



Dhaka South City Corporation
The People's Republic of Bangladesh
Japan International Cooperation Agency

FUTURE VISION OF SOLID WASTE MANAGEMENT IN DHAKA SOUTH CITY

*Environmentally-Advanced City with Integrated and Sustainable Solid
Waste Management: toward Zero-Waste*

NEW CLEAN DHAKA MASTER PLAN 2018–2032

July 2019

Dhaka South City Corporation
The People's Republic of Bangladesh
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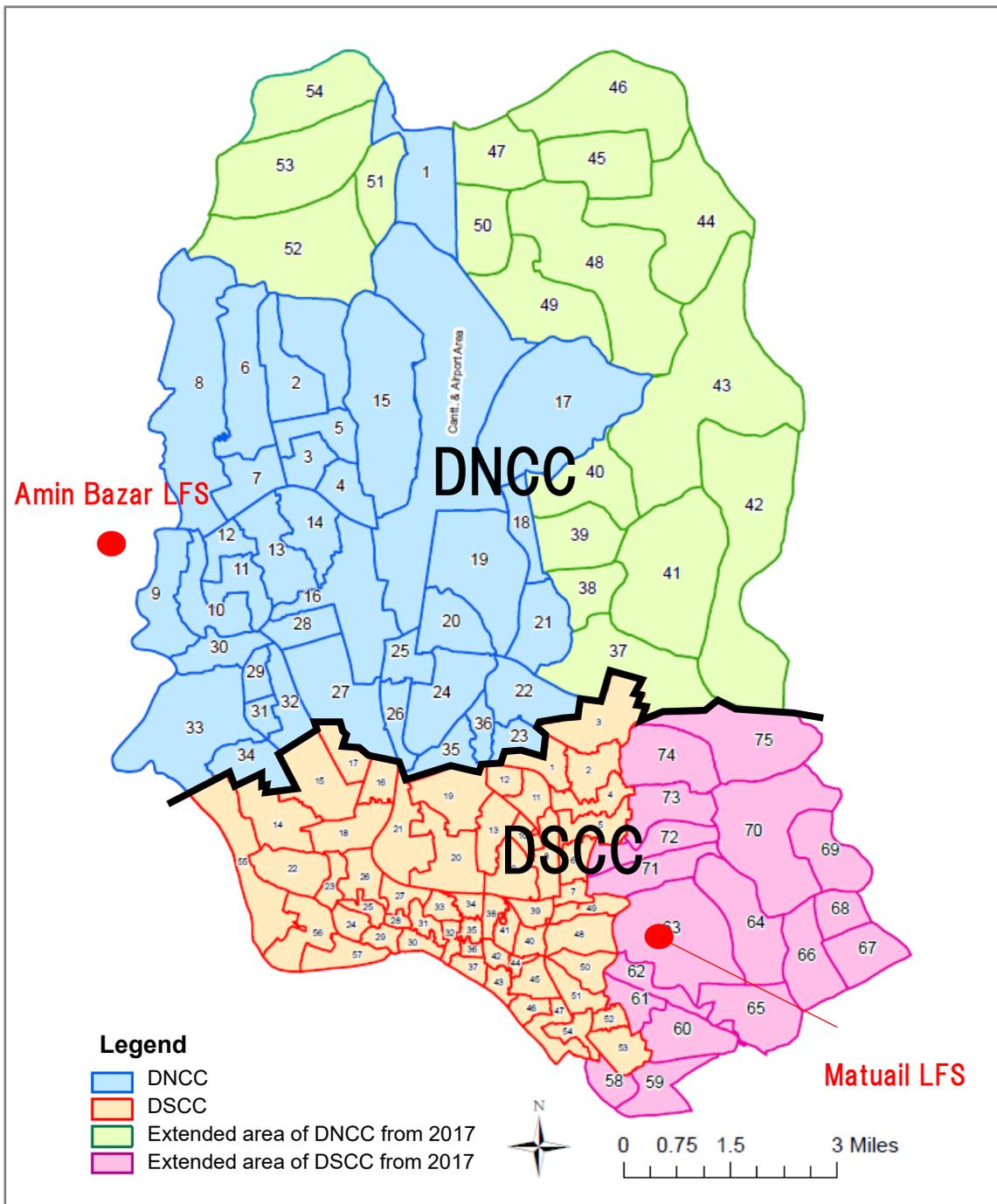
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The following foreign exchange rate is applied in the Master Plan:
US\$ 1 = Tk. 83 (Bangladeshi Taka) as of the end of August 2018.





Source: JICA Project Team

Areas of Dhaka North City Corporation (DNCC) and Dhaka South City Corporation (DSCC)

List of Abbreviations and Acronyms

AAP	Annual Activity Plan
ACWMO	Assistant Chief Waste Management Officer
Ad. CWMO	Additional Chief Waste Management Officer
ADB	Asian Development Bank
AE	Assistant Engineer
BBS	Bangladesh Bureau of Statistics
BCC	Barisal City Corporation
BDT	Bangladesh Taka
BPDB	Bangladesh Power Development Board
BUET	Bangladesh University of Engineering and Technology
BWDB	Bangladesh Water Development Board
CAP	Community Action Plan
CBO	Community Based Organization
CC	City Corporation
CCC	Chittagong City Corporation
CEO	Chief Executive Officer
CI	Conservancy Inspector
CNG	Compacted Natural Gas
CO	Conservancy Officer
COCC	Cumilla City Corporation
CUWG	Community Unit Working Group
CWMO	Chief Waste Management Officer
DCC	Dhaka City Corporation
DGHS	Directorate General of Health Services, Ministry of Health and Family Welfare
DNCC	Dhaka North City Corporation
DoE	Department of Environment, Ministry of Environment and Forests
DPP	Development Project Proposal
DSCC	Dhaka South City Corporation
ECC	Environmental Clearance Certificate
ECNEC	Executive Committee of National Economic Council
ED	Engineering Department
EE	Executive Engineer
EGAP	Environmental Grand Aid Project
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ERD	Economic Relations Division, Ministry of Finance
FTFP	Fixed-Time and Fixed-Place Collection
FY	Fiscal Year
GAP	Grant Aid Project
GCC	Gazipur City Corporation

GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIS	Geographic Information System
GoB	Government of Bangladesh
HCEs	Health Care Establishments
JDCF	Japan Debt Cancellation Fund
JICA	Japan International Cooperation Agency
JOCV	Japan Overseas Cooperation Volunteers
KCC	Khulna City Corporation
LFS	Landfill Site
LGD	Local Government Division, Ministry of Local Government, Rural Development and Co-operatives
LGED	Local Government Engineering Department
LMU	Landfill Management Unit
MCC	Mymensingh City Corporation
MD	Mechanical Division of Engineering Department
MTBF	Mean Time Between Failure
MLGRD&C	Ministry of Local Government, Rural Development and Cooperatives
MLSS	Member of Lower Subordinate Staff
MoEF	Ministry of Environment and Forests
NCC	Narayanganj City Corporation
NEDO	New Energy and Industrial Technology Development Organization
NGO	Non-Governmental Organization
O&M	Operation and Maintenance
OHSE	Occupational health, safety and environment
PAPS	Public Awareness Planning Section
PCG	Public Consultative Group
PCSP	Primary Collection Service Provider
PRD	Public Relation Department
PRISM	PRISM Bangladesh Foundation
PWD	Public Works Department
RACC	Rangpur City Corporation
RAJUK	Rajdhani Unnayan Katripakkha: Capital City Development Authority
RCC	Rajshahi City Corporation
SAE	Sub Assistant Engineer
SCC	Sylhet City Corporation
SCP	Secondary Collection Point
SPD	Store and Purchase Department
SPM	Suspended Particulate Matter
SREDA	Sustainable and Renewable Energy Development Authority
SSC	Safety and Sanitation Committee
STS	Secondary Transfer Station
SWM	Solid Waste Management

SWMSC	Solid Waste Management Standing Committee
TD	Transport Department
TOR	Terms of Reference
UNDP	United Nations Development Program
UPD	Urban Planning Department
WB	World Bank
WBA	Ward-based Approach
WHO	World Health Organization
WtE	Waste to Energy
ZO	Zone Officer
3R	Reduce, Reuse, Recycle

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CHAPTER 1 INTRODUCTION

1.1 Background

Dhaka¹, the capital and the largest city of Bangladesh, has experienced remarkable economic development since the 1990s in association with the country's rapid Gross Domestic Product (GDP) growth. Accordingly, waste generation has increased rapidly, and its composition has become complicated. Such economic growth leads to higher living standards for residents, who pay more attention to waste cleaning services provided by the local government. It is fundamentally vital for local governments to equip a communication channel to connect the government's cleaning business with communities for mutual understanding and cooperation.

Considering such critical circumstances of waste management in Dhaka, the Japan International Cooperation Agency (JICA) in 2003 began to support the Dhaka City Corporation (DCC) for improving solid waste management (SWM). In most cases, the need for SWM becomes apparent after economic development. However, the DCC has developed its SWM system without delay, in tandem with the rapid economic growth.

For example, in correspondence to the increased waste generation, not only did the DCC reform its institution to fit a new waste management operation; it also improved the 25 ha open dump site, located in the southeastern part of Dhaka City, into a sanitary landfill and built a new 25 ha sanitary landfill in the northwest region. Furthermore, the DCC successfully closed two huge illegal dumping sites. For waste collection improvement, the conventional collection methods were modified to be more efficient, and the institution for waste collection within the Waste Management Department (WMD) of the DCC was strengthened. The people's participation in SWM was then realized over time through a community participatory framework known as the Ward-based Approach (WBA). As a result, requests and complaints from citizens were handled gradually with by the WMD and ward offices, which oversee the SWM on-site. The SWM activities of the DCC thus became connected with the society in Dhaka, and the social interest and responses instilled job pride in the DCC staff members.

After the DCC established the system for SWM through the implementation of the previous Master Plan (2005–2015), Dhaka City was administratively divided into two areas in 2011, and the DCC was

¹ "Dhaka" or "Dhaka City" in this Master Plan indicates the geographical area of Dhaka administered by the DNCC and DSCC, formerly by the DCC.

also split into Dhaka North City Corporation (DNCC)² and Dhaka South City Corporation (DSCC)³. However, a serious issue remained in that the capacities of both existing landfills in DNCC and DSCC were only two years, and no location would be available for waste disposal in the near future.

Therefore, DSCC, as a way to solve this issue, has devised a subsequent Master Plan by newly introducing an integrated waste management and advanced technology. Looking toward to the future of DSCC, this new Master Plan essentially includes administrative public awareness, WBA dissemination, efficient and hygienic waste collection, life extension of the existing landfill sites (LFSs), legal and institutional reform, and stakeholder's capacity development.

1.2 Review of the previous Master Plan (2005–2015)

The previous Clean Dhaka Master Plan (2005–2015) aimed to improve the SWM of Dhaka City based on social acceptability and technical capacity to achieve Clean Dhaka status. This plan has seven parts including three technical and four institutional and social components. The technical components include Primary Collection, Secondary Collection and Transport, and Disposal. The institutional/social components, which were integrated with the three technical components, are Legal Aspect, Organizational Aspect, Financial Aspect, and Privatization.

The following overall objectives were identified to achieve the goal of the Master Plan (2005–2015):

- (i) To expand DCC service coverage and quality.
- (ii) To enhance DCC operation capacity with sufficient manpower, equipment, and facilities.
- (iii) To facilitate well-managed operation by relevant departments.
- (iv) To encourage progressive involvement of public participation.
- (v) To pursue proper work sharing with the private sector and the community.

The progress of this plan was monitored in 2013 targeting a seven-year period from 2006 to 2012. At that time, almost all priority projects and programs were implemented by the DCC with JICA's assistance, such as the technical cooperation project, Environmental Grand Aid Project (EGAP), Japan Debt Cancellation Fund (JDCF), and Japan Overseas Cooperation Volunteers (JOCV).

The main outcome during the seven-year period is summarized as follows.

- (i) The SWM organization was strengthened by establishment of the WMD and introduction of the WBA.
- (ii) The WMD Directives (2007–2012) was developed, and an administrative procedure book was drafted for enforcement of law and regulations.

² North Dhaka City Corporation (DNCC) is a public administrative body for the northern part of Dhaka City.

³ South Dhaka City Corporation (DSCC) is a public administrative body for the southern part of Dhaka City.

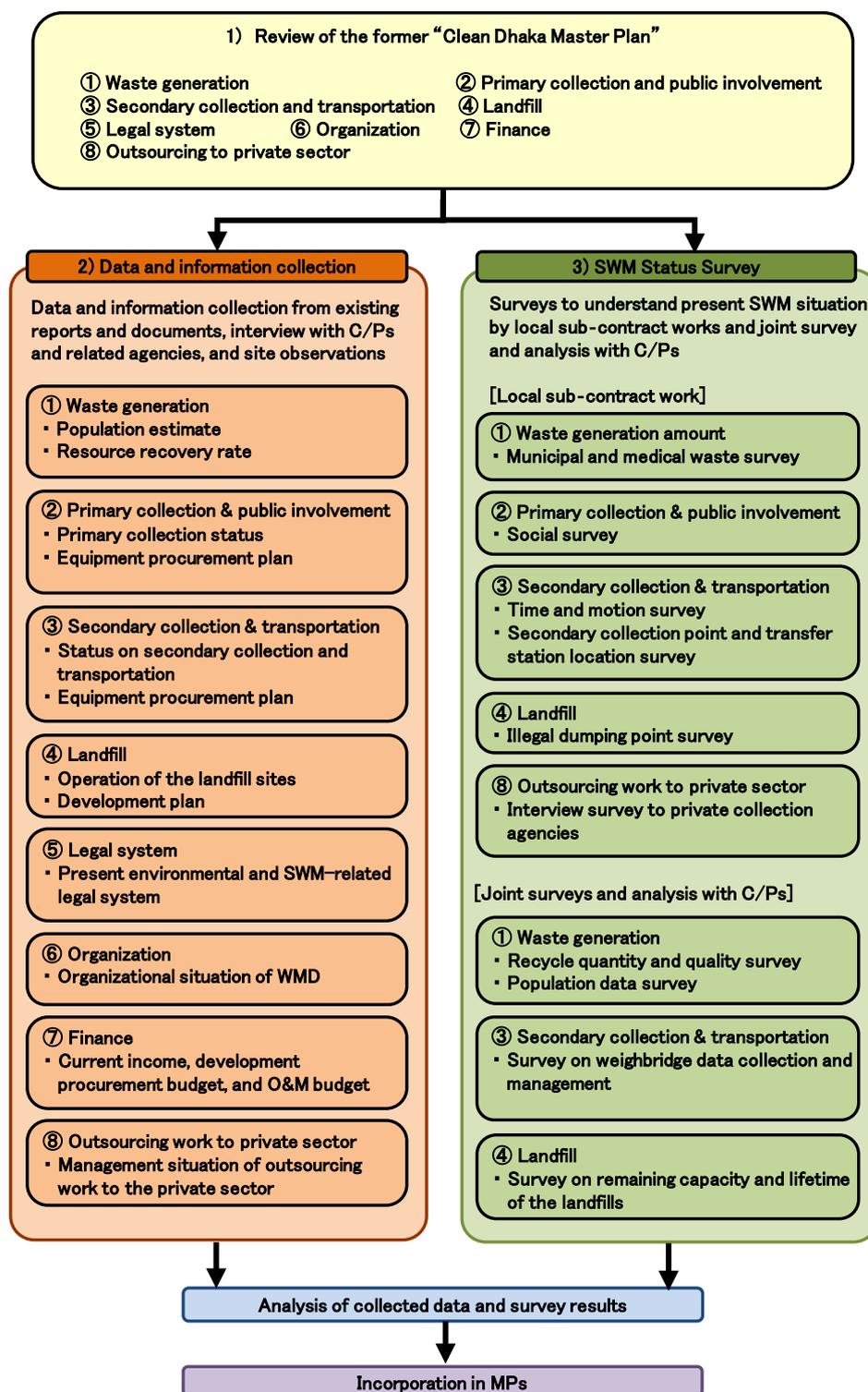
- (iii) Community participation in SWM was encouraged through WBA 3, and Fixed-Time and Fixed-Place (FTFP) collection by compactors began with the support of the community. The FTFP collection contributed to close unsanitary containers and dustbins on the road. In addition, the new collection system was strengthened by introducing 35 new compactors in corporation with Primary Collection Service Providers (PCSPs).
- (iv) Matuail LFS, which was initially an open dumping site, was improved as a sanitary landfill including a leachate treatment facility. A landfill management unit (LMU) was organized for successful landfill operation.

However, after the monitoring period and evaluation from 2014 to 2017, the progress of the Master Plan appeared to decrease, and several critical issues remained unresolved. For example, although the necessity of extending the lifespans of existing LFSs was known, no action was taken by DSCC to acquire new land or to negotiate with surrounding cities to establish a regional treatment system. As a result, the need for this lifespan extension has become crucial. In addition, unfortunately, even though the knowledge and experience of the WBA is widespread, its promotion has not been well managed by the WMD member staff including conservancy inspectors (CIs).

1.3 Preparation Process of the Master Plan

For preparation of the new Master Plan, basic information and data on SWM in DSCC was collected and was then analyzed after reviewing the former Master Plan, as shown in Fig. 1-1. After preparation of the Master Plan draft, DSCC established a committee to review the draft and finalize the Master Plan.

This master plan is a dynamic document and will therefore be revised every three to five years or at any suitable time as per requirement of the authority (LGD or City Corporation) with updated data and information in order to meet the current conditions of the city's situation and needs of the society



Source: JICA Project Team

Fig. 1-1 Preparation Process of the Master Plan

1.4 Target Area and Waste

1.4.1 Target Area

As mentioned in Section 1.1, Dhaka, together with the DNCC area, is facing the enormous population and economic growth with modernization of people's living, resulting in skyrocketing waste generation, and it is very likely to continue for a while. Although many efforts have been taken to make the city cleaner as a pioneer of waste management in Bangladesh, the DSCC jurisdiction became larger in 2017 corresponding to autonomous expansion of the urban area, and various issues have yet to be solved. The master plan therefore intends to tackle various kinds of issues on waste management systematically and strategically for the sustainable Dhaka City.

The Master Plan covers the entire jurisdiction of DSCC as of 2017, including new DSCC area, which is composed of 75 wards in 10 zones. The total area is approximately 115 km², as estimated by the JICA Project Team based on Geographic Information System (GIS) data, including an expanded area of 88 km² in 18 wards.⁴ This Master Plan also covers the Matuail LFS and future LFSs.

1.4.2 Target Year

The reference year of the Master Plan is fiscal year (FY) 2017 (FY⁵ 2017–2018), and the target year is set as 2032 (FY2032-2033).

⁴ DSCC's jurisdiction area was expanded in 2017.

⁵ Twelve months from July 1 in the reference year to June 30 the following year. In the case of FY2017, the term is from July 1, 2017 to June 30, 2018 and is referred to as FY2017–2018.

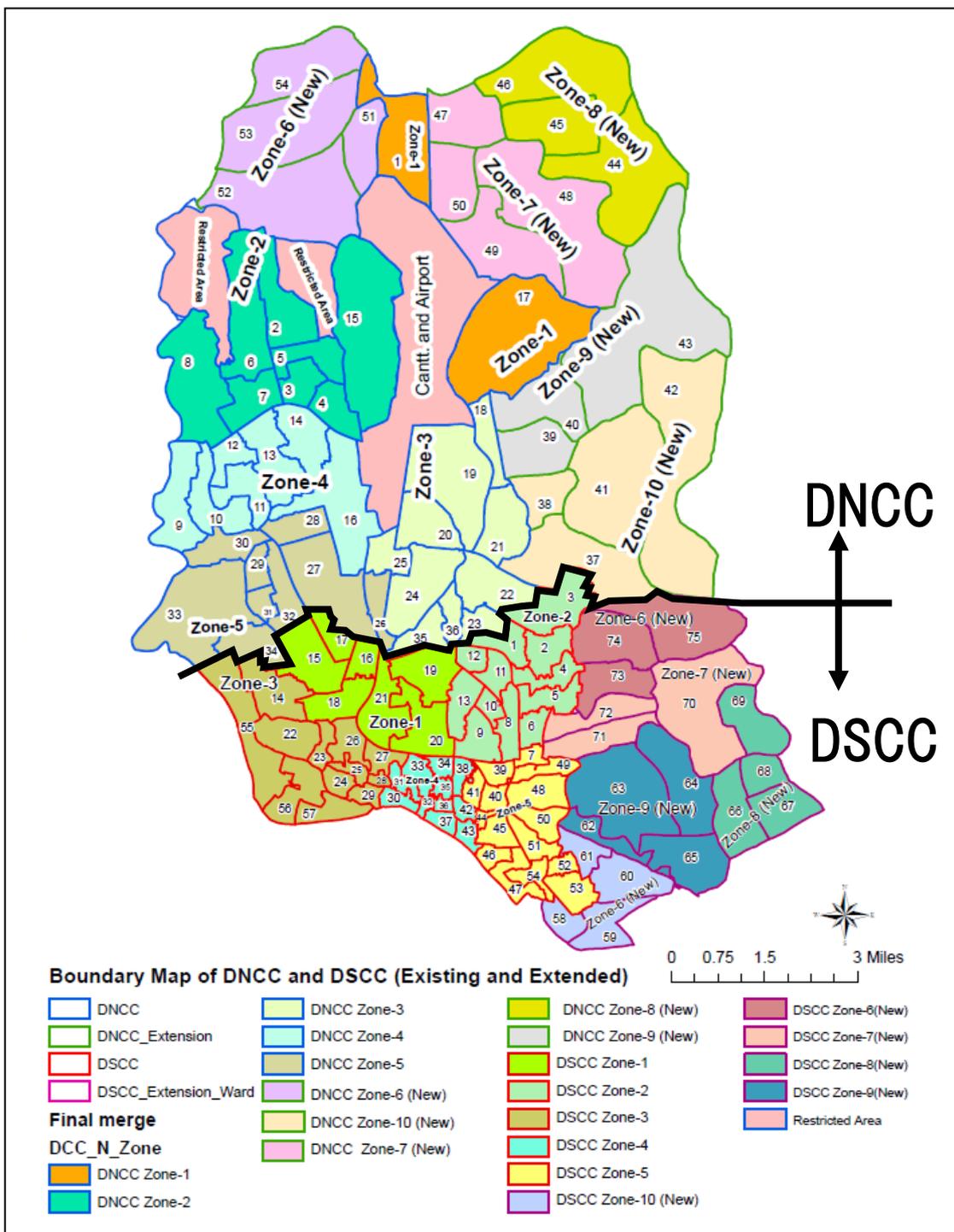


Fig. 1-2 DSCC Jurisdiction of Dhaka

1.4.3 Target Waste

The target waste in this Master Plan comprises three types of waste: municipal solid waste, business waste, and medical waste, as shown in Table 1-1. The DSCC recognizes that some construction waste is received at the DSCC’s LFS, whereas some other portion is likely to be dumped illegally. For hazardous waste and other industrial waste, some private companies have already established their own disposal systems without the involvement of DSCC, but the detail is unknown until now. Thus, the DSCC will further investigate that detail of these wastes including generation, collection and transport, and final disposal to incorporate them into the future Master Plan for appropriate solution.

Table 1-1 Target Waste in This Master Plan

Waste Category	Contents
Waste	“Waste” refers to any solid, liquid, gaseous, or radioactive substance, the discharge, disposal, and dumping of which may cause harmful changes to the environment
Solid Waste	Non-hazardous and non-poisonous waste (solid or partially solid) which may have value or no value.
Municipal Solid Waste	Waste generated from residences and collected by local government
Household Waste	Solid waste collected from households.
Street Waste	Solid waste collected from streets, including a sludge from drainage.
Industrial Waste	General term of waste from business properties, which sometimes includes chemical components, generated from business, commerce, agriculture, building construction, and other activities
Business Waste	Industrial waste collected from restaurants, hotels, markets, and offices
Construction Waste	Industrial waste collected from building construction
Other	Industrial waste collected from other businesses
Hazardous Waste	Waste having particular physical and chemical properties or that mixed with other waste and materials to cause poisonous effects, viral transmission, flaming, explosive effects, radioactivity, corrosiveness, and other destructive effect on the environment
Medical Waste	Waste emitted, generated, or accumulated from the treatment, vaccination, or diagnosis of diseases or research related to the diagnosis of human health
Non-hazardous waste	Non-hazardous waste generated in HCEs
Hazardous waste	All other wastes apart from non-hazardous waste such as infectious, sharp, radioactive waste

: Target waste in this Master Plan

CHAPTER 2 REGULATORY FRAMEWORK AND PREVIOUS PROJECTS FOR SOLID WASTE MANAGEMENT

2.1 Regulatory Framework

2.1.1 Central Government Policies, Acts, Rules and Regulations

The Government of Bangladesh (GoB) has formulated various regulatory documents such as policies, acts, rules, and strategies related to waste management as shown in Table 2-1. Solid Waste Management Rules 2018 has been drafted as a fundamental law of waste management, and are currently in the process of endorsement. In addition, recently, the GoB is planning to introduce intermediate treatment as a powerful tool for waste reduction.

Table 2-1 Regulatory Documents related to Solid Waste Management

Title/Contents	Year	Organization
Bangladesh Environment Conservation Act, 1995, amended in 2000, 2002, and 2010	1995	DoE
National Environmental Management Action Plan	1995	DoE
Environmental Conservation Rules, 1997	1997	DoE
Lead Acid Battery Recycling Related Circular	2006	DoE
Medical Waste (Management and Handling) Rules, 2008	2008	DoE
National 3R Strategy for Waste Management, 2010	2010	DoE
Local Government (City Corporation) (Amended) Act 2011	2011	LGD
Hazardous Waste and Ship Breaking Waste Management Rules, 2011	2011	DoE
Ship Breaking and Recycling Rules, 2011	2011	Ministry of Industries
National Environmental Policy, 2013	2013	DoE
Seventh Five Years Plan (FY2016–FY2020)	2015	Ministry of Planning
Electrical and Electronic Product Induced Waste (E-waste) Management Rules, 2017	2017	DoE
Solid Waste Management Rules, 2018 ¹	2018	DoE

¹ This rule is in the process of endorsement as of July 2019.

2.1.2 Responsibility Defined in the Regulatory Documents

The waste management-related laws define the responsibility of SWM regarding waste collection and transport in addition to waste treatment and disposal, as shown in Table 2-2. Despite the case that the regulation appoints the central government agencies as a supervisory authority. CCs and municipalities are often involved in its supervision

Table 2-2 Responsibility of Agencies Regarding Solid Waste Management

Type of Waste*	Responsibility		Supervision
	Collection and Transport	Treatment and Disposal	
Municipal solid waste ¹	Licensed contractor, society, association, community or private company (primary collection) and local government: CC and municipalities (secondary collection and transport)	Local government: CC and municipalities	Local government: CC and municipalities
Industrial waste ^{1,3}	Discharger and licensed entities	Discharger and licensed entities	DoE, CC
Construction waste ¹	Discharger and licensed entities	Discharger and licensed entities	Local government: CC and municipalities
Hazardous waste ³	Discharger and licensed entities	Discharger and licensed entities	DoE, CC
Household hazardous waste ¹	Licensed contractor, society, association, community or private company (primary collection) and local government: CC and municipalities (secondary collection and transport)	Local government: CC and municipalities	Local government: CC and municipalities
Medical waste ²	Discharger or licensed entities of skilled personal/company/contractor	Discharger or licensed entities of skilled personnel/company/contractor	DGHS, DoE, and Local government: CC
E-waste ⁴	Discharger and licensed entities (producer, collection center, collector or transporter)	Discharger and licensed entities (dealer/dismantler/recycler/refurbished)	DoE, CC
Leachate	Discharger and licensed entities	Discharger and licensed entities	DoE, CC
Flammable Waste ^{3,4}	Discharger and licensed entities	Discharger and licensed entities	DoE, CC

* The type of waste here is based on the regulations; thus, it may be different from the categorization used in this Master Plan as described in Table 1-1.

Source:

¹ Solid Waste Management Rules, 2018 (Draft)

² Medical Waste (management and processing) Rule (Amendment), 2014

³ Hazardous Waste and Ship Breaking Waste Management Rules, 2011

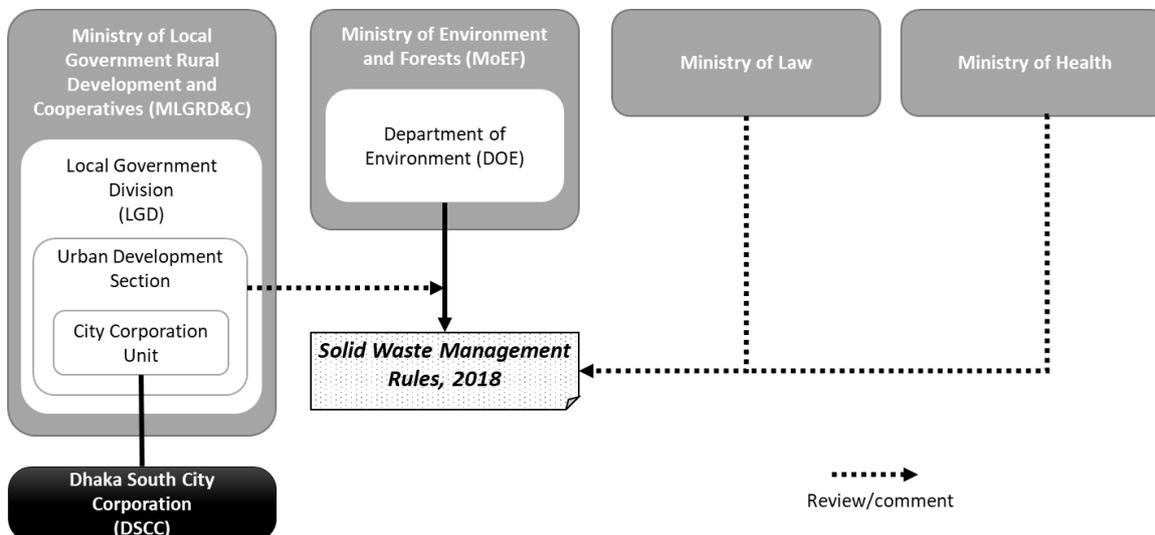
⁴ Electrical and Electronic Waste (Management and Handling) Rule, 2017

2.1.3 Structure of Central and Local Government in Solid Waste Management

In general, the supreme authority of local government management lies in the central government, which is essentially responsible for policy and decision making, planning, finance, and human resources management. Local government is a delivery organization for executing or implementing a service.

DSCC is responsible for SWM service delivery through SWM planning. From the perspective of the country-level governance structure, the LGD is responsible for managing all city corporations (CCs)

and municipalities in administrative aspects and provides budgetary support. The major central government organizations and departments and their roles in SWM are shown in Fig. 2-1.



Source: JICA Project Team based on “Solid Waste Management Rules, 2018 (draft)”

Fig. 2-1 Structure of Central and Local Government in Solid Waste Management

Local government is responsible for SWM in CCs and municipalities in formulating a project and obtaining approval from the Planning Commission or ECNEC..

For SWM, the role of Department of Environment (DoE) under the Ministry of Environment and Forests (MoEF) is vital in a legal aspect. The DoE has been formulating various environmental laws in close association with the LGD and other related departments and ministries.

The Solid Waste Management Rules 2018, which details the process of SWM in households and commercial purposes, is still in the draft stage; the MoEF has requested DNCC and DSCC through the LGD for providing comment. This shows an example of how different ministries, departments, divisions and local government organizations work together.

Because local government organizations such as CCs and municipalities are service delivery organizations for municipal solid waste, staff with sufficient knowledge and skills for understanding the coordination with other departments and divisions is crucial for formulating various waste management-related policies, rules, or strategies and for materializing different new projects in waste management. However, the first 12CC’s SWM information exchange meeting held in December 2018 revealed that there are no CCs which have established an executive department of integrated waste management including waste collection, landfill site management, and 3R, other than DNCC and DSCC. Besides, there are little waste management data maintained in the CCs.

2.1.4 Local Government Rule and Regulations

(1) Waste Management Department Directives

Among the various departments of DSCC, the WMD is responsible for providing daily SWM services to citizens. Initially, the directives for WMD was formulated with the support of the previous technical cooperation project financed by JICA in August 2008, under the Local Government (City Corporation) Act. The objective of preparing the WMD directives is to declare the policy of SWM for five years, and the WMD directives enable the chief waste management officer (CWMO) to manage the WMD in a consistent manner, and DSCC dwellers to learn techniques of proper waste management. The WMD should renew the directives every five years based on the Master Plan for SWM and it will help to form a policy consensus among the WMD, community, cleaners, and other stakeholders. The current WMD directives renewed in November 2012, and eight main points were stressed, as listed in Table 2-3.

Table 2-3 Components of WMD Directives, 2012

WBD Directives	
1. Strengthening of the WMD's Institutional Capacity	5. Evaluation of New Waste Treatment System
2. Promotion of Public Private Partnership	6. Optimization of Allocation and Enhancing Efficiency of SWM Equipment
3. Implementation of City-Wide Awareness Raising Program	7. Expansion of WBA considering 3Rs
4. Improvement of Existing System of Waste Collection and Final Disposal	8. Improvement in Work Environment and Occupational Health as Part of WBA 2

Source: WMD Directives, 2012

(2) Solid Waste Management Administrative Procedure Book

The SWM administrative procedure book, hereafter referred to as “Admin Book,” is a support guide that describes the administrative rules and procedures. The Admin Book was developed on the basis of the enacted laws, regulations, and rules related to SWM. The first draft was prepared in 2012 with the support of JICA. On the basis of the first draft, the first edition of the Admin Book was prepared in Bengali in 2018.

2.2 Projects Related to Solid Waste Management

2.2.1 Projects by Bangladesh Side

(1) Development Project Proposal for Solid Waste Management Improvement

DSCC submitted a development project proposals (DPP) to secure the budget for extension area of Matuail LFS, and two DPPs for the development of new city area waste management. The status of the DPPs are summarized below.

(i) DPP-1: Extension of Matuail LFS

#	Item	Information
1	Purpose	• Expansion and modernization of Matuail LFS
2	Components	• Securing budget of the land extension and development for the Matuail LFS
3	Application status	<ul style="list-style-type: none"> • The original DPP for expansion of the LFS was approved in 2017, but because of land price increase, the additional DPP was submitted to secure the price gap in 2018. • The additional DPP has not been approved by the ECNEC yet, and is now waiting for Pre-ECNEC meeting. • Expected approval: August 2019 (by ECNEC)

(ii) DPP-2: New city area waste management 1

#	Item	Information
1	Purpose	• Development of waste collection system in the extended DSCC area
2	Components	<ul style="list-style-type: none"> • Recruitment of 19 firms • Training of 50 stakeholders • Awareness creation of 200 people • To survey and research • Procurement of 1 pickup • Procurement of 4 motor cycles and • Procurement of furniture
3	Application status	<ul style="list-style-type: none"> • The DPP was submitted in 2018. • The final approval is to be done by LGD, not ECNEC. • Expected approval: August 2019 (by LGD)

(iii) DPP-3: New city area waste management 2

#	Item	Information
1	Purpose	<ul style="list-style-type: none"> • Procurement of vehicles and associated machineries for transportation and disposal of waste • Construction of STS and associated facilities for waste management
2	Components	<ul style="list-style-type: none"> • Internal and foreign training • Awareness creation • Procurement of collection vehicles • Procurement of heavy equipment • Land acquisition and land development for the STS • STS Construction

#	Item	Information
3	Application status	<ul style="list-style-type: none"> • The DPP was submitted in 2018, and is now under review by LGD. • Expected approval: Early 2020 (by ECNEC)

(2) Compost Project in Matuail Landfill Site

This project is a pilot project under the 3R project by the DoE. The compost plant in the project is located on a 0.75-acre site in the Matuail LFS with the capacity of 15 tons/day of waste. The objectives of this project are listed below.

- Promotion of the 3R initiative throughout Bangladesh
- Public awareness raising for waste segregation at source and waste recycling
- Waste reduction to save the landfill capacity
- Initiative for recycling with public–private partnership

According to the tender document, the project construction work takes ten months. The DoE will operate the plant for the next six months as a test stage to obtain a license from the Ministry of Agriculture. After having the license, the plant will be handed over to DSCC for future operation. Currently the construction work is ongoing, and will be completed in August 2019, and the test operation by the DoE is expected to start by January 2020.

(3) Projects by Bangladesh Climate Change Trust

GoB under Bangladesh Climate Change Trust⁶ has allocated public funds to the DoE toward the cost of the Programmatic Clean Development Mechanism (CDM) Project Using Municipal Organic Waste of Towns (CCs/municipalities) in Bangladesh. The fund disbursement is shown in Table 2-4.

Table 2-4 Bangladesh Climate Change Trust Fund Disbursement

1 st Phase	2 nd Phase
<ul style="list-style-type: none"> ● Approval Date: April 2010 ● Closing Date: June 2017 ● Total project cost: Tk. 139,158,000 	<ul style="list-style-type: none"> ● Approval Date: July 2016 ● Closing Date: June 2019 ● Total project cost: Tk. 139,158,000

(4) Projects by Bangladesh Power Development Board

The Bangladesh Power Development Board (BPDB) in affiliation with the Sustainable and Renewable Energy Development Authority (SREDA) is currently attempting to implement the country’s first WtE project with the technical support of the German Development Cooperation Agency (GIZ) to produce 1 MW of electricity and heat (430 kW electricity and 480 kW heat). The project will be set up on BPDB-

⁶ Bangladesh Climate Change Trust organized under the MoEF manages funds to be utilized for climate change related issues.

owned land in Keraniganj. The GIZ was requested by SREDA at the beginning of 2015 to conduct a detailed feasibility study to identify prospective energy solutions from waste in Keraniganj. International experts appointed by the GIZ conducted the study for six months in collaboration with SREDA officials, local government officials, and public representatives from Keraniganj. BPDB has already started procurement process for the project on a pilot basis.

Apart from this, several non-governmental organizations (NGOs) are working in various municipalities with small-scale waste management and biogas projects under different donors.

(5) Programmatic Clean Development Mechanism Project Using Municipal Organic Waste of 64 Districts of Bangladesh

The project is the first large-scale attempt to improve waste handling by composting on a national scale. As a pioneering effort by the project proponent and the municipalities to be involved in the activities, the project will contribute to the sustainable development of Bangladesh. The following environmental, economic, and social benefits will be achieved by executing the project.

(i) Environmental benefits

These benefits include assistance in preventing uncontrolled greenhouse gas (GHG) generation and emission from waste that would have been disposed of at the landfill as well as the production of a soil improver (compost) to battle soil degradation.

(ii) Economic benefits

Composting on this scale may be a new industrial activity for Bangladesh, and the projects will contribute to partial replacement of imported chemical fertilizer by locally produced compost.

(iii) Social benefits

The project will increase jobs for local workers, and staff training will improve their skills. The project includes the design and building of composting plants at cities throughout Bangladesh with a daily input capacity of between 5 and 100 more tons/day. Apart from compost, the project will reduce methane emissions by diverting high organic waste from being dumped at a landfill, where anaerobic processes occur, to a composting plant to promote aerobic processes.

2.2.2 Foreign Aid provided by International Donors

Several projects are in progress for SWM in DSCC. The project outlines are shown in Table 2-5. Different donor agencies have supported SWM activities in DSCC.

Table 2-5 SWM-related Projects Supported by International Donors

Project	Donor	Contents
Project for Strengthening of Solid Waste Management in Dhaka North City, Dhaka South City, and Chittagong City (2017–2021)	JICA	JICA has initiated its support on SWM of Dhaka city since 2003. The knowledge and experiences of the “WBA Promotion,” “Waste Collection,” and “Workshop Operation and Management” in the previous JICA’s projects are applied in this project, with emphasizing on institutional development of the WMD.
Demonstration Project for Proper Management of Electronic Waste and Metal Recycling	NEDO	This project aims to introduce an appropriate waste disposal system and to commercialize metal recycling by utilizing separation and concentration technology for ferrous and nonferrous metals from electronic waste in cooperation with DNCC, DSCC, and local companies. The feasibility study was implemented in 2017.
Urban Public and Environmental Health Sector Development Program	ADB	This project supports DNCC, DSCC, Chittagong, Barisal, Khulna, Rajshahi, and Sylhet from 2010 to 2018. The program includes activities for constructing landfills, transfer stations, and food laboratories; introduces an electronic accounting system; and implements a capacity-building program.
Community-based Solid Waste Management in Dhaka	UNDP	This project produces compost from kitchen waste collected from communities for improvement of the sanitation environment and waste reduction. However, because the target area and target waste are limited, this project did not improve the waste management of entire Dhaka city. In particular, some of the composting factories installed in residential areas were forced to close owing to the lack of understanding on continuous use of land from cooperating organizations.

CHAPTER 3 OVERVIEW OF SOLID WASTE MANAGEMENT IN DHAKA SOUTH CITY

3.1 Profile of Dhaka South City Corporation

Dhaka is located in the middle of the country's territory with the Old City at the south, the New City at the north, and downtown, where government offices, company headquarters and commercial buildings are situated at the center. In 2011, Dhaka was divided into two administrative jurisdictions, DNCC and DSCC.

In this city, the world's second-largest textile industry after China has led to increase in middle- and high-income classes. Economic growth in the country has skyrocketed, with 4.1 million people (2.7% of the population) in the high-income group, and 47 million (31.3%) at the middle-income, according to research by the University of Dhaka in 2012. A profile of DSCC is summarized in Table 3-1.

Table 3-1 Profile of Dhaka South City Corporation

Item	Description
Area	Approximately 115 km ² ¹
Population	3,371,831 (FY 2017–2018) ²
Population density	29,320 people/km ²
Geography	<ul style="list-style-type: none">- Located on the eastern banks of the Buriganga River- Lies on the lower reaches of the Ganges Delta- Tropical vegetation and moist soils- Flat and close to sea level- Susceptible to flooding during the monsoon seasons owing to heavy rainfall and cyclones- Bounded by the districts of Munshiganj, Narayanganj, and Manikganj
Climate	<ul style="list-style-type: none">- Hot, wet, and humid tropical climate- Monsoon season from May until the end of September- Nearly 80% of the annual average rainfall of 1,854 mm occurs in the Monsoon season
Economic growth rate (GDP)	7.3 % (FY 2017–2018) ³

Source:

¹ JICA Project Team measured based on the GIS data

² Bangladesh Bureau of Statistics (BBS)

³ The World Bank Open Data

3.2 Organizational Structure in Solid Waste Management

Although DSCC’s WMD was developed to provide a unified agency considering the conservancy and engineering aspects of waste management, it has yet to be fully materialized. However, the WMD has been successfully managing about 3,000 tons of waste per day in close coordination with other departments, including the Transport Department (TD), Engineering Department (ED), and Store and Purchase Department (SPD). The organizational structure of DSCC is shown in Fig. 3-1.

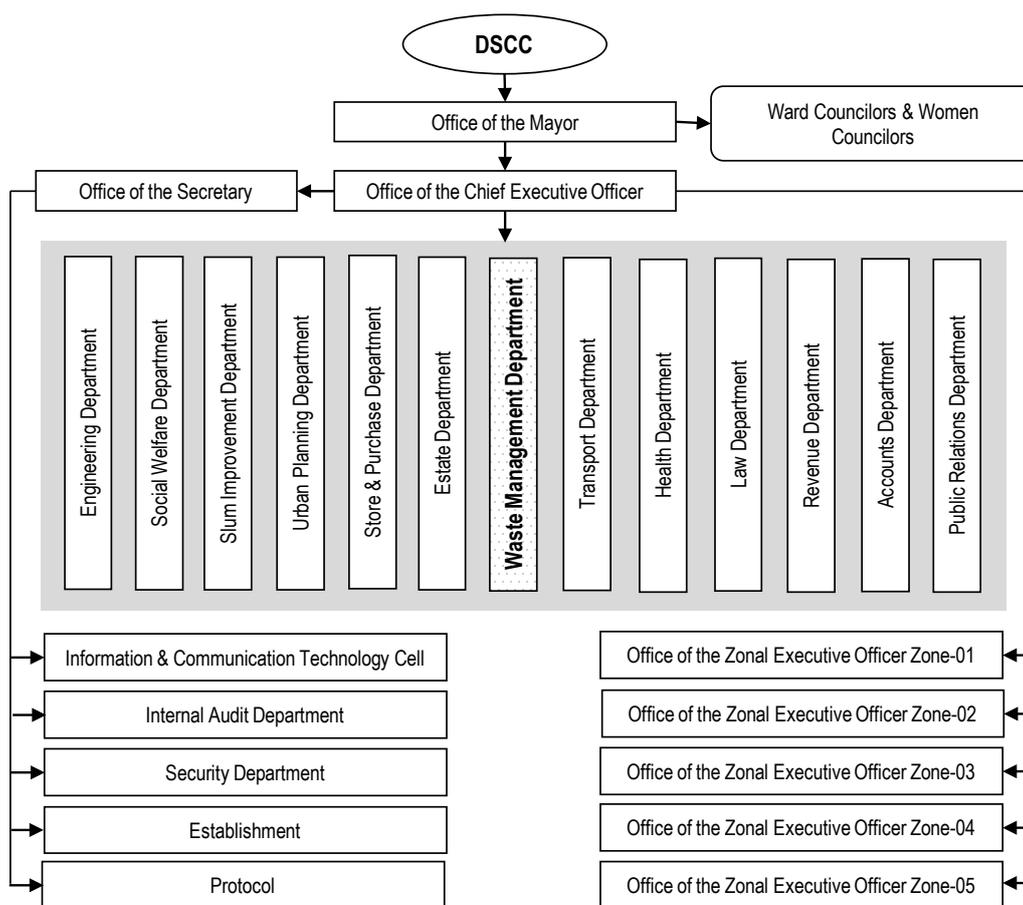
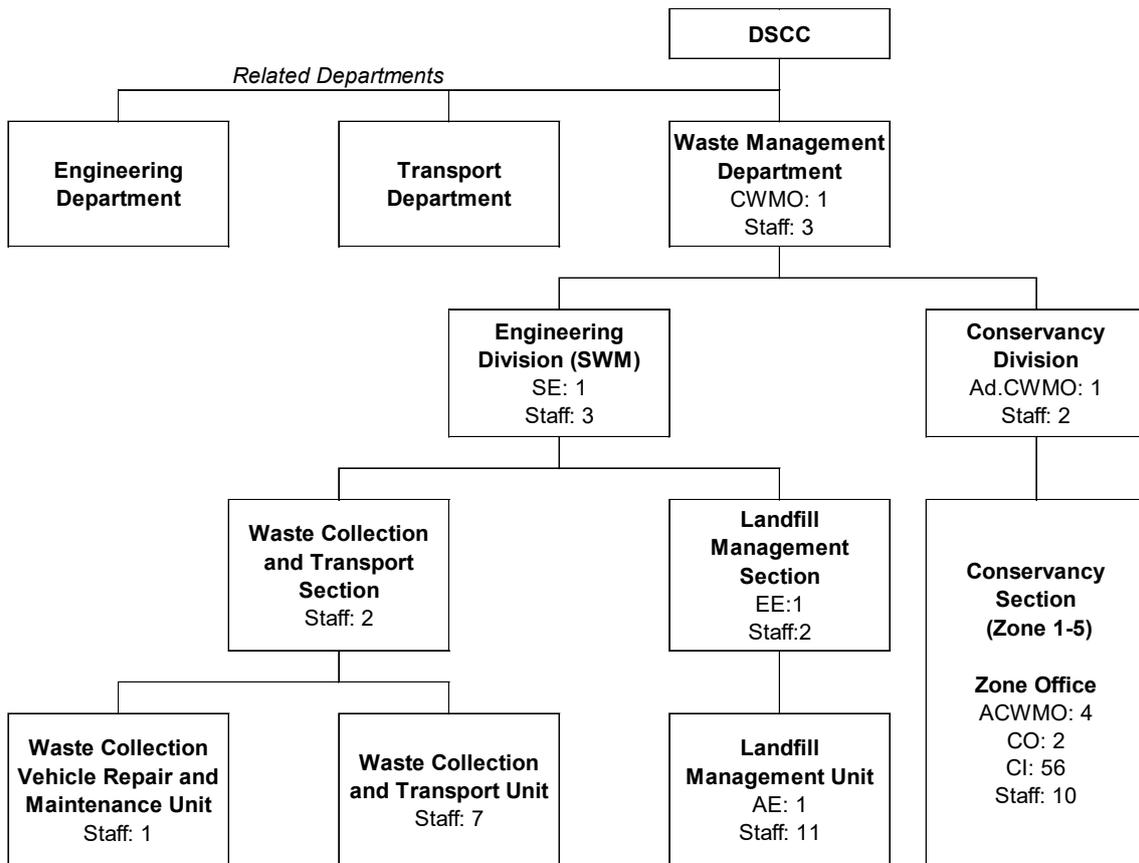


Fig. 3-1 Organization Structure of DSCC

Fig. 3-2 shows an organogram of the WMD and related departments in DSCC. The WMD is composed of the Engineering Division and the Conservancy Division. In general, the Engineering Division manages waste collection and transport, including the repair and maintenance of waste collection vehicles; the Conservancy Division manages road and drain cleaning based on the WBA.



Source: Information updated by JICA Project Team based on "Provision Survey Report of Solid Waste Management Equipment (2015)"

Fig. 3-2 Organization Structure of WMD and Related Departments in DSCC

Table 3-2 shows the approved posts and number of staff members of the WMD in DSCC. A huge shortage of manpower in this agency; although 325 positions has been approved, 244 positions (69%) are currently vacant. DSCC is composed of 75 wards, including newly 18 newly added which makes the coverage area of DSCC nearly 1.5 times as large as the original coverage area. Additional positions, especially CIs, conservancy officers (CO), and assistant chief waste management officers (ACWMOs), have not been allocated owing to approval procedure by the government authority. DSCC needs to fill the vacant posts immediately to provide and sustain proper SWM service, especially important management positions.

Table 3-2 Approved Posts and Number of Staff members of the WMD in DSCC

Organization	Approved Posts	Number of Staff	Vacancies	Staffing Rate
Headquarters	8	4	4	50%
Conservancy Division	91	75	16	82%
Engineering Division	253	29	224	11%
<i>Waste Collection and Transport Section</i>	206	10	196	5%
<i>Landfill Management Section</i>	43	15	28	35%
<i>Others</i>	4	4	0	100%
TOTAL	352	108	244	31%

Source: JICA Project Team based on “Provision Survey Report of Solid Waste Management Equipment (2015)”

3.3 Financial Information

3.3.1 Budget and Revenue

Annual budget and revenue of DSCC for FY 2014–2015 are shown in Table 3-3. The revenue income of DSCC was Tk. 4.6 billion and the development income was Tk. 14.2 billion in FY 2017–2018. The main source of the revenue income is holding tax. Conservancy tax, which is the exclusive revenue of SWM, is collected as part of holding tax. The conservancy tax for FY 2017–2018 was Tk. 300 million, or 1.5% of the total revenue. Development income is funded by the central government and foreign aid; part of this income increased gradually to 70% in FY 2017–2018.

Table 3-3 Budget and Revenue of DSCC

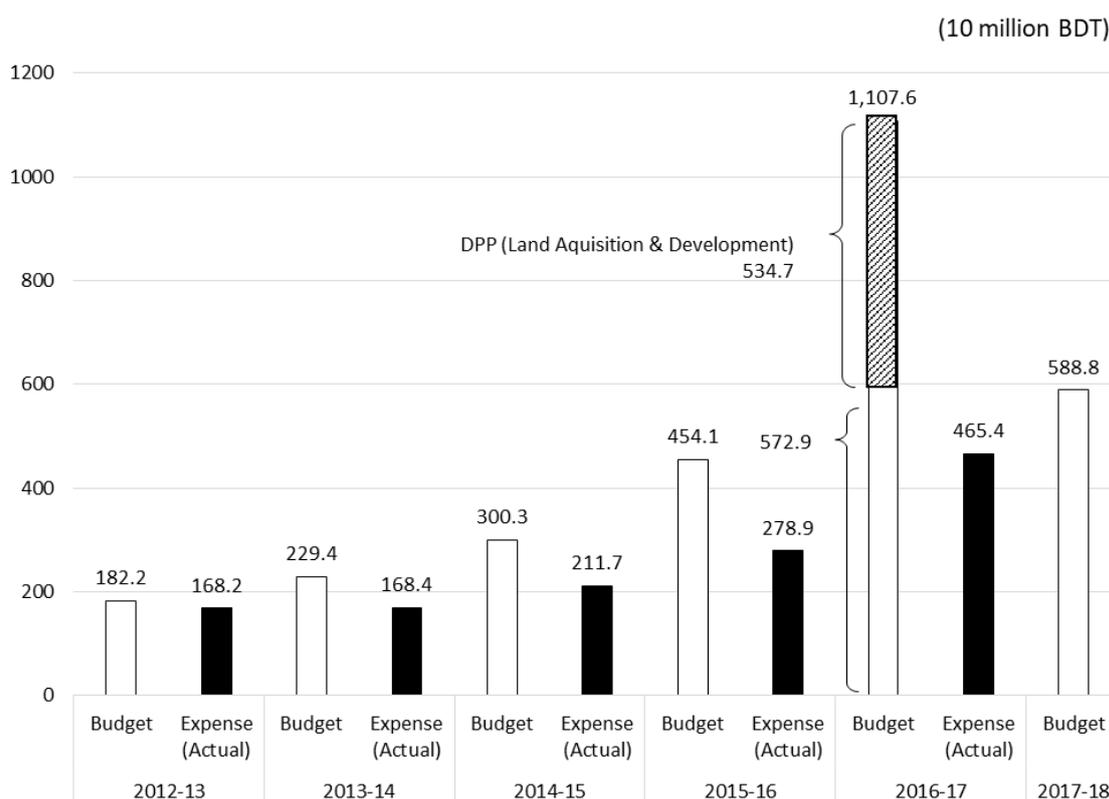
Unit: 10 million BDT

Item	2014-2015		2015-2016		2016-2017		2017-2018		2018-2019	
	Budget	Revenue (Actual)								
Initial Status	64	77	50	78	78	92	136	138	123	-
Revenue Income	618	397	647	436	1,402	520	1,073	459	917	-
Tax (Holding, Lightening & Conservancy)	275	174	285	180	500	195	515	180	330	-
Conservancy	46	29	48	30	83	33	86	30	55	-
Others	229	145	238	150	417	163	429	150	275	-
Others	343	223	362	256	902	325	558	279	587	-
Development Income	884	169	1,388	539	1,703	1,177	2,129	1,418	2,558	-
Government Grant (Lump sum)	20	9	27	12	18	38	40	30	70	-
Government Special Grant	100	104	300	241	200	0	150	71	440	-
Government, Foreign aid & PPP Projects	764	56	1,061	286	1,485	1,139	1,939	1,317	2,049	-
TOTAL	1,566	643	2,085	1,052	3,184	1,789	3,338	2,014	3,599	-

Source: DSCC Budget Book 2017–2018

3.3.2 Expenditures Related to Solid Waste Management

The expenditures of the WMD during the last five years are shown in Fig. 3-3, and the breakdown is shown in Table 3-4. The total SWM expenditures have increased since FY 2012–2013, and reached approximately Tk. 4.65 billion in FY 2016–2017, of which 86% and 14% were revenue and development expenditures, respectively. In FY 2016–2017, more than Tk. 5 billion of the budget was allocated for land acquisition and development of the Matuail LFS expansion in accordance with the approved Development Project Proposal (DPP)⁷ by the central government; however, the land acquisition has not been initiated on schedule. DSCC set a budget of Tk. 33.4 billion for FY 2017–2018 as shown in Table 3-3; of this, the SWM budget accounted for 18%, at Tk. 5.89 billion as shown in Table 3-4. The conservancy tax income was 573 million, which is insufficient for covering the total expenditures of SWM.



Source: DSCC Budget Book 2017–2018

Fig. 3-3 Expenditures Related to Solid Waste Management in DSCC

⁷ Development Project Proposal (DPP) is a proposal document submitted to the central government by local government to secure a budget for new project. Detailed information about the approved DPP is summarized in “3.10.7 Matuail New Extension Landfill Site” in this Master Plan.”

Table 3-4 Breakdown of Expenditure Related to Solid Waste Management in DSCC

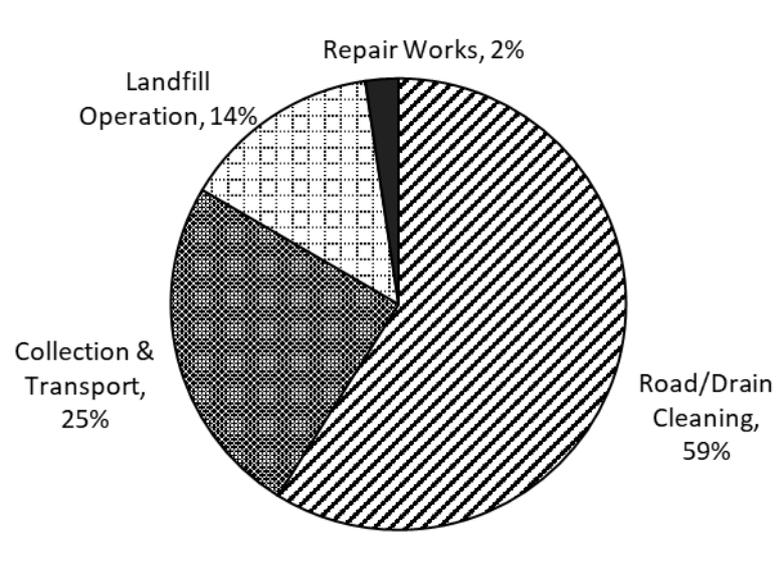
Unit: 10 million BDT

Item	2012-13		2013-14		2014-15		2015-16		2016-17		2017-18	
	Budget	Expense (Actual)	Budget	Expense (Actual)	Budget	Expense (Actual)						
Central	14	19	16	10	20	11	61	8	44	14	59	–
Salary (Central)	2	2	2	2	3	2	3	3	4	4	4	–
Cleaners colony management	12	17	14	9	16	8	58	5	40	10	55	–
Road/Drain Cleaning	111	89	138	105	181	131	210	159	249	231	244	–
Salary (ACWMO, CO, CI and cleaners)	105	85	130	101	178	128	161	157	215	217	224	–
Ward SWM Office construction	0.2	0	0.4	0	0.5	0.5	0.5	0.1	0.5	0.5	0.5	–
Beautification, Cleaning Program & Community SWM	4	3	6	3	2	1	46	2	31	12	17	–
Expendable supplies	3	1	2	0.4	1	2	2	0.4	2	1	2	–
Collection and Transport	45	45	56	44	81	54	169	95	234	164	119	–
Salary (Driver)	10	8	13	10	17	12	16	15	21	21	22	–
vehicle fuel , gas (collection & transport)	27	31	36	32	36	36	36	41	41	38	36	–
Facility and Equipment (TS, waste bin etc.)	7	6	8	3	8	6	10	9	109	40	34	–
Private Waste Management	0	0	0	0	0	0	0	0	5	1	8	–
Special program (SWM modernization etc.)	0	0	0	0	20	0	106	30	59	64	19	–
Landfill	5	8	11	6	9	6	7	7	566	44	155	–
Landfill Operation & vehicle fuel	4	4	5	4	4	4	4	6	5	4	5	–
Landfill Maintenance and Development	2	4	6	3	5	2	3	1	27	39	150	–
Land Acquisition and development	0	0	0	0	0	0	0	0	535	0	0	–
Repair and Maintenance	7	7	9	3	9	9	8	11	15	12	12	–
SWM Garage / Workshop (Repair works)	1	1	3	0	3	2	3	2	5	5	5	–
Spareparts including tires and tubes of vehcls	6	6	6	2	6	7	5	8	10	8	8	–
TOTAL	182	168	229	168	300	212	454	279	1,108	465	589	–

Source: DSCC Budget Book 2017–2018

3.3.3 Operation-wise Solid Waste Management Expenditure

The operation-wise expenditures of SWM were analyzed as shown in Fig. 3-4. The SWM operation in DSCC is categorized into four types: i) Cleaning of roads and drains, ii) Collection and transport, iii) Landfill operation, and iv) Repair works. The first category accounts for 60%, the second for 24%, the third for 14% and the last for 2%.



Source: JICA Project Team analysis based on the DSCC budget book 2016–2017

Fig. 3-4 Operation-wise Solid Waste Management Expenditures (FY2016–2017)

**Table 3-5 Operation-wise Solid Waste Management Expenditure per ton
(FY2016–2017)**

Operation	Waste Amount	Yearly Expenditure (BDT)	Cost per ton (BDT)
Cleaning of roads and drains	413 tons/day	1,828 million	4,775
Collection and transport	2,511 tons/day	720 million	1,995
Landfill operation	2,270 tons/day	417 million	509
Repair works	-	69 million	-
Total*	2,511 tons/day	3,033 million	3,310

* Itemized totals may not agree exactly with those in Fig. 3-4 owing to rounding of the fractional amounts.
Source: JICA Project Team analysis based on the DSCC budget book 2016–2017

3.4 Municipal Solid Waste and Business Waste

3.4.1 Solid Waste Generation

(1) Household Waste

Households waste is divided into three categories depending on income level: high income, medium income, and low income⁸. The waste generation amount, population, and unit generation rate in each

⁸ According to the BBS “Preliminary Report on Household Income and Expenditure Survey (HIES) 2016,” the average monthly income per household was Tk. 15,945 in 2016. Under this Master Plan, the clarification of income level is defined in accordance with UNDP “Politics, Governance and Middle Income Aspirations Realities and Challenges

category are summarized in Table 3-6, based on the survey results collected in 2018 by the JICA Project Team. As of the FY2017–2018, total waste generation was estimated to be 1,412 tons/day associated with a population of 3.4 million; this does not include the population of the expansion area newly added in DSCC in mid-2017. However, the population and amount of waste generated in the FY2018–2019 considers this expansion area.

**Table 3-6 Estimated Household Waste Generation by Income Level
in FY2017–2018 and FY2018–2019**

Category	Unit Generation Rate ¹	Population ² (2017–2018)	Waste Generation (2017–2018)	Population ² (2018–2019)	Waste Generation (2018–2019)
High-income	496 g/person/day	541,326	268 tons/day	569,648	285 tons/day
Medium-income	483 g/person/day	2,071,671	997 tons/day	2,614,463	1,259 tons/day
Low-income	193 g/person/day	758,834	147 tons/day	1,306,700	255 tons/day
Total	—	3,371,831	1,412 tons/day	4,490,811	1,799 tons/day

Source:

¹ JICA Project Team, “Waste Amount and Composition Survey Report (2018)”

² BBS “Population Census 2011” and “Population Projection of Bangladesh 2011–2061”

Table 3-7 shows the household waste generated in FY2017–2018 and FY2018–2019; the amount of waste in the latter includes the extension area. The waste generated in the existing 57 wards by a population of 3.4 million was 1,412 tons/day in FY2017–2018; 1,799 tons/day was generated by 4.5 million people in the total 75 wards.

(2016).” That is, high income is Tk. 80,000 or more, middle income is more than Tk. 10,000 and less than Tk. 80,000, and low income is Tk. 10,000 or less.

**Table 3-7 Estimated Household Waste Generation by Ward
in FY2017–2018 and FY2018–2019**

Category	No.	2017-2018		2018-2019		Category	No.	2017-2018		2018-2019	
		Population	Waste (tons/day)	Population	Waste (tons/day)			Population	Waste (tons/day)	Population	Waste (tons/day)
Existing Ward	1	75,265	32	76,209	33	Existing Ward	39	41,843	16	42,368	16
	2	123,682	60	125,232	60		40	50,701	19	51,336	19
	3	94,919	44	96,109	45		41	44,317	16	44,872	16
	4	90,300	43	91,433	45		42	30,444	11	30,826	11
	5	66,374	32	67,206	33		43	43,723	16	44,271	16
	6	86,592	41	87,678	41		44	29,414	12	29,783	12
	7	63,675	23	64,473	24		45	55,052	20	55,742	20
	8	38,071	18	38,548	18		46	43,967	19	44,518	19
	9	45,974	22	46,550	22		47	52,439	22	53,097	22
	10	23,987	11	24,287	11		48	64,139	27	64,943	28
	11	65,512	29	66,334	30		49	66,568	25	67,403	27
	12	55,760	26	56,459	26		50	61,982	24	62,759	24
	13	65,119	31	65,936	32		51	75,776	24	76,726	24
	14	140,770	60	142,532	62		52	47,993	19	48,595	19
	15	79,106	37	80,098	38		53	64,371	27	65,178	28
	16	87,333	39	88,428	39		54	72,760	28	73,673	28
	17	64,272	29	65,078	29		55	103,263	41	104,558	42
	18	54,074	25	54,752	25		56	89,610	38	90,734	39
	19	61,058	29	61,824	30		57	81,088	28	82,105	28
	20	41,711	20	42,234	20		58			69,727	24
	21	36,593	17	37,051	17		59			132,924	45
	22	92,285	36	93,443	37		60			141,323	48
	23	53,366	20	54,035	20		61			66,334	22
	24	72,578	27	73,488	28		62			80,937	28
	25	32,573	13	32,982	13		63			97,737	33
	26	48,633	20	49,243	19		64			57,486	20
	27	31,146	13	31,537	13		65			47,425	17
	28	26,922	12	27,259	13		66			77,169	26
	29	63,584	24	64,381	24		67			59,967	21
	30	36,702	13	37,162	13		68			35,978	11
	31	38,932	15	39,421	15		69			10,545	3
	32	39,469	14	39,963	15		70			29,016	10
	33	71,288	34	72,182	34		71			35,937	11
	34	55,276	23	55,969	23		72			32,954	11
	35	30,654	14	31,038	14		73			31,303	10
	36	28,606	7	28,965	7		74			46,309	16
	37	19,840	7	20,088	7		75			23,635	7
	38	50,380	20	51,011	21		Total		3,290,743	1,412	4,490,811

Source: JICA Project Team analysis based on BBS “Population Census 2011,” “Population Projection of Bangladesh 2011–2061,” and “Waste Amount and Composition Survey Report in DSCC (2018)”

(2) Street Waste

In the survey results gathered by the JICA Project Team in 2018, variation occurred in unit generation rate of street waste by zone. As of FY2017–2018, the total waste generated was estimated to be 138 tons/day with a population of 3.4 million; that in FY2018–2019 was 182 tons/day with a population of 4.5 million. The increments of the street waste were set at 1% per year.

Table 3-8 Estimated Street Waste Generation in FY2017–2018 and FY2018–2019

Unit Generation Rate by Zone ¹	Population ² (2017–2018)	Waste Generation (2017–2018)	Population ² (2018–2019)	Waste Generation (2018–2019)
19–188 g/person/day	3,371,831	138 tons/day	4,490,811	182 tons/day

Source:

¹ JICA Project Team, “Waste Amount and Composition Survey Report (2018)”

² BBS, “Population Census 2011” and “Population Projection of Bangladesh 2011–2061”

(3) Business Waste

In the Master Plan, waste from markets, restaurants and hotels, and offices are considered as business waste. The total waste from the abovementioned business sources was estimated to be 994 tons/day in FY2017–2018, and 1,038 tons/day in FY2018–2019, as shown in Table 3-9. The waste increment was set at 1% per year, and the generation rate in the expansion area was estimated to be 10% of the existing area owing to limited business activities in the expansion area.

Table 3-9 Estimated Business Waste Generation in FY2017–2018 and FY2018–2019

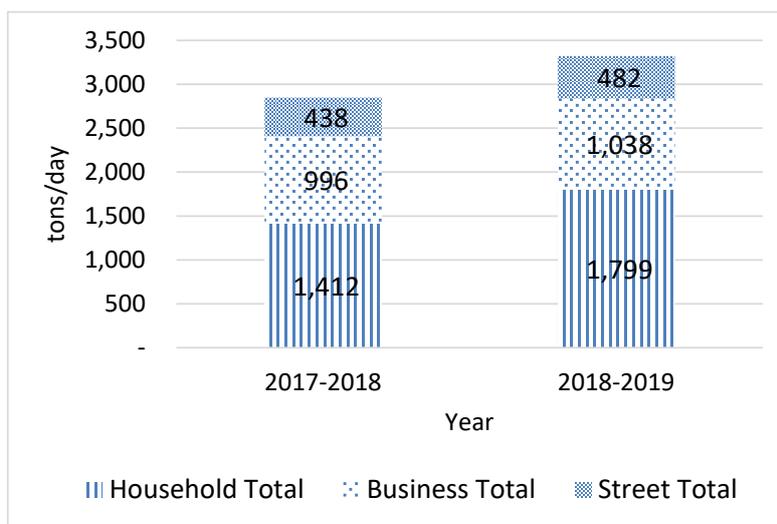
Category	Population ¹ (2017–2018)	Waste Generation (2017–2018)	Population ¹ (2018–2019)	Waste Generation (2018–2019)
Markets	3,371,831	498 tons/day	4,490,811	519 tons/day
Restaurants and Hotels	3,371,831	362 tons/day	4,490,811	377 tons/day
Offices	3,371,831	136 tons/day	4,490,811	142 tons/day
Total	—	996 tons/day	—	1,038 tons/day

Source:

¹ BBS, “Population Census 2011” and “Population Projection of Bangladesh 2011–2061”

(4) Total Waste Generation

The total waste generation of the three aforementioned waste types—household waste, street waste together with partial construction waste, and business waste—was approximately 2,788 tons/day in FY2017–2018 and 3,288 tons/day in FY2018–2019.

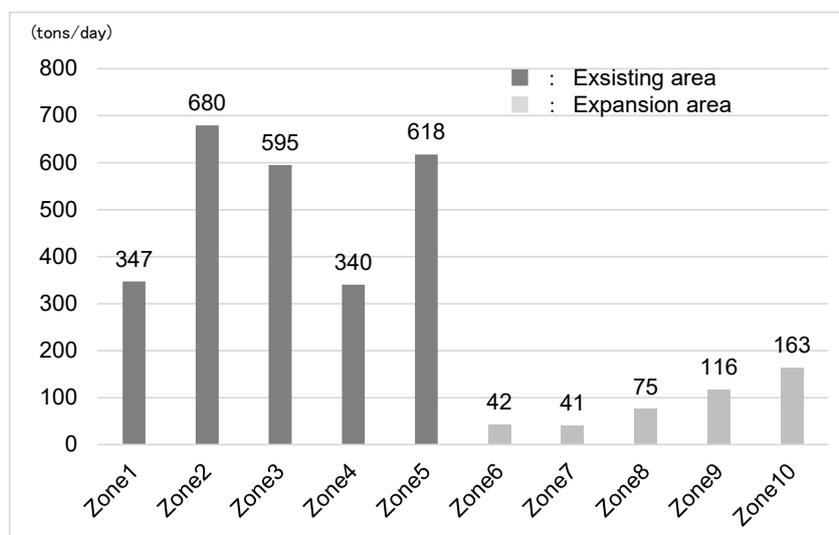


Source: JICA Project Team analysis based on BBS “Population Census 2011,” “Population Projection of Bangladesh 2011–2061,” “Economic Census 2013,” and “Waste Amount and Composition Survey Report (2018)”

Fig. 3-5 Estimated Waste Generation by Waste Type

(5) Waste Generation by Zone

The waste generation by zone in the FY 2018–2019 is shown in Fig. 3-6. The zonal average of waste generation is estimated at 299 tons/day with the maximum at 679 tons/day in Zone 2, and the minimum at 38 tons/day in Zone 7. Waste generation in the existing area is 2,521 tons/day, and 465 tons/day in the expansion area (77% and 23% of the total waste generation respectively). The zonal waste generation reflects the population size and business activities in each zone.



Source: JICA Project Team analysis based on BBS “Population Census 2011,” “Population Projection of Bangladesh 2011–2061,” “Economic Census 2013,” and “Waste Amount and Composition Survey Report (2018)”

Fig. 3-6 Estimated Waste Generation by Zone

3.4.2 Solid Waste Composition

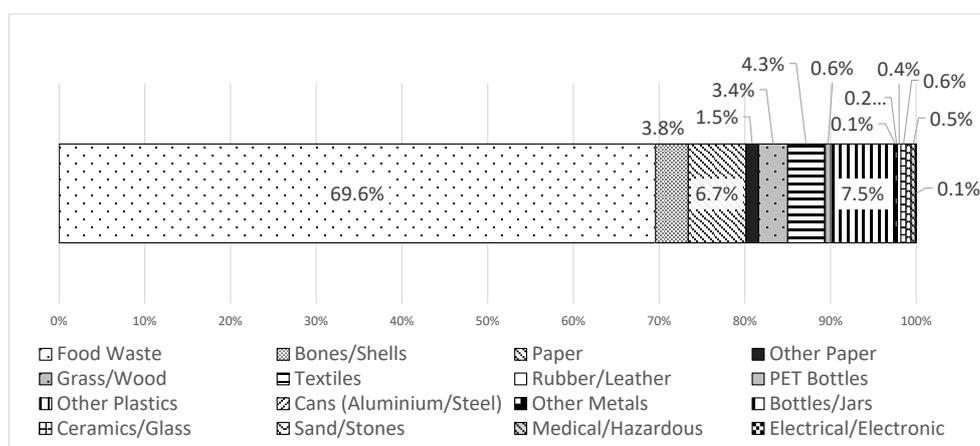
The waste composition survey was conducted during the Master Plan preparation by the JICA Project Team. The collected waste in the survey was sorted into 16 types, as shown in Table 3-10.

Table 3-10 Types of Waste by Composition

Waste Type	
1. Food Waste	9. Other Plastics
2. Bones/Shells	10. Cans (Aluminum/Steel)
3. Paper	11. Other Metals
4. Other Paper (including disposable diapers and sanitary napkins)	12. Bottles/Jars
5. Grass/Wood	13. Ceramics/Glass
6. Textiles	14. Sand/Stones
7. Rubber/Leather	15. Medical/Hazardous
8. PET Bottles	16. Electrical/Electronic

(1) Household Waste

The composition of household waste is shown in Fig. 3-7. Food Waste accounted for 69.6% of the total waste, which is the highest proportion. Other Plastics and Paper each accounted for approximately 7%.

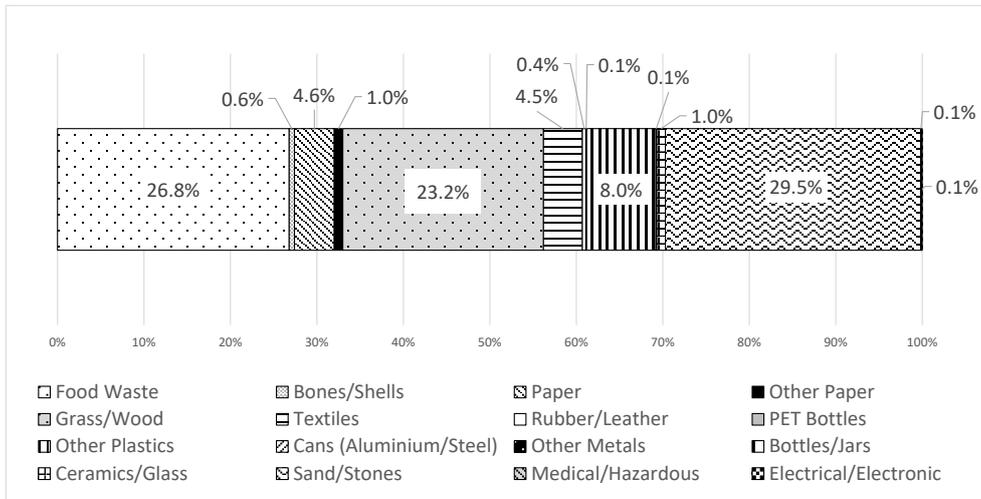


Source: JICA Project Team, "Waste Amount and Composition Survey Report (2018)"

Fig. 3-7 Composition of Household Waste

(2) Street Waste

The composition of street waste is shown in Fig. 3-8. Sand/Stones, Food Waste, and Grass/Wood accounted each for more than 20% of the street waste generated. Paper, Textiles, and Other Plastics also made up significant proportions.



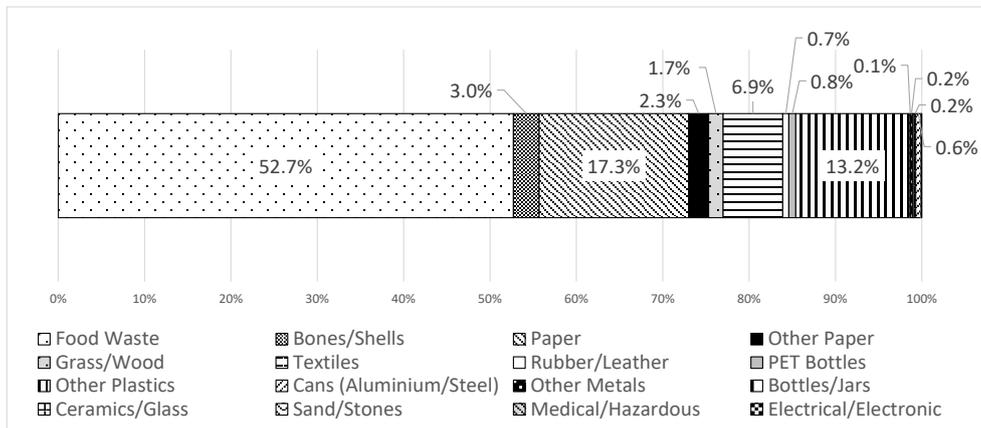
Source: JICA Project Team, "Waste Amount and Composition Survey Report (2018)"

Fig. 3-8 Composition of Street Waste

(3) Business Waste

1) Market

The composition of market waste is shown in Fig. 3-9. The items having large proportions were Food Waste, Other Plastics, and Paper, at 52.7%, 13.2%, and 17.3%, respectively, which is the same trend shown in household waste and restaurant and hotel waste. However, the percentages of Other Plastics and Paper were more than 10% higher than those of household waste and restaurant and hotel waste.

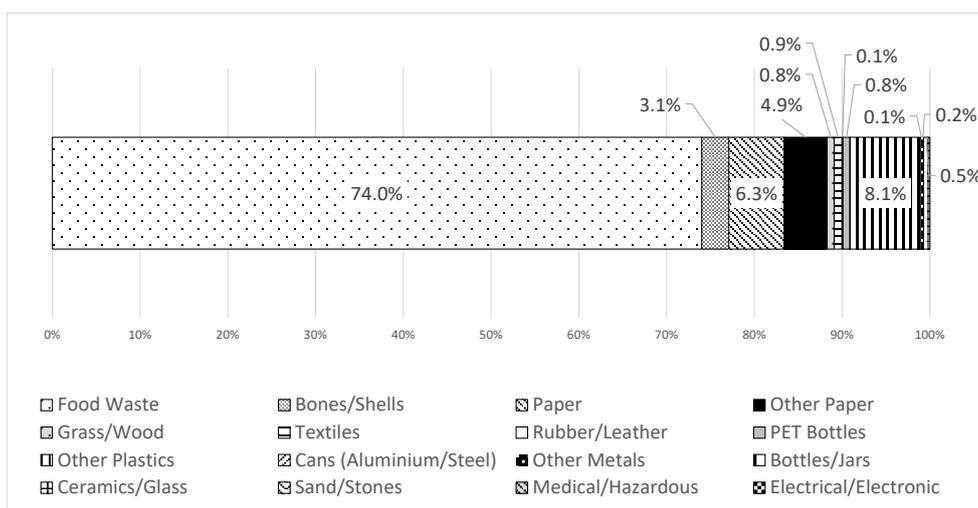


Source: JICA Project Team, "Waste Amount and Composition Survey Report (2018)"

Fig. 3-9 Composition of Market Waste

2) Restaurant and Hotel

The waste composition of restaurant and hotel waste is shown in Fig. 3-10. Similar to that in household waste, Food Waste accounted for the highest proportion followed by Other Plastics and Paper at 74.0%, 8.1%, and 6.3%, respectively.

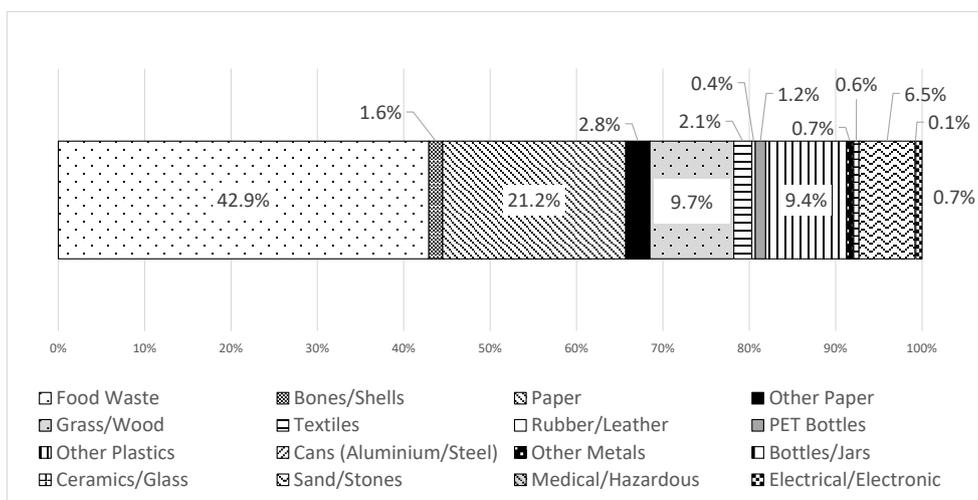


Source: JICA Project Team, "Waste Amount and Composition Survey Report (2018)"

Fig. 3-10 Composition of Restaurant and Hotel Waste

3) Office

The composition of office waste is shown in Fig. 3-11. Food Waste made up the highest proportion, at 42.9%, followed by Paper at 17.3%. Grass/Wood and Other Plastics each accounted for approximately 10%.



Source: JICA Project Team, "Waste Amount and Composition Survey Report (2018)"

Fig. 3-11 Composition of Office Waste

3.4.3 Waste Flow

The waste flow diagram of the DSCC area, from waste generation to final disposal, and the sum of the waste at each point in FY 2017–2018 at each point are shown in Fig. 3-12. This diagram considers waste generated only in the existing wards and excludes the extended wards because DSCC expanded in mid-2017. Street waste transported by the WMD, and construction waste carried by the private sector are taken directly to the Matuail LFS. Non-recyclable waste generated from households and local businesses is collected mainly by primary collectors and is transported to the landfill via municipal collection points. Recyclable waste is collected in three ways by recyclable buyers, primary collectors, and waste pickers at the LFS. In FY 2017–2018, the total waste generated was 2,847 tons/day; this includes 2,293 tons/day of incoming waste to the LFS and 241 tons/day sent to the recyclables shop.

The waste flow for FY 2018–2019, which includes the waste generated from the extended area, is shown in Fig. 3-13. The total waste generated increased to 3,319 tons/day, which is approximately 1.2 times more than that of the previous year.

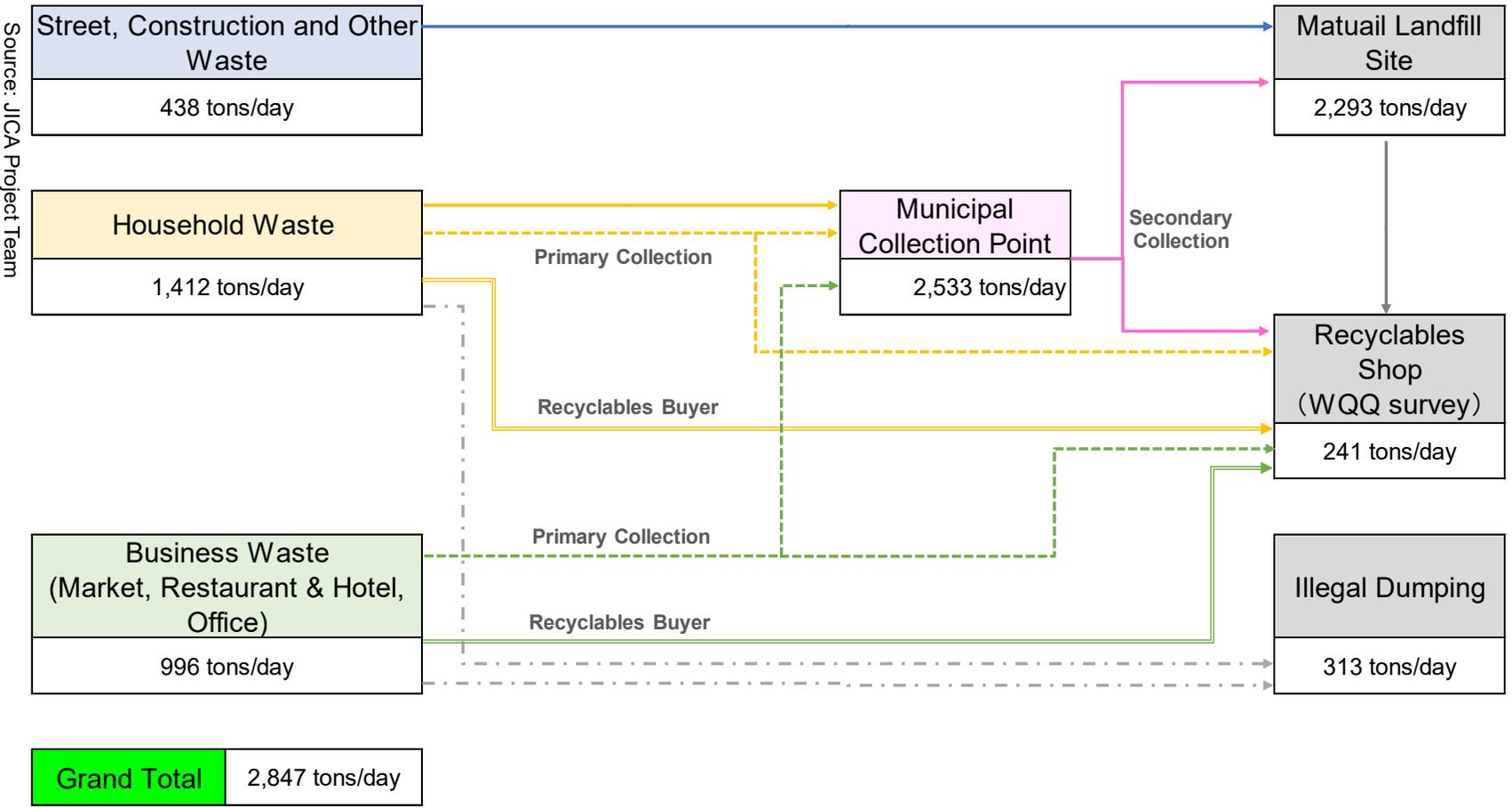
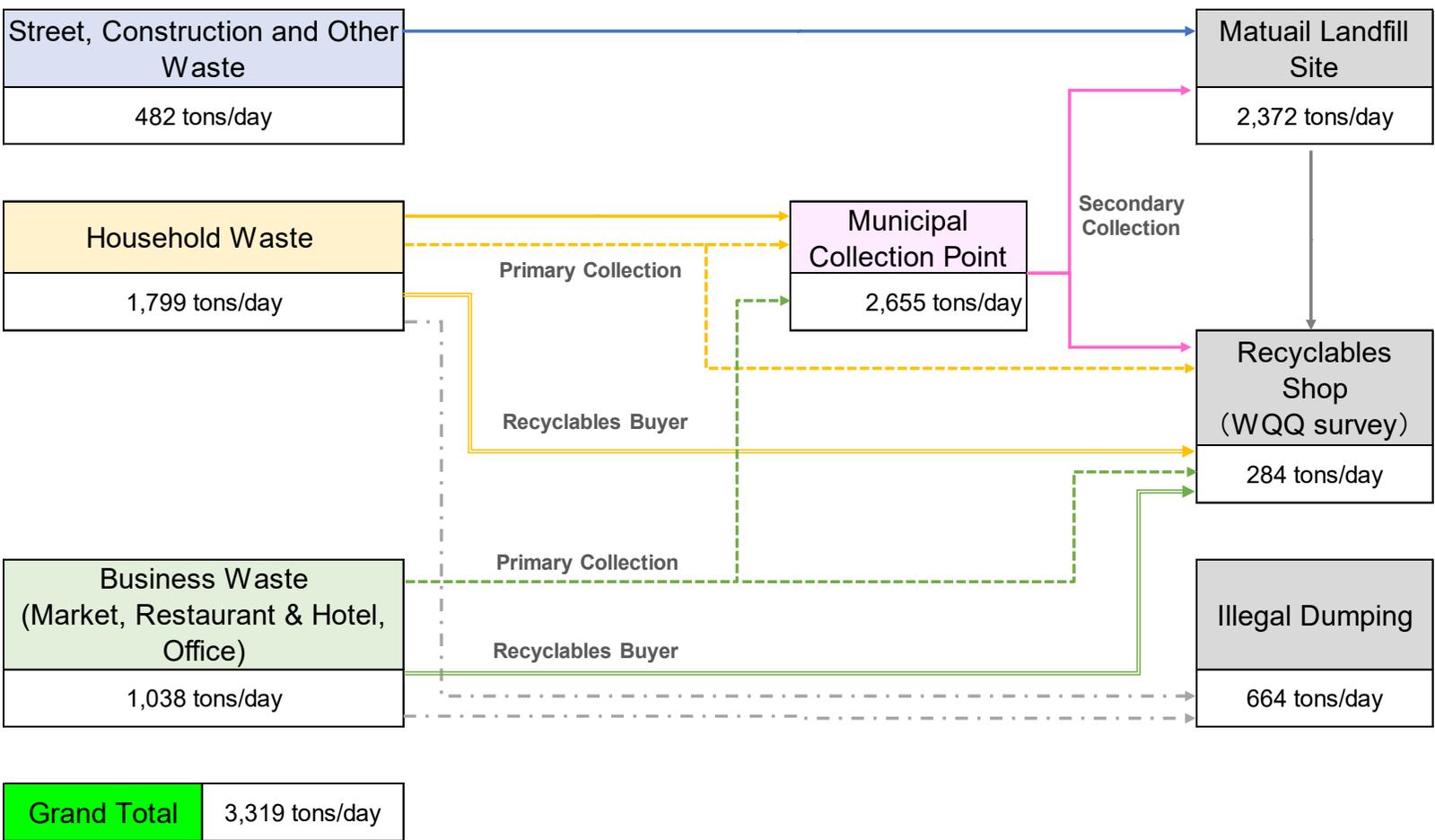


Fig. 3-12 Waste Flow in FY2017-2018



Source: JICA Project Team

Fig. 3-13 Waste Flow in FY2018-2019

3.5 Public Relations and Awareness

3.5.1 Public Relations Department of Dhaka South City Corporation

The Public Relations Department (PRD) of DSCC is generally responsible for public relations and awareness activities and sometimes represents the CC. The PRD's main activities are listed below.

- (i) Clips all information about various DSCC departmental activities
- (ii) Relays the clippings the mayor and concerned departments for necessary steps
- (iii) Publish all kinds of notices and advertisements in daily newspapers and other media
- (iv) Develop all kinds of awareness programs for citizen

The PRD works actively and sincerely to provide any information related to DSCC activity. When an interview of the PRD is requested by the mass media regarding a specific topic, the PRD forwards the request to the appropriate department. In the case of waste management, when the WMD issues tender notices, press releases, or press invitations to waste management events, journalists sometimes contact WMD personnel directly for interviews.

3.5.2 Waste Management Department Public Relations Strategies and Activities

Despite the lack of a comprehensive public relations and awareness strategy in addition to the vacant position of ACWMO (Community) who is in charge of community relations and awareness, the WMD pursues public awareness activities not only through WBA but also at the CC level. The WMD performs its duties by collecting complaints or suggestions from city dwellers through following systems.

- (i) Letters, phone calls, or in-person conversations from residents regarding different issues in various locations
- (ii) CIs, who receive complaints directly from the community
- (iii) Zone Officers (ZOs), ACWMOs who occasionally receive complaints from their community
- (iv) Different organization and authorities such as LGED and the Public Works Department (PWD)
- (v) Various print media and electronic media outlets
- (vi) DSCC's Facebook page

In addition, the following activities have been recently performed.

- (i) Clean Dhaka Campaign: The DSCC launched a weeklong "Clean Dhaka Campaign." The mayor requested support from citizen to keep the city clean, and urged them to call the DSCC hotline if there is any waste accumulated on the street. The campaign began on March 17, 2018, and ended on March 23, 2018. The aim of this occasion was to aware citizen regarding cleanliness as well

as accelerating a function of the WMD, and to clean the drainage system to let water flow smoothly during the upcoming monsoon season.

- (ii) Jonotar Mukhomukhi Jonoprotinidhi: DSCC organized a program titled “Jonotar Mukhomukhi Jonoprotinidhi,” which implies “open discussion and activity between people representatives (the elected Mayor and Councilor) and citizen,” at Mugda Bazar area under Ward 6. The events covered all activities of the DSCC including waste management. The mayor and the ward councilor were present to listen to people regarding local issues.
- (iii) Clean Dhaka Festival: The previous technical cooperation project of JICA arranged “Clean Dhaka week” for the “Clean Dhaka Ward Contest” with participation of communities, PCSPs, Community-based Organizations (CBOs)/NGOs, JOCV, and DSCC. The project gave the best cleaning award to PCSPs and communities. After the project, however, the DSCC was unable to organize this contest. Instead, it arranged several cleaning campaigns as public relations and increased awareness activities, for example, Clean Dhaka 2016 which was held in Old Dhaka area, and a Bangladesh cricket team captain, the planning minister, and the mayor inaugurated the campaign. The PRD was involved in public relations related activities.
- (iv) PCSP meetings and workshops: DSCC organizes a zonal PCSP meeting for Eid-ul-Adha every year attended by the mayor, chief executive officer (CEO), CWMO, chairperson of the SWM standing committee, and WMD officials.

The PRD has been involved in large-scale festivals. In other cases such as PCSP workshops, cleaner workshops, and zonal workshops, however, it has not been involved.

3.5.3 Stakeholder Participation

WMD has established the SWM advisory committee to oversee the corporation’s waste management, involving 10 councilors and one executive engineer of the WMD, instead of having the SWM standing committee as per Local Government (City Corporation) Act 2011. This committee has no positions with voting power for academic and other experts such as NGOs and research organizations thus far. However, the committee may involve academic personnel, professors, and experts from NGOs and research organizations to express their expertise.

DSCC has continued to periodically hold public meetings in which the mayor, councilors, and WMD officials respond to the community’s opinions and stakeholder concerns in zones and wards. In addition, Eid-related workshops, PCSP meetings and workshops, special cleaning programs, and environmental education programs in schools are occasionally organized by the WMD to increase the awareness of the citizens.

3.5.4 Information Disclosure System

In the past, the WMD offered a webpage within the DSCC website to describe its function. To enhance the efficiency of the WMD, other social media such as the DSCC’s Facebook page and WhatsApp are operated by the WMD, monitored by Information and Communications Technology (ICT) Department as social communication tool. The PRD collaborates with WMD through press invitation, press and media coverage, live telecast of any higher personnel, especially respected the mayor of DSCC. The PRD is now planning to publish a newsletter which introduces all activities of DSCC including waste management. Moreover, leaflet distribution, logistic support for programs or seminars, and rallies for public awareness in communities are organized by the WMD through outsourcing sometimes in support with the PRD. In the WMD, the department’s officials and CIs sometimes personally advertise and report WMD’s activities on social media such as Facebook. Other than these offerings, passive information disclosure and sharing is rarely provided by the WMD.

3.6 Ward-based Approach

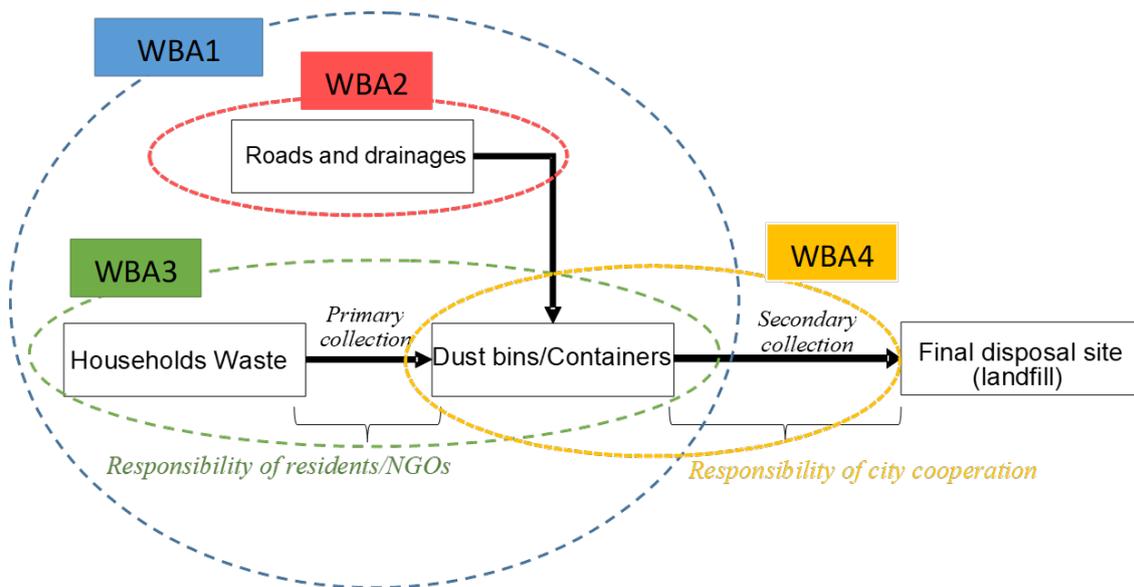
3.6.1 Definition of Ward-based Approach

The WBA was first introduced to Dhaka city as part of the previous JICA project and was launched in 2007 with a pilot project in two wards. This approach was then expanded actively to other wards throughout the project period. The WBA aims to build synergy of related activities in the wards and the CC by synchronized intensive resource input, which include the four main components described in Table 3-11. All components of the WBA are interlinked; the relationship between WBA activities and the target location of waste is shown in Fig. 3-14.

All stakeholders for the WBA including DSCC officers, CIs, COs, and cleaners as well as ward councilors need to jointly work together for successful WBA activities.

Table 3-11 Definition of WBA

Activity	Ripple Effects
WBA 1: Construction and management of ward SWM office	<ul style="list-style-type: none"> ● Community-based SWM in wards to cultivate mutual cooperation ● Establishment and implementation of an administrative command system between the headquarters and ward offices ● Word-of-mouth awareness raising in communities ● Training for staff, officers, and residents ● More democratic local autonomy in wards
WBA 2: Safety education for cleaners and establishment of safety and sanitation committee	
WBA 3: Public awareness raising	
WBA 4: Improvement of waste collection service in each ward	



Source: JICA Project Team

Fig. 3-14 Structure and Activity Contents of WBA

3.6.2 Office Order Related to the Ward-based Approach

The WBA has been officially implemented in DSCC, in support initially with JICA, for community-based SWM improvement with related office orders. This approach considers field level experiences and ideas DSCC has issued two office orders, and proposed three orders related to the WBA to make the activities official.

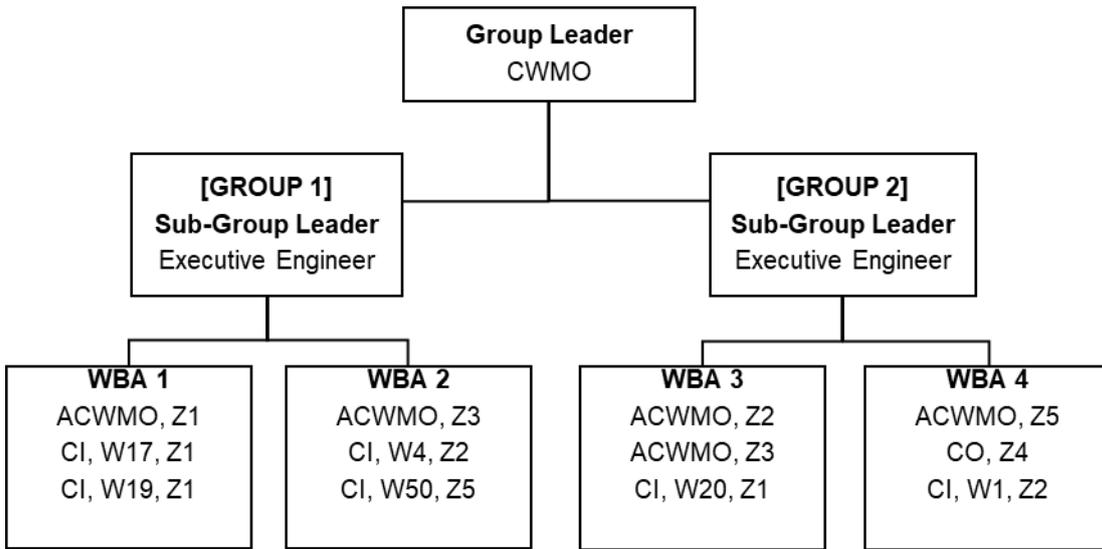
Table 3-12 WBA Related Office Orders in DSCC

Office orders	Status	Date
1) WBA activity implementation as an official project of CC	Issued (by DCC)	March 9, 2010
2) WBA Core Group formulation	Issued	March 18, 2018
3) Preparation of WBA Annual Activity Plan (WBAAAP)	Proposed	-
4) CI's duty to report SWM data to Zone Officer on a daily basis	Proposed	-
5) Safety and Sanitation Committee Formation	Proposed	-

3.6.3 Organization and Staffing

(1) Organization of the Ward-based Approach

DSCC issued an office order to formulate a WBA core group in March 2018 to encourage WBA activities together with field managers. As shown in Fig. 3-15, the WBA Core Group is composed two sub-groups, led by EEs. Each of these sub-groups include ACWMOs and CIs as WBA team members.



Source: Office Order issued in March 18, 2018

Fig. 3-15 WBA Core Group as of 2018

(2) Staffing

Currently 65 staffs related to the WBA, including CWMO, 4 ACWMOs, 2 COs, and 56 CIs, under the conservancy division of the WMD. Although DSCC consists of 71 wards, only 56 CIs are assigned, with some oversees more than two wards.

3.6.4 Current Situation of Ward-based Approach

The WBA was initially introduced more than 10 years ago in Dhaka City; thus, some CIs and DSCC officers who were involved in the previous project have a good understanding of this approach. According to the WBA-related survey conducted in 2017, the concept of ward-level SWM is unconsciously infiltrated in some wards, especially through the CI's perception, despite the fact that the WBA does not appear to be sufficiently active. The current situation of the WBA is summarized below.

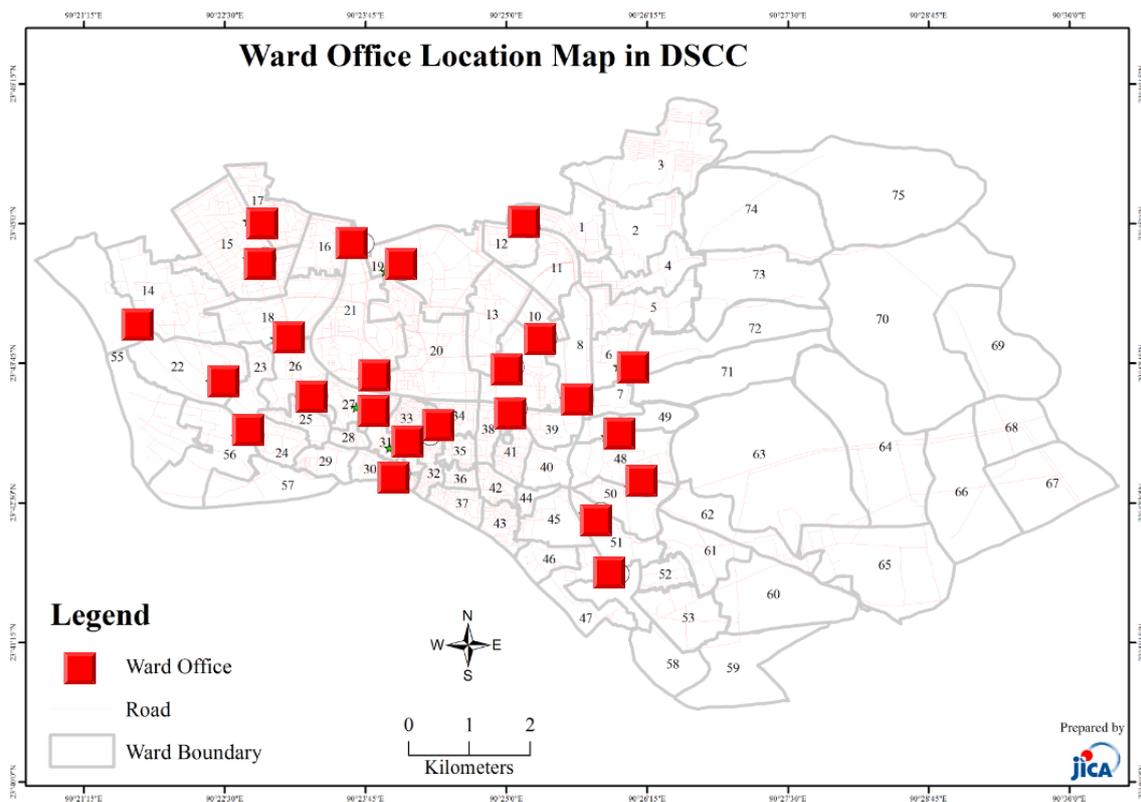
(1) Ward Office Management (WBA 1)

The objective of WBA 1 is to strengthen the ward office management for handling various types of SWM activities in each ward office such as SWM data management, cleaner management, and communication with communities for problem solving and complaint response. The function of the CI shall be consequently changed from mere supervision of cleaner's work to overarching ward-wide SWM, aiming to make DSCC less centralized.

The first ward office in Dhaka was constructed in 2008, and 24 ward offices have been built in DSCC

since then (Fig. 3-16). However, office equipment is not sufficient in each ward office. Most CIs use small sheds and small spaces as temporary offices or have no office. Currently, DSCC plans to construct one additional ward offices, but acquisition of private land for ward office construction is a problem owing to complicated and unclear land ownership rules.

As a regular job function, the CI maintains a daily record of cleaner attendance but does not maintain other records such as incident records or community complaint reports. Instead, the CI reports daily activity and other important notices to the ACWMO by using a commercially available SNS application. Some zonal officers manage and maintain ward office data reported from CIs. In some zones, CIs and ACWMOs hold a meeting at a zone office on a weekly basis for sharing issues related to the WBA and daily job issues.



No. of Wards	No. of Ward Offices	Under Planning
75 Wards	24 Ward Offices	1 Ward Office

Source: JICA Project Team based on Ward Office Survey (2018)

Fig. 3-16 Location of Ward Offices

(2) Safety and Sanitary Education for Cleaners (WBA 2)

Improvement on the working environment of cleaners is important for better Occupational Health, Safety and Environment (OHSE). It is also essential for cleaners to learn knowledge on OHSE to protect themselves. The components of WBA 2 are given below.

- (i) To provide safety gear to raise awareness on OHSE
- (ii) To formulate a Safety and Sanitation Committee (SSC)
- (iii) To introduce a Cleaners Working Manual for reference

Currently, WBA 2 differs somewhat from the original. In cases in which the SSC is ineffective in some wards, the CI gives instruction to cleaners on a daily basis, and some ACWMOs regularly patrol their wards to provide supervision. In addition, DSCC and the ACWMO hold a special cleaning workshop every year in each zone prior to Eid-ul-Adha week to motivate cleaners for immediate cleanup and a safe working environment. Some ACWMOs and CIs who are very active occasionally hold a ward-wide cleaner workshop for communication with DSCC. However, the recent survey revealed that most ward offices have rarely replenished the first-aid kits or safety gear provided in the previous JICA project owing to the DSCC's complicated financial disbursement system, which is not widely known or practiced.

(3) Community Participation (WBA 3)

WBA 3 originated from the concept of participatory SWM by organizing a community group, known as Community Unit Working Group (CUWG), and by increasing public awareness locally. These measures are intended to engage the community regarding the ward's SWM. The following principles guide the implementation of WBA 3.

- (i) Implementation of a community-led planning and decision-making process known as the Community Action Plan (CAP)
- (ii) Encouragement of participation by women and men
- (iii) Flexibility in approaches according to local situations and lessons learned from the field
- (iv) Community sustainability
- (v) Coordination and collaboration among various stakeholders

WBA stakeholders have become diversified in one decade. Almost all CIs have been transferred to other wards, which means they must start over to build up relationships with their new communities. Nevertheless, some CI who learned how to promote the community-based SWM in the previous JICA project have organized community meetings regularly with the ward councilor to discuss SWM and other issues. Activities to increase community awareness have been implemented by NGOs in some

wards using a participatory method similar to that used in WBA 3. In some communities, an active housing society has taken the initiative in the area's SWM by holding community gatherings and SWM environmental education.

(4) Waste Collection Improvement (WBA 4)

The objective of WBA 4 is to harmonize primary and secondary collection and to promote a safe and sanitary work environment. WBA 4 consists of two categories: WBA 4A and WBA 4B. Their functions are given below.

- (i) WBA 4A: Introduces new collection system to improve efficiency and sanitary conditions of collection and transport
- (ii) WBA 4B: Improves the present collection system with the involvement of the community and the PCSP

The activities of WBA 4 are strongly related to those in WBA 3 because the community's understanding and engagement are necessary for improving the collection system.

Dustbin and dumping site closure is ongoing with the DSCC initiative. Thus far, 225 dustbins and more than 30 containers have been removed from the streets. Some collection routes have been reformed accordingly to improve the collection efficiency by introducing compactors with FTFP collection. The PCSP often discusses and collaborates with CIs and ACWMOs for work efficiency, during special events such as Eid-ul-Adha. PCSP training is offered in some wards and zones, although this practice is not systematically organized.

3.7 Waste Reduction

Currently, no formal recycling system is provided for households in DSCC. A flow diagram of recyclables and mixed waste in DSCC generated by households is shown in Fig. 3-17.

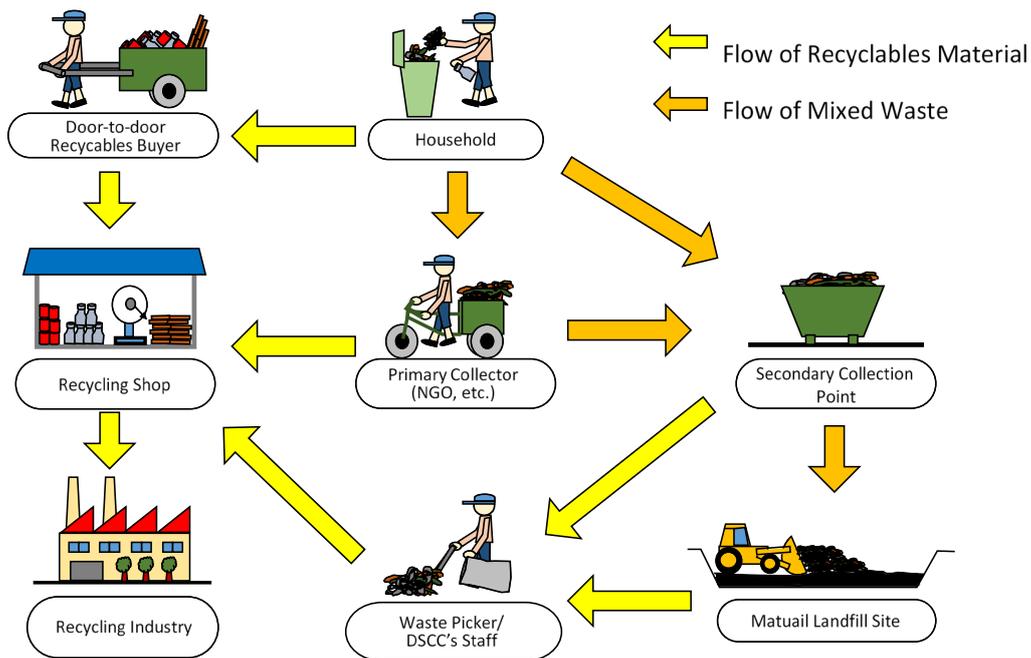


Fig. 3-17 Flow Diagram of Household Waste in DSCC

Although some households separate recyclables and sell them to buyers, most households combine their waste for discharge. This mixed waste is collected by primary collectors or is taken to secondary collection points (SCPs) by a household member. However, some households still dump their waste in open spaces, drains, or rivers.

The primary collectors separate some recyclables from the mixed waste and then sell them to recycle shops. In this way, they earn extra income from the shops in addition to regular salaries paid by the PCSP. After collecting the recyclables, they bring the remaining waste to the SCP from which the waste is transported to the Matuail LFS.

Waste pickers separate some recyclables at the SCP or the LFS. Supporting staff members in charge of loading the waste from the SCP to collection vehicles sometimes take recyclables from the accumulated mixed waste to recycle shops. Finally, the recycle shops sell these items to recycling industry in Dhaka.

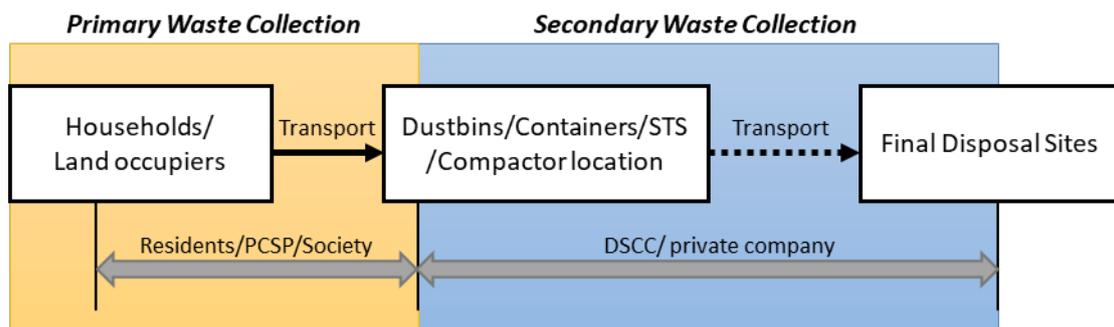
3.8 Collection and Transport

3.8.1 Waste Collection System

(1) Current Waste Collection System

Waste collection in CC is stipulated in the law titled “Local Government (City Corporations) Act 2011.” According to Section 41 of the act, waste collected in dustbins or containers is an asset of the CC. In

In addition to overall management, the waste-related responsibilities of CC include collection of waste from dustbins or containers for transport to its final disposal sites. Heads of households and land occupiers under CCs, as waste generators in other words, are responsible for carrying their waste to CC's waste collection points where dustbins or containers are located and to secondary transfer stations (STSs). This activity is accomplished by the PCSP. DSCC began to privatize the waste collection system through private companies in January 2018. After the PCSP's activity, secondary collection of the waste from SCPs and STSs is the CC's responsibility, as shown in Fig. 3-18.



Source: "Clean Dhaka Master Plan 2005–2015"

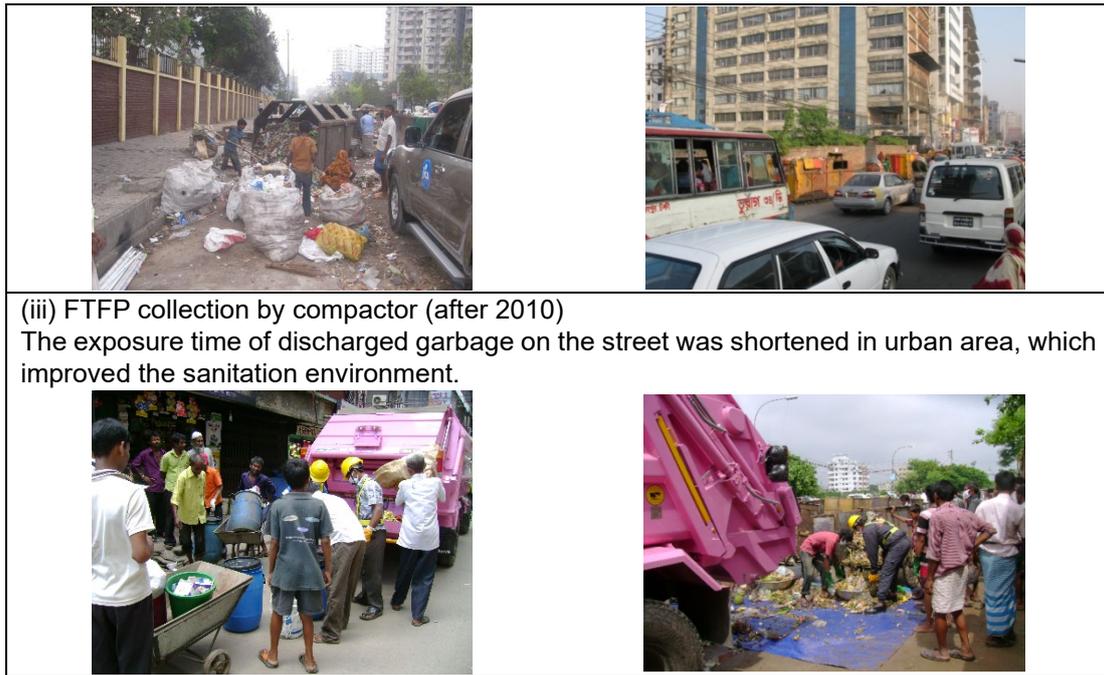
Fig. 3-18 Current Waste Collection System

(2) Transition of Waste Collection System

The waste collection system has improved in the last 10 years, as shown in Fig. 3-19. Prior to JICA's technical cooperation project in 2005, waste was collected by an open truck from a dustbin composed of concrete blocks without a lid. This collection style caused scattering of waste and strong odor because the waste was dumped anytime and was left until a collection vehicle came.

(i) Waste collection from dustbin by open truck (before 2005)
 At dustbins in which people dispose of waste, unsanitary conditions were present all day long, and waste loading by the cleaners from the dustbins to the truck was difficult.

(ii) Waste collection by container carrier (from 2005 to 2010)
 Although the efficiency of the collection by container carrier is high, the containers still created unsanitary condition and aggravated traffic congestion.



Source: JICA Project Team

Fig. 3-19 Transition of Waste Collection System

Loading waste from the dustbin to the open truck is a harsh task for cleaners. The cleaner scoops the waste from the dustbin to a hand bucket, and lifts it to the loading platform of the truck at the same height as the cleaner. The work efficiency as well as the cleaner's working environment is obviously unfavorable. Therefore, DSCC began to abolish the dustbins as part of the JICA's technical cooperation project. DSCC has thus far removed 225 dustbins and replaced them with containers. However, the replaced containers are also problematic because they also cause strong odors when waste is left.

After 2010, new waste collection equipment and compactors were procured by EGAP, and FTFP collection was introduced accordingly. FTFP allows direct collection of the waste from PCSPs, rather than keeping the waste outside in urban area. As part of this measure, 40 containers that caused waste scattering and traffic congestions were then removed.

3.8.2 Primary Waste Collection

Waste collection from the points of generation, or households and buildings, is generally considered to be primary collection if such waste is disposed of to the SCPs of DSCC. A door-to-door waste collection system is common in almost all wards of DSCC to accommodate the high population density and long distances to SCPs. The business entities providing primary collection or door-to-door collection services are recognized as PCSPs or primary waste collection service providers (PWCSP). According to the survey conducted by the JICA Project Team in 2018, approximately 246 PCSPs are regularly working in the DSCC area.

PCSPs collect waste door-to-door and transport the waste by rickshaw vans to dustbins/containers, and sometimes to vacant land for illegal dumping, whereas PCSPs near the LFS and in the extension area of DSCC take the waste directly to the LFS. Various types of STPs are used by PCSPs, such as compactors, containers, and a combination of these. In some cases, however, they take the waste to open dumping or illegal collection points.

(1) Status of Primary Collection Service Providers

The PCSP is defined as an entity providing door-to-door waste collection service. They are registered or unregistered individual persons, organizations, or associations with one or more rickshaw vans with or without hand trolleys. The forms of PCSPs are variable among the wards and according to the characteristics of the community. In general, CBOs, NGOs, private companies, housing societies, and individuals are common PCSPs.

An association of PCSPs in DSCC, known as the Primary Waste Collection Service Providers Association (PWCSA Association), was formed cater to the wellbeing of PCSPs and their workers. However, the participation of PCSPs is currently only 40%; that is, of 246 PCSPs, 143 PCSPs do not belong to the PWCSA Association.

(2) Registration of Primary Collection Service Providers

The permission and registration system of PCSPs was developed as part of JICA's first technical cooperation project from 2007 to 2013. DSCC adopts the same system for its application and monitoring with minor changes in the registration process. The PWCSA Association is newly incorporated in the permission and registration system. However, the selection and acknowledgement process of the PCSP is neither fully transparent nor legitimate.

PCSPs are gradually shifting from informal to formal sectors in association with increasing recognition by different government bodies despite the fact that conflicts in PCSP ownerships and area demarcation still prevail in many wards. Local political leaders often control the primary collection business because many PCSPs are not registered at DSCC. This situation is considered to be a severe problem that hinders the improvement of PCSPs to be legally and properly controlled. The registration entities of PCSPs in DSCC are shown in Table 3-13. Currently, 16% of PCSPs are not registered in the DSCC registration system.

Table 3-13 Registration Entities of PCSPs in DSCC

Registration Entities	Counted Registered PCSPs in DSCC	Proportion
Registered ¹	206	84%
DSCC	146	59%
Union (Parishad) ²	12	5%
Ministry of Social Welfare	9	4%
Other	39	16%
No Registration	40	16%
Total	246	100%

Note:

¹ PCSP may have multiple registrations.

² Union (Parishad) is a form of local government

Source: JICA Project Team analyzed based on the primary collection survey (2018)

(3) Distribution and Coverage of Primary Collection Service Providers

In total, 246 PCSPs work in DSCC and provide the services to 2,450 fieldworkers, including 177 supervisory staff members who collect service charges from households, buildings, and other establishments. The PCSP coverage information for each zone, including the collection trip distance and household coverage, is shown in Table 3-14. The PCSPs use 1,228 rickshaw vans covering 396,402 of households and 8,951 businesses per day at an average of two trips per day per van. Rickshaw vans cover 165 households/trip at 330 households per day per van on average.

Table 3-14 PCSP Information in DSCC

Zone No.	Counted PCSP	Rickshaw Van	Household Coverage	Commercial Coverage		
				Shops	Hotels/ Restaurants	Total
DSCC	246	1,228	396,402	6,259	1,417	8,951
1	41	173	41,789	433	495	1,182
2	61	210	78,678	2,609	153	2,850
3	42	241	71,720	740	448	1,281
4	37	143	36,290	283	80	1,164
5	33	259	102,684	1,552	178	1,750
6	3	9	2,170	0	0	0
7	1	10	3,000	450	2	452
8	6	52	16,700	100	2	105
9	6	55	14,496	77	16	100
10	15	41	13,875	15	13	37
6, 9	1	35	15,000	0	30	30

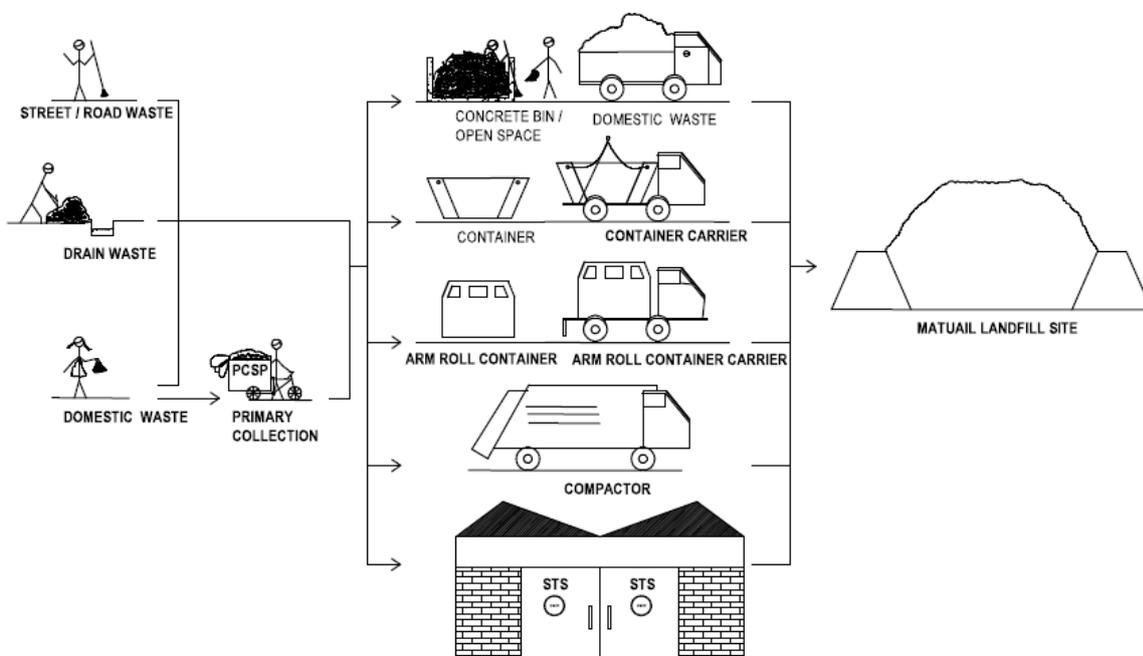
Source: JICA Project Team analysis based on the primary collection survey (2018)

3.8.3 Secondary Waste Collection

(1) Secondary Waste Collection System

Waste accumulated in SCPs, STSs, and dustbins are categorized in three major types based on the source of waste: household waste, street waste including sludge from drainage, and business waste. Street waste and drain waste are collected daily by DSCC cleaners after road sweeping and drain cleaning. The cleaners then take the waste by a trolley to a nearby SCP such as an STS, compactor, or dustbin. Domestic waste generated in households and commercial and office spaces is collected at the sources by PCSPs and is carried to the SCPs. There are four different types of secondary collection receptacles: concrete bins, containers, arm roll containers, and compactors for direct transport without waste storage. Open curbside waste accumulation is sometimes used at designated points for areas in which container placement is not suitable. The accumulated waste at STSs is then transported to final disposal by open trucks and compactors.

STS facilities have been newly constructed in DSCC, and conventional and arm roll containers are stored at the STS facilities. PCSPs collect waste in their rickshaw vans and transfer it into containers stored in the STS facilities from 11 a.m. to 4 p.m. local time. Then, the filled-up containers and compactors are transported to the LFS. Compactors receive collected waste directly from PCSPs and businesses and transport the waste directly for final disposal.



Source: JICA Project Team

Fig. 3-20 Waste Collection and Transport Flow from Source to Final Disposal

(2) Organization Related to Secondary Waste Collection

The WMD is the core organization responsible for secondary solid waste collection from SCPs such as dustbins, containers, STSs, and compactors and for loading and unloading the waste at Matuail LFS. The TD is responsible for transporting waste from SCPs to LFS. Allocation of the waste collection vehicles to wards is executed by TD after formal proposal from the WMD.

(3) Secondary Collection Points

With the exception of STSs, SCPs are designated spots in which PCSPs keep the collected waste every day and include containers, open spots, dustbins, and compactor locations. There are 502 SCPs identified in the DSCC. Dustbins composed of concrete blocks on roadsides are increasingly becoming obsolete; only 26 dustbins are functional in Ward 34, 35, 37, 38, 40, 42, and 50. Moreover, 206 open spots and 270 containers are also functional in the DSCC. In general, SCPs are located in densely populated areas or narrow roads, which prevent frequent access by a waste collection vehicle; unmanaged waste creates unsanitary conditions in the surrounding environment.

(4) Secondary Transfer Station

There are 19 STSs in 18 wards among all DSCC wards. 39 wards have no STSs, whereas Ward No. 22 has two STSs.

(5) Current Operation of Secondary Waste Collection

The arm roll can make a maximum of five trips to Matuail LFS per day, whereas container carriers can make four trips. Open trucks and compactors can make three trips per day. Compactors with a capacity of five ton can complete only two trips per a day because the compactors need considerable hours to wait for loading waste from rickshaw vans by PCSPs. Table 3-15 shows the average types and average trips per day by collection vehicles.

Table 3-15 Average Number of Trip by Vehicle Type

Vehicle type	Capacity (tons)	Average trips per day
Arm Roll	7	5
Compactor	5	2
Compactor	2	3
Container Carrier	5	4
Open Truck	5	4
Open Truck	3	3

Source: JICA Project Team “Time and Motion Survey Report (2018)”

(6) Working Conditions and Occupational Safety

The waste collection staff normally works under considerably unsafe conditions. A limited number of collection staff members wear typical safety gear such as masks, hand gloves, and sometimes boots. Nonetheless, violations of traffic rules occur. All staff members work on roads day and night mostly aside heavy traffic in many areas without special traffic signs, signals, or markings.

3.8.4 Privatization

(1) Private Company Information

Before DCC was split in two CCs, Urban Planning Department (UPD) of DCC began an initiative for private sector involvement in waste collection, and successfully introduced outsourcing of the collection activity in two zones, Zone 1 and Zone 9. After the enforcement of Public Procurement Act 2006 and Public Procurement Rule 2008, the procurement system was reformed to the current one.

At present, the waste collection and transport system has been outsourced to and implemented by private sector in three wards of DSCC. A summary of the private sector operation is presented in Table 3-16. Three private companies (or organizations) are outsourced for the waste management program in Ward 55, Ward 56 and Ward 57 of Zone 3.

Table 3-16 Summary of Private Company Information

Name of Company	Working Area	Total Staff	Total Vehicles & Equipment	Years of Experience in Waste Collection
Rakib Enterprise	Zone 3: Ward 55	315	80	6
M/S Aman Traders And Clean Dhaka International (JB)	Zone 3: Ward 56	57	25	5
Khondokar Brothers and Network	Zone 3: Ward 57	390	62	5

Source: JICA Project Team summary based on contracts with companies in DSCC

(2) Contract Type

The three types of the outsourcing contracts for private waste collectors are listed below.

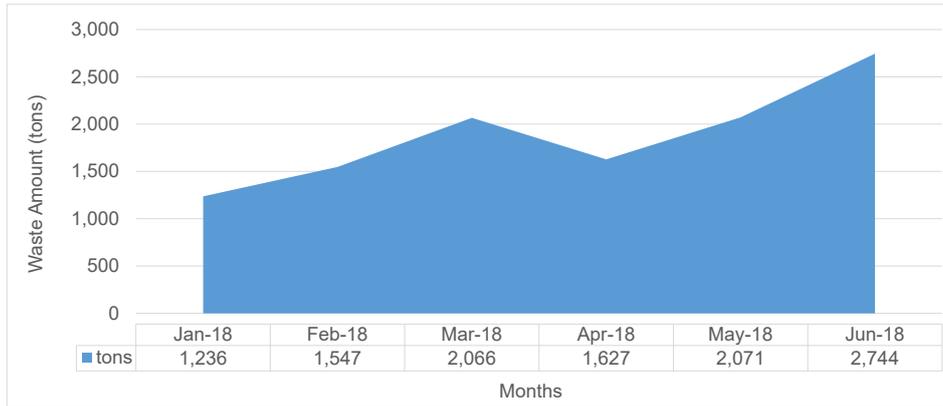
- (i) Ton-based contract
- (ii) Person-, vehicle-, and equipment-based contract
- (iii) Ton-, and person-based contract

Rakib Enterprise, the first contractor of the outsourcing in DSCC, began waste collection in January 2018, and has been contracted with contract type (iii) for the first year.

(3) Waste Collection Amount

1) Collection Amount by Private Companies

Three private companies began waste collection in 2018 for the first time. The amount of waste collected by private companies are shown in Fig. 3-21.

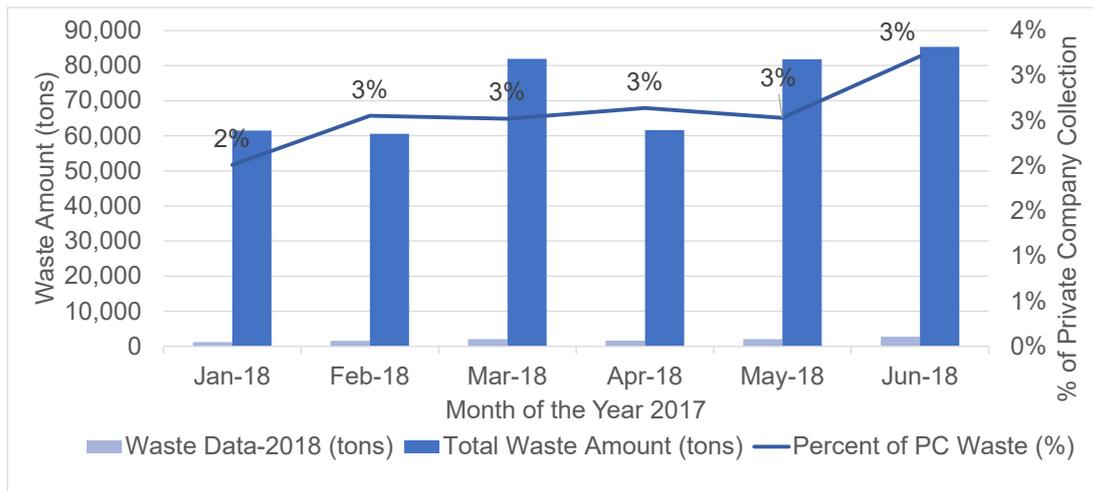


Source: JICA Project Team analysis based on report by private contractors

Fig. 3-21 Private Company Waste Collection in DSCC (2018)

2) Comparison between DSCC and private companies

Waste collection data of the private waste collection companies are compared with the data of DSCC from January to June 2018 in Fig. 3-22. Approximately 2–3% of the waste was only collected by these companies, with the maximum amount collected in June 2018.



Source: JICA Project Team

Fig. 3-22 Waste Collected by Private Companies and the Total Waste Collected

3.9 Waste Collection Vehicle Maintenance

3.9.1 Waste Collection Vehicle Information

The number of waste collection vehicles in DSCC is shown in Table 3-17. Currently, WMD has 76 vehicles provided by EGAP, or 27% of the total, whereas the ED has 205 vehicles, or 73%, including 142 open trucks. Waste collection vehicles are generally procured by ED with DSCC's own budget, and are then transfer to TD for operation. Compactors were procured and introduced in DSCC by EGAP for the first time. ED is planning to purchase 95 new waste collection vehicles in 2018, including 15 compactors (5 tons), 13 dump trucks (5 tons), six dump trucks (3 tons), and container carriers for the rest.

Table 3-17 Number of Waste Collection Vehicles by Type

Vehicle type	WMD	ED
Arm roll	12	0
Container carrier	31	51
Compactor	17	4
Open Truck	0	142
Dump Truck	16	8
Total	76	205
Grand Total		281

Source: JICA Project Team analysis based on the DSCC waste collection inventory

Most of the open trucks of the DSCC became obsolete. Accordingly, ED has prepared a plan for replacing the old vehicles with new types of waste collection vehicles. Approximately 162 vehicles out of the total 281 are ready to sell at auction. WMD is also planning to purchase new vehicles, subject to budget allocation and approval of the central authority. In addition, JICA has extended its cordial cooperation toward DSCC for easing the waste collection pressure by providing new vehicles such as compactors and dump trucks through the GAP of JICA, as shown in Table 3-18.

Table 3-18 Type, Capacity, and Number of Waste Collection Vehicle of Grant Aid Project

Lot No.	Types of Vehicles	Capacity (tons)	No. of Vehicles
1	Dump Truck (small)	2.5	3
	Dump Truck (4WD)	5.4	3
	Dump Truck (Large)	6.8	4
2	Container Carrier	6.0	24
3	Compactor (small)	3.2	8
	Compactor (large)	7.5	14
Total			56

Source: JICA Project Team, "Implantation Report of Grant Aid Project (GAP) Plan (2018)"

3.9.2 Relationships and Responsibility for Operation and Maintenance of Waste Collection Vehicles

Four organizations are directly related to the operation and maintenance (O&M) of the waste collection vehicles: WMD, TD, Mechanical Division (MD) of ED and SPD. Their responsibilities are summarized in Table 3-19.

Allocation of the waste collection vehicles is executed by the TD after formal proposal from the WMD. Fuel coupons for the collection vehicles are issued by the TD, and are handed out to the drivers. For the vehicle repair and maintenance, the drivers may receive a job card from the TD, and can submit it to the DSCC workshop located in Dhalpur. Regular vehicle maintenance service and repair of the containers and body parts are performed at the workshop.

Normally, the WMD and ED implement periodical inspection and maintain their own vehicles in each department, whereas the TD is responsible for daily inspection. The SPD is responsible only for the procurement process. It purchases spare parts including tire tubes and batteries for the collection vehicles and equipment in accordance with requests from the ED and WMD, and supplies the necessary items to the DSCC workshop annually.

Table 3-19 Responsibility for Operation and Maintenance of Waste Collection Vehicles

	WMD	ED	TD
Vehicle Allocation			✓ All Vehicles
Purchase and Auction of Vehicle		✓ All Vehicles	
Purchase of Fuel		✓ DT in ED	✓ Vehicles except DT in ED
Driving Vehicle		✓ DT in ED	✓ Vehicles except DT in ED
Daily Inspection		✓ DT in ED	✓ Vehicles except DT in ED
Periodical Inspection	✓ EGAP Vehicles and Others	✓ Except WMD Vehicles	*Issuing Job Card
Purchase and Replacement of Parts	✓ EGAP Vehicles and Others	✓ Except WMD Vehicles	*Issuing Job Card
Workshop Management	✓ Lent a part of ED Workshop	✓ ED Workshop	
Spare Parts Management	✓ Parts for EGAP Vehicles and Others	✓ Parts for except WMD Vehicles	

Note) DT: Dump Truck
 Source: JICA Project Team

3.9.3 Staffing for Repair and Maintenance of Waste Collection Vehicle

All collection vehicle drivers for waste collection, including the WMD vehicle drivers, belong to the TD. However, a shortage of drivers still exists, with insufficient staff available to handle available open trucks, container carriers, and other collection vehicles. To fill the gap, some drivers work two shifts or overtime. In addition, the DSCC workshop staff of the ED has not been recruited for many years; currently, only two mechanics are available to work in the workshop, whereas approximately 500 vehicles are now functional including office vehicles. Spare parts are procured by the SPD and are maintained by the respective storekeepers at the DSCC workshop office.

3.9.4 Vehicle Inspection and Maintenance Condition

Vehicle inspection and maintenance condition is summarized in Table 3-20. The vehicle inspection in DSCC is broadly classified as (i) daily inspection, (ii) periodical inspection, and (iii) inspection when drivers report troubles. Drivers prepare a job card, and the mechanics inspect the subject vehicle for (ii) and (iii). Minor repairs such as replacement of lubricants and filters are completed by mechanics. When a severe breakdown occurs that requires replacement of major parts such as an engine or brakes, the repair and maintenance service is outsourced.

The TD issues a job card for all services. The period for replacement of parts is not standardized and is determined by drivers or mechanics.

Table 3-20 Vehicle Inspection and Maintenance Condition

		WMD	ED
1. Inspection			
Daily Inspection	Inspector	Driver (TD)	
	Location	Garage	
	Inspection items	Engine oil, coolant, battery, and other items; investigates abnormal noises	
	Remarks	-Issues job card, if any abnormal items are found -No standard and recording sheet is needed for the inspection	
Periodical Inspection	Frequency	Every three months	When drivers report troubles
	Inspector	Mechanic (WMD)	Mechanic (ED)
	Location	Garage	
	Inspection items	Lubricants, filters etc.	Items which drivers request
	Remarks	- No recording sheet - No standard for inspection	- No recording sheet - No standard for inspection
2. Repair and Maintenance			
Replacement of parts	Repair staff	Mechanic (WMD)	Mechanic (ED)
	Location	Workshop	

		WMD	ED
(lubricants, filters etc.)	Frequency of Service	1. Parts are replaced if required after periodical inspection 2. Parts are replaced if drivers report trouble	Parts are replaced if drivers report trouble
	Remarks	Recording sheet: records the parts to be replaced	
Replacement of parts (tires, tubes, and batteries)	Repair staff	Mechanic (WMD)	Mechanic (ED)
	Location	Workshop	
	Frequency of Service	Parts are replaced if drivers report trouble	
	Remarks	Recording sheet: history book. Date, replaced parts, and cost are recorded.	
Replacement of parts (engines, brakes etc.)	Repair staff	Mechanic (WMD) + Outsource	Mechanic (ED) + Outsource
	Location	Workshop	
	Frequency of Service	Parts are replaced if drivers report trouble	
	Remarks	Recording sheet: history book. Date, replaced parts, and cost are recorded.	

Source: JICA Project Team

3.9.5 Spare Parts Management (Inventory Management)

The WMD or ED purchases spare parts for periodical maintenance such as various filters, lubricants, batteries, tires, and tubes, which are stored in the department's own storage facility in the workshop. Each department receives these parts from the SPD or market after procurement and keeps the spare parts as inventory. The current situation of spare parts management in the WMD and ED is described in Table 3-21.

Table 3-21 Spare Parts Management in WMD and ED

	WMD	ED
Stored spare parts	-Various lubricants -Various filters -Tires -Tubes -Parts supplied in EGAP	-Various lubricants -Various filters -Tires -Tubes
The Location of spare parts storage	-Storage owned exclusively by WMD in DSCC workshop	-Storage owned exclusively by ED in DSCC workshop
Recording item	[Incoming items] -Procurement company -Number of procured parts -Date of part procurement	[Outgoing items] -Delivery Date -Delivered vehicle No. -Number of delivered parts

Source: JICA Project Team

3.9.6 Outsourcing Process for the Collection Vehicle Maintenance

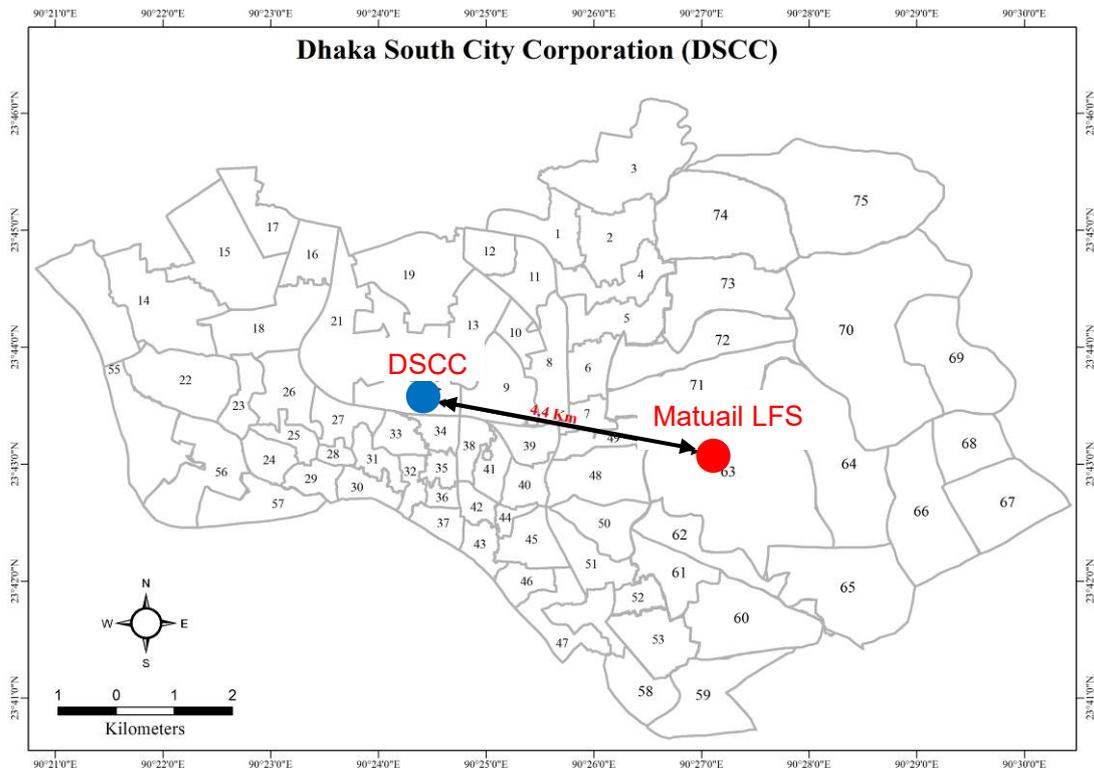
DSCC has its own process for outsourcing vehicle maintenance to private companies, except for periodical maintenance. The outline of the process is given below.

- (i) The WMD or MD selects a private company by the official tendering process. A company is selected for each vehicle model of container carrier (5 tons) or compactor (3 tons).
- (ii) After the tendering process, a service agreement for one year is prepared. The WMD/ED determines the upper limit of the total price for servicing the vehicle in the agreement. The WMD/ED is unable to ask the company to provide services exceeding the upper limit of the price.
- (iii) The companies cannot service vehicles for non-listed items, as stated in the agreement.

3.10 Landfill

3.10.1 Overview of Matuail Landfill Site

Matuail LFS is the only formal landfill site for DSCC. As shown in Fig. 3-23, Matuail LFS is located about 4.4 km east of the DSCC headquarters. Waste dumping in Matuail LFS started in 1993, and improved afterwards from an open dumping site to a sanitary landfill. Matuail LFS became the first sanitary LFS in Bangladesh in 2007.



Source: JICA Project Team

Fig. 3-23 Location of Matuail LFS

A layout of Matuail LFS is shown in Fig. 3-24, and its basic information is given in Table 3-22. Currently, Matuail LFS receives all types of waste in DSCC except for tannery and medical waste.

At present, Matuail LFS consists of two areas: the existing area and the extension area. Both areas are composed of an embankment, gas vent pipes, flood lights, access and operation road, and dumping platforms. The anaerobic method is applied inside and under the embankment of both areas, whereas the semi-aerobic method is used above the embankment. In the existing area, auxiliary facilities such as a weighbridge, a car washing pool and equipment, an administrative building, a workshop, a diesel generator house, and a rainwater drainage are installed. The extension area has a leachate treatment facility only.

As per high court injunction, the waste is transported to Matuail LFS only at night from 10:00 p.m. to 6:00 a.m. with the busiest time from 1:00 to 3:00 am. However, daytime dumping is ongoing, although relatively small amount, according to weigh bridge data. The existing area is expected to be filled up by 2018.

Table 3-22 Basic Information of Matuail LFS

Item	Description	
	Existing Area	Extension Area
Current Situation	Under preparation for safety closure.	Ongoing waste dumping
Type of Receiving Waste	All types of waste (mostly domestic waste and business waste) except for tannery waste and medical waste of DSCC	
Target Receiving Area	Entire DSCC jurisdiction composed of 57 wards	
Operating Hours	Nighttime only, from 10:00 p.m. to 6:00 a.m.; daytime dumping is still ongoing	
Area and Capacity for Disposal	Area = 19 ha Volume = 1.5 million m ³ (above the embankment)	Area = 20 ha Volume = 3.1 million m ³
Disposal Method	Under and inside the embankment: Anaerobic method Above the embankment: Semi-aerobic method	
Main Facilities	<ul style="list-style-type: none"> - Embankment - Leachate treatment facility (with anaerobic treatment system) - Leachate collection / drainage facility - Rain water collection facility (open ditch) - Gas vent pipes - Landfill management office - Truck scale - Car wash facility - Dumping platform - Access road - Workshop 	

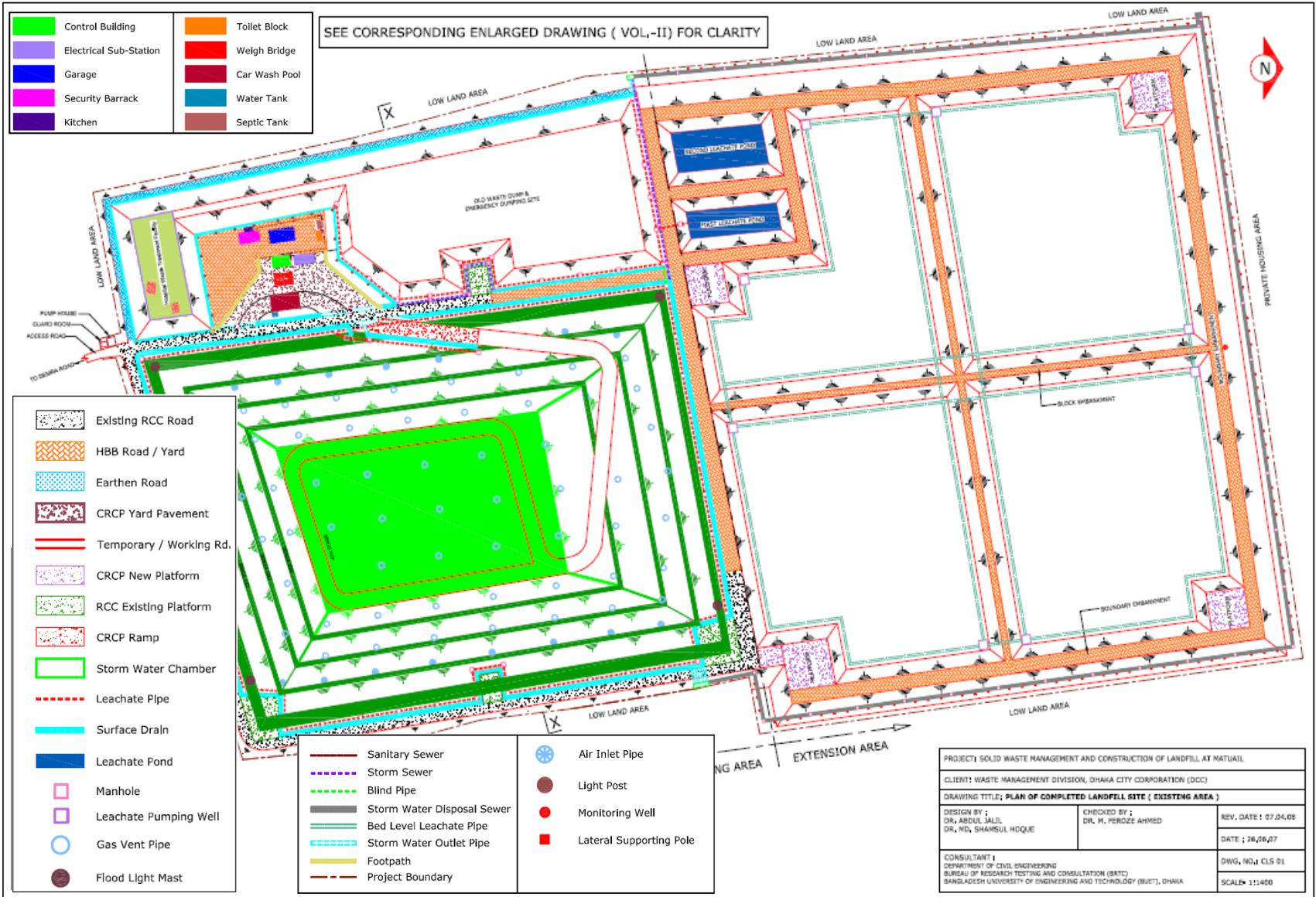


Fig. 3-24 Layout of Matuail LFS

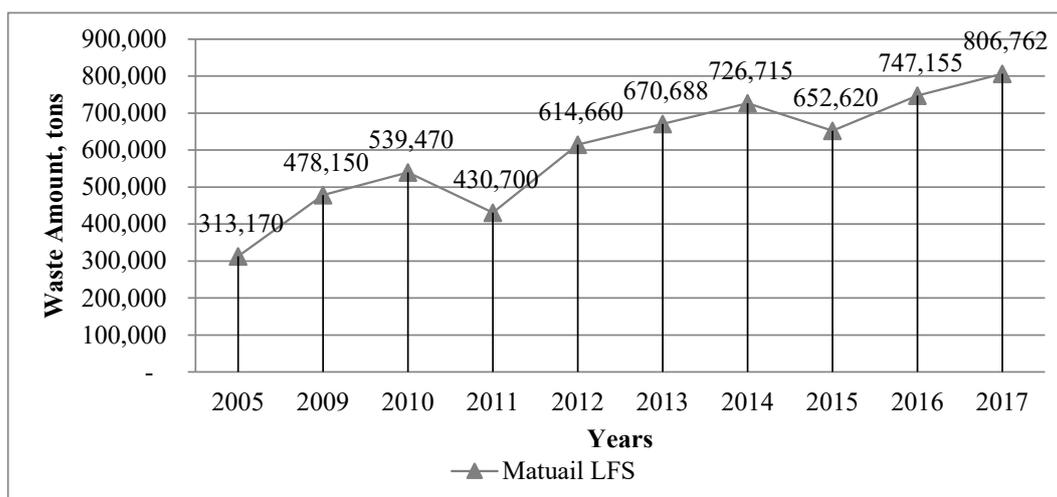
3.10.2 Roles and Responsibility of Waste Management Department and Related Departments

In DSCC, the WMD and ED are engaged in the LFS operation. The ED supports the WMD by providing heavy vehicles. The roles and responsibilities of the WMD and ED are shown below.

- i) WMD
 - Landfill site procurement, operation and maintenance
 - Yearly budget preparation
 - Construction and installation of weighbridge, peripheral embankment, car wash pool, lighting tower, dumping platform, leachate treatment plant, gas vent pipe etc.
 - Environmental management by cover soil layering of the dressed wastes of the LFS
 - Ensures the security of the LFS by preventing unwanted entry of unauthorized people
- ii) ED
 - Provides heavy equipment with fuel and driver for landfill operation
 - Spreads and compacts waste and soil cover

3.10.3 Disposal Amount

The annual disposal amount of waste is shown in Fig. 3-25. In 2011, the amount of waste decreased owing to the jurisdiction division of DCC into DSCC and DNCC, but the amount in 2012 became higher quickly than that of the year 2010. The highest amount of waste dumping is generally reported in the month of June, the time of the Eid-ul-adha festival. The huge amount of waste is generated owing to cattle slaughtering.



Source: Weigh bridge data from Matuail LFS

Fig. 3-25 Disposal Waste Amount in Matuail LFS (tons/year)

3.10.4 Remaining Capacity of Matuail Extension Landfill Site

As of 2017, the estimated remaining landfill capacity of the extension area is 1,843,343 m³, as shown in Table 3-23. Matuail LFS is designed to fill up as high as about 20 m above the embankment. The estimated completion date of waste disposal in the extension area is August 2020. The current and proposed completion shape of Matuail LFS is shown in Fig. 3-26.

Table 3-23 Estimated Disposal Amount and Remaining Landfill Capacity

	Capacity			
	2017	2018	2019	2020
Estimated Disposal Amount		692,515 m ³	710,564 m ³	728,657 m ³
Remaining Landfill Capacity	1,843,343 m ³	1,150,828 m ³	440,264 m ³	-288,393 m ³

* Compacted density 0.80 m³/ton

Source: JICA Project Team

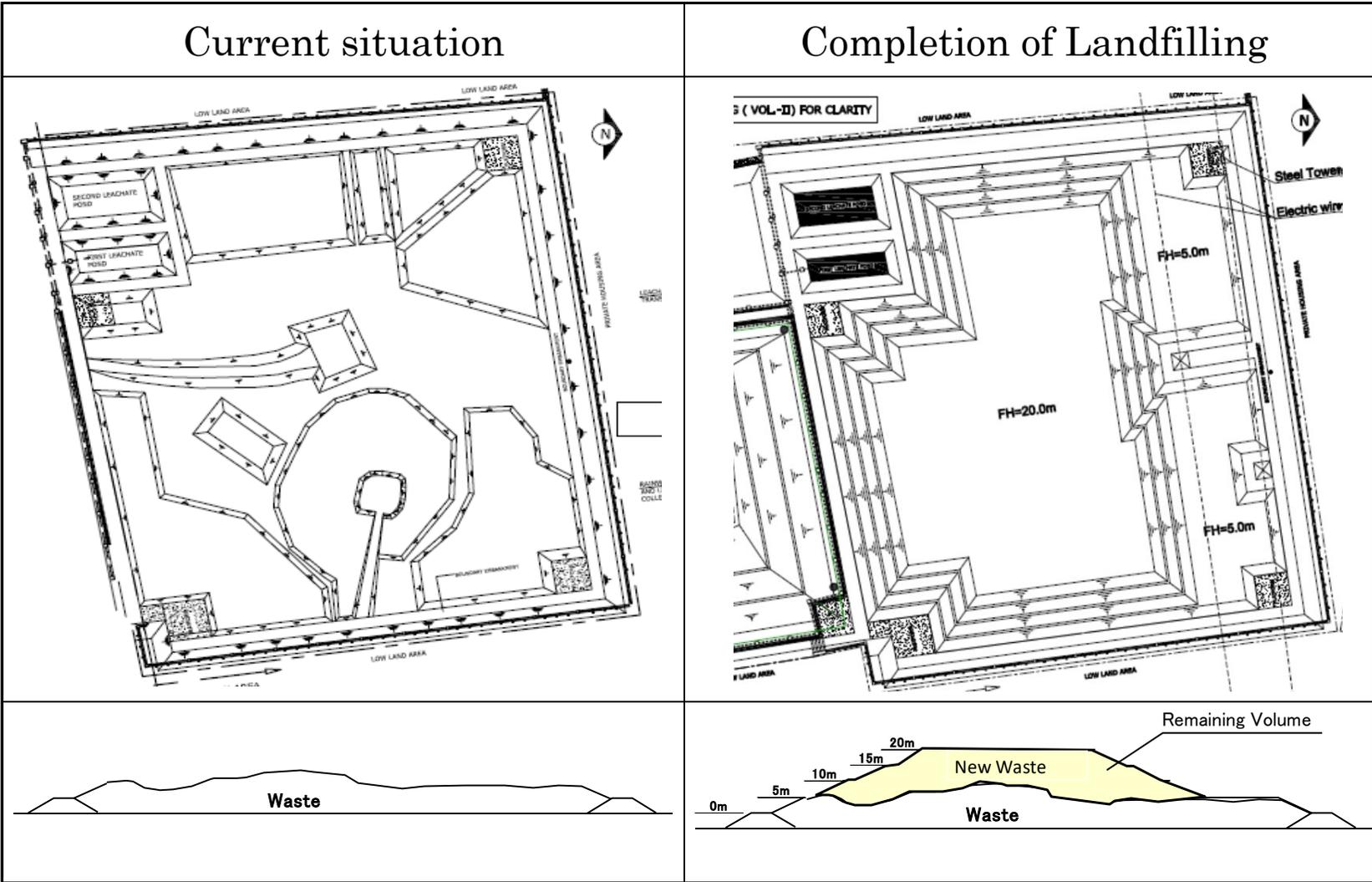


Fig. 3-26 Current and Proposed Completion Shape of Waste Disposal

3.10.5 Heavy Equipment for Landfill Operation

The general characteristics of heavy equipment for landfill operation are shown in Table 3-24. The bulldozer is superior for pushing and placing waste and is appropriate for compacting the waste in any type of ground. The wheel dozer is also superior for pushing and placing the waste and mobility, although its compaction performance is worse than that by the bulldozer. The wheel loader is used mainly for loading waste. The excavator (power shovel) is used for digging soil cover in the natural ground. The landfill compactor can effectively be used for crushing and compaction, although it could become stuck if used on soft ground such as an LFS.

Table 3-24 Characteristics of Heavy Equipment Needed for Landfill Operation

Heavy Equipment	Capacity	Waste		Covering Soil				Disposal Scale
		Pushing & Placement	Compaction	Excavation	Pushing & Placement	Compaction	Transportation	
Bulldozer	Weight: 3.5-40 tons Running Speed: 0-14 km/h Bucket Capacity: 0.5-10 m ³	◎	○	△	◎	○	×	Large to Small
Wheel Dozer	Weight: 5-6.2 tons Running Speed: 0-35 km/h Bucket Capacity: about 1m ³	◎	△	△	○	○	×	Large to Small
Wheel Loader	Bucket Capacity: 0.2-9m ³ Running Speed: 0-40km/h	○	△	△	○	△	×	Large to Small
Excavator (Power Shovel)	Bucket Capacity: 0.2-9 m ³	×	×	◎	△	×	×	Large to Small
Landfill Compactor	Weight: 20-34 tons Height of Gear Tooth: 15 cm	◎	◎	×	○	○	×	Large to Small

◎ Best function ○ Good function △ Applicable but function is not sufficient × Inadequate

Source: JICA Project Team

The heavy equipment used for landfill operation are supplied by the ED; that is, the WMD does not have any equipment for this purpose. The DSCC currently uses bulldozers and wheel dozers for removing and compacting waste, and excavators for loading and unloading waste from trucks. .

3.10.6 Current Situation of Operation and Management

(1) Landfill Operation and Management

The main roles of Matuail LFS are to receive waste, to place the waste in systematically arranged cells, to protect the environment, and to stabilize the waste and return waste to the soil. Matuail LFS should

be managed and operated properly to fulfill these roles. The major five activities of landfill operations and management are given below.

- Vehicle Management
- Disposal Management
- Landfill Facility Management
- Safety Management
- Environmental Management

(2) Leachate Treatment

A leachate Treatment by using physical and chemical treatment is introduced in Matuail LFS. The flow of the leachate treatment is shown in Fig. 3-27. Raw leachate flows into an anaerobic pond (Pond 1), and the leachate is pumped up a chemical mixing tank. At this point, polymer, ferrous sulfate, and lime are added with purified water. The leachate is then transferred to a primary clarifier to remove sludge, and to a secondary aerobic unit (Pond 2) with 24-hour aeration to keep aerobic bacteria alive. The leachate is again transferred back to a secondary clarifier and sent to a sump for discharge.

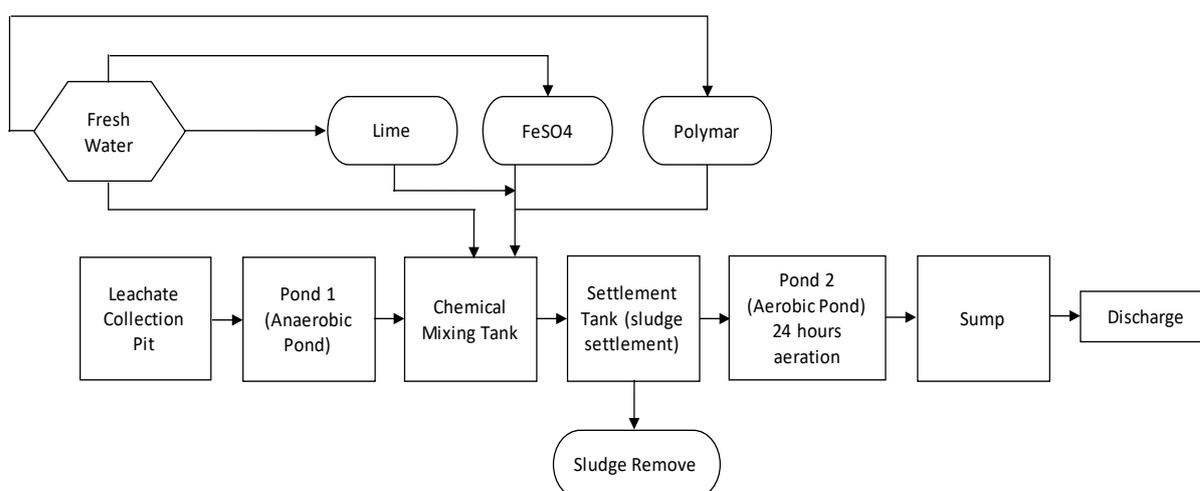


Fig. 3-27 Schematic Flow Diagram of Leachate Treatment in Matuail LFS

In this facility, leachate is treated at 10 to 20 m³ per hour in dry season, and 50m³ per hour in wet season. A private company, OSMO Corporation devised the system with a chemical dosing procedure using coagulation and sedimentation with polymer, ferrous sulfate, and lime in 2012. In this process OSMO Corporation conducted some parameter tests of leachate at the environmental laboratory of the Bangladesh Water Development Board (BWDB), and the Bangladesh University of Engineering and Technology (BUET). The result of tests is shown in Table 3-25. All items, PH, COD, BOD and TSS have recorded less than target quality in the test conducted in 18th October 2012.

Table 3-25 Result of Leachate Tests in Matuail LFS

Parameters	31 Jul 2012				25- Aug 2012	18-Oct 2012	Remarks
	Sample 1	Sample 2	Sample 3	Sample 4	Sample 4	Sample 4	
	Raw Leachate / Inlet of anaerobic pond	Anaerobic pond	After Chemical Mixing / inlet of Aerobic Pond	Aerobic pond Outlet/ Final Treated water	Aerobic pond Outlet/ Final Treated water	Aerobic pond Outlet/ Final Treated water	Target Quality
PH	7.23	8.01	8.58	7.72	7.84	7.4	5.5 – 9.0
COD	11830	3264	819	576	295	116	250
BOD5	5800	1440	360	48	24	12	30
TSS	3051	225	59	42	40	25	100

Source: Draft Final Report of Ex-Post Evaluation Survey of Project for Strengthening of SWM in Dhaka City

3.10.7 Matuail New Extension Landfill Site Development Project Proposal

The DSCC has submitted a DPP to the LGD related to improvement of waste management, including construction of new LFS. Components of the DPP and budget is described as Table 3-26. The budget of land acquisition for Matuail new LFS is 3,173 Tk. million for 20 ha and budget of the construction for Matuail new LFS is Tk. 963 million. Details such as layout plan are explained in Section 5.8 .

Table 3-26 Components of Development Project Proposal for Matuail New Landfill Site

Component	Description	Budget (Tk. million)
Land acquisition	20 ha of the land acquisition	3,173
Infrastructure	Embankment, land development, landfill construction, leachate treatment facility etc.	963
Procurement of equipment	Bulldozer, excavator, wheel loader etc.	517
Consulting service	Land use plan, tender, advertising, facility visit	41

3.10.8 Illegal Dumping

Although considerable efforts has been made by the WMD for closing illegal dumping sites, 35 sites remain in DSCC as of 2018. The smallest and the largest sizes of the illegal dumping sites are 1.52 m² and 5,484 m² respectively.

3.11 Medical Waste Treatment

3.11.1 Categories of Medical Waste

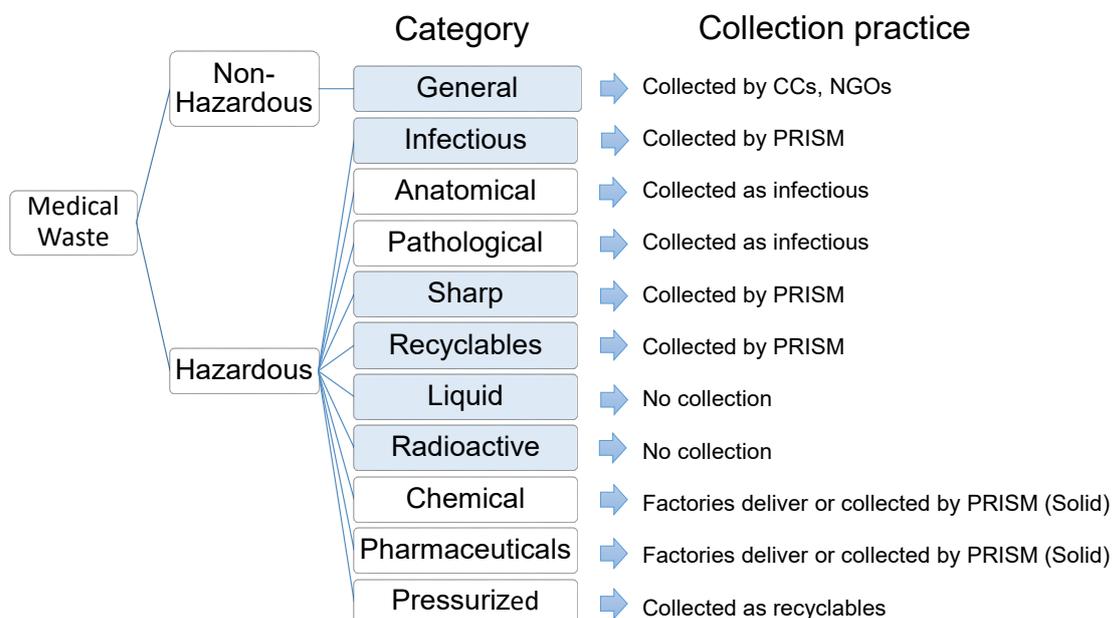
In-house medical waste management, i.e., segregation at source according to the color codes, internal transport, and storage, is the responsibility of respective government hospitals, private hospitals, and clinics. However, medical waste collection and transport from the medical facilities is the responsibility of CC or municipality (Pourashava). PRISM Bangladesh Foundation (PRISM) has been working on behalf of DSCC since 2005 to collect medical waste from all government and private health care establishments (HCEs).

PRISM executes intermediate treatment to the collected medical waste at medical waste treatment plants allocated by DSCC. The overall program activities are monitored by the DSCC medical waste management committee (WMC). Environmental compliance at the treatment plants is regulated by DoE. An Environmental Clearance Certificate (ECC) is issued by DoE and is renewed every year.

Medical Waste (Management and Processing) Rules defines the type of waste as shown in Fig. 3-28. In practice, general waste generated in the HCEs are collected by DSCC or designated NGOs by DSCC. Anatomical and pathological wastes are collected as a part of infectious waste without specific segregation because the treatment methods are almost same. Sharp waste and recyclables are collected separately, and some of pressurized waste are partially collected as recyclables.

Chemical and pharmaceutical waste are mostly generated in the pharmaceutical factories and they deliver these waste to PRISM only a few times a year. PRISM collect these sometimes upon request but not on regular basis. PRISM receives only solid form of chemical or pharmaceutical waste owing to the available treatment facility.

There are separated bins available for liquid and radioactive waste, but no collection in place. Liquid waste is mostly discharged to drain or sewerage directly, and radioactive waste is not properly collected or sometimes discharged as general waste. As a situation on the ground, infectious, sharp and recyclables are collected in separate bins and treated.



Source: JICA Project Team, "Survey Report on Medical Waste Management in Dhaka South and North City (2018)"

Fig. 3-28 Category of Medical Waste and Collection Practice

DSCC has 595 HCEs including hospitals, clinics, dental clinics, and laboratories, with 11,620 inpatients and 51,807 outpatients. Currently, only six color codes are used to separate waste generated in categories of general, infectious, sharp, recyclables, liquid, and radioactive.

Table 3-27 shows the categories of medical waste and the responsible organizations. The general waste, including non-infectious waste, is collected by DSCC or NGOs, the liquid waste is discharged into drains and sewerage system by the HCEs and radioactive waste is managed under the jurisdiction of Bangladesh Atomic Energy Commission without proper collection in place hence, only infectious, sharp and recyclables waste are discussed in this section.

Table 3-27 Categories of Medical Waste and Responsible Organizations

Color Code	Category of Waste	Responsible Organization	Present Situation
Black	General	CC/Pourashava	CC/Pourashava
Yellow	Infectious	CC/Pourashava	PRISM on behalf of CC
Red	Sharp	CC/Pourashava	PRISM on behalf of CC
Green	Recyclable	CC/Pourashava	PRISM on behalf of CC
Blue*	Liquid	Hospital Effluent Treatment Plant (ETP)	No Treatment

Color Code	Category of Waste	Responsible Organization	Present Situation
Silver*	Radioactive	Bangladesh Atomic Energy Commission	Bangladesh Atomic Energy Commission

*No data is available for liquid and radioactive waste.

Source: JICA Project Team, "Survey Report on Medical Waste Management in Dhaka South and North City (2018)"

3.11.2 Medical Waste Generation

The medical waste generated in DSCC in 2018 was about 3.2 ton/day, whereas around 3,362 ton/year generated in HCEs in total of both city corporation. Table 3-28 shows the daily medical waste generated trend from 2013 to 2018.

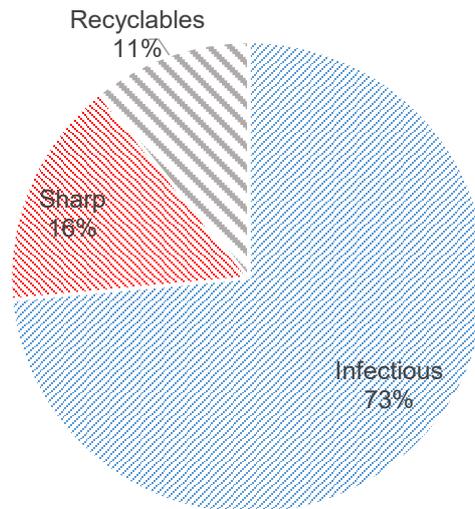
Table 3-28 Daily Medical Waste Generated in DSCC from 2013 to 2018

Year	Infectious (kg)	Sharp (kg)	Recyclables (kg)	Total (kg)
2018	2,388	509	351	3,248
2017	2,628	396	360	3,384
2016	2,438	406	329	3,174
2015	2,345	374	323	3,041
2014	1,976	342	292	2,610
2013	1,420	236	206	1,862

Source: JICA Project Team, "Survey Report on Medical Waste Management in Dhaka South and North City (2018)"

3.11.3 Medical Waste Composition

Fig. 3-29 shows the medical waste composition in DSCC based on a composition study conducted in 2018. Of the medical wastes, 73% was infectious, at 2,355 kg/day; 16% was sharp, at 502 kg/day; and 11% was recyclable, at 346 kg/day.

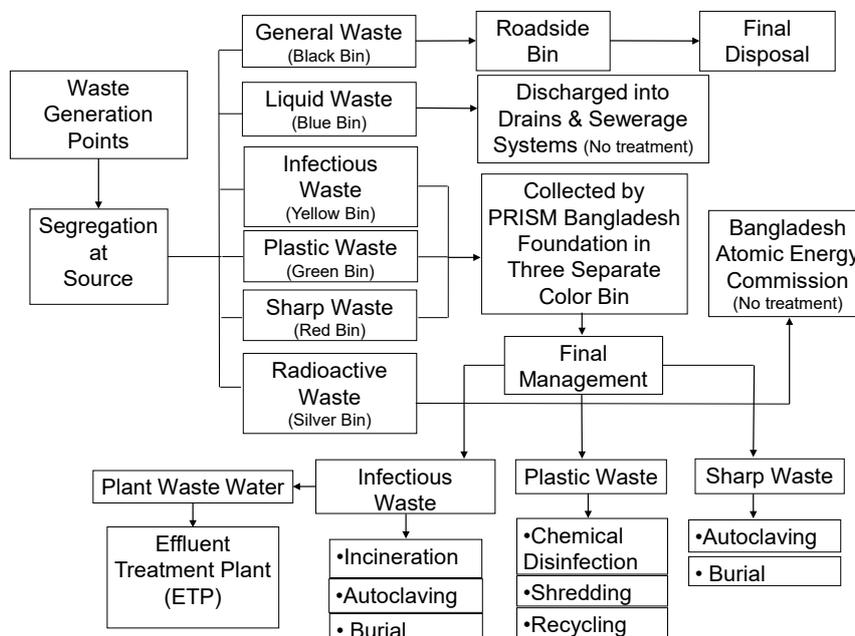


Source: JICA Project Team, “Survey Report on Medical Waste Management in Dhaka South and North City (2018)”

Fig. 3-29 Medical Waste Composition in DSCC

3.11.4 Medical Waste Flow

Fig. 3-30 shows a waste flow diagram of medical waste in DSCC. Different treatment methods are selected or combined depending on characteristics of the waste.



Source: JICA Project Team, “Survey Report on Medical Waste Management in Dhaka South and North City (2018)”

Fig. 3-30 Medical Waste Flow

3.11.5 Treatment Process

(1) Waste Discharge

Medical waste is categorized into six categories and disposed into corresponding colored bins. General waste, liquid waste, and infectious waste go in black, blue, and yellow bins, respectively. Plastics (recyclables), sharp and radioactive waste go in green, red and silver bins, respectively.

(2) Collection and Transport

1) Collection Frequency

In general, medical waste is collected once per day for hygienic reasons. PRISM has collected medical waste from HCEs on a daily basis. However, these HCEs are very small and generate small quantities of waste infrequently. On the contrary, large HCEs generate huge quantities of medical waste, and thus PRISM collects the waste there sometimes twice per day.

2) Type and Number of Collection Vehicle

PRISM collects medical waste by using eight vehicles with special specifications, each of which has a fixed route for collection.

Table 3-29 Collection Equipment of PRISM

Name of equipment	Specification	No. of equipment units	Remarks
Collection truck	3-ton capacity	5	Covered van
Collection truck	1.5-ton capacity	3	Covered van
Total		8	-

Source: Survey Report on Medical Waste Management in Dhaka South and North City (2018)

3) Loading Method

According to the manual, medical waste is separated at source, contained into bins, and loaded to the collection vehicles.

4) Collection Fee

PRISM collects a service charge from HCEs on a monthly basis for the collection, transport, and treatment or final disposal; however, the collection fee is not clarified because it is combined with other fees. The service charge varies according to the HCE's size or number of beds.

(3) Intermediate Treatment

Table 3-30 shows the type of treatment method, process and available facilities in PRISM, according to the waste category. Some of the waste require additional segregation prior to treatment and

sometimes different treatment methods are combined depending on the characteristics of the waste. All treatment facilities are located in the Matuail LFS.

Table 3-30 Treatment Method and Process of Medical Waste

Method	Category of Waste	Capacity and Year of Purchase	After Treatment
Autoclaving	Infectious with high moisture content	2,500 liter ×1 (2012) 1,500 liter ×1 (2006)	Landfilling in the special cell
Incineration	Infectious without moisture or low moisture	135 kg/h ×2 (2007, 2018) 60 kg/h ×1 (2006)	Landfilling in the special cell
Chemical disinfection	Recyclables	Tank 1 m ³ ×3 (2004)	Shredding
Effluent treatment *	Generated waste water	2,000 L/h ×1 (2013)	Discharge into drains
Shredding	Recyclables	1 (2019)	Sale to manufacturer
Deep Burial	Infectious, sharp	12 pits	-

*Effluent treatment is applied only for waste water generated from the autoclaving and chemical disinfection process, not for liquid waste.

Source: Survey Report on Medical Waste Management in Dhaka South and North City (2018)

1) Autoclaving

Infectious waste is disinfected by autoclaving at 135–140 °C and 3 bars atmospheric pressure for 45 min, following the method recommended by the World Health Organization (WHO). Then, the treated waste is dumped directly into the special cell for medical waste with 2–3 inches of soil cover and is decomposed for at least six months. In some cases, infected recyclable waste is also disinfected through the autoclaving process.

2) Incineration

Infectious wastes which containing low moisture, less than 33%, and expired medicines materials, are being incinerated by double chamber pyrolytic incinerator. This incinerator is using fossil fuel to keep the temperature ranging from 800 - 1250 degrees Celsius. Operational guideline is strictly followed to minimize dioxin gas keeping within the limit of Bangladesh emission standard. The residue is finally kept into a concrete pit.

3) Chemical Disinfection

Recyclable waste as plastics, glass, and metals are disinfected in a three-chambered tank with chlorinated water. Recyclable waste is sunk into the first chamber with 50–250 ppm chlorine water for about 30–45 min and then in the second chamber with 20–50 ppm chlorine water for 15–20 min. The materials are next transferred to the third chamber for rinsing with fresh water. If the materials are closed tubes or containers, they should be cut into small pieces so that all surfaces can be disinfected. The disinfected materials are then categorized into different types according to their materials.

4) Deep Burial

Some of infectious waste and sharp waste are kept in concrete pits that are completely closed. In addition, bleaching powder is used as a disinfectant for additional safety measures. Amputated body parts and other recommended waste are also managed by using this process. When the tank or pit is completely filled, it is then permanently sealed.

(4) Final Disposal and Recycling

Medical waste after successful autoclaving and ash or residue application after the incineration process is buried in a deep hole and is disposed of in the LFS after being covered with soil to aid decomposition.

The recyclables are segregated according to the category of raw materials after chemical disinfection. Some recyclables are shredded to create chips for use in molding machines to prepare final products; others are sold to manufacturers.

3.11.6 Financial Information

(1) Fee Collection

The treatment fees are not particularly specified in the monthly service charge because they are fixed by the management committee. The approved monthly service charge list is shown in Table 3-31.

Table 3-31 Approved Monthly Service Charge

Unit: thousand BDT

Beds of HCE	Service Charge Excluding VAT & Tax	VAT 15%	Income Tax 1.5%	Total Service Charge Including VAT & Tax
1–20	1,200	180	18	1,398
21–50	2,400	360	36	2,796
51–100	5,400	810	81	6,291
101–200	7,200	1,080	108	8,388
201–250	14,400	2,160	216	16,776
251–350	18,000	2,700	270	20,970
351–500	36,000	5,400	540	41,940
501–750	42,000	6,300	630	48,930
751+	48,000	7,200	720	55,920
Diagnostic Center				
A Category	14,400	2,160	216	16,776
B Category	6,000	900	90	6,990
C Category	3,600	540	54	4,194
D Category	2,400	360	36	2,796
E Category	1,200	180	18	1,398

Source: Survey Report on Medical Waste Management in Dhaka South and North Cities (2018)

(2) Income and Expenditures

Operation of medical waste treatment is financed by the service charges from HCEs above. Table 3-32 shows the income and expenditures from 2014 to 2018. As the amount of waste increase, income and expenditures also increase. According to the data of the past five years, expenditures exceeded the income for three out of five years.

Table 3-32 Medical Waste Income and Expenditure from 2014 to 2018

Unit: thousand BDT

Year	2014	2015	2016	2017	2018
1. Income					
Income	9,102	11,435	12,101	15,577	17,140
2. Expenditure					
Collection	4,875	5,338	6,298	7,663	8,507
Treatment	2,049	2,306	2,526	3,339	3,635
Disposal	2,953	3,673	3,988	4,391	5,799
Total	9,876	11,317	12,813	15,393	17,942

Source: Survey Report on Medical Waste Management in Dhaka South and North City (2018)

3.12 Current Issues

Through the long-term support of the JICA on SWM using the program approach, establishment of the WMD and proper collection, transport, and disposal of waste were organized during the last 15 years. Accordingly, DSCC needs to shift from simply removing the waste in the city to a higher-level SWM including intermediate treatment such as recycling and incineration. One of the urgent issues is lack of land for LFS in DSCC; WtE can serve as an effective solution.

3.12.1 Organization of Solid Waste Management

The WMD still has empty positions with unappointed staff. To reform the organizational structure of the WMD in an integrated and systematic manner, the planning capacity including coordination, monitoring, and evaluation of the process should be enhanced. In addition, capacity development of management personnel is required to encourage ward-wise and zone-wise management in building on the fundamental planning skill, which will reactivate field-level activities. Although the promotion system is stagnant, exchange of human resources among management personnel and field officers may be effective.

3.12.2 Financial Conditions of Solid Waste Management

The budget plan does not reflect the actual conditions; therefore, the budget plan and the actual SWM expenditures are not consistent. Actual SWM expenditures are not managed by category, and the

validity of the cost cannot be assessed. The SWM cost is appropriated from the conservancy tax, although the amount of income is not sufficient for covering all of the WMD's expenditures. Considering the large-scale investment and operation of new intermediate treatment facilities, new income sources must be found.

3.12.3 Public Relations and Public Awareness

(1) Organizational Structure for Public Relations and Awareness Raising

The position of assistant CWMO (Community), in charge of community relations outlined in the WMD organogram, has been vacant for a long time. In addition, no personnel has officially been assigned to work with the PRD. This situation makes it difficult for the WMD to effectively and strategically promote public relations and awareness activities.

(2) Public Relations and Awareness Strategy of Waste Management Department

PR activities for waste management are conducted occasionally by the WMD and its staff without an officially established strategy for public relations and awareness. To consolidate and link together all such activities targeting toward a vision and objectives stated in this Master Plan for more effective involvement of citizens and stakeholders, it is essential to develop an officially recognized strategy and system of public relations and awareness raising.

(3) Information Disclosure

An information disclosure and sharing system should be systematically installed for transparency and accountability and as a communication tool. Although, the Right-to-Information (RTI) Act 2009 has been issued in Bangladesh, only a few initiatives toward this act have been taken. Providing necessary information to people in a timely manner enhances their continuous engagement for SWM. Stakeholder's response to the information provided also helps the WMD to discuss further waste management planning.

3.12.4 Ward-based Approach

(1) Waste Management Department and Conservancy Inspector's Mindset as Official Work

After the previous JICA project, WBA activities have been slowed down owing to lack of support from the headquarters. WBA drives field-level activities that cover the entire DSCC jurisdiction under the WMD and is a key tactic for boosting the community participatory SWM for Dhaka's clean environment as well as the CI's work efficiency. The WBA activities are outlined as an official work

of DSCC by office order. The headquarters, WMD, CI and every field officer should strongly recognize of the importance of WBA activities, and the community participation should be greater enhanced by the CI's proactive management.

(2) Planning Skills and Community Budget Disbursement

The community budget for first-aid kits and safety gear on WBA 2 and for community meetings on WBA 3 has not been properly allocated in the wards. Such budget requests and disbursement processes for WBA activities should be properly recognized and practiced. Most CIs have strong implementation skills at the field level, but have little planning skills. This is also observed in the entire conservancy division and prevents a community budget to be acquired for WBA-related activities. To enhance the planning skill of the WBA, SWM administrative procedures and the DSCC's chain of command should be clarified.

(3) Conformity with Rules and Orders

Ward offices should be operated in compliance with rules, regulations, and orders in a systematic manner. In addition, the administrative procedures book, which includes all administrative processes necessary for SWM operation in DSCC, should be prepared by discussion with CIs and DSCC officers to facilitate understanding by the internal stakeholders for proper implementation.

(4) Data Collection and Practical Use

Despite daily and occasional reporting from the CIs to the ACWMOs at the field level, these data have not been fully utilized for SWM improvement. Operation and management based on these acquired data are fundamental for improving the current situation by analyzing data and implementing measures.

3.12.5 Waste Reduction

Promotion of waste reduction is not active in DSCC. Instead of CCs, waste pickers collect recyclables at the waste collection point and at Amin Bazar LFS. In addition, the primary waste collectors, who deliver waste from houses to collection points, also collect recyclables during their work.

Many waste pickers in DSCC collect recyclables to earn their livings. Therefore, introduction of source segregation for promoting recycling may destroy their livelihoods. In general, the number of waste pickers is expected to decrease as the economy grows. However, a co-existence and co-prosperity system with waste pickers still needs to be considered.

3.12.6 Collection and Transport

(1) Issues of Primary Collection

DSCC is attempting to improve the PCSP's service through capacity building and empowerment activities such as a registration system, training, stakeholder dialogue, and other programs. Despite this effort, many issues remain in association with the DSCC's primary collection service management. However, such issues are not common to all wards or areas, and the severity of the issues differs among the wards. Typical categories these issues are given below.

- (i) Organizational
 - Lack of coordination among community, PCSP, DSCC, and private companies
 - Very limited motivational or capacity building efforts
 - Ownership of the PCSP and control of the coverage area conflicts between PCSPs in some cases
- (ii) Financial
 - The actual service charge is not fixed by DSCC
 - The salary of rickshaw van pullers and helpers are limited
 - Maintenance cost is sometimes borne by drivers rather than PCSP owners
- (iii) Occupational health and safety
 - Insufficient or no safety gear
 - Lack of safe working environment and prevalence of injuries
 - Limited or no uniforms or personal protective clothing
 - Almost no health care such as vaccinations or primary treatment
- (iv) Political/local power
 - Pressure by local leaders to take control in some cases
 - PCSPs may likely to lose business or ownership or coverage areas with the change of political power
- (v) Legislation
 - Lack of specific policy documents for primary collection service standards
 - Lack of specific policy documents for controlling, supporting or managing PCSP
- (vi) Technical / Logistics
 - No standards for waste collection or handling practices
 - Equipment is not standardized or certified
 - Weak harmonization of primary and secondary collections in STSs, compactor stations, and containers to shift waste from primary collection rickshaw vans to secondary collection facilities
- (vii) Social

- Scavenging in and near containers or other SCPs
- PCSPs go up and down stairs between building floors to collect waste in some cases
- PCSP is not perceived as a noble job in some cases
- Buildings do not have storage facilities downstairs or drums in some cases
- Some low-income communities pay lower collection fees; therefore, the waste remains uncollected or is not served by PCSPs
- Open dumping and existence of dustbins reduce the PCSP demand

(2) Issues of Secondary Collection

(i) Short term

- An adequate amount of manpower should be appointed for proper handling of the waste collection system.
- Improvement is needed in coordination among the different divisions of DSCC related to the waste collection system.
- WMD facilities are needed for repairs and regular maintenance of spare parts, tires, and tubes for their vehicles.
- Minimization is needed for the long queue when purchasing spare parts and other regular important servicing items.
- Drivers need adequate training facilities.
- Training needed for maintaining new vehicles.
- Unauthorized people should not be allowed to drive waste collection vehicles of DSCC.
- Safety of the drivers as well as the helpers, and waste collectors should be ensured.
- Safety gear should be provided to waste collectors on a regular basis.
- Overweight waste should not be carried by any vehicles.
- Road safety of the transported vehicles should be ensured.
- Safe transport of waste on the road requires proper covering of the waste and monitoring.

(ii) Long term

- The budget allocation for repair and maintenance of vehicles should be increased.
- The regular and special repair of compactors or hydraulic parts of dump trucks should be conducted on a regular basis.
- Emergency repair/maintenance facilities of the waste collection vehicles should be available.
- Job satisfaction of waste collection drivers should be ensured through allocation of funding and facilities.
- Health risks to drivers, helpers, and cleaners working with secondary collection vehicles should be recognized.
- An adequate number of mechanics for the WMD should be ensured.

- Efficient vehicles should be allowed for the waste collection system.
- Road conditions should be improved for maintaining the vehicles.

(3) Issues of Privatization of Waste Collection

- Contact type of tipping fee (unit cost contract per ton) and short-term contract (annual renewal of contract) prevents long-term business plan including procurement of waste collection vehicles.

3.12.7 Workshop

(1) Unintegrated Management System

The WMD, ED, and TD are separately responsible for the management of workshops and for operating and maintaining waste collection vehicles. Procurement of collection vehicles and equipment is not organized well among the related departments. Possession of vehicles and equipment, the procurement process, and O&M should be integrated and managed in the same department to increase the efficiency of SWM.

(2) Unclear Institutional Process

The rules and regulations for workshops such as work rules, safety and sanitary standards, budget approval process, and reporting format are not organized. The inventory of spare parts is managed by handwriting, which should be computerized. To introduce a preventive maintenance system, a standard for repair/replacement of parts is required.

3.12.8 Landfill

(1) Remaining Life Span for Waste Disposal in Matuail LFS

The expected completion date of waste disposal in Matuail LFS is August 2020. It is necessary to find out a new landfill site immediately.

(2) Vehicle Management

1) Vehicle Control

Owing to lack of site staff, some vehicles do not go through the weighbridge. Therefore, it is very likely that the waste amount data is not precise.

2) Weighbridge Operation

The weighbridge is sensitive equipment, and is sometimes broken down, causing non-accurate weighbridge data.

(3) Disposal Management

It has been calculated that four bulldozer and standby might be needed. Waste pickers sometimes cause problems in the operation because they surround the heavy equipment in order to collect recyclable waste. To ensure efficient operation of the equipment and the safety of the waste pickers, they must be instructed to not gather around heavy equipment that spreads and compacts waste.

(4) Landfill Facility Management

1) Landfill Area

Leachate collection pipes and gas vent pipes installed in the extension area were already broken down. As a result, the leachate is not being treated properly, and landfill gas is being spread out around the site.

2) Leachate Treatment Facility

The chemical operation system is occasionally malfunctioning owing to shortage of the budget.

(5) Safety Management

Safety management in Matuail LFS is quite poor. A list of issues for safety management is given below.

- (i) Safety training is not conducted for all site staff members.

In order to prevent accidents at the site, it is highly important to conduct safety training for all site staff members. However, it is quite difficult to hold the regular training sessions under the current situation.

- (ii) Site staff members are not wearing sufficient personal protective equipment (PPE)

In order to prevent injuries to all staff members working at the site, PPE such as helmets, safety gloves, and safety shoes are important. However, some site staff members are not wearing sufficient PPE.

- (iii) Waste pickers are not wearing sufficient PPE

Waste pickers are wearing only safety boots, which is insufficient protection.

(6) Environmental Management

Environmental monitoring of water quality, landfill gas, and air quality are not conducted at Matuail LFS. In addition, waste is not covered by soil. In order to protect the environment and to maintain site sanitation, these problems must be resolved.

3.12.9 Medical Waste Treatment

(1) Institution

Currently, medical waste management is not recognized as priority issues in the government or public. Supervision of DoE on medical waste management is limited and also there is no specific section designated from the CCs. Institutional set up needs to be considered for the CCs to be actively handling medical waste management instead of PRISM or at least regular inspection is necessary.

(2) Proper Segregation

Out of 11 categories of medical waste in the rule, only six have separate bins. At the moment, liquid and radioactive waste are neither collected nor treated. PRISM collects only three categories of waste which the treatment facilities are available. In order to treat liquid waste and radioactive waste, proper facilities and transport equipment needs to be procured and segregation needs to be properly taught to the staffs in HCEs. Pharmaceutical and chemical waste also need to be separately collected based on the rule. Liquid form of such waste need different means of transport and treatment facility. To minimize the risk of infection or accident, further segregation conducted in PRISM before treatment needs to be stopped hence, proper segregation at source needs to be enhanced.

(3) Improvement of facilities

Some of the equipment installed in the PRISM plant are operating more than 10 years and became old. Facilities need to be renewed and upgraded in order to process medical waste properly since it has been increasing year by year. Preferably, autoclave can be replaced with incinerator to reduce the volume of waste in more hygienic way. As mentioned above, available facilities at present cannot cover all types of medical waste. Suitable treatment facilities need to be procured.

CHAPTER 4 FRAMEWORK OF MASTER PLAN

4.1 Vision of the Master Plan

Vision is an ideal state showing the optimal long-term direction for DSCC. The new Clean Dhaka Master Plan was designed for the next 15 years on the basis of the vision, envisaged for the next 30 years.

VISION:

<p style="text-align: center;"><i>Environmentally Advanced City with Integrated and Sustainable Solid Waste Management: toward Zero-Waste</i></p>
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Environmentally Advanced City

As a capital city of Bangladesh, DSCC has been undertaking ambitious efforts to address the challenges of waste management and material cycling. However, the DSCC acknowledges that environmental countermeasures are still insufficient, and the health and quality of life of citizens may be adversely affected. Therefore, the DSCC shall take an initiative to meet the global standards of solid waste management by introducing advanced technology, and to protect the health and sanitary environment for the residents.

Integrated and Sustainable Solid Waste Management

The current rapid economic growth and overflow of population has caused SWM to increasingly complicated and diverse. Each process of SWM such as waste generation, collection and transport, intermediate treatment, and final disposal should be planned and implemented in a balanced and integrated manner, in consideration of economic, social, and environmental impacts to sustain the system. The WBA is a consolidated method for managing cross-field activities. The DSCC shall strive to enhance the level of governance, including institutional and financial capacities, as a basis for integrated and sustainable SWM.

Zero-Waste

Zero-Waste is a slogan for promoting Reduce, Reuse, and Recycle (3R). Public awareness will be strengthened to encourage community participation and Public Private Partnership. DSCC shall work on establishing an effective intermediate treatment system such as Eco-Town, an intermediate

treatment zone with various provisions of treatment facilities (WtE, biogas, composting, recycling etc.), as an iconic symbol of Zero-Waste.

4.2 Goals

Goals were set to realize the vision. Three goals of the Master Plan are given below.

- (i) Environmental impact caused by waste is mitigated with environmentally advanced technology.
- (ii) Integrated and sustainable SWM system in a megacity is established.
- (iii) Participatory SWM is promoted with a slogan of “Zero-Waste.”

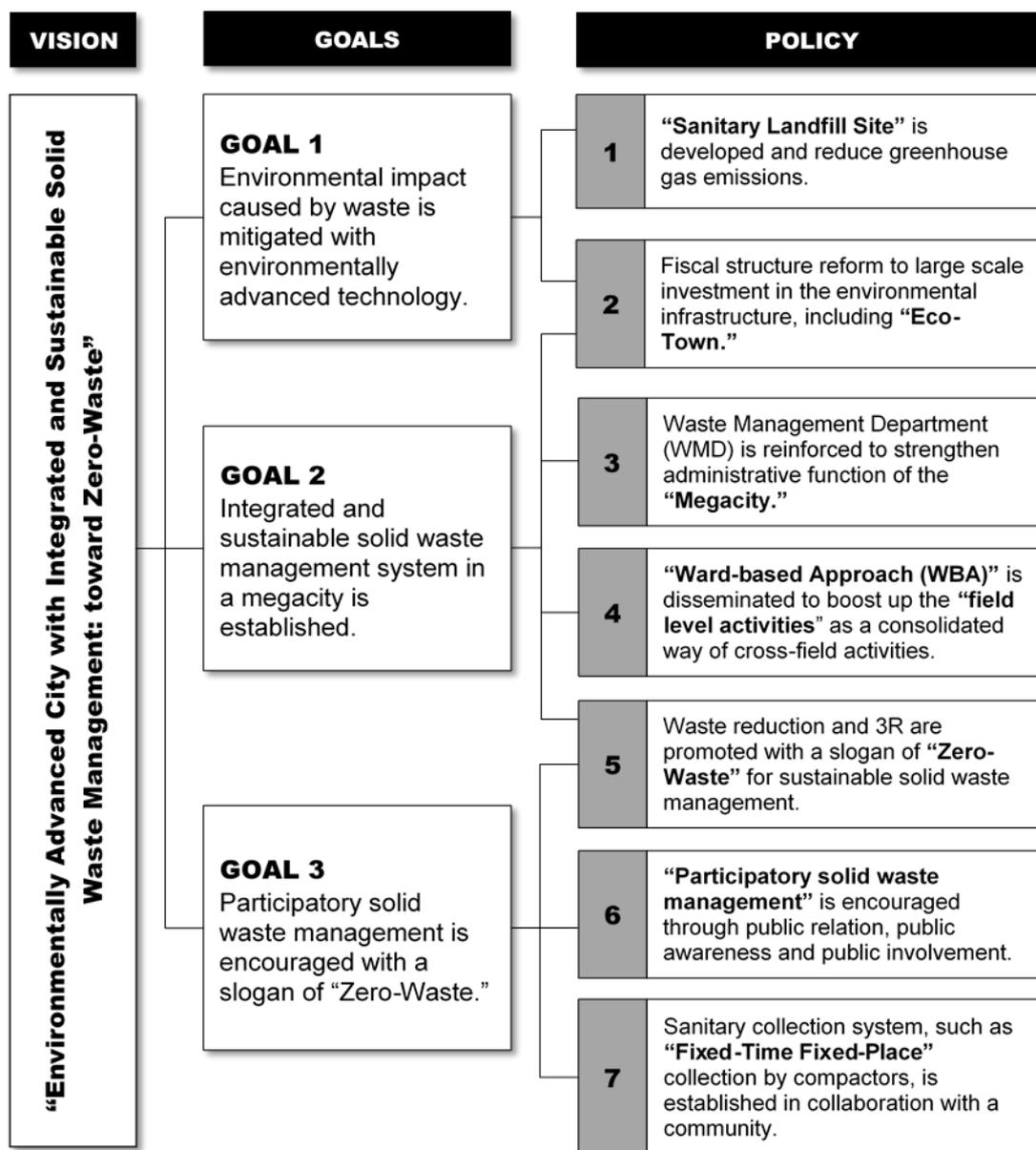
4.3 Policy and Target

4.3.1 Policy

The Master Plan has seven policies for fulfilling the goals.

- (i) A “**Sanitary Landfill Site**” is constructed to reduce GHG emissions.
- (ii) Fiscal structure reform to large scale investment is provided in the environmental infrastructure, including “**Eco-Town**.”
- (iii) The WMD is reinforced to strengthen the administrative function of the “**Megacity**.”
- (iv) **The Ward-based approach** is disseminated to boost the “**Field-level activities**” for consolidating cross-field activities.
- (v) Waste reduction and 3R are promoted with a slogan of “**Zero-Waste**” for sustainable SWM.
- (vi) “**Participatory solid waste management**” is encouraged through public relation, public awareness, and public involvement.
- (vii) A sanitary collection system, such as “**Fixed-time and Fixed-place**” collection by compactors, is established in collaboration with the community.

The framework of the Master Plan is structured as shown in Fig. 4-1, with illustrating a relationship between the abovementioned vision, goals, and policies



Eco-Town: an intermediate treatment zone with various provisions of treatment facilities (WtE, biogas, composting, recycling etc.)

Fig. 4-1 Framework of the Master Plan

4.3.2 Target

In principle, appropriate solid waste management is accomplished by (i) collecting more waste generated at households with increasing the collection capacity, (ii) reducing waste with introducing waste separation and recycling, and (iii) minimizing the volume of the remaining waste that goes to LFSs with intermediate treatment so that LFSs can be used longer. This Master Plan highlights four indicators, waste collection, waste reduction, recycling, and landfill disposal, to quantitatively monitor the DSCC’s achievement in consideration with the framework toward the proper waste management.

The targets toward 2032 are set for each indicator as shown below, based on the population and waste generation projections described in Chapter 5. The indicators require periodic monitoring to assure the progress.

(1) Waste Collection

The DSCC currently collects 89% of solid waste with using all available vehicles. If more efficient collection system and new vehicle introduction is applied, the waste collection rate can increase up to 90% by 2032.

Current situation (2017)	89%	Intermediate target (2025)	86%	Final target (2032)	90%
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(2) Waste Reduction

The WBA activities contribute to reducing waste at source, which can make the waste reduction achievable to 12% by 2032.

Current situation (2017)	0%	Intermediate target (2025)	7%	Final target (2032)	13%
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*Waste reduction is the amount of waste reduced at the generation source.

(3) Recycling

Introducing Eco-Town as an intermediate treatment zone can drastically change the recycling business in the DSCC, enough to achieve 48% of waste recycling by 2032.

Current situation (2017)	10%	Intermediate target (2025)	49%	Final target (2032)	48%
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*The recycling rate consists of the waste processed through Eco-Town facilities and informal recycling.

(4) Landfill Disposal

Putting together all efforts to diverse and minimize waste by means of the abovementioned activities, the final disposal will be 29% of the waste generated by 2032.

Current situation (2017)	80%	Intermediate target (2025)	30%	Final target (2032)	29%
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4.4 Scenario for Improvement of Solid Waste Management

4.4.1 Scenario Setting

Prior to setting the policies mentioned above, this Master Plan first examined possible long-term SWM scenarios which the DSCC may move forward to the vision and goals. Owing to the limited land availability and high land prices, two fundamental scenarios were given for improvement of SWM, as shown below:

Scenario 1: Keep on developing new LFS (LFS Scenario)

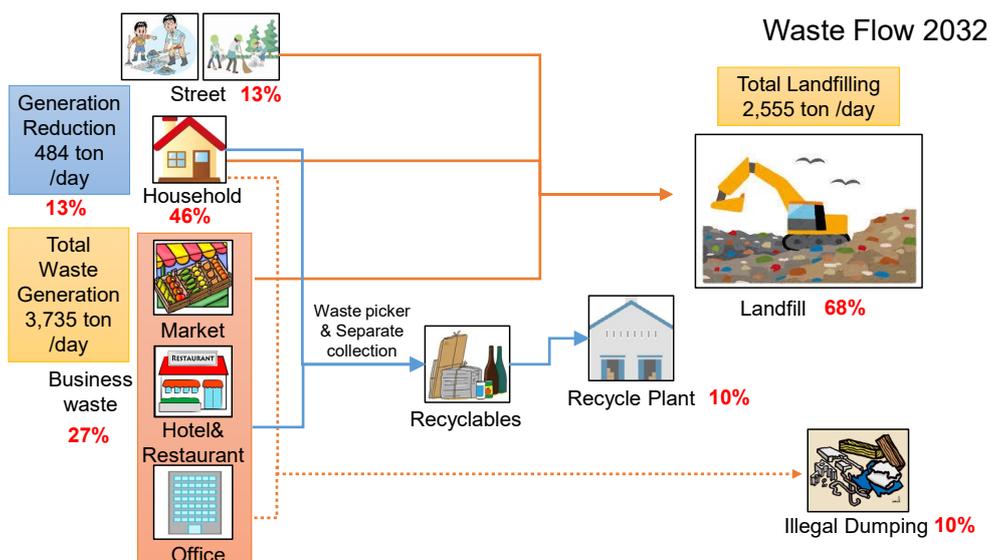
Scenario 2: Introduce 3R with intermediate treatment system (Eco-Town Scenario)

These scenarios were compared to determine a long-term direction up to 2032, assuming the same waste generation and reduction at source in both scenarios. Note that medical waste is not included in either scenario because it has to be collected and transported separately from other wastes and incinerated in a designated medical waste incinerator, as a closed system.

4.4.2 Scenario 1: Keep on Developing New LFS (LFS Scenario)

(1) General Information

In the LFS Scenario, which is equivalent to a Business-as-usual, all collected waste will be received at the DSCC's LFS. A conceptual waste flow of the LFS scenario in 2032 is shown in Fig. 4-2. Recycling activities are done as private companies and waste pickers.

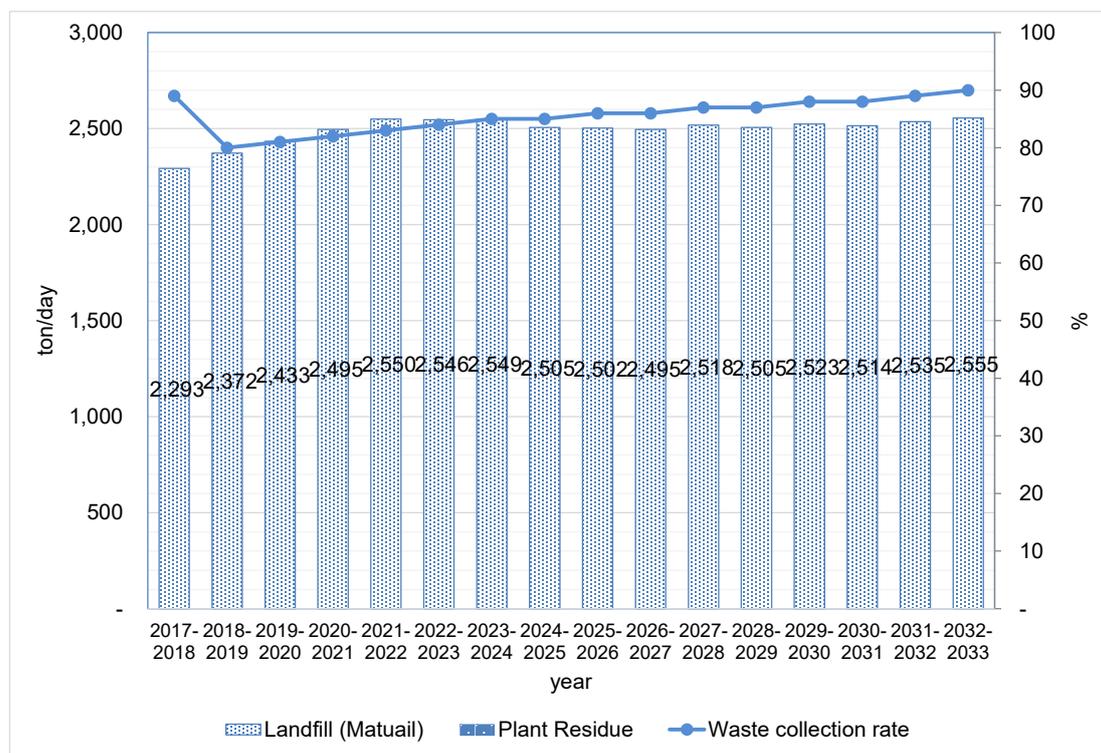


Source: JICA Project Team

Fig. 4-2 Conceptual Waste Flow of the Landfill Site Scenario in 2032

(2) Final Disposal

The estimated amount of final disposal until FY 2032-2033 in the LFS Scenario is shown in Fig. 4-3. Because of no solutions or technologies in place which give significant waste reduction, waste disposal rate becomes high year by year as more waste collection is achieved.

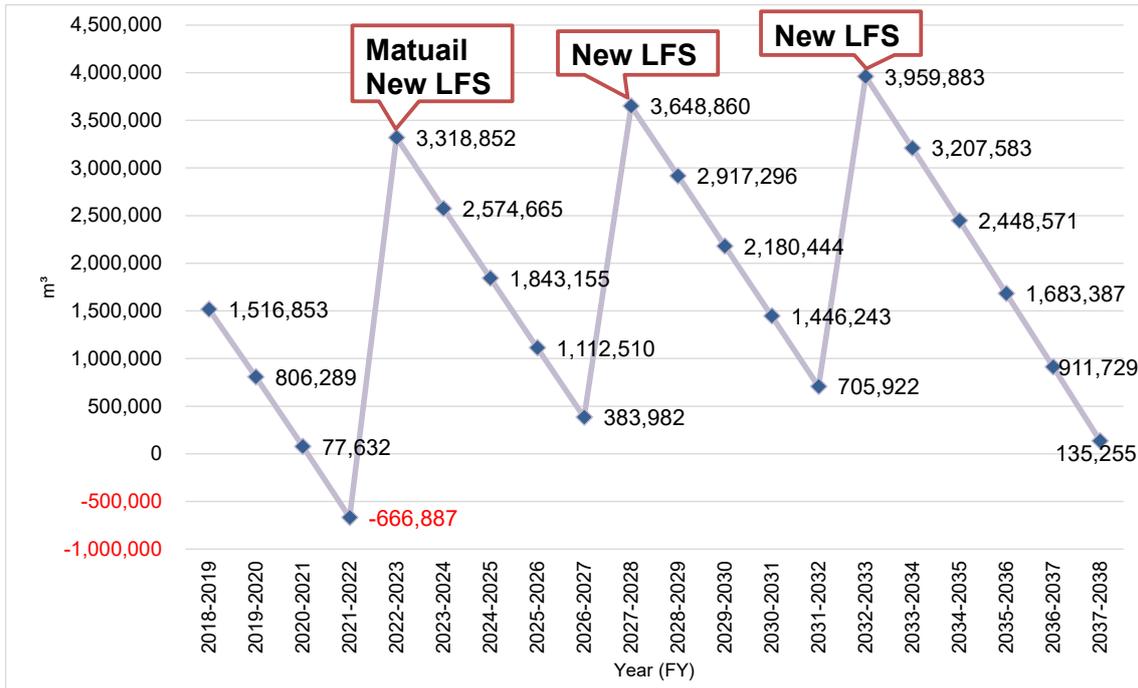


Source: JICA Project Team analysis based on BBS “Population Census 2011,” “Population Projection of Bangladesh 2011-2061,” “Economic Census 2013,” “Waste Amount and Composition Survey Report (2018)”

Fig. 4-3 Estimated Final Disposal at Landfill in the LFS Scenario

(3) Remaining Lifespan and Capacity of the Landfill Sites

Fig. 4-4 describes the remaining landfill capacity in the LFS Scenario. After the construction of Matuail New extension LFS, a new LFS construction would be required periodically, e.g. every five years with a new 4,000,000 m³ site. As previously mentioned, land acquisition in the DSCC area is very challenging; therefore, this scenario seems unrealistic for the future SWM in DSCC, and more dramatic waste reduction is necessary to save the landfill capacity.



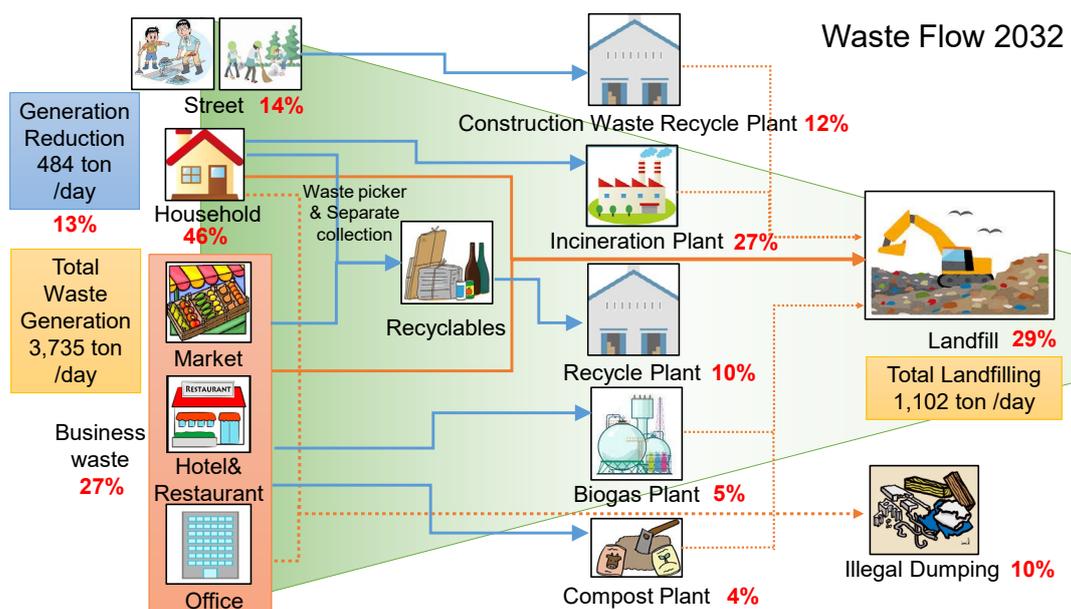
Source: JICA Project Team

Fig. 4-4 Remaining LFS Capacity in the LFS Scenario

4.4.3 Scenario 2: Introduce 3R with Intermediate Treatment System (Eco-Town Scenario)

(1) General Information

Considering lack of land availability in Dhaka, source separation as well as a significant waste reduction through intermediate treatment is unavoidable to secure final disposal sites. As a most powerful solution to reduce and diversify waste, the 3R concept with WtE is introduced here as the Eco-Town scenario. Fig. 4-5 shows a conceptual waste flow of the Eco-Town Scenario which contains various intermediate treatment options, such as WtE, food waste treatment, recycling, and medical waste treatment. Altogether with these waste reduction menus in assumption with reasonable treatment capabilities, the Eco-Town scenario could achieve 61% of waste reduction by waste recycling and generation reduction.



Source: JICA Project Team

Fig. 4-5 Conceptual Waste Flow of the Eco-Town Scenario

The following intermediate treatment methods can be considered in the Eco-Town Scenario.

1) Waste-to-Energy Plant

WtE plant, or incineration plant with electricity production, has significant potential to reduce waste to one tenth of the original volume. It is costly on both the construction and operation and the DSCC does not have any experience on such a high-end technology implementation. Biogas from a biogas plant may be used as supplemental fuel to WtE.

2) Food Waste Treatment

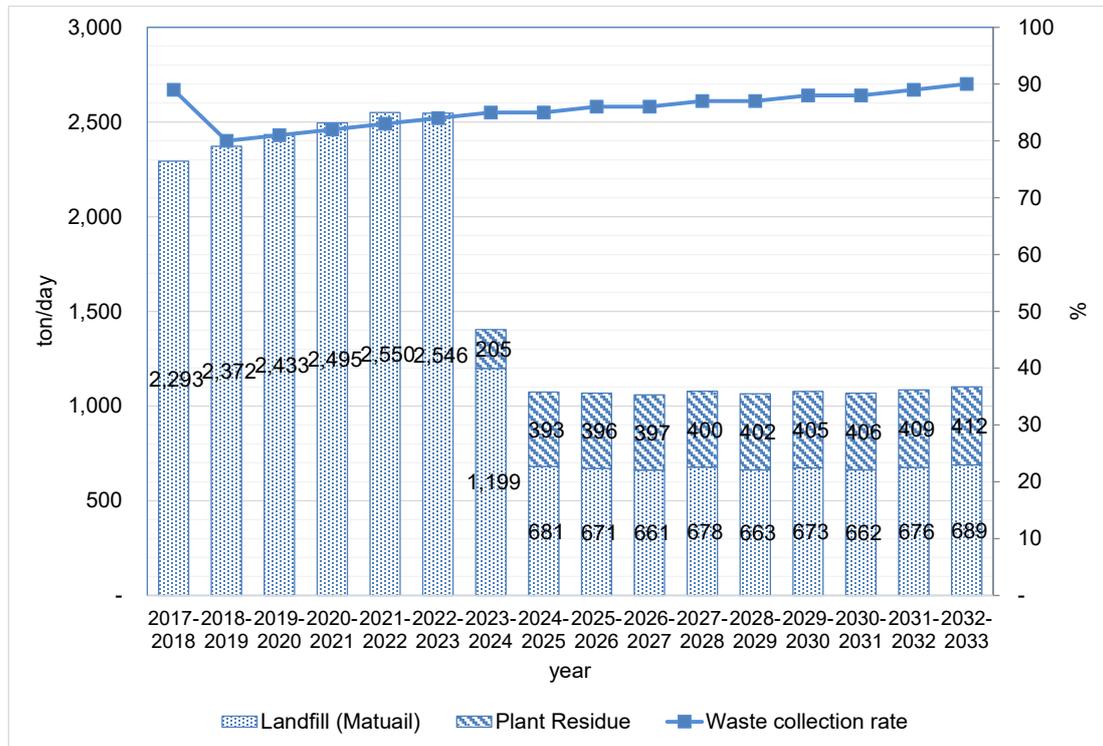
Food waste from restaurants and markets who produce large amount of food waste with less contamination can be treated in a composting plant. The compost s used as organic fertilizers.

3) Recycle Plant

Waste from drainage, road cleaning, or construction sites is sorted and recycled at the recycle plant. After waste sorting, some of organic items such as construction waste, can be used as raw materials or filling materials for the LFS. Sorted recyclables such as paper, bottles, cans, and plastics are sent further to process for recycling.

(2) Final Disposal

Fig. 4-6 shows the estimated final waste disposal amount up to FY 2032–2033. If the intermediate treatment system described in Fig. 4-5 is constructed in FY 2023–2024, the volume of waste for waste disposal would drastically decrease to about a half of the collected volume.

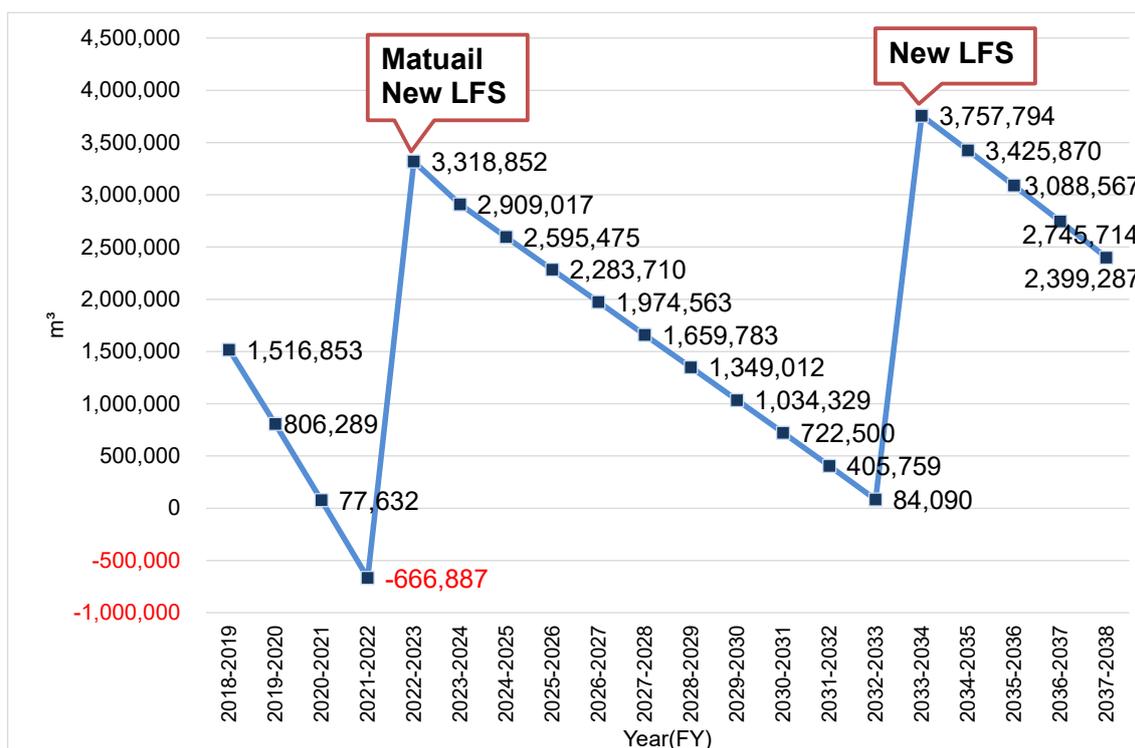


Source: JICA Project Team analysis based on BBS “Population Census 2011,” “Population Projection of Bangladesh 2011-2061,” “Economic Census 2013,” and “Waste Amount and Composition Survey Report (2018)”

Fig. 4-6 Estimated Final Disposal at Landfill in the Eco-Town Scenario

(3) Remaining Lifespan and Capacity of Landfill Site

Fig. 4-7 describes the remaining LFS capacity in the Eco-Town scenario. After the construction of Matuail new extension LFS, the Eco-Town scenario could reduce new landfill construction needs owing to significant waste reduction resulting in longer lifespan of the LFSs.



Source: JICA Project Team

Fig. 4-7 Remaining LFS Capacity in the Eco-Town Scenario

4.4.4 Scenario Analysis

Based on the abovementioned characteristics of two scenarios, the comparison between two scenarios are summarized below.

Table 4-1 Summary of Scenario Comparison

	Scenario 1: Keep on developing new LFS	Scenario 2: Introduce 3R with intermediate treatment system
Landfill capacity	<ul style="list-style-type: none"> Securing landfill becomes more problematic as waste generation increased year by year. 	<ul style="list-style-type: none"> Landfill capacity is saved because WtE plant significantly reduce waste volume.
Cost	<ul style="list-style-type: none"> The construction cost is affordable but construction of landfill is more frequent. Land acquisition is necessary as per new site construction. 	<ul style="list-style-type: none"> WtE plant implementation costs very high in general, although depending on the incineration capacity. Operation and maintenance cost have to be newly secured.
Organizational capacity	<ul style="list-style-type: none"> LFS operation and construction is a part of WMD's current work, so no difficulty is observed although the capacity building is still necessary. 	<ul style="list-style-type: none"> Organizational setup for intermediate treatment system is necessary. WtE construction and operation has never been done in

	Scenario 1: Keep on developing new LFS	Scenario 2: Introduce 3R with intermediate treatment system
		Bangladesh; therefore, WMD and related organization's capacity development is vital.
Social acceptance	<ul style="list-style-type: none"> • LFS is not new in DSCC so no difficulties are observed. • Involuntary resettlement may be associated with a new site construction more frequently than the Scenario 2. 	<ul style="list-style-type: none"> • Citizens have little knowledge on WtE and other intermediate treatment facilities, so they might become suspicious.
Environmental impact	<ul style="list-style-type: none"> • Sanitary LFS with proper wastewater treatment, lining, and soil covering prevents environmental impacts. 	<ul style="list-style-type: none"> • By-product from incineration such as pollutants may affect surrounding environment if not treated properly.

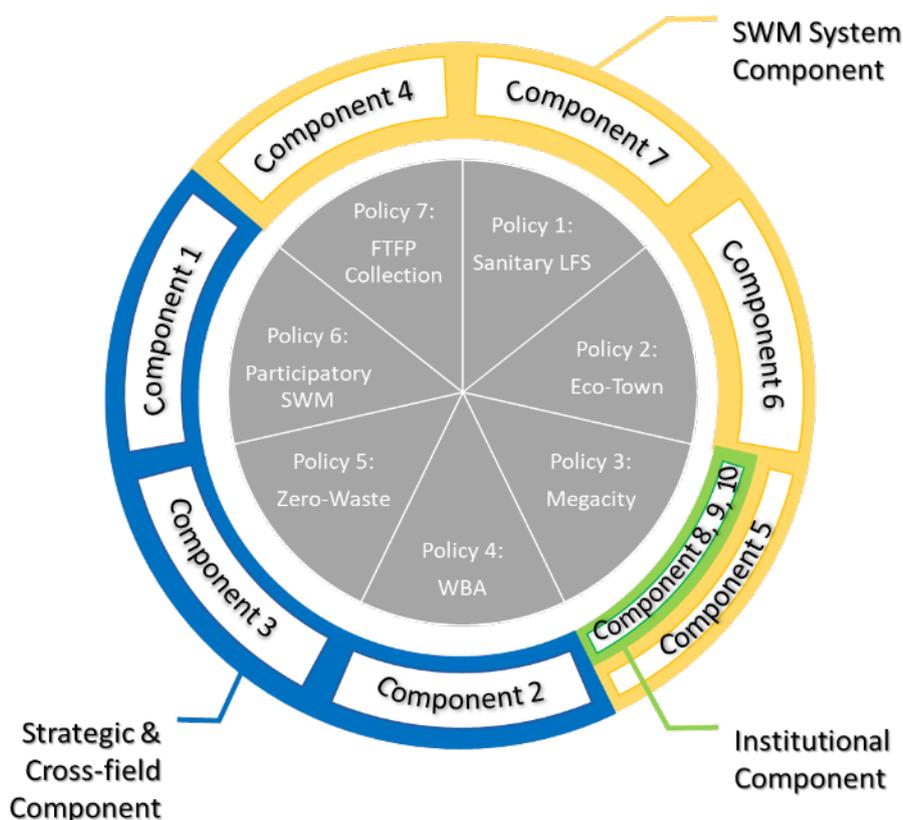
The most considerable issues on the LFS scenario is more LFS construction associated with land acquisition which is very difficult to proceed in Dhaka, and growing population with waste generation. Considering the future sustainability of the DSCC's SWM, the Scenario introducing 3R with an intermediate treatment system (Eco-Town Scenario) is a preferred option in this Master Plan.

4.5 Key Components

There are still many challenges that the DSCC faces to move forward. In order to fill gaps between the current WMD's situation and the ideal state which fulfills the vision and goals, the DSCC sets the policies as stated in Section 4.3, and takes off with 10 associated components to accomplish better SWM introducing 3R with an intermediate treatment system and stronger WM as listed below.

- Component 1: Public relations, public awareness, and public involvement
- Component 2: WBA activities
- Component 3: Waste reduction
- Component 4: Waste collection and transport
- Component 5: Vehicle maintenance system
- Component 6: Intermediate treatment system (Eco-Town: WtE, composting, recycling etc.)
- Component 7: Sanitary landfill
- Component 8: Rules and regulations
- Component 9: Organizational capacity
- Component 10: Financial management

The relations between the policies and the components are described in Fig. 4-8. The components, which can be categorized simply into “SWM system,” “institutional,” and “strategic and cross-field” aspects, are vital to structure the DSCC’s business sustainable and solid. Most of the policies correspond to one component, except Policy 3: *the WMD is reinforced to strengthen the administrative function of the “Megacity*, which consists of four components. This Master Plan highlights development of a strong and consolidated institutional foundation correlating various functions of the WMD for sustainability. Each component includes corresponding objectives and strategies, as further detailed in Section 4.6.



Source: JICA Project Team

Fig. 4-8 Policies and Key Components of the Master Plan

4.6 Objectives and Strategy

The Master Plan identifies the objectives and strategies in 10 key components of SWM in DSCC, as summarized in Table 4-2.

Table 4-2 Objectives and Strategies

Objective	Strategy
Component 1: Public Relations, Public Awareness, and Public Involvement [C1]	
C1-O1. Establish DSCC's capacity to promote public involvement in SWM	<ul style="list-style-type: none"> - Strengthen the WMD's organizational structure of public relations and awareness raising
C1-O2. Enhance public knowledge and understanding to work together	<ul style="list-style-type: none"> - Open communication channels with various stakeholders for active involvement and mutual understanding - Promote collaboration among DSCC, universities and companies to strengthen the country's SWM field
C1-O3. Stimulate public participation for waste management	<ul style="list-style-type: none"> - Systemize DSCC's public relations and awareness activities - Develop and implement information disclosure and sharing system in WMD
Component 2: Ward-based Approach Activities [C2]	
C2-O1. Improve quality and efficiency of field-level SWM through WBA activities in existing wards, and expand WBA to new wards	<ul style="list-style-type: none"> - Encourage CO/CIs to implement WBA activities through WBA core group meeting and other activities - Develop WBA AAP in each ward for the proper community budget allocation to cooperate with the community
C2-O2. Enhance institutional capacity including planning skill of the conservancy wing within the WMD	<ul style="list-style-type: none"> - Hold training sessions and workshops for CO/CI, cleaners, PSCP, the community and other stakeholders to promote community and stakeholder participatory SWM - Educate cleaners for occupational safety in wards - Organize proper administrative procedure and chain of command in the conservancy wing within the WMD in accordance with the administration procedure book
Component 3: Waste Reduction [C3]	
C3-O1. Reduce waste amount generated	<ul style="list-style-type: none"> - Prepare waste reduction plan - Introduce 3R activities through WBA activities
Component 4: Waste Collection and Transport [C4]	
C4-O1. Promotion of community participatory waste collection	<ul style="list-style-type: none"> - FTFP collection by compactor in all residential area by community participatory waste management
C4-O2. Expand the capacity of collection/transport	<ul style="list-style-type: none"> - Procure waste collection vehicles and equipment - Replace old vehicles with new vehicles - Examine collection and transport operation methods for expansion area - Increase storage capacity of waste containers - Implement capacity development of workers and drivers

Objective	Strategy
C4-O3. Prepare for receiving the GAP vehicles	<ul style="list-style-type: none"> - Introduce GAP vehicles and the new collection system - Increase employment of drivers and workers for the GAP vehicles - Prepare vehicle allocation plan of the GAP vehicles and containers
C4-O4. Unify DSCC's waste collection management system	<ul style="list-style-type: none"> - Discuss and coordinate among related departments in DSCC for unification - Propose the unification to decision makers for official approval
Component 5: Vehicle Maintenance System [C5]	
C5-O1. Improve maintenance workshop operation and management and develop the capacity of workers and drivers	<ul style="list-style-type: none"> - Examine outsourcing of maintenance - Standardize maintenance works - Introduce new maintenance system
Component 6: Intermediate Treatment System (Eco-Town: WtE, composting, recycling etc.) [C6]	
C6-O1. Develop Eco-Town (WtE, composting, recycling etc.) for sustainable waste management in Dhaka	<ul style="list-style-type: none"> - Propose the Eco-Town and obtain approval from related organization - Conduct a feasibility study for Eco-Town - Secure construction and operation cost - Obtain ECC
C6-O2. Establish the intermediate treatment (Eco-Town) section in the WMD	<ul style="list-style-type: none"> - Examine operation and management strategy and methods of Eco-Town - Establish intermediate treatment (Eco-Town) section in the WMD to implement proper operation and management - Implement capacity development of intermediate treatment (Eco-Town) section and related parties
Component 7: Sanitary Landfill [C7]	
C7-O1. Improve extension Matuail LFS	<ul style="list-style-type: none"> - Properly dispose of and contain waste inside the LFS - Repair the periphery embankment with access road - Install rainwater drainage, gas ventilation pipes, and leachate collection facilities - Introduce final soil cover on the top - Repair the leachate pond - Continue to prepare dumping platforms and operation roads - Compact a waste layer and shape its surface in a gentle slope
C7-O2. Conduct safety closure at Matuail LFS	<ul style="list-style-type: none"> - Prepare safety closure plan - Secure budget for safety closure
C7-O3. Develop a future LFS	<ul style="list-style-type: none"> - Acquire land by facilitating the necessary legal procedures

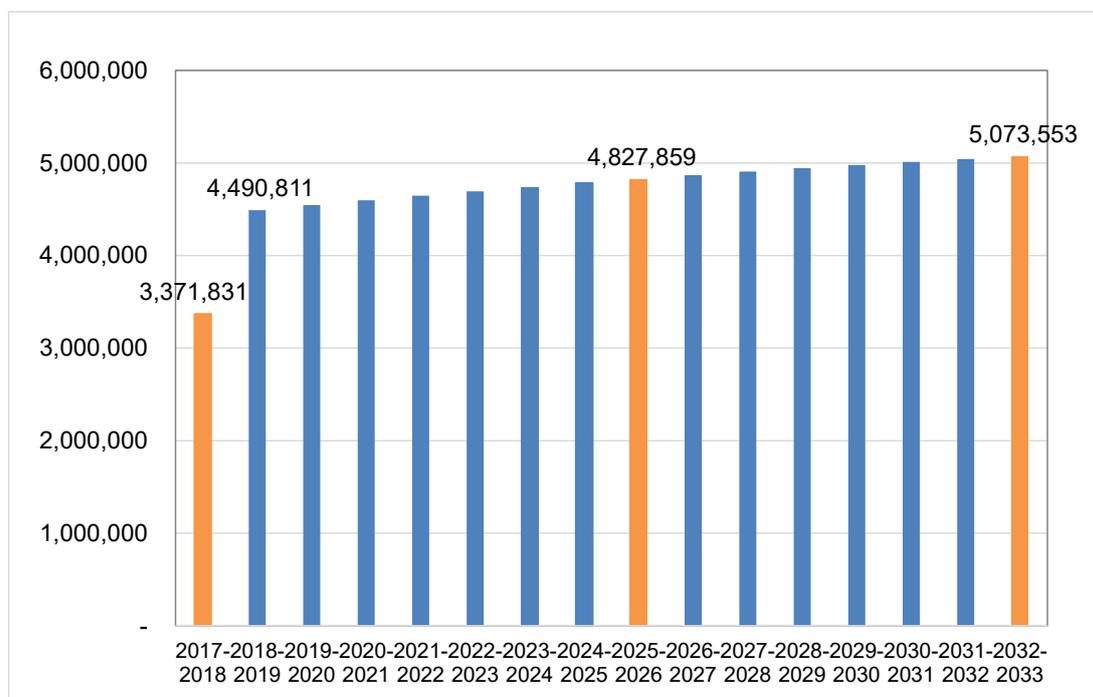
Objective	Strategy
	- Obtain ECC
Component 8: Rules and Regulations [C8]	
C8-O1. Conduct daily SWM work in compliance with the administrative procedure book	<ul style="list-style-type: none"> - Prepare the administrative procedure book in accordance with related laws and regulations - Disseminate the process written in the administrative procedure book in daily SWM practice through training and field work
C8-O2. Enact SWM-related orders and WMD directives	<ul style="list-style-type: none"> - Develop and issue SWM-related orders and WMD directives in a timely manner to smoothly and efficiently proceed with DSCC activities - Disseminate the orders and WMD directives for CC staff
Component 9: Organizational Capacity [C9]	
C9-O1. Strengthen planning, coordination, monitoring, and evaluation capability of DSCC	- Consolidate an organizational function of planning, coordination, monitoring, and evaluation in WMD
C9-O2. Cover collection and transport work, collection vehicle operation, and landfill operation work exclusively in the WMD	<ul style="list-style-type: none"> - Enhance the function of Zone Offices for secondary collection and transport - Conduct study on the procedure for repair of conservancy vehicles and heavy equipment - Reorganize the WMD organizational structure to include sections for collection vehicle management, waste collection, and landfill operation
Component 10: Financial Management [C10]	
C10-O1. Reform SWM accounting system for budgeting and cost control	<ul style="list-style-type: none"> - Introduce a modified accounting system for actual SWM cost - Prepare WMD annual budget report - Introduce financial assessment system
C10-O2. Enhance financial capacity for Master Plan implementation	<ul style="list-style-type: none"> - Increase revenue by reassessing estate tax system, raising conservancy rate of holding tax, and improving the tax collection rate and user fee collection - Prepare a financial plan to cover the cost for implementation of the Master Plan

CHAPTER 5 MASTER PLAN FOR SOLID WASTE MANAGEMENT IN DHAKA SOUTH CITY

5.1 Planning Basis

5.1.1 Population Projection

Fig. 5-1 shows the projected population for 15 years in DSCC. The population is estimated on the basis of the 2011 population census, and its growth rate is applied in accordance with the “Population Projection of Bangladesh 2011–2061” calculated by the Bangladesh Bureau of Statistics (BBS). In 2032, which is the target year of the Master Plan, the total population is estimated to increase to about 5 million, including the expansion area.



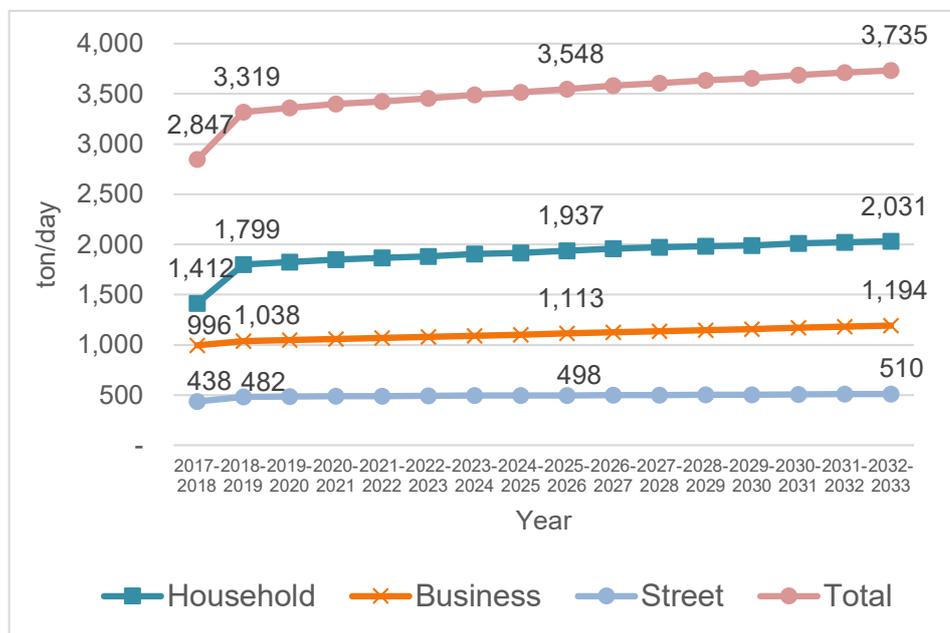
Source: JICA Project Team analysis based on BBS “Population Census 2011” and “Population Projection of Bangladesh 2011–2061”

Fig. 5-1 Population Projection in DSCC (2017–2032)

5.1.2 Solid Waste Generation

Municipal solid waste generation from FY 2017–2018 to FY 2032–2033 was estimated as shown in Fig. 5-2. The waste generation is estimated to increase from 2,847 tons/day to 3,735 tons/day for 15 years, which is calculated on the basis of the unit generation of household waste; business waste including that from markets, restaurant and hotels, and offices; and street waste mentioned in Section

3.4.1 and the future population mentioned in Section 5.1.1. Business waste and street waste were calculated to increase 1% per year.⁹



Source: JICA Project Team analysis based on BBS “Population Census 2011,” “Population Projection of Bangladesh 2011–2061,” “Economic Census 2013,” “Waste Amount and Composition Survey Report in DSCC (2018)”

Fig. 5-2 Estimation of Municipal Solid Waste Generation

5.1.3 Target Waste Collection Rate

The target waste collection rate was set as 90% of waste generation compared with 89% for the current waste collection rate. Table 5-1 shows the annual target waste collection amounts and rates. The waste collection rate dropped in FY 2018–2019 owing to expansion of the service area.

Table 5-1 Target Waste Collection Rate

Year	Total Waste Amount (tons/day)	Total Waste Collection * (tons/day)	Waste Collection Rate (%)
2017–2018	2,847	2,293	89
2018–2019	3,319	2,372	80
2019–2020	3,359	2,433	81
2020–2021	3,398	2,495	82
2021–2022	3,426	2,550	83
2022–2023	3,454	2,546	84
2023–2024	3,492	2,549	85

⁹ Business waste and street waste is set as increasing 1 % per year, based on the population projection and economic growth rate.

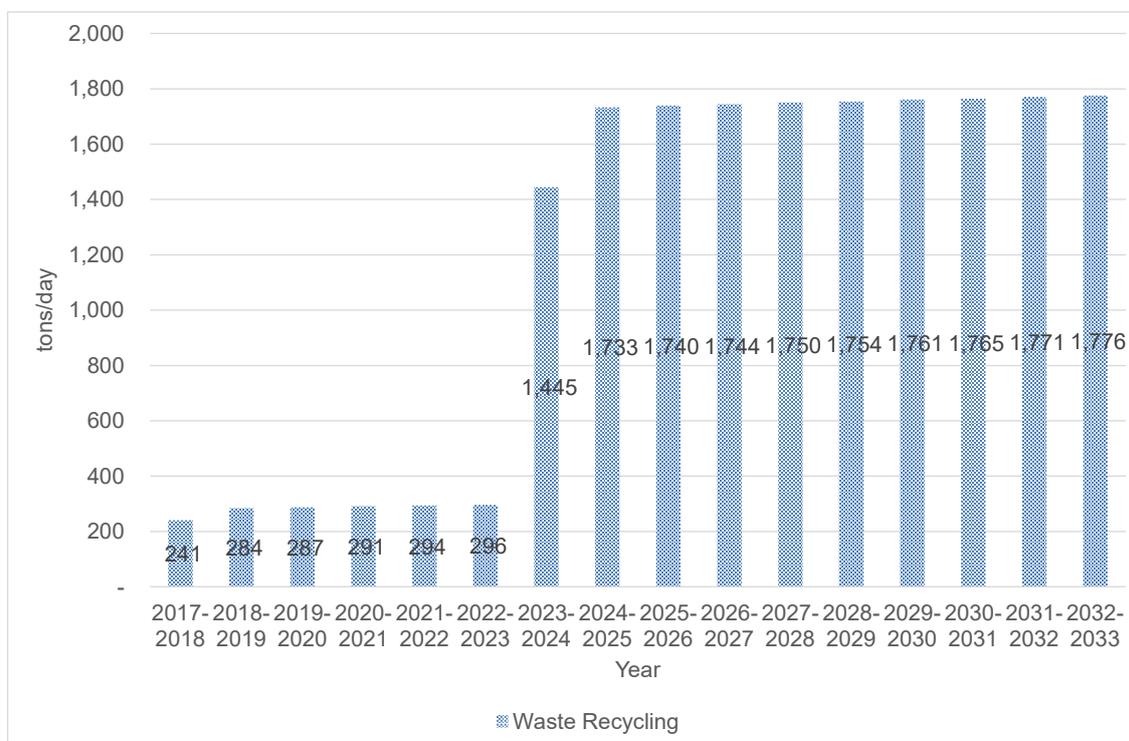
Year	Total Waste Amount (tons/day)	Total Waste Collection * (tons/day)	Waste Collection Rate (%)
2024–2025	3,516	2,505	85
2025–2026	3,548	2,502	86
2026–2027	3,582	2,495	86
2027–2028	3,608	2,518	87
2028–2029	3,636	2,505	87
2029–2030	3,655	2,523	88
2030–2031	3,689	2,514	88
2031–2032	3,713	2,535	89
2032–2033	3,735	2,555	90

*Total waste collection excludes the amount of generation reduction and informal recycling

Source: JICA Project Team

5.1.4 Estimate of Waste Recycling

On the basis of the recycling survey, the recycling amount was estimated to be 10% of household and business waste, and the amount of recycling was estimated to be 241 tons/day in FY2017–2018. By the year of 2023, when centralized waste recycling will begin at Eco-Town, separate collection of recyclables is expected to begin from markets, hotels, and restaurants. By this term, the recycling amount will increase to 1,740 tons/day in FY 2025–2026 and 1,776 ton/day in FY 2032–2033.



Source: JICA Project Team

Fig. 5-3 Estimation of Recycling

5.2 Public Relations, Public Awareness and Public Involvement (Component 1)

5.2.1 Establish DSCC's Capacity to Promote Public Involvement in SWM [C1-01]

(1) Establishment of Public Awareness Planning Section

Democratic local governance in the field of SWM are enhanced not only by increasing public awareness but also through public relations, which connects local authorities and citizens. Establishment of Public Awareness Planning Section (PAPS) in WMD is indispensable to strategically build close partnerships and strong connections among DSCC, the community, NGOs, news media, and other governmental entities for socially acceptable SWM; The PRD is in charge of DSCC's overall public relations.

1) Roles and Responsibility

The PAPS intends to take responsibility solely in waste management to plan, and implement DSCC's awareness raising activities, to lead in the related information disclosure, to communicate with the news media in coordination with the PRD, and to promote corporate communications, as shown below.

- i) Public awareness raising activities
 - Outline, supervision, and other support work of WBA activities
 - Environmental education and 3R promotion to citizens
 - Planning of city-wide awareness activities such as the Clean Dhaka festival, promotion activities, special workshops, etc.
 - Public relations and public awareness strategy development, including regional public relations programs
- ii) Information disclosure
 - Information disclosure and sharing system planning (items, methods, timing workflow, etc.)
 - Management of distributing information through various media tools such as press conferences, social media, websites, newspapers, annual reports, stakeholder consultation
 - Coordinating key stakeholder group consultation such as Public Consultative Group (PCG) and Solid Waste Management Standing Committee (SWMSC)
 - Development of information disclosure policy
- iii) Media relations
 - Liaising with the news media
 - Media monitoring and analysis for proactive public relation strategy
 - Providing media training to spokespeople
 - Development of media relations policy

iv) Corporate communications

- Coordination with stakeholders across DSCC for public relations and increasing awareness
- Sharing information among DSCC staff
- Liaising with LGD, DNCC, and other CCs for information exchange meetings

2) Staff Allocation and Official Approval

At least one full-time staff member should be allocated for PAPS, and work closely with and lead other WMD staff for the PAPS activities. The official approval of PAPS by DSCC and staff allocation is expected after 2021. Until then, preparation and negotiation for the PAPS setup will continue by DSCC staff who is officially appointed for this purpose. The appointed staff will also begin PAPS works in accordance with the aforementioned roles and responsibility as the pilot phase so that PAPS will smoothly operate immediately after the approval.

(2) Coordination with Public Relations Department

PAPS works closely with the PRD in accordance with the DSCC’s PR strategy. The PRD, at the forefront of DSCC public relations, releases an official announcement related to waste management such as a press release and public notice, whereas PAPS plans the contents in coordination with related parties. The PRD also reviews other public relations content and disclosure materials as needed. Table 5-2 summarizes the work relationships of public relations for waste management.

Table 5-2 Work Relationships of Public Relation for Waste Management

Public relation activities in WBD	PRD	PAPS	Ward office
i) Public awareness raising activities – CC level	Support	Plan & Implement	Support
Public awareness raising activities – WBA		Support	Plan & Implement
ii) Information disclosure	(Review & Implement)	Plan	
Official announcement (press release, public notice etc.)	Release	Plan & coordinate	
iii) Media relation	(Support &) work as contact point	Plan & implement	
iv) Corporate communication		Plan & Implement	

Source: JICA Project Team

(3) Financial Allocation by Dhaka North City Corporation or Sponsors

Funds for DSCC's public relations and awareness raising activities should be secured and allocated sufficiently in a timely manner. Major items for which financial allocation is necessary from DSCC's annual budget or external financial sources such as donors, private companies, and other organizations are listed below.

- (i) PAPS operation: staff salary, office equipment, etc.
- (ii) Key stakeholder group consultation: PCG and SWMSC meeting expenses
- (iii) SWMSC operation: meeting expenses, etc.
- (iv) Public relations activities: public consultation meeting expenses, publishing, advertisement, public relations tools, etc.
- (v) Public awareness raising activities: city-wide and regional SWM campaign expenses, etc.

Concurrently, WBA activities are secured within DSCC's annual budget separately from the PAPS budget and are disbursed by each ward through the proper administration process.

5.2.2 Enhance Public Knowledge and Understanding to Work Together [C1-O2]

(1) Public Consultative Group for Solid Waste Management Facilities

The PCG for a SWM facility will be introduced first here to provide multiple channels of communication among the project proponent, operator, DSCC, and community for socially acceptable and sustainable facility operation. PCG meeting results such as discussion minutes should be publicly available for accountability and transparency. The framework of the PCG is summarized below.

- (i) Target facility
 - SWM facility such as an LFS, intermediate treatment plant such as an incineration plant and recycling facility, transfer station, and other facilities are critical for its operation wherever discussion among stakeholders occurs
- (ii) Purpose
 - To report the status of the facility operation
 - To consult with residents and other group members for improvement of facility operation
- (iii) Group members
 - WMD CWMO, MoEF, representatives of nearby residents, a SWM facility manager, environmental experts from universities
- (iv) Information to be provided from the facility side (examples)
[Planning phase]
 - Background of development

- Conceptual design and schedule
- Environmental and social impact assessment

[Construction phase]

- Construction plan, schedule, and status
- Environmental and social measures to be implemented during construction

[Operation phase]

- Operation status of facility including environmental and social monitoring data
- Financial information of its operation

(2) Information Exchange Meeting with Other City Corporations

CCs other than the DNCC and DSCC do not have the WMD, and their waste management is operated by the conservancy division or the health department. Their operation has not been well-established, and importance of the waste management service to citizen with proper field-level implementation is not clearly recognized even internally within the CCs. On the other hand, considering the situation in Bangladesh, all CCs must be facing similar issues such as shortage of LFS, and improper waste collection with increasing waste volume.

Proper waste management requires collection vehicle procurement, securing a sufficient landfill capacity, their maintenance, skilled personnel, and more importantly, enormous investment and O&M costs enough to continue the services. It indicates that the organization responsible for waste management should have a strong governance among other departments and organizations within the CC to secure such costs. The DNCC and DSCC have experienced the WMD establishment from the very beginning since 2003, and built a new era of waste management in Bangladesh. Considering the future solid waste management in the country, information exchange among the CCs is worthwhile to discuss the emerging issues, stimulate each other, and to come up solutions for the better practice.

The LGD will therefore organize a national SWM conference annually to share information and support among 12 CCs and nearby local governments. PAPS will closely support the LGD as a liaison for the meeting preparation, and the WMD will take a leading role in the meetings as a high-level waste management practitioner. The meeting framework is summarized in Table 5-3. Initially as a startup, regional cooperation meetings are held in Dhaka and surrounding areas including DNCC, Gazipur, DSCC, and Narayanganj.

Prior to the meeting of the first 12 CCs, general information on SWM is reported by each CC to understand how SWM is being practiced in terms of organizational, financial, and operational aspects. The information is then used as a reference in forthcoming meetings for improvement. It is preferable

that all reported data are consolidated into one data book to be officially published by the LGD and updated periodically, which would make LGD's governance monitoring of the CCs more efficient.

Table 5-3 Information Exchange Meeting for 12CCs

Host Organization and secretariat	Host organization: LGD Secretariat: DNCC and DSCC
Members	LGD and 12 CCs (BCC, CCC, COCC, DNCC, DSCC, GCC, NCC, KCC, MCC, RCC, RACC, SCC)
Schedule	Annually (the 1 st meeting in December 2018)
Venue	LGD meeting room
Topics (example)	<ul style="list-style-type: none"> - Lessons learned from Clean Dhaka Project - WMD establishment - WBA activities - Waste management technology implementation

BCC: Barisal City Corporation; CCC: Chittagong City Corporation; COCC: Cumilla City Corporation; DNCC: Dhaka North City Corporation; DSCC: Dhaka South City Corporation; GCC: Gazipur City Corporation; NCC: Narayanganj City Corporation; KCC: Khulna City Corporation; MCC: Mymensingh City Corporation; RCC: Rajshahi City Corporation; RACC: Rangpur City Corporation; SCC: Sylhet City Corporation

5.2.3 Stimulate Public Participation for Waste Management [C1-O3]

(1) Planning Framework

The WMD will develop a communication plan as public relations and public awareness strategy based on this Master Plan, which illustrates activity frameworks and comprehensive methodology including the following topics (Table 5-4).

Table 5-4 Planning Framework of Public Relations and Public Awareness

Planning Framework	Remarks
Public Awareness Planning Section (PAPS)	- PR section establishment as part of WMD reform
Mission, vision, and strategies of public relation and awareness raising	- Zero-waste campaign, 3R campaign, etc.
Promotion of community participation and environmental education	<ul style="list-style-type: none"> - Mass media relations - Marketing and promotions
Risk communication and grievance mechanism	- Responses and procedures to community complaints regarding environmental pollution, etc.
Information disclosure system	- Based on Bangladesh's Right-to-Information Act and incoming bylaws
Public Consultancy Group for SWM facility (including Eco-Town, LFSs, etc.)	- Promoting community participatory facility development and operation
Information exchange meetings	<ul style="list-style-type: none"> - Coordinated by LGD and subsequently led by DSCC - Initial regional cooperation among DNCC, Gazipur, DSCC, and Narayanganj

Source: JICA Project Team

(2) Public Relations and Awareness Raising Activities

Public awareness raising activities should be implemented in an effective and cost-saving manner mainly through WBA 3 or community-level activities on the ground. PAPS, as a control tower, will outline and supervise community activities implemented ward-by-ward in accordance with PAPS’s supervision or WMD’s public relations and public awareness strategy. PAPS covers and implements the CC-level awareness activities.

According to the current DSCC practices and future prospects, the following city-wide public awareness activities are implemented during this Master Plan period. PAPS is responsible for securing and allocating funds for these activities.

- (i) Public awareness activity and PCSP and cleaners workshops for Eid-ul-Adha
- (ii) Clean Dhaka Campaign/Festival
- (iii) Information sharing via the DSCC’s website, magazine, and SNS
- (iv) Environmental education at schools

(3) Information disclosure

Information disclosure is needed not only to increase transparency and accountability but also to boost the level of public understanding of DSCC’s waste management. Currently, a bylaw on information disclosure is under discussion in DSCC in relation to the RTI Act that was enacted in 2009. The information disclosure strategy of the WMD needs to consider the upcoming bylaw.

The information coverage for proactive and request-based disclosure may vary and needs to be determined. The procedure of information disclosure with applicable methods and tools will be carefully discussed. Table 5-5 shows examples of the methods and tools pertaining to information.

Table 5-5 Examples of Methods and Tools for Information Disclosure

Information	Methods	Tools	Timing
Annual budget, annual activity plan, annual report	<ul style="list-style-type: none"> - Issue annual basis report and distribute to interested parties - Publish a summary on appropriate media - Explain to stakeholders 	<ul style="list-style-type: none"> - Annual report (hardcopy) - Newspaper - DSCC website - Stakeholder meeting 	To be determined (annually)
SWM plan	<ul style="list-style-type: none"> - Issue a summary and explain to stakeholders - Publish a summary on appropriate media 	<ul style="list-style-type: none"> - SWM plan summary (hardcopy) - Newspaper - DSCC website - Stakeholder meeting 	One month after release
Environmental monitoring data	<ul style="list-style-type: none"> - Process raw data and visualize them to facilitate understanding 	<ul style="list-style-type: none"> - DSCC website - Stakeholder meeting 	To be determined (annually)

Information	Methods	Tools	Timing
	<ul style="list-style-type: none"> - Provide a summary on appropriate media - Explain to stakeholders 		
EIA and Environmental Management Plan (EMP) for SWM facilities	<ul style="list-style-type: none"> - Disclose publicly for certain days at appropriate locations after issuing a notice in the newspaper - Explain to stakeholders 	<ul style="list-style-type: none"> - Draft EIA report (hardcopy) - Final EIA report (hardcopy) - DSCC website - Stakeholder meeting 	Immediately after release

Source: JICA Project Team

5.3 Ward-based Approach Activities (Component 2)

5.3.1 Improve Quality and Efficiency of Field-level SWM [C2-O1]

(1) Philosophy of Ward-based Approach

The WBA is an innovative solution for enlightened thinking to strengthen the field activities of SWM. This approach enables field officers to think and act independently and to simultaneously function in a well-organized and systematic matter. In megacities such as DSCC, decentralization of organization is inevitable; otherwise, public cleaning services and administrative works for SWM would fail to function. The philosophy of WBA is summarized below in four points.

Philosophy of WBA

- (i) ***“Field-oriented” Solid Waste Management***
- (ii) ***“Bottom-up” and “Decentralized” Management Style***
- (iii) ***“Cross-organizational” Structure***
- (iv) ***“Participatory” Solid Waste Management with Multiple Stakeholders***

“Field-oriented” Solid Waste Management

The WBA defines the practical roles and responsibilities of field officers to establish the foundation of SWM as a public service. Cleaning and waste collection services are performed in practice by field officers such as CIs and cleaners. The community evaluates the quality of cleaning services through everyday practices in neighboring areas. Field officers are first to receive complaints from citizens. Ward SWM offices function as the center of field activities in the designated area and it should be open to the community to sustain SWM harmony with society.

“Bottom-up” and “Decentralized” Management Style

The SWM system for a megacity must be different from that in a small town. The large population of a megacity makes decision making slow down by the leaders. Quality control of SWM is difficult, and

penetration of the policy from the top to the bottom takes time. Decentralization in the WMD is necessary to avoid a malfunction of the administration. Bottom-up management style is also a characteristic of the WBA. To realize decentralization and bottom-up management of the WMD, the terms of reference (TOR), CI/CO/ACWMO, and chain of command in the WMD should be reassessed, and the authority should be transferred to enable them to handle the issues in their wards. In particular, middle management must be strengthened. Considering the current capacities of field officers, training on ward-wise planning, SWM data management, and monitoring of WBA activities as a ward SWM officer is required.

“Cross-organizational” Structure

Several types of issues occur at the field level, which are not fully covered by the existing scope of the work. For example, before the WBA was introduced, CI’s work includes neither management of the working environment of cleaners nor community awareness raising. The WBA provides a solution for filling the gaps in the existing work and enables connection of the related department/division such as transport, mechanics, law, finance, and public relations.

“Participatory” Solid Waste Management with Multiple Stakeholders

WBA 3 is intended to promote “community participatory SWM” through CUWG. The community is involved in the process of selecting the SWM system suitable for that area in consideration of social, environmental, cultural, and economic aspects. Even though SWM is a public service, cooperation of the community is inevitable. WBA 3 enables development an ownership of a CAP. The community is not the only target; also multiple stakeholders such as universities, journalists, cleaners and PCSPs should be involved in the process of SWM.

(2) WBA Field Activity Implementation

WBA activities will be promoted and disseminated in all 75 DSCC wards. For strengthening the WBA concept on site, 14 major field activities will be implemented, as shown in Table 5-6.

TARGET	<i>WBA is in practice in every ward of DSCC (75 wards).</i>
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Table 5-6 WBA Field Activities

	Main activities
WBA 1	<ul style="list-style-type: none"> ● Reinforcement of zone management ● Strengthening of planning and management capacity <ul style="list-style-type: none"> - Ward-level WBA AAP based on WMD directives - Budget request and disbursement for WBA activities - SWM administrative procedure book ● Improvement of data management system ● Construction of a ward office in all 75 wards of DSCC
WBA 2	<ul style="list-style-type: none"> ● Provision of safety gear and awareness raising on OHSE ● Formulation of Safety and Sanitation Committee (SSC) ● Distribution of Cleaners' Working Manual ● Training of cleaners regarding the new concept of WMD directives, such as waste reduction
WBA 3	<ul style="list-style-type: none"> ● Promotion of community action with CUWG ● Public awareness regarding the new concept of WMD directives, such as waste reduction ● Receipt of complaints by community
WBA 4	<ul style="list-style-type: none"> ● Unsanitary dustbins and containers closure ● Improvement of primary and secondary collection based on the SWM data ● FTTP collection by compactor in extension area

Source: JICA Project Team

(3) Safety and Sanitation Committee management (WBA 2)

A safety and sanitation committee (SSC) will be organized for each workplace such as the landfill and ward office for creating a safe and sanitary working environment. An example of the SSC structure and activities at a ward office is shown in Table 5-7.

Table 5-7 Examples of Safety and Sanitation Committee

Member	CI, leader of the cleaners, six representative cleaners
Frequency	Once a month
Activity	<ul style="list-style-type: none"> ● Confirm the safety and sanitation of work (cleaner manual) ● Analyze the cause of injury ● Analyze the cause of accident ● Safety patrol (work supervision) ● Report to zone office; zone office compiles a report of SSC and shares it with other zones. The report is filed in the zone office. ● Organize a zone level SSC annually and issue a report to each ward in the meeting.

(4) Community Unit Working Group (WBA 3)

The CUWG is responsible for collection improvement and waste reduction. The CI will activate the WBA 3 activities more with the CUWG in accordance with the Master Plan. WBA 3 will be further promoted in collaboration with PAPS and PRD.

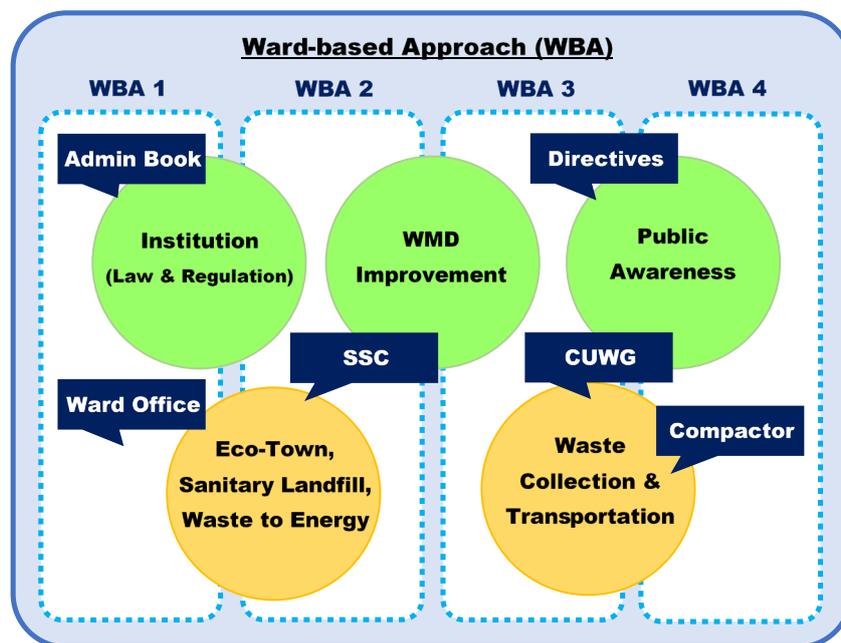
(5) Cross-Organization Structure

The WBA includes a cross-organizational structure and requires implementation of cross-field activities. WBA 1 to WBA 4 clarify the core domain and activities, which strongly motivated CIs to promote field activities in the previous project. However, it has been more than 10 years since the WBA was first introduced in Dhaka City. Considering the change of social circumstances and SWM needs, the WBA concept must be renewed or reinterpreted.

Owing to the rapid economic growth and population overflow, SWM will become more complicated and diverse. Expectations for quality in the public cleaning service from the community and society will be higher. Field officers need flexibility and proper judgment in the field; otherwise, SWM cannot be sustained appropriately. In principle, the WBA aims for complete ward-wise SWM under the ward office for preparing policy and budget execution. This also requires flexibility in daily works and tolerance in the scope of the work to handle all issues occurring in a ward, which in turn requires creative actions to fill the gap among existing assignments, organizations, and relationships with stakeholders. Social, cultural, and economic backgrounds also must be considered. In the Master Plan, five domains which closely relates the WBA are found, as shown in Fig. 5-4.

[Main domains closely related to the WBA]

- Institution (law and regulations)
- WMD organization improvement
- Public awareness and public relations
- New concept and facility of waste treatment, including Eco-Town, sanitary landfill, and WtE
- Waste collection and transport, including FTFP collection by compactor



Source: JICA Project Team

Fig. 5-4 Main Domains Closely Related to WBA and Its Function

5.3.2 Enhance Institutional Capacity of the Conservancy Division [C2-O2]

(1) Bottom-up and Decentralized Management

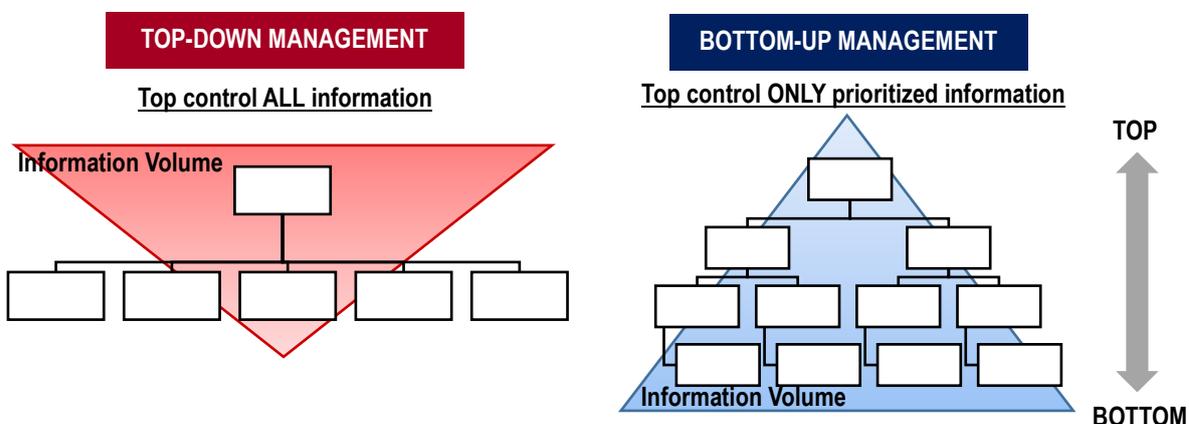
1) Reinforcement of Zone Management

The top-down management style has been in practice for a long time in DSCC. The CWMO managed every issue regardless of the volume or quality. This management style is suitable especially when initiated by strong leadership in emergency situations.

The suitable population size for SWM is said about 100,000 to 150,000; higher population creates difficulties in SWM. DSCC has a population of 3.2 million, and the cleaning services are managed by the CWMO only. In contrast, the average population of the 75 wards was 59,877 in FY 2018–2019, with maximum and minimum populations of 142,532 in Ward 14, and 10,545 in Ward 69, respectively. Ward-wise SWM is an effective and proper management method considering the manageable population size.

The WBA is bottom-up management style. Field activities are promoted independently by the CO/CI. The WBA functions in a well-organized and systematic manner because field officers such as COs/CIs fully understand their responsibilities, middle-management officers such as ACWMOs manage and monitor their work properly. In this context, the job description and chain of command should be

reviewed and reformed. Several training programs are proposed for developing management skills in the WMD.



Source: JICA Project Team

Fig. 5-5 Top-down and Bottom-up Management Styles

2) Strengthening of Planning and Management Capacity

An annual activity plan of SWM should be prepared at each level, including 75 wards, 10 zones and the WMD, based on WMD directives. The WMD directives should be revised in line with the Master Plan. One of the main topics that must be reflected in field activities is “Waste Reduction.” Such new planning helps the WMD to disseminate the new concept and policy.

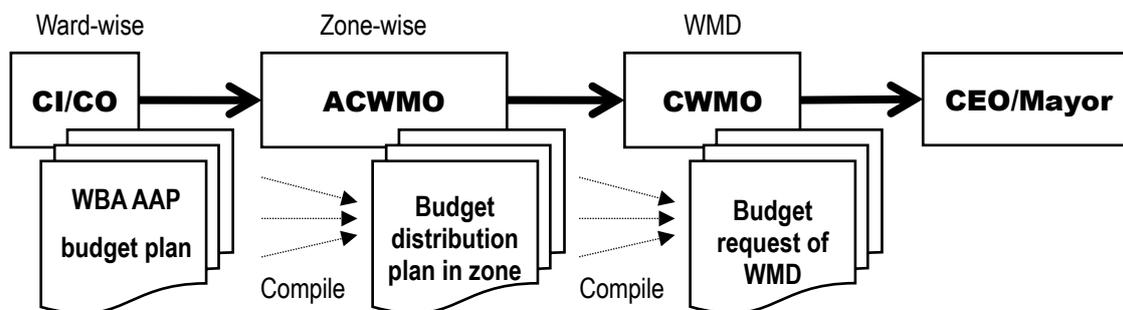
The annual activity plan will urge proper budget disbursement. In 2018, the community budget was approximately Tk. 2 million. However, this budget and the WBA-related budget had not been properly allocated previously owing to the lack of a proper financial management system. The budget plan should be prepared and assessed on the basis of the annual activity plan and should proceed in accordance with the SWM administrative procedure book. The key factors for strengthening the planning and management capacity are summarized below.

[Key factors for strengthening the planning and management capacity]

- WMD directives and SWMSC
- Ward-level WBA AAP based on WMD directives
- Budget request and disbursement for WBA activities
- SWM administrative procedure book

Examples of the budget request and approval process are shown in Fig. 5-6. For example, when each ward office drafts a WBA budget at the end of the fiscal year and submits it to ACWMO, the ACWMO compiles a budget distribution plan in each zone and submits to the CWMO. The CWMO then assesses

the plan and submits it to the CEO and mayor for approval. An office order will be issued and endorsed for this process in DSCC. The SWM administrative procedure book should be reviewed periodically to reflect new orders or regulations.



Source: JICA Project Team

Fig. 5-6 Example of Budget Approval Process in DSCC

3) Improvement of Data Management System

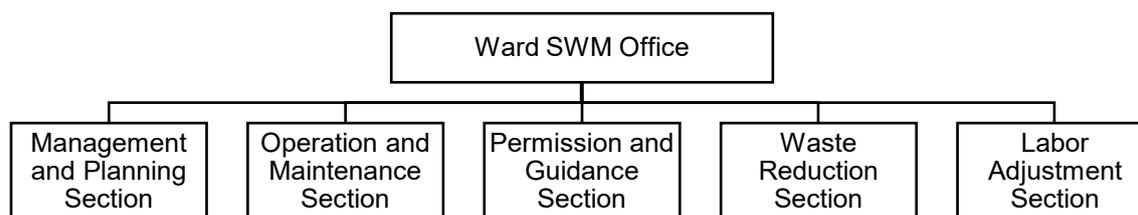
The daily and occasional reporting system from CIs to the ACWMO requires recording to utilize the information for SWM improvement. Operation and management based on the acquired data are fundamental for improving the current situation by analyzing data and implementing measures. Examples of data management items are shown below. DSCC issues an annual SWM Report that includes ward-wise population and waste collection amounts. These SWM data will be useful for better communication with the CSP, cleaners, and the community.

[Example of Data Management Items]

- | | |
|---|---|
| 1. Annual activity plan and report | 5. Cooperation with community |
| 2. Primary and secondary waste collection | 6. Management of cleaning appliance and equipment |
| 3. Management of cleaners | 7. SSC activities |
| 4. Local cleanliness | 8. Budget plan and report |

4) Organization of Ward Office Management

A ward office is the center of field level activities, and the CI is expected to be a ward office manager. For appropriate ward management, a ward office should have a management organization which enables the CI to extend his capacity and authority in the ward. Fig. 5-7 shows an example of the organizational structure with 5 sections in a ward office; the management and planning section, the operation and maintenance section, the permission and guidance section, the waste reduction section, and the labor adjustment section.



Source: JICA Project Team

Fig. 5-7 Example of Organization for Ward Office Management

(2) Training and Workshop

1) WBA Related Training

WBA training programs are planned to involve various stakeholders. Table 5-8 shows examples of the WBA related trainings. These programs will be developed on the basis of existing training modules. A training module for drainage cleaners and that for planning/SWM data management will be newly set.

Table 5-8 Examples of WBA training

Training Program	Contents
1) WBA Training (CI Training)	- Training of Trainers for Workshop
2) Zone Level Training	- WBA Introduction
3) Road Cleaner Workshop	- WBA 2
4) Drainage Cleaner Workshop	- Safety and Sanitation (WBA2) - Risk Management
5) PCSP Workshop	- WBA 4b
6) CUWG Workshop	- WBA 3
7) Drivers Workshop	- WBA 4a
8) WMD Directives/Planning Seminar	- WMD Directives - Planning of Ward-wise Annual Activity Plan - SWM Data Management
9) Admin Book Seminar	- SWM Administrative Procedure Book
10) Medical Waste Seminar	- Awareness raising on Medical Waste - Risk Preparation

[Related Programs]

- Training: Training of Trainers for CI provided by WMD
- Workshop: Interactive information exchange with stakeholders initiated by CI
- Seminar: Lecture on the specific topics initiated by WMD

Source: JICA Project Team

5.4 Waste Reduction (Component 3)

5.4.1 Reduce Waste Amount Generated [C3-O1]

Waste reduction, often described as 3R, is a key tactic used to minimize the disposal waste to LFSs. Table 5-9 shows examples of 3R activities.

Table 5-9 Examples of 3R Activities

Category	Activities
Reduce	<ul style="list-style-type: none"> • Stop using disposable materials Examples: Use my-cup instead of paper cup or bottled drinks Bring my-bag for shopping instead of receiving shopping bag • Do not waste food Examples: Go food shopping after conducting inventory of your refrigerator Use up your food by freezing or use for multiple menus Order dishes at restaurants only if you can finish it • Dry up food waste before you throw it out so that the waste volume can be reduced • Choose products that can be used for a long time
Reuse	<ul style="list-style-type: none"> • Use products many times and repair them if necessary • Donate unnecessary toys, clothing, furniture, and electrical products to those who need them
Recycle	<ul style="list-style-type: none"> • Separate recyclable waste such as cans, bottles, PET bottles, plastics, paper, food waste, and electrical waste at the source

For promoting waste reduction activities such as 3R, the cooperation of citizens is indispensable. Therefore, DSCC will implement such activities efficiently and effectively, taking advantage of the WBA function. The waste reduction activity plan in the WBA is summarized in Table 5-10.

Table 5-10 Waste Reduction Activity Plan in WBA

WBA	Activities
WBA 1	<i>Ward Office Management</i>
	<ul style="list-style-type: none"> • WMD directives are revised to emphasize the importance of waste reduction. • Measures for waste reduction are clarified by each ward in the WBA AAP based on the WMD directives. • ACWMO monitors the progress of WBA activities and promotes waste reduction regularly.
WBA 2	<i>Safety and Sanitation Education for Cleaners</i>
	<ul style="list-style-type: none"> • Cleaners are trained to persuade citizens to contribute to waste reduction.
WBA 3	<i>Community Participation</i>

WBA	Activities
	<ul style="list-style-type: none"> • CUWG of each ward takes responsibility for promotion of waste reduction in a target area. • Main activities are for reduction and source separation at household. Details of these activities are discussed by CUWG and are determined on the basis of social and cultural backgrounds of each area.
WBA 4	<p><i>Waste Collection Improvement</i></p> <ul style="list-style-type: none"> • Collection of recyclables separated at source is introduced for improvement of the conventional waste collection system. • FTFP collection system encourages participation of the community, which helps the WMD to interact with the community for waste reduction.

Many waste pickers work in DSCC. Prior to introducing waste reduction activities, DSCC will study the state of their work and will consider hiring additional waste pickers as, for example, Eco-Town staff, if their livelihood is adversely affected by waste reduction activities depending on the study results.

5.5 Waste Collection and Transport (Component 4)

5.5.1 Promotion of Community Participatory SWM [C4-O1]

Although aimed toward implementation of efficient and sanitary waste collection and transport, conventional waste collection method such as container collection has disturbed the landscape of the city and causes traffic congestion. To solve these issues, expansion of FTFP collection by using plastic bins and compactors need to be considered to replace the existing collection method.

FTFP collection requires cooperation of communities. WBA 3 encourages communication between the DSCC and residents, and promotion of the FTFP collection is carried out through WBA 4. Target areas of the FTFP collection will be extended and cover all residential area.

5.5.2 Expand the Capacity of Collection and Transport [C4-O2]

(1) Vehicle Procurement

The WMD will procure waste collection vehicles and equipment and in principle, aged arm-roll trucks and container carriers need to be replaced with new compactor trucks, whereas dump trucks will be allocated for street and drainage cleaning. 70% of the DSCC's waste collection vehicles is the target to replace with compactor truck. Considering the fact that the collection vehicles are managed not only by WMD but also other departments, discussion and coordination have to be strongly encouraged among related departments in DSCC for the efficient management.

In addition, waste collection and transport operation for the expansion area should be examined carefully and immediately. There is only little practice of SWM in the expansion area. Recruitment and capacity development of new collection workers and drivers for the expansion area is necessary.

A vehicles procurement plan will be prepared to achieve FTFP collection by using plastic bins and compactors for the entire area of the DSCC by FY 2022–2023. Table 5-11 shows the precondition for calculating the number of necessary vehicles. Dump trucks are assumed to be used for street and drainage cleaning.

Table 5-11 Assumption for Calculating Necessary Number of Vehicles

Item	Assumption
Vehicle Lifetime	20 years (50% of the procured vehicles are scrapped after 15 years, 50% after 20 years)
Replacement Condition	Arm roll and container carriers are replaced with compactor trucks.
Vehicle Type	Compactor : Dump truck = 8 : 2 (Dump truck is allocated for street and drainage cleaning)

Source: JICA Project Team, "Time and Motion Survey Report (2018)"

The necessary number of waste collection vehicles by vehicle type in FY 2022–2023 is estimated as shown in Table 5-12, taking into account the vehicle lifetime and waste generation. Table 5-13 shows the number of necessary vehicles for FY 2027–28, and Table 5-14 shows that for FY 2032–2033. By FY 2032–2033, the DSCC needs to have the vehicles doubled in FY 2022–2023.

Table 5-12 Waste Collection Vehicle Planning in FY 2022–2023

Type	Capacity (tons)	Vehicles			Total
		Existing	Provided by GAP	Procured by DSCC	
Compactor	2	10	8	13	31
Compactor	5	9	14	22	45
Container Carrier	3	12	-	-	12
Container Carrier	5	28	24	-	52
Dump Truck	3	0	3	5	8
Dump Truck	7	4	4	7	15
Dump Truck (4WD)	6	0	3	-	3
Open Truck	5	0	-	-	0
Open Truck	3	10	-	-	10
Open Truck	1.5	0	-	-	0
Arm Roll Truck	7	12	-	-	12
Total	-	85	56	47	188

Source: JICA Project Team

Table 5-13 Waste Collection Vehicle Planning in FY 2027–2028

Type	Capacity (tons)	Vehicles			Total
		Existing	Provided by GAP	Procured by DSCC	
Compactor	2	10	8	30	48
Compactor	5	9	14	37	60
Container Carrier	3	12	-	-	12
Container Carrier	5	28	24	-	52
Dump Truck	3	0	3	11	14
Dump Truck	7	4	4	12	20
Dump Truck (4WD)	6	0	3	-	3
Open Truck	5	0	-	-	0
Open Truck	3	10	-	-	10
Open Truck	1.5	0	-	-	0
Arm Roll Truck	7	12	-	-	12
Total	-	85	56	90	231

Source: JICA Project Team

Table 5-14 Waste Collection Vehicle Planning in FY 2032–2033

Type	Capacity (tons)	Vehicles			Total
		Existing	Provided by GAP	Procured by DSCC	
Compactor	2	0	6	56	62
Compactor	5	2	11	70	83
Container Carrier	3	0	-	-	0
Container Carrier	5	0	18	-	18
Dump Truck	3	0	2	15	17
Dump Truck	7	4	3	25	32
Dump Truck (4WD)	6	0	2	-	2
Open Truck	5	0	-	-	0
Open Truck	3	10	-	-	10
Open Truck	1.5	0	-	-	0
Arm Roll Truck	7	0	-	-	0
Total	-	16	42	166	224

Source: JICA Project Team

(2) Storage Capacity of Waste Container

A container carrier can generally have four trips on average, and eight trips at a maximum. However, the number of the trips is limited owing to shortage of the containers in the DSCC area. This situation is a bottleneck to increase the waste collection rate. Therefore, the WMD will locate more containers in the DSCC area for efficient use of the container carriers.

(3) SWM Framework in Extension Area

In the extension area, FTFP collection by compactor will be introduced proactively. PCSP is effective under certain circumstances, especially in the initial stage of SWM. On the contrary, open dustbins and containers easily make the surroundings dirty with scattered waste. Odor emitted and flies bred from dustbins and containers in the unsanitary environment.

The SWM framework in the extension area is shown in Table 5-15. In the framework, the DSCC will make contracts with private companies for waste collection and vehicle maintenance. Waste treatment including recycling will be implemented by five zones, and ward offices are responsible for the WBA activities and awareness raising. The SWM cost will be financed by DSCC headquarters.

Table 5-15 SWM Framework in Extension Area

Item	Responsible Organization	Remarks
Waste collection system	Private	FTFP collection system by compactor without PCSP
Maintenance of collection vehicles	Private	—
Treatment of waste	Private by zone	WtE, recycling
WBA activity	Ward office	—
Awareness raising	Ward office	—
Finance	DSCC Headquarters	—

Source: JICA Project Team

(4) Capacity Development of Workers and Drivers

The DSCC street cleaner's and drainage cleaner's ability is about 300 m per day and 200 m per day respectively.¹⁰ They work with a group of four cleaners as instructed by the DSCC, continue the cleaning in an assigned area for two to four hours until streets get clean, and then go back home afterward.

The WMD encourages each cleaners and cleaner's group to support each other by, for example, helping other group's work after finishing own work. The drivers are also to be advised to help cleaners to load waste into compactors. Such an on-job training contributes to changing mind setting of the cleaners and drivers for mutual assistance and respect, and to better organizational governance.

¹⁰ Data from the previous Clean Dhaka Plan

5.5.3 Prepare for Receiving the GAP Vehicles [C4-O3]

The DSCC has received total of 56 GAP vehicles which consist of container carriers, compactors, and dump trucks, as mentioned previously. The GAP vehicle allocation is planned for their efficient use as follows.

(1) Container Carriers

The old container carriers that are currently operational will be substituted to the GAP vehicles. New driver recruitment for the GAP container carriers is not necessary.

(2) Compactors

The GAP compactors will be assigned in the densely populated areas in the city for FTFP collection system with introducing 70L plastic bins. Some of the WBA wards are selected for this collection system because communities in a WBA ward are relatively active and cooperative. The compactor is planned to travel to the LFS two trips per day.

These compactors are additions to expand the compactor collection area. The DSCC must hire new drivers and provide proper training for the compactor operation, and also instruct them to help cleaner's loading work at correction points.

(3) Dump Trucks

The old dump trucks that are currently operational will be substituted to the GAP vehicles. Dump trucks are used for transport of drainage sludge, food waste from restaurants and shops, green waste, and construction waste. New driver recruitment for the GAP dump trucks is not necessary.

5.5.4 Unify DSCC's Waste Collection Management System [C4-O4]

In the DSCC, most of the collection vehicles are managed by TD, not by the WMD, based on the TD's official work statement. This situation makes the WMD very hard to allocate the vehicles flexibly to collect unscheduled waste wherever necessary. The WMD has few collection vehicles, and they are not enough to cover all DSCC area.

The collection vehicles and their drivers should be transferred to the WMD's responsibility for more efficient waste collection and sound waste management. The WMD would face challenging issues to achieve it such as securing the drivers' welfare and paying off vested interests; thus, decision making in high level official is vital, and the discussion should be strongly encouraged among related departments for the smooth transfer.

5.6 Vehicle Maintenance System (Component 5)

5.6.1 Improve Maintenance Workshop Operation and Management [C5-O1]

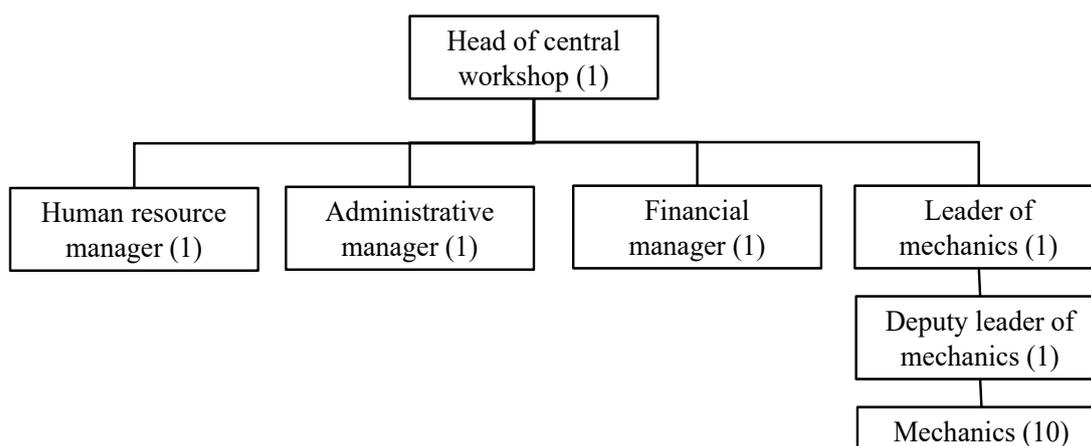
(1) Workshop Management Rules Development

WMD should formulate workshop management rules to standardize operation and to make an effective organization of the workshop. Examples contents of the management rules and the organizational structure of the workshop are shown in Table 5-16 and Fig. 5-8.

Table 5-16 Examples of Workshop Management Rules

Contents
(1) Job Description of each level
(2) Rules on General Affairs
(3) Work Rules
(4) Rules on Working Time and Holidays
(5) Guidelines for Reporting System and Forms
(6) Safety and Sanitation Standards
(7) Guidelines for Safety and Sanitation Improvement <ul style="list-style-type: none"> a. General Rules b. Chief Manager of Safety and Sanitation c. Safety and Sanitation Committee d. Safety Gear e. Medical Examination and Other Health Management Methods f. Education and Training for Safety and Sanitation
(8) Rules on Staff Training

Source: JICA Project Team



Source: JICA Project Team

Fig. 5-8 Example of New Workshop Structure

(2) Workshop and Maintenance System Reform

Three departments, namely the WMD, ED, and TD, currently manage, maintain, and operate collection vehicles; however, no comprehensive maintenance plan, procurement plan, or repair plan is in place. To unify management, maintenance and operation of the collection vehicles should be performed solely by the WMD. That is, the workshop, which is owned by the ED for collection vehicles, should belong to the WMD together with the vehicle ownerships, and the collection vehicle operation including drivers should be transferred gradually to the WMD.

(3) Introduction of Preventive Maintenance Method

Periodic daily or monthly inspection and maintenance is very important for preventing serious accidents or breakdowns. Preventive maintenance is a method for maintenance by controlling the expiration date of each vehicle part. Main items for the preventive maintenance is summarized below

1) Type of Inspection

- (i) Daily inspection before work
- (ii) Daily inspection after work
- (iii) Weekly inspection
- (iv) Monthly inspection
- (v) Annual inspection
- (vi) Two-year inspection

2) Steps of Inspection

- (i) The standard replacement interval is determined on the basis of inspection records, and replacement will be implemented periodically.
- (ii) Inspection is based on a check sheet, which includes the previous replacement time.
- (iii) The mechanic in charge of inspection decides whether replacement is needed.
- (iv) The inspection results are analyzed to evaluate parts replacement.
- (v) Vehicle condition is confirmed with the driver.
- (vi) Repairs beyond replacement of filters or oil are outsourced.

3) Annual Inspection/Two-Year Inspection

If the vehicle was procured within the last five years, the inspection is conducted by the WMD. For vehicles procured more than years before, the inspection is outsourced.

4) Spare Parts Management System

Software for an inventory management system should be developed.

(4) Introduction of Preventive Maintenance Method

As mentioned above, preventative maintenance is introduced for the workshop operation so as to improve the work efficiency of the collection vehicles. The preventative maintenance basically aims at avoiding a serious failure by replacing parts at the workshop in advance. When a serious failure occurs, the vehicle is sent to an outsourced private workshop for repair. This method leads to improve the Mean Time Between Failures (MTBF) as well. It is important that the further data be accumulated and analyzed to establish a better maintenance system.

5.7 Intermediate Treatment System (Eco-Town: WtE, Composting, Recycling etc.) (Component 6)

5.7.1 Develop Eco-Town (WtE, composting, recycling etc.) for Sustainable Waste Management in Dhaka [C6-O1]

(1) Necessary Intermediate Treatment

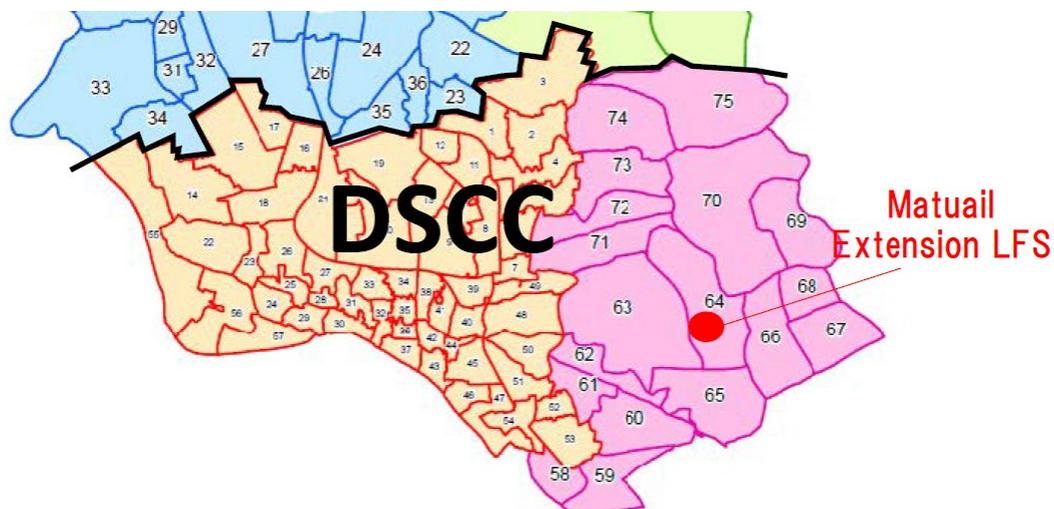
Currently, the maximum remaining lifespan of the existing LFS is only 3 years, while the amount of generated waste is increasing as a result of population growth and expansion of the city area. Under such conditions, for example, even if 20 ha of a sanitary LFS were constructed for the DSCC, which is the same size as the existing LFS, it would be only extend the lifespan of landfilling to only 4–5 years resulting in another landfill site construction within 3 years. Owing to limited land availability and high land prices, land acquisition for a new LFS is becoming difficult. DSCC therefore must change its waste treatment process to divert waste from the LFS. To achieve the objectives, it is vital to develop an intermediate treatment system such as an Eco-Town, an intermediate treatment zone with various kinds of treatment facilities (WtE, biogas, composting, recycling etc.).

(2) Intermediate Treatment System (Eco-Town) Planning

The planning conditions for an Eco-Town is initially set as follows in this Master Plan. The detail of the intermediate treatment system (Eco-Town), including plant type and its capacity, will be determined later depending on actual development planning and project characteristics.

- (i) DSCC is planning to construct intermediate treatment facilities in the Matuail extension area, described in the DPP. The location of the site is shown in Fig. 5-9. The layout plan of the LFS is shown in Fig. 5-10.
- (ii) The target waste for the intermediate treatment and recycling includes municipal waste, medical waste, electronic waste (E-waste) etc. Medical waste and E-waste are not treated by DSCC, but by private entities. It is expected that private entities will invest recycling and treatment facilities in the Eco-Town for these wastes.

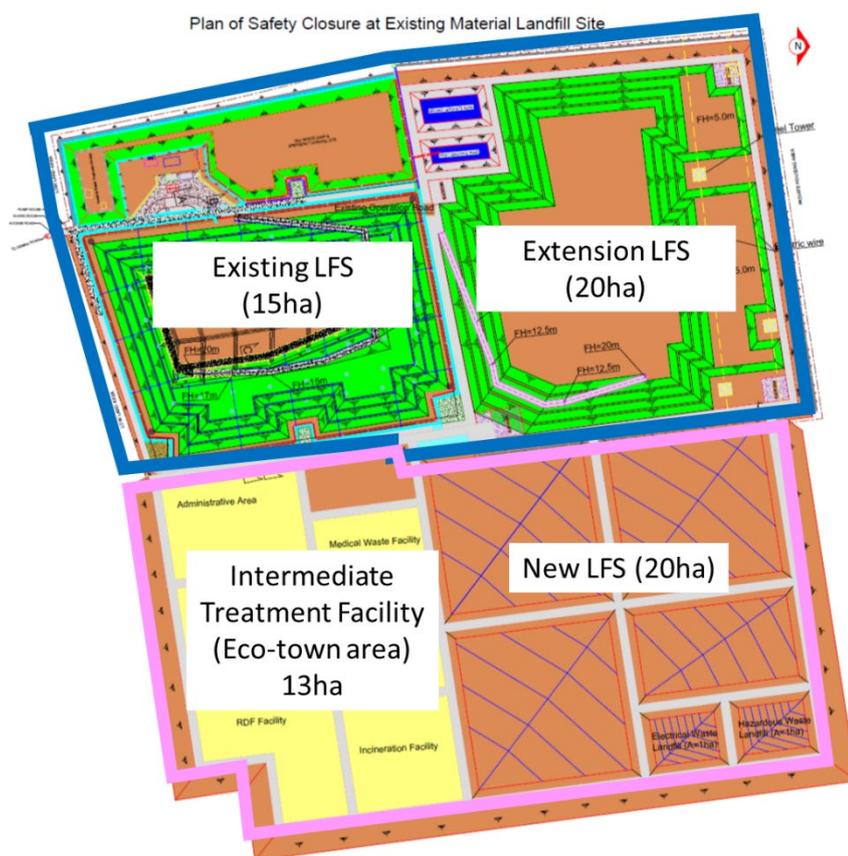
- (iii) The capacity of each facility in the Eco-Town is set to satisfy the target recycling rate and landfill rate as shown in Section 4.3.2.



Source: JICA Project Team

Fig. 5-9 Location of Eco Town

- (iv) Primary collectors and waste pickers sell recyclables from mixed waste discharged from households. When source separation is introduced, they will possibly lose this source of income. Therefore, until the number of them decreases as the economy grows, coexistence with these people is desired; thus, source separation at household will be less prioritized to reduce waste.
- (v) In order to increase the available capacity of the LFSs, it is highly important to promote food waste recycling, which accounts for a large portion of municipal waste. Therefore, source separation will be introduced at restaurants and markets, where the generation of food waste is high, and the waste separation is relatively easy to implement. Recycling methods for food waste include composting and biogasification, both of which have proven results in Bangladesh.
- (vi) In the Eco-Town, priority is given to materials recycling, to reuse waste as product materials. The remaining waste from the material recycling will be treated at a WtE facility as thermal recycling.



Source: JICA Project Team

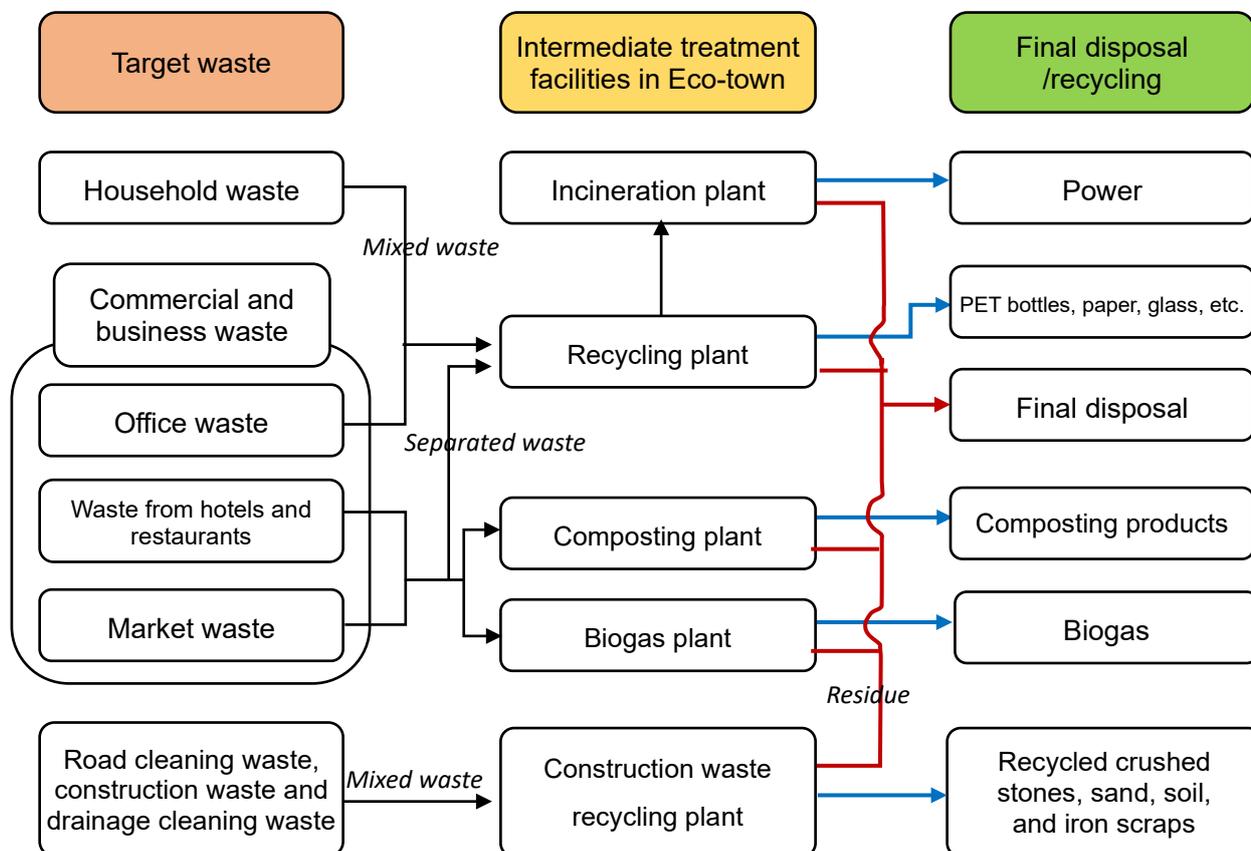
Fig. 5-10 Layout plan of Eco-Town in Matuail LFS Extension Area

(3) Waste Management Flow

The waste management flow of intermediate treatment in Eco-Town is described below.

- (i) Household waste and office waste: These wastes are collected as mixed waste at the discharging points and transported to the recycling plant. PET bottles, paper, glass bottles and other valuable materials are separated at the plant for recycling, and the remaining waste is incinerated at the WtE facility for power generation or transferred directly for final disposal to landfill.
- (ii) Market waste and food waste from restaurants and hotels: These wastes are discharged separately into organic waste and non-organic waste. The organic waste is used as a raw material for composting products at the composting plant or for biogas at the biogas plant. The other waste will be transported to the recycling plant to collect valuable materials.
- (iii) Street waste (road and drainage cleaning waste) and construction waste: These wastes are collected as mixed waste and transported to the construction waste recycling plant, and crushed

stones, sand, soil, iron scraps, and other valuable materials are separated at the plant. The remaining waste are transferred for final disposal to landfill.



Source: JICA Project Team

Fig. 5-11 Waste Management Flow Diagram of Intermediate Treatment in Eco-Town

(4) Contents of Intermediate Treatment Facilities in Eco-Town

In this Master Plan, the following treatment facilities are considered to be constructed in the Eco-Town area. Table 5-19 shows the facilities and their capacities for satisfying the interim target values of recycling rate and final disposal rate. Fig. 5-12 shows the waste generation and treatment flow diagram in the mid-term target year of 2025. The components of the Eco-Towns and capacities in this Master Plan are only examples, and it should be determined depending on actual development planning and project characteristics.

(i) Recycling Plant

The target wastes of the recycling plant include household waste and commercial and business waste. The planned facility capacity in this Master Plan is 300 tons/day in Matuail Eco-Town. The plant includes a trommel, belt conveyor, crusher, grinder, cutting machine, and ancillary equipment.

(ii) Composting Plant

The target wastes of composting plants are organic waste, and the planned facility capacity in this Master Plan is 150 tons/day in Matuail Eco-Town. The windrow composting process is adopted, and the plant uses heavy equipment for turning over, and furnishes a trommel, a vibrating screening machine, a bagging machine for composting products, and ancillary equipment.

(iii) Biogas Plant

The target waste of the biogas plant is organic waste, and the planned facility capacity in this Master Plan is 100 tons/day in Matuail Eco-Town. The wet digestion process is adopted, and each plant includes facilities for waste receiving/supply, pretreatment, methane fermentation, biogas storage, biogas utilization, deodorization, and ancillary equipment.

(iv) Construction Waste Recycling Plant

The target wastes of the construction waste recycling plant is street waste (road and drainage cleaning waste), and construction waste. The planned facility capacity in this Master Plan is 430 tons/day in Matuail Eco-Town. The plant includes a trommel, belt conveyor, crusher, grinder, cutting machine, and ancillary equipment.

(v) WtE Plant

The target wastes of the incineration plants are household waste and commercial and business waste. The planned facility capacity in this Master Plan is 1,000 tons/day in Matuail Eco-Town, and the incinerator is stoker-type. Each plant is composed of facilities for waste receiving, combustion and gas cooling, exhaust gas treatment, water supply, drainage treatment, power generation, and ancillary equipment.

Table 5-17 Outline of Intermediate Treatment Facilities in Eco-Town (2025year)

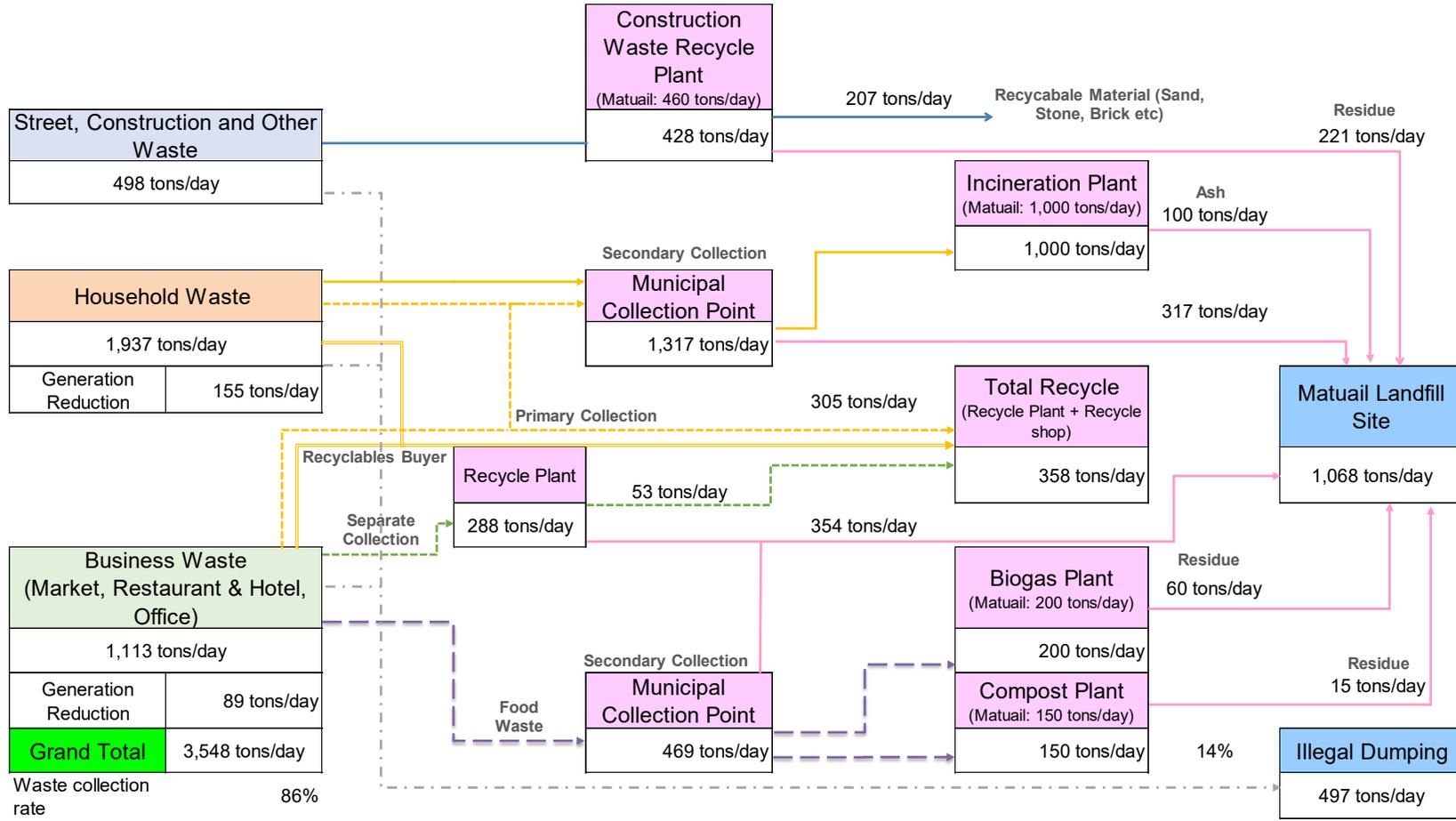
Facility	Capacity *	Outline
	300 tons/day	<p>Recycling Plant</p> <ul style="list-style-type: none"> • Target waste: household commercial and business waste • Construction cost : approximately Tk. 410 million. • Operation and maintenance (O&M) cost : approximately Tk. 6 million per year. • Facility outline: trammel, belt conveyer, crusher, grinder, cutting machine, etc.
	150 tons/day	<p>Composting Plant</p> <ul style="list-style-type: none"> • Target waste to be received: Organic waste • Construction cost : approximately Tk. 410 million. • O&M cost : : approximately Tk. 4 million. • Process type: Windrow composting • Facility outline: heavy equipment for turning over, trammel, vibrating screening machine, bagging machine for composting products, etc.
	100 tons/day	<p>Biogas Plant</p> <ul style="list-style-type: none"> • Target waste to be received: Organic waste • Construction cost : approximately Tk. 4,900 million • O&M cost : approximately Tk. 120 million • Process type: Wet digestion • Facility outline: facilities for receiving/supply, pretreatment, methane fermentation, biogas storage, biogas utilization, deodorization, etc.

Facility	Capacity *	Outline
	460 tons/day	<p>Construction Waste Recycling Plant</p> <ul style="list-style-type: none"> • Target waste: street waste (road and drainage cleaning waste), and construction waste • Construction cost : approximately Tk. 490 million • O&M cost : approximately Tk. 7 million per year • Facility outline: trommel, belt conveyor, crusher, grinder, cutting machine, etc.
	1,000 tons/day (500 tons/day × 2 unit)	<p>WtE Plant</p> <ul style="list-style-type: none"> • Target waste: household waste, commercial and business waste • Construction cost : approximately Tk. 16,400 million • O&M cost : Tk. approximately 640 million • Process type: Stoker type incinerator • Facility outline: facilities for receiving, combustion and gas cooling, exhaust gas treatment, water supply, drainage treatment, power generation, etc.

* The capacities here are only examples, and it should be determined depending on actual development planning and project characteristics.

Source: JICA Project Team

Fig. 5-12 Waste Generation and Treatment Flow in 2025



(5) Project Implementation Schedule

Because the remaining lifespan of the existing LFS is short and construction of new sanitary LFS will take time, the Eco-town (WtE, composting, recycling etc.) construction project should be commenced immediately on a designated land once the land is developed in accordance with the ongoing LFS development DPP. Hence, the feasibility study for Eco-Town needs to be started in 2019, as shown in Table 5-20. Work period includes 1 year for the feasibility study, 2 years for the basic design, and 3 years for the construction.

Table 5-18 Project Implementation Schedule

Item	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
【New Sanitary Landfill Development Project】															
Extension of Matuail Landfill Site															
【Eco-town Development Project】															
(1) Feasibility Study															
(2) Basic Design (Preparation of Tender etc.)															
(3) Construction															
(4) Operation															

Source: JICA Project Team

(6) Required Cost of Eco-town (WtE, Composting, Recycling etc.)

The total proposed budget for implementing all before mentioned Eco-Town facilities, including the feasibility study, consultant service, construction and initial O&M, is approximately Tk. 20,000 million. The total O&M cost for the Eco-Town from 2023 to 2032 is approximately Tk. 8,000 million. The O&M cost is expected to be covered by fee collection and by selling electricity produced at the WtE plant. The sources of the funds for construction and operation cost are summarized in Table 5-21.

If the incineration plant, i.e. WtE plant is constructed and operated by a private company (PPP), the construction cost (approx. Tk. 16,400 million) and O&M cost (approx. Tk. 640 million per year) will be considered as zero.

Table 5-19 Required Cost of Construction and Operation at Eco-town

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Total
Feasibility study	•							•							–
Consultant Service		•	•	•	•	•			•	•	•	•	•		–
Construction				•	•	•					•	•	•		–
Operation & Maintenance					○	•	•	•	•	•	•	•	•	•	–
DNCC own revenues					800	800	800	800	800	800	800	800	800	800	8,000
Grant from central government / international donors	100	100	100	6,500	6,500	6,500									19,800

Note) This table shows the case that the GoB bears all cost of the intermediate facilities in the Eco-Town. All the cost is estimated by JICA Project Team.

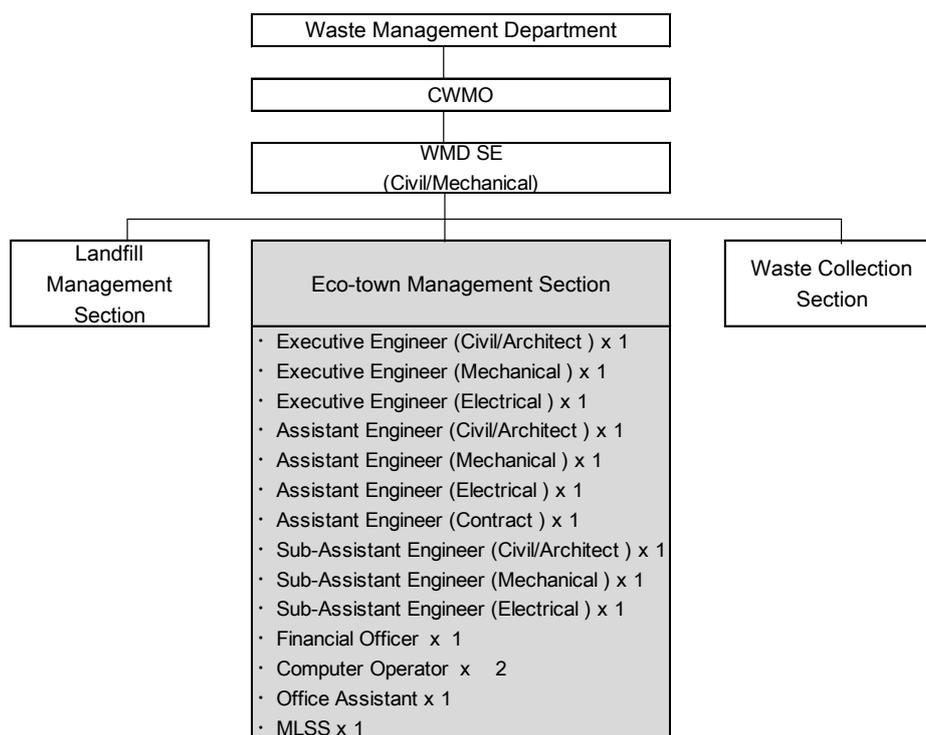
* ○ represents partial operation starting.

Source: JICA Project Team

5.7.2 Establish the Intermediate Treatment (Eco-Town) Section in WMD [C6-O2]

(1) Intermediate Treatment (Eco-Town) Section

Considering complicated operation of a WtE plant, it is recommended that a private company operate under an agreement with the DSCC, and it can be applicable to other facilities as well. DSCC should organize an O&M section for intermediate treatment, called “Eco-Town Section” to manage planning, designing, construction, operation, and management for the intermediate treatment facilities in the Eco-Town. In the Planning stage, the superintendent engineer in the WMD is responsible, and the EEs for landfill management and for waste collection will be support him. In the basic design stage, three EEs and four AEs should be newly assigned, and an administrative staff member should join in. Finally, in the construction stage, SAE will be assigned in the section. Fig. 5-13 shows the organizational structure of the Eco-Town, and Table 5-22 shows the required staff members.



Source: JICA Project Team

Fig. 5-13 Management Structure of Eco-Town in Future

Table 5-20 Required Staff for Intermediate Treatment (Eco-town) Section

Position	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	
【Project Schedule】																
• Planning (Feasibility Study) Stage	←→															
• Basic Design (Preparation of Tender etc.)			←→													
• Construction Stage				←→												
• Operation Stage								←→								
【Required Staff】																
• WMD Superintendent Engineer	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
• Executive Engineer (Civil/Architect)			1	1	1	1	1	1	1	1	1	1	1	1	1	
• Executive Engineer (Mechanical)			1	1	1	1	1	1	1	1	1	1	1	1	1	
• Executive Engineer (Electrical)			1	1	1	1	1	1	1	1	1	1	1	1	1	
• Assistant Engineer (Civil/Architect)			1	1	1	1	1	1	1	1	1	1	1	1	1	
• Assistant Engineer (Mechanical)			1	1	1	1	1	1	1	1	1	1	1	1	1	
• Assistant Engineer (Electrical)			1	1	1	1	1	1	1	1	1	1	1	1	1	
• Assistant Engineer (Contract)			1	1	1	1	1	1	1	1	1	1	1	1	1	
• Sub-Assistant Engineer (Civil/Architect)					1	1	1	1	1	1	1	1	1	1	1	
• Sub-Assistant Engineer (Mechanical)					1	1	1	1	1	1	1	1	1	1	1	
• Sub-Assistant Engineer (Electrical)					1	1	1	1	1	1	1	1	1	1	1	
• Financial Officer			1	1	1	1	1	1	1	1	1	1	1	1	1	
• Computer Operator			1	1	2	2	2	2	2	2	2	2	2	2	2	
• Office Assistant			1	1	1	1	1	1	1	1	1	1	1	1	1	
• MLSS			1	1	1	1	1	1	1	1	1	1	1	1	1	

Source: JICA Project Team

(2) Capacity Development for Intermediate Treatment (Eco-Town) Section

At the feasibility study, basic design and construction stage, the capacity development of O&M organization will be implemented by collaborating with a consultant. At the operation stage, DSCC should closely cooperate with the company which will operate Eco-Town facilities.

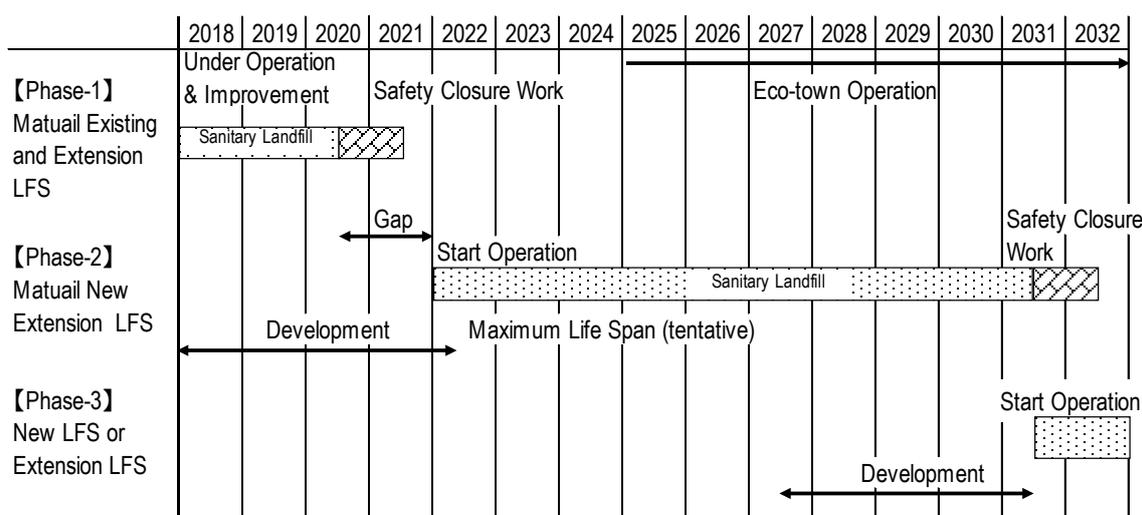
5.8 Sanitary Landfill (Component 7)

5.8.1 Landfill Development Plan Overview

In order to fulfill the DSCC’s urgent needs for waste disposal, the landfill development is planned in this Master Plan. The development plan consists of three phases listed below, considering the Eco-Town development and commencement

- ✓ Phase-1: Improvement of Matuail existing and extension LFS
- ✓ Phase-2: Construction of Matuail new extension LFS
- ✓ Phase-3: Construction of new LFS

In Phase-1, improvement and safety LFS closure of Matuail existing and extension LFS will be implemented. In Phase-2, Matuail new extension LFS will be prepared and operated. New LFS plan needs to be developed as Phase-3 while landfilling is ongoing in Phase-2. The schedule of the development is proposed as shown in Fig. 5-14. In each Phase, land acquisition and necessary legal requirements including ECC approval have to be properly proceeded in a timely and appropriate manner.



Source: JICA Project Team

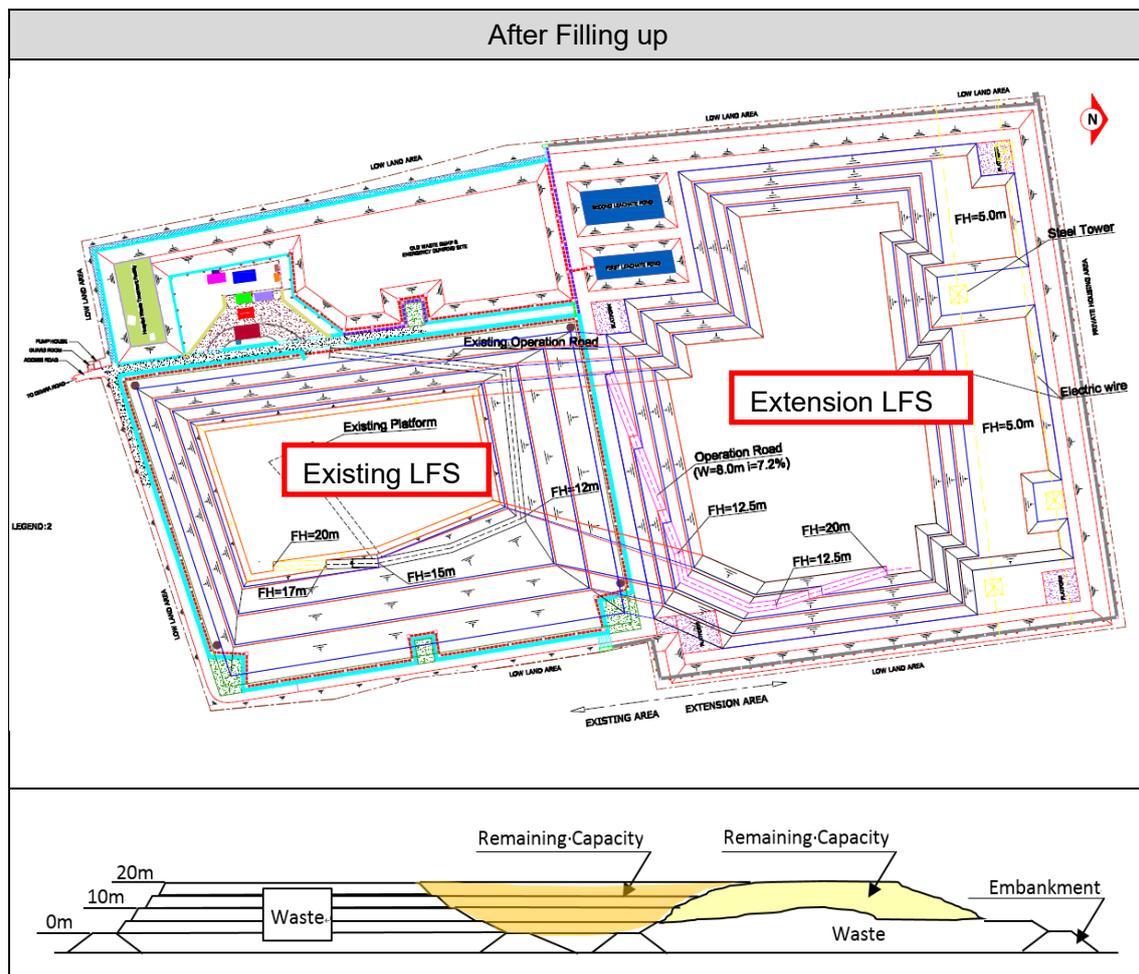
Fig. 5-14 Proposed Future Landfill Development Schedule

5.8.2 Improve Matuail LFS [C7-O1]

(1) Site Layout

As previously mentioned, the Matuail existing and extension LFS is expected to be full by August 2020, whereas construction of Matuail new extension LFS will fully be completed at the end of 2021. Therefore utilization of the area between the Matuail existing and extension LFS, currently being used as operation road, is proposed as shown in Fig. 5-15. The Phase-1 activity extends the lifespan of the existing and extension Matuail LFS so as to minimize the 16-month gap.

The remaining capacity after the rehabilitation will be extended to February 2021. Even if this improvement is completed, it would still be insufficient for securing the required amount of dumping area to fulfill the gap; thus, the new extension area in Phase-2 should be partially operational in advance with the minimum construction of embankment.



Source: JICA Project Team

Fig. 5-15 Proposed Layout Plan for Waste Disposal

(2) Leachate Treatment

Leachate treatment by using physical and chemical methods will be introduced in Matuail LFS. The schematic flow diagram of leachate treatment is shown in Fig. 5-16. Raw leachate is released into an anaerobic pond (Pond 1), and the treated leachate is transferred through pumps to a chemical mixing tank. At that point, some chemicals such as polymers, ferrous sulfate, and lime are added with purified water. Afterward, the leachate is transferred to a primary clarifier to remove the sludge. The leachate is then transferred to a secondary aerobic unit (Pond 2) that uses 24 h aeration to keep the aerobic bacteria alive. The leachate is again transferred to a secondary clarifier, and the treated leachate is discharged to a sump to discharge into ambient water.

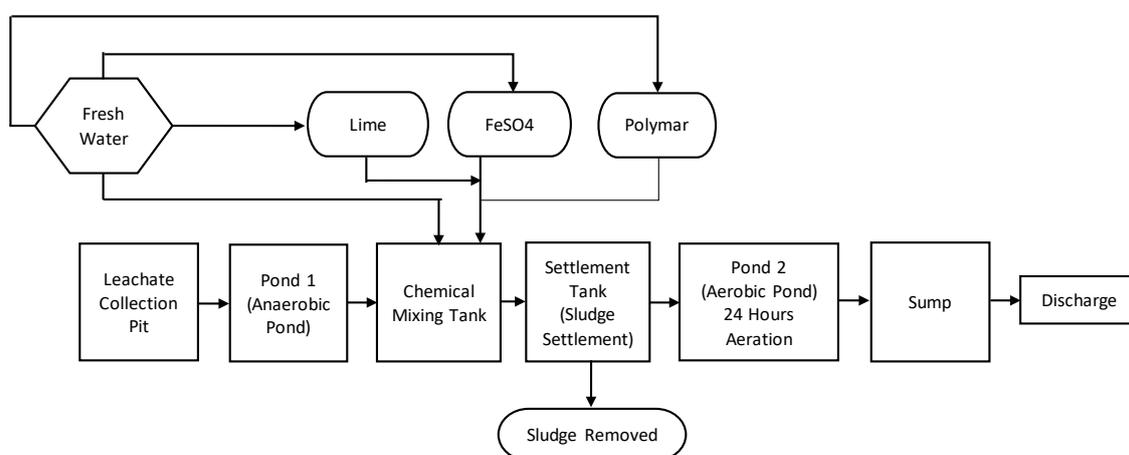


Fig. 5-16 Schematic Flow Diagram of Leachate Treatment in Matuail LFS

(3) Other Activities for the Improvement

Other operation and construction works for the improvement of the existing LFS are shown below.

- Operation work
 - Proper disposal and containment of waste
 - Final soil covering at the top of waste surface
 - Compaction of a waste layer, and levelling and grading
- Construction and rehabilitation work
 - Repair of the periphery embankment with access road
 - Installation of rainwater drainage and gas ventilation pipes
 - Preparation of dumping platforms and operation roads

5.8.3 Conduct Safety Closure at Matuail LFS [C7-O2]

After completion of waste disposal in the existing and extension LFS, safety closure of the LFS should be properly implemented in a timely manner. The DSCC will prepare a safety closure plan of the Matuail LFS for closure activities, including installation of gas vent pipe and rainwater drainage ditch, 50 cm-thick soil cover on the slope and the top of the dumping site surface, and stabilization of the landfill side slope with 1:2 (H:V). In addition, planting trees on the top and lawn on the slopes is recommended for environmentally and socially friendly landscape. The closed landfill site can be renovated to post-closure use such as a parking lot and a park. The DSCC will prepare a DPP to acquire the necessary cost of the landfill closure plan implementation to be borne by GoB.

5.8.4 Establish Management Section in WMD for Matuail LFS [C7-O3]

(1) Landfill Management Unit

The proposed assignment plan of Matuail LFS is shown in Table 5-23. Assistant Engineer (AE) of leachate treatment is proposed as a new position.

The total number of staff members proposed by DSCC in 2018 is 43 until 2032. Currently, 37 out of 43 staff members, consists of 16 permanent and 21 temporary members, are employed. Although the proposed number is not fully assigned, O&M is implemented properly because some of them who have been trained in the previous JICA technical cooperation project are still working there. Operators of heavy equipment were dispatched from TD in the past; however, currently the WMD recruited some of them, and the WMD is reinforcing the organization steadily. If increasing or decreasing the number of staff members is necessary in the future, DSCC should flexibly change the staff number depending on the situation.

Table 5-21 Proposed Deployment Plan of Staff

Position / Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Matuail Existing and Extension LFS															
Operation	←														
Matusil New Extension LFS															
Design & Construction	←														
Operation					←										
New LFS															
Design & Construction							←								
Construction											←				
Total	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43
Office of Executive Engineer	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Matuail LFS	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39

(2) Replacement of Heavy Equipment

The estimated replacement years of the operational heavy equipment in Matuail LFS is shown in Table 5-24. 3 bulldozers have to be replaced in 2027, 1 wheel loader in 2021, 2024 and 2027, and 3 excavators to be replaced; 2 in 2020 and one in 2027.

Table 5-22 Replacement of Heavy Equipment

Year	Matuail LFS		
	Bulldozer	Wheel Loader	Excavator
Class (Average)	21 tons	4.0 m ³	3.2 m ³
Total Number	3	3	4
Year of Replacement	2027: 3 Bulldozers	2021: 1 Wheel Loader 2024: 1 Wheel Loader 2027: 1 Wheel Loader	2020: 2 Excavators 2027: 1 Excavator

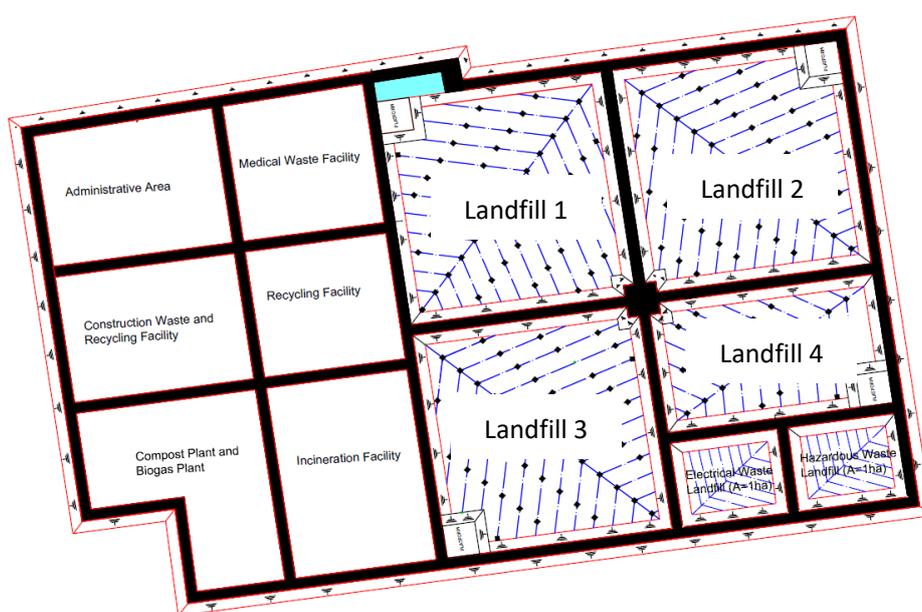
Source: JICA Project Team

5.8.5 Develop Future LFS [C7-O3]

(1) Outline of Matuail New Extension LFS

1) Layout Plan and Outline

DSCC has already obtained approval of the DPP from LGD so as to develop Matuail new extension LFS. The layout plan of the Matuail new extension LFS is shown in Fig. 5-17, and the outline of the extension LFS is summarized in Table 5-25. At the extension LFS, the semi-aerobic method will be introduced, and municipal waste in DSCC will be received. The extension LFS composed of embankment, liner, leachate collection pipe, gas vent pipes, access road, operation road and dumping platform.



Source: JICA Project Team

Fig. 5-17 Layout Plan of Matuail New Extension LFS

Table 5-23 Outline of Matuail New Extension LFS

Item	Description
Current situation	DPP has been approved by GoB, and revised DPP for additional budget of land acquisition is under process for approval (as of July 2019)
Type of receiving waste	Municipal waste
Target receiving area	Entire DSCC area including new 18 wards
Operating hours	From 10:00 p.m. to 6:00 a.m. local time
Area	33 ha (New landfill area:20 ha, Intermediate treatment (Eco-town) area:13 ha)
Landfill system	Semi-aerobic method
Main facilities	Embankment, liner, leachate collection pipe, gas vent pipes, access road, operation road, dumping platform

2) Waste Disposal Plan

The Matuail new extension LFS includes four landfill cells. At first, each cell will be filled up to the top of embankment, then continuously filled up to a height of 20 m. Finally, it is proposed to use the area between the existing, extension and new extension LFSs for lifespan extension. Total capacity for waste disposal will be 4,062,334 m³, which make the landfilling last until May 2031.

3) Acquisition of the land by facilitating the necessary legal procedures

The necessary legal procedures of land acquisition have been completed. However, DSCC needed to prepare another DPP for extra budget owing to the land acquisition cost increment. The new DPP has been submitted to the ECNEC in November 2018, and currently DSCC is waiting for the approval.

4) Obtaining ECC

DSCC decided to request BUET to obtain ECC after completion of land acquisition.

(2) Securing New Landfill Site

Because the Matuail new extension LFS is expected to be closed in the middle of 2031, it will be necessary to construct a new LFS. The estimated lifespan and required area for a new LFS is shown in Table 5-26. According to the table, planning of the new LFS should be completed before June 2027 to begin its development on schedule.

Table 5-24 Estimated Life Span and Required Area for New Landfill Site

Lifespan (year)	No. of LFS	Required Area
5	1	40 ha

	2	25 ha
7	1	60 ha
	2	40 ha
10	1	100 ha
	2	60 ha

5.8.6 Estimated Final Disposal Amount

The estimated annual final disposal amount until 2032 is shown in Fig. 5-18. The amount of waste will increase until 2022 owing to population growth. After the installation of an incineration plant in 2023, the amount of waste for final disposal will decrease to about half.

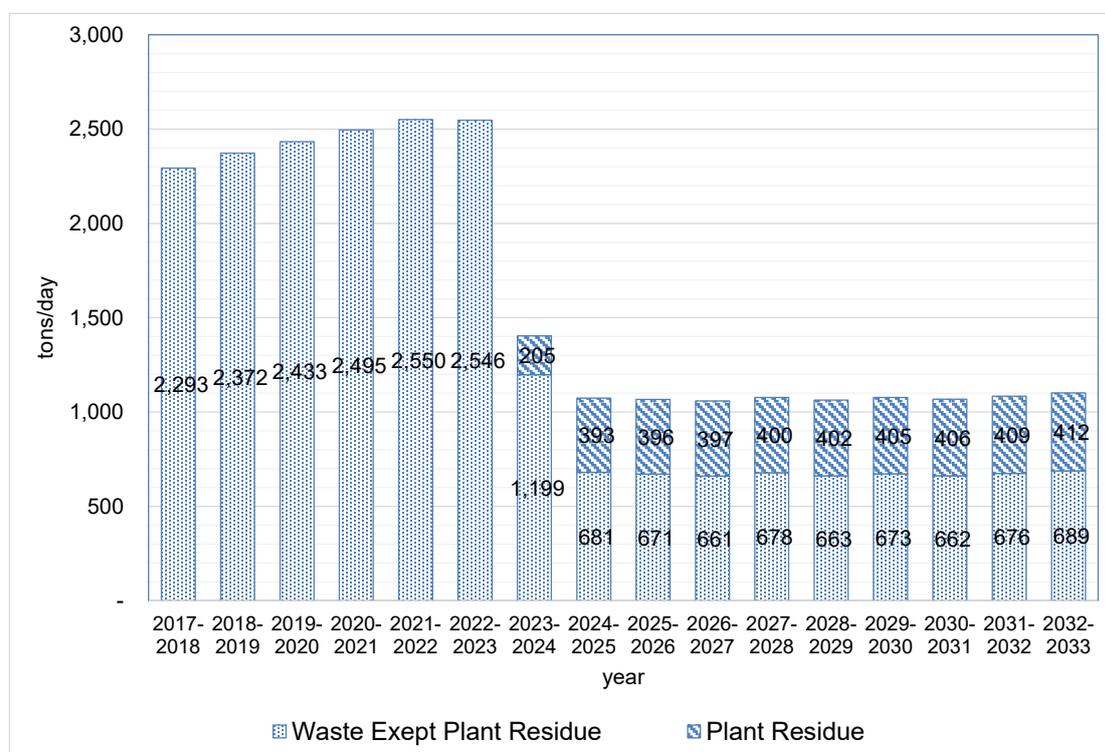


Fig. 5-18 Transition of Estimated Final Disposal Amount

5.8.7 Budget Plan for Landfill Development, Operation and Maintenance

The budget plan for landfill development, operation and maintenance is shown in Table 5-27. The staff salary is estimated on the basis of the abovementioned staff deployment plan. Fuel cost is estimated based on the actual cost in 2017 and the increasing rate of the final disposal amount. Electricity is estimated according to the actual cost in 2017 multiplied by the number of the LFSs. Other costs are estimated according to the actual unit cost in the past based on the estimated final disposal amount. Proposed budget is about Tk. 13,588 million in total, expecting to be prepared by the GoB and international donors. Operation maintenance budget is about Tk. 1,220 million in total, borne by

DSCC. In 2031, when the new extension Matuail LFS is nearly full, the DSCC should start another new landfill site preparation; thus, the cost of the new LFS development is expected from 2030.

Table 5-25 Budget Plan of Landfill Development, Operation and Maintenance

DSCC	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Total	
Priority Project	←→																	
Existing and Extension Matuail LFS																		
Operation	←→																	
New Extension Matuail LFS																		
Design & Construction	←→																	
Operation						←→												
New LFS																		
Design & Construction												←→						
Operation																←→		
DNCC Own Revenues	69	81	105	70	69	72	70	71	82	69	105	69	84	80	69	54	1,220	
Grant from central government / international donors	378	6,572	0	150	146	0	0	0	0	0	0	6,198	0	0	0	146	13,588	

Source: JICA Project Team analyzed the approved DPP of DSCC

5.9 Rules and Regulations (Component 8)

5.9.1 Conduct Daily Solid Waste Management Work in Compliance with Administrative Procedure Book [C8-O1]

The SWM Administrative Procedure Book, or the Admin Book, describes the formal steps and the authority of the administrative procedures. Moreover, it helps to provide a mutual understanding between the drafter and approvers of the proposal, such as the CI, CO, EE, and CWMO.

Training sessions and workshops for DSCC staff and related stakeholders are required to disseminate the process written in the Admin Book. The Admin Book will be revised regularly in accordance with the revision of laws and orders and with practical experiences. A review committee for the development of the Admin Book will be established to include the CWMO, sub-group leaders of the WBA Core Group, legal staff, and financial staff.

5.9.2 Enact Waste Management related Orders and Waste Management Department Directives [C8-O2]

Office orders are one of effective tools to stimulate the WMD's work. The WMD should issue them in a timely manner in order to avoid delaying important waste management activities.

The existing WMD directives, approved in 2012, states the framework of WMD's activities for the following five years. The updated version of the directives should be in place for maintaining the consistency of the current activities, based on this Master Plan. It is essential that the draft of new WMD directives be discussed thoroughly and endorsed by the SWMSC, and then officially approved by the mayor. SWMSC, which was originally planned as part of the previous JICA project in 2011, basically aims to monitor the overall WMD activities and to offer advice for waste management improvement. The SWMSC is responsible for discussing not only WMD directives but also other

WMD's rules and regulations, and the institutional system. The committee consists of representatives from DSCC management officials, ward councilors, experts from academia, NGOs, and other related organizations, and communities, and holds meetings regularly. The PAPS takes a liaison role for committee activities and prepares the meeting minutes for public disclosure.

5.10 Organizational Capacity (Component 9)

5.10.3 Strengthen Planning, Coordination, Monitoring and Evaluation Capacity of DSCC [C9-O1]

(1) Organizational Reform of Waste Management Department

In addition to the Engineering Division and the Waste Collection Division in the WMD, establishment of the Management Division is newly proposed in this Master Plan to enhance the planning, coordination, monitoring, and evaluation capacity of the department. Fig. 5-19 describes the new organizational structure of the WMD. Most of the sections are to be newly established.

The Management Division includes four sections as described below.

- **Planning and Strategy Section:** This section is responsible for SWM planning, business operation and improvement, short-term business policy, data collection and management, coordination with other departments, business administration, internal audit, research and technological development, and emergency response.
- **Rules and Regulation Section:** This section works for regulatory related issues such as WMD directives development and revision, the admin book development and revision, office order issuance and management, and other document management.
- **Personnel Management Section:** This section is responsible for staff allocation planning, capacity building of WMD staff and training, labor management and welfare, and occupational safety.
- **Public Awareness Planning Section:** This section is responsible for public awareness solely in waste management to plan and implement DSCC's awareness raising activities. The detail of the section is referred as to Section 5.2.1.

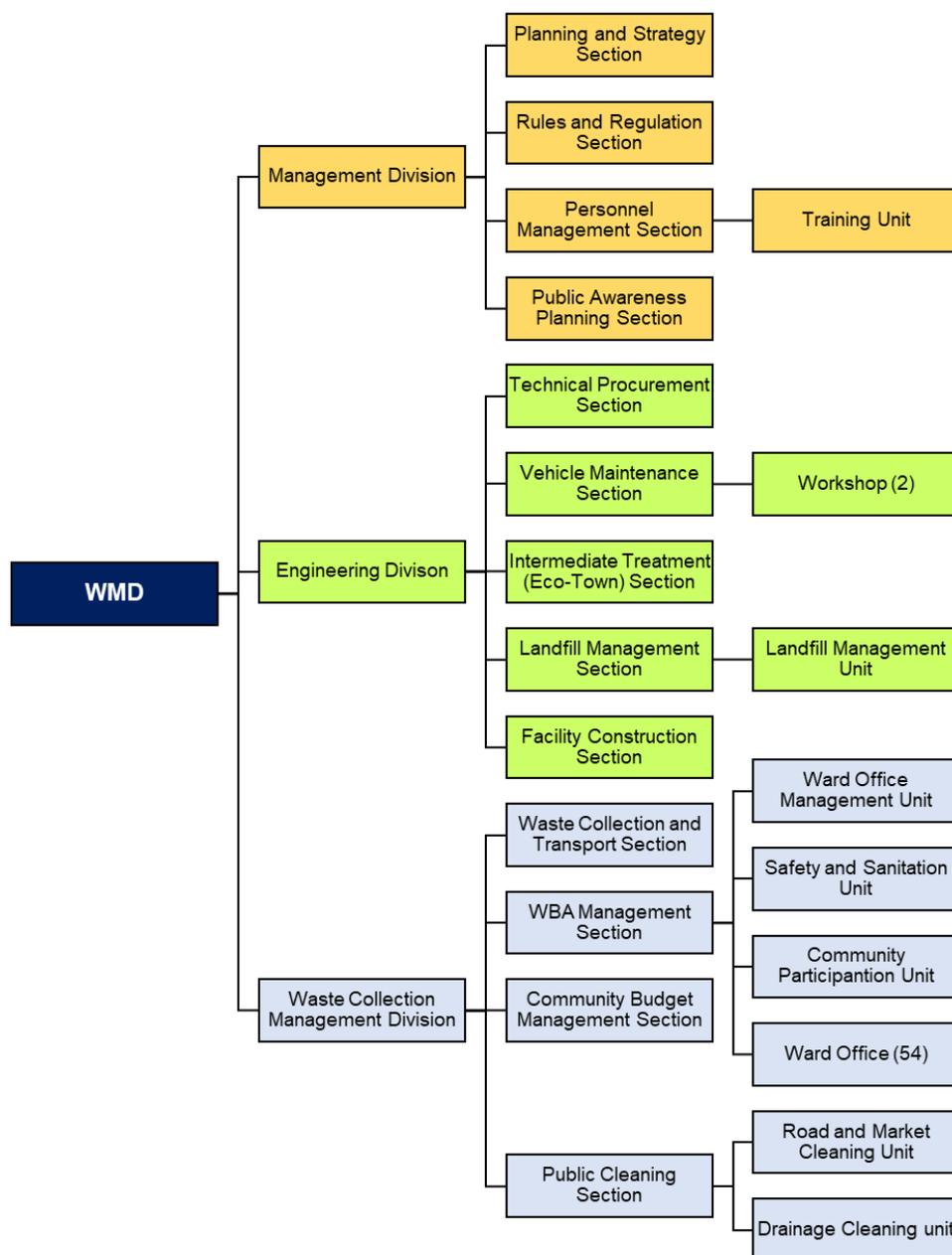


Fig. 5-19 Proposed Organization Structure of WMD

(2) Capacity Development Program

1) Capacity Development of Management Personnel

Capacity development of the WMD staff, especially management personnel, is inevitable to reinforce the organization and human resources management for providing continuous service to citizen.

Job descriptions and the roles and responsibilities of each position as well as the command chains in the WMD need to be clarified to establish a smooth and dependable SWM system from top management to the field level and vice versa. This will enhance the institutional resilience of the WMD in response to the rapid economic growth and social changes. Temporary exchange of staff among management personnel and field officers may be considered for mutual understanding of their works in a practical manner.

2) Occupational Safety and Sanitation Management (WBA 2)

Risk for occupational accidents and disease must be avoided. For improvement of the cleaner's working environment, three objectives are implemented in WBA 2 to raise awareness on safety and sanitation: i) to provide safety gear, ii) to formulate the "Safety and Sanitation Committee (SSC)," and iii) to introduce the "Cleaner's working manual."

For further improvement, it is necessary to develop rules and regulations on occupational safety such as safety regulations and accident compensation.

3) Staff Training Course

Staff training depending on their positions in the WMD is very important to strengthen individual and institutional capacities. The training unit of the Personnel Management Section provides SWM training courses regularly for the staff. An example of the training course for management personnel is shown below. In addition to such a program, technical training courses for technical personnel are provided.

[Example of Staff Training Course]

- | | |
|---------------------------|--------------------------|
| ● Labor management | ● Strategy development |
| ● Organization management | ● Risk management |
| ● Time management | ● Leadership |
| ● Presentation skill | ● Personnel management |
| ● Logical thinking | ● Personnel evaluation |
| ● Budget management | ● Information disclosure |
| ● Policy making | ● Basic theory of SWM |

4) Collaboration with Educational and Research Institution

SWM is an emerging field for research and development in public administration, universities, and companies for new technology and its implementation. DSCC therefore promotes collaboration with universities and companies to strengthen the SWM field in terms of waste management sustainability.

5.10.4 Cover Collection and Transport Work, Cooperation Vehicle Operation and Landfill Operation Work Exclusively in WMD [C9-O2]

(1) Engineering Division

The Engineering Division is expected to lead the installation of modern technology, including development of the intermediate treatment in Eco-Town. The division includes five sections as described below.

- **Technical Procurement Section:** This section is responsible for procurement of collection-related equipment, heavy vehicles for landfill management, spare parts, maintenance tools, and expendables, and for purchase processing, record keeping, and efficient purchase planning.
- **Vehicle Maintenance Section:** The section is originally in the ED and expected to be transferred to the WMD. Once transferred and unified to the WMD, this section should be more systematic and strategic for vehicle maintenance. The section is responsible for maintenance-related works not only implementation of vehicle maintenance, but also budget planning, regulation compliance, occupational safety, staff trainings, policy making, development of a maintenance plan, internal restructuring, and staff allocation and management.
- **Intermediate Treatment (Eco-Town) Section:** This section is established for intermediate treatment including WtE plants and Eco-Towns, responsible for their planning and construction, operation and maintenance, data collection and management, legal processing, staff allocation, and securing budget.
- **Landfill Management Section:** This section is responsible for landfill planning and construction, operation and maintenance, data collection and management, legal processing and coordination, staff allocation, and securing budget.
- **Facility Construction Section:** This section works for facility planning, development and management such as ward offices, workshops, parking lots, and facility management. Facilities such as landfill sites, and Eco-Towns are out of its responsibility but for the Intermediate Treatment Section and the Landfill Management Section, as mentioned above. The section is also responsible for data collection and management, legal processing and coordination, staff allocation, and securing budget.

(2) Waste Collection Management Division

The Waste Collection Management Division is proposed to unify conservancy (cleaning) services and waste collection in a consolidated manner. All waste collection vehicles have to be managed by the WMD, which is the critical point to realize the organizational reform as proposed. The Waste Collection Management Division includes four sections as described below.

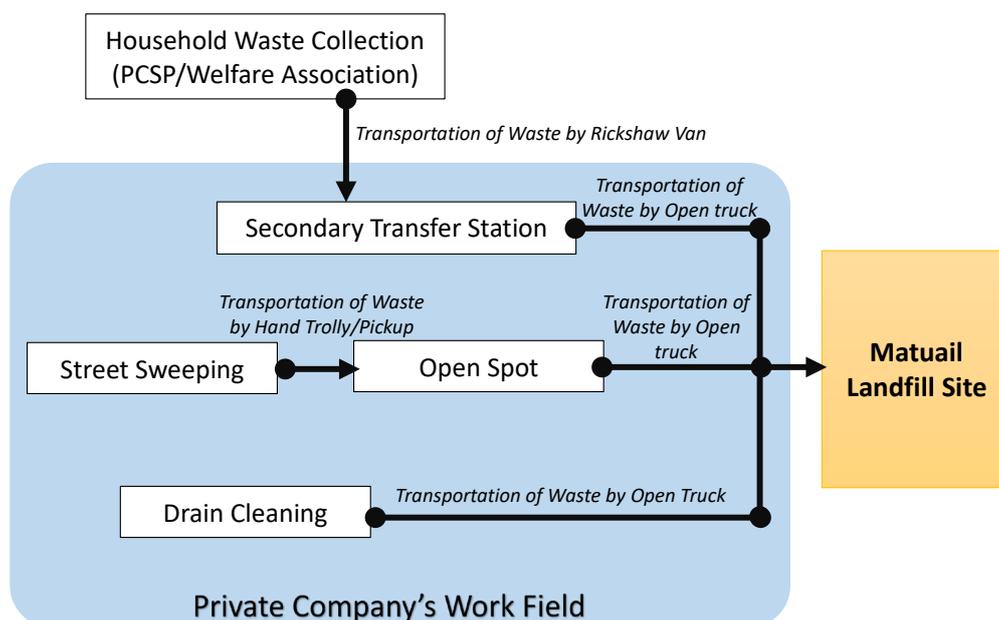
- Waste Collection and Transport Section: The section is responsible for waste collection planning, data collection and management, and effective collection system development, execution of waste collection, legal processing and coordination, staff allocation, and securing budget.
- WBA Management Section: The section is responsible for WBA planning and implementation, data collection at ward level, WBA maintenance, ward office administrations, coordination with WBA related stakeholders, CI allocation, securing budget, and field level implementation of the admin book.
- Community Budget Management Section: The section works for community budget allocation for WBAs to ward offices, and management of the budget.
- Public Cleaning Section: The section is responsible for management planning on road, drainage cleaning, and market wastes, staff allocation, securing budget, and cleaning tool procurement planning.

(3) Privatization

Privatization of a certain field of SWM is effective, although proper management of the contract and supervision of the daily operation of the private waste management company are essential. Examples of the potential role of privatization are given below.

- (i) Collection of household waste from the STS
- (ii) Street cleaning of the designated ward area
- (iii) Transport of street waste to the open spots by hand trolley/pickup van
- (iv) Transport of waste at STSs and open spots to Matuail LFS
- (v) Transport of drain cleaning waste to Matuail LFS
- (vi) Management of Matuail LFS

A potential working field of privatization is shown in Fig. 5-20.



Source: JICA Project Team

Fig. 5-20 Potential Field of Privatization

5.11 Financial Management (Component 10)

5.11.1 Reform SWM Accounting System for Budgeting and Cost Control [C10-O1]

(1) Accounting System Modification and Annual Budget Report

In the current accounting system, the actual SWM cost is not managed by category, and the validity of the cost cannot be assessed. Such accounting system should be modified to explicitly exhibit the actual SWM cost, and DSCC should prepare an annual budget report to secure accountability to citizens as a public service and to enlighten the validity and issues of the expenditure, while considering the budget of the following year.

(2) Financial Assessment

Financial assessment should be introduced with two objectives: i) to secure the accountability to citizens and ii) to enhance the accuracy of the WMD's budget request. Standard values for the budget planning need to be set, which enable the WMD to assess the validity of the draft budget plan. Examples of the standard value are show in Table 5-28.

Table 5-26 Examples of the Standard Values for Financial Assessment

Item	Standard value
Road working distance per cleaner	0.3 km/person/day
Drainage cleaning distance per cleaner	0.2 km/person/day
Waste collected daily per cleaner	2.0 tons/person/day
Fuel consumption by compactor per ton of waste	2.0 L/ton
Fuel consumption by container carrier per ton of waste	2.5 L/ton

Source: Project Completion Report of "Project for Strengthening of Solid Waste Management in Dhaka City (Extension) (2013)"

5.11.2 Enhance Financial Capacity for Master Plan Implementation [C10-O2]

(1) Reassessment of Conservancy Tax

DSCC collects holding tax including four types of taxes from citizens: i) building and land tax, ii) water tax, iii) lighting tax, and iv) conservancy tax. Holding tax is calculated by multiplying the holding tax rate per square foot, which is officially set in each ward, and the house or flat size. The housing or flat value is assessed annually by the Revenue Department and is based on the valuation, to determine the amount of tax payment.

The waste treatment cost is allocated from the conservancy tax. However, the four abovementioned taxes are not managed separately, and it is unclear how much in fact is collected as conservancy tax. Currently, conservancy tax is collected only for 2% of the housing or flat value, although it can be increased up to 7% in line with the tax regulation¹¹. In case of large-scale investment by the GoB in SWM infrastructure such as a WtE facility, the operation cost of such infrastructure should be borne essentially by citizens, and the "polluter pay" principle should apply to the conservancy tax. Increase of the conservancy tax rate should be carefully considered in the long term.

(2) Financial Allocation for the Master Plan Implementation

DSCC will prepare a long-term financial plan to realize this Master Plan. For large-scale investment mentioned in this document such as Eco-Town construction, subsidies from the national government and foreign donors may be considered, depending on the development characteristics. However, the operation cost of the WMD facilities and regular public cleaning services should be covered thoroughly by DSCC with the conservancy tax income. The required capital and operation costs are discussed further in Chapter 6.

¹¹ "City Corporation Ideal Tax Schedule-2015" defines that the conservancy tax rate is up to 7%.

5.12 Medical Waste Treatment

5.12.1 Establishment of Proper Organizational Structure

Medical waste management is basically a responsibility of DSCC, and PRISM is partially covering this area at present under the contract. The current privatized system may be sustained under the proper supervision of the DSCC because it is autonomously operated up to today. The Medical Waste Management Committee is the decision making stakeholders for medical waste in DSCC so that proper reporting, analysis of the issues and providing countermeasures needs to be determined in this committee as well as implementation of an audit system for medical waste treatment operated by private companies or NGOs, with regular inspection to make sure their operation.

5.12.2 Improvement of Existing Medical Waste Treatment

(1) Estimated Amount of Waste

Table 5-29 shows the estimated daily amount of medical waste from 2018 to 2032, which is expected to increase 12.56%¹² per year.

Table 5-27 Estimated Daily Amount of Medical Waste

Year	Infectious (kg)	Sharps (kg)	Recyclables (kg)	Total (kg)
2018	2,388	509	351	3,248
2019	2,688	573	395	3,656
2020	3,026	645	445	4,116
2021	3,406	726	501	4,633
2022	3,833	817	564	5,214
2023	4,315	920	635	5,869
2024	4,857	1,036	714	6,606
2025	5,467	1,166	804	7,436
2026	6,153	1,312	905	8,370
2027	6,926	1,477	1,019	9,421
2028	7,795	1,662	1,146	10,605
2029	8,775	1,871	1,290	11,937
2030	9,877	2,106	1,453	13,436
2031	11,118	2,371	1,635	15,123
2032	12,514	2,668	1,840	17,023

Source: JICA Project Team

¹² Growth rate is set based on the average growth rate of medical waste amount generated from 2013 to 2018 and the draft of “Medical Waste Management Policy” issued by the Ministry of Health and Family Welfare in 2016.

(2) Waste Treatment Method

1) Waste Discharge

Waste segregation by using different bins has been already introduced. When the number of target HCEs increase, same methodology can be applied.

2) Waste Collection and Transport

Current waste collection covers 450 HCEs in DNCC and 350 in DSCC. Both wastes are transported to Matuail LFS for its treatment. To collect waste efficiently, separation of the waste collection system in DNCC and DSCC needs to be considered.

3) Intermediate Treatment

Infectious waste has to be autoclaved (having the moisture content more than 33%) and incinerated (moisture less than 33%). It is assumed, based on the existing proportion of waste composition and treatment options, that 65% of infectious waste will be incinerated, 30% will be autoclaved and 5% will be buried. Renewal of the intermediate treatment facility in Matuail LFS is desirable. As one of intermediate treatment facilities in Matuail Eco-Town, a new plant can be constructed in the area of Matuail extension area. Table 5-30 shows the estimated amount of infectious and sharp waste and necessary capacity of treatment facility. When 80% of all infectious waste is incinerated, which is the same as the current state and capacity of incinerator when set as 3,000 kg/day, one to five incinerators will be needed.

Table 5-28 Estimated Infectious, Sharp Waste Generation and Required Treatment Facility

Year	Annual Incineration (Infectious, Sharp)	Incinerator (Operation : 240days*, 24 hours) (Capacity of Unit : 3,000kg/day/unit)	
		Required Capacity	Required Incinerator
	ton	kg/day	Unit
2018	1,057	2,291	1
2019	1,190	2,579	1
2020	1,340	2,903	1
2021	1,508	3,268	2
2022	1,697	3,677	2
2023	1,911	4,140	2
2024	2,151	4,660	2
2025	2,421	5,246	2
2026	2,725	5,904	2
2027	3,067	6,645	3
2028	3,452	7,479	3
2029	3,886	8,419	3
2030	4,374	9,477	4
2031	4,923	10,668	4
2032	5,541	12,006	5

*Except holidays

Source: JICA Project Team

4) Final Disposal and Recycling

A final disposal pit can be allocated within the area of Matuail LFS. Shredded and incinerated waste can be disposed of at the LFS in the same manner as other general waste. Recycling may also be performed easily in the Eco-Town with other recycling companies.

(3) Cost of Construction, Operation and Maintenance

The budget for five incinerator by 2032 is estimated to be Tk. 960 million. The O&M cost for future medical waste management is estimated in Table 5-31. Apart from the cost of incinerator, a budget increase up to the doubled, that is around 0.96 million BDT/day is required in DNCC in 2032. Tariff will need to be reviewed if PRISM looks after its operation by the time.

Table 5-29 Annual Cost Estimation for Medical Waste Treatment

Year	Amount of Waste for Incineration kg/day	Incinerator (million BDT)			Other cost (million BDT)	Total (million BDT)
		Purchase	Operation	Maintenance		
2018	2,291	192	33	8	19	252
2019	2,579		33	8	21	62
2020	2,903		33	8	24	65
2021	3,268	192	66	15	27	300
2022	3,677		66	15	30	111
2023	4,140		66	15	34	115
2024	4,660		66	15	38	119
2025	5,246		66	15	43	124
2026	5,904		66	15	49	130
2027	6,645	192	99	23	55	369
2028	7,479		99	23	62	184
2029	8,419		99	23	69	191
2030	9,477	192	132	30	78	432
2031	10,668		132	30	88	250
2032	12,006	192	165	38	99	494

Source: JICA Project Team

5.12.3 Improvement of Segregation and Enhancement of Facilities

As mentioned earlier, medical waste segregation is implemented only six categories out of 11. For the liquid waste, an effluent treatment plant needs to be installed in large hospitals or established as a centralized facility. Proper waste water tankers and storage tanks in the hospital need to be equipped when the centralized facility is established. Size of facilities and equipment needs to be determined after the survey of liquid waste generation. Required facilities differs according to the type of liquid such as infectious, examination and dialysis.

Bangladesh Radioactive Energy Commission needs to instruct HCEs for proper segregation and storage of radioactive waste. Specialized containers, storages and trucks need to be provided as well as proper disposal site.

Solid pharmaceutical, chemical, anatomical and pathological waste can be collected together with the infectious waste when proper incinerators are installed and no further segregation after collection is desirable to avoid hazards in operation. Liquid pharmaceutical and chemical waste need specialized treatment plant separately from the liquid waste and separate collection is required.

Most of the facilities for medical waste are highly specialized. Hence, it is desirable to be privatized for each category of waste after proper survey and cost estimation. Capital investment of facilities is potentially high, thus the public-build-private-operate scheme together with financing by international donors can be considered. Overall plan needs be discussed in key stakeholders, such as the Medical Waste Management Committee of DSCC.

CHAPTER 6 FINANCIAL REQUIREMENTS

6.1 Total Budget

The required total budget to achieve the goal of the Master Plan is estimated at Tk. 82,600 million for 15 years, including Tk. 38,800 million for the capital cost and Tk. 43,800 million for the operating and managing cost, as shown in Table 6-1. This budget considers all intermediate treatment facilities (Eco-Town), described in the previous Chapter, to be constructed and operated by the DSCC. This Chapter discusses on financial requirements in this case.

Table 6-1 Capital Cost and Operating & Management cost (from FY2018 to FY2032)

Unit: million BDT

Cost and Financial Sources	Budget
Capital Cost (Intermediate treatment (Eco-town), collection vehicle and equipment etc.)	38,800
DSCC (50 %)	19,400
Foreign Donor (40 %)	15,500
Private Sector (10 %)	3,900
Operating and Managing Cost (15 years)	43,800
DSCC (70 %)	30,700
Foreign Donor (0 %)	0
Private Sector (30 %)	13,100
Total Budget (15 years)	82,600

Source: JICA Project Team analysis based on “DSCC Budget Book 2017–2018” and information from DSCC

6.2 Financing Plan

6.2.1 Securing Capital and O&M Cost

In order to secure capital and O&M cost for the next 15 years, three measures are considered: i) use of excess electricity generated in WtE facility, ii) increment of conservancy tax, and iii) fee collection from the large scale waste dischargers.

(1) Sale of Excess Electricity

Electricity generated at the WtE facility will be used as a power source for its equipment, and the surplus electricity will be supplied to the adjacent facilities in the Eco-Towns and the landfill sites, and neighboring lighting. The annual income of the DSCC from such electricity sales is expected to approximately Tk. 550 million or 4.4 million USD in total, based on the calculation below.

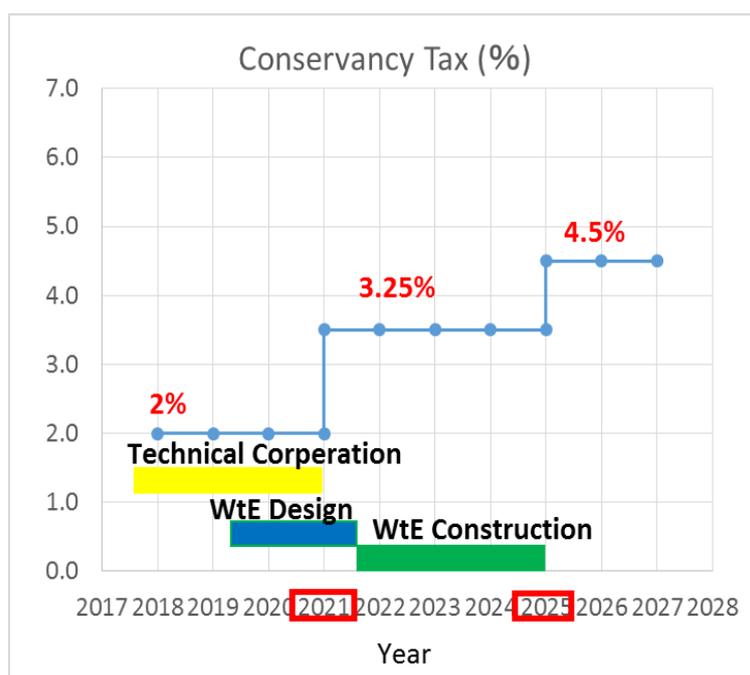
Sales of electricity (USD/year)

$$\begin{aligned} &= \text{Surplus electricity (kW)} \times 24 \text{ (hrs)} \\ &\quad \times \text{Days of operation (days/year)} \\ &\quad \times \text{Unit price (¢/kWh)} \\ &\quad \times \text{Number of WtE facilities} \\ &= 2,500 \text{ (kW)} \times 24 \text{ (hrs)} \times 280 \text{ (days/year)} \times 13 \text{ (¢/kWh)}^* \times 2 \text{ (facilities)} \\ &= \text{Approximately 4.4 million (USD/year)} \end{aligned}$$

** Highest purchase price for renewable energy, based on the interview for SREDA.*

(2) Conservancy Tax Raise

The conservancy tax rate can be legally defined from 2% to 7%. Currently, DSCC has adopted 2%, the lowest tax rate. The conservancy tax will be raised from the current 2% to 4.5%, and the raised portion will be used for O&M for the intermediate treatment facilities in the Eco-Town. As shown in Fig. 6-1, the plan is to raise the rate in two steps: the first step to 3.25% at the design stage of the WtE facilities, and the second step to 4.5% by the time of the construction completion. The tax collection, estimated at approximately Tk. 550 million or 6.6 million USD per year with the rate of 2% in 2018, will be increased to Tk. 1,920 million or 23 million USD per year with the rate of 4.5% in 2025, taking into consideration the population increase. The DSCC will thus far secure additional Tk. 1,070 million or 13.4 million USD per year.



Source: JICA Project Team based on Ideal Tax Schedule 2015

Fig. 6-1 Timing of Conservancy Tax Increment

(3) Fee Collection from Large Volume Waste Dischargers

Waste disposal fees will be collected from large volume waste dischargers such as markets, hotels, restaurants, in order to be used for O&M expenses of the WtE facilities. As shown in Table 6-2, the number of the large dischargers in 2017 was 1,030. If the fee is collected with an average of 2,000 USD/year per discharger, it will be approximately Tk. 190 million or 2.26 million USD/year.

Table 6-2 Fee Collection Plan for Large Volume Waste Dischargers

Discharger	Number	Fee per discharger (USD /year)	Total (million USD/year)
Market	260	2,000	0.52
Hotel and Restaurant	870	2,000	1.74
Total	1030	-	2.26

Source: JICA Project Team

6.2.2 Financing Plan from FY 2018–2019 to FY 2032–2033

Detail of financial requirements and financing plan are shown in Table 6-3.

Table 6-3 Financing Plan (from FY2018 to FY2032)

Category		Budget (million BDT)		Financial Source	Outside Capital Rate
		Capital	O&M (annual)		
1. Central					
(1)	Salary (Central)	-	1,148.05	DSCC	0%
(2)	Special Program	-	42.36	DSCC	0%
2. Management Division					
(1)	Salary (Management Division)	-	-	DSCC	0%
(2)	Personnel Training	-	-	DSCC	0%
(3)	Public Relations, Public Awareness, and Public Involvement	-	-	DSCC	0%
3. Engineering Division					
(1)	Vehicle Maintenance (Workshop)	-	144.46	DSCC	0%
(2)	Intermediate Treatment (Eco-Town)	-	-	-	-
i.	Design and Construction	3,866.1	-	Foreign Donors/Central	100%
	(Depreciation Cost)	-	-	DSCC	100%
ii.	Operation and Maintenance	-	1,134.59	DSCC	0%
(3)	Landfill Management	-	-	-	-
i.	Construction Works	84.73	-	Central	100%
	ii. Operation and Maintenance	-	52.55	DSCC	0%
4. Waste Collection Management Division					
(1)	Waste Collection and Transport	-	700.8	DSCC	0%
(2)	Privatization	-	21.18	DSCC	0%
(3)	WBA Management	-	35.37	DSCC	0%
i.	Ward Office Construction in Extension Area	76.89	-	Central	100%
(4)	Cleaners Colony Management	20.3	20.3	DSCC	0%

6.2.3 Validity of Financing Plan

Annual SWM expenditure to be borne by DSCC is estimated at 5,503.5 million BDT/year, while the total income of three measures mentioned in Section 6.2.1 amounts to approx. 2,667.4 million BDT/year, which covers 48.47% of expenditure, as shown in Table 6-4.

Table 6-4 Total Income from the Measures for O&M

Measures	Income (million BDT/year)
(1) Sale of Electricity	554.4
(2) Conservancy Tax Increment (up to 4.5%)	1923
(3) Fee Collection from Large Volume Waste Dischargers	190
Total	2,667.4

CHAPTER 7 PRIORITY PROJECTS AND PROGRAMS

7.1 Priority Projects and Programs

This Master Plan is focused on 10 major components of waste management in DSCC. Of these, some projects and programs are prioritized and extracted, as shown in Table 7-1, considering the urgency of its implementation. The projects and programs will be key for opening a new era of “Zero-Waste” emission that will promote SWM to the highest level ever achieved by its own capacity.

Table 7-1 Priority Projects and Programs

Project and Program		Executing Body	Concerning Body	Time of Execution (FY)
Component 1: Public relations, Public Awareness, and Public Involvement				
(1)	Preparation of Public Awareness Planning Section establishment in WMD	WMD	PRD	2017-2021
(2)	Development of information disclosure system	WMD	PRD	2017-2021
(3)	Active involvement on information exchange meetings among all CCs	LGD	All CCs	2018-2032
(4)	Establishment of a PCG for SWM facilities	WMD	PRD, ED, TD	2018-2019
Component 2: Ward-based Approach Activities				
(1)	Improvement and expansion of WBA implementation in wards with encouraging CO/CIs	WMD	-	2017-2032
(2)	Proper community budget allocation with WBA AAP	WMD	-	2018-2032
(3)	Daily work practice in accordance with the administration procedures book	WMD	-	2018-2032
Component 3: Waste Reduction				
(1)	Preparation of waste reduction plan	WMD	DoE	2017-2021
(2)	3R activities through WBA activities	WMD	-	2017-2032
Component 4: Waste Collection and Transport				
(1)	Examination of collection and transport operation method for the expansion area	WMD	ED, TD	2017-2018
(2)	Introduction of new waste collection system including harmonization of primary collection and secondary collection system	WMD	TD	2017-2021
(3)	Unification of waste collection management	WMD	ED, TD	2017-2021
(4)	Improvement of management for maintenance workshops	WMD	MD, TD	2017-2021

Project and Program		Executing Body	Concerning Body	Time of Execution (FY)
(5)	Capacity development of workers and drivers	WMD	ED, TD	2017-2021
Component 5: Vehicle Maintenance System				
(1)	Formulation of workshop management rules	WMD	LGD, MD, TD	2018-2021
(2)	Reform of workshop and maintenance system	WMD	ED, TD	2018-2032
(3)	Introduction of preventive maintenance method	WMD	ED, TD	2018-2032
Component 6: Intermediate Treatment System (Eco-Town: WtE, composting, recycling etc.)				
(1)	Propose of Eco-town and obtain approval from related organization	WMD	LGD, ERD, DoE	2018-2019
(2)	Implementation of feasibility study for Eco-town	WMD	LGD, ERD, DoE	2019
(3)	Preparation of construction and operation cost	WMD	LGD, ERD	2020-2021
(4)	Establishment of Intermediate Treatment (Eco-Town) section in the WMD	WMD	LGD, ED	2020-2021
(5)	Capacity development of Intermediate Treatment (Eco-Town) Section	WMD	ED	2020-2024
Component 7: Sanitary Landfill				
(1)	Improvement of extension Matuail landfill site	WMD	ED	2017-2018
(2)	Closure of existing and extension Matuail landfill site	WMD	ED	2020-2021
(3)	Capacity Development of the landfill management section	WMD	ED	2017-2021
Component 8: Rules and Regulations				
(1)	Preparation and release of SWM administrative procedures book	WMD	-	2017-2018
(2)	Development of WMD directives through SWMSC	WMD	SWMSC	2018-2032
(3)	Training for rules and regulations provided to DSCC staff, and related stakeholders	WMD	-	2018-2021
Component 9: Organizational Capacity				
(1)	Reform of the WMD organizational structure	WMD	ED, TD	2018-2021
(2)	Preparation of an annual activity plan in accordance with the new Master Plan	WMD	ED, TD, RD, AD	2018-2032
(3)	Capacity development of implementing organizations in the WMD for the new Master Plan through training and workshops	WMD	ED, TD	2018-2021
Component 10: Financial Management				
(1)	Modification of accounting system to explicitly exhibit the actual SWM cost	WMD	AD, RD	2017-2021
(2)	Securing operation and maintenance cost for intermediate treatment (Eco-Town) development	WMD	LGD, AD, RD	2017-2021
(3)	Financial allocation for the Master Plan implementation	WMD	AD, RD	2017-2032

Project and Program		Executing Body	Concerning Body	Time of Execution (FY)
(4)	Development of financial assessment system	WMD	AD, RD	2018-2021

7.2 Schedule for the Implementation

Despite the short lifespan of the Matuail LFS at less than 2 years, DSCC faces difficulties in securing land for new LFSs owing to the high cost. Therefore, it is indispensable for DSCC to move from conventional landfill practice to a new waste treatment system that will reduce the amount of waste disposal while seeking to secure land for a new LFS. This situation indicates that DSCC should begin this Master Plan with no delay. Table 7-2 shows the schedule of priority projects and programs which should be started during the next five years.

Table 7-2 Implementation Schedule of Priority Projects and Programs

No.	Priority Projects and Programs	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Component 1: Public relations, Public Awareness, and Public Involvement																	
(1)	Establishment of a unit for public awareness raising in WMD	■	■	■	■	■											
(2)	Development of information disclosure system	■	■	■	■	■											
(3)	Active involvement in information exchange meetings among all CCs		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
(4)	Establishment of a PCG for SWM facilities		■	■	■												
Component 2: Ward-based Approach Activities																	
(1)	Improvement and expansion of WBA implementation in wards with encouraging CO/CIs	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
(2)	Proper community budget allocation with WBAAAP		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
(3)	Daily work practice in accordance with the administration procedures book		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Component 3: Waste Reduction																	
(1)	Preparation of waste reduction plan	■	■	■	■	■											
(2)	Introduce 3R activities through WBA activities	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Component 4: Waste Collection and Transport																	
(1)	Examination of collection and transport operation methods for expansion area	■	■														

No.	Priority Projects and Programs	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	
(2)	Introduction of new waste collection system including harmonization of primary collection and secondary collection	■																
(3)	Unification of waste collection management	■																
(4)	Improvement of management for maintenance workshops	■																
(5)	Capacity development of workers and drivers	■																
Component 5: Vehicle Maintenance System																		
(1)	Formulation of workshop management rules		■															
(2)	Reform of workshop and maintenance system		■															
(3)	Introduction of preventive maintenance method		■															
Component 6: Intermediate Treatment System (Eco-Town: WtE, composting, recycling etc.)																		
(1)	Propose of Eco-town and obtain approval from related organization		■															
(2)	Implementation of feasibility study for Eco-town			■														
(3)	Preparation of construction and operation cost				■													
(4)	Establishment of intermediate treatment (Eco-Town) section in the WMD				■													
(5)	Capacity development of intermediate treatment (Eco-Town) Section				■													
Component 7: Sanitary Landfill																		
(1)	Improvement of extension Matuail LFS	■																
(2)	Closure of extension and existing Matuail LFS				■													
(3)	Capacity development of the landfill management section	■																
Component 8: Rules and Regulations																		
(1)	Preparation and release of the administration procedures book	■																
(2)	Development of WMD directives through SWMSC		■															

No.	Priority Projects and Programs	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
(3)	Training for rules and regulations provided to staff and related stakeholders		■	■	■	■											
Component 9: Organizational Capacity																	
(1)	Reform of WMD organizational structure		■	■	■	■											
(2)	Preparation of an annual activity plan in accordance with new Master Plan		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
(3)	Capacity development of implementing organizations in the WMD for the new Master Plan through training and workshops		■	■	■	■											
Component 10: Financial Management																	
(1)	Modification of accounting system to explicitly exhibit actual SWM cost		■	■	■	■											
(2)	Securing operation and maintenance cost for intermediate treatment (Eco-Town) development		■	■	■	■											
(3)	Financial allocation for the Master Plan implementation		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
(4)	Development of Financial assessment system		■	■	■	■											

7.3 Budget

The proposed budget for implementing the priority projects and programs is estimated at Tk. 21,600 million. The tentative sources of the funds for development and procurement costs are summarized in Table 7-3. This budget considers all intermediate treatment facilities (Eco-Town) to be constructed and operated by the DSCC. This Chapter discusses on the budget in this case. Some of the funds have been already budgeted.

Table 7-3 Proposed Budget for the Priority Projects and Programs

Projects and Programs	Source of Funds (million BDT)		
	SWM own revenues	Grant from Central Government / Foreign Donors	Total
Component 1: Public relations, public awareness, and public involvement			
All projects and programs	1 (per year)	—	15
Component 2: WBA activities			
All projects and programs	5 (per year)	—	75
Component 3: Promotion of waste reduction			

Projects and Programs		Source of Funds (million BDT)		
		SWM own revenues	Grant from Central Government / Foreign Donors	Total
(1)	Preparation of waste reduction plan	—	—	—
(2)	3R activities through WBA activities	—	—	—
Component 4: Transformation of waste collection to citizen participation				
(1)	Examination of collection and transport operation method for expansion area	—	—	—
(2)	Introduction of new waste collection system including harmonization of primary collection and secondary collection	4	—	4
(3)	Unification of waste collection management	—	—	—
(4)	Improvement of management for maintenance workshops	—	—	—
(5)	Capacity development of workers and drivers	—	—	—
Component 5: Improvement of workshop operation				
(1)	Formulation of workshop management rules	—	—	—
(2)	Reform of workshop and maintenance system	—	—	—
(3)	Introduction of preventive maintenance method	—	—	—
Component 6: Development of intermediate treatment system (Eco-Town: WtE, composting, recycling etc.)				
(1)	Propose Eco-town and obtain approval from related organization	—	—	—
(2)	Implementation of feasibility study for Eco-town	—	72	72
(3)	Preparation of construction and operation cost	—	20,700	20,700
(4)	Establishment of Eco-Town management section in WMD	—	—	—
(5)	Capacity development of Eco-Town management Section	—	—	—
Component 7: Securing of new LFS and sanitary LFS				
(1)	Improvement of extension Matuail LFS	550	—	550
(2)	Closure of extension and existing Matuail LFS	—	135	135
(3)	Capacity development of the landfill management section	—	—	—
Component 8: Rules and regulations				
	All projects and programs	1 (per year)	—	15

Projects and Programs	Source of Funds (million BDT)		
	SWM own revenues	Grant from Central Government / Foreign Donors	Total
Component 9: Organization			
All projects and programs	1 (per year)	—	15
Component 10: Financial management			
All projects and programs	—	—	—

Source: JICA Project Team

CHAPTER 8 CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

In DSCC, waste generation and waste composition have changed dramatically owing to the population growth and economic development. However, it is necessary for DSCC to introduce integrated waste management with various kinds of technologies and methods considering the short lifespan of the existing landfill. Although the previous Master Plan 2005-2015 focused on organizing a system to promote waste management from the beginning, this Master Plan aims to establish a sustainable waste management system.

The Master Plan emphasizes the necessity of waste reduction to save the landfill capacity so as to sustain its operation. The policy of waste reduction must be strongly enforced by the WMD with public relations and public awareness through WBA. Promotion of waste reduction at source is key for achieving 10% waste reduction, which depends on the field-level efforts by CI.

The concept of Eco-town (WtE, composting, recycling etc.), an intermediate treatment system that can treat various types of waste, was introduced in the Master Plan for the first time. This would contribute to reduce the large volume of waste and to mitigate the impact of environmental pollution. The establishment of such a consolidated intermediate treatment system including a WtE plant requires strengthening of human resources with high technical skills.

The Master Plan suggests the following various directions for approaching a sustainable administration for SWM.

- (i) Establishment of an intermediate treatment system (Eco-town) to extend the life of landfill
- (ii) Administrative efforts made for enhancing the governance capabilities
- (iii) Strengthening of the WMD organization, expansion of WBA, revision of the WMD directives that details the DSCC's policy on SWM
- (iv) Necessity of staff participation in human resources development activities through social learning
- (v) Introduction of a SWM administrative procedure book that utilizes existing laws and office orders
- (vi) Implementation of participatory waste management through public relations, public awareness, and WBA activities

8.2 Recommendations for the Future of Solid Waste Management

The conclusion of the Master Plan suggests the direction beyond 2032. Essentially, the trend of main issues on solid waste, such as the lack of landfill space, will not drastically change. Therefore, the policy of waste reduction and strengthening of institutional capacity as an administrative authority could be better prioritized and accelerated. In addition, the following points are raised as potential issues that may occur in the near future, which can be discussed in the future Master Plan for the next term.

8.2.1 Promotion of Waste Reduction

Waste reduction at source would be promoted by CIs through WBA3 in collaboration with the communities, business enterprises and other stakeholders, which is explained repeatedly in the Master Plan. Responsibility of each stakeholder for waste reduction, including DSCC, should be clarified.

Obviously, community awareness is important and should be continued regularly. In addition, public awareness for large-scale buildings should be a focus for the next step. A Reporting system of large-scale buildings where the waste discharge amount depends on waste type and discharge method, should be established with better communication of administrative guidance.

Moreover, extended producer responsibility, a policy approach under which producers are given a significant responsibility for the treatment or disposal of post-consumer products, should be considered in the planning stage. DSCC may need to establish regulations for promotion of eco-friendly products or penalties for single-use disposable products. The charging of service fees for waste collection is an option worth considering to secure the financial source. In this Master Plan, industrial waste and hazardous waste cannot be covered owing to lack of information. The plans for these waste types should be developed in the future.

8.2.2 Appropriate Technology of Solid Waste Treatment

(1) Waste-to-Energy for Waste Reduction

In general, an incinerator reduces the volume of the solid mass of the original waste to about one-twentieth of its former size. This method is the most effective way to save a landfill space, and therefore to extend lifespan of the LFS. The pollution control technology is becoming mature significantly to purify HCl, NO_x, SO_x, and dioxin contained in incineration exhaust gas. Consequently, WtE technology is inevitable for the future SWM in DSCC. Promotion of research and development based on collaboration of industry, academia, and government should be accelerated.

(2) Electronic Waste Recycling

Full recovery of materials from E-waste requires a complicated treatment process using an expensive facility. At this time, DSCC should focus on the recycling of plastics to reduce the incoming landfill volume. The target of E-waste, such as TVs, refrigerators, air conditioners, washing machines, PCs and other products, should be clarified before the DSCC starts E-waste recycling.

8.2.3 Sustainability of Solid Waste Management

(1) Decentralization of Waste Management

SWM in a big city such as DSCC requires a strong foundation of governance to make important decisions, and solid organization to enforce and disseminate regulations at the field level. As mentioned repeatedly, establishment and strengthening of the WMD, and promotion of WBA are a core competence of DSCC, which makes SWM of DSCC sustainable and independent. Decentralization is the key concept for promotion of WBA. The CI must be an office manager for each ward, which has to be endorsed by legislation to justify the authority of planning, finance, and human resources management. Continuous capacity development of the CI is also needed. Exchange of human resources between the Conservancy Division and the Engineering Division is an innovative and effective option for capacity development to overcome the rigid structure of organization.

The WMD directives describes the policy of the WMD for 5–10 years and secure the consistency of administrative decisions based on the policy. The process for developing WMD directives should be open to the public such as communities, universities and NGO; however, this cannot be achieved without active involvement of public relations.

(2) Solid Waste Management Rules of the City Corporation

Bangladesh has already drafted “Waste Management Rules 2018, which shall be gazetted soon. This draft rules will be enacted as per the power given in Section 20 of Bangladesh Environment Conservation Act 1995, and executed by the DoE. To strengthen the SWM of CCs more systematically, an SWM rule exclusively for DSCC is desirable to interpret the DoE’s rules into the practical field. LGD should prepare separate SWM rules having more stringent and adjuvant for the CCs as per the powers given in Section 40 under the Local Government (City Corporation) Act 2009, for the sustainable and efficient SWM.

(3) Ordinance and Guidelines for Waste-to-Energy

In Section 7 of the draft Solid Waste Management Rules, 2018, three types of standards i.e., operation standards, emission standards, and radioactivity standards, have been described. These standards may be applied to the WtE projects, including incineration; however, there is no specific ordinance or guidance exclusively for WtE or waste incineration in Bangladesh. Such a regulatory framework for incinerators and WtE facilities must be developed immediately.

8.2.4 Spatial Coverage of DSCC's Waste Management

The Dhaka metropolitan area was expanded recently, as seen in the extension area newly added into the DSCC jurisdiction in 2017. It is conceivable that more area will be taken in the DSCC jurisdiction in near future, considering the current infrastructure and new town development inside and outside of Dhaka such as the Dhaka Metro project and Purchabal New Town development.

The DSCC has just started to work on SWM planning in the extension area, and still needs some time to develop it because of data and information deficiency; on the other hand, the DSCC currently has the following long-term idea for the extension area at this moment.

- Set up a zonal SWM office at each zone
- Outsource waste collection to private companies
- Construct a WtE plant in each zone for intermediate treatment, and dispose of the ash in the Matwail LFS

The DSCC will detail SWM in the extension area and include a framework for the potential DSCC area in the time of this Master Plan revision scheduled in 2020. In the meanwhile, to the extent possible, information sharing and technical support to not only the other CCs, but also the outer townships of Dhaka is encouraged to disseminate better solid waste management practice.