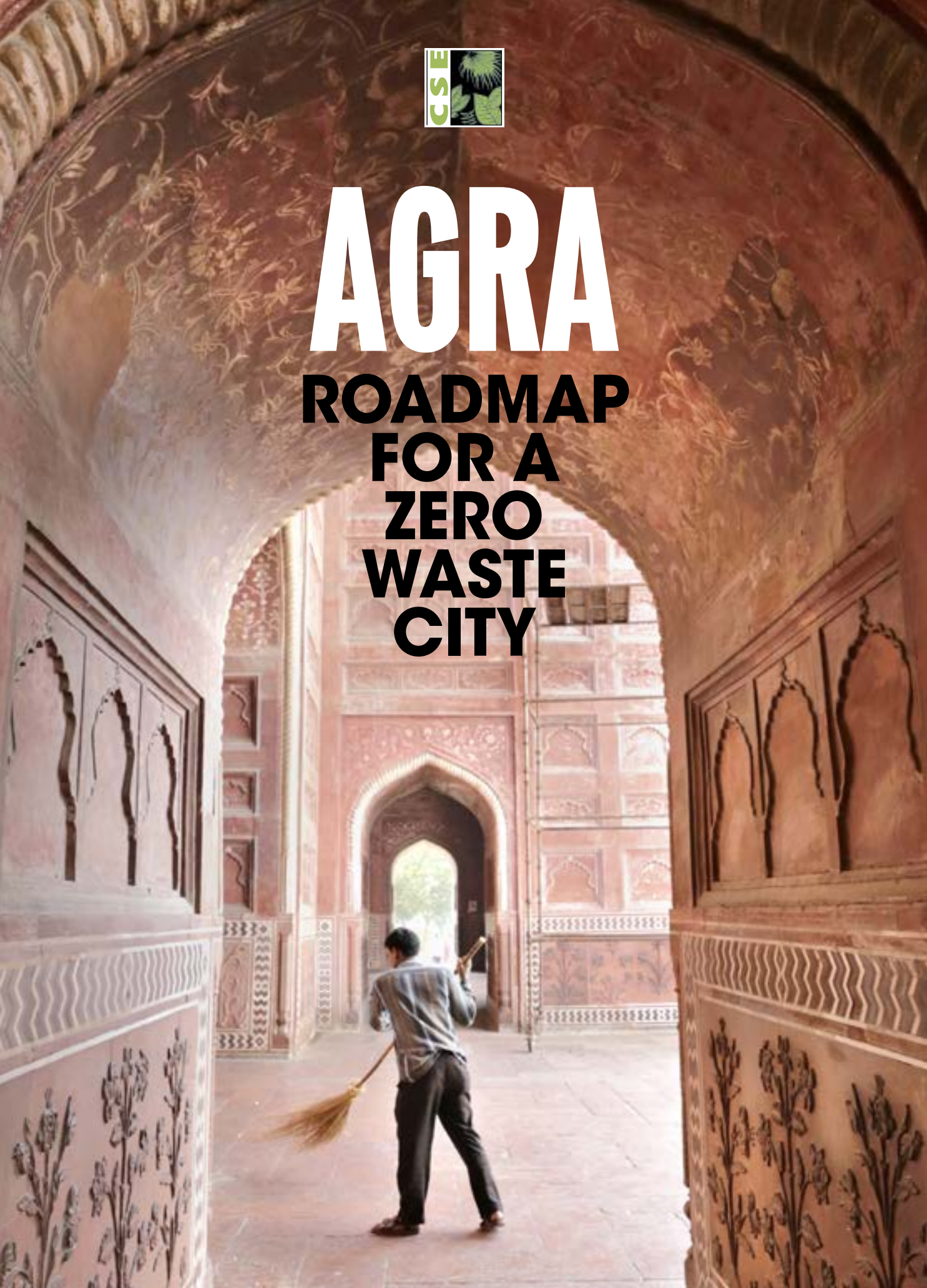

AGRA

ROADMAP FOR A ZERO WASTE CITY

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AGRA

Roadmap for a Zero Waste City

Contents

About Agra

Agra, located on the western bank of river Yamuna, 206 km south of the national capital New Delhi, is a culturally rich and historically important city. It is home to as many as 48 protected monuments (as per Archaeological Survey of India's classification). The very thought of Agra reminds us of the Taj Mahal, one of the seven wonders of the world and a universal symbol of love. Agra is a popular national and international travel destination, receiving more than a million tourists every year.

The city is the headquarter of the Agra district of the state of Uttar Pradesh. Agra Municipal Corporation (AMC) has jurisdiction over the entire city minus the area under the Cantonment Board. Besides being a prominent tourist destination of India, being centrally located on the national map, Agra forms an important regional urban centre. Agra is a Class I town. The city stretches over about 9 km along the Yamuna River. A major part of the city is on the western side of Yamuna and is called cis-Yamuna, while the newer part to the east of the river is termed trans-Yamuna.

In addition to the 1.58 million people that reside within the municipal limits (as per Census 2011), an additional floating population of 0.3 million (as per Agra Jal Sansthan), that includes tourists, also uses the municipal infrastructure and services of the city. According to the Agra Smart City project, the city hosts 17 per cent of the total international tourists visiting India every year (which is estimated to be close to 1.15 million). Taj Mahal alone receives seven–eight million domestic and foreign tourists every year, which is the highest in the country. The city government faces a monumental challenge in providing the citizens and the floating population with basic civic amenities like sanitation and waste management services.

Table 1: Agra—vital statistics

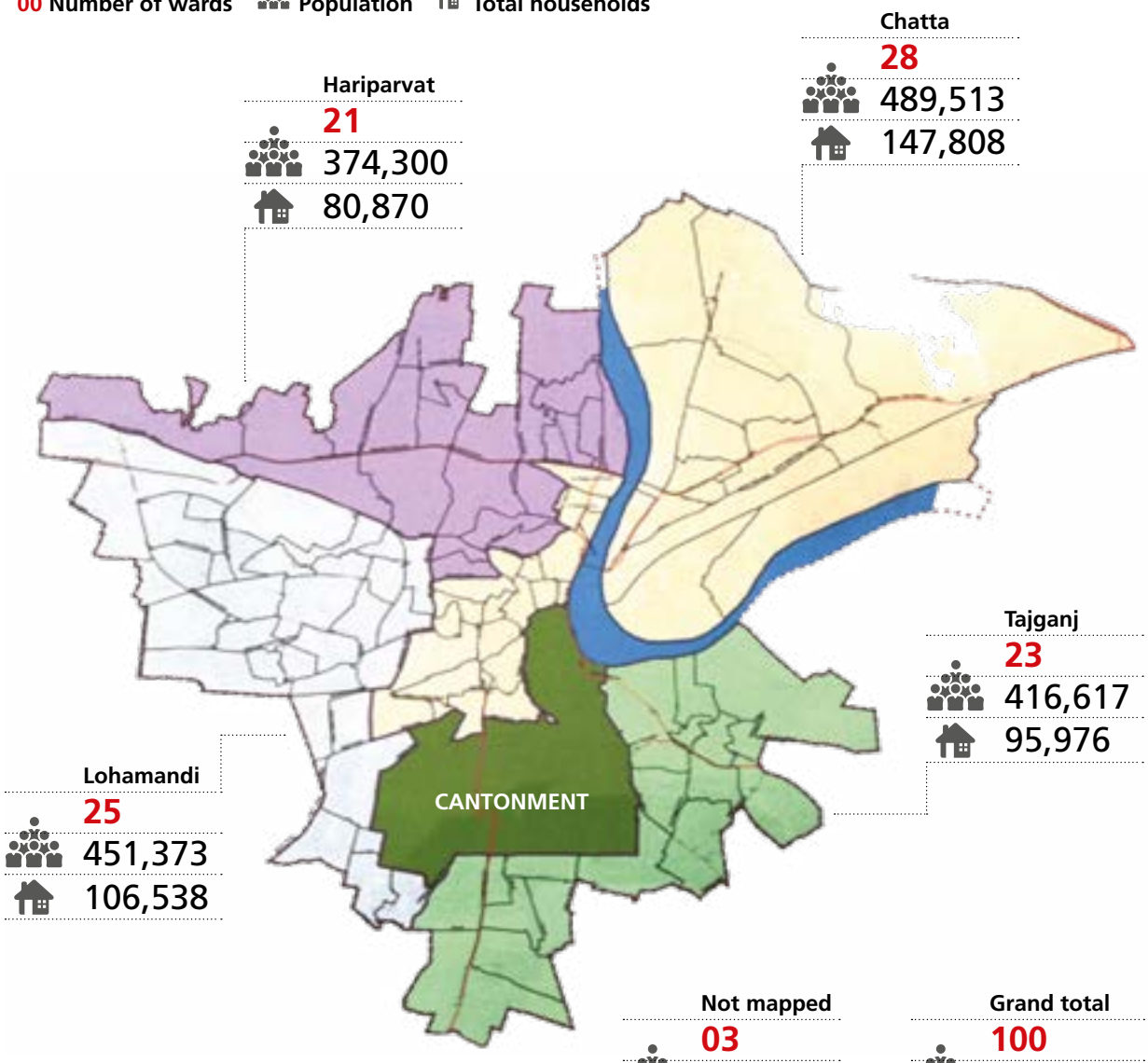
Total area of the city	141 sq km
Population (2020 estimate)	2,087,006
No. of households	0.44 million
No. of bulk waste generators	2,352
No. of commercial entities	29,081
No. of wards	100
No. of zones	4
Waste generation (2017)	712 TPD
Total processing capacity (2020)	455 TPD

Source: CSE, 2020

The city has 100 wards (*parshad kaksh*) and is divided into four zones for operation and management of sanitation and waste management services (see *Map 1: Agra Municipal Corporation map*).

Map 1: Agra Municipal Corporation map

00 Number of wards | Population | Total households



Source: Agra Smart City Ltd; AMC Report, 2019

The economy of Agra has three key pillars: tourism, the shoe industry and iron foundries. According to National Sample Survey Organization data (2000), 431 of every 1,000 male in Agra are self-employed, which grew to 603 per 1,000 in 2005, which further underlines livelihood opportunities in the tourism and small-scale industries. There are about 12 major and medium-scale industrial units, producing electrical goods, pipes, leather goods etc. and as many as 7,200 small-scale industrial units in the city. More than 1.5 lakh pairs of shoes are manufactured in Agra every day by various footwear producing companies, a significant part of them working in the informal sector.

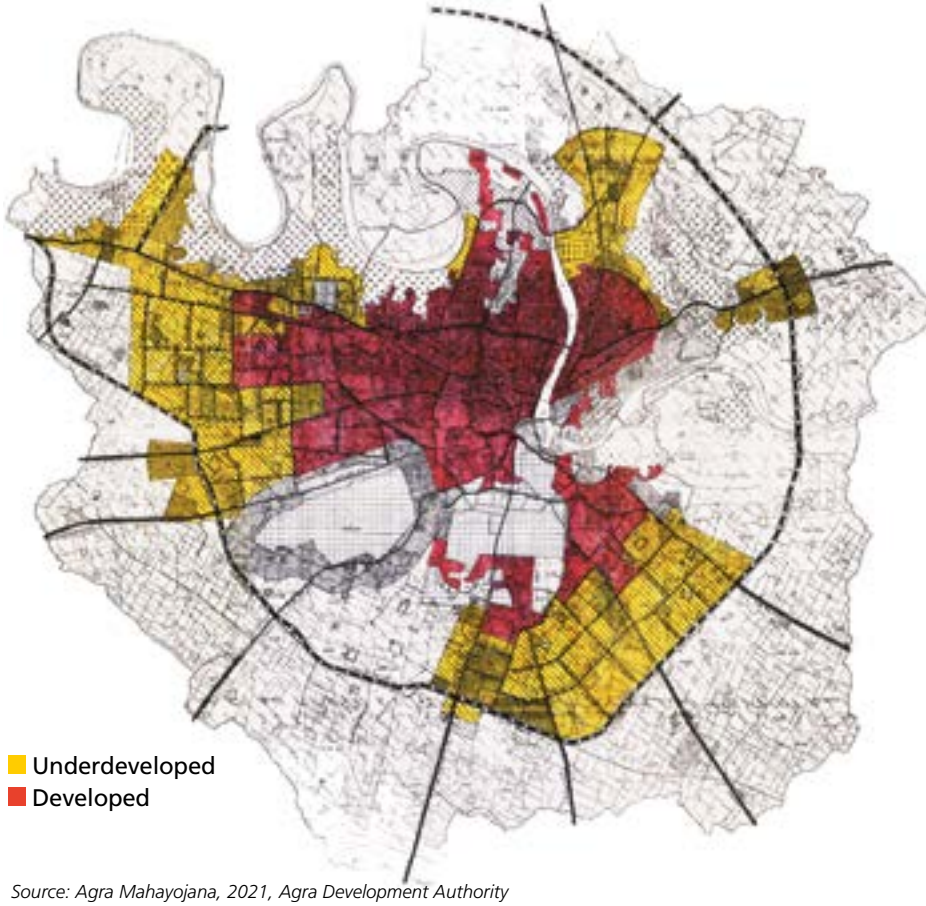
Table 2: Summary of public institutions and commercial establishments

Number of commercial areas	159
Number of shops	45,899
Number of healthcare facilities	257
Number of hotels	310
Number of schools	313
Number of parks	101
Number of offices	258
Number of religious places	204
Number of fruit and vegetable markets	132
Number of fish and meat markets	104

Source: CSE 2020, based on data collected by AMC

Agra Development Authority (ADA) was established in 1974 under the Uttar Pradesh Planning and Development Act, 1973. An area of 52,020 hectares (ha) comes under its purview, a small part of which spills outside the city limit to cover 144 revenue villages. ADA is mandated to prepare a master plan for less developed areas in terms of connectivity, sewer networks, road beautification and making markets business-friendly. The master plan has produced a map which can be a strong reference point to identify relatively more developed habitations vs less developed ones (see *Map 2: Agra Master Plan*).

Map 2: Agra Master Plan



Source: Agra Mahayojana, 2021, Agra Development Authority

Solid waste management scenario

Production and consumption patterns, population, population density and economic conditions are some of the factors that influence the rate at which solid waste is generated in a city, town or village.

City waste profile

Quantification of solid waste

Quantification and characterization of municipal solid waste are key indicators to plan and strategize waste management operations. AMC conducts studies from time to time to ascertain the quantity of waste produced in the city. Regional Centre for Urban and Environmental Studies (RCUES) prepared a detailed project report (DPR) for Agra in 2017, when waste generation was close to 712 TPD (excluding street sweeping waste and drain silt), at the rate of 0.4 kilogram per capita per day. AMC has also started preparing a DPR in 2020 through the Waste Management Corporation (WMC), which will help gain a fresh perspective from the strategic point of view. *Table 3: How Agra compares with other cities* draws a comparison with a couple of other cities of almost the same size and population.

Table 3: How Agra compares with other cities

City	Population	Number of wards	Total waste generated (TPD)
Bhopal	2.3 million	85	877.57
Indore	2.7 million	85	1165
Jaipur	3 million	91	1050

Source: CSE, 2020

Waste distribution in wards and zones

Table 4: Waste generation in Agra provides an overview of the city's municipal waste situation. Ward numbers 20, 25 and 77 could not be mapped to any zone, a total of 19.3 tonnes per day (TPD) of solid waste is generated from these three wards.

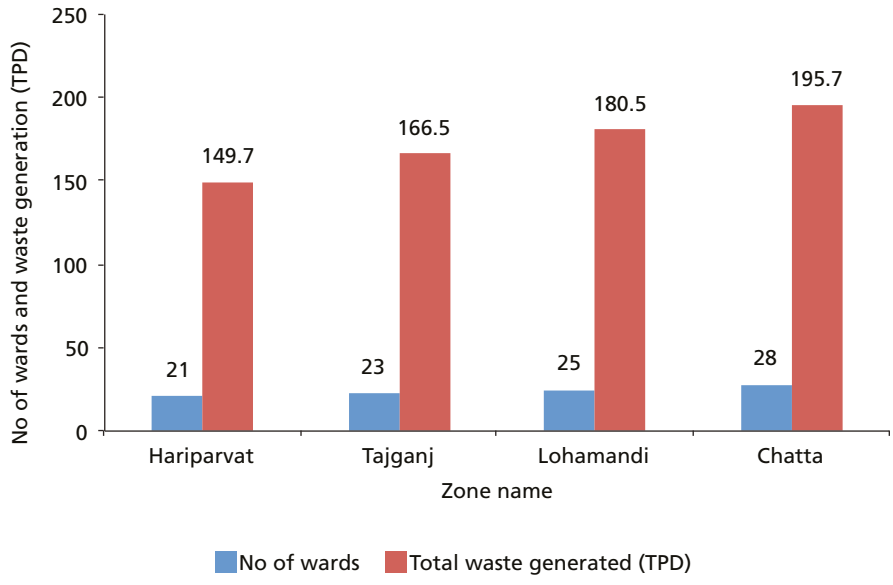
Table 4: Waste generation in Agra

Zone number	Zone name	No. of wards	Total waste generated (TPD)
1	Hariparvat	21	149.7
2	Tajganj	23	166.5
3	Lohamandi	25	180.5
4	Chatta	28	195.7
	All four zones	97	692.4
-	Could not be mapped	3	19.3
	Total	100	711.7

Source: CSE, 2020 with data inputs from AMC

Zone-wise waste generation is proportional to the number of wards in each zone (see *Graph 1: Zone-wise waste generation*).

Graph 1: Zone-wise waste generation



Source CSE, 2020 with data inputs from AMC

On an average, each zone has approximately 24 wards, and average solid waste generation in each zone is 173 TPD. Hariparvat has the lowest number of wards, producing the least quantity of solid waste, and Chatta has the highest number of wards and generates the highest quantity of solid waste. The average waste generation per ward stands at 7.117 TPD.

Ward-wise waste generation

Within Hariparvat (Zone 1), the least quantity of waste is generated by Ward 29 (6.1 TPD) and the highest quantity of waste is generated by Ward 31 (8.2 TPD). Average solid waste generation in Hariparvat is 7.12 TPD.

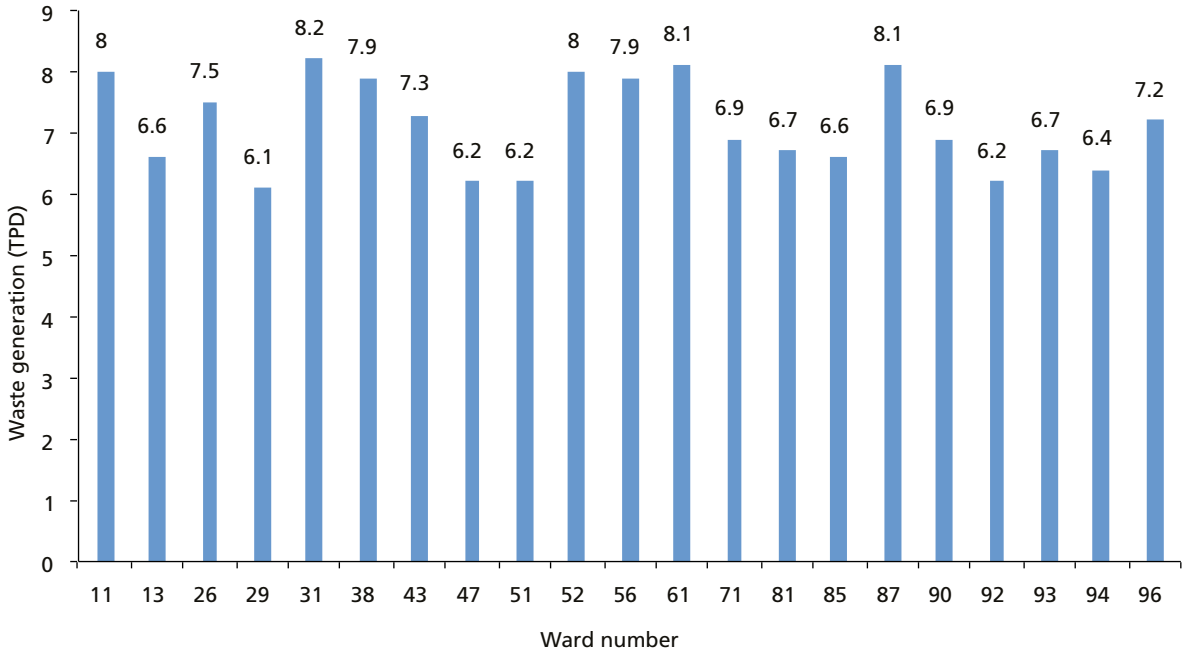
Tajganj (Zone 2) is one of the prime localities in Agra; it is spread around the Taj Mahal and is home to people who work as support staff at the historic monument. There are a total of 23 wards in this zone. The least quantity of waste is generated by Ward 97 (6.4 TPD) and the highest quantity of waste is generated by Wards 15 and 48 (8.1 TPD). Average solid waste generation in Tajganj is 7.24 TPD.

Lohamandi (Zone 3) is situated in the western part of the city. There are 25 wards in this zone. The least quantity of waste is generated by Wards 49 and 80 (6.1 TPD) and the highest quantity by Wards 75 and 84 (8.1 TPD). Average solid waste generation in Lohamandi is 7.22 TPD.

Chatta (Zone 4) is situated in the northeastern part of the city, with a majority of it falling east of the Yamuna. There are 28 wards in this zone. The least

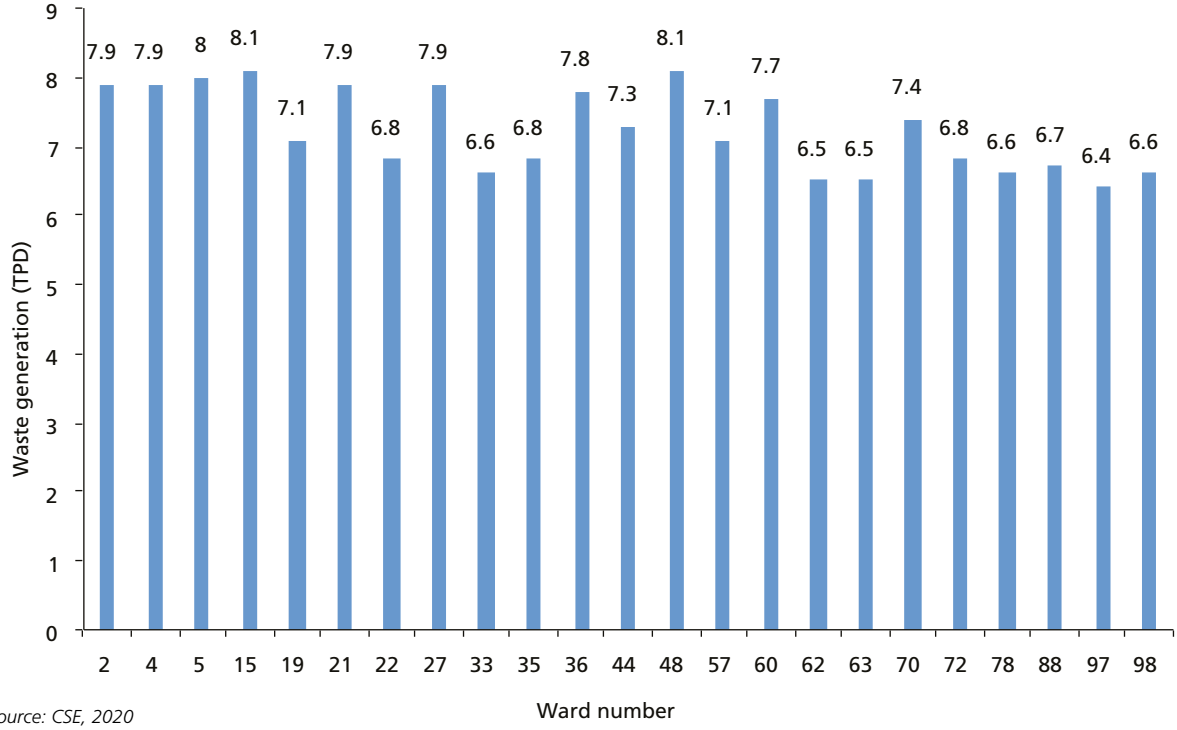
quantity of waste is generated by Wards 23, 42 and 100 (6.2 TPD) and the highest quantity by Ward 50 (8.2 TPD). Average solid waste generation in Chatta is 6.99 TPD.

Graph 2: Ward-wise waste generation in Hariparvat



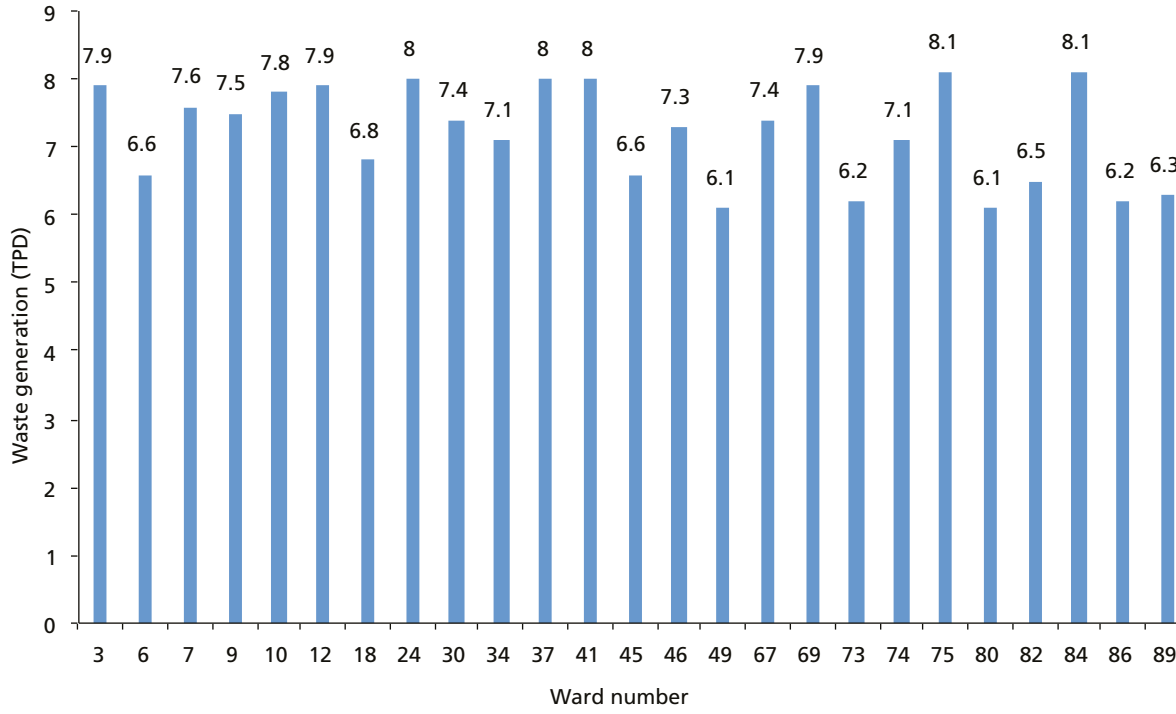
Source: CSE, 2020

Graph 3: Ward-wise waste generation in Tajganj



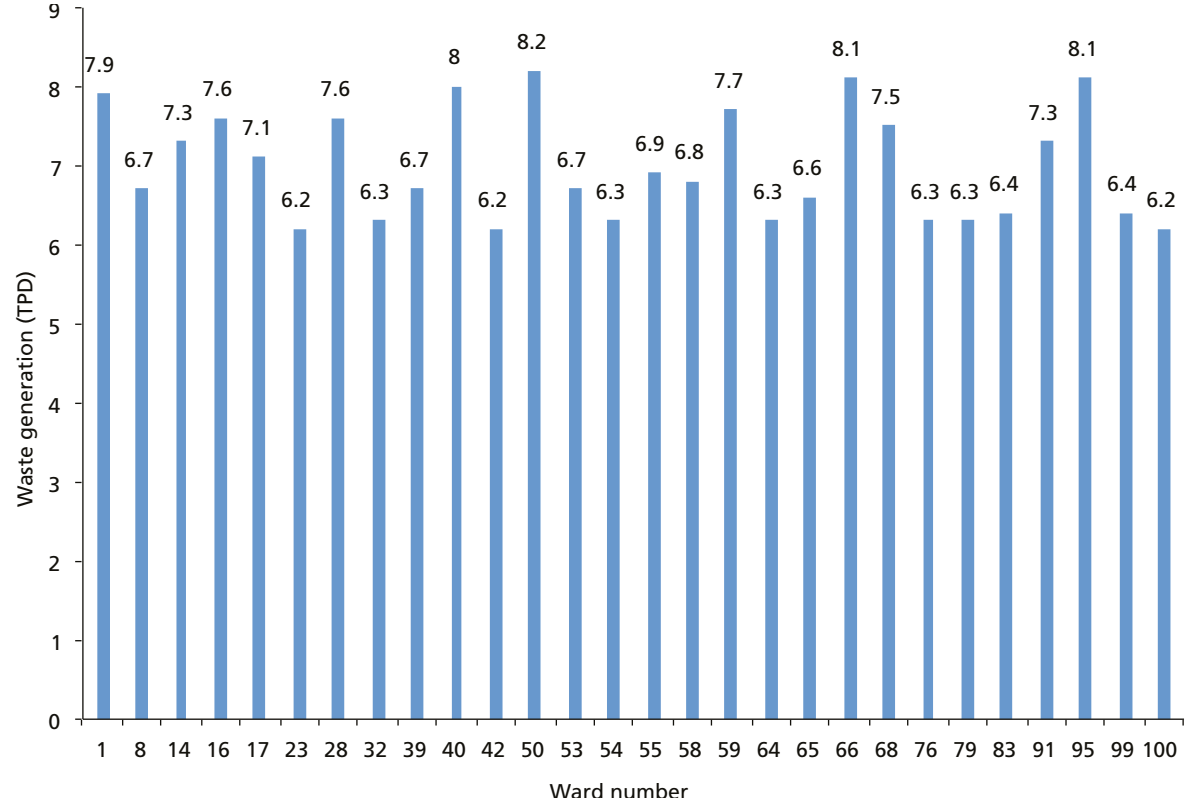
Source: CSE, 2020

Graph 4: Ward-wise waste generation in Lohamandi



Source: CSE, 2020

Graph 5: Ward-wise waste generation in Chatta



Source: CSE, 2020

Bulk waste generators

As per the Solid Waste Management Rules of 2016, bulk waste generators (BWGs) includes buildings occupied by Central government departments or undertakings, state government departments or undertakings, local bodies, public sector undertakings or private companies, hospitals, nursing homes, schools, colleges, universities, other educational institutions, hostels, hotels, commercial establishments, markets, places of worship, stadia or sports complexes with an average waste generation rate exceeding 100 kg per day. According to secondary data collected from officials of AMC, there are approximately 2,352 BWGs in Agra.

Nationwide Waste Management Systems (NWMS), a single-window service provider for all waste management needs, has been appointed by the AMC to collect and process waste (both wet and dry) from all BWGs in the city. As per the city sanitation report, submitted by the state Department of Urban Development to the National Green Tribunal (NGT) on 23 October 2019:

> 'Door-to-door collection of dry waste is being done in special bags by AMC-appointed collection agencies. The waste is being collected ward-wise by these agencies and brought to the six specific collection points on a daily basis where it is weighed by NWMS. This waste is transferred to the material recovery facility (MRF) through vehicles modified to handle only dry waste. At the MRF, waste is segregated manually and mechanically (through a conveyor belt system) by 60–70 workers. Segregated waste is further sifted into 15–17 categories. This waste is then bailed and sent to recycling facilities located at Gajrola and Kashipur. Non-recyclables are sent to waste-to-energy plants at Ghazipur. Since it is mandatory for BWGs in the city to process their waste as per applicable norms, AMC provides them pay-and-use facilities (with a processing fee of Rs 6 per kg and collection fee of Rs 1 per kg per km). NWMS has set up four dry waste processing facilities with a total capacity of 210 TPD for processing dry waste generated by the BWGs. In addition, a 120 TPD MRF has been set up at the TediBagiya site (NH-93). These processing facilities have been set up in November 2018 and are in operation. The expenditure for the 120 TPD MRF and six dry waste collection points at various location in the city is borne by NWMS and is approximately Rs 3.97 crore and no expense falls on AMC's shoulders.' (Suitably edited.)

The sanitation report, 2019 also elucidates the manner in which AMC is trying to address the issue of wet waste generated by BWGs in the city:

> 'For the processing of wet waste from BWGs in the first phase, a plant with a capacity of 4 TPD capacity will be installed. The scientific disposal plant will be fully automatic, based on technology of waste-to-compost developed in Netherlands, operated by NWMS, and will treat wet waste from hotels, marriage halls, residential welfare associations (RWAs), group housing societies (at a processing fee of Rs 12,500 per tonne and a collection fee of Rs 1,000 per tonne per km) on a pay-and-use basis. The service will provide for development, supply, installation, and maintenance by establishing a common processing facility. AMC will facilitate the operator by providing 750 sq m of land, at the rate of Rs 1 per sq m per year of lease rent. The operator has paid for civil infrastructure, including boundary walls, floors, sheds and machinery, which is estimated to be Rs 4.75 crore. NWMS is also supposed to inspire and spread awareness by information, education and communication (IEC) activities to BWGs regarding the resources which are generated by segregating wet and dry waste. For doing so, NWMS will also integrate door-to-door collection with campaign meetings, and engage rag-pickers and BWGs through various schemes.' (Suitably edited.)

Solid waste composition and characterization

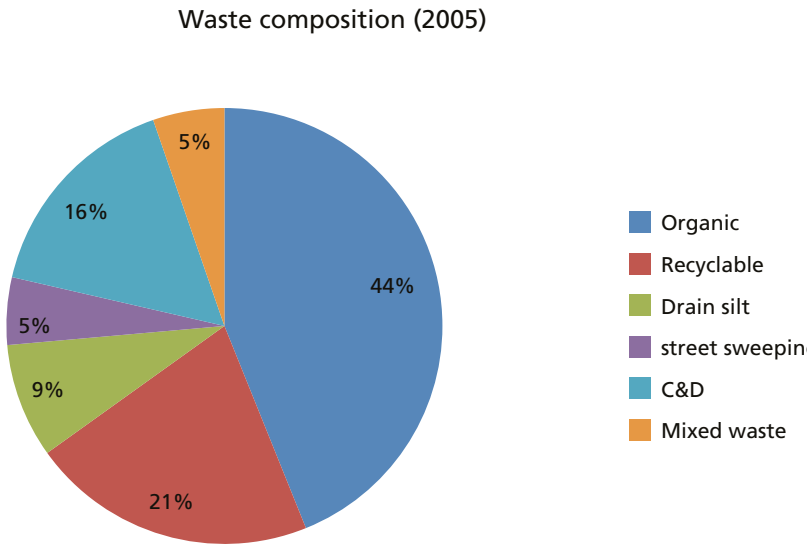
A waste composition study was carried out by RCUES in 2005 as part its solid waste management DPR for Agra. Unfortunately, this is the latest data available in the public domain which analyses, on the basis of an extensive survey, the characterization of solid waste generated in Agra (see *Graph 6: Composition of waste generated by Agra*).

The graph includes data regarding construction and demolition (C&D) waste but not domestic hazardous waste as the composition study was done on the basis of the Solid Waste (Management and Handling) Rules, 2000, which include C&D waste but not domestic hazardous waste in the definition of municipal solid waste.

Solid waste is very heterogeneous in nature and its composition varies with place and time, even samples obtained from the same sampling point on the same day but at different times may show totally different characteristics and composition (see *Graph 7: Change in waste composition as per establishment*). Usually the 'quartering' method is preferred for estimating the composition of waste. RCUES's DPR has detailed the waste composition of Agra. The report has taken into consideration waste generation from residential, commercial and other establishments and also taken into consideration waste generated by the floating population in Agra (see *Graph 8: Waste composition in Agra*).

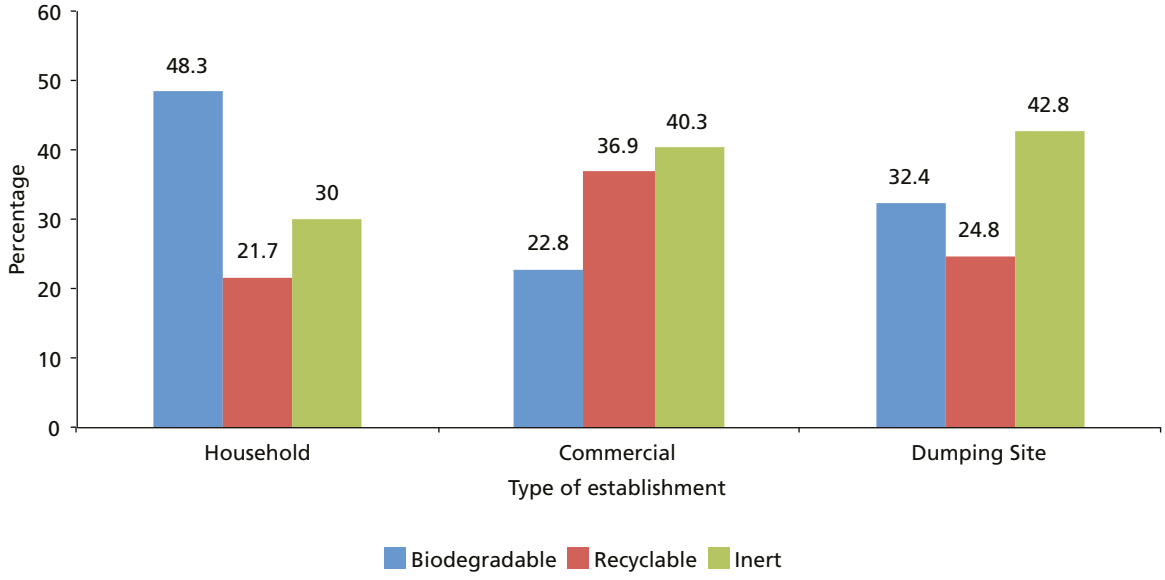
If we collapse the categories of waste into broader streams, we can get a sense of the amount of wet, dry and inert material that the city generated in 2017. The mapping study found that 58 per cent of the waste generated in the city is wet waste, which can be taken care of by simple composting methods, close to 29 per cent of the material had the capacity to be recycled or to be sent for energy recovery and only 13 per cent waste was classified as inert or hazardous (see *Graph 9: Waste composition in Agra in 2017*).

Graph 6: Composition of waste generated by Agra



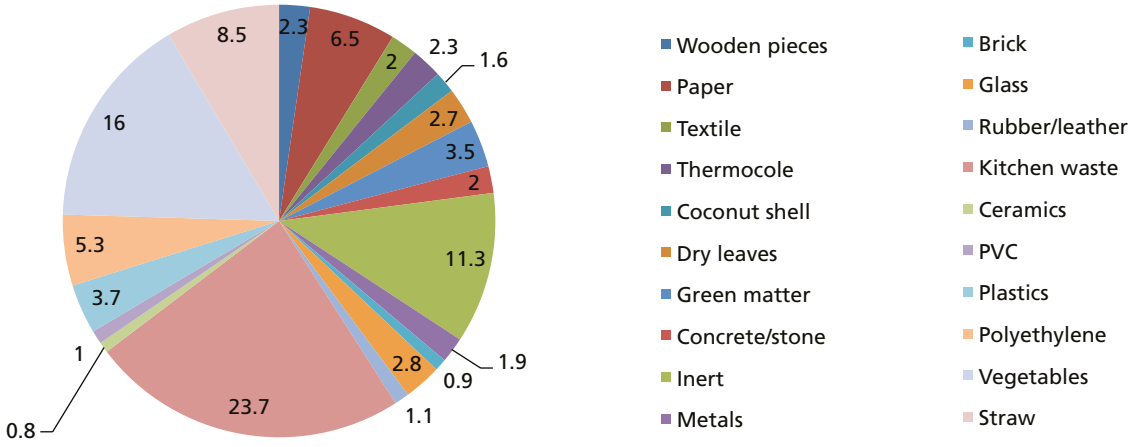
Source: CSE, 2020, compiled from RCUES DPR for Agra, 2005

Graph 7: Change in waste composition as per establishment



Source: CSE 2020, compiled from RCUES DPR for Agra, 2005

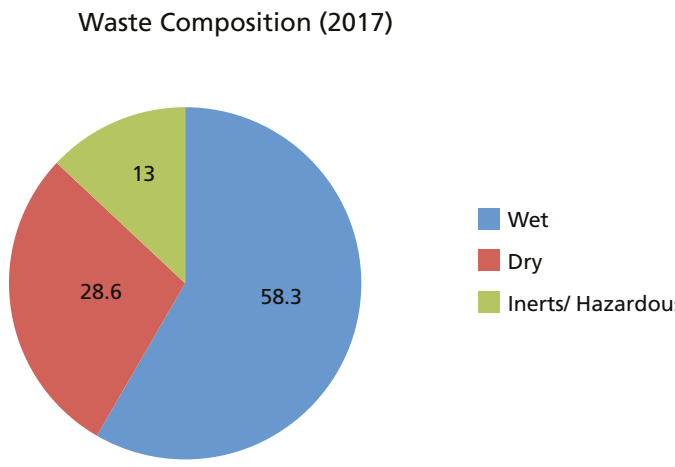
Graph 8: Waste composition in Agra



Source: RCUES, DPR for solid waste management scheme in Agra, 2017

Average per capita waste generation varied from 0.37 grams to 0.45 grams as per the study conducted by RCUES in 2017. The study also found that total waste generation in Agra was close to 712 TPD, of which residential establishments contribute almost 70 per cent (approximately 487 TPD), and commercial and institutional establishments contribute only 30 per cent (approximately 213 TPD). It should be noted that street sweeping waste and drain silt was not considered in this analysis, together the two contribute another 84 TPD of waste reaching the dumpsite. So the figure of the total burden of waste settles at 796 TPD.

Graph 9: Waste composition in Agra in 2017



Source: CSE, 2020

Waste management operations

Till 2019, primary collection of municipal solid waste was carried out by door-to-door collection agencies, whereas secondary collection was AMC's responsibility. Both collections were done using handcarts, tricycles and small motorized vehicles. Each vehicle had a trained team accompanying it and a specific area of operation. Private parties were monitored by an officer of AMC, usually a Supervisor, Sanitary Inspector and Zonal Sanitary Officer. AMC claims that the collection used to take place in three streams—in green bins for organic and biodegradable waste, in blue bins for dry and recyclables and in red bins for domestic hazardous waste. Street sweeping staff of AMC was responsible for collection of inerts from commercial areas and streets of the city.

The contracts of all the agencies were terminated in 2020. Currently, AMC is responsible for door-to-door collection, transportation and disposal of all the solid waste generated in the city.

Table 5: Current AMC workforce for managing solid waste

Designation	Number
Sanitary Supervisors	137
Safai Karmacharis	3,890
Municipal Chief Health Officer	1
Municipal Health Officer	1
Zonal Sanitary Officers	4
Chief Sanitary and Food Inspectors	4
Sanitary and Food Inspectors	16

Source: Agra Municipal Corporation

Table 6: Current AMC fleet engaged in solid waste management

Details	Number
Tippers	49
Dumper placers	44
Hook loaders	9
Loaders	43
Earth movers and chain machines	27
Refuse collector compactors	28
Total	200

Source: Agra Municipal Corporation

Other major stakeholders involved in transportation of waste:

1. NWMS is responsible for collection and transportation of wet and dry waste generated by bulk generators up to its decentralized composting plant (4 TPD) in Dhandoopura and 120 TPD MRF at Rambagh-Tedhibagiya.
2. JRR Waste Management Services Pvt Ltd (JRR) collects and transports biomedical waste from all hospitals and healthcare facilities (HCFs) to its incineration facility that has a processing capacity of 20 TPD.
3. C&D waste is collected and transported by the Rise Eleven Group through Friends Stone Crushing Company, Faridabad.

Collection of waste

Each of the city's four zones was handled by one door-to-door collection (DTDC) agency in the past. When the DTDC mechanism was operational, the city average of coverage was estimated to be 91.66 per cent. It is to be clarified here that the coverage doesn't represent practice of source segregation and collection of user charges. The city's performance on these two parameters is not good. User charges had been notified on 22 April 2018 through newspaper advertisements. In the same order, a total of Rs 1,24,98,090 was received in the Board Fund through the user fee collection. However, with limited fleet and manpower, the corporation's collection and transportation percentages are constrained.

Primary collection

This was earlier under the scope of DTDC agencies. DTDC agencies operated 203 small vehicles of 2 m^3 capacity each, with an average of two vehicles per ward. The agencies used to collect waste from each establishment in their respective area limits as defined in their contracts and dump the waste at designated transfer points, community bins or *dhalaoghars*. Inert waste such as from road sweeping and drain silt was collected by AMC's sanitation staff on a daily basis and transferred to dedicated bins as well. Since the contracts of DTDC agencies have been revoked, AMC is handling the primary collection on its own. Contemporary data on the coverage by AMC is not available.

Informal waste collection mechanisms are also prevalent in Agra, wherein localities have verbal agreements with informal waste collectors who provide services through pushcarts or tricycles and collect user charges on a monthly basis (that vary between Rs 25–50 per family per month). Centre for Science

and Environment's (CSE) field visit revealed that this arrangement is rather common even in the most affluent residential establishments.

Transportation of waste

As already mentioned, transportation of waste is currently carried out by AMC and is divided into:

- Primary transportation: From *dhalaoghars* and bins to secondary storage points or transfer stations
- Secondary transportation: From secondary storage points and transfer stations to the Kuberpur dumpsite

Primary transportation: This includes transfer of waste dumped by waste collection agencies (at present, AMC) and informal waste workers at the *dhalaoghars* or bins to secondary transfer stations. Tractors available with the AMC are used to transfer only inert waste such as drain silt and street sweeping waste. During CSE team's visit, it was observed that tractors are properly covered during the transfer of waste.

Secondary transportation of wet waste and inert waste: Vehicles with capacity higher than 2 m^3 are used for secondary transportation. They are responsible for transfer of wet and inert waste from the respective transfer points to the Kuberpur dumpsite.

Secondary transportation of dry waste: NWMS is responsible for collection and transportation of dry waste once it has been brought to the transfer points. The transfer points are:

a. ISBT
b. Four Point Hotel
c. Kalindi Plaza
d. Indian Oil Building, near Rui Ki Mandi Fatak

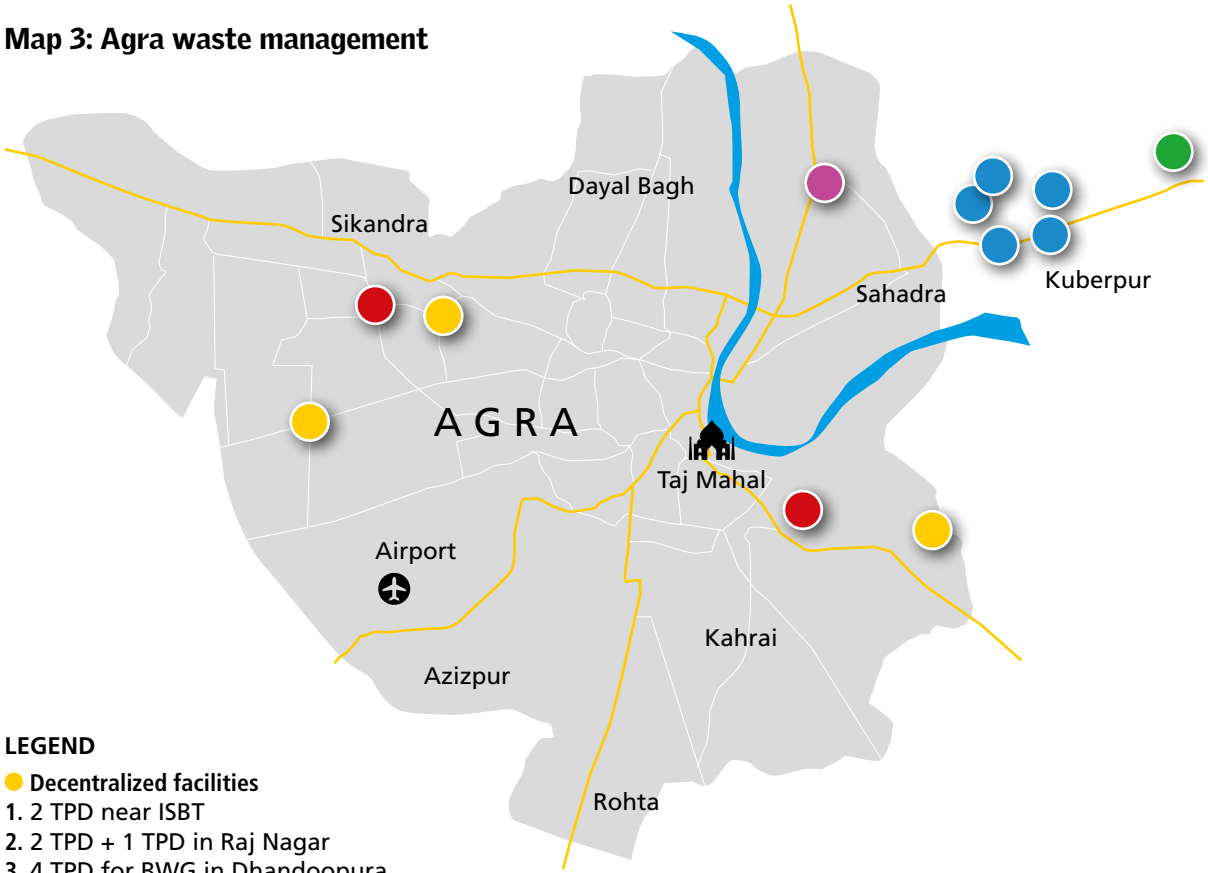
Only one transfer point (ISBT) could be located and was not functional during consecutive visits by CSE. On further interaction with NWMS officials, it was brought to our notice that at present NWMS is only collecting dry waste from roughly 100 BWGs and not from these transfer points as the waste (at the transfer points) is generally mixed in nature and not valuable.

Processing of wet waste

Processing of wet waste is done in four decentralized and three centralized waste-to-compost treatment facilities. Three of the decentralized facilities are owned by AMC and one by a private agency; together, they have a processing capacity of 9 TPD. The decentralized composting facilities treats flower waste and waste received from vegetable markets.

The three centralized composting plants located at the Kuberpur dumpsite are owned by private agencies with a total processing capacity of 325 TPD. Almost all waste that reaches the dumpsite is mixed in nature and goes through pre-sorting, windrow management and processing sections before reaching the finishing section. Refused-derived fuel (RDF) and segregated

Map 3: Agra waste management



LEGEND

Decentralized facilities
1. 2 TPD near ISBT
2. 2 TPD + 1 TPD in Raj Nagar
3. 4 TPD for BWG in Dhandoopura

Centralized facilties
1. 300 TPD waste-to-compost
2. 20 TPD waste-to-compost
3. 5 TPD organic waste composter
4. Proposed waste-to-energy plant
5. Kuberpur dumpsite

Transfer station
1. Tajganj transfer station
2. Lohamandi and Hariparvat transfer station

MRF
1. 120 TPD Rambaug-Tedibagiya

JRR biomedical waste management services

Source: CSE, based on data from Agra Smart City Ltd

combustible fractions (SCF) are recovered from the mixed waste using 125 mm and 80 mm sieves in the pre-sorting section. The organic fraction with plastic contamination goes through a windrow section for stabilization using inoculums. In the processing section, the stabilized part is again passed through a 35 mm and 16 mm sieves, after which it is left for curing. The cured fraction is passed through a 4 mm sieve and a de-stoner to achieve the final product. Every batch of compost goes through a quality check, but the mixed nature of the waste received is very likely to affect the quality of the compost, as chances are high of heavy metal and pathogen contamination.

Processing of dry waste

Dry waste processing capacity of Agra currently stands at 120 TPD, in a facility owned and operated by NWMS at Tedibaghiya. This plant is not to be confused with a recycling plant and serves only as a transit point for the dry waste generated in the city. The processes followed here are sorting, sub-sorting, bailing and transportation. NWMS has tied up with Al-Mehtab recyclers who take away the sorted and bailed waste at regular intervals to

HOW MUCH WASTE GOES TO THE KUBERPUR DUMPSITE?

AMC keeps a record of the total quantity of waste that reaches the Kuberpur dumpsite on a daily basis. CSE obtained data for the months of September, October and November 2020. Even a cursory analysis of the data revealed that huge quantities of waste was reaching the dumpsite. This was in variance with the reported 712 TPD that Agra claims to generate. Three random days were picked in each month to arrive at the average amount of waste that reaches the dumpsite daily (see *Table 7: Waste received by the Kuberpur dumpsite)*.

Table 7: Waste received by the Kuberpur dumpsite

Month and date chosen for analysis by random sampling	Waste received at the dumpsite (tonnes)	Daily average (tonnes)
1 September 2020	767.71	759
15 September 2020	681.015	
30 September 2020	828.38	
10 October 2020	868.355	850
20 October 2020	830.305	
31 October 2020	851.26	
1 November 2020	583.87	780
20 November 2020	833.9	
30 November 2020	922.235	

Source: CSE 2020, with data inputs from Agra Municipal Corporation

their recycling facilities. NWMS also claims to have six collection points for dry waste collection, of which three could be located in Transport Nagar and were not functional during all CSE team visits, the other three dry waste collection points could not be located.

However, during CSE team's visits, it was observed that recyclables from hospitals also reach the processing facility. Such material is supposed to reach the facility only after autoclaving, but the material seen at the site contained sharp metal objects (including needles).

Plastic waste management

A plastic ban is in force in the city. The ban was implemented in three stages:

a. First stage: All plastics of size less than 50 microns were banned.
b. Second stage: Thermocol, disposable or one-time-use plastic products such as spoons, plates, glasses, etc. were banned.
c. Third stage: All types and sizes of plastic and thermocol products were banned.

However, people were found non-compliant with the ban in meetings and during IEC activities. It became the duty of AMC to penalize offenders. Although the number of challans issued cumulatively are not even 0.1 per cent of the population, the penal provision has led abatement of the nuisance.

PROCESSING OF BIOMEDICAL WASTE, INCLUDING DOMESTIC HAZARDOUS WASTE

Management of biomedical waste generated in healthcare facilities is a state subject. JRR Waste Management has been awarded the contract for collection and processing of biomedical waste generated in Agra. The facility for processing biomedical waste is located in the outskirts of the city in Etmadullah, Dharera away from residential areas and human settlement, as specified in the Biomedical Waste Management Rules, 2016.

With the advent of COVID-19, urban local bodies (ULBs) have been roped in by prescribed authorities to manage biomedical waste. The primary responsibility of ULBs is to prepare an inventory of all isolation wards, quarantine camps and homes—and ensure that waste is channelized from these hotspots to common biomedical waste treatment facilities (CBWTFs).

CSE's team found that around 20 TPD of biomedical waste was being treated in Agra. The facility did not receive sanitary waste from non-COVID-19 households. However, COVID-19 waste like PPE kits, gloves, masks and other paraphernalia was received in huge quantities by the CBWTF. The increase in the quanity of biomedical of waste due to the pandemic could not be ascertained.

Landfill

Agra dumps its mixed waste at the Kuberpur dumpsite, spread over 75 acres. The site was planned as an integrated waste processing-cum-sanitary landfill. A 750 TPD waste processing plant was installed for processing incoming waste, and a small sanitary landfill covering an area of 15,000 sq m was developed for residual inert from the processing plant. Kuberpur became operational for use in December 2011. However, in 2013 the concessionaire stopped operating the processing plant. Since then, the site has become a dumping ground for mixed waste. As of now, an area of 30 acres is covered with unprocessed waste, with the dumping height ranging from 5 to 20 metres. During CSE team's visit, it was observed that mixed waste is being dumped without any compaction, liners or any air pollution prevention measures in place.

Biomining operations: The dumpsite is estimated to contain 800,000 tonnes of legacy waste. In 2018, AMC floated an expression of interest (EOI) for its management. The EOI explored options of scientific closure by biocapping or biomining. In 2019, an agency called PAKS was awarded the biomining contract. An estimated 1,500 TPD of legacy waste is being handled by the concessionaire. The concessionaire is solely responsible for exploring the market for sale of recovered or mined materials and generating revenue. The estimated cost of the project is around Rs 26 crore.

Challenges

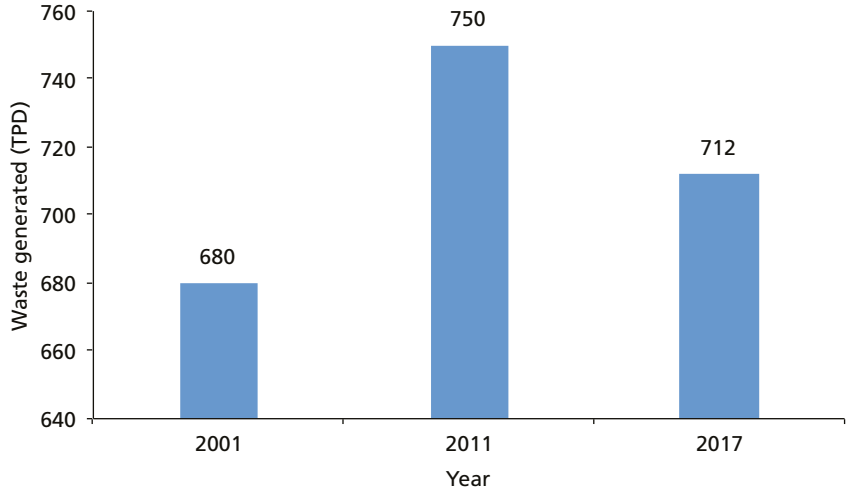
The solid waste management challenges that Agra faces are no different from the ones faced by any other city administration in the country. This chapter focuses on aspects which need to be made a priority by AMC to ensure a sound waste management system in the city.

Quantification of waste generation

The exact quantity of solid waste generated in Agra is uncertain. As per data provided by AMC, 680 TPD of solid waste was generated in 2001. AMC's Action Plan report states that this increased to 750 TPD in 2011 and stands at 712 TPD at present (see *Graph 10: Agra's waste generation timeline*). It is unlikely that waste generation would have decreased during these years as the city's population increased and consumerism took deeper roots. Moreover, the city sanitation plan report, jointly prepared by the Central Ministry of Urban Development, AMC and Administrative Staff College of India (ASCI) states that the city generates 824 TPD of waste. To confuse matters further, this figure is also reported on the AMC site, along with its own estimate.

Pertinently, the report submitted by state urban development department to the NGT does not include data on the quantity of waste generated in the city. However, a report submitted by Central Pollution Control Board (CPCB) to NGT indicates that about 690 TPD solid waste was being dumped into the landfill without any treatment.

Graph 10: Agra's waste generation timeline



Source: CSE, 2020, on the basis of data provided by AMC

Operational challenges

Segregation

Although AMC claims that it segregates 40 per cent of Agra's waste, during CSE team's visit to the collection sites and transfer stations it was observed that a much lower percentage of segregation was achieved. A handful of BWGs, mostly hotels, are definitely segregating their waste and handing it over to the concerned concessionaire, but most of them are not practising source segregation. Segregation majorly happens at the back of the primary collection vehicles, with dedicated staff for taking out any resaleable high value material like PET bottles, metals and cardboard boxes, but this cannot be in any dimension of reality termed as source segregation. As far as commercial establishments are concerned, some of them follow source segregation, but the waste is given to *kabbadiwallahs* and it never reaches the primary waste collection vehicle. As per the Action Plan report prepared by AMC in 2019, the average source segregation in the city is 9 per cent.

Collection

The Action Plan report further states that the city's average door-to-door collection percentage was 91.66 per cent. Door-to-door collection is very efficient in certain pockets. Collection is definitely one aspect in which Agra has shown progress but it needs to be improved further to achieve 100 per cent waste collection from all kinds of establishments to ensure there is no illegal dumping and littering on the streets, especially by small commercial establishments like *petha* and leather dealers. The Action Plan report also presents a gap of 215 non-motorized vehicles, 39 motorized vehicles, approximately 550 workers and 14 personnel for monitoring. It was observed during the CSE team's visit that all primary collection vehicles have been equipped with two–four sets of three-colour coded bins (green, blue and red), but they are not used for the intended purpose of collecting segregated waste.

Primary transportation

Primary transportation is done by AMC in 114 motorized vehicles and 1,500 tricycles, the current gross capacity of the vehicles available for primary collection is approximately 100 tonnes (for motorized vehicles) and close to 200 tonnes (for tricycles). The gaps presented in the Action Plan have been approved by the floating finance commission, but the funds have not yet been disbursed due to the pandemic. Agencies that were collecting waste earlier brought it to the *dhalaoghars* or community bins from where it was picked up by AMC workers and taken to transfer stations. The waste was then transferred to secondary transport vehicles which took the waste to the dumpsite. AMC is trying to eradicate the culture of using community bins to dump waste. Therefore, transfer stations have been proposed in every zone. CSE's team visited some transfer stations. Tajganj transfer station was functional. The one at Transport Nagar, designed to receive waste from Lohamandi and Hariparvat, had been commissioned but was not receiving waste on a regular basis. Chatta does not have a transfer station, and since a major portion of it lies across the Yamuna, it needs a transfer station of its own to cut fuel and labour costs of primary transportation.

Secondary transportation

Secondary transportation is carried out by 93 secondary collection vehicles, of 2–9.45 tonnes capacity. The gross capacity of the fleet is 400 tonnes and most vehicles make multiple trips every day to the Kuberpur dumpsite. A request for fifty five 18 m^3 reversible compacters has been approved by the floating finance commission which will add approximately 450 tonnes of carrying capacity to the fleet. Funds for this have also been approved but have not yet been disbursed due to the pandemic. Almost all waste received at the transfer stations is mixed. The whole idea of secondary transportation of mixed waste is thus unsustainable and needs to be reviewed by city authorities.

Processing capacity

The combined wet waste and dry waste processing capacity of Agra is roughly 450 TPD. It can be said that the processing capacity of the city is close to 56 per cent which is commendable, but the existing facilities are not being used to the intended scale and for the purpose for which they have been designed.

There is a clear need of decentralized processing facilities, which could considerably reduce the transportation expenses of carrying all the waste generated in the city to the dumpsite which is almost 15 km away from the city limits.

Informal sector

Agra has a very strong presence of the informal sector in its solid waste management segment. Informal rag-pickers are a common sight in the city. The 2019 Action Plan put the number of rag-pickers operating in the city at 273, which is almost three per ward. Although the techniques and modus operandi of the informal sector are debateable, their reach cannot be ignored. There is a dire need to identify all informal hotspots in the city and plan their inclusivity into the waste management operations of AMC.

Financial sustainability

To increase the financial sustainability of the overall process, the city needs to shift focus on minimizing the cost of transportation, channelizing segregated waste from transfer stations to relevant processing facilities, and extracting optimum amounts of valuable resources from the waste while also creating meaningful livelihood opportunities for the formal and informal workers in the process.

Roadmap for a Zero Waste Agra

The challenge in Agra is to design and institute a more sustainable, affordable and eco-friendly value chain for solid waste management around the concept of circular economy. The city secured the 16th position in the Swachh Survekshan 2020 by demonstrating a strong commitment to improvement in sanitation and waste management services. By strengthening the existing weak links, Agra could achieve an even higher ranking in the SS scorecard and get a platinum rating in Prerak Dauur Samman (see *Box: Prerak Dauur Samman*). Agra could also emerge as a model city by moving towards decentralized

PRERAK DAUUR SAMMAN

In addition to the system of score-based ranking on defined thematic areas, Swachh Survekshan (SS) 2021 has introduced Prerak Dauur Samman (PDS) as an additional performance category to promote decentralized waste management practices. PDS is divided into five subcategories, i.e. Divya (Platinum), Anupam (Gold), Ujjwal (Silver), Udit (Bronze) and Aarohi (Aspiring), based on the performance of the cities on the following indicators:

- Segregation of waste into wet, dry and hazardous categories
- Ratio of wet waste processing capacity to total wet waste generated
- Processing and recycling of wet and dry waste
- C&D waste processing
- Percentage of waste going to landfills

PDS is a great value addition to the previous versions of SS and will provide significant mileage to incentivize cities on sustainable waste management and their movement towards zero waste by bringing issues like source segregation, processing efficiency, recycling and zero landfills into renewed focus.

Table 8: Criteria for Prerak Dauur Samman

Ranking category	Criteria					
	Segregation of waste into wet, dry and domestic hazardous (Mandatory for Platinum)	**Ratio of processing capacity against total wet waste generated**	**Processing and recycling of waste (dry and wet)**	**C&D waste processing**	**Percentage of waste going to the landfill**	**Current sanitation status (as on 31 December 2020)**
Platinum (Divya)	> 95 per cent wards	> 91 per cent	> 91 per cent	> 50 per cent	Up to 10 per cent	Water +
Gold (Anupam)	> 75 per cent wards	> 81 per cent	> 81 per cent	> 40 per cent	Up to 15 per cent	ODF ++
Silver (Ujjwal)	> 55 per cent wards	> 71 per cent	> 71 per cent	> 30 per cent	Up to 20 per cent	ODF +
Bronze (Udit)	> 35 per cent wards	> 61 per cent	> 61 per cent	> 20 per cent	Up to 25 per cent	ODF+
Aspiring (Aarohi)	> 15 per cent wards	> 50 per cent	> 50 per cent	> 10 per cent	> 25 per cent	ODF

Source: SS Toolkit, MoHUA

management of solid waste, increasing its recycling and processing efficiency and gradually decreasing the quantity of waste being brought to the dumpsite. In order to achieve this, AMC needs to have strong institutional arrangements, high capacity human resource at key leadership positions, ward and zone level officials and a sanitation task force with a robust interface with the people. The entire process has to be supervised by a multisectoral team at the corporation led by the Commissioner.

CSE recommends a roadmap for two years as follows:

Ensuring 100 per cent source segregation

Source segregation is a non-negotiable and fundamental sustainable waste management criterion. It must be the preamble to the agenda for change. Solid Waste Management (SWM) Rules of 2016 created a new mandate for segregation of waste. These Rules state that source segregation of waste is necessary so that waste can be turned into wealth, through recovery, reuse and recycling. All generators of solid waste, including households, have to segregate waste into three streams: biodegradables, dry (plastic, paper, metal, wood, etc.) and domestic hazardous (cleaning agents, diapers, napkins, mosquito repellents, etc.) before handing it over to waste collectors.

Segregation target

(a) 100 wards, four zones
(b) 4.39 lakh households
(c) 2,352 BWGs
(d) 712 tonnes of municipal solid waste

Strategy for source segregation

a) Adopting a 360-degree communication campaign focusing on source segregation. The campaign to include:
   I. Video messages by the District Magistrate, Commissioner, Mayor, local MP, MLA, and eminent personalities and opinion leaders in Agra on source segregation. The video would be broadcast over social media platforms (target audience), AMC website, cinema halls, etc.
   II. A communication toolkit to engage with and educate school children using virtual platforms with the objective to introduce segregation in schools and at home. Agra has 319 schools with an average of 500 students per school. The reach will be about 150,000 households.
   III. IEC material with messages on source segregation in the form of sign boards, posters and leaflets.
   IV. Communicating with households through push SMS (in local vernacular) using a dedicated SMS gateway to communicate with property tax payers.
   V. Coining 'Green Agra' as the key message for source segregation.

b) Property tax rebate to households—AMC can adopt bye-laws to introduce tax rebates for households giving segregated waste to doorstep collectors.

c) Inviting local industrial units to provide CSR funds for hiring volunteers for hyper-local level campaigns of six month duration in all wards to

Table 9: Roadmap for achieving source segregation

Programme component	Month																							
Timeline	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
Source segregation	**Quarter-1**			**Quarter-2**			**Quarter-3**			**Quarter-4**			**Quarter-5**			**Quarter-6**			**Quarter-7**			**Quarter-8**		
Preparing communincation products	■	■	■																					
Campaign through social media				■	■	■	■	■	■	■	■	■												
Door-to-door campaign by trained CSR volunteers and distribution of colour-coded bins				■	■	■	■	■	■															
Declaration of property tax rebate after adopting bye-laws on the same			■																					
Declaring a cut-off date for source segregation including puniive measures							■																	
Separating days for collection of wet and dry waste after mapping of waste treatment facilities							■	■	■	■	■	■												
Targetting specific locations for enforcing source segregation in order of priority				■	■	■	■	■	■	■	■	■												
Developing a monitoring tool (mobile app based) for ward-wise collection of segregation data	■	■	■																					
Collecting daily data on source segregation (ward-wise) for concurrent monitoring and review				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

Source: CSE

reach each and every individual and institutional waste generator. The volunteers would be trained to motivate and build capacity of waste generators to adopt source segregation.

d) Declaring a cut-off date for enforcement of source segregation in the entire city—ideally after the communication campaign has been rolled out city-wide to inform citizens of the punitive measures (challan) against giving mixed waste to collectors.

e) Separating out days for collection of wet and dry waste—wet waste would be collected daily and dry waste weekly or bi-weekly.

f) Distribution of colour-coded bins to individual waste generators for storing wet, dry and domestic hazardous wastes separately—CSR funds may be utilized for procurement of bins with their branding.

g) Adopting a roadmap for implementation of source segregation and gradually increasing it to achieve 100 per cent source segregation over a period of 12 months. In order of priority, BWGs would be targeted first, followed by economically progressive areas (without slum population) and finally developing areas with slum population.

h) Developing a ward-level daily monitoring mechanism for dcollection of segregated waste—AMC may introduce a customized mobile app and mandate submission of daily collection and segregation data by ward-level officials. The monitoring data would be reviewed for need-based course correction.

Support from CSE on source segregation

(a) Developing communication tools and finalizing them in consultation with AMC.

(b) Developing a training module for CSR volunteers on source segregation—CSE would conduct a training of trainers (ToT) with AMC officials. Trained master trainers would train all volunteers in a cascading mode, keeping in view the deployment plan to achieve source segregation.

(c) CSE would assist AMC in drafting bye-laws for property tax rebate, notification to enforce source segregation with penal provisions and designating days for separate collection of wet and dry waste.

(d) CSE would assist AMC in developing a monitoring tool (using an open source third party mobile app—mWater) for reporting ward-wise segregation status along with compilation of the report on source segregation for review by AMC officials.

Decentralized management of organic waste

Agra produces about 712 tonnes of municipal solid waste every day, out of which about 58 per cent (412.96 tonnes) is wet or organic waste. There are two main generators of organic waste, BWGs, which contribute about 30 per cent (123.88 TPD), and individual households, contributing about 289.08 TPD. AMC needs to manage organic waste in a decentralized manner so that the dumpsite at Kuberpur receives only the inert non-hazardous fraction.

Efforts should be made to create decentralized composting facilities at household, institution, ward, cluster of ward and zone levels, to increase the overall treatment efficiency. Instituting decentralized management of organic waste will have manifold benefits including improving the quality of compost, substantial reduction in the cost of waste transportation, significant reduction in the load on the dumpsite, and decrease in the resultant GHG emissions and leachate. In order to increase the efficiency of decentralized organic waste treatment, CSE recommends the following:

Target for setting up decentralized organic waste management facilities

(a) 289.08 TPD generated by individual households.

Table 10: Roadmap for decentralized management of organic waste

Programme component	Month																							
Timeline	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
Organic waste management	**Quarter-1**			**Quarter-2**			**Quarter-3**			**Quarter-4**			**Quarter-5**			**Quarter-6**			**Quarter-7**			**Quarter-8**		
Preparing communincation products to promote home composting including easy-to-do composting technologies																								
Campaigning on social media																								
Door-to-door campaign by trained CSR volunteers to raise awareness on home composting																								
Declaration of additional property tax rebate for adopting home composting																								
Identifying suitable spaces for setting up small-scale composting facilities (starting with the 88 wards that are generating 5 TPD or less waste)																								
Partnering with local industries for CSR funds to meet the CAPEX for the composting facilities																								
Partnering with local NGOs/ companies to run the composting plants																								
Enforcing SWM 2016 rule to all BWGs for managing their organic waste by AMC enlisted agencies																								
Developing of monitoring tool (mobile app based) for ward-wise collection data on composting																								
Collecting daily data on composting (ward-wise) for concurrent monitoring and review																								

Source: CSE, 2020

(b) 114.88 TPD, the current gap between organic waste generated by BWGs and treated.

Strategy for decentralized management of organic waste

(a) Starting a large-scale city-wide communication campaign to promote home composting, using volunteers to take the message to each households.

(b) Incentivizing home composting practices by additional rebate on property tax—adopting specific bye-laws in this respect.

(c) Publishing the name(s) of households adopting home composting on the AMC website and AMC social media platforms for motivating other households. Introducing a 'Green Agra Household' campaign for households that are composting the organic waste they produce.

(d) Targeting relatively developed areas as mapped by Agra Development Authority to promote home composting.

(e) Setting up ward-level small composting facilities, wherever possible—beginning with wards generating around 5 tonnes or less of organic waste per day. Currently, there are 88 such wards. Wards with higher waste generation could be taken up either at the ward-level or as a cluster of wards for setting up similar facilities.

(f) Building partnerships with local industrial units for leveraging CSR funds for capital expenditure to create small-scale decentralized composting facilities, naming the facilities after the sponsoring industrial unit to allow brand promotion.

(g) Building partnerships with local NGOs or waste-to-compost companies to run the composting facilities, marketing the final product with quality monitoring.

(h) Enforcing the provision of SWM Rules, 2016 to ensure BWGs manage their organic waste on their own by partnering with agencies enlisted with AMC. This will help reduce the organic waste management burden on AMC.

(i) Collaborating with the state agriculture department to create a value chain for compost—at least 10 per cent to be procured by local fertilizer companies.

(j) Adopting a roadmap for operationalizing decentralized organic waste treatment facilities and gradually increasing the treatment efficiency to 100 per cent over a period of 12 months, reinforced by a systematic monitoring mechanism and periodic review of the progress made.

(k) Registering with the SBM scheme to avail higher selling value for the compost.

Support from CSE on management of organic waste

(a) Developing communication tools to promote home composting and finalizing a dissemination strategy in consultation with AMC .

(b) Developing a training module for CSR volunteers on home composting and a simple, eco-friendly and low-cost composting technology manual. CSE would do a training of trainers (ToT) with AMC officials. The trained

master trainers would train all volunteers in a cascading mode, keeping in view a deployment plan to popularize home composting.

(c) CSE would assist AMC in drafting bye-laws for additional property tax rebate to promote home composting and notification to BWGs to enforce management of organic waste through enlisted agencies.

(d) CSE would assist AMC in developing a monitoring tool (using an open source third party mobile app—mWater) for reporting of ward-wise home composting and organic waste processing efficiency.

Decentralized management of dry waste

As per AMC's 2019 report, Agra produces 161.37 TPD of dry waste, that constitutes about 22 per cent of the municipal solid waste produced by the city. However, RCUES's 2017 DPR for Agra puts the percentage of dry waste the city produces at 28.6, yielding a quantity estimate of 203.63 TPD. The RCUES report further states that 30 per cent (61.08 TPD) of the dry waste is contributed by BWGs and the remaining (142.88 TPD) comes from individual generators. Agra has a good dry waste management system, especially for the waste generated by BWGs. Dry waste collection from individual generators can be improved if source segregation picks up.

Looking at the current situation, CSE recommends the following measures:

Target for collecting segregated dry waste from individual waste generators and processing at the decentralized dry waste management facilities

(a) 142.88 TPD generated by individual households
(b) 61.08 TPD generated by BWGs

Strategy for decentralized management of dry waste

(a) Introducing a system of door-to-door collection with designated days for collecting dry waste only from individual and institutional generators—piloting this initiative in a relatively receptive ward before scaling it up in all 100 wards of the city.

(b) Partnering with local industrial units for CSR funds to meet the CAPEX for strengthening existing MRFs with improved automation for secondary segregation, sorting, baling and storing.

(c) Redesigning the waste transportation mechanism to bring the entire volume of dry waste directly to the processing facilities or MRFs for secondary segregation.

(d) Dispatching segregated recyclables (dry waste) to authorized recyclers and non-recyclables to designated waste-to-energy plants, cement kilns or brick kilns, thus ensuring nothing needs to be transported to the Kuberpur dumpsite.

Table 11: Roadmap for decentralized management of dry waste

Programme component	Month																							
Timeline	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
Dry waste management	**Quarter-1**			**Quarter-2**			**Quarter-3**			**Quarter-4**			**Quarter-5**			**Quarter-6**			**Quarter-7**			**Quarter-8**		
A roadmap for communication strategy to achieve source segregation will be adopted																								
The city will adopt a bye-law for separating out days for collection of wet and dry waste and notify all concerned																								
Piloting collection of dry waste separately in one ward																								
Scalling up the learning from the pilot and implementing the new segregatation rule city-wide																								
Redesigning the waste transport mechanism to collect dry waste from source to MRFs for secondary sorting and processing																								
Mapping of the informal waste collectors' network in Agra and recommending an economic model for their integration in the waste value chain																								
Developing a monitoring tool (mobile app-based) for ward-wise collection of data on dry waste																								
Collecting daily data on dry-waste (ward-wise) for concurrent monitoring and review																								

Source: CSE, 2020

(e) Mapping the catchment areas served by informal waste collectors, building their capacity and integrating them in the process of door-to-door collection of dry waste on designated days or engaging them in secondary segregation at the MRFs.

(f) Identifying potential recyclers to whom dry waste can be sold.

Support from CSE on dry waste management

(a) CSE would assist AMC in drafting bye-laws for separate collection of wet and dry waste

(b) CSE would facilitate a pilot with support from AMC and volunteers to encourage households to segregate their waste at source and document the process for further review before the process is scaled up to a city-wide level.

(c) CSE would undertake extensive research to map the informal waste collectors' network and the aggregators (scrap dealers) to propose a model for integration of the informal workforce in the waste management value chain.

(d) CSE would assist AMC in developing a monitoring tool (using an open source third party mobile app—mWater) for reporting ward-wise collection of dry waste to enable AMC to review the status at regular intervals.

Decentralized management of domestic hazardous waste

Despite a clear mandate for it in the Solid Waste Management Rules of 2016, collection, transportation, treatment and disposal of domestic hazardous waste is the least discussed of all waste streams. As a result of this, it does not receive the attention it requires. Domestic hazardous waste has two broad categories:

(a) Domestic biomedical waste comprised of sanitary napkins, baby or adult diapers, expired medicines, bandages, cotton, syringes, etc.
(b) Domestic hazardous waste that involves bulbs, tubes with mercury, broken mercury thermometers, batteries, drain cleaners, toilet cleaners, rat poisons, shoe polish, etc.

Data on how much hazardous waste is generated in Agra is fuzzy. The 2017 RCUES report states that 13 per cent of the waste generated in the city is hazardous and inerts. A study done by United States Environment Protection Agency (USEPA) set the thumb rule for calculating domestic hazardous waste; it is 3 per cent of the total waste generated. By that calculation, Agra produces about 21.36 TPD of domestic hazardous waste.

In order to treat biomedical components of the domestic hazardous waste it generates, Agra may consider setting up a dedicated incinerator at an appropriate location and adopt a roadmap to increase the collection, transportation and treatment efficiency of domestic hazardous waste. The other components of domestic hazardous waste—plastics, metals, glass, paper, etc.—could be pre-treated and recycled at par with segregated dry waste.

Target (estimated) for collection of segregated domestic hazardous waste

(a) 21.36 TPD from individual and institutional generators

Strategy for management of domestic hazardous waste

(a) Sensitizing the people of Agra on three-way segregation of waste at source through appropriate communication tools.

Table 12: Roadmap for management of domestic hazardous waste

Programme component	Month																							
Timeline	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
Domestic hazardous waste management	**Quarter-1**			**Quarter-2**			**Quarter-3**			**Quarter-4**			**Quarter-5**			**Quarter-6**			**Quarter-7**			**Quarter-8**		
A roadmap for communication strategy to achieve source segregation will be adopted																								
Piloting collection of domestic hazardous waste separately in one ward for a month and documenting the learnings																								
Distributing yellow pouches and bags for storing segretated domestic hazardous (biomedical) waste usng CSR funds (with branding)—at least for a month in the pilot ward to enourage																								
Introducing separate collection of domestic hazardous waste in all wards on days designated for collection of dry waste																								
Redesigning the door-to-door waste transport mechanism to have dedicated bins for domestic hazardous waste to be sent to MRFs for secondary sorting and disposal																								
Setting up an incinerator at an appropriate location or the Kuberpur dumpsite for treatment of domestic hazardous waste																								
Developing a monitoring tool (mobile app-based) for ward-wise collection of data on domestic hazardous waste																								
Collecting daily data on domestic hazardous waste (ward-wise) for concurrent monitoring and review																								

Source: CSE, 2020

(b) Piloting three-way segregation in a select ward to come up with process documentation for necessary course correction before the same is up-scaled.

(c) Distributing yellow bags or pouches to every household for storing domestic hazardous waste (biomedical) on a monthly basis—inviting CSRs to fund the bags and pouches with their branding.

(d) Collecting segregated domestic hazardous waste in yellow pouches and bags on days designated for collection of dry waste. Storing it separately at the MRFs and sending it for incineration.

(e) Introducing a bar-coding mechanism for tracking biomedical components of domestic hazardous waste from collection to transportation and disposal.

(f) Composition of the team of volunteers should include a woman member to educate the female members of households to use yellow pouches or bags for segregated storing of sanitary napkins, baby or adult diapers, expired medicines, etc.

(g) Setting up a dedicated incinerator for treatment of sanitary waste.

Support from CSE on domestic hazardous waste management

(a) CSE would assist AMC in developing communication material to sensitize individual and institutional generators to segregate domestic hazardous waste.

(b) CSE would assist AMC in building the capacity of volunteers for a door-to-door campaign with the help of communication material.

(c) CSE would assist AMC in drafting bye-laws for introducing segregated collection of domestic hazardous waste.

(d) CSE would facilitate a pilot with support from AMC and the volunteers in a selected ward to encourage households to segregate and store their domestic hazardous waste in yellow pouches or bags, and document the process for further review before it is scaled up city-wide.

(e) CSE would recommend appropriate technology solutions for setting up a dedicated incineration facility for treatment of sanitary waste.

(f) CSE would assist AMC in developing a monitoring tool (using an open source third party mobile app—mWater) for reporting ward-wise collection of domestic hazardous waste to enable AMC to review the status at regular intervals.

Redesigning the concessionaire agreement

AMC needs to make a systematic departure from the traditional practice of hiring a concessionaire based on tipping fee to a concessionaire agreement based on quantity of waste brought to the dumpsite, the quantity of segregated dry waste and domestic hazardous waste brought to the MRFs and the quantity of organic waste brought to the decentralized composting facility.

Table 13: Roadmap for redesigning the concessionaire agreement

Programme component	Month																							
Timeline	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
Redesining the concessionaire agreement	**Quarter-1**			**Quarter-2**			**Quarter-3**			**Quarter-4**			**Quarter-5**			**Quarter-6**			**Quarter-7**			**Quarter-8**		
Collecting best practices in India and globally for the concessionaire agreement																								
Collection and study of concessionaire agreements of cities that have already adopted similar models for hiring concessionaire for management of municipal solid waste																								
Developing a draft concessionaire agreement for AMC																								
Hiring concessionaire based on the terms of engagement envisaged in the concessionaire agreement																								
Developing a monitoring framework for tracking the quantity of segregated waste brought to treatment, processing and disposal facilities																								
Operationalizing a robust monitoring mechanism for the concessionaiire for periodic review and release of bills to the concessionaire																								

Source: CSE, 2020

AMC should also consider imposing fees and tariffs for the concessionaire for using the dumpsite for disposing of inerts and process rejects to ensure that the concessionaire brings minimum waste to the landfill.

Strategic issues to consider in redesigning the concessionaire agreement

(a) Identify best practices in India and globally for review and understanding of the elements to be considered as terms for a new concessionaire agreement.

(b) Study concessionaire agreement of cities that have adopted a similar model for hiring a concessionaire for management of municipal solid waste.

(c) Introduce a PAYT (Pay-As-You-Throw) system as an integral part of the concessionaire agreement so that:
   (i) The dumpsite or landfill site is not considered to be an easy option to dispose of wastes which otherwise could be reused or recycled.
   (ii) Only non-hazardous, non-reactive inerts and process rejects are brought to the dumpsite.

Support from CSE to redesign the concessionaire agreement

(a) CSE would assist AMC with necessary research, collection and analysis of best practices adopted by cities to engage concessionaire(s) based on the quantity of segregated waste.

(b) CSE would assist AMC in drafting a concessionaire agreement for consultation and implementation.

Integration of the informal sector

The informal sector plays a vital role in Agra's waste management. Integrating the informal sector in the waste management value chain so as to secure livelihoods while improving collection, segregation and material recovery will have major implications on waste collection expenditures and reduce the need for landfills.

Swachh Survekshan also lays emphasis on integration of the informal sector in the waste management value chain. Performance of cities on this has implications on the overall score and, thereby, on the rank of the city.

Target

(a) Mapping the entire network of informal waste collectors in Agra.
(b) Mapping aggregators (scrap dealers) at various levels.
(c) Mapping dry waste recycling facilities to gain operational knowledge of the economy of informal waste collectors.

Strategy for integration of the informal sector

(a) Identification of local scrap dealers, building rapport and mapping the size of the informal workforce linked to scrap dealers for day-to-day operations.

(b) Using GPS-enabled mobile devices and customized mobile apps for data collection from local scrap dealers and plotting the data on AMC's map to get a spatial view of the network to enable AMC to plan collection of dry waste appropriately.

(c) Collecting data with the support of local volunteers to generate a database of local waste collectors, scrap dealers, recyclers (formal and informal), for further analysis and interpretation.

(d) Finalization of the study report through required consultation with AMC officials, arriving at key takeaways that could be fed into the waste governance mechanism to integrate the informal sector.

Table 14: Roadmap for integration of the informal sector

Programme component	Month																							
Timeline	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
Integration of the infomal sector	**Quarter-1**			**Quarter-2**			**Quarter-3**			**Quarter-4**			**Quarter-5**			**Quarter-6**			**Quarter-7**			**Quarter-8**		
Finalization of research design and orientation of volunteers for data collection from the ground																								
Completion of the study, preparation of the study report and discussing with AMC officials for finalization																								
Piloting findings of the study in a select ward with support from AMC officials and documentation of the process of implementation for necessary course corrections																								
Scalling up ingeration of the informal waste collectors to the extent possible																								
Formalizing the integration of the informal sector by adopting a byelaw or resolution, etc. with an institutional oversight mechanism to monitor the outcome of the integration																								
Designing a monitoring tool for collection of ward-wise data for door-to-door collection of dry waste by the informal sector																								
Monitoring the dry waste collection system by the informal sector																								

CSE, 2020

(e) The adopted model could be piloted in one ward for process documentation and based on the experience, the approach could be scaled up after necessary course correction.

Support from CSE for integration of the informal sector

(a) CSE will assist AMC with necessary research, mapping of informal waste collectors' network, local scrap dealers and recyclers (informal and formal) to recommend an economic model for integration of the informal sector.

(b) CSE would assist AMC to pilot the model in a select ward, document the implementation process and scale up the learning to other wards after necessary course correction.

Capacity building of AMC officials on the Integrated Solid Waste Management System

It is of paramount importance to build capacity of AMC officials on integrated management of solid waste and create a resource pool at key leadership positions that can drive the entire initiative to institutionalize a more sustainable, environment friendly and decentralized system of waste management. The process of capacity building needs to be planned in a phased manner to facilitate a 'learn and do' mode of implementation. The capacity building process also needs to create a pool of master trainers across themes concerning various facets of municipal solid waste management. The master trainers would be responsible for building capacity of ward-level officials, door-to-door collectors, volunteers for IEC campaigns and others to develop a common understanding around key parameters of circular economy that are vital for decentralized management.

Capacity building target

The target for capacity building input is the workforce responsible for managing solid waste. In addition, Swachh Bharat Mission Unit and Agra Smart City Project Unit also play a role in the operation, management and monitoring of solid waste in the city. AMC may, therefore, carefully select a good mix of resources, ideally from city to ward level, that is capable of cascading the training input to people at their level and below.

Table 15: Key officials for capacity building

Designation	Number
Municipal Chief Health Officer	1
Municipal Health officer	1
Zonal Sanitary Officer	4
Chief Sanitary and Food Inspectors	4
Sanitary and food Inspectors	16
Sanitary Supervisors	137
Safai Karmacharis	3890

Source: CSE, 2020

Strategy for capacity building

(a) Design and impart training on the Integrated Solid Waste Management System for senior officials around the concept of circular economy with sessions for planning, monitoring and contemporary best practices.

(b) Design and impart training on planning a communication campaign on source segregation, home composting, anti-litter campaign and campaign for school children.

(c) Design and impart training on monitoring of planned activities.

(d) Design and impart training on the most appropriate, affordable, eco-friendly technologies for managing organic and other streams of waste.

Table 16: Roadmap for capacity building

Programme component	Month																							
Timeline	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
Capacity building	**Quarter-1**			**Quarter-2**			**Quarter-3**			**Quarter-4**			**Quarter-5**			**Quarter-6**			**Quarter-7**			**Quarter-8**		
Training of senior AMC officials in Anil Agrawal Environment Training Institute (AAETI)			■																					
Development of training and communication materials and preparation of a training calendar—respondent category, theme and time-wise		■																						
Training of select AMC officials and volunteers on communication to promote source segregation, home composting, etc., aligned with the timeline for the planned activities at AMC's training facility in Agra			■		■			■			■					■						■		
Exposure visit to cities with best practices to learn from others' experiences						■												■						
Monitoring all capacity building activities with details of trainees and outcome monitoring			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

Source: CSE, 2020

(e) Prepare an annual training calendar for capacity building of AMC officials keeping in mind the pace of implementation and roadmap for various activities.

(f) Exposure visits to cities with best practices for learning through field visits and interaction with city officials and other stakeholders.

Support from CSE on capacity building

(a) CSE will support AMC by providing all knowledge products, bringing resources, organizing trainings on integrated waste management at its state-of-the-art Anil Agarwal Environment Training Institute (AAETI) in Rajasthan and bearing all logistic costs for nominated AMC officials for the entire duration of the training.

(b) CSE will support AMC in producing content, organizing resource persons and undertake the logistics of all training events in the AMC office or elsewhere in Agra (except the cost to be borne for the venue—AMC office or otherwise).

(c) CSE will support AMC by organizing exposure visits for key AMC officials to cities showcasing best practices. The number of exposure visits and the number of officials will be mutually agreed as per the needs of the programme.

Financial sustainability

Financial sustainability of any service determines the duration of its survival. In simpl terms, if waste management is not affordable to city governments, it is least likely to be sustainable. In its 2017 book *Not In My Backyard*, CSE reported that municipal solid waste management gets only a tiny apportionment in the municipal budget. RBI's report on municipal finance in India estimates that between 1999 and 2004, the expenditure on solid waste management was around 13 per cent of the budgetary allocations of municipal corporations. No update is available on this but it is very unlikely that the scenario will have changed.

The 2006 World Bank report *Improving Management of Solid Waste in India: Overview and Challenges* reported that municipal solid waste expenditure is 15–25 per cent of the total municipal revenue expenditure in large cities and mid-size towns. In smaller and hill towns, this could go up to 45 per cent. The report also found that the major portion of the cost of solid waste management, 45–60 per cent in large and mid-size cities went into the salaries of employees and workers. But in small towns and cities located in hilly areas this could go up to 90 per cent. The ratio of worker per tonne managed also ranged from 3.5–16. In terms of the break-up of costs, the World Bank report finds that the cost of primary collection is 25–40 per cent and that of transportation is 15–25 per cent of the total cost of solid waste management. The rest is spent on salary costs in almost all cases.

CSE is yet to analyse AMC's expenditure on managing solid waste in Agra but from preliminary observations, it is apparent that it is quite heavy on OPEX. The collection of user charges are relatively low, and revenues earned from sale of compost or recyclable dry waste are meagre. Since a bulk of the waste is collected in a mixed state and transported to the dumpsite, a substantial share of waste management is spent in managing a large fleet of diesel vehicles. The quality of compost produced at the dumpsite is yet to be tested. The expenditure made on biomining legacy waste is also quite high.

In view of this, it is imperative that AMC move towards an integrated waste management approach based on the principle of decentralized management, adopt a roadmap and set a target to achieve source segregation, and introduce inclusive management of solid waste through promotion of extensive behavioural change.

Recommendations for a financially sustainable waste management

(a) An intensive communication drive with citizens to induce behavioural changes to ensure source segregation.

(b) Enforcing collection of user charges (under provisions of the existing bye-laws of AMC) and punitive action against offenders.

(c) Production of quality compost in decentralized facilities from segregated organic waste and creating a value chain to sell the compost to local farmers, nursery owners, fertilizer companies, farmers cooperatives, etc.

(d) Sale of segregated clean recyclable dry wastes (plastic, paper, glass, metal, etc.) after secondary segregation and sorting at MRFs.

(e) Transportation of only inerts to dumpsites. This will reduce the cost of transportation by up to 75 per cent.

(f) Introducing a plastic deposit refund system (DRS) at all monuments in Agra. Considering the annual tourist footfall (of more than 0.5 million), this will be a substantial amount.

(g) Introducing spot fines for street and public place littering (with the help of the CCTV network).

(h) Geo-tagging the entire fleet of waste-carrying vehicles to track authorized movement.

Support from CSE towards financial sustainability of waste management

(a) Identifying and providing information on the best practices of financial sustainability in managing municipal solid waste.

(b) Testing of compost at CSE's lab for quality monitoring.

(c) Research support to establish a sustainable value chain on sale of compost.

(d) Research support to introduce the deposit refund system at monuments, malls, etc.

Managing *petha* waste

If there is anything that comes close to the popularity of Taj Mahal in Agra, it is the famous *Agra ka petha*, translucent, soft, chewy and candy-like, eaten dry or dipped in sugar syrup. *Petha* is made from ash gourd. Its popularity means thousands of shops sell *petha* in Agra, resulting in substantial *petha* waste. Managing this waste is a challenge.

CSE will dive deep into this issue to come up with comprehensive data, mapping of the shops, consumption patterns, challenges to manage, etc. to devise a strategy for more efficient management of *petha* waste in Agra.

Managing leather waste

Agra is also known for its leather goods. The city is surrounded by 7,200 small-scale leather industrial units. More than 1.5 lakh pairs of shoes are manufactured in Agra every day, a significant number in the informal sector.

The informal shoe manufacturing network also processes raw leather using acids and chemicals that generate a lot of toxic effluents that are often released untreated into water bodies. AMC recognizes that this is a huge challenge to manage.

CSE would support AMC with appropriate plan, strategy and technology solution apart from mapping the informal leather industry to devise a sustainable decentralized solution for the leather waste.

Managing drain silt and sludge

A report submitted to the NGT in October 2019 states that 60 per cent of Agra is un-sewered. As a result, large quantities of sludge and silt gets accumulated in surface drains, requiring periodical de-sludging and cleaning by AMC. Recognizing the challenge of dealing with such high volumes of sludge and silt, AMC has sought technical support from CSE.

CSE has ample experience in the field and will support AMC with research to determine the necessary plan, strategy and technology solutions to deal with this issue.

Institutional arrangements

CSE recommends the following institutional arrangements to improve waste governance:

(i) **Formation of a task team:** AMC should consider formation of a task force with select senior officials from all units concerning sanitation and solid waste management services and create an institutional mechanism to periodically review the progress made on various programme components and take necessary course correction measures.

(ii) **Improved coordination among various units of AMC:** The different units involved in providing sanitation and waste management services—the Sanitation Unit, Horticulture Unit and Engineering Unit—must interact with each other through a well-designed institutional arrangement.

(iii) **Enforcement of the provision of the rules for waste governance under Environment Protection Act, 1986 and relevant NGT orders**: All units under AMC must adequately exercise their power and authority to ensure that the city achieves source segregation, zero littering, prevention of unauthorized waste dumping, waste burning, etc. Offenders under the NGT Act (or local bye-laws) must be penalized accordingly.

(iv) **Mandatory registration of all industrial units:** AMC must ensure that all industrial establishments operating within its jurisdiction manage their waste properly. AMC also needs to ensure that all industrial establishments either engage contractors for collection and management of the solid waste generated by them on their own or enter into an agreement with AMC for regular collection by the concessionaire or municipal machinery.

(v) **Prohibit dumping of industrial or chemical waste in informal dumpsites:** AMC must enforce provisions in existing legal instruments against dumping of industrial or chemical waste in dumpsites meant for disposal of municipal solid waste.

(vi) **Mandatory registrations of BWGs:** Agra has more than 2,300 BWGs. Under provision of the Solid Waste Management Rules of 2016, the BWGs have to manage the waste they generate through an agency enlisted with the municipal authority or enter into an agreement with AMC after paying the required tariff to get their waste collected, transported and treated.

(vii) **Mapping of migrant settlements:** Agra has many settlements (seasonal and permanent) of migrant labourers. These settlements gradually develop into temporary slums and it is a challenge to manage their solid waste. AMC needs to map such settlements and undertake appropriate measures to manage their waste.

(viii) **Collaborate with law enforcement agencies:** AMC needs to collaborate with the local police to strengthen anti-littering and waste dumping using the city's CCTV network managed by local police authorities to track offenders.

(ix) **Strengthening community-level surveillance to ensure source segregation and the anti-littering initiative (garbage-free city):** Ensuring source segregation is a shared responsibility and citizens have an important stake in it. It is, therefore, imperative for AMC to engage citizens using appropriate IEC vehicles at the local level for awareness generation and creating a community surveillance network. Learning lessons from implementation of the flagship Swachh Bharat Mission (Urban), community-level volunteers could be identified to introduce morning and evening surveillance in areas to prevent littering and encourage people to give segregated waste to collectors. These volunteers could be incentivized with some honorarium (by leveraging CSR funds) to create a city-wide network that would act as eyes and ears of AMC.

Table 17: Institutional monitoring framework summarizes the activities to be undertaken by AMC.

Table 17: Institutional monitoring framework

S. no.	Action point	Key indicators
1.	Administrative	
i.	Form a task team at AMC with heads of various departments concerning waste management to review and monitor the progress made on the roadmap	The task team meets at least once every month to review the situation for necessary interventions: 1. Report prepared on the number of BWGs not registered or that have not hired agencies for collection and management of waste or have not entered into an agreement with AMC for waste collection. 2. Report prepared on the number of industrial establishments dumping chemical or industrial effluents in informal dumpsites or drains. 3. Report prepared and mapping of number of illegal migrant settlements in the city. 4. Report prepared on the number of ward-level surveillance committees formed to monitor and report segregation and littering. 5. Report prepared on the number of informal dumpsites or garbage vulnerable points (GVPs) in the city, and the nature of waste being dumped in them, etc. 6. Report prepared on review of the route map for waste collection to ensure hotspots (GVPs) are covered. 7. Enforcement of plastic ban.
ii.	Formation of a joint surveillance team with local police authorities and AMC officials for CCTV network-based monitoring to locate GVPs	1. Number of waste littering offenders booked with challans issued under provisions of the NGT Act or local bye-laws. 2. GVPs are geo-tagged with photographic evidence and plotted in the city map for spatial monitoring.
2.	Operational	
i.	Segregation: Segregation of waste was introduced as a legal mandate and policy plank in the Municipal Solid Waste (Management and Handling) Rules, 2000. The current state of source segregation in Agra is far from desirable. In order to institute a sustainable waste management system, AMC needs to ensure 100 per cent source segregation. The following strategies are recommended to promote source segregation: (a) Create a toll-free helpline number to receive complaints and reports around source segregation, illegal dumping or littering, etc. for immediate action by city authorities. Existing helplines may also be expanded for this purpose (b) Public announcement in residential colonies, markets and migrant settlements to request citizens to mandatorily segregate their waste and the penal provision thereof may be made (c) Developing appropriate IEC and communication tools to create public awareness and capacity building on segregation	1. Toll free number activated and citizens have been notified 2. Toll free number has been circulated on all social media and other platforms (Whatsapp, Facebook, AMC website, Twitter, text message to tax payers database, etc.) 3. Plan for public announcement prepared along with a route map focusing on source segregation and garbage vulnerable points. 4. IEC and communication tool for awareness building on source segregation is prepared. 5. A campaign roadmap is prepared for community engagement. 6. The CSR partner has been brought on board and MoU has been signed with AMC (the CSR cobranding with Swachh Bharat Mission should be an integral part of the MoU). 7. Volunteers have been hired and trained (@5 volunteers per ward) and deployed after mapping them with in all the 100 wards. 8. Supervisors (@2 per zone) are hired and placed in each zone to monitor and supervise volunteers. 9. The campaign is planned for at least six months. 10. Volunteers are tagged with waste collection vehicles to engage with citizens for awareness generation.

S. no.	Action point	Key indicators
	(d) Preparing a communication and IEC roadmap for awareness generation on source segregation (e) Partnering with CSR-seeking companies to hire volunteers and supervisors and mapping them to wards for undertaking a sensitization drive for awareness generation (f) Public notification on enforcing source segregation with a timeline beyond which mixed waste will not be collected by the AMC	11. Public notification on enforcing collection of segregated waste is issued to all residential areas, commercial establishments and public institutions—the notification is issued ahead of mobilizing the volunteers on the ground.
ii.	Collection: AMC needs to ensure the concessionaire collects only segregated waste from all generators, segregated into at least three streams i.e. organic, wet waste, dry waste and domestic hazardous waste. The following measures are recommended to strengthen collection: (a) Ensure collection of only segregated waste from all sources (b) Ensure collection time is maintained consistently across the city (c) Integrate informal collection networks with the concessionaire to ensure that the informal sector does not use informal dumpsites (d) Resident welfare associations (RWAs) need to be registered with AMC and manage their waste as per SWM Rule, 2016 (e) Improve coordination between the sanitation workforce of AMC, responsible for street sweeping and collection of roadside waste, and the concessionaire fleet to ensure roadside bins are emptied in time on a regular basis (f) Ensure safety of sanitation workers and concessionaire workforce engaged in waste collection, which is all the more relevant in the wake of the pandemic. They must be provided with basic safety gear like masks, boots, gloves, etc. (g) The entire fleet of the concessionaire needs to be geo-tagged to track their movement with special focus on garbage vulnerable points (h) All collection vehicles and tricycles must be equipped with compartments for collection of waste in segregated form	1. Number of wards, commercial establishments and public institutions practising source segregation and giving segregated waste to AMC. 2. Number of wards reporting timely collection of waste in the mornings and evenings. 3. Number of households across the city (ward-wise) served by the network of informal waste collectors. 4. Number of informal waste collectors' networks integrated into AMC's collection network and linked to the concessionaire. 5. Number of BWGs registered with AMC. 6. Number of RWAs hiring agencies for managing the waste they produce or entering into an agreement with AMC for collection of the waste on a regular basis. 7. Number of roadside bins cleared by the concessionaire fleet. 8. Mapping of garbage vulnerable points where bins have been installed and that have been linked to the concessionaire's collection route map. 9. Geo-tagging of all collection and transportation vehicles is completed and AMC is tracking the coverage on a regular basis. 10. All tricycles and small tipper trucks have compartments for transportation of segregated waste to the nearest transfer stations for material recovery. 11. Collection of user charges from individual and bulk waste generators.
iii.	Transportation: Currently, AMC's own staff and vehicle fleet collects and transports only mixed waste from all sources to the four transfer station-cum-material recovery facilities. The transfer stations are equipped with fixed compactors for baling mixed waste. In order to improve transportation, the following measures are recommended: (a) All primary transfer stations must be converted into MRFs	1. All primary transfer stations receiving only segregated waste from all collection vehicles and tricycles. 2. All primary transfer stations are also working as MRFs for secondary segregation of dry waste. 3. The capacity of the three primary transfer stations is assessed to ascertain whether there is space for secondary segregation of the entire volume of dry waste received.

S. no.	Action point	Key indicators
	(b) Wet and dry waste must not be picked up on the same day or by the same vehicle (c) Waste streams produced after secondary segregation are sold to appropriate recycling facilities for further processing (d) Collected organic waste should be sent to the nearest facility for shredding, microbial composting, vermi-composting, bio-methanation and sold as organic manure (e) Setting up decentralized composting facilities in required numbers if the existing composting facilities are found to be inadequate to cater to the collected quantity of organic waste (f) Only inerts collected from road sweeping and silt collected from cleaning of roadside drains is transported to the dumpsite (g) C&D waste is collected and managed separately and not brought to the primary transfer station along with municipal solid waste	4. The concessionaire or AMC has entered into an agreement with the recycling units for the sale of recyclable streams of dry waste. 5. Assessment is done to ensure that the capacity of all decentralized composting facilities meets the total quantity of organic waste generated. 6. Organic waste is treated in decentralized composting facilities. 7. A marketing network is built for sale of compost, and monitored on a regular basis. 8. Quantity of inerts and rejects received at the dumpsite as compared to the total quantity of waste generated by AMC. 9. Quantity of C&D waste sent for processing by the recycling facility compared to the total quantity of C&D waste collected in the area under AMC's jurisdiction.
iv.	Treatment: Currently, the treatment of fresh waste is a challenge for AMC as the entire volume of mixed waste is brought to the Kuberpur dumpsite. It receives more than 700 tonnes of mixed waste every day. The dumpsite has a total area of 70 acres, of which about 60 per cent is occupied by close to 1.9 million tonnes of legacy waste from the city. Under the direction of NGT, biomining of the legacy waste is currently underway to derive soil and RDF for further processing. Besides, the highly toxic leachate is a pollutant for air, water and soil. In view of the challenges in connection with treatment of waste, the following measures are recommended for implementation: (a) Considering the space constraint, the entire volume of legacy waste should be biomined and the land reclaimed (b) AMC should focus on decentralized management of solid waste so that only non-reactive and non-hazardous inerts and process rejects (about 12 per cent) are brought to the dumpsite which will not only take much lesser space but also not cause any environmental pollution (c) Adoption of decentralized waste management will reduce the cost of transportation by 75 per cent	1. A roadmap for biomining legacy waste and landfill reclamation is prepared. 2. A roadmap is prepared for treatment and processing of segregated organic waste at composting facilities and dry waste MRFs. 3. A roadmap is created for gradual reduction of waste being brought to the dumpsite. 4. The quantity of waste being brought to the dumpsite is monitored to ensure compliance of the roadmap to institute decentralized treatment of segregated waste.

S. no.	Action point	Key indicators
v.	Policy reforms: AMC needs to make a systematic departure from the current concessionaire agreement based on tipping fee on the quantity of waste brought to the dumpsite to an agreement based on the quantity of processed segregated waste after secondary segregation at MRFs and the quantity of organic waste produced at the decentralized composting facility. AMC may also consider imposing fees for the concessionaire for using the dumpsite for disposing of inerts and process rejects to ensure that the concessionaire brings minimum waste to the landfill	1. The current concessionaire agreement is reviewed and revised to create a sustainable waste management system.

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