



CLEAN CITIES, BLUE OCEAN

Initial Solid Waste Management Assessment (ISWMA) | Sri Lanka and the Maldives



Submission Date: December 18, 2020

This assessment was produced for review by the United States Agency for International Development by Tetra Tech under the Clean Cities, Blue Ocean program.

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This assessment was produced for review by the United States Agency for International Development by Tetra Tech, through USAID Contract No. AID-OAA-I-14-00059/7200AA19F00016, USAID Clean Cities, Blue Ocean Program.

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Note: This report was developed by Clean Cities, Blue Ocean to inform the program's approach. The report was developed through desk research and represents the best available data accessible to the program.

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Acronyms and Abbreviations

3Rs	Reuse, Reduce, and Recycle
ASL	Aruwwakalu Sanitary Landfill
BUC	Boralesgamuwa Urban Council
CCBO (USAID)	Clean Cities, Blue Ocean
CEA	Central Environmental Authority
CMC	Colombo Municipal Council
COWAM	Construction Waste Management
DMMC	Dehiwala-Mount Levinia Municipal Council
DS	Divisional Secretariats
EPR	Extended Producer Responsibility
GMC	Galle Municipal Council
GN	Grama Seva Nildaris (<i>village within MCI/UCIPC</i>)
ISWMA	Initial Solid Waste Management Assessment
JICA	Japan International Cooperation Agency
JMC	Jaffna Municipal Council
km	Kilometers
KTS	Kelaniya Transfer Station
LA	Local Authority
MC	Municipal Council (First Tier level local legislative body)
ME&NR	Ministry of Environment & Natural Resources
MEPA	Marine Environmental Protection Authority
MRF	Material Recovery Facility
MT	Metric Tons
MVR	Maldivian Rufiyaa (currency)
MWRP	Municipal Waste Recycling Program
MWSC	Male' Water & Sewerage Company
NGOs	Non-Governmental Organizations
PET	Polyethylene Terephthalate
PHED	Public Health Engineering Division
PS	Pradeshya Sabha (Third Tier level local legislative body-rural)
RDF	Refuse Derived Fuel
RRC.AP	Regional Resource Center for Asia and the Pacific
SLR	Sri Lankan Rupee
SWM	Solid Waste Management
SWMD	Solid Waste Management Division
TPD	Tons Per Day
UC	Urban Council (Second Tier level local legislative body)
ASAIID	United States Agency for International Development
USD	US Dollars
WAMCO	Waste Management Corporation Limited
WPWMA	Western Province Waste Management Authority
WMA	Waste Management Authority

I. Introduction

On August 28, 2019, Tetra Tech was awarded the Clean Cities, Blue Ocean (CCBO) Program, a five-year contract from the U.S. Agency for International Development's (USAID) Bureau of Economic Growth, Education, and Environment. CCBO is the Agency's flagship program to respond to the global crisis of marine plastic pollution. The objectives of CCBO are to:

Objective 1: Promote reduce, reuse, recycle (3Rs) and strengthen local and regional markets for recycled plastics

Objective 2: Build social and behavior change for 3Rs and sustainable solid waste management (SWM)

Objective 3: Increase capacity and effective governance of SWM and 3Rs systems; and

Objective 4: Support international fora, public-private partnerships (PPPs), and multi-stakeholder alliances.

As a cross-cutting objective, CCBO also works to support and enhance the livelihoods of those working in the waste and recycling sectors, particularly women, as well as advance gender equality within the sector and opportunities for women's economic empowerment.

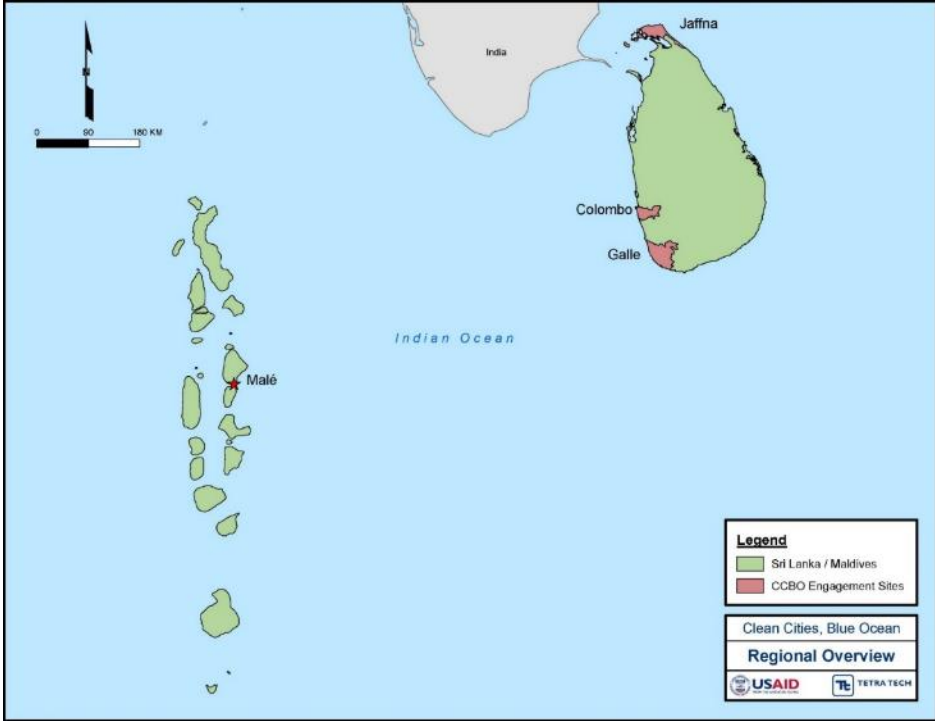
The following presents CCBO's Initial Solid Waste Management Assessment (ISWMA) for the program's four "engagement sites" in the Democratic Socialist Republic of Sri Lanka (Sri Lanka) and the Republic of Maldives (Maldives). Sri Lanka engagement sites include the Colombo Metropolitan Area, Galle, and District of Jaffna. Malé is CCBO's engagement site in the Maldives. CCBO's engagement sites are illustrated in Figure I.

The ISWMA is one of CCBO's first steps in its launch of in-field implementation and will support its engagement sites to create improvements that will lead to sustainable, integrated waste management systems that will help restore the region's natural environment, advance urban planning and management, and improve public health. The ISWMA's main objectives are to:

- Identify the existing components of the solid waste management (SWM) systems in each of the engagement sites;
- Assess and determine those areas that are expected to need improvements;
- Identify additional information that is needed to support implementation for improved systems; and
- Provide recommendations which will ultimately inform the program's Year One and subsequent Works Plans as well as local SWM Plans for each engagement site.

Due to the coronavirus pandemic and resulting international travel restrictions, CCBO has developed this report through extensive desk research, utilizing the websites of multiple governmental agencies (state, provincial, and city), institutions, non-governmental organizations (NGOs), news media, Google Earth, and other relevant websites. A full list of sources is included in Section 6. When international travel resumes and local lockdowns are lifted, CCBO plans to update and validate data and findings, as needed, to ensure accuracy and obtain the support and validation from its local partners. It should be noted, that because reported data could not be verified directly by the CCBO team, when data from different sources (including governmental agencies) appeared to contradict each other or were, in our experience, likely inaccurate, it was stated as such in the document.

Figure I. CCBO Engagement Site Map



2. Current Status of Solid Waste Management in Sri Lanka and Maldives

As island nations, both Sri Lanka and the Maldives face unique waste management challenges. Although Sri Lanka is contained to one, larger land mass and the Maldives is spread over 1,200 islands, both share decentralized populations, steady population growth, and limited current governmental and structural frameworks to enable their waste management systems to keep pace with current trends and reduce generation of ocean-bound plastics.

2.1 Sri Lanka

Globally, Sri Lanka is estimated to be the fifth-largest contributor to ocean plastics pollution. As of 2018, its population reached 21.67 million and continues to steadily increase, with its urban centers generating the bulk of the country’s waste. The country’s capital of Colombo generates 10% of the nation’s total waste, although its residents represent only ~2.5% of the national population and live within 1% of the country’s total land area.

2.1.1 Sri Lanka’s National Laws and Regulations Impacting 3Rs and SWM

For over twenty years, Sri Lanka has had a growing body of laws and regulations that have strengthened its approach toward economically and environmentally sound management of solid waste. This began with the National Environmental Act No. 47 of 1980, followed by a series of amendments which included actions

such as:

- Creating the CEA (Central Environmental Authority) to prevent, abate and control pollution through regulation, licensing and education;
- Establishing the Ministry of Environment and Natural Resources with the overall responsibility in the affairs of the CEA, primarily focusing on the integration of environmental issues in Sri Lanka;
- Making roadside and waterway dumping illegal;
- Seeking to establish sanitary landfills but abiding by the waste hierarchy (seen in Figure 2) and encouraging the 3Rs;
- Supporting the “Polluter Pays Principle” and “Extended Producer Responsibility;”
- Making local authorities (LAs) responsible for 3R/SWM collection services; and
- Establishing requirements for licensing for collectors and waste/recycling facilities.



Figure 2. Sri Lanka's Waste Hierarchy¹

In the 1988, in an effort to limit use of plastic in Sri Lanka, amendments to the law provided for greater enforcement authority to prohibited acts of manufacturing products that used certain polythene plastics (polyethylene, polypropylene, polystyrene, polyvinyl chloride, and polyethylene terephthalate) for use within the country.

As concerns over SWM grew, additional documents were created to provide guidance. The National Strategy for Solid Waste Management (NSSWM) put forth by the Ministry of Forestry and Environment in 2000 endorsed the need for integrated SWM and provides the overall guidance for the management of the country’s solid waste. Even though the required framework for developing an appropriate waste management system has been in place for quite a while, SWM in Sri Lanka continues to be chaotic.² A second version of the NSSWM was developed in 2007.

Most recently, in 2019, the Ministry of Environment and Wildlife Resources developed the National Policy on Waste Management (416/C/1, ‘Sobadampiyasa’). This updated policy was designed to establish an agreed upon integrated waste management system by providing more detailed focused direction for policy makers and implementers. It goes into detail about all aspects of the 3R/SWM system and indicates its intention to be closely linked to the UN Sustainable Development Goals as well as climate change mitigation and adaptation. This document provides great detail on the direction the national government

¹ “Why do we need sanitary landfills to manage waste?” Ceylon Digest, September 30, 2019. <https://www.ceylondigest.com/why-do-we-need-sanitary-landfills-to-manage-waste/>

² <https://www.adb.org/projects/51077-003/main#project-pds>

intends to go. Of particular note (to CCBO) is its support for 3R implementation, sound disposal methods, annual reporting requirements, bans on the importation of post-consumer waste, and support for Extended Producer Responsibility (EPR) and the “Polluter’s Pay Principle.” At the time of finalizing this assessment, CCBO was exploring grant agreements with organizations to assist the Ministry of the Environment and the Central Environmental Authority to establish an EPR system in Sri Lanka that is effective and sustainable—in line with national policy.

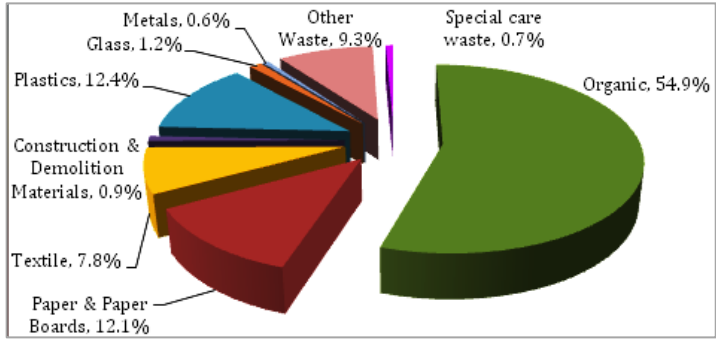
2.1.2 Solid Waste Management Systems and Capacities in Sri Lanka

While actual implementation of 3Rs/SWM practices have been thwarted by civil unrest, and subsequently have not always met the goals established by Sri Lanka’s national policies, progress has been made. This section describes CCBO’s understanding of that progress.

Solid Waste Generation and Characterization

Similar to other countries in the region, Sri Lanka’s waste stream predominantly consists of organic materials. A waste characterization study posted by the Sri Lanka Recyclers Association, determined that about 55% of the country’s waste stream is organics; paper and plastic are the next largest components (about 12% each). Figure 3 shows the full breakdown of Sri Lanka’s waste composition.

Figure 3. Sri Lanka's Waste Composition by Percentage³



Collection

Only a fraction of the total municipal solid waste that is generated in Sri Lanka is collected by the LAs. According to the country’s National Solid Waste Management Report for 2007, the total amount of collected waste in 311 LAs was 2,838 MT (metric tons) per day. Across the country, it is estimated that only 20% of households have access to waste collection services. 47% burn their waste, 23% dispose of it in their communities or natural environments, and about 8% practice backyard composting for organic waste. To contextualize these rates, with the number of households in Sri Lanka forecasted to reach 5.1 million in 2021,⁴ this means that more than 4 million households will not have access to public waste collection services.

While urban collection rates are higher than those of rural areas, even in Colombo, only 75% of waste generated is estimated to be collected.⁵ Sri Lanka’s current collection rates represent an opportunity for

³ Sri Lanka Recyclers Association website.
⁴ Number of households in Sri Lanka from 2013 to 2021, Statista. <https://www.statista.com/statistics/728353/number-of-households-sri-lanka/>
⁵ United Nations Food and Agriculture Association, Food Waste Management in City Region Food System Policy Brief, 2018. <http://www.fao.org/3/CA1110EN/ca1110en.pdf>

increased system efficiency not only in Colombo but also in other rapidly urbanizing population centers.

Markets/End Uses for Plastics and Recyclable Waste

Because Sri Lanka is an island country, there are limited local markets for materials; where they do not exist transporting the materials through export is the only option. This makes the development of local markets very important. Unfortunately, these local markets currently seem to be limited. Given that the largest component of the waste stream in Sri Lanka is organics, a significant amount of resources (over 450 million Sri Lankan Rupees [SLR]) under the Pilisaruru Project has gone into developing large and small-scale compost facilities. These facilities produce soil amendments that are sold into the local market.

Recycling of plastics in Sri Lanka has proven to be difficult due to the lack of local markets that can use the materials as feedstock. The Institute of Policy Studies of Sri Lanka conducted a study of the plastic industry in Sri Lanka. It was determined that because of the lack of a PET bottle manufacturing in the country, the 80 metric tons of PET collected annually was exported (mainly to India). This study indicated that post-consumer PVC and film plastic bags were being recycled. ISWMA research was unable to locate these facilities.⁶



To increase the segregation and collection of recyclable waste materials for marketing, Sri Lanka has developed its National Colour Code (Figure 4)⁷ for on waste management to create a uniform system within the country.⁸

Figure 4. National Color Code for Waste Segregation

Disposal

Waste management has become a priority in the country in recent years following public health threats from high rates of dengue fever, which was partially spread from standing water and breeding grounds resulting from uncollected municipal solid waste. Additionally, the Meethotamulla landfill in Colombo collapsed in 2017, resulting in multiple deaths, bringing escalated attention to the issue of managing waste and improving safety and health issues for waste workers.⁹

Sri Lanka has several sanitary landfills, and there are two engineered landfills—Dompe Sanitary Landfill and Arawakkalu Sanitary Landfill. There are also semi-engineered landfills at Sandatenna in Nuwara: Eliya and Ampara. At present, four more new sanitary landfills have been designed and are awaiting construction.

⁶ Steele & Gunawardena, Institute of Policy Studies of Sri Lanka, "Study on Post-consumer Plastics in Sri Lanka," <https://www.ips.lk/study-on-post-consumer-plastics-in-sri-lanka/>

⁷ https://www.facebook.com/SLRA.srilanka/community/?ref=page_internal

⁸ "Why do we need sanitary landfills to manage waste?" Ceylon Digest.

⁹ Fernando, R. L. S. (2019). "Solid waste management of local governments in the Western Province of Sri Lanka: An implementation analysis." *Waste Management* 84: 194-203.

One waste to energy project is also under construction.¹⁰ Due to the COVID-19 outbreak, it is not clear when this facility will be operational.

Education

Sri Lanka has focused on education as a means of increasing recycling and knowledge of proper SWM in the country. As early as 2007, a documentary titled 'Rata Saru Pilisaru' and a docudrama on 'Balan Kadathura Hera Dese' were produced and action was taken to telecast these programs in the National Rupavahini to raise public awareness of 3R practices and the advantages of sanitary land filling for final disposal of waste. Additionally, a television program titled 'Mr. Green' was created to promote the concepts of reduce and reuse. Programs, focused on schools, have also been produced to introduce resource management and use. Sri Lanka's laws and policies include and provide support for 3R and SWM capacity development.

2.2 The Maldives

Although the Maldives' total land area (115 sq. mi) makes it the smallest country in Asia (roughly the area equivalent to the country of Portugal), it is spread over almost 35,000 square miles, making it one of the most geographically dispersed countries in the world. This dispersion has proven to be extremely challenging for SWM and has led to a number of models being deployed that range from central and regional waste management dump sites, hybrid systems for resorts, and a series of informal practices for local communities. Geologically, the Maldives' islands are composed of coral, which prevents digging a suitably deep sanitary landfill/s.

2.2.1 National Laws and Regulations Impacting 3Rs and SWM

The Maldivian government established legal efforts addressing SWM that have been carried out under the Ministry of Environment and the Environment Protection Agency (EPA). The Ministry provides a top-down approach by implementing and monitoring policies and regulating through legal frameworks, projects and research, and building capacity and necessary infrastructure. Complementary to this, the EPA provides ground level authority through providing approval of SWM plans, permitting related to waste, and monitoring SWM operations. The Ministry of Health, Ministry of Tourism, and Ministry of Foreign Affairs also play roles in national waste management structuring and policymaking. Existing legislation targeting waste management and environmental protection includes Sections 7 and 8 of the Environmental Protection and Preservation Act (EPPA) of 1993 (Act No. 4/93), which provides regulation addressing waste disposal, oil, and poisonous substances, and hazardous/toxics or nuclear waste.¹¹ Additionally, the country implemented the National Solid Waste Management Policy of 2008 which, as of 2015, was revised.

The Policy has eleven main targets accompanied by supporting actions:

- Establish governance structure for solid waste management;
- Hold waste producers accountable for waste they generate;

¹⁰ "Why do we need sanitary landfills to manage waste?" Ceylon Digest.

¹¹ Ministry of Environment, 2019.

- Manage and dispose waste as close as possible to the location of generation;
- Accommodate specific requirements of special waste;
- Base SWM on variable facts on known effective strategies;
- Make the SWM system economically viable through fees, EPR, and a dedicated fund;
- Consolidate legislation to support implementation;
- Facilitate private sector participation and partnership with the government;
- Implement financial incentives to support best practices;
- Discourage harmful goods and unacceptable waste activities; and
- Maximize community participation and awareness.

The country currently is moving towards developing political frameworks for phasing out single use plastic and addressing marine litter.

2.2.2 Solid Waste Management Systems and Capacities in the Maldives

The Maldives generates over 750 tons of waste each day across its more than 200 inhabited islands. In addition to its geography, it has a host of other unique challenges including an extremely limited amount of land to store waste and being home to one of the most densely populated cities in the world (Malé). Therefore, the country has been overwhelmed to not only manage its own domestic waste, but also the marine debris generated from other countries that is carried in by currents. Given the limited choices, Metropolitan Malé and many other islands deposit solid waste on Thilafushi Island which is part of Greater Malé. Thilafushi is a constructed island that serves as an open dump. Unfortunately, much of the waste is managed through open burning, resulting in the highest measured rate of microplastics in the world.

Solid Waste Generation and Characterization

As a region, South Asia has an average per capita waste generation rate of 0.52 kg per day, compared to the global average of 0.74 kg per day. The Maldives has the highest national per capita waste generation rate in region at 1.44 kg per day,¹² however, this can vary between the local systems. The resort industry sees the highest waste generation rate of 2.5-3.5 kg per person per day, compared to 0.8-1.0 kg per person per day in inhabited islands, and 0.8-2.48 kg per person per day in the nation’s capital, Malé.

Based on current population estimates for the country, approximately 206,000 metric tons of waste are generated annually in the Maldives. Both the tourism and fishing industries are expected to grow and so waste associated with these sectors may be a key concern to sustainable

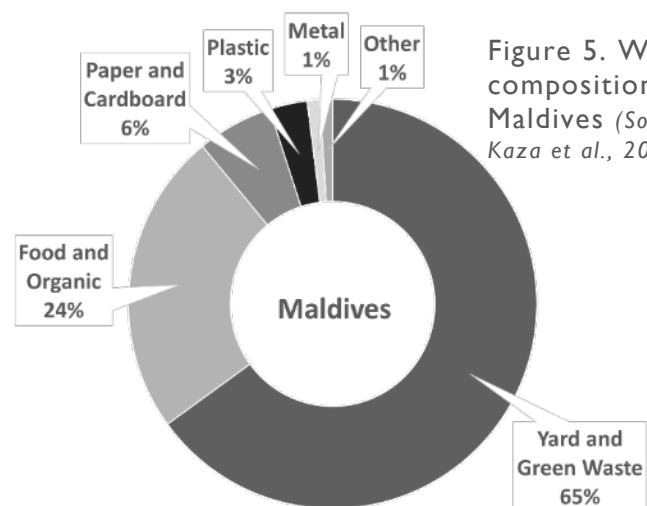


Figure 5. Waste composition in the Maldives (Source: Kaza et al., 2018.)

¹² Kaza, S., L. Yao, P. Bhada-Tata, F. Van Woerden and K. Ionkova (2019). What a waste 2.0 : a global snapshot of solid waste management to 2050, World Bank Group.

marine environment management.¹³ From a waste composition perspective, the Southeast Asia has a regional average plastic composition of 7.8%, which is lower than the world average of 12%.¹⁴ Comparatively, the Maldives plastic composition is much lower than the regional average at 3% (Figure 4). Composition differs between the general Maldivian population and the resort industry, with recyclables (including metals and plastics) making up 5% of the tourism industry waste stream.¹⁵

Collection

The Maldives has a particularly unique challenge due to the dispersed geography and populations there which are spread over an average distance of 860 km.¹⁶ Most residents live in Malé, while the remaining islands typically have less than one thousand people inhabiting them, and another 100 islands are dedicated to tourist resorts and activities.¹⁷ Because of this, the waste management system in the country is disparate and dependent upon the location within the nation. Little information is available regarding waste collection coverage in the country. Regionally, the Southeast Asian region has a waste collection rate of 51 percent. In urban areas, this rate increases to 77 percent, but this can vary by country and city, and rural area coverage is considerably less at 40 percent.¹⁸ Only 38.2 percent of the Maldives' population's waste is collected, and this is usually through a paid service that comes door-to-door,¹⁹ but is often not regular.²⁰ The state-owned waste management service, Waste Management Corporation Limited (WAMCO), was recently revived in 2015 and serves the main urban settlements of the country including Malé Region, Hulhumalé, Addu City, and Fuvahmulah City.²¹ In the less populated islands, waste is either collected by island councils and community operators or is taken to designated disposal sites or Island Waste Management Centers (IWMCs) by households themselves.²² There is little published data on the informal sector in the Maldives, however, in the city of Fuvahmulah, it has been documented that 100 percent of waste is collected by informal waste pickers.²³

Markets/End Uses for Plastics

Recycling of plastics in the Maldives is particularly challenging, largely due to the distance and cost to transport materials to end markets. Sri Lanka, the nearest country that uses post-consumer plastic as a feedstock, is about 500 miles away. It is also challenging to aggregate sufficient quantities of plastics to support local manufacturers that might use recyclable material as feedstock. The Maldives has had about 30 years of information, education, and communication campaigns for 3R/SWM, as well as environmental education in schools, but this approach has not succeeded.

¹³ Stevens, G. M. W. and N. Froman (2019). Chapter 10 - The Maldives Archipelago. *World Seas: an Environmental Evaluation* (Second Edition). C. Sheppard, Academic Press: 211-236.

¹⁴ Kaza et al., 2018.

¹⁵ The World Bank (2016). Maldives Clean Environment Project (PI60739)

¹⁶ Malatesta et al. 2015.

¹⁷ Saliu, F., S. Montano, M. G. Garavaglia, M. Lasagni, D. Seveso and P. Galli (2018). "Microplastic and charred microplastic in the Faafu Atoll, Maldives." *Marine Pollution Bulletin* 136: 464-471.

¹⁸ Kaza, S., L. Yao, P. Bhada-Tata and F. Van Woerden (2018). What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. *Urban Development Series*. Washington, DC, World Bank.

¹⁹ Pucino, N. (2016). "Wastes in Paradise."

²⁰ World Bank (2020). Maldives Development Update, June 2020 : In Stormy Seas. Washington, DC, World Bank.

²¹ Wong, S. L., N. Ngadi, T. A. T. Abdullah and I. M. Inuwa (2015). "Recent advances of feed-in tariff in Malaysia." *Renewable and Sustainable Energy Reviews* 41: 42-52.

²² Ministry of Environment, 2019.

²³ Kaza et al., 2019.

Disposal

Just as the rates of waste generation differ among local systems, the way in which waste is managed also varies across areas of the country (see Table 1). However, as a whole, the Maldives' waste management system exists in three main parts: 1) central and regional waste management dumpsites; 2) hybrid systems implemented by resorts; and 3) informal waste management practices followed by local communities.²⁴

Table 1. Overview of solid waste management systems and practices in the local systems of the Maldives. (Source: Malatesta et al., 2015)

Solid Waste Management Systems and Practices	Inhabited Islands	Urban Settlements	Uninhabited Islands	Resorts
Dumpsite and open-air burning	Majority	No	Yes	No
Onsite incinerator	Few cases	Planned	No	Yes
Waste treatment	Few cases	Few cases	No	Yes
Waste reuse or recycle	Majority	Few cases	No	Yes
Shipping to Central or Regional sites	Very few cases	Yes	Yes	Yes
Organic fraction dumped in the sea	Majority	Yes	Yes	Yes

In the Maldives, most waste (63%) is reportedly disposed of via waterways and marine environments. Being that it is a small island nation, in this case, this is likely direct disposal in the ocean. Notably, one of the main waste disposal locations is an artificial island called Thilafushi which serves as a non-engineered landfill, and so much of the waste deposited there has the potential for direct disposal into the sea. Small fractions of the waste stream are managed via a few other ways according to the World Bank: composting (7%) and incineration (6%), respectively. The remaining 24% is reportedly managed via burying (17%) and burning (7%).²⁵ Recyclables like metals and plastics typically only make up a small fraction (3%) of the waste that is burned.²⁶

In the last decade, and particularly in the latter half, a significant amount of international donor and bank funds have been channeled toward the Maldives' 3R/SWM challenges. In 2018, for example, the Asian Development Bank (ADB) launched a \$35 million grant and \$38 million loan program for the Greater Malé Project to establish a Waste-to-Energy facility. This ADB project will also close Thilafushi open burning and replace it with a sanitary landfill. The \$73 million package was also supported by additional funding from the Japan Fund for the Joint Crediting Mechanism (\$10 million grant) and the Asian Infrastructure Investment Bank (\$40 million loan). The World Bank is working on a different initiative to address this challenge in the Maldives and has pledged \$17.5 million for the Maldives Clean Environment Project (project through 2023) to improve SWM in select zones within the Maldives. This commitment is part of the roughly \$70 million dollars World Bank has committed to the Maldives.

²⁴ Malatesta et al., 2014, Malatesta et al., 2015.

²⁵ Kaza et al., 2018.

²⁶ Malatesta et al., 2015.

3. Current Status of 3R/SWM in CCBO Engagement Sites

3.1 ISWMA Summary

Through this ISWMA, high-level information has been gathered on each of its engagement sites in Sri Lanka and the Maldives, covering governance, waste generation, recycling, resource recovery, disposal, and related supporting education and outreach. The ISWMA provides information not only on current capabilities but identifies critical gaps that should be filled and presents related recommendations and next steps. The following summary provides a brief overview of the system capacities and gaps found across the engagement sites.

Waste Generation and Processing

Across each of the sites, annual waste generation ranges from 120,000 to 600,000 tons, with waste generation increasing in line with population sizes with the exception of Malé (see Table 2). Malé’s per capita waste generation is much higher than those found in Sri Lanka, which is likely attributable to the significance of its tourism industry.

Table 2. Baseline Waste Generation Estimates Across CCBO Engagement Sites

CCBO Engagement Sites	Local Authorities (#)	Population (2015) ²⁷	Per Capita (lbs./day)	Waste Generation (Tons/Year 2020 Projection) ²⁸
Colombo District	12	2.6 million	0.9 to 1.9	600,000
Galle District	20	1 million	0.9 to 1.0	200,000
Jaffna District	17	580,000	1.4	120,000
Malé	1	177,000	5.5	176,000

In the following section, because CCBO was unable to travel to the sites, many of the operations/facilities listed below were found using Google Earth and Maps, which provided visual examples of what waste management facilities looked like at each of the engagement sites. Registered business records also provided listings of these operations/facilities. Facilities/operations listed in Table 3 are only those that were identified as formal and/or established facilities/operations.

²⁷ Note: In conducting the ISWMA, multiple data sources were found with significant variation in estimates, projections, and calculations. In these cases, the Tetra Tech Solid Waste West research team calculated projection estimates based on the most recent and consistent data available. See Sections 3.2, 3.3, 3.4, and 3.5 for multiple sources.

²⁸ See Sections 3.2.2, 3.3.2, 3.4.2, and 3.5.2 for multiple sources and Tetra Tech Team calculations.

Table 3. Existing Operations/Facilities at CCBO Engagement Sites

CCBO Engagement Sites	Recycling Center – Processing/Exporter (#)	Transfer Station (#)	Material Recovery Facility (#)	Organics Processing (Composting) (#)	Waste-to-Energy Facility (#)	Dump (#)	Intermodal Facility (#)	Sanitary Landfill (#)
Colombo District	(4) - Sampath Piyasas - Collection Center CMC - Eco-Kiosk Torrington - SWM Depot CMC	(2) - Kelaniya - Name not available	(2) - Karadiyana - Mihisaru	(3) - Kaduwela - Name not available - Name not available	(2) - Colombo WTE - Karadiyana	(5) - Karadiyana - Kerawalpitiya - Kotikawatta - Meetotamulla® - Bloumendhal®	(1) - Kelaniya	(2) - Green Park - Aruwakkalu
Galle District	(2) - Thalpe - DNP-ECO	0	(1) - Baddegama Pradeshiya Sabha	(1) - Monroviawatta	(0)	(3) - Mahamodara - Monroviawatta - Koggala	(0)	(0)
Jaffna District	(1) - Jaffna	0	(1) - Russell Square	(0)	(0)	2 - Kallundai - Kakaithivu (Chippitharai)	(0)	(1 proposed) - Keerimale
Malé	(0)	(2) - Male Hulhulmale - Male	(1) - Name not available	(0)	(0)	(1) - Thilafushi	(0)	(0)

3.2 Colombo District

Colombo District is located in the Western Province of Sri Lanka (as shown in the previous section in Figure 1). The district’s administrative structure has 13 *Divisional Secretariats Divisions* (DS Divisions), as shown in Figure 5, and is further sub-divided into 566 *Grama Niladhari Divisions* (GN Divisions) or villages.

The local government is the lowest level of government in Sri Lanka after the central government and provincial councils. The local government bodies are also known as the local government authorities (LAs), which are responsible for providing public services, including SWM. The local authorities of Sri Lanka are divided into three groups: municipal councils, urban councils, and divisional councils (preshiya sabha or pradesha sabhai).

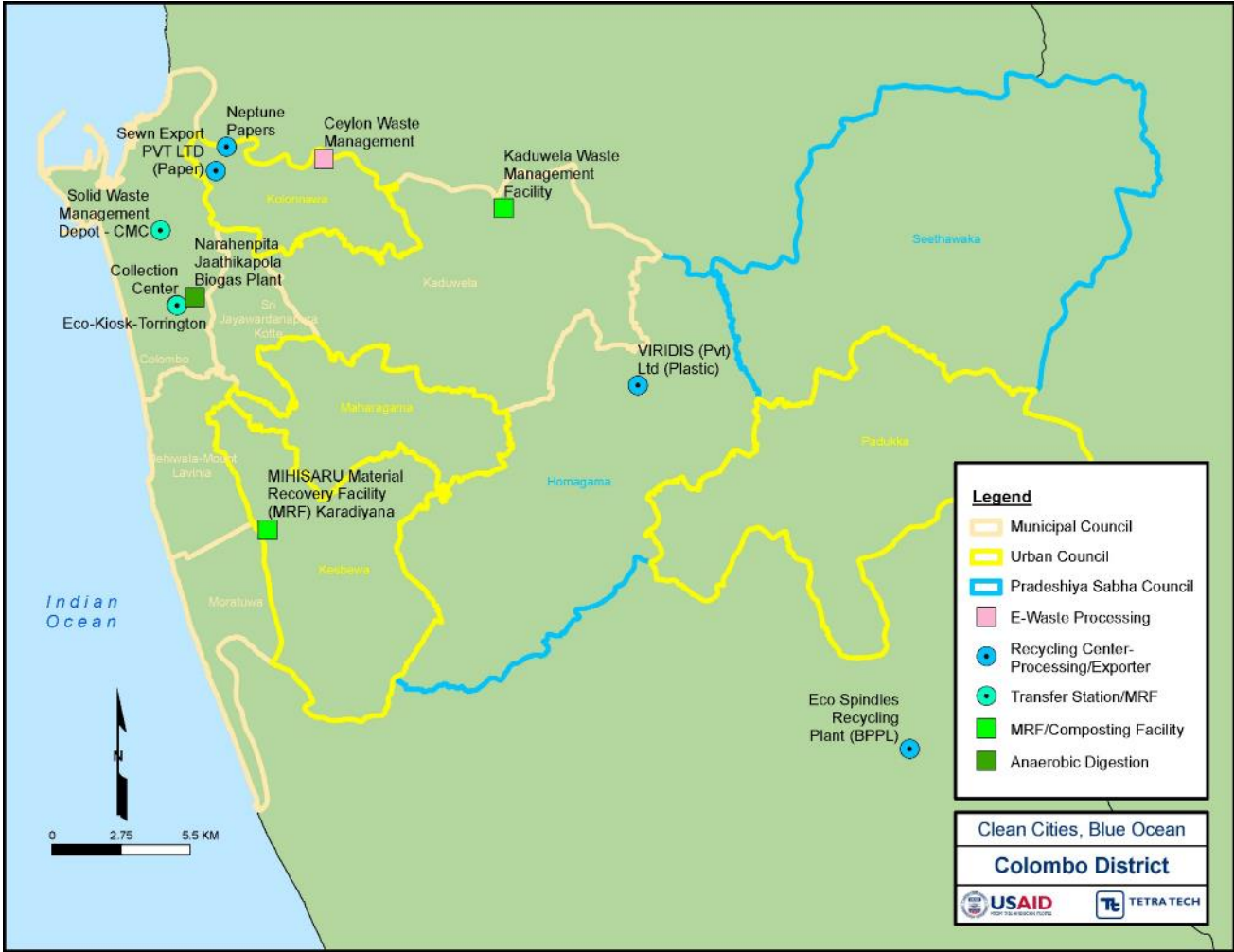
Colombo District is comprised by the Colombo Municipal Council (CMC) and other peripheral municipalities, urban councils, and Praheshiya Sabhas. The area of the City of Colombo is approximately 14 square miles (sq. mi.) with a population density of 52,000 people per square mile. As such, the City of Colombo’s population density is approximately 50 percent higher than that of New York City (approximately 28,000 people per sq. mi.), the most populated city in the U.S.

Both the administrative capital (Sri Jayawardhanapura Kotte) and the commercial capital (City of Colombo) are situated in Colombo District. The western portion is more highly urbanized than the eastern portion. The District’s economy is supported by the activities surrounding the Port of Colombo. Due to its strategic location in the Indian Ocean, the port serves as an important terminal in Asia. It is also the largest port in Sri Lanka and is one of the busiest ports in the world. Because of this, the Colombo District—with an estimated population of approximately 2.3 million²⁹—was officially recorded as having the highest income on average per household in Sri Lanka in 2016.

The Kelani Ganga River forms the Northern and North-Eastern border of the City of Colombo and stretches from the Sri Pada Mountain Range to Colombo. The river is used for transport, fisheries, sewage disposal, sand mining, and hydroelectricity. sand mining and for production of hydroelectricity.

²⁹ Department of Census and Statistics, Sri Lanka.

Figure 6. Map of Colombo District and Waste Management Operations



3.2.1 Governance

Waste Management Authority Western Province - The Western Province’s Waste Management Authority (WMA) was established in 2004 by the Western Provincial Council to assist local government institutions to protect, improve and manage the environment of the Western Province under statue No. 09 of 1999. To further strengthen the legal status on Waste Management, the statute was amended as No. 01 of 2007 - Solid Waste Management. Rules No 01 of 2008 were introduced via the Extraordinary Gazette No 1560/6 in July 2008 to get the legal support to implement the seven management steps. The WMA supports the region through the establishment and continuous improvement of appropriate waste management streams and strategies in the Western Province in collaboration with the central government and the provincial councils. The WMA currently manages the Karadiyana dump site and has been part of the development of the Colombo South Waste Processing Facility, a waste-to-energy plant currently being built adjacent to the Karadiyana dump site.

Councils/Divisional Secretariats - As part of the ISWMA the following Municipal Councils, Urban Councils, and Pradeshiya Sabhas were identified as part of Colombo District—some of which maintain

websites, but lack current, accessible information regarding SWM regulatory requirements due to broken links being broken or websites without translation capabilities. Therefore, to date very few local rules, ordinances, and/or regulations have been found at the council level of government with the exception of the Colombo Municipal Council (CMC). Colombo District is divided into 13 local authorities, including:

Five Municipal Councils:

1. Colombo MC
2. Dehiwala-Mount Lavinia MC
3. Kaduwela MC
4. Moratuwa MC
5. Sri Jayawardenepura Kotte MC

Five Urban Councils:

1. Boralesgamuwa UC
2. Kesbewa UC
3. Kolonnawa UC
4. Maharagama UC
5. Seethawakapura UC

Three Praheshiya Sabhas:

1. Homagama
2. Kotikawatta Mulleriyawa
3. Seethawaka

Colombo Municipal Council - The CMC has a Solid Waste Management Division (SWMD) that is responsible for the collection, transport and disposal of municipal solid waste within Colombo City. The SWMD has introduced SWM practices including recycling, home composting, an Eco-School project, and Eco-Kiosk Centers to facilitate the 3Rs. They also have been a part of the development of a waste-to-energy plant in association with Western Power Company (Pvt) at Kerawalapitiya. Projects undertaken by the CMC SWMD include:³⁰

- Distribution of compost bins at no cost;
- Distribution of green bins for organic waste at no cost to encourage source separation, and establishment of smart bins and smart truck for waste collection;
- Establishment of a monthly waste market where people can sell their recyclables such as aluminum, and plastic;
- Conducting awareness programs for the general public about best practices on SWM, as well as an Eco-School Project that promotes 3Rs among school children and creates awareness about best practices on SWM;
- Development of a smart mobile application (presumed to be in the development stages as there is limited information about the app available). Outside of Colombo district, the Minuwangoda Urban Council and the Western Provincial Council launched a mobile app called UCMINU. The application informs residents of the dates and times for garbage collection, allows residents to submit complaints relating to garbage collection, as well as upload pictures of areas and garbage dumps that need to be cleaned) It is assumed that the CMC app will be similar;
- Establishing smart bins and smart truck for collecting waste;
- Installation of closed-circuit television (CCTV) and mobile CCTV to reduce illegal disposal and littering;
- Support for bailing non-recyclables and dispatching collected recyclable waste to recyclers; and
- Repairing existing litter bins.

³⁰ CMC SWMD Official Website.

3.2.2 Waste Generation

According to the CMC, the Western Province generates most of the country's waste, and Colombo is the largest waste generating district in Sri Lanka. The Colombo Metropolitan Area generates an estimated 1,200 tons each day, 700 of which come from CMC alone. The Asian Institute of Technology reported that on average, the per capita per day waste generation was 0.85 kg (1.9 lbs) in CMC, 0.75 kg (1.7 lbs) in other Municipal Councils (MC), 0.60 (1.3 lbs) in Urban Councils (UC) and 0.4 kg (0.9 lbs) in Pradeshiya Shabhas (PS).³¹

As shown in Table 4, the projected daily waste generation is estimated at approximately 1,700 tons per day for the Colombo District. Based on waste generation calculations developed through this assessment, an estimated 600,000 tons of waste are projected for Colombo District in 2020. The current actual tonnages may likely be higher, however, since this estimate was based on a projection from 2011.

Table 4. Waste Generation Estimates Across Colombo District Councils

Local Authorities	Per Capita Waste Generation (lbs per person/day)	2011 Population by Council ³²	Total Projected Waste Generation by Council (Tons/Day)
Colombo MC	1.9	561,314	533
Dehiwala Mount Lavina MC	1.7	184,468	157
Kaduwela MC		252,041	214
Moratuwa MC		168,260	143
Sri Jayawardenepura Kotte MC		107,925	92
Boralesgamuwa UC		60,110	39
Kesbewa UC	1.3	185,122	120
Kolonnawa UC		60,044	39
Maharagama UC		196,423	128
Seethawakapura UC		30,308	20
Homagama PS		252,469 ³³	114
Kotikawatta Mulleriyawa PS	0.9	Not Available	NA
Seethawaka PS		133,919 ³⁴	60
Total		1,806,035²⁰	1,659

3.2.3 Waste Collection

Collection rates in Colombo District vary drastically among the LAs (Figure 5),³⁵ which are responsible for the collection of waste generated by the people within their territory. Except for the Municipality of Colombo, which has a separate Solid Waste Management Unit, each LA's public health department is responsible for SWM.

³¹ Bandara, 2011.

³² Department of Census and Statistics, Sri Lanka.

³³ State of Sri Lankan Cities Official Website.

³⁴ Ibid.

³⁵ Food and Agriculture Organization of the United Nations.

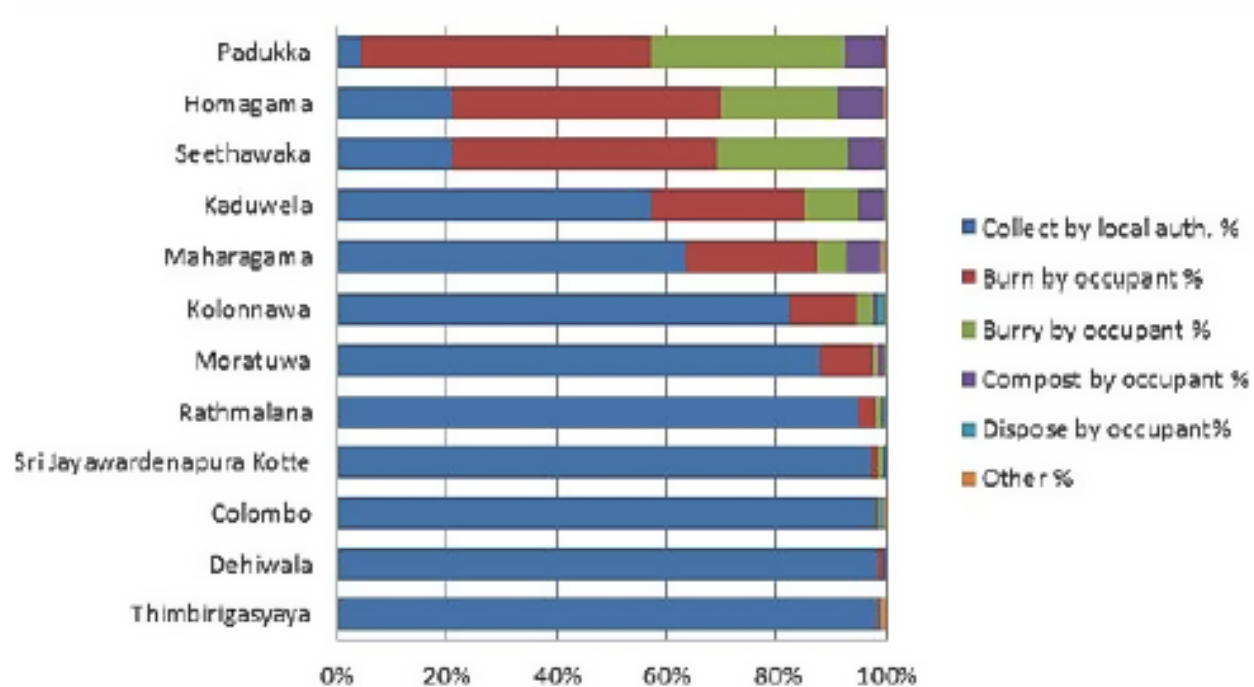


Figure 7. Methods of Solid Waste Disposal in Colombo District (2012)

In the CMC, collection, street cleaning, and waste transportation are conducted by three private companies: Carekleen, Abans, and Burns. Waste collection is conducted using 90 vehicles, including 63 compactor trucks that were provided by JICA in the 1990s (Figure 8).³⁶ Collection may also occur using a tractor (Figure 9). The collection area is divided into six districts. The ratio of waste collected to waste generated ranges drastically from approximately 93 percent in CMC to as little as 5 percent in some of the smaller urban areas. Waste collection tonnages by local authority is demonstrated in Table 5.

Table 5. Waste Collection by Local Authorities

Local Authority	Waste Collection (ton/day) ³⁷
Colombo MC	775
Dehiwela Mt. Lavinia MC	170
Kaduwela MC	85
Moratawa MC	85
Sri Jayawardenapura Kotte MC	100
Boralesgamuwa UC	N/A
Kesbewa UC	54
Kolonnawa UC	30
Maharagama UC	82
Seethawakapura UC	N/A
Homagama PS	N/A
Kotikawatta Mulleriyawa PS	38
Seethawaka PS	N/A

³⁶ JICA, 2016.

³⁷ Ibid.

In some areas, door to door collection is also carried out and waste is separated at the time of collection for both composting and for recycling. Segregation is done for polythene (also called polyethylene) plastics, glass, paper, etc. The LAs use tractors and hand carts to collect these recyclables.³⁸

Currently, municipal councils must pay the private companies that collect these materials about SLR 3,000/per ton (approximately US\$16.26) for separated waste and SLR 5,000/per ton (approximately US \$27.10) for mixed waste.



Figure 8. Waste Collection Truck (Google Street View 11-2015)



Figure 9. Waste Collection Using Tractor (Google Street View 11-2015)

3.2.4 Recycling System

Source separation is practiced in some areas of Colombo District. For example, the Moratuwa MC introduced source separation to the region in January 2015 and has been implementing separate collection services ever since. The Western Province Waste Management Authority (WPWMA) and the MC committed budgets of SLR 2.25 million (approximately US \$12,196) and SLR 7.55 million (approximately US \$40,924), respectively, and purchased 45,000 buckets (with a capacity of 20 liters each) to store organic waste. The buckets were distributed only to tax-paying residents.³⁹ “Sampath Piyasa” centers (Figure 10) have also been established around Colombo District to collect economically viable waste such as metal, glass, plastics, polythene, etc.

³⁸ Homagama Development Plan 2019-2030.

³⁹ JICA, 2016.



Figure 10. Sampath Piyasa Center at the Office of the Provincial Director of Health Services in Colombo⁴⁰

“Kasala Pola” (waste fair) is a waste management strategy proposed by the CEA in the Boralessgamuwa Urban Council area of Colombo District. Kasala Polas are mobile waste markets where residents can hand over economically viable waste. The program is a private-public partnership where informal solid waste traders collect valuable waste on behalf of the BUC. The BUC usually organizes the “Kasala Pola” at a local playground or a Buddhist shrine in one of the ten wards of the UC. Posters and banners are advertised near the venue and the BUC media unit announces the

event using a vehicle and loudspeakers. Rather than payment from the informal traders for the waste, residents receive tree saplings such as banana, guava, lemon, jack, and teakwood.⁴¹

The waste plastic recycling rate from the formal sector in Sri Lanka is estimated at four percent and three percent from the informal sector. According to the WPMMA, there are an estimated 60 commercial plastic recyclers in the Colombo metropolitan area—all of which run their facilities at less than 50 percent operational capacities.

Three actors exist in the informal waste sector:

1. Small-scale informal waste workers who work for small-scale waste traders, equipped with a cart or a trolley to collect valuable waste;
2. Small-scale independent waste traders (middlemen) who employ a small number of informal waste workers to collect economically viable waste. They store the collected waste in small warehouses and then sell collected waste to large-scale recyclers; and
3. Large-scale recyclers who purchase the economically viable waste from small-scale waste traders and purify the waste and make billets (small bars of waste which is similar to an ingot) out of the collected waste to export to India and China.

The relationship between informal waste companies and LAs is mixed. In general, informal waste workers and traders are negatively stigmatized. According to officials who were interviewed, informal waste traders carry out illegal activities such as selling and distributing drugs, stealing, and polluting, but they’re also perceived as a necessary component of the system.⁴² Additional information to verify this statement was not found through the ISWMA, however additional sources did show that most informal waste traders do not properly store collected waste in a safe manner. In some locations, batteries and chemicals have leaked into the ground and waterways. Some plastic items are melted without appropriate safety measures; and residents living near waste traders have complained about the unhygienic conditions of these recycling centers.

⁴⁰ http://healthdept.wp.gov.lk/web/?page_id=426.
⁴¹ Fernando et al.
⁴² https://serval.unil.ch/resource/serval:BIB_29F77F296EC5.P001/REF

Other officials have a more positive attitude about informal waste workers. In the Dehiwala Mount Lavinia Municipal area (DMMC), there are approximately 30 private traders who buy approximately 10 MT (11 U.S. tons) of recyclable waste each day. An executive official of DMMC stated, “The Dehiwala-Mt. Lavinia Municipal Council is appreciative of the services that are provided by informal solid waste workers to our residents and also to our council. According to our records there are 34 informal solid waste traders in the DMMC wards. They manage most of the recyclable waste generated in the DMMC. If not for them, the DMMC would have to spend additional funds to manage recyclable waste. When we think about the salaries, vehicle maintenance, and fuel costs, they are actually saving millions for us each month.” Local authorities are well aware of informal waste practices and permit the waste workers to carry out these duties.

Recycling Centers

Collection centers (see Figures 11 and 12) and eco-kiosks (see Figure 13) are available throughout Colombo District for local residents to drop off recyclables. Despite the establishment of these centers by local authorities, informal SWM activities continue to occur less than a couple hundred feet away from some of these locations (see Figure 14).



Figure 11. Collection Center CMC (Google Street View 11-2015)



Figure 12. Solid Waste Management Depot CMC (Google Street View 11-2015)



Figure 13. Eco-Kiosk Torrington
(Google Street View 11-2015)



Figure 14. Solid Waste Management
Activities Near CMC Depot
(Google Street View 11-2015)

Other eco-kiosk centers in CMC include:

- Greenpath
- Vauxhall Street
- Aluthmawatha
- Kuppiyawatte East

Material Recovery/Composting Facilities

Kaduwela Waste Management plant is a project in Colombo District, which includes a composting plant (Figure 15). The SLR 40 million (approximately US \$216,818) project enables material recovery and composting in the region.⁴³ The Kaduwela composting expansion project was opened on April 24, 2009 by the Honorable Minister of Environment and Natural Resources,⁴⁴ and produces fertilizers using the waste-rolling system. Approximately 10 tons of waste is used for manufacturing fertilizers each day.⁴⁵ According to the Kaduwela Municipal Council official website, composting in Kaduwela is further promoted by:

- Providing 200 bins to produce compost each year;
- Educating the public on the importance and necessity of manufacturing compost fertilizers;

⁴³ Southtec Engineering Consultants Official Website.

⁴⁴ Dassanayake.

⁴⁵ Kaduwela Municipal Council Official Website.

- Imparting the knowledge necessary to manufacture fertilizers in the household to people of the area;
- Implementing a “Green Bucket Project” and supplying free polysack bags to promote waste segregation;⁴⁶ and
- Raising public awareness on waste segregation and following up by making home visits.



Figure 15. Kaduwela Waste Management Facility (Google Aerial 2-2020)



Figure 16. MIHISARU Material Recovery Facility - Karadiyana (Google Aerial 2-2020)

To be operational in the future, Fairway Waste Management is developing an integrated solid waste processing facility in Karadiyana to address the estimated 500+ TPD of waste received at the site (Figure 16). The processing facility will reduce the amount of waste diverted to landfills by as much as 80 percent by mass and 90 percent by volume. The facility consists of a biological treatment plant

that will process organic waste in a wet fermentation anaerobic digestion system, and will treat as much as 140 TPD of organic waste. The remaining waste will be diverted to an incinerator facility that has a maximum capacity of 500 TPD.

3.2.5 Waste Transformation

The Colombo Waste-to-Energy Plant, with a cost of over \$100 million USD, will convert 500-700 MT (550-770 tons) per day of waste into 11.5 megawatts (MW) of power in the near future (Figure 17). Construction was delayed due to the Easter Sunday attacks and now the Coronavirus pandemic, but once

⁴⁶ [https://www.colombo.mc.gov.lk/engineering-services.php#prettyPhoto\[gallery1181\]/6/](https://www.colombo.mc.gov.lk/engineering-services.php#prettyPhoto[gallery1181]/6/)

developed, will employ grate incineration technology—a proven technology used around the world. The plant is located outside Colombo District, about three miles north of the Kelani River in Gampaha District (see Figure 18). The project is being managed by Western Power Company Pvt. Ltd, a member of Aitken Spence Group. Feedstock will come from the Colombo Municipal Council Area and the majority of the power generated will be sold to the Ceylon Electricity Board (a power purchase agreement is already in place). An official from the Ceylon Electricity Board said that they welcome alternative energy projects of this nature as it offers a permanent solution to Colombo’s garbage clearing and provides green energy to the national grid.⁴⁷



Figure 17. Colombo Waste to Energy Plant (Aitken Spence Power Station) (Google Aerial 3-2020)

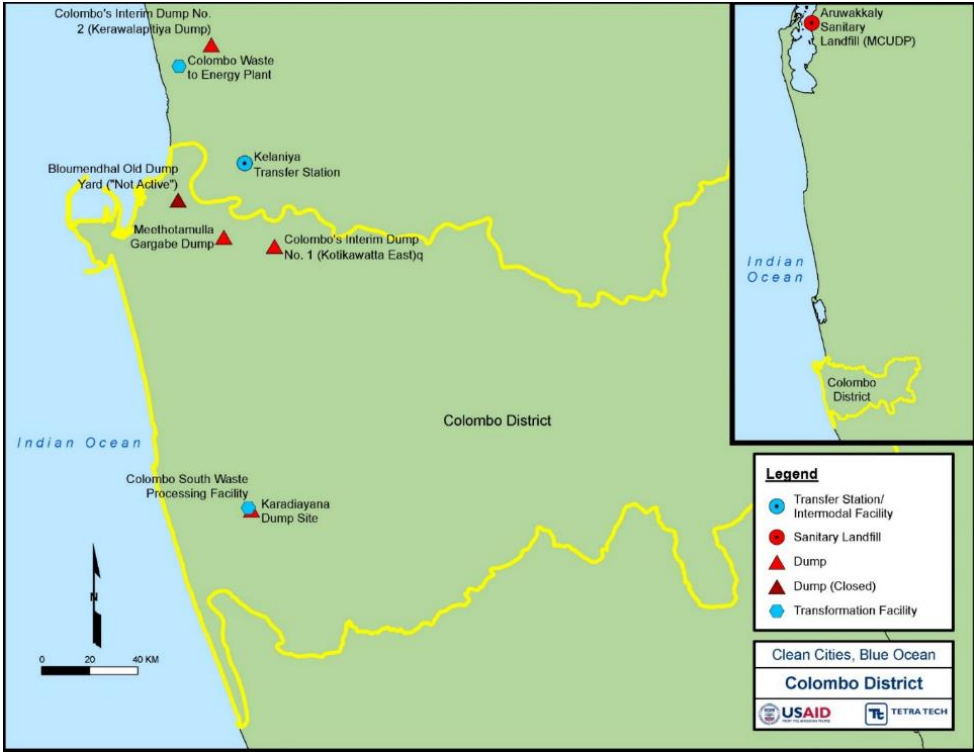


Figure 18. Map of Colombo District Solid Waste Management Facilities

⁴⁷ Daily News, 2020.



A second waste-to-energy plant, the Colombo South Waste Processing Facility power plant (Figure 19), is scheduled to open in December 2020 and will be located adjacent to the Karadiyana dump site in Colombo District. The plant is being developed by a Korean company, K.C.H.T. Jang, which (as part of a public-private partnership) will invest over US \$95 million to process up to 630 MT (700 tons) per day of waste generated in the suburbs of Colombo and Gampaha Districts.⁴⁸

Figure 19. Colombo South Waste Processing Facility (Google Aerial 2-2020)

3.2.6 Waste Disposal

On April 14, 2017, a devastating landslide occurred at the Meethotamulla garbage dump (Figure 19), which overtook surrounding houses and caused the death of 32 people. This event became a catalyst for significant changes to waste disposal in Colombo District and spurred the formation of the Metro Colombo Solid Waste Management Project (MCSWMP). This project plans to bring on several new facilities to replace the mix of open dumps and sanitary landfills that are currently in use. These facilities include a transfer station/intermodal facility and waste-to-energy plants. The location of these facilities is shown on the map in Figure 18.

Figure 20. Meethotamulla Garbage Dump (Google Aerial 4-2020)



⁴⁸ <https://www.ejAtlas.org/print/hazardous-garbage-dumping-and-new-waste-to-energy-projects-in-colombo-sri-lanka>

Colombo Solid Waste Management Project

The Kelaniya Transfer Station (KTS) is currently being built as part of the MCSWMP, which includes the development of a second transfer station in Aruwakkalu to receive, unload, and compact waste (bale) prior to disposal at the new Aruwakkalu Sanitary Landfill located in Puttalam District approximately 170 kilometers (105 miles) south of the Colombo Metropolitan Area.

The 18-hectare (44.5 acres) KTS site is located in Kelaniya Pradeshiya Sabha, outside of the Colombo District (see map, Figure 18). It is located adjacent to the Colombo Railway Main Line and near the Colombo-Kandy Highway. Waste will be brought to the KTS via a new access road (to avoid narrow roads) and then loaded into waste carrying trains that will connect to the mainline.



Figure 21. Kelaniya Transfer Station/Intermodal Facility (under construction) (Google Aerial 3-2020)

As planned under the MCSWMP, the final disposal location is the Aruwakkalu Sanitary Landfill (ASL) located in the Puttalam District, approximately 170 km north of Colombo. The ASL is located on an abandoned limestone quarry in the buffer zone of Sri Lanka's Wilpattu National Park and was designed to receive 1,200 tons of waste per day coming from Colombo via railway from the KTS. The ASL site has an estimated 10-year life expectancy with an overall capacity of 4.7 million cubic meters (m³) (approximately 3.5 million tons assuming .75 tons/m³) of waste. Environmental controls at the ASL include surface water, leachate, and landfill gas management systems.



Figure 22. Aruwakkalu Sanitary Landfill (MCUDP) (Google Aerial 3-2020)

The ASL, expected to be completed in 2021, is being developed by the China Harbour Engineering Company, which has had a controversial history.⁴⁹ Locals and environmentalists have objected to the ASL's

development since its announcement in 2014. Campaigns, such as the “Clean Puttalam” campaign, have been launched to attempt to halt the project, and locals have participated in demonstration marches,

⁴⁹ http://www.colombopage.com/archive_20B/Sep15_1600194234CH.php.

strikes, petitions, awareness programs, and public debates to discuss the environmental impacts that will be created by the ASL.



Figure 23. Green Park Sanitary Landfill and Integrated Waste Management Center (Google Aerial 1-2020)

Existing Sanitary Landfills

The Green Park Sanitary Landfill and Integrated Waste Management Center at Kirindiwela (Figure 23) accepts 30 tons of garbage collected daily from six LAs including the CMC. This landfill was jointly funded by the Korean International Cooperation Agency and the Sri Lankan Government and is located about 20 miles northeast of the Colombo Metropolitan Area in Gampaha District (see Figure 18 map).

Existing Dumps

After the collapse of the Meethotamulla dump, two other open dumpsites located within the Colombo Metropolitan Area began operations. Between the two, approximately 800 tons of waste that was previously being dumped at the Meethotamulla dump are being disposed of in the same fashion (open dumping with no environmental controls). Since these dumps have no name, they are referred to as Colombo Interim Dump No. 1 and 2 in Figures 24 and 25, respectively.

The Karadiyana dump site receives waste from as many as seven local authorities; some of this waste is used to produce compost while the majority is disposed in the open dump (see Figure 25). The site is managed by the Western Provincial Waste Management Authority and historically received waste, as shown in Figure 26.⁵⁰ The Colombo South Waste Processing Facility power

Figure 24. Colombo’s Interim Dump No. 1: Kotikawatta East (Google Aerial 4-2020)



⁵⁰ JICA, 2016.

plant will be located just north of the dump.



Figure 26. Colombo's Interim Dump No. 2: Kerawalpitiya (Google Aerial 4-2020)



Figure 25. Karadiyana Dump Site (Google Aerial 2-2020)

Figure 27. Tons Received at Karadiyan Dump (Waste Management Authority of the Western Province)

No	Benefited Institute	2013		2014			2015 (Jan - Aug)		
		Daily (ton/day)	Rate	Total (ton/year)	Daily (ton/day)	Rate	Total (ton/year)	Daily (ton/day)	Rate
1	Moratuwa M.C.	124.5	25.2%	43,738	119.8	23.1%	17,597	72.4	14.7%
2	Boralesgamuwa U.C.	27.3	5.5%	10,209	28.0	5.4%	7,183	29.6	6.0%
3	Kesbawa U.C.	48.9	9.9%	19,446	53.3	10.3%	13,480	55.5	11.2%
4	Dehiwala - Mount Lavinia M.C. Sri	157.1	31.8%	60,332	165.3	31.9%	39,073	160.8	32.6%
5	Jayewardanapura Kotte M.C.	37.3	7.5%	13,427	36.8	7.1%	9,285	38.2	7.7%
6	Maharagama U.C.	69.1	14.0%	27,244	74.6	14.4%	18,963	78.0	15.8%
7	Homagama P.S.	22.6	4.6%	11,102	30.4	5.9%	7,019	28.9	5.8%
8	Government Institution *1	0.9	0.2%	547	1.5	0.3%	1,843	7.6	1.5%
9	Government Institution *2	0.7	0.1%	2	0.0	0.0%	120	0.5	0.1%
10	Other	6.1	1.2%	3,207	8.8	1.7%	5,456	22.5	4.5%
	Total	494.3	100.0%	189,254	518.5	100.0%	120,018	493.9	100.0%

*1: General Sir John Kotelawala Defence University, *2: Provincial Road Development Authority
Data source: Waste Management Authority of the Western Province

Closed Dumps

The Bloemendhal Dump has been closed, but without proper closure and environmental mitigation it continues to cause environmental impacts and associated dangers. Fires at the Bloemendhal garbage dump are a typical occurrence when Western Province extreme weather conditions are prevailing. Fire fighters and Army troops have to be sent out to control the fires. The latest reported fire occurred on April 6, 2019. Unless properly closed, fires will continue to occur, placing surrounding residents in the path of

toxic fumes and obnoxious odors.



Figure 28. Bloemendhal Old Dump Yard (Google Aerial 4-2020)

3.2.7 Education and Outreach

The Open School Program, a product of the National Institute of Education located in Colombo (Maharagama), runs countrywide and provides access to sustainable and learner-led quality education.⁵¹ The program primarily targets low-income, marginalized communities in Sri Lanka, focusing on literacy and livelihood to enable learners not only to complete vocational courses and programs, but also enter the environmental workforce with sustainable development knowledge. The program highlights topics such as proper disposal of garbage, food hygiene, zero food waste, organic farming and general education on green practices.

The program has been implemented at primary, secondary, and tertiary levels, primarily with farming and working communities. The system is innovative and flexible since learners can work towards a specific exam or qualification without the potential limitations of formal classrooms and term times. Teachers meet learners at convenient times and study is backed up by work plans and self-learning materials.

As part of the Sustainable Cities Program in Sri Lanka, UN Habitat outlined a SWM strategy for the Western Province and conducted a number of demonstration projects, which included the Sustainable Colombo Core-Area Project.⁵² One demonstration project focused on reducing the need for collection of public market waste by installing a biogas unit that would take all local market wastes. The Badowita Community Based Collection and Sorting Centre was another demonstration project as well as one of the first efforts to promote active community engagement to improve SWM, collection, and disposal.

USAID's Municipal Waste Recycling Program (MWRP) (2016-2021) has focused on identifying and scaling innovation that will improve SWM and recycling practices in Sri Lanka and address deficiencies in the DMMC's current SWM system. To date, MWRP has launched five private waste collection microenterprises and has provided assistance to several private recyclers so they can generate more

⁵¹ UNESCO, 2018.

⁵² UN Habitat.

income through the sale of recyclable materials.⁵³ More than just improving collection, the program aims to create a responsive civil society and work in partnership with the local government to prevent the discharge of polythene and plastics waste into marine environments. As part of its objectives, MWRP aims to raise awareness among canal front communities to prevent disposal of waste into the canal and the surrounding environment and raise general public awareness on the negative effects of improper disposal of polythene and plastics. Expected outcomes include community practice of source segregation, increased community participation in waste management, and systems to facilitate this—including community waste banks.

Under MWRP, the Public Interest Law Foundation is working towards the reduction of marine plastic waste in Sri Lanka through law review and reform, legal training, awareness, and enhanced law enforcement. As such, the existing legal framework on marine plastic waste will be assessed to identify gaps and solutions. Thereafter, recommendations will be made for legislative reform in close consultation with the key government agencies such as the Central Environmental Authority (CEA) and the Marine Environmental Protection Authority (MEPA).⁵⁴

In July 2017, a social pilot project was launched in two wards belonging to the CMC with the intention of adopting the learnings from the pilot in expanding the project.⁵⁵ Plasticcycle targets plastic pollution reduction by supporting proper waste disposal, promoting recycling initiatives, and encouraging reduction in the use of single-use plastics. Plasticcycle has installed specially designed bins to support responsible disposal of recyclable plastic (Figure 29).



Figure 29. Plasticycle Recyclable Plastic Collection Bins (*PlasticCycle Official Website*)

3.3 Galle

Galle District is located in the Southern Province of Sri Lanka. The district consists of 19 DS divisions within an area of approximately 640 sq. mi. The region is further sub-divided into 896 *Grama Niladhari Divisions* (GN Divisions) or villages. According to the 2012 census, Galle District has an estimated population of 1.06 million.⁵⁶ The District is comprised of the Galle Municipal Council (GMC), Ambalangoda Urban Council, Hikkaduwa Urban Council, and 17 Pradeshiya Sabhas. The Gin Ganga River stretches 70 miles, from Hiniduma Pattuwa to the Ginthota area of Galle District, where it flows into the Indian Ocean.

The City of Galle is comprised of approximately six square miles, with an estimated population of 93,000 and population density of approximately 15,000 per square mile. As such, the City of Galle's population density is approximately 47 percent higher than that of the City of Los Angeles (approximately 8,000

⁵³ SEVANATHA Official Website.

⁵⁴ Public Interest Law Foundation Official Website.

⁵⁵ Plasticcycle Official Website.

⁵⁶ Department of Census and Statistics, Sri Lanka.

people per sq. mi.), the second most populated city in the United States.

Figure 30. Map of Galle District with Solid Waste Facilities



3.3.1 Governance

Central Environmental Authority

See section 2.1.1 for CEA regulatory authority under the National Environmental Acts.

Southern Provincial Council Secretariat

No information was found regarding the SWM efforts of the Southern Provincial Council. The official website (www.sp.gov.lk/) was down through the time of research (September to December 2020).

Councils/Divisional Secretariats

As part of the ISWMA the following MC’s, UC’s, and PS’s were identified as part of Galle District. Some of

the identified councils had websites that were visited with the intent of finding regulatory requirements related to SWM. Very little to no information was found through this process due to links being broken or websites with no translation capabilities. Therefore, to date very few local rules, ordinances, and/or regulations have been found at the council level of government with the exception of the Galle Municipal Council (GMC).

Galle District is divided into 20 local authorities, including one Municipal Council (Galle Municipal Council), two Urban Councils (Ambalangoda Urban Council and Hikkaduwa Urban Council), and 17 Pradeshiya Sabhas:

- | | |
|-----------------|-------------------------|
| 1. Akmeemana | 10. Karadeniya |
| 2. Ambalangoda | 11. Nagoda |
| 3. Baddegama | 12. Neluwa |
| 4. Balapitiya | 13. Niyagama |
| 5. Bentota | 14. Rajgama |
| 6. Bope-Poddala | 15. Thawalama |
| 7. Elpitiya | 16. Welivitiya-Divitura |
| 8. Habaraduwa | 17. Yakkalamulla |
| 9. Imaduwa | |

Galle Municipal Council

The GMC is the main administration authority in City of Galle and was established under the Municipalities Ordinance of 1865. According to the GMC official website, the engineering department's waste management unit is responsible for collecting garbage, implementing recycling programs, reporting and addressing public complaints, and performing sewerage activities and town cleaning activities.⁵⁷

The health department is responsible for implementing environmental programs and disposing of human (sewage) waste.

3.3.2 Waste Generation and Composition

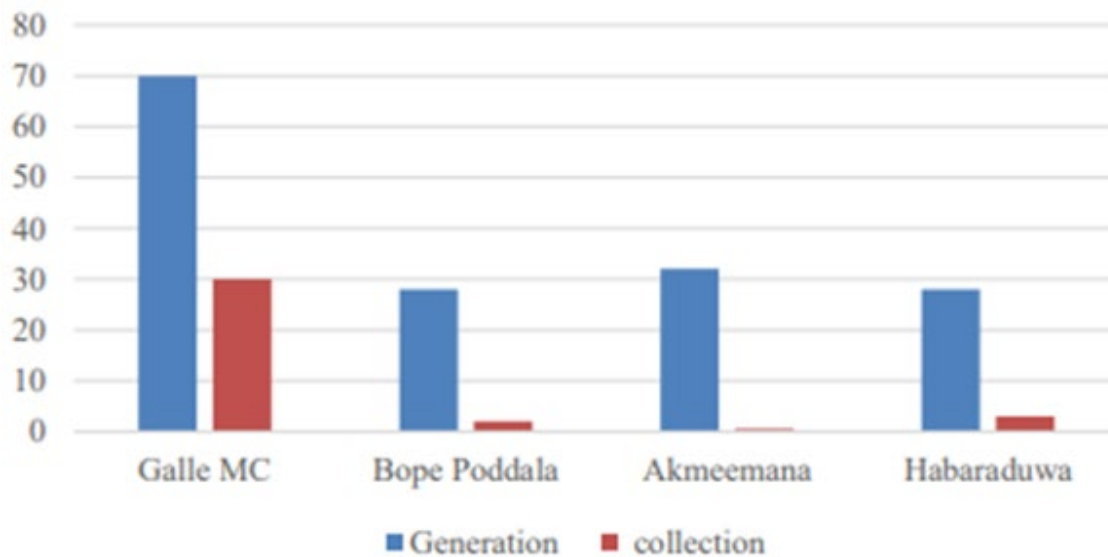
According to UN Habitat, the average waste generation for each LA and the weighted average total for Galle district is similar; the daily per capita rate is between 0.9 and 1.0 lbs and an annual per capita rate between 361.6 and 370.2 lbs.⁵⁸ Galle District generates an estimated 505 MT (557 tons) each day. Based on waste generation calculations developed through the ISWMA, an estimated 200,000 tons of waste are projected for Galle District in 2020. Figure 31 provides an approximation of the daily waste generation and collection in some of the local authorities.⁵⁹

⁵⁷ Galle Municipal Council Official Website.

⁵⁸ UN Habitat, 2016.

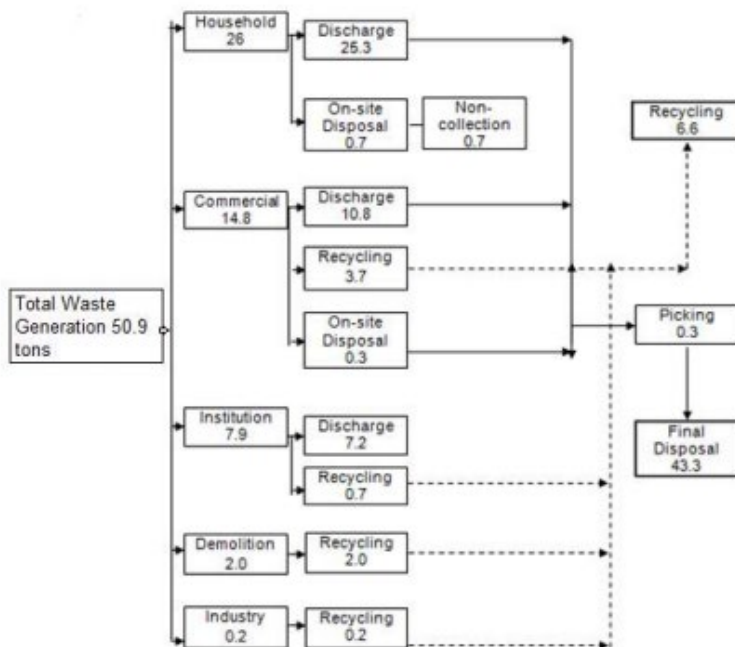
⁵⁹ Urban Development Authority.

Figure 31. Waste Generation and Collection (metric tons per day) in Selected Local Authorities (NSWMC Unpublished Data, 2013)



The GMC generates approximately 51 tons of waste daily.⁶⁰ According to calculations made based on Figure 32, 51 percent of the generated waste was considered residential waste, 29 percent was commercial waste, 16 percent was institutional waste, four percent was demolition waste, and less than one percent was industrial waste.

Figure 32. Waste Streams in Galle MC in Tons (Balasooriya et al., 2015)



A waste composition analysis was conducted in GMC on collected residential and commercial waste (Figures 33 and 34).⁶¹ The study indicated that the majority of residential and commercial waste consisted of biodegradable waste—including kitchen waste, garden waste, paper, and cardboard.

⁶⁰ Balasooriya et al., 2015.

⁶¹ Ibid.

Waste Type	Residential Waste				
	High Income	Middle Income	Low Income	Non-collection Area	Average*
Kitchen	71.3	61.8	76.7	75.0	68.1
Garden	8.6	17.2	3.8	7.6	11.6
Paper, Cardboard	7.7	5.4	6.5	4.1	6.2
Soft Plastic	4.6	4.2	5.6	4.5	4.6
Hard Plastic	1.8	1.8	1.5	1.9	1.7
Textiles	0.2	1.2	1.3	1.5	1.0
Rubber, Leather	0.4	0.9	0.1	0.8	0.6
Metal	1.2	1.0	0.3	0.5	0.9
Glass	0.8	2.6	1.0	1.9	1.8
Ceramics	0.0	1.1	0.3	0.3	0.6
Hazardous	0.1	0.4	0.1	0.2	0.2
E Wastes	0.0	0.1	0.0	0.1	0.1
Miscellaneous	3.4	2.3	2.9	1.5	2.7

Figure 33. Residential Waste Composition in GMC (percentage by weight basis)
(Balasooriya et al., 2015)

Waste Type	Commercial			
	Hotel	Restaurant	Organic Shop	Non-organic shop
Kitchen	69.3	76.6	96.5	44.5
Garden	0.0	0.0	0.0	0.0
Paper & Cardboard	8.2	12.3	2.1	29.2
Soft Plastic	9.8	10.7	1.3	19.3
Hard Plastic	0.9	0.0	0.0	5.0
Textiles	0.5	0.0	0.1	1.1
Rubber & Leather	0.0	0.0	0.0	0.0
Metal	1.4	0.3	0.0	0.7
Glass	2.4	0.0	0.0	0.2
Ceramics	6.7	0.0	0.0	0.0
Hazardous	0.3	0.0	0.0	0.0
E Wastes	0.0	0.0	0.0	0.0
Miscellaneous	0.4	0.0	0.0	0.0

Figure 34. Commercial Waste Composition in GMC (percentage by weight basis)
(Balasooriya et al., 2015)

3.3.3 Waste Collection

Of the estimated 505 MT (557 tons) of waste generated in Galle District, only 120 MT (132 tons) are collected each day.⁶² Collection rates vary drastically within the District. According to 2015 statistics, Galle District has one compactor and 101 tractors available for collection. In GMC, the collection rate was estimated to be 85 percent. According to a 2008 report, the collection rate in Hidawakka UC was 49 percent and between 14 and 19 percent in the Pradeshiya Sabha areas.⁶³

In GMC area, collection occurs more frequently in commercial and densely populated areas. Collection and street sweeping occur daily on main roads and twice a week on other roads. In Hikkawuda UC and other areas, collection was carried out three times a week while the Pradeshiya Sabha areas collected four times per week.

Solid waste management is handled by the GMC by first collecting from collection points where residents deposit their garbage. Although some residences and institutions have adapted curbside collection

⁶² UN Habitat. 2016.

⁶³ Jayakody et al., 2008.



Figure 35. Waste Collection Near Monroviawatta
(Google Street View 05-2015)

practices, most waste is collected from bins, households, and disposal points.⁶⁴ Concrete bins have been provided at secondary collection points but tend to overflow as a result of irregular collection. Drains are also choked as a result of this overspill. Because waste collection points have not been properly established or maintained, they appear like mini dumping sites along the streets. Primary collection at the source is also carried out by handcarts and moving from house to

house but, due to inconsistency, residents often dump their garbage on roadsides. Collection and transportation vehicles primarily consist of open and uncovered trailers pulled by tractors (Figure 35), which can spread odor, garbage, and pests throughout the area.



Figure 36. GMC Collection Truck at Monroviawatta
(Google Maps 11-2019)

Galle City has taken innovative steps to improve their waste management system, including the use of dump trucks to transport waste to recycling/disposal facilities (Figure 36). The city has promoted separated waste collection in all 15 wards since November 2016,⁶⁵ and has also set up a waste collection schedule and disposal plan. However, without an integrated SWM plan, these efforts cannot be implemented to their fullest extent, resulting in the lack of consistent collection and disposal, low cooperation from community members, and illegal waste disposal.

3.3.4 Recycling System

Recyclable material collectors and waste pickers play a major role in Galle District's municipal waste management systems. Households are regularly visited by recyclables collectors who pay a nominal fee for the materials, which are then delivered to processing factories through middlemen. Key recycling items include paper, cardboard, metal, plastics, and construction/demolition materials. Local buyers collect metal and plastic, glass bottles and some e-waste. The GMC assists with paper/cardboard and construction/demolition recycling. At dumpsites, household waste separation occurs, with plastic, glass and

⁶⁴ Jayakody et al., 2008.

⁶⁵ Dickella et al, 2017.

tin cans sold to large scale vendors in Colombo.⁶⁶

Composting Facilities

According to a 2016 report from JICA, there were nine composting facilities in Galle District. However, only two composting facilities were identified by name. Of these two, Monroviawatta Compost Plant is a centralized composting facility that has been operated by the Southern Provincial Council since 2012 in Monrovia, 20 km away from Galle City. The composting facility was constructed with the financial and technical support of the Pilisaru Project, a national project that was launched in 2009 to implement a sustainable and environment-friendly waste management system. The composting facility accepts separated biodegradable waste from Galle as well as other neighboring cities and uses a windrow composting method and back-loaders to make and turn the composting piles (Figure 37). With a capacity of 40 TPD, only 300 MT (330 tons) of compost are currently produced each month.



Figure 37. Monroviawatta Composting Plant (Google Aerial 4-2020)



Material Recovery Facilities

Baddegama Prahesiya Sabha Garbage Recycling Center includes materials recovery, organics composting, and a garbage dump as shown in Figure 38.

Figure 38. Baddegama Pradeshiya Sabha Garbage Recycling Center (Google Aerial 4-2020)

Junkshops

No junkshops were identified as part of this ISWMA.

Recycling Center

Thalpe Recycling Center is a community-supported initiative that is located in the Talpe Region of Galle

⁶⁶ Balasooriya, 2015.



Figure 39. Thalpe Recycling Center
(Google Street View, 03-2016)

District (Figure 39). The center offers recycling pickup throughout the southern coast of Sri Lanka, and collects recyclable plastic, glass, metal, and paper for cleaning and sorting. The sorted material is then sold to recycling organizations. The center works with local schools, community members, businesses and organizations such as Greener Galle and Saving Sri Lanka to raise awareness and promote a zero-waste economy in southern Sri Lanka.



Figure 40. COWAM Center
(Google Street View, 03-2016)

The Construction Waste Management (COWAM) center is a construction and demolition recycling plant established in response to the Indian Ocean tsunami of 2004 and funded by the European Union from 2005-2009 (Figure 40). The project was intended to examine the most sustainable way of managing construction and demolition waste from the disaster. The center is currently operated under the direct supervision of GMC.



Figure 41. DNP Eco
(Google Maps, 09-2015)

Lastly, the DNP Eco polythene recycling center is located in the Thalgaswala region of Galle District (Figure 41).

3.3.6 Waste Disposal

Waste collected in Galle is currently disposed into open dumps in an uncontrolled manner. Waste that hasn't been collected can land in the streets and in drains, contributing to pollution, flooding, and the spread of diseases. As previously noted, the lack of an integrated waste management plan has resulted in inconsistent disposal, lack of compliance from residents, and illegal waste disposal. Waste disposal facilities used by Galle District include a mix of open dumps co-located with composting, material recovery facilities or both.

Waste disposal in Galle District is significantly different than that in Colombo District which utilizes large dump sites to dispose of solid waste. It has been reported that in Galle District the utilization of multiple privately owned lands, specifically those in low-lying areas are used as dumpsites. The landowners intent is the reclamation of the land for urban development uses, unfortunately the GMC sees this practice as the norm, lacking other feasible alternatives.⁶⁷ The majority of the privately owned low-lying lands with the City of Galle have been reclaimed by dumping waste. New locations include the coastal belt and municipal lands such as parks and pits near town hall premises.⁶⁸ As part of ISWMA research, only four dump sites were identified, yet the expectation is that there may be several dozen. Additional sites were difficult to locate via Google Aerial due to their commonly small size and the area's tree canopy.

Galle's hospital medical waste is disposed of in a waste incinerator in Moratuwa. The incinerator has a processing capacity of 7 TPD and was constructed in 2014 under the Grant Aid by the Government of Korea. The operation and maintenance of the facility was given to a private company under the principle of public-private partnership. The treatment fee is 67 SLR/kg (approximately US \$0.36) for general medical waste and 80 SLR/kg (approximately US \$0.43) for hazardous and infectious medical waste. Additionally, there are also several small-scale medical organizations with small incinerators.



Figure 42. Mahamodara Dump
(Google Aerial 4-2020)

The Mahamodara Dump is located on the northern banks of the Mahamodara Lake/River (see map, Figure 30, and Figure 42), which is located within the boundaries of the City of Galle.

The Monroviawatta Dump (Figure 43) was originally proposed as a sanitary landfill by the CEA to serve as a long-term solution to the region's increased waste generation. The dump is located in Monroviawatta within the boundaries of Rajgama Pradeshiya Sabha. The Monroviawatta Compost Site was constructed with the financial and technical support of the Pilisary Rajgama Pradeshiya Sabha.⁶⁹ The dump serves seven local authorities, handling an

⁶⁷ UN-Habitat Sustainable Cities Programme – Sri Lanka

⁶⁸ Ibid.

estimated 40 percent of the waste generated in Galle District and about 74 percent of the waste currently collected (114 tons/day).⁷⁰



Figure 43. Monroviawatta Dump
(Google Aerial 1-2020)



Figure 44. Koggala Dump (Google Aerial 4-2020)

As previously identified, the Baddegam Praheshiya Sabha Garbage Recycling Center includes materials recovery, organics composting, and a garbage dump. The dump is located within the jurisdiction of Baddegam Praheshiya Sabha, which is located approximately 10 miles north from the City of Galle. The stream adjacent to the dump site eventually meets with the Gin Ganga River which flows into the Indian Ocean in Ginthota area located approximately four miles northwest of the City of Galle.

Lastly, the Koggala Dump, identified through the ISWMA’s Google Earth surveillance, is located on the northern banks of Koggala Lake within the boundaries of the Koggala Free Trade Zone (a.k.a., Export Processing Zone) in Harabarduwa Pradeshiya Sabha.

3.3.7 Education and Outreach

The City of Galle is home to some of Sri Lanka’s oldest leading schools. Under the direction of an Environmental Officer of the GMC, an environmental education program has been launched in 13 schools in City of Galle, with the main objective of motivating students towards environmental protection. The program includes a recyclable solid waste and compost pilot project at Southlands College in the City of Galle, as well as a tree planting program at a school in the District’s coastal town of Unawatuna.

Also in Galle District, an MWRP grantee promoted plastic waste reduction and recycling by minimizing plastic bag use and introducing solid waste segregation within 25 schools and among 11,500 youth. In the same region, the Public Health Inspector’s Office attributed a decrease in dengue fever cases (nearly 80

⁷⁰ Urban Development Authority, District office - Galle

percent in some neighborhoods) from 2017 to 2018 to the drastic decline in improper plastic waste disposal that reduced breeding grounds for mosquitoes.

Another project, the “Community Based Solid Waste Management Project,” was launched by the GMC with support from HELP-O (Human and Environment Links Progressive Organization). The project aims to promote behavioral change to develop a “waste free city,” educate Galle citizens on the importance of the 3Rs, improve partnerships for a waste free city, and formulate responsible teams for the waste management program to continue.

As part of the project, HELP-O implemented a pilot project in China Garden, a ward in the heart of the City of Galle with a number of challenges such as limited land space, road facilities, and increasing population. The pilot project implemented community awareness campaigns as well as a separated waste collection system using upcycled rice bags as collection bags, produced by local women for SLR 50 (approximately US \$0.27). The project distributed about 300 waste collection bags to the China Garden ward residents to collect segregated waste. Following, in September 2017, a handcart waste collection program was introduced (Figure 45).



Figure 45. Handcart in Galle City (HELP-O)

HELP-O has also launched awareness campaigns for Galle City traders and residents, including cleaning campaigns for the Karapitiya Teaching Hospital area with support from stakeholders. The NGO has also implemented several school awareness programs which focus on topics such as waste segregation and tree planting. A cleaning program and awareness campaign were also launched, which included activities such as beach clean ups and awareness campaigns (walks).

Other notable initiatives include the “Strategic Cities Development Project,” implemented by the World Bank from 2014 to 2019 in partnership with the Ministry of Economic Development, with Galle District as one of the target areas. The \$192 million project included SWM as one of its components. Lastly, community composting was also facilitated by the Artacharya Foundation, an NGO working through organized women's groups. Through the program, groups of approximately five families deposit all their organic waste in a steel barrel. As a result, around 100 kg of compost is harvested each month and sold to local residents for about SLRs 20/kg.

3.4 Jaffna District

Jaffna District is located in the Northern Province of Sri Lanka. It consists of 15 DS divisions within an area of approximately 400 sq. mi., sub-divided into 435 GN Divisions and comprised of the Jaffna Municipal Council (JMC), Chavakacheri Urban Council, Point Pedro Urban Council, Valvettihurai Urban Council, and 17 Pradeshiya Sabhas (Figure 46). According to the 2012 census, Jaffna District has an estimated population of 583,000. A map of Jaffna District’s SWM facilities is presented in Figure 47. Similar to in the northern and eastern regions in Sri Lanka, the population in Jaffna District has been heavily affected by the Sri Lankan Civil War that took place from 1983-2009, which resulted in approximately 100,000 deaths and the migration of several hundred thousand Sri Lankan Tamils to the western region of Sri Lanka.

The City of Jaffna is the capital city of the Northern Province. It is comprised of approximately 8 sq. mi. and has an estimated population of 88,000 and a population density of approximately 11,000 per square mile.

Figure 46. Map of Jaffna District

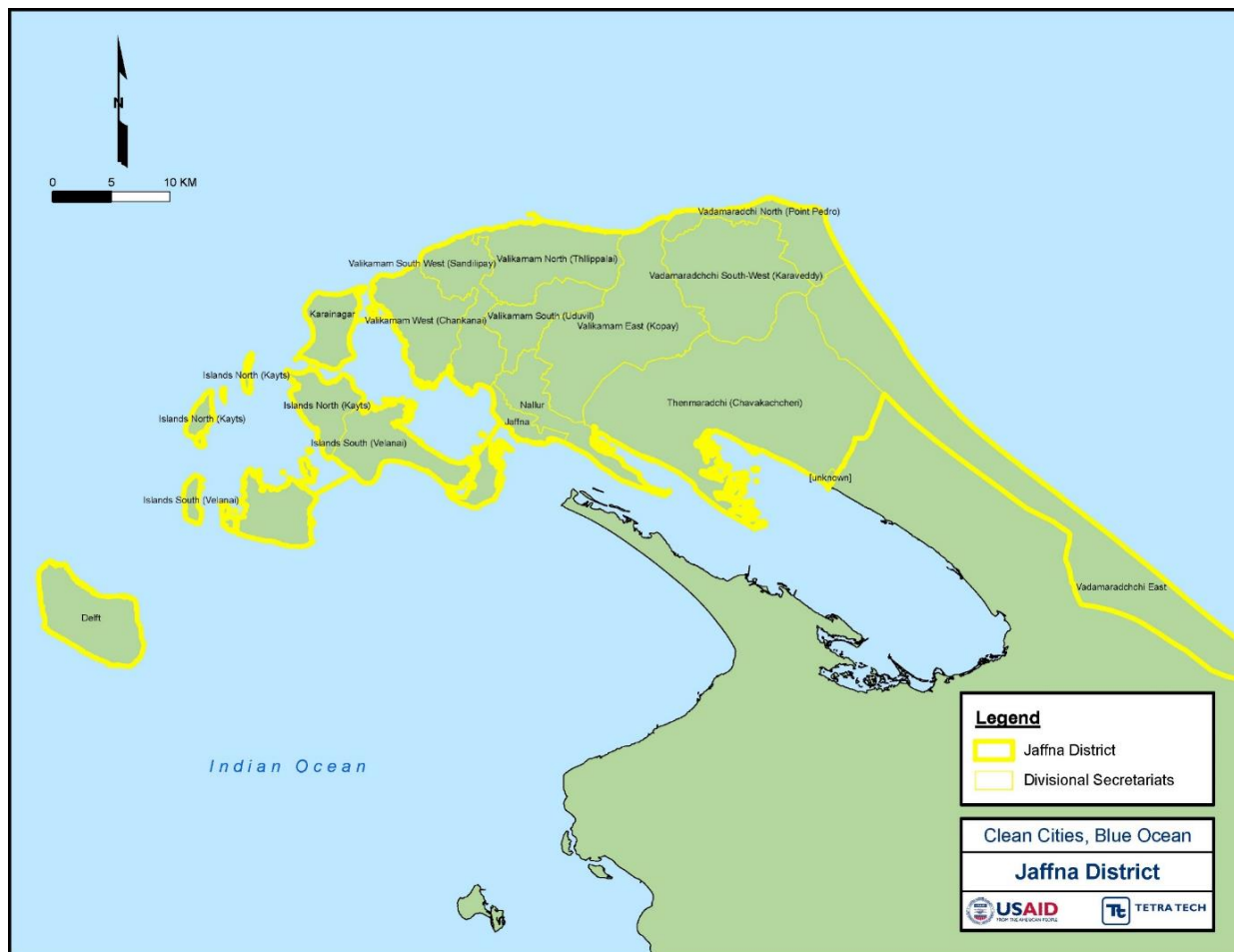


Figure 47. Map of Jaffna District with Waste Management Facilities



3.4.1 Governance

Central Environmental Authority

See section 2.1.1 for CEA regulatory authority under the National Environmental Acts.

Northern Provincial Council Secretariat

The Northern Provincial Council appropriated a budget for solid waste management across LAs to promote community development. However, the Five-Year Investment Program (2009-2013) has yet to be updated or renewed since the previous program ended in 2013.⁷¹

No information was found through ISWMA research regarding the SWM efforts of the Northern Provincial Council (www.np.gov.lk/).

Councils/Divisional Secretariats

As part of the ISWMA the following MC's, UC's, and PS's were identified as part of Jaffna District. Some of

⁷¹ JICA, 2016.

the identified councils had websites that were visited with the intent of finding regulatory requirements related to solid waste management. Very little to no information was found through this process, due to links being broken or websites with no translation capabilities. Therefore, to date very little local rules, ordinances, and/or regulations have been found at the council level of government.

Jaffna District is divided into 17 local authorities, including one Municipal Council (the Jaffna Municipal Council), three Urban Councils (Chavakacheri Urban Council, Point Pedro Urban Council, and Valvettihurai Urban Council), and 13 Praheshiya Sabhas:

1. Chavakacheri
2. Delft
3. Karainagar
4. Kayts
5. Nallur
6. Point Pedro
7. Vadamarachi South West
8. Valikamam East
9. Valikamam North
10. Valikamam South
11. Valikamam South West
12. Valikamam West
13. Velanai

Jaffna Municipal Council

The Public Health Engineering Division (PHED) in the JMC is responsible for collecting municipal solid waste, sweeping streets and public areas, operating treatment facilities such as compost plants, and operating disposal sites.⁷² The Engineering Department is in charge of the maintenance of collection vehicles and the assembly of public waste bins through workshops. The main duties of the PHED include:

- Waste collection and transportation services;
- Public health services (prevention of infectious diseases, such as dengue fever);
- Street sweeping;
- Fee-based waste collection services;
- Operation of the compost plant and disposal sites; and
- Promotion of waste separation.

The JMC has not yet formulated any master plan or action plan related to SWM.

3.4.2 Waste Generation

The total amount of waste generation in Jaffna District is estimated to be approximately 300 MT (330 tons) per day.⁷³ Based on waste generation calculations developed through the ISWMA, an estimated 120,000 tons of waste are projected to be generated in Jaffna District in 2020.

In the JMC, about 105 tons of waste is generated daily.⁷⁴ According to the State of Sri Lankan Cities official website, the per capita waste generation in the council is 1.3 kg (2.9 lbs.) per capita per day.⁷⁵ The majority of generated waste is considered biodegradable (i.e., kitchen waste, grass, and wood) as presented in Table 6. Commercial waste is the primary source of waste generation, followed by residential waste (Table 7).

⁷² JICA, 2016.

⁷³ UN Habitat, 2016.

⁷⁴ State of Sri Lankan Cities.

⁷⁵ JICA, 2016.

Table 6. Waste Composition in JMC (JICA, 2016)

Category	Rate (%)
Kitchen Waste	68.9
Paper	2.7
Textiles	1.3
Grass and wood	15.1
Soft Plastics	3.6
Hard Plastics	0.4
Rubber and Leather	0.2
Metal	0.3
Glass and Bottles	0.4
Stone and Ceramic	7.1
Other	0.0
Total	100.0

Table 7. Waste Generation in JMC by Source (JICA, 2016)

	Source	Generation Rate	Unit	Generation Sources	Generation (ton/day)
Residential	Collection	0.47	Kg/person/day	80,829	37.99
Commercial	Hotels (middle)	17.00	Kg/(hotel)	93	1.58
	Restaurants (middle)	17.00	Kg/(restaurant)	99	1.68
	Organic shop (large)	50.00	Kg/(shop)	66	3.30
	Organic shops (middle)	17.58	Kg/(shop)	42	0.74
	Non-organic shops (large)	50.00	Kg/(shop)	527	26.35
	Non-organic shops (small)	17.58	Kg/(shop)	1,285	22.59
Institutions	Schools	8.00	Kg/(school)	60	0.48
	Hospitals	5.25	Kg/(hospital)	19	0.10
	Public Office	20.00	Kg/(institution)	374	7.48
	Bank/Private Office	5.25	Kg/(institution)	43	0.23
	Buddhist Temples	5.25	Kg/(temple)	1	0.01
	Hindu Temples	5.25	Kg/(temple)	60	0.32
	Mosques	5.25	Kg/(mosque)	3	0.02
	Churches	5.25	Kg/(church)	27	0.14
Industries	Large	187.50	Kg/(industry)	0	0.00
	Domestic	6.00	Kg/(industry)	143	0.86
Drainage			Kg	1	1.00
Total					104.87

3.4.3 Waste Collection

Curbside collection and stationary collection systems have been implemented in the JMC. Mixed waste from residents is stored in the waste collection bins and discharged on the curb for collection vehicles. In inaccessible areas where collection vehicles cannot pass, waste is collected at collection points by handcarts. Tractors and trailers then collect the garbage from designated points. Larger amounts of waste generated by businesses such as shops and restaurants are stored in 100-liter or 200-liter barrels (Figure 48), then collected door to door by a collection vehicle.



Figure 48. Waste Storage Barrels for Large Waste Generators in JMC (JICA, 2016)

Curbside and stationary collection occur approximately twice a week, while large amounts of waste are collected daily through door to door collection. According to surveyed households in JMC, the most common method of garbage collection is placing it outside (64 percent), followed by carrying waste to the collection truck (27 percent).⁷⁶

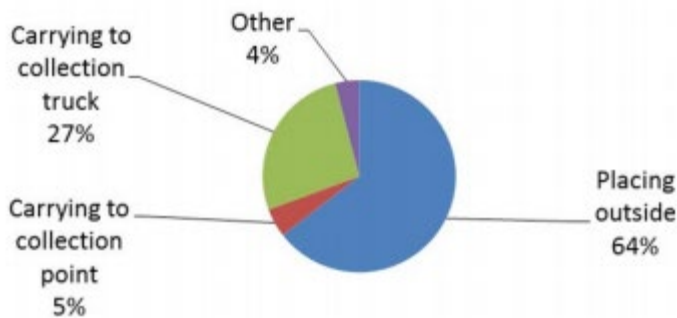


Figure 49. Survey Results for Methods of Collection in JMC (JICA, 2016)

Data from the same 2016 study showed that 11,123 households were covered by garbage collection, with 7,412 households not covered⁷⁷—an approximately 60 percent coverage rate, although JICA estimated the rate of waste collection coverage in the administrative area to be as high as 80 percent. The larger District collection rate is much lower than JMC, estimated to be between 14 and 33 percent.⁷⁸

An undated document from the Northern Provincial Council official website presents the waste collection amount by LA in Jaffna District (Table 8),⁷⁹ however it is assumed that this document is outdated as these quantities are lower than what has been reported by multiple sources, including JICA.

⁷⁶ JICA, 2016.

⁷⁷ State of Sri Lankan States.

⁷⁸ UN Habitat, 2016.

⁷⁹ Northern Provincial Council, Sri Lanka.

Table 8. Waste Collection in Jaffna by Local Authority (Northern Provincial Council)

Local Authorities	Waste Collection (TPD)
Jaffna Municipal Council	70
Chavakacheri Urban Council	4.5
Point Pedro Urban Council	4
Valvettihurai Urban Council	3
Velanai Pradeshiya Sabha	3
Nallur Pradeshiya Sabha	4
Vali South West Pradeshiya Sabha	4.8
Vali West Pradeshiya Sabha	1.82
Vali South Pradeshiya Sabha	10
Vali North Pradeshiya Sabha	3.5
Vali East Pradeshiya Sabha	8
Chavakacheri Pradeshiya Sabha	2.6
Vadamarachchi Pradeshiya Sabha	6
Point Pedro Pradeshiya Sabha	4

Both curbside and stationary collection in residential areas of the JMC is free. The collection of large amounts of waste varies by barrel size. Garden waste collection costs SLR 575 (approximately US \$3.12). A breakdown of collection charges in the JMC is presented in Table 9.⁸⁰

Table 9. Waste Collection Fees in JMC (JICA, 2016)

Types of Waste Collection		Cost (SLR)
Curbside collection and stationary collection in residential area		Free
Collection of large amounts of waste	200-liter barrel	230 (~\$1.25)
	100-liter barrel	150 (~\$0.81)
Garden waste (1 load of tractor)		575 (~\$3.12)

3.4.4 Recycling System

As a public awareness program, the JMC has implemented source separation and separate collection with a designated tractor in the Bazar area. The JMC supports schools and local community groups to promote the source separation and separate collection through separate bins. Additionally, the JMC has distributed pamphlets to households in the JMC to further promote waste separation.

World Vision Sri Lanka has recently provided “resource banks” or “sampath piyasa” to areas in Colombo as well as Chavakacheri in Jaffna.⁸¹ The “resource banks” serve as resource recovery centers and provide a location for locals to segregate and drop off their non-biodegradable and clean waste. This initiative is a result of the Philippines, Indonesia, Sri Lanka Project (PHINLA), a global program focusing on waste

⁸⁰ JICA, 2016.

⁸¹ World Vision, Sri Lanka.

management systems. The project is funded by the German government and is implemented by World Vision Lanka in collaboration with the Sevantha Urban Resource Center. Additionally, the PHINLA Project plans to promote behavioral change through resource recovery methods of waste management. The project will also assist the recycling industry to contribute to waste management and circular economic principals. This project is expected to run until 2022.

Composting Facilities

There are three composting facilities in Jaffna District, although their exact locations were unable to be determined. According to JICA, the JMC operates one of the compost plants, established in 2002.⁸² The plant receives between nine to ten tons of garden waste and produces approximately 200 kg (440 lbs) of compost on a weekly basis—below full capacity as a result of lack of staffing. At the plant, a sorting yard for recyclable waste is also being funded under the Pilisaru project (under construction in 2015 and assumed to now be completed).

Recycling Center

One (unnamed) recycling center was identified in Jaffna, located south of the Russel Square Neighborhood Park (Figure 50).⁸³

Figure 50. Recycling Center in Jaffna
(Ministry of Megapolis and Western Development, 2019)



Material Recovery Facilities

None identified in Jaffna.

Source Separation/Recycling

Since source separation and separate collection are not officially conducted by the JMC (with the exception of the Bazar area), residents separate and sell recyclables to private recycling shops. According to JICA, there are two recyclable waste operations in Jaffna. These shops purchase materials such as plastic, cans, metal, and other materials. Table 10 shows the buying price for each material type at local recycling shops.

Table 10. Purchase Prices for Recyclables in Jaffna (JICA, 2016)

Material Type	Buying Price (SLR)
Plastic	35 (~\$0.19)
Can	35 (~\$0.19)
Polyethylene	10 (~\$0.054)
Plastic Chair	80 (~\$0.43)
Bucket	50 (~\$0.27)

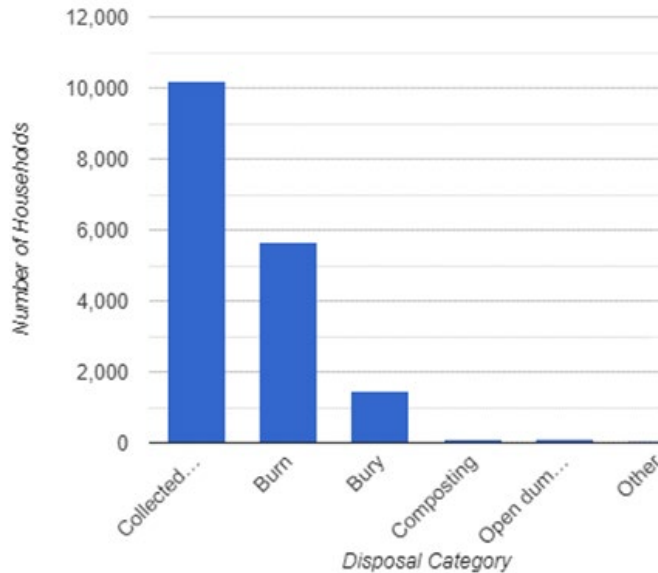
⁸² JICA, 2016.

⁸³ Ministry of Megapolis & Western Development, 2019.

3.4.5 Waste Disposal

Methods of disposal include collection by LAs, burning, burying, composting, and open dumping. In JMC, most waste is collected by the municipal council, with burning as the second most common method.⁸⁴

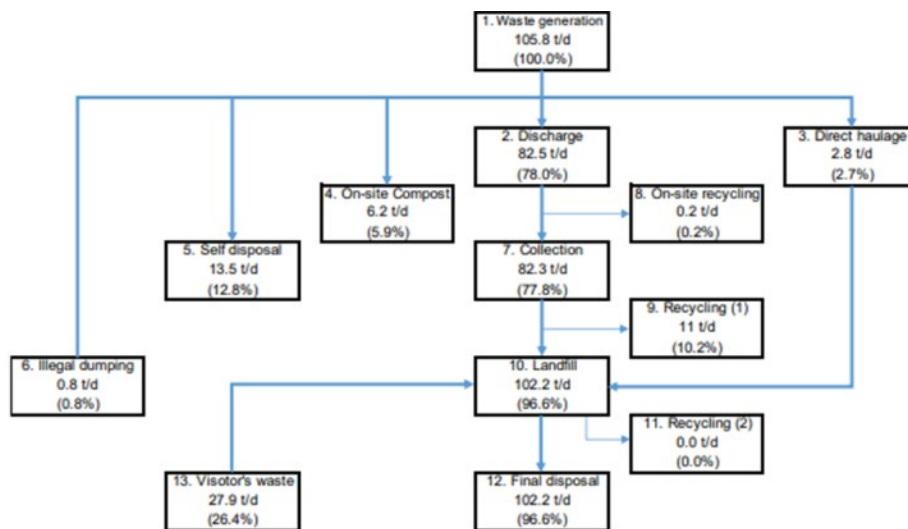
Figure 51. Disposal Methods in JMC



The flow of waste in JMC is presented in Figure 51, which—as illustrated—the majority of which is discharged and collected by the LAs for final disposal. Self disposal accounts for 13 percent of waste disposal, followed by on-site composting (six percent).

Local authorities in Jaffna use several dumpsites that are in close proximity to the source of the solid waste. Storm water collection ponds have typically been used as dumping grounds. Dumping yards that have been used in the past include: Kakaithivu, Nayanmarkaddu, Muniswaran Road, Selvapuram, and Cynor.⁸⁵ All dumping yards have been abandoned, with the exception of the Kakaithivu dumpsite (Figure 53) as well as a new site that has been established at Kallundai.

Figure 52. Waste Flow in JMC (JICA, 2016)



These dumps have no protection against seepage nor have structures in place to restrict children, animals, or scavengers from accessing the dumps. As is the case with Galle, medical waste from hospitals in Jaffna are disposed at a facility in Moratuwa.

⁸⁴ State of Sri Lankan Cities.

⁸⁵ UN Habitat



Kallundai has been operating since 2002 and is utilized by the Jaffna PS, Valikamam-South West PS, and Nallur PS. According to gate records at the disposal site, the dump receives approximately 113 tons each day. Jaffna disposes 102.2 tons/day, Valikamam-South West PS disposes 3.1 tons/day, and Nallur PS disposes 7.8 tons/day).⁸⁶

Figure 53. Kakaithivu Dump
(Google Aerial 8-2020)



Figure 54. Kallundai Dump
(Google Aerial 8-2020)

The Kallundai site is approximately 10 hectares (24.7 acres), although the boundary of the disposal site is unclear and waste is scattered around the site without organized management. The site has not been officially approved for use as a disposal site by the three LAs since its establishment in 2002. In June 2013, the Northern Provincial land commissioner requested to lease 20.8 hectares (51.4 acres), including the current 10 hectares and another future 10.8 hectares (26.7 acres) as a long term contract on behalf of the JMC. However, a long-term lease has yet to be approved by the central land commissioner general. The JMC plans to establish a new final disposal site next to the existing disposal site that will serve as a regional dumpsite for several LAs.



Figure 55. Kallundai Dump (Google Street View 2-2015)

⁸⁶ JICA, 2016.



With assistance from the Korean government, the CEA is hoping to construct four large-scale sanitary landfills in Sri Lanka, including one at Keerimale in Jaffna.⁸⁷ The ISWMA was unable to determine if construction has begun. As shown in Figure 56, the site has already been used as a dump site.

Figure 56. Proposed Landfill in Keerimale, Jaffna
(National Audit Office, 2016)

3.4.6 Education and Outreach

The “Physical Plan for the Northern Province Volume One: The Plan Ministry of Construction, Engineering Services, Housing and Common Amenities” was drafted in December 2012 and proposes the review of current waste management and recycling practices as well as the development of a waste management plan.⁸⁸ The project includes a waste education strategy, with a focus on existing and proposed urban centers and industrial sites. The agencies involved in this project include the CEA, Department of Wildlife, and Department of Forestry.

The CEA has also provided financial assistance for selected schools under the Environmental Pioneer Brigade Program in Jaffna and other regions of Sri Lanka.⁸⁹ The program was first implemented by the CEA in 1984 to promote environmental education among school children, and under the program teachers from selected schools are trained at workshops to implement ecofriendly projects within schools.

3.5 Malé

Malé, the capital of the Maldives, is an island located southwest of Sri Lanka within the Indian Ocean. The Maldives has 192 inhabited islands out of 1,190 in total. Malé is one of the most densely populated cities in the world with a population of approximately 177,000 living on about 5.8 km (3.6 miles) of land.^{90,91} The entirety of the city consists of the central island of Malé along with five more islands, Hulhulé, Hulhumalé, Vilimalé, Gulhifalhu and Thilafushi. According to Maldives publication, the Edition, “...uncontrolled urbanization and lack of zoning has caused residential, commercial, and institutional land to be in close and unsafe proximity to each other.” The city lacks an organized waste management system. Massive amounts of litter are transferred each day to Thilafushi Island for unregulated open burning. Some communities in

⁸⁷ Auditor General, 2016.

⁸⁸ JICA, 2016.

⁸⁹ Central Environment Authority, 2010.

⁹⁰ World Factbook Official Website, 2020.

⁹¹ Zaki, Avas Official Website, 2017.



parts of the island find it difficult to transport waste, therefore, they resort to openly tossing or burning their waste.

Figure 57. Maldivian Capital of Malé (iStock image, 2015)



Figure 58. Map of Malé

3.5.1 Governance

The Maldives is a presidential republic that has twenty-six natural atolls and a few island groups on isolated reefs—divided into twenty-one administrative divisions. Malé is divided into six divisions, four of which are on the island: Henveiru, Galolhu, Maafannu and Macchangolhiand. The remaining two, Vilingili and Hulhumalé, are on neighboring islands. Each atoll is administered by an elected Atoll Council, and the islands are administered by an elected Island Council. The president heads the executive branch and appoints the cabinet which is approved by the parliament. He also oversees the armed forces and there is no separation of powers.⁹² See Section 2.2.1 for details on the SWM regulatory authority under the national government.

⁹² Wikipedia.

The Greater Malé Environmental Improvement and Waste Management Project was proposed to the Republic of Maldives through the President’s manifesto in 2013. It calls for the establishment of a waste collection, transfer, and disposal system and will set forth the legal and institutional framework for the waste industry. The proposal phase began in 2018 and is an ongoing project with an estimated completion date of late 2023. It is up to standard with all national policies and regulations. The Waste Management and Pollution Control Department in the Ministry of Environment and Energy in the Maldives has been mandated to ensure that this project achieves safe municipal solid waste disposal to all inhabited islands.⁹³

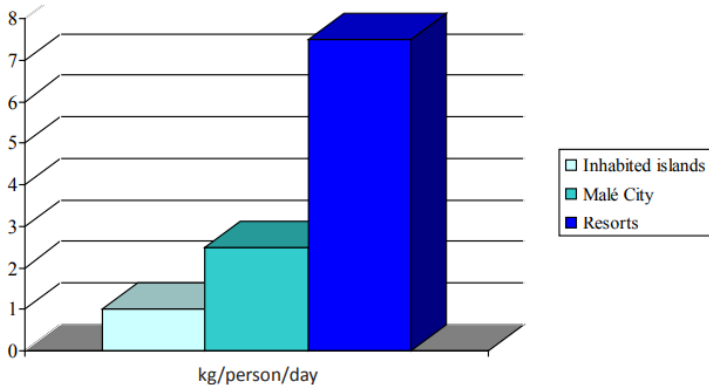
All government institutions and buildings, including the President’s office, are located within the island of Malé. For local governance, the Malé City Council manages all public interests of the city and is responsible for all operations regarding the city’s only landfill, Thilafushi Island.⁹⁴ No other regulatory requirements were found through ISWMA research, and Malé’s official website (www.malecity.gov.mv) does not provide any information on SWM.

3.4.2 Waste Generation and Composition

Malé generates an estimated 440 MT (480 tons) of waste per day, or roughly 2.5 kg (5.5 lbs.) of solid waste per capita.⁹⁵ The capital hosts nearly all of the government buildings, hospitals, and the country’s most advanced schools. Based on ISWMA waste generation calculations, an estimated 160,000 MT (176,000 tons) of waste are projected to be generated in Malé in 2020. The quantity of waste generated per capita by various local systems is shown in Figure 59.

The tourism industry is rapidly growing in the Maldives, with visitors all year round. According to the Environmental Justice Atlas (in 2014), a single tourist produces about 3.5 kg of garbage per day (7.7 lbs/day)—twice as much as a local Maldivien.⁹⁶ This amount is most likely much higher today. Tourism solid waste is a prevalent issue in the Maldives overall, as well as poorly controlled urbanization. Malé, however, has fewer resorts than its surrounding islands and is often bypassed by tourists who are only passing through the Malé International Airport—a major source of waste itself. It is the main gateway into the Maldives and the only airport in the country offering international flights.⁹⁷ The World Bank reports that the waste generated by both tourist resorts and the international airport are roughly six times the rate of local residents.⁹⁸

Figure 59. Maximum amount of waste produced by different entities in the Maldives (Source: Colombo et. al. 2014)



⁹³ Asian Development Bank, 2018.
⁹⁴ Country Analysis, 2013.
⁹⁵ UN Environment Programme, 2012.
⁹⁶ Environmental Justice Atlas Official Website.
⁹⁷ Malé International Airport Guide.
⁹⁸ The World Bank, 2016.

A 2013 waste composition study by the Minister of Environment and Energy showed that organic waste makes up more than 80 percent of the city’s solid waste, yet the city has no uniform compost or sorting methods.

Table 11. Waste Composition in Malé (Mohamed, 2016)

Composition	Percentage (%)
Total Compostable Waste	79.45
Yard Waste	50.85
Food Waste	22.22
Dirt, Ash, Stone, Sand	7.60
Other Organic Waste	4.64
Steel Cans	2.35
Paper	1.87
Plastic Film	1.84
Textiles	1.75
Wood	1.74
Cardboard	1.55
Glass	1.37
Rubber and Leather	0.77
Other Plastics	0.66
Other Metals	0.34
Hazardous Waste (Batteries)	0.17
Aluminum Cans	0.15
Pet	0.14

3.5.3 Waste Collection

Waste Management Corporation Limited (WAMCO) is responsible for waste management functions for the entire Malé region, which includes the daily transfer of waste from the city to the Thilafushi dump. They offer both doorstep and building services to all households/facilities in the city for a fee as listed below.

Daily Waste Generation Pick-up:

- 150 Maldivian Rufiyaa (MVR) (~\$9.74) - per each household per month
- MVR 100 (~\$6.49) - per each apartment per month

Bulk Waste Pick-up (Furniture, electronics etc.):

- MVR 250 (~\$16.24) - for 350 kg truck/trip
- MVR 550 (~\$35.72) - for 1.5-ton truck/trip
- MVR 750 (~\$48.71) - for 2-ton truck/trip
- MVR 950 (~\$61.70) - for 4-ton truck/trip

Solid waste is either sorted by WAMCO for recyclable items or transported straight to Thilafushi Island

and dumped without undergoing any treatment process.⁹⁹

There are many informal waste collectors in the Malé due to unorganized waste management and affordability. According to BioCycle, there are about 200 informal collectors who will pick up and transport waste on bicycles or pushcarts for a fee. On a bicycle, the average weight per load is 33 lbs. with five to seven collection trips per day. Pushcart loads average about 150 to 220 lbs. per trip, with collectors averaging two to three trips a day to the transfer station. Most collectors have other jobs and collect waste to augment their income for an additional, approximate ~\$36 per month.¹⁰⁰

As a result of the COVID-19 pandemic, WAMCO has made small changes in their transfer routes in attempt to delegate solid waste. They now categorize specific types of waste as “sensitive wastes that must be destroyed for various reasons immediately,” which include expired, spoiled, or decomposed foods; foods asked to be destroyed by the Maldives Food and Drug Authority; and goods asked to be destroyed by other agencies. In addition, instead of all waste being taken to Thilafushi Island, food wastes are now handled by the Malé transfer station.¹⁰¹ ISWMA research did not uncover any additional information regarding COVID-19 and SWM changes.

3.5.4 Recycling System

Malé does not have a municipal recycling program, therefore recyclables are recovered informally by either local scavengers or other environmental organizations. According to BioCycle, mostly metals and polyethylene terephthalate (PET) are recovered for recycling in the Maldives—about 330 to 440 tons per month of ferrous and nonferrous metals and 33 tons per month of PET. Most recovered recyclables are imported to India, the closest large market.¹⁰⁰

Material Recovery Facilities

WAMCO has collaborated with Parley for the Oceans, a global network whose goal is to raise awareness for ocean destruction, to establish a Plastic Recycling Lab in Malé.¹⁰² The lab can process up to 100 kilos (220 lbs) of plastic per day to be repurposed into other items such as phone cases, files, and flowerpots.

Smart Bin is another recycling facility in the city—a reverse vending machine with one location in Malé as of 2018. The device was launched as the first of its kind on the Maldivian islands through the collaboration of the Malé Water and Sewerage Company (MWSC) and the Ministry of Environment and Energy. According to local publication, the Maldivian, the smart bin has the capacity to collect approximately 538 bottles per day and accepts empty plastic bottles between 330 mL to 1.5 L. Users receive 0.15 points per bottle to redeem on the MWSC mobile application.¹⁰³

Transfer Stations/Ferry Transfer Stations

There are transfer stations for both industrial wastes and municipal wastes, however, there is limited

⁹⁹ WAMCO Official Website.

¹⁰⁰ BioCycle Official Website, 2012.

¹⁰¹ One Online Official Website, 2020.

¹⁰² Global Recycling Official Website.

¹⁰³ The Maldivian Official Website, 2018.

information available on these facilities' collection and operation processes. Two stations were identified through ISWMA research: WAMCO Waste Disposal Area, southwest of the capital (Figure 60), and another on Hulhulmalé Island (Figure 61) in the northwest area. The trash collected from the transfer

stations is taken to Thilafushi Dump by ferry and openly burned on site. As illustrated in Figure 63, food waste and construction materials are the bulk of the waste generated. Recyclables such as metals and plastic only account for about 3% of the discards.



Figure 60. WAMCO Waste loading zone in Malé to be transferred to Thilafushi Island
(Google Aerial Image 2-2019)



Figure 61. WAMCO Waste loading zone on Hulhulmalé Island to be transferred to Thilafushi Island
(Google Aerial Image 2-2019)

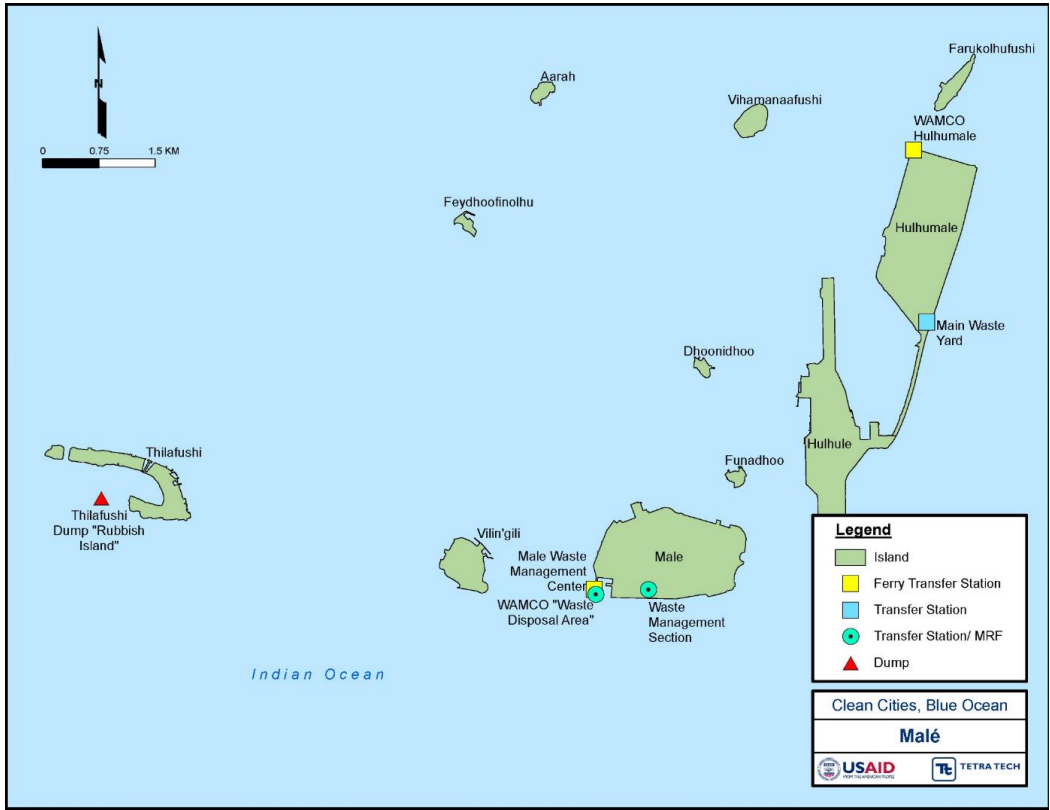
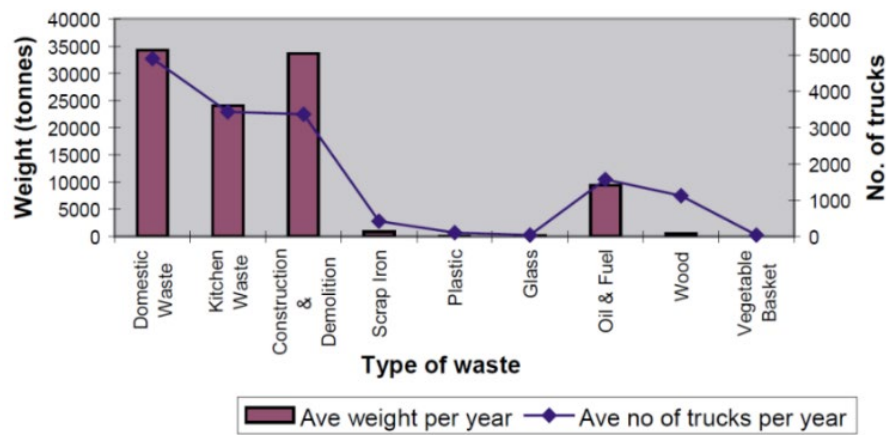


Figure 62. Map of Malé Waste Management Facilities/Operations

Figure 63. Composition of Malé waste and average number of trucks and weight to Thilafushi each year (Regional Resource Center for Asia and the Pacific, 2002)



1.5.5 Waste Disposal

In 1992, the Malé City Council made the decision to establish the Thilafushi lagoon as the final destination for the rapidly increasing amount of solid waste, attributed largely to the flourishing tourism industry. Since, the island has received about 330 tons of garbage a day for the past 20 years, earning the nickname “Rubbish Island.”¹⁰⁴

The only recovery/recycling of waste is done by 200 Bangladeshi migrant workers who sift through the trash each day.¹⁰⁵ Trucks empty their contents onto the ground, which is unlined, covering an area of 124 acres. Despite limited recovery and recycling rates, the island is expected to still contains space for at least the next thirty years. Thilafushi is only 4.3 miles from the coast of Malé, and its plumes of smoke are visible from city, the international airport, and surrounding resorts. It also compromises air quality and toxic leachate contaminates soil and groundwater. The impacts of this uncontrolled SWM system are devastating to the environment.



Figure 64. Thilafushi Dump (Google Aerial Image 8-2020)

¹⁰⁴ Atlas Obscura Official Website.

¹⁰⁵ Charismatic Planet Official Website.



Figure 65. Ferry delivering trash to be dumped directly onto Thilafushi Island (*Oceanwildly Official Website*)

3.5.6 Education and Outreach

WAMCO and Parley for the Oceans, an organization dedicated to addressing major threats to oceans and ecosystems, collaborated on the installation of a recycling lab in Malé (Figure 66). The collaboration sought to involve the public in recycling through raising awareness and bringing in students of schools to tour and observe the process. The recycling lab utilizes recovered materials to repurpose into all sorts of items. Similarly, Parley has also formed a collaboration with Adidas to create shoes from recycled plastic waste collected from the Maldives.



Figure 66. Plastic Recycling Lab in Malé (*Sunphoto, Afrah*)

Other instances of educational awareness amongst students include another collaboration between Parley for the Oceans and Dhiraagu, the leading telecommunications and digital services provider in the Maldives. Together they worked to create awareness sessions for schools. The Ministry of Education in the Maldives also launched a nation-wide ocean exploration program called, Ufaa to raise ocean pollution awareness within schools and ensure students in every school are able to explore the reefs of the Maldives. The program eventually helped to ban single-use plastic in all schools in April 2018.¹⁰⁶

¹⁰⁶ SunOnline International.

The Republic of Maldives collaborated with the Asian Development Bank, to create a multi-donor funded project that will establish a sustainable SWM system for the Greater Malé capital region and the surrounding islands—including public awareness components.¹⁰⁷ According to the Ministry of Environment for the Republic of Maldives, this project was launched in 2018 and is targeted for completion in late 2023. The project is being



Figure 67. Greater Malé Environmental Improvement and Waste Management Project Proposed Site Plan (Source: Asian Development Bank, 2018)

implemented in two phases: Phase I (US \$40 million) and Phase II (US \$127.5 million). Phase I seeks to establish an integrated regional SWM system (including collection, transfer, waste-to-energy/incineration treatment, disposal, recycling, and dumpsite closure and remediation); strengthen institutional capacities for solid waste services transportation, environmental monitoring, and improve public awareness in the 3Rs; and reduce greenhouse gas emissions, create a cleaner environment, and combat climate change. Phase II will establish a regional waste management facility with waste-to-energy treatment plant and engineered landfill and address dumpsite rehabilitation/remediation. The five-year project will be financed by multiple institutions See proposed layout in Figure 67.

4. Additional Information/Data Required

In order to develop a more detailed SWM assessment, additional information and data will be required as outlined throughout this report. Additional data will enable CCBO to establish high confidence in the critical information being presented, such as existing waste generation, collection, recycling, and final disposal data. The following lists some of the information that will be needed to address CCBO-identified priorities:

- Solid Waste Generation – Need to identify breakdown of tons of waste generated by each sector including residential, commercial, and industrial.
- Per Capita Generation – Verification of publicized calculations is needed.
- Waste Characterization – If additional waste characterization data is not found, it is recommended

¹⁰⁷ Republic of Maldives Ministry of Environment, 2018.

- that waste characterization be conducted at the source generation and final disposal.
- Identification of collection methods for all sectors at each engagement site.
 - Collection – Identify collection method and associated volumes (recovered materials and residual).
 - Existing Processing Infrastructure – Identification/verification of active:
 - Aggregation Points,
 - Material Recovery Facilities (MRF),
 - Construction and Demolition (C&D) Operations, and
 - Organics Processing.
 - Permitted/Certified Operations/Facilities – Identify permitting/certification process for the various types of operations/facilities. Available mechanisms to shut down operations/facilities.
 - Recovered/Recycled Material Quantities – Tons received, recovered, and residual as applicable. Types of materials recycled. The identification of processors, brokers, or end-users.
 - Programs or initiatives involving reuse or reduction of materials.
 - Solid Waste Disposal – Total tons disposed on a daily and annual basis and associated tipping fee at:
 - Dumps,
 - Landfills, and
 - Sanitary Landfills.
 - Existing Active and Inactive Open Dumps – Estimated waste in-place calculations to assess proper closure of dump sites.
 - Waste Pickers – Need to identify the number of waste pickers associated with dumps and landfills.
 - Outreach and Education – Need to identify all existing/current publicly funded education and outreach efforts and NGO’s with focus on SWM.
 - Regulatory Enforcement and Penalties – Need to identify enforcement actions and penalties if any by any of the engagement sites.
 - An understanding of funding and financial systems as well as fee structures and how fees are collected.
 - Field Observations – It is obvious that solid waste at CCBO engagement sites is not properly managed, field observations should be focused on set-out, aggregation, collection, and processing (resource recovery).

5. Recommendations and Next Steps

CCBO has learned a lot through its online research and will build upon this knowledge as the program progresses. Through the ISWMA, CCBO was able to identify several immediate steps that the team believes should be taken and recommends the following be considered in this initial phase of the CCBO program in Sri Lanka and the Maldives.

Recommendations:

- Continue to research and better understand the existing 3R/SWM systems in the engagement sites.
- Support ongoing work in the City of Colombo and the Greater Malé area to support optimization, continued progress, and/or scaling of successful interventions.
- Work within the communities to further develop a network of government officials, civic society, citizens, workers, NGOs, private sector and other entities that have been involved in the current systems and can help improve them.
- Work with these stakeholders to increase their capacity to develop sound 3R/SWM systems.
- Learn more about the funding for the 3R/SWM systems and work with stakeholders to consider additional or alternative revenue generation and financing options to support improvements to their systems.
- Seek ways in which to expand and develop the markets for plastics (those that are currently valuable and those that are not) and bio-degradable materials.
- Support communities to develop and improve the services needed to create efficient collection, aggregation and transport of materials as part of a sound SWM system.
- Support communities in updating and revising their SWM Plan to improve their 3R/SWM systems.
- Develop a network and understanding of the current circumstances for youth and women in the engagement sites and begin to formulate a path toward improving them as part of the 3R/SWM planning process.
- Review existing laws, policies and regulations pertaining to SWM systems and support additions or revisions that would support the SWM planning and implementation process.
- Engage stakeholders and the private sector to seek mutually beneficial means of building the infrastructure needed in improved 3R/SWM systems (MRFs, compost facilities, anaerobic digestion, sanitary landfills or other appropriate technologies.)
- Learn more about existing social behavior of those in Sri Lanka and the Maldives related to 3Rs/SWM and seek appropriate ways to create awareness for increasing material separation at the source.

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Annex I. Women’s Economic Empowerment, Gender and Current Opportunities

The Maldives and Sri Lanka have significantly different histories and consequently gender roles, although both are patriarchal societies. Their historical, political and cultural contexts exert a large influence on women’s role in SWM in the two countries.

Sri Lanka –

Gender in Context: In 2009, Sri Lanka emerged from a 26-year brutal civil war pitting Sinhalese and Tamils against each other. Jaffna, one of CCBO’s focal areas, was a stronghold of the Tamils, who eventually lost the war. However, rancor continues to simmer. According to one source, rape was used extensively as a weapon of war by the Sinhalese, especially against male Tamil combatants and sympathizers. It is likely that women were also subject to this practice. Tamils may also have used rape as a weapon of war, but information on this was not easily available.

Whether warfare or aggressive patriarchy figure more prominently, the prevalence of gender-based violence (GBV) against women, especially intimate partner violence (IPV) is high. In a 2015 paper, authors report that a “recent survey” found IPV prevalence rates of 24-34%, and among the urban poor in Western Province, where Colombo is found, rates as high as 60%.¹⁰⁸ Presumably, the urban poor would include informal waste collectors. Guruge et al report, as in many other countries, women seldom report abuse to the police, and when they do they are likely to be blamed. Single mothers working on dumps or collecting from streets to support their families are, hence, highly vulnerable to abuse.

In 1948, Sri Lanka emerged from more than 150 years of British colonial control. In addition to subjection to British colonial power, Sri Lanka has other similarities to India, which is only about 55 km away by sea. Like India, Sri Lanka has a caste system, which has a direct effect on who becomes a waste picker and how informal waste collectors are treated. The influence of the caste system may be declining.¹⁰⁹ However, notions that are prevalent throughout South Asia about impurity attach not only to substances—such as waste—but also to castes and occupations coming into contact with impure substances. A number of sources report that waste handlers are highly stigmatized. For example, in Galle, “[Informal waste collectors] are often marginalized by the rest of the society, and survive in a hostile physical and social environment.”¹¹⁰

Women in the SWM value chain: In order to understand the interaction of the social category of gender, as well as the economics and political and historical climate of Sri Lanka’s SWM, the concept of the “wastescape” may be useful. Jaysinghe (2015) developed the concept to understand SWM in Sri Lanka. “Wastescape is used to conceptualize the space(s) within which formal and informal waste workers operate. The idea of a wastescape includes both waste as material and as a social-space constructed by and (re)producing a set of social, cultural and political relationships. Thus, I present the wastescape as a space where social, cultural and political aspects of waste management and its stakeholders operate.”

¹⁰⁸ Guruge, et al., 2015: 134.

¹⁰⁹ Jaysinghe, 2015.

¹¹⁰ Patabendi and Jayatilleke, 2011.

Sri Lanka appears to be more aggressively patriarchal than the Maldives. In the loose caste system of Sri Lanka, low caste women working as informal waste collectors seem to be at or very near the bottom. However, not all women in Sri Lanka who work in waste are informal waste collectors. Although ISWMA research was unable to find any information about women's presence in the formal waste collector sector in Sri Lanka, it is possible that they are missing.

Poor women may become waste pickers alongside their husbands and children, or they may be single mothers trying to eke out a living to support their families. If waste pickers are stigmatized, women are the most stigmatized of all because they engage in a polluted profession, occupy a low status anyway, and are out working. In addition, as women they are subject to the authority of their husbands or male consanguines, so are triply burdened. However, Jaysinghe (op cit) suggests that women who bring in money through waste collection are able to increase their power slightly within the family.

Advancing up the value chain, women work either as employees or as workers in family small or micro-enterprise waste selling businesses,¹¹¹ which collect and further segregate waste from waste pickers or smaller waste sellers and clean the waste. Women with connections may be found at much higher levels of the SWM value chain. In Colombo, the owner of a family operated small waste selling business commented, "...[small waste selling businesses] are not allowed to collect waste from an industrial zone in the area anymore as a politician's wife has taken the contract to collect all recyclable waste generated by this trade zone."¹¹² Industrial waste is generally much cleaner and of higher value than waste collected on the streets, garbage bins, or dumps. Although ISWMA research was unable to find information on women at the highest levels of the SWM value chain in Sri Lanka, it was found that women reportedly suffer from a glass ceiling at the executive level of private sector companies in Sri Lanka, which may also be the case in SWM companies.¹¹³

Some community-based women's organizations have been active in assisting women to develop composting businesses, e.g., in Galle¹¹⁴ or collect recyclables.¹¹⁵ Caution about trying to formalize the informal waste collection system has been expressed both by Jaysinghe (op cit) and the Asian Development Bank, "Once working conditions improve and formalization proceeds, women in the informal sector are often forced out of their roles in the waste management and recycling sector. Formalizing relationships and access to micro-loans can help women maintain access to employment in the waste management and recycling sector."¹¹⁶

The Maldives –

Gender in Context: The Maldives has had a varied history regarding colonization. For 15 years in the 16th century, Portuguese attempted to colonize the country, followed by the Dutch in the 18th century, who were succeeded by the British in the 19th and 20th century. Throughout, however, women enjoyed a relatively high status. "Ibn Baṭṭūṭah, a notable North African traveler, resided there during the mid-1340s and described conditions at that time, remarking disapprovingly on the freedom of the women—a feature

¹¹¹ Jaysinghe, 2015.

¹¹² Ibid.

¹¹³ Bombuela, De Avis, and Chamaru, 2013.

¹¹⁴ Asian Development Bank, 2006.

¹¹⁵ Jaysinghe, 2015.

¹¹⁶ Asian Development Bank, 2006.

that has been noticeable throughout Maldivian history.”¹¹⁷ In the past, the Maldives was ruled by a king (or sultan) and queen, who divided governance responsibilities. The queen was traditionally responsible for levying and collecting taxes and distributing these to the rest of the country, including the outer islands. The king handled trade and foreign policy.

Contemporary sources remark on women’s relatively high status, which seems to be declining somewhat. Western sources declare that with the advent of more fundamentalist Islam, particularly among under- or unemployed male youth, women’s status may be eroding. However, since status decline also coincides with increased globalization, which has been shown often to result in a decline in women’s status, the cause of any decrease in women’s status is ambiguous. There appears to also be a strong feminist movement in the Maldives working to reverse the decline in Maldivian women’s status. Maldivian women’s relatively high status does not seem to protect them from the GBV experienced by many South Asian women. The World Bank reports that 25% of Maldivian women have experienced GBV.¹¹⁸

Women in the SWM value chain: Traditionally, women have been responsible for maintaining cleanliness in public spaces. Perhaps this traditional role, together with women’s traditionally high status, has led to the Maldives being one of the few countries where women are found working in both the formal and informal waste collection sectors, at least in Malé. As in Sri Lanka, informal waste collectors tend to have lower education, which is otherwise generally high in Maldives, and are stigmatized. Studies of women as junk dealers and aggregators are missing. However, women are present as upcyclers making expensive crafts and clothing to sell in the Maldives’ tourist economy. Unfortunately, there do not seem to be any studies specifically of women in the SWM sector in Maldives.

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Annex II. Glossary of Terms

Dump or Open Dump – A facility where waste is disposed by both the public sector and private individuals in an uncontrolled manner. Such sites generally lack even minimal environmental controls and can have a significant negative impact on the local community.

Junkshop – Informal solid waste management operations typically operated by individuals out of residences or small street facing lots with canopies.

Landfill – A landfill typically means that a site has undergone some type of siting process to ensure that its environmental impacts to the community are minimized. Generally, a disposal site falling into this category involves the excavation of land to create a “cell” and the waste is covered with soil on a regular basis to minimize odors and vectors. However, it may or may not include modern environmental controls such as methane and leachate collection systems, proper drainage for stormwater run-off and other controls. Minimal equipment is on site to compact the waste to preserve the capacity of the site.

Material Recovery Facility – For the purposes of this document, a material recovery facility is a facility that receives recyclable wastes for processing, final segregation, compaction/baling, storage and transportation to a market (i.e. buyer) for each material type.

Sanitary Landfill – A sanitary landfill is typically an engineered facility built to store known or projected waste streams over a long-term horizon. A site of this variety typically goes through a rigorous siting and environmental impact process, before being designed and constructed by engineering and solid waste professionals. A sanitary landfill has environmental systems in place to control methane and other air emissions, leachate, stormwater run-off and daily cover material and includes monitoring systems to maintain metrics for operating and reporting requirements. Such facilities are operated with modern equipment, including compaction of the waste to optimize the available “airspace” based on a “fill plan” or “fill sequence” that places an economic value on the airspace.

Transfer Station/Material Recovery Facility (U.S.) – For the purposes of this document a transfer station is a facility where waste is aggregated by both the public sector and private individuals (self-haul) in a controlled manner. Materials separation occurs utilizing manual labor and automated equipment if possible. Recyclables are baled and sent to market. Residual waste is then transferred into larger vehicles and taken to a landfill for final disposal. They may handle multiple streams including commercial and residential waste, recyclables, organics, and construction and demolitions debris.