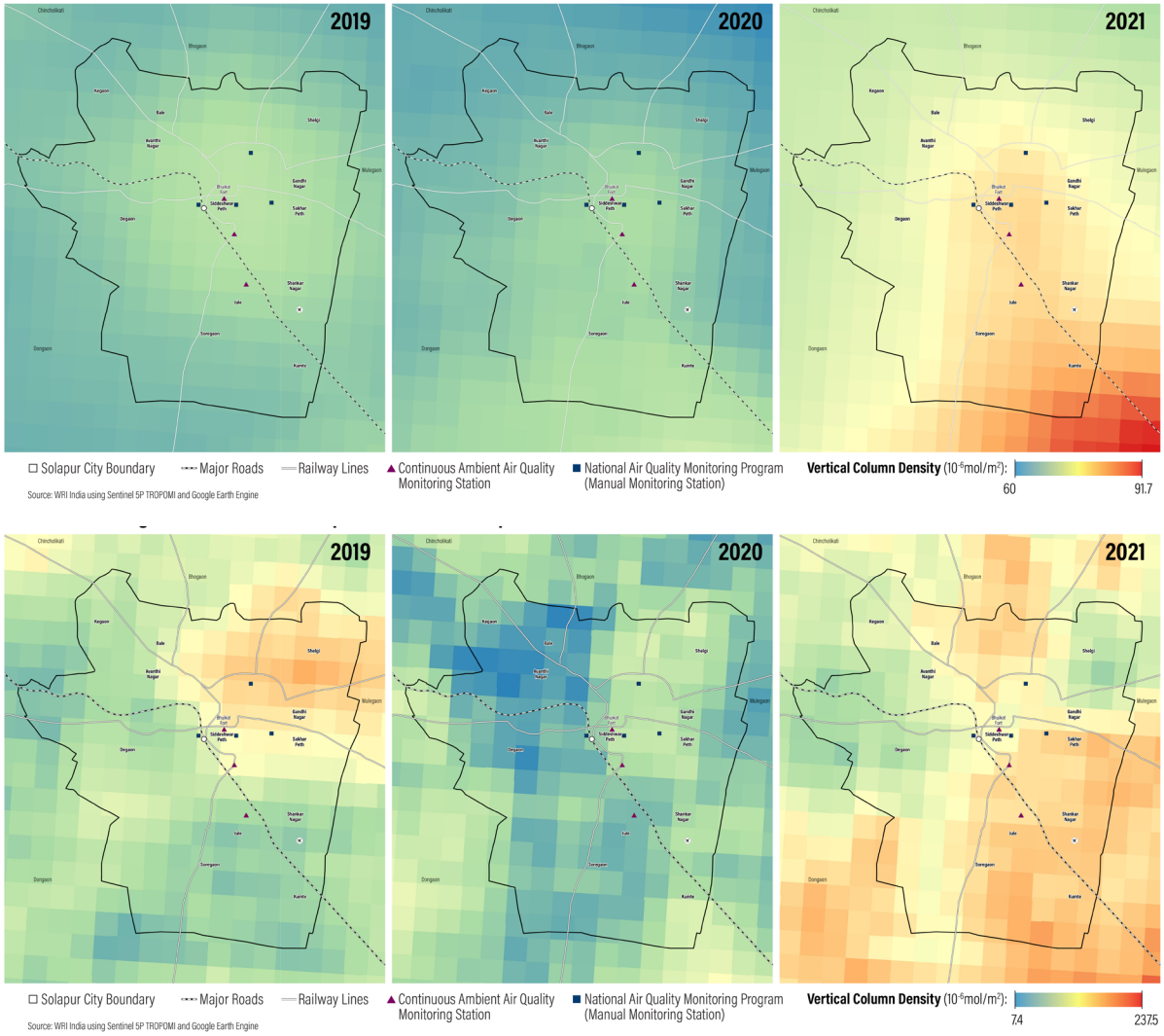
- **PM_{10} or (RSPM)** levels had high values crossing above the annual safety threshold of 60 µg/m^3 across three stations from 2004 to 2021. On aggregating daily averages; there were 1,428 days where the threshold was crossed, mainly in November and May.
- **$PM_{2.5}$:** 10% of daily average concentrations are above the daily threshold of 60 µg/m^3 in the duration considered (from January 2016 to July 2022).
- **NO_x:** Averages at the three stations are observed to be reaching close to the safety threshold of 40 µg/m3, with the monitoring station at SMC premises crossing the threshold 7 times since 2012.
- **O_3:** The AQ monitoring station at the SMC premises monitors ozone. Between January 2016 and July 2022, the daily CPCB threshold (100 µg/m^3) was crossed on 317 days, significantly during November and May.
- **CO: (**The daily average threshold of 2 mg/m^3 was crossed 22% of the days at the AQ monitoring station at SMC between January 2016 and July 2022.
- **SO_2** : Annual average concentrations are much lower than the stipulated regulatory limit (50 µg/m^3) since 2004 across three stations (2004 to 2021).

Key findings from the Source Apportionment study are as follows:

- PM_{10} and $PM_{2.5}$
  - The major sources are industries (30-36%), bakeries (20-25%), open eat-outs (24- 35%), and vehicles (7-8%). The pollution levels also coincide with the type of fuel usage.
  - The emission load of PM is high due to burning biomass, coal, and wood as a fuel for bakeries, eateries, and industrial processes.
  - The MIDC area is located towards the eastern side of the city, showcasing a higher concentration of $PM_{2.5}$ and $PM_{10.}$

- CO, NO_x and SO_2
  - Vehicles (38%) are the major contributors to CO emissions caused by fossil fuel burning, followed by open eat-outs (33%) and industries (13%).
  - Vehicles contribute 96% to NOx levels.

Figure E-6 : Annual average concentration of NO_2 and SO_2 from 2019-2021



Source: WRI India analysis

c. Rainfall variability

The assessment of rainfall variability is based on analysing two parameters: extreme rainfall events and their impact on Solapur and the larger region. This analysis uses rainfall data from IMD rain gauges in and around Solapur to assess the long-term variation of rainfall patterns, including intensity, duration, and frequency.

The mean annual rainfall in Solapur is ~725 mm, showing no significant trend. The variation of seasonal precipitation in pre-monsoon rainfall (February-May) has a significant increasing trend of 0.58 mm/ year. The number of extreme rainfall events or ERE (rainfall more than 35 mm per day) in Solapur has decreased to less than 3% in the last 20 years.

Figure E-7 : Regional map for Solapur located in the Upper Bhima river basin

Source: WRI India analysis using SRTM (USGS), CWC Streams, HydroBASINS level 4, HydroLAKES

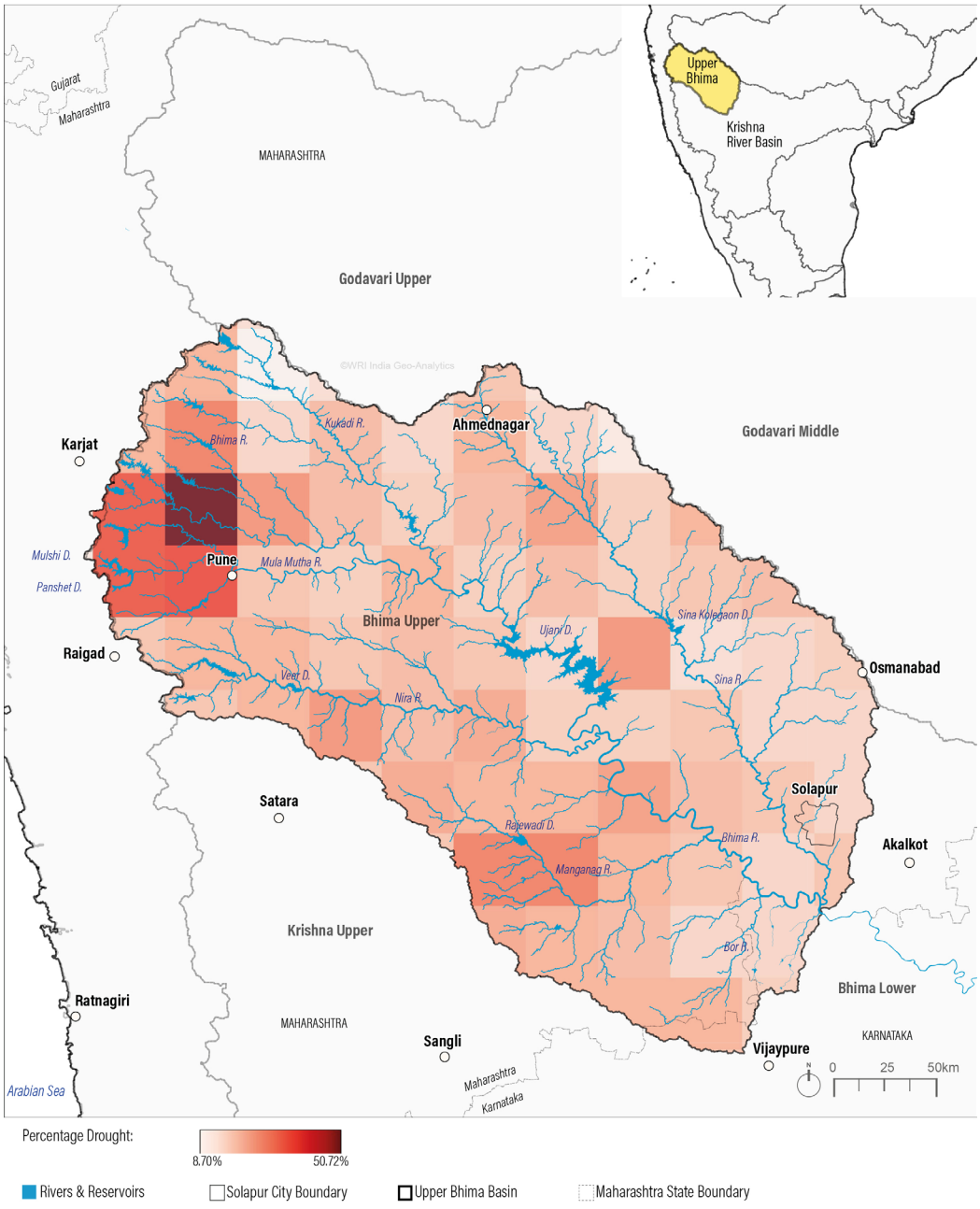
d. Urban waterlogging risk

- Based on the data shared by SMC, 62 locations were frequently waterlogged. Waterlogging is caused by the densely populated urbanised areas where the stormwater drains, and sewage network become overwhelmed even after moderate rainfall.
- The rainfall analysis indicates that the probability of a flood-like situation in Solapur is unlikely. However, the city experiences waterlogging during the rainy months for a day or two. The reasons for waterlogging are mostly associated with clogging of open and closed sewage pipelines and drainage and not due excess rainfall.
- The number of households impacted due to waterlogging was 1,445 .

e. Drought risk

- Drought risk is assessed based on the probability of drought at a sub-basin scale. This analysis is carried out by using rainfall data from IMD gridded rainfall data.
- The probability (expressed as a percentage) of meteorological drought is calculated for each grid in the Krishna River basin's Upper-Bhima catchment. Solapur is located near the outlet of the Upper Bhima. The city has four IMD grids across its extent. The probability of meteorological drought is obtained by calculating the mean of the values for the four grids, which is 16.5% and falls within the 'normal' condition.
- According to WRI Aqueduct, Solapur district has a high baseline water stress, which means a significant portion of its available water resources has been overused. Additionally, the city of Solapur has a high (40-80%) to extremely high (>80%) level of water stress, which indicates that the city is facing a significant amount of competition for its water resources from various sectors, such as agriculture, industry, and domestic use. This can lead to a water shortage for various uses and cause conflicts between water users.

Figure E-8 : Probability (%) of meteorological drought



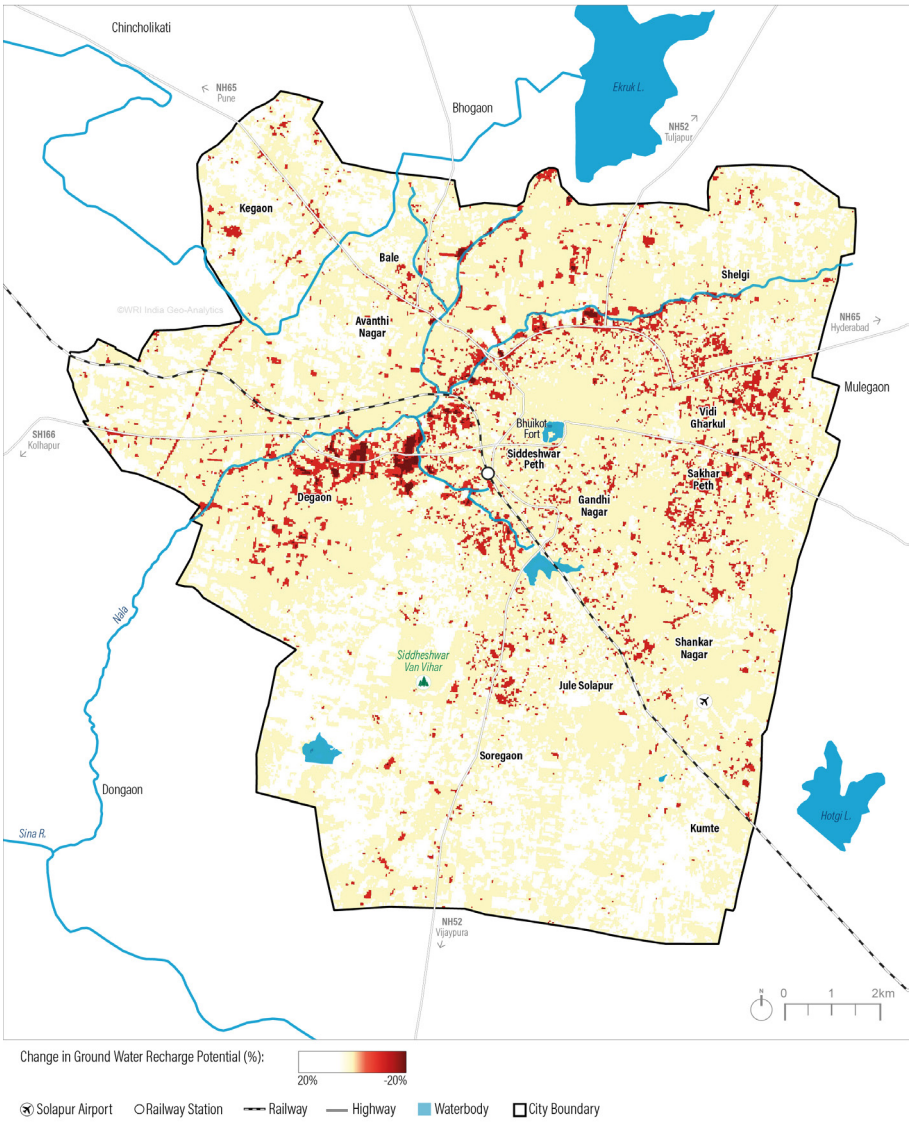
Source: WRI India analysis using IMD Gridded Rainfall, SRTM (USGS), CWC Streams, HydroBASINS level 4, HydroLAKES

f. Groundwater management

- Groundwater Recharge Potential (GWRP) for the city was studied for 2000 and 2020. The city exhibits a 'moderate' groundwater recharge potential throughout its limits, while the recharge potential improves to 'good' around the water bodies.
- The extent of the good recharge potential has decreased in the western part of the city due to newer developments, whereas areas towards the south of the city have shown good recharge potential in 2020.

- The change in GWRP is calculated as the ratio of the change between 2000 and 2020 to the conditions of the year 2000 and is expressed as a percentage. Nearly 11% of the population residing in the city live in areas with decreased GWRP. Apart from the newly built areas, the agricultural land thriving with vegetation and now devoid has also been captured as decreased GWRP.

Figure E-9 : Percentage change in ground-water recharge potential



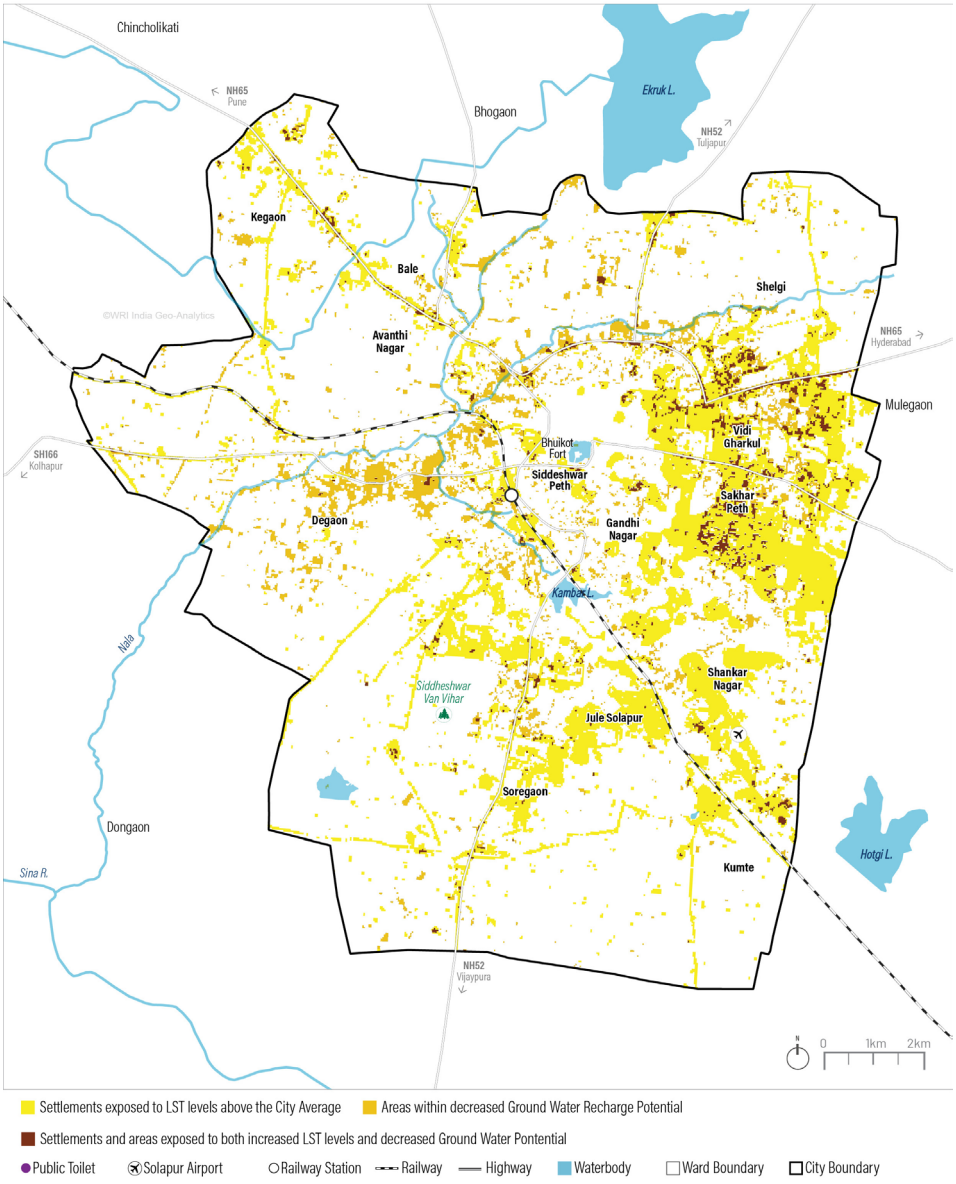
Source: WRI India analysis

g. Multi-hazard analysis

- Certain city zones of the city are vulnerable to more than one climate-related risk. The concept of 'multi-hazard risk' refers to the overlap of urban neighbourhoods that are especially in danger from more than one climate-related threat. This analysis helps identify vulnerable zones where the city authorities can prioritise at-risk populations and industries to deploy the necessary mitigation strategies (optimised to fit all the potential hazards).

- The analysis shows that 33.4% of Solapur's population is exposed to LST levels above 33°C. Most of this population resides on the eastern side of the city, which is densely populated and has sparce vegetation.
- 10.94% of Solapur's population resides within the areas with decreased GWRP. Most of this population reside in the periphery of the city where agricultural land is converted into new establishments or developments are ongoing.
- Approximately 3.4% of Solapur's population is vulnerable to both above average LST and decreased GWRP, a majority of which is in the eastern part of the city.

Figure E-10: Multi-hazard analysis - Settlements and areas exposed to LST levels above the city average and decreased Ground Water Recharge Potential



Source: WRI India analysis

6. ASSESSMENT OF ADAPTIVE CAPACITY

Solapur city's demographic aspects are analysed using Census of India 2011 data. This analysis helps understand the potential effects of climate change on different socio-economic groups, the sensitivity of the population and its variation based on demographic diversity such as age, gender, and education, and how it manifests spatially in the city.

a. Demographic context

Table E-1: Key findings - Demographic context

	Indicator	Vulnerability Analysis
	Literacy	While Solapur's overall effective literacy rate is 82.8%, the effective female literacy rate is lower, at 75.87%. The areas in wards 68, 69, 70, and 77 perform poorly, with an effective overall literacy rate of less than 76%. .
	Access to School	95% of the population have easy access (within 10 minutes walkable distance) to schools. Kegaon (Ward no. 1) is the most vulnerable, with only 43.92 % of the population having ease of access to schools.
	Social Composition	Data shows that city has overall 16.26% of the population belonging to the Scheduled Castes and Scheduled Tribes community. Jamna Wasti (Ward no. 10), parts of Mane Vasti, New Budhwar Peth (Ward no. 11), Mahesh Nagar (Ward no. 12) and Keshav Nagar (Ward no. 69), have more than 52% of population belonging to SC and ST community and a higher population density.

b. Accessibility analysis

Table E-2: Key findings- Accessibility & Socio-Economic aspects

	Indicator	Vulnerability Analysis
	Access to information	The city-wide average for households owning mobiles is 61% and households owning both mobiles and landlines is 7.7%. On average, 71.5% of households in Solapur have access to broadcast media. The citywide average percentage of households radio/transistor is 24.6% on average, and those having access to a computer with Internet connection is 4.6% on average.
	Home ownership	On average, 69.8 % of Solapur's population lives in houses owned by them. Bhavani Peth (ward No 25), parts of Joshi Galli, Raviwar Peth (ward No 27), parts of Bapuji Nagar (ward No 58), have less than 56% of households living in 'own' houses.

c. Physical environment

Table E-3: Key findings- Physical environment aspects

	Indicator	Vulnerability Analysis
	House condition	On an average, 59.6% of Solapur's households live in houses with temporary roofing material. Parts of wards 68, 69,70 and 73 have more than 71% of the houses with temporary roofing material, and higher population density increases their vulnerability. In ward no. 71, where 98.35% settlements are slums, 92% of households live in houses with temporary roofing materials and 64.07% population at risk due to heat.
	Access to Public Recreational Spaces	While 65.1% of Solapur's population has access to public recreational spaces within the threshold values distance of 1 km within 10 minutes walkable distance, 34.9% does not have access to any parks, gardens, playgrounds, or maidans within 1km.

d. Infrastructure and services

Table E-4: Key findings: Infrastructure and Service aspects

	Indicator	Vulnerability Analysis
	Access to drinking water	8.93% of households in Solapur do not have the provision of treated drinking water. 32.48% of households lack access to drinking water inside their premises.
	Access to Clean Cooking fuel	Overall, 34.67% of households do not have access to clean cooking fuel. At least 30% of the households have a household size of more than six, making them more vulnerable to deteriorating indoor air condition.
	Access to Sanitation	Accessing the proximity of latrines, 35.4% of households do not have access to a latrine inside the premises. 3.44% of households have lack of access to treated sewage disposal methods, while 39.11% of households dispose wastewater in an untreated manner.
	Access to Electricity Grid	Overall, 6.16% of households do not have access to electricity as main source of lighting.
	Access to Public Transit	Around 48.46% of Solapur's population lives within 5 minutes access radius of each bus stop in the city.
	Access to Emergency Healthcare Services	Approximately 97.56% of the population has the ease of access (within 8 minutes response time) to hospitals. The level of access also varies temporally throughout the day, based on traffic and road conditions. A 25% reduction in service area during peak traffic hours increases the potential risk.
	Access to Emergency Fire Services	Approximately 22.9% of the population can access fire stations within five minutes of walking distance. 45.16% of slums in Solapur have limited access to a fire station and are at potential heat risk.

7. PROJECTED CLIMATE SCENARIOS

The Representative Concentration Pathways (RCPs) describe four different 21st century pathways of GHG emissions and atmospheric concentrations, air pollutant emissions and land use. These climate projections, in turn, are used for impacts and adaptation assessment.

The current assessment studies minimum and maximum temperature, and precipitation changes for two climate scenarios– RCP 4.5 and RCP 6 up to the year 2100 with intervals of short-term (the year 2023-2050) and long-term (the year 2071-2100) to align with targeted strategies under Solapur Climate Action Plan. The goal of working with scenarios is not to predict the future but to better understand uncertainties and alternative futures to consider the robustness of various decisions or options in a wide range of possible futures (IPCC, 2014).

Table E-5: RCP analysis - Contributing parameters

Parameter	Method used	Data Source
Minimum Temperature	*For RCP 4.5:* Temporal Variations in minimum air temperature from the baseline (Magnitude of change based on 21 models)	NASA Earth Exchange Global Daily Downscaled Projections (NEX-GDDP) for RCP 4.5 CMIP5 daily data for RCP 6
	For RCP 6: Temporal Variations in minimum air temperature from the baseline (Magnitude of change based on 13 models)	
Maximum Temperature	*For RCP 4.5:* Temporal Variations in maximum air temperature from the baseline (Magnitude of change based on 21 models)	
	For RCP 6: Temporal Variations in maximum air temperature from the baseline (Magnitude of change based on 13 models)	
Precipitation	*For RCP 4.5:* Temporal Variations in precipitation from the baseline (Magnitude of change based on 21 models); including Spatio-temporal variations' examples using selected GCMs.	
	For RCP 6: Temporal Variations in precipitation from the baseline (Magnitude of change based on 13 models);	

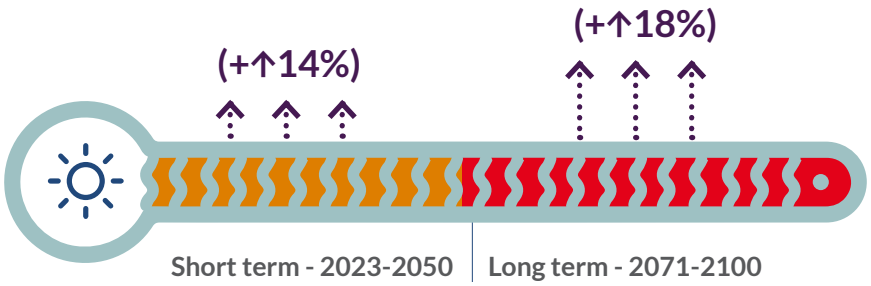
Source: WRI India analysis 2022

a. Minimum Air Temperature

1. RCP 4.5

The 'intermediate scenario' shows the average temperature rise by +↑14% for the short-term epoch and +↑18% for the long-term epoch in the Upstream to Ujani Dam study domain. Solapur, being in a dry (arid and semi-arid) climate zone (Köppen, 2011) may continue to face the brunt of heat with warmer nights heightening Urban Heat Island effect. The energy and water demand in the region may also grow as the temperature is observed to increase at a similar for the upstream catchment and the rest of the sub-basin.

Minimum Air Temperature- RCP 4.5

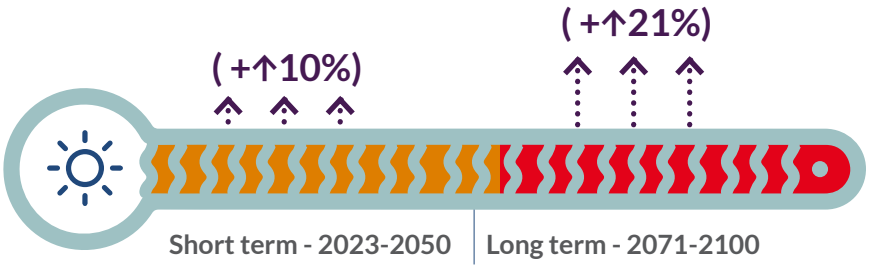


Upstream to Ujani Dam

2. RCP 6

The 'high greenhouse gas emission scenario' is projected to soar as high as +↑10% for the short-term epoch and +↑21% for the long-term epoch for upstream to Ujani dam study domain. The plausible trend of a comparably hotter region (outside of the city) is very likely the result of the continued rise in temperatures altering the precipitation, soil moisture, and vegetation patterns throughout the study area along with the perceived economic development in the region. Most models project the precipitation in the upstream area of the Bhima Upper sub-basin to decrease.

Minimum Air Temperature- RCP 6



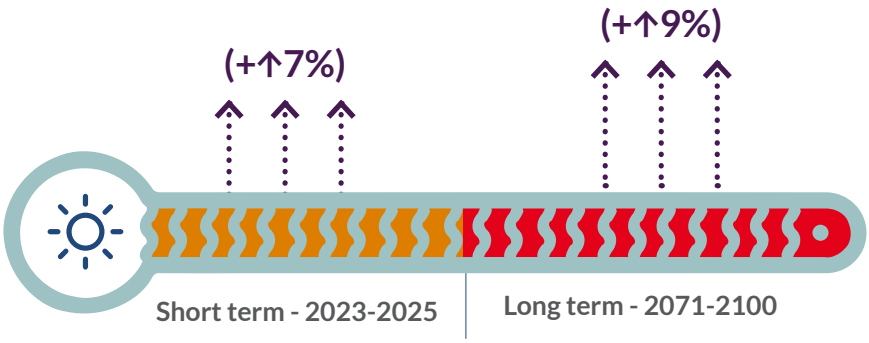
Upstream to Ujani Dam

b. Maximum Air Temperature

1. RCP 4.5

For the short-term epoch, all the study extents which are Bhima Upper, Upstream to Ujani Dam and SMC limits project a maximum increase of +↑7%. While for Upstream to Ujani Dam, the maximum air temperature is projected to rise at most by +↑9% during the long-term epoch.

Maximum Air Temperature- RCP 4.5

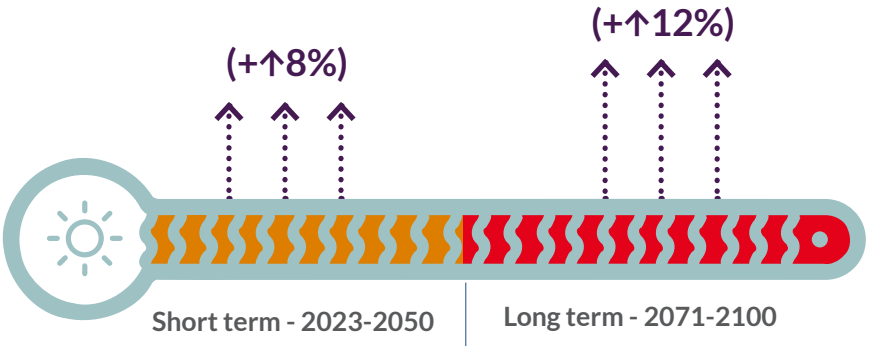


Upstream to Ujani Dam

2. RCP 6

Most of the model's projects accelerated increase by +↑13% in the maximum air temperature for SMC in both the studied epochs. The upstream to Ujani Dam region projects the increase varying between +↑8% to +↑12% in the short and long terms respectively.

Maximum Air Temperature- RCP 6



Upstream to Ujani Dam

c. Precipitation

1. RCP 4.5

Across the study areas Bhima Upper, upstream to Ujani dam and SMC limit for entire 78 years study period, the average change in precipitation is between +↑11-14% that indicates lack of consensus amongst the models. Most models continue to project an erratic increase and decrease for the precipitation with a decrease as high as -↓92% and an increase of nearly +↑203% for SMC over the 78-year-long period.

78 year long period (2023 – 2100) SMC limits

A similar pattern is observed for the upstream catchment area and the rest of the Bhima Basin with a decrease at most by -↓85% and -↓87% and an increase at most by +↑223% and +↑254%, respectively for both the study domains.

2. RCP 6

Across the study area, for entire study period, the average change in precipitation is between +↑5-9% that indicates lack of consensus amongst the models. SMC is projected to have the highest increase amongst the study areas by more than +↑438% in this scenario for the short-term period while the decrease for SMC is -↓78% for the long-term.

Short term - 2023-2050 | Long term - 2071-2100

SMC limits

For the other study domains, Bhima Upper and Upstream catchment to Ujani, respectively, in the 78 year long period, a similar pattern for decrease and increase is observed: -↓81% and -↓86% decrease and +↑362% and +↑317% increase projecting both drought and flood years occurrences in the region.

To ensure a sustainable development pathway, the Maharashtra State Adaptation Action Plan on Climate Change (MSAAPC) 2014 makes sector-specific adaptation recommendations and identifies the concerned departments to implement these. The city would have to implement and enhance these recommendations in various sectors, such as agriculture, water resources, ecosystems, and health, to safeguard the city against potential climate hazards. Enhancing the resilience of farming systems, groundwater recharge, and water-use efficiency are among the recommendations that would help build a climate-resilient future for the city and, in turn, for the state.

8. ASSESSMENT OF GHG INVENTORY AND SCENARIO ANALYSIS

a. GHG emissions inventory for Solapur city

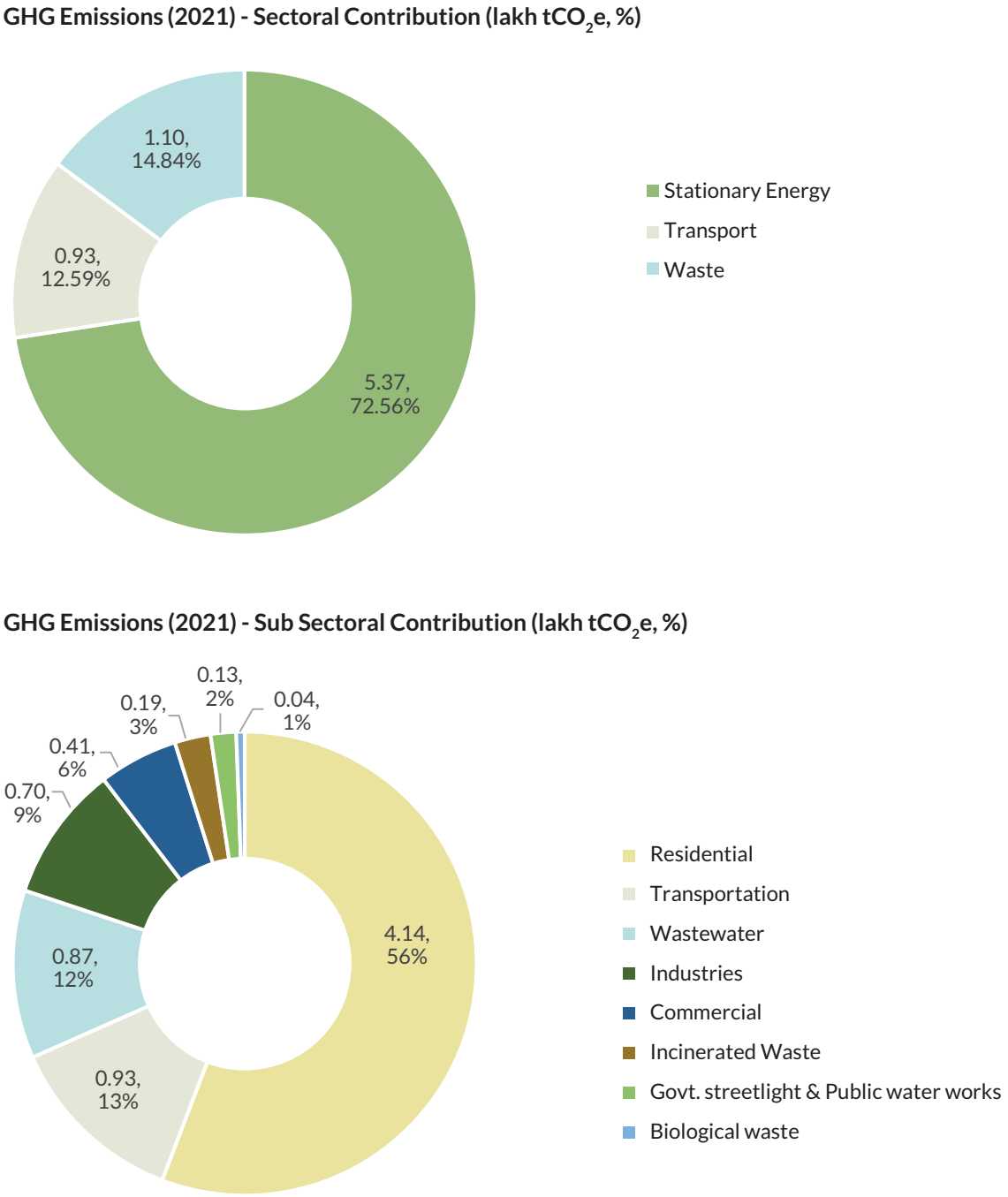
A citywide GHG emissions inventory forms a critical part of any CAP and provides an overview of sector-wise GHG emissions in the city. A GHG emissions inventory helps understand the GHG emissions contribution of different sectors and activities in the city, prioritise mitigation actions, and monitor reductions. It also allows for aggregating city-level inventories with national and state inventories to measure the contribution of city mitigation actions to state or national emissions reduction targets.

The GHG emissions inventory for Solapur is aligned with the Global Protocol for Communities (GPC) framework and covers the three sectors of stationary energy, transportation, solid waste management along with wastewater. The stationary energy sector includes two segments — electricity and fuel (LPG) consumption by residential, commercial, and industrial sectors. The waste sector comprises two sub-sectors — wastewater and solid waste management.

In 2021, the estimated amount of GHG emissions in the SMC area was 7.41 lakh tonnes of CO_2 equivalent (tCO_2e). This is approximately 0.60 tCO_2e per person based on an estimated population of 12.27 lakh for 2021.

The highest contribution to GHG emissions is the stationary energy sector (72.6%), followed by waste (14.8%) and transportation (12.6%) sectors.

Figure E-11: GHG emissions inventory – sectoral and sub-sectoral breakup



Source: WRI India analysis

b. GHG emissions - scenario analysis

The scenario modelling for Solapur City has been developed using the Climate Action for Urban Sustainability (CURB) tool. CURB allows cities to plan across six sectors in an integrated way — private buildings, municipal buildings and lighting, electricity grid decarbonisation, solid waste, wastewater and water, and transport. For the modelling study, 2021 has been accounted for as the base year. The future interim target years are 2030, 2040, and 2050.

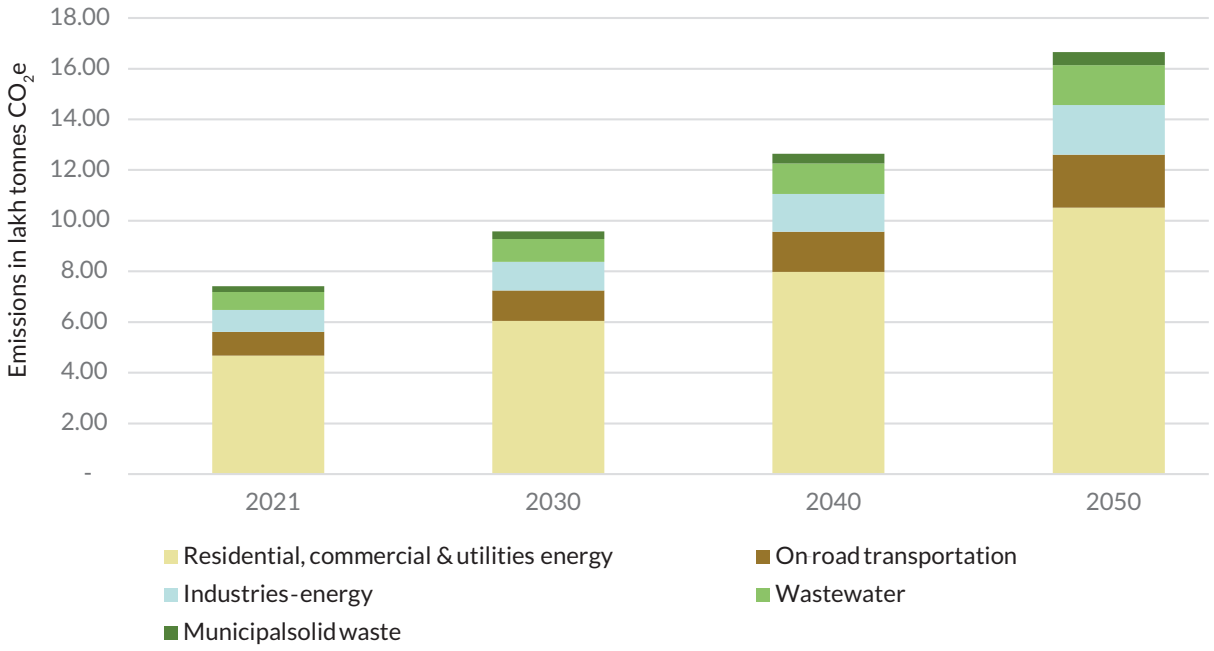
As per the tool, three scenarios are developed.

Business-as-usual scenario

Business-as-usual (BAU) scenario is a no-action scenario but includes some of the existing policies that are under implementation by the government. The BAU scenario represents an emissions trajectory based on the expected growth in energy demand for key economic sectors.

Under the BAU scenario, if no action is taken to mitigate climate change, the city's overall GHG emissions will likely increase nearly 2.25 times between 2021 and 2050, reaching 16.64 lakh tonnes of CO_2e/year in 2050.

Figure E-12 : Business-as-usual scenario (emissions in lakh tCO_2e)



Source: WRI India analysis

Existing and Planned scenario

The Existing and Planned (E&P) scenario uses data from the existing and planned city, regional and national actions, policies, and programmes to demonstrate the emissions reduction trajectory for the city as per the current ambition level. It considers the current and planned development strategies with indirect co-benefits of emissions reductions. In sectors with no planned projects, the existing or past level of growth or ambition is assumed. Examples include actions to subsidise photovoltaic solar installations, solar rooftops, and electric vehicle policy.

By 2050, the overall emission reduction target set up by the city is 80%; however, actions under the planned scenario will help the city achieve only 22% of emission reduction.

Figure E-13 : Existing & Planned Scenario analysis

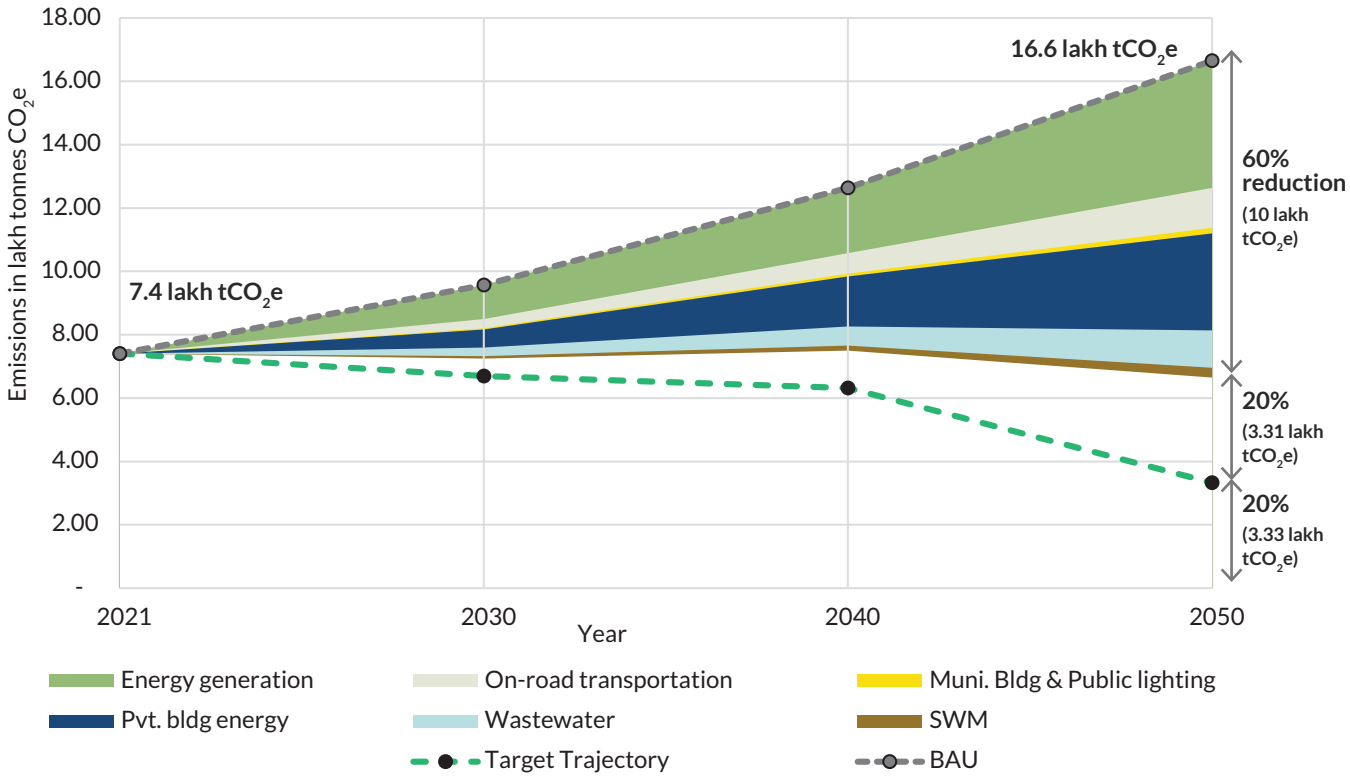
Source: WRI India analysis

Ambitious or Achievable scenario

This scenario was modelled to bridge the gap between the current trajectory and the 1.5°C Paris Agreement goals. In the ambitious scenario, some ambitious yet achievable targets were set in consultations with the city. This scenario aligns with India's 2070 net zero target announced at COP26 in Glasgow.

Considering the actions proposed as per the Ambitious scenario are implemented by 2050, the GHG emissions will be reduced by 10 lakh tCO_2e, approximately a 75% reduction compared with the target of 13.28 lakh tCO_2e reduction by 2050. Thus, there will be residual emissions of 3.31 lakh tCO_2e, 9% of the emissions reduction target.

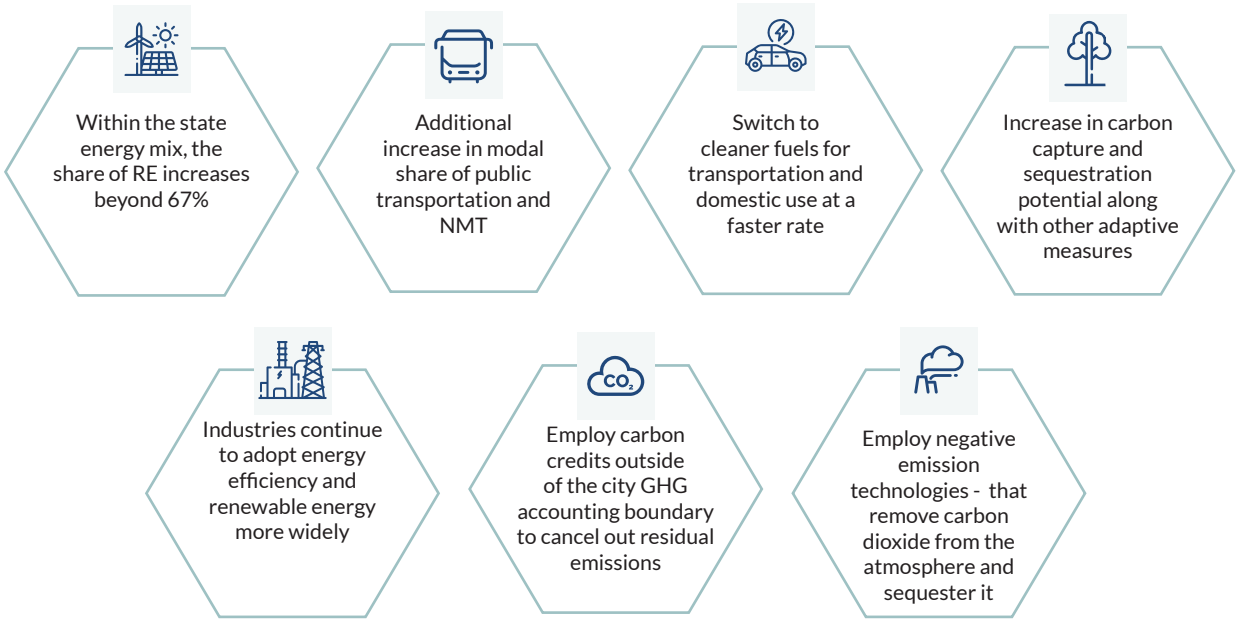
Figure E-14 : Ambitious Scenario analysis



Source: WRI India analysis

Based on the city's institutional and financial capacities and constraints in political will, Solapur city will still have some residual emissions in the year 2050. However, their projected emissions reduction aligns with Government of India's 2070 net zero emission target. To reach a net zero by the year 2050, the state of Maharashtra and Solapur Municipal Corporation must take additional vital measures, as presented in Figure E-15.

Figure E-15 : Measures to achieve the extended scenario



9. VISION

The goal is to promote water-sensitive, inclusive, and low-carbon development in Solapur city, focusing on conserving natural resources and building resilient systems for people, nature, and businesses to achieve a net-zero emissions pathway for 'Climate Forward Maharashtra'.

LAXMI MARKET
Photo credit: Pravin Gaikwad

10. SECTORAL RECOMMENDATIONS

To achieve the Solapur CAP vision, six priority sectors are identified, following extensive stakeholder consultations and assessment of vulnerability and GHG emissions scenarios to develop strategies and actions under both adaptation and mitigation. The primary sectors are analysed further based on the Ambitious scenario, and critical strategy goals and targets are presented. The assumptions and targets are developed based on secondary research and consultations with various stakeholders.

Figure E-16 : Key sectors and strategic pointers

Urban Heat and Greening - focus on mitigation of heat risk and heat hotspots by adopting measures like greening, Nature-based Solutions (NbS), and water-circularity interventions; creating awareness among citizens

Air Quality - improve air quality by adopting activity-related actions, adopting measures to reduce road dust, improving air quality monitoring, and air pollution hotspots mitigtion

Sustainable Mobility - through transition to cleaner fules including adoption of electric mobility, focus on improving public transport, expanding NMT infrastructure

Sustainable MSW Management - measures to promote decentralised waste processing (recycling, composting and bio-methanation) complimenting with existing centralised processes and ensure scientific landfill management

Water Resource Management – measures for groundwater management, water conservation, wastewater recycling and reuse for non-potable usages

Energy and Buildings - adopt RE at municipal buildings and utilities, promote energy conservation, promote passive designs and green buildings, and promote rooftop solar at a wider scale

Table E-6: Summary of sectoral targets

Indicator	2030	2040	2050
Private Residential buildings and energy			
Energy-efficient lighting in existing residential buildings	40%	50%	70%
Energy-efficient cooling in existing residential buildings	40%	55%	75%
Energy-efficient water heating in existing residential buildings	40%	60%	85%
Energy-efficient lighting in new residential buildings	45%	75%	100%
Residential PV on-grid connected electricity	25%	40%	60%
Private Commercial buildings and energy			
Energy-efficient lighting in existing commercial buildings	30%	80%	100%
Energy-efficient cooling in existing commercial buildings	30%	55%	80%
Energy-efficient water heating in existing commercial buildings	20%	40%	60%
Commercial PV on-grid connected electricity	10%	20%	40%

Municipal buildings, Public street -lighting and Traffic lights			
Energy-efficient lighting in existing municipal buildings	60%	80%	100%
Energy-efficient cooling in existing municipal buildings	60%	80%	100%
Public streetlight LED retrofit	50%	80%	100%
LED traffic signals	70%	90%	100%
Electricity decarbonization			
Solar PV	10%	15%	25%
Total by renewables	**39%**	**50%**	**67%**
Coal and others	61%	50%	33%
Sustainable Mobility			
Mode share for public transport	14%	25%	35%
Mode share of NMT and walking	40%	35%	35%
4 & 2 wheelers in modal split	35%	25%	15%
Share of auto in modal split	11%	15%	15%
Total modal split	**100%**	**100%**	**100%**
Electrification of passenger automobiles (Three-wheeler auto)	10%	25%	50%
Share of electrification of light-duty freight	5%	15%	35%
Share of electrification of buses	5%	15%	35%
Fuel switch of all on-road transport (CNG , electric etc.)			
2W	25%	45%	75%
3W	25%	50%	100%
4W	10%	25%	50%
LDV	10%	40%	65%
HDV	5%	20%	40%
Bus standard	20%	40%	70%
Municipal Solid Waste Management			
Share of organic waste composted	60%	80%	90%
Share of CNG SWM transport vehicles	10%	30%	50%
Share of recycling – Paper waste	40%	65%	90%
Share of recycling – Plastic waste	40%	65%	90%
Waste–energy optimization	30%	50%	80%
Wastewater Management			
Improved centralized treatment	30%	55%	80%
Improved decentralized treatment	30%	55%	80%
Waste-water to biogas optimization	30%	55%	80%
Water Management			
Share of pumps with improved efficiency	15%	30%	50%
Share of NRW	40%	25%	15%

INDIRA GANDHI STADIUM
Photo credit: Abhi Dulange

a. Recommendations - Energy & Buildings

- **Strategy E&B-1:** Decarbonise grid through an increase in RE mix in the electricity generation, with a target share of 42% by 2030, 56 % by 2040, and 67% by 2050.
- **Strategy E&B-2:** Unlock the city's energy efficiency and conservation potential with a target for energy-efficient demand management at 50% by 2030, 70 % by 2040, and 90% by 2050.
- **Strategy E&B-3:** Switch towards cleaner fuels for cooking and water heating in residential, commercial, and institutional sectors, with targeted emissions reduction of 22% by 2030, 31% by 2040, and 32% by 2050.
- **Strategy E&B -4:** Facilitate low carbon transition of industrial process.

b. Recommendations - Sustainable Mobility

- **Strategy SM-1:** Strengthen the public bus transport system to ensure that it is affordable, reliable, and sustainable and provides access to all by 2030.
- **Strategy SM-2:** Introduce policies and interventions that promote NMT infrastructure and improve last-mile connectivity.
- **Strategy SM-3:** Facilitate the transition of IPT and private vehicles to cleaner fuels through incentivisation and awareness programmes.
- **Strategy SM-4:** Prepare a comprehensive freight management plan for the city along with the transition to cleaner fuels.

c. Recommendations - Solid Waste Management

- **Strategy SW-1:** Achieve 100% waste segregation at source and promote community-based organic waste management by 2030.
- **Strategy SW-2:** Adopt a Zero landfill approach towards waste management, focusing on reducing, reusing, recycling and recovering by 2040.
- **Strategy SW-3:** Adopt sustainable and inclusive practices for waste management and fuel usage by 2030.

d. Recommendations - Urban Greening and Heat Mitigation

- **Strategy UG-1:** Increase vegetation cover and access to recreational spaces and surface permeability for groundwater recharge to 30-40% by 2030.
- **Strategy UG-2:** Enhance, maintain, and preserve tree cover in the city and increase the healthy green cover to 10-15% by 2030.
- **Strategy UG-3:** Reduce heating effect through greening measures by 2040.
- **Strategy UG-4:** Increasing awareness and sensitisation to help restore, maintain and enhance the city biodiversity ecosystem.

e. Recommendations - Water Resource Management

- **Strategy-WS1:** Extend the formal piped water network to improve water access and address intermittent water service.
- **Strategy-WS2:** Adopt measures to reduce UFW from 55% to 15% and NRW management through governance, technological, and Smart interventions.
- **Strategy-WS3:** Adopt and implement supply-side management measures, such as optimisation of consumer demand, behaviour change, and awareness.
- **Strategy-GW1:** Map the aquifers within SMC areas, and implement aquifer rejuvenation and management measures.
- **Strategy-GW2:** Promote rainwater harvesting.
- **Strategy-WW1:** Collect and treat 100% of the wastewater generated within SMC through a combination of centralised and decentralised wastewater management systems.
- **Strategy-WW2:** Capture methane from STPs by improving the system at Degaon STP and installing a new system at the remaining STPs.
- **Strategy-WR1:** Explore opportunities for wastewater recycling, and supply the same to the NTPC plant for their processes.
- **Strategy-WR2:** Explore opportunities for wastewater recycling and reuse for non-potable purposes.

f. Recommendations - Air Quality

- **Strategy AQ1 :** Strengthening Air Quality Monitoring: Improve air quality monitoring and create avenues for decentralised data collection to strengthen data gathering, monitoring, and information dissemination by 30% by 2030.
- **Strategy AQ 2:** Reduction of air pollution levels by 20-30%: Target the reduction of air pollution levels by 50% through mainstreaming targeted actions in the transport,
  non-exhaust emission (NEE) and waste management sectors by 2030.
- **Strategy AQ 3:** Air pollution-related activity Mapping: Identify and monitor current and
  future activities (apart from transport and waste) that contribute towards the city's high emission levels and take measures to regulate them.
- **Strategy AQ 4:** Disseminate information on the risk and impact of air pollution on human health; address air pollution through a multi-sector approach.

11. INCLUSIVITY IN CLIMATE ACTION PLANNING

Achieving the goals of the Paris Agreement requires a collective, sustained, and long-term effort and more inclusive climate action. Formulating the CAP for Solapur aligns with the Mumbai CAP and C40 Cities' Climate Action Planning Framework. However, besides formulating the GHG inventory for cities and setting targeted actions for 2050, the Solapur CAP has addressed inclusivity and equity considerations by adopting the inclusive planning guidance/framework of C40 Cities and WRI.

Inclusivity can be considered in terms of Processes, Policies, and Impacts. In terms of process, primary consultations were held with the NGOs, civil society stakeholders and those working in the environment space, including the District Forest Office, on various initiatives such as greening, transport, water, etc. Regarding policy considerations, relevant inputs from NCAP, the City's Source Apportionment study, the Development Plan, etc., were incorporated. The impacts of climate change, especially extreme weather events, are felt disproportionately by the poor and the marginalised. The impact analysis considers the assessment of risks by identifying hotspots attributed to LST, flooding or waterlogging, and air pollution and overlaying them with the most vulnerable population in the city. The assessment of impacts is done through a multihazard lens as well, where, in the case of Solapur, heat hotspots, traffic congestion hotspots, and decreased GWRP levels were studied.

12. CO-BENEFITS

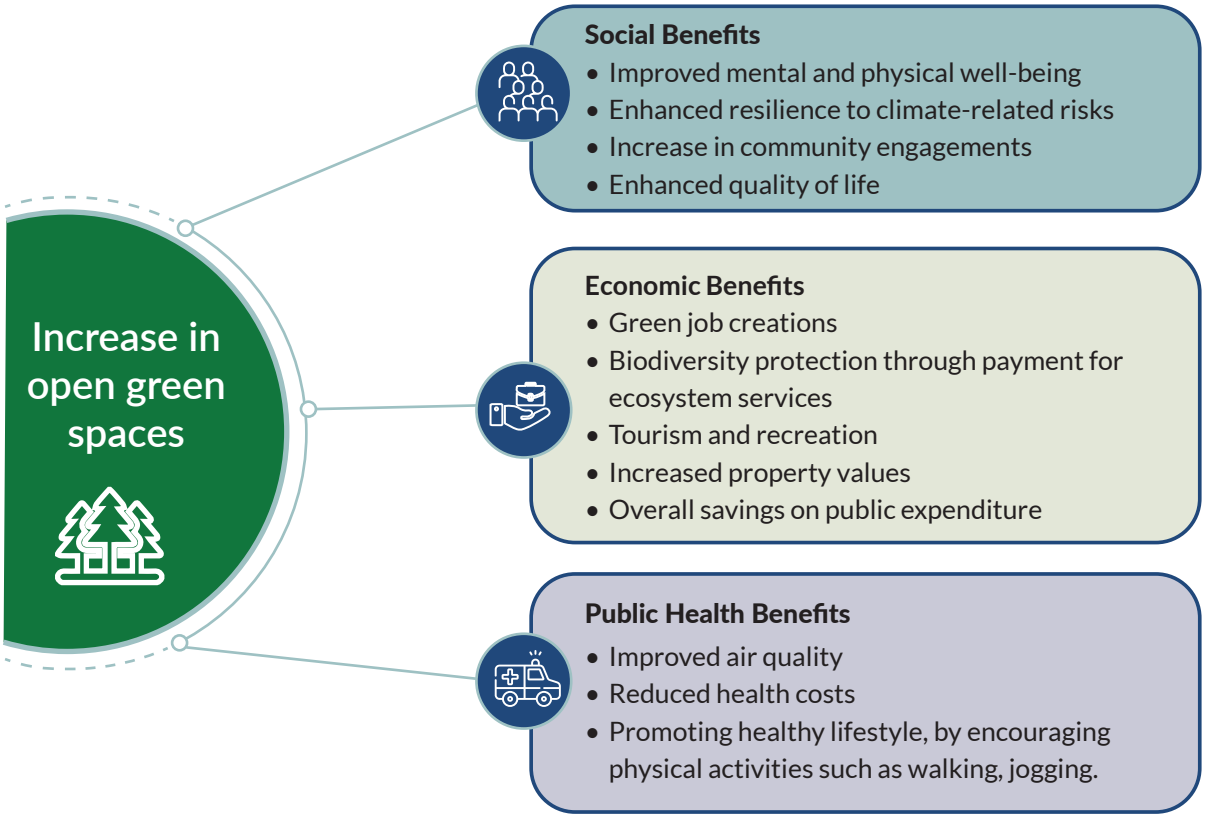
Climate action planning have added co-benefits in addition to climate risk mitigation and adaptation outcomes. It has wider social, economic and public health related co-benefits that impact the people and environment.

Social- Some actions emphasise on equity and inclusivity with a focus on vulnerable areas and communities. This has been addressed through prioritisation of action in hazard prone areas, strengthening information dissemination and increased awareness campaigns. Focus on vulnerable groups such as women, children, elderly and urban poor is also ensued.

Economic- Employment through green jobs, financial incentives to switch to sustainable practices, savings on public expenditure such as lowered travel cost with public transport or switching to cleaner appliances, and opportunities for vulnerable groups such as women are some of the economical benefits through climate action planning.

Public health- The overall mental and physical health and well-being is addressed through increased access to green spaces and protected biodiversity, cleaner air and safety of citizens with reduced exposure to climate risks amongst other measures

Figure E-17 : Illustration of the co-benefits under increase in green spaces



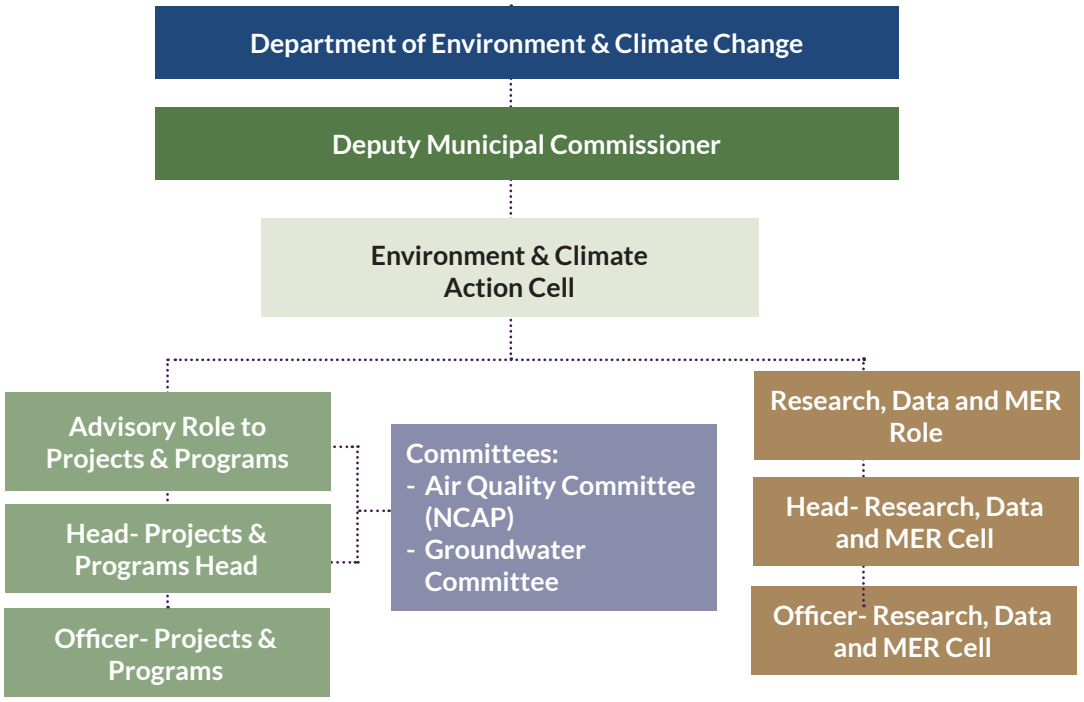
13. GOVERNANCE

The organisational setup of SMC consists of a Deliberative wing, which comprises the city's elected representatives and an administrative wing, comprising appointed representatives responsible for infrastructure and service provision. Additionally, parastatal agencies fall outside the purview of SMC and provide services, technical data, and support to the city.

The primary functions of the Environment Department include working on the nexus of waste management, air pollution under NCAP, and greening under Majhi Vasundhara Abhiyan (MVA). It is proposed that the current Environment Department headed by the Deputy Municipal Commissioner be the nodal coordinating agency for the Solapur CAP. In line with the Ministry of Environment and Climate Change as well as the changes instituted by the Government of Maharashtra, the newly named Department of Environment and Climate Change at the state level addresses issues pertaining to environment and accelerates climate action in Maharashtra. It is also proposed that the Environment Department be expanded, strengthened, and renamed as the Department of Environment and Climate Change (ECC) following official protocol.

As the Department of ECC provides advisory support for developmental projects to a certain extent, creating a Climate Action Cell is essential to facilitate and support the implementation of the Solapur CAP. This Environment and Climate Action Cell (ECAC) would play a critical role in data management and research, coordinate with other interdepartmental and parastatal agencies, and support the projects and programmes pertaining to the environment as well as monitor the outcomes and outputs of the Solapur CAP. The structure of the Environment and Climate Action Cell is subject to changes if any, based on consultation with SMC.

Figure E-18: Proposed changes to the Environment Department



source: SMC and WRI India analysis

14. FINANCING

The SMC budget has two major heads - revenue and capital. The SMC's budget for 2023-2024 has been analysed with data from the Financial year (FY) 2019-20 to FY 2022-23 based on SMC's budget of FY2022-23. There is minimal revenue surplus from observing the trend of revenue income during FY20-FY23. The revenue income and expenditure grew at a compounded annual growth rate (CAGR) of 13% during this period.

Under the National Clean Air Program (NCAP), in FY 2022-2023, INR 10.70 crore were used for air pollution-related work, building awareness, road maintenance, and plantation activities. Furthermore, under NCAP, for the financial year 2023-2024, INR 17.62 crore has been sanctioned, of which INR 8 crores has been distributed in FY23 and INR 10 crores budgeted for FY24. These grants represent

significant funding sources for SMC, particularly in road maintenance, waste management, and gardening sectors.

Going forward there is a need for reclassification, reallocation, and fresh budget allocation for climate actions, both for adaptation and mitigation. Based on this, a dedicated climate budget can be prepared so that the city can prioritise climate actions.

15. NEED FOR CLIMATE BUDGET

Given the need for reclassification, reallocation, and fresh allocation of some of the budget for climate actions, a climate budget is essential for Solapur to ensure that financial resources are dedicated to the CAP. It is also important to leverage this as a governance tool so that institutional barriers identified in the city's existing governance structure.

Although the budget will be anchored within SMC and prioritise activities directly under SMC's control will be prioritised, the ECAC and the climate budget will ensure that the departments within SMC or parastatal agencies assume the responsibility to implement climate actions that lie within their control to ensure better coordinated outcomes. Through this engagement, the city will prepare a climate budget for the FY 2024-25 with sector-specific emission ceilings, in alignment with the plan.

16. TRACKING PROGRESS

It is crucial to establish a continuous Monitoring, Evaluation and Reporting (MER) framework in place to track the progress of the implementation of Solapur CAP. The framework aids in tracking, assessing, and reporting actions towards achieving accountability in implementation and making improvements based on the insights gained. Monitoring is essential for tracking the progress of actions through continuous, systematic data collection. Evaluation is important for assessing the impact of actions, while reporting and learning enable transparency and data-driven accountability amongst various stakeholders.

The ECAC is an essential division within the Department of ECC. Its primary responsibilities include conducting data management and research, coordinating with other interdepartmental and parastatal agencies, supporting environment-related projects and programmes, and monitoring the outcomes and outputs of the Solapur CAP.

Table E-7: Energy & Buildings- Illustrative table of Key Performance Indicators for key strategies/ priority actions

SN	Sectoral strategy/ priority actions	Key performance indicator
1	Support grid decarbonisation by increasing RE mix in the city	• Increase in Renewable Energy (in % and MW) at government buildings and utilities • RE cell within the city • Increase in localised energy generation (solar, wind etc.) via Renewable Energy (in % or MW) sources • Strengthen waste to energy systems at STPs and SWM sites
2	Adoption of cleaner fuels in residential, commercial, and industrial users	• Transition of HHs or users from coal/ fossil fuel to LPG/ PNG/ biogas • Transition of HHs or users from LPG/ PNG to electric / solar • Transition of HHs or users from low- income or vulnerable sections of the society from coal/ fossil fuel to LPG/ PNG/ solar/ biogas
3	Energy efficiency and energy conservation	• 100% Led streetlights, sensor based lighting within SMC premises and gardens

17. CONCLUSION

Solapur is one of the important and culturally vibrant cities in Maharashtra. While the city will continue to attract investment and jobs, leading to its further growth, it is time to reexamine its planning and future development process with a focus on sustainability and climate resilience is the need of the hour. The Solapur CAP serves as a roadmap of SMC's commitment to combat climate change and to increase the climate resilience of the city. Solapur CAP aligns with the policies and plans developed at the national, state, regional and city levels. Plans and strategies such as CSCAF, NCAP, and City Development Plan, provide a strong base for planning current and future strategies related to climate action in the city. The CAP is a guiding document for the city to contribute towards a net-zero emission target, with a vision of creating low-carbon development aligned with Climate Forward Maharashtra.

Prepared and compiled by WRI India

https://wri-india.org/

WRI India

WRI India

@WRIIndia I @WRICitiesIndia