

Pune, India

City Waste Management Profile



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1. Introduction to Urban Ocean

Urban Ocean is a capacity-building and accelerator program for cities that champions circular economy principles, builds awareness of ocean plastic pollution, and assesses waste management systems. The program leverages city leaders to bring new ideas, partners, and resources together and solve interrelated resilience challenges related to waste management; plastic leakage; and protecting water bodies and the ocean. The program demonstrates how actions to improve waste management and recycling can provide resilient and sustainable solutions that reduce ocean plastic pollution while addressing key city priorities, such as improving public health, supporting economic development, and reducing greenhouse gas emissions. Furthermore, Urban Ocean provides cities with the opportunity to demonstrate thematic leadership and share knowledge and experience across the Resilient Cities Network (R-Cities) community and beyond. The program is jointly led by R-Cities, Ocean Conservancy (OC), and The Circulate Initiative (TCI).

Figure 1
Urban Ocean cities map



Overview of the Urban Ocean challenge

Cities are home to over half of the global population and account for nearly three-quarters of global greenhouse gas (GHG) emissions (IPCC, 2021). No climate nor social target will be met without a deep transformation of urban centers towards a more inclusive, sustainable, and resilient path. Approaching urban waste management systems through a resilience lens reveals complex, interrelated ramifications for social, economic, and environmental indicators. In 2018, the International Labor Organization estimated that the waste management sector alone has the potential to create 45 million jobs globally by 2030 while reducing GHG emissions by 15 to 20%. Additionally, circular economies offer a USD 4.5 trillion economic opportunity by reducing waste, stimulating innovation, and creating employment by 2030 (WRI, 2021). Currently, plastic usage is growing and continues to be a threat to public and environmental health in the ocean and in cities. A huge opportunity exists for city governments to implement policies and projects that promote a more resilient and circular waste sector in their cities. Now is the time to set out on the path towards a more resilient urban–ocean relationship that highlights the importance of preventing marine plastic debris.

Program objective

The Urban Ocean program aims to collaborate with urban leaders to gather new ideas, partners, and resources to address interconnected challenges related to resilience in waste management, reduce plastic leakage and protect water bodies and the ocean. Urban Ocean provides a platform for ocean advocates and urban leaders to join forces in developing comprehensive solutions that meet the needs and priorities of governments, cities, communities, and other stakeholders to create real and lasting impacts.

Cohorts 1 and 2

Urban Ocean works closely with cities to demonstrate tangible solutions and highlight progress in addressing waste management challenges. The first cohort of Urban Ocean cities included Pune (India), Can Tho (Vietnam), Panama City (Panama), Semarang (Indonesia) and Melaka (Malaysia).

The work further expanded to four additional cities in Cohort 2 – Chennai, Surat and Mumbai (all India) and Santiago (Chile) – to expand the geographic scope of the program, expand the waste management, circular economy and resilience ecosystem, increase collaboration with local governments and establish effective waste management systems that generate environmental, social and economic co-benefits to cities.

Methodology

This report provides a summary of the information collected for the purpose of developing a resilience-oriented analysis of the urban waste management system in Pune. The profile was created in collaboration with the Pune Municipal Corporation, R-Cities, Ocean Conservancy, The Circulate Initiative and Centre for Environment Education (CEE). The analysis involved desk research, a collaborative workshop with city stakeholders, and interviews. The following table presents the key stakeholders who were consulted as part of the program.

Table 1
Interviewed stakeholders



Government

Pune Municipal Corporation

Pune Smart City Development



Academia

Pune University



NGOs

Janwani

Mera Farmer

Samuchit Enviro



Service Providers

SWaCH Pune (cooperative of self-employed waste pickers)

Kagad Kach Patra Kashtakari
Panchayat



Civil Society

Aundh Baner Citizens Forum



Private sector

Social Lab

EY (formerly Ernst & Young)

The Green Thumb

INORA | Institute of Natural Organic
Agriculture

NEPRA Pvt. Ltd.

2. About the City Waste Management Profile

As part of Urban Ocean, cities create a City Waste Management Profile, in which a city's waste management systems are presented, including technical and sustainability aspects, and formal and informal actors in the system. The City Waste Management Profile ("the Profile") examines major disturbances and stresses prevalent in the city that impact the city's waste management system. It brings together preexisting data and information collected in the initial phases of the program to allow the city to assess the risks and vulnerabilities of the system, as well as support project design.

The Profile seeks to provide insight for the city to better plan and identify appropriate solutions to increase the resilience of their waste management system, reduce plastic leakage into the environment, and improve the city's ability to respond to, adapt to, or otherwise address current and future shocks and stresses. It summarizes the baseline assessment conducted in all cities in the Urban Ocean program and highlights the most relevant data and information to address urban resilience, ocean conservation, and plastic pollution.

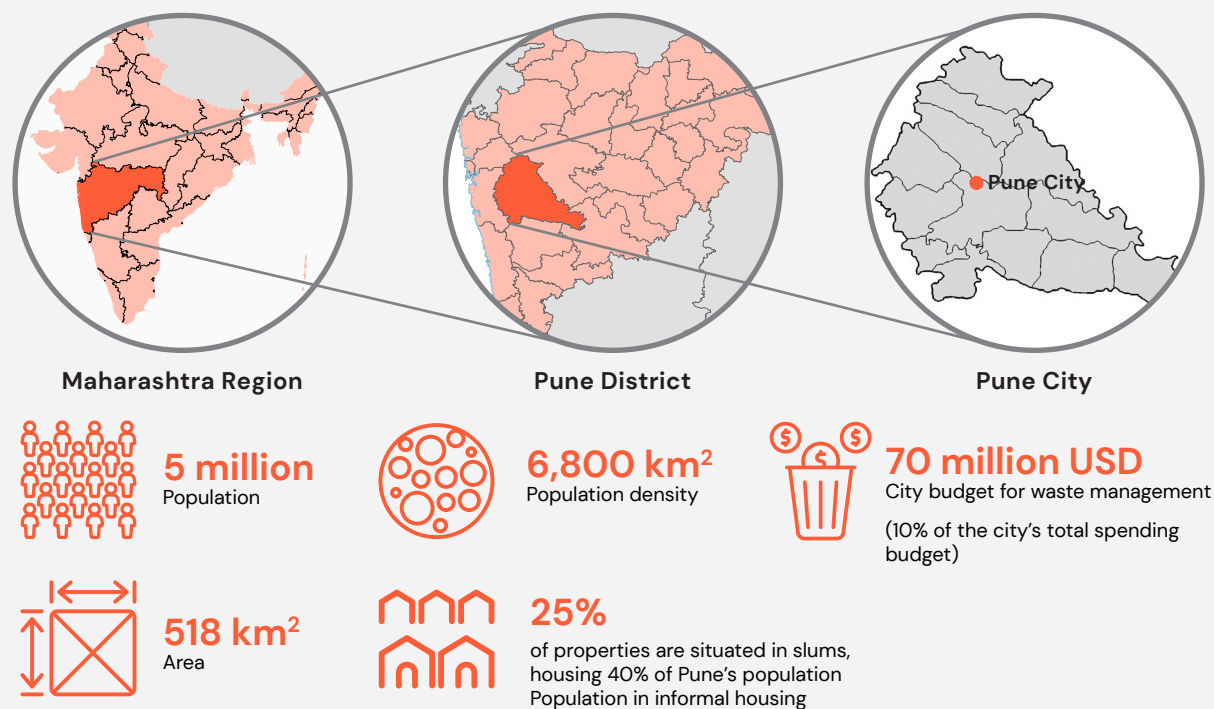
The Profile encourages a more holistic approach to existing challenges and supports cities in the development of individual solutions suited to their specific history, economy, demographics and culture while being aligned with the city's unique institutional, environmental, and financial resources. An added benefit of being part of Urban Ocean is how cities can learn from each other by comparing common elements in their respective Profile.



3. Overview of Pune and its Resilience Journey

Pune is considered the cultural and industrial capital of the Indian state of Maharashtra, with a strong economy. The city's growth is driven by its knowledge economy, diverse economies of auto, manufacturing, Information Technology (IT) and IT-enabled services (ITES), a fertile hinterland, proximity to Mumbai and the western coastline. The city also has a fairly young population and is known for its active citizen participation in the city's urban projects. Pune has been documented as one of the fastest growing cities in the Asia-Pacific region for the past 40 years. However, the rapid rate of urbanization in Pune has not been matched by strategic infrastructure development and service expansion. This has caused significant stresses in the city such as air and water pollution, traffic congestion, lack of affordable and secure housing, and poor service delivery, especially in peri-urban areas.¹

Figure 2
Socio-demographic indicators of Pune



¹ Pune Resilience Strategy, 2017 https://resilientcitiesnetwork.org/downloadable_resources/Network/Pune-Resilience-Strategy-English.pdf

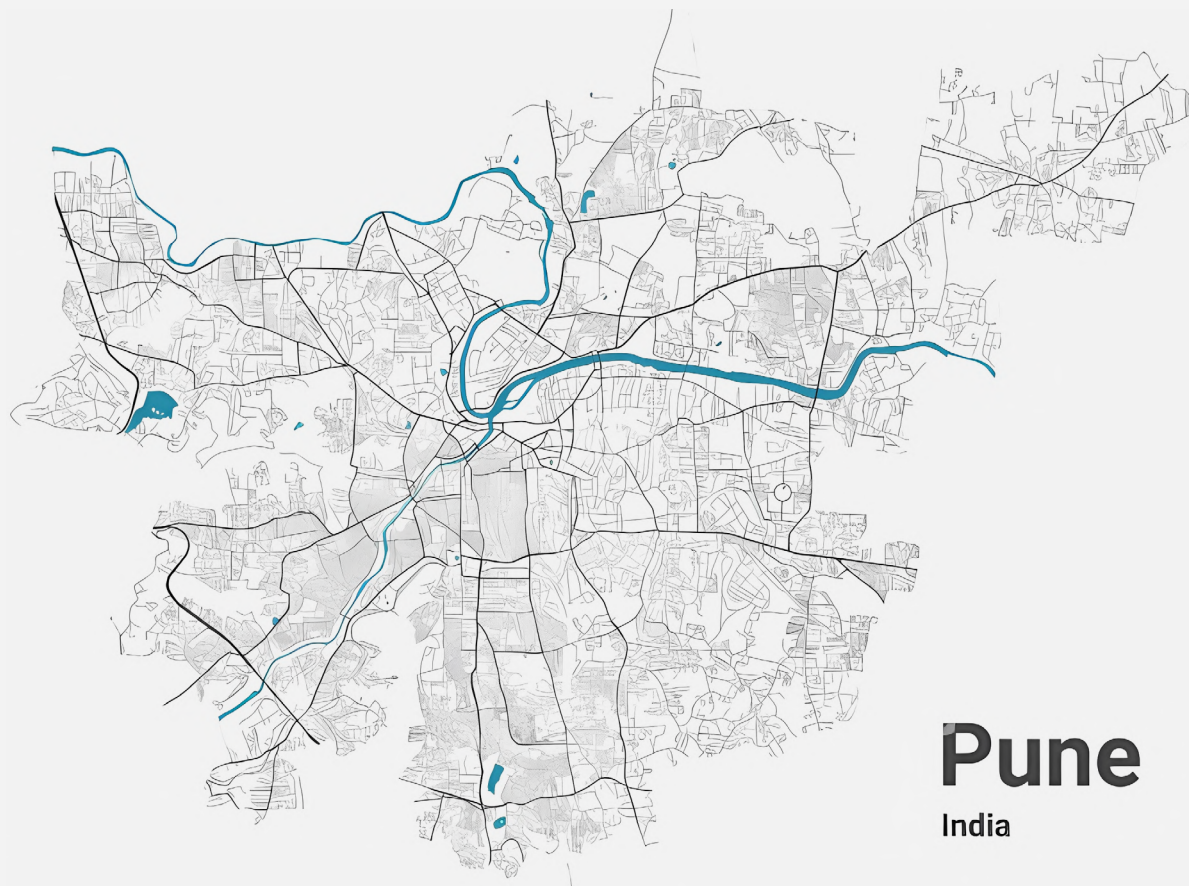
Source: Pune Municipal Corporation, 2021;
Budget 2018-19, Pune Municipal Corporation <https://www.pmc.gov.in/en/budget-2018-2019>

City's connection with the waterbodies

The rivers of Mula and Mutha, the two rivers flowing through Pune, originate in the Western Ghats and meet in the city to eventually drain into the Bay of Bengal. The rivers meet in the middle of the city, and the combined Mula-Mutha river flows out of Pune to the east. There are three major lakes in the city: Pashan, Katraj and Jambulwadi. The city is also surrounded by dams – Khadakwasla, Panshet, Warasgaon and Temghar – that provide water to the city.

The effects of increasing population density, industrialization and urbanization, and poor environmental management practices are causing significant degradation of Pune's environment, severely impacting its rivers. Upstream settlements with limited basic sanitation services, several rapidly urbanizing fringe areas outside the jurisdiction of the Pune Municipal Corporation (PMC), and areas within city limits that are not connected to the sewer system release untreated sewage, industrial effluents, and agricultural runoff into the rivers. Lack of awareness among citizens also causes dumping of solid waste in the water bodies. Thus, the Mula and Mutha rivers have been severely polluted by sewage and solid waste and see reduced flows of water due to upstream dumping. Though Pune has made significant advances in urban development, solid waste management and sewage treatment need improvements.

Figure 3



Key shocks and stresses impacting the city's waste management systems

Pune is rich in natural resources with 35% of its land area under green cover². The rapid rate of urbanization in Pune has not been accompanied by equal pace of development, causing significant environmental and infrastructural stresses such as traffic congestion, lack of affordable and secure housing, and poor service delivery, especially in peri-urban areas. Encroachments along the water bodies have disrupted the riparian zones, causing siltation and other problems, thereby reducing their water-holding capabilities. Inadequate solid and liquid waste management practices, especially in upstream settlements, have severely reduced the capacities of the city's ecosystems. The city also experiences disruptions from flooding of the Mula-Mutha river when upstream dam flood gates are opened, and extreme rainfall and flooding instances have increased over the recent years.


Building resilience through waste management

The Pune resilience strategy was a result of two years of highly committed and dedicated efforts by city leaders and staff from multiple city departments, NGOs and associations, experts from institutes and universities in the city, enterprises, as well as local communities. Using a resilience lens, the strategy focuses on three key areas for improvement, considering Pune's current pattern of development and its expected growth: urban mobility; urban environment including water bodies and waste management and conservation of biodiversity; and urban economy, particularly the informal sector.

Among the challenges identified, the strategy highlighted solid waste management as one of the most severe stresses the city is currently facing, with an urgent need to look at holistic interventions to address and enhance waste management systems in the city. Municipal solid waste generation in Pune is among the highest in Indian cities and challenges such as inadequate coverage in door-to-door solid waste collection, inefficiencies in waste processing, and suboptimal citizen behavior has led to dumping of solid waste in the water bodies. The strategy has a dedicated goal under its Environment pillar to promote the circular economy of Pune through waste management.

Figure 4
Key shocks and stresses in the city

SHOCKS

-  Flooding
-  Extreme rainfall
-  Disease outbreaks

STRESSES

-  Water pollution and health of water bodies
-  Mobility
-  Access to affordable housing
-  Air pollution
-  Solid waste management

² Revolutionizing Pune City: Through A Circular Economy, 2020. Earth5R. <https://earth5r.org/revolutionizing-pune-city-circular-economy/#:-:text=Pune%20is%20rich%20in%20natural,and%20poor%20environmental%20management%20practices.>



The following goals in the strategy align with the Urban Ocean Program.

Goal 2.3 Promote circular economy through waste management

- Strengthen the capacity of PMC and the circular economy ecosystem towards 100% in situ processing of organic waste, recovery of recyclables and liquid waste management.
- Support formalization of scrap recycling economy and improve sanitation worker safety and livelihoods.
- Promote public behavior change to sustain the circular economy.

Goal 3.2 Ensure every individual in Pune has the opportunity to work with dignity

- Ensure universal delivery of social protection and improve government regulation and worker entitlements for informal work.
- Improve women's participation in paid work across income groups and education levels to increase economic productivity and gender equity.

Goal 3.3 Promote Pune as a center for innovation by focusing on creativity, research, and development

- Create pathways for the transfer of knowledge and technology between industries, research institutions and universities.
- Promote collection, storage and dissemination of

quality, open data in a way that maintains privacy.

The amount of domestic solid waste generated in the city is expected to increase with the growth in population. Approaching urban waste management systems through a resilience perspective reveals the complex, interrelated ramifications for social, economic, and environmental indicators. Waste management needs to be tackled in an integrated manner with an objective of reducing waste, managing the exiting waste efficiently to reduce waste leakage in water bodies, promoting sustainable innovations, and impacting livelihoods. Actions to improve waste management and recycling can provide resilient and sustainable solutions that reduce waste pollution and address key stresses in the city, such as improving public health, supporting unemployment and economic development, and reducing environmental degradation.

Pune has undertaken several initiatives and innovative approaches in solid waste management. However, with ever-increasing migration and growth in the city, waste remains a key stress in the city. To address the interrelated resilience and waste challenges, Pune joined the Urban Ocean program in March 2020 to advance solutions in waste management and move towards achieving the priorities set out under the solid waste master plan of the city.

The Urban Ocean program aims to advance the goals aligned with the Pune resilience strategy, through rigorous research and stakeholder engagement, define opportunity areas in the city and conceptualize pilot ideas ready to implement. The program was jointly led by Urban Ocean partners Resilient Cities Network, Ocean Conservancy, and The Circulate Initiative, and implemented by Pune Municipal Corporation (PMC) and the Centre for Environment Education (CEE) in the city. For the Urban Ocean Gap Assessment, the Circularity Assessment Protocol, a baseline assessment of waste and circularity within the city conducted as part of the Urban Ocean program, was deployed. The local team also collaborated with other relevant partners for the implementation of specific project ideas.

The Pune Urban Ocean initiative is changing the relationship between the city and the waste it produces. It aims to strengthen the waste processing and recycling industry and the informal sector from a resilience and circularity perspective; decrease health and environmental risks associated with inadequate waste disposal and work to support workers' welfare, environmental quality and eliminating plastic and other material leakage.

The Urban Ocean program was implemented in Pune as below:

2016–17

Resilience strategy

Pune identified solid waste management as a key challenge

2020

Launch of Urban Ocean

Launch of program and Preparation forum

Pune joined the Urban Ocean program to address the interrelated resilience challenges related to waste

2020–21

Gap Assessment (Circularity Assessment Protocol –CAP, City Waste Management Profile, Opportunity Assessment Tool – OAT)

Undertook assessment of risks and vulnerabilities within the waste management systems that lead to plastic leaking into the municipal environment and beyond; identification of opportunities by rethinking waste management through circular economy and resilience principles

2021–22

Design Proposal

Project Statements and Accelerator summit

Developed specific actions to advance solutions to address plastic waste challenges

Figure 5

Shocks and stresses impacting the city's waste systems



4. Legal, Policy and Governance

State and local regulations and guidelines

Solid waste management in India is regulated primarily through the Solid Waste Management (SWM) Rules 2016, issued by the Ministry of Environment, Forest and Climate Change and the Central Pollution Control Board, Government of India. Additionally, a regulatory framework specifically for the management of plastic waste is also in place through the Plastic Waste Management Rules (PWM), 2016 (later amended to PWM Rules 2022) which includes Extended Producer Responsibility (EPR) for plastic waste. The SWM Rules 2016 provide an overall framework for municipal solid waste management in urban and rural areas. The rules include clauses which clearly intend the manufacturer to be responsible for the waste they are producing by stating that it should be the duty of manufacturers to provide financial assistance to local authorities for a waste management system for all non-biodegradable packaging material, and to educate people on best disposal mechanisms.³

The PWM rules mandate that generators of plastic waste must take steps to minimize plastic waste,

prevent littering of plastic waste, and ensure segregated storage of waste among other measures. They also include instructions on EPR for plastic packaging with obligations for producers, importers, brand owners and plastic waste processors. The rules also mandate the responsibilities of local bodies, surrounding villages, waste generators, retailers and street vendors to manage plastic waste and promote the development of new alternatives to plastics, providing a roadmap for businesses to move towards sustainable plastic packaging. The Government of India also banned the manufacture, import, stocking, distribution, sale and use of identified single use plastic items, which have low utility and high littering potential, across the country from July 2022.⁴

The Urban Development Department, Government of Maharashtra and the Maharashtra Pollution Control Board facilitate the cities in implementation of waste management. There is also a state policy in place (Maharashtra Plastic and Thermocol Products Manufacture, Usage, Sale, Transport, Handling and Storage Notification, 2018) which bans single use plastics of less than 50-micron thickness.

Pune Municipal Corporation has framed their Public Health and Sanitation Bylaws 2017 for regulating all matters connected with the segregation, collection, removal, recycling, transportation, processing and disposal of solid waste and liquid waste generated or brought within the jurisdiction of Pune Municipal Corporation in accordance with these rules. The city also has a 2025 Solid Waste Management Strategic Plan in place with ambitious and specific goals around collection, management, and monitoring, and a detailed project report for waste management.

³ Ministry of Environment, Forest and Climate Change (MOEFCC) (2016). Solid Waste Management Rules, 2016. Government of India. New Delhi.

⁴ Ministry of Environment, Forest and Climate Change, 2022 - <https://pib.gov.in/PressReleasePage.aspx?PRID=1837518#:~:text=In%20line%20with%20the%20clarion,2021%2C%20on%2012%20August%202021.>

Governance structure

The following authorities are involved and impact the waste management systems in Pune. Their roles and responsibilities are as below:

LEVEL OF GOVERNANCE	ROLES AND RESPONSIBILITIES
National level	<p>The SWM Rules, 2016 by the Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India mandate provision of municipal SWM services by municipal authorities in urban areas in the country. The MoEFCC is responsible for monitoring the implementation of these rules in the country.</p> <p>The Central Pollution Control Board co-ordinates with the State Pollution Control Boards for implementation of these rules and adherence to the prescribed standards by local authorities.</p>
State level	<p>In line with the national regulations and policies, the Urban Development Department, Government of Maharashtra and the Maharashtra Pollution Control Board look into the matters of SWM at the state level. The state government acts as a facilitator with implementation undertaken by cities.</p>
City level	<p>PMC with involvement of multiple stakeholders carries out SWM in accordance with the SWM Rules 2016. The primary responsibility for implementation of these rules lies with PMC, including tasks such as:</p> <ul style="list-style-type: none"> • Prepare a SWM plan, arrange door to door collection of waste, establish a system to recognize organizations of waste pickers and/or their integration into formal door-to-door services, facilitate formation of self-help groups of waste collectors and provide them identity cards. • Prescribe user fees and collect the fees from waste generators directly or through an authorized agency. • Set up material recovery facilities or secondary storage facilities with space for sorting of recyclables enabling easy access to authorized waste pickers and collectors; establish waste deposit center for domestic hazardous waste. • Involve communities in waste management and promotion of home composting, biogas generation, decentralized processing of waste at community level. • Collect and transport different categories of waste including collection from vegetable markets, street sweepings, construction and demolition waste etc. • Facilitate construction, operation and maintenance of waste processing facilities and infrastructure by themselves or with private sector entities. • Allow only the non-reusable, non-recyclable, non-biodegradable, non-combustible and non-reactive inert waste and pre-processing rejects and residues from waste processing facilities to go to sanitary landfill, and appropriate management of the landfill; create public awareness about solid waste.

Existing programs for waste management

Swachh Bharat Mission

The Swachh Bharat Mission (SBM) was launched in 2014 by the Prime Minister of India and is implemented by the Ministry of Housing and Urban Affairs for all the cities in India. Under the mission, every Urban Local Body (ULB) i.e. the municipal authority is required to adopt 100% source segregation of waste and have access to a Material Recovery Facility (MRF) for sorting the dry waste, including plastic waste for recycling and/or processing into value added products, thereby reducing to a minimum, the amount of plastic and dry waste ending up in dumpsites or waterbodies. SBM aims to build capacities of the cities to design, execute and operate all systems related to service provision. This requires close linkage between planning, operationalizing and sensitizing of the sanitation and waste management services within the departments as well as with citizens for achieving the goals of SBM. The initiative has also encouraged the participation of the private sector by providing an enabling environment for their active and reliable participation.

Key city strategies and plans for waste management

As per the Municipal Solid Waste Master Plan 2017–25 of Pune Municipal Corporation, the city has set the following targets in enhancing waste management systems:

- Achieve 100 % door-to-door coverage of segregated waste collection
- Minimize waste generation
- Process 100% of waste collected in Pune city
- Develop an integrated waste management system through citizen engagement using IT solutions for monitoring the entire system
- Complete capping of the existing dumpsite

Existing projects for waste management

There are multiple existing projects for waste management in the city, especially with the involvement of the private sector and mobilization of Corporate Social Responsibility Funding:

- Janwani partnered with PMC, Cummins India, SWaCH, waste pickers and other stakeholders to establish a Zero Garbage Ward in Katraj
- PMC with P&G corporate for sanitary waste processing and management
- ITC Limited supported Multi-Layer Plastic Collection Programme in Pune, as part of which 200 tons of multilayered plastic (MLP) is collected and sent for recycling every month
- ITC with local recycling partner Shakti Plastics by extending technical support and sharing best practices for better value realization from recycling MLP



5. Waste Management in the City

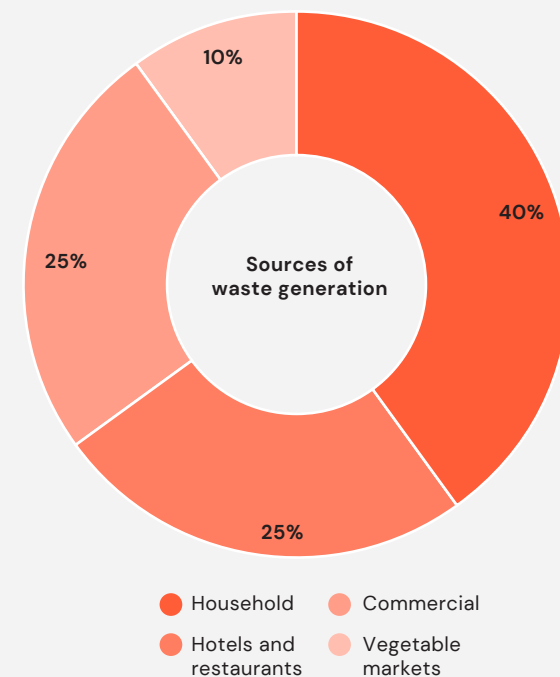
Overview of Pune's waste management system

According to the city's Environment Status Report, the average amount of solid waste generated in the city is about 2,000 tons per day.⁵ Pune has made strides in recent years towards maximizing its waste collection and management and reducing the amount of waste leakage. However, with a growing population and future projections of waste generation, waste management still remains a challenge. Municipal waste streams in Pune are highly complex because of urbanization, an extensive informal sector workforce and value chain, waste volume, variety of material movement, high-priced urban land and frequent changes in rules, regulations and bylaws. PMC, the Solid Waste Collection and Handling (SWaCH) cooperative, informal-sector recyclers, compost service providers, private enterprises in waste management, a range of micro-enterprises and several voluntary civil society organisations are part of the waste management ecosystem in the city. The following figure summarizes the city's existing waste management value chain:

Waste generation and characterization

Growing urbanization, an influx of service sector companies and workers and improved living standards have caused a sharp growth in municipal solid waste in the city of Pune. The waste generation of the city is 2,000 tons per day, which is 455 grams per capita. The city has is making efforts to improve waste segregation at the household level. A high percentage of segregation levels are achieved in areas where door-to-door waste collection services are operational. Even with good segregation rates in the city, the CAP assessment shows consumers expressing that segregation requirements weren't clear to waste collectors who were losing profit because of improper household sorting. Even researchers and business owners noted that the segregation process is convoluted and differs between formal and informal structures in Pune. Mandates on source segregation and open dumping are not well enforced.

Figure 6
The main sources of waste generation



Source: Down to Earth, 2014

⁵ PMC Environment Status Report 2020-21 https://www.pmc.gov.in/sites/default/files/reports_dpr/ESR%202020-21%20Submitted%20to%20GB_0.pdf

Figure 7
The city's existing waste management value chain

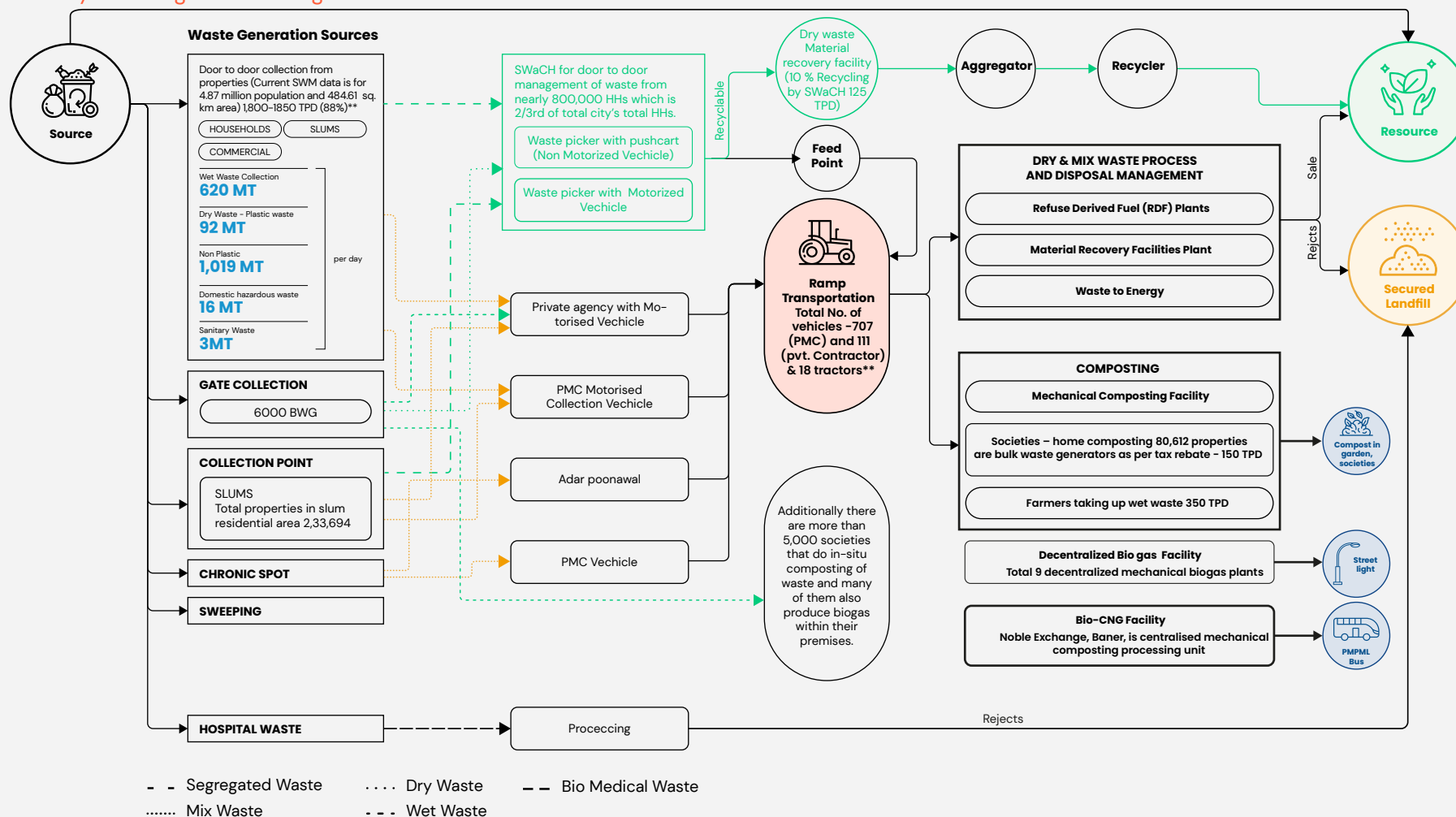
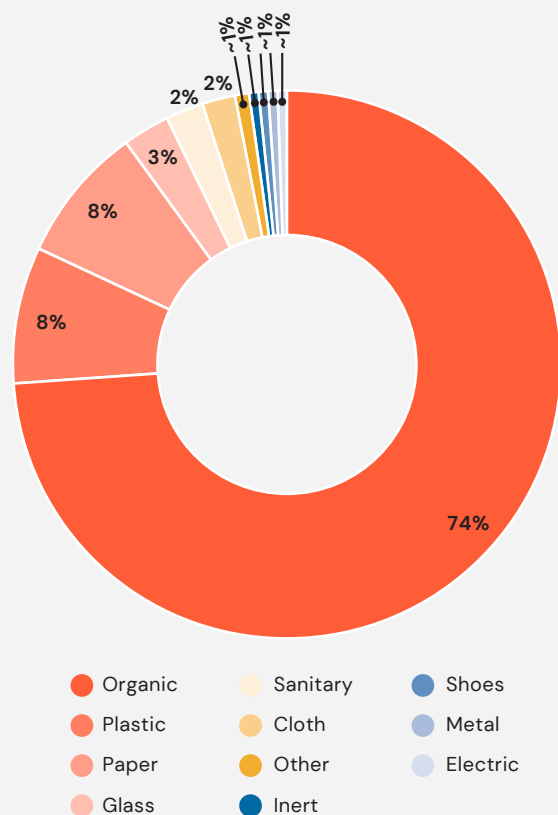


Figure 8
Waste characterization in the city



Source: Sohkhlet and Nagargoje, 2020

Waste characterization

Most of the domestic waste in Pune is organic, biodegradable food waste. Plastics account for 8% of the entire household solid waste stream in the city.

Waste collection and transportation

System: Pune has a unique structure for its waste collection in the form of a collaboration between PMC and SWaCH, which is a national cooperative of self-employed waste collectors in India, with around 3,500 members, most of whom are women and economically disadvantaged workers. It is a first of its kind effort in India, supported by PMC and evolved out of the local trade union for waste pickers, Kagad Kach Patra Kashtakari Panchayat. It is reported that around 70% of households are serviced by SWaCH through the door-to-door waste collection.⁶ SWaCH maintains data on doorstep collection and segregation, conducts awareness programs, and monitors segregation rates in the city. SWaCH currently serves nearly 800,000 households or about two-thirds of the total households in the city.⁷ Started as a workers' movement focused on informal waste workers' rights to safe and secure livelihoods, SWaCH has now evolved to be a critical actor in Pune's waste management system.

SWaCH also launched the 'Red Dot Campaign' in 2017, to promote segregation and collection of sanitary waste, which is an occupational and health hazard. The campaign promotes segregation of sanitary waste and disposing the used sanitary napkins in paper marking them with a red dot, so that waste pickers know that it needs to be handled differently.

PMC provides doorstep collection using ghanta gaadis (waste collection vehicles), in certain localities. For the few neighborhoods which do not have doorstep collection services, households deposit waste in neighborhood receptacles or large metal bins, which are then collected by PMC vehicles.

Street sweeping on public roads is primarily carried out using brooms by municipal staff attached to various ward offices. On certain arterial and sub-arterial roads, street sweeping is carried out with vacuum cleaners owned and operated by Adar Poonawalla Clean City Initiative as a corporate social responsibility activity.

Cost of services: SWaCH levies INR 70 (USD 0.85) per month for residential households, INR 140 (USD 1.7) per month for commercial entities and INR 50 (USD 0.6) per month for slum households. A slum subsidy of INR 10 (USD 0.1) per month per property is given by PMC. Leveraging the services and labor of SWaCH saves PMC INR 200 million⁸ (USD 2.4 million)

⁶ SWaCH Impact 2021 <https://swachcoop.com/>

⁷ SWaCH Impact 2021 <https://swachcoop.com/>

⁸ SWaCH 2021- <https://swachcoop.com/about/swach-pmc-partnership/>

per annum in waste-handling costs alone. The model is resource-efficient and environmentally beneficial as SWaCH waste-pickers recycle and reduce the quantity of waste sent to landfills. This in turn reduces carbon and other greenhouse gas emissions responsible for global warming.

Service provision to low income households: PMC has entered into an agreement with SWaCH for door-to-door collection of waste. SWaCH currently provides doorstep waste collection services and under this partnership, waste collection services are extended to the lower-income areas and slums at reduced user fees, which PMC subsidizes.

Treatment and disposal

Existing treatment facilities/landfills

The large amount of organic material and the diversity of the waste streams in Pune have led to several processing plants being established for waste treatment in the city.

As of 2021, Pune relied on seven transfer stations and about fifty processing plants that include organic waste and dry-waste processing plants – encompassing bio-methanation plant, bio-Compressed Natural Gas (CNG) plant, mechanical composting plants, hazardous waste processing plant, plastic-to-fuel processing

plant, and several material recovery facilities (MRFs).⁹ Local technology providers have recently been encouraged to develop equipment tailored to meet the needs of waste processing in Pune. This has increased the amount of waste being processed and reduced the amount of waste heading to landfills. However, it is important to note that waste to energy plants have negative consequences because of associated GHG emissions and no reuse and recovery of plastics for recycling. Urban Ocean partners recognize the need for implementable and circular solutions in Semarang that hold plastics producers accountable for the full lifecycle of their products, cease the leakage of plastics into the environment, and incentivize reuse.

Several reports suggest that many of these waste treatment plants are not operating at their full capacity. Mechanized and centralized processing options pose threats in operations due to requirements in higher operations costs, upgradation of systems and skilled workers for maintenance. This has been reflected in the plants' performances in the last few years, as seen in the gaps in processing capacity and actual processed waste. As per the CAP report, it was estimated in 2017 that the processing plants were collectively operating at around half their capacity. Two of the largest plants in particular – Rochem and Noble Exchange Bio-methanation – were only processing at 36% and 16%

of their installed capacity, respectively.¹⁰ In 2021, the Noble Exchange plant surpassed 50% of its capacity while the Rochem plant was shut down.¹¹ The Rochem plant's backyard, close to the residential areas, created foul problems for locals. The residents filed a petition with the Pune bench of National Green Tribunal (NGT) requesting the plant be shut. This coupled with the poor performance of the plant led to its closure.

Despite these efforts, a large quantity of waste in the city still ends up in the landfill. The main landfill that services Pune, Urali Devachi, is being filled at a faster rate than planned and is rapidly running out of capacity. As of 2020, around 35% of the 43-hectare landfill had reached full capacity and been permanently sealed.¹² The Municipal Solid Waste Strategic Plan states that the city has concerns over available land for waste management and associated infrastructure to support the city's growing needs, particularly to handle wet waste.

⁹ PMC 2021

¹⁰ PMC 2021

¹¹ PMC 2021

¹² Sohkhlet and Nagargoje, 2020 – https://www.e3s-conferences.org/articles/e3sconf/abs/2020/30/e3sconf_evf2020_04001/e3sconf_evf2020_04001.html

Figure 9

Waste collection, transportation and recovery by SWaCH



Recycling of waste

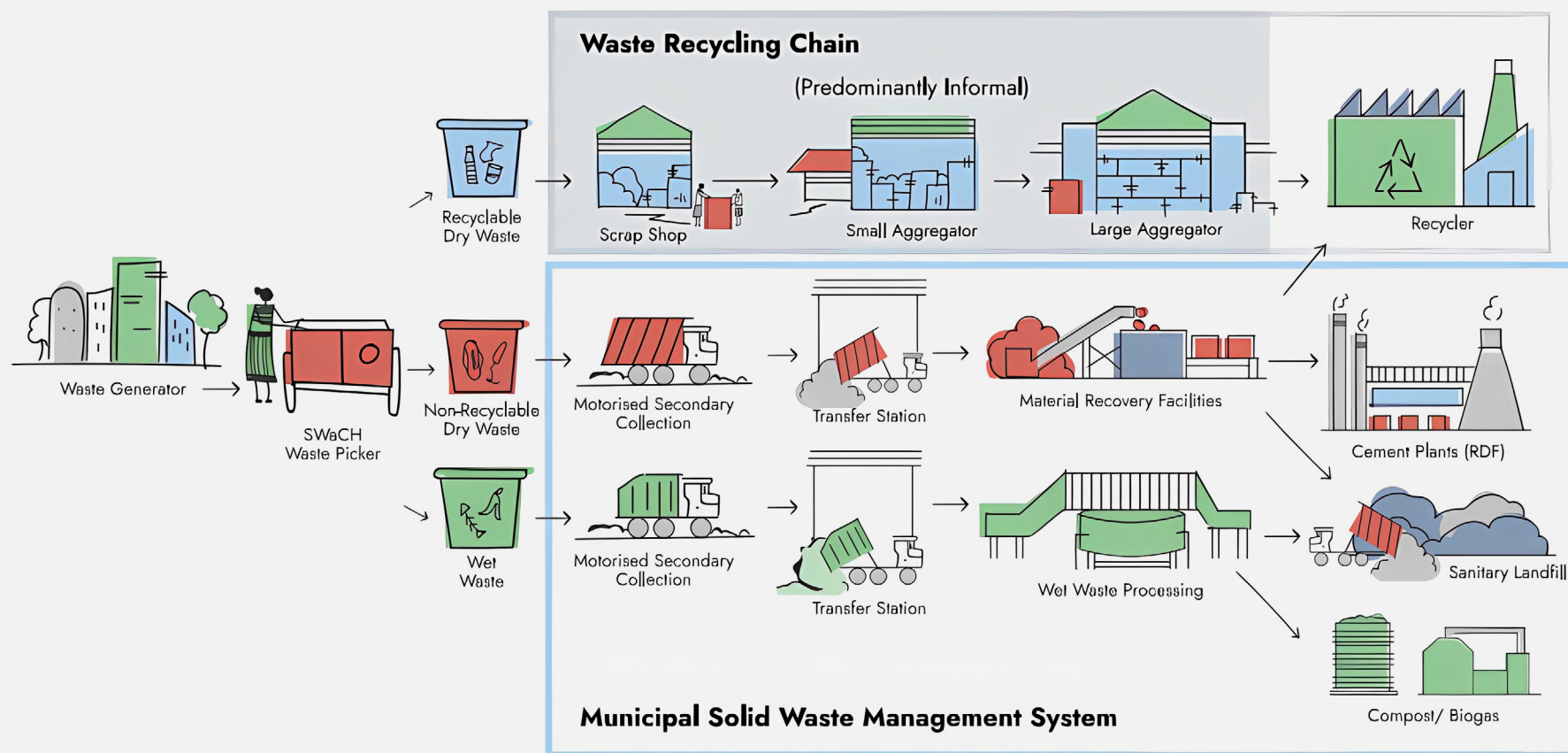
Based on numbers released by PMC and SWaCH in 2021, around 62% of all waste collected by SWaCH is recycled (plastic is largely sent to Shakti Plastics, a large plastic recycler). As per SWaCH's terms of agreement, waste pickers retain the right to recover and sell any recyclable materials from the waste they collect. Of the remaining waste, around 31% is sent to PMC waste processing plants and around 6–7% is sent to the landfill.¹³ Waste pickers form the base of recycling in the city who sort the waste into around 20 categories before selling it to scrap shops. Scrap shops sell the sorted waste to waste aggregators, who further sell it to wholesalers, after which it is ultimately sent to the recyclers.¹⁴

As per the CAP stakeholder interviews, while the improvement in processing capacity and technology is promising for the city, the hope is to also increase the amount of waste that is directly diverted to recycling by SWaCH. However, to achieve this, adequate sorting practices and sorting space are critical. The SWaCH system depends on Pune residents paying user fees, which directly ties the income of the waste pickers to the value of recyclable items. If the system cannot be optimized, the value of recyclable items may decrease. Due to the decentralized nature of the waste collection structure, it is also difficult for waste collectors to have access to all areas throughout the city, where they can safely sort waste that has not already been segregated and have access to short-term storage for recycling.

¹³ SWaCH monthly report, June 2021

¹⁴ Lakshmi Narayan, Lubna Anantkrishnan 2022 – <https://swachcoop.com/pdf/202302-KP-WC-Report-Digital-02.pdf>

Figure 10
Waste recycling system in the city



Source: Lakshmi Narayan, Lubna Anantkrishnan 2022

6. Key Findings and Opportunities

Key challenges

Potential opportunities



Urbanization and governance

- Pune is a fast-growing city with increasing inward migration, improving lifestyles and associated increase in waste production.
- As the administration works within their own departments, interdepartmental coordination has been a gap for the city.

- The city has developed a solid waste management master plan which aims to create an enabling environment, setting up local operational systems, stakeholders' engagement and information systems.
- The city can leverage its active citizen participation to play an important role in promoting decentralized solutions for waste management.
- The city also can leverage the growing private sector economy for private sector funding for waste management services.



Resilience

- Rapid urbanization has not been matched by development initiatives causing significant stresses such as air and water pollution, solid waste leakage and poor service delivery in the city.
- The Mula and Mutha rivers have faced severe pollution by sewage and solid waste due to upstream settlements with limited basic sanitation services, rapidly urbanizing fringes and areas that are not connected to the sewer system releasing untreated sewage into the rivers. This has also led to an increase in flooding instances in the city.

- The city can explore possibilities to focus on infrastructure upgrades, coupled with active citizen engagement and decentralized practices for sustainable waste management, to match the growing needs of the city.



Existing waste management systems

- The city has a unique model for its waste collection through the SWaCH cooperative of self-employed waste collectors in India, which has proved to be an effective collaboration. This has helped the city in improving its waste segregation and collection. However, waste segregation at the neighborhood level is limited to areas where door-to-door collection by SWaCH exists.
- Waste streams in Pune are highly complex, because of urbanization, increasing migration and waste generation, an extensive informal-sector workforce and value chain and frequent changes in regulations.
- The city has multiple stakeholders who are a part of city's waste ecosystem including local government, SWaCH, informal-sector recyclers, compost service providers, private enterprises, micro-enterprises and several voluntary civil society groups and residents' associations.
- Most of the waste still ends up in the landfill, which has almost reached its full capacity. The city has concerns over available land for waste management and associated infrastructure to support the city's growing needs.
- The city can explore possibility to enable expansion of SWaCH services to the entire city to improve waste segregation and door to door collection.
- The city can leverage its existing partnerships with multiple stakeholders for promoting source segregation and connecting with waste aggregators for further recycling and streamline and expand facilities to recover materials. Formalization of informal aggregators and recyclers to improve the safety and livelihoods of the informal waste sector can be explored.
- Community led decentralized models can be promoted for sustainable waste management in the city.

7. Glossary of Terms

Bio-methanation: Bio-methanation is a process by which organic material is microbiologically converted under anaerobic conditions (absence of oxygen) to biogas.

CAP: Circularity Assessment Protocol. Assessment protocol developed by the University of Georgia to identify and analyze waste streams, particularly plastics.

CEE: Centre for Environment Education

EPR: Extended Producer Responsibility

GHG: Greenhouse Gases

IPCC: Intergovernmental Panel for Climate Change

IT: Information Technology

ITES: Information Technology Enabled Services

MLP: Multilayered Plastic

MoEFCC: Ministry of Environment, Forest and Climate Change

MRF: Material Recovery Facility. A materials recovery facility receives, separates, and prepares recyclables to be sold to an end buyer. An MRF uses a combination of equipment, machines, and manual labor to separate and prepare the materials.

MSW: Municipal Solid Waste. Waste that originates in homes and establishments such as commercial establishments, hotels, educational institutions etc.

MT: Metric Ton

NGO: Non-Governmental Organization

OAT: Opportunity Assessment Tool

OC: Ocean Conservancy

PMC: Pune Municipal Corporation

PWM Rules 2022: Plastic Waste Management Rules notified specifically for plastic waste along the SWM Rules in 2016, later modified in 2022. The PWM Rules define Extended Producer Responsibility on Producer, Importer, and Brand Owner for both pre-consumer and post-consumer plastic packaging waste.

R-Cities: Resilient Cities Network

SBM: Swachh Bharat Mission. The mission was launched on 02 October 2014 by the Ministry of Housing and Urban Affairs as a national campaign to promote cleanliness, sanitation, and proper waste management in urban areas.

SWM: Solid Waste Management

SWM Rules 2016: Solid Waste Management Rules 2016 notified by the Ministry of Environment, Forest and Climate Change of Government of India

TCI: The Circulate Initiative

WRI: World Resources Institute

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URBAN
OCEAN