



**DATA COLLECTION SURVEY
ON
SOLID WASTE MANAGEMENT IN DILI MUNICIPALITY
FOR
REDUCING MARINE PLASTIC WASTE IN TIMOR-LESTE**

Result of Survey

October 2024

JICA Survey Team

Contents of Presentation

1. Current Status of Waste Management in Dili City
2. WACS and Current Waste Flow
3. Future Projection of Waste Amount
4. Identification of Issues Based on the Current Status of Waste Management Including Marine Plastic Waste
5. Consideration of Solutions for Solving Issues

1. Current Status of Waste Management in Dili City

1.1 Current Situation of Solid Waste Management in Dili Municipality

Population: **344,700** people

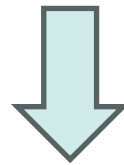
Area: **224 km²**

Distance from Dili city center to the disposal site: **Approximately 13 km**



1.2 Main Law and Regulations in Related to Waste Management by the Government of Timor-Leste

- Decree Law for Environmental Basic Law: Number 26/2012
 - Basic law regarding environmental management in Timor-Leste
- Decree Law for SWM: Number 2/2017
 - Basic law regarding solid waste management in Timor-Leste
- Decree Law for Sale, Import, and Production of Plastic Bags, Packaging, and Other Plastic Items No. 37/2020 of September



- There is no basic law and regulations regarding the establishment of circular society
- There are no detailed regulations or guidelines for the implementation of the above-mentioned laws.

1.3 Main Organization related to Solid Waste Management in National Level

Organization	Role
Ministry of State Administration	Responsible for developing infrastructure to provide public services carries out the establishment of national-level waste management laws and systems, and provides technical and financial support for infrastructure development in each municipality.
Ministry of Tourism and Environment	Responsible for establishment of legal framework regarding solid waste management and regulatory authority of overall environmental management body
Ministry of Health	Responsible for medical waste management

1.4 Current Condition of SWM in Dili Municipality

Discharge, Collection and Transportation



- Before the introduction of new collection and transportation system, waste is discharged into collection points made by concrete boxes, and since it is not placed in bags, the waste is scattered.
- It takes time to load the waste into the collection vehicles due to the scattered waste within a certain area.
- After establishment of new collection and transportation system, containers or trash bins have been placed at collection points, and it has commenced that the waste has been transported from these points to the disposal site by compactor trucks or container trucks.

1.5 Current Condition of SWM in Dili Municipality

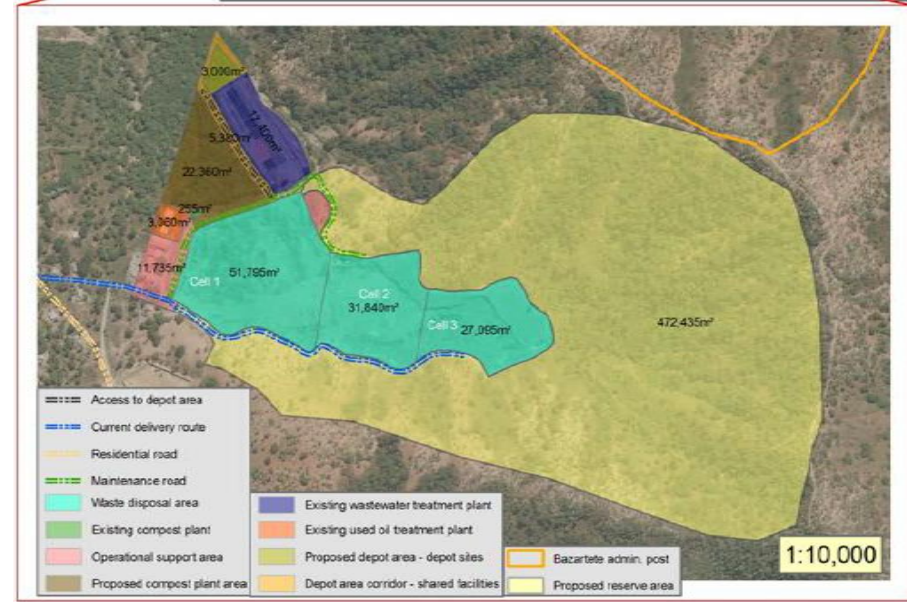
3R and Intermediate Treatment



- There are several companies engaged in recycling, in which largest one is Caltech.
- In Caltech, plastics and glass are crushed and molded, then recycled into materials for road base, paving tiles, indoor boards, etc.
- Cardboard and similar materials are reportedly composted, though the objective is unknown.
- Although recycling is being carried out as mentioned above, recyclable waste is still present in the residuals, indicating insufficient collection and limitation of capacity of recycling facilities.

1.6 Current Condition of SWM in Dili Municipality

Final Disposal



Source: MSA, Dili Municipality

- The current Tibar Landfill site operates as an open dumping facility, lacking essential infrastructure such as a liner system, stormwater drainage channels, and a leachate treatment facility.
- There is a plan to expand the landfill area, excavate the waste that has already been landfilled, and, after excavation, install a liner system, leachate collection pipes and gas ventilation pipes, as well as embankment to prevent the landslide of landfilled waste, stormwater drainage to avoid inflow of rainwater inflow from surrounding catchment area, in order to improve the site into a sanitary landfill.

2. WACS and Current Waste Flow

2.1 Waste Amount and Composition Survey (WACS)



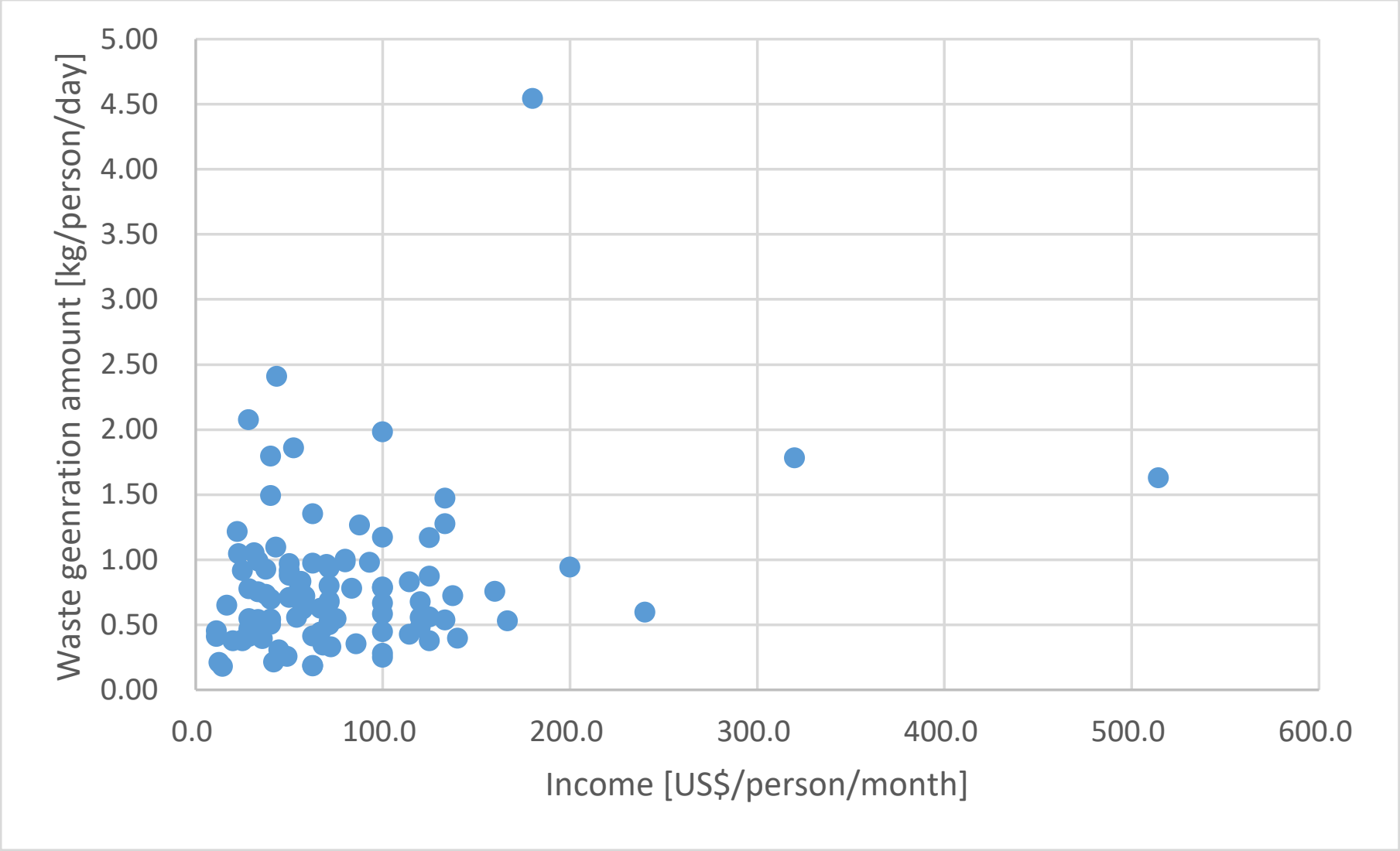
Waste Amount Survey		Waste Composition Survey	
Generation source	Sampling number (7 days)	Sampling number (3 days)	Method
Household (High, middle, low incomes)	100	6	1. Mixing all the sample and conducting sample reduction for separating effectively 2. Sorting Sorting is conducted for following each category for physical composition measurement. (1) Physical composition 1) Paper/cardboard, 2) Glass, 3) Plastic (hard and PET), 4) Plastic (laminated), 5) Plastic (non-recyclable such as PVC, etc), 6) Aluminum, 7) Other Metal, 8) Food waste, 9) Green/Garden waste, 10) Builders Waste, 11) Soil and Dirt, 12) Hazardous Waste, 13) Miscellaneous) 3. Bulk density Remaining samples in sample reduction is used for measurement of bulk density. A certain volume of bucket is measured before and measure the weight of samples to calculate bulk density
Restaurant	10	1	
Hotel	10	1	
Shop	10	1	
Office, school	10	1	
Clinic	10	1	

2.2 Current Condition of SWM in Dili Municipality

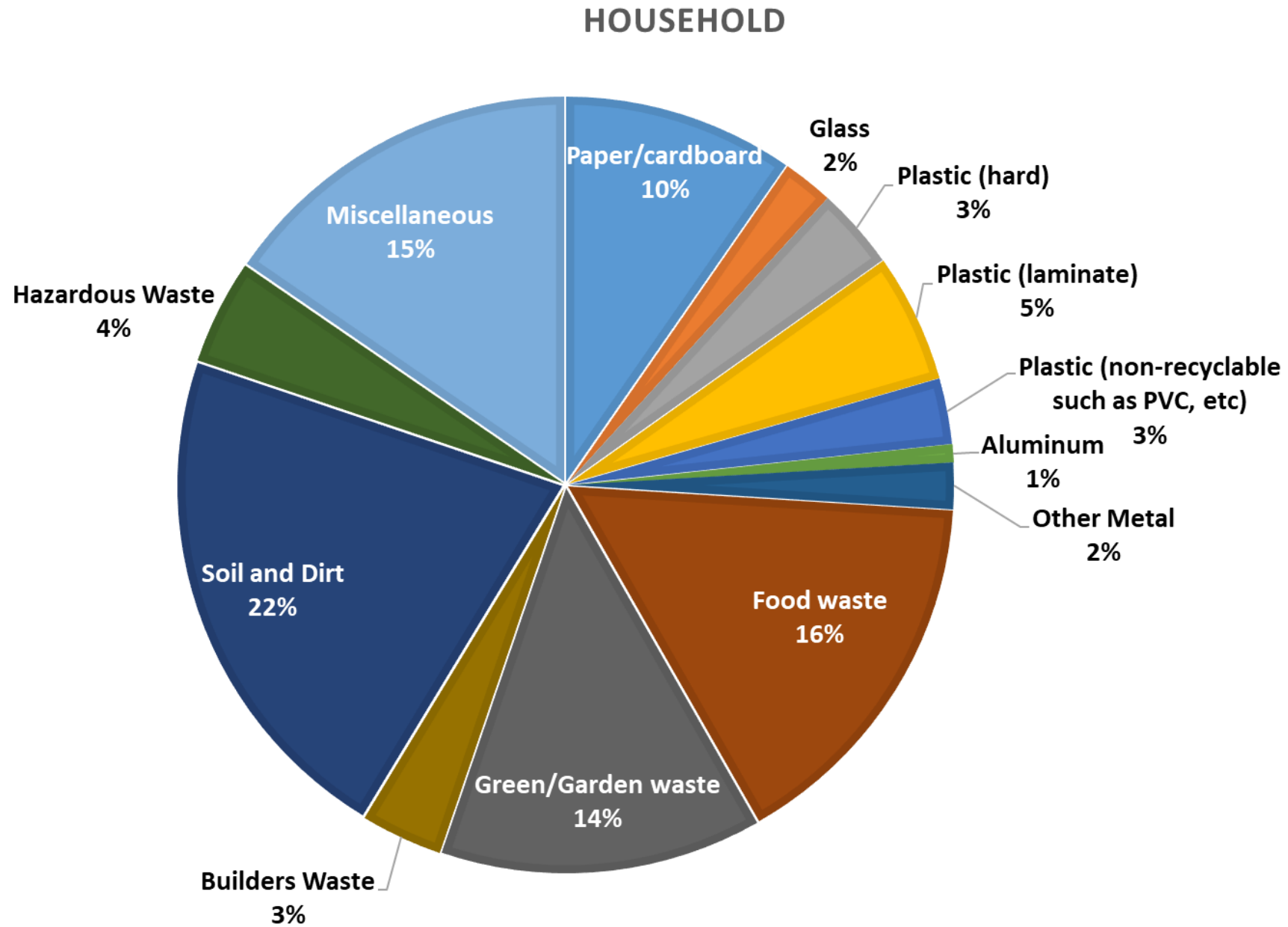
Waste Generation Amount

Item		Number of person / establishment	Per unit generation rate [kg/day]	Waste Amount [ton/day]
Household	Crist Rei	80,976	0.57	46.0
	Dom Aleixo	175,800	0.71	124.8
	Metinaro	7,601	0.57	4.3
	Nain Feto	35,550	0.71	25.2
	Vera Cruz	44,399	0.71	31.5
	Total	344327	0.67	231.9
Hotel		61	18.40	1.1
Restaurant		3058	7.90	24.2
Shop/company		3044	10.8	32.9
School/institution		1143	10.8	12.3
Hospital/clinic		63	9.6	0.6
Total				303.0

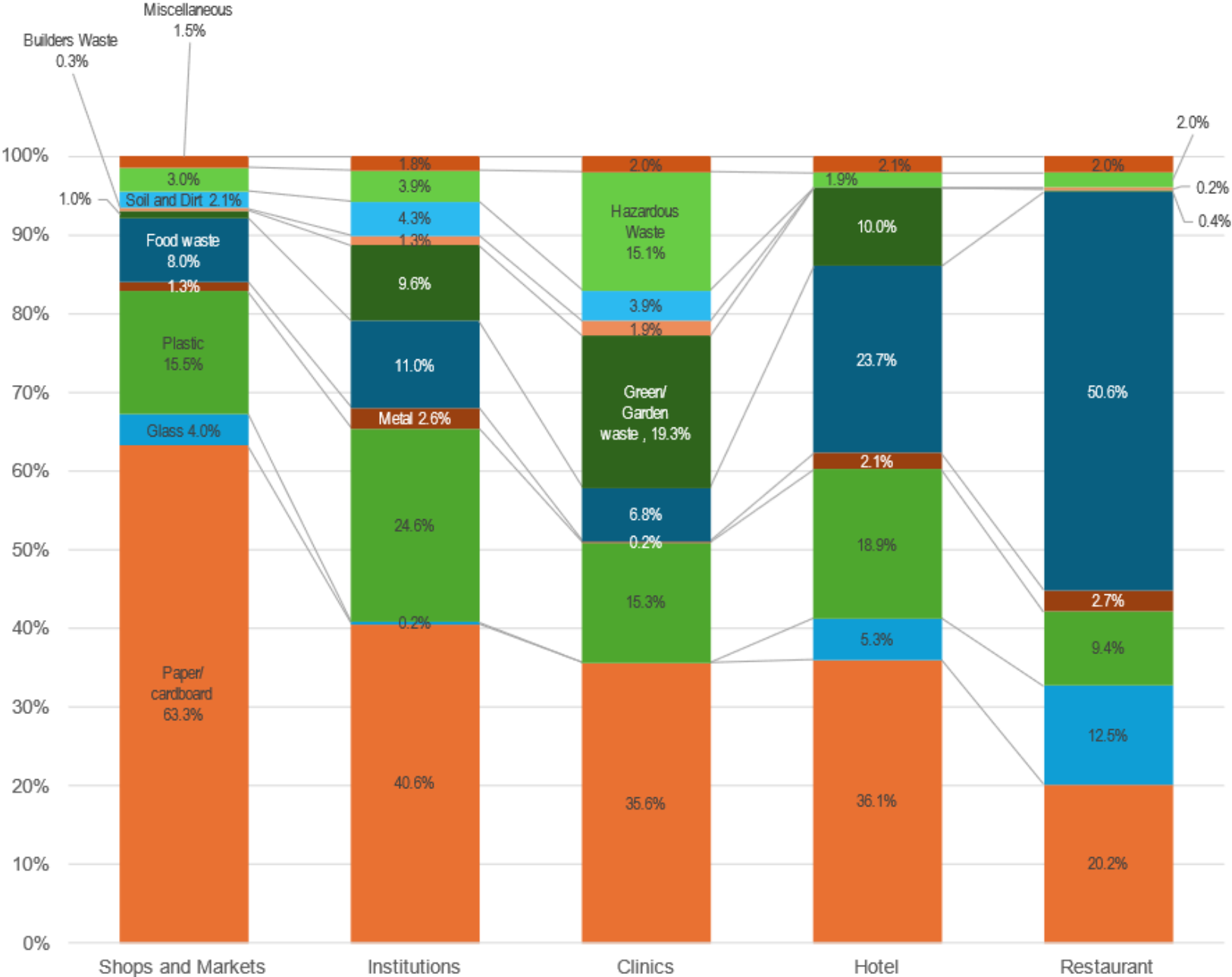
2.3 Waste Characterization Survey (Per capita waste generation)



2.4 WACS (Physical Composition at Household Waste)



2.5 WACS (Physical Composition of Business Waste)



2.6 WACS (Waste Amount of each Physical Composition from each Generation Source)

Unit : t/day

Physical component	Household	Hotel	Restaurant	Shop/company	School/institution	Hospital/clinic	Total
Paper/cardboard	22.4	0.4	4.9	20.8	7.8	0.2	56.5
Glass	4.9	0.1	3.0	1.3	0.5	0.0	9.8
Plastic (hard)	8.0	0.1	1.0	2.5	0.9	0.0	12.5
Plastic (laminated)	12.5	0.0	0.7	0.7	0.3	0.0	14.2
Plastic (non-recyclable such as PVC, etc)	6.4	0.1	0.6	1.9	0.7	0.1	9.7
Aluminum	1.7	0.0	0.1	0.3	0.1	0.0	2.2
Other Metal	4.4	0.0	0.5	0.1	0.1	0.0	5.2
Food waste	36.5	0.3	12.2	2.6	1.0	0.0	52.7
Green/Garden waste	31.3	0.1	0.1	0.3	0.1	0.1	32.0
Builders Waste	8.0	0.0	0.0	0.1	0.0	0.0	8.2
Soil and Dirt	49.9	0.0	0.0	0.7	0.3	0.0	50.9
Hazardous Waste	10.2	0.0	0.5	1.0	0.4	0.1	12.1
Miscellaneous	35.8	0.0	0.5	0.5	0.2	0.0	37.0
Total	231.9	1.1	24.2	32.9	12.3	0.6	303.0

Remark: The figures of which amount is more than 10 ton/day are highlighted.

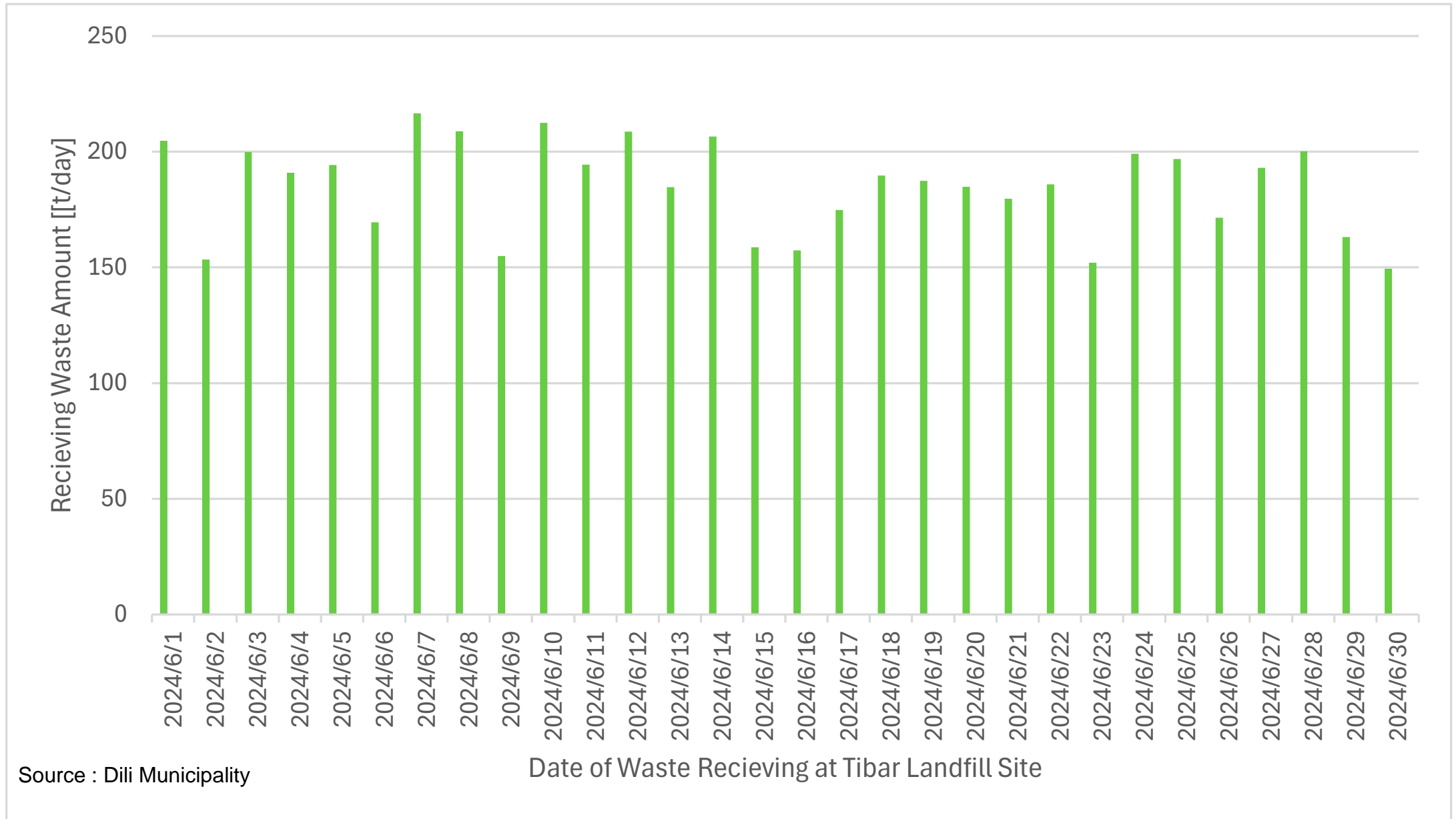
2.7 Recycling Survey

Unit : t / month

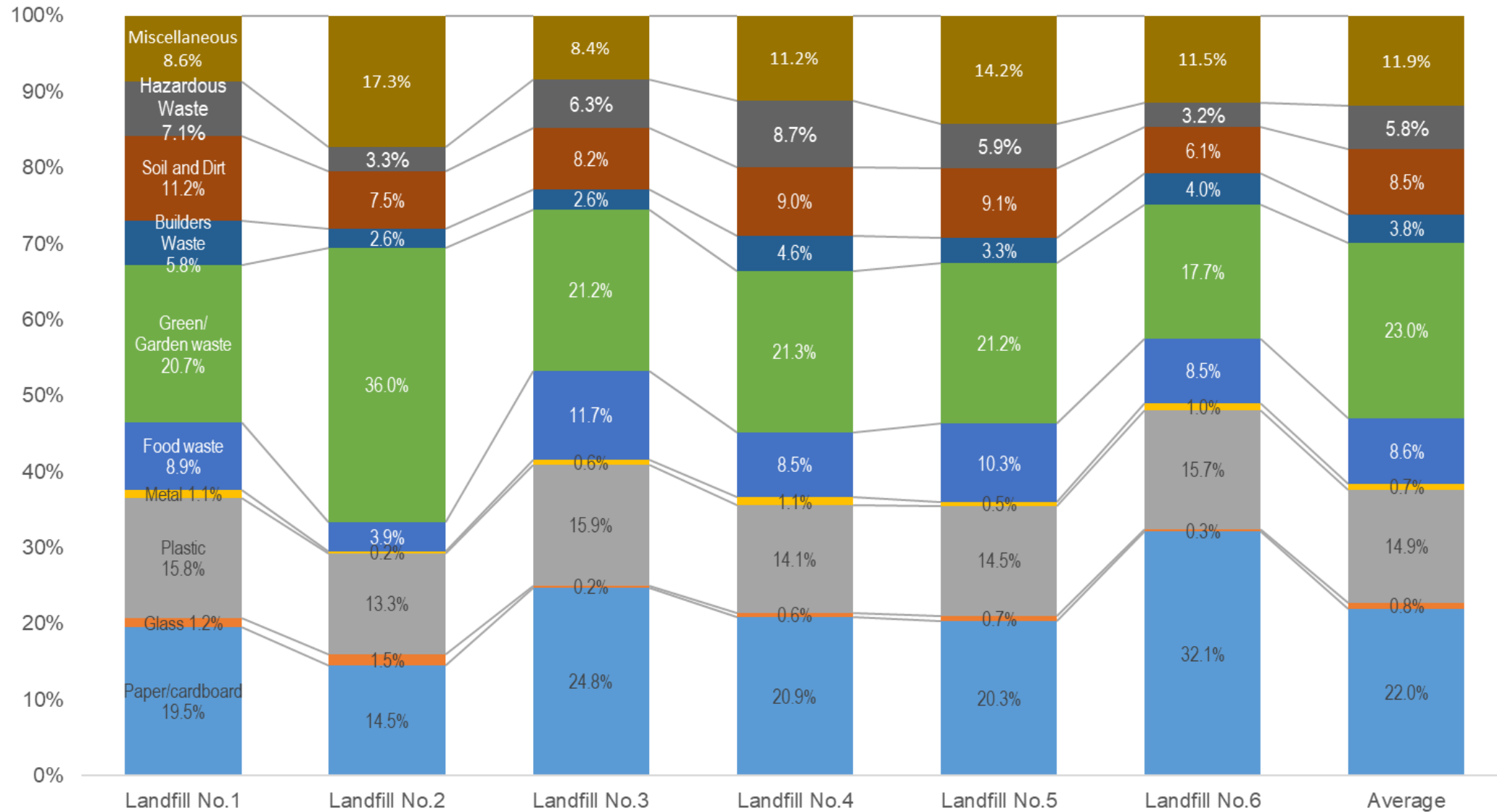
Recyclable Waste	Recycle Dealer	Community	Waste Picker
Paper	0.26	0.00	0.00
Plastic	26.50	0.43	1.97
Glass	9.50	0.15	0.03
Metal (without Aluminum)	665.89	0.00	4.07
Aluminum	26.63	0.00	1.98
Other	10.25	0.04	0.00

Note: Around 80% of metal is industrial waste according to hearing from recycling dealer and field inspection

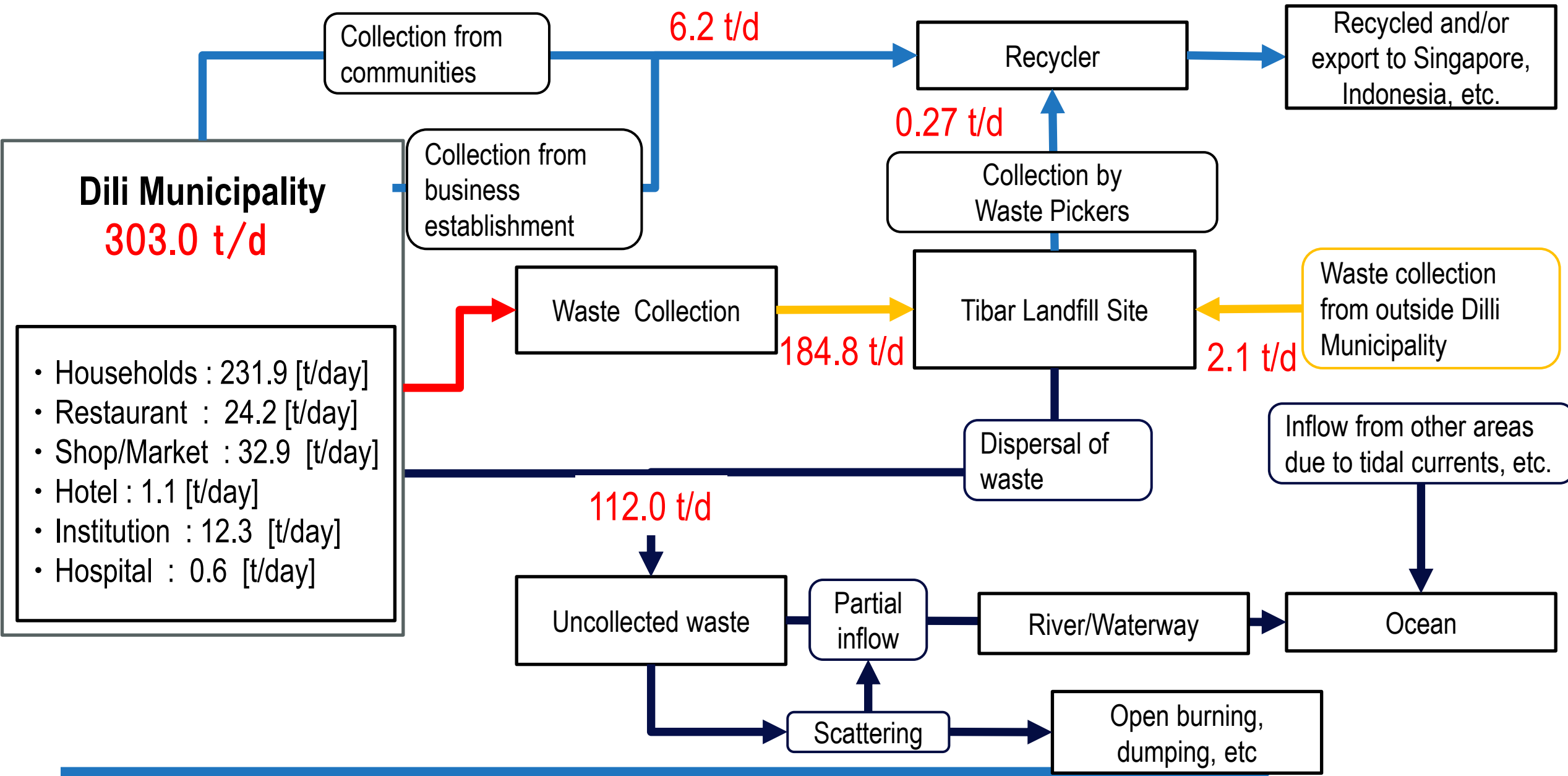
2.8 WACS (Waste Amount at Tibar Landfill Site)



2.9 WACS (Physical Composition at Tibar Landfill Site)

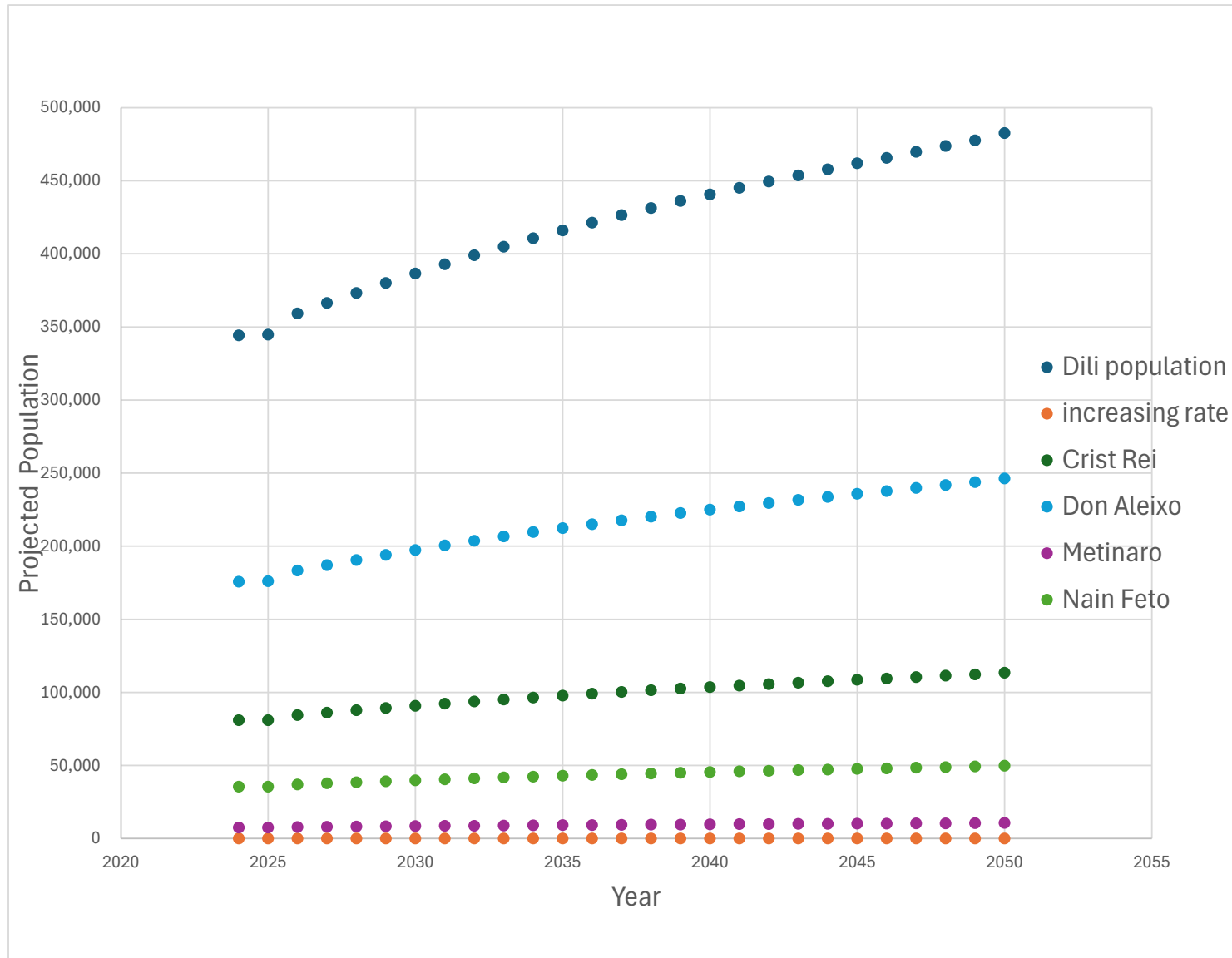


2.10 Current Waste Flow



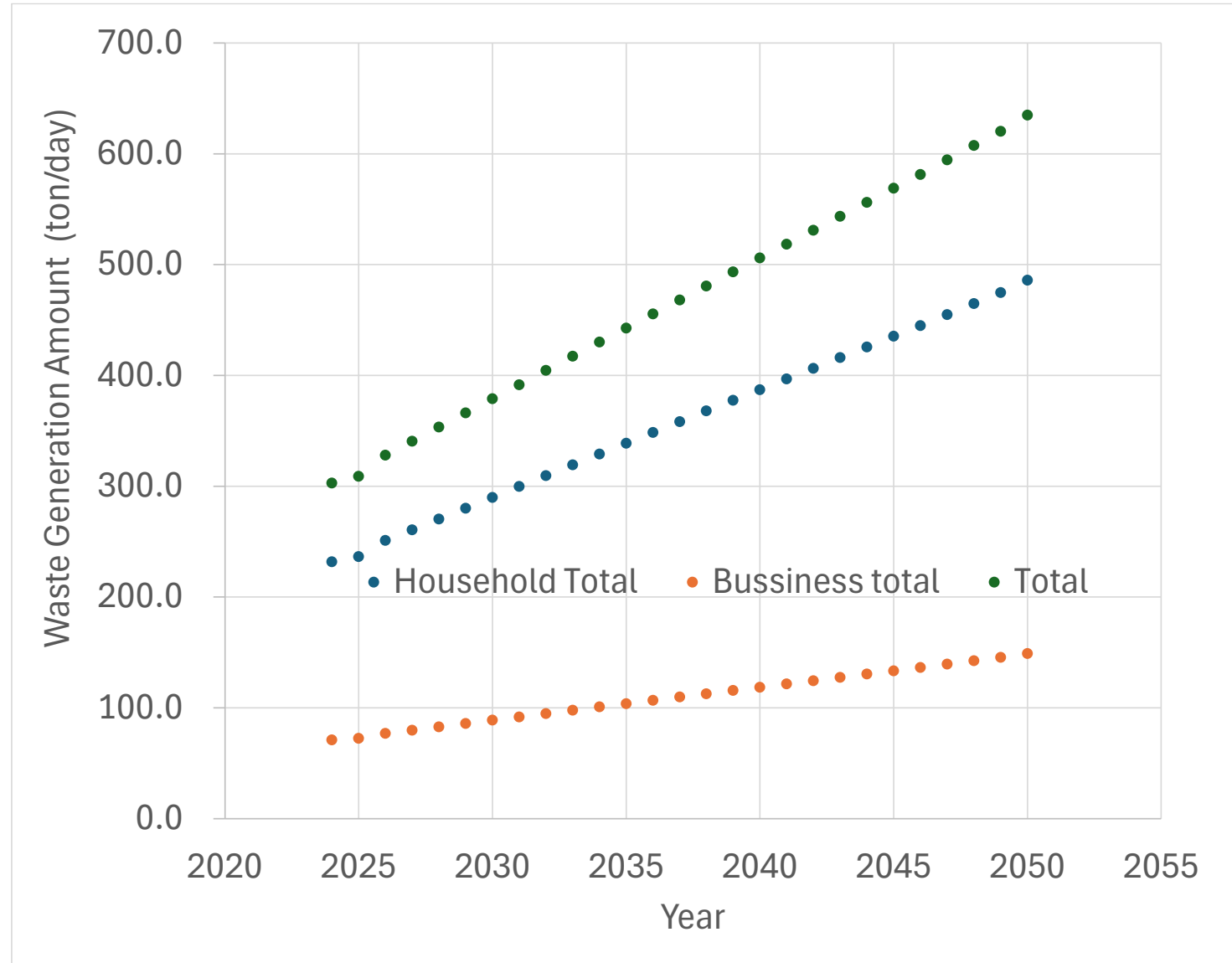
3. Future Projection of Waste Amount

3.1 Population Projection



Source : National Institute of Statics

3.2 Future Projection of Waste Generation Amount



3.3 Future Projection of Waste Generation Amount for Each Physical Composition

(Unit : t/day)

Year	2024	2030	2035	2040	2045	2050
Paper/cardboard	53.7	67.2	78.5	89.7	100.9	112.6
Glass	9.3	11.7	13.7	15.6	17.6	19.6
Plastic (hard)	13.6	17.0	19.9	22.7	25.5	28.5
Plastic (lamine)	14.4	18.0	21.1	24.1	27.1	30.2
Plastic (non-recyclable such as PVC, etc)	9.5	11.9	13.9	15.9	17.9	20.0
Aluminum	2.3	2.9	3.4	3.9	4.4	4.9
Other Metal	5.2	6.6	7.7	8.7	9.8	11.0
Food waste	53.1	66.4	77.6	88.6	99.7	111.2
Green/Garden waste	33.1	41.4	48.4	55.3	62.2	69.4
Builders Waste	8.3	10.4	12.1	13.8	15.5	17.3
Soil and Dirt	51.1	64.0	74.7	85.4	96.1	107.2
Hazardous Waste	12.2	15.3	17.9	20.5	23.0	25.7
Miscellaneous	37.0	46.3	54.1	61.8	69.5	77.6
Total	303.0	379.0	442.9	506.1	569.2	635.1

4. Identification of Issues Based on the Current Status of Waste Management Including Marine Plastic Waste

4.1 Main Assistant Activities of Donors and NGOs in Timor-Leste

(1) ADB

- Implementing a project for the improvement of waste collection and transportation and the expansion and enhancement of the landfill in Dili City.
- It contributes the introduction of new waste collection and transportation in urban areas outside of parts of Cristo Rei and Metinaro.
- The project could improve the landfill site with operations and maintenance managed by a Chinese company as well as the above collection and transportation.

(2) UNDP

- UNDP has implemented the Recycling Pilot Promotion (RPP) Project, a community-based upcycling and recycling initiative, targeting four villages.









(3) USAID, KOICA

- "USAID, KOICA, and the EU collaborated to establish the Plastic Solutions Alliance (PSA) and worked with Heineken and Mercy Corps to install dedicated plastic waste bins for businesses, households, and communities. The collected plastic was then processed into materials such as tiles and blocks by Caltech and sold, but the three-year PSA initiative has now come to an end."

4.2 Issues and Challenges

- While there is a basic law on waste management, including marine plastic waste, there is no basic law or specific laws related to a circular society.
- There is no waste strategy or waste management plan, including marine plastic waste.
- The collection of waste service fees and disposal fees, for both business and household sectors, is not being implemented.
- Waste collection and transportation is planned to be carried out under a new system except for the suburbs of Dili. The landfill is also expected to be operated and managed by a private Chinese company.
- Although recycling is being conducted by companies like Caltech, it is insufficient due to uncollected recyclable waste and a lack of processing capacity.
- The recycling market in Timor-Leste is not fully developed, and it is necessary to confirm the end-users and demand.
- There is illegal dumping and littering.
- The collection of plastics, which enter the ocean through rivers or are generated in the water area, is needed."

4.3 Countermeasure for Each Issue and Challenge

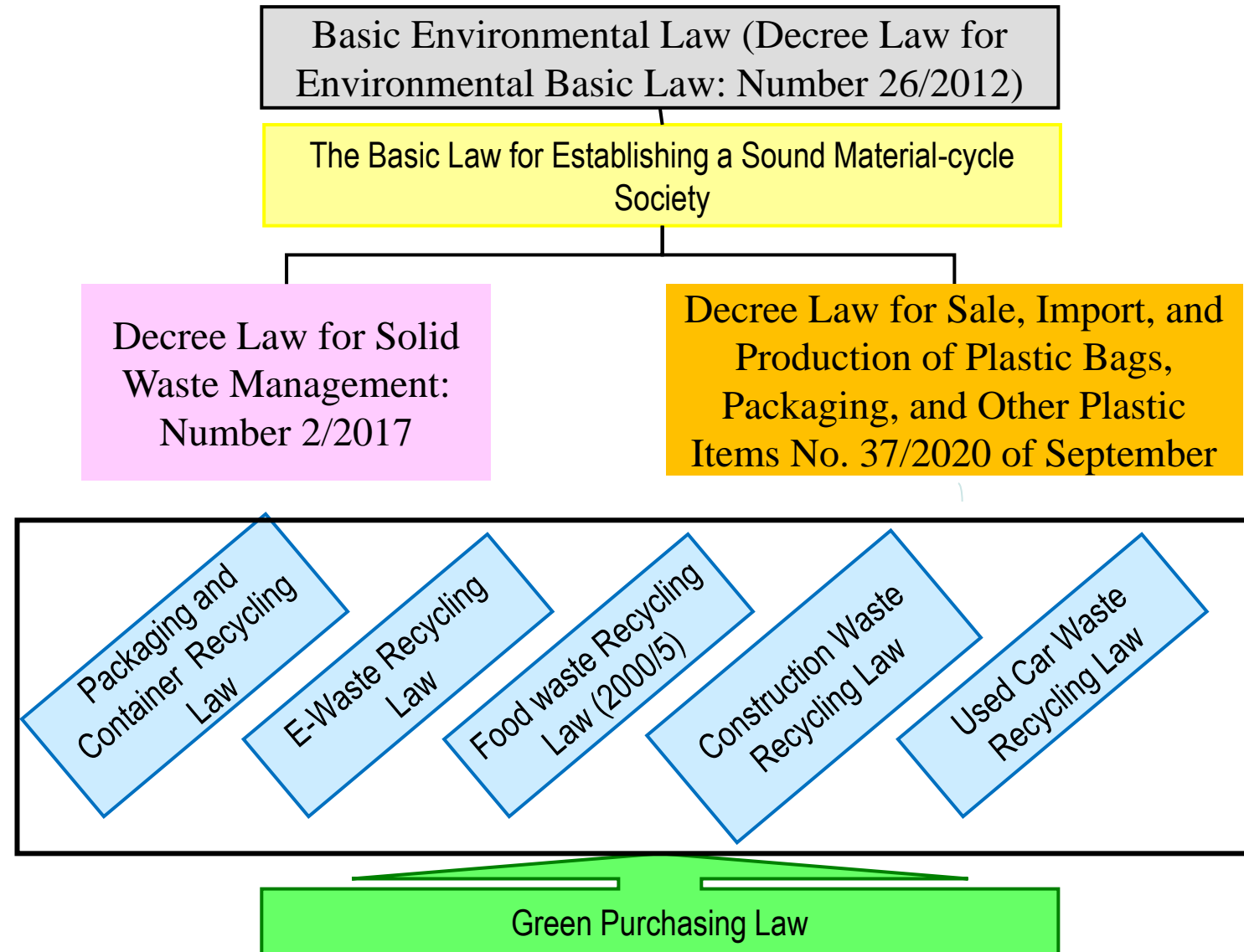
- | | | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| 1. There is a basic law for waste management, including marine plastic waste, but there is no basic law or specific legislation related to a circular society. |  | Establishment of legal system for circular society |
| 2. There is no waste strategy or waste management plan, including marine plastic waste. |  | Formulation of strategies and plans for marine plastic waste and waste management |
| 3. The collection of waste service fees and disposal fees is not being implemented for either the business or household sectors. |  | Improvement of financial systems (such as waste management service fee collection system) |
| 4. Waste collection and transportation, except for the rural area of Dili, are planned to be carried out under a new system. |  | Necessary of consideration of waste management system in rural area |
| 5. Recycling is being carried out by companies like Caltech, but due to uncollected recyclable waste and insufficient processing capacity, it cannot be considered adequate. |  | Improvement of systems of the collection system for resource recovery of plastic waste. |
| 6. The recycling market in Timor-Leste is not fully developed, and it is necessary to confirm the market conditions. First, the end-users need to be identified. |  | Development of recycling markets and improvement of current recycling technologies |
| 7. Monitoring of littering and dumping sites is required. |  | Implementation of monitoring and management utilizing DX (Digital Transformation). |
| 8. The collection of plastics that enter the ocean from land through rivers or are generated in water bodies is necessary. |  | Consideration of technologies for waste collection in rivers and seas |

5. Consideration of Solutions for Solving Issues

5.1 Prioritization and Timing of Each Countermeasure

Necessary Future Measure		Priority/Term	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr. 9	Year 10
			Short Term			Middle Term			Long Term			
Formulation of law and regulation, strategy and plan regarding SWM toward establiment of circluar society	Establishment of the Basic Law for a Circular Society	Shor Term										
	Development of laws and regulations related to the establishment of a circular society, including ordinances and regulations concerning industrial waste	Long Term										
	Formulation of a waste management strategy and the master plan for waste management	Shor Term										
	Formulation of waste management plan for Dili City	Shor Term										
Challenge for formulation of institutioal system :	Introduction of waste management service fee collection system (disposal fees for final disposal sites)	Shor Term										
	Introduction of waste management service fee collection system (collection of fees from bussines establishment)	Middle Term										
	Introduction of a waste management service fee collection system (collection of fees from residents)	Long Term										
	Introduction of systems to promote recycling	Long Term										
Countermeasure regarding collection and transportation	Expansion of collection and transportation services and measures for self-treatment, especially for rural areas	Middle Term										
	Improvement of collection methods to promote 3R (Reduce, Reuse, Recycle)	Middle Term										
Countermeasure regarding waste reduction and recycling	Raising public awareness and providing environmental education	Middle Term										
	Promotion of the recycling business	Long. Middle Term,										
Countermeasure for waste discharged into waterbody	Monitoring of waste	Shor Term										
	Collection of waste discharged into marine and river environments	Middle Term										

5.2 Example of Proposed of Framework of Laws toward Circular



5.3 Consideration of Fee Collection System for Municipal Solid Waste Service

	Concept regarding fee collection	Collection Method
Collection and Transportation Service Fee	<ul style="list-style-type: none">- All the beneficiary pay the waste collection service fee- Incentive toward waste reduction	<ul style="list-style-type: none">- Designated bag for the collection of waste collection service fee- Collection with other fee such as electricity fee- Collection from business establishment which discharge large amount of waste as contract fee
Waste Disposal Fee	Collection through waste collectors Incentive toward waste reduction and recycling	<ul style="list-style-type: none">- Tipping fee through the monitoring record at the weighing bridge in Tibar Landfill Site

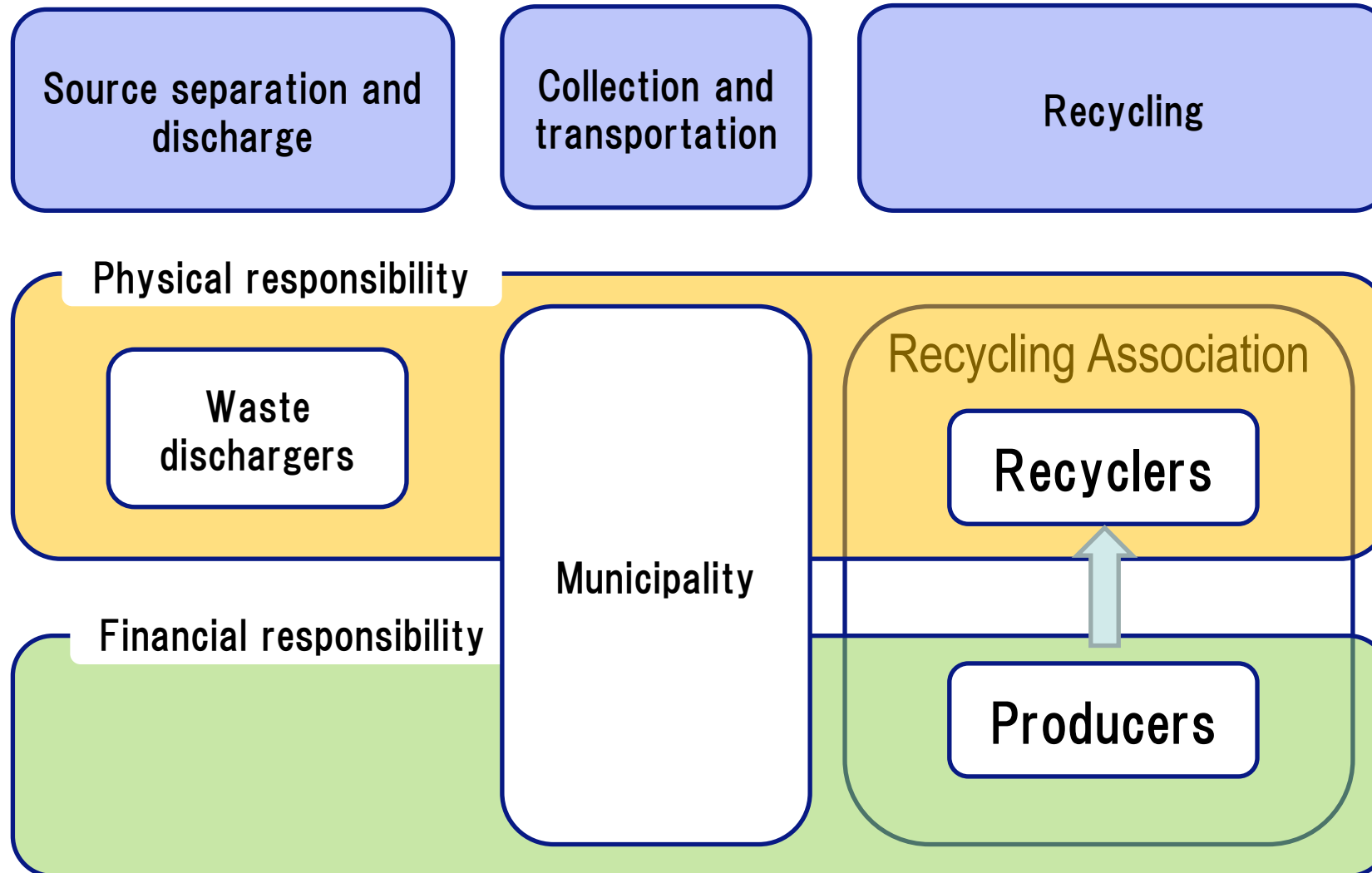
5.4 Introduction of Designated Garbage Bag (Japanese Case) Waste Collection Service

The **Designated Garbage Bag System** is a program implemented by municipalities requiring households and businesses to use specific, designated garbage bags for waste disposal.

- **Waste Reduction:** Residents become more aware of the necessity of waste reduction
- **Enhanced Sorting:** The bags could be designed with different colors or patterns for various types of waste
- **Collection Efficiency:** Bags are designed to improve the efficiency of waste collection processes.
- **Fair Distribution of Waste Disposal Costs:** The cost of waste disposal is distributed more equitably according to the number of bags purchased



5.5 Institutional Setup of EPR System for Container and Package Waste in Japan



5.6 Self-disposal Procedure and Expansion of Collection and Transportation Service for Non-collection Area



No collection of the area of Hera or Metinaro



Station Collection for Rural Area (e.g. once a week collection of inorganic recyclable and non recyclable waste only)



Promotion of home composting of organic waste by some incentive

5.7 Consideration of Collection System toward the Promotion of Recycling such as Deposit System, Separate Collection and Station Collection

Deposit System

- Deposit the money for product
- After use the product, bring the collection point to get back the deposit subtracted recycling fee

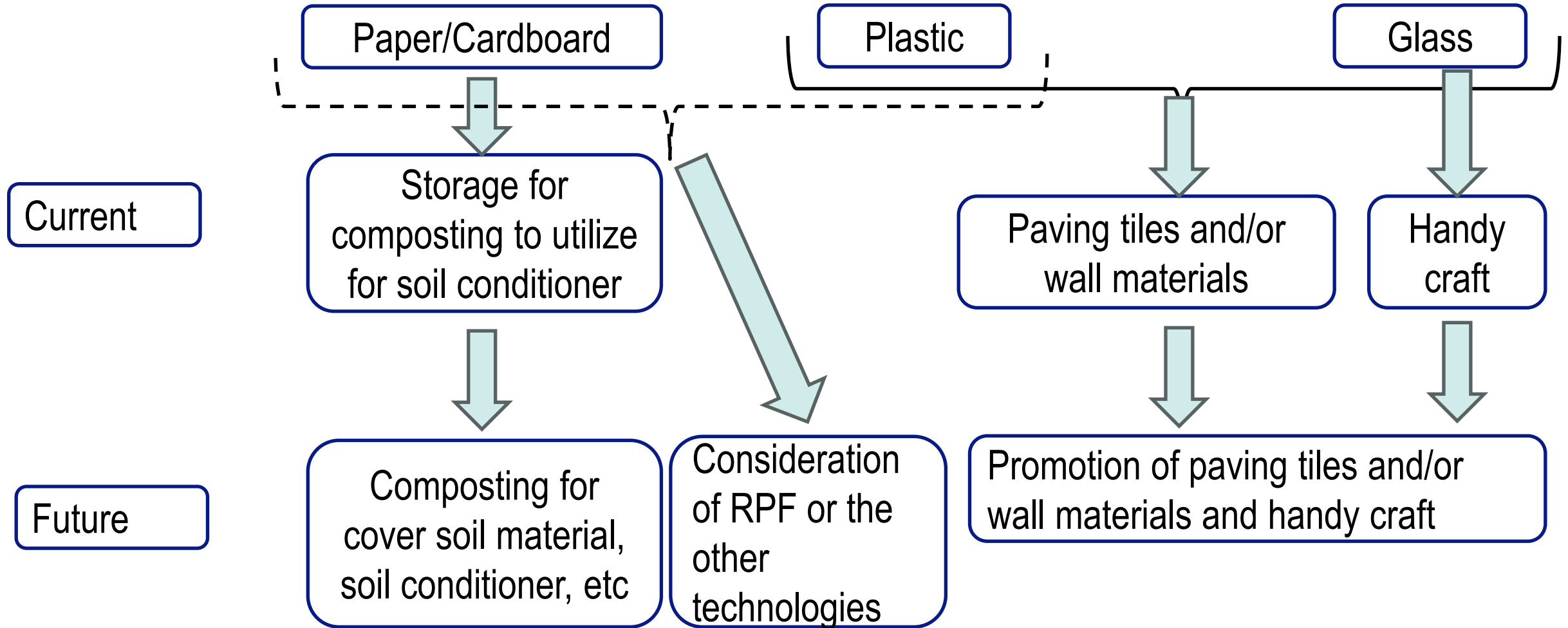
Separate Collection

Collect each type of waste such as recyclable and non-recyclable separately with the cooperation of waste dischargers

Station collection for recyclable waste

Waste dischargers bring the recyclable waste to waste collection points such as store or school or collection points in community

5.8 Development of Recycling Markets and Improvement of Current Recycling Technologies



5.9 Implementation of Monitoring and Management Utilizing Digital Technology



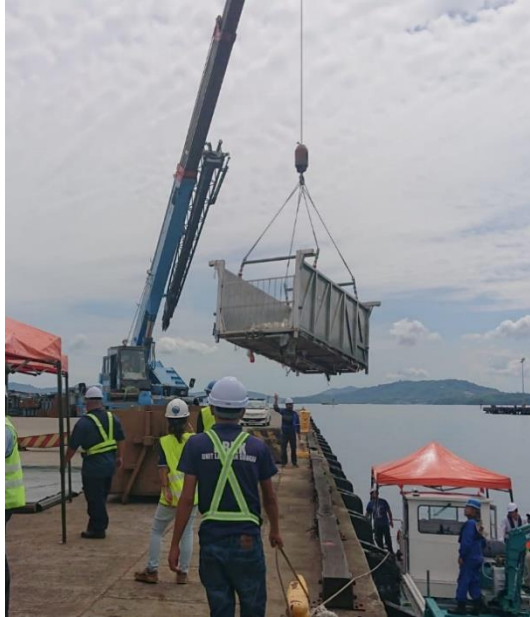
Source : Pirika, Inc.

Taking photo of scattering waste in the pavement



Mapping the waste scattering points and monitoring for raising public awareness and planning the countermeasure for waste management

5.10 Technologies for Waste Collection in Rivers and Seas



Source : Nippon Koei Co., Ltd.

Collection by marine waste collection vessel

Collection of the waste from drainage and/or river by net or oil fence

5.11 Technologies for Recycling Business of Waste Plastic



Source : Guun Co., Ltd.

Waste plastics and papers collected at collection points with separate collection are processed into RPF and fluff fuel



Without additives

With additives

Source : Kao Global Chemicals Japan

Collected waste plastics are processed into additives for asphalt road