



# CHALLENGES AND OPPORTUNITIES OF SOURCE-SEGREGATED WASTE COLLECTION IN SRI LANKA

March 2021

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This report presents the challenges faced and opportunities revealed through a study of two cases of source-segregated waste collection by local authorities in Sri Lanka; Moratuwa Municipal Council, in Colombo, and Kataragama Pradeshiya Sabha, in Monaragala. It offers a profound analysis of means to improve waste collection systems for segregated waste as well as effective means and tools for communication and promotion. This report intends to raise planning and decision making capacities not only in Sri Lanka but also abroad, thus helping to achieve source-segregated waste collection over a much wider area.

## The case studies in this report identified the following critical factors for replication:

- ▶ Proper planning based on analysis of the field survey together with appropriate use of internal and external financial and technical resources are required in establishing a successful source segregation programme.
- ▶ For sustainable source segregation, both installation of a waste treatment facility and continuous promotion of source segregation are needed.
- ▶ Improvements in the collection service such as frequent and punctual collection will raise the level of cooperation from waste generators (i.e., citizens and business sectors) in waste separation at source.
- ▶ Provision of supporting equipment such as segregation bins helps waste generators to easily adapt to the desired disposal behaviours.
- ▶ Adopting step-by-step approaches are practical. Start with a two-category separation in a selected area as a first step and expand the area and/or increase the categories based on success and learning.
- ▶ Acknowledging and respecting waste collectors by providing comfortable working environment, fair treatment, and attractive working condition motivate them as facilitators who communicate with waste generators to promote appropriate source segregation.
- ▶ Messages/instructions used for information, education and communication (IEC) materials should be simple yet sufficiently detailed to act on.
- ▶ Different effective communication methods and tools should be used according to target audience.
- ▶ Clear information/instructions should be provided continuously and repeatedly until new practices become a habit (Behaviour does not change overnight).

# 1 INTRODUCTION

## 1.1 Background

Dense populations in urban areas and a take-make-dispose linear economy eventually lead to excessive amounts of waste from residential, commercial and institutional sectors, most of which ends up in uncontrolled disposal sites, causing grave environmental and health issues and also shortening the life of existing disposal sites worldwide. Mismanagement of solid waste also causes marine plastic pollution – now of a serious global concern. Collective efforts have been made to overcome the problems by both the government and private sector in many developed countries, while most developing countries struggle to find effective, enduring solutions to waste management.

Sri Lanka is no exception. It has experienced steady economic growth and infrastructure development in urban and rural areas, which has brought many benefits. GDP per capita has risen to 4,073 USD (2017) and the total population stands at 21.4 million. In parallel with the rapidly expanding economy and urban populations have been the many challenges facing authorities in protecting the environment and urban sanitation. The total Municipal Solid Waste (MSW) generation in Sri Lanka was 7,210 Metric Tonnes Per Day (MTPD) and growing annually at 1.2% as reported by Basnayake et al. (2020). Most wastes were previously openly dumped, especially in low lying areas. People used to burn waste, dispose of it on roadsides, in drains or rivers especially in rural areas. Source segregation was seldom practiced. Industrial and bio-medical waste was also frequently disposed of unsegregated. These practices created huge environmental, health and social and economic burdens. While valuable waste was picked for reuse and recycling by informal collectors, market prices had deep and direct effects on this collection system, with low prices leading to lost motivation to collect recyclables, which then end up in dumpsites. While various practices have been adopted by municipalities, rates of resource recovery from waste remain low. MSW management has thus become one of the key environmental and social issues facing the country.

## 1.2 Objective

Through its involvement in activities in Sri Lanka, IGES Centre Collaborating with UNEP on Environmental Technologies (CCET) noted several good practices of source segregation. In view of the merits of these practices, CCET proposed a body of successful cases be compiled, assisted by the various related actors, with the objective of knowledge enhancement and capacity building at the Local Authority (LA) level in Sri Lanka. In so doing, this was intended to raise planning and decision making capacities not only within Sri Lanka but also abroad, thus helping to achieve source-segregated waste collection over a much wider area.

This report presents the challenges faced and opportunities revealed through a study of two cases of source-segregated waste collection by local authorities. It offers a profound analysis of means to improving waste collection systems for segregated waste as well as effective means and tools for communication and promotion. The two cases presented are Moratuwa Municipal Council, in Colombo, and Kataragama Pradeshiya Sabha, in Monaragala.

## 1.3 Solid Waste Management Policy in Sri Lanka

Although source segregation featured little at the level of national debate in the early 2000s, some LAs and other organizations initiated waste reduction and reuse programmes at the local level, which mainly focused on home composting and reducing plastics or polythene usage. A few examples are the public campaigns involving use of posters conducted by Kandy Municipal Council, and promotion of eco bags to replace plastic shopping bags by Arthachrya Foundation (Thomas, 2002).

Under such situation, the *National Waste Management Policy* was introduced by Ministry of Environment and Natural Resources in 2007 with the aim of ensuring integrated, economically feasible, and environmentally sound solid waste management practices at all levels – national, provincial and local. A year later in 2008, *National Strategy on Solid Waste Management* (NSSWM) was developed to provide directions to improve solid waste management in the country, and suggested policies be formulated to encourage waste

avoidance, reduction, re-use, recycling, treatment and final disposal.

Consequently, a paradigm shift took place in the perception of the role of waste management from being an LA-led one of removal and disposal while avoiding any public nuisance<sup>1</sup>, to that emphasizing waste minimization and resources recovery, which led to the launch of a national sustainable solid waste management programme, 'PILISARU'. PILISARU was launched by the Ministry of Environmental and Natural Resources, with participation by other related government organizations, private Institutions, NGOs, and experts, aiming at maximizing the reutilization of resources and disposing of non-utilizable residues in an environmentally acceptable manner. It had a timeframe of five years starting in 2008 and central government funding of 5.675 billion LKR (43.6 million USD) for the first three years. It took many attempts for PILISARU to raise public awareness of the importance of waste separation. Certain LAs in urban areas constructed material recovery facilities such as composting plants, plastic recycling centres as well as "Sampath Piyasa", where valuable materials are traded as part of integrated SWM under the National waste management policy.

The policy was subsequently revised in 2018 to both accommodate growing concerns over the Polluter Pays Principle which imposes waste collection fee on households that used to be excluded as well as involve the private sector in waste management

activities. It was finally approved by the Office of the Cabinet of Ministries on 3 Sep. 2019. In carrying out the policy under the new legal framework together with the National Solid Waste Management Support Centre (NSWMSC), source separation activities were strengthened owing to the legal provision allowing refusal of mixed waste collection. As a result, many awareness-raising programmes have been carried out involving door-to-door visits and mass media, and many LAs have initiated programmes to extract valuable materials from collected wastes.

## 2 MORATUWA MUNICIPAL COUNCIL

### 2.1 Background

Moratuwa Municipal Council (MMC), in Colombo district, Western Province of Sri Lanka has an area of 23.4 km<sup>2</sup> and in 2019 had a population of 177,190 (Moratuwa Municipal Council, 2019). MMC was classified as a 'sub-regional centre' of Colombo Metropolitan Region by the Urban Development Authority in 1998.

Waste generation in MMC has risen considerably due to population growth, urban expansion, economic growth, and change in lifestyles. From 1996 to 2009, MMC and neighboring LAs (Dehiwala Mt. Lavinia MC, Boralasgamuwa Urban Council (UC),



<b>Province</b>	Western
<b>District</b>	Colombo
<b>Size</b>	23.4 km <sup>2</sup>
<b>Topography</b>	Flat terrain
<b>Land use</b>	Residential, commercial, industrial areas
<b>Population</b>	Residential 177,190 (2019) Floating 30,000
<b>Dwellings</b>	41,887 (2019)
<b>Waste generation</b>	125 MTPD (JICA, 2016)
<b>Waste collection</b>	72 MTPD (JICA, 2016)

Figure 2-1 Location of Moratuwa Municipal Council (MMC)

<sup>1</sup> All MSW generated within LA boundaries is considered the property of the LA, according to Municipal Council Ordinance (No. 29, 1947), Urban Council Ordinance (No. 61, 1939) and Pradeshiya Sabha Act (No. 15, 1987).

Kesbewa UC) disposed of all collected solid waste at the government-owned Karadiyana disposal site, near the MMC boundary within Kesbewa UC limits. These LAs were charged a tipping fee of 800 LKR/MT (about 7.3 USD/MT) by a private contractor. However, equipped with only a few bulldozers and five workers, operations were limited. Expansion of the disposal site to 4 ha by 2008 created environmental pollution and high health risks to nearby residents (Esakku et al., 2007). Consequently, in late 2008, this led to protests involving several residents and environmentalists at the site, who eventually reverted to legal action through the magistrate's court against operation of the disposal site (Jabbar, 2013). The court admitted that mismanagement of the disposal site had occurred, and an order was issued by the Cabinet Sub-Committee directing the Ministry of Local Government, Ministry of Environment and Waste Management Authority - Western Province (WMA-WP) to improve conditions at the site. However, the private contractor, while agreeing to design and construct a sanitary landfill, lacked the necessary finances, which led to WMA-WP assuming responsibility for disposal site management, in 2010. Subsequently, several initiatives took place to develop an integrated solid waste management facility at Karadiyana. WMA-WP maintained the same tipping fee but concluded that additional funding would be necessary to establish facilities such as a weighbridge, access road, soil covering, and drainage works. In 2012, WMA-WP then constructed a large composting facility (50 MTPD) at Karadiyana disposal site to treat biodegradable waste. In order to incentivize appropriate segregation of biodegradable waste, WMA-WP introduced two tipping fee rates for collected waste from all LAs in 2014 – one for mixed waste, 1,800 LKR/MT (15 USD/MT), and a much lower one for well segregated biodegradable waste, at 250 LKR/MT (2 USD/MT) (JICA 2016).

## 2.2 Initiative

Under such fee regulation, MMC concluded that source-segregated waste collection would reduce MSW management costs significantly, though some LAs continued to collect mixed waste and send it to Karadiyana. Records from MMC show that an average of 125 MTPD of waste was collected in 2013, of which, according to a basic waste composition survey conducted in 2014 (JICA, 2016), biodegradables

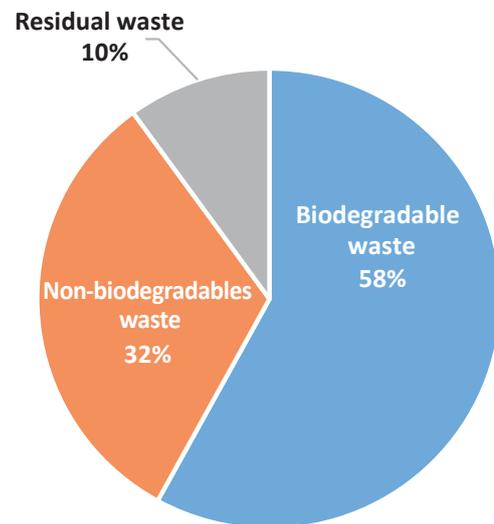


Figure 2-2 Composition of MSW generated in MMC (Source: JICA, 2016)

comprised 58%, non-biodegradables (paper, plastics, glass and metals) comprised 32%, and residuals, mainly construction waste, soil, sand, and drain cleaning debris comprised about 10% (Figure 2-2). MMC then started to separately send the residual fraction to Karadiyana disposal site. As this waste incurred no tipping fees due to its utility as material for use in constructing the site's internal access road, MMC was only required to pay the tipping fee for the remaining mixed waste, volumes of which were around 106–110 MTPD during 2013–2014.

In the meantime, WMA-WP formulated a five-year Action Plan for 2015–2020 to improve collection and recycling rates of all LAs in Western Province. The plan targeted improvements in both collection coverage, which was to rise from 61% in 2015 to 72% by 2020, and for waste generation reduction rate, which was to rise from 17% in 2015 to 38% by 2020 (JICA 2016). In line with the provincial policy, the waste management section under the Department of Health in MMC formulated a three-year waste management action plan for 2015–2018 based on the result of the waste composition and quantitative analysis. One of the plan's goals was to reduce the waste disposal fee paid to Karadiyana disposal site by implementing source segregated waste collection and delivery. To bring this about, a proposal to implement a source segregated waste collection scheme in the MMC area was forwarded to the city council by the Mayor, which was approved in early 2015. WMA-WP assisted MMC in terms of technical requirements such as for planning

the awareness-raising programme, developing the necessary training modules for workforce training and developing new collection route maps. The WMA-WP also continually monitored development of the source-segregated waste collection programme.

### 2.3 Supportive activity

Raising public awareness on segregated waste collection was a key component of the program. This involved MMC introducing waste segregation by-laws at the inception of the source-segregated waste collection programme in 2015. MMC planned and implemented various mechanisms to train MMC’s workforce and raise awareness among waste generators. The awareness programs were planned and implemented with support from WMA-WP. MMC prepared leaflets and posters with waste separation instructions and distributed them to households and institutions, then a team of MMC workers headed by a zonal Public Health Inspector (PHI) and supervisors carried out door-to-door visits and community awareness activities in public places. Other activities included placing billboards and posters (Figure 2-3) illustrating the new source-segregated waste collection scheme in public places and at roadsides, as well as providing instruction, via PHIs, to Health Clubs of schools within MMC’s area, members of which then relayed learnings to other students for wider dissemination.

A further step taken involved improvement of the composting process through reducing the need to separate plastic bags from biodegradable waste. For

this purpose, MMC donated special reusable waste bins (25 litre size; not sold in ordinary markets) to 41,459 families in the municipal area, to substitute for the plastic bags (shopping bags) which were used to hold biodegradable waste (Figure 2-4). MMC imposed a rule that such waste would only be collected if it was placed in the special bins. Costs related to the bins were equally shared by MMC and WMA-WP and bins were made available only to households from which regular tax revenue was received. This system not only encouraged waste segregation at source but also helped raise tax revenues.

As part of efforts to promote 3R among the public and reduce amounts of waste scattered throughout the city, MMC held monthly “Waste Fair” flea markets in zonal divisions, which involve collections of all non-



Figure 2-4 Residents using the distributed bins for biodegradable waste collection (Source: author)



Figure 2-3 Leaflets and posters to raise public awareness (Source: MMC)

biodegradable waste such as clothes, shoes, rubber, and leather bags. Since municipal collectors may retrieve any items desired for reselling from such fairs, this helps reduce amounts of waste in the city, especially plastic bottles, used tires, and cans.

On a related topic, MMC established a communication hotline to the higher authorities and Commissioner to enable direct reporting by citizens of any lapses or malpractices of MMC staff. MMC maintains a log of such reports as well as actions taken to solve any issues raised. Such logs, containing valuable feedback on MMC’s waste management programme, are often used to aid new programme planning.

## 2.4 Progress

Source-segregated waste collection was initiated in MMC in 2015 using the physical and human resources available in the LA without resorting to external resources. Waste generators were first instructed to separate waste into two categories; biodegradable and non-biodegradable. Biodegradables were collected daily, while non-biodegradables were collected on weekends. Sufficient community bins were placed in public places such as at bus stops, in the central market and parks.

At first, citizens exhibited low willingness to separate waste and started dumping it illegally in various places in the morning and at night. Commercial institutions refused to segregate waste owing to

storage space limitations and the lack of labour for waste segregation. The same issue posed a challenge to restaurants and retailers since separating waste depended entirely on cooperation from customers. Despite such difficulties, some commercial institutions agreed to separate waste into biodegradable and non-biodegradable waste in 2017, while demanding a frequent and reliable collection service. Consequently, MMC introduced a waste collection fee scheme for all commercial establishments (traders, vendors, private institutes) and allocated three separate collection vehicles for this purpose. This fee scheme enabled waste to be segregated more efficiently, and the two-category waste segregation with improved collection service introduced into the commercial sector achieved a remarkable success rate of over 70%.

Three years later in 2018, MMC developed another waste management action plan, covering 2018–2021, to improve and upgrade the segregated waste collection programme through introduction of seven categories for non-biodegradable waste: paper, plastic, metal, polythene, glass, coconut shells, and tires and e-waste. Accordingly, a new waste collection schedule was set up, as shown in Table 2-1, in which biodegradable collection took place on weekdays and other categories of non-biodegradable waste was collected on weekends. This schedule and categories of non-biodegradable waste have since been revised in accordance with the volumes and demands from waste generators – such as with the new collection of sanitary waste including diapers, and contaminated polythene, used lunch sheets, and packaging bags.

Table 2-1 Waste collection schedule of Moratuwa MC

#	Waste category	Types of materials	Collection days
<b>Biodegradable: treated by MMC facility (capacity: 1 tonne) and remainder delivered to Karadiyana compost facility</b>			
1	Biodegradables	Vegetable and fruit, meat and fish, plant leaves, eggshells, coconut scrap residues, smashed king coconut shell pieces (different from category No. 7), etc.	Weekdays
<b>Non-biodegradables: sold by MMC workers except for E-waste and tyres which are delivered to Karadiyana disposal site</b>			
2	Paper	Newspapers, books, cardboards, paper wrappings, Styrofoam	1 <sup>st</sup> Saturday
3	Plastic	PET bottles, all types of hard plastics	1 <sup>st</sup> Sunday
4	Metal	Salmon tins, metal sheets, all types of metals	2 <sup>nd</sup> Saturday
5	Polythene	All types of polythene, polythene bags, polythene wrappings	2 <sup>nd</sup> Sunday
6	Glass	Glass bottles, glass fragments except windscreens	3 <sup>rd</sup> Saturday
7	Coconut shells		3 <sup>rd</sup> Sunday
8	E-waste and tyres		4 <sup>th</sup> Saturday and Sunday

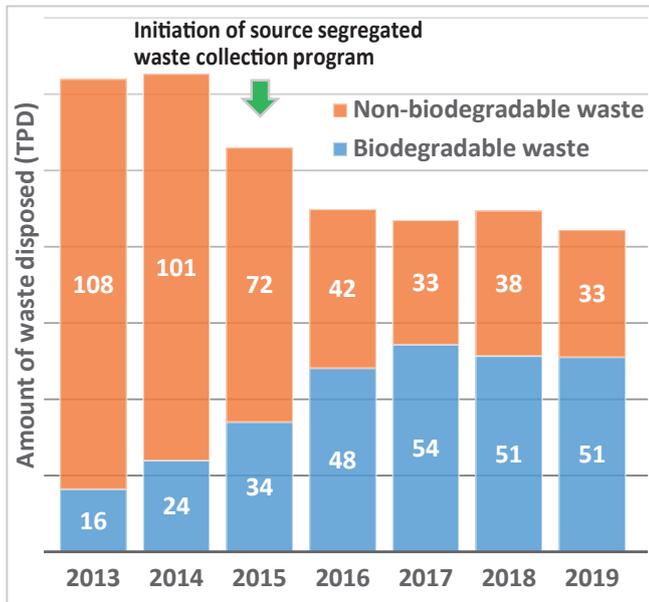


Figure 2-5 Change in amount of waste collection by MMC from 2013 to 2019 (Source: developed by Author based on the data from MMC)

Figure 2-5 shows trends in amounts of waste collected from 2013 to 2019. The first drop observed from 2014 to 2015 is attributed to separation and diversion of construction and demolition waste. MMC’s practice of not mixing biodegradable waste directly from vegetable, fruit and fish markets with other waste is also notable (e.g., 16 MTPD in 2013). Overall, based on data on average daily waste from the Karadiyana site, the composting facility near the market, and from estimations of recyclable collection and sales (JICA, 2016), a noteworthy reduction in waste occurred after 2015, resulting from increased onsite disposal and home composting of biodegradable waste including garden waste. The study also revealed that the overall waste collection rate in amount was only 71.0% compared to the MMC’s collection service coverage, which was almost 99%. This can be partly explained by the assumption that littering of waste must still take place, presumably due to those wishing to avoid collection fees or being unable to wait until the designated collection day.

Initially, the separated biodegradable waste was not treated at the composting facility as it lacked the capacity, and was disposed of at Karadiyana disposal site. Other recyclable waste was sold directly to buyers who were selected through a tender procedure. As no waste sorting facility existed, MMC entered into an agreement with buyers to sell the non-biodegradable

waste without sorting. However, the agreement only lasted two months since a large portion of non-biodegradable waste remained unsold and was left unattended at the storage, due to lack of demand or the low-quality nature of plastics, which did not meet buyers’ requirements. Eventually, MMC terminated the agreement, and in its place decided to allow MMC’s collection workers to collect and sell the recyclable items. This practice, which enables collection workers to supplement their income, has since become a common occurrence in Sri Lanka, though some LAs implement it through different mechanisms.

## 2.5 Current Waste Collection

The Public Health Department in MMC is responsible for MSW management, including waste collection and transportation; public health activities and measures (public cleansing); road sweeping; and public awareness raising on waste management activities. Its top management consists of a chief executive – the Medical Officer of Health (MOH), and the Chief Public Health Inspector (CPHI), who is responsible for executing all activities with support from PHIs and health overseers assigned under the CPHI. The mechanical engineer of the Department of Works is responsible for maintaining the waste collection vehicles.

MMC is divided into five waste collection zones: Soyzapura, Katubedda, Moratumulla, City Centre, and Korallawalla (Figure 2-6). Waste collection in each zone is managed and supervised by a PHI, and several health overseers, drivers with vehicles, and labourers are deployed depending on zone size and population. Collection methods include door-to-door collection, curbside collection, and bell collection especially in residential areas. Table 2-2 shows the types of vehicles used for waste collection in MMC. Tractors, dump trucks, and tripper trucks are used at commercial and highly residential areas where access roads are wide enough and hand carts or small trucks are used at a place where access is more challenging to heavy traffic or narrow roads. The service coverage rate is currently about 99% – the remaining 1% representing areas where MMC cannot access by any means.

Table 2-2 Type of vehicle for waste collection service

Type of vehicle	Number of vehicles
Tractors with trailer	16
Dump trucks	2
Small trucks	5
Tipper trucks	8
Hand carts	25
Compactor trucks	2

Table 2-3 Staff for waste collection service

Workers	Male	Female
Medical Officer of Health (MOH)	1	
Chief Public Health Inspector (CPHI)	1	-
PHI (Solid waste section head)	1	-
PHI (For 5 zones)	5	-
Health overseers (supervisors)	12	-
Drivers	27	-
Labourers	292	12
<b>Total</b>	<b>339</b>	<b>12</b>

As shown in Table 2-3, MMC’s waste management section has a staff complement of 351, most of whom are labourers (304 staff; 87%). Twelve female workers are mainly employed for sweeping in major streets and public places. While in principle MMC ensures equal opportunities for men and women in the workplace, none of the women have supervisory roles, chiefly owing to the difficulty of them travelling in the field but also ingrained chauvinistic attitudes held by the majority of the male collectors limiting women’s participation in the role. This stereotype could be eliminated by providing more resources to address the problem and increase gender sensitivity among all members. In other respects, there are no disparities in terms of salary and benefits regarding gender. In general, all MMC workers use personal protective gear such as gloves, gum boots, and protective clothing during waste collection duties. In terms of welfare, MMC conducts medical checkups via health campaigns twice a year for all workers free of charge. Rest areas, toilets and washing facilities are provided in the LA to improve the work environment. To address absenteeism, a major issue in Sri Lanka, MMC provides an additional 100 LKR as a daily allowance for good attendance (JICA, 2019).

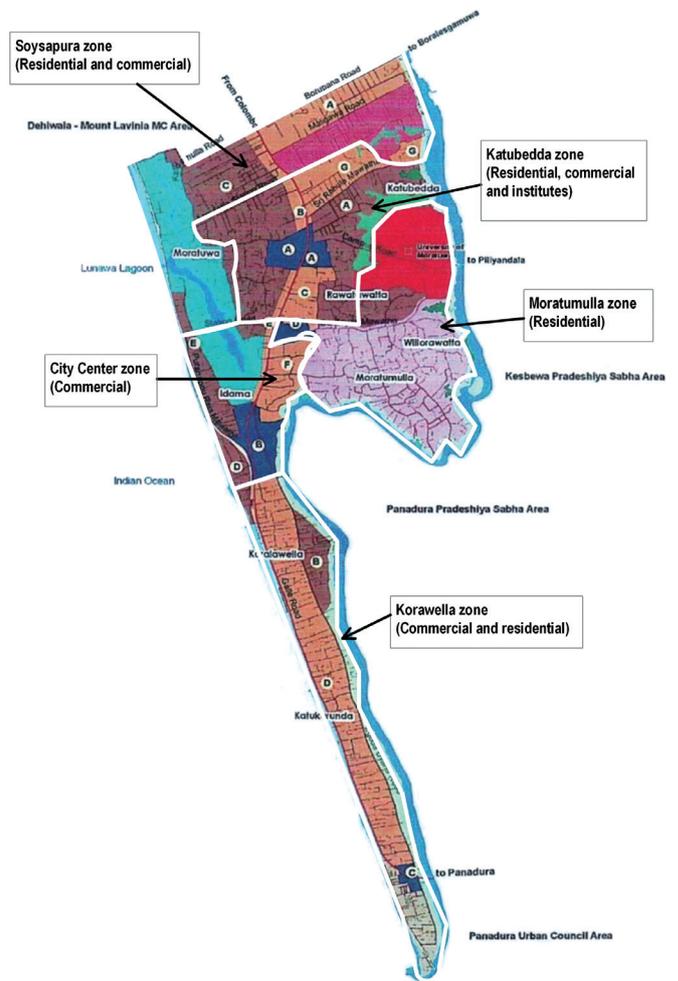


Figure 2-6 Waste collection zones of MMC

## 2.6 Outcomes and Lessons Learned

This case study demonstrates that it was possible to raise the fraction of source-segregated biodegradable waste (from 32% in 2015 to 60% in 2019). As a result, amounts of waste disposed of at the disposal site was reduced. Implementation of source-segregated waste collection over the five year period from 2015 also resulted in a lower tipping fee than mixed waste. One of the keys behind the overall success of the improved source segregation programme was that MMC did not solely rely on external financial and technical assistance. Instead, it endorsed the provincial government’s offer to dispose of biodegradable waste at a discount tipping fee. Although many LAs facing crisis-level issues in waste management resort to securing alternative land for MSW disposal, MMC concluded that improvement of the disposal site itself would be necessary. It was also convinced this course of action, despite the inherent challenges in attempting to bring about behaviour shift in its citizens, could offer

new opportunities for introducing source-segregated waste collection.

Awareness campaigns and transparency of the programme helped to increase community cooperation. For example, the leaflets and posters used in public awareness campaigns provided details of the historical environmental issues and public protests at Karadiyana site, which led to citizens cooperating in the new programme. While the level of cooperation was very low at the outset since awareness in itself was not sufficient to change disposal habits, after the introduction of special waste bins for collection by MMC, levels of cooperation gradually rose in the residential area. Another key aspect to its success was the proper implementation of legal provisions, enabling fines to be issued to illegal waste disposers.

Further, levels of source segregation were raised without the need to resort to expanding the workforce or use of more vehicles, owing to MMC’s decision to allow municipal workers to collect and sell the recyclable waste. Through this decision workers became more motivated in their work and made extra efforts to inform waste generators of appropriate separation.

## 3 KATARAGAMA PRADESHIYA SABHA

### 3.1 Background

Kataragama Pradeshiya Sabha (KPS) is located in Monaragala district, Uva Province of Sri Lanka, 228 km southeast of Colombo, the capital. It has a land area of 607.92 km<sup>2</sup>, of which only about 25% is inhabited by a population of 19,349 (5,389 households), with the remainder comprising forests and scrubland. Since KPS is located at the entrance to Yala National Park, a well-known safari tourism destination, and due to the presence of popular shrines for visiting Buddhist-Hindu pilgrims, its floating population normally expands over the long weekends and vacation periods (April, August and December), and tops 50,000 at its peak between July and August during the *Katharagama Dewala Perahara* festival (Figure 3-1).

As a fast-growing township of large rural area, together with its status as historic, religious and tourist destination, KPS struggled to manage the large quantities of waste produced, owing to insufficient resources and treatment facilities, leading to waste being dumped near forest boundaries. During the high season for tourism, waste generation rose to 60 MTPD (i.e., 25 tractor loads/day). Despite the assistance provided by the Physical Planning Department (affiliated with the Ministry of Housing and Construction) for religious institutes to collect all post-worship waste such as food and fruit offerings from religious sites, almost all waste from religious sites, households, tourist hotels,



<b>District</b>	Monaragala
<b>Size</b>	607.92 km <sup>2</sup>
<b>Topography</b>	Flat terrain (approx. 48 m above MSL)
<b>Land use</b>	Forest & scrubland (> 75%)
	Home gardens & built-up lands
<b>Population</b>	Residential 17,401 (2016)
	Floating 10,000/day on ordinary days, rising to > 50,000 during religious festival season
<b>Dwellings</b>	4,818 (2016)
<b>Waste generation</b>	14–16 MTPD (estimated)
<b>Waste collection</b>	12 MTPD (estimated)

Figure 3-1 Location and description of Katharagama Pradeshiya Sabha



Figure 3-2 Waste disposal site of Kataragama PS in 2015 (Source: Author)

guesthouses and commercials ended up in several open dumpsites, the largest being Galapitayaya. Prior to 2019, when improvements were made, wild elephants used to travel to the forest boundaries in search of waste food (Figure 3-2).

### 3.2 Initiative I

A number of interventions were made by KPS to reduce the risks resulting from environmental pollution. One involved a Swedish NGO, in 2013, during the time a master plan was being drawn up for solid waste management. The NGO, Alliance for Appropriate Technology Exchange, funded the establishment of a Waste Management Centre (WMC), which comprised a small composting facility (capacity: 0.35 MTPD), a biogas facility (capacity: 5 Kg/day) and a recyclable collection centre near the Galapitayaya dumpsite. Despite its small capacity, KPS had to employ as many as 12 labourers to sort the 4.5 MTPD (three tractor loads) of mixed waste, which was highly inefficient and costly.

To reduce the labour cost, KPS distributed leaflets to citizens to request cooperation on waste segregation at source and donated plastic bins for this purpose. However, the citizens instead used the bins for cooking and washing. Thus, in 2014 the first attempt in waste separation failed owing to poor planning. KPS was therefore forced to continue sorting recyclable and biodegradable waste at the WMC in order to reduce amounts of waste being disposed of at the dumpsite.

The next intervention from KPS came in 2015, when it initiated a pilot project for source-segregated waste collection (biodegradable and non-biodegradable). It was designed to cover two residential areas (Areas B and C), and received financial and technical support from an NGO, Hambandotta Social Mobilization Development Foundation (H-SMDF). Table 3-1 illustrates the door-to-door waste collection schedule that KPS introduced in 2015. Two major townships (Area A and Sellakataragama) were excluded by KPS on the assumption that implementation would be challenging in the commercial centres due to the high numbers of visiting pilgrims.

Table 3-1 Waste collection schedule of KPS in 2015 (JICA, 2016)

Zone	Type of waste	Frequency
Area A and Sella Katharagama	Mixed waste	Daily
Area B & C (pilot project)	Biodegradable waste	Twice a week
	Non-biodegradable waste	Once a week

According to a follow-up survey conducted by JICA in 2015, biodegradable waste accounted for about 57% of total waste, of which only 25% was collected separately (JICA, 2016). The remaining 75% of total biodegradable was not segregated and often disposed of at the dumpsites. Though KPS extended great efforts throughout the time to promote source segregation, progress was severely hampered by the lack of continuity, human and physical resources, and planning, all of which resulted in a lack of public cooperation. Most of the waste therefore continued to be disposed of at the dumpsite until 2017.

### 3.3 Initiative II

The second initiative involved the Central Environmental Authority (CEA) in a three-year project titled "Pollution Control and Reduction of Environment Burden in Solid Waste Management (ReEB Waste)", with financial and technical support from JICA. Its aim was to raise the level of MSW management in three cities – Kataragama PS, Rathnapura MC and Kurunegala MC (2017-2019) – by means of 1), promoting 3R (Reduce, Reuse and Recycle), 2) establishing a sanitary landfill site at Galapitayaya in

Table 3-2 Demography of MSW management divisions of KPS

MSW management division	Population (2016)	Demography and land use
Sella Katharagama (Ward 2)	2,037	Small township with a Hindu temple, situated 4 km away from main city. Several logging facilities, shops, and households.
Katharagama (Ward 3) & Kataragama New Town (Ward 7)	3,666	Main township with a mixture of logging facilities (hotels, restaurants, guest houses, homestays), shops, service centres (banks, public institutes, etc.) and households.
Detagamuwa (Ward 6)	4,662	Mainly a residential area, with several logging facilities and shops along two main roads
Kandasurindugama (Ward 5)	4,287	Mainly a residential area.
Karavile (Ward 1) & Mylagama (Ward 4)	4,786	Mainly a residential area with several logging facilities and shops along the main road.

KPS, and 3) improving the capacity and operations of an existing composting facility at Ratnapura MC and KPS. Based on the recommendations and assistance received through the project, KPS developed a new MSW management master plan that emphasized the need to establish both the basic infrastructures for waste recycling and disposal as well as implementation of source-segregated waste collection.

One step of the project involved conducting a waste composition survey at the start of the newly developed source segregation programme, in early 2017. This was designed to cover public opinion and knowledge of 3R, as well as a need assessment of residents and commercial owners on waste separation (Sato et al., 2020). The study revealed that only half of kitchen waste was collected as source-segregated biodegradable waste, and that the remaining kitchen waste and all other types of waste were disposed of unsegregated. It further revealed that, while over 99% of citizens had a basic understanding of separating waste such as into perishables and non-perishables, less than 15% (households, managers and owners of hotels and accommodations, shop owners, vendors, etc.) had a correct understanding of source separation rules, waste categories, and separate disposal (ReEB, 2019). Even workers or officers of KPS failed to demonstrate a full understanding of the purpose and means of waste separation. Therefore, aiming at raising the overall level of understanding, KPS, CEA and JICA experts collectively agreed to plan awareness-raising activities to ensure a thorough understanding of both the *How* and *Why* (method and purpose) of waste separation.

Subsequently, KPS's seven wards were divided into five waste management divisions based on population characteristics, type of activities and road infrastructure

(Table 3-2).

Source separation was introduced step by step, the first of which aimed at implementing waste separation using two categories, biodegradables and nonbiodegradables. KPS, with expert assistance from JICA, developed a visually appealing instructional leaflet for distribution among waste generators. It explained the purpose and methods of separation using illustrations and photos, thus enabling even those of low literacy to easily follow the instructions (Figure 3-3). The community was then informed, by KPS workers, of the new collection scheme using the created leaflet through door-to-door visits, community meetings and billboards in residential areas and at roadsides.

Other efforts included awareness-raising campaigns organized in schools, government offices, and companies, as well as field tours, organized by KPS, which invited citizens to Galapitayaya waste management facility (composting, material recovery and landfilling) to learn about facility improvements. After the field tour, citizens who attended voluntarily pass on their knowledge of the purpose of and need for source separation to their neighbours. All community meetings were also held in the presence of Environmental Police and PHI, who gave explanations of the waste disposal rules and laws that enable the police to take legal action against cases of infringement.

To target the nearly two million pilgrims visiting Kataragama during the festive season from July to August, KPS launched a media campaign in early July 2018, involving national TV, ads in national newspapers and billboards on roadsides, calling on all pilgrims to avoid the use of plastics bags and



Figure 3-3 Samples of leaflets developed for promoting 3Rs at KPS (Source: KPS)

bottles and to use proper bins for segregated waste. Afterwards, it was also revealed that the visitors had cooperated with KPS citizens in source-segregated waste disposal.

Further, waste collection and transportation were improved by raising the number of weekly collections to 4 days/week for biodegradable waste and 3 days/week for non-biodegradable waste. KPS labourers were instructed not to collect non-separated waste during waste collection, and were provided full support from PHIs and Health overseers in dealing with difficult households. The ward's field coordinators maintained a state of constant vigilance and monitoring to improve the level of source-segregated waste collection.

### 3.4 Progress

Figure 3-5 shows the historical change in amounts of waste received at the Galapitayaya disposal site from 2017 to 2019. It should be noted that the target area was expanded twice at the Step 1 and 2, and also that



Figure 3-4 Billboard on roadside (Source: Author)

KPA accepted waste from neighboring LAs in times of emergency. Therefore, the total amount of waste fluctuated over these three years.

The overall amount of waste amount disposed of at the disposal site showed little variation prior to and during the Step 1, except for between December 2017 and January 2018 when the neighboring LAs had to deliver waste to Galapitayaya due to an emergency. Large amounts of waste were generated in July and August, coinciding with the pilgrim visits

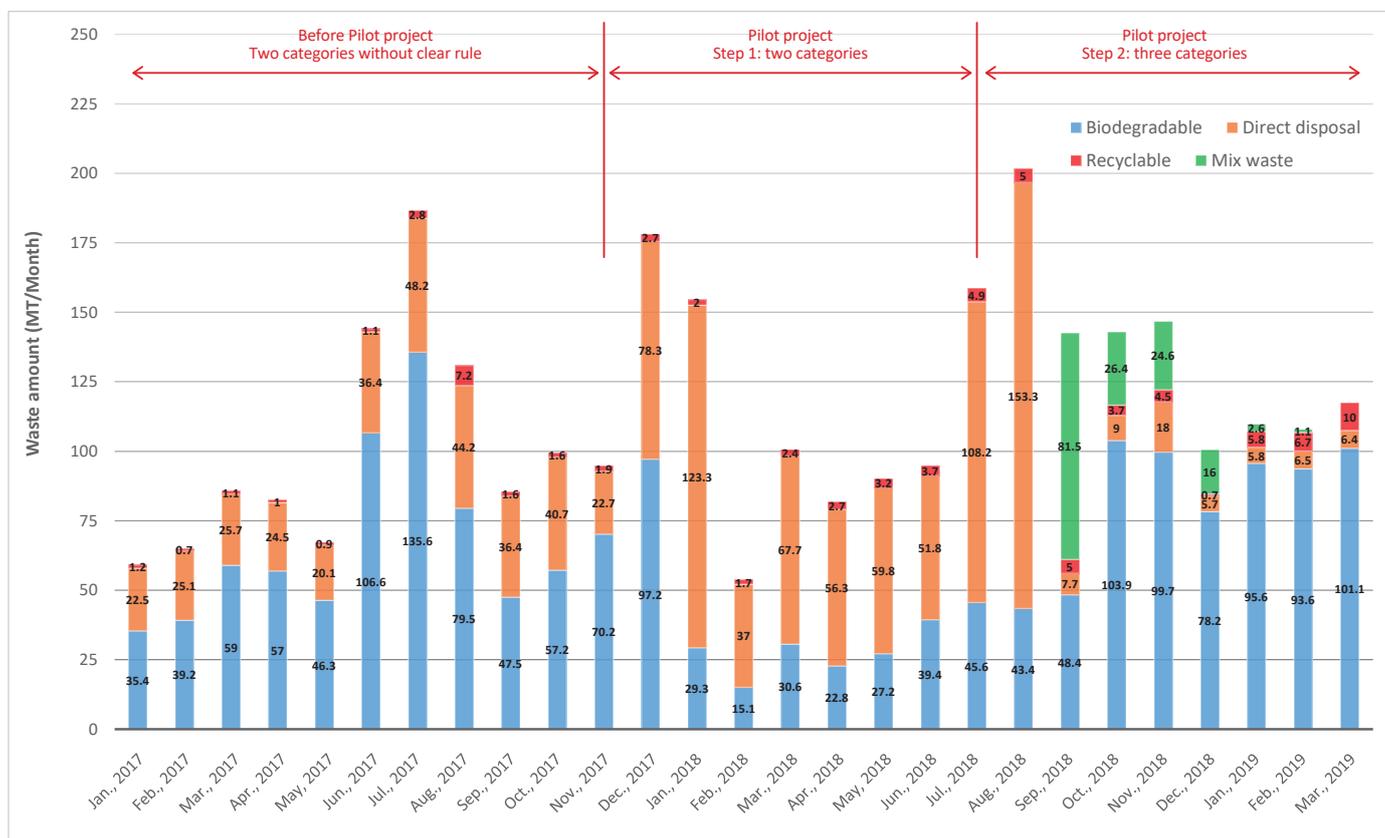


Figure 3-5 Quantitative assessment of waste disposal and resources recovery 2017–2019 by KPS (Sato et al., 2020)

to the city. A large reduction in biodegradable waste is observed from December 2017 to February 2018, after the introduction of the two-category separation rule in November 2017 as part of the Step 1. The segregated biodegradable waste was treated at the upgraded composting facility. According to the results of a waste composition survey carried out in June 2018, it was found that 99.7% (wet weight basis %) of biodegradable waste and 97.9% (wet weight basis %) of non-biodegradable waste was accurately separated in the two wards. The segregated biodegradable waste was found to be mostly free of non-biodegradable waste (inorganics, paper, etc.) and only a small fraction (2%) of biodegradable waste was present in the non-biodegradable waste collection, which proves that the actions taken by KPS in raising public awareness produced the results anticipated within eight months.

A few months after the Step 2 began, amounts of biodegradable waste started to rise again, which resulted from the inclusion of waste from other areas where waste generators had not completely adopted three-category separation; i.e., biodegradable waste (mainly kitchen and garden waste), recyclable waste (paper, cardboard, plastic, polythene, metals, coconut

shells, glass) and other waste (non-recyclables and non-biodegradables, and E-waste). After the expansion in target area in the Step 2 period, mixed waste generation reduced significantly while amounts of recyclable waste steadily increased, resulting in a reduction of overall waste disposed of at the KPS disposal site from 40.7 MT/month in October 2017 (before landfill construction) to 35.4 MT/month in October 2018.

In line with the activities carried out in the step-wise approach, changes also took place in the collection and transportation service. Four days of the week were allocated to biodegradable and recyclable waste collection, and waste in other categories was collected once a week. Tractors with two partitions enabled simultaneous collection of biodegradable and recyclable waste. The biodegradable waste was used for composting and the recyclable waste was further segregated into over 13 categories by KPS labourers at the resource recovery centre at Galapitayaya. The remaining residual waste was delivered to the new sanitary landfill designed for residual waste disposal. As of the end of 2018, KPS had fully implemented three-category separated waste collection in all wards.

### 3.5 Supportive activities

The most recent public opinion survey, conducted at the end of the ReEB Waste project, clearly showed that the targeted population had a clear understanding of waste separation and source segregated waste disposal, which had been realised through ongoing awareness, education, and monitoring practices. Environmental awareness was raised among schoolchildren and the community as well through trainings, information sharing, and so on.

To facilitate waste separation, KPS distributed subsidized purchase of biodegradable waste collection bins (50% below market price) to those in pilot project areas requesting them. Financial support for the programme was received from Ministry of Local Government, Provincial Councils and the ReEB waste project. Business premises (mainly hotels and guesthouses) and households received 45-litre and 20-litre plastic bins, respectively, and by January 2019 a total of 45 bins had been purchased by households. Public willingness to share the cost burden is a strong indicator that the source separation programme was appreciated by the waste generators, and further, that the reforms would be accepted and complied with. It also helped strengthen the bonds between KPS and the community. The cost-sharing strategy adopted helped extend and stabilise the state of KPS's funds.

To draw public attention to and participation in waste separation activities, KPS held a logo and slogan contest in all schools and government organizations in its jurisdiction. The most popular combination, which won, adopted a religiously-themed slogan, "Clean Tomorrow for the City of God Skanda" (Figure 3-6). Use was made of the winning slogan and logo in various promotion and awareness activities throughout the pilot project period.

One of the improvements made to the monitoring system was the indirect benefits for source segregation activity. For example, installation of a low-cost GPS monitoring system for collection vehicles enabled the KPS office to check the location of collection vehicles in real time and attend to any issues or problems related to the workers or waste generators, but also identified other issues such as road traffic for rerouting of vehicles, which improved logistical aspects at the KPS office. The installation of a weighbridge in early 2017

කදඳෙව් පුරවරයට  
සුපිරිසිදු හෙට දිනක්  
கந்தனின் நகரம்  
தூய்மையின் சிகரம்

Clean Tomorrow  
for the City of God Skanda



Figure 3-6 Wining logo and slogan of the project

enabled the KPS office to accurately record amounts of waste received at Galapitayaya WMC, which in turn helped evaluate the source segregated waste collection. Data collected from both the GPS system and weighbridge were also used for planning and administrative tasks.

### 3.6 Current Waste Collection

KPS currently employs a female WMC supervisor to manage resource recovery and landfilling activities while a male health supervisor and labour supervisor assist in labour management. The waste collection corps consists of 22 permanent labourers (18 male and 4 female), and 13 casual labourers (6 male and 7 female). Female casual labourers are usually employed for composting and resource recovery activities at WMC. The waste collection, street sweeping, and handcart collection are performed by 18 workers, and the remaining are employed at WMC.

As is generally the case in Sri Lanka's LA-level MSW service sector, males outnumber females in the workforce, especially in the labour category and field duties, owing to the heavy physical demands involved. However, there are exceptions, such as the female supervisor who manages a workforce of 12 male and 5 female staff in the KPS resource recovery centre. Fully trained in landfill management, recycling activities, composting, data management and administration tasks by the ReEB, she works alongside the labourers and attends to many of the administrative duties of KPS. She has exemplary management skills and a cooperative nature as a supervisor, and her keen interest in proper waste management is one of the key factors behind the success in waste management in KPS.

Six 4-wheel tractors, and one 2-wheel tractor are allocated for waste collection. In general, collection workers start work at 7:00 am and all collection vehicles are dispatched according to a schedule, shown in Table 3-3. The collection areas of KPS were mainly decided based on vehicle access, thus the main collection routes are major roads and streets. Narrow or congested collection areas in the town are connected to main routes by using handcarts. Door-to-door collection is the main collection method used; however, four handcarts, each operated by two workers are employed in the town centre.

Regarding the status of waste collection workers in society, due to ingrained attitudes they have only received low recognition (JICA, 2016). However, all labourers at KPS are protected by KPS officers from discrimination and ill-treatment. Instances where KPS labourers may rightfully refuse to accept unsegregated waste represent a good opportunity to deal with any attitude issues on the part of waste generators. Support received from the administration staff to resolve problems in the community as well as issues related to the bylaws affecting proper waste disposal encourages workers in their duties and instills a sense of self-respect.

### 3.7 Outcomes and Lessons Learned

This case study demonstrates that comprehensive analysis, proper planning, appropriate use of financial

and technical supports from external organizations (ReEB experts), as well as high level of commitment of LA officers and workforce together led to a complete transformation of KPS’s waste management system. The dedicated nature of KPS leadership as well as methods used to mobilize resources efficiently and effectively paved the way to success in the source segregation programme within a short period.

LAs in Sri Lanka often fail to sufficiently plan and implement appropriate source separate collection systems or infrastructure for recycling, composting and proper final disposal. KPS was no exception at the inception of its integrated waste management plan in late 2017. It failed to secure public cooperation owing to the lack of improvement in collection, resources recovery as well as conditions at dumpsites. The infrastructure required for recycling and composting was also insufficient. Further, awareness raising programs were often executed with little planning, such as simple leaflet distribution and announcement, and neglected KAP (knowledge, attitude, practice) assessments of the needs of target groups. This was one of the reasons behind KPS’s failure to secure full cooperation from the public prior to 2017. The case study shows that KAP analysis was as important as waste data collection to plan awareness-raising activities and develop materials. It is also important to conduct regular monitoring and evaluation on awareness-raising programmes to gauge the impact of methods and materials used in the communications.

Table 3-3 Waste collection Schedule

Collection area	Type of waste	Day of collection	Vehicles	No. of labourers
Wards 1, 3 & 4 in Kataragama	Non-degradable	Monday	4-wheel tractors	4
	Degradable, Recyclable	Wednesday, Saturday	4-wheel tractors	4
Ward 2 (Sellakataragama)	Non-degradable	Monday	4-wheel tractor, 2-wheel tractor	3 2
	Degradable, Recyclable	Wednesday, Saturday	4-wheel tractor, 2-wheel tractor	3 2
Wards 5, 6 & 7 in Kataragama	Non-degradable	Friday	4-wheel tractors	4
	Degradable, Recyclable	Tuesday, Thursday, Sunday	4-wheel tractors	4
Kiriwehera road	Non-degradable	Friday	4-wheel tractor, 2-wheel tractor	3 2
	Degradable, Recyclable	Thursday, Sunday	4-wheel tractor, 2-wheel tractor	3 2

## Acronyms

Acronyms	Complete name
CEA	Central Environmental Authority
GDP	Gross Domestic Production
LA(s)	Local Authority (ies)
MC	Municipal Council
MSW	Municipal Solid Waste
MTPD	Metric Tonnes Per Day
PHI	Public Health Inspector
UC	Urban Council
USD	United States Dollar
WMC	Waste Management Centre

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