Performance Audit Report

PAO-2023-01

SOLID WASTE MANAGEMENT PROGRAM

Progress in the Achievement of the Goals of the Ecological Solid Waste Management Act Needs Stronger Support and the Cohesive Efforts and Strategies of All Stakeholders

Audit Highlights

Why COA did this Study

The country's waste generation continues to rise with the increase in population, rapid economic growth, and industrialization. Hence, Republic Act No. 9003 (RA 9003), otherwise known as the Ecological Solid Waste Management (ESWM) Act of 2000, was enacted in January 2001. It creates the National Solid Waste Management Commission (NSWMC) to address the growing solid waste problem. The NSWMC, chaired by the Secretary of the Department of Environment and Natural Resources (DENR), shall oversee the program's implementation.

More than 20 years after the passage of RA 9003, solid waste generation in the country has steadily increased from 9.07 million metric tons in 2000 to 16.63 million metric tons in 2020. The situation may be attributed to the frail enforcement and compliance with the law due to political, financial, and technical limitations of the local government units (LGUs) and implementing agencies. Many LGUs have yet to comply with establishing local SWM Boards, submission of SWM Plans and establishment of MRFs.

The COA assessed the (a) extent to which the Solid Waste Management Program (SWMP) achieves its goals and objectives; (b) challenges in its implementation; and (c) the extent to which the NSWMC, the DENR through the Environmental Management Bureau (EMB), and other concerned agencies administer the program following established policies and procedures.

COA reviewed the program documents, accomplishments, and status reports; gathered information through surveys from the LGUs, waste facility workers, households, students, and teachers; interviewed key agency officials, municipal and city environment and natural resources officers (M/CENROs), non-government organizations (NGOs), and barangay heads; and assessed the extent of coordination with other stakeholders.

What COA recommends

COA recommends, among others, that NSWMC: (a) conduct massive and continuing information, education, and communication (IEC) campaign, particularly on understanding the provisions of RA 9003 to improve compliance; (b) ensure the operationalization of MRFs, including waste diversion and effective record management; (c) ensure the prohibition on the use of open dumpsites or similar uncontrolled facilities; (d) coordinate with concerned agencies on the establishment of the Solid Waste Management Fund; and (e) coordinate with concerned agencies to help LGUs institutionalize an Environment and Natural Resources Office.

April 2023

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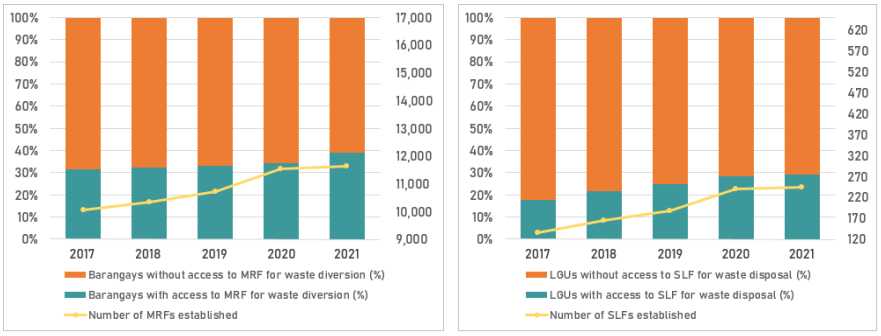
What COA found

Despite the continuous efforts of the NSWMC, the DENR through its EMB, and the LGUs in implementing RA 9003 to ensure the protection of public health and the environment, the program still needs collective and robust efforts from the implementing agencies to address the challenges prompted by the increasing trend of waste generation and to progress in attaining its goals and objectives.

The government has endeavored to improve its solid waste management by passing RA 9003. It mandated the DENR to provide secretariat support to the NSWMC in the implementation of the solid waste management plans, and prescribes policies to achieve the objectives of the National Ecology Center (NEC), which is in charge of information dissemination, consultation, education, and training of various LGUs on ecological waste management. In addition, the SWMP is expected to assist the LGUs in implementing RA 9003 particularly in developing their 10-year SWM Plan, closure and rehabilitation of dumpsites, and establishing Materials Recovery Facilities (MRFs), and the implementation of an environmentally sound disposal system. However, after two decades of implementation, the program may not be seen as progressively achieving its goals and objectives, as manifested by the steadily increasing volume of generated solid waste, including the many gaps noted in the program implementation.

Access to MRFs by Barangays and SLFs by LGUs vis-à-vis Number of Established SWM Facilities



Source: DENR-EMB and NSWMC Data (CYs 2017 to 2021)

Instead of reducing solid waste generation, it steadily increased through the years. We identified key challenges that led to this scenario, such as: the inconsistent implementation of waste segregation and waste diversion, wherein the significant presence of mixed wastes was found in landfills. This condition reduced the capacity of the MRFs for diversion, causing the waste volume in landfills to exceed capacity and shorten serviceable lifespans. In addition, there were no sufficient waste facilities and landfills to service the LGUs and barangays nationwide. As at CY 2021, the country has 11,637 total MRFs only servicing 16,418 (39.05 percent) out of 42,046 barangays; and 245 total operational Sanitary Landfills (SLFs) only servicing 478 (29.25 percent) out of 1,634 LGUs. Due to the limitation in disposal facilities, the operation of the illegal dumpsites could not be avoided in some LGUs. Further on the noted challenges was the non-establishment of the Solid Waste Management Fund, a special account in the National Treasury intended to fund the approved solid waste management plans of LGUs. Lastly, there were fragmentations in the program implementation causing the non-delivery of important interventions to generate reliable and accurate data and ensure proper operationalization. Hence, it is also notable that progress in attaining Sustainable Development Goal (SDG) 12.5, which aims to substantially reduce waste generation through prevention, reduction, recycling, and reuse by CY 2030, has not yet been monitored and tracked by the government.

On a positive note, we recognize the efforts of the DENR-EMB, which successfully decreased the number of illegal dumpsites in CY 2021. Likewise, establishing NEC in CY 2021 was an important step to move forward on the key administrative functions crucial to the program's implementation. Its absence (or non-establishment thereof) for 20 years formed a vast gap in the effective and efficient administration of the program.

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Acronyms

3R	Reduce, Reuse, Recycle
5R	Refuse, Reduce, Reuse, Recycle, Recover
ADB	Asian Development Bank
AQM	Audit Query Memorandum
BARMM	Bangsamoro Autonomous Region in Muslim Mindanao
BOC	Bureau of Customs
BSWM	Bureau of Soils and Water Management
BTr	Bureau of Treasury
CAR	Cordillera Administrative Region
CDO	Cease and Desist Order
CFDF	Categorized Final Disposal Facilities
CHB	Concrete Hollow Block
CLUP	Comprehensive Land Use Plan
CO2eq	Carbon Dioxide Equivalent
COA	Commission on Audit
CRERDEC	Coastal Resources and Ecotourism Ecosystems Research and Development Extension Center
CSWMP	Coalition of Solid Waste Management Providers
CY	Calendar Year
DA	Department of Agriculture
DAO	DENR Administrative Order
DBM	Department of Budget and Management
DENR	Department of Environment and Natural Resources
DFA	Department of Foreign Affairs
DILG	Department of Interior and Local Government
DOH	Department of Health
DOST	Department of Science and Technology
DTI	Department of Trade and Industry
ECC	Environmental Compliance Certificate
EMB	Environmental Management Bureau
EnMOs	Environmental Monitoring Officers
EPR	Extended Producer Responsibility
ERDB	Ecosystems Research and Development Bureau
ESWM	Ecological Solid Waste Management
FNRI	Food and Nutrition Research Institute
FTA	Foreign Tourist Arrival
GAA	General Appropriations Act
GAD	Gender and Development
GI	Galvanized Iron
GIA	Grants-in-Aid
GMA	General Mariano Alvarez
GWP	Global Warming Potential
HDPE	High Density Polyethylene
HUCs	Highly Urbanized Cities
IEC	Information, Education and Communication
IPPU	Industrial Processes and Product Use
IRR	Implementing Rules and Regulations

Acronyms

ISSAI	International Standards of Supreme Audit Institutions
LGU	Local Government Unit
M/CENRO	Municipal/City Environmental and Natural Resources Officer
MC	Memorandum Circular
MGB	Mines and Geosciences Bureau
MIRCA	Mintal Resource Collectors Association
MMDA	Metro Manila Development Authority
MOA	Memorandum of Agreement
MRF	Materials Recovery Facility
MRS	Materials Recovery System
NCR	National Capital Region
NEAP	Non-Environmentally Acceptable Products/Packaging
NEC	National Ecology Center
NGO	Non-Government Organization
NHA	National Housing Authority
NOAP	National Organic Agriculture Program
NOV	Notice of Violation
NSW	New South Wales
NSWMC	National Solid Waste Management Commission
OECD	Organization for Economic Cooperation and Development
PD	Presidential Decree
PDP	Philippine Development Plan
PEZA	Philippine Economic Zone Authority
PPP	Public-Private Partnership
PRO	Producer Responsibility Organization
PSA	Philippine Statistics Authority
RA	Republic Act
RCA	Residual Containment Area
RT	Regional Traveler
SCRP	Safe Closure and Rehabilitation Plan
SDG	Sustainable Development Goals
SEPO	Senate Economic Planning Office
SET-UP	Small Enterprise Technology Upgrading Program
SLF	Sanitary Landfill
SWEEP	Solid Waste Enforcement and Education Program
SWM	Solid Waste Management
SWMD	Solid Waste Management Division
SWMP	Solid Waste Management Program
TSO	Technical Services Office
TWG	Technical Working Group
ULABs	Used Lead Acid Batteries
ULAP	Union of Local Authorities of the Philippines
UN	United Nations
UNIO	United Nations and International Organizations Office
VMLS	Vitas Marine Loading Station
WACS	Waste Analysis and Characterization Studies
WEEE	Waste Electrical and Electronic Equipment

REPUBLIC OF THE PHILIPPINES
COMMISSION ON AUDIT
Commonwealth Avenue, Quezon City

April 11, 2023

Honorable MARIA ANTONIA YULO LOYZAGA
Secretary, Department of Environment and Natural Resources, and
Chairperson, National Solid Waste Management Commission
Quezon City

Dear **Secretary Loyzaga:**

In line with the Commission on Audit's (COA) vision to become an enabling partner of the government in ensuring a better life for every Filipino, we conducted performance audits to help government agencies better perform their mandates and achieve program goals and objectives more economically, efficiently, and effectively.

For CY 2021, COA identified the Solid Waste Management Program (SWMP) as one of the priority programs for audit due to its significance and projected impact on the Filipino people and the environment. The Republic Act (RA) No. 9003 or Ecological Solid Waste Management (ESWM) Act, which establishes a systematic, all-encompassing, and ecological waste management program to assure the protection of public health and the environment, was passed into law in January 2001 as part of the efforts to enhance solid waste management. The ESWM Program is anticipated to support Local Government Units (LGUs) in putting RA 9003 into effect, particularly in the creation of their 10-year Solid Waste Management (SWM) Plan, the closure and rehabilitation of dumpsites, the establishment of Materials Recovery Facilities (MRFs), and the implementation of an environmentally sound disposal system.

The national government has identified this program as one of the key programs that primarily contributes to achieving Sustainable Development Goal[1] (SDG) 12 Target 12.5 which aims to substantially reduce waste generation through prevention, reduction, recycling, and reuse.[2] It is also reported that achieving SWM objectives will promote other SDGs, including SDG 11: Sustainable Cities and Communities and SDG 13: Climate Action. Based on the Philippines' Adjusted CY 2010 Greenhouse Gas Inventory for Industrial Processes and Product Use (IPPU) and Waste Sectors, emissions from solid waste account

[1] The SDGs are a collection of 17 interlinked global goals designed to be a "shared blueprint for peace and prosperity for people and the planet, now and into the future". The SDGs were set up in 2015 by the United Nations General Assembly and are intended to be achieved by 2030.
[2] *Implementation of Ecological Solid Waste Management Regulations*. Retrieved September 7, 2022, from https://sdg.neda.gov.ph/implementation-of-ecological-solid-waste-management-regulations/

for about 25 percent or about 6.5 million CO2-eq[3], which is mainly from the decomposition of organic waste in the disposal facilities. Other sources of emissions in the solid waste sub-sector are methane resulting from the biological treatment of organic waste (i.e., composting and anaerobic digestion of waste) and open burning of waste.

However, despite the enactment of the ESWM Act more than two decades ago, solid waste generation in the country steadily increased from 9.07 million metric tons in CY 2000 to 16.63 million metric tons in CY 2020. This problem worsened further due to the increased production of hazardous and infectious wastes caused by the COVID-19 pandemic. Due to this, stakeholders, including but not limited to legislators and non-governmental groups, have voiced the same concern and called for action regarding our increasing waste generation.

This audit aims to determine the (a) extent the program achieves its goals and objectives; (b) challenges in implementing the program; and (c) the extent the program implementers administer the program following established policies and procedures.

We reviewed the program documents, accomplishments, and status reports; gathered information through surveys from the LGUs, waste facility workers, households, students, and teachers; interviewed key agency officials, municipal and city environment and natural resources officers (M/CENROs), non-government organizations (NGOs), and barangay heads; and assessed the extent of coordination with other stakeholders. To enhance stakeholder relations, we adopted a Citizen Participatory Audit approach. This involved engaging a Citizen Partner who is a former COA Auditor with extensive knowledge and experience in the field. She assisted us in collecting information and evidence from CSOs/NGOs and specific barangays. The collection of information was done through the conduct of surveys and interviews.

The audit scope covers program implementation from CYs 2001 to 2021, with some information extending until September 15, 2022, to provide timely and relevant data to stakeholders. We used non-generalizable samples, hence the data only indicates the presence but not the extent of the condition in the population.

We conducted our performance audit from June 2021 to September 2022 following the International Standards of Supreme Audit Institutions (ISSAI) 3000 – Standard for Performance Auditing. The standard requires that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe the evidence obtained provides a reasonable basis for our findings and conclusions.

[3] Carbon dioxide equivalent (CO2eq) stands for a unit based on the global warming potential (GWP) of different greenhouse gases. The CO2eq unit measures the environmental impact of one tonne of these greenhouse gases in comparison to the impact of one tonne of carbon dioxide.

Background

The Republic Act (RA) No. 9003 or the Ecological Solid Waste Management Act (ESWM) of 2000 provides for adopting a systematic, comprehensive, and ecological SWMP. This act aims to protect public health and environment; encourage resource conservation and recovery; promote greater public participation in the formulation and implementation of the SWM programs; encourage the private sector in SWM to be complemented by greater use of market-based instruments and strict enforcement of the provisions of the law; supporting research on effective technologies and techniques for efficient SWM and the promotion of environmental awareness.

History. In CY 2000, estimates show that the Philippines generated 19,700 tons of garbage daily *(see Table 1)*. In the same year, the Payatas dumpsite landslide happened, A large pile of garbage collapsed and went up in flames, destroying about 100 informal settlers' houses, killing 2,018 people, and leaving another 300 people missing under the rotting garbage. This incident prompted the passage of RA 9003 which mandates the closure of open dumpsites in the Philippines by 2004 and controlled dumpsites by 2006.

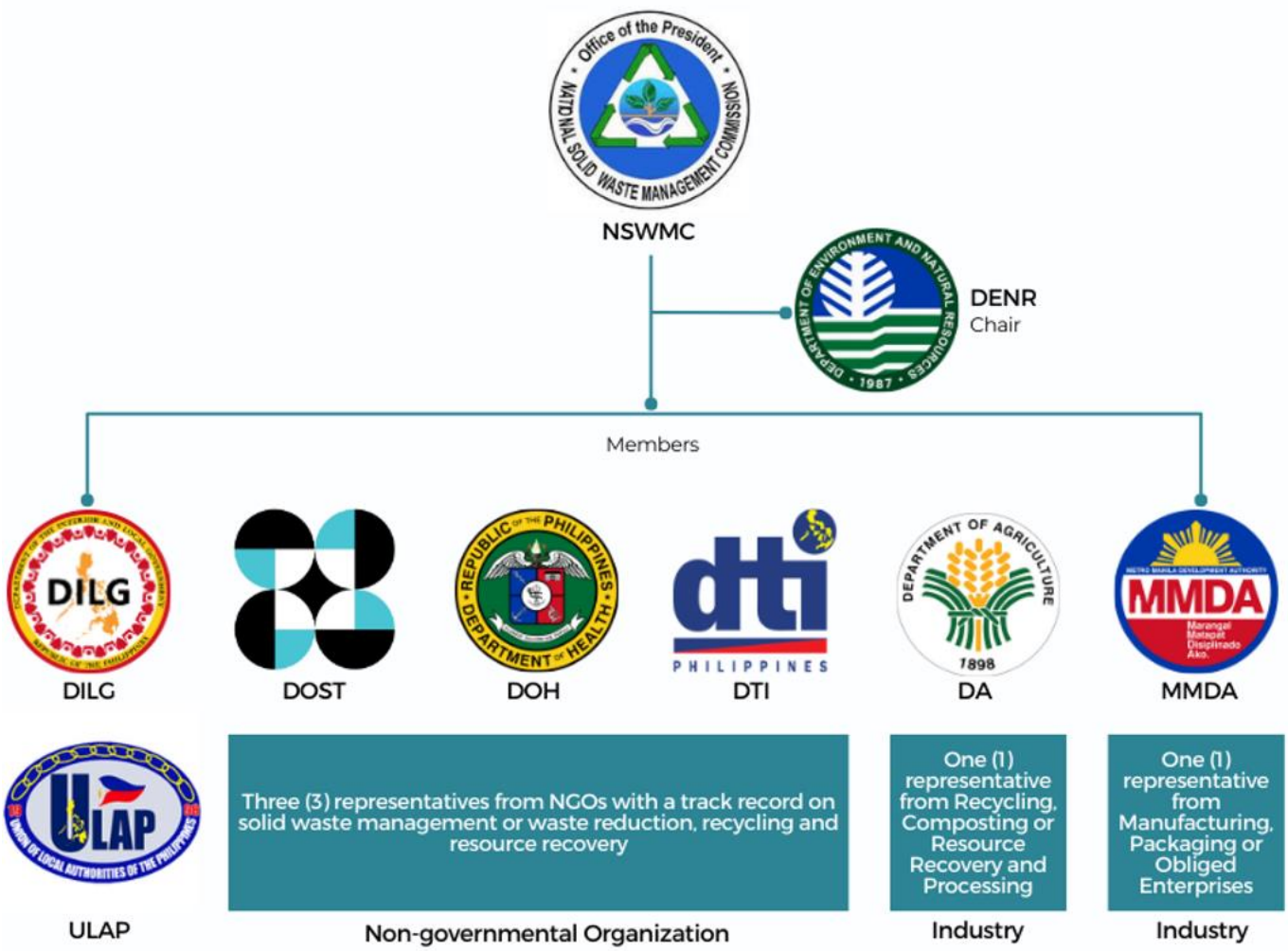
Table 1: Distribution of Waste Generated per Region in CY 2000

Region	CY 2000	
	Tons/day	Percentage
National Capital Region (NCR)	4,953	24.6
Cordillera Administrative Region (CAR)	223	1.11
1	873	4.33
2	271	1.35
3	2,729	13.56
4	3,935	19.55
5	654	3.25
6	969	4.81
7	1,607	7.98
8	336	1.67
9	417	2.07
10	748	3.72
11	986	4.9
12	432	2.14
Autonomous Region in Muslim Mindanao	253	1.26
Caraga	314	1.56
PHILIPPINES	**19,700**	**100**

Source: National Solid Waste Management Framework 2004

Stakeholders and their respective roles and responsibilities. The National Solid Waste Management Commission (NSWMC) headed by the Secretary of the Department of Environment and Natural Resources (DENR) is tasked to oversee the implementation of SWM plans and prescribe policies to achieve the objectives of RA 9003 *(see Figure 1)*.

Figure 1: Revised NSWMC Organizational Framework



Source: RA No. 11898 also known as the Extended Producer Responsibility (EPR) Act of 2022

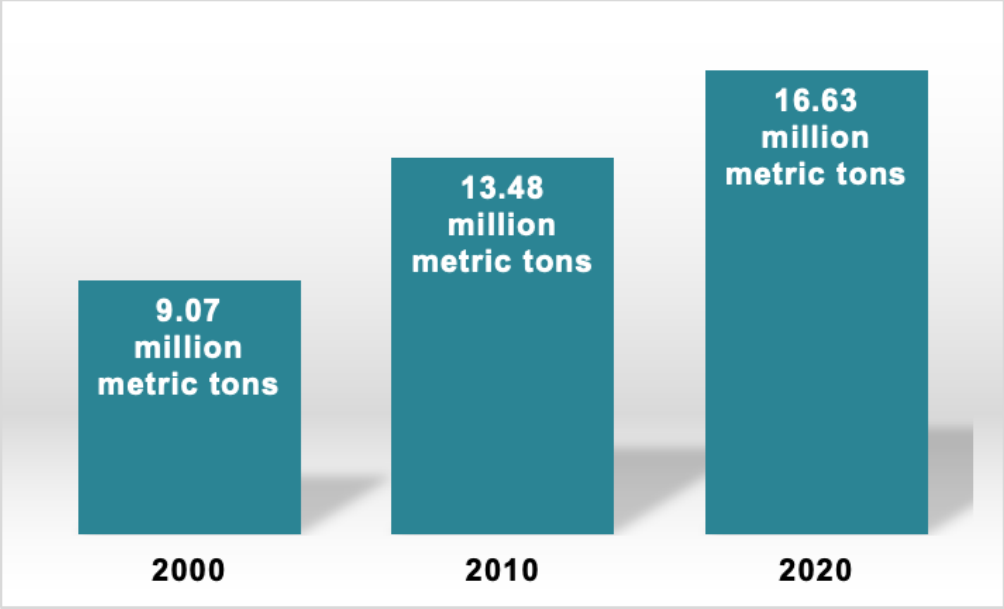
On the other hand, the Commission shall comprise eight members from the government sector and five from the private sector. The government sector shall be represented by the heads of the Department of Science and Technology (DOST), Department of Health (DOH), Department of Agriculture (DA), Department of Interior and Local government (DILG), Department of Trade and Industry (DTI), Metro Manila Development Authority (MMDA), and the Union of Local Authorities of the Philippines (ULAP). The private sector shall be represented by three NGO representatives with a track record in SWM or waste reduction, recycling, and resource recovery, one from Recycling, Composting, or Resource Recovery and Processing, and one from Manufacturing, Packaging or Obliged Enterprises.

The RA 9003 also highlighted that local governments (i.e., from provincial, municipal/cities, and barangay levels) are responsible for enforcing and implementing the law in their respective jurisdictional areas.

RA 9003 also established the National Ecology Center (NEC) under the NSWMC, tasked to collect, prepare and distribute information and conduct educational and training programs to help implement the SWMPs. The NEC is also expected to inform the public of the relationship between the generation of different types of wastes and quantities of solid wastes, alternatives available to handle these wastes and the implementation of the SWM hierarchy.

Present situation. More than 20 years after the passage of RA 9003, solid waste generation in the country has steadily increased from 9.07 million metric tons in CY 2000 to 16.63 million metric tons in CY 2020 *(see Figure 2)*.

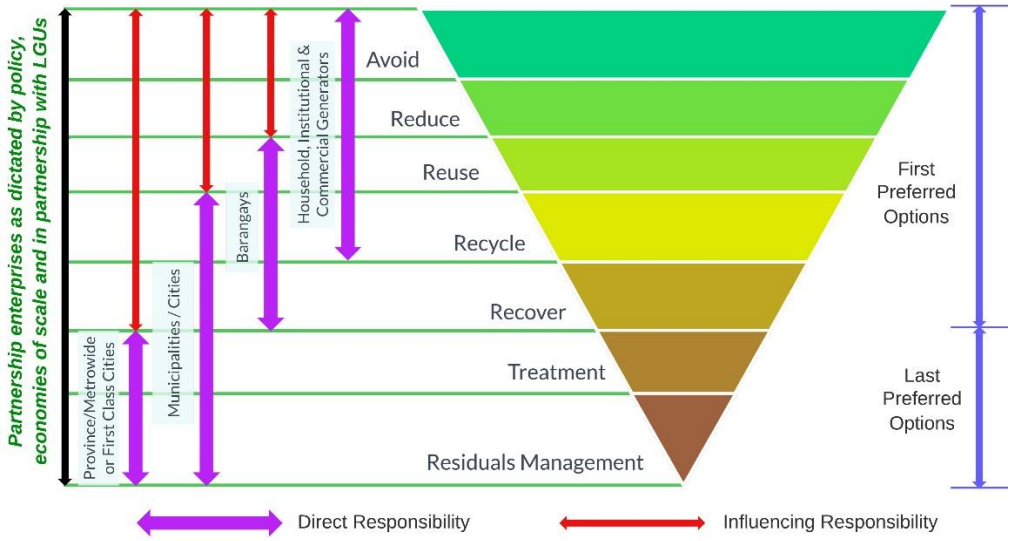
Figure 2: Reported Waste Generation for CYs 2000, 2010 and 2020



Source: NSWMC Status Report 2008-2018, Case Study of RA 9003 Implementation

SWM Hierarchy. The RA 9003 promotes SWM following a hierarchy of options covering waste management activities, from volume reduction to final waste disposal. In line with this, the hierarchy also corresponds to the levels of governance, starting from the households to the province or metro-wide level of government.

Figure 3: SWM Hierarchy

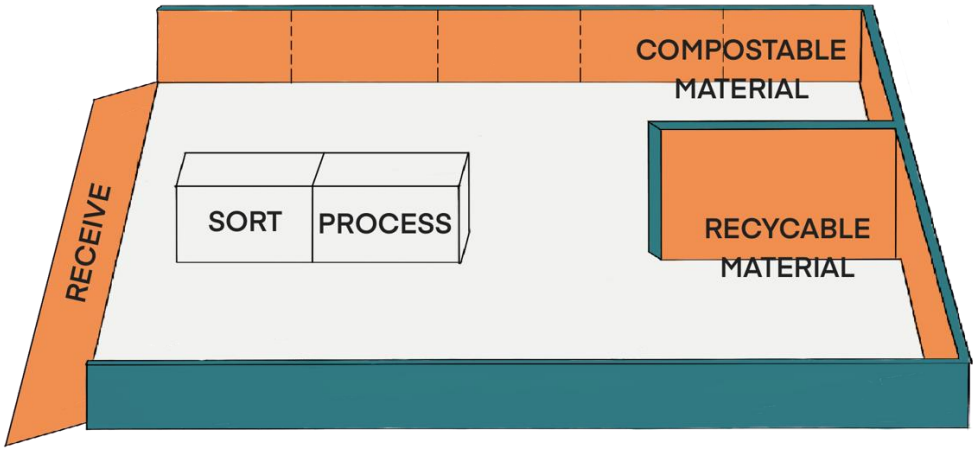


Source: National Solid Waste Management Framework 2004

As shown in Figure 3, at the base of the hierarchy are avoiding and reducing waste. The objective is to reduce the amount of materials and products entering the waste stream. The basic approach to volume reduction covers avoidance, product reuse, increased product durability, reduced material uses in production, and decreased consumption. The next level of the hierarchy is recycling and recovery, which differs from volume reduction since it involves the recovery of products from the waste stream. At this level of the hierarchy, a critical aspect is the MRF, which will separate, clean, and prepare the recyclables for marketing or segregate only the biodegradables for commercial composting. These five levels, from volume reduction to recycling and recovery, constitute the first preferred options under the waste management hierarchy. The last two levels of the waste hierarchy considered the last preferred option under the waste management hierarchy is treatment and disposal.

Mandated Waste Facilities. The RA 9003 has mandated the establishment of MRF in every barangay or cluster of barangays to enable waste diversion at the local level. An MRF shall be designed to receive, sort, process, and store compostable and recyclable material efficiently and in an environmentally sound manner *(see Figure 4)*.

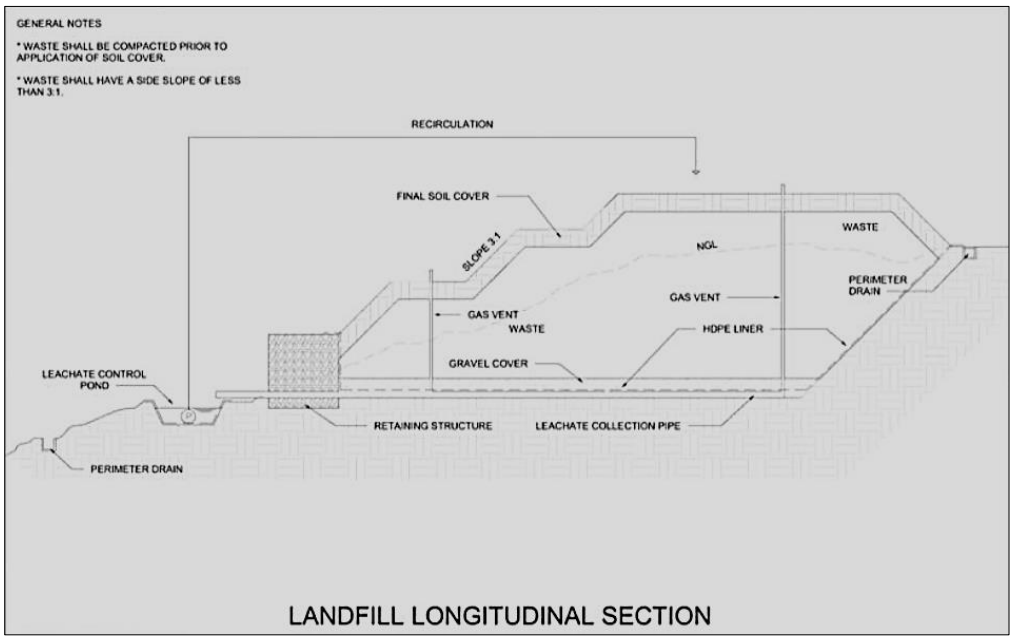
Figure 4: Materials Recovery Facility (MRF)



Source: RA 9003, Section 33 - COA Analysis

The MRF shall receive mixed waste for final sorting, segregation, composting, and recycling. The resulting residual wastes shall be transferred to LGU's long-term storage or disposal facility or sanitary landfill (SLF).

Figure 5: Typical SLF System



Source: Technical Guidebook on Solid Waste Disposal Design and Operation

An SLF is a disposal site designed, constructed, operated, and maintained in a manner that exerts engineering control over significant potential environmental impacts arising from the development and operation of the

facility *(see Figure 5)*. The basic operational controls include the following: leachate collection and treatment systems, landfill gas management, waste compaction, application of soil cover, all-weather primary and access roads, trained labor force, and a ban on waste pickers, among others. Site design is based on Hydrogeological considerations, while site preparation includes surface run-off control and containing earth movements.[4]

Some qualities of an SLF include a natural impermeable lower layer to block the movement of leachate into ground water; a leachate collection system; gravel layers permitting the control of methane; and daily covering of garbage with soil. In sanitary landfilling, wastes are compacted and covered at the end of each day.

DENR Administrative Order (DAO) No. 10, Series of 2006 refers to Guidelines on the Categorized Final Disposal Facilities (CFDF) into four categories *(see Table 2)* based on net residual waste generation, after considering the waste diverted through composting, recycling, and recovery efforts as well as the environmental, financial, and socio-economic conditions of the LGUs, including its hydro-geological dimensions. These guidelines comply with Sections 37, 40, 41, and 42 of RA 9003 and its Implementing Rules and Regulations (IRR).

Table 2: SLF Categories

Features	Category 1 (≤ 15 tons/day)	Category 2 (> 15 tons/day to 75 tons/day)	Category 3 (> 75 tons/day to 200 tons/day	Category 4 (> 200 tons/day)
Daily and Intermediate Soil Cover	✔	✔	✔	✔
Embankment / Cell Separation	✔	✔	✔	✔
Drainage Facility	✔	✔	✔	✔
Gas Venting	✔	✔	✔	✔
Leachate Collection	✔	✔	✔	✔
Leachate Treatment	Pond System	Pond System	Pond System	Combination of physical, biological & chemical
Leachate Recirculation	At a later stage of operation	At a later stage of operation	At a later stage of operation	Treatment
Clay liner	At least 60 cm thick and has a permeability of 10^{-5} cm/sec	At least 75 cm thick and has a permeability of 10^{-6} cm/sec		
Clay liner and/or synthetic liner			Clay liner at least 75 cm thick and has a permeability of 10^{-7} cm/sec or better. If not available, an equivalent replacement would be a composite liner consisting of at least 1.5mm thick High Density Polyethylene (HDPE) membrane	Synthetic liner at least 1.5mm thick HDPE membrane over at least 60 cm thickness of compacted clay materials with permeability no more than 10^{-7} cm/sec

[4] Technical Guidebook on Solid Waste Disposal Design and Operation

Features	Category 1 (≤ 15 tons/day)	Category 2 (> 15 tons/day to 75 tons/day)	Category 3 (> 75 tons/day to 200 tons/day	Category 4 (> 200 tons/day)
			over at least 60 cm thickness of compacted fine materials with permeability no more than 10^{-6} cm/sec	

Source: DAO No. 10

On the other hand, RA 9003 prohibits the use of open dumpsites and promotes the conversion or upgrading of such into a controlled facility within three years upon effectivity of RA 9003, provided that controlled dumpsites shall no longer be allowed five years following the effectivity of RA 9003.

Budget and Resources. To finance SWM, RA 9003 mandated the creation of the SWM Fund to be administered by the NSWMC. This Fund shall finance products, facilities, technologies, and processes to enhance proper SWM, awards and incentives, research programs, information, education, communication and monitoring activities, technical assistance, capability building activities, and approved SWM plans of LGUs. Overall, this Fund shall be made available to the NSWMC, the NEC, and LGUs to achieve and perform their roles and responsibilities for achieving the goals of SMWP. However, according to DENR-EMB, this Fund was not yet established. Hence, the budget for SWMP was spread through various agencies and LGUs. Also, it varies per agency and LGU. At this point, there was no document consolidating all SWMP-related expenditures.

Available data shows that the total accumulated funds allocated for SWMP were at least ₱47.997 billion as at CY 2021 *(see Table 3)*.

Table 3: Sample Government Agencies Budget for SWMP

Year	DENR-EMB	MMDA	250 LGUs[5]	TOTAL
2001	/	/	/	/
2002	₱261,795,000	₱665,564,000	/	**₱927,359,000**
2003	/	/	/	/
2004	/	/	/	/
2005	193,775,000	665,564,000	/	**859,339,000**
2006	/	/	/	/
2007	215,154,000	775,564,000	/	**990,718,000**
2008	264,957,000	1,302,709,000	/	**1,567,666,000**
2009	352,935,000	1,302,709,000	/	**1,655,644,000**

[5] We requested all LGUs to submit relevant SWM information through Google Forms. However, only 591 out of 1,634 LGUs have responded, and only 250 LGUs submitted budget information for CYs 2019 to 2021.

Year	DENR-EMB	MMDA	250 LGUs[5]	TOTAL
2010	494,954,000	1,076,599,000	/	**1,571,553,000**
2011	458,165,000	518,621,000	/	**976,786,000**
2012	502,931,000	793,068,000	/	**1,295,999,000**
2013	735,816,000	898,538,000	/	**1,634,354,000**
2014	1,215,589,000	898,538,000	/	**2,114,127,000**
2015	712,631,000	993,538,000	/	**1,706,169,000**
2016	591,921,000	1,048,538,000	/	**1,640,459,000**
2017	944,551,000	993,538,000	/	**1,938,089,000**
2018	910,096,000	1,003,960,000	/	**1,914,056,000**
2019	733,142,000	933,926,000	6,221,402,145	**7,888,470,145**
2020	1,471,978,000	1,989,973,000	6,427,670,103	**9,889,621,103**
2021	632,922,000	2,549,016,000	6,245,277,465	**9,427,215,465**
TOTAL	**₱10,693,312,000**	**₱18,409,963,000**	**₱18,894,349,713**	**₱47,997,624,713**

/Data is not available

Source: General Appropriations Acts (GAA) and LGU data

For more than 20 years since the enactment of RA 9003, waste management has remained an issue as waste generation continues to increase

Since the passage of RA 9003 more than 20 years ago, waste management has continued to be an issue of concern, made even more pronounced by a projection that annual solid waste generation will rise from 16.63 million metric tons in CY 2020 to 19.76 million metric tons in CY 2030 and 24.50 million tons in CY 2045 with the increase in population, rapid economic growth, and industrialization. Also, our audit found delays in the preparation and approval of LGUs' 10-yr SWM Plan, and the total number of MRFs and SLFs was inadequate to service all barangays and LGUs nationwide. As a result, a number of LGUs were also left with no other resort but to reopen or establish new illegal dumpsites.

Solid waste generation is continually increasing and is projected to increase further in future years

One of the primary goals of RA 9003 is to reduce waste to benefit the environment and public health. Similarly, this is also in line with SDG Target 12.5, which aims to substantially reduce waste generation through prevention, reduction, recycling, and reuse. However, more than 20 years after the enactment of RA 9003, the municipal solid waste generated has been projected to increase from 9.07 million metric tons in CY 2000[6] to 16.63 million metric tons in CY 2020. Therefore, assuming a steady rate of waste generation, solid waste production shall continue to increase in future years, negating its goal of reducing waste.

By definition, waste generation is the act or process of producing solid waste. For every waste generated, there exist two pathways *(see Table 4)*. A significant amount of the waste is aimed to be diverted through reuse, recycling, composting, and other resource recovery activities. The remaining waste not diverted must be safely disposed of in a final disposal facility.

Table 4: Waste Generation Formula

$$Waste\ Generated\ =\ Waste\ Diverted\ +\ Waste\ Disposed\ (in\ tons)$$

Source: New South Wales (NSW) Environment Protection Authority

[6] Case Study on RA 9003 Policy Implementation

On the other hand, for a specific economic area, the waste generated per capita is used to evaluate the intensity of waste generation in an area that has varying economic activities from another *(see Table 5)*.

Table 5: Waste Generated per Capita

$$Waste\ Generated\ per\ Capita\ = \frac{Waste\ Generated}{Population}$$

Source: NSW Environment Protection Authority

To compute the previously mentioned projected waste generation, the DENR-EMB used the 2010 waste generation per capita as a base.[7] The waste generation per capita for the Philippines is 0.4 kg/capita per day (weighted average). However, the distribution of waste generation differs from urban to rural. More waste was produced in densely populated cities and municipalities, which was traced to Metro Manila, the capital of the Philippines, with a rate of 0.61 kg/capita per day. Moreover, if other highly urbanized cities (HUCs) were included, the rate would increase to 0.69 kg/capita per day. On the other hand, compared to the urban areas, the rural areas produce significantly lesser waste, as shown, with a rate of 0.31 kg/capita per day *(see Table 6)*.

Table 6: Philippines' Waste Generation per Capita

Scope/ Coverage	Sample size (as % of demographics)	Range	Weighted Average
		kg/ capita/ day	
PHILIPPINES (Nationwide)	79%	0.10-0.79	0.40
Metro Manila (NCR)	100%	0.27-1.00	0.61
Metro Manila and some HUCs	*Not available*	0.27-1.00	0.69
Other cities and provincial capitals (excluding NCR/HUCs)	*Not available*	0.29-0.64	0.50
All LGUs in the country, excluding Metro Manila	76%	0.10-0.71	0.34
Municipalities (cities and some capital towns excluded)	*Not available*	0.10-0.64	0.31

Source: DENR Data

Hence, using the 0.4kg/capita per day (weighted average) waste generation rate in the Philippines, the total estimated waste generation increased from CYs 2010 to 2020. From 13,481,326 metric tons in CY 2010, the volume has

[7] National Solid Waste Management Status Report 2008-2018, published by NSWMC

been projected by NSWMC to grow to 16,628,026 metric tons in CY 2020 *(see Figure 2)*.

However, even the calculated waste generation per capita computed by the DENR-EMB was not fixed. In a 2012 paper, the World Bank also estimated that solid waste generation will double to 0.9 kg/capita per day by CY 2025, an increase of 400 grams of waste produced per person daily[8].

In Metro Manila alone, the estimated waste generation report[9] from the MMDA shows that in CY 2015, the amount of waste estimated to be generated was 16,499,825.00 cubic meters. After five years, in CY 2020, it has increased to 22,003,784.58 cubic meters *(see Table 7)*. Based on the six-year period from CYs 2015 to 2020, the total estimated waste generation grew by 33.36 percent, or at a rate of 5.56 percent annually.

Table 7: Metro Manila's Estimated Waste Generation Report

Year	Estimated Waste Generation (cu.m.)	Budgeted Waste Requirement Based on 55% EWG (cu.m.)	Actual Waste Disposed of (cu.m.)
2015	16,499,825.00	9,074,903.75	10,269,460.15
2016	19,212,602.70	10,566,931.49	10,720,031.08
2017	19,740,973.90	10,857,535.65	10,334,449.28
2018	20,449,260.05	11,247,093.03	11,608,753.54
2019	21,210,993.15	11,666,046.23	11,950,709.90
2020	22,003,784.58	12,102,081.52	12,054,818.89
January - June 2021	22,774,711.55	12,526,091.35	6,169,334.55

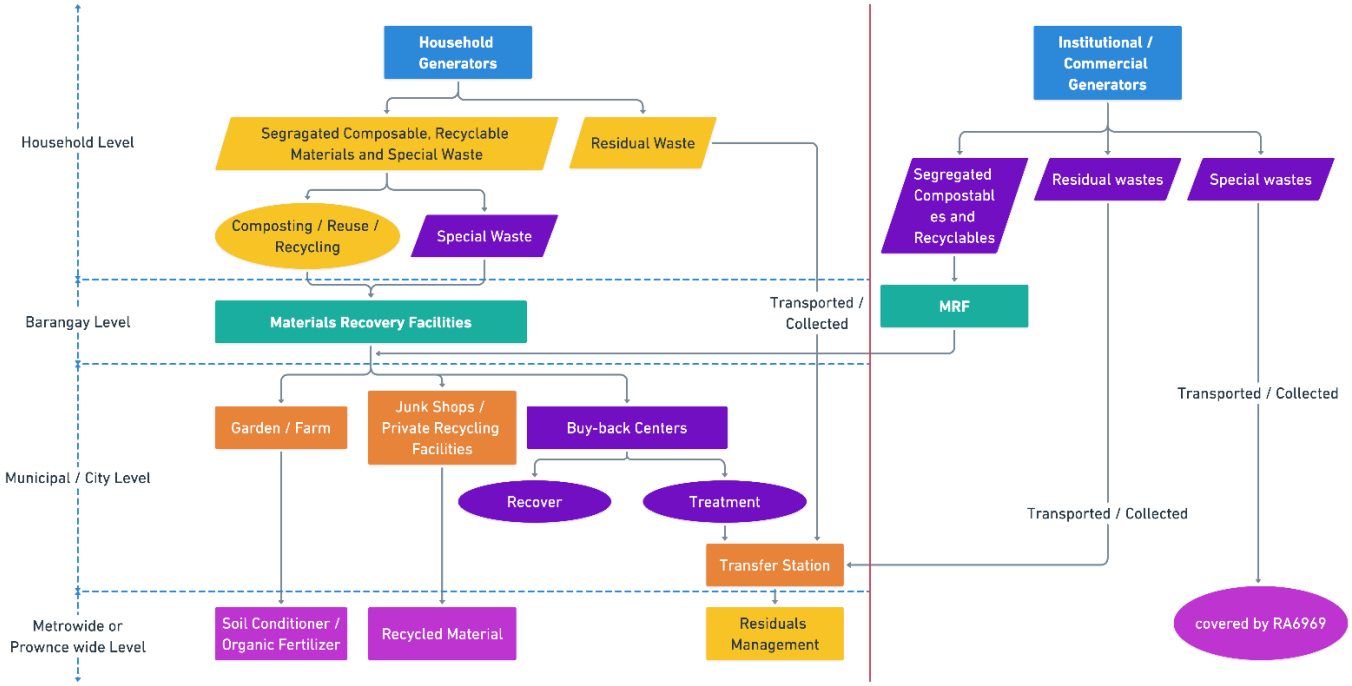
Source: Metro Manila Waste Disposal (2015-2021), MMDA

[8] Hoornweg, D. and Bhada-Tata, P. (2012, March). *What a Waste: A Global Review of Solid Waste Management*. Retrieved January 4, 2023, from https://www.researchgate.net/publication/306201760_What_a_waste_a_global_ review_ of_solid_waste_management

[9] Metro Manila Waste Disposal, 2015-2021, Metro Manila Development Authority Report

What are the sources of all these wastes? According to RA 9003, the computation of estimated solid waste generation and projection in the Philippines is referred to by source, such as residential, market, commercial, industrial, construction/demolition, street waste, agricultural, agro-industrial, institutional, and other wastes. On the other hand, according to the NSWMC Framework, the primary source of waste comes from the household level and the institutional/commercial level *(see Figure 6)*.

Figure 6: SWM System

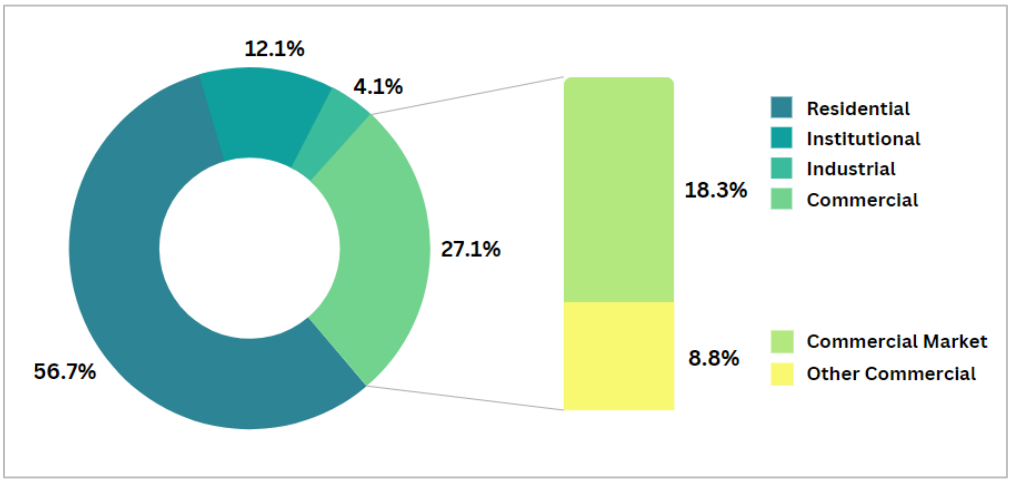


Source: NSWMC Framework 2004

Based on the latest available data summarizing the composition of waste in the Philippines using the Waste Analysis and Characterization Studies (WACS)[10], presented in Figure 7, are the sources of municipal solid wastes in the Philippines. Residential wastes form the majority of the waste at 56.7 percent, followed by commercial waste at 27.1 percent. The commercial waste was further classified as commercial market waste at 18.3 percent and other commercial waste at 8.8 percent. This was followed by institutional waste at 12.1 percent, and the least source of waste was an industrial waste at 4.1 percent.

[10] Composition and sources of municipal solid wastes in the Philippines, 2008-2013, NSWMC Status Report 2008-2018

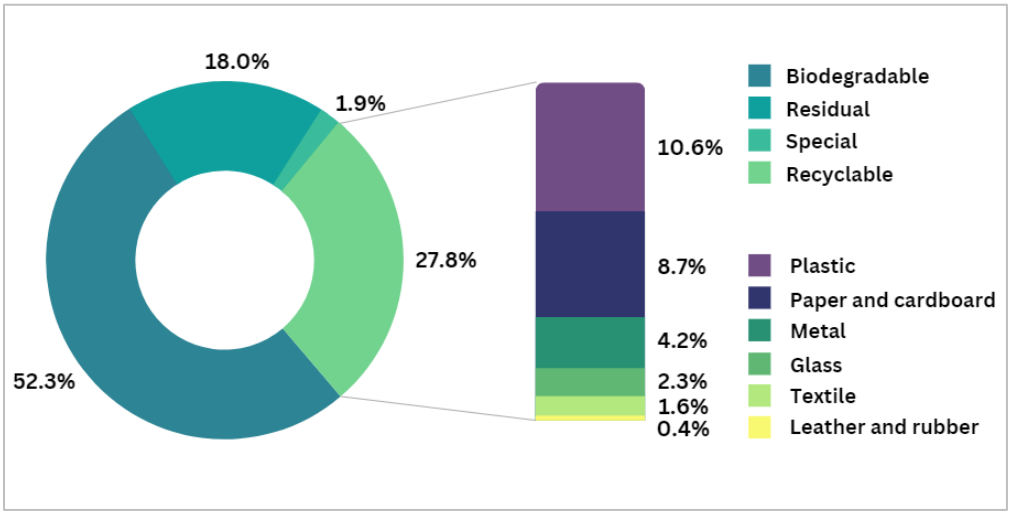
Figure 7: Percentage Distribution of Municipal Solid Wastes by Source from CYs 2008 to 2013



Source: NSWMC Status Report 2008-2018

As to the composition *(see Figure 8)*, most were biodegradable wastes at 52.3 percent, followed by residual wastes at 18.0 percent. Special wastes comprise 1.9 percent of the waste composition, while the remaining 27.8 percent were accounted for as recyclable wastes. The recyclable wastes were broken down as follows: the majority comprises plastics at 10.6 percent, followed by paper and cardboard at 8.7 percent. Although small in contribution, metals also composed the recyclables group at 4.2 percent, glass at 2.3 percent, textile at 1.6 percent, and leather and rubber at 0.4 percent.

Figure 8: Percentage Distribution of Composition of Municipal Solid Wastes from CYs 2008 to 2013



Source: NSWMC Status Report 2008-2018

We identified at least seven major causes attributed to the failure to reduce waste over the years substantially. Some will be discussed further in the succeeding chapters.

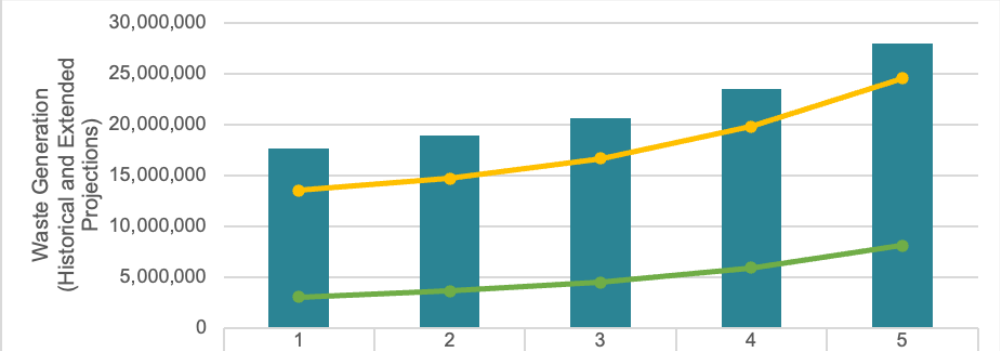
1. Interventions to reduce the waste generators (e.g., households and industrial/commercial), starting with IEC campaigns.
2. Increasing population, with challenges in family planning, especially in urban areas.
3. Lack of studies on materials with reusability/ recyclability that can be promoted.
4. Dependence on single-use items without exception to Non-Environmentally Acceptable (NEAP) Products, especially in urban areas.
5. Waste imports from developed countries were still enforced in the absence of ratification of the Basel Ban Amendment
6. Prevalence of COVID-19 household and healthcare waste since 2020.
7. Insufficient solid waste facilities to help divert and safely dispose of solid wastes.

To highlight one of the identified causes, waste avoidance is also given little importance in the waste management programs of LGUs, even as it was the first preferred option in the waste management hierarchy *(see Figure 3)*. Avoidance refers to an action to reduce the amount of waste generated by households, industries, and all levels of government. It is also the waste management hierarchy's most important but challenging component. However, despite different IEC campaigns or information dissemination to communities, implementing waste prevention or avoidance remains challenging, according to LGUs. We gathered from LGU interviews that changing people's attitudes were critical to a successful waste avoidance program. However, shifting towards positive social acceptance and responsibility has also remained challenging for them.

Unless the above causes are addressed, furthering the extent of waste generation's effect will result in the projected annual waste generation[11] of 19,764,384.95 metric tons in CY 2030 to 24,499,946.53 metric tons in CY 2045 *(see Figure 9)*. With this scenario, the Philippines is yet to come closer to achieving SDG Target 12.5 of substantially reduced waste generation by 2030.

[11] Because of the absence of actual data on waste generation, we used the projections of NSWMC to forecast the future waste generation, provided that no interventions are made.

Figure 9: Projected Waste Generation for CYs 2010 to 2045



	1	2	3	4	5
Year	2010	2014	2020	2030	2045
Population	93,970,000.0	100,500,000.	109,600,000.	125,266,578.	148,656,710.
Philippines	13,481,326.0	14,661,414.0	16,628,026.0	19,764,384.9	24,499,946.5
Metro Manila	2,990,814.00	3,595,593.00	4,441,634.00	5,895,671.24	8,067,075.38

Source: COA Extended Waste Projection for CYs 2030 to 2045, from DENR Waste Projection for CYs 2010 to 2020.

Moreover, we compared the projected increase in waste generation[12] with the manner of growth of SWM facilities that were expected to receive all residual and special wastes after solid waste diversion *(see Table 8)*. At the rate the waste generation continues to increase, there is also a need to increase the rate at which these facilities need to be established and remain operational to ensure that the amount of solid waste can still be treated in an environmentally safe and sound manner. If left unsolved, this looming amount of waste is susceptible to more problems as it goes into the waste stream, causing stress to public health and increasing waste management costs, which will be further discussed in the following chapters.

Table 8: Comparison of Population, Established MRFs, and SLFs from CYs 2010 to 2021

Year	Population	Established MRFs for Solid Waste Diversion	Established SLFs for Solid Waste Disposal
2010	94,636,700	6,957	33
2011	96,337,913	7,312	34
2012	98,032,317	7,713	44
2013	99,700,107	8,486	55
2014	101,325,201	8,656	86
2015	103,031,365	9,335	101
2016	104,875,266	9,883	118
2017	106,738,501	10,052	135
2018	108,568,836	10,340	165
2019	110,380,804	10,722	187
2020	112,190,977	11,546	241
2021	113,880,328	11,637	245

Source: Macrotrends LLC and DENR Data

[12] Projected without COVID-19 household and healthcare waste.

Lastly, the addition of COVID-19 household and healthcare wastes, as well as imported wastes coming from developed countries (to be discussed in the succeeding chapters), shall also contribute to the growing waste situation, with all its challenges and setbacks.

Delay in LGUs' implementation of 10-year SWM plans

The development of 10-year SWM Plans[13] is mandated in RA 9003 to serve as the blueprint for LGUs to implement SWM. However, over two decades after adopting the law, gaps remain in various areas, starting with the delay in the submission, review, and approval of the 10-yr SWM Plans, and the absence of active SWM Boards at the provincial, city/municipal, and barangay levels.

According to the National Solid Waste Management Framework published by the NSWMC in CY 2004, RA 9003 placed particular importance on planning as a basis for the rational implementation of the SWM strategy. It was reiterated that preparing the national framework and the requirement for LGUs to prepare their respective 10-yr SWM Plans emphasizes the indispensability of planning in the entire spectrum of strategy implementation. The 10-yr SWM Plan shall ensure the long-term management of solid waste.

Hence, the submission of SWM Plans by the local government was mandated at the provincial, city, and municipal levels by the respective SWM Boards instituted at the provincial level and at the city and municipal level per Sections 11(1) and 12(1) of RA 9003, respectively. The Provincial SWM Boards shall develop the provincial SWM Plan from the submitted 10-yr SWM Plans of the respective City and Municipal SWM Boards. Similarly, the City and Municipal SWM Boards shall develop the city or municipal SWM Plan by integrating the various SWM plans and strategies of the barangays in its area of jurisdiction.

On the other hand, as part of the powers and functions of the NSWMC in fulfilling its oversight arrangements, per Section 5(b) of RA 9003, they are mandated to approve local SWM Plans following its rules and regulations. Moreover, the NSWMC shall develop a model provincial, city, and municipal SWM Plan to establish content and format prototypes.

Delay in submission, review, and approval of the 10-yr SWM Plans. As at December 2021, out of the 1,716 expected 10-yr SWM Plans to be enforced by the LGUs nationwide, 96.27 percent or 1,652 were prepared and submitted by the LGUs *(see Table 9)*. The remaining 3.73 percent (64) were still for submission, with the majority coming from Bangsamoro Autonomous Region in Muslim Mindanao (BARMM) Region.

[13] Hereinafter shall be referred to as the "10-yr SWM plan"

Table 9: CY 2021 Status of Submission and Review of 10-yr SWM Plans

Region	Submitted			Not yet submitted (D)	Grand Total (E=C+D)
	Approved (A)	Under Evaluation (B)	Total Plans Submitted (C=A+B)		
NCR	17	0	17	1	18
CAR	77	6	83	0	83
1	76	53	129	0	129
2	69	28	97	1	98
3	123	14	137	0	137
4A	106	41	147	0	147
4B	38	40	78	0	78
5	39	81	120	0	120
6	118	21	139	0	139
7	90	46	136	0	136
8	77	71	148	1	149
9	54	21	75	0	75
10	92	6	98	0	98
11	48	6	54	0	54
12	45	8	53	0	53
13	78	0	78	0	78
BARMM	44	19	63	61	124
TOTAL	**1,191**	**461**	**1,652**	**64**	**1,716**
%	**69.41%**	**26.86%**	**96.27%**	**3.73%**	**100.00%**

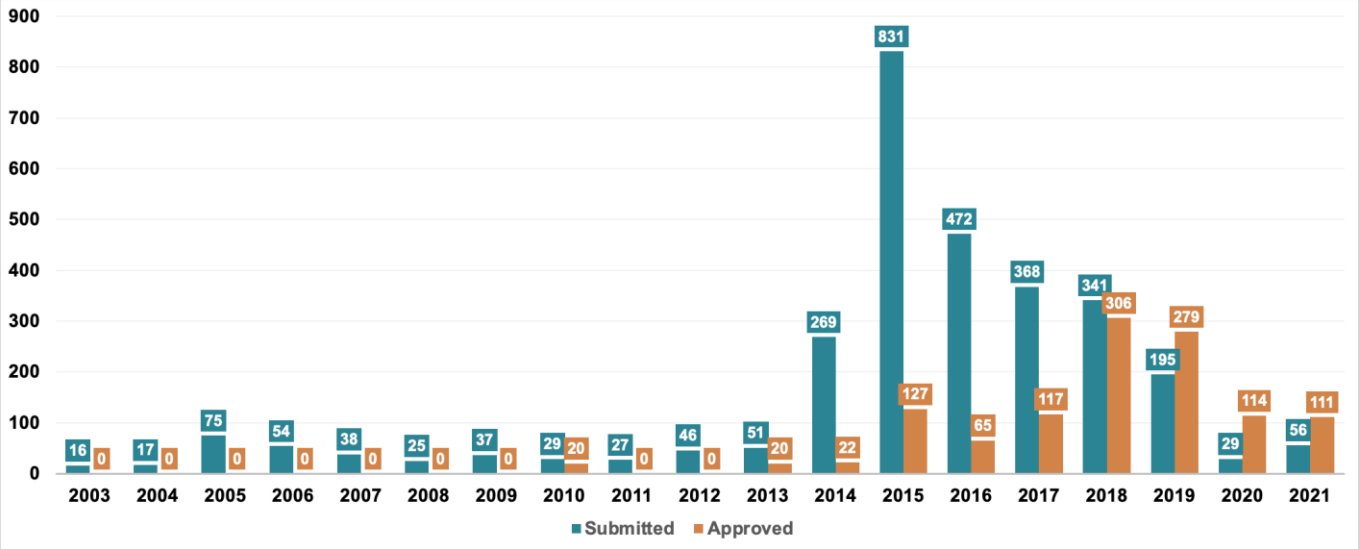
Source: DENR-EMB Data

Of the 1,652 submissions, 69.41 percent or 1,191 10-yr SWM Plans were approved by the NSWMC, while the remaining 28.86 percent (461) were under review and evaluation. A 10-yr SWM Plan under review and evaluation covers those with pending submission of additional data, mostly involving budgetary requirements and specifics on proper final disposal facilities.

Based on the review of documents and interviews conducted, we found delays in submitting, reviewing, and approving the 10-yr SWM Plans. Figure 10 shows that submissions started as early as CY 2003, while the review and approval process of the NSWMC commenced only in CY 2010. The bulk of the submissions ranged from CYs 2014 to 2019, while the plans' approval started to gain traction from CYs 2015 to 2017. Without a timely prepared and approved SWM Plan, the local governments lack a basis for planning their SWM activities and the required budget for implementation.

According to NSWMC, they do not approve submissions from LGUs with an operating open dumpsite unless there is evidence of closure and a Safe Closure and Rehabilitation Plan is in place. On the other hand, if they see that the site proposal for SLF establishment and institutionalization of Municipal/City Environmental and Natural Resources Officer (M/CENRO) are in the plan but will commence beyond the incumbent mayor's term, they will ask them to move it within the current term, before approval.

Figure 10: Submission and Approval of 10-yr SWM Plans from CYs 2003 to 2021



Source: COA Analysis of Submitted and Approved 10-yr SWM Plans

According to DENR-EMB, the NSWMC has only released an Annotated Outline[14] to LGUs to guide them in developing their respective 10-yr SWM Plans. This was contrary to Section 5(f) of RA 9003, which mandates NSWMC to develop a model SWM Plan that provinces, cities, and municipalities can use to meet the 10-yr SWM Plan requirement. Accordingly, this resulted in the delay of submission to the NSWMC, with the bulk of submissions only occurring in CY 2014, 14 years after RA 9003 was enacted. This failure of NSWMC to provide a model SWM Plan highlighted the lack of national policy to guide the local governments in preparing the 10-yr SWM Plans as mandated under the law.

Furthermore, personnel and evaluation process limitations were among the challenges in fast-tracking the review and approval of submitted plans. According to DENR-EMB, approval takes time as the 10-yr SWM Plans undergo first and second-level reviews from the DENR-EMB Regional Offices up to the DENR-EMB Central Offices, which takes up to 30 days maximum for each level according to the guidelines.[15] And once the bulk of submissions came through, NSWMC shouldered the expedition of review and approval of the submitted plans as part of their mandate based on the said law.

In CY 2018, the NSWMC established an Executive Committee[16] to expedite reviewing and deliberating the submitted 10-yr SWM plans to mitigate those

[14] This Annotated Outline consists of 13 parts, namely: Executive Summary, Introduction, City Profile, Current Solid Waste Management Conditions, Waste Characteristics, Legal/Institutional Framework, Plan Strategy, SWM System, Implementation Strategy, Institutional Aspects, Social and Environmental Aspects, Cost Estimates /Financial Aspects, and Plan Implementation.
[15] NSWMC Resolution No. 39, Series of 2009: Resolution Amending NSWMC Resolution 8 re: Guidelines on the Review and Approval of the 10-Year Solid Waste Management Plans of Local Government Units (LGUs)
[16] NSWMC Resolution No. 1081, Series of 2018: Resolution Establishing the Executive Committee for the Review and Deliberation of the 10-Year Solid Waste Management Plans

delays. This resulted in a commendable increase in the number of plans approved. As at the latest figures, 27.7 percent (476) of the 1,716 submissions are awaiting approval. This commitment of the NSWMC to expedite the approval of the 10-yr SWM Plan submissions following its rules and regulations will grant the local government basis for properly implementing their SWM activities with the appropriate budget required.

Absence of active SWM Boards at the provincial, city/municipal, and barangay level. Another gap resulting in the delay of submission of the 10-yr SWM Plan was the insufficiency of active SWM Boards for the provincial, city, or municipal levels that will ensure the preparation of SWM Plans. In a 2017 report by the Senate Economic Planning Office (SEPO)[17], only 67.1 percent of SWM Boards were instituted and remained active at the provincial level, 37.6 percent at the city/municipal level, and 13.2 percent at the barangay level as presented in Table 10.

Table 10: No. of Active Barangay, City/Municipal and Provincial SWM Boards

Region	Province-Level			City/ Municipal-Level			Barangay-Level		
	No. of Provinces	% Created SWM Boards	% Active SWM Boards	No. of Cities/ Municipalities	% Created SWM Boards	% Active SWM Boards	No. of Barangays	% Created SWM Boards	% Active SWM Boards
NCR	1	100	100	17	100	100	1,710	88.20	No data
CAR	6	100	100	77	100	100	1,178	99.70	99.70
1	4	100	100	125	7.20	7.20	3,267	No data	No data
2	5	80	60	93	68.80	52.70	2,311	39.7	20.50
3	7	100	42.90	130	100	26.10	3,102	3.40	3.40
4A	5	100	100	142	86.60	60.60	4,019	80.80	16.90
4B	5	100	100	73	100	47.90	1,460	99.80	39.40
5	6	100	100	114	50	50	3,471	5.10	4.60
6	6	100	16.70	133	92.50	72.90	4,051	99.70	0.70
7	4	100	100	132	No data	3.80	3,003	No data	0.50
8	6	50	50	143	66.40	36.40	4,390	21.10	6
9	3	100	100	72	83.30	69.40	1,904	68.30	44.60
10	5	60	No data	93	5.40	No data	2,022	2.40	No data
11	5	80	60	49	93.90	57.10	1,162	99.10	69.40
12	4	80	75	50	88	No data	1,195	74.10	No data
13	5	100	100	73	100	24.60	1,311	99.90	32
BARMM	5	No data	No data	118	No data	No data	2,490	No data	No data
Total	**82**	**85.40**	**67.10**	**1,634**	**61**	**37.60**	**42,046**	**43.40**	**13.20**

Source: NSWMC CY 2010 Data

There is a significant gap in the number of active SWM Boards, especially at the barangay level, that will ensure that the planning of SWM activities and development of the SWM plans are followed through up to the provincial level. Moreover, this affected the data collection and monitoring, given that the gap in active SWM Boards involved the local government's sufficiency of human resources to ensure that implementation of the SWM Plans is followed.

[17] *Philippine Solid Wastes At A Glance*. (2017, November). Retrieved January 4, 2023, from https://legacy.senate.gov.ph/publications/SEPO/AAG_Philippine%20Solid%20Wastes_Nov2017.pdf

Waste diversion accomplishments were far from the targets

One of the mechanisms in place to assess the goals and objectives of RA 9003 was establishing mandatory solid waste diversion targets by each LGU. However, aside from the limited availability of reliable and complete data to measure the success of waste diversion nationwide, LGUs were also finding difficulty in attaining their targets.

RA 9003 defines waste diversion as activities that reduce or eliminate the amount of solid waste from waste disposal facilities. Reusing, recycling, composting, and other resource recovery activities can achieve this. Each LGU is required to divert at least 25 percent of solid waste within five years from the adoption of RA 9003, and this goal shall increase every three years thereafter.

The law also mandates each LGU to include an implementation schedule for waste diversion targets to prepare their respective 10-yr SWM Plans. Table 11 shows the consolidated regional waste diversion targets gathered by the DENR-EMB from the Waste Analysis and Characterization Study (WACS) of all LGUs with approved 10-yr SWM Plans.

Table 11: Average Percentage of Waste Diversion Targets per 10-yr SWM Plans from CYs 2015 to 2021

Region	2015	2016	2017	2018	2019	2020	2021
NCR	44.3	50.4	53.6	56.8	60.1	62.7	66.0
CAR	46.8	52.8	56.7	59.4	63.2	67.1	70.4
1	47.7	53.4	58.3	61.6	64.9	68.4	71.3
2	66.8	60.9	64.6	65.0	67.6	69.2	71.3
3	55.2	59.5	60.9	64.1	68.1	71.6	75.4
4A	41.8	52.2	57.2	60.7	64.6	68.2	71.6
4B	37.9	42.6	47.4	52.1	54.7	58.5	63.3
5	39.0	36.7	43.3	50.0	58.3	66.7	77.7
6	47.0	52.0	54.5	58.1	62.1	66.1	69.4
7	41.0	49.9	56.8	61.1	66.5	70.1	73.7
8	52.1	58.2	56.5	62.0	65.1	68.4	71.4
9	55.0	62.7	71.3	76.3	79.3	82.0	84.3
10	48.0	55.7	62.6	59.9	62.3	62.1	68.2
11	54.3	64.0	66.4	68.4	70.9	75.1	80.7
12	66.5	68.3	67.7	69.2	71.7	73.9	76.1
13	53.1	58.3	62.3	65.7	69.0	72.1	74.8
BARMM	No data	50.0	57.9	60.1	63.2	66.0	69.0
Average	**49.8**	**54.6**	**58.7**	**61.8**	**65.4**	**68.7**	**72.6**

Source: DENR-EMB Data

At the national level, the solid waste diversion targets per the Philippine Development Plan (PDP) 2017-2022 increased from 55 percent in 2017 to 80 percent in 2022 *(see Table 12)*.

Table 12: PDP Targets for Solid Waste Diversion

Year	2017	2018	2019	2020	2021	2022
Nationwide Percentage Targets	55%	60%	65%	70%	75%	80%

Source: PDP 2017-2022

Limited visibility of the nationwide accomplishments on waste diversion. There was no overall visibility of the nationwide accomplishments on waste diversion because DENR-EMB's recording and monitoring were limited to EMB-funded MRFs from CYs 2012 to 2019. However, this will be reduced to only operational MRFs with proper documentation and record-keeping systems. Hence, waste diversion accomplishments from LGUs with or without MRF, if recorded and maintained, were not readily available from DENR-EMB.

Table 13 shows the number of operational EMB-funded MRFs with complete data per DENR-EMB. Based on this, only 750 out of 1,171 (64.05 percent) operational EMB-funded MRFs have maintained and reported complete data. Provided that only these MRFs produced complete data, any reported total accomplishments of the regions were only a fraction of the nationwide population.

Table 13: CY 2019 Operational EMB-funded MRFs with Complete Data

Region	EMB-funded MRFs	Operational EMB-funded MRFs		
		Operational MRFs (A)	MRF with complete data (B)	Percent of MRF with complete data (C=B/A)
NCR	133	53	31	58.49
CAR	104	82	11	13.41
1	99	75	74	98.67
2	140	70	64	91.43
3	113	82	70	85.37
4A	110	76	58	76.32
4B	120	50	9	18.00
5	109	60	7	11.67
6	132	88	42	47.73
7	121	90	72	80.00
8	116	90	59	65.56
9	88	79	79	100.00
10	129	77	67	87.01
11	113	64	17	26.56
12	114	67	43	64.18
13	99	68	47	69.12
Total	**1,840**	**1,171**	**750**	**64.05**

Source: COA Analysis of MRF Summary Report

Further, the Philippines has 42,046 barangays but the DENR-EMB has reliable data from only 750 MRFs, indicating the deficiency in monitoring data resulting in the limited visibility of the overall statistics. In addition, deeper causes were

noted at the micro level regarding the barangay level *(see Lack of Recording Mechanism in MRFs Resulting in Unreliable and Incomplete Data on Waste Diversion on page 104)*. These deficiencies validated the constituents' lack of data production and collection as performance indicators. Furthermore, SDG 12.5 is classified as Tier 2[18] by the Philippine Statistics Authority (PSA). Therefore, unless the corresponding SDG indicator has been included in the monitoring and follow-up by the PSA, no progress can be tracked on attaining the SDG target until CY 2030.

Without the necessary record-keeping and data monitoring, data visibility decreases, and decision-making by government leaders becomes strained. Thus, there is a need for institutionalized data production and collection methodology to measure the accomplishments of solid waste diversion. Without it, the Philippines will remain deprived of timely and relevant data analysis to aid sound decision-making. Such decision-making involves the local government's planning and implementation and the national government's estimation of targets.

Non-attainment of solid waste diversion targets for operational MRFs with acceptable data completeness. The data on waste diversion accomplishments submitted by the DENR-EMB to us was limited only to data recorded by EMB-funded operational MRFs and had varying percentages of data completeness.

To ensure reliable data, we used 85 percent and above as the threshold for data completeness to support the reported solid waste diversion accomplishments. Only five out of 16 regions have passed the data completeness threshold. Among those five, no region has met its target based on the average rates from the 10-yr SWM Plans. Further, the PDP 2017-2022 national target for CY 2020 is higher than the averaged targets indicated in the 10-yr SWM Plans of 10 out of 16 regions. Therefore, considering the data completeness threshold, no region could meet the national target of 70 percent diversion for CY 2020, as shown in Table 14.

Table 14: CY 2020 Waste Diversion Target vis-à-vis Actual Accomplishment

Region	% of MRF with complete data	Waste Generation per day (kg) (A)	Waste Diversion per day (kg) (B)	% Waste Diversion Actual (C=B/A)	% Waste Diversion Target (D)	% Waste Diversion Variance (E=D-C)
NCR	58.49	1,148,128.83	543,172.64	47.31	62.70	15.39
CAR	13.41	814,813.48	618,416.54	75.90	67.10	-8.80
1	**98.67**	**408,859.92**	**234,360.92**	**57.32**	**68.40**	**11.08**
2	**91.43**	**677,128.00**	**330,584.00**	**48.82**	**69.20**	**20.38**
3	**85.37**	**912,696.07**	**584,617.71**	**64.05**	**71.60**	**7.55**
4A	76.32	1,161,789.00	435,390.00	37.48	68.20	30.72
4B	18.00	77,849.70	44,964.37	57.76	58.50	0.74
5	11.67	18,370.00	11,759.81	64.02	66.70	2.68

[18] An SDG performance indicator classified as Tier 2 means it is conceptually clear and has an internationally established methodology and standards available, but countries do not regularly produce data.

Region	% of MRF with complete data	Waste Generation per day (kg) (A)	Waste Diversion per day (kg) (B)	% Waste Diversion Actual (C=B/A)	% Waste Diversion Target (D)	% Waste Diversion Variance (E=D-C)
6	47.73	61,019.30	23,475.50	38.47	66.10	27.63
7	80.00	209,159.40	103,209.24	49.34	70.10	20.76
8	65.56	349,808.50	258,194.00	73.81	68.40	-5.41
9	**100.00**	**246,855.28**	**164,586.57**	**66.67**	**82.00**	**15.33**
10	**87.01**	**404,153.63**	**91,019.21**	**22.52**	**62.10**	**39.58**
11	26.56	1,142,878.40	14,372.09	1.26	75.10	73.84
12	64.18	478,565.39	175,868.74	36.75	73.90	37.15
13	69.12	407,545.00	183,937.00	45.13	72.10	26.97
TOTAL	**64.05**	**6,910,521.81**	**3,222,313.67**	**46.60**	**68.70**	**22.07**

Source: COA Analysis of Waste Diversion Target and Accomplishment

According to DENR-EMB, the common factors of non-attainment of solid waste diversion targets were the availability of funds and LGU's strong support for implementation. We further noted that the mechanism to implement waste diversion was strained by the delay in submitting and approving 10-yr SWM Plans, which should have included those targets *(see Delay in LGUs' implementation of 10-year SWM plans on page 18)*. In addition, there was a lack of rewards and incentives to promote waste diversion *(see Non-Establishment of SWM-Mandated Funding Sources on page 123)*.

Although RA 9003 mandated at least an initial 25 percent waste diversion within five years after the effectivity of the law and an increase every three years thereafter, the specific percentage or value of such subsequent increase was not provided in the said law and its IRR. Hence, since CY 2003, the LGUs have determined their waste diversion target.

As for meeting the national targets per PDP, the targets presented in Table 12 are considered estimates only to meet the commitment to improving the management of solid wastes. On the contrary, LGUs were not consulted about these estimates, resulting in a disparity between the LGUs' targets and those from the PDP 2017-2022. By CY 2020, the national target for solid waste diversion reached 70 percent, which the majority, if not all, of the LGUs have not attained.

As more waste enters the waste stream, the opportunity for waste diversion increases. However, not meeting waste diversion targets will result in more waste being transported to disposal facilities. Consequently, this extra waste will increase the demand for more disposal facilities resulting in more costs to the government. In addition, to a greater extent, this extra waste that was not diverted has the potential to form mixed waste and can harm the environment and the health of the public.

The total number of MRFs was not sufficient to service all barangays nationwide

Currently, the Philippines has 42,046 barangays that were mandated to have access to an MRF, whether solely or clustered with other barangays. However, based on interviews and validation, the goal of local governments to provide accessible MRFs for barangays was met with financial, logistical, and technical issues. Hence, as at CY 2021, only 16,418, or 39.05 percent of barangays nationwide, are being served by an MRF *(see Table 15)*. The total established MRFs have yet to comply with RA 9003 to provide access for every barangay or cluster of barangays. It also has yet to surpass the targets by the national government in the PDP 2017-2022.

Table 15: Number of Barangays with Access to MRFs in CYs 2020 to August 2022

Year	Total Barangays (A)	with MRF access (B)	without MRF access (C)	% with MRF access (D=B/A)
2020	42,046	14,450	27,596	34.37
2021	42,046	16,418	25,628	39.05
August 2022	42,046	17,047	24,999	40.54

Source: DENR-EMB Data

Aside from the RA 9003, there was also the national government's target number of barangays that MRFs should serve for the CYs 2017 to 2022. Based on the PDP, the national government targeted a five percent annual increase in the barangays that should be serviced by an MRF in pursuance of the total service target. However, the percentage targets set in the PDP were not met with a growing disparity, ranging from -3.3 percent as at CY 2017, to -19.45 percent as at August 2022, respectively. As of latest data, there are 8,174 barangays which are still not yet served by an MRF against the CY 2022 target as at August 2022 *(see Table 16)*.

Table 16: PDP Targets, DENR-EMB Reported Actual Number of Barangays Served by MRF, and Actual Percentage

Year	Percentage Target per PDP (A)	Target No. of Barangays Served by an MRF (B)	Percentage of Actual No. of Barangays Served by an MRF (C)	Actual No. of Barangays Served by an MRF (D)	Percentage Difference, Actual Less Target (E=C-A)	Barangays Served, Actual Less Target (F=D-B)
2017	34.99	14,712	31.69	13,324	-3.3	-1,388
2018	39.99	16,814	32.37	13,612	-7.62	-3,202
2019	44.99	18,916	33.28	13,994	-11.71	-4,922
2020	49.99	21,018	34.37	14,450	-15.62	-6,568
2021	54.99	23,119	39.05	16,418	-15.94	-6,701
2022	59.99	25,221	40.54	17,047*	-19.45	-8,174

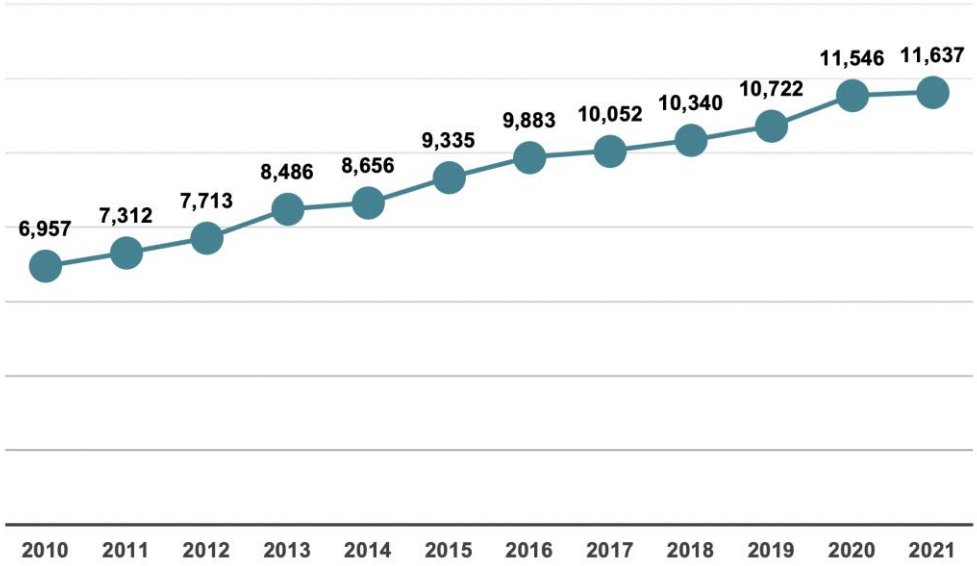
*Data as at August 2022 only

Source: PDP 2017-2022, DENR-EMB Data

Although nationwide MRF coverage has yet to be achieved, the goal to provide barangays access to MRFs is still supported by the continuous increase in the establishment of MRFs. MRF establishments increased steadily between CY

2010 and CY 2021. Since CY 2010, MRFs have increased by 67.27 percent, going from 6,957 to 11,637 MRFs *(see Figure 11)*.

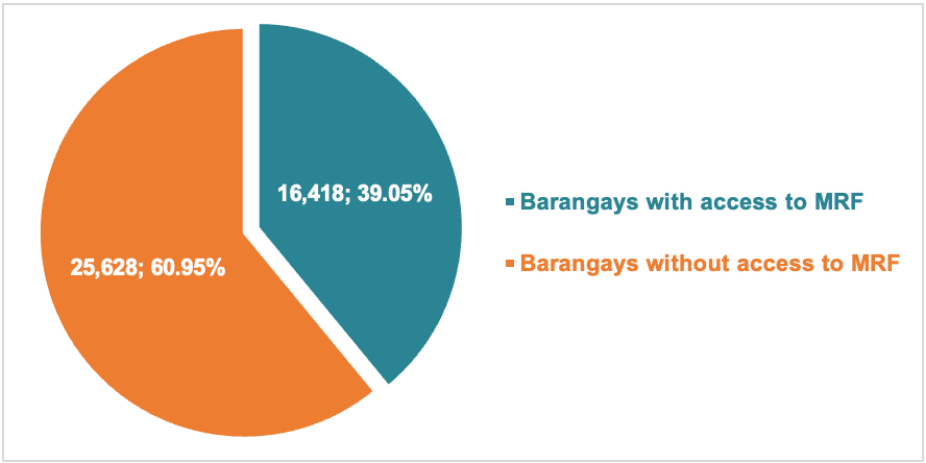
Figure 11: MRFs Established from CYs 2010 to 2021



Source: DENR-EMB Data

On a larger scale, while there are 11,637 MRFs all over the country servicing 16,418 (39.05 percent) barangays by the end of CY 2021, there are still 25,628 (60.95 percent) barangays nationwide that do not have access to an MRF. Even though DENR-EMB extends financial assistance to LGUs for MRF establishment, this covers only a fraction of the targets. Thus, the goal of RA 9003 still has a long way to go before full service can be achieved at this rate.

Figure 12: Percentage Distribution of Barangays With and Without Access to MRF for CY 2021



Source: DENR-EMB Data

To identify the reasons or causes for the gap highlighted in Figure 12, we interviewed the DENR-EMB and validated selected LGUs. Based on the interview, the challenges the local governments faced in establishing MRFs were lack of funds, available land, and the technical know-how on the setup and operation procedures.

On the other hand, there were three main reasons revealed by the DENR-EMB as to why 669 (36.3 percent) of the 1,840 MRFs funded from CYs 2012 to 2019 became non-operational *(see Table 17)*.

Table 17: Reasons for Non-Operation of EMB-funded MRFs

Reason for Non-Operation	Count	Percentage
Already been constructed but has not yet operated	340	50.82
Still in the construction/ procurement stage	313	46.79
Financial issues (e.g., stale checks, unreleased funds, funds returned to the National Treasury)	16	2.39
Total	**669**	**100.00**

Source: DENR-EMB Data

Moreover, during our validation, it was subsequently found that some EMB-funded MRFs tagged as operational were not established due to financial and logistical challenges *(see Table 18)*.

Table 18: MRF Validation Findings – Not Established

Location	Observation
Barangay Poblacion East, Pidigan, Abra	Funds were unutilized and remained unliquidated for four years up to the present
Barangay Mintal, Davao City, Davao del Sur	LGU cannot locate a site for the MRF. Funds became idle and, thus, were returned to the Bureau of Treasury (BTr)
Barangay Bua, Itogon, Benguet	Funds were not yet transferred/ turned over by the LGU to the barangay, thus, the establishment of an MRF did not materialize.

Source: COA Validation

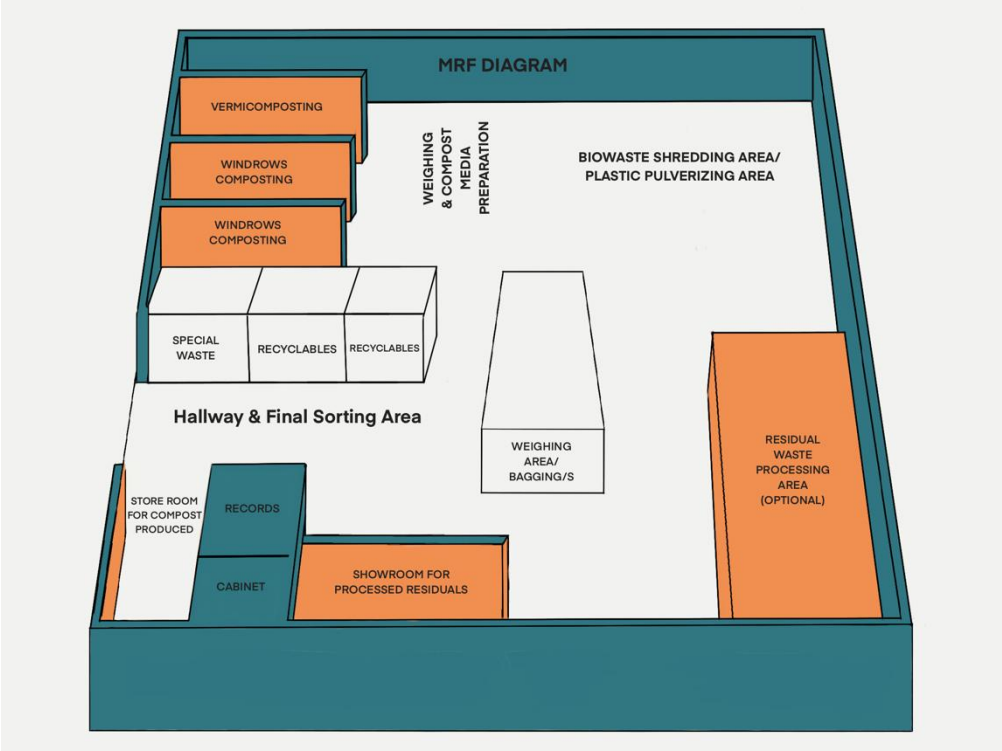
Further review disclosed that there were more unutilized and unliquidated funds similar to Pidigan, Abra, to be discussed in detail in Chapter 2. On the other hand, Barangay Mintal in Davao City and some LGUs were able to resolve their lack of land or MRF site and still have good diversion *(see Examples of Best Practices Observed during Validation on page 116)*. This includes Masinloc, Zambales, where the barangay (North Poblacion) secured land for their MRF through a Deed of Usufruct, permissible per RA 9003.

Without access to an MRF, the opportunities for waste diversion become limited for barangays, and the risk for mixed waste collection and disposal increases. Hence, the remaining 60.95 percent (25,628 out of 42,046) of

barangays nationwide that do not have access to MRF must be resourceful in finding ways to divert waste. Otherwise, these barangays are more prone to practicing mixed waste collection, the presence of dumpsites, or increased disposal to SLFs.

MRF Design and Usage. While the local government and the barangays are responsible for establishing MRFs, DENR-EMB also provided technical and financial support to the LGUs to implement their 10-yr SWM Plans. Part of this support was the provision of financial assistance to LGUs in establishing or upgrading MRFs from CY 2012 to CY 2019. Moreover, complementary to the establishment of MRF was the provision of shredder and composter that would reduce the volume and size of biowaste for composting at the MRF as well as hasten the decomposition process *(see Some EMB-funded MRFs, including several units/sets of equipment, were neither established nor operational on page 95)*.

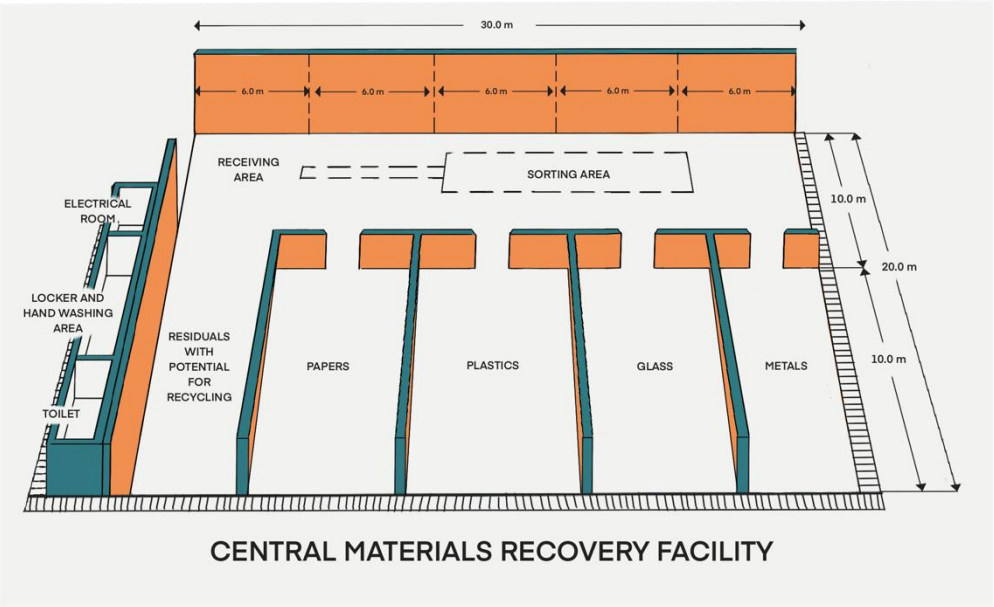
Figure 13: Prescribed Layout for EMB-funded MRFs



Source: DENR Data

The prescribed layout for EMB-funded MRF *(see Figure 13)* ensures that the facility can receive, sort, process, and store compostable and recyclable material efficiently and in an environmentally sound manner. The DENR-EMB also released a sample layout and dimension of a centralized MRF as a component of an SLF, as shown in Figure 14.

Figure 14: Prescribed Layout for Central MRF



Source: DENR Data

To validate how the MRFs were established and operated following the minimum requirements of RA 9003 and the prescribed layout for EMB-funded MRFs, we validated a total of 45 MRFs from nine regions, namely: NCR, CAR, Regions 1, 3, 4A, 5, 7, 9, and 11. In addition, engineers from the Technical Services Office (TSO) of COA also conducted the technical inspection accompanied by focal persons from DENR-EMB Regional Offices and LGUs.

A number of EMB-funded MRFs were compliant with DENR-EMB guidelines on financial assistance. In addition, most of the MRFs we visited complied with the layout prescribed by the DENR-EMB following Section 33 of RA 9003 *(see Figure 15)*.

Figure 15: Inspection of Municipal MRF in Barangay Tagodtod, Lagangilang, Abra

External façade

Enclosed area for recyclable raw materials

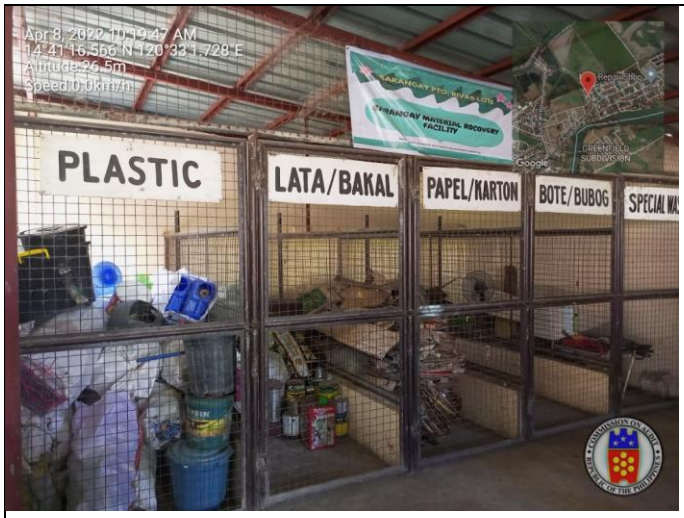
Enclosed area for waste processing of unsellable bottles using crusher/pulverizer equipment

Designated area for finished Concrete Hollow Blocks (CHBs) made from pulverized unsellable bottles mixed with concrete

Source: COA Validation in the Municipal MRF in Barangay Tagodtod, Lagangilang, Abra, CAR

In Barangay Tagodtod, Lagangilang, Abra, there were portioned areas for raw residual and recyclable materials and work-in-process materials from working equipment such as pulverizer, crusher, and molder. In addition, there was also an area dedicated to the processed residuals.

Figure 16: Inspection of Various MRFs in Barangay Lote Pto Rivas, Balanga, Bataan



Barangay Lote Pto Rivas, Balanga, Bataan

Barangay Poblacion, Maragusan, Davao de Oro

Barangay Pingit, Baler, Aurora

Barangay Poblacion, Bucloc, Abra

Source: COA Validation of MRFs in Bataan, Aurora, Davao de Oro and Abra

In Barangay Lote Pto Rivas, Balanga, Bataan, enclosed areas were reserved for segregating types of waste such as plastic, metal, paper, glass bottle, and special waste. Highlighted in Figure 16 were some of the validated MRFs that we found to comply with RA 9003 and the guidelines set by the DENR-EMB for EMB-funded MRFs.

On the other hand, we and the TSO engineers found that a number of MRFs not funded by DENR-EMB did not possess the required waste processing capabilities *(see Appendix III for the other TSO observations)*.

1. **Cage-Type MRFs (hereinafter referred to as "Caged MRF").** Based on their appearance, these caged MRFs were not designed to process the waste they can receive *(see Figure 17)*. Instead, the caged MRFs found in some barangays serve as a receiving area for recyclables, pending its collection and transfer by the LGU to a bigger and more centralized MRF. The caged MRFs were located in a barangay *purok*[19], which formed part of an arranged network and was coined by the locals as the *purok* system. In the *purok* system, a *purok* leader was assigned to manage the wastes in their *purok* and ensure that the residents could deliver recyclable materials to nearby designated caged MRFs. The operation of caged MRFs illustrated in the *purok* system was beneficial, especially for barangays with narrow and impassable roads. It is also easier for the LGUs to collect waste because the pick-up points are lessened when considering these *purok* MRFs instead of going house-to-house.

Figure 17: Examples of Caged MRFs

Barangay Cabinuangan, Davao de Oro

Barangay Poblacion, Bucloc, Abra

Source: COA Validation of MRFs in Davao de Oro and Abra

According to DENR-EMB, the minimum requirements for the operation of an MRF follow Section 33 of RA 9003, which states that MRFs shall be designed to receive, sort, process, and store compostable and recyclable material efficiently and in an environmentally sound manner. However, we found no equipment inside or nearby these caged MRFs to process the received wastes.

[19] *Purok* – (English: district or zone) is a division within a barangay in the Philippines. While not officially considered a local government unit, a *purok* often serves as a unit for delivering services and administration within a barangay.

As for accounting these MRFs in their monitoring, the DENR-EMB said that as long as it meets the minimum requirements, they have included the caged MRFs in their reporting of total MRFs nationwide. Further, they ascertained that they may still monitor these caged MRFs' proper segregation, storage, data recording, and overall implementation.

Given the absence of processing equipment nearby or inside these caged MRFs, we considered these as floating and unmonitored if they were not accounted for by the DENR-EMB, despite their imminent contribution to the SWM Program of the barangays.

2. **Materials Recovery System (MRS).** Apart from centralized and caged MRFs, we also found Materials Recovery Systems present only in the NCR. These were monitored and accounted for by the DENR-EMB separate from the compliant MRFs *(see Figure 18)*.

The MRS only addresses a single type or classification of waste in a limited scope or manner, contrary to an MRF that was supposed to handle multiple types or classifications of waste. According to DENR-EMB, there were currently no existing guidelines for implementing MRS. The implementation of MRS was informally conceptualized such that it may be tied up or a component system to other programs or activities on SWM, specifically addressing segregation and recovery.

Figure 18: Examples of MRS

Source: COA Validation of MRFs in Barangay Corazon de Jesus, San Juan, Metro Manila

For example, an LGU operates a centralized MRF, and the MRS in-place was a partnership with a junk shop operator or a temporary storage area that caters to a specific sitio, *purok*, or barangay, thereby mitigating the need for the LGU to collect recyclable wastes from the said area daily. For example, in Barangay Corazon de Jesus, San Juan Metro Manila, the MRS resulted from a Memorandum of Agreement

(MOA) between the barangay and a junk shop named Prixidio Junkshop due to the absence of identified sites for a barangay MRF. Therefore, although not complying with Section 33 of RA 9003, the MRS was still separately accounted for from the MRFs in the NCR.

Caged MRFs and MRS were the products of the local government's difficulties in logistics and financing.

Due to the absence of identified sites for a barangay MRF, the MRS, in partnership with a junk shop, was conceptualized, as illustrated in Barangay Corazon de Jesus, San Juan Metro Manila. The highly urbanized location and high population density in barangays like Barangay Corazon de Jesus made it difficult for them to locate a space to construct an MRF. We also visited Barangay 71, Manila, and found similar MRS's near the mayor's office, surrounded by a basketball court and households filled with vast crowds.

Further, setting up cage structures as MRF costs less than building a compliant MRF. The indicative costing of the cage MRFs we visited ranged from ₱20,000 to around ₱60,000 *(see Table 19)*.

Table 19: Fabrication of Caged MRF

Location	Detailed Unit Price Analysis
Barangay Gairan, Bogo, Cebu	₱ 20,106.46
Barangay Poblacion, Bucloc, Abra	20,205.78
Barangay Lonor Sur, Inabanga, Bohol	41,787.71
Barangay Cabinuangan, Davao de Oro	60,252.13

Source: Detailed Unit Price Analysis conducted by COA TSO Engineers

Comparing these costs with the DENR-EMB Terms of Reference specifications for financial assistance revealed higher setup requirements.

In the DENR guidelines for financial assistance to establish MRFs *(see Table 20)*, the minimum components required to operate manual and semi-automated MRFs include but are not limited to the following:

a. Working area for shredding and compost media preparation
b. Storage for recyclables
c. Composting area (Windrows and/or Vermicomposting) with Leachate Management
d. Safe storage area for Special Waste
e. For a medium MRF, requirement of one (1) fabricated equipment estimated at ₱150,000.00
f. For a small MRF, requirement of two (2) fabricated equipment estimated at ₱150,000.00 each for a total of ₱300,000.00

Table 20: DENR Fund Support Options for LGU Beneficiaries

Option	Description	Floor Area (in sqm)	MRF Estimated Cost	Equipment Cost
1	Large MRF (No equipment)	Anywhere between 76 to 100 sqm.	₱ 600,000.00	₱ -
2	Medium MRF (With equipment)	Anywhere between 50 to 75 sqm.	450,000.00	150,000.00
3	Small MRF (With equipment)	Minimum of 50 sqm.	300,000.00	300,000.00

Source: DENR Fund Support Guidelines CY 2019

On the other hand, MRF validation also revealed underperforming MRFs that affected the effective and efficient operations of MRFs and, ultimately, the low waste diversion. These MRFs were either not operating, with repairable defects, or unutilized equipment. And worst, some MRFs were turned into a dumpsite *(see Chapter 2)*.

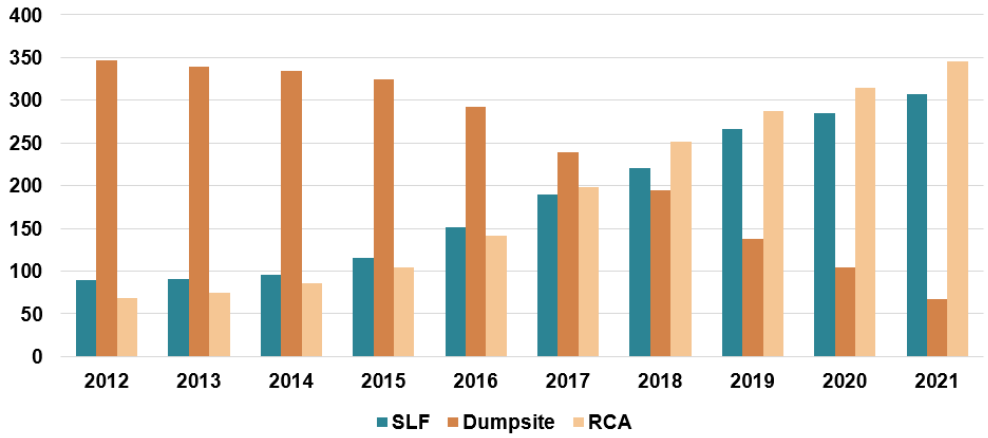
The total number of SLFs was not sufficient to service all LGUs nationwide

Due to the prohibition of the use of illegal dumpsites and to ensure the safe disposal of residual wastes, RA 9003 has provided the development of an SLF as an alternative. At the same time, the operation of the Residual Containment Area (RCA) has been approved by the DENR while LGUs are awaiting the construction of the SLF or finalization of the MOA with the SLF operator. Therefore, while there was an evident decrease in dumpsites and an increase in the number of SLFs, the problem remains that the total number of SLFs was insufficient to service all LGUs nationwide.

In the Philippines, SLF is defined as a waste disposal site that has been designed and engineered to accept municipal residual waste, while ensuring minimal negative impact on the environment; or a specially engineered site for disposing of solid waste on land, constructed in such a way as to reduce the hazard to public health and safety.

LGUs were transitioning from the use of dumpsites to SLFs or RCA. Over the years, LGUs using dumpsites have significantly decreased as LGUs transition to using either SLF or RCA. Figure 19 highlights this transition, as reported by 591 LGUs when asked what kind of disposal facility was utilized from CYs 2012 to 2021.

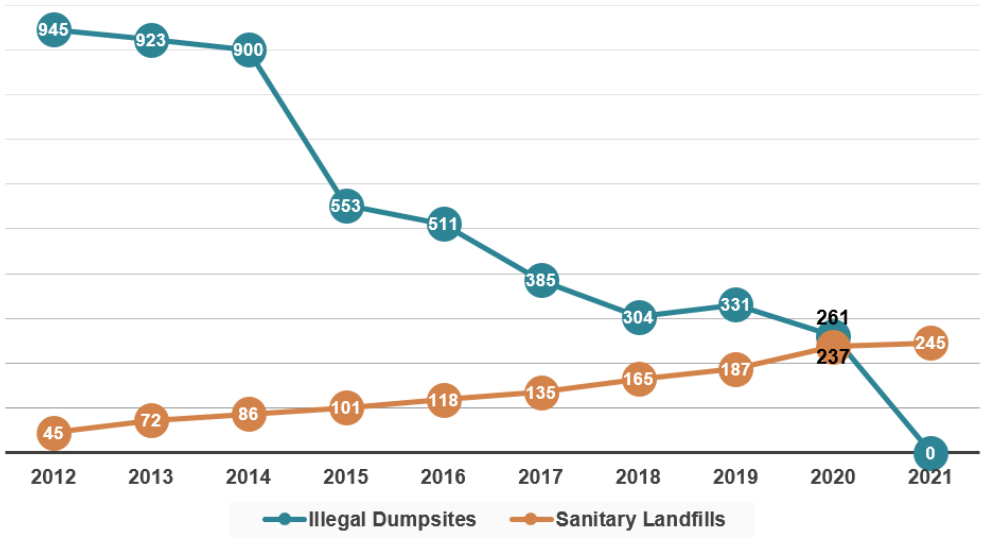
Figure 19: Comparative Number of LGUs using Dumpsites, SLFs, and RCAs from CYs 2012 to 2021



Source: COA Analysis of LGU data

Similarly, this was confirmed with the reported disposal facilities by DENR-EMB from CYs 2012 to 2021, showing a downward trend for dumpsites and an upward trend for SLFs, as represented in Figure 20.

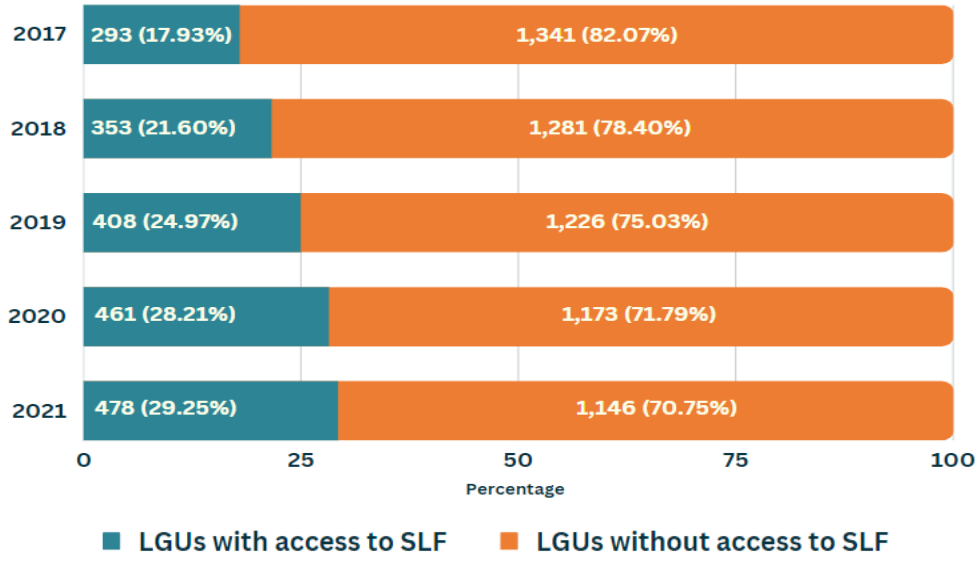
Figure 20: Comparative Trends on the Number of Disposal Facilities by Type from CYs 2012 to 2021



Source: DENR-EMB Data

The total number of SLFs was insufficient. DENR-EMB's data shows that SLFs were serving 293 (17.93 percent) out of 1,634 LGUs in CY 2017. By CY 2021, the number of LGUs being served by SLFs had increased to 478 (29.25 percent) as shown in Figure 21.

Figure 21: Distribution of LGUs With and Without Access to Operational SLFs from CYs 2017 to 2021



Source: NSWMC and DENR-EMB Data

However, further analysis of the latest available data showed that only LGUs in NCR have 100 percent access to SLF, and Regions 1, 2, 3, 4A, and 12 have at least 50 percent of its LGUs with access to SLF. However, for the remaining regions, only 0.85 to 36.36 percent of its LGUs were served by SLF, as shown in Table 21.

Table 21: Disaggregated Data on Percentage of LGUs with SLF Access by Region in CY 2021 and September 2022

Region	No. of LGUs (A)	As at December 31, 2021			As at September 15, 2022		
		No. of Operational SLF	No. of LGUs Served by SLF (B)	% of LGU Served (C=B/A)	No. of Operational SLF	No. of LGUs Served by SLF (D)	% of LGU Served (E=D/A)
CAR	77	10	16	20.78	9	15	19.48
NCR	17	1	17	100.00	1	17	100.00
1	125	31	41	32.80	51	65	52.00
2	93	41	46	49.46	41	47	50.54
3	130	12	111	85.38	15	114	87.69
4A	142	43	93	65.49	44	102	71.83
4B	73	12	12	16.44	13	13	17.81
5	114	7	12	10.53	9	34	29.82
6	133	13	20	15.04	15	32	24.06
7	132	15	46	34.85	16	48	36.36
8	143	6	6	4.20	10	11	7.69
9	72	1	1	1.39	2	2	2.78
10	93	19	23	24.73	20	24	25.81
11	49	9	9	18.37	8	8	16.33
12	50	21	21	42.00	21	29	58.00
13	73	4	4	5.48	4	4	5.48
BARMM	118	0	0	0.00	1	1	0.85
TOTAL	**1,634**	**245**	**478**	**29.25**	**280**	**566**	**34.64**

Source: NSWMC and DENR-EMB Data

To determine the reasons for the insufficient number of SLFs servicing the LGUs, we conducted various interviews with DENR and selected LGUs. Results of interviews revealed at least five major reasons *(see Figure 22)*.

Figure 22: Major Reasons for the Low Number of Operating SLFs

Source: COA Various Interviews

LGUs with certain land characteristics are not suitable for SLF operation. During an interview, DENR confirmed that not all LGUs could construct an SLF. For example, in densely populated LGUs like Metro Manila, the availability of land with a large surface for landfilling is often limited or scarce. Moreover, some LGUs cannot just construct an SLF because of underlying characteristics in their area or available land.

According to LGUs and DENR, the approval for establishing an SLF follows a very stringent process. All waste disposal facilities, regardless of category, shall satisfy the criteria for siting an SLF as stated in Section 40 of RA 9003 and Rule XIV of its IRR. Moreover, in CY 2013, NSWMC adopted modified guidelines to climate-proof the siting criteria and assessment procedure for SLFs to integrate disaster-risk reduction and other safety nets from the changing climate.[20] Included in these modified guidelines were two categories, the Absolute and Conditional Criteria *(see Figure 23)*. Absolute Criteria refers to the requirements that must be fully satisfied during the initial screening of proposed landfill sites. On the other hand, the Conditional Criteria refers to parameters for second-tier evaluation that may render a site suitable, provided that its corresponding siting considerations were complied with or applicable only in cases where the implementation of mitigating measures were within the capacity of project proponents. To satisfy the Conditional Criteria, modifications may be done through engineering interventions.

[20] NSWMC Resolution No. 64, Series of 2013. Adoption of Modified Guidelines on Site Identification Criteria and Suitability Assessment Procedure for Sanitary Landfills

Figure 23: Absolute and Conditional Landfill Site Identification Criteria

Site Selection Parameters	Absolute Criteria	Conditional Criteria
Proximity to Groundwater Sources	The site shall not be located on shallow unconfined aquifers.	Avoid sites within 1 kilometer of confined aquifers (deep wells). A minimum distance of 2 meters shall be maintained between the base of the landfill liner and the highest water table.
Proximity to Perennial Surface Waters	The site shall not be located within 300 meters of watershed areas or upgradient of any surface waters.	Avoid areas within 1 kilometer upgradient or perennial stream, river, or lake.
Local Geological Conditions (Underlying Rock Formation)	The site shall not be located in areas with underlying rocks characterized as jointed, fractured, or fissured; carbonate (limestone or dolomite); karst, and other porous rock formations; or in areas with sinkholes or caverns.	Avoid areas within 300 meters of jointed fissured, fractured, or porous rock formations. Avoid areas classified as geological hazards.
Seismic Conditions (Proximity to Faults)	No facility shall be constructed at a site within 75 meters from a Holocene fault or a known recent active fault.	No facility shall be constructed at a site within 75 meters from a Holocene fault or a known recent active fault.
Soil Properties and Availability of Cover Material	The site shall not be located in unstable, very soft, and settling soils with high potential for liquefaction, slumping, or erosion.	Avoid areas with highly permeable soils.
Topography (Terrain and Slope)	The site shall not be located on a landslide-prone area. No site shall be situated in old quarries or abandoned mine pits.	Avoid mountainous or hilly areas with ground slopes nominally greater than 20% or 5:1 horizontal-to-vertical ratio.
Vulnerability to Flooding	The site shall not be located in areas prone to seasonal flooding such as swamplands, marshes, and wetlands.	Avoid locating site in areas that may be subject to washout or inundation during a major flood.

Figure 23: Absolute and Conditional Landfill Site Identification Criteria (cont.)

Site Selection Parameters	Absolute Criteria	Conditional Criteria
Proximity to Residential Areas and Other Sensitive Land Users	The site shall not be located in or within 250 meters of existing or proposed residential, commercial, or urban development areas, and areas of historical, archaeological, cultural, geological, or scientific interests.	Avoid locating the facility within 1 kilometer of residential, commercial, industrial, or urban development areas, memorial sites, churches, schools historical sites, and other public places.
Proximity to Ecologically Sensitive or Environmentally Critical Areas	The site shall not be located within 500 meters of the boundaries of ecologically sensitive areas proclaimed as protected areas.	Avoid areas within 500 meters of the boundaries of potentially ecologically sensitive areas.
Consistency with Current or Proposed Land Use Classification	The location of the facility shall be consistent with the existing or proposed land use classification or comprehensive land use plan (CLUP) of the host LGU.	Avoid areas with valuable mineral and energy resources, tourist destinations, ion routes, water, gas, electrical power, or communication transmission infrastructures. Also, avoid areas classified as prime agricultural land or inconsistent with the strategic agricultural zones of the Bureau of Soils and Water Management (BSWM) of DA.
Proximity to Airports	The site shall not be located within three (3) kilometers of an airport servicing turbojet aircraft or 1.6 kilometers of an airport servicing piston-driven or turboprop aircraft.	Avoid areas within 13 kilometers of the nearest airport.
Landfill Area and Lifespan	The site shall be large enough to accommodate waste for a period of five (5) years, with provision for expansion.	Avoid sites where the area is insufficient for a landfill designed to have a total lifespan of at least ten (10) years.
Haul Distance, Accessibility and Road Conditions	The site shall be accessible from major roadways and thoroughfares, provided that if it is not accessible, the project design shall include means of access.	Areas more than 30 kilometers away or 30 minutes travel time from primary waste generation centers have to be avoided as much as possible.

Source: NSWMC Resolution No. 64, Series of 2013

While the above guidelines provide the necessary precaution, LGUs, on the other hand, find the Absolute Criteria in the SLF Siting challenging to comply with and thus prevent them from establishing an SLF all the same. According to LGUs, non-compliance with a single absolute criterion automatically eliminates the proposed site from being considered a prospective SLF location. Moreover, unlike the Conditional Site Identification Criterion, an engineering intervention can be applied to the proposed area to establish an SLF.

To illustrate, one absolute criterion is that an SLF shall not be located in areas with underlying rocks characterized as jointed, fractured, or fissured;

carbonate (limestone or dolomite); karst, and other porous rock formations; or in areas with sinkholes and cavern. However, during interviews and validations, we learned that some LGUs could not comply with the minimum requirements for constructing SLF due to land conditions detailed in Table 22.

Table 22: Example of LGUs with Land Condition Limitations

Location/ Proposed SLF	Land Condition
Benguet Province	Lies on top of the Cordillera Mountains, with rugged and sloping terrain and deep valleys.
Proposed SLF Site at Sitio Candait, Barangay Dampas, Tagbilaran City, Bohol	Based on the Geological Assessment of the proposed SLF, the area is underlain by coralline porous limestone, and numerous sinkholes surround the proposed site.
Proposed Mabuhay SLF located at Barangay Catipan Mabuhay, Zamboanga Sibugay	Based on the Site Suitability Assessment Report, the area is in a Karst environment. The entire municipality of Mabuhay is underlain by the Pliocene to Pleistocene Olutanga Limestone.
Proposed Olutanga SLF located at Purok 3, Barangay Kahayagan, Olutanga, Zamboanga Sibugay	Based on the Site Suitability Assessment Report, Olutanga island is composed of coralline limestone, and the surface materials within the proposed site are prone to slumping and erosion.

Source: PSA and DENR-EMB Data

The land condition of the Benguet Province restricts the LGUs from constructing SLF. Although landfilling is feasible on steep slopes, it demands higher costs in engineering, and precautions must be taken to reduce disaster risks in steep slope areas. The results of the MGB's Subsidence Hazard Mapping in Bohol after the 2013 Mw 7.2 earthquake show that the proposed site was within an area with high susceptibility to land subsidence and located on an identified sinkhole, thus, does not meet one of the absolute criteria.

The proposed Mabuhay SLF also failed to satisfy one absolute criterion because it was situated in a Karst environment, which might threaten the environment and negatively affect the municipality's residents.

Like the land condition in Tagbilaran City, Olutanga Island is composed mainly of coralline limestone. When NSWMC was asked about the options available for the LGUs in limestone areas, they responded that there are expensive engineering methodologies that can be considered options for LGUs to comply with proper SWM.

In addition to the above conditions, the DENR-EMB also mentioned that Cotabato City was below sea level and thus could never be suitable for establishing an SLF.

LGUs with insufficient or no budget for establishing an SLF. The construction and operation of SLF require significant financial investments to meet RA 9003 for public safety and reduced environmental impact. Table 23 shows the costing of SLF by category.

Table 23: Comparative Cost of SLF by Category

Designed Landfill	Category 1	Category 2	Category 3	Category 4
Capacity	60,000 cu.m.	164,655.56 cu.m.	1,451,185 cu.m.	840,400 cu.m.
Total site area	2.1 hectares	5 hectares	20 hectares	6.6 hectares
Lifespan	16.76 years	10 years	10 years	5-10 years
Total Capital Cost	**₱43,329,813.46**	**₱67,046,620.00**	**₱319,399,765.10**	**₱195,792,556.88**

Source: DENR-EMB Data

Moreover, the overall cost depends on the proposed site's topography and area, wherein NSWMC can only provide technical assistance. DENR-EMB also stated instances wherein LGUs want to build SLF but could not pass the criteria or will require engineering measures which means additional costs for the LGUs when assessed by the Mines and Geosciences Bureau (MGB) or DENR-EMB. As a result, LGUs resort to loans from reputable banking institutions, financial assistance from government entities, endorsement from politicians, and loans from the private sector.

Social acceptability of residents. Social acceptance by the local community was considered a major challenge in establishing an SLF within a municipality or city. An example was in Cuyapo, Nueva Ecija, where residents petitioned their LGU government to turn down a 10-hectare landfill project at Barangay Simimbaan last 2013[21], saying they did not want their town to be known as the "garbage town". Recently, the residents of Langkaan I in Dasmariñas City, Cavite, strongly objected to constructing an SLF in their area in 2021.[22] Similarly, finding a host LGU for clustering was also affected by strong resistance from the community or the not-in-my-backyard (NIMBY) phenomenon.

Clustering was not easily attainable. Usually, LGUs with their own SLF restrict their operation within their jurisdiction only and opt not to share their SLF with other LGUs. Nevertheless, the clustering of LGUs was greatly encouraged.

Section 13, Article X of the 1987 Constitution allows LGUs to group themselves, consolidate, or coordinate for purposes beneficial to them and in

[21] Roque, A. (2013, January 27). *Nueva Ecija townsfolk protest landfill project*. Inquirer. Retrieved November 10, 2022, from https://newsinfo.inquirer.net/347673/nueva-ecija-townsfolk-protest-landfill-project

[22] *Pulso ng Bayan.* Dasmariñas City News. Retrieved November 10, 2022, from https://www.facebook.com/DasmaCityNews/posts/pfbid02grZmmGwB993zcT2rnRPGQdhVjd11FrQ3mwtoiUUzYr1HLpA4b6WKBs9KuMb522W3l

accordance with the law. Similarly, Section 17 of the Local Government Code authorizes LGUs to exercise such power as "necessary, appropriate, or incidental" to the efficient and effective provision of basic services and facilities, including solid waste disposal systems or environmental management systems and services or facilities related to general hygiene and sanitation. Furthermore, RA 9003 mandates LGU coordination for jointly addressing: (a) common SWM problems; and/or (b) establishing common waste treatment and disposal facilities. Accordingly, clustering has various advantages and benefits to LGUs, as outlined in Table 24.

Table 24: Advantages and Benefits of Clustering to LGUs

Advantages of Clustering	Benefits to LGUs
Preservation of common heritage and identity	Scarce resources to implement projects will be supplemented by other members' shares
Development needs easier to identify and address	High possibility of funding assistance and approval of proposals from donor agencies/financial institutions
Serves as a tool in establishing growth centers in the Province/Region	Equipment needed for infrastructure development and waste management will be supplemented by other members
Ensures greater benefits thru equitable sharing	Wider market for services will be established
Allows wider area jurisdiction to achieve desired economies of scale	Increase in employment opportunities for constituents

Source: National Solid Waste Management Strategy; P. Maceda, Jr., August 2006

According to a research project report, one of the success stories of inter-LGU collaboration was the Surallah Cluster SLF in South Cotabato.[23] The South Cotabato Provincial Office started this because the financial resources needed to construct an SLF facility were too high for a single LGU; instead, it would be more practical for LGUs to cluster together. According to the report, a cluster SLF was more cost-effective than an individual SLF in terms of economies of scale. For example, six LGUs would need to invest ₱54 million to construct their SLF facility, excluding human resources, equipment, and operational costs. However, with the cluster SLF, the required investment was only ₱15 million with a capacity of 30 tons per day, excluding human resources, equipment, and operational costs. Thus, the LGUs can make significant savings using the cluster SLF, which they can use to provide other public services to the community.

In CY 2013, the NSWMC issued Resolution No. 68 for clustering LGUs on a common ecological SWM system. It is an option in which small LGUs can pool their resources into setting up common solid waste disposal facilities. It also enables them to attain large economies of scale and reduce the cost of solid

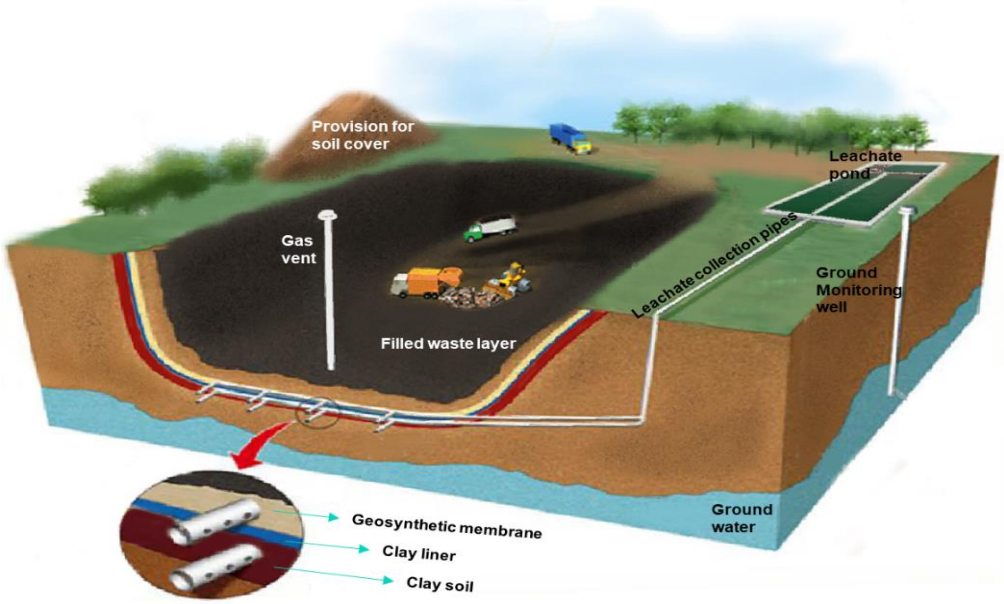
[23] *Regional Waste Management – Inter-municipal Cooperation and Public and Private Partnership*. (2020, July 2). Economic Research Institute for ASEAN and East Asia - ERIA. Retrieved January 4, 2023, from http://www.eria.org/research/regional-waste-management--inter-municipal-cooperation-and-public-and-private-partnership/

waste disposal per unit. Furthermore, since the volume of waste is too small for most LGUs, alliance building regarding the clustering of municipalities for SLF construction and operation can result in economies of scale.[24]

On February 22, 2022, the NSWMC issued Resolution No. 1505, Series of 2022, empowering the Coalition of Solid Waste Management Providers (CSWMP) by adopting and implementing the SWM solution to optimize waste recovery and utilization in the SLFs prior to disposal. Through this, the CSWMP will cooperate and collaborate with the government to review, assess and propose strategies to support the implementation of the Total Solid Waste Management Solution concept that aims to ensure optimum utilization of solid wastes that enter the SLFs, by integrating processes before disposal thereby extending the life of the disposal facility. Previously, the NSWMC issued Resolution No. 1452, Series of 2021, wherein the DENR mobilized the group of SWM service providers to organize themselves to support the government in expanding the number of LGUs with access to approved SLFs through Public-Private Partnerships (PPPs). Therefore, CSWMP will act as a catalyst in addressing the SWM and disposal in the country by formulating various programs and initiatives which will cater to the development and availability of SLFs for all LGUs.

Standards on SLF were not fully complied with, increasing risk to health and the environment. SLF is an essential component of effective SWM. Accordingly, it is necessary to establish standards and proper engineering in establishing and operating SLFs to minimize or avoid the negative impacts on the environment. As mandated in RA 9003, the essential elements of SLF include gas vents, a leachate collection system, a ground monitoring well, liners, and earth cover to lessen the possibility of wastes seeping beneath to the groundwater and generation of landfill gasses (*see Figure 24)*.

Figure 24: Elements of SLF



Source: DENR Data

[24] National Solid Waste Management Strategy 2012-2016

We visited 12 SLFs to inspect their compliance with the minimum standards provided in RA 9003, its IRR, and other relevant guidelines. Accompanying us were engineers from the COA TSO, and focal persons from DENR-EMB Regional Offices and LGUs. We noted various observations during the inspection, including but not limited to the absence of a leachate system, daily soil cover, groundwater monitoring wells, and a separate containment area for household hazardous wastes *(see Appendix III for complete observation)*.

1. According to Section 1 (k) Rule XIV, RA 9003 IRR, an SLF must have a leachate collection and removal system. Although the SLF in La Trinidad, Benguet, has a leachate collection and removal system, it is not well maintained *(see Figure 25)*. The leachate collected was not treated and stocked in the drainage. At the time of inspection, the leachate pond has soil and vegetation. Moreover, one worker shared that the leachate overflows when raining, damaging nearby plants or crops. The drainage was clogged, preventing the leachate from Cells 1 and 3 from flowing straight to the leachate pond.

Figure 25: Inspection of SLF in La Trinidad, Benguet, CAR

Requirement: Leachate collection and removal system
Actual: Leachate collection and removal system is not well maintained.

Source: COA Validation in La Trinidad, Benguet, CAR

2. The leachate collection of the SLF in Norzagaray, Bulacan, was also through the leachate pond *(see Figure 26)*. However, when the pond is full, it discharges untested leachate to the nearest river, about 75.90 meters away. No discharge permit has been issued by the DENR-EMB. This has caused the DENR-EMB to issue the Cease and Desist Order (CDO) to the operating LGU, as it will detrimentally affect the river.

Figure 26: Inspection of SLF in Norzagaray, Bulacan, Region 3

Requirement: Leachate collection and removal system
Actual: Leachate collection and removal system is not well maintained

Source: COA Validation in Norzagaray, Bulacan, Region 3

3. We found no leachate collection system at the SLF in General Mariano Alvarez (GMA), Cavite. Moreover, no leachate pond was constructed based on the Monitoring/Inspection Report of DENR Regional Office No. IV, dated October 8, 2021. As a result, the leachate was retained inside the cell or waste-filling area.

4. Section 1 (l) Rule XIV, RA 9003 IRR provided that leachate storage shall be designed with containment systems and shall include a geomembrane liner system for leachate impoundment ponds. Leachate ponds in six SLFs were made of concrete/CHB wall; however, there was no HDPE liner *(see Figure 27)*. Leachate may seep through the concrete if it is impounded or not discharged. The lack of HDPE liners should have been validated before the operation of the landfills. A review of the Monitoring and Inspection Reports of the DENR-EMB showed that it was not reported.

Figure 27: SLFs without Required Leachate HDPE Liner

Requirement: Leachate storage shall be designed with containment systems and liner
Actual: Leachate ponds made of concrete/CHB wall without HDPE liner

Location: Maragusan, Davao de Oro, Region 11

Location: Alaminos City, Pangasinan, Region 1

Location: Aringay, La Union Region 1

Location: Pugo, La Union, Region 1

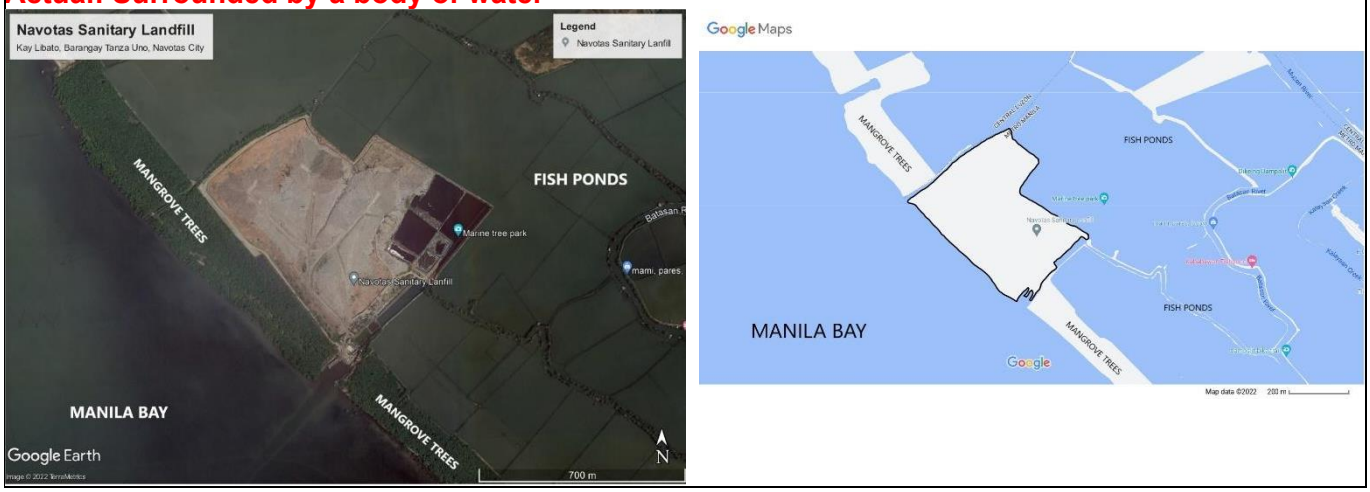
Source: COA Validation in Regions 1 and 11

5. Section 1 (m.1) Rule XIV, RA 9003 IRR requires that an SLF be at least 50 meters away from any perennial stream, lake, or river. However, the SLF in Navotas City was on a separate island surrounded by bodies of water *(see Figure 28)*. It was located in Manila Bay with nearby fish ponds. However, except for the mangroves planted around it, we did not observe any additional measures taken to operate the SLF when bodies of water surround it. This has made the approval of the construction and operation of the SLF questionable, knowing that many environmental consequences to Manila Bay may occur in its current set-up. In a news report in 2017, the DENR investigators discovered that Phileco's Vitas Marine Loading Station (VMLS) violated its Environmental Compliance Certificate (ECC) for letting the untreated wastewater flow directly into Manila Bay while solid waste

piled up along the shoreline.[25] In 2017, a Navotas Case Story was conducted by Ibon International.[26] It noted that the landfill has contributed to the death of nearby mangroves and damaged the marine ecosystems. Local fishermen within the community claim that their average daily catch has decreased from at least 10 to 15 kilograms in 1981 to only 2 to 3 kilograms in 2017. Furthermore, the EcoWaste Coalition has called for government officials to stop dumping wastes[27] in the environmentally-critical area of Manila Bay and immediately shut down all operating dumpsites and landfills within the area.

Figure 28: Inspection of SLF in Navotas City, NCR

Requirement: Minimum of 50 meters away from any perennial stream, lake, or river
Actual: Surrounded by a body of water



Source: Google Earth and Google Maps

[25] *DENR suspends waste facility on Manila Bay*. (2017, October 8). ABS-CBN News. Retrieved November 10, 2022, from https://news.abs-cbn.com/news/10/08/17/denr-suspends-waste-facility-on-manila-bay
[26] P. (2017, August 11). *Development for Whom? How Navotas fisherfolk resist the displacement of their people and livelihood*. IBON INTERNATIONAL. Retrieved November 10, 2022, from https://iboninternational.org/2017/08/11/development-for-whom-how-navotas-fisherfolk-resist-the-displacement-of-their-people-and-livelihood/
[27] *Close the Dumps to Ensure Manila Bay Rehab, Say EcoGroups*. (2009, August 29). EcoWaste Coalition. Retrieved November 10, 2022, from http://ecowastecoalition.blogspot.com/2009/08/close-dumps-to-ensure-manila-bay-rehab.html

6. Another example was the SLF in Iriga City, Camarines Sur, where the nearest Waras River was only about 30.20 meters away *(see Figure 29)*. A pumping station was built to prevent the overflowing of leachate or for the recirculation process. However, this will not guarantee that leachate will not be discharged without a permit from the DENR-EMB, which may contaminate the nearest/connected river.

Figure 29: Inspection of SLF in Iriga City, Camarines Sur, Region 5

Requirement: Minimum of 50 meters away from any perennial stream, lake, or river
Actual: Surrounded by a body of water

Source: Google Earth and COA Validation in Iriga City, Camarines Sur, Region 5

7. In addition to being surrounded by water, the SLF in Navotas City was also at a low altitude ranging from 1.30 meters to 16.30 meters which could be prone to flooding since the country has weather patterns of southwest and northeast monsoon and is frequented by typhoons that can cause heavy rainfall *(see Figure 30)*. Furthermore, storm surges may occur during strong typhoons, which may cause flooding to the island, and trash can be swept away due to its waterfront location, causing marine pollution. Therefore, this contradicts Section 1 (m.2) Rule XIV, RA 9003 IRR that the site shall be evaluated for the presence of geologic hazards, faults, unstable soils, its foundation stability, and hydrological character, and shall not be located in a floodplain.

Figure 30: Inspection of SLF in Navotas City, NCR

Requirement: The site shall be evaluated for the presence of geologic hazards, faults, unstable soils, its foundation stability, and hydrological character. The site shall not be located in a floodplain
Actual: Surrounded by a body of water

Source: COA Validation in SLF in Navotas City, NCR

8. Section 1 (m.1) Rule XIV, RA 9003 IRR requires a daily cover to be applied at the end of each workday. In two cases, a daily soil cover was not applied, which caused some light wastes to be carried by the wind and scattered nearby or within the facility. In the sample photo taken in Asturias, Cebu, it can be seen that layers of waste were still exposed, similar to Maragusan, Davao de Oro *(see Figure 31)*.

Figure 31: Inspection of SLFs with No Regular Daily Soil Cover

Requirement: Daily soil cover
Actual: Without regular soil cover

Location: Asturias, Cebu, Region 7

Location: Maragusan, Davao de Oro, Region 11

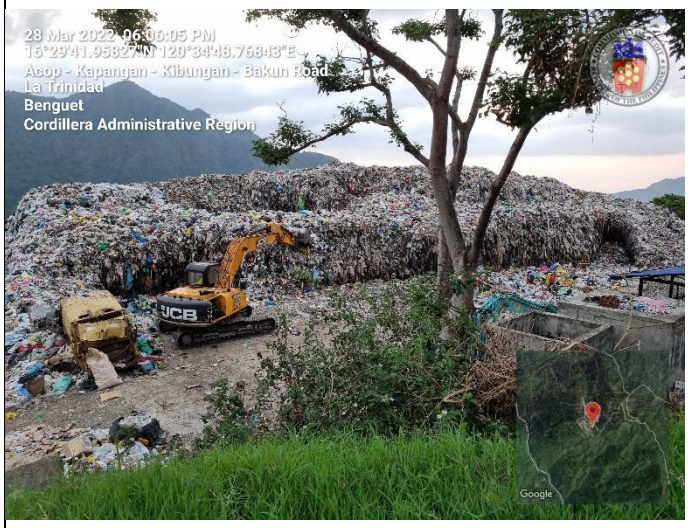
Source: COA Validation of SLFs in Regions 7 and 11

9. Two SLFs do not apply soil cover which may lead to a faster generation of landfill gasses such as methane and carbon dioxide that will harm the people and the environment *(see Figure 32)*. In addition, the exposed waste generated a bad odor that affected the people at the facility. In connection with this, waste workers at the SLF in La Trinidad were confirmed to experience dizziness, cough, and colds.

10. Nine SLFs have establishments within its 200-meter radius *(see Inconsistent implementation of waste segregation nationwide - Extended risks to the people and environment on page 90)*, contrary to the prohibited acts of RA 9003. Hence, the risks posed by landfills, if not appropriately managed, are higher for these establishments within the 200-meter radius.

Figure 32: Inspection of SLFs with No Daily Soil Cover

Requirement: Daily soil cover
Actual: Without soil cover



Location: La Trinidad, Benguet, CAR

Location: Aringay, La Union, Region 1

Source: COA Validation of SLFs in CAR and Region 1

11. Section 1 (v) Rule XIV, RA 9003 IRR requires the groundwater monitoring well to be placed at the appropriate location and depth for taking water samples. However, inspection revealed that three SLFs in (a) La Trinidad, Benguet; (b) GMA, Cavite; and (c) Asturias, Cebu, do not have groundwater monitoring wells on site. Hence, the effect of landfill on the groundwater cannot be monitored if it is being affected.

12. Section 1 (t) Rule XIV, RA 9003 IRR also requires a separate containment area for household hazardous wastes. However, the three SLFs visited do not have a separate containment area for household hazardous wastes. For example, in Navotas SLF, workers that we surveyed confirmed that gloves and face masks were sometimes mixed in the general waste *(see Figure 33)*. This can put waste workers at high occupational risk as they are the most susceptible to infectious diseases.

Figure 33: Ratio of Worker Survey Respondents on Presence of COVID-19-Related Waste in Navotas SLF

Source: COA Survey Results

While serving as a short-term alternative, RCAs have potential risks if operated longer than intended

With the prohibition and closure of dumpsites and the inadequate number of operating SLFs, DENR has allowed using RCA as a temporary disposal site. Based on the latest available data, DENR reported that 534 RCAs were operating nationwide as at October 2022 *(see Table 25)*. However, RCAs pose potential risks if operated longer than intended since there are no formal guidelines and minimum requirements for their establishment (i.e., no liner, no leachate pond, etc.) to contain the effects of the wastes.

Table 25: Number of Operating RCAs

Region	CAR	NCR	1	2	3	4A	4B	5	6	7	8	9	10	11	12	13	Total
No. of RCAs	**58**	**0**	**36**	**28**	**16**	**22**	**15**	**56**	**58**	**18**	**22**	**13**	**63**	**33**	**27**	**69**	**534**

Source: DENR-EMB Data

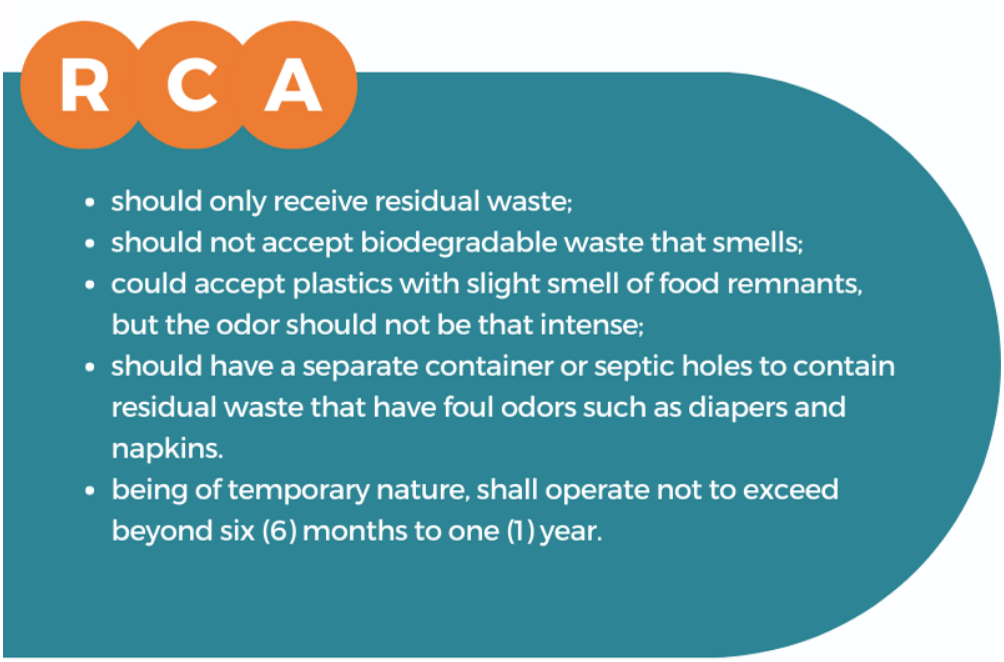
According to DENR-EMB, the RCA is intended to temporarily store residual wastes while LGUs are awaiting access to a final disposal facility, such as the construction of an SLF or finalization of an agreement with an SLF operator *(see Figure 34)*.

Figure 34: Final Disposal Options of LGUs

Source: DENR-EMB Data

However, an interview with DENR-EMB revealed no established and signed guidelines for establishing these temporary RCAs. And the only available criteria were verbally instructed to LGUs *(see Figure 35)*.

Figure 35: Criteria of RCA

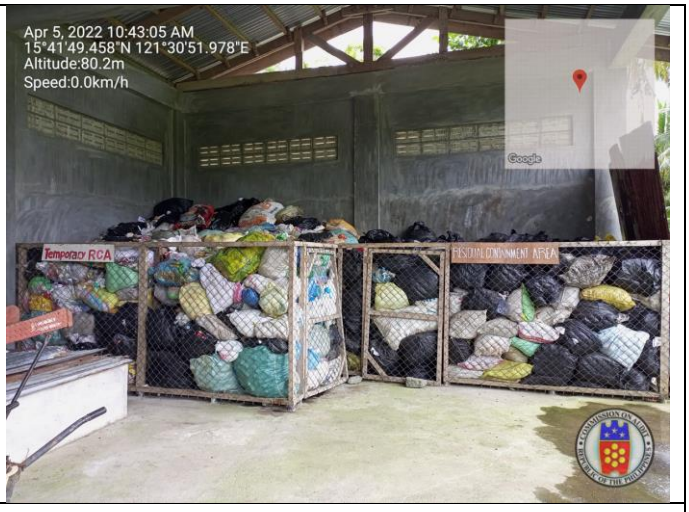


Source: DENR-EMB Data

However, during validation, we and the TSO Engineers noted observations contrary to the draft criteria of RCA. The first observation concerns the purpose of RCAs. The RCA in Kibungan, Benguet, receives residual wastes and recyclables because the facility also serves as an MRF. No RCA was found accepting biodegradables *(see Figure 36)*.

Figure 36: Examples of RCAs from Team Validation

Location: CAR – Kibungan, Benguet



Location: Region 3 – San Luis, Aurora

Location: Region 7 – Calape, Bohol

Location: Region 11 – Monkayo, Davao de Oro

Source: COA Validation

The second observation concerns the material condition of the RCAs. Some of the RCAs were found without concrete flooring. For example, in San Luis, Aurora, and Monkayo, Davao de Oro, wastes touched the ground and were exposed to the floor prone to wetness when exposed to rain *(see Figure 36)*.

Table 26: Sample RCA Observations from the Technical Inspections of COA Engineers

	Kibungan, Benguet	San Luis, Aurora	Calape, Bohol	Monkayo, Davao de Oro
Operation Started	June 2020	2018	2011	June 2020
Operating Years (as at April 2022 validation)	1 year and 10 months	4 years	11 years	1 year and 10 months
Operating Office	MENRO	MENRO	MENRO	MENRO
Waste Collected	Recyclables and Residual Wastes	Residual Wastes	Residuals	Residual with potential for recycling/ diversion
Floor Area	160 sqm.	18 sqm.	96 sqm.	45.15 sqm.
Materials Used	Two-storey reinforced concrete building enclosed by CHB Wall and Galvanized Iron (GI) Sheet Roofing	Reinforced Concrete Facility with CHB Wall and GI Sheet Roofing.	Open storage made of concrete columns and GI Sheet Roofing in the wood truss.	Open storage made of wood columns and GI Sheet Roofing in the wood truss.
Status	Operational	Operational	Operational	Operational

Source: COA Technical Inspection Report

The third observation concerns capacity. The RCA in San Luis, Aurora has a floor area of 18 sqm, significantly smaller than the other RCA sites visited. However, we observed some wastes stored in the facility were exposed to rain due to full capacity. Since the RCA has inherently no concrete flooring, a GI sheet was used as an alternative to protect the waste from the ground.

The fourth observation concerns the operating timeline of the visisted RCAs *(see Table 26)*. They all operated beyond six months to one year, violating the minimum requirement verbally instructed by the DENR-EMB. Some have been operating for over a decade, for example, in San Luis, Aurora, and Calape, Bohol. Per an interview with the officials, they have been resetting the operating timeline once the RCA has been emptied of residual wastes for transfer to an accredited SLF. However, we were not furnished with monitoring records to validate this practice.

In an interview with DENR-EMB official, we discovered that RCAs were already been operating since 2006, meant to be temporary storage areas. However, when asked about the differences between the RCAs that were already established a long time ago and the temporary RCAs as an alternative to those whose dump sites have closed and without access yet to an SLF,

another official said that there was no distinction yet that was officially disseminated.

In hindsight, establishing and operating an RCA should have a minimum requirement similar to an SLF because the types of waste that should be received are residual. Most RCAs we visited served as temporary storage areas or transfer stations for recyclable wastes or residuals with potential, similar to an MRF.

However, we did not find other residual wastes, such as napkins and diapers, which have a foul smell. In addition, no septic holes or vaults were shown to us by the LGUs operating RCAs that can handle such wastes. Given that more than half of barangays, or 64.73 percent nationwide *(see Figure 12)*, still lack access to an MRF, there may be LGUs whose RCAs will not only receive residual with potential and recyclable wastes, but also residual and harmful wastes as well.

No formal guidelines on the establishment and operation of RCA. While the temporary RCAs were meant to serve as an alternative to local governments' pending access to SLF, this instruction was only verbalized by NSWMC during technical conferences, because the guidelines on RCA did not reach resolution by the members of the Commission.

The draft Policy on the Guidelines on the Establishment and Operation of Residuals Containment Area was presented and discussed in the Consultation on Support Policies for the implementation of the ESWM Act and Training/Workshop on the Greenhouse Gas Inventory and Mitigation options of Solid Waste Sub-Sector last March 14, 2017. According to DENR-EMB, it was also agreed that the said draft Guidelines would be disseminated to the participants for further review, input, and comments. Unfortunately, confirmation with DENR-EMB on the status revealed no recent development on this Policy.

NSWMC admitted that there are RCAs that are indeed mismanaged and agreed on the need to revisit and review the guidelines for managing RCAs.

Prolonged Lifespan of RCAs. As for the reasons and implications of prolonging the operation of their RCAs, the officials from the visited LGUs had the following reasons:

- Kibungan, Benguet, has a proposed SLF awaiting approval from the DENR-EMB.
- Monkayo, Davao de Oro already has its own SLF and uses the established RCA.
- San Luis, Aurora, has an ongoing MOA with a private SLF operator to dispose of residual wastes. The purpose of their RCA is to serve as a holding area for accumulating residual wastes before collection and delivery to private SLF. The LGU officials disclosed that they already had an approved ECC last November 2020, and the SLF was already due for construction.
- Calape, Bohol, has a MOA with another LGU, the Municipality of Alburquerque, as a disposal site. The purpose of their RCA is also to

serve as a holding area for the accumulation of residual wastes before transfer to the SLF.

Given that the RCAs visited have already been established using government funds, the DENR-EMB said that with proper management and operation, the RCA could be an integral part of the SWM and/or the SLFs once access to an SLF is already available, as it can be used for the processing of the residual waste that has the potential for recycling and fuel.

Cement factories in cement production can use residual waste with a high calorific value. Also, there are established markets where the residual wastes are mixed with sand and cement to produce construction materials.

The DENR-EMB also mentioned that LGUs who invested money in their RCAs have plans for their use in the long run. For example, some LGUs use the structure that they have previously operated as an RCA to be a transfer station, sorting station, or in many cases, an MRF. Hence, the structure itself can serve other purposes planned by the LGUs. Such was the case in the LGUs of San Luis, Aurora, and Calape, Bohol. With plans to have access to an SLF long-term, they were already utilizing the RCA as a prerequisite in managing residual waste before transfer to an accredited SLF.

We noted that the DENR-EMB did not yet have a national policy on the recommended use of established RCA for those LGUs already finished with its temporary use.

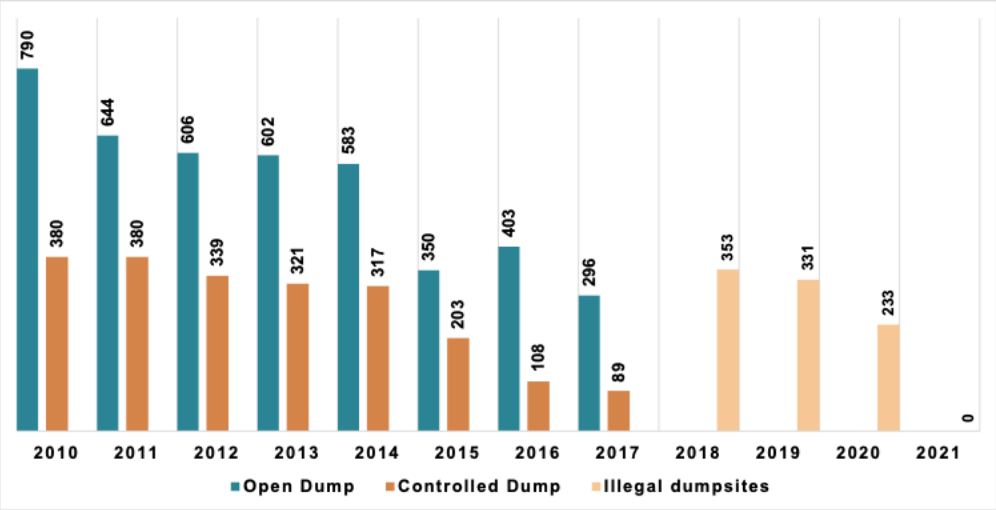
Potential Risks of Prolonged Operation of an RCA. According to the DENR-EMB, one of the potential risks of an RCA being operated for a longer span is that an RCA is only limited in capacity. Once that capacity is reached, and the LGU fails to anticipate it, it often ends up being operated as an Open Dumpsite. Since the RCA will operate similarly to an SLF temporarily, there is no minimum requirement for its establishment (no liner, no leachate pond, etc.) to contain the effects of the wastes. The risk is that as wastes undergo decomposition, they produce methane and leachate. If the leachate is not properly contained, it could contaminate the surface and groundwater. Likewise, methane is produced and may cause spontaneous combustion.

Mandated closure, transition, and prohibition of dumpsites were not met

Section 37 of RA 9003 prohibits the establishment and operation of open dumps or any practice or disposal of solid waste which constitutes the use of open dumps. The law also states that all open dumps shall be converted into controlled dumps until 2004 and that no controlled dumps shall be allowed until 2006.[28] However, this legally mandated transition was not fully realized, as many open and controlled dumps or illegal dumpsites were still operating after 2006 *(see Figures 37 and 38)*.

[28] According to Section 37 of RA 9003, all open dumps shall be converted into controlled dumps within three (3) years after the effectivity of the Act, and that no controlled dumps shall be allowed five (5) years follow the effectivity of the Act.

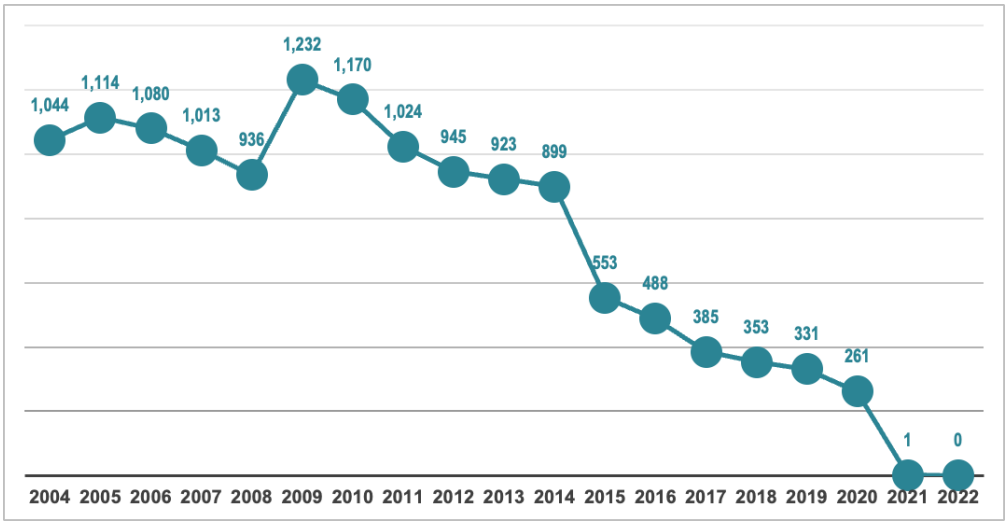
Figure 37: Comparative Number of Open, Controlled, and Illegal Dumpsites from CYs 2010 to 2021



Source: DENR-EMB Data

On the other hand, data reported by DENR-EMB revealed that the number of operating dumpsites reached as high as 1,232 in CY 2009.

Figure 38: Trend in the Numbers of Illegal Dumpsites from CYs 2004 to 2022



Source: DENR Data

In CY 2021, DENR announced the successful closing of all dumpsites nationwide.[29] However, our validation from March to April 2022 revealed that not all dumpsites were successfully closed *(see Figure 39)*. We found eight

[29] *DENR shuts down 100% of all illegally operating dumpsites nationwide.* (2021, May 2023). DENR. Retrieved January 3, 2023, from https://www.denr.gov.ph/index.php/news-events/press-releases/2606-denr-shuts-down-100-of-all-illegally-operating-dumpsites-nationwide

illegal operating dumpsites during validation. According to the LGUs, they had to reopen or establish a new dumpsite due to a lack of capacity to construct their own SLF and/or lack of funds to enter into an agreement with an SLF operator and pay tipping fees. The NSWMC later attested that there were occurrences of the reopening of dumpsites, especially when the LGU had nowhere to dump its waste. Mother Earth Foundation commented that DENR did not give support when it closed the LGUs' dumpsites. Thus, LGUs encountered problems when they disposed of their waste.

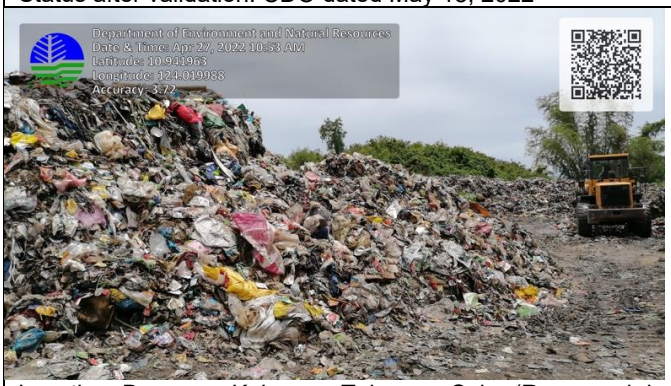
Figure 39: Operating Illegal Dumpsites during Validation

Location: Barangay Bagong Sirang, Pili, Camarines Sur (Reopened dumpsite)
Status after validation: Technical Conference was held last June 22, 2022.

Location: Barangay Poblacion, Guipos, Davao Del Sur (Reopened dumpsite)
Status after validation: CDO dated June 20, 2022

Figure 39: Operating Illegal Dumpsites during Validation (cont.)

Location: Barangay Caidocan, Medellin, Cebu (Reopened dumpsite)
Status after validation: CDO dated May 18, 2022



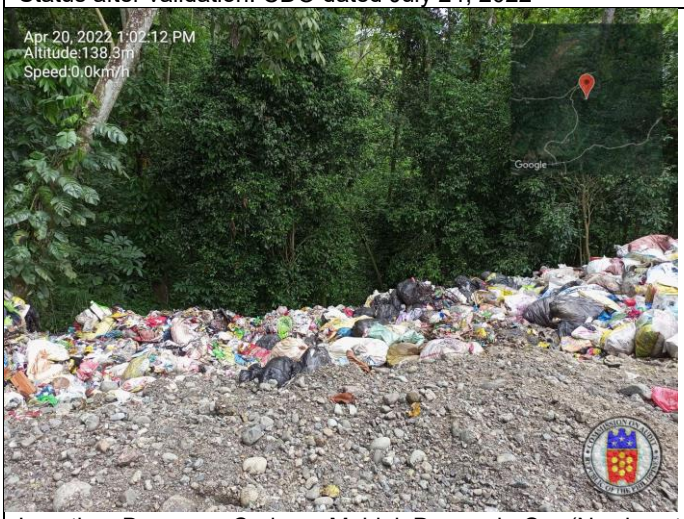
Location: Barangay Kal-anan, Tabogon, Cebu (Reopened dumpsite)
Status after validation: CDO dated May 18, 2022

Location: Barangay Tabunok, Tabuelan, Cebu (Reopened dumpsite)
Status after validation: CDO dated May 18, 2022

Location: Barangay Kangdampas, Barili, Cebu (Reopened dumpsite)
Status after validation: CDO dated July 11, 2022

Figure 39: Operating Illegal Dumpsites during Validation (cont.)

Location: Barangay Sikatuna, Guipos, Davao Del Sur (Newly established dumpsite)
Status after validation: CDO dated July 24, 2022



Location: Barangay Caduan, Mabini, Davao de Oro (Newly established dumpsite)
Status after validation: Closed with Ongoing/Partial Rehabilitation as of October 7, 2022

Source: COA Validation

Out of the eight dumpsites, the one in Barangay Bagong Sirang, Pili, Camarines Sur, remains operational during the latest validation of DENR-EMB Region 5 on October 3, 2022 *(see Figure 40)*. According to DENR-EMB Region 5, in the late months of 2020 and early quarters of 2021, the LGU of Pili had initially undertaken closure and rehabilitation activities by applying soil cover and constructing fences, including the operation of a central MRF. However, during their March 2022 monitoring, DENR-EMB Region 5 found that LGU Pili utilized the open dumpsite in Barangay Bagong Sirang as the final disposal site for the municipality's solid waste. As a result, a technical conference was conducted on June 2022, where LGU Pili committed to cease operating the open dumpsite and initiate an RCA operation in one of its barangays. However, the limited space and capacity of the RCA to accommodate the daily collected residual waste and some other inherent

issues have hindered the development of an SLF. Thus, the open dumpsite was re-utilized as the final disposal site for solid waste.

Figure 40: Open Dumpsite in Pili, Camarines Sur

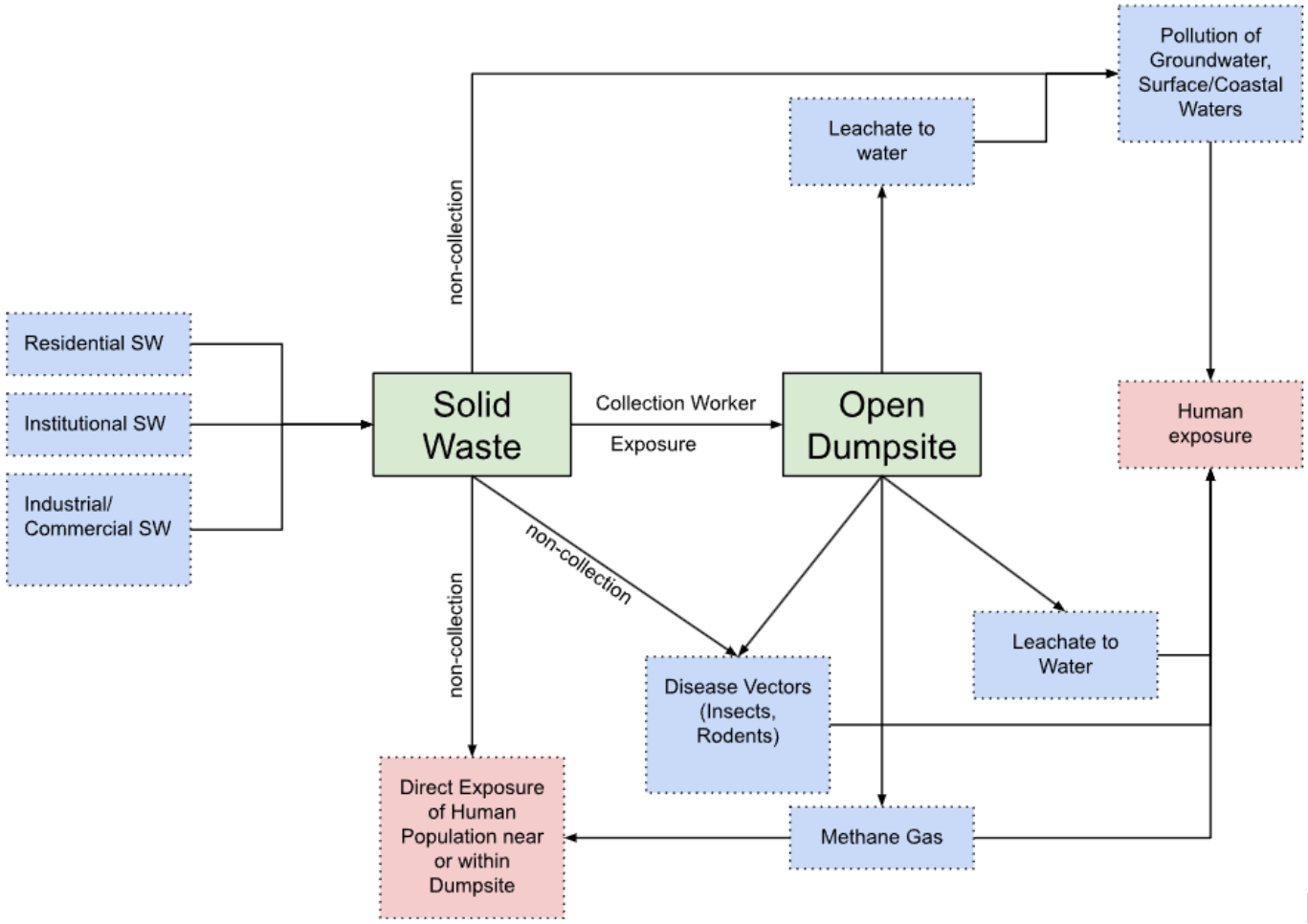
Taken: April 26, 2022
Left: Municipal MRF adjacent to disposal area; Right: Active area of the disposal site

Taken: October 3, 2022
Left: Municipal MRF adjacent to the disposal area. The piled sacks are carbonized rice hulls for composting; Right: Active area of the disposal site

Source: COA Validation and MENRO Pili Photographs

Since the operation of an open dumpsite lacks the safety measures of a landfill, the leachate produced from solid waste can contaminate groundwater and surface waters. Methane gases emitted by dumpsites also harm the health of those exposed to them and contribute to global warming. This can also cause increased flooding and infrastructure destruction due to clogged waterways *(see Figure 41)*.

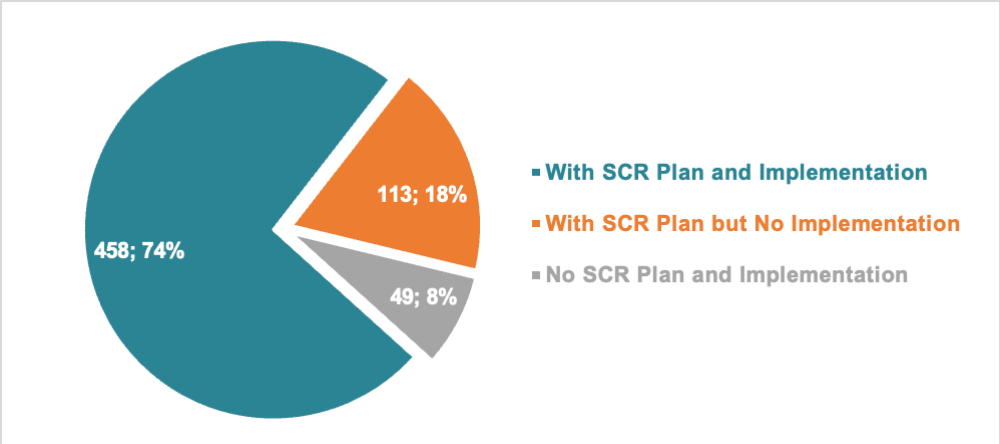
Figure 41: Solid Waste Exposure Pathway



Source: National Solid Waste Management Report (2008-2018)

Safe Closure and Rehabilitation Plan (SCRP). Regarding the closure of illegal dumpsites, the DENR has issued guidelines to ensure the proper order of closing and rehabilitation of open and closed dumpsites by requiring the concerned LGUs to submit an SCRP for review, approval, and immediate implementation.

Figure 42: Distribution on the Status of Submission and Implementation of SCRPs of Closed Dumpsites from 16 Regions



Note: According to DENR-EMB CAR, no dumpsites have been operated in the region. On the other hand, data from BARMM was not submitted.

Source: DENR-EMB Regional Offices

Since DENR did not maintain a database for monitoring the rehabilitation plans, we requested DENR-EMB RO to submit the latest status. Data from 16 regions revealed that only 74 percent, or 458 of the 620 dumpsites, had completed their SCRP implementation, 18 percent, or 113 with plans but without implementation, and 8 percent or 49 had no plans established yet *(see Figure 42)*. The data gathered on the 620 dumpsites were only 50.32 percent of the reported 1,232 dumpsites that operated in CY 2009 *(see Figure 38)*. Data or progress on the safe closure and rehabilitation of the remaining 612 dumpsites was still unknown.

However, it could not be denied that LGUs disregarded the deadline set by RA 9003, notwithstanding the series of Notices of Violation (NOVs) issued by the Commission and capability-building assistance provided by DENR-EMB. The nonattention was attributed to a lack of political will, technical know-how, and financial capability to implement the mandates of the law.

Open and controlled dumpsites continue to be sources of methane gas emissions; hence, failure to close these facilities exacerbates greenhouse gas emissions. Conversely, their proper closure and rehabilitation will significantly contribute to greenhouse gas reduction.

Achieving SWM objectives will promote relevant SDGs

From a broader perspective, the SWMP spans activities that directly and indirectly affect the achievement of SDGs. Moreover, it is irrefutable that the SWM process concerns not only public health and the environment but also energy sustainability, human capital and labor, economic impact, aided by institutional mechanisms.

Figure 43: SWM Cuts Across All SDGs

Source: COA Analysis

As shown in Figure 43, several general and specific activities[30] contribute in one way or another to all 17 SDGs in a global sense *(see Appendix IV for the complete details)*.

Consequently, our analysis disclosed an evident relationship between achieving SWM objectives and the SDGs, as discussed below:

Not improving the economic conditions of waste workers (e.g., pickers, sorters, machine operators, and administrators) has not helped them to lift themselves from poverty. Local governments enable and accept the informal sector to manage their solid waste. Thus, the demand will remain for the waste workers who want to work for a decent living to provide for their families.

Non-collaboration with implementing stakeholders results in overlapping programs and unnecessary use of government resources. The connection between diverting and recycling organic solid waste and its purpose in the agricultural industry is undeniable. Yet, the duplicate equipment we observed also speaks of duplicate efforts and resources that could have been avoided if an integrated approach had been employed by member agencies in the implementation of their programs, projects, and activities. For example, biowaste shredders were both provided by DENR and DA. An integrated approach combining purposes of solid waste diversion for disposal and agricultural processing will minimize the duplication of costs and resources spent by the government.

Proper handling of solid waste and medical waste from COVID-19 and safe collection, transportation, and disposal supports a healthy and disease-free environment. As a result, COVID-19 has been an urgent health matter recently. However, this does not set back other communicable diseases, such as malaria and hepatitis, which can be transmitted through water and other means.

Opportunities for women are present from the ground up. However, female representation in the SWM industry is unequal, as observed. Out of the total number of M/CENROs nationwide, excluding BARMM, only 28 percent are females *(see Unequal distribution of men and women in SWM and leadership on page 114)*.

[30] Elsheekh, K. M., Kamel, R. R., Elsherif, D. M., & Shalaby, A. M. (2021, September 15). *Achieving sustainable development goals (SDG) from the perspective of solid waste management plans*. Journal of Engineering and Applied Science, 68(1). Retrieved November 10, 2022, from https://doi.org/10.1186/s44147-021-00009-9

The solid waste industry has not yet realized the goal of increasing the share of renewable energy in the energy mix. Pending the negotiations of different stakeholders on the future of Waste-to-Energy, implementers can turn to other methods for new and affordable energy sources.

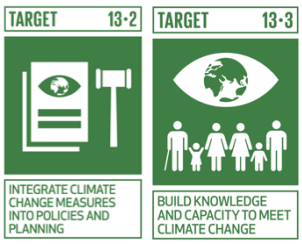
Adopting the green circular economy model was challenged because the 3Rs (reduce, reuse, recycle) promotion is lackluster. No recycling markets have been established to encourage innovative solutions in ensuring sustainable and responsible consumption and production patterns.

Access to adequate, safe, and affordable housing services for communities living in slums was continually affected by dumpsites' lingering presence. Despite the 100 percent closure order last May 2021, discovering open dumpsites nearby communities hounds their safety and health.

The environmental impact of waste was more felt in urban areas than in rural areas. All LGUs have chances for an integrated SWM system through the preparation of 10-year plans. Carefully planned systems shall help reduce the negative environmental impacts of solid waste, most especially for urban centers.

Dumpsites converted to green and public spaces are replicable and encouraged for a sustainable city and community. Degraded land from buried wastes still has a chance of utilization. Selected dumpsites converted into eco-parks that we validated are a replicable opportunity for other LGUs in the same situation.

Achieving the target of substantially reducing waste generation through prevention, reduction, recycling, and reuse is still far from what is envisioned. The current orientation of the 3Rs is not as efficient as preferred. Waste generation continues to increase, waste diversion has gaps in implementation and monitoring, and waste disposal continues to have challenges from being built. In addition, the demand for waste disposal facilities increases as the lifespans of existing ones are shortened due to problems in the waste stream.



Integrating climate change measures into the planning and implementation of SWM is important as they are greatly interrelated. From open burning emissions of carbon monoxide, carbon dioxide, greenhouse gases, nitrogen oxides, hydrocarbons, and other particulate matter, up to the solid waste disposal facilities' emissions of methane and carbon dioxide from leachate, the effects of solid waste mismanagement translate to our growing concerns over climate change. Moreover, these pose a greater need to build adequate knowledge and capacity to institutionalize education of SWM with climate change. By improving the curricula of our primary, secondary, and tertiary education systems and multi-sectoral IEC campaigns, raising awareness on the effects of solid waste and climate change will help us better mitigate, adapt, and reduce its impacts.

Dumping solid waste into water bodies increases marine pollution and will affect the lives of marine organisms and humans in the long run. For example, an SLF on an island surrounded by water and voluminous sightings of solid wastes discovered in oceans harm organisms living underwater. Studies have also already emerged detailing the effects of micro plastics on these organisms that we, in turn, consume.

There is a relationship between the government and non-government entities, such as the formal private sector, the informal sector, the local community, and donors. Albeit imperfect, efforts to encourage and promote effective public, public-private, and civil society partnerships were made through consultations and meetings. When civil society organizations file cases, the intention is to mobilize and persuade government leaders to take action.

To provide a closer perspective on how the Philippines is fairing in achieving SDGs[31], we identified for comparison the SDG Targets 11.6, 12.5, 13.2, and 13.3.[32]

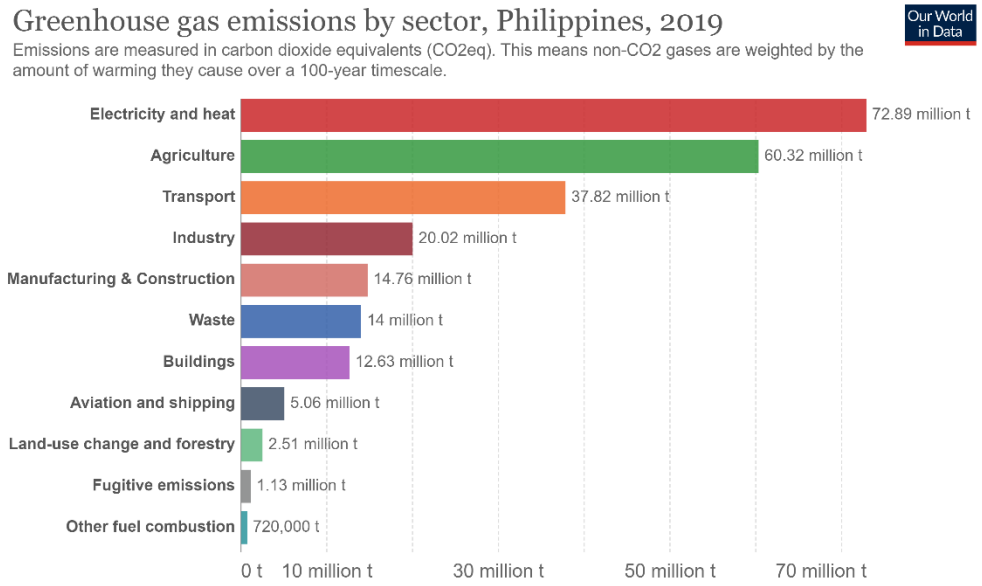
There was a low probability of achieving the SDG target of substantially reducing waste generation through prevention, reduction, recycling, and reuse by 2030. As discussed earlier, this Program has been identified by the national government as one of the key programs which primarily contributes to the achievement of SDG 12 Target 12.5, which aims to substantially reduce waste generation through prevention, reduction, recycling, and reuse. However, based on the projections of NSWMC to forecast future waste generation, waste is projected at 19,764,384.95 metric tons in CY 2030. Therefore, with this scenario, the Philippines is not yet in a position to achieving SDG Target 12.5 of substantially reduced waste generation by 2030. In addition, this SDG indicator has yet to be monitored by the PSA since

[31] The only SDG Target adopted in the Philippines with direct relation to SWM is SDG Target 12.5, however, this target is in Tier 2 – with established methodology but data is not regularly collected.
[32] We focused on selected targets that are directly referenced by observations and validations from physical inspections and data analysis.

it is still under Tier 2, or data are not regularly collected even with established methodology.

Climate change accelerated the need to find measures to reduce and manage the waste we create. But, ultimately, waste also contributes to climate change. Poor waste management practices, such as open burning, dumping in creeks and bodies of water, using open and unmanaged dumpsites, and non-segregation of waste, have contributed to greenhouse emissions. According to Our World in Data[33], waste is the 6th largest sector producing greenhouse gas emissions in CY 2019 *(see Figure 44)*.

Figure 44: Philippines' Greenhouse Gas Emissions by Sector in 2019

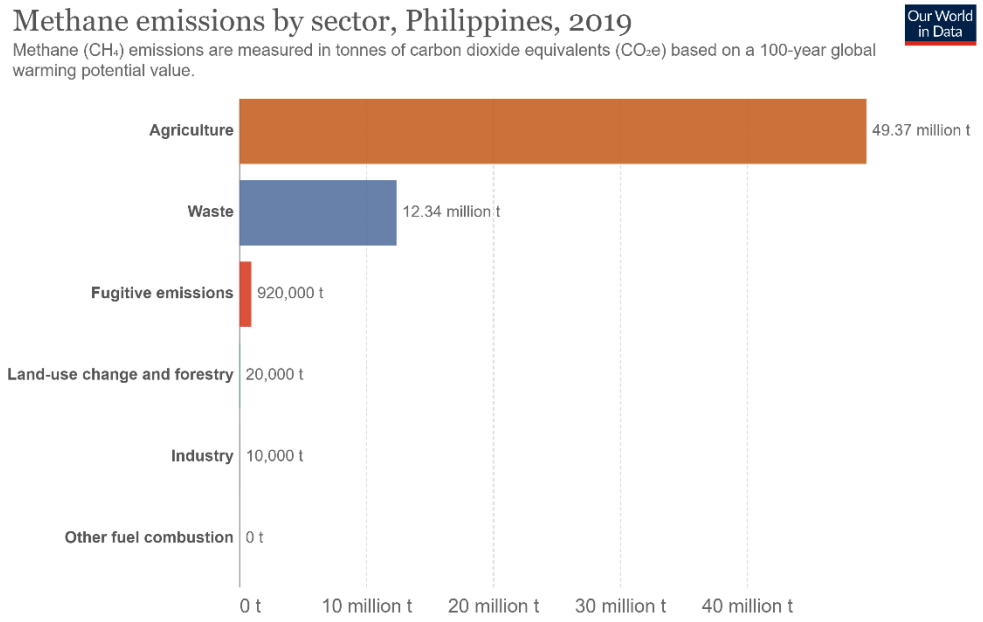


Source: Our World in Data

As mentioned earlier, majority of the municipal wastes in the Philippines were biodegradable at 52.3 percent. However, due to a lack of segregation, the accumulated biodegradable wastes in landfills and dumpsites enter the decomposition stage, producing carbon dioxide and methane emissions, which are about 23 times stronger at warming the atmosphere than carbon dioxide. According to reports, methane was a strong greenhouse gas, mainly produced through agricultural activities followed by waste activities *(see Figure 45)*.

[33] Hannah Ritchie, Max Roser and Pablo Rosado (2020). *CO_2 and Greenhouse Gas Emissions*. Published online at OurWorldInData.org. Retrieved September 14, 2022, from https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions

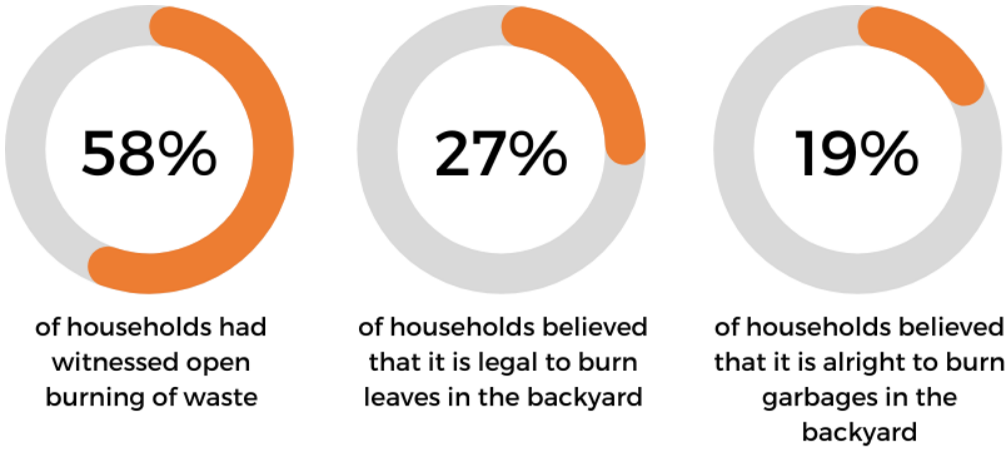
Figure 45: Philippines' Methane Emissions by Sector in 2019



Source: Our World in Data

Similarly, the open burning of biodegradable waste produces methane and carbon dioxide emissions. However, the survey revealed an information gap, wherein households confirmed the occurrence of open burning. At the same time, some were unaware that open burning should not be done and is illegal *(see Figure 46)*. Thus, there was also a need to strengthen knowledge and capacity to meet climate change solutions.

Figure 46: Household Survey Results – Open Burning



Source: COA Survey Results

Although governments will be responsible for creating laws and institutions to address the growing garbage nationally, individuals and communities may contribute to lowering waste output *(see Figure 47)*.

Figure 47: 5R's of Waste Management

Source: Secretariat of the Pacific Regional Environment Programme Factsheet No. PYCC-004 (Published in July 2009)

Challenges encountered that prevented the NSWMC and LGUs from effectively and efficiently implementing solutions

While LGUs were consistently provided with technical assistance, capability support, and information dissemination on SWM, LGUs were still burdened with challenges that hamper the effective and efficient implementation of their 10-yr SWM Plans. These challenges include inconsistent waste segregation and collection implementation, non-establishment of MRFs and unutilized SWM equipment, lack of recording mechanism in MRFs, recyclable wastes overwhelming some MRFs, non-establishment of M/CENRO, and unequal distribution of men and women in SWM. Hence, these challenges show that while a national policy was available, the coherence and integration across levels of government were not maintained and supported. These same difficulties have also hindered the NSWMC in attaining the goals of RA 9003, thus resulting in mixed waste collection, unnecessary hazards to workers in landfills, and SLFs and MRFs exceeding capacity levels. On the other hand, we also note some best practices observed during the validation.

Inconsistent implementation of waste segregation nationwide

Segregation plays a vital role in ensuring that the mandated waste diversion is achieved and that the landfills receive less waste than the actual waste generated. However, segregation was also a critical concern of LGUs, resulting in mixed waste collection, hazards to workers in landfills, and SLFs exceeding capacity levels.

Mother Earth Foundation emphasized the importance of source segregation in all households, with the LGUs as the focal point for its implementation. According to RA 9003, segregation at source refers to an SWM practice of separating, at the point of origin, different materials found in solid waste to promote recycling and re-use of resources and to reduce the volume of waste for collection and disposal. At the local level, LGUs prescribe a no-segregation, no-collection policy as an ordinance that aims to prevent violating prohibited acts indicated in Section 48 of RA 9003, which disallows the collection of non-segregated or unsorted wastes.

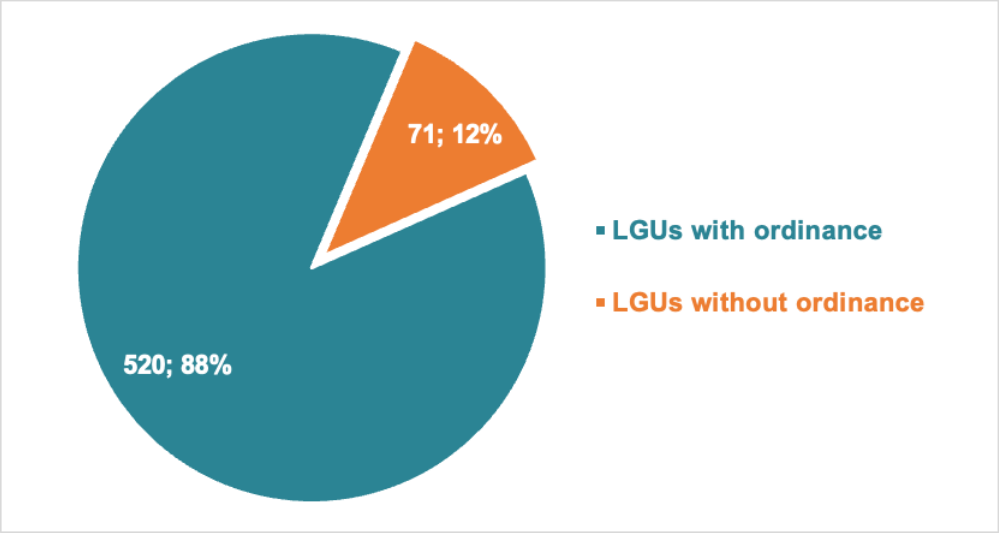
However, decades after, the inconsistent waste segregation implementation across the country was continually criticized. Likewise, in a press release by Senator Win Gatchalian on February 11, 2020[34], it was revealed that only 30 percent (12,614) out of 42,045 barangays segregate solid waste, based on data from the DENR.

[34] *'Reduce, reuse, recycle' a failure says Gatchalian; pushes for Waste-to-Energy technology.* (2020, February 11). Retrieved November 10, 2022, from https://legacy.senate.gov.ph/press_release/2020/0211_gatchalian1.asp

To help with this, the DENR also issued a statement in March 2021 encouraging the LGUs to establish ordinances instructing barangays to undertake waste segregation at source and to act against those who will not comply.[35]

Results of the survey conducted by the audit team on sample LGUs also echo the same concern. For example, when asked whether an ordinance on segregation-at-source had been passed and put into effect, 12 percent or 71 of the 591 LGU respondents were found to have no segregation ordinance[36], which emphasizes the issue further *(see Figure 48 and Table 27)*.

Figure 48: Distribution of LGU Survey Respondents With and Without Segregation-at-Source Ordinance



Source: COA Survey Results

Further analysis revealed that this issue might affect at least 1,160 MRFs if no segregation is implemented, and MRFs may be underperforming, if not overwhelmed, due to unsegregated wastes received.

Table 27: No. of LGUs With No Segregation Ordinance and No. of Operational MRFs

Region	No. of LGUs with No Segregation Ordinance	Total No. of Barangays	Total No. of Operational MRFs
CAR	2	132	4
NCR	2	48	2
2	8	184	185

[35] *DENR pushes for at-source waste segregation through local ordinances. (2021, March 9).* Retrieved November 10, 2022, from https://www.denr.gov.ph/index.php/ news-events/press-releases/2264-denr-pushes-for-at-source-waste-segregation-through-local-ordinances

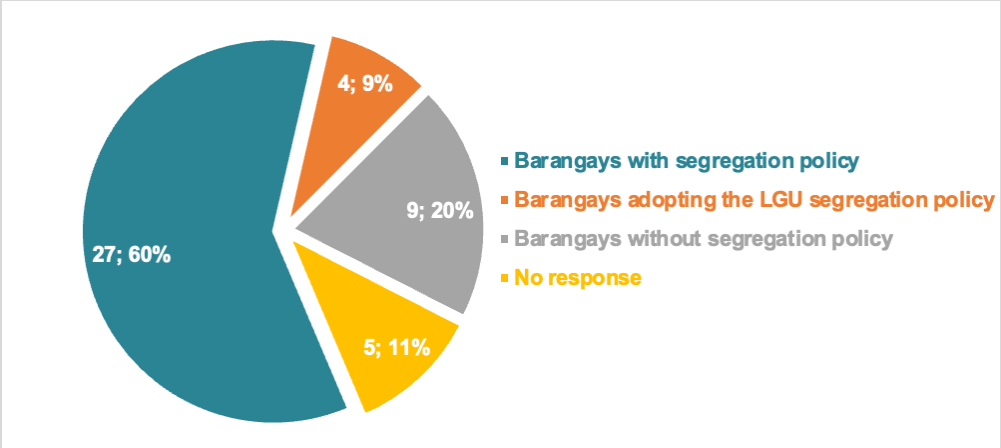
[36] Based on survey results, 557 LGUs confirmed implementing an ordinance on segregation. However, only 520 LGUs have submitted a copy of the said ordinance.

Region	No. of LGUs with No Segregation Ordinance	Total No. of Barangays	Total No. of Operational MRFs
3	9	214	46
4A	2	81	26
4B	13	256	299
5	6	226	149
6	6	138	116
7	10	231	23
8	1	24	25
9	5	114	117
11	3	49	51
12	4	101	117
Total	**71**	**1,798**	**1,160**

Source: COA Survey Results

During validation, we confirmed the survey results and found that of the 45 barangays interviewed, nine confirmed they do not have a policy on "no segregation, no collection" in place. On the other hand, 27 barangays have a segregation policy, while four adopted their LGU segregation policy *(see Figure 49)*.

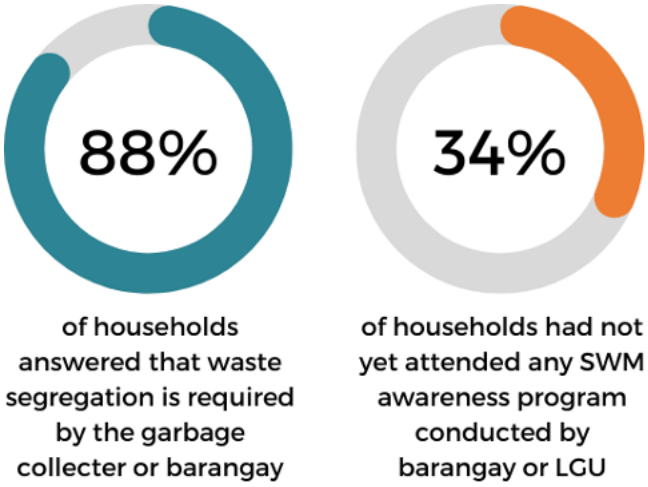
Figure 49: Distribution of Barangay Survey Respondents With and Without Segregation-at-Source Policy



Source: COA Interview Results

However, even with an appropriate policy to enforce segregation, LGUs still need their people's active participation to succeed. This also necessitates that LGUs properly educate their communities. Based on our household survey, 88 percent of respondents confirmed that they were required to segregate waste *(see Figure 50)*. On the other hand, 34 percent responded that they have not yet attended any awareness program on SWM conducted by either their barangay or LGU.

Figure 50: Percentage of Household Survey Respondents Who are Aware of Waste Segregation



Source: COA Survey Results

On the other hand, applicable to public places was another segregation requirement in RA 9003, requiring a separate container for each type of waste from all sources. In addition, for each solid waste container, there should be proper markings or identifiers for on-site collection depending on its use, such as “compostable,” “non-recyclable,’ “recyclable,” or “special waste,” or any other classification as may be determined by the NSWMC.

However, it was only in CY 2020 that the NSWMC released guidelines prescribing the color coding of waste bins/ bags according to its classification as follows: green for “biodegradables,” blue for “recyclables,” red for “household special waste,” and black for “residual waste.” The NSWMC Resolution No. 1380, Series of 2020, prescribed the color coding to help all stakeholders (e.g., households, tourists, business establishments, and waste collectors) prevent the formation of mixed waste in handling and managing solid waste.

Hence, with the two-decade gap, it was only expected that waste bins implemented in LGUs vary in color, quantity, and labels *(see Figure 51)*.

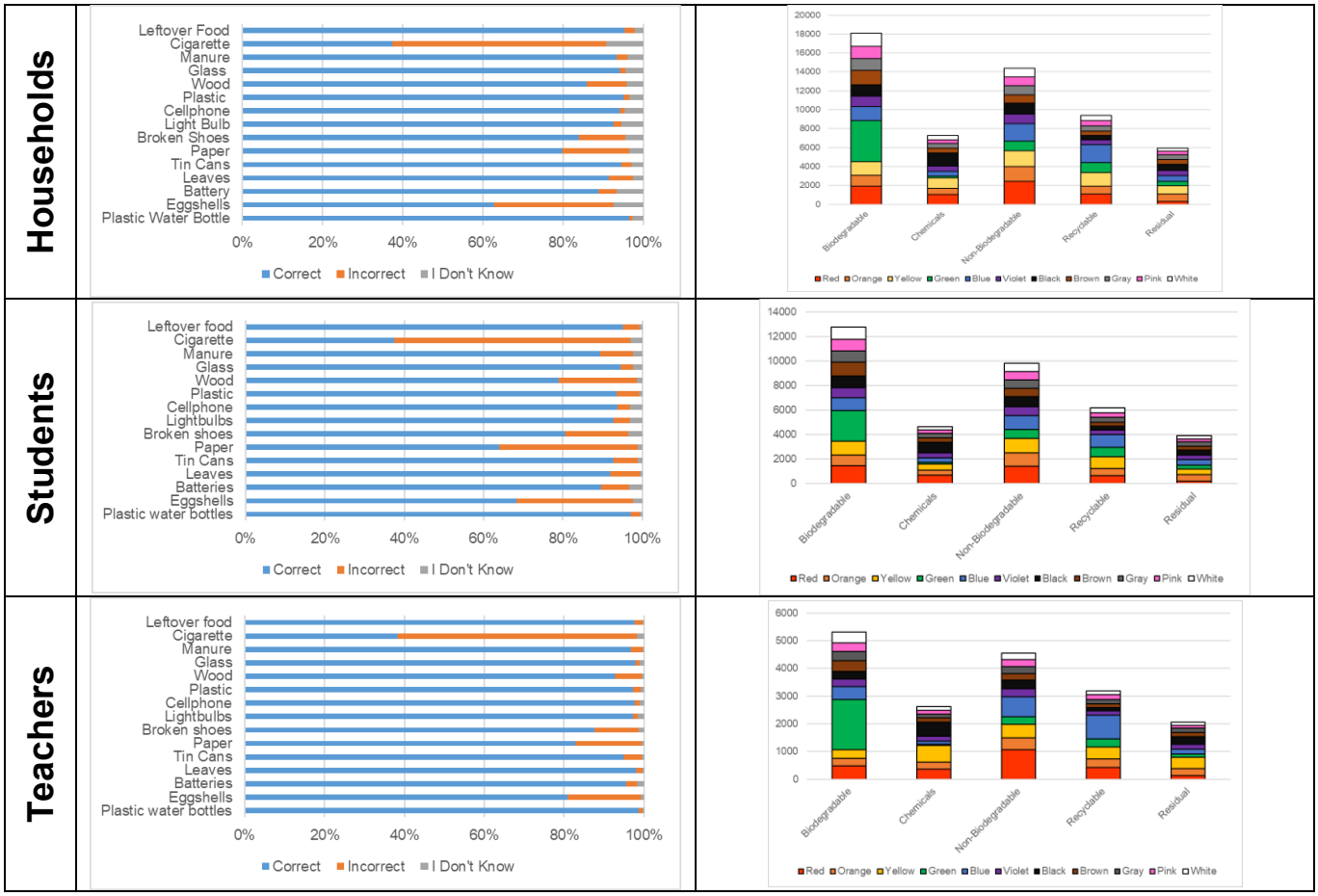
Figure 51: Variation of Waste Bins

Source: COA Validation

The expected differences were reflected in various policies and memoranda the local and regional governments implemented. For example, in one municipality, the Municipality of San Isidro, Province of Nueva Ecija, their ordinance on segregation and collection was enforced by using three containers: one collected by a green truck was for “all scrap paper, plastic, metals, glass, and plastic bottles,” the second collected by a red truck was for “food, animal wastes, and garden wastes,” and the third collected by a blue truck was for “everything not in the first and second categories such as “disposable sanitary napkins and diapers, toy and flashlight batteries, upholstery, pentel and ballpen, hazardous household wastes such as dressings and bandages, expired medicines, shoes and slippers, mats, rags upholstery.”

On the other hand, we conducted surveys of households as well as teachers and students to determine their perception and knowledge of solid waste segregation. As the primarily responsible for conducting segregation-at-source, we validated whether segregation can succeed based on their understanding and perception of colors and labels of waste containers.

Figure 52: Waste Type and Container Identification by Select Group



Source: COA Survey Results

Based on survey responses on waste type identification and waste container identification, we found that households, students, and teachers have mostly answered correctly in determining the waste types *(see Figure 52)*. However, the survey found a similar color and label recognition disparity among households, students, and teachers.

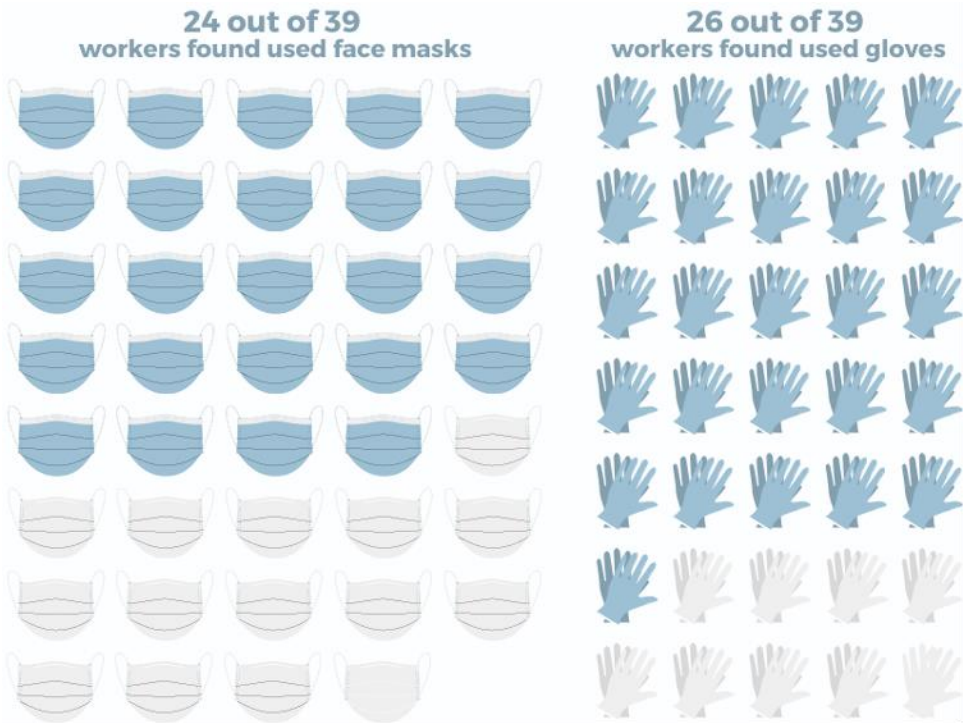
What will happen when segregation is not consistently implemented? Numerous papers describe the effects of lack of segregation on general waste, including mixed waste collection and disposal and landfills at overcapacity levels. Additionally, because households were disposing of healthcare waste during this pandemic, the absence of segregation was more apparent.

When the pandemic affected the country in March 2020, segregation was further impacted with the addition of segregating COVID-19-related waste (e.g., used face masks, cotton, tissue papers, testing kits, etc.) which were considered infectious and contaminated healthcare wastes per Section IV (c) of NSWMC Resolution No. 1364. Per guidelines, COVID-19-related waste should be segregated by using yellow plastics/ribbons as visual markers. However, the survey revealed that 55.6 percent (200) of household survey

respondents do not use yellow plastics/ ribbons as a sign of COVID-19-related waste.

This lack of segregation was the most serious concern now that the country was dealing with the pandemic. According to surveyed SLF workers, healthcare wastes such as gloves and face masks were mixed with the residual waste, contrary to NSWMC COVID-19 guidelines *(see Figure 53)*.

Figure 53: Presence of COVID-19-Related Wastes in SLF per Respondent Workers



Source: COA Survey Results

On the other hand, there was also a concern about tourists' movement, which can be a great source of solid waste. An interview with local officials from LGU Baler, Aurora, revealed that prior to the pandemic, the public had frequently been moving in and out of the country, as well as within the regions of the Philippines. Traveling, especially in tourist hot spots has become the concern of these LGU officials who manage the SWM in their jurisdiction. Further, an interview with local officials from Balanga, Bataan, revealed that people, also called "transients", have moved indefinitely from one place to another to stay longer. This has happened a lot during the lockdown period of the COVID-19 pandemic.

To validate, we extracted data on the annual movement of tourists[37] in the Philippines, including Foreign Tourist Arrivals (FTAs)[38] and Regional Travelers (RTs)[39] from the CYs 2012 to 2020 *(see Table 28)*.

Table 28: Annual Foreign Tourist Arrivals and Regional Travelers from CYs 2012 to 2020

Year	FTAs	FTA Growth Rate (%)	RTs	RT Growth Rate (%)
2012	4,272,811	9.07	23,858,406	-9.06
2013	4,681,307	9.56	26,566,834	11.35
2014	4,833,368	3.25	30,967,024	16.56
2015	5,360,682	10.91	37,842,030	22.20
2016	5,967,005	11.31	42,482,420	12.26
2017	6,620,908	10.96	47,049,242	10.75
2018	7,168,467	8.27	53,373,577	13.44
2019	8,260,913	15.24	56,766,370	6.36
2020	1,482,535	-82.05	11,873,332	-79.08
Total	**48,647,996**		**330,779,235**	

Source: COA Analysis

The information provided above can help infer that the sheer number of tourist movements reflects different knowledge and awareness levels among the public regardless of whether they ascertained their segregation abilities.

Although the pandemic has badly hit the tourism industry since CY 2020, the numbers are slowly picking up by 2022[40], as quarantine protocols were relaxed to accommodate tourists again. These were tourists from different backgrounds and places of origin with different understanding, knowledge, and awareness of waste segregation.

Thus, without a streamlined mechanism on how the public can segregate solid waste for collection, coupled with the movement of the public coming from different places of origin for transient, tourism, and other purposes, waste segregation will remain a problem for the majority of program implementers and the environment.

Mixed Waste Collection. When proper segregation is not implemented, this leads to mixed waste collection. Once the mixed waste is present in the stream, it will take additional resources (e.g., time, labor, and money) to segregate, clean, and decontaminate before it reaches the disposal facilities. If left untreated, the probability of mixed waste approaching an SLF becomes high, and final segregation, if still possible, is covered by waste sorters hired by the SLF operator or LGU. Examples of mixed wastes reaching final disposal

[37] *Visitor Arrivals to the Philippines, and Regional Travelers.* Retrieved November 10, 2022, from http://www.tourism.gov.ph/tourism_dem_sup_pub.aspx

[38] Foreign tourist arrivals (FTA) are foreign persons admitted under tourist visas (if required) for purposes of leisure, recreation, holiday, visits to friends or relatives, health or medical treatment, or religious pilgrimage.

[39] Regional travelers (RT) consist of domestic travelers, foreign travelers, and overseas Filipinos travelling from one region to another inside the Philippines.

[40] PANTI. (2022, August 31). *Department of Tourism: Philippines received 1.3M foreign tourists so far in 2022.* GMA News Online. Retrieved November 10, 2022, from https://www.gmanetwork.com/news/topstories/nation/843316/ dot-philippines-received-1-3m-foreign-tourists-so-far-in-2022/story/

facilities were found in SLFs in La Trinidad, Benguet, Norzagaray, Bulacan, and Navotas City, Metro Manila *(see Figure 54)*.

Figure 54: Mixed Wastes Present in SLFs

Location: SLF in La Trinidad, Benguet
Left: Landscape view of SLF; Right: SLF workers sorting wastes

Location: SLF in Norzagaray, Bulacan
Left: Tipping area; Right: Central MRF and volunteer “sorters”

Location: SLF in Navotas City, Metro Manila

Source: COA Validation

According to the MENRO in Norzagaray LGU, the Sangguniang Bayan Ordinance requiring waste segregation-at-source was already in place. However, LGU Norzagaray claims that the problem was that dump trucks continue to receive mixed waste from households and barangays.

Similar to Norzagaray, LGU La Trinidad, Benguet also mandates segregation at source and allows the issuance of citation tickets to violators. However, LGU La Trinidad claims that the problem was the lack of segregation and limited waste diversion since their Centralized MRF does not service all barangays. In CY 2017, this SLF in La Trinidad was also reported to be nearly filled due to a lack of segregation. According to reports, despite having personnel assigned at trading posts to segregate waste, sacks, baskets, plastics, and other unnecessary waste can still be found in the landfill

Therefore, even though policies demand segregation, the compliance of waste generators was still necessary for the policy to be successful.

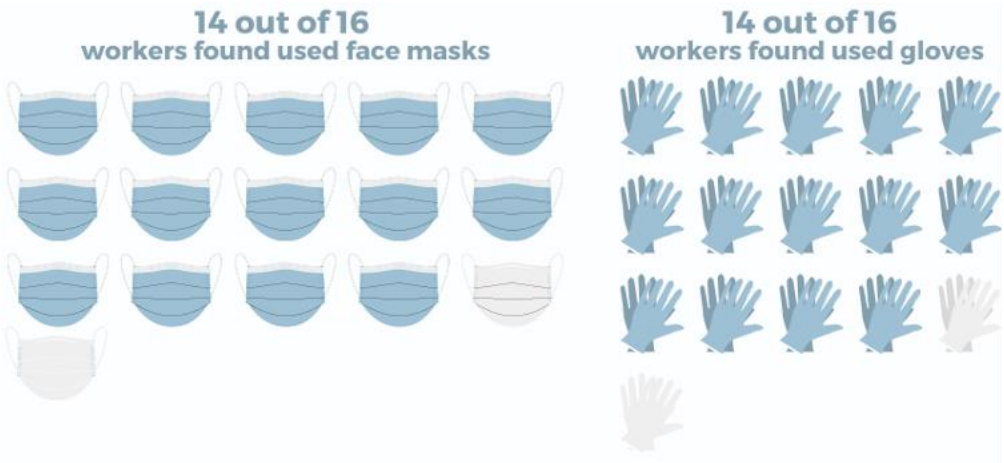
To resolve the mixed wastes for disposal to landfills, the Norzagaray LGU allows volunteers to conduct sorting at the centralized MRF beside the SLF's tipping area/residual waste cell. On the other hand, LGU La Trinidad, Benguet hires sorters to conduct the final sorting of the mixed wastes disposed of in the SLF tipping area.

However, both efforts seem lacking because mixed wastes remained after final sorting. Moreover, those workers or sorters are also at risk of scavenging through the waste. For example, in Cell No. 3 in the SLF in La Trinidad, the mountain of garbage measures as high as 5 to 6 meters.

Hazards to Workers at Landfills. Workers that deal directly with solid waste were either involved in waste collection, sorting, recycling, or disposal at the end of the process. However, additional occupational risks come with this kind of labor that workers rarely acknowledge in order to survive. Thus, to protect them, it was mandated, through the IRR of RA 9003, that all collectors and other personnel directly dealing with the collection of solid waste shall be equipped with personal protective equipment and paraphernalia such as, but not limited to gloves, masks, and safety boots, to protect them from the hazards of handling solid wastes.

However, during the validation of SLFs, we found that workers were not equipped with personal protective equipment and paraphernalia, contrary to RA 9003. For example, as shown in Figure 54, La Trinidad and Norzagaray SLFs have sorters to conduct final segregation. However, these sorters were found sorting waste materials with their bare hands. This was despite the fact that 88 percent of the workers surveyed, in the three SLFs accepting mixed waste had found used hospital gloves and face masks in the area where they were gathering recyclable waste *(see Figure 55)*. On the other hand, these workers answered that they were provided with protective equipment but opted not to wear it due to the hot weather.

Figure 55: Percentage of Worker Survey Respondents Who Found Used Face Masks and Gloves in SLFs



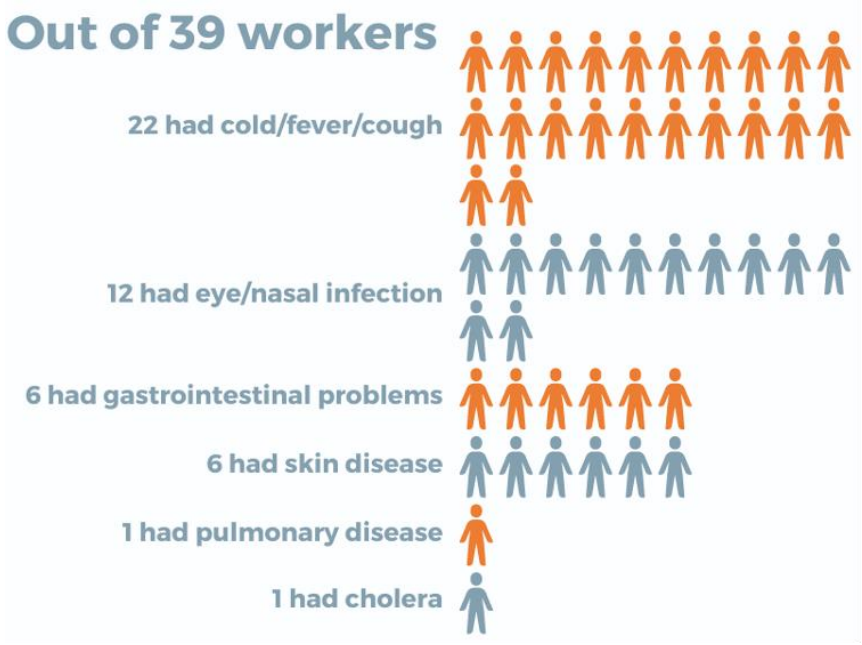
Source: COA Survey Results

The inadequate use of personal protective equipment in such a work environment will negatively impact the health conditions of the workers as they are highly susceptible to infectious diseases, injuries, and accidents. According to the International Journal of Occupational Safety and Health, waste workers suffer from diseases and face many health problems. Runny nose, sneezing, coughing, respiratory symptoms, frequent headache, and musculoskeletal symptoms like tiredness, backache, and body pain were common symptoms they faced. Similarly, skin rashes, vomiting, and diarrhea were common problems waste pickers experienced.[41]

Based on the survey conducted on 39 workers from nine SLFs, we noted that most had a cold, fever, and cough, while others have experienced eye or nasal irritation, skin disease, gastrointestinal problems, cholera, and pulmonary disorder *(see Figure 56)*.

[41] Baral, Y. R. (2018, December 31). *Waste Workers and Occupational Health Risks*. International Journal of Occupational Safety and Health, *8*(2), 1–3. Retrieved October 5, 2022, from https://doi.org/10.3126/ijosh.v8i2.23328

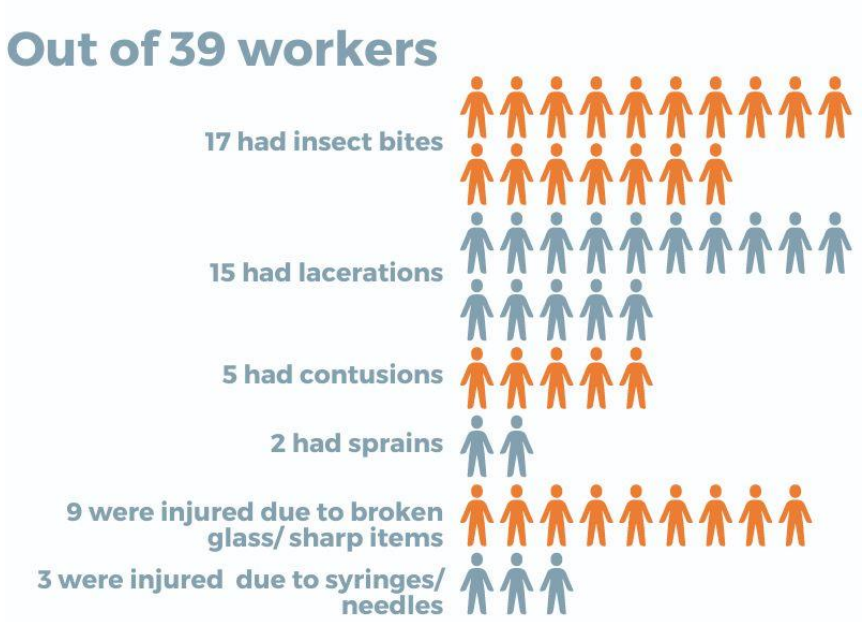
Figure 56: Distribution of SLF Worker Survey Respondents by Type of Disease Caught or Experienced While at Work



Source: COA Survey Results

In addition, some of these workers suffered from insect bites, sprains, contusions, and lacerations *(see Figure 57)*. Needles or syringes wounded three workers, and nine were injured by sharp objects like broken glass mixed with residual and biodegradable wastes, which can lead to infections such as COVID-19 that can be contagious and endanger everyone.

Figure 57: Distribution of SLF Worker Survey Respondents Who Caught/Suffered Injuries Caught While at Work



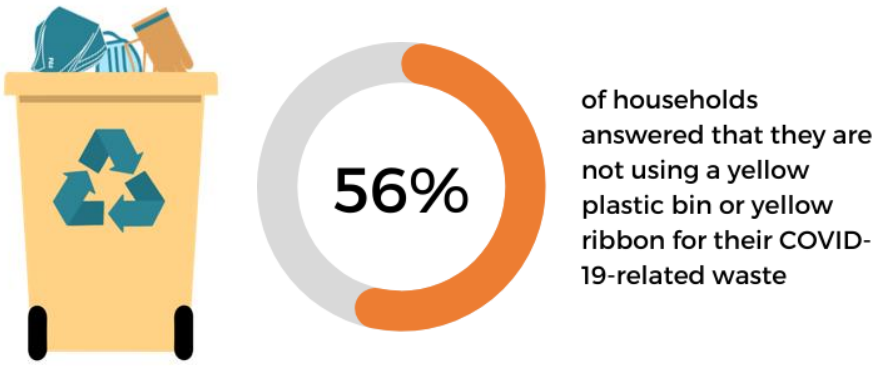
Source: COA Survey Results

Their experiences show that wearing personal protective equipment was crucial in ensuring their safety. This will protect workers from bacteria, contaminated objects, and hazardous chemicals and pathogens by acting as a barrier and reducing transmission. This will also lower their risks of injuries caused by falling objects, sharp objects, and accidents.

COVID-19 Healthcare Waste. As mentioned in the survey conducted in three SLFs accepting mixed waste (Figure 55), 88 percent of the workers had observed hospital gloves and face masks where they gathered recyclable waste. This maybe the case because used masks were usually disposed of as general waste mixed with the municipal waste stream. Aside from face masks, COVID-19 requires everyone to wear face shields to prevent disease transmission. Hence, the NSWMC released an interim guideline on managing COVID-19-related healthcare waste to avoid this further on April 25, 2020. This guideline covers proper handling and managing of the said waste generated by households, offices, and the like because these are potentially infectious and contaminated. In congruence, DILG also issued Memorandum Circular (MC) No. 2020.147 on October 29, 2020, to support the interim guidelines of the NSWMC to provide comprehensive information on roles, duties, and responsibilities on the proper handling and management of all COVID-19-related healthcare wastes within the jurisdiction of the LGUs.

Also emphasized in the NSWMC COVID-19 guidelines was that waste generators shall strictly implement proper waste segregation at the source and ensure that COVID-19-related infectious wastes are not mixed with other domestic solid wastes. Moreover, it required that COVID-19-related infectious wastes shall be stored in yellow plastic bags/container bins or any storage bags/container bins properly labeled. But the household survey results showed that, 56 percent or 200 people were not using a yellow plastic bin or yellow ribbon for their COVID-19-related waste *(see Figure 58)*.

Figure 58: Percentage of Household Survey Respondents Using Yellow Plastic Bag or Yellow Ribbon for COVID-19-Related Waste



Source: COA Survey Results

With the rapid increase in consumption of household healthcare wastes such as masks and gloves, a technical system is needed for segregation, collection, and transport to proper disposal, including proper storage and treatment. Moreover, there is also a need to check the condition of our waste workers since workers are compromising their health, yet they are hardly

acknowledged and lack support. These workers play a vital role in recovering recyclable materials at final disposal in SLFs and filling the gaps in managing solid waste due to the weak enforcement of segregation by the respective LGUs that led to mixed waste disposal. Without them, the recyclable materials will mix with other types of waste that fill up the SLFs faster and harm the environment by increasing carbon emissions.

MMDA reports about challenges due to waste management. There were also reports of unsegregated solid wastes that did not reach disposal facilities. These affect the drainage systems resulting in unnecessary flooding in Metro Manila, the capital of the Philippines. MMDA has reminded the public to be responsible and disciplined in throwing their waste into legitimate solid waste containers.[42] The agency said that they do cleaning and declogging of the drainages every day; however, wastes always appear the following days. Some examples of the solid wastes they found were plastic bags, styro foam, plastic cups, and plastic bottles, all non-biodegradables, and should be brought to waste facilities or MRFs for diversion.

SLFs Have Exceeded Capacity Levels. Aside from the survey results illustrated in Figures 55 and 57, several accounts made by the SLF workers highlighted the risks looming in their everyday work, including workers' worries in La Trinidad SLF over the risk of a "trash slide" accident every time it rains heavily in Benguet. This concern of workers in the SLF is due to the incident in Barangay Irisan, Baguio City, wherein the wall of the dumpsite collapsed after it was flooded at the height of Typhoon Mina last August 27, 2011, in which at least five people were killed.[43]

The mountain of mixed waste at Cell 3 in La Trinidad SLF already required its early closure in September 2018, only 19 months from its inception. This Cell 3, with a 3-year life span, began its operation in February 2017 with an area of 4,000 m^2 and a capacity of an estimated 34,810 cu.m. However, based on CY 2019 waste data provided by La Trinidad LGU, the LGU's estimated daily total solid waste generation per day is 66.99 tons, and only 5.6 tons were diverted. If the behavior pattern is the same since CY 2017, the LGU would have accumulated a total of 70,280.87 cu.m. for the 19-month duration of the operation, which is almost twice the capacity of the SLF *(see Table 29)*. According to reports[44], the local government blamed the lack of segregation as the culprit and admitted that many plastics were mixed with the residual waste, which was also evident during our validation.

[42] *Dahil sa walang disiplinang pagtatapon ng basura.* MMDA. Retrieved January 4, 2023, from https://www.facebook.com/100068612142206/posts/334536202176782
[43] *Mina triggers fatal avalanche of garbage in Baguio City*. GMA News Online. Retrieved January 4, 2023, from https://www.gmanetwork.com/news/topstories/regions/230808/mina-triggers-fatal-avalanche-of-garbage-in-baguio-city/story/
[44] *Alno sanitary landfill full by end of 2017.* Sunstar. Retrieved January 4, 2023, from https://www.sunstar.com.ph/article/165624/alno-sanitary-landfill-full-by-end-of-2017

Table 29: Computation of Waste Disposed at La Trinidad Cell 3 SLF Exceeding its Capacity

Particulars	Value
Total number of days of SLF operation (February 2017-September 2018)	607 days
x Average daily tons of waste disposed at Cell 3	x 61.39
= Total tons of waste disposed at Cell 3	(A) 37,263.73
Conversion to metric tons (A x 0.907185)	(B) 33,805.10
Conversion to kilograms (B x 1,000)	33,805,096.90
Total accumulated waste disposed at Cell 3 (Converted to cubic meter with 481 density)	**70,280.87**

Source: COA Analysis using the CY 2019 LGU Waste Data

At the time of validation, the accumulated mountain of waste measured from 5-6 meters in height, which was higher than the maximum designed height requirement of 2.9 meters from the pavement or road level or 4 meters from the ground level. According to monitoring reports by EMB CAR, this waste reached 7 meters high in February 2022 despite its closure in CY 2018 because the SLF was still being used as the staging area.

This case of La Trinidad SLF was not unique, as at least 29 SLFs in September 2022 have already exceeded their capacity level *(see Table 30)*.

Table 30: Number of SLFs Exceeding their Capacity by Region

Region	As at December 31, 2021		As at September 15, 2022	
	Operational SLF	Exceeded Capacity	Operational SLF	Exceeded Capacity
CAR	10	0	9	0
NCR	1	0	1	0
1	31	8	51	8
2	41	2	41	2
3	12	0	15	0
4A	43	3	44	5
4B	12	1	13	1
5	7	0	9	0
6	13	1	15	1
7	15	0	16	0
8	6	2	10	2
9	1	0	2	0
10	19	4	20	3
11	9	1	8	2
12	21	1	21	5
13	4	0	4	0
BARMM	0	0	1	0
Total	**245**	**23**	**280**	**29**
% of Exceeded Capacity	**9.39**		**10.36**	

Source: NSWMC and DENR-EMB Data

Similar to La Trinidad SLF, aside from these SLFs exceeding their capacity, some SLFs were also unable to complete nor maximize their original service life. Of the 29 SLFs reported to have exceeded capacity in September 2022, four SLFs only started operating in CY 2019 and have a service life of 10 years, and nine SLFs remain operational despite completing their service life.

Because these SLFs exceeded their capacity, LGUs will have to look for other means to dispose of their waste. Hence, LGUs will have to find another SLF or LGU that is willing to accept their waste and incur tipping fees. Otherwise, they will have to expand their existing landfill or look for another site to construct another one.

As regards the situation in La Trinidad, LGU had to haul and transport waste to the SLFs in Urdaneta, Pangasinan, and Capas, Tarlac, using its dump trucks to reduce its disposal costs. In addition, LGU La Trinidad incurred tipping fees totaling ₱24.1 million for four years *(see Table 31)* since Cell 3 had been unserviceable for three years and used only for 19 months.

Table 31: Total Tipping Fees Paid by the LGU La Trinidad, Benguet from CYs 2018 to 2021

Year	Actual Amount Spent on Tipping Fees
2018	₱ 3,500,000
2019	7,100,000
2020	5,500,000
2021	8,000,000
Total	**₱24,100,000**

Source: LGU data

Consequently, if the mismanagement and overcapacity of existing SLFs continue, eventual scouting for the future land availability of new sites will be necessary. However, establishing a new SLF will be difficult for some provinces, including Benguet, a mountainous area. Also, the LGUs may be overwhelmed by the rising need for more waste disposal sites and may face a scarcity of land in the long run.

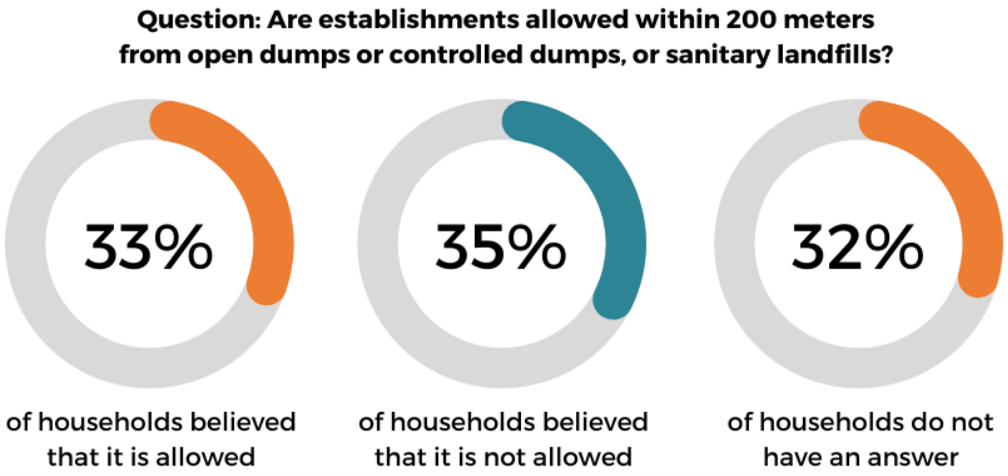
Extended risks to the people and environment. Validation revealed that the situation in some SLFs may pose extended risks to the people and environment. For example, site visits to nine SLFs and nine dumpsites revealed establishments within the 200-meter radius of the SLF or dumpsite *(see Figure 59)*. This is a prohibited act under RA 9003, specifically the construction of any establishment within 200 meters of open dumps, controlled dumps, or SLFs.

Figure 59: Establishments within a 200-Meter Radius of SLFs and Dumpsites

Source: Google Earth

On the other hand, survey results revealed that there were also information gaps as to whether or not establishments are allowed near landfills and dumpsites. Of the 360 households surveyed, 33 percent believe establishments were allowed within 200 meters of SLFs *(see Figure 60)*.

Figure 60: Percentage Distribution of Household Survey Respondents on Establishments within 200-Meter Radius from Dumpsites and SLFs



Source: COA Survey Results

According to DENR-EMB, the LGU is responsible for monitoring and ensuring that no establishments are built within 200 meters of the open dumps, controlled dumps, or SLFs. When establishments are built, the action or solution shall be the removal and relocation of the establishment/structure built within the 200-meter radius of the SLF. The LGU shall coordinate with the National Housing Authority (NHA), other government agencies, NGOs, and people organizations concerned to determine the assistance needed in the possible relocation and alternative livelihood for the families affected by the disposal site.

On the other hand, there was also an issue with closed dumpsites. Even though it was legally closed, risks were still present, especially in dumpsites where the rehabilitation was not yet implemented or the progress was minimal. Hence, it was also necessary to relocate the community or families living within the 200-meter radius of the dumpsite until such was closed and fully rehabilitated.

Overall, exposure to either landfill or dumpsite may lead to health problems such as pulmonary disorders, eyes/nasal/skin irritation, and gastrointestinal problems. According to the Oxford University Press in 2016, health is at risk for those who live within five kilometers of a landfill site. The results showed a strong association between Hydrogen Sulphide (used as a surrogate for all pollutants co-emitted from the landfills) and deaths caused by lung cancer, as well as deaths and hospitalizations for respiratory diseases, which are more prominent in children. In addition, respiratory symptoms were detected among residents living close to waste sites due to inhalation exposure to endotoxin, microorganisms, and aerosols.[45]

[45] Oxford University Press. (2016, May 24). *Living near a landfill could damage your health*. Retrieved September 7, 2022, from https://www.science daily.com/releases/2016/05/160524211817.htm

Moreover, it poses a greater risk for people living near the dumpsites due to the absence of safety measures that SLFs have, particularly when people are still disposing of waste despite the reported closure of all the dumpsites. In addition, nearby water was more prone to pollutants caused by leachate, and more gases were produced, affecting the air. The Clinical Epidemiology and Global Health concluded in its study on open dumping sites and health risks to proximate communities in Mumbai, India, that morbidities' prevalence was significantly higher among the exposed group than the non-exposed group *(see Table 32)*.[46]

Table 32: Comparison of Morbidities Between the Exposed Group and Non-Exposed Group Dumpsites

Selected Morbidities	Exposed Group v Non-exposed Group
Respiratory illness	23% v 10%
Eye irritation	20% v 9.5%
Stomach problem	27% v 20%

Source: Clinical Epidemiology and Global Health

However, interviews with DENR-EMB Regional Offices showed no consistent procedure for reprimanding LGUs that disregard the law on the 200-meter distance. For example, Region 3 sends an NOV to LGU-violators, Region 4A reminds LGUs of their responsibilities through a letter, while Region 7 has no record of penalties issued.

Inconsistent implementation of waste collection nationwide

According to RA 9003, segregation and collection of solid waste, specifically for biodegradable, compostable, and reusable wastes, shall be conducted at the barangay level. On the other hand, the collection of residual wastes shall be the responsibility of the municipality or city. However, during validation, we noted that collection assignments and responsibilities differed in actual due to either limitation at the barangay level or a lack of coordination with their local government. Thus, LGUs cover and collect all types of waste, or household wastes were not collected.

Interviews with barangay officials disclosed various ways of waste collection at the local level. As shown in Table 33, out of the 45 barangays, only 11 collected all wastes from their households, while the remaining barangays varied from collecting only recyclable wastes to not collecting at all.

[46] Shri Kant Singh, et al., (2020, July). *Open dumping site and health risks to proximate communities in Mumbai, India: A cross-sectional case-comparison study.* Clinical Epidemiology and Global Health. Retrieved September 7, 2022, from https://www.researchgate.net/publication/342669314_Open_dumping_site_and_health_risks_to_proximate_communities_in_Mumbai_India_A_cross-sectional_case-comparison_study

Table 33: Distribution of Barangay Survey Respondents on Waste Collection Responsibilities by Activity

Collection Activity	No. of Barangays
All types of wastes	11
Recyclables and Biodegradables	5
Recyclables and Residuals	2
Recyclables only	10
Residuals only	1
None. LGU collects all the wastes	11
None. LGU also does not collect wastes	2
No answer	3
Total	**45**

Source: COA Interview Results

Moreover, some barangays claim there was no need to collect waste, particularly biodegradable waste, because residents already use it to generate fertilizer for their plants. On the other hand, some barangays also raised the issue of a lack of adequate budget to cover the responsibility of barangays for SWM, even for collecting household waste. Based on the comparison of the annual budget of barangays to their budget allocated for SWM, allocation varies from 0.33 percent to 16 percent in visited barangays in NCR and 0 to 8.75 percent in Regions 1, 3, 4A, 5, 9, 11, and CAR *(see Table 34)*.

Table 34: Annual Barangay Budget vis-à-vis SWM Budget of Sample LGUs by Region

Region	Province	LGU	Barangay	Total Budget (B)	SWM Budget (A)	% (B/A)
NCR	Metro Manila	Quezon City	Bagong Silangan	₱123,000,000.00	₱ 400,000.00	0.33
		Pasig	Rosario	96,000,000.00	6,800,000.00	7.08
		Malabon	Panghulo	25,000,000.00	4,000,000.00	16.00
CAR	Abra	Pidigan	Poblacion	3,097,296.00	5,000.00	0.16
	Benguet	Kibungan	Sagpat	1,560,000.00	25,000.00	1.60
1	Pangasinan	Mangatarem	Sapang	2,000,000.00	-	0.00
		Bugallon	Padilla	4,000,000.00	35,000.00	0.88
		Alcala	Caranglaan	2,219,584.00	46,219.00	2.08
	La Union	Pugo	Maoasas Norte	3,000,000.00	70,000.00	2.33
3	Zambales	Masinloc	North Poblacion	4,552,037.00	9,000.00	0.20
	Bulacan	San Jose Del Monte	Minuyan 3	5,024,455.00	150,000.00	2.99
	Bataan	Balanga	Lote Pto. Rivas	6,573,184.00	270,000.00	4.11
4A	Quezon	Atimonan	Inaclagan	2,378,600.00	20,000.00	0.84
	Cavite	Kawit	Aplaya	5,000,000.00	67,000.00	1.34
	Rizal	Tanay	Tandang Kutyo	73,045,588.45	1,520,000.00	2.08
5		Bula	Sto Niño	3,200,000.00	5,000.00	0.16

Region	Province	LGU	Barangay	Total Budget (B)	SWM Budget (A)	% (B/A)
	Camarines Sur	Sagnay	Minadongjol	4,100,000.00	10,000.00	0.24
		Libmanan	Bagumbayan	4,600,000.00	35,000.00	0.76
		Pili	San Jose	17,000,000.00	210,000.00	1.24
9	Zamboanga del Sur	Kumalarang	Poblacion	9,700,000.00	20,000.00	0.21
		Lakewood	Poblacion	7,400,000.00	120,000.00	1.62
	Zamboanga Sibugay	Mabuhay	Catipon	2,200,000.00	65,000.00	2.95
11	Davao del Sur	Davao City	Mintal	23,000,000.00	200,000.00	0.87
	Davao de Oro	New Bataan	Cabinuangan	13,666,081.00	340,000.00	2.49
		Mabini	Cuambog	8,000,000.00	700,000.00	8.75
Total				**₱449,316,825.45**	**₱15,122,219.00**	**3.37**

Source: COA Interview Results

With little to no budget for SWM, some barangays also have no choice but to make ends meet and collect household waste whenever there is a lack of coordination or when their local government fails to collect waste from their jurisdictions. However, if that were not a workable option for a barangay, then those households, *purok*, or even a whole barangay would have no one to collect their solid wastes.

As mentioned earlier, a good practice called the "*purok* system" was also observed during validation. Under the *purok* system, barangays set up collection points in strategic areas where residents put their waste so that when the day and time of waste collection comes, the LGU or barangay can collect their waste more efficiently. According to the barangays implementing this system, there are two points to make this work. First, there should be a waste collection schedule to avoid unsegregated waste. Second, this schedule must be communicated to residents through IEC to ensure they know the schedule for collecting specific types of waste.

Some EMB-funded MRFs, including several units/sets of equipment, were neither established nor operational

Following Section 8 of RA 9003, to support the LGUs in implementing their local SWM plans, DENR, through EMB, has provided financial assistance to LGUs to establish MRF and fabricate SWM equipment since CY 2012 *(see Table 35)*. On the other hand, to further increase LGUs' compliance with the mandatory waste diversion, starting in CY 2016, DENR-EMB transferred sets of equipment (shredder and composter) to LGUs as support to existing MRFs. However, validation revealed that some financial assistance was either unutilized or refunded, while several units/sets of equipment were not operational.

Table 35: DENR-EMB's MRF Assistance to LGUs from CYs 2012 to 2021

Year	Establishment of MRF	Establishment of MRF and Fabrication of SWM Equipment[47]	Donation of MRF Equipment	Total
2012	₱ 16,000,000	₱ -	₱ -	₱ 16,000,000
2013	26,350,000	-	-	26,350,000
2014	26,000,000	-	-	26,000,000
2015	21,500,000	-	-	21,500,000
2016	60,000,000	-	40,000,000	100,000,000
2017	53,000,000	-	22,000,000	75,000,000
2018	150,000,000	20,000,000	75,000,000	245,000,000
2019	-	336,000,000	-	336,000,000
2020	-	-	490,000,000	490,000,000
2021	-	-	320,000,000	320,000,000
Total	**₱352,850,000**	**₱356,000,000**	**₱947,000,000**	**₱1,655,850,000**
No. of LGUs	**1,076**	**600**	**1,510***	

*Data on the number of LGU recipients for CY 2017 is unavailable.

Source: DENR-EMB Data

Some EMB-funded MRFs were not yet established or not operational. DENR, through EMB, has provided total financial assistance of ₱708.85 million and supported 1,676 LGUs nationwide for eight consecutive years to establish MRFs for LGUs to meet the requirement of RA 9003 on mandatory waste diversion *(see Table 36)*.

Table 36: DENR-EMB's Financial Assistance to LGUs for the Establishment of MRF and Fabrication of SWM Equipment from CYs 2012 to 2019

Year	Establishment of MRF	Establishment of MRF and Fabrication of SWM Equipment	Total
2012	₱ 16,000,000	₱ -	₱ 16,000,000
2013	26,350,000	-	26,350,000
2014	26,000,000	-	26,000,000
2015	21,500,000	-	21,500,000
2016	60,000,000	-	60,000,000
2017	53,000,000	-	53,000,000
2018	150,000,000	20,000,000	170,000,000

[47] In CYs 2018 to 2019, LGUs have the discretion to divide the financial assistance between the establishment of MRF and the fabrication of SWM equipment. Hence, DENR-EMB has no information on the amount allocated for MRF and equipment and the number of LGUs that opted to fabricate equipment.

Year	Establishment of MRF	Establishment of MRF and Fabrication of SWM Equipment	Total
2019	-	336,000,000	336,000,000
Total	**₱ 352,850,000**	**₱ 356,000,000**	**₱ 708,850,000**
No. of LGUs	**1,076**	**600**	**1,676**

Source: DENR-EMB Data

However, based on the review of balances, there were at least ₱189.92 million and ₱124.22 million outstanding balances from the financial assistance to LGUs as at December 31, 2021 and June 30, 2022, respectively *(see Table 37)*.

Table 37: Outstanding Balances of Financial Assistance to LGUs for the Establishment of MRFs as at December 31, 2021, and June 30, 2022

Region	December 31, 2021	June 30, 2022
CAR	₱ 7,540,911.25	₱ 6,903,512.81
NCR	17,499,500.00	13,095,000.00
1	1,514,369.34	447,352.38
2	23,103,565.34	16,602,018.57
3	4,644,742.73	2,199,631.20
4A	7,568,452.48	4,895,423.09
4B	14,602,026.87	12,419,742.92
5	11,639,629.54	9,065,754.65
6	5,910,055.69	2,297,593.34
7	1,401,693.17	1,401,693.17
8	16,881,377.30	16,881,377.30
9	29,428,000.00	10,479,298.82
10	29,585,000.00	12,202,414.44
11	322,531.00	291,511.00
12	6,300,000.00	6,300,000.00
13	11,977,402.45	8,738,875.26
Total	**₱ 189,919,257.16**	**₱ 124,221,198.95**
No. of MRFs	**612**	**435**

Source: DENR-EMB Data

Further analysis revealed that of this ₱124.22 million outstanding balance as at June 30, 2022, ₱14.32 million was already outstanding for 6-10 years, ₱45.91 million outstanding for 4-5 years, and ₱63.99 million for three years *(see Table 38)*.

Table 38: Aging of DENR-EMB Outstanding Financial Assistance to LGUs for the Establishment of MRFs as at June 30, 2022

Region	3 years	4 to 5 years	6 to 10 years
CAR	₱ 4,885,462.42	₱ 1,840,771.10	₱ 177,279.29
NCR/CO	7,981,500.00	1,465,000.00	3,648,500.00
1	261,349.42	186,002.96	-
2	12,267,043.55	3,673,402.86	661,572.16
3	1,014,321.95	645,309.25	540,000.00
4A	2,947,904.35	1,947,518.74	-
4B	1,977,318.25	8,590,924.67	1,851,500.00
5	4,157,379.12	4,908,375.53	-
6	2,297,593.34	-	-
7	-	800,000.00	601,693.17
8	9,076,814.64	7,163,249.65	641,313.01
9	6,275,134.41	1,353,150.70	2,851,013.71
10	2,863,397.24	6,493,623.10	2,845,394.10
11	-	285,000.00	6,511.00
12	2,500,000.00	3,800,000.00	-
13	5,484,078.32	2,754,678.94	500,118.00
Total	**₱ 63,989,297.01**	**₱ 45,907,007.50**	**₱ 14,324,894.44**
No. of MRFs	**159**	**221**	**55**

Source: DENR-EMB data

Moreover, of the ₱124.22 million outstanding as at June 30, 2022, fund transfers to LGUs totaling ₱41.57 million remain outstanding with no movement or liquidation at all *(see Table 39)*.

Table 39: Fund Transfers to LGUs With No Liquidation Since Grant Year as at June 30, 2022

Year of Grant	Amount Granted/Balance
2015	₱ 350,000.00
2016	1,440,000.00
2017	2,936,500.00
2018	8,829,000.00
2019	28,010,000.00
Total	**₱41,565,500.00**
No. of MRFs	**89**

Source: DENR-EMB Data

Not surprisingly, some LGUs refunded the full financial assistance to the BTr. As at June 30, 2022, these refunds were equivalent to at least ₱2.32 million from six LGUs *(see Table 40)*.

Table 40: LGUs with Full Refund of Financial Assistance as at June 30, 2022

LGU Recipients	Year Granted	Amount Granted/ Refunded
Tuguegarao City, Cagayan	2016	₱ 285,000.00
Bambang, Nueva Vizcaya	2017	260,000.00
Makatao, Aklan*	2018	427,500.00
Lallo, Cagayan	2019	300,000.00
San Juan City, NCR	2019	570,000.00
Talalora, Samar	2019	475,000.00
Total		**₱2,317,500.00**

* No available MRF area, as disclosed by the LGU

Source: DENR-EMB Data

During validation, we visited some of the LGUs with either outstanding balances or refunded the financial assistance provided by DENR-EMB.

The MRF in the Municipality of Pidigan was not yet constructed despite funding in CY 2018. According to the MENRO, the LGU Pidigan initially intended to establish a centralized MRF with additional funding from the Development Fund. However, the initially proposed land allocated for the construction of the MRF was discovered to be privately owned, which the LGU could not utilize. As an alternative, the LGU planned to allocate a space in the area where LGU intends to build the hospital and fire station. However, some LGU officials objected due to the proximity to the hospital, which may cause health risks. As the LGU Pidigan could not establish the MRF in years passed, when the pandemic hit the country, the LGU Pidigan realigned the supposed additional fund allocation for the MRF to build an isolation facility instead.

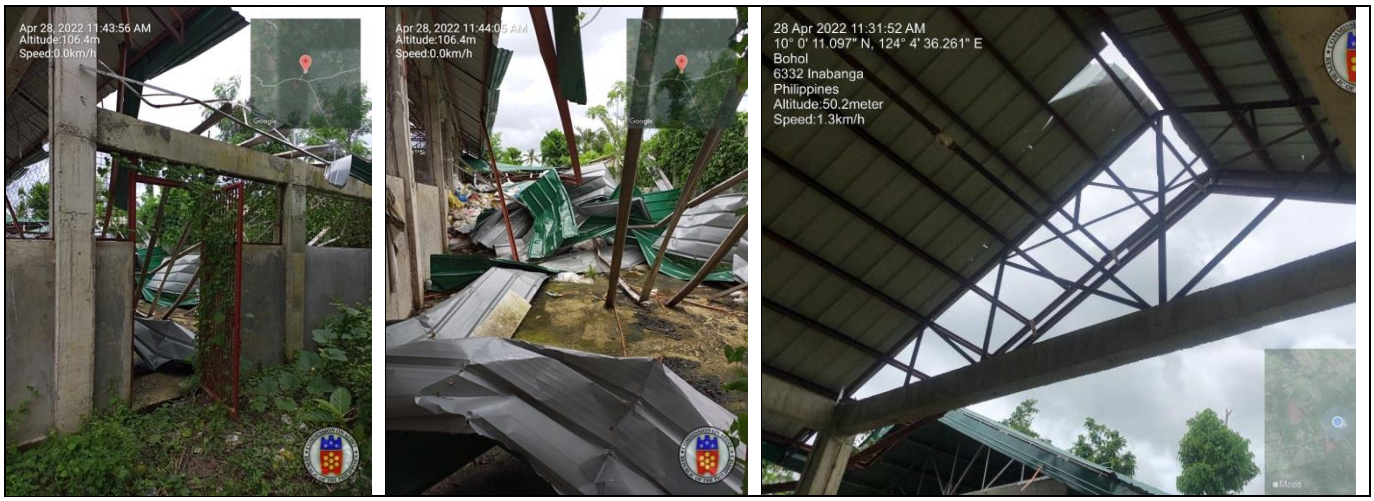
Aside from the LGUs listed in Table 40, there was also the Barangay Mintal in Davao City, which refunded a total of ₱358,000 in CY 2020. According to the barangay, they received the grant in CY 2016 but encountered issues in land ownership and acquiring legal documents for the proposed site.

Due to the challenges disclosed by these LGUs, the refund and non-establishment of MRFs only showed that financial grants were transferred without ensuring that the LGUs could provide available land within their jurisdiction to qualify as recipients. Likewise, the financial grants that become idle due to the different issues encountered would have benefited other LGUs that might have qualified or can establish the MRFs.

On the other hand, there were also those established MRFs that were found to have damages and thus disrupting the MRF operation and waste diversion. And since it is already established that LGUs lack funds for SWM, repairs and replacements of damages in MRFs are not a priority. For example, on

December 16, 2021, Super Typhoon Odette made nine landfalls in seven provinces of the Visayas and Mindanao, bringing torrential rains, violent winds, storm surges, and floods that left devastation across several islands. One of the provinces affected is Bohol, of which two MRFs we visited were noted to have been severely damaged by the typhoon *(see Figure 61)*.

Figure 61: MRF in Bohol Damaged by Super Typhoon Odette



Source: COA Validation

Both the MRFs in Barangay Lonor Sur in Inabanga, Bohol, and Barangay Bolod in Panglao, Bohol, remained in a state of needing repair at the time of our validation in late April 2022, even after four months since Super Typhoon Odette hit the province. According to both LGUs, the local government's efforts were still focused on the COVID-19 response since the pandemic is still ongoing. In addition, due to the limited resources of the LGUs, they had to prioritize renovating other damaged properties, such as healthcare facilities.

Several SWM Equipment were not operational. As mentioned, in CY 2016, DENR-EMB started providing equipment to LGUs to improve waste diversion and complement its previous fund assistance in establishing the MRFs since CY 2012. As shown in Table 41, DENR-EMB targeted to donate equipment to at least 1,510 LGUs totaling at least ₱947 million *(see Table 41)*.[48]

[48] In CYs 2018 and 2019, DENR-EMB has provided ₱356 million for the establishment of MRF and fabrication of SWM equipment, however, as noted in Table 36, DENR-EMB cannot determine the amount allocated for the fabrication of equipment as well as number of LGUs opting to fabricate equipment. Hence, we opted not to include the amount of ₱356 million in the balance.

Table 41: Fund Support for SWM Equipment from DENR-EMB Central Office by Region from CYs 2016 to 2021

Region	2016	2017*	2018	2020	2021	Total
CAR	₱ 2,000,000	₱ 400,000	₱ 4,650,000	₱ 8,000,000	₱ 7,000,000	₱ 22,050,000
NCR	2,000,000	1,800,000	4,650,000	-	3,000,000	11,450,000
1	2,200,000	1,200,000	4,650,000	47,000,000	27,000,000	82,050,000
2	2,200,000	1,200,000	4,650,000	30,000,000	30,000,000	68,050,000
3	2,800,000	3,000,000	4,800,000	15,000,000	10,000,000	35,600,000
4A	2,800,000	2,600,000	4,800,000	28,000,000	10,000,000	48,200,000
4B	2,200,000	1,400,000	4,650,000	31,000,000	11,000,000	50,250,000
5	2,600,000	600,000	4,650,000	48,000,000	42,000,000	97,850,000
6	2,200,000	800,000	4,650,000	56,000,000	40,000,000	103,650,000
7	2,200,000	1,000,000	4,650,000	47,000,000	39,000,000	93,850,000
8	3,000,000	1,200,000	4,800,000	27,000,000	33,000,000	69,000,000
9	2,200,000	1,000,000	4,650,000	19,000,000	25,000,000	51,850,000
10	2,200,000	1,000,000	4,650,000	34,000,000	24,000,000	65,850,000
11	2,400,000	1,200,000	4,800,000	36,000,000	7,000,000	51,400,000
12	2,400,000	1,400,000	4,650,000	39,000,000	7,000,000	54,450,000
13	2,400,000	800,000	4,650,000	25,000,000	5,000,000	37,850,000
BARMM	-	-	-	-	-	-
Negros Island Region (NIR)	2,200,000	1,400,000	-	-	-	3,600,000
Total	**₱ 40,000,000**	**₱ 22,000,000**	**₱ 75,000,000**	**₱ 490,000,000**	**₱ 320,000,000**	**₱ 947,000,000**
No. of LGU Recipients	**200**	***Not available***	**500**	**490**	**320**	**1,510***

*Data on the number of LGU recipients for CY 2017 is unavailable.

Source: DENR-EMB Data

However, according to data gathered by DENR-EMB Regional Offices, at least ₱555.65 million worth of equipment or at least 635 units or sets of equipment were reported as not operational as at May 31, 2022 *(see Table 42)*.

Table 42: Total Value of Equipment Reported as Not Operational by Region from CYs 2016 to 2021

Region	2016	2017	2018	2019	2020	2021	Total
CAR	₱ -	₱ -	₱ -	₱ -	₱ 5,000,000	₱ 7,000,000	₱ 12,000,000
NCR	-	-	-	-	12,740,000	-	12,740,000
1	-	-	-	-	36,000,000	15,000,000	51,000,000
2	-	-	-	-	-	29,910,000	29,910,000
3	-	-	-	-	-	72,740,000	72,740,000
4A	-	-	-	-	-	67,000,000	67,000,000
4B	-	-	-	-	-	5,000,000	5,000,000
5	-	-	-	-	34,000,000	35,100,000	69,100,000

Region	2016	2017	2018	2019	2020	2021	Total
6	-	-	-	-	41,000,000	26,000,000	67,000,000
7	-	-	-	478,200	-	-	478,200
8	–	1,160,000	3,152,400	237,400	-	33,630,000	38,179,800
9	1,000,000	400,000	3,000,000	-	13,000,000	18,000,000	35,400,000
10	200,000	-	712,500	350,000	-	53,940,000	55,202,500
11	-	-	-	-	-	12,200,000	12,200,000
13	400,000	-	300,000	-	23,000,000	4,000,000	27,700,000
Total	**₱1,600,000**	**₱1,560,000**	**₱7,164,900**	**₱1,065,600**	**₱164,740,000**	**₱379,520,000**	**₱555,650,500**
Units/ Sets of Equip-ment	**8**	**10**	**54**	**5**	**165**	**393**	**635**

Source: DENR-EMB Data

According to the DENR-EMB Regional Offices, the lack of electricity lines topped why several units/sets of equipment provided to LGUs are not operational, as presented in Table 43. Surprisingly, two LGUs declined the donated equipment.

Table 43: Distribution and Value of Not Operational Equipment by Cause

Reason	No. of Units/Sets	Total Cost of Equipment
No electricity line	128	₱ 104,477,700.00
For installation to an appropriate facility	96	89,188,700.00
For training and demonstration of supplier	85	79,396,000.00
For upgrade of an electrical system or procurement of a transformer	65	65,350,000.00
Ongoing or delayed MRF construction	48	34,815,400.00
Unutilized	15	13,662,200.00
Lack of manpower	20	13,612,500.00
Damaged/defective	21	12,444,000.00
No collection of biodegradable waste	6	6,000,000.00
LGU declined the equipment	2	1,960,000.00
Unserviceable	4	645,000.00
Total	**490**	**₱ 419,551,500.00**

Source: DENR-EMB Data

During validation, we visited several LGUs with SWM equipment that are not operational and validated the causes noted above *(see Table 44 or Appendix III for the complete TSO findings)*.

Table 44: Distribution of Not Operational SWM Equipment by Cause and Source

SWM Equipment from DENR-EMB: **39 units of equipment were found to be not operational**	4 units of equipment were not operational because of the absence of electricity lines in 2 MRFs
	15 units of equipment need upgrading of electrical system or procurement of transformer to operate
	1 unit of equipment needs a 3-Phase power connection, but the MRF can only support single phase
	1 unit of equipment was defective and subject to repair
	4 units of equipment were not yet installed
	12 units of equipment were waiting for staff training and supplier demonstration
	2 units of equipment were unutilized
SWM Equipment from DA, DOST and LGU: **26 units of equipment were found to be not operational**	8 units of equipment were not operational because of the absence of electricity lines in 5 MRFs
	14 units of equipment need upgrading of electrical system or procurement of transformers to operate
	1 unit of equipment was defective and subject to repair
	3 units of equipment were unutilized

Source: COA Validation

Aside from the EMB-funded equipment, included in the above observations were units of equipment donated by DA, DOST, and LGUs *(see Overlap in Beneficiaries Due to Lack of Coordination Among Implementing Agencies on page 129)*. On the other hand, there were also 25 units of not operational equipment. However, the source of funds for these could not be identified by the personnel at the site.

In addition to the aforementioned, NSWMC commented that certain LGUs had requested equipment to display in their MRFs as a matter of compliance. While they conduct capacity development and monitoring, the trained personnel will be replaced every time elected officials change. Their support for LGUs is also affected by a political issue when the incumbent mayor refuses to utilize the equipment because the former mayor requested it.

The noted difficulties of LGUs, such as the insufficiency or lack of electricity or biowaste, only highlighted the mismatching of the donated equipment compared to the needs of the LGU recipient. Additionally, when these units of equipment are left inactive, they risk of needless wear and tear if not used for an extended period.

On the other hand, the problem to be addressed remains, and waste diversion target will still not be achieved if these units of equipment are not put into operation where they are needed. Consequently, this might lead to more waste in landfills or accumulation of recyclable waste materials in MRFs, similar to the situation in Ginatilan, Cebu *(see Uncollected and unprocessed waste materials are accumulating in MRFs on page 105)*. It will also limit the capabilities of the LGUs to conserve natural resources by composting and producing recycled outputs that can be used in their respective programs and projects or generate income.

Lack of Recording Mechanism in MRFs Resulting in Unreliable and Incomplete Data on Waste Diversion

As mentioned earlier, there was limited availability of reliable and complete data to measure the success of waste diversion nationwide due to the lack of monitoring of all MRFs. However, there was also the issue that not all operational EMB-funded MRFs maintain complete data. This issue led us to validate the cause and found that there was no reliable recording mechanism for the operations of MRF.

According to IRR of RA 9003, MRFs shall keep and maintain records of daily weights and volumes of wastes that are accurate and adequate for overall planning purposes and tracking of the success of waste diversion goals. Moreover, proper MRF record keeping is an integral part of the preparation and updating of the LGUs' 10-yr SWM Plan and their overall waste diversion data,

However, despite the requirement in RA 9003 that MRFs keep daily weight records, validation revealed that 14 of the 45 inspected MRFs did not have daily records of weights or volumes of waste *(see Table 45)*. Moreover, only 12 MRFs have weighing equipment; thus, those with records of weights, if there are any, were just derived from estimates.

Table 45: No. of MRFs Without Daily Records and Weighing Equipment

MRF Checklist	With	Without
Record of Daily Weight Records	31	14
Weighing Equipment	12	33

Source: COA Validation

According to DENR-EMB, technical assistance to LGUs concerning SWM was regularly conducted by the DENR-EMB Regional offices, which includes sustainable MRF operation. Moreover, Environmental Monitoring Officers (EnMos) constantly inform the DENR-EMB or LGU-funded MRF operators on proper record keeping. In turn, the LGU must maintain a daily record book of the MRF and provide such records as daily weights or volumes of waste received and processed during monitoring.

However, despite the constant assistance provided by DENR-EMB, the LGUs still have difficulties maintaining MRF records. According to DENR-EMB, this may be due to a lack of qualified personnel or measuring equipment in the MRF, which was also confirmed during our validation.

Thus, several MRF operators were still not keeping records or not correctly recording the MRFs' operation. Likewise, this gap results in the lack of accurate data or no data on waste diverting through the MRFs.

Uncollected and unprocessed waste materials are accumulating in MRFs

One of the major functions of an MRF is to recycle to divert waste. However, validation revealed that uncollected and unprocessed waste materials accumulated in some MRFs due to LGUs' difficulties in processing, selling, or disposing of their recyclable wastes. Hence, this accumulation of waste was overwhelming the MRFs and posing a risk to possible environmental hazards if not managed soon.

According to RA 9003, DTI, in cooperation with the DENR, the DILG, and other concerned agencies and sectors, shall publish a study of existing markets for processing and purchasing recyclable materials and the potential steps necessary to expand these markets to stimulate the demand for the production of products containing post-consumer and recovered materials. Furthermore, the NSWMC, the NEC, the DTI, and the DOF shall establish procedures, standards, and strategies to market recyclable materials and develop the local market for recycled goods.

However, contrary to RA 9003, validation revealed that LGUs had difficulties processing, selling, or disposing of their recyclable wastes, resulting in the piling up in their MRFs or RCAs *(see Figure 62)*.

Figure 62: Accumulated Recyclable Wastes in MRFs and RCAs

Location: Lagangilang, Abra

Location: Ginatilan, Cebu

Figure 62: Accumulated Recyclable Wastes in MRFs and RCAs (cont.)

Location: Kumalarang, Zamboanga del Sur

Location: Olutanga, Zamboanga Sibugay

Source: COA Validation

To highlight further the dilemma of these LGUs, provided in Figure 63 were images of the MRF in Barangay Poblacion in Ginatilan, Cebu, including a Google Earth Image taken in September 2021 and our validation photographs taken on April 2022. By comparing the pictures, it was evident that the accumulated waste had indeed piled up and overwhelmed the MRF.

Figure 63: Accumulated Recyclable Wastes in MRF in Barangay Poblacion, Ginatilan, Cebu

The front portion of the MRF structure
Left: Google Earth Image was taken September 2021; Right: COA Validation on April 2022

Figure 63: Accumulated Recyclable Wastes in MRF in Barangay Poblacion, Ginatilan, Cebu (cont.)

The rear side of the MRF structure

Source: Google Earth and COA Validation

On the other hand, validation revealed that Barangay Poblacion in Ginatilan, Cebu, also received equipment from DENR-EMB, such as a bio shredder and bottle pulverizer. However, inspection revealed that both pieces of equipment remain unutilized due to a lack of skilled personnel to operate the bio shredder and sufficient electricity voltage in the MRF to operate the bottle pulverizer. Moreover, there was also an equipment mismatch since most of the waste outside this MRF was recyclable materials such as glass and plastic collected by the barangay. Ultimately, as the recyclable waste accumulates in the MRF and the pandemic limits the transfer of this waste to a more capacitated MRF, the barangay opted to sell the recyclable waste on its own. However, this initiative proved challenging, as buyers or junkshops only purchase selected and limited types of waste, and thus the MRF remained overwhelmed.

Similar to Barangay Poblacion in Ginatilan, Cebu, were Barangays Tagodtod, in Lagangilang, Abra, Poblacion in Kumalarang, Zamboanga del Sur, and Kahayagan in Olutanga, Zamboanga Sibugay. Aside from defective equipment or a mismatch that prevented the barangays from processing their recyclable wastes, these barangays have a limited number of junk shops or buyers in their area. Even though junk shops in Barangay Tagodtod buy recyclable waste, not all recyclable waste is taken; hence, the recyclable wastes accumulate even more. On the other hand, Barangay Poblacion used to give the remaining recyclable waste, not bought by junk shops, to schools for recycling. However, because face-to-face classes were postponed due to the pandemic, recyclable waste accumulated in Barangay Poblacion. Lastly, Olutanga, Zamboanga Sibugay's predicaments were that no one buys recyclable waste materials, and Region 9 lacks recycling facilities. Therefore, if they intend to sell them, they must take them to another region, which would be costlier for a municipal island like theirs.

With the observations noted during the validation, we requested information on how the NSWMC or its member/s ensure that LGUs will have a market for

their recyclable waste and the challenges preventing the NSWMC from effectively developing active markets for recyclable materials. However, we found no clear answer to the query, and the project, programs, and activities provided by DTI were not directly related to the Recycling Market Development. On the other hand, we found that the non-establishment of the National Ecology Center (NEC), being one of the supposed key implementers, has also affected this issue *(see Non-Establishment of NEC - Non-establishment of a National Recycling Network on page 127)*.

Overall, this challenge significantly affects waste diversion, as the barangay could not effectively perform recycling, which is one of the major functions of the MRF. This could also limit the barangays in their collection if their storage areas are nearly full or already full. On the other hand, these barangays may also have missed opportunities for industry growth that can generate jobs across LGUs and potential revenue from selling processed or unprocessed recyclable materials. In addition, waste left in open areas in Ginatilan, Cebu, could become marine waste during stormy weather since the site is only 261 meters from the shore and where Tañon Strait is located *(see Figure 64)*. The build-up of waste in an open area can eventually clog drains leading to flooding during the rainy season since Cebu is one of the provinces often hit by typhoons. In addition, it can cause adverse environmental impacts, such as endangering marine life, as plastic materials take thousands of years to decompose and contaminate bodies of water.

Figure 64: Distance between Barangay Poblacion MRF and Sea Shore

Source: Google Earth

Moreover, there was also a growing concern about microplastics. Based on a study, Cebu has the highest density of microplastics among the 10 study areas nationwide, such as Subic Bay, Boracay Island, Tañon Strait Protected

Seascape, and Davao Gulf.[49] To highlight the issue further, the Tañon Strait in Badian and Moalboal is about 46 kilometers from the LGU of Ginatilan, Cebu.

Solid waste is one of the primary sources of pollution in oceans. Universal plastic usage has increased non-biodegradable waste litter in natural environments, of which, in 2016, the world generated 242 million tonnes of plastic waste.[50] According to the Ellen MacArthur Foundation, if nothing is done, more plastic will be in the oceans than fish by 2050.[51] Consequently, the Philippines was reported to be the "third-worst polluter into the world's oceans" after China and Indonesia.[52]

The overwhelming work of EnMOs affects the reliability of data and delivery of services to the LGUs

The EMB hires EnMOs in the regions to augment the EMB's capacity. Generally, the EnMOs assist in inspecting and monitoring SWM facilities, initial review and monitoring of 10-yr SWM Plans, information and education and communication (IEC) campaigns, and enforcement of other environmental laws. However, the analysis revealed that LGU assignments per EnMO vary in numbers, thus, casting doubt on whether EnMOs can handle the assigned work effectively and efficiently.

Analysis revealed that the number of LGUs handled varied from one EnMO to another *(see Figure 65)*. For example, while one EnMO is reported to be assigned to monitor 43 LGUs, ten EnMO personnel are handling only one LGU.

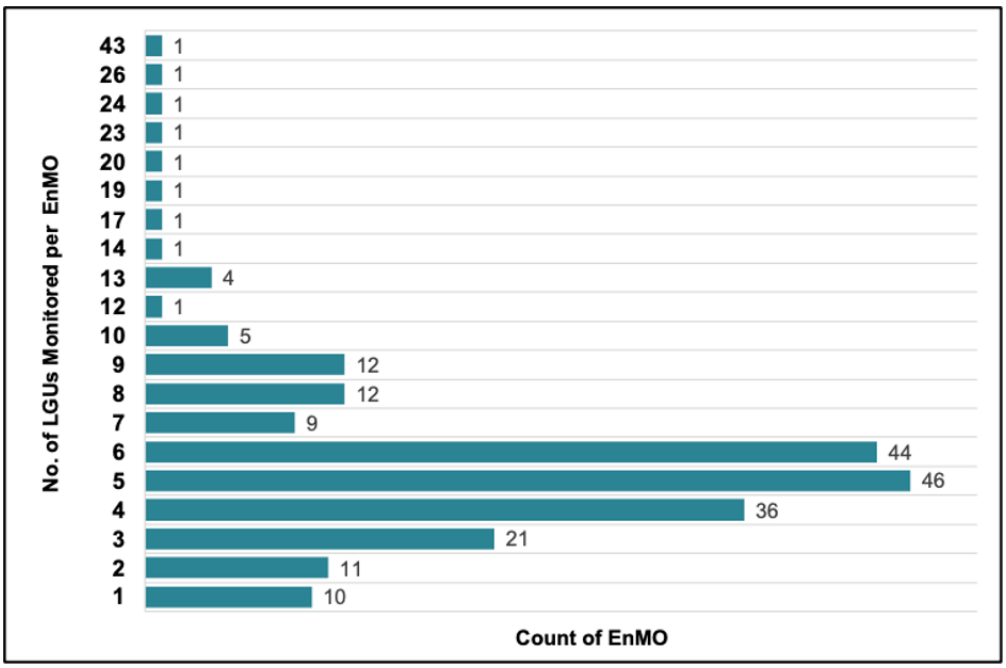
[49] *CRERDEC's study confirms presence of microplastics in the Philippine marine waters, highest density in Tañon Strait Protected Seascape in Badian and Moalboal, Cebu - Ecosystems Research and Development Bureau - DENR*. (2021, October 18). DENR-Ecosystems Research and Development Bureau (ERDB). Retrieved September 7, 2022, from https://erdb.denr.gov.ph/2021/10/19/crerdecs-study-confirms-presence-of-microplastics-in-the-philippine-marine-waters-highest-density-in-tanon-strait-protected-seascape-in-badian-and-moalboal-cebu/

[50] Kaza, S., Yao, L. C., Bhada-Tata, P., & Woerden, F. V. (2018, September 20). *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050*. Retrieved November 10, 2022, from https://doi.org/10.1596/978-1-4648-1329-0

[51] World Economic Forum, Ellen MacArthur Foundation and McKinsey & Company. (2016). *The New Plastics Economy - Rethinking the Future of Plastics*. Retrieved September 7, 2022, from https://ellenmacarthurfoundation.org/the-new-plastics-economy-rethinking-the-future-of-plastics

[52] *Greenpeace: PH is third worst plastic polluter of oceans*. (2017, September 23). Inquirer. Retrieved September 7, 2022, from https://newsinfo.inquirer.net/932739/greenpeace-environment-water-pollution-polluter-manila-bay

Figure 65: LGU Assignments per EnMO



Source: DENR-EMB Regional Offices Data

The hiring of EnMOs started in CY 2017 to accomplish the targets of the Solid Waste Enforcement and Education Program (SWEEP). The SWEEP was designed to augment the existing capacity of the DENR-EMB regional offices to validate, monitor, and improve reported unclean sites, as well as monitor and inspect SWM facilities such as EMB-funded MRFs and SLFs, among others.

At the latest guidelines *(see Table 46)*, an EnMO's responsibilities include the enforcement and education functions, site suitability assessment of proposed SLF sites (EnMO Geologists), and design of identified SWM facilities (EnMO Engineers).

Table 46: Functions, Targets, and Deliverables of EnMOs

FUNCTION	TARGET	OUTPUT
A. Enforcement Functions		
1. Monitor and geotag unclean sites	Five (5) to ten (10) sites monitored and geotagged per EnMo per month	Monitoring Report; Map of the geotagged sites.
2. Advise the barangay and city/municipal LGU and facilitate clean-up of unclean sites. Geotag validated sites	Five (5) to ten (10) cleaned-up sites facilitated per EnMo per month *Same geotagged sites monitored.	Advice/Letter to the Barangay and city/ municipal government to conduct the clean-up. Validation Report Map of geotagged validated sites
3. Conduct another site inspection if LGU did not submit any update or if there was no clean-up done.	All sites with no response from the LGU	Validation Report (2nd validation)

FUNCTION	TARGET	OUTPUT
4. Draft NOV to LGUs that did not comply with the advice from the DENR-EMB Regional Office to conduct clean up.	All re Inspected sites without action by the LGU	NOV Complete Staff Work
5. Conduct monitoring of rivers and other water bodies in the HUCs and Components Cities including siltation in rivers	All rivers and other water bodies	Monitoring Report
6. Assist in the conduct of Technical Conferences based on the issued NOVs. This can be done virtually or face to face.	Based on NOVs.	Report on the agreements/ commitments during the technical conference(s)
7. Monitor SWM Facilities such as SLF; MRF; RCA; Biogas Digester, and Transfer Station.	Annex E list of SWM facilities in the Region	Monitoring Report including 1. Data on waste diversion and 2. Updates on liquidation report on DENR-EMB downloaded funds
8. Conduct of monitoring of the rehabilitation of closed dumpsites in compliance with DAO 2006-9 or the General Guidelines in the Closure and Rehabilitation of Open Dumpsites and Controlled Dump Facilities	Annex E list of SWM facilities in the Region	Monitoring Report
B. Education Functions		
1. Support in the dissemination of information on Activities and Programs during the Environment Month and International Coastal Clean-Up Month	Environment Month International Coastal Clean-Up	Activity Report on the types and quantity of wastes collected during clean-up activities
C. Site Suitability Assessment of Proposed SLF Sites by EnMo Geologists		
1. Assessment of Proposed SLF Sites	5 proposed sites per Region (except NCR)	Geological Assessment Report (copies to be provided to the DENR-EMB Central Office)
D. Design of Identified SWM Facilities by EnMo Civil Engineers/Civil Sanitary Engineers		
1. Civil Engineers/ Civil Sanitary Engineers	5 designs including the site assessment, costing, operational cost, profitability analysis of SLF, MRF, Biogas Digester, and RCA per Region	Inputs in the Design of SLFs, MRF Biogas Digester, and RCA

Source: Guidelines on the Implementation of SWEEP for CY 2022

However, based on the data gathered from DENR-EMB Regional Offices, some EnMOs have other responsibilities besides RA 9003. These other assignments include but are not limited to assisting in or conducting investigation or inspection in compliance with Presidential Decree (PD) 1586, RA 9275, RA 8749, RA 6969, and RA 9512.

Despite the variety and volume of assignments and responsibilities, DENR-EMB and its EnMOs have continued to maximize their operation to the extent of their capabilities. The operation and monitoring conducted by DENR-EMB and EnMOs nationwide were extensively tested during the pandemic. Despite the restrictions and challenges brought about by the pandemic, all 326 DENR-

EMB EnMOs nationwide completed the monitoring of 28,671 sites and facilitated the cleanup of 23,180 unclean sites in CY 2021 *(see Table 47)*.

Table 47: SWEEP and EnMOs Accomplishments

SWM Activities	CY 2020	CY 2021
Monitored sites	22,416	28,671
Unclean sites clean-up	19,751	23,180

Source: DENR-EMB Accomplishments for CYs 2020 and 2021

Both in CYs 2020 and 2021, the EnMOs were also able to assist in the inspection and monitoring of SWM facilities, such as MRFs and disposal sites, and review and implementation of 10-yr SWM Plans.

Non-Establishment of M/CENRO

The Local Government Code, or RA 7160, mandates that LGUs provide basic services and facilities. These services include providing solid waste disposal systems, environmental management systems, and services or facilities related to general hygiene and sanitation. However, Section 484 of the same law provides that the appointment of the environment and natural resources officer is optional for provincial, city, and municipal governments. Consequently, the provision allows LGUs to create a M/CENRO position (Full-Fledged), assign the waste management function in any of its different offices (Designated), or assign no M/CENRO at all. Hence, services for SWM in some LGUs become fragmented and, therefore, not integrated.

According to the National Solid Waste Management Status Report from 2008-2018, one of the challenges of the SWM in the country was the institutionalization of an Environment and Natural Resources Office. As disclosed in the same report, SWM was not the priority of some Local Chief Executives; hence, not all LGUs have created their M/CENRO with personnel.

To garner insights into how M/CENRO was institutionalized across LGUs nationwide, we requested data from all DENR-EMB Regional Offices and received data representing 1,483 LGUs. Of the 1,483 LGUs, 29 percent have a full-fledged M/CENRO position, 70 percent designate only the M/CENRO position, and seven LGUs did not have or did not designate a M/CENRO position *(see Table 48)*.

Table 48: LGUs with M/CENRO Position

Region	Full-Fledged	Designated	No M/CENRO	Total
NCR	14	3	0	17
CAR	4	73	0	77
1	77	48	0	125
2	26	66	0	92
3	36	101	0	137

Region	Full-Fledged	Designated	No M/CENRO	Total
4A	42	100	0	142
4B	13	37	0	50
5	26	85	0	111
6	22	111	0	133
7	25	100	6	131
8	35	106	0	141
9	15	57	0	72
10	19	74	0	93
11	21	23	0	44
12	32	17	0	49
13	25	43	1	69
Total	**432**	**1,044**	**7**	**1,483**
Percentage	**29**	**70**	**0**	**100**

Source: DENR-EMB Regional Offices Data

Based on the requested summary of M/CENRO to DENR-EMB, we learned that these designated M/CENRO were initially assigned from another office and not necessarily trained for the SWM task (e.g., Municipal Agriculture Office, Municipal Engineer, Municipal General Service Office, Municipal Planning & Development Coordinator Office, Municipal Disaster Risk Reduction and Management Office). Most of them were preoccupied with other tasks regarding their original department or office and burdened by not having an adequate budget, if provided, for SWM.

On the other hand, interviews with focal persons from different DENR-EMB Regional Offices revealed that they, too, have experienced challenges due to problems in M/CENRO institutionalization. According to them, due to the co-terminus nature of most designated M/CENROs, previous priorities or ongoing plans, including SWM implementation, were not always sustained. Moreover, there was also the issue of training every new designate and its staff if M/CENRO was provided with a functional office as some designated M/CENROs work alone. Finally, according to NSWMC, the LGU's personnel services budget salary cap is another challenge in the institutionalization of M/CENRO.

NSWMC stated that whenever LGUs are asked about their capacity, the typical response is a lack of funding, personnel, and capacity, which explains why some LGUs struggle to comply. According to them, the capacity of LGUs decreases due to the 3-year term transitions of LGUs, which results in a loss of knowledge transfer. This is not just limited to officials being replaced by every new administration but also involves the personal knowledge acquired by individuals. Although DILG provides orientation and training programs for new local chief executives, such programs are unavailable for technical personnel. As a result, when these individuals retire or are replaced, their

capacity is lost. To address this issue, continuous capacitation is being implemented.

NSWMC also commented that the 3-year term of local chief executives is a systemic problem because changing the local chief executive may result in the change of the M/CENRO. Another ongoing issue is the lack of a proper turnover process when changing M/CENRO, which results in a failure to transfer capacity effectively.

Consequently, the need for institutionalizing M/CENRO or its equivalent was more reasonable, given that the LGUs were responsible for enforcing and implementing RA 9003 in their respective jurisdictional areas. The Environment and Natural Resources Office in every LGU was vital in formulating measures for the consideration of the *sanggunian* and in providing technical assistance and support in carrying out measures to ensure the delivery of basic services and provision of adequate facilities relative to environment and natural resources services. This will also ensure that services are highly efficient through sustained leadership and accountability in SWM, the environment, and natural resources.

Similarly, DENR still recommends creating or institutionalizing M/CENRO to address environmental concerns. Accordingly, one of the action plans was to conduct meetings or workshops with DILG to identify strategies for creating the M/CENRO position.

Unequal distribution of men and women in SWM and leadership

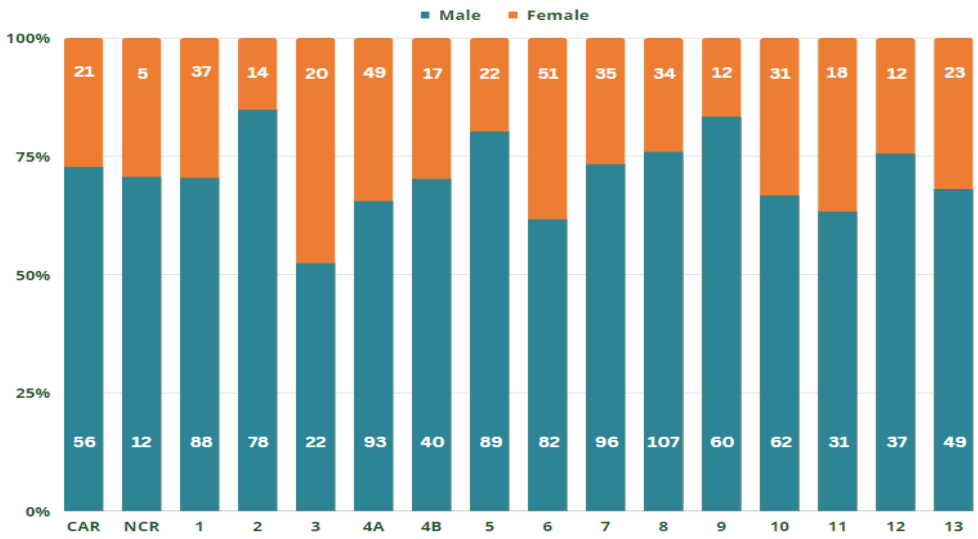
There was an imbalance in the number of male and female M/CENROs and EnMOs, with men holding 72 percent and 58 percent of the jobs, respectively. Therefore, if plans or targets to balance the ratio are not included in the relevant Gender and Development Plans, the country may not attain the nationally agreed targets for SDG 5.5 to achieve a proportion of 50 percent of positions held by women.

SDG 5 is aimed to “achieve gender equality and empower all women and girls”, or simply “Gender Equality”. SDG 5 is focused on pursuing the main goal of real and sustained gender equality in all aspects of women’s and girls’ lives, which includes ensuring women’s full and effective participation and equal opportunities for leadership.[53] To achieve the 2030 Agenda, the indicators for the nationally agreed target SDG 5.5 is at a 50 percent proportion of women.[54]

In compliance with the Magna Carta of Women, we looked into the sex-disaggregated data of M/CENROs and found more men than women. Of the 1,498 M/CENRO nationwide, excluding BARMM, about 72 percent, or 1,076, were men, while 28 percent, or 422, were women. Based on Figure 66, across the country and every region except BARMM, there were more men in M/CENRO than women *(see Figure 66)*.

[53] Sustainable Development Goal 5
[54] 2030 Nationally Determined Numerical Targets for the SDGs. Retrieved September 7, 2022, from https://sdg.neda.gov.ph/2030-nationally-determined-numerical-targets-for-the-sdgs/

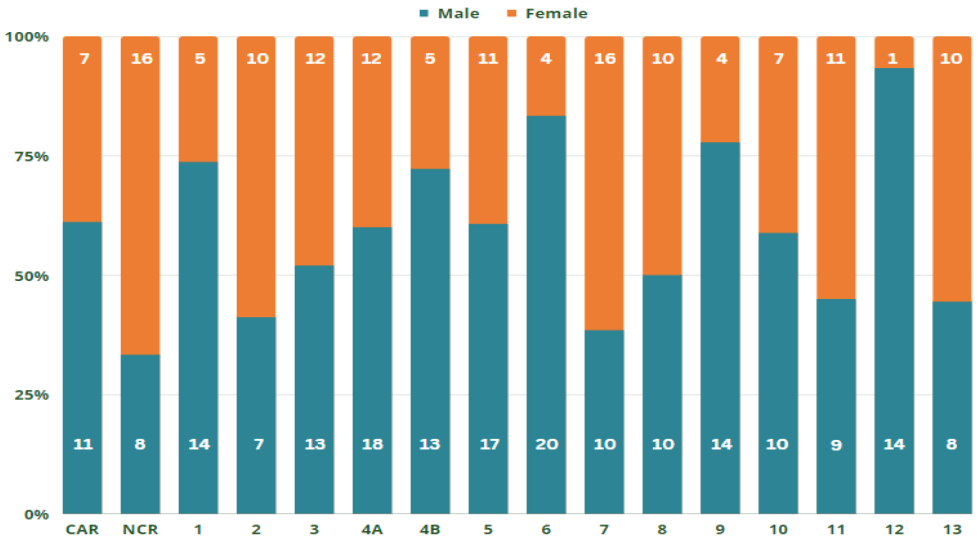
Figure 66: Number of Male and Female M/CENROs



Source: DENR-EMB Regional Offices Data

On the other hand, we also looked into the sex-disaggregated data of EnMOs and found that there were slightly more men than women. Of the 337 EnMOs nationwide, excluding BARMM, about 58 percent, or 196, are men, while 42 percent, or 141, are women. Figure 67 shows that while certain regions have more women EnMOs than men, many regions have more men EnMOs. Interestingly, the number of men and women EnMOs in Region 8 was the same.

Figure 67: Number of Male and Female EnMOs



Source: DENR-EMB Regional Offices Data

The M/CENRO is designated by the local chief executive of an LGU. The local chief executive has the power to appoint all officials and employees whose

salaries and wages were wholly or mainly paid out of municipal funds and whose appointments were not otherwise provided for in RA 7160 and those he may be legally authorized.[55] As shown in Figure 66, most of the local chief executives hired more male M/CENRO.

On the other hand, the hiring of EnMOs for CY 2022 was based on the Guidelines on the Implementation of the SWEEP for CY 2022. However, upon desk review of the said guidelines, there was no indication of the ratio of hiring men and women for EnMO positions. In addition, a review of the GAD Plan and Budget of DENR-EMB for CY 2022 disclosed no plan nor target to balance the number of male and female EnMOs.

Examples of Best Practices Observed during Validation

Despite the noted challenges and limitations, a number of LGUs showcased resourcefulness in finding ways to divert waste. On the other hand, various private companies, including non-governmental organizations, have also participated in local SWM programs to contribute to waste diversion and effective waste management.

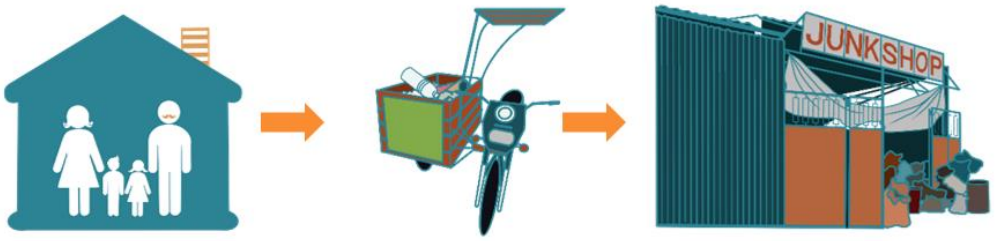
According to RA 9003, one of the goals of the SWMP is to encourage greater private-sector participation in SWM. While SWM's primary enforcement and responsibility shall remain with the LGUs, RA 9003 also focuses on establishing a cooperative effort among the national government, other LGUs, NGOs, and the private sector.

PHINLA and Limadol. As mentioned earlier, Barangay Mintal in Davao City had problems utilizing its MRF assistance from DENR-EMB due to a lack of appropriate land suitable for MRF establishment. As a result, the fund assistance, which remained idle for almost four years, was refunded to BTr, and no MRF was established. However, this predicament did not prevent Barangay Mintal from diverting its waste because of its partnership with PHINLA and Limadol, which started in the 2nd Quarter of 2021 and December 2021, respectively.

PHINLA was a partnership project of the Eco Waste Coalition and World Vision Development Foundation, Inc, with funding from the German Federal Ministry for Economic Cooperation and Global Development (BMZ). PHINLA, coined from the name of the countries where the project is being implemented (the Philippines, Indonesia, and Sri Lanka), seeks to empower waste workers and communities affected by poor waste management by using waste as a resource to create meaningful employment and to earn income while tackling health and environmental issues associated with waste management.[56]

[55] RA 7160 Chapter 3 Section 444(v)
[56] *Empowering Waste Workers and their Communities.* World Vision. Retrieved September 7, 2022, from https://www.worldvision.org.ph/news/empowering-communities/

Figure 68: Collecting and Selling of Recyclable Materials by Mintal Resource Collectors Association (MIRCA)



Source: COA Interview Results

Through this project, the residents of Barangay Mintal, mostly from indigent communities, constitute the MIRCA. The members of MIRCA were given a livelihood by collecting all recyclable materials in the barangay *(see Figure 68)*. This project has also equipped the waste collectors with PPEs, such as gloves, raincoats, and boots, and donations to the barangay, such as cellular phones, *trisikads*, and weighing scales. Ultimately, this has given "*mangangalakal*" more support, a more dignified work environment, and better opportunities to collect more recyclables as they could not afford to shell out a portion of their earnings to buy the materials mentioned earlier because that would mean less food on the table.

In addition to PHINLA, Barangay Mintal has a partnership with Limadol to help the barangay manage its kitchen/ or food waste *(see Figure 69)*. Limadol is a start-up enterprise aiming to divert food waste from Mindanao landfills, reduce methane, enrich the soils with natural fertilizers, and replace imported fishmeal or soya to feed organic livestock.[57] According to Barangay Mintal, Limadol initially agreed with five food establishments to collect food and kitchen waste thrice a week beginning in January 2022. The collected food and kitchen wastes are then converted into fertilizers, where black soldier flies consume food waste and produce a byproduct called frass which is useful feed for poultry or organic fertilizers[58]. At the time of validation, Limadol is already collecting food and kitchen waste from 14 food establishments at the barangay, Mintal Barangay Hall, and the Mintal Public Market. Barangay Mintal and Limadol are also targeting to include fruit stands outside the public market, other non-food establishments, and all the households of the barangay.

[57] *About Limadol*. Retrieved August 23, 2022, from https://limadol.com/about
[58] *Davao City waste-to-energy project to fuel climate change, groups warn*. (2022, May 15). Philstar. Retrieved September 7, 2022, from https://www.philstar.com/headlines/climate-and-environment/2022/05/15/ 2181288/davao-city-waste-energy-project-fuel-climate-change-groups-warn

Figure 69: Limadol's Food and Kitchen Waste Management Partnership

Source: COA Interview Results

By implementing these projects through partnerships with PHINLA and Limadol, Barangay Mintal could divert recyclable waste from households and kitchens and food waste from food establishments. Based on data provided by Barangay Mintal, the barangay could divert 32,926.80 kgs of waste as at the first quarter of CY 2022 *(see Table 49)*.

Table 49: Diverted Recyclable Waste Materials through Partnership with PHINLA and Limadol from 2nd Quarter 2021 to 1st Quarter 2022 (in kilograms)

Period	Recyclable Waste	Biodegradable Waste (food/ kitchen waste)	Total
2nd Quarter of CY 2021	611.80	-	612.00
3rd Quarter of CY 2021	1,606.00	-	1,606.00
4th Quarter of CY 2021	5,937.00	729.00	6,666.00
Subtotal	**8,154.80**	**729.00**	**8,883.80**
1st Quarter of CY 2022	18,378.00	5,665.00	24,043.00
Grand Total	**26,532.80**	**6,394.00**	**32,926.80**

Source: COA Interview Results

The collected recyclable waste materials generated a total income of ₱418,645.01 from the second quarter of 2021 to the second quarter of 2022, as presented in Table 50. This income benefited 12 to 30 MIRCA waste collectors.

Table 50: Income Generated from Diverted Recyclable Materials through Partnership with PHINLA and Limadol from 2nd Quarter of CY 2021 to 2nd Quarter of CY 2022

Period	CY 2021	CY 2022	Total
1st Quarter	₱ -	₱ 137,465.70	₱ 137,465.70
2nd Quarter	5,705.00	156,956.96	162,661.96
3rd Quarter	21,347.00	-	21,347.00
4th Quarter	97,170.35	-	97,170.35
Total	**₱ 124,222.35**	**₱ 294,422.66**	**₱ 418,645.01**

Source: COA Interview Results

Proper management and reduced kitchen/food waste were effective ways to protect the environment. According to the Science Research Specialist at the DOST-Food and Nutrition Research Institute (FNRI) in CY 2018, the food wastage in the country reached an average of 1,717 metric tons each day, and the greatest amount of plate waste comes from energy food groups[59] such as rice, corn, and starchy roots. In Metro Manila, 2,175 tons of food are in trash bins daily, as the World Wildlife Fund-Philippines[60] reported. These reports reflect the challenges of the country in kitchen/food waste that need to be addressed sooner than later. For example, oil generated from food and kitchen waste could be chucked into the drainage system, clogging up pipes and later on, could result to flooding. In addition, the food and kitchen wastes disposed of in landfills or dumpsites produce methane gas that impacts climate change.

Mother Earth Foundation. During the Pilot Study in Barangay San Rafael Village, Navotas City, we engaged the Citizen Partner in the conduct of survey and interview with the Foundation and barangay officials. We noted that the Mother Earth Foundation helped barangays and LGUs in SWM. This partnership was their initiative as an NGO to achieve Zero Waste Philippines *(see Figure 70)*. In addition, the partnership's objective is to empower barangays to become self-reliant through holistic environmental education and community participation by maximally increasing their capacity to comply with RA 9003 and to divert the barangays' waste from dumps and/or landfills and help enable them to attain continued compliance with RA 9003.

[59] *DOST-FNRI eyes evidence-based solutions for food insecurity*. Retrieved September 7, 2022, from https://www.dost.gov.ph/knowledge-resources/news/49-2018/1433-dost-fnri-eyes-evidence-based-solutions-for-food-insecurity.html

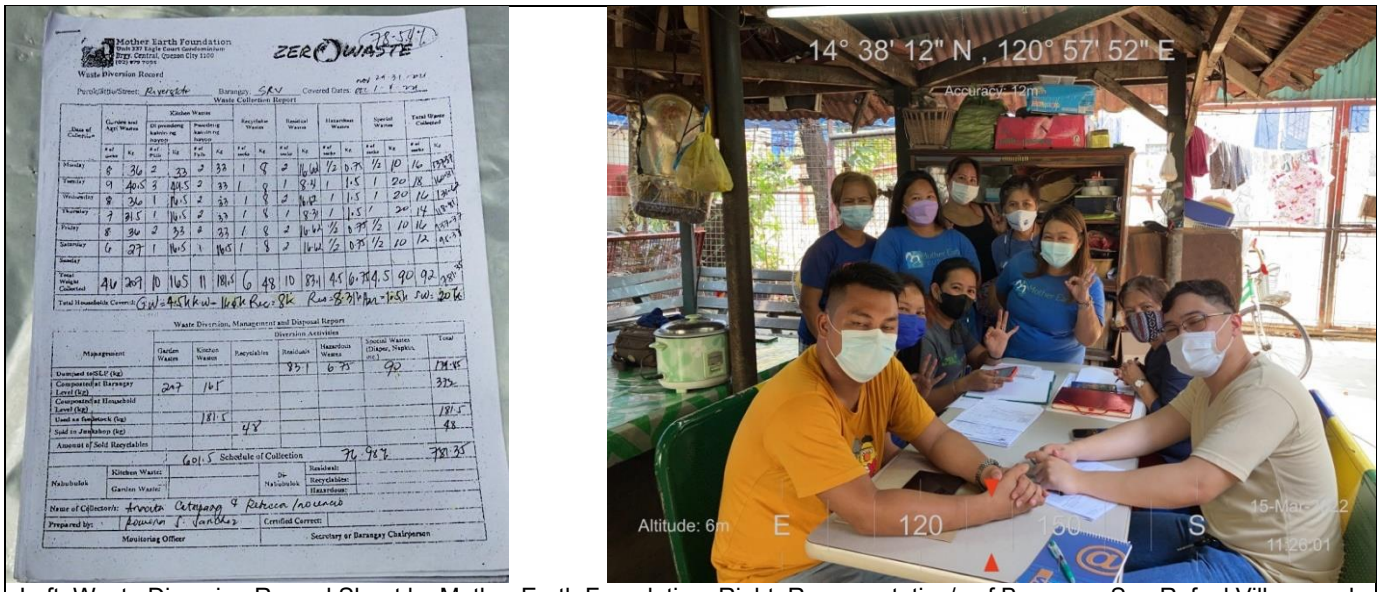
[60] Sustainable Consumption and Production. (2022, November 17). WWF-SCP. Retrieved September 7, 2022, from https://wwf.org.ph/what-we-do/food/thesustainablediner/

Figure 70: Mother Earth Foundation SWM Support to Barangay San Rafael, Navotas City

Source: Mother Earth Foundation

During the interview in Barangay San Rafael Village, we found that house-to-house waste collection was conducted by Mother Earth Foundation, including the segregation of waste if households failed to do it. Mother Earth Foundation also helps the barangays maintain a record of different types of waste collected during a given number of days and its corresponding diversion *(see Figure 71)*.

Figure 71: Mother Earth Foundation in Barangay San Rafael Village, Navotas City



Left: Waste Diversion Record Sheet by Mother Earth Foundation; Right: Representative/s of Barangay San Rafael Village and Mother Earth Foundation, Victoria Yumang (Citizen Partner) and Marco Crespo (Audit Team Member)

Source: COA Validation

Aside from collecting and recording waste, Mother Earth Foundation also helps process segregated biodegradable wastes into compost for use in gardens where the barangay grows vegetables, such as cabbage. On the other hand, the segregated recyclable wastes were sold to junkshops, and the income was divided among themselves. Finally, the residual wastes from the collection were hauled in the dump truck owned by the barangay for final disposal in the Navotas SLF.

Apart from actual SWM, Mother Earth Foundation conducts community information and educational campaign to teach households how to segregate waste properly. This campaign also includes informing the households of the collection schedule for different types of waste.

Lastly, they also conduct training for the barangay official on proper SWM. The training covers the roles and responsibilities of the barangay in implementing RA 9003. These roles and responsibilities include the proper segregation and collection at source, operation of MRF where the biodegradable wastes were processed to make compost, and the recyclables to either use within the barangay or sell to junkshops to get additional income to be used in the operation of the MRF.

We revisited the barangay in October 2022 and found that Mother Earth Foundation had already completed its partnership with Barangay San Rafael Village. However, this follow-up validation revealed that the barangay did not continue some of Mother Earth's programs and activities, including segregating collected waste. Currently, barangay waste collectors only segregate recyclables that can be sold to junkshops. While biodegradable and residual wastes were disposed of together at the SLF because the barangay does not utilize their garden anymore, where they used to put biodegradable waste to fertilize their crops.

Private Companies Accepting Wastes from LGUs. Several interviews with LGUs highlighted how private companies helped them further reduce their residual wastes. Based on information gathered from DENR-EMB Regional Offices, waste collected and processed by these companies varied from residual waste with potential, plastics, and recyclables *(see Table 51)*.

Table 51: Examples of Private Companies Accepting Wastes from LGUs

Private Company	Type of Waste Accepted
CEMEX	Residual wastes
Eagle Cement	Residual with potential
FDR Construction Company Inc.	Residual wastes
Guun Private Limited	Residual wastes
Holcim Mining and Development Corporation	Residual wastes
Holcim Philippines	Residual wastes, residual with potential, and qualified non-biodegradable
Iriga City Plastic Recycling Company	Recyclables
Republic Cement	Residual with potential
Solid Merchandising	Residual wastes

Private Company	Type of Waste Accepted
Starplus/Tamaraw Plastics	Recyclable plastics
Villar Sipag Foundation	Plastics
Winder Plastic Recycling Company	Residual wastes

Source: DENR-EMB Regional Offices Data

As shown in the table above, most of the wastes being diverted by these partnerships were residual wastes that should have been disposed of in the SLFs or RCAs. According to LGUs, these residual wastes must be cleaned and dried, and some need to be shredded before collection by private companies.

During MRF validation in Barangay Tandang Kutyo in Tanay, Rizal, we learned about their partnership with CEMEX. Tanay LGU partnered with CEMEX to have an additional waste diversion for their residual waste that should have been dumped in landfills. The wastes collected by CEMEX include plastic wrappers, plastic *labo*, and other plastic wastes not accepted by junkshops.

According to their website, CEMEX collects the segregated residual wastes from communities and properly treats them through co-processing. This method reduces solid waste and carbon emissions using less fossil fuels for cement kilns[61]. According to DENR-EMB Region 4A, the co-processing of residual waste is being monitored by DENR-EMB through its Air Quality Section, which monitors different industries, including the cement factory.

As for plastic industries, they collect and use residual wastes such as plastics to make products such as school chairs, pots, pallets, plastic bottles, laundry hangers, and other plastic products.

These partnerships between private companies and LGUs can help the country address the SWM problems for every LGU, especially on waste diversion. Benefiting both parties, LGUs' residual wastes that would have been disposed of in SLFs and RCAs can still be used and processed by private companies.

[61] *Waste Management Solution: The CEMEX Way.* CEMEX Holdings Philippines. Retrieved January 15, 2023, from https://www.cemexholdingsphilippines.com/-/waste-management-solution-the-cemex-w-1

Gaps in the planning, implementation, and monitoring of the program

We noted gaps in the program's planning, implementation, and monitoring under RA 9003, mainly due to inadequate institutional mechanisms to kick-start the program, such as the non-establishment of the SWM Fund and the NEC. On the other hand, we also found room for improvement in coordination among implementing agencies to avoid overlap and to maximize sharing of responsibility, recording, and monitoring of wastes to ensure reliability and attainment of waste diversion targets, and prioritization of updating the NEAP to contribute to waste avoidance.

Non-Establishment of SWM-Mandated Funding Sources

To kick-start the SWM implementation, RA 9003 mandated the appropriation of ₱20 million for the initial operating expenses of the NSWMC, the NEC, and the LGUs to carry out the mandate of RA 9003. Moreover, the law also created the SWM Fund[62] that shall be made available to the NSWMC, the NEC, and LGUs to achieve and perform their roles and responsibilities to attain the goals of SMWP. However, according to DENR-EMB, the ₱20 million was not released, and the SWM Fund has not been established since the adoption of RA 9003. Thus, the NSWMC and some LGUs cannot cope complying with the law because of, among others, financial and technical capacity.

Initial Operating Expenses. Over the years, the NSWMC, through DENR-EMB, has worked on the release of the ₱20 million initial operating expense through various requests done through the issuance of resolutions and communications with the various agencies *(see Table 52)*.

Table 52: Various Funding Requests from NSWMC

NSWMC Resolution/Letter	Brief Description
NSWMC Resolution No. 10, Series of 2008, dated January 30, 2008	Resolution adopting and endorsing the Ph20M NSWMC Initial Operating Budget and Work and Financial Plan for submission to Department of Budget and Management (DBM) for inclusion as a line budget item in the succeeding GAAs
NSWMC Resolution No. 54, Series of 2010, dated October 22, 2010	Resolution Requesting the DBM to Create Plantilla Positions for Executive Director, Deputy Executive Director, and Staff of the NSWMC Secretariat at the Environmental Management Bureau, Central Office
NSWMC Resolution No. 63, Series of 2013, dated July 5, 2013	Resolution for the Institutionalization of the NSWMC and the Offices Created Under it. Particularly the Secretariat and the NEC (The resolution provided for the creation and institutionalization of plantilla positions for the NSWMCS and

[62] Section 46 of RA 9003 stipulates that a Solid Waste Management Fund shall be created, as a special account in the National Treasury, to be administered by the NSWMC.

NSWMC Resolution/Letter	Brief Description
	NEC to effectively achieve the mandated functions and efficient performance of the said offices)
NSWMC Resolution No. 82, Series of 2014, dated June 24, 2014	Resolution Adopting the NSWM Comprehensive Plan as the basis for Budget Proposal. This was developed in line with the NSWM Strategy which was adopted through NSWMC Resolution No. 59, Series of 2013 and was presented to the NSWM-Technical Working Group (TWG) meeting on June 5, 2014. The objective of the NSWM Comprehensive Plan is to increase the country's waste diversion rate from 34% in 2010 to 50% by 2016
NSWMC Letter to Office of the President on April 15, 2016	Request for (1) Recognition of the NSWMC under the Office of the President as provided in Section 4 of RA 9003; (2) Provision of the initial operating expense for the NSWMC to carry out mandates of the Act as provided in Section 58 of RA 9003; (3) Provision of a fund for the establishment of the National Solid Waste Management Fund as provided in Section 46 of RA 9003

Source: NSWMC Data

However, more than two decades after the adoption of RA 9003, no initial operating budget had been released by DBM to the NSWMC despite repeated submission requests for the budget allocation.

Since CY 2001, DENR-EMB has provided Secretariat support to NSWMC, following RA 9003. In addition, the NSWMC has been working on a budget provided to the DENR-EMB for SWM activities. Nonetheless, although the budget allocation for SWM activities of the DENR-EMB is not solely for the NSWMC, the Commission has continued to deliver some of its mandates *(see Table 53)*.

Table 53: NSWMC Accomplishments

POLICY	○ National Solid Waste Management Framework ○ National Solid Waste Management Strategy ○ Approved Local SWM Plans ○ Adopted Various SWM Guidelines
TECHNICAL	○ Life Cycle Assessment Study in support of the identification of NEAPs ○ Recycling Market Development Study
FINANCIAL	○ Participated in the finalization of project proposals endorsed for funding by various development partners
ENFORCEMENT	○ Filing of complaints to the Office of the Ombudsman against 50 non-complying LGUs

Source: DENR-EMB Data

While the DENR-EMB provided certain budgetary allocations of the NSWMC, it did not include, however, the realization of some mandates of the NSWMC that includes, among others, the provision of a fund under the SWM Fund to finance products, facilities, technologies, and processes to enhance proper SWM, awards and incentives, research programs, IEC and monitoring activities, technical assistance, and capability building activities as stipulated in Section 46 of RA 9003.

SWM Fund. According to the provisions of RA 9003, the SWM Fund shall be sourced from fines and penalties imposed, proceeds of permits and licenses issued by the DENR under RA 9003, donations, endowments, grants, and contributions from domestic and foreign sources, and amounts specifically appropriated for the SWM Fund under the annual GAA.

This fund, which NSWMC and NEC can access, also extends to LGUs. LGUs are entitled to avail of the SWM Fund based on their approved 10-yr SWM Plan. While subject to the availability of funds, the SWM Fund may be made available to the SWM project/activities of the LGUs based on a set of criteria formulated through a consultative process. Hence, if available, the SWM Fund can catalyze full compliance and sustainability of SWM initiatives at national and local levels.

To date, the SWM Fund has not been established yet nor funded. According to DENR-EMB, the SWM Fund cannot be established under the current institutional engagement because the needed human resource of the NSWMC to manage and administer the SWM fund was not established.

Non-Establishment of NEC

One of the institutional support mechanisms necessary to implement RA 9003 is the NEC, which shall support the implementation of the Act by making available information, consulting, training, and networking services. However, despite the existing mandate that NEC be established, no organizational structure, no personnel assigned, and no budget has been allotted for the NEC. Hence, to implement its mandate, the Secretariat or the DENR-EMB has been partly functioning as the NEC since CY 2002.[63]

Under the NSWMC Resolution No. 34, Series of 2009, the Solid Waste Management Division (SWMD) of DENR-EMB, which also serves as the Secretariat of the Commission, was formally affirmed to perform the functions of NEC.

The NEC, through DENR-EMB, was able to release various guidelines *(see Table 54)* to perform its mandate; however, these were not fully implemented due to a lack of resources and an initial operating budget as stipulated in Section 58 of RA 9003.

[63] Based on review of minutes of meetings of the NSWMC, DENR-EMB has been performing the functions of NEC since CY 2002.

Table 54: NEC Guidelines

1.	NSWMC Resolution No. 51, Series of 2010	Guidelines on the Operation of the NEC as well as Regional Ecology Center
2.	NSWMC Resolution No. 1500, Series of 2021	Resolution Adopting the Guidelines on the Establishment of the NEC
3.	Guidelines on Establishing Partnership Between the NEC and Government or Private Sector Owners of Existing Training and Integrated SWM Facilities for the Conduct of the NEC Training	

Source: DENR Data

Despite working with a limited and shared budget, the NEC, through DENR-EMB, managed to accomplish some, if not all, of the functions mandated to them *(see Figure 72)*.

Figure 72: Accomplishments of NEC through DENR-EMB

Source: DENR-EMB Data

On the other hand, we identified the two most negative effects in the absence of fully operating NEC: (1) Inadequate SWM Database and (2) Non-establishment of a National Recycling Network.

Inadequate SWM Database. One of the issues often raised by stakeholders was the non-existence of a database that could help synchronize and coordinate the SWM implementation at all levels.

For example, the NSWMC currently relies on the 10-yr SWM Plans of LGUs to determine the waste generation data. However, this data from LGUs were just waste management estimated generation for 10 years, and therefore not the actual information on waste generation. Thus, because of the absence of data on waste generation, the NSWMC may not perceive the actual condition of the solid waste generation dilemma in the Philippines *(a similar discussion can be found in Projected Waste Generation on page 17)*.

Non-establishment of a National Recycling Network. Another significant effect of the absence of a fully operating NEC was the non-establishment of a national recycling network that will enhance the opportunity to recycle and facilitate the network of buying and selling recyclable wastes. For example, one of the MRF locations we visited was in Barangay Poblacion in Ginatilan, Cebu, where the barangay has concerns about the disposition of its enormous volume of collected recyclable wastes.

Figure 73: Inspection of MRF in Barangay Poblacion, Ginatilan, Cebu, Region 7

Source: COA Validation in Barangay Poblacion, Ginatilan, Cebu, Region 7

As can be seen in Figure 73, the MRF was full of recyclable wastes. According to Barangay Poblacion officials, no one was collecting their recyclable wastes, and they have no information on possible buyers. If a buying-selling network is established, Barangay Poblacion and similar barangays or LGUs will greatly benefit in marketing and ultimately diverting their collected wastes.

On the other hand, the mandated multi-sectoral, multi-disciplinary pool of experts that will significantly help the NEC to accomplish its goals and objectives has yet to be created. Based on the review of documents, we found that the NSWMC had been discussing the criteria or qualifications for hiring the NEC pool of experts as early as CY 2002, yet no pool of experts was created. Nonetheless, the creation of this pool of experts was reiterated in the amended provisions in RA 11898 or the Extended Producer Responsibility Act of 2022. Hence, the NEC was still directed to maintain a pool of experts, including those from the academe, inventors, practicing professionals, business and industry, youth, women, and other concerned sectors, who shall be screened according to qualifications set by the NSWMC.

In addition to the amended provisions stated in RA 11898, the NEC will now be headed by the Assistant Director of DENR-EMB under an ex-officio capacity. Moreover, additional functions are also listed for NEC *(see Table 55)*.

Table 55: Comparison of NEC under RA 9003 and Amendments in RA 11898

RA 9003	Amendments in RA 11898
Head: DENR-EMB Director (ex officio capacity)	Head: DENR-EMB Assistant Director (ex officio capacity)
Functions:	**Functions:**
Facilitate training and education	Facilitate training and education
Establish and manage an SWM information database	Establish and manage an SWM information database
Promote the development of a recycling market	Promote the development of a recycling market
Provide or facilitate expert assistance in pilot modeling of SWM facilities	Provide or facilitate expert assistance in pilot modeling of SWM facilities
Develop, test, and disseminate model waste minimization and reduction	Develop, test, and disseminate model waste minimization and reduction
	Additional functions
	Maintain an EPR Registry containing the registered EPR Programs
	Monitor and evaluate the compliance of obliged enterprises and Producer Responsibility Organizations (PROs)
	Develop and maintain a database, including digital formats, that is reliable, effective, secure, transparent, and accessible to the public
	Receive sampling and assessment reports and undertake the necessary action
	Provide an assessment on the volume or footprint of other generated wastes

Source: Official Gazette

With the additional functions expected from NEC, there is now a greater need to establish and fulfill its needed staffing and funding resources to fully operate as intended in its mandate. Currently, the NEC remains under the staffing and funding from SWMD of DENR-EMB.

Overlap in Beneficiaries Due to Lack of Coordination Among Implementing Agencies

As mentioned in Chapter 2, DENR-EMB provided financial assistance to LGUs in establishing MRFs from CYs 2012 to 2019 and various equipment from CYs 2020 to 2022 to improve compliance and increase waste diversion of solid wastes nationwide. However, during validation, we found that besides DENR, DA and DOST also have a similar waste facilities program providing equipment to barangays and LGUs. Hence, some barangays or LGUs have received multiple and similar equipment from different agencies *(see Table 56)*. Since the programs and their beneficiaries overlap, there was an evident lack of coordination among these agencies.

Table 56: Barangays or LGUs with Multiple and Similar Units of SWM Equipment from EMB, DA, and DOST

LGU Recipient	Composter				Bio Shredder			
	EMB	DA	DOST	LGU	EMB	DA	DOST	LGU
1. Barangay Maoa-oas, Pugo, La Union	1	1	-	-	1	1	-	1
2. Barangay San Pedro, Alcala, Pangasinan	1	1	-	1	1	1	-	-
3. Barangay Puerto Rivas Lote, Balanga, Bataan	1	-	-	-	1	1	-	-
4. Barangay Minadongjol, Sagnay, Camarines Sur	1	1	-	-	1	1	-	1
5. Barangay Barubuhan, Sominot, Zamboanga Del Sur	1	1	-	-	1	1	-	-
6. Barangay Catipan, Mabuhay, Zamboanga Sibugay	1	1	-	-	1	-	-	-
7. Barangay Kahayagan, Olutanga, Zamboanga Sibugay	1	-	1	-	1	-	1	-
8. Barangay Cuambog, Mabini, Davao de Oro	1	1	-	-	1	-	-	-

Note: Highlighted in red are equipment found to be not operational due to insufficient supply of bio waste, staff having no training, and no source of electricity.

Source: COA Validation

Based on research, we confirmed *(see Table 57)* that DA has the National Organic Agriculture Program, which donated rotary composters to LGUs to help with biodegradable waste.[64] On the other hand, DOST donated a bioreactor, plastic 'densifier', and shredder to LGUs under their Small Enterprise Technology Upgrading Program (SET-UP).

Table 57: Comparison of EMB, DA, and DOST SWM-Related Programs

	EMB	DA	DOST
Program/ Project Name	Financial Support and Incentive to functional EMB-Funded MRFs	National Organic Agriculture Program (NOAP)/ Composting facilities for Biodegradable Waste	Grants-in-Aid (GIA) Program/Establishment of Bioreactor and Vermicomposting Facility
Objective related to SWM	Increase LGU compliance to RA 9003 and waste diversion	Support the use of organic fertilizer/compost made from biodegradable market wastes in rural farming and urban communities to increase net revenue, and lower production costs	Upgrade the facility through the acquisition of Bioreactor Technology to further improve the processing of Biodegradable materials
Beneficiaries	LGUs	LGU	Any Filipino public or private entity.

Source: COA Analysis

[64] *Composting Facilities for Biodegradable Wastes.* BSWM. Retrieved January 4, 2023, from http://bswm.da.gov.ph/download/composting-facilities-for-biodegradable-wastes-cfbw/

Through an Audit Query Memorandum (AQM), DENR-EMB confirmed no coordination with other agencies, such as DA or DOST, regarding distributing assistance and equipment to LGUs nationwide. Moreover, DENR-EMB added that there were no existing guidelines as to the extent the concerned agencies were ensuring that there was no overlap or duplication.

As far as DENR-EMB was concerned, the data on waste segregation was the basic information vital to determining the target LGU beneficiaries for equipment assistance. This data emanating from the WACS will eventually dictate what kind of SWM equipment is needed to impact waste diversion and provide livelihood opportunities to residents significantly.

According to DENR-EMB, the prioritization of LGUs receiving equipment was based on the waste generation data and coordination with its Regional Offices. Once the recipients are identified, LGUs will receive notices about the equipment donation. However, one clear criterion about their guidelines was that the LGU should not have been a recipient or was not yet able to receive equipment from any DENR-EMB procurement before. Consequently, DENR-EMB validates whether the LGU recipient already has similar equipment received from DENR-EMB but not from other agencies.

Additional research revealed that this concern was not entirely new, as this was already reported in previous SWM dialogues. According to the report, no existing database can assist in synchronizing and coordinating the SWM implementation at all levels. Similarly, DENR-EMB confirmed no inventory of existing solid waste facilities from other agencies, such as DA and DOST, nationwide. Based on records, inventory was only limited to EMB-funded equipment.

According to DENR-EMB, several challenges prevent accumulating data from the LGUs or other agencies providing equipment. These include a lack of ownership as to who was responsible for the access of needed data, the reluctance of some stakeholders to share data, and given less priority in lieu of more important matters, especially pandemic-related issues and concerns, and connectivity issues, especially from those LGUs in remote locations.

In addition to discovering multiple and similar types of equipment *(see Figure 74)*, we also noted that not all units were being used. The LGUs we interviewed explained that they already had the necessary equipment, and therefore, saw no need to use similar equipment. On the other hand, there were also LGUs or barangays we interviewed that had not yet received equipment from DENR-EMB and hence, would like to request equipment to increase their waste diversion. Moreover, based on validation, we identified eight MRFs without equipment for recycling *(see Appendix III for complete TSO findings)*.

Figure 74: Sample Units of SWM Equipment Donated by DA and DOST in MRFs

Location: Barangay Maoas-oas, Pugo, La Union (Left: Composter; Right: Shredder)

Location: Barangay Minadongjol, Sangay, Camarines Sur (Left: Composter; Right: Shredder)

Location: Barangay Catipan, Mabuhay, Zamboanga Sibugay

Location: Barangay Kahayagan, Olutanga, Zamboanga Sibugay

Source: COA Validation

However, suppose this lack of coordination resulting in an overlap of beneficiaries continues, the government's scarce resources will be divided further without accounting for whether beneficiaries need the assistance or whether the different programs cover the entirety of applicable beneficiaries to ensure no one is left behind.

Non-Establishment of Standard Tipping Charges by NSWMC

NSWMC had neither established adequate guidelines nor formulas for tipping charges and rates that SLF operators will charge for managing or disposing of residual wastes, among others. Hence, no standard tipping fee was available to LGUs for benchmarking and transparent decision-making.

According to RA 9003, NSWMC shall establish, after notice and hearing of the parties concerned, standards, criteria, guidelines, and formula that are fair, equitable, and reasonable, tipping charges and rates that the proponent will charge in the operation and management of SWM facilities and technologies.

However, confirmation from DENR-EMB revealed that these standards and formulas were not established. Instead, the private sector was ceded the power to impose fees based on the stipulated agreement in the contract or MOA with the LGUs. According to Rule XVII Section 3 of IRR of RA 9003, the private sector or civil society group shall impose fees for collection, transport, and tipping in their SLFs. While, receipts and invoices shall be issued to the paying public or to the government.

Consequently, this resulted in varying tipping fees for LGUs nationwide *(see Table 58)*.

Table 58: Tipping Fees Charged to LGUs from CYs 2019 to 2021

LGU	Tipping Fee per metric ton		
	2019	2020	2021
NCR (thru MMDA)*	₱ 356.38	₱ 534.59	₱ 534.02
Marikina, NCR	2,272.92	3,145.91	3,090.20
Ballesteros, Cagayan	1,667.36	1,643.66	1,401.79
Bayombong, Nueva Viscaya	1,458.08	2,470.37	2,754.46
Ilagan, Isabela	3,371.23	4,230.96	5,291.06
Aurora, Isabela	837.72	984.95	924.66
Tumauini, Isabela	297.15	307.30	371.69
Bocaue, Bulacan	1,250.00	1,109.78	1,206.65
Guinayanagan, Quezon	5,042.12	5,154.18	5,831.75
Tiwi, Albay	4,999.92	5,000.00	5,000.00
Catigbian, Bohol	1,500.00	1,500.00	1,500.00

Note: Data from MMDA were converted from cubic meters to metric tons using the equation 1 cubic meter = 481 kgs[65]

Source: Various LGU data

Moreover, DENR-EMB confirmed that NSWMC does not monitor these tipping fees. Due to the current condition of the limited SLF in the country, the NSWMC Secretariat, through the DENR-EMB Regional Office, monitors the tipping fees charged by the SLF operators for the data-keeping.

[65] *Weight of Garbage, household rubbish*. Retrieved January 3, 2023, from https://www.aqua-calc.com/calculate/volume-to-weight/substance/garbage-coma-and-blank-household-blank-rubbish

Over the years, LGUs and MMDA have spent billions of pesos on tipping fees yearly without adequate standards, criteria, guidelines, and formulas issued by NSWMC. Although Rule XVII of the IRR of RA 9003 discussed the minimum factors to be considered in the tipping fees for solid waste disposal, a proper study and guidelines will ensure that tipping fees are not disadvantageous to the government.

Non-Preparation of the list of NEAPs from 2001 to 2020

Only two products were listed as NEAP: plastic soft drink straws and plastic coffee stirrers. These NEAPs were listed only on February 2, 2021, through the NSWMC Resolution No. 1428, Series of 2021.

One of the provisions of RA 9003 is to prepare, review, and update the list of NEAPs, provided, however, that NEAP shall not be prohibited unless the Commission first finds that there are alternatives that are available to consumers at no more than ten percent greater cost than the disposable product.

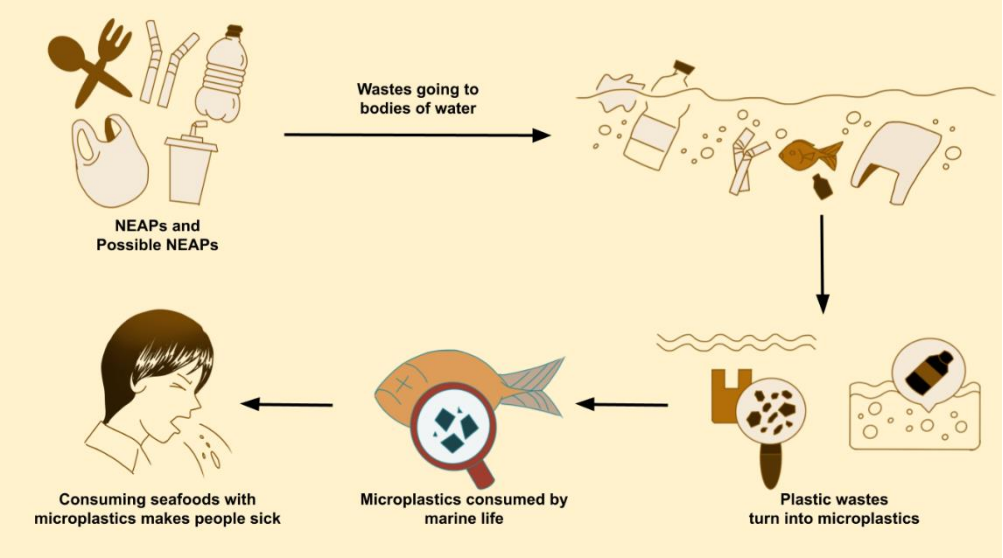
In addition, the IRR of RA 9003 detailed what must be done to decide which products should be declared as NEAP. According to Section 5, Rule XII of IRR of RA 9003, prohibiting NEAP and any decision to prohibit certain packaging types and products must be supported by available scientific, environmental, technical, and economic information and technical studies through, but not limited to life cycle assessment and economic analysis. The IRR also requires the Commission to consult with representatives from affected industries, subject to public notice and hearing.

As reported by DENR, the consultation from affected industries was one of the challenges they encountered, resulting in the delay of the NEAP list. In addition, NSWMC also experienced financial constraints in complying with the requirement of producing a study supporting the prohibition of products listed as NEAP. As established earlier, the NSWMC had not received any funding, including the mandated initial operating expense, and thus, the Commission has been working on a budget from DENR-EMB.

NSWMC explained that removing plastic from the market would make people unable to use any products at all. They further elaborated that shifting to reusable products could lead to a water shortage and worsen the wastewater discharge problem. These are some of the factors that they are evaluating. However, they are currently hindered in identifying alternatives unless the law is amended and the provision is removed, or a wonder product is developed. Thus, finding alternatives would be a challenge for the Commission.

According to reports, several plastic products may be considered NEAP and, therefore, could have been avoided. Once listed in NEAP, the prohibition will ensure this waste will not add to the already occupied SLFs, RCAs, or dumpsites. These products may include plastic cups lower than 0.2 mm in thickness, plastic spoons, plastic forks, plastic knives, and plastic *labo* and thin-filmed *sando* bags lower than 15 microns.

Figure 75: NEAP and Microplastics Explained



Source: COA Analysis

What could have been avoided? NEAP will act as a waste avoidance strategy and aid in the growing concern over microplastics. In CY 2019, a study conducted by the Coastal Resources and Ecotourism Research, Development and Extension Center (CRERDEC) of the DENR-ERDB confirmed the presence of microplastics in 10 study areas nationwide, with the highest density found in the Tañon Strait Protected Seascape in Badian and Moalboal, Cebu[66]. There was also a study by Negros Oriental State University, Silliman University, and Arizona State University confirming the presence and diversity of microplastics in an edible finfish in the Philippines. According to this study, consuming seafood products contaminated with microplastics can negatively affect the human body. If microplastics accumulated in human bodies, this can result in an enhanced inflammatory response, size-related toxicity of plastic particles, chemical transfer of adsorbed chemical pollutants, and disruption of the gut microbiome, while microplastics and their chemical constituents may cause localized particle toxicity.[67] Although the primary sources of microplastics were not specifically identified in the study, the alarming effects are present, concerning the negative effects on our bodies from consuming seafood that may be contaminated with microplastics *(see Figure 75)*.

[66] DENR-ERDB, *supra* note 49, at 109.
[67] *Microplastics in marine sediments and rabbitfish (Siganus fuscescens) from selected coastal areas of Negros Oriental, Philippines*. (2019, November 6). ScienceDirect. Retrieved November 16, 2022, from https://doi.org/10.1016/j.marpolbul.2019.110685

Ratification of Basel Ban Amendment remains in progress

The Philippines has yet to ratify the Basel Ban Amendment to ensure that no illegal waste will be imported. This is despite the overall beneficial impact on the Philippines, where the long-term financial, environmental, and social benefits outweigh the short-term costs based on the results of a Cost/Benefit Study[68] and calls from different NGOs to ratify the Amendment.

One prohibited act of RA 9003 is importing toxic wastes misrepresented as “recyclable” or “with recyclable content”. In addition to the said RA, there is also the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (hereinafter referred to as “the Basel Convention”), which was adopted on March 22, 1989, and entered into force on May 5, 1992. The Basel Convention was convened in response to a public outcry following the discovery, in the 1980s, in Africa and other parts of the developing world of deposits of toxic wastes imported from abroad.[69]

In 1995, due to continued challenges faced by developing countries and countries with economies in transition in controlling imports of hazardous and other wastes, parties to the Basel Convention adopted the Basel Ban Amendment.[70] The Amendment would restrain the member states of the European Union, Organization for Economic Cooperation and Development (OECD), and Liechtenstein from exporting hazardous wastes either for recovery, treatment, or disposal to developing countries or countries with economies in transition. This will ensure that developing nations like the Philippines do not become convenient dumping sites for trash, even those intended for recycling.

While the Philippines is a party to the Basel Convention, which treaty was ratified by Congress on October 21, 1993, and entered into force on January 19, 1994, the country has yet to ratify the Basel Ban Amendment, which other parties have adopted since CY 1995.

The ratification of this amendment is under the responsibility of DENR, as the Competent Authority and Focal Point to the Basel Convention. Other stakeholders would be the private sectors that include Registered Importers of recyclable materials, industry associations, civil societies, and other government agencies such as the DTI, Philippine Economic Zone Authority (PEZA), Bureau of Customs (BOC), and Department of Foreign Affairs (DFA). DENR disclosed that ratifying the Basel Ban Amendment started with consultations with affected stakeholders from different parts of society. And to facilitate the consultations, a Socio-Economic Impact Study was commissioned by DENR focusing on the beneficial impact of ratifying the Ban Amendment. After the consultations were completed, DENR initiated the request for a Certificate of Concurrence from other Government Agencies to inform them of the result of the study and consultations. This Certificate of Concurrence shall be signed by respective secretaries/heads of the concerned agencies as the basis of DENR to endorse the Ratification Dossier to the DFA through the United Nations and International Organizations Office (UNIO). The

[68] Cost/Benefit Study relative to the ratification of the Basel Ban Amendment
[69] *History of the negotiations of the Basel Convention*. Retrieved September 13, 2022, from http://www.basel.int/TheConvention/ Overview/History/Overview/tabid/3405/Default.aspx
[70] *The Basel Convention Ban Amendment*. Retrieved September 13, 2022, from http://www.basel.int/ Implementation/LegalMatters/BanAmendment/Overview/tabid/1484/Default.aspx

final step will be DFA's preparation of the Instrument of Ratification to be endorsed to the Office of the President for approval and signature. Once approved, the DFA will transmit the said instrument of ratification to the United Nations (UN) Headquarters in New York for official acceptance.

At present, DENR is still securing approval of the Certificates of Concurrence from DTI, PEZA, and BOC. On the other hand, NGOs, such as Greenpeace and EcoWaste Coalition, have expressed their strong support for ratifying the Basel Ban Amendment so that the Philippines will no longer be a garbage dump for some foreign countries. According to these NGOs, the government should address the policy gaps or loopholes in the governing laws exposing our country to threats of exploitative and unjust trade in hazardous waste and other wastes.

According to DENR-EMB, the delay in ratifying the Basel Ban Amendment is the concerns raised by the recycling industries dependent on importing recyclable materials, either classified as hazardous or non-hazardous wastes. By ratifying the Ban Amendment, our local recyclers or importers will no longer be able to import recyclable materials from OECD states. This includes importing Used Lead Acid Batteries (ULABs) and Waste Electrical and Electronic Equipment (WEEE) for recycling and recovery.

However, the results of the Socio-Economic Impact Study on Ratifying the Ban Amendment showed an overall beneficial impact on the Philippines where the long-term financial, environmental, and social benefits outweigh the short-term costs per Final Study Report on the Cost-Benefit/Economic Study Relative to the Ratification of the Basel Ban Amendment commissioned by the DENR-EMB *(see Table 59)*.

Table 59: Summary of the Costs and Benefits of the Basel Ban Amendment

Hazardous Waste	Scenario A: Increase Imports from Non-OECD Countries	Scenario B: Increase Imports of Primary Raw Materials / No Replacements for OECD Imports
Financial		
ULABs	(+)$100,822,010.00 (+) ₱5,041,100,500.00 Additional Benefit of Increased Local Collection and Recycling >= $54,260,006.00	(+)$3,269,484.00 (+) ₱163,474,217.00
WEEE	(-)$17,025,908.00 (-) ₱851,295,400.00	(+)$1,988,929.00 (+) ₱99,446,430.00
Total Financial Benefit	**(+) ₱6,902,805,400**	**(+) ₱262,920,647.00**
Non-Financial		
ULABs	None	Positive Impacts • Reduced Lead releases by 121kg • Less worker exposure from ULAB

Hazardous Waste	Scenario A: Increase Imports from Non-OECD Countries	Scenario B: Increase Imports of Primary Raw Materials / No Replacements for OECD Imports
		recycling
WEEE	None	Positive Impacts ● Reduced emissions/discharges from WEEE recycling ● Less worker exposure from WEEE recycling ● Increased local collection and recycling of WEEE through EPR Negative Impact ● Closing of businesses that recycle WEEE only and only those that are imported from OECD countries

Source: Socio-Economic Impact Study on Ratifying the Ban Amendment commissioned by DENR-EMB

By ratifying the Ban Amendment, the recycling industry would benefit from ULABs for $3,269,484.00 or $155,082,016.00 ($100,822,010.00 + $54,260,006.00) per year, depending on the chosen scenario. While the recycling industry for WEEE would benefit from $1,988,929.00 per year. There are also non-monetary benefits for both ULABs and WEEE recycling industries, such as a reduction of lead releases by 121 kg per year, less worker exposure from ULAB recycling, reduced emissions/discharges from WEEE recycling, less worker exposure from WEEE recycling, and increased local collection and recycling of WEEE through EPR. Lastly, one major disadvantage to the recycling industry is the closure of businesses that recycle only WEEE sourced from OECD countries. These non-monetary benefits/disadvantages will only occur if the country adopts Scenario B.

Since the Philippines has yet to ratify the Basel Ban Amendment, the country risked accepting toxic or hazardous waste mislabeled or misdeclared as "recyclable" or "with recyclable content". Below are some of the reported illegal waste imported to the Philippines *(see Table 60)*:

Table 60: Reported Illegal Waste Imported to the Philippines

Year Imported and Country of Origin	Volume/Weight of Waste	Actual waste found	Year and Action Taken
2014, Canada	103 container vans or 2,400 tons of hazardous waste mislabeled as plastic for recycling[71]	Plastic bottles, plastic bags, newspapers, household garbage, and used adult diapers	34 containers were disposed of in the SLF of Metro Clark Waste Management Corporation by a virtue of a Court Order

[71] *Timeline: Canada garbage shipped to the Philippines.* Rappler. Retrieved September 13, 2022, from https://www.rappler.com/newsbreak/iq/188654-timeline-canada-garbage-philippines/

Year Imported and Country of Origin	Volume/Weight of Waste	Actual waste found	Year and Action Taken
			69 containers were shipped back to Canada[72]
2018, South Korea	331 container vans of toxic waste mislabeled as plastic synthetic flakes	Unsorted plastic materials, used dextrose tubes, soiled diapers, discarded electronics, and household garbage	All were shipped back to South Korea[73]
2019, Hong Kong	2,561 tons of smashed components of electronic devices misdeclared as assorted electronic accessories	Shredded gadget parts and plastic scraps	All were shipped back to Hong Kong[74]
1999, Japan	122 container vans of hazardous waste misdeclared as 80% waste paper and 20% plastic	Disposable plastic syringes, rubber surgical gloves, adult diapers, candy wrappers, aluminum foil, rubber soles, sanitary napkins, plastic bags, and noodle cups bearing Japanese characters	All were shipped back to Japan[75]

Source: Various sources

While the Philippines has managed the disposal or return of these illegal wastes to its origin country, our country continues to be exposed to the illegal waste trade not until the Basel Ban Amendment is ratified and adopted. Nonetheless, the DENR, in ensuring that illegal waste importation will not occur again, committed to strengthening and updating environmental laws and waste importation policies, and capacity building and coordination with border authorities, particularly the BOC, DENR-EMB Regional Offices, other government agencies, and international organizations.

[72] *Canada takes garbage back from Philippines, ending long dispute.* GMA News Online. Retrieved September 13, 2022, from https://www.gmanetwork.com/news/topstories/nation/699354/canada-takes-garbage-back-from-philippines-ending-long-dispute/story/
[73] *Philippines Returns 80 Containers of South Korean Garbage*. IPEN. Retrieved September 13, 2022, from https://ipen.org/news/philippines-returns-80-containers-south-korean-garbage
[74] *E-wastes held in MisOr shipped back to Hong Kong.* Philippine News Agency. Retrieved September 13, 2022, from https://www.pna.gov.ph/articles/1071417
[75] *Japan takes back hazardous waste from Philippines.* The Free Library. Retrieved September 13, 2022, from https://www.thefreelibrary.com/Japan+takes+back+hazardous+waste+from+Philippines.-a058532706

Conclusions

More than 20 years after the passage of RA 9003, waste management has continued to be an issue of concern. The projection made it even more pronounced that annual solid waste creation will rise from 16.63 million metric tons in CY 2020 to 19.76 million metric tons in CY 2030 and 24.50 million tons in CY 2045.

While the NSWMC, the DENR-EMB, and the LGUs, have partnered to achieve the goals of RA 9003, the intended results still need to progress. We found delays in the preparation and approval of LGUs' 10-yr SWM Plans, which affected the budgeting and implementation of LGU's SWM activities. While LGUs strived to comply with the mandated waste diversion, results from available data showed that actual waste diversion is still far from targets. Further, records showed that the total number of MRFs is insufficient to service all barangays nationwide, and the total number of SLFs is insufficient to service all LGUs nationwide. DENR has allowed using RCA as a temporary disposal site to remedy this gap. However, while serving as a short-term alternative, the operations of RCAs without formal guidelines have potential risks if operated longer than intended.

On a positive note, DENR, through EMB, has successfully reduced the number of illegal dumpsites from 1,232 in CY 2009 to zero in CY 2021. However, our validation from March to April 2022 revealed that not all dumpsites were successfully and permanently closed. We found that LGUs had to reopen or establish a new dumpsite due to a lack of capacity to construct their own SLF and/or lack of funds to enter into an agreement with an SLF operator and pay tipping fees. Further, climate change has also accelerated the need to find measures to reduce and manage the waste generated and to reduce the greenhouse gas emissions resulting from open burning and biodegradable wastes in landfills or dumpsites.

Achieving SWM objectives cuts across a number of SDGs. However, at the rate the waste generation is projected to increase, it will heavily impact SDG 12.5 which is to substantially reduce waste generation, through prevention, reduction, recycling, and reuse by CY 2030. Unfortunately, the relevant SDG indicator has not yet been included in the monitoring by PSA; thus, no progress in attaining the target can be tracked. Meanwhile, even national targets on waste diversion rate and the number of barangays served by an MRF were not attained during the audit period.

LGUs are consistently provided with technical assistance, capability support, and information dissemination on SWM; however, LGUs are still burdened with challenges that hampered the effective and efficient implementation of its 10-yr SWM Plans and the achievement of the goals of RA 9003. For example, the inconsistent implementation of waste segregation nationwide inadvertently resulted in mixed waste collection, hazards to workers in landfills, and SLFs exceeding capacity levels. Therefore, there is a need for more consistent implementation of waste collection nationwide. In addition, we found that collection assignments and responsibilities deviated from RA 9003 due to either limitations at the barangay level or a lack of coordination with their local government. Thus, either LGUs cover and collect all types of waste, or household wastes are not collected.

Several EMB-funded MRFs, including units/sets of equipment, have yet to be established or operational. Due to a lack of appropriate land siting or delay of utilization by the LGUs, there are at least ₱124.22 million earmarked for MRF establishment and SWM equipment fabrication which remained outstanding as at June 2022. Likewise, there is at least ₱555.65 million worth of equipment, or at least 635 units or sets of equipment which are reported as not operational as at May 31, 2022, due to various reasons, but mainly due to lack of electricity lines. Further, some MRFs lack the mandated recording mechanism, including a weighing scale, and thus would result in unreliable and incomplete data on waste diversion. In addition, uncollected and unprocessed waste materials accumulate in some MRFs due to LGUs' difficulties in processing, selling, or disposing of their recyclable wastes. Hence, this accumulation of waste is overwhelming the MRFs and posing a risk to possible environmental hazards if waste is not managed soon. Furthermore, there are noted non-establishment of M/CENRO positions and overwhelming work of EnMOs.

On the other hand, we gathered several practices that can be replicated or improved by LGUs. Despite the challenges and limitations of LGUs, there are still LGUs that showcased resourcefulness in finding ways to divert waste. Moreover, various private companies, including non-governmental organizations, have also participated in local SWM programs to contribute to waste diversion and effective waste management.

Regarding the program's planning, implementation, and monitoring under RA 9003, we found gaps mainly due to inadequate institutional mechanisms to kick-start the program. The mandated appropriation of ₱20 million for the initial operating expense of the NSWMC, the NEC, and the LGUs was not released. Moreover, the SWM Fund has not yet been established, which would have been used by NSWMC and LGUs to implement their 10-yr SWM Plans. Because these mandated funding sources were not realized, NSWMC has worked only on a budget provided to the DENR-EMB for SWM activities. While the DENR-EMB has provided certain budgetary allocations of the NSWMC, it does not include, however, the realization of some mandates of the NSWMC. This includes the establishment of the NEC, which shall support the implementation of RA 9003 by making available information, consulting, training, and networking services. However, no organizational structure, personnel assigned, or budget has been allotted for the NEC. Hence, to implement the NEC mandate, the Secretariat or the DENR-EMB has been partly functioning as the NEC since CY 2002.

We also noted overlapping LGU beneficiaries due to a lack of coordination between DENR, DA, and DOST, resulting in barangays or MRFs with multiple and similar equipment from different agencies. While some barangays or MRFs benefit from this larger capacity to divert waste, some units/sets of equipment were also found idle and unused. Additionally, the Basel Ban Amendment has not yet been ratified despite the commissioned study by DENR-EMB showing that ratification would have an overall beneficial impact on the Philippines where the long-term financial, environmental, and social benefits outweigh the short-term costs. Lastly, we found that the NSWMC updated the NEAP list only in CY 2021, thus delaying the beneficial effects it would have accorded the environment.

Overall, necessary and appropriate steps have to be implemented to improve the enforcement and compliance with RA 9003, which currently remains a difficult task because of political, financial, and technical limitations of the LGUs and other concerned agencies, as observed in our performance audit.

Recommendations

Given the opportunities for improvement noted in the performance audit of the SWMP, COA recommends to NSWMC the following courses of action:

(a) Continue the technical assistance provided to LGUs in the preparation of timely and relevant SWM plans;
(b) Expedite the review and approval of SWM plans submitted by LGUs;
(c) Institutionalize a robust data system, including collection and reporting on waste generation, diversion and disposal, and inventory of waste facilities, to improve monitoring and to enable review of future targets and plans for the effective, efficient, and economical SWM implementation, as well as monitoring and assessment in relation to national targets and SDGs.
(d) Prepare relevant guidelines to ensure the establishment and operation of MRS, caged MRFs, and RCAs are compliant with Sections 33 and 37 of RA 9003;
(e) Ensure that established MRFs are utilized, and wastes diverted are recorded;
(f) Ensure that established SLFs adhere to applicable standards and measures for safe and sustainable operation, especially avoidance of landfills operating at overcapacity levels;
(g) Review and provide alternative options for LGUs to comply with the minimum criteria in establishing an SLF;
(h) Assist and encourage LGUs to take advantage of the benefits of clustering a Common Solid Waste Disposal Facility;
(i) Review the applicable fines and penalties to violators of RA 9003 and effectively enforce the same through DENR;
(j) Review and strengthen the incentives and penalty mechanisms to provide clear structures to the public who are the primary implementers of segregation-at-source;
(k) Facilitate coordination or sharing of responsibility and best practices among national agencies and local governments to resolve the financial, logistical, and technical issues encountered by LGUs in establishing MRFs and to ensure that there is no overlap of beneficiaries and that all LGUs have an equitable chance to benefit from the program;
(l) Assist LGUs, in coordination with other agencies, in providing waste management education and awareness to households and institutions, particularly waste avoidance, segregation, and proper disposal;
(m) Assist LGUs, in coordination with other agencies, in selling segregated or processed recyclable wastes to ensure that these wastes are not accumulated in MRFs or disposed of in landfills;
(n) Coordinate with concerned agencies on the provision of the initial operating budget mandated in RA 9003 and the establishment of the

SWM Fund, including the establishment of the necessary institutional arrangement to administer the fund properly;

(o) Coordinate with concerned agencies to formally operationalize the National Ecology Center, including the establishment of the organizational structure, personnel and experts, and budget to deliver the mandates of NEC;
(p) Coordinate with concerned agencies to review and establish standards, criteria, guidelines, and formulas for establishing tipping charges to ensure that tipping fees by proponents or SLF operators are fair, equitable, and reasonable;
(q) Coordinate with concerned agencies to prioritize the process of review and approval of submitted and future NEAP proposals;
(r) Coordinate with concerned agencies to help LGUs institutionalize the Environment and Natural Resources Office, that would ensure that the objectives and plans for delivering environmental and natural resource development principles are carried out effectively and efficiently;
(s) Coordinate with concerned agencies and LGUs to ensure an equal proportion of men and women holding M/CENRO positions; and
(t) Coordinate with NGOs or Private Companies with SWM Partnerships with national or local governments to ensure that best practices are recorded for information dissemination and practices are maintained after partnerships are completed.

On the other hand, COA recommends that the NSWMC coordinate with the DENR-EMB to take the following actions:

(a) Ensure that recipients of MRF financial assistance and SWM equipment have the necessary requirements to establish or operate the MRF and the equipment, including appropriate matching of equipment to what type of waste needs to be processed;
(b) Monitor the utilization of MRF financial assistance and SWM equipment provided to LGUs to ensure that MRFs and equipment are established and utilized as intended;
(c) Ensure that necessary training and demonstration are provided to beneficiaries after delivery of SWM equipment by the supplier;
(d) Coordinate with concerned agencies to prioritize the ongoing process of ratifying the Basel Ban Amendment and to continue strengthening implementation and updating their policy on importing recyclable materials containing hazardous substances; and
(e) Monitor the assignments of EnMOs nationwide to ensure work viability and personnel's well-being.

Finally, COA recommends that the NSWMC, through the DENR-EMB, coordinate with the DILG and ULAP to ensure that LGUs will examine and provide appropriate actions or measures on the following significant concerns:

(a) Incomplete/Non-recording of waste generation, diversion, and disposal
(b) Inconsistent waste segregation and collection
(c) Mixed waste collection and disposal
(d) Non-compliance of mandatory waste diversion
(e) Non-establishment of MRFs
(f) Non-operational units/sets of SWM equipment

(g) Accumulated wastes in MRFs
(h) Illegal use of dumpsites
(i) Social unacceptability of SLFs among the residents
(j) Reluctance to clustering for a Common Solid Waste Disposal Facility
(k) Non-enforcement of fines and sanctions to violators of RA 9003
(l) Hazards to workers at landfills, including household healthcare waste
(m) Hazards to establishments or residents within 200m from landfill or dumpsite
(n) Gender inequality in the hiring of M/CENROs.

Agency Comments

We provided a draft of this report to the NSWMC for comment. NSWMC provided written responses which we incorporated as appropriate in this report.

Contact points for our Performance Audit Office may be found on the last page of this report. Major contributors to this report are listed in Appendix V.

In addition, the report will be available at the COA website at https://www.coa.gov.ph.

MICHAEL L. RACELIS
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Performance Audit Office
Special Services Sector

Appendix I: Objectives, Scope and Methodology

COA conducts performance audits to help government agencies better perform their mandates and achieve program goals and objectives more economically, efficiently, and effectively. It identified the Solid Waste Management Program (SWMP), which implementation is under the supervision of the National Solid Waste Management Commission (NSWMC) chaired by the Secretary of the Department of Environment and Natural Resources (DENR), as one of the priority programs, which will be audited. The audit aimed to determine: (1) the extent the program achieved its goals and objectives; (2) the challenges in implementing the program; and (3) the extent the program implementers administered the program following established policies and procedures.

To determine the extent the SWMP achieved its goals and objectives and the challenges encountered in implementing the program, we conducted desk reviews on relevant laws, policies, rules, and regulations related to SWMP. This includes documentation such as accomplishments and status reports of established Materials Recovery Facilities (MRFs), Sanitary Landfills (SLFs), Residual Containment Areas (RCAs), 10-year SWM Plans, and Illegal Dumpsites. Moreover, validations were conducted on sample LGUs and barangays with MRF, SLF, RCA, or dumpsite to assess the operation and the challenges encountered. We also obtained and analyzed relevant documentation on SWM from the DENR, scholarly articles, and third-party evaluation reports. Moreover, we also conducted site visits to different Local Government Units (LGUs) and barangays and took geo-tagged photographs.

To enhance stakeholder relations, we adopted a Citizen Participatory Audit approach. This involved engaging a Citizen Partner who is a former COA Auditor with extensive knowledge and experience in the field. She assisted us in collecting information and evidence from CSOs/NGOs and specific barangays. The collection of information was done through the conduct of surveys and interviews.

To determine the extent to which the NSWMC, the DENR, and other concerned agencies administer the program following established policies and procedures, we reviewed applicable laws, rules, and regulations related to SWMP to determine the respective roles of the concerned government agencies and stakeholders. We also interviewed DENR, LGUs, barangay officials, and various stakeholders, including NGOs, to determine the actions taken to implement the program according to the established guidelines.

In the surveys and validations conducted, we used a combination of generalizable and non-generalizable samples; hence, some data will only indicate the presence but not the extent of the condition in the population.

We used generalizable sampling to obtain a broad understanding of SWM. We consulted the NSWMC, DENR-EMB Central and Regional Offices, and other concerned agencies and gathered LGU survey and summary reports. The survey and summary reports were inclusive of all Regions. The LGU survey

provided us with a basic overview of the waste management facilities utilized by the local government entities. In addition, the summary reports offered information regarding the progress of SCRPs, EnMO, M/CENRO posts, private sector contributions, MRF equipment acquisitions, and financial assistance.

Regarding the non-generalizable sample used, we grouped the regions based on the area's average MRF cost and diversion rate. Then, selecting the location of interest was based on its data quality by selecting the extremes (high and low-quality data). Next, we drew a stratified random probability sample of 45 MRFs from the selected regions from the DENR-EMB's data of 978 MRFs. With that probability sample, each member of the study population had a nonzero probability of being included, and that probability could be computed for any member. After drawing a sample, we stratified the population into six (6) groups based on the MRF's diversion, cost, and data quality, such as High Cost-High Diversion, High Cost-Low Diversion, High Cost-No Data, Low Cost-High Diversion, Low Cost-Low Diversion, and Low Cost-No Data. Finally, for clarity, we calculated the sample size of 45 from the population of 978 using Cochran's formula for the finite population since the population size is known (determined). Since each sample could have provided different estimates, we presented its confidence in the precision of the particular sample with a confidence level of 80 percent, a margin of error of 9.3 percent, a probability of success, and failure of 50 percent.

On the other hand, we used a non-generalizable sample again to gather insights on audit objectives about disposal facilities, such as SLFs, RCAs, and dumpsites. We selected nine (9) regions that will be used for the validation, where one SLF, one RCA, and one dumpsite shall be visited per region. On top of validating the disposal facilities, we interviewed at least five workers in each facility, if there were any. However, due to various limitations, we used the convenience sampling method to validate SLFs, RCAs, dumpsites, and the workers.

Overall, we determined that the data used in this report were sufficiently reliable to assess the status and condition of the SWMP implemented by the NSWMC, the DENR, and LGUs.

We conducted the audit from June 2021 to September 2022 following the Standard for Performance Auditing as embodied in the International Standards of Supreme Audit Institutions (ISSAI) 3000. The standard requires that we plan and perform the audit to obtain sufficient and appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. Accordingly, we believe the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Appendix II: Survey and Interview Results

To gather the additional source of information to answer the audit objectives, we conducted various methodologies in gathering testimonial evidence from relevant stakeholders. The participants of these methodologies, include households, workers, teachers, students, barangays, and LGUs. While the type of methodology used is highly dependent on the convenience of the participants or respondents.

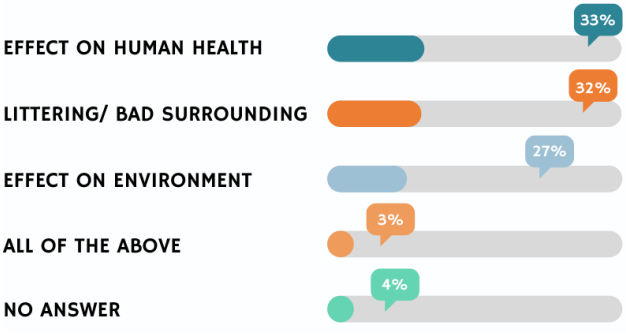
Stakeholder	Methodology	Number of Actual Respondents
Households	Face-to-face Survey	360
Workers	Face-to-face Survey	96
Teachers	Google Forms	2,646
Students	Google Forms	4,952
LGUs	Google Forms	591 out of 1,634
Barangay	Structured Interview	42 out of 45

Overall, we targeted to visit and interview 45 barangays and inspect the EMB-funded MRF in each of that barangay. For every barangay/MRF, we surveyed eight (8) households. For the other stakeholders, the number of respondents depended on the availability of workers in inspected MRFs, SLFs, and RCAs and the submissions received after the cut-off for online surveys for teachers, students, and LGUs. On the other hand, we could not gather responses from three (3) barangays due to limitations during the validation.

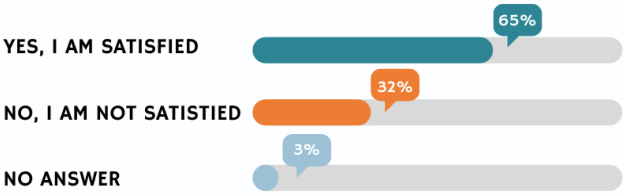
As to the results of these testimonials, they served as a source of information for validation of the existence of beneficiaries, processes, and mechanisms the officials have used to implement the program, level of awareness of stakeholders on the SWMP, areas for improvement and other data for analysis in support of the audit objectives.

Households Survey

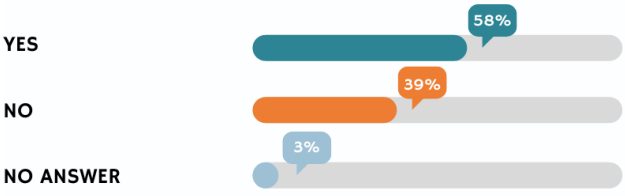
WHICH IS THE PRIORITY CONCERN?



ARE YOU SATISFIED WITH THE CURRENT WASTE COLLECTION SERVICE?



ARE THERE ANY PUBLIC BINS NEAR YOUR HOUSE?

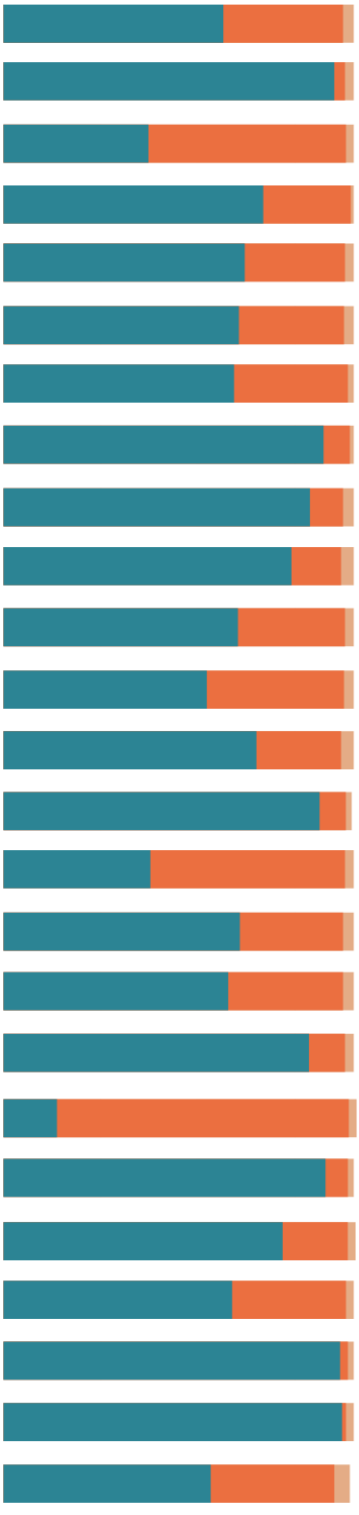


SWM KNOWLEDGE & AWARENESS

33%	33% of households surveyed said it is legal to have an open dumpsite.
66%	66% of households surveyed said it is legal to burn leaves in the backyard.
77%	77% of households surveyed said that burning garbage in the backyard is not allowed.
88%	88% of households surveyed said that reduce means lessening the amount of trash/garbage produced.
89%	89% of households surveyed said that people are not allowed to live in open dumps and sanitary landfills.
95%	95% of households surveyed said that throwing garbage in roads, sidewalks, canals, esteros or parks is not allowed.
78%	78% of households surveyed said it is legal to throw batteries in open dumps or controlled dumps, or sanitary landfills.
69%	69% of households surveyed said that plastics are thrown in non-biodegradable trash bin.
96%	96% of households surveyed said there should be a materials recovery facility in every barangay.
33%	33% of households surveyed said that establishments are not allowed within 200 meters from open dumps or controlled dumps, or sanitary landfills.
60%	60% of households surveyed said that biodegradable waste is waste or garbage that cannot be broken down or decomposed.
16%	16% of households surveyed said that hospital waste is not allowed in open dumps or controlled dumps, or sanitary landfills.
92%	92% of households surveyed said that toxic materials present in the waste stream should be separated at the materials recovery facility.
54%	54% of households surveyed said that throwing their own garbage directly in a sanitary landfill or open dumpsite is not allowed.
12%	12% of households surveyed said that throwing light bulbs in open dumps or controlled dumps, or sanitary landfills is not allowed.

Appendix II: Survey and Interview Results

HOUSEHOLD EXPERIENCES



- 63% have attended awareness program on SWM conducted by barangay/LGU
- 94% of households surveyed know how to segregate waste
- 41% received incentives from barangay for segregating wastes
- 74% of households surveyed know about penalties for violation of SWM
- 69% of households surveyed know about RA 9003
- 67% of households surveyed are aware of electronic waste
- 66% of households surveyed know how to dispose electronic waste
- 91% of households surveyed answered that their LGU is segregating waste
- 88% confirmed that waste segregation is being required by collector/barangay
- 82% confirmed that public bins are segregated according to type of waste
- 67% confirmed that trash can been seen littered in their area
- 58% answered that they saw people burning waste
- 72% answered that they saw garbage collectors equipped with PPE
- 90% answered that they segregate COVID-19 related waste
- 42% answered they are using yellow plastic/bin/ribbon for COVID waste
- 68% answered they have discussed waste issues with community/barangay
- 64% know that recyclables, biodegradable, or both go to the MRF
- 87% answered that their LGU has ordinances for collection and disposal
- 15% answered they know how much is being paid to dispose waste in landfills
- 92% would like to receive more IEC about waste collection and disposal
- 80% answered that they conduct recycling
- 65% answered they take recyclable wastes to shops for refund/sale
- 96% will participate in waste segregation if recycling program exists
- 97% believed that individuals should take action to correct waste problems
- 59% answered that their barangay collect different waste on different days

HOUSEHOLDS' COMMENTS AND SUGGESTIONS

- Trash is not being collected every week
- Need to enforce segregation in all households
- Need stricter implementation of penalties for SWM violations
- Need more IEC about SWM
- Satisfied with current SWM practices and no complaints

Worker Survey

EXPERIENCES

NEGATIVE EFFECTS OF WORKING IN MRF/SLF

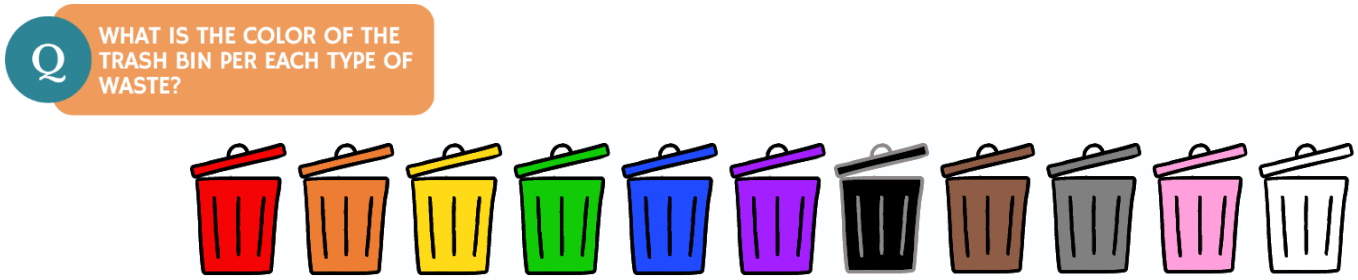
- Colds
- Fever
- Allergies
- Cough
- Headache
- Chest pains
- Nausea
- Fatigue

CHALLENGES IN WORKING IN THE FACILITIES

- Job uncertainty
- Need more equipment
- Need more maintenance
- Health risk over household COVID waste
- Need electricity for equipment
- Unsegregated waste need sorting
- Low salary
- Need PPE, more so during bad weather
- Need more benefits, like medicine or insurance

Appendix II: Survey and Interview Results

Teachers and Students Survey



Waste	Red	Orange	Yellow	Green	Blue	Violet	Black	Brown	Gray	Pink	White
Biodegradable	1,945	1,142	1,408	4,347	1,497	1,083	1,212	1,534	1,251	1,265	1,379
Non-Bio	2,445	1,551	1,666	1,013	1,858	1,007	1,139	881	980	929	906
Chemicals	1,025	686	1,082	189	509	566	1,355	510	537	370	444
Recyclable	1,089	856	1,426	1,047	1,884	501	484	444	544	567	547
Residual	309	786	874	453	606	537	684	502	483	363	351

LGU Survey

Region	LGUs with ordinances	LGUs without ordinances	LGUs with submitted ordinances to the team
CAR	32	0	30
NCR	12	0	10
1	6	0	6
2	81	1	74
3	83	13	87
4A	15	0	13
4B	61	5	53
5	27	3	24
6	41	6	41
7	75	3	68
8	9	0	8
9	36	1	32
10	5	0	5
11	37	1	35
12	32	1	29
13	5	0	5
Total	557	34	520

Appendix II: Survey and Interview Results

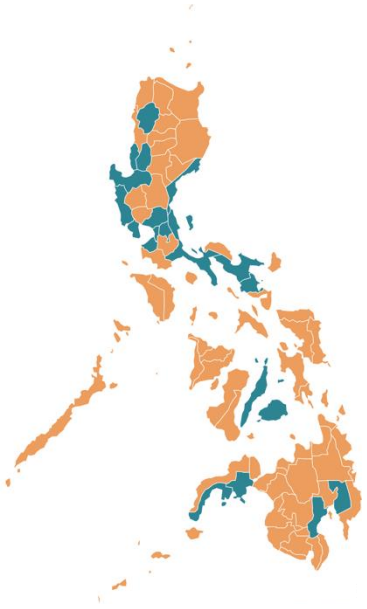
Q HOW MANY MRFS ARE OPERATING AND SERVICING BARANGAYS?

A OUT OF 591 LGUS, 10,135 MRFS ARE OPERATING AND SERVICING A TOTAL OF 11,393 BARANGAYS

Region	City	Municipality	No. of Barangays (A)	No. of MRFs (B)	No. of Operational MRFs (C)	No. of Barangays serviced by MRFs (D)	% of Operational MRFs (C/B)	% of Barangays serviced by MRFs (D/A)
CAR	1	31	523	315	271	449	86	86
NCR	11	1	563	348	304	371	87	66
1	2	4	199	172	172	199	100	100
2	4	78	2,062	1,499	1,377	1,693	92	82
3	10	86	2,331	1,318	1,253	1,987	95	85
4A	0	15	400	232	214	282	92	71
4B	2	64	1,365	1,131	1,055	1,019	93	75
5	2	28	983	782	731	713	93	73
6	2	45	1,269	839	820	864	98	68
7	10	68	1,850	1,194	1,100	1,353	92	73
8	1	8	402	242	196	288	81	72
9	2	35	966	761	642	670	84	69
10	0	5	77	107	97	67	91	87
11	6	32	987	1,420	1,364	817	96	83
12	3	30	788	491	434	559	88	71
13	1	4	88	105	105	62	100	70
Total	**591**		**14,853**	**10,956**	**10,135**	**11,393**	**93**	**77**

Barangay Interview

	Region	No. of Sample Barangay
Luzon	CAR	4
	NCR	4
	1	5
	3	6
	4A	5
Visayas	5	5
	7	4
Mindanao	9	5
	11	5
	Total	**43**



Appendix II: Survey and Interview Results

Q DO YOU DIRECTLY COLLECT ALL THE WASTES FROM HOUSEHOLDS BEFORE PANDEMIC?	A 14 BARANGAYS SAID YES, WHILE 29 SAID NO.
Q IF NOT, WHO COLLECTS THE REMAINING WASTE FROM HOUSEHOLDS BEFORE PANDEMIC?	A 22 SAID WASTE IS COLLECTED BY LGU, 1 BY A PRIVATE COMPANY, 4 DELIVERED TO MRF, AND 2 USED BIODEGRADABLE AS BACKYARD COMPOST
Q WHAT DO YOU DO WITH THE RECYCLABLES COLLECTED FROM HOUSEHOLDS?	A 18 SOLD TO JUNKSHOPS, 4 GIVEN TO PRIVATE INSTITUTIONS, AND 7 GIVEN TO LGUS
Q WHAT DO YOU DO WITH THE BIODEGRADABLES COLLECTED FROM HOUSEHOLDS?	A 15 TURNED INTO COMPOST, 5 GIVEN TO LGUS, AND 1 COLLECTED BY PRIVATE INSTITUTION
Q DOES YOUR BARANGAY HAVE A NO SEGREGATION, NO COLLECTION POLICY?	A 27 HAVE SEGREGATION POLICY, 4 HAVE ADOPTED LGU POLICY
Q HOW DOES THE BARANGAY ENSURE THAT THE RESIDENTS ARE SEGREGATING WASTE?	A SIMILAR ANSWERS, INCLUDING: IMPLEMENTATION OF NO SEGREGATION, NO COLLECTION POLICY; REMINDERS THRU VISITATION OR MEETINGS; AND IEC
Q IS THERE A DEPUTIZED MEMBER OF THE BARANGAY WHO ISSUES SOLID WASTE VIOLATION TICKETS TO VIOLATORS?	A 8 HAVE DEPUTIZED MEMBER
Q WHAT ARE THE TYPICAL SWM VIOLATIONS IN YOUR BARANGAY?	A 25 BARANGAYS HAVE SIMILAR ANSWERS, INCLUDING: BURNING OF WASTE, AND LITTERING (IN LAND OR BODIES OF WATER)

Appendix III: Summary of Significant Technical Findings by TSO

Materials Recovery Facilities (MRFs)

Criteria	MRF Observations		Inspected Site Location			
			Region	Province	City/Municipality	Barangay
Sec. 1 (a) and (b) Rule XI, IRR of the RA 9003: The building and/or layout and equipment must be designed to accommodate efficient and safe materials processing, movement and storage. The building must be designed to allow efficient and safe external access and to accommodate internal flow.	Out of the 45 MRFs inspected, 10 MRFs are not utilized for their intended purpose	3 MRFs had no personnel managing the facility	CAR	Abra	Pidigan	-
			CAR	Benguet	Itogon	Tuding
			V	Camarines Sur	Pili	San Jose
		1 MRF was used only as a storage for biodegradable wastes	V	Camarines Sur	Libmanan	Bagumbayan
		1 MRF was turned into a “bodega”	VII	Cebu	San Fernando	South Poblacion
		1 MRF is fully occupied by the collected waste generated during the pandemic, and some wastes were stored outside the facility and exposed to any weather conditions	VII	Cebu	Ginatilan	Poblacion
		3 MRFs had no composting and segregated storage	I	La Union	Aringay	Poblacion
					Mangatarem	Sapang
			IV-A	Quezon	Atimonan	Inaclagan
		1 MRF was flooded and is currently not operational	NCR		Quezon City	Bagong Silangan
	Out of the 45 MRFs constructed, 6 MRFs were open and not secured		CAR	Abra	Pidigan	-
			III	Bataan	Bagac	-
			V	Camarines Sur	Libmanan	Bagumbayan
					Pili	San Jose
			VII	Bohol	Panglao	Bolod
			XI	Davao de Oro	Mabini	Cuambog
	Of the 37 EMB-funded MRFs, 7 MRFs were constructed as an extended facility		I	La Union	Alcala	San Pedro
				Pangasinan	Bugallon	Laguit Padilla

Appendix III: Summary of Significant Technical Findings by Technical Services Office (TSO)

Criteria	MRF Observations	Inspected Site Location			
		Region	Province	City/Municipality	Barangay
		III	Bulacan	San Jose Del Monte City	-
			Bataan	Bagac	-
			Aurora	Baler	-
		VII	Cebu	Ginatilan	Poblacion
				San Fernando	South Poblacion
	EMB Fund for the construction of 2 MRFs was not utilized	CAR	Abra	Pidigan	-
		XI	Davao del Sur	Davao City	Mintal
	1 MRF is built on private property under a Deed of Usufruct	III	Zambales	Masinloc	South Poblacion
	The roofing of 2 MRFs was damaged, allegedly due to Typhoon Odette that struck the Philippines last December 2021	VII	Bohol	Inabanga	Lonor Sur
				Panglao	Bolod
	The wire mesh perimeter wall of Barangay Kahayagan, Olutanga, Zamboanga Sibugay MRF was damaged, allegedly due to corrosion of metal	IX	Zamboanga Sibugay	Olutanga	Kahayagan
Sec. 1 (d) Rule XI, IRR of the RA 9003, that records shall be kept and maintained	14 MRFs do not have daily records of weights or volumes of wastes	CAR	Abra	Bucloc	Poblacion
				Pidigan	-
			Benguet	Itogon	Tuding
				Kibungan	Sagpat
		NCR		Quezon City	Bagong Silangan
		I	La Union	Aringay	Poblacion
			Pangasinan	Mangatarem	Sapang
		IV-A	Quezon	Atimonan	Inaclagan
			Camarines Sur	Pili	San Jose
				Libmanan	Bagumbayan
		VII	Cebu	Ginatilan	Poblaction
				San Fernando	South Poblacion
			Bohol	Inabanga	Lonor Sur
		IX	Zamboanga Sibugay	Mabuhay	Catipan
	33 MRFs do not have weighing equipment	CAR	Benguet	Itogon	Tuding
			Abra	Bucloc	-

Appendix III: Summary of Significant Technical Findings by Technical Services Office (TSO)

Criteria	MRF Observations	Inspected Site Location			
		Region	Province	City/Municipality	Barangay
			Abra	Pidigan	-
		NCR		Malabon City	Panghulo
				Marikina City	Fortune
				Quezon City	Bagong Silangan
		I	La Union	Aringay	Poblacion
				Pugo	Maoas-oas
			Pangasinan	Bugallon	Laguit Padilla
				Mangatarem	Sapang
		III	Aurora	Pingit	-
			Bataan	Atilao	-
		IV-A	Cavite	Kawit	Aplaya
				Ternate	Sapang Uno
			Quezon	Atimonan	Tayuman
				Infanta	Magsaysay
			Rizal	Tanay	Tandang Kutyo
		V	Albay	Legazpi City	-
			Camarines Sur	Bula	Sto. Niño
				Libmanan	Bagumbayan
		VII	Bohol	Inabanga	-
				Panglao	Bolod
			Cebu	Ginatilan	Poblacion
				San Fernando	-
		IX	Zamboanga del Sur	Lakewood	Baking (Poblacion)
				Sominot	Barubuhan
			Zamboanga Sibugay	Mabuhay	Catipan
				Olutanga	Kahayagan
		XII	Davao de Oro	Mabini	Cuambog
				Maragusan	Poblacion
				New Bataan	Cabinuangan
			Davao del Sur	Davao City	Mintal
				Matanao	Langa-an
Sec. 4 (a) Rule XI, IRR of the RA 9003, that facility shall not be sited in areas subject to frequent flooding	1 MRF was sited in an area subject to frequent flooding. The barangay has an on-going construction of a new MRF in a location with high altitude	NCR		Quezon City	Bagong Silangan

Appendix III: Summary of Significant Technical Findings by Technical Services Office (TSO)

Criteria	MRF Observations	Inspected Site Location			
		Region	Province	City/Municipality	Barangay
	and allegedly no frequent flooding				
Terms of Agreement of DENR-EMB for the provision of establishing MRFs that area is big enough for the 2 MRF components (composting and segregated storage)	23 MRFs have composting and segregated storage	NCR		Taguig City	Katuparan
				Marikina City	Fortune
		I	La Union	Pugo	Maoas-oas
			Pangasinan	Alcala	San Pedro
				Alaminos City	-
				Bugallon	Padilla
		III	Aurora	Baler	-
			Bataan	Balanga	Puerto Rivas Lote
			Bulacan	San Jose del Monte City	-
		IV-A	Rizal	Tanay	Tandang Kutyo
			Quezon	Infanta	Magsaysay
		V	Albay	Legazpi City	San Roque
			Camarines Sur	Bula	Sto Niño
				Iriga City	-
				Pili	San Jose
				Sagnay	Minadongjol
		VII	Cebu	Bogo City	Poblacion
		IX	Zamboanga del Sur	Sominot	Barubuhan
				Lakewood	Poblacion
				Kumalarang	-
			Zamboanga Sibugay	Mabuhay	Catipan
		XI	Davao del Sur	Matanao	Langaan
			Davao de Oro	Maragusan	Poblacion
	17 MRFs only have segregated storage	CAR	Benguet	Itogon	Tuding
				Kibungan	Sagpat
			Abra	Bucloc	Poblacion
				Lagangilang	-
		NCR		Malabon City	Pangulo
				Quezon City	Bagong Silangan
		III	Zambales	Masinloc	North Poblacion
			Bataan	Bagac	Atilao

Appendix III: Summary of Significant Technical Findings by Technical Services Office (TSO)

Criteria	MRF Observations	Inspected Site Location			
		Region	Province	City/Municipality	Barangay
		IV-A	Cavite	Kawit	Aplaya
				Ternate	Sapang I
		VII	Cebu	Ginatilan	Poblacion
				San Fernando	South Poblacion
			Bohol	Inabanga	Lonor Sur
				Panglao	Bolod
		IX	Zamboanga Sibugay	Olutanga	Kahayagan
		XI	Davao de Oro	Mabini	Cuambog
				New Bataan	Cabinuangan
	1 MRF has only composting	V	Camarines Sur	Libmanan	Bagumbayan
	4 MRFs do not have composting and segregated storage	NCR		Pasig City	Rosario
		I	La Union	Aringay	Poblacion
			Pangasinan	Mangatarem	Sapang
		III	Quezon	Atimonan	Inaclagan

Sanitary Landfills (SLFs)

Criteria	SLF Observations	Inspected Site Location		
		Region	Province	City/ Municipality
Section 1 (b) Rule XIV, RA 9003 IRR, that *the site shall be accessible from major roadways*	1 SLF is accessible by boat	NCR		Navotas City
Section 1 (m.1) Rule XIV, RA 9003 IRR, *that the facility shall be minimum of 50 meters away from any perennial stream, lake or river*	1 SLF is surrounded by bodies of water or Manila Bay	NCR		Navotas City
	The nearest river distance to the Waras River was about 30.20 meters (m). A pumping station was built to prevent the overflowing of leachate or for the recirculation process.	V	Camarines Sur	Iriga City
Section 1 (m.2) Rule XIV, RA 9003 IRR, *that the site shall be evaluated for presence of geologic hazards, faults, unstable soils, its foundation stability, and its hydrological character. The site shall not be located in floodplain*	1 SLF is located in an area surrounded by bodies of water or Manila Bay	NCR		Navotas City
Section 1 (j) Rule XIV, RA 9003 IRR, *that landfills shall be provided with a base system consisting of clay and/or geosynthetic membranes (geomembrane)*	No photographs before and after the construction/ operation of the SLF were presented. It was also reported in the Monitoring/Inspection report of DENR Regional Office No. IV, approved by Noemi A. Paranada, Regional Director, dated October 08, 2021, that there are no details for HDPE or clay liner within the cells.	IV-A	Cavite	GMA
Section 1 (t) Rule XIV, RA 9003 IRR, that *designation of a separate containment area for household hazardous wastes*	3 SLFs do not have a separate containment area for household hazardous wastes. Navotas and La Union SLFs do not accept such wastes	NCR		Navotas City
		I	La Union	Aringay
		VII	Cebu	Asturias
Section 1 (v) Rule XIV, RA 9003 IRR, g*roundwater monitoring wells*	3 SLFs do not have groundwater monitoring wells on site; hence, the effect of a landfill on groundwater cannot be monitored or identified. For La Trinidad SLF, MENRO staff explained that it was due to site geological features which are terraneous or mountainous	CAR	Benguet	La Trinidad
		IV-A	Cavite	GMA
		VII	Cebu	Asturias

Appendix III: Summary of Significant Technical Findings by Technical Services Office (TSO)

Criteria	SLF Observations	Inspected Site Location		
		Region	Province	City/ Municipality
Section 1 (w) Rule XIV, RA 9003 IRR, *daily soil cover*	2 SLFs apply soil cover but not daily	VII	Cebu	Asturias
		XI	Davao de Oro	Maragusan
	2 SLFs do not apply soil cover	CAR	Benguet	La Trinidad
		I	La Union	Aringay
Section 1 (k) Rule XIV, RA 9003 IRR, *Leachate collection and removal system*	Leachate collected is not treated and stocked in the drainage. The worker also reported that the leachate overflows when raining, damaging nearby plants or cops	CAR	Benguet	La Trinidad
	When the pond is full, it discharges untested leachate to the nearest river but without a discharge permit from the DENR-EMB	III	Bulacan	Norzagaray
	The SLF has no leachate pond constructed per the Monitoring/Inspection Report of DENR Regional Office No. IV, dated October 8, 2021	IV-A	Cavite	GMA
Section 1 (l) Rule XIV, RA 9003 IRR, *that leachate storage shall be designed with containment systems and shall include a geomembrane liner system for leachate impoundment ponds*	Leachate ponds at 6 SLFs are made of concrete/CHB wall; however, there is no HDPE liner. Therefore, leachate may seep through the concrete if impounded or not discharged.	CAR	Benguet	La Trinidad
		I	La Union	Aringay
				Pugo
			Pangasinan	Alaminos City
		VII	Cebu	Asturias
		XI	Davao de Oro	Maragusan
Section 2 (a) Rule XIV, RA 9003 IRR, *Disposal site records*	1 SLF does not have records of wastes disposed of.	CAR	Benguet	La Trinidad
(15) Section 48, Chapter VI of RA 9003 – Prohibited Acts, *Construction of any establishment within 200 meters from open dumps or controlled dumps or SLFs*	There are establishments within 200 meters from the 9 SLFs	CAR	Benguet	La Trinidad
		I	La Union	Aringay
				Pugo
			Pangasinan	Alaminos
		III	Bulacan	Norzagaray
		IV-A	Cavite	GMA
		V	Camarines Sur	Iriga
		VII	Cebu	Asturias
		IX	Zamboanga Sibugay	Zamboanga City
Section 1 (x) Rule XIV, RA 9003 IRR, that *Closure of the landfill shall be*	Cell 3 of the landfill that has reached overcapacity was still operating after its designed height. At the time of	CAR	Benguet	La Trinidad

Appendix III: Summary of Significant Technical Findings by Technical Services Office (TSO)

Criteria	SLF Observations	Inspected Site Location		
		Region	Province	City/ Municipality
completed within one year of cessation of landfill operation	inspection, it has reached 5 to 6 meters in height from the pavement/road level.			
	It was cited in the Monitoring/Inspection Report of the DENR Regional Office No. IV, dated October 8, 2021, that the SLF status was operational but on-going closure since August.	IV-A	Cavite	GMA

Appendix III: Summary of Significant Technical Findings by TSO

SWM Equipment

A. MRF

Inspected Site Location				EQUIPMENT													
Region	Province	City/ Municipality	Barangay	Fund Source	Bio Shred-der	Shred-der	Rotary Drum/ Comp-oster	Biogas Digest-er	Bottle Pulveri-zer/ Crusher	Bricks Maker	Compac-tor/ Baling Machine	Conveyor Shredding & Sorting Machine	Styrofo-am Recycling Machine	Sifter	Fish Drier	Vermi Sepa-rator	Total
Units of equipment that are not operational																	
a) 16 units of equipment are not operational because there is no electricity line in 7 MRFs																	
NCR	-	Marikina	Fortune		-	1	-	-	-	-	-	-	1	-	-	-	2
I	Pangasinan	Bugallon	Laguit Padilla	LGU	1	1	1	-	-	-	-	-	-	-	-	-	3
					-	-	-	-	1	-	-	-	-	1	-	-	2
III	Aurora	San Luis	-	DA	-	-	1	-	-	-	-	-	-	-	-	-	1
	Bataan	Bagac	-	EMB	1	-	1	-	-	-	-	-	-	-	-	-	2
			-	DA	-	-	1	-	-	-	-	-	-	-	-	-	1
VII	Bohol	Inabanga	-	DA	1	-	1	-	-	-	-	-	-	-	-	-	2
IX	Zamboanga Sibugay	Mabuhay	Catipan	EMB	1	-	1	-	-	-	-	-	-	-	-	-	2
				DA	-	-	1	-	-	-	-	-	-	-	-	-	1
Subtotal					**4**	**2**	**7**	**-**	**1**	**-**	**-**	**-**	**1**	**1**	**-**	**-**	**16**
b) 33 units of equipment need upgrading of electrical system or procurement of transformer to operate																	
CAR	Abra	Bucloc	-	EMB	-	-	-	-	1	-	-	-	-	-	-	-	1
I	La Union	Aringay	Poblacion	EMB	1	-	1	-	-	-	-	-	-	-	-	-	2
				LGU	-	1	-	-	-	-	-	-	-	-	-	-	1
		Pugo	Maoas-oas	EMB	1	-	1	-	-	-	-	-	-	-	-	-	2
				DA	1	-	1	-	-	-	-	-	-	-	-	-	2
				LGU	1	-	-	-	-	-	-	-	-	-	-	-	1
	Pangasinan	Mangatarem	Sapang	EMB	1	1	1	-	-	-	-	-	-	-	-	-	3
IV-A	Cavite	Ternate	Sapang Uno	EMB	1	-	1	-	-	-	-	-	-	-	-	-	2
				LGU	-	1	-	-	1	1	-	-	-	-	-	-	3
V	Albay	Legazpi City	32		-	1	-	-	-	-	-	-	-	-	-	-	1
	Camarines Sur	Bula	Sto. Niño	LGU	-	1	-	-	-	-	-	-	-	-	-	-	1
VII	Cebu	Asturias	-	EMB	-	-	1	-	-	-	-	-	-	-	-	-	1
					-	-	-	-	2	-	-	-	-	-	-	-	2

Appendix III: Summary of Significant Technical Findings by TSO

Inspected Site Location				EQUIPMENT													
Region	Province	City/ Municipality	Barangay	Fund Source	Bio Shred-der	Shred-der	Rotary Drum/ Comp-oster	Biogas Digest-er	Bottle Pulveri-zer/ Crusher	Bricks Maker	Compac-tor/ Baling Machine	Conveyor Shredding & Sorting Machine	Styrofo-am Recycling Machine	Sifter	Fish Drier	Vermi Sepa-rator	Total
IX	Zamboanga del Sur	Sominot	Barubuhan	EMB	1	-	1	-	-	-	-	-	-	-	-	-	2
				DA	1	-	1	-	-	-	-	-	-	-	-	-	2
		Kumalarang	-	DA	-	-	1	-	-	-	-	-	-	-	-	1	2
IX	Zamboanga Sibugay	Olutanga	Kahayagan	EMB	1	-	1	-	-	-	-	-	-	-	-	-	2
				DOST	1	-	1	-	-	-	-	-	-	-	-	-	2
					-	-	-	-	-	-	-	-	-	-	1	-	1
Subtotal					**10**	**5**	**11**	**-**	**4**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**33**
c) 2 units of equipment need a 3-Phase power connection but the MRF can only support for single phase																	
VII	Cebu	Asturias	-		-	-	-	-	1	-	-	-	-	-	-	-	1
VII	Cebu	Ginatilan	-	EMB	-	-	-	-	1	-	-	-	-	-	-	-	1
Subtotal					-	-	-	-	**2**	-	-	-	-	-	-	-	**2**
d) 9 units of equipment are subject to repair																	
CAR	Abra	Lagangilang	Tagodtod	EMB	-	1	-	-	-	-	-	-	-	-	-	-	1
NCR	-	Malabon Cityt	Panghulo		-	1	-	-	-	-	-	-	-	-	-	-	1
		Pasig	Rosario		-	-	-	1	-	-	-	-	-	-	-	-	1
III	Aurora	Baler	Pingit		-	1	-		-	-	-	-	-	-	-	-	1
	Zambales	Masinloc	South Poblacion		-	1	-	-	-	-	-	-	-	-	-	-	1
	Bulacan	San Jose del Monte City	-		-	-	-	-	-	-	-	2	-	-	-	-	2
IV-A	Rizal	Tanay	Tandang Kutyo		-	1	-	-	-	-	-	-	-	-	-	-	1
XI	Davao de Oro	Monkayo	-	DA	-	-	1	-	-	-	-	-	-	-	-	-	1
Subtotal					**-**	**5**	**1**	**1**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**9**
e) 6 units of equipment are not yet installed																	
CAR	Abra	Pidigan	-		-	-	1	-	-	-	-	-	-	-	-	-	1
III	Aurora	Baler	Pingit	EMB	-	-	1	-	-	-	-	-	-	-	-	-	1

Appendix III: Summary of Significant Technical Findings by TSO

Inspected Site Location				EQUIPMENT													
Region	Province	City/ Municipality	Barangay	Fund Source	Bio Shred-der	Shred-der	Rotary Drum/ Comp-oster	Biogas Digest-er	Bottle Pulveri-zer/ Crusher	Bricks Maker	Compac-tor/ Baling Machine	Conveyor Shredding & Sorting Machine	Styrofo-am Recycling Machine	Sifter	Fish Drier	Vermi Sepa-rator	Total
	Bulacan	San Jose del Monte City	-	EMB	-	-	1	-	-	-	-	-	-	-	-	-	1
XI	Davao de Oro Mabini		Cuambog	EMB	1	-	1	-	-	-	-	-	-	-	-	-	2
					-	-	-	-	1	-	-	-	-	-	-	-	1
Subtotal					**1**	**-**	**4**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**6**
f) Lack of training and demo before LGU can operate 12 units of equipment																	
I	Pangasinan	Alaminos City	-	EMB	1	-	1	-	-	-	-	-	-	-	-	-	2
IV-A	Quezon	Atimonan	Tayuman	EMB	1	-	1	-	-	-	-	-	-	-	-	-	2
		Infanta	Magsaysay	EMB	1	-	1	-	-	-	-	-	-	-	-	-	2
V	Camarines Sur	Sagnay	Minadongjol	EMB	1	-	1	-	-	-	-	-	-	-	-	-	2
		Bula	Sto. Niño	EMB	1	-	1	-	-	-	-	-	-	-	-	-	2
VII	Cebu	Ginatilan	-	EMB	1	-	-	-	-	-	-	-	-	-	-	-	1
XI	Davao de Oro	Monkayo	-	EMB	-	-	1	-	-	-	-	-	-	-	-	-	1
Subtotal					**6**	**-**	**6**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**12**
g) 5 units of equipment unutilized																	
NCR		Taguig	Katuparan	EMB	-	1	-	-	-	-	-	-	-	-	-	-	1
III	Pampanga	Sta. Ana	-		-	1	1	-	-	-	1	-	-	-	-	-	3
V	Camarines Sur	Iriga City	-		-	2	-	-	-	-	-	-	-	1	-	-	3
V	Camarines Sur	Sagnay	Minadongjol	DA	1	-	1	-	-	-	-	-	-	-	-	-	2
VII	Bohol	Panglao	Bolod	EMB	1	-	-	-	-	-	-	-	-	-	-	-	1
VII	Cebu	Asturias			1	-	-	-	-	-	-	-	-	-	-	-	1
XI	Davao de Oro	Mabini	Cuambog	DA	-	-	1	-	-	-	-	-	-	-	-	-	1
Subtotal					**3**	**4**	**3**	**-**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**12**
TOTAL					**24**	**16**	**32**	**1**	**8**	**1**	**1**	**2**	**1**	**2**	**1**	**1**	**90**
7 units of unserviceable equipment																	
I	Pangasinan	Alcala	San Pedro		-	-	1	-	-	-	-	-	-	-		-	1

Appendix III: Summary of Significant Technical Findings by TSO

Inspected Site Location				EQUIPMENT													
Region	Province	City/ Municipality	Barangay	Fund Source	Bio Shred-der	Shred-der	Rotary Drum/ Comp-oster	Biogas Digest-er	Bottle Pulveri-zer/ Crusher	Bricks Maker	Compac-tor/ Baling Machine	Conveyor Shredding & Sorting Machine	Styrofo-am Recycling Machine	Sifter	Fish Drier	Vermi Sepa-rator	Total
VII	Cebu	San Fernando	-		1	1	4	-	-	-	-	-	-	-		-	6
TOTAL					**1**	**1**	**5**	**-**	**-**		**-**	**-**				**-**	**7**
2 units of equipment are for disposal																	
I	Pangasinan	Alcala	San Pedro		-	-	1	-	-	-	-	-	-	-		-	1
III	Aurora	San Luis		LGU	-	1	-	-	-	-	-	-	-	-		-	1
TOTAL					**-**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**		**-**	**2**
3 units of equipment are rarely used due to insufficient supply of bio waste																	
III	Bataan	Balanga	Lote Pto. Rivas	EMB	1	-	1	-	-	-	-	-	-	-		-	2
				DA	1	-	-	-	-	-	-	-	-	-		-	1
TOTAL					**2**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**		**-**	**3**
9 MRFs without equipment for recycling																	
CAR	Benguet	Itogon	Tuding	-	-	-	-	-	-		-	-	-	-	-	-	-
NCR	-	Quezon City	Bagong Silangan	-	-	-	-	-	-		-	-	-	-	-	-	-
III	Bataan	Bagac	Atilano Ricardo	-	-	-	-	-	-		-	-	-	-	-	-	-
III	Bataan	Bagac	San Antonio	-	-	-	-	-	-		-	-	-	-	-	-	-
III	Bulacan	San Jose del Monte City	Minuyan III	-	-	-	-	-	-		-	-	-	-	-	-	-
IV-A	Cavite	Kawit	Aplaya	-	-	-	-	-	-		-	-	-	-	-	-	-
V	Camarines Sur	Pili	San Jose	-	-	-	-	-	-		-	-	-	-	-	-	-
		Libmanan	Bagumbayan	-	-	-	-	-	-		-	-	-	-	-	-	-
XI	Davao de Oro	Maragusan	Poblacion	-	-	-	-	-	-		-	-	-	-	-	-	-

Appendix III: Summary of Significant Technical Findings by TSO

B. SLFs

Inspected Site Location			Equipment								
Region	Province	City/Municipality	Fund Source	Bio Shredder	Shredder	Rotary Drum/ Composter	Baling Machine	Bulldozer	Compactor Truck	Weighing Bridge	Total
Units of equipment that are not operational											
a) 2 units of equipment are subject to repair											
III	Bulacan	Norzagaray		-	-	-	-	1	-	-	1
VII	Cebu	Asturias		-	-	-	-	-	1	-	1
Subtotal				**-**	**-**	**-**	**-**	**1**	**1**	**-**	**2**
b) 6 units of equipment are unutilized											
CAR	Benguet	La Trinidad	EMB	1	-	1	1	-	-	-	3
			LGU	-	3	-	-	-	-	-	3
Subtotal				**1**	**3**	**1**	**1**	**-**	**-**	**-**	**6**
TOTAL				**1**	**3**	**1**	**1**	**1**	**1**	**-**	**8**
Only 1 SLF is equipped with a weighing bridge											
I	Pangasinan	Alaminos City		-	-	-	-	-	-	1	1
TOTAL				**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**

Appendix III: Summary of Significant Technical Findings by TSO

C. Dumpsites

Inspected Site Location							
Region	Province	City/Municipality	Fund Source	Bio Shredder	Rotary Drum/ Composter	Plastic Maker	Total
10 units of equipment are not operational							
III	Bulacan	Malolos	EMB	1	1	-	2
			LGU	-	7	-	7
			DOST	-	-	1	1
TOTAL				**1**	**8**	**1**	**10**
7 units of equipment are for disposal							
III	Bulacan	Malolos		-	7	-	7
TOTAL				**-**	**7**	**-**	**7**

D. Residual Containment Areas (RCAs)

Inspected Site Location			Equipment							
Region	Province	City/Municipality	Fund Source	Bio Shredder	Shredder	Rotary Drum/ Composter	Baling Machine	Bottle Pulverizer/ Crusher	Compactor Truck	Total
1 unit of equipment is for disposal										
CAR	Benguet	Kibungan		-	-	-	-	1	-	1
TOTAL				**-**	**-**	**-**	**-**	**1**	**-**	**1**

Appendix IV: Solid Waste Management (SWM) on Sustainable Development Goals (SDGs) Achievement

Solid Waste Management Program (SWMP) Activity	SDG	Target and Indicator Affected
Processes and Methods		
Recycling technology provides more opportunities for higher levels of economic productivity	Goal 8: Decent work and economic growth	8.2 Achieve higher levels of economic productivity through a focus on high value-added and labor-intensive sectors
Recycling material processes in SWM promotes creating opportunities for unlimited industries and small projects that stimulate innovation processes in various fields of industry	Goal 9: Industry and Innovation	9.2 Promote inclusive and sustainable industrialization and significantly raise the industry's share of employment
Integrated and sustainable SWM raises the value of indicators of quality of life for cities and maintains the sustainability of local communities	Goal 11: Sustainable cities and communities	11.1 Ensure access for all to adequate, safe, and affordable housing and basic services and upgrade slums
Adopting the green circular economy model ensures the sustainability of responsible consumption and production patterns	Goal 12: Responsible consumption and production	12.1 Implement the 10-year framework of programs on sustainable consumption and production 12.2 Achieve the sustainable management and efficient use of natural resources
Adopting the extended producer responsibility policy (EPR)	Goal 12: Responsible consumption and production	12.6 Encourage companies to adopt sustainable practices
Human Capital		
Incorporating waste pickers and improving their economic conditions has improved poverty rates in the developing world	Goal 1: No poverty	1.1 Eradicate extreme poverty for all people everywhere
Recycling and reuse of solid waste have great potential to create jobs and employment opportunities	Goal 1: No poverty	1.2 Reduce at least by half the proportion of men, women, and children of all ages living in poverty
Separating food waste and managing food waste supports providing a measure of food for the poor and vulnerable groups, thus supporting the reduction of hungry populations	Goal 2: Zero hunger	2.1 End hunger and ensure access by all people, in particular, the poor and people in vulnerable situations, including infants, to safe, nutritious, and sufficient food all year round
Recycling organic solid waste produces very good organic fertilizers, increases the chances of doubling agricultural productivity, and enhances the success of agricultural practices for small food producers	Goal 2: Zero hunger	2.3 Double the agricultural productivity and incomes of small-scale food producers, in particular, women, indigenous peoples, family farmers

Appendix IV: Solid Waste Management on SDGs Achievement

Solid Waste Management Program (SWMP) Activity	SDG	Target and Indicator Affected
Reducing the sorting processes in the informal system by the denomination of pregnant and postpartum women reduces the maternal mortality rates	Goal 3: Good health and well-being	3.1 Reduce the global maternal mortality ratio
Preventing waste sorting processes in informal solid waste communities that take place indoors and in the streets, reducing the risk of disease exposure for children and infants	Goal 3: Good health and well-being	3.2 End preventable deaths of newborns and children under five years of age, with all countries
Follow the proper management of medical waste disposal inside the health facilities and use protectors for the hands to prevent injuries, the transmission of diseases, and hepatitis during the collection and sorting processes Proper handling of solid waste and disposal methods supports a healthy, disease-free environment	Goal 3: Good health and well-being	3.3 End the epidemics of AIDS and combat hepatitis, water-borne diseases, and other communicable diseases
Reducing child labor, as children are part of the informal solid waste system, which increases illiteracy and school dropout rates	Goal 4: Quality education	4.1 Ensure that all girls and boys complete free, equitable, and quality primary and secondary education
Providing technical and vocational education related to the SWM system supports school enrollment and learning opportunities for garbage collectors' communities	Goal 4: Quality education	4.3 Ensure equal access for all women and men to affordable and quality technical, vocational, and tertiary education 4.4 Increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs, and entrepreneurship
Reducing the exploitation of women in the informal system, as they play a major role in the waste sorting stage, making them more vulnerable to diseases	Goal 5: Gender equality	5.1 End all forms of discrimination against all women and girls everywhere
Providing healthy proper job opportunities based on solid waste recycling directed at women and girls	Goal 5: Gender equality	5.5 Ensure women's full and effective participation and equal opportunities 5.6 Ensure universal access to reproductive health and reproductive rights as agreed
Health and Environment		
The efficient orientation of Refuse, Reduce, Reuse, Recycle, and Recover (5Rs) greatly reduces waste production	Goal 12: Responsible consumption	12.5 Substantially reduce waste generation through prevention, reduction, recycling, and reuse

Appendix IV: Solid Waste Management on SDGs Achievement

Solid Waste Management Program (SWMP) Activity	SDG	Target and Indicator Affected
	and production	
Reducing pollution caused by dumping plastic and hazardous wastes into or near waterways increases access to higher water quality	Goal 6: Clean water	6.3 Improve water quality by reducing pollution and minimizing the release of hazardous chemicals and materials
The use of solid waste in energy production processes supports the provision of a new and affordable source of energy	Goal 7: Affordable and reliable energy	7.1 Ensure universal access to affordable and reliable energy services 7.2 Increase substantially the share of renewable energy in the global energy mix
An integrated SWM system reduces the individual negative environmental impacts of cities	Goal 11: Sustainable cities and communities	11.6 Reduce the adverse per capita environmental impact of cities, including municipal waste management
Full landfill sites could be converted into green spaces and public spaces	Goal 11: Sustainable cities and communities	11.7 Provide universal access to safe, inclusive, and accessible green and public spaces
Safe disposal of solid waste and the reduction of open garbage burning and its emitting rates of pollution and greenhouse gases are among the most important measures related to climate change	Goal 13: Climate action	13.2 Integrate climate change measures into national policies, strategies, and planning
Reducing pollution resulting from dumping solid waste into water bodies, especially plastic, supports the chances of preserving the life of marine organisms underwater	Goal 14: Life below water	14.1 Prevent and significantly reduce marine pollution of all kinds
Environmentally sound management of solid waste reduces the spread of carbon dioxide, which absorbs about a quarter of its emissions by the oceans and increases their acidification	Goal 14: Life below water	14.3 Minimize and address the impacts of ocean acidification
The safe disposal of solid waste is one of the aspects of preserving the ecosystems on Earth	Goal 15: Life on land	15.1 Ensure the conservation, restoration, and sustainable use of terrestrial and inland freshwater ecosystems and their services 15.9 Integrate ecosystem values into national and local planning and development processes
Integrated and sustainable SWM reduces the amount of waste and landfill areas, that is, reduction of the need for land utilized for the sanitary burying of waste	Goal 15: Life on land	15.3 Restore degraded land and strive to achieve a land degradation-neutral world

Appendix IV: Solid Waste Management on SDGs Achievement

Solid Waste Management Program (SWMP) Activity	SDG	Target and Indicator Affected
Economic Impact		
Merging the informal SWM system into the formal system ensures an improvement in the informal work environment and supports economic growth opportunities	Goal 8: Decent work and economic growth	8.1 Sustain per capita economic growth in accordance with national circumstances 8.3 Promote development-oriented policies that support productive activities and decent job creation and encourage the formalization and growth of micro-, small-, and medium-sized enterprises
The merge between the formal and informal SWM sectors promotes social and economic inclusion and reduces inequality in developing countries	Goal 10: Reduce inequalities	10.2 Empower and promote the social and economic inclusion of all
Institutional Mechanisms		
SWM within a clear institutional framework that supports the organization of the relationship between the central authority and local administrations; ensures responsive, inclusive, participatory, and representative decision-making at all levels; and provides tools and methods of transparency, accountability, and monitoring of the service delivery process	Goal 16: Peace, justice, and institutions	16.6 Develop effective, accountable, and transparent institutions at all levels 16.7 Ensure responsive, inclusive, participatory, and representative decision-making at all levels
The integrated and sustainable SWM system depends on the participation of multiple parties, such as the formal private sector, the informal sector, the local community, and donors. This is to support the system financially and technically	Goal 17: Partnerships for the goals	17.17 Encourage and promote effective public, public-private, and civil society partnerships

Appendix V: COA Contact and Staff Acknowledgments

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Staff Acknowledgments

Directors Michael L. Racelis and Roberto D. Mabagos, Jr. provided technical assistance from planning the audit to developing the report. OIC Director III Dondon P. Marcos assisted in the review process. Director Sofia C. Gemora (Audit Team Supervisor), Janine Joy Ilagan-Valdecantos (Audit Team Leader), Melody O. Tan, Ria Mae P. Gutierrez, Christopher Alpha R. Bernardo, Marco Rafael F. Crespo, Engr. Toshio R. Toba Jr., Engr. Ser Louis Paulo P. Cawicaan, Engr. Gregorio A. Doblas Jr., Engr. Kevin Sherwin B. Aragon, and Victoria R. Yumang, as citizen partner (All Team Members), conducted the audit and made key contributions to this report.

Assistant Commissioner Alexander B. Juliano provided invaluable input in finalizing the report.