

**Commune Urbaine d'Antananarivo
Republic of Madagascar**

**PREPARATORY SURVEY
ON
THE PROJECT FOR THE IMPROVEMENT
OF SOLID WASTE MANAGEMENT
EQUIPMENT FOR CLEAN CITY
IN ANTANANARIVO
FINAL REPORT**

February 2022

JAPAN INTERNATIONAL COOPERATION AGENCY

**CTI ENGINEERING INTERNATIONAL CO., LTD.
EX RESEARCH INSTITUTE LTD.**

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All Madagascar Ariary (MGA) amounts including project costs shown in this report are stated in 2021 prices unless otherwise indicated. The amounts are estimated on the basis of foreign prices by applying the interbank currency exchange rates as of 1st of June 2021, namely;
USD 1 = EUR 0.81909 = MGA 3,714.87 =JPY 109.62

PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey and entrust the survey to CTI Engineering International Co., Ltd., and EX Research Institute Ltd.

The survey team held a series of discussions with the officials concerned of the Government of Madagascar and conducted a field investigation. As a result of further studies in Japan, the present report was finalized.

I hope that this report will contribute to the promotion of the project and the enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Madagascar for their close cooperation extended to the survey team.

February 2022

Eiji Iwasaki
Director General,
Global Environment Department
Japan International Cooperation Agency

SUMMARY

1. Outline of Madagascar

The Republic of Madagascar (hereinafter referred to as “Madagascar”) is the fourth largest island in the world, with a land area of 587,295 km² (about 1.6 times that of Japan), approximately 12 to 26 degrees south latitude, and 43 to 51 degrees east longitude. The country stretches from north to south, and the highlands are lined up in the center, and it is strongly affected by trade winds and seasonal winds. Therefore, the climate varies greatly from region to region, but it is generally roughly divided into two seasons: the rainy season (November to April) and the dry season (May to October). During the rainy season, cyclones in the Indian Ocean can damage them. The city of Antananarivo, the capital of Madagascar, which is the target area of this project, is located on the central plateau at an altitude of about 1,400m.

Madagascar has a population of 27.69 million (2020, World Bank), with agriculture, forestry and fisheries, mining and tourism as its main industries. The Gross Domestic Products (GDP) and the Gross National Income per capita are 13.7 billion USD and 480 USD, respectively (2020, World Bank). About 74% of the working population is engaged in agriculture; however, due to low agricultural productivity and lack of infrastructure, agriculture accounts for only 24.7% of the GDP (2016). In the wake of the political upheaval in 2009, the economy was sluggish because of the suspension of aid by major donors, the withdrawal of foreign investment, and the decrease of tourists, but in 2016, the IMF's support was introduced, and the World Bank and other donor countries began to borrow.

2. Background of the Project

The city of Antananarivo is undergoing rapid urbanization with a population growth rate of 5.17% (2018, United Nations). The amount of waste generated by the population of 3 million is 1,500 tons per day. The autonomous Maintenance Service of the City of Antananarivo (SAMVA: Service Autonome de Maintenance de la Ville d'Antananarivo), which is responsible for waste management, collect wastes 7 days a week, including collection at night, but the collection rate remains at 50% due to the lack of vehicles and equipment. In uncollected areas, wastes are scattered on the side of roads, rivers, and drainage channels, causing flooding of drainage channels during the rainy season. Poor sanitary conditions have influenced the plague epidemic (2017), and health risks are becoming more serious.

The collected waste is carried to the Andralanitra landfill site (open dumping site), which is the only final disposal site in the city. However, since the 1960s, as a result of the accumulation of waste up to about 20 m above ground without proper management, the capacity of the landfill site has become tight, and fatal accidents have occurred due to the collapse of the mountain of garbage and landslides. Furthermore, there is concern that untreated leachate, smoke, offensive odor, pests, etc., has adversely affected the surrounding Fokontany and the health of residents.

Under this situation, strengthening the integrated waste management capacity is urgently needed with a view of improving the collection rate for the purpose of improving sanitation and reducing environmental load, reduction of waste by intermediate treatment (introduction of sorting and recycling), improvement and life extension of Andralanitra landfill site and transferring the function of the landfill to a new landfill site.

The Government of Madagascar (GOM) has placed urban solid waste management as a priority in its General State Policy (PGE: Politique Generale de l'Etat), the Madagascar Emergency Initiative 2019-23 (IEM: Initiative Émergence Madagascar). The National Health Strategy Policy (PSNA: Politique Stratégie Nationale de l'Assainissement), which was updated in 2013, also focuses on strengthening solid waste management capabilities.

Under the circumstances, the GOM had requested the Government of Japan (GOJ) for technical and financial cooperation for the “Project for the Improvement of Solid Waste Management Equipment

for Clean City in Antananarivo” (hereinafter referred to as "the Project"), to improve the equipment necessary for waste collection, transportation, intermediate treatment, and improvement/life extension of the existing landfill site. The request of the GOM as of 2019 are as shown in Table 1.

It must be noted that SAMVA was dissolved in February 2021 and the Project has been taken over by a municipal sanitation company (SMA: Société Municipale d'Assainissement) under the umbrella of the city of Antananarivo (CUA: Commune Urbaine d'Antananarivo). The responsible entity for waste administration and ownership of equipment and land is CUA and SMA was established as an implementing agency for solid waste management and operations (hereinafter referred to as "SWM") by a concession agreement with CUA.

Table 1 Items Requested by GOM

Classification	Name of Item	Quantity
Procurement of Waste Collection & Transportation Vehicles and Equipment for the operation of the landfill site	Dump Truck: 12t	6
	Bulldozer	2
	Waste Sorting Machine	1
	Excavator	2
	Wheel Loader	2
	Container Carrier	24
	Iron Container: 6m ³	400
	PVC Container: 2,000L	100
	Monitoring Vehicle	2
	Monitoring Motorcycle	8
	Spare Parts	1 set
Construction of the Waste Sorting and Composting Facilities	Basic survey, planning and designing for the construction of facilities	1 set
	Construction of the Waste Sorting facility	9,000m ²
	Construction of the Composting facility	3,000m ²
	Construction of a Stockyard for the waste delivered and products	6,000m ²
Improvement Works of the Landfill site	Loading and leveling the waste	180,000m ³
	Installation of Gabions at the edge of slopes	1,200m ²
	Laying leachate collection pipes	Main line: 400m Branch line: 5,340m
	Laying exhaust gas pipes	30 set
	Construction of the Inside Road	4,800m ²
	Leachate Treatment equipment	1 set

3. Outline of the Survey/Design and Contents of the Project

Due to the spread of COVID-19, the investigation used local experts to collect information remotely and held discussions with local related organizations at web conferences. The mission to Madagascar was dispatched from November 21 to December 6, 2021, and the outline design was discussed and confirmed with the Madagascar side and agreed upon.

Based on this, it was decided that the Project will cover the procurement of equipment (including initial operation guidance of procured equipment) for waste collection and transportation and landfill site operation and will not construct large-scale facilities (sorting facilities, etc.). In addition, since the capacity improvement of operational technology related to equipment procurement is carried out in a technical cooperation project scheduled to be implemented in parallel with the Project, soft components related to its capacity improvement, etc. will not be implemented in the Project.

The list of planned procurement items is as shown in Table 2.

Table 2 List of Planned Procurement Items

Item No.	Items	Quantity
1	Skip Loader	33
2	Dump Truck 1 (waste collection and transportation)	6
3	Dump Truck 2 (landfill operation)	3
4	Bulldozer	2
5	Excavator	4
6	Garbage Container	326
7	Pick-up Truck	2
8	Off-road Bike	8
9	Improvement Work of Waste Collection Points	8
10	Repair Tool for Vehicle	1
11	Floodlight	4
12	Flat-body Truck	2

4. Implementation Period

The Project is expected to be completed for 5 months (including the bidding period) for the detailed design and 17.5 months for the procurement of equipment.

5. Project Evaluation

(1) Relevance

1) Improvement of Urban Environment and Hygiene

The Project will improve the waste management of Madagascar with the procurement of equipment related to the waste management in Antananarivo and will contribute to the maintenance of sanitary conditions. The validity of the Project is high.

2) Waste Management in National Policy

The Government of Madagascar has prioritized urban waste management in PGE and IEM. The Project will greatly contribute to the realization of these national policies by procuring equipment for improving waste management.

(2) Effectiveness

1) Quantitative Effect

“Waste collected amount” and “Waste collected rate” are set as indicators of the quantitative effect of the Project as shown in Table 3.

Table 3 Quantitative Effect of the Project

Indicator	Existing Value in 2021	Target Value in 2027 (3 years after the completion of the Project)	Note
Waste collected amount	347 ton / day	596 ton / day	It is assumed that 8 of the existing trucks are still in operation 3 years after the completion of the Project.
Waste collected rate*	43% (Trucks owned by SMA)	66%	

* The waste collected rate is calculated from "waste collected amount/waste discharged amount (tons/day)", and the target areas are the 6 districts of Antananarivo city and the area around the Andralanitra landfill site.

2) Qualitative Effect

The qualitative effects of the Project are as follows:

- Improvement of the living environment of Antananarivo with the reduction of uncollected waste and illegally dumped waste.
- Mitigation of Environment Impacts, such as offensive odor, waste scattering, and fire prevention due to the improvement of operation and management of the Andralanitra landfill site.

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FINAL REPORT

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ABBREVIATIONS

3R	Reduce, Reuse, Recycle
AFD	French Development Agency (Agence Française de Développement)
A/P	Authorization to Pay
B/A	Banking Arrangement
CCE	Environmental Mitigation Measures (Cahier de Charges Environnementale)
COVID-19	Coronavirus Disease 2019
CTE	Technical Evaluation Committee (Comité Technique d'Evaluation)
CUA	Urban Commune of Antananarivo (Commune Urbaine d'Antananarivo)
D/D	Detailed Design
E/N	Exchange of Notes
EIA	Environmental Impact Assessment (Étude d'Impact Environnemental)
EIS	Environmental Information System
EMP	Environmental Management Plan
G/A	Grant Agreement
GDP	Gross Domestic Products
GOJ	Government of Japan
GOM	Government of Madagascar
IEM	Madagascar Emergency Initiative (Initiative Émergence Madagascar)
IUCN	International Union for Conservation Nature
JICA	Japan International Cooperation Agency
JIRAMA	Malagasy Electricity and Water (Jiro sy Rano Malagasy)
MATP	Ministry of Territorial Planning and Public Works (Ministère de l'Aménagement du Territoire et des Travaux Publics)
MEAH	Ministry of Water, Sanitation and Hygiene (Ministère de l'Eau de l'Assainissement et de l'Hygiène)
MECIE	Décret N°99-954 du 15 décembre 1999 modifié par le décret n° 2004 -167 du 03 février 2004 relatif à la mise en compatibilité des investissements avec l'environnement
MEF	Ministry of Economy and Finance (Ministère de l'Économie et des Finances)
MGA	Malagasy Ariary
NGO	Non-Governmental Organization
O&M	Operation and Maintenance
OJT	On the Job Training
ONE	National Office for the Environment (Office National pour l'Environnement)
PGE	General State Policy (Politique Generale de l'Etat)
PGEP	Project Environmental Management Plan (Plan de Gestion Environnementale du Projet)
PREE	Environmental Management Plan (Programme d'Engagement Environnemental)
PSNA	National Health Strategy Policy (Politique Stratégie Nationale de l'Assainissement)
RF2	Sanitation and Sanitation System (Rafitra Fikojana ny Rano Fidiovana ary Fikoloam-Pahasalama)
SAMVA	Autonomous Maintenance Service of the City of Antananarivo (Service Autonome de Maintenance de la Ville d'Antananarivo)
SDGs	Sustainable Development Goals

SEA	Strategic Environmental Assessment
SMA	Municipal Sanitation Company (Société Municipale d'Assainissement)
SWM	Solid Waste Management
TOR	Terms of Reference
WHO	World Health Organization

CHAPTER 1. BACKGROUND OF THE PROJECT

1.1 Background of the Project

The City of Antananarivo, capital of the Republic of Madagascar, is undergoing rapid urbanization with a population growth rate of 5.17% (United Nations, 2018). The amount of waste generated by the population of 3 million is 1,500 tons per day. The autonomous Maintenance Service of the City of Antananarivo (Service Autonome de Maintenance de la Ville d'Antananarivo, hereinafter referred to as "SAMVA"), which is responsible for waste management, collect wastes 7 days a week, including collection at night, but the collection rate remains at 50% due to the lack of vehicles and equipment. In uncollected areas, wastes are scattered on the side of roads, rivers, and drainage channels, causing flooding of drainage channels during the rainy season. Poor sanitary conditions have influenced the plague epidemic (more than 165 people died in the metropolitan area in 2017), and health risks are becoming more serious.

The collected waste is carried to the Andralanitra landfill site (open dumping site), which is the only final disposal site in the city. However, since the 1960s, as a result of the accumulation of waste up to about 20 m above ground without proper management (levelling, compaction, and soil cover), the capacity of the landfill site has become tight, and fatal accidents have occurred due to the collapse of the mountain of garbage and landslides. Furthermore, there is concern that untreated leachate, smoke, offensive odor, pests, etc., has adversely affected the surrounding environment and the health of residents.

Under this situation, strengthening the integrated waste management capacity is urgently needed with a view of improving the collection rate for the purpose of improving sanitation and reducing environmental load, reduction of waste by intermediate treatment (introduction of sorting and recycling), improvement and life extension of Andralanitra landfill site and transferring the function of the landfill to a new landfill site.

Under the circumstances, the Government of Madagascar (hereinafter referred to as "the GOM") had requested the Government of Japan (hereinafter referred to as "the GOJ") for technical and financial cooperation for the "Project for Improvement of Solid Waste Management Equipment for Clean City in Antananarivo" (hereinafter referred to as "the Project"), to improve the equipment necessary for waste collection, transportation, intermediate treatment and improvement/life extension of the existing landfill site. The implementation of the Project is envisioned to contribute to the cooperation policy of Japan, so that the Japan International Cooperation Agency (hereinafter referred to as "JICA") has decided to carry out the Preparatory Survey for the Project.

1.2 Requested Items and Project Summary

Items requested by the GOM in 2019 are as shown in Table 1.1.

Table 1.1 Items Requested by the GOM

Classification	Item No.	Name of Item	Quantity
Procurement of Waste Collection & Transportation Vehicles and Equipment for the Operation of the Landfill site	1	Dump Truck: 12t	6
	2	Bulldozer	2
	3	Waste Sorting Machine	1
	4	Excavator	2
	5	Wheel Loader	2
	6	Container Carrier	24
	7	Iron Container: 6m ³	400
	8	PVC Container: 2,000L	100

Classification	Item No.	Name of Item	Quantity
	9	Monitoring Vehicle	2
	10	Monitoring Motorcycle	8
	11	Spare Parts	1 set
Construction of the Waste Sorting and Composting Facilities	1	Basic survey, planning and designing for the construction of facilities	1 set
	2	Construction of the Waste Sorting facility	9,000m ²
	3	Construction of the Composting facility	3,000m ²
	4	Construction of a Stockyard for the waste delivered and products	6,000m ²
Improvement Works of the Landfill site	1	Loading and leveling the waste	180,000m ³
	2	Installation of Gabions at the edge of slopes	1,200m ²
	3	Laying leachate collection pipes	Main line: 400m Branch line: 5,340m
	4	Laying exhaust gas pipes	30 set
	5	Construction of the Inside Road	4,800m ²
	6	Leachate Treatment equipment	1 set

Source: JICA Survey Team (Hereinafter, JICA Survey Team created tables and figures unless otherwise specified in this report.)

Based on the above request, the Preparatory Survey of the Project (hereinafter referred to as "the Survey"), as summarized in Table 1.2, has started.

Table 1.2 Summary of the Survey

(1) Objective of the Project	To strengthen the waste management capacity of SAMVA and to contribute to improve the sanitary environment of the target area by improving the equipment for collecting and transporting waste and final disposal
(2) Target Area	The City of Antananarivo
(3) Items of the Project	Equipment: Waste collection and transportation vehicles (Container carrier and container), Equipment for the operation of the landfill (Bulldozer, Excavator, Wheel loader, Landfill compactor, etc.), Spare parts, Maintenance tools
(4) Related Agencies	Supervisory Authority: Commune Urbaine d'Antananarivo (CUA) Implementing Agency: SAMVA, The Municipal Sanitation Company (SMA)

It has to be noted that SAMVA was dissolved in February 2021 and the Project has been taken over by a municipal sanitation company (Société Municipale d'Assainissement: hereinafter referred to as "SMA") under the umbrella of the city of Antananarivo (Commune Urbaine d'Antananarivo, hereinafter referred to as "CUA"). The responsible entity for waste administration and ownership of equipment and land is CUA and SMA was established as an implementing agency for solid waste management and operations (hereinafter referred to as "SWM") by a concession agreement with CUA.

1.3 Assistance by Japan

Past assistance by Japan on the SWM sector in Madagascar are as shown in Table 1.3.

Table 1.3 Past Assistance by Japan on the SWM Sector in Madagascar

No.	Period	Name of the Project	Outline
1	2016~2019	Project on Master Plan Formulation for Economic Axis of TaToM	Formulation of the urban development plan and transportation development plan in the Tananarive City and Toamasina City including the SWM sector.
2	2017~2020	Data collection survey on the solid waste sector in the Africa region	Data collection, analysis of the SWM sector, and investigation of the possibility of future assistance to support the improvement of SWM and promote SDGs in Africa in cooperation with related international organizations.

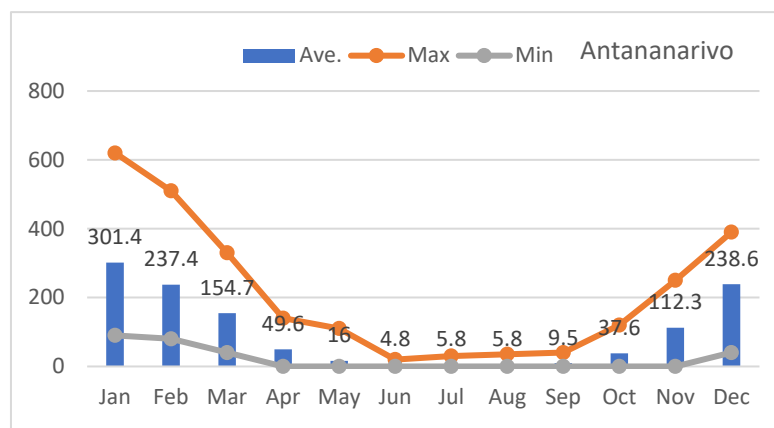
1.4 Environmental Condition

1.4.1 Climate

Antananarivo is situated nearly in the center of the island. The climate zone is categorized into a temperate summer rain zone. The altitude is approximately 1,270m and it is a plateau. Most of the annual rainfall occurs during the rainy season from November to April. The average annual temperature is approximately 17 °C. The maximum daytime temperature often exceeds 30 °C throughout the year.

1.4.2 Precipitation

Figure 1.1 shows the monthly precipitation in Antananarivo from 1990 to 2017 (excluding 2000). It is divided into a rainy season and a dry season, with the rainy season from November to April and the dry season from May to October. The average precipitation in January, which has the highest rainfall, is about 300 mm. In the dry season, precipitation is very low, especially between June and September. The average annual precipitation is estimated to be about 1,170 mm, a maximum of 1,780 mm, and a minimum of 700 mm during the same period.



Source: Ministry of Transportation and Meteorology, Madagascar

Figure 1.1 Monthly Precipitation in Antananarivo

1.4.3 Results of Geological Survey

A geological survey was conducted in the Project at the Andralanitra landfill site. As a result of the survey, 8 to 20m of waste was deposited at the landfill site, and it is estimated that about 1.6 million m³ of waste is being landfilled since the 1960s.

1.5 Environmental and Social Considerations

1.5.1 Project Overview and the Environment and Social Impact Assessment

The Project involves the procurement of equipment for waste collection and landfill operation and the installation of garbage containers at the collection points, etc. The environmental and social impacts from the equipment procurement are needed to be inspected. The list of planned procurement items is as shown in Table 1.4. The Project is classified into Category C of the "JICA Environmental and Social Consideration Guidelines (April 2010)". Since the environmental permit of the existing landfill site has expired, assistance to CUA in updating the permit was implemented in the Project, and the permit was updated in January 2022.

Table 1.4 List of Planned Procurement Items

Item No.	Items	Quantity
1	Skip Loader	33
2	Dump Truck 1 (waste collection and transportation)	6
3	Dump Truck 2 (landfill operation)	3
4	Bulldozer	2
5	Excavator	4
6	Garbage Container	326
7	Pick-up Truck	2
8	Off-road Bike	8
9	Improvement Work of Waste Collection Points	8
10	Repair Tool for Vehicle	1
11	Floodlight	4
12	Flat-body Truck	2

1.5.2 Basic Environmental and Social Conditions

The Antananarivo administrative framework is as shown in Figure 1.2. The City of Antananarivo is the target area of the Project. CUA is positioned as the capital of Madagascar (Government-designated city under Municipal Law No. 2015-004), and it is divided into six (6) wards (Arrondissement).

Each Arrondissement is further divided into sub-administrative divisions, Fokontany. Other than the government-designated cities, there is no ward (Arrondissement) as a local commune. The survey area is six (6) Arrondissements in Antananarivo and Fokontany, one of the Ambomangakely communes where the Andralanitra landfill site is located. There are 192 Fokontany under the jurisdiction of SMA. Fokontany is further informally divided into subdistricts or villages, whose administrative capacities are appointed by residents or Fokontany chiefs.

This section mainly summarizes the environmental and social conditions around the planned project site obtained from the existing documents, site visits, and interviews.

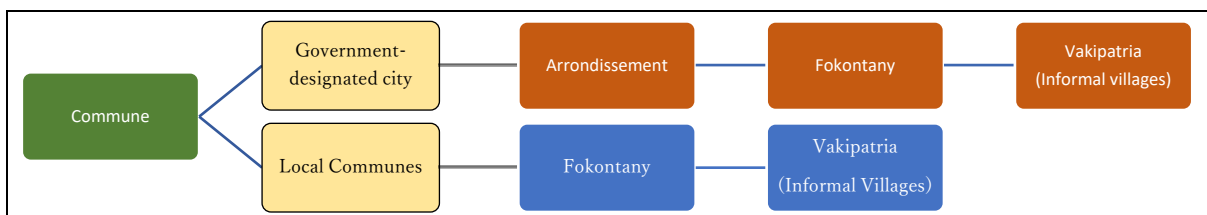


Figure 1.2 Antananarivo Administrative Framework

(1) Overview of Environmental Conditions

(a) Water

The Andralanitra landfill site is located in the Ambomangakely commune at the eastern end of the urban area, 9 km from the city center of Antananarivo. The altitude is 1,260 m on the northwest side and 1,340 m on the south side, and there is Lake Mandroseza (elevation 1,313 m), which is the water source of Antananarivo City, at approximately 2.5 km from the landfill site. Locations of Lake Mandroseza and the Andralanitra landfill site are shown in Figure 1.3.

The water supply is carried out by a water utility, JIRAMA (Jiro sy Rano Malagasy). The Ikopa River runs from the east to the west in the direction of Lake Mandroseza, about 2 km south of the landfill site. Lake Mandroseza intakes water from the Ikopa River through a water gate and pumping equipment. The area of the lake is about 47ha, the water depth is 3 to 3.5m, the average capacity is about 1.6 million m³ which is the water demand of Antananarivo city for 2 days. The lake is not particularly protected, and the area from the landfill site to the river is a lowland green area. The terrain is such that leachate from the landfill site can easily flow into it.



Source: JICA Survey Team based on Google Earth

Figure 1.3 Lake Mandroseza and Andralanitra Landfill Site Locations

(b) Biodiversity

The landfill area is approximately 18 hectares (ha). Before the construction of the landfill site, it was farmland or wasteland. The area is not included in the ecosystem conservation area. According to the environmental impact survey conducted in 2011, *Cyperus sp* (a type of *Leucaena* family used for local housing construction), *Lantana camara* (an evergreen small shrub of the *Verbenaceae* family) and *Leucaena leucocephala* are located on the south side of the area around the Andralanitra landfill site. The grassland of secondary vegetation consisting of (Aquatic plants of the family *Verbenaceae*) spreads, and the north side is adjacent to the urban area and residential area. There are no endangered species. As wild birds, many small birds of *Acridotheres tristis* (Passerine Starlings) have been observed. As for animals, rats (*Rattus rattus*) and poultry have been observed. Currently, landfills are not included in nature reserves or other restricted

development areas. No animal or plant is listed above the near threatened species on the International Union for Conservation Nature (IUCN) Red List.

(c) Environmentally Protected Zones

A private park (Parc de Tsarasaotra) in Antananarivo is registered as a wetland under the Ramsar Convention. Other than that, the target area of the Project does not have environmentally protected zones.

(2) Administrative Boundaries and Population

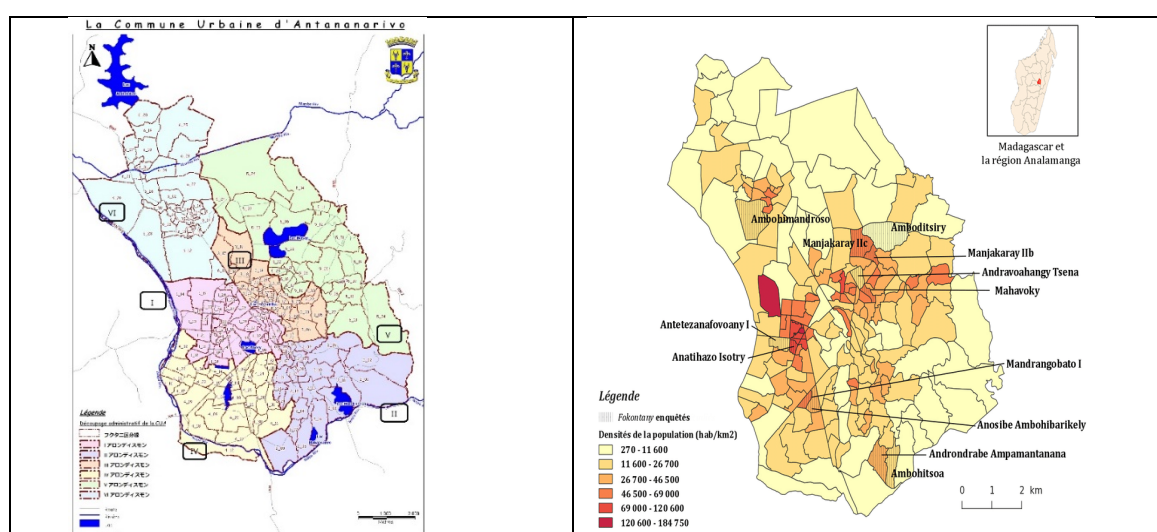
The following Table 1.5 shows the population estimate by administrative boundaries in Antananarivo. Each arrondissement and Fokontany is as shown in Figure 1.4.

Table 1.5 Population Estimate by Administrative Boundaries in Antananarivo

No.	Arrondissement	Population 2018 ²⁾	Fokontany ¹⁾
①	I	238,126	44
②	II	192,215	24
③	III	133,322	34
④	IV	255,847	32
⑤	V	334,964	27
⑥	VI	120,733	31
Total		1,275,207	192

Source: ¹⁾ CUA <https://www.cua.mg/monographie-dantanarivo-renivohitra/>

²⁾ JICA, The Project on Master Plan Formulation for Economic Axis of TaToM (Antananarivo-Toamasina, Madagascar), Final Report: Future Vision, Growth Scenarios and Socio-Economic Framework for Antananarivo Agglomeration, Vol. 1, p. 11-16. Table 11.1.12 Population Framework for TaToM by Commune until 2033, October 2019.



Source: Bureau de Développement du Grand Tana (BDGA), https://www.researchgate.net/figure/Carte-de-localisation-de-la-Commune-Urbaine-dAntananarivo-et-des-Fokontany-enquetes_fig1_343187517

Figure 1.4 Arrondissement and Fokontany Locations

(3) Social Condition in the Vicinity of Andralanitra Landfill Site

The Andralanitra landfill site is located in Ikanja Fokontany in the Ambomangakely commune. Villages in Ikanja Fokontany in the vicinity of Andralanitra are shown in Table 1.6. The population of Ikanja Fokontany is 23,400 (interviewed in February 2021). Ikanja Fokontany is further informally divided into 6 villages (Vakiparitra). Among them, the villages directly adjacent to the landfill site are Akamasoa village and its branch villages, Antaninarenina and Ambaniala. Land use in the community is mainly for residential use, and indigenous people do not live there. These three

villages were founded and supported by AKAMASO, an organization founded by a missionary leader, Father Pedro, to support the poor. Father Pedro has a substantial influence on the social security activities of the area. In these villages, 80% of people do waste picking at Andralanitra. In addition, there are 7 villages in the distances between 500m and 1.2km, and some villagers earn income from waste picking.

Table 1.6 Villages in Ikanja Fokontany in the Vicinity of Andralanitra

Item No.	Village (Vakiparitra)	Distance from Andralanitra	Fokontany	Commune	Pop. (2019)	Waste Pickers (%)
1	Akamasoa Cité	0 km	Ikanja	Ambomangakely	700	Approx. 80%
2	Ambaniala	0 km	Ikanja	Ambomangakely	1,399	Approx. 80%
3	Antaninarenina	0 km	Ikanja	Ambomangakely	388	Approx. 80%
4	Ankadiefajoro	0.5 km	Ikanja	Ambomangakely	1,900	Approx. 50%
5	Ampasika	0.5 km	Ikanja	Ambomangakely	1,400	-
6	Ambovokely	0.5 km	Ikanja	Ambomangakely	-	1 (HH)
7	Amoronankona secteur 1	1 km	Amoronankona	Ambomangakely	7,000	10 (HH)
8	Amoronankona secteur 2	1.2 km	Amoronankona	Ambomangakely	6,000	10 (HH)
9	Amoronankona secteur 3	1 km	Amoronankona	Ambomangakely	5,000	20 (HH)
10	Ambatolampy Kely	1 km	Ambatomaro	Antananarivo	2,430	4 (HH)

Note: * (HH) household

Source: Ikanja interview in February 2021

According to the interviews, most of the methods are waste picking inside the Andralanitra landfill site, but some people go out to the city and collect garbage directly from the waste collection points.

1.5.3 Environmental and Social Consideration System / Organization of Madagascar

(1) Laws and Guidelines relating to Environmental Impact Assessment

The laws and guidelines relating to the environmental impact assessment, including revisions, are shown in Table 1.7.

Table 1.7 Quantity and Specifications of Facilities and Equipment of the Cooperation Project

Title	Year
Charte environnementale N°90-033	1990.12.21
Charte de l'Environnement Malagasy Loi n° 90-033 du 21 décembre 1999, modifiée par les lois n° 97-012 du 06 juin 1997 et n° 2004-015 du 19 août 2004.	1997.6.6 2004.8.19 Revised
MECIE: Décret N°99-954 du 15 décembre 1999 --modifié par le décret n° 2004 -167 du 03 février 2004 relatif à la mise en compatibilité des investissements avec l'environnement	1999.12.15 2004.02.03 Revised
Loi sur l'utilisation de l'eau N°98-029	1999.01.20
Loi n° 98-029 du 20 janvier 1999 portant Code de l'Eau	
Loi N° 99-021 DU 19 AOÛT 1999 sur la politique de gestion et de contrôle des pollutions industrielles	1999.08.19
Loi N°99-023 réglementant la maîtrise d'ouvrage publique et la maîtrise d'oeuvre privée pour des travaux d'intérêt général	1999.08.19
Loi Organique n°2014-018 Régissant les compétences, les modalités d'organisation et de fonctionnement des Collectivités Territoriales Décentralisées, ainsi que celles de la gestion de leurs propres affaires.	2014. 08.14
Loi n° 2014-020 du 27 septembre 2014 relative aux ressources des Collectivités Territoriales Décentralisées, aux modalités d'élections, ainsi qu'à l'organisation, au fonctionnement et aux attributions de leurs organes	2014.09.27
Loi n°2015-004 relative aux Collectivités Territoriales Décentralisées à statut particulier	2015. 01.21
Loi N° 95.035 du 03 Octobre 1995 autorisant la création des organismes chargés de l'assainissement urbain et fixant les redevances pour l'assainissement urbain	1995. 10.03

Title	Year
Ordonnance ministérielle prévoyant des dispositions relatives à la participation du public à l'étude d'impact sur l'environnement n°6830/2001 Arrêté n° 6830/2001 du 28 juin 2001 fixant les procédures et les modalités de participation du public à l'évaluation environnementale	2001.06.28
Ordonnance ministérielle sur les zones écologiquement vulnérables n°4355/97	1997
Ordonnance n° 62-023 du 19 septembre 1962 relative à l'expropriation pour cause d'utilité publique, à l'acquisition amiable de propriétés immobilières par l'État ou les collectivités publiques secondaires et aux plus-values foncières)	1962. 09.19
Arrêté du Cabinet sur la classification des eaux de surface et des eaux usées n°2003/464 Décret n° 2003/464 du 15/04/03 PORTANT CLASSIFICATION DES EAUX DE SURFACE ET REGLEMENTATION DES REJETS D'EFFLUENTS LIQUIDES	2003.04.15
Loi N° 2014 – 020 Relative aux ressources des Collectivités Territoriales Décentralisées, aux modalités d'élections, ainsi qu'à l'organisation, au fonctionnement et aux attributions de leurs organes -modifiée par la Loi n°2015-008 du 1er avril 2015 modifiant certaines dispositions de la loi n° 2014-020 du 27 septembre 2014 relative aux ressources des Collectivités Territoriales Décentralisées, aux modalités d'élection, ainsi qu'à l'organisation, au fonctionnement et aux attributions de leurs organes	2014.08.202015.04.01 Revised
Loi n°2005-019 du 17 octobre 2005 fixant les statuts des terres à Madagascar	2005.10.17
Décret N° 96.173 du 06 mars 1996 portant Réorganisation du Service Autonome de Maintenance de la Ville d'Antananarivo	1996.03.06
Décret N°2009-1166 portant réforme et réorganisation du Service Autonome de Maintenance de la Ville d'Antananarivo (SAMVA)	2009.09.15
Décret N°2003-792, N°2003- 943 -relatif aux déversements, écoulements, rejets, dépôts directs ou indirects dans les eaux superficielles ou souterraines	2003
Décret N° 2003-464 portant classification des eaux de surface et réglementation des rejets d'effluents liquides	2003
Arrêté interministériel n°4355 du 13 mai 1997 Portant définition et délimitation des zones sensibles (voir Périmètres de protection des eaux potables, minérales ou souterraines)	1997.05.13
Arrêté municipal n°826/13 du 27 août 2013 portant Code Municipal d'Hygiène de la Commune Urbaine d'Antananarivo modifié et complété par les arrêtés municipaux N°219/20 du 12 mars 2020 et N°260/20 du 25 mai 2020	2013.08.272020.05.25 Revised
Convention de concession entre SAMVA et Commune Urbaine d'Antananarivo	1996.10.11
Loi n°2011 – 002 du 15 Juillet 2011 portant Code de la Santé	2011. 07.15
Loi n° 2015 - 052 relative à l'urbanisme et à l'habitat	2015.12.16

Regarding the procedure for obtaining an environmental permit, the above-mentioned "Government Ordinance on Balancing Development Investment and the Environment" (MECIE: Décret N° 99-954 du 15 décembre 1999 modifié par le décret N° 2004 -167 du 03 février 2004 relatif à la mise en compatibilité des investissements avec l'environnement) stipulates the procedures. According to the MECIE, projects must undertake an environmental impact assessment (EIE: Etude d'Impact, hereinafter referred to as "EIA") in accordance with the type, scale and location of the planned projects. Alternatively, it is required to prepare an environmental management plan (PREE: Program d'Engagement Environnemental). Articles 4 and 5 of MECIE stipulate the selection criteria on which assessment procedures are selected. As a general rule, the preparation of an EIA is required for projects related to waste. According to MECIE, depending on the implementation stage of the project, the project operator can manage the environmental assessment through five procedures: screening, scoping, implementation of EIA, environmental management and monitoring, and environmental audit.

(2) Environmental Impact Assessment (EIA)

(a) Target Projects for Environmental Impact Assessment

MECIE stipulates the products and wastes subject to EIA as itemized below. The applicant will bear approx. 0.2% fee for an investment of between 25 billion and 50 billion MGA.

- Agricultural chemical storage unit with a capacity of over 10 tons
- Any unit for the collection, removal, or disposal of household waste
- Industrial waste and other hazardous waste
- Hospital waste treatment or disposal unit over 50 kg/d
- Storage of all kinds of radioactive products and/or waste
- Storage of dangerous products
- Household wastewater treatment unit

The target project related to PREE waste is the disposal of medical waste of 3 tons or more.

(b) Approval Procedures for Environmental Impact Assessment

The general EIA approval procedure in Madagascar is as follows. An applicant for a development project, which may affect the surrounding natural and social environment, undertakes a scoping process, which, in many cases is called an initial environmental survey using the information from the outline of the project prior to the start of the assessment. The results will be documented and are submitted to the Environment Bureau (Office National pour l'Environnement, hereinafter "ONE") as Terms of Reference (TOR) of the EIA survey.

The EIA process is classified as an EIA or a simpler environmental management plan (PREE: Program d'Engagement Environnemental). ONE reviews the submitted TOR proposal and decides which document is required to be prepared depending on the scale and content of the project. In principle, which of EIA or PREE is required to be submitted is determined case by case in consultation with MECIE as a legal reference. The project operator carries out the EIA specified by ONE for the application of an environmental permit for the planned project.

Regarding the Andralanitra landfill site, an environmental assessment was conducted, and an environmental permit was granted in connection with the project implemented with the support of AFD in 2011. However, the validity of this permit has expired. Therefore, in this Project, in addition to the environmental evaluation for renewal of the expired environmental permit, the impact of the equipment procured in the Project will be examined and an assessment report will be submitted to ONE. This has been agreed among ONE, CUA and JICA. The flow chart in Figure 1.5 shows the flow of the approval procedure for EIA.

Planning Phase	Responsibility
1. Confirmation of procedures by conducting screening	Project owner
↓	
Preliminary F/S, preparatory survey phase	
2. Preparation of TOR through screening and submission of an EIA to ONE to obtain approval.	Project owner
↓	
Survey Phase	
3. ONE examines the TOR and determines the type and necessity of EIA	ONE
4. Conduct necessary EIA in accordance with the TOR approved by ONE. The assessment report is submitted to ONE.	Project owner
5. Examination and approval of EIA report, environmental monitoring plan, issuance of the environmental permit. Review by the Technical Evaluation Committee (CTE)	ONE (60 working days)
↓	
Implementation Phase	
6. Implementation of environmental management and monitoring plans	Project Owner
7. Monitoring plan, confirmation of the implementation of the environmental permit incidental conditions, examination	ONE

Source: JICA Survey Team based on MECIE

Figure 1.5 Outline of EIA Procedure

(c) Procedures for the EIA of the Project

SAMVA implemented a waste landfill site improvement project and waste treatment in 2011 with the support of AFD for the Andralanitra landfill site under the assumption of closure of the Andralanitra landfill site after some time. At the time, an EIA was conducted, and based on the results of this assessment survey, an environmental permit (Permit Number: 11-EF / ONE / DG / PE) was issued by the ONE on January 30, 2011.

The environmental permit was issued in 2011 based on the assumption that the Andralanitra landfill site will be closed in the near future for function reinforcement works of the landfill site: (1) Installation of vehicle parking space; (2) Drainage facility; and (3) New office construction. This environmental permit was valid for five years or until 2011 and had already expired.

JICA had indicated that renewal of the environmental permit is a prerequisite for the vehicle and equipment procurement in the Project. For the improvement and prolongation of life of the landfill site, equipment procurement and improvement of operation and maintenance of the landfill site were suggested as intervention measures.

The CUA expressed an intention to work on all of these. As support from JICA, procurement of equipment and collection vehicles is being proposed through the Project. To supplement the procurement of equipment, training on maintenance of the landfill site may be implemented in the technical cooperation scheme.

Regarding the environmental permit for the maintenance of the landfill site, after the project content is clarified, an environmental survey with regard to the project contents needs to be carried out for the project owner to obtain a permit. Since the details of the landfill site development project will not be determined in the Project, the environmental survey will be conducted when the details of the project contents have been decided.

The main points required for the issuance of the new environmental permit indicated by ONE are as follows:

- The survey should include creating a project overview description including “impact analysis” under Article 11 and General Provisions of the MECIE Decree.
- The project owner bears the fees for the environmental permit application to ONE in proportion to the investment cost (Appendix III of Decree MECIE: The project owner

whose project is subject to the EIA depends on the investment level and requirements. It is necessary to bear the cost of permit examination and monitoring of a project environmental management plan (Plan de Gestion Environnementale du Projet, hereinafter referred to as "PGEP").

- PGEP including an environmental monitoring program and communication plan shall be prepared.

In the past environmental permit, the "project owner" was named as SAMVA. SAMVA was dissolved in 2021, and its activities were taken over by SMA under CUA. Since the responsible entity for waste administration, equipment, and land ownership is CUA, the "applicant" for the revised environmental permit is CUA.

(d) Inspection Authority

In Madagascar, as an authorizing organ relating to environmental and social considerations, ONE, which was established in 1995, carries out the approval process of environmental permits. ONE is in charge of the examination of EIA and environmental monitoring reports, and also disseminates environmental information and environmental education as part of its work. ONE is the responsible body for review and approval. Due to the dismantling of SAMVA, the application for renewal of the environmental permit in the Project was submitted in the name of CUA, and the permit was updated in January 2022.

(e) Contents of Environmental Assessment Report

The MECIE regulations stipulate the items in Table 1.8 as the main contents to be included in the EIA report.

Table 1.8 Items to be Included in the EIA Report (based on MECIE Regulations, Chapter II Article 11)

Documents	Required Contents of the Report
EIA Report	(A) Applicant (B) Legal status of the project site (C) Outline explanation of the project plan (D) Appropriate and sufficient outline explanation of the environment affected by the plans such as the planned location and site map. Technical, economic, and social description of environmental characteristics that are or may be affected (E) Analysis of the aforementioned possible environmental impacts of the planned project (F) Project Environmental Management Plan (PGEP) (G) Outline of the inhabitant public meeting (non-technical summary is acceptable, languages are Malagasy and French) Initial state of the project site environment, changes made by the project and their impact
PREP Plan	Contents included in the environmental management plan: (A) Environmental management program directly managed by the environmental manager of the organization in charge of supervising project activities (B) Take measures to reduce the environmental impact of project activities The activities of the project and measures to protect the environment

Source: JICA Survey Team based on MECIE

(3) National Standards for EIA

Table 1.9 outlines the environmental standards related to this project in Madagascar's environmental system.

Table 1.9 Madagascar Environmental Laws or Provisions (Excerpts)

Laws	Provisions
MECIE Decree Art.9	Atmospheric standards
Decree 2003/464	Water quality environmental standard
Decree 2003/464	Drainage of surface water
2401-31	Waste management regulations
2401-61	Environmental impact assessment regulations
2401-71	Air pollution control regulations

(a) Air Quality

Section 9 of the MECIE Decree stipulates that the standards recommended by international organizations affiliated with the United Nations should be referred to as the standards in the absence or lack of national standards in Madagascar. For the atmosphere, the standards of the World Health Organization (WHO) shown in Table 1.10 are to be referred to.

Table 1.10 Air Quality Standard

Pollutants	Concentration Standard (WHO)	Standard in Japan	Exposure Time
Sulfur dioxide (SO ₂)	20µg/m ³	0.04ppm or less	24-hour average
PM _{2.5} :	25µg/m ³	35µg/m ³ or less	24-hour average
PM 10:	50µg/m ³	100µg/m ³	24-hour average
Carbon monoxide (CO)		10ppm or less	
Photochemical oxidant	8 hour average 100 µg/m ³	1 hour 0.06 ppm or less	
Nitrogen dioxide (NO ₂)	200 µg/m ³	0.04ppm-0.06ppm or less	Hourly average

Source: World Health Organization 2005 (WHO), Ministry of the Environment (Japan)

(b) Water Quality

Environmental quality standards for water quality as stipulated in Decree 2003/464 are as shown in Table 1.11. The comparison with Japanese standards follows.

Table 1.11 Water Quality Environmental Standards

Parameters	Unit	Madagascar Standard	Japan Standard
pH	mg/l	6,0 - 9,0	6.0-8.5
BOD ₅	mg/l	50	1-10
COD	mg/l	150	1-8
Suspended solids (MES)	mg/l	60	25-100
Dissolved oxygen	mg/l	2-5	2.0-7.5
E. coli	MPN/100ml	500	<50-5000
Nitrogen	mg/l	-	0.1-1.0
Organophosphorus pesticides	mg/l	0.1	0.005-0.1

Source: Décret n° 2003/464 du 15/04/03, Décret n°2011-1239, Ministry of the Environment (Japan)

The elements in Table 1.12 have been established as substances that cause health hazards.

Table 1.12 Water Pollutants

Substances	Unit	Madagascar Standard
AS (ARSENIC)	mg/l	0.05
Hexavalent chromium	mg/l	0
Cyanide	mg/l	0
Fluorine	mg/l	1
Lead	mg/l	0.05

Substances	Unit	Madagascar Standard
Nickel	mg/l	0.05mg/l
PCB (polychloro-biphenyl)	mg/l	0
Zn zinc	mg/l	5
Cadmium	mg/l	0.01
Mercury	mg/l	0
Barium	mg/l	1

Source: Décret N° 2003-941

Regarding the drainage of surface water, the classifications and standards in Table 1.13 are as stipulated in Decree 2003/464.

Table 1.13 Drainage Quality Classification of Surface Water

Substance	Class A	Class B	Class C	Unit: µg/L
				Out of Class
Biological elements				
Dissolved oxygen (mg/l)	5<=OD	3<OD<5	2<OD<=3	OD<2
BOD5 (mg/l)	BOD<=5	5< BOD<=20	20< BOD<=70	70< BOD
COD (mg/l)	COD <=20	20< COD <=50	50< COD <=100	100< COD
Bacterial pathogen	None	None	None	Existent
Physical and chemical elements				
Color (Scale Pt-Co)	color <20	20<= color <=30	c 30< color	—
Temperature (°C)	θ<25	25<=θ<30	30<=θ<35	35<θ
pH	6,0<=pH<=8,5	5,5<pH<6,0 or 8,5<pH<9,5	pH<=5,5 or 9,5<=pH	
Suspended solids (SS) (mg/l)	SS<30	30<=SS<60	60<=SS<100	100<SS
Conductivity (µS/cm)	c<=250	250<c<=500	500<c<=3000	3000<c

Source: Décret n° 2003/464

(c) Noise

Environmental standards for noise are not set in Madagascar, and a comparison of the Environmental Standards of the World Bank (Environmental, Health, and Safety (EHS) Guidelines) and Japanese standards are shown in Table 1.14.

Table 1.14 Noise Environmental Standard (Reference)

Item	Unit	WB Standards	
		Daytime (07H-22H)	Night (22H-07H)
Residential area, office district, educational facility area	dBA	55	45
Industrial and commercial areas	dBA	70	70
Item	Unit	Japan Standards	
		Daytime (06H-22H)	Night (22H-06H)
Areas that require special tranquility, such as medical treatment facilities and social welfare facilities	dBA	50	40
Housing area	dBA	55	45
Commerce, industry, etc. together with residential areas	dBA	60	50

Source: World Bank (Environmental, Health, and Safety (EHS) Guidelines), Ministry of the Environment (Japan)

(4) Strategic Environmental Assessment (SEA)

SEA has not been institutionalized in Madagascar's EIA.

1.5.4 Comparison of Alternatives (including Zero Option)

(1) Comparison of Alternatives

Since the Andralanitra landfill site is expected to be closed, various efforts and many studies have been made before the proposal for equipment procurement for the Project was decided. The outline of the interventions is elaborated on below.

- The Andralanitra landfill site (area of about 18ha) has been landfilled as a waste landfill site since the 1960s. Due to decades of operation and population growth, the waste amount is increasing and landfill capacity is tight. The amount of waste continues to increase due to the urbanization and population growth of Antananarivo City. The city faces challenges such as (1) the collection is not on time and garbage piles up in the streets, (2) the leachate from the waste piled up at the landfill site, which causes foul odor and smoke from burning and the adverse effects are observed by surrounding residents and commercial facilities in adjacent urban areas. In order to improve this situation, the construction of a new landfill site has been under discussion. Several candidate sites and collection and transportation scenarios have been considered; however, no agreement has been reached.
- With these backgrounds, CUA carried out improvement activities for the Andralanitra landfill site in 2010-2017 with the support of France. In the projects implemented from 2010 to 2017, namely; (1) improvement of the living environment of the surrounding residents by measures to reduce the leakage of leachate and securing safe water by improving the water supply network to the surrounding area; (2) in the surrounding urban area, improvement of garbage collection and transportation work; (3) support for the improvement of waste picking activities at landfill sites of local residents and securing livelihood means through vocational training, etc.
- In 2021, SAMVA was disbanded, and it was decided that waste management will be carried out under the control of CUA and the organization will be reorganized.
- While the policy of closing the Andralanitra landfill site has been maintained, the location of the new landfill site and the overall picture of the waste treatment system have not been decided, so the landfill site will have to continue operating for the time being. On the other hand, there is an urgent need to improve the maintenance technology of the facility to improve the current environment, to improve the collection and transportation capacity, and to improve the garbage accumulation situation in the city.

In the process of planning the construction of a new landfill site, multiple proposals such as "a plan to set up several landfill sites" and "a plan to set up another landfill site" were put into consideration. In Madagascar, SEA has not been institutionalized, but in the process of selecting candidate sites, discussions including environmental perspectives were made at the planning stage. Based on these discussions and the current state of waste disposal, multiple alternatives shown in Table 1.15 as measures were examined to improve the current situation.

As alternatives, four options have been taken into consideration: zero option, construction of a new landfill site, procurement of equipment such as waste collection vehicles, and installation of sorting facilities. In case the zero option is adopted, the current transportation equipment cannot sufficiently carry out collection and transportation operations, and the scattering of garbage in the city will be further exacerbated, i.e., improper littering in the City of Antananarivo will increase, leading to the deterioration of living environment; it will take some time to secure land for the construction of a new landfill site. Therefore, the Andralanitra landfill site will have to be put into operation for the time being. The issue of collection is imminent to the sanitary condition of the city so that the implementation of measures to reduce pollution at the landfill site through the improved collection in the city is expected.

Table 1.15 Results of Examination of Multiple Alternative Proposals for Antananarivo

Item No.	Option	Evaluation
1	Zero Option	<p>The amount of discharged waste is increasing due to urbanization and population growth. Deterioration of the containers of the existing collection points (garbage dumps) and the shortage in number will aggravate the living and sanitary conditions. In SMA, there is a shortage of waste collection equipment and a primary collection point, so that garbage is scattered throughout the city of Antananarivo. The sanitary condition of the city will be exacerbated when the zero option is adopted. Therefore, the procurement of collection vehicles and the increase in the number of collection points will mitigate the exacerbating sanitary condition of the city. If measures for operation and maintenance of the landfill site are not implemented, Andralanitra will be saturated soon and will have a serious impact on waste management.</p>
2	Plan to construct a landfill site in a place other than the Andralanitra landfill site	<p>The following locations have been proposed as candidate sites for construction of a new landfill site, and the selection of candidate sites and proposals for measures are being considered.</p> <ol style="list-style-type: none"> 1) Manandriana 2) Andoharanofotsy 3) NOVIBEAL Soamanandray Fiaferana 4) Anosiala Avarabohitra 5) Antsahamarofoza 6) Ambohipamonjy <p>As future plans, multiple plans are being considered: (1) a plan to develop multiple landfill sites, and (2) a plan to develop one landfill site and several intermediate treatment facilities. Discussions are still ongoing, and no concrete agreement has been reached on the policy in 2021. It will still take time to select and agree on candidate sites, agree on treatment methods, formulate construction plans, etc., and this option cannot be implemented immediately.</p>
3	A plan to improve the scattering of garbage in the city by increasing the number of collection and transportation vehicles and the primary collection point.	<p>Currently, the number of collection trucks is insufficient, and existing trucks are overwhelmed. To cover the insufficiency, vehicles are rented from a private company to collect and transport wastes.</p> <p>There are many areas in the city where no temporary collection point is placed. The number of containers for primary collection points is also insufficient. As a result, hygiene and the living environment are deteriorating in those areas due to garbage overflow from containers and illegal dumping. Therefore, the provision of vehicles and containers for primary collection points may:</p> <ol style="list-style-type: none"> (1) increase and standardize the number of garbage collections; and (2) improve hygiene and living environment in the city. <p>This is effective as an urgent measure for an improvement of the hygiene and living environment in the city.</p>
4	Improvement of efficiency of the landfill site to extend the life of the landfill site. In addition, installation of a sorting facility to promote the recycling of waste and reduce the amount of waste brought into the landfill site.	<p>For the maintenance of the landfill site, it is necessary to take time to train the staff to improve their abilities on the maintenance of the landfill site and compression of the wastes.</p> <p>SAMVA has begun a trial of composting and recycling on a small scale.</p> <p>Examples)</p> <ul style="list-style-type: none"> - Resale of collected products - Collection of plastics (high-density polyethylene (HDPE), polypropylene (PP), polyvinyl chloride (PVC), polyethylene terephthalate (PET), etc.), production and sales of recycled products - Compost production (Madacompost supported by French NGOs, GRET/Gevalor and AFD/SYCTOM) <p>The amount of waste brought to landfill sites is expected to be reduced through promoting the recycling and composting initiatives and activating the recycling market. The nature of activities may be included in a technical cooperation scheme rather than a grant aid scheme from JICA. The activity mainly involves the development of mechanisms, the devising of manufacturing technologies, and sales promotions.</p>

Urgency is high for the improvement of sanitation environment of the city through the improvement of waste collection and transportation in the city. The Project can assist Option 3 as a short-term action and improve the collection and transportation of waste. In addition, Option 4 can be further assisted in the technical cooperation scheme, which will increase the efficiency of the operation and maintenance of the landfill site.

(2) Comparison with JICA Guidelines for Environmental and Social Considerations (April 2010)

The gaps between the EIA provisions in Madagascar and the JICA guidelines for environmental and social considerations have been identified as summarized in Table 1.16. In addition to the JICA guidelines, the World Bank's Safeguard Policy has been used as a reference for proper implementation of the EIA. The requirements of Madagascar's EIA regulations do not deviate significantly from the JICA guidelines.

Table 1.16 JICA Guidelines and Madagascar EIA Regulations (MECIE EIA Report Requirements)

Content	Items	JICA Environmental and Social Consideration Guidelines	Madagascar EIA Regulations (2401-61)	World Bank Safeguard Policy (OP4.01, OP4.01 Annex B)	Gaps
EIA Report Principles	Compliance with domestic law	If the country has an environmental assessment procedure system and the project is the target, the procedure must be formally completed and the approval of the government of the partner country must be obtained.	MECIE Decree No. 99-954 covers the guidelines on the right.	Same as JICA guidelines	No divergence
	Language	The environmental assessment report must be written in the official language or widely used language in the country where the project is carried out. In addition, the explanation must be written in a language and format that can be understood by the local people.	MECIE Decree No. 99-954 requires EIS to be easy to read for the public and decision-makers.	Same as JICA guidelines	No divergence
	Information disclosure	The environmental assessment report is open to the public in the countries where the project is implemented, including local residents, and it is required that stakeholders such as local residents can view it at any time and that the acquisition of copies is permitted.	MECIE Art16.17 stipulates public reviews and comments and includes an information disclosure process. The information disclosure period is 10 to 30 days.	For Category A projects, publish an environmental assessment report in a location accessible to those affected by the project and NGOs.	No divergence
	Consultation	Before preparing the environmental assessment report, sufficient information must be disclosed, discussions must be held with stakeholders such as local residents, consultation records, etc. must be prepared.	In MECIE Art15, public reviews and comments are to be secured by questionnaires or public hearings. The method is specified by ONE for each matter.	As mentioned above, discussions are made with related parties and information is disclosed.	No divergence
Principals of EIA	Timing of consultation	Discussions with stakeholders such as local residents should be held as necessary throughout the project preparation period and implementation period, but it is desirable that discussions be held especially when selecting EIA items and when drafting.	MECIE Art15 states that discussions with stakeholders such as local residents should be conducted as necessary throughout the project preparation period and implementation period.	For Category A and B projects, stakeholder opinions and their reflection are made in the project plan at the earliest possible stage. At least two consultations are made for category A projects.	No divergence

Content	Items	JICA Environmental and Social Consideration Guidelines	Madagascar EIA Regulations (2401-61)	World Bank Safeguard Policy (OP4.01, OP4.01 Annex B)	Gaps
Contents of EIA report	Project overview	Briefly describe important outcomes and recommended actions.	MECIE Art 11 stipulates the contents of the EIA report.	Briefly describe important outcomes and recommended actions.	No divergence
	Policy, legal, and administrative framework	Describe the policy, legal, and administrative framework for the implementation of the environmental assessment report.	MECIE Art 11 requires information on the legal framework for implementation.	Describe the policy, legal, and administrative framework for the implementation of the environmental assessment report. In addition, when co-financing is provided, the environmental requirements required by the donor will be explained, and the international environmental treaty agreed upon by the borrowing country will be clearly stated.	No divergence
	Description	Briefly describe the submitted project and its geographical, ecological, social, and temporal background. Clarify the need for a relocation plan, indigenous peoples plan, or social development plan. It usually includes a map showing the area of the project and the extent of the impact of the project.	Briefly describe the submitted project and its geographical, ecological, social, and temporal background. Clarify the need for a relocation plan, indigenous people plan, or social development plan. It usually includes a map showing the area of the project and the extent of the impact of the project.	Briefly describe the submitted and its geographical, ecological, social, and temporal background. Clarify the need for indigenous people relocation plans and indigenous people development plans. It usually includes a map showing the area of the project and the extent of the impact of the project.	No divergence
	Basic information	Assess the characteristics of the study area and describe the relevant physical, biological, and socio-economic conditions. The description also includes changes that are expected before the project starts. It also takes into account ongoing and proposed development activities within the project area but not directly related to the project. The information provided here should relate to decisions regarding project location, design, operation, and mitigation measures. Numerical accuracy, reliability, and sources are also described in this section.	The table of contents items required by MECIE Article 11.2 cover the above information.	Assess the characteristics of the study area and describe the relevant physical, biological, and socio-economic conditions. The description also includes changes that are expected before the project starts. It also takes into account ongoing and proposed development activities within the project area but not directly related to the project. The information provided here should relate to decisions regarding project location, design, operation, and mitigation measures. Numerical accuracy, reliability, and sources are also described in this section.	No divergence

Content	Items	JICA Environmental and Social Consideration Guidelines	Madagascar EIA Regulations (2401-61)	World Bank Safeguard Policy (OP4.01, OP4.01 Annex B)	Gaps
Contents of EIA report	Environmental impact	Quantitatively predict and evaluate the positive and negative impacts of the project to the extent possible. Identify all mitigation measures and all non-mitigable negative environmental impacts. Explore opportunities to improve the environment. Recognize and evaluate the range and quality of available information, the lack of important information, and the uncertainties associated with predicted values. Also, identify matters that do not require further consideration.	The table of contents items required by MECIE Article 11.3. cover the information on the left.	Quantitatively predict and evaluate the positive and negative impacts of the project to the extent possible. Identify all mitigation measures and all non-mitigable negative environmental impacts. Explore opportunities to improve the environment. Recognize and evaluate the range and quality of available information, the lack of important information and the uncertainties associated with predicted values. Also, identify matters that do not require further consideration.	No divergence
	Analysis of alternatives	Effective alternatives to project location, technology, design, and operation (including "no project implementation"), the potential impact of each alternative on the environment, the mitigation of that impact, initial and recurring costs. Systematically compare from the viewpoint of suitability for local conditions and necessary system development, training, and monitoring. For each alternative, quantify the environmental impact to the extent possible and attach an economic assessment if possible. Clarify the rationale for choosing a particular project design and justify the desired emission levels and pollution control and reduction measures.	MECIE also covers the consideration of alternatives by regulation.	Effective alternatives to project location, technology, design, and operation (including "no project implementation"), the potential impact of each alternative on the environment, the mitigation of that impact, initial and recurring costs, systematically compare from the viewpoint of suitability for local conditions and necessary system development, training, and monitoring. For each alternative, quantify the environmental impact to the extent possible and attach an economic assessment if possible. Clarify the rationale for choosing a particular project design and justify the desired emission levels and pollution control and reduction measures.	No divergence
	Environmental Management Plan (EMP)	Strengthen mitigation measures, monitoring, and systems to eliminate, offset and reduce negative impacts during construction and operation.	MECIE Art.11.5 covers the formulation of environmental management plans (PGEP), mitigation measures (Cahier de Charges Environnementales: "CCE"), and monitoring plans.	Mitigation measures, monitoring, and strengthening of systems.	No divergence
	Consultations	Record of the consultation (time and place of the meeting, participants, agenda, opinions of major local stakeholders and their response, etc.). It also includes records of consultations held to gain informed views by affected people, local non-governmental organizations (NGOs), and regulators.	In MECIE Art. 15, consultation records, lists of parties to discuss, etc., are stipulated as items to be described in EIA.	Records of meetings and consultations by various organizations. It also includes records of consultations held to gain the informed views of affected people and local non-governmental organizations (NGOs). Clarify in the record any means other than consultations (e.g., surveys) used to obtain the views of the affected people, local NGOs.	No divergence

1.5.5 Scoping

Table 1.17 shows a scoping plan for environmental and social impacts when procuring the equipment. Since this Project is an equipment procurement project, the impact after equipment procurement (in-service) is scoped.

Table 1.17 Scoping

Environmental Items		Assessment*		Reasons for Scoping
		During construction	In service	
(1)	Air pollution		✓	<In service> Exhaust gas may increase slightly due to the increase in operating vehicles depending on the equipment procured.
(2)	Water pollution		✓	<In service> There is concern that leachate will deteriorate due to an increase in the amount of waste carried in.
(3)	Waste		✓	<In service> Waste collection and illegal dumping due to insufficient garbage collection will be improved by the construction of the primary collection points. On the other hand, there is concern that the amount of waste carried into the landfill site will increase and the amount of waste accumulated in the landfill site will increase.
(4)	Soil pollution			The impact of soil pollution due to the provision of equipment is not expected.
(5)	Noise/vibration	✓	✓	<During construction> Work noise during construction is expected. <In service> Noise is expected during the operation of collection vehicles and landfill maintenance equipment.
(6)	Ground subsidence		✓	<In service> The risk of slope failure of sedimentary waste is improved by utilizing maintenance equipment.
(7)	Offensive odor		✓	<In service> The frequency of waste collection will be improved, and the generation of foul odors due to the waste accumulated at the collection points will be improved. On the other hand, there is concern that the odor in and around the landfill site may worsen due to the increase in waste carried into the landfill site.
(8)	Protected area			The project site is not within the area designated as a protected area by Madagascar's laws and international treaties.
(9)	Ecosystem			No impact on the ecosystem is expected from equipment procurement.
(10)	Site management			The impact of site management is not expected.
(11)	Resettlement			Resettlement by the Project is not expected.
(12)	Poverty			The impact on the poor is not expected.
(13)	Living condition		✓	<In service> It is necessary to change the garbage collection frequency, change the garbage disposal method due to addition, etc., and understand the service. The number of vehicles will increase due to the increase in transportation vehicles.
(14)	Livelihood		✓	<In service> Changes in landfill management methods may reduce waste picker picking opportunities.
(15)	Employment and local economy		✓	<In service> The project may increase the employment of workers and improve their livelihoods.
(16)	Land use			The impact on land use and local resource use is not expected.

Environmental Items	Assessment*		Reasons for Scoping
	During construction	In service	
(17) Water usage			The increase in water use for equipment procurement such as cleaning is minor, and no impact is expected.
(18) Existing social infrastructure and services		✓	<In service> Improving the garbage collection service will improve the sanitary environment in the city. Equipment maintenance will improve waste disposal at the landfill site.
(19) Social capital and local decision-making bodies			The impact of project implementation on social capital and social organizations such as local decision-making bodies is not expected.
(20) Uneven distribution of damage and benefits			The implementation of the project will not bring unfair damage and benefits to the areas.
(21) Conflicts of interest			No impact is expected on the conflict of interests within the area due to the implementation of the project.
(22) Cultural heritage			There is no cultural heritage in the surrounding area.
(23) Landscape		✓	<In service> Procurement equipment will increase the amount of waste carried-in, and there is concern that visual discomfort will worsen in the landfill site.
(24) Ethnic minorities and indigenous peoples			There are no ethnic minorities or indigenous people in the project site.
(25) Gender			No gender impact is expected by the equipment procurement.
(26) Children's rights			No impact is expected on children's rights.
(27) Infectious diseases such as HIV / AIDS	✓	✓	<During construction/in service> It is necessary to consider infectious diseases of workers from the viewpoint of safety and health.
(28) Working environment	✓	✓	<During construction/in service> As the employment of workers will increase, it is necessary to promote understanding of safety and health by using the equipment.
(29) Accidents	✓	✓	<During construction/in service> There is a concern of accidents during the works or using maintenance equipment.
(30) Cross-border impacts and climate change			Cross-border impacts and climate change impacts are not expected.

*Assessment: A+/-: Significant positive/negative impact B+/-: Moderate positive/negative impact C: Impact degree unknown D: No impact is expected

1.5.6 TOR of Environmental and Social Consideration Survey

As a result of scoping in relation to the Project, surveys on the necessary items have been conducted as items in Table 1.18. The scope of the survey will be around the Andralanitra landfill site and the primary collection points.

Table 1.18 TOR of Environmental and Social Consideration Survey

No.	Environment Item	Survey Items	Survey Methods
(1)	Air pollution	Related criteria Status of the surrounding area	Confirmation of laws and regulations Confirmation of project content, period, location, etc.
(2)	Water pollution	Related criteria Status of the surrounding area	Confirmation of laws and regulations Survey of existing materials Interview with related organizations
(3)	Waste	Status of the surrounding area	Field reconnaissance visits Interview with related organizations
(5)	Noise/Vibration	Noise and vibration caused by vehicles around the temporary collection point and landfill site	Field reconnaissance visits Interview with related organizations
(7)	Bad odor	Confirmation of odor in the city and around the landfill site	Residents' interviews on and around the site Complaints records
(13)	Living condition	Impact of this project on local life	Field reconnaissance visits Interview with related organizations
(14)	Livelihood (Area Economy)	Impact of this project on the local economy	Field reconnaissance visits Interview with related organizations
(23)	Landscape	Current landscape	Field reconnaissance visits Existing documents
(28)	Working environment	Occupational safety regulations Impact of this project on the working environment	Interviews with people involved Existing materials Confirmation of related legal system Discussions on possible occupational accidents
(29)	Accidents	Possibility of accident	Field reconnaissance visits Interview with related organizations
Other	Stakeholder consultation	Opinions of stakeholders regarding scoping results, TOR of environmental and social consideration surveys, and impact survey results	Discussion content: Scoping results, environmental and social impacts and mitigation measures, and discussions related to them Explanation of EIA report draft, discussion on EIA report draft

1.5.7 Environmental and Social Consideration Survey Results

The results of the survey conducted in accordance with the TOR proposal created in the previous section are summarized below.

(1) Air pollution

The number of times the waste transportation truck enters the Andralanitra landfill site is 92 times in 24 hours, or about once every 15 minutes, and the transportation truck operates continuously 24 hours a day, 7 days a week. During the field survey, old existing collection vehicles that emit black smoke were observed. Mechanics and assistants are engaged in maintenance work based on the experience of OJT and have not received systematic maintenance training. Therefore, the current waste collection vehicles may cause air pollution due to exhaustion.

The introduction of equipment through the Project will increase the number of waste collection vehicles by 39 and equipment for landfill maintenance by 8. They may emit exhaust gas slightly, but the impact is very minor. On the other hand, stopping the use of old vehicles will improve exhaust emissions. In addition, maintenance training for mechanics may increase capacity for proper operation of the equipment to suppress the generation of exhaust gas.

(2) Water Pollution

(a) Impact on City Canals and Ditches

Illegal dumping waste can be seen in the canals and ditches of the city. Increasing the frequency of garbage collection by procured equipment and improving the maintenance of collection points will lead to the improvement of water in canals and ditches.

(b) Leachate

Regarding the impact of leachate at the landfill site on the surrounding water environment, the amount of leachate is affected by the amount of rainfall and the landfill area. Therefore, the amount of leachate is not expected to change with the increase of transported wastes due to equipment procurement.

In addition, systematic landfill site maintenance by using procured equipment and cleaning will clear drainage ditches around the landfill site. Furthermore, the Fukuoka method (semi-aerobic landfill method) is expected to accelerate waste decomposition and improve the leachate water quality.

(3) Waste

In the vicinity of the primary collection point, due to the insufficient frequency of garbage collection, the garbage overflows from the containers and is scattered around. Increasing the frequency of collection and conducting regular collection with procured equipment will improve the waste scattering situation at the primary collection points and reduce illegal dumping.

In addition, at the landfill site, waste is currently being carried in and loaded unplanned. The procured equipment will increase the amount of waste brought into the landfill site. The procured maintenance equipment will implement landfill site maintenance such as soil covering, slope stabilization, and extend the life of the landfill site.

(4) Noise and Vibration

Noise and vibration are engine sounds when collecting vehicles and maintenance equipment are passing. The vehicles emit a sound of about 70 to 90 dBA depending on the condition and type, but it attenuates by about 20 dBA at a distance of 10 m. The IFC guidelines recommend levels in residential and educational areas: 55 dBA from 7 am to 10 pm and 45 dBA from 10 pm to 7 am, so that the impact on the surrounding area in normal vehicle operation and landfill maintenance is minor and no impact expected.

(5) Offensive Odor

In the city, there is an offensive odor from the area around the primary collection points and illegally dumped garbage. By repairing and maintaining the primary collection points and increasing the frequency of collection by procured vehicles, the amount of wastes scattered in the city will be reduced and the offensive odor will be improved.

On the other hand, in the community adjacent to the landfill site, there are many complaints about the unpleasant odor from the accumulated waste at the landfill site, and the offensive odor worsens especially in the rainy season. The main sources of odor are putrefactive odors such as organic matter, biogas, and malodor of leachate. Increased waste brought in may increase complaints. The plan is to prevent the generation of offensive odors by covering soil and promoting the early decomposition of waste by using the procured equipment.

(6) Living Condition

An increase in the frequency of garbage collection by procured equipment will improve the sanitary environment in the city. The increase in the number of transportation vehicles may increase the truck traffic and traffic accidents around collection points and landfill sites in the city, but this can be avoided by proper planning of collection routes and collection times, so that no major impact is expected. It is also important to promote the understanding of the mechanism of the garbage collection service among the residents, such as the garbage disposal method and the implementation method.

(7) Livelihood

The number of collection workers will increase with the operation of procured equipment and serve for garbage collection services. The new workers are recruited from the surrounding communities and this will have an impact on job creation.

On the other hand, the increase in procured vehicles and the implementation of maintenance with equipment will limit the activities of waste pickers who make a living at the landfill site and increase the risk of accidents. Improvement of the management of the landfill site will secure the safety and improve the efficiency of the waste pickers. Waste reuse will be promoted by utilizing the activities of waste pickers, and picking activities will help reduce the amount of waste carried into the site.

(8) Landscape

There is concern that the landscape will further deteriorate due to the disorderly accumulation of carried-in waste to the landfill site. A plan for landfill maintenance is laid using the procured equipment to improve the landscape through landfill readjustment, dumping area plan, introduction of semi-aerobic landfill system, and slope greening.

(9) Infectious diseases such as HIV / AIDS

Prevention of infectious diseases for workers is necessary during the works of the primary collection points. The impact will be minor if proper safety management is carried out. During the service, the number of collection workers is increased in order to operate procured equipment and increase garbage collection services. Workers are hired from the surrounding communities, and precautions are made to prevent infectious disease through safety management and training.

(10) Working Environment

(a) Impact on the Working Environment

The number of collection workers will increase with the operation of procured equipment and increase garbage collection services. Workers are hired from the community from the surrounding communities. The new employees will receive instructions and training on safety management and work rules necessary for work to properly understand and maintain the working environment. The procurement of lighting equipment in the landfill site makes it possible to ensure safety at night.

(b) Impact on Health and Hygiene

The number of workers will increase due to the procurement of equipment. New employees need to be informed and instructed on safety and health. The following issues will be improved by conducting safety and health training, wearing gloves and masks, and deploying emergency medical sets in the control office.

- Infectious diseases: Infectious diseases from waste, infectious diseases transmitted by pests.
- Chronic disease: Respiratory disease, especially those due to exposure to potentially harmful dust and smoke.
- Accidental injuries: Injuries, burns, etc., while working.

(11) Accidents

The risk of accidents occurring in the landfill site will increase as the number of times the waste is brought in and the equipment in operation increases. The risk of slope failure of sedimentary waste can be stabilized by a stable slope and compacting it. At the primary collection points, there is the risk of accidents related to vehicle movement during garbage loading work by procured vehicles, but safety and health management training will be conducted for workers to ensure thorough accident and safety measures.

1.5.8 Impact Assessment

Table 1.19 summarizes the results of evaluating the items selected by scoping for the EIA due to the provision of equipment and the renovation of primary collection points. Mitigation measures and measures for evaluation results are reflected in the monitoring management plan.

Table 1.19 Impact Assessment Results

Items	Scoping		Assessment		Reasons for Assessment
	During construction	In service	During construction	In service	
(1) Air pollution		✓	D	D	Air pollution will be improved by replacing the current black exhaust gas vehicles with new collection vehicles. The increase in exhaust gas due to the increase in procured equipment is minor.
(2) Water pollution		✓	D	D	No impact on leachate is expected without enlargement of the landfilling area. The quality of leachate is expected to be improved by semi-aerobic landfill and the water pollution of city canals will be improved.
(3) Waste		✓	D	A+	Waste management is improved at the landfill site by procured equipment, and the life of the landfill site is expected to be extended. Littering and illegal dumping of waste at the primary collection points will be improved by increased collection visits.
(4) Soil pollution			D	D	The impact on soil pollution is not expected.
(5) Noise/vibration	✓	✓	D	D	The noise to the surrounding area during the renovation work of the primary collection points is minor and no impact is expected on the normal vehicle operation and landfill site maintenance.
(6) Ground subsidence		✓	D	B+	The risk of slope failure is improved by securing a stable slope and compacting the slope by utilizing maintenance equipment.
(7) Offensive odor		✓	D	B+	Waste collection is improved and offensive odors from waste are improved. At the landfill site, improvements will be made by soil covering with procured equipment and implementing a semi-aerobic landfill system to reduce offensive odors.
(8) Protected areas			D	D	The area is not designated as a protected area by Madagascar's laws and international treaties.
(9) Ecosystem			D	D	No impact on the ecosystem is expected from this project.

Items		Scoping		Assessment		Reasons for Assessment
		During construction	In service	During construction	In service	
(10)	Site management			D	D	No impact on site management is expected.
(11)	Resettlement			D	D	Resettlement is not expected.
(12)	Poverty			D	D	No impact on the poor is expected.
(13)	Living conditions		✓	D	B+	The sanitary environment will be improved in the city. Vehicle traffic due to an increase in the number of vehicles can be managed by a work plan, and no impact on the citizens is expected.
(14)	Livelihood		✓	D	B+	Additional employment of workers creates employment opportunities in the area. Waste picking activities may be improved by improving the operation and management of the landfill site.
(15)	Employment and local economy		✓	D	B+	Implementation of this project may increase the employment of workers and improve livelihoods.
(16)	Land use			D	D	No impact on land use and local resource use is expected.
(17)	Water use			D	D	The increase in water use for equipment procurement is minor, such as cleaning, and no impact is expected.
(18)	Existing social infrastructure and services		✓	D	B+	In service: Improving the garbage collection service will improve the sanitary environment in the city. Equipment will improve the maintenance of the landfill site.
(19)	Social capital and local decision-making bodies			D	D	No impact on social capital and social organizations such as local decision-making bodies is expected.
(20)	Uneven distribution of damage and benefits			D	D	Unfair damages and benefits to the area are not expected.
(21)	Conflicts of interest			D	D	No impact is expected on the conflict of interests within the area.
(22)	Cultural heritage			D	D	There is no cultural heritage in the surrounding area.
(23)	Landscape		✓	D	D	The increase in the amount of waste carried in will not affect the landscape.
(24)	Ethnic minorities and indigenous peoples			D	D	There are no ethnic minorities or indigenous peoples in the planned area.
(25)	Gender			D	D	No gender impact is expected from this project.
(26)	Children's rights			D	D	No impact on children's rights is expected
(27)	Infectious diseases such as HIV / AIDS	✓	✓	D	B-	Measures need to be taken for infectious diseases of workers from the viewpoint of safety and health.

Items	Scoping		Assessment		Reasons for Assessment
	During construction	In service	During construction	In service	
(28) Working environment	✓	✓	D	D	The impact of this project on the working environment will be minor, but training will be required as new workers will be hired more.
(29) Accident	✓	✓	D	B-	The risk of accidents may increase due to the increase in operational equipment, and training and safety management are required.
(30) Cross-border impacts and climate change			D	D	Cross-border impacts and climate change impacts are not expected.

Note: *Assessment: A+/-: Significant positive/negative impact; B+/-: Moderate positive/negative impact C: Impact degree unknown; D: No impact is expected

1.5.9 Mitigation Measures and Costs for Mitigation Measures

Mitigation measures are included in the environmental management plan in Madagascar. In this plan, mitigation measures will be formulated to avoid or minimize the expected negative impacts and maximize the effect of the procured equipment. Table 1.20 summarizes mitigation measures to be monitored by this plan.

Table 1.20 Environmental Mitigation Measures

No.	Impact Items	Mitigation Measures	Implementing Agency	Responsible	Costs
During construction					
(27)	Infectious diseases	• Implementation of work health and safety management training	Contractor	CUA	Included in construction work.
(28)	Working condition	• Disinfection and pest control • Implementation of occupational accident prevention according to safety and health regulations and plans			
(29)	Accident	• Mandatory wearing of safety training, work clothes, helmets, and other safety equipment	Contractor	CUA	Included in construction work.
In service					
(1)	Air pollution	• Periodic inspection and maintenance of equipment and use of vehicles in good condition • Implementation of mechanic training on vehicle maintenance and maintenance	SMA	CUA	Included in the operational cost : Budget estimate 1,000,000 MGA/year
(2)	Water pollution	• Implementation of public awareness to prevent illegal dumping in waterways in the city • Implementation of planned landfill site maintenance utilizing procured equipment • Maintenance and cleaning of rainwater drainage structures	SMA	CUA	Included in the operational cost

No.	Impact Items	Mitigation Measures	Implementing Agency	Responsible	Costs
(5)	Noise/vibration	<ul style="list-style-type: none"> • Periodic inspection and maintenance of equipment and use of vehicles in good condition • To stop the engine when it is not in use to suppress noise generation. • Comply with collection work schedule and work time • Appropriate placement of personnel in charge to reduce collection work time 	SMA	CUA	Included in the operational cost
(7)	Offensive odor	<ul style="list-style-type: none"> • Restrictions on waste exposed to the outside air due to soil cover of landfill waste • Recommendation for reducing waste accumulated at the landfill sites due to composting, etc. • Cleaning and repairing drainage ditches 	SMA	CUA	Included in the operational cost
(13)	Living conditions	<ul style="list-style-type: none"> • Appropriate planning and implementation of collection routes and collection times • Observance of legal speed of vehicle operation speed, compliance with traffic rules • Hold briefing sessions on the start of the garbage collection service and promote understanding of the garbage collection 	SMA	CUA	Included in the operational cost
(14)	Livelihood	<ul style="list-style-type: none"> • Improved collection process by improving waste picker activity (e.g., picking from pre-sorted waste) • Employment creation by hiring workers from the surrounding area 	SMA	CUA	Included in the operational cost
(23)	Landscape	<ul style="list-style-type: none"> • Planned plot maintenance with procured equipment, compression, and soil cover 	SMA	CUA	Included in the operational cost
(27)	Infectious diseases such as HIV / AIDS	<ul style="list-style-type: none"> • Implementation of health and safety management training for additional personnel 	SMA	CUA	Included in the operational cost
(28)	Working environment	<ul style="list-style-type: none"> • Implementation of health and safety management training for new personnel • Disinfection and pest control • Implementation of occupational accident prevention according to safety and health regulations and plans 	SMA	CUA	Included in the operational cost
(29)	Accident	<ul style="list-style-type: none"> • Awareness to Waste Pickers regarding safety measures at the landfill sites • Safety measures, action plan formulation for accident prevention and establishment of compliance • Training for staff regarding operation/operation and maintenance of procured equipment • Mandatory wearing of safety equipment such as work clothes and helmets 	SMA	CUA	Included in the operational cost: Waste picker training budget:1,000,000 MGA/year SMA staff training 500,000 MGA /session

1.5.10 Environmental Monitoring Plan

The draft monitoring plan is as shown in Table 1.21. The purpose of environmental monitoring is to ensure that mitigation measures are implemented effectively. Based on the results of environmental monitoring, it is necessary to modify mitigation measures and take corrective measures.

Table 1.21 Environmental Monitoring Plan (Draft)

No.	Items	Contents	Location	Frequency	Reference	Responsible	Costs
During construction							
(27)	Infectious diseases	Implementation status of safety management training and safety training	Primary collection points	Monthly	Antananarivo sanitation ordinance	SMA	Included in the operational cost
(28)	Working condition						
(29)	Accident	Record of accident occurrence	Primary collection points	Monthly	Labor law	SMA	Included in the operational cost
In service							
(1)	Air pollution	Maintenance status of equipment, especially engine and exhaust related	Landfill site	During operation/ every year	Vehicle maintenance manual	SMA	Included in the operational cost
(2)	Water pollution	<ul style="list-style-type: none"> • Public awareness to prevent illegal dumping in waterways in the city • Landfill site maintenance using procured equipment • Maintenance and cleaning of drainage structures 	Landfill site	During operation/ every year	Antananarivo sanitation ordinance	SMA	Included in the operational cost
(5)	Noise/vibration	Interview with local residents about noise	Vicinity of Landfill site	During operation/ every year	Antananarivo sanitation ordinance	SMA	Included in the operational cost
(7)	Offensive odor	Confirmation of odor	Primary collection points, vicinity of Landfill site	During operation/ every year	Antananarivo sanitation ordinance	SMA	Included in the operational cost
(13)	Living conditions	Interview with local residents about garbage collection and collection vehicle operation	Primary collection points, vicinity of Landfill site	During operation/ every year	Antananarivo sanitation ordinance	SMA	Included in the operational cost
(14)	Livelihood	Interview with workers and waste picker's livelihood impact	Primary collection points, vicinity of Landfill site	During operation/ every year	Antananarivo sanitation ordinance	SMA	Included in the operational cost
(23)	Landscape	Landfill site maintenance with procured equipment, compression, and soil cover	Landfill site	During operation/ every year	Antananarivo sanitation ordinance	SMA	Included in the operational cost
(27)	Infectious diseases such as HIV / AIDS	Implementation of safety management training and safety enlightenment	Landfill site	During operation/ every year	Antananarivo sanitation ordinance	SMA	Included in the operational cost
(28)	Working environment	Implementation of safety management training and safety enlightenment	Landfill site	During operation/ every year	Labor law	SMA	Included in the operational cost

No.	Items	Contents	Location	Frequency	Reference	Responsible	Costs
(29)	Accidents	Record of accident occurrence situation	Landfill site	During operation/ every year	Labor law	SMA	Included in the operational cost

(1) Roles and Responsibilities in Implementing the Environmental Management Plan

(a) Project Owner

CUA is responsible for the administration of the Andralanitra landfill site. Therefore, it is responsible for the proper implementation of the relevant mitigation measures (CCE).

(b) Environmental Management Responsibility

SMA appoints project environmental managers within the organization. Environmental managers prepare environmental monitoring reports for projects responsible for SMA's environmental and social behavior.

(c) Environmental Management of Construction Companies

The construction company that renovates the primary collection points shall comply with the environmental measures stipulated in the project environmental management plan in relation to the work to be carried out. Environmental managers of construction companies ensure that these measures are implemented.

(d) Office National Environment (ONE)

Under the supervision of the Ministry of the Environment, ONE, as an authority entrusted with environmental management, will provide one-stop administrative services for making environmentally friendly investments. ONE issues technical evaluation committee (CTE) coordination, directions on the EIA, and environmental permits. ONE monitors the implementation of environmental management plans.

(2) Other Important Aspects in an Environmental Management Plan

(a) Relationship with Local Communities

CUA/SMA will ensure effective communication with the community in the project area (Ambohimangakely community, Ikanja Fokontany). Information sessions may be held regarding schedules, work progress, activities, and operation of the Andralanitra landfill site.

(b) Complaint Management

Complaints shall be reported to the SMA Environment Department immediately upon receipt. The complaints are recorded in writing. Contact details of the SMA environment representative are clarified. All complaints and their follow-ups are recorded in the database.

(c) Social Support

The Andralanitra landfill site is required to take actions that contribute to social development in cooperation with communities. To the extent possible, CUA/SMA will (i) prioritize local people in hiring employees for employment, and (ii) contribute to the public interest of surrounding community activities.

(d) Environmental Management Plan for Repair Work at the Collection Site

For the renovation work of primary collection points, the construction company formulates an environmental management plan within the work plan for the site in accordance with the Safety and Health Ordinance of Antananarivo City.

1.5.11 Stakeholder Meetings

(1) Interview with Stakeholders

Meetings and interviews with residents and related parties were conducted as shown in Table 1.22.

Table 1.22 Residents / Related Parties Consultation Implementation

Overview	Results
Notification/implementation date and time	June 7, 10, 14, and 17, 2021
Venue	Communities in the vicinity of the Andralanitra landfill site
Method (residents' meeting, individual interview, language)	Interview and public consultation meeting (Language: Malagasy)
Consideration method for vulnerable groups	Individual hearings from waste pickers, meetings near the landfill site outdoors to make it easier for residents to participate
Notification method	Announcement through Fokontany, adjustment by Andralanitra landfill site

Interviews were conducted with relevant parties on June 7, 10 and 14, 2021. The purpose of these interviews was to provide an overview of the envisioned project and to gather information on the impact of waste on the surrounding population (odor, health, pests, exudates). The occasions were also used to gather information on people, waste pickers, landfill work, health, and working conditions. Individual interviewees were local governments, recyclers, landfill staff, environmental personnel, collection workers, local residents, and Akamasoa staff.

Many households in the community adjacent to the landfill site depend on waste picking at the landfill site for their livelihood. So far, attempts have been taken to find alternative sources of income. Many waste pickers are willing to reduce picking if they have a rewarding job. The desired jobs include activities related to agriculture and crafts. These activities are considered appropriate given Waste picker's knowledge and skill levels. In addition to waste picking, many residents are already engaged in other activities.

In the interviews, many of them objected to the closure of the landfill site and confirmed that they would like to continue to make a living at the Andralanitra landfill site, especially if the conditions of the landfill site are improved.



Interview with AKANJO's environmental staff team leader and SMA staff



Interview with Ambohimananina Fokontany representative

Photo 1.1 Stakeholder Interviews

(2) Public Consultations

On June 17, 2021, a public consultation was held in Ikanja Fokontany. Approximately 20 people attended the meeting. The purpose of the consultation was to explain the equipment provision project planned at the Andralanitra landfill site, present the socio-environmental impacts and the measures to be taken to mitigate them, and hear opinions, dissatisfactions, suggestions, and remarks from the residents. Opinions from local residents and people involved in the operation of the landfill site were collected. These are to be reflected in the environmental management plan.



Photo 1.2 Public Consultation at Ikanja Fokontany

(3) Opinions and Concerns about the Project

Interviews and consultations gathered local perceptions on the project. Table 1.23 summarizes the perceptions of people interviewed during the field visit. A list of interviewees is shown in Table 1.24.

Table 1.23 Opinions and Concerns about the Project

Interviewees	Opinions	Reflecting Comments Received in the Plan
Andralanitra landfill site		
Waste pickers	I do not oppose the project, but I have no other livelihood options, so I would like to be able to continue activities at the landfill site. Landfill management by the project and SMA will prevent waste pickers from continuing their activities freely (access should not be restricted). The landfill site should not belong to anyone and should be freely available to everyone.	In order for the waste pickers to contribute to waste separation, an area will be designated where waste picking can be done in the landfill site.
Residents	We hope that the project at Andralanitra will have a positive impact on the health and environment of the local population. We wish to find a solution for odors, insect outbreaks, and smoke damage during the rainy season.	By covering the soil with equipment maintenance, it is possible to suppress the generation of foul odors and pests.
Akamasoa public service staff	Several projects have been undertaken to improve landfill management, but nothing has changed so far (e.g., persistent smoke, foul odors). We have to find a new place to relocate the premises.	The construction of a new landfill site is an urgent issue. However, this is outside the scope of the project.
Primary collection point		

Interviewees	Opinions	Reflecting Comments Received in the Plan
Androntra (2053-2056) Fokontany, Madera Fokontany	SMA trucks do not collect waste on a regular basis. As a result, the overflowing garbage causes discomfort to the local residents and traffic.	The frequency of garbage collection can be increased by new collection vehicles.
Androntra (2053-2056) Fokontany	Previously there were three collection points, but recently the one in front of the FJKM Church has been removed. Two collection points are inadequate for the number of populations, so we are calling for resumption of collection points.	Increase the number of primary collection points.
Faravohitra (1050-1052) Fokontany	Restored depots are often the subject of complaints because SMA does not collect waste on a regular basis.	The frequency of garbage collection can be increased by new collection vehicles.

Table 1.24 List of Interviewees

Interviewees	Contents of Discussion
Andralanitra landfill site	
Ikanja Fokontany chief	-Population and socio-economic activity -Environmental and social impact from Andralanitra final landfill site on surrounding Fokontany -Management of local residents' dissatisfaction
MADACOMPOST Group Leader	-Activities of MADA COMPOST -Monthly productivity -Sales price and buyer characteristics -Worker's health and working conditions
SMA/ Environment Officer	-Number of staff
AKANJO Environment Leader	-Personal hygiene protective equipment and materials used -Worker's health and working conditions
Waste picker	-Information about waste picking activities -Working conditions -Health
Individual/ Compost production	-Information about compost extraction activities -Working conditions -Health and hygiene
STOI Security company worker	-Company activities -Monthly productivity
STOI shop keeper	-Sales price and buyer characteristics -Worker health and working conditions
Waste picker	-Information about waste picking activities -Working conditions -Health
Andralanitra final landfill site Deputy Site Manager	-Site security -Use of fire -Personal protection equipment and equipment available to staff -Staff health and hygiene -Recorded complaints and management methods
SMA truck driver	-Working conditions -Speed limit -Accidents encountered -Available personal hygiene protective equipment and equipment -Health and hygiene
Local residents	-Impact on the social environment of landfills (agriculture, farming, health, air quality, water quality) and complaints
Local residents	-Crop type, planting schedule -Types of breeding, types of animals being bred
Home Akamasoa	-Impact on the social environment of the landfill site (agricultural activity, health, air quality, water quality) and complaints

Interviewees	Contents of Discussion
	-Akamasoa Association's waste collection activities, public campaign, and social support -Children's work and enlightenment at the landfill site -Accidents encountered in connection with waste collection work
Doctor Akamasoa dispensary Akamasoa clinic medical doctor	-Frequently consulted types of illness -Types of recorded accidents -The impact of pandemics and epidemics (plague) on the population living near the repository -Patient's place of residence and consultation fee at the clinic level
SMA-ARTELIA person in charge at the time of the survey	-Additional information on the above discussion topics -Visit to Ambaniara Village and Antanina Renina Village -Direct reports and discussions on water quality of wells in villages around the landfill site, leachate discharge, various activities, infrastructure, health, and accidents encountered at the landfill site
Ambohimangakely deputy mayor	-Information about the project -Discussion on wetlands since the issuance of environmental permits -Thoughts and concerns about project continuity.
Primary collection points	
Anosisoa area primary school principal	-Impact on the social environment of the depot (agricultural activity, health, air quality, water quality) and complaints -Steps started to improve social engagements -Weekly frequency of waste collection by SMA -Accidents that occurred during collection
Ambohibarikely Anosibe Planète Cœur private school Principal	
Resident	
Resident	
Ambohitsinjo Ambohimanarina Fokontany chief	-Impact on the social environment of the collection site (agricultural activity, health, air quality, water quality) -Recorded complaints and management methods -Weekly frequency of waste collection by SMA -Accidents that occurred during collection
Ambohibarikely Anosibe Fokontany Chief	
Androndrakely Saropody Antonta Fokontany Chief	
Androndrakely Ampamatanana Fokontany Chief	
Faravohitra Ambony Fokontany Chief	
Mandrosoa Faravohitra Fokontany Chief	
Behoririka Ambatomitsangana Fokontany Chief	

1.5.12 Monitoring Form (Draft)

The following is a draft monitoring form for the monitoring plan after equipment procurement.

a) Air

Basic Information	Monitoring Items	Remarks
Date/Time	Vehicle maintenance and confirmation of inspection status, especially on the engine and exhaust related maintenance records.	Review of the maintenance records and vehicle inspection
Surveyor's Name		
Description		
Location		

b) Waste

Basic Information	Monitoring Items	Remarks
Date/Time	Checking of the cleanness of the primary collection points. Primary collection system is put in place and functional.	Interviews of the residents
Surveyor's Name		
Description		
Location		

c) Noise/Vibration

Basic Information	Monitoring Items	Remarks
Date/Time	Checking of the noise and vibration and its cause	Interviews of the residents
Surveyor's Name		
Description		
Location		

d) Offensive Odor

Basic Information	Monitoring Items	Remarks
Date/Time	Checking of the odor and the cause of the smell	Interviews of the residents
Surveyor's Name		
Description		
Location		

e) Living Conditions / Livelihood

Basic Information	Monitoring Items	Remarks
Date/Time	Checking of the situation of traffic jam, activities of waste pickers	Interviews of the residents
Surveyor's Name		
Description		
Location		

f) Infectious Diseases such as HIV/AIDS / Working Environment

Basic Information	Monitoring Items	Remarks
Date/Time	Implementation status of safety management training and safety enlightenment activity	Record each activity by SMA
Surveyor's Name		
Description		
Location		

g) Accidents

Basic Information	Monitoring Items	Remarks
Date/Time	Checking of the situation of an accident	Interviews of the residents
Surveyor's Name		
Description		
Location		

1.5.13 Environmental Checklist

The Environmental Checklist of the Project is as shown in Table 1.25.

Table 1.25 Environmental Checklist

Nr	Impact Items	Primary Check point	Yes: Y No: N	Specific environmental and social considerations (Reason for Yes / No, grounds, mitigation measures, etc.)
1 Permit / Explanation	(1)EIA and Environmental Permits	(a) Is an environmental assessment report (EIA report)prepared? (b) Are EIA reports, etc. approved by the government of the country concerned? (c) Does approval of EIA reports, etc. involve incidental conditions? If there are incidental conditions, are those conditions satisfied? (d) In addition to the above, have you obtained an environmental permit from the local competent authority if necessary?	(a)Y (b)Y (c)Y (d)Y	(a) EIA report is prepared and submitted it to CUA. (b) CUA will submit an application for a permit to the Office National Environment for approval. (c) There are no incidental conditions (d) There are no permits other than the above.
	(2)Explanation to local stakeholders	(a) Are the contents and impacts of the project properly explained to local stakeholders, including information disclosure, and gained their understanding? (b) Did you reflect the comments from the residents in the project content?	(a)Y (b)Y	(a) A briefing session for local residents was held on June 17, 2021. In addition, interviews with related parties were conducted on June 7, 10 and 14. (b) An environmental management plan was formulated by reflecting the opinions of the residents.
	(3)Considering alternatives	(a) Are multiple alternatives to the project plan considered (including environmental and social items when considering)?	(a)Y	(a) Alternatives are compared and examined.
2 Pollution control	(1)Air	(a) Do the air pollutants in the vehicle exhaust gas generated from the provided equipment match the emission standards and environmental standards of the country concerned? Will measures be taken against air quality?	(a)Y	(a)In order to reduce the load on the current over-operated collection vehicle, new equipment will be procured in this project and measures will be taken to reduce exhaust gas emissions.
	(2)Water quality	(a) Does the wastewater from the facility match the emission standards and environmental standards of the country concerned?	(a)Y	(a)There is no further deterioration of water quality due to the provision of equipment
	(3)Waste	(a) Is the construction waste generated during the renovation of the temporary collection point properly treated?	(a)Y	(a)Appropriate treatment will be implemented by taking mitigation measures.
	(4)Soil contamination	(a) Are measures taken to prevent soil and groundwater from leachate generated from waste disposal sites?	(a)-	(a)Soil pollution does not occur from equipment procurement. General soil pollution countermeasures are included in the environmental management plan.
	(5)Noise/vibration	(a) Do the noise and vibration caused by procured equipment be consistent with the standards of the country concerned?	(a)Y	(a)Mitigation measures will reduce the inconvenience to the surrounding living environment.
	(6)Bad odors	(a) Are measures taken to prevent bad odors?	(a)Y	(a)Illegal dumping and bad odors in the city will be reduced by the procured equipment. General odor control measures at the disposal site are included in the environmental management plan.
3 Natural environment	(1)Reserve	(a) Is the site located in a protected area stipulated by the laws and international treaties of the country concerned?	(a)-	(a)No reserve exists in the target area.
	(2)Ecosystem	(a) Does the site include primeval forests, tropical natural forests, and ecologically important habitats ? (b) Does the site include habitats for valuable species that require protection under the laws and international treaties of the country concerned? (c) If there are concerns about significant impacts on the ecosystem, are measures taken? (d) Is there a risk of adverse effects on aquatic life? (e) Is there a risk of adverse effects on vegetation and wild animals?	(a)- (b)- (c)- (d)- (e)-	(a) The target area is mainly urban areas and residential areas, and there are no important nature, flora and fauna. (b) Does not include habitats for valuable species. (c) There is no concern about the significant impact of equipment procurement on the ecosystem. (d) There is no concern about the significant impact of equipment procurement on aquatic life. (e) There is no concern about the serious impact of equipment procurement on vegetation and wildlife.
		(3)Site Management	(a) Are environmental protection measures taken into consideration after the operation of the disposal site is completed?	(a)-
4 Social environment	(1)Relocation of residents	(a) Will there be involuntary relocation of residents as a result of the implementation of the project?	(a)-	(a)This is an equipment procurement project and no relocation are expected.
	(2)Living conditions/livelihood	(a) Will the project have a negative impact on the lives of the inhabitants? Will mitigation measures be taken if necessary? (b) Will consideration be given to existing resource recovery systems, including waste pickers? (c) Is there any impact on local transportation due to waste transportation? (d) Does the wastewater from this project, leachate generated from the disposal site, etc. adversely affect the water use (especially drinking water) of the fishing industry and local residents? (e) Will sanitary pests occur?	(a)N (b)Y (c)Y (d)- (e)-	(a)The collection of uncollected waste and the increase in the number of collections will have a positive impact on the lives of residents. (b) Environmental management plans include consideration for West Pickers. (c) Consider traffic in the collection plan due to the increase in traffic volume. (d) Since this is an equipment procurement project, it will not have a significant impact. (e) It does not have a big impact.
	(3)Cultural heritage	(a) Is there a risk that the project will damage archaeological, historical, cultural and religiously valuable heritage, historic sites, etc.?	(a)-	(a)There is no cultural heritage in the area.
	(4)Landscape	(a)If there is a landscape that needs special consideration, does it have an adverse effect on it?	(a)Y	(a)The amount of waste brought into the disposal site will increase due to the equipment procurement. The method of stacking waste in the disposal site will be improved.
	(5)Ethnic minorities, indigenous peoples	(a)Are there any considerations to reduce the impact on ethnic minority and indigenous cultures and lifestyles?	(a)-	(a)No ethnic minorities or indigenous peoples live in the target area.
5 Others	(6)Working environment	(a) Are the laws regarding the working environment of the country observed? (b) Will there be any safety measures for the project, such as safety equipment to prevent occupational accidents and the management of harmful substances? (c) Will soft measures be taken for the project, such as the formulation of safety and health plans and the implementation of safety training (including traffic safety and public health) for workers, etc.? (d) Will appropriate measures be taken to prevent the malicious behaviours of project personnel to other project personnel and local residents?	(a)Y (b)Y (c)Y (d)Y	(a) Training on occupational safety and health through worker training, etc. will be included in the environmental management plan. (b) It will be included in the environmental management plan. (c) It will be included in the environmental management plan. (d) It will be included in the environmental management plan.
	(1)Impact during the construction	(a)Are mitigation measures prepared for pollution during construction? (b) Does the construction have an adverse effect on the natural environment ? (c) Does the construction have an adverse effect on the social environment?	(a)Y (b)Y (c)Y	(a) Mitigation measures will be included in the work plan for the renovation work of the collection points. (b) No components affect it. (c) The renovation of the collection points will improve the public health environment.
	(2)Monitoring	(a) Of the above environmental items, will the monitoring for the items be conducted? (b) How are the items, methods, frequencies, etc. of the plan defined? (c) Is the monitoring system of the operator (organization, personnel, equipment, budget, etc. and their continuity) established? (d) Is the method, frequency, etc. of reporting from the operator	(a)Y (b)Y (c)Y (d)Y	(a) The plan is to request the implementation of monitoring in accordance with the monitoring plan. (b) Determined by the environmental standards and regulations of the country concerned. (c) It is a mechanism that is handled by SMA and CUA and is examined by the Environment Bureau (ONE). (d) Specified by the environmental management plan.

CHAPTER 2. CONTENTS OF THE PROJECT

2.1 Basic Concept of the Project

2.1.1 Overall Goal and Project Objective

The overall goal of the Project is to improve the sanitary environment in Madagascar by improving the equipment for waste collection and transportation and the landfill site in Antananarivo.

Based on the overall goal and the current situation of the sector, the project object is "To develop the waste management capacity of Antananarivo city by improving the equipment for waste collection and transportation and the landfill site, and to contribute to improving the sanitary environment of the city".

2.1.2 Outline of the Project

As a result of the Survey and through discussions with the relating agencies, it was decided that the Project shall include equipment procurement for waste collection, transportation, and landfill operation, and shall not include construction of large-scale facilities. In addition, since technical transfer related to equipment procurement is scheduled to be implemented in another technical assistance project of JICA that is scheduled to be implemented in parallel with the Project, soft components are not to be implemented in the Project.

A list of the procured equipment in the Project is as shown in Table 2.1.

Table 2.1 List of the Procured Equipment in the Project

No.	Equipment	Qty	Specification
1	Skip Loader	33	Loading weight: 4.5t
2	Dump Truck 1 (waste collection and transportation)	6	Loading weight 8t
3	Dump Truck 2 (landfill operation)	3	Loading weight 12t
4	Bulldozer	2	Operation weight: 21t
5	Excavator	4	Bucket Capacity: 0.8m ³
6	Garbage Container	326	Capacity: 7m ³
7	Pick-up Truck	2	2,000~3,000cc
8	Off-road Bike	8	125cc
9	Improvement Work of Waste Collection Points	8	Stone
10	Repair Tool for Vehicle	1	Scan tool etc.
11	Floodlight	4	LED
12	Flat-body Truck	2	Loading weight: 1t or more

2.2 Outline Design of the Japanese Assistance

2.2.1 Design Policy

(1) Basic Policy

As a result of consultations with the Madagascar side and JICA, procurement of equipment will be mainly implemented and the construction of large facilities will not be included in the Project. The basic policies of the Project are as follows:

- Equipment with high urgency and need shall be selected;
- Equipment covering flow from waste generation, collection, transportation, intermediate treatment to final disposal shall be selected since it is essential to comprehensively improve the SWM flow;

- Since there is no master plan for SWM in Antananarivo, equipment for the waste collection and transportation shall be selected considering the actual waste collection rate with the operation system;
- Equipment for the landfill operation including spare equipment with maximum efficiency combination for loading and levelling the delivered waste shall be selected in consideration of driving conditions and breakdowns;
- Based on the contents of a new technical cooperation project which is planned to be implemented in parallel with the Project, both projects shall have consistency and complement each other, and produce the maximum effect; and
- Since traveling to Madagascar is restricted due to the spread of COVID-19, the Project shall be implemented with maximum effort using remote communication.

(2) Policy on Natural Environmental Condition

Since the environmental permit for the Andralanitra landfill site had already expired in January 2016, it was necessary to renew the permit as a prerequisite for the Project (already updated in January 2022). The construction work schedule avoids the rainy season in Madagascar (from November to April).

(3) Policy on Socio-economic Condition

On the JICA survey, “The Project on Master Plan Formulation for Economic Axis of TaToM” (2019), the following development strategies are shown regarding the development of Antananarivo City:

- To strengthen urban center functions within the CUA especially those of accommodating the headquarters of international, regional, and national corporations and organizations.
- To improve the high-density residential environment within CUA by providing local roads with gutters and providing water supply infrastructure

Since it is also necessary to improve and expand SWM to improve the living environment of the city, equipment is to be procured for improving the living environment including the waste collection points in the city.

(4) Policy on Procurement Condition

In Madagascar, there are local agencies that have tie-ups with vehicle and construction equipment manufacturers of Japan and other countries, which sell, repair, and procure parts for equipment. Therefore, daily inspection and simple repair of equipment for SWM can be carried out by them without any problem. Repair for serious failures can be handled by dispatching engineers from overseas manufacturers and agencies that have signed the agreement with the local agencies.

(5) Policy on Utilization of Local Suppliers / Contractors

Local suppliers will be involved in the equipment procured in Madagascar, as well as the other equipment, during the operation and maintenance period. In addition, local contractors will implement construction works of small-scale facilities. There are several contractors with hundreds of employees in Madagascar and small-scale construction work in the Project is sufficiently feasible by them.

(6) Policy on Operation and Maintenance by the Implementing Agency

(a) Operation and Maintenance for Waste Collection and Transportation

Operation and maintenance (hereinafter referred to as “O&M”) of equipment for waste collection and transportation will be carried out by the Automobile Maintenance Division, Technical Service of SMA as currently practiced under the concession agreement with CUA. Regular inspections and routine maintenance, as well as major maintenance, will be done with both existing tools/equipment and new tools/equipment recommended by the Project.

Spare parts procured together with the new equipment will be planned to be stored on-site. SMA is currently clearing its store space (approximately 20m x 5m). It is necessary to set up an inventory management system, but storing the spare parts could be possible by limiting the spare parts to be procured to minimum and consumables only.

(b) Operation and Maintenance for Landfill Site

The O&M of equipment used at the Andralanitra landfill site will be carried out by the Landfill Site Division, Household Waste Service of SMA under the supervision by CUA.

In the future, it will be indispensable to improve the site and to extend the life of the landfill site with adequate O&M. In addition, it is also essential to improve the technical capacity of the landfill site for proper maintenance at the new landfill site in the future.

(c) Operation and Maintenance for the Waste Collection Points

Fixed waste collection points are set up in public areas such as roadsides, and the owner of the facilities is CUA. O&M of the waste collection points is undertaken by the Infrastructure & Works Division, Technical Service of SMA, and there is no problem since the structure of these facilities is not complicated and these have been maintained and managed by SAMVA so far.

(7) Policy on Setting Grade of Facilities and Equipment

(a) Equipment for Waste Collection and Transportation

Waste collection equipment is to be designed for industrial use and does not include special specifications considering O&M after procurement.

(b) Equipment for the Landfill Operation

Operation of the Andralanitra landfill site is chronically inefficient and inadequate due to the significant shortage of equipment for operation, such as bulldozers, while the amount of waste increases. On the other hand, there is no prospect to secure a new landfill site, and extension of the operation life of the site has become an extremely important administrative issue for the city. Furthermore, the site has a very large area of approximately 18 ha, and waste is accumulated for 20 m overall. For this maintenance, enough maintenance equipment that can carry out the construction work in the site is necessary, together with the daily acceptance of delivered waste.

Under the above situation, the introduction of enough highly versatile equipment, such as bulldozers, excavators, and dump trucks, is planned as maintenance equipment for the landfill site.

(c) Improvement Work of Waste Collection Points

Of the fixed collection points, repair of the existing facilities that require structural partial repair work is left to the self-help efforts of the Madagascar side. On the other hand, improvement work

of the facilities that require complete or full renovation work is required by the SMA and CUA, so that this work will be conducted as one of the procurements under the following policies:

- The fixed collection points (57 facilities) are classified into three categories according to the damage status: (1) facilities that do not require repair; (2) facilities that require partial repair; and (3) facilities that have fatal damage and require full repair. The damage status of fixed collection points is as shown in Table 2.2.
- There is a plan of SMA/CUA to install steel containers instead of fixed collection points.
- Thus, target facilities for the improvement work are selected from 20 severely damaged facilities considering the scale of facilities, construction materials and necessity of the facilities, etc.

Table 2.2 Damage Status of Fixed Collection Points

Item No.	Degree of Damage	Number of Fixed Facilities	Remarks
(1)	Damage-free facilities	9	
(2)	Partially damaged facilities	28	Damage can be repaired by self-help efforts of the Madagascar side
(3)	Severely damaged facilities	20	Mostly to be applied as a fixed facility for the Project
	Total	57	Total number of fixed collection points

Source: JICA Survey Team based on SMA

(8) Policy on Construction / Procurement Method and Construction Period

In principle, equipment for waste collection and transportation shall be procured from Japan considering their service life and securing the maintenance system. Equipment for the landfill operation shall be procured from Japan or third countries to secure competitiveness. Equipment that is currently manufactured in Madagascar such as waste containers shall be procured locally. In addition, improvement works of the waste collection points will be carried out by general construction methods, such as concrete works and masonry works, since these works are not complicated.

Regarding the construction period, a sufficient transportation period such as marine transportation is set considering the influence of COVID-19. The construction work period is set in consideration of the rainy season (from November to April).

2.2.2 Basic Plan of Waste Collection and Transportation

(1) Current Condition of Existing Waste Collection and Transportation Equipment

SMA is currently using Chinese dump trucks (16 tons and 18 tons) and Chinese skip loaders (9 tons) to collect waste from 288 primary collection points around the city in 24 hours, 7 days a week. The operation ratio for dump trucks is 60-90% with frequent breakdowns of drivetrains and suspension.

Likewise, the skip loaders which account for more than half of its fleet have only a 10% operation ratio. Major breakdowns are similar to that of dump trucks (drivetrains suspension, and engine as well), in which according to the chief mechanic, the main cause of the failures lies in Chinese parts that are available but do not meet industrial standards.

(2) Selection of Equipment for Waste Collection and Transportation

(a) Target for Waste Collection Ratio

The current waste collection ratio reaches only 40 to 50% range. On the other hand, SMA has its target set for two-thirds (2/3) of discharged waste to be collected as a first step. Considering these and needs for suppressing a rapid increase in O&M cost due to increased waste collection vehicles and necessary human resources, the target for the waste collection ratio in the Project shall aim from 70 to 80% of discharged waste.

(b) Vehicle Composition

Table 2.3 shows the type of waste collection vehicles that collect the waste from fixed / container-type primary collection points. At present, SMA uses 13 dump trucks (out of 16 owned) and 2 skip loaders (out of 21 owned) to carry out waste collection and transportation activity. Considering the current operation ratio of skip loaders estimated at 9%, the number of available skip loaders at the time of procurement is assumed to be none. On the other hand, it is assumed 8 dump trucks will be still available from the current operation ratio and the average lifetime of Chinese trucks¹.

Skip loaders collect waste from container-type primary collection points. Dump trucks, on the other hand, can collect from both container-type and fixed-type primary collection points; thus, container-type primary collection points will be served by either skip loaders or dump trucks. The possibility of introducing compactor trucks is considered for replacing skip loaders.

Table 2.3 Type of Primary Collection Points and Vehicles

Type of primary collection point	Dump Truck	Skip Loader	Compactor Truck
Fixed	Existing trucks	-	-
Container	Existing and New Trucks	New truck	New trucks (in place of Skip Loaders)

(c) Dump Trucks

Dump trucks are used mainly to collect waste from 70 fixed collection points around the city. Furthermore, dump trucks can be utilized to collect waste from container-type collection points, giving flexibility in waste collection/transportation plans in response to various circumstances. Dump trucks which are about 90% of the operational trucks in SMA's fleet, can be easily maintained since the Technical Service is mostly used to manage them.

The result of dump truck selection is shown in Table 2.4. A dump truck with high walls is selected since it carries municipal solid waste which has much less specific gravity than soils/rocks.

Table 2.4 Specifications for Dump Truck to be Procured

Item	Specifications	Reasons
Loading capacity	Loading weight: 8-ton (15m ³)	The average capacity of fixed-type primary collection point is 10m ³ . It would give excess load for suspension and gears to collect 2 fixed-type collection points (20m ³) due to the hilly terrain of the city. Thus, the limit shall be smaller than that volume.

¹ It is assumed that 8 trucks, which is half of all 16 trucks, will be in operation in 2023, which is about 5 to 6 years after delivery since the average lifespan of medium-size dump trucks in China is 10.1 years (Science China Technological Sciences, "Vehicle survival patterns in China", March 2011).

(d) Skip Loader

Skip loaders are used to collect waste from 220 container-type collection points throughout the city. A skip loader carries an empty container on its way to the collection point, unloads the empty container at the collection point, and load the filled containers for transport. The transported container with waste is then dumped at the landfill site. In this respect, it should be noted that SMA has a plan to convert waste collection points from fixed collection points to container-type collection points. Although the operational rate is very low with the existing skip loaders, there have been many experiences in inspecting/doing performing maintenance work for this type of vehicle. Therefore, it can be said that the SMA has enough skills and experience if appropriate spare parts are supplied.

Specifications of a skip loader are as shown in Table 2.5.

Table 2.5 Specifications of Skip Loader

Item	Specifications	Reasons
Loading capacity	Loading weight: 4.5-ton (>7m ³)	Location to install containers is very limited in the city. If a larger container is to be placed, the base needs to be reinforced/constructed. Thus, the current size of containers is selected.

(e) Collection Plan by Collection Vehicle

(i) Apparent Specific Gravity

It should be noted that, the apparent specific gravity of waste in Antananarivo has been calculated from the truck scale data, excluding abnormal figures, from the Andralanitra landfill site and capacity of SMA's trucks as shown in Table 2.6. The apparent specific gravity of 0.35 is used for both types of collection vehicle. (It should be noted that the apparent specific gravity may fluctuate due to the accuracy of data recorded, which may also affect the waste collection ratio calculated under various assumptions.)

Table 2.6 Estimated Apparent Specific Gravity

Equipment	Average Loading Weight	Apparent Specific Gravity (t/m ³)
Dump Trucks	5.22 ton	0.34
Skip Loaders	2.21 ton	0.36

(ii) Collection Plan for Fixed-type Primary Collection Point

Table 2.7 shows a waste collection plan for fixed-type primary collection points covered by dump trucks. The source of the waste discharged at fixed collection points is households; thus, waste generated for a particular fixed collection point can be calculated by the population of the fokontany times waste generation unit. In total, 106.0 ton/day for all 6 districts.

According to the result of the Waste Amount and Composition Survey carried out in the Project, 40% of middle-income households and 25% of high-income households have practiced some sort of kitchen waste, papers and/or plastics for recycling; hence about 20% of waste can be assumed to be either recycled or self-treated, and not to be discharged to the primary collection points. Based on this assumption, waste discharged to the fixed-type primary collection points are calculated as 594 tons per week. When waste is to be collected with a 70% or 80% collection rate, 415.7 ton/week for 70% and 475 ton/week for 80% are the volume of waste collected in one week period.

- 106.0 ton/day x 80% = 84.8 ton/day
- ⇒ 84.8 ton/day x 7 days x 70% = 415.7 ton/wk (collection rate @ 70%)
- ⇒ 84.8 ton/day x 7 days x 80% = 475.0 ton/wk (collection rate @ 80%)

Next, assuming 90% loading ratio is kept for a week, number of trips necessary to collect the calculated waste become as follows.

- 415.7 ton/wk / (5.25 ton x 90%) = 88 trips (collection rate @ 70%)
- 475.0 ton/wk / (5.25 ton x 90%) = 100 trips (collection rate @ 80%)

Table 2.7 Collection Plan by Dump truck from Fixed-type Primary Collection Point (Collection Ratio: 70%)

Dist.	Waste Generated (t/d)	Waste Discharged (80%)	Waste Discharged per week	Waste Collected (t/w)	# of Trips at 90% Loading Ratio
Dist. 1	8.6	6.9	48.3	33.8	7.1
Dist. 2	36.9	29.5	206.5	144.6	30.6
Dist. 3	4.5	3.6	25.4	17.8	3.8
Dist. 4	27.5	22.0	153.9	107.7	22.8
Dist. 5	18.3	14.7	102.6	71.8	15.2
Dist. 6	10.2	8.2	57.2	40.1	8.5
Total	106.0	84.8	593.8	415.67	87.97

Table 2.8 shows an example of a collection plan in a week. From the result of the Time and Motion study, the number of trips for a dump truck is 3.65 trips/day. Thus, the number of trips in a day divided by 3.65 gives the number of trucks necessary to perform collection work for the day. A total number of necessary trips is calculated as follows:

- 88 trips / 3.65 trips/day / 7 days = 3.4 trucks (≅ 4 trucks) (collection rate @ 70%)
- 100 trips / 3.65 trips/day / 7 days = 3.9 trucks (≅ 4 trucks) (collection rate @ 80%)

Table 2.8 Example of Weekly Collection Plan by Dump Trucks from Fixed-type Primary Collection Point (Collection Ratio: 70%)

Dist.	Number of Trips							# of Trips/wk
	Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	Sun.	
Dist. 1	1	1	1	1	1	1	1	7
Dist. 2	4	5	4	4	5	4	5	31
Dist. 3	1		1		1	1		4
Dist. 4	3	4	3	3	3	3	4	23
Dist. 5	2	2	2	3	2	2	2	15
Dist. 6	1	1	1	2	1	1	1	8
Total	12	13	12	13	13	12	13	88
# of Trucks	4	4	4	4	4	4	4	4

Based on the above, the number of dump trucks necessary to carry out waste collection/transportation from the fixed-type primary collection points is calculated as four (4).

Assuming the number of available dump trucks in 2024 will be 8, dump trucks which will be used for collecting waste from the container-type primary collection points are 4 dump trucks (8 total existing and still available dump trucks – 4 dump trucks necessary for fixed primary

collection points). Now, 1 dump truck is to be assumed for reserve truck for maintenance, dump trucks can be summarized as:

- 4 dump trucks for fixed-type primary collection points,
- 3 dump trucks for container-type primary collection points, and
- 1 dump truck as a reserve for maintenance.

(iii) Collection Plan for Container-type Primary Collection Point

Container-type collection points which are primarily served by skip loaders, are also served by dump trucks. The following Table 2.9 shows the collection plan for container-type collection points using both skip loaders and dump trucks.

Table 2.9 Volume of Waste Discharged/Collected at Container-type Collection Points (ton/day)

Dist.	Household Waste	Commercial Waste	Total Discharged	Volume Collected by Collection Ratio of:	
				70%	80%
1	127.1	21.29	148.36	103.9	118.7
2	75.5	17.36	92.91	65.0	74.3
3	70.4	12.01	82.37	57.7	65.9
4	119.8	23.24	143.09	100.2	114.5
5	187.0	33.12	220.13	154.1	176.1
6	67.4	12.16	79.56	55.7	63.6
Total	647.2	119.17	766.4	536.5	613.1

Based on the capacity, loading ratio (90%) and number of daily trips of the trucks, volume of waste collected in one day for both dump trucks and skip loaders can be calculated as follows:

- Dump truck: $5.25 \text{ ton/trip} \times \text{loading ratio (90\%)} \times 3.65 \text{ trip/day} = 17.2 \text{ ton/day}$
- Skip loader: $2.45 \text{ ton/trip} \times \text{loading ratio (90\%)} \times 5.62 \text{ trip/day} = 12.4 \text{ ton/day}$

From above, the following 3 different cases of procurement patterns have been examined, i.e. Case A: procuring no dump truck, Case B: procuring 4 dump trucks, and Case C: procuring 6 dump trucks. Prerequisites for this calculation are shown in Table 2.10.

Table 2.10 Prerequisites for Comparing Number of Dump Trucks and Skip Loaders

Item	Condition	Evidence etc.
Operating ratio	90%	From existing data
Collection ratio	70%, 80%	Considered 2 scenarios
# of existing trucks	8 trucks	Assumed from the current operation
Fuel consumption	1.61km/L	Dump truck (existing), from data provided by SMA
	2.8km/L	Skip loaders (existing), from data provided by SMA
	4.14km/L	Dump truck (new) ²
	4.15km/L	Skip loaders (new), data for arm roll truck is substituted
Travel distance	3.53km/ton	Distance travelled per ton of waste, dump truck (from SMA's Feb. data)
	14.19km/ton	Distance travelled per ton of waste, skip loader (from SMA's Feb. data)
Fuel price	3,400MGA/L	
# of workers	2 drivers/truck	Driver, same for dump truck and skip loader
	12-14 crew/truck	Collection crew, dump truck
	4-6 crew/loader	Collection crew, skip loader

² KENPAIKYO, average fuel consumption in questionnaire survey for waste collection and transportation in FY2013
https://www.kenpaikyo.or.jp/works/file/2013_nenpi.pdf

Item	Condition	Evidence etc.
Labor cost	500,000MGA/month	Driver (work 24hrs and rest 24hrs)
	250,000MGA/month	Collection crew (work 18hrs and rest 30 hrs)

(iv) Calculations for Number of Trucks Needed

Case A (procuring 0 dump truck) is shown here to illustrate how the necessary number of trucks were calculated.

As mentioned above, if the number of remaining existing dump trucks would be 8 while the loading ratio is 90%, the number of available dump trucks for operation becomes 7 (8 dump trucks x 90% \doteq 7). Among these 7 dump trucks, 4 dump trucks will be used for fixed-type primary collection points, meaning 3 dump trucks can be used for container-type primary collection points. The volume of waste collected with 3 dump trucks can be calculated as follows:

- 3 trucks x 17.2 ton/day = 51.7 ton/day

On the other hand, volume of waste discharged for container-type collection point is 536.5 ton/day for 70% collection ratio and 613.1 ton/day for 80% collection ratio, as shown in Table 2.9. Thus, volume of waste collected by skip loaders is as follows:

- 536.5 ton/day - 51.7 ton/day = 484.8 ton/day (collection rate @ 70%)
- 613.1 ton/day - 51.7 ton/day = 561.4 ton/day (collection rate @ 80%)

Since volume of waste collected by a skip loader in one day is 12.4 tons, number of necessary skip loaders can be calculated as follows:

- 484.8 ton/day / 12.4 ton/day = 39.0 trucks (\doteq 39 trucks) (collection rate @70%)
- 561.4 ton/day / 12.4 ton/day = 45.2 trucks (\doteq 45 trucks) (collection rate @80%)

Considering some vehicles are needed as reserves for maintenance, a total number of skip loaders will be shown as follows. For Case 1 in which no dump truck is procured, 43 skip loaders for 70% collection ratio and 50 skip loaders for 80% collection ratio are needed.

- 39 trucks / 90% = 43.3 trucks (\doteq 43 trucks) (collection rate @70%)
- 45 trucks / 90% = 50.0 trucks (\doteq 50 trucks) (collection rate @80%)

(v) Calculations for Cost

Maintenance costs have been calculated using Case A (procuring 0 dump truck) as follows.

<p>■ Fuel cost for dump truck (used for fixed-type collection point)</p> <ul style="list-style-type: none"> - Travelling distance <u>Volume of waste collected 84.8 ton/day x distance traveled per ton of waste 3.53km/ton = 299.3km/day</u> - Fuel consumption <u>Distance traveled 299.3 km/day ÷ fuel consumption for existing dump truck 1.61km = 186L/day</u> - Fuel cost <u>Fuel consumption 186 L/day x fuel cost 3.400MGA/L = 632,400 MGA/day</u> <p>■ Fuel cost for dump truck (used for container-type collection point)</p> <ul style="list-style-type: none"> - Traveling distance <u>Volume of waste collection 51.7 ton/day x distance traveled per ton of waste 3.53km/ton = 182.5 km/day</u>

- Fuel consumption

Distance traveled 182.5 km/day ÷ fuel consumption for existing dump truck 1.61km/L = 113 L/day

- Fuel cost

Fuel consumed 113 L/day x fuel cost 3,400MGA/L = 384,200 MGA/day

■ Skip loader

Skip loader is calculated likewise. In case of 70% collection ratio, travelling 6,879.2km, 1,658 L fuel consumed, and 5,635,996MGA for fuel cost, while in case of 80%, travelling 7,966.9km, 1,920L fuel consumed, and 6,527,074MGA fuel cost.

As for labor cost, the number of necessary staffs in a 24-hour period, though actual working hours are quite long, 2 drivers (requiring 2 drivers in 48 hours), 12-14 collection crews for dump trucks (1 team consist of 6-7 crews have been in rotation for 48 hour cycle) and 2-3 collection crews for skip loaders are needed. Therefore, the labor cost is to be the number of trucks multiplied by the number of staff yields.

■ Dump truck (used for fixed-type collection point)

- Drivers: 4 trucks x 2 drivers x 500,000MGA/mth = 4,000,000MGA/mth

- Collection crews: 4 trucks x 6 crews x 250,000MGA/mth = 6,000,000MGA/mth (7 crews: 7,000,000MGA/mth)

■ Dump truck (used for container-type collection point)

- Drivers: 3 trucks x 2 drivers x 500,000MGA/mth = 3,000,000MGA/mth

- Collection crews: 3 trucks x 6 crews x 250,000MGA/mth = 4,500,000MGA/mth (7 crews: 5,250,000MGA/mth)

■ Skip loader

(Collection rate @ 70%)

- Drivers: 39 trucks x 2 drivers x 500,000MGA/mth = 39,000,000MGA/mth

- Collection crews: 39 trucks x 4 crews x 250,000MGA/mth = 39,000,000MGA/mth (6 crews: 58,500,000MGA/mth)

(Collection rate @ 80%)

- Drivers: 45 trucks x 2 drivers x 500,000MGA/mth = 45,000,000MGA/mth

- Collection crews: 45 trucks x 4 crews x 250,000MGA/mth = 45,000,000MGA/mth (6 crews: 67,500,000MGA/mth)

The result of the examination for Case A (no new dump truck is procured and thus collected by existing dump trucks and new skip loaders) is shown in Table 2.11 through Table 2.13.

Table 2.11 Volume of Waste Collected by Truck Type for Case A (0 dump truck)

Number of Procurement / Collection Volume	Collection Rate @ 70%		Collection Rate @ 80%	
	Dump Truck	Skip Loader	Dump Truck	Skip Loader
Number of procurements	0	43	0	50
Number of existing trucks	8	0	8	0
Total number of trucks	8	43	8	50
Number of trucks for reserve (from operation rate)	1	4	1	5
Number of trucks used for the fixed-type collection point	4	-	4	-
Volume of waste collected @ fixed collection point	84.8 ton/day	-	84.8 ton/day	-
Number of trucks used for container-type collection point	3	39	3	45
Volume of waste collected @ container-type collection point	51.7 ton/day	484.8 ton/day	51.7 ton/day	561.4 ton/day

Table 2.12 Number of Drivers/Collection Crews by Truck Type for Case A (0 dump truck)

Driver / Collection Crew		Collection Rate @ 70%		Collection Rate @ 80%	
		Dump Truck	Skip Loader	Dump Truck	Skip Loader
Number of personnel	Drivers	14	78	14	90
	Collection crews	84 – 98	156 – 234	84 – 98	180 – 270
Labor cost	Drivers	14,000,000 MGA/mth	39,000,000 MGA/mth	14,000,000 MGA/mth	45,000,000 MGA/mth
	Collection crews	21,000,000~ 24,500,000 MGA/mth	39,000,000~ 58,500,000 MGA/mth	21,000,000~ 24,500,000 MGA/mth	45,000,000~ 67,500,000 MGA/mth

Table 2.13 Mileage and Fuel Cost by Truck Type for Case A (0 dump truck)

Travelling Distance / Fuel Cost	Collection Rate @ 70%		Collection Rate @ 80%	
	Dump Truck	Skip Loader	Dump Truck	Skip Loader
Collection volume	136.6 ton/day	484.8 ton/day	136.6 ton/day	561.4 ton/day
Volume collected by existing trucks	136.6 ton/day	0.0 ton/day	136.6 ton/day	0.0 ton/day
Volume collected by new trucks	0.0 ton/day	484.8 ton/day	0.0 ton/day	561.4 ton/day
Distance traveled for existing trucks	482 km/day	0 km /day	482 km/day	0 km/day
Distance traveled for new trucks	0.0 km/day	6,879.2 km/day	0.0 km/day	7,966.9 km/day
Volume of fuel necessary (existing fuel)	299 L/day	0 L/day	299 L/day	0 L/day
Volume of fuel necessary (new truck)	0.0 L/day	1,658 L/day	0.0 L/day	1,920 L/day
Fuel cost (existing trucks)	385,599 MGA/day	0 MGA/day	385,599 MGA/day	0 MGA/day
Fuel cost (new trucks)	0 MGA/day	5,635,996 MGA/day	0 MGA/day	6,527,074 MGA/day

Same calculations were done for both Case B (procuring 4 dump trucks) and Case C (procuring 6 dump trucks), and results are shown in Table 2.14 through Table 2.17.

Table 2.14 Comparison of Number of Trucks and Waste Collected (Collection Ratio: 70%)

Cases	Types of Truck	Quantity of Trucks				Volume of Waste Collected (ton/yr)
		Procured	Existing	For Reserve	For Operation	
Case A	Dump Truck	0	8	1	7	49,822
	Skip Loader	43	0	4	39	176,952
Case B	Dump Truck	4	8	1	11	75,008
	Skip Loader	36	0	3	33	151,768
Case C	Dump Truck	6	8	1	13	87,418
	Skip Loader	33	0	3	30	139,175

Table 2.15 Comparison of Number of Trucks and Waste Collected (Collection Ratio: 80%)

Cases	Types of Truck	Quantity of Trucks				Volume of Waste Collected (ton/yr)
		Procured	Existing	For Reserve	For Operation	
Case A	Dump Truck	0	8	1	7	49,822
	Skip Loader	50	0	5	45	204,911
Case B	Dump Truck	4	8	1	11	75,008
	Skip Loader	43	0	4	39	179,726
Case C	Dump Truck	6	8	1	13	87,418
	Skip Loader	40	0	4	36	167,134

Table 2.16 Comparison of Cost of Each Case (million MGA/year) (Collection Ratio: 70%)

Cases	Types of Truck	Labor			Fuel	Maintenance	Total (Mil. MGA/Yr)
		Driver	Collection Crew				
Case A	Dump Truck	168	252	294	371	37	4,027~4,303
	Skip Loader	468	468	702	2,057	205	
Case B	Dump Truck	264	396	462	444	44	3,881~4,145
	Skip Loader	396	396	594	1,713	171	
Case C	Dump Truck	312	468	546	480	48	3,808~4,066
	Skip Loader	360	360	540	1,618	161	

Note: Maintenance cost is assumed to be 10% of fuel cost.

Table 2.17 Comparison of Cost of Each Case (million MGA/year) (Collection Ratio: 80%)

Cases	Types of Truck	Labor			Fuel	Maintenance	Total (Mil. MGA/Yr)
		Driver	Collection Crew				
Case A	Dump Truck	168	252	294	371	37	4,529~4,841
	Skip Loader	540	540	810	2,382	238	
Case B	Dump Truck	264	396	462	444	44	4,383~4,683
	Skip Loader	468	468	702	2,089	208	
Case C	Dump Truck	312	468	546	480	48	4,310~4,604
	Skip Loader	432	432	648	1,943	194	

Note: Maintenance cost is assumed to be 10% of fuel cost.

(f) Number of Procurement

Case C at a collection rate of 70% has been selected as the most appropriate option since the cost is minimized but still holds flexibility with the use of dump trucks in both fixed and container-type collection points in accordance with several discussions made on the above information. Therefore, waste collection for container-type collection points will be carried out with 7 dump trucks, i.e., 3 existing and 4 new dump trucks, together with 30 new skip loaders. Assuming that 10% is necessary for maintenance, total procurement is as shown in Table 2.18, i.e., equipment procured under the Project are six (6) dump trucks and thirty-three (33) skip loaders.

Table 2.18 Number of Procured Dump Trucks and Skip Loaders

Type of Truck	Existing Truck	New Truck (Procurement)	Total	Collection Points		
				Fixed	Container	Reserved for Maintenance
Dump truck	8	6	14	4	9	1
Skip loader	0	33	33	0	30	3

(g) Possibility of Compactor Truck

Compactor trucks can compress waste into about 1/2 of the original volume, so that it is the preferable method of waste collection and transportation in terms of efficient use of transportation equipment.

However, SMA has a plan to shift the use of collection point type from the fixed-type collection point to the container-type of collection point. Therefore, a comparison was made between the compactor truck and the dump truck for fixed collection points.

(i) Dump Truck

Dump truck requires a certain time and labor to load the waste since the loading platform is quite high. In general, 6-7 collection crews are necessary, and they can only collect from 1 collection point in 1 trip. On the other hand, many collection crews mean it can handle the waste indiscriminately accumulated at the collection point. Moreover, the truck is structured in general mechanism/materials therefore it has a high affinity with the existing experiences in terms of usage and maintenance.

(ii) Compactor Truck

Compactor trucks require little time and labor to load the waste since the loading hopper is located low. Furthermore, it could compact the waste to 1/2 of its original volume at a time, therefore, serving multiple collection points in a single trip could be possible.

Unfortunately, however, compactor trucks which require a series of rather complicated electrical sequences and hydraulic systems to control the waste loading, compacting, and pushing mechanisms, have never been used in Madagascar. Some electronic parts, indeed, are special kinds and acquiring such special parts may be difficult in Madagascar. Additionally, poor road condition in Antananarivo is also unfavorable to the compactor trucks. If introduced, it is inevitable to face difficulty to repair when breakdowns or deterioration occurs.

To yield the maximum efficiency from the compactor trucks, waste discharge practice, allowing citizens to indiscriminately discharge waste stream at the fixed collection point to discharging waste in a garbage bag or bins. SMA has also no willingness to introduce the compactor truck. Table 2.19 shows a summary of the comparison.

Table 2.19 Advantages and Disadvantages of Introducing Dump Trucks and Compactor Trucks

Truck	Advantages	Disadvantages
Dump truck	It is easily accepted in terms of both operational and maintenance techniques since this is a very familiar vehicle type in Madagascar.	<ul style="list-style-type: none"> - Compared to compactor trucks, waste collection and transportation by dump trucks is an inefficient method. - Dump truck requires more collection crews than compactor truck.
Compactor truck	It is possible to carry twice the volume thus realizing efficient collection and transportation. Hygienically advantageous as collected waste is put into the enclosed body.	<ul style="list-style-type: none"> - It can be anticipated to face difficulty in both maintenance and operation since there has no experience in using compactor trucks in Madagascar. - Many parts may cause malfunctions, and some parts may be difficult to obtain in Madagascar. - Waste discharge practice at the fixed-type primary collection point by the residents may need modification. - Madagascar side does not wish to use compactor truck.

As mentioned above, the disadvantages of introducing compactor trucks are far outweighed the advantages in the viewpoint of sustainable use of waste collection and transportation equipment; therefore, compactor trucks are not considered as waste collection and transportation vehicles in the Project. If Japanese compactor trucks are to be introduced in the future, it is desirable to precede one or two compactor trucks along with a Japanese expert who trains maintenance techniques to accumulate the necessary knowledge and skills.

(h) Containers

(i) Distribution of Containers

According to the primary collection point survey, it has become clear that enough containers are not distributed. Also, SMA itself has been reviewing the use of the primary collection points and has plans to convert fixed-type collection points to container-type collection points as well as increasing numbers of distributed containers.

Therefore, based upon the SMA's improvement plan on primary collection points, the number of necessary containers are calculated for containers that need to be replaced, added, and used for everyday collection work as follows.

(ii) Step 1: Understanding of New Container by District

A total number of containers is calculated by adding additional containers to existing containers based on the SMA's improvement plan as follows.

- Dist. 1) Existing containers (47 units) + Additional containers (72 units) = 119 units

Next, new containers by the district are calculated by multiplying the ratio of containers necessary to be replaced for each district according to the figure specified in the primary collection point survey. Table 2.20 shows the number of new containers by the district.

- Dist.1) Existing containers (47 units) x Container necessary to be replaced (33%) = 15.51 units (\approx 16)
- New containers (72 units) + Containers to be replaced (16 units) = 88 units

Table 2.20 Number of Containers by District

Dist.	Existing Containers	Additional Containers	Total Containers	# of Containers need to be Replaced	New Containers
Dist. 1	47	72	119	16	88
Dist. 2	39	55	94	13	68
Dist. 3	45	45	90	15	60
Dist. 4	44	51	95	15	66
Dist. 5	42	49	91	14	63
Dist. 6	20	27	47	7	34
Total	237	299	536	80	379

(iii) Step 2: Understanding Number of Containers for Reserve and Operation

The number of containers in reserve and operation is calculated here. Based on the result of the primary collection point survey, the number of reserves is assumed to be 10% of the total. Also, a skip loader carries one container per trip, indicating there will be 30 containers necessary for daily operation. Thus, containers in reserves and operation are as follows:

[Reserves]

Total number of containers 536 units + number of containers used on skip loaders 30 units) x reserves (10%) = 57 units

[New]

New containers for all districts 379 units + reserves 57 units + operational containers 30 units = 466 units

(iv) Step 3: Understanding Number of Containers need to be Procured

SMA has acquired 140 containers by its own efforts until October 2021, therefore, the total number of containers to be procured under the Project is 326 units. Table 2.21 shows a summary of the calculation.

- Number of containers necessary (466 units) – Number acquired (140 units) = 326 units

Table 2.21 Summary of Containers in the Calculation

Item	Number of Containers
Existing containers	237
Additional containers	299
Containers total	536
Containers need to be replaced (33%)	80
New containers (b + d)	379
Containers in reserves	57
Containers in operation (# used by skip loaders)	30 (30 skip loaders)
Containers already acquired by SMA	140
Containers to be procured (e + f + g -h)	326

(3) Improvement on Waste Collection Rate

(a) Estimating Waste Volume

Table 2.22 and Table 2.23 shows estimated population and waste volume in 6 districts in Antananarivo and villages near the Andralanitra landfill site for 2021 (base year), 2024 (procurement year), and 2027 (3 years after procurement).

Table 2.22 Population by Type of Primary Collection Point Types and Waste Generated

Year	Population (people)			Waste Generated (t/d)		
	Type of Collection Point		Total	Type of Collection Point		Total
	Fixed	Container		Fixed	Container	
2021	165,314	1,229,496	1,394,810	99.8	758.3	858.1
2024	175,565	1,311,742	1,487,307	106.0	809.0	915.1
2027	183,181	1,400,469	1,583,650	110.8	864.0	974.8

Table 2.23 Waste Discharged by Type of Primary Collection Point Types

Year	Waste Discharged (t/d)			
	Households		Businesses	Total
	Fixed	Container	Container	
2021	79.8	606.7	111.8	798.3
2024	84.8	647.2	119.1	851.2
2027	88.6	691.2	127.0	906.8

(b) Estimating Waste Collected

As of February 2021, SMA has 13 dump trucks and 2 skip loaders, and the collection volume per dump truck is 24.0 tons/day, and the skip loader is 17.3 tons/day according to the truck scale data installed at the landfill site. Therefore, the volume of waste collected in 2021 is 312.9 tons/day for dump trucks (13 units x 24.0 tons/day) + 34.5 tons for skip loaders/day (2 units x 17.3 tons/day) = 347.4 tons.

For 2024 onward, a total of 14 dump trucks, assuming 8 are operational out of 13 currently operated, and 33 skip loaders are used to collect waste, and estimated volume is as shown in Table 2.24.

Table 2.24 Estimated Waste Collected by Type of Primary Collection Point Types

Year	Type of truck	Waste Collected (ton/day)		Total (ton/day)
		Fixed	Container	
2021	Dump truck	312.9		347.4
	Skip loader	-	34.5	
2024/ 2027	Dump truck	69.1	155.3	596.4
	Skip loader	-	372.0	

(c) Improvement of Waste Collection Rate

Table 2.25 shows the waste collection rate for each year calculated from waste discharge volume and waste collection volume.

Table 2.25 Waste Collection Volume by Each Collection Point Type

Year	Type of Primary Collection Point	Waste Discharged (A)	# of trucks		Waste Collected (ton/day)		Total collected (B)	Collection rate (B/A)
			Dump truck	Skip loader	Dump truck	Skip loader		
2021	Fixed	79.8	13	-	312.9	34.5	347.4	43%
	Container	718.5		2				
	Total	798.3	13	2	312.9	34.5		
2024	Fixed	84.8	4	0	69.1	0	596.4	70%
	Container	766.4	9	30	155.3	372.0		
	Total	851.2	13	30	224.4	372.0		
2027	Fixed	88.6	4	0	69.1	0	596.4	66%
	Container	818.2	9	30	155.3	372.0		
	Total	906.8	13	30	224.4	372.0		

Note: * Operation ratio for maintenance/ repair is assumed to be 90%.

Due to rounding after the decimal point, the calculation and the calculation result may not always match.

(4) Selection of Maintenance Equipment for Waste Collection and Transportation

(a) Pickup Trucks and Motorcycles

To monitor not only the condition of collection points throughout the city but also illegal dumping in all the six (6) districts in Antananarivo, two (2) pickup trucks are needed. Likewise, eight (8) motorcycles are needed to monitor collection points and illegal dumping sites.

Specifications of pickup trucks and motorcycles are as shown in Table 2.26.

Table 2.26 Specifications of Pickup Truck and Motorcycle

Items	Specifications	Reasons
Pickup Truck	4-door type (double cabin)	A monitoring/inspection team can be transported along with necessary gears and others. Used to go around the 6 districts in the city.
Motorcycle	Off-road type, 125cc class	Considering poor road conditions in the city, small off-road type motorcycles give ideal mobility to go around the 6 districts in the city.

(b) Tools for Maintenance

To enable SMA to perform all maintenance work by themselves, the survey team consulted with the Service Department on the preparation of minimum maintenance tools/equipment to properly maintain the procured vehicles. Those tools and equipment are included in Table 2.27.

Table 2.27 Tools and Equipment Necessary to Perform Minimum Maintenance in-house

Items	Unit	Specifications
Scan tool	1	Capable to scan trucks (24V vehicles)
Garage jack	2	20-ton

Items	Unit	Specifications
Rigid rack	2	20-ton
High-pressure washing machine	1	Engine type: >10.0 MPa
Air compressor	1	> 10 ps
Tire changer	1	Rim Size: 14-26 inches

The tools and equipment mentioned above require proper training to utilize their functions fully and safely. For example, if the scan tool gives an error code for a sensor, replacing the sensor may or may not fix the problem since this error might have been caused not only by faulty the sensor, but also by cracks in the manifold, faulty fuel system, or many other possible causes. Therefore, mechanics need to understand what an error code means and learn how to diagnose based on that error code. Likewise, changing tires of especially heavy-duty trucks are very dangerous since the high-pressure air may explode if dealt with carelessly. Thus, training on the proper handling of tires is necessary when using the tire changer. Technical assistance in this area is thus highly desirable.

(5) Improvement Work of Waste Collection Points

(a) Selection of Target Collection Points for Improvement Work

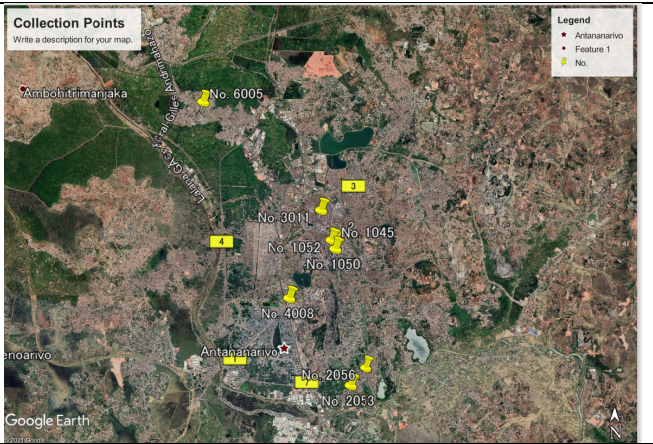
Eight (8) fixed facilities have been finally selected based on the magnitude scale of the facility, construction materials, the need for the facility, etc., in accordance with the agreement between the SMA/CUA and the survey team on the target of the Project that requires renovation work.

As for the typical structural type, the slit wall type with excellent maintenance has been selected from the checklist of the fixed waste collection facilities. A notch is to be provided on the front wall surface, which is a plan that makes it easy to take out the garbage and has good work efficiency for collection and transportation, so that workers can easily enter and exit the facility. In addition, the facility structure has to be made of solid wet stone masonry for durability.

Table 2.28 shows the locations of the selected eight (8) fixed collection facilities and their code numbers, road names, latitude, and longitude of the facilities scheduled for renovation work.

Table 2.28 Locations of Eight (8) Fixed Facilities Scheduled for Renovation

Item No.	Code No.	Arrondissement/ Road Name
1	1045	1 e/ faravohitra
2	1050	1 e/ faravohitra
3	1052	1 e/ faravohitra
4	2053	2 e/ androntra
5	2056	2 e/ androntra
6	3011	3 e/ behoririka
7	4008	4 e/ madera
8	6005	6 e/ ambohimanarina mitsofoka



Source: JICA Survey Team based on SMA

Note: PB (Fixed collection facility (in French, PB ou PARCS A BŒUFS))

(b) Drawing Plan

The drawing plan of collection points for improvement work is as shown in Figure 2.1.

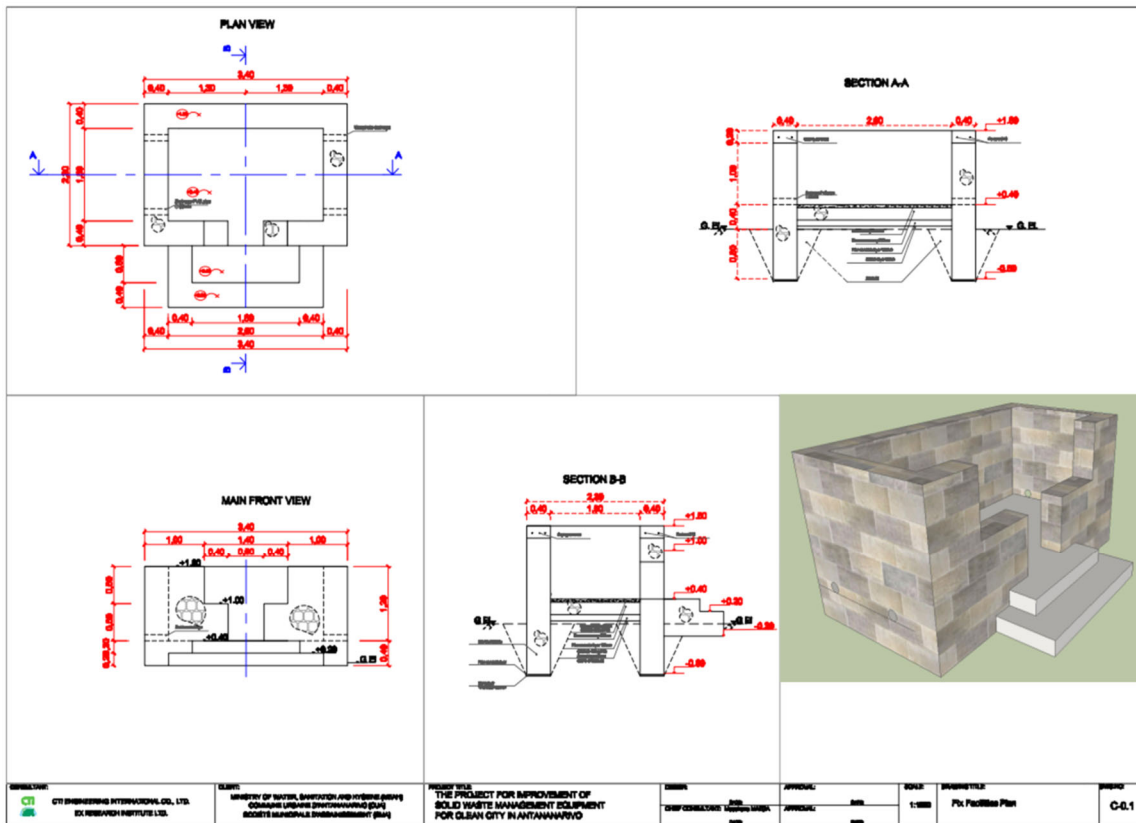


Figure 2.1 Three-view Drawings of a Fixed Masonry Type Facility for Renovation Work

(c) Improvement Work Schedule

The improvement work at each of the two points (a total of eight points) will be carried out by four (4) teams. The construction process for one team is as shown in Table 2.29. Construction processes include preparatory works, earth works, masonry and concrete works, and finishing work for a total construction period of one (1) month for one point. Therefore, the total process will take 2.0 months.

Table 2.29 Work Schedule of the Eight Fixed Primary Collection Facilities

Working Period	1 month				2 month			
	1w	2w	3w	4w	1w	2w	3w	4w
Team A	Point 1				Point 2			
Preparation works	■				■			
Earth works	■	■			■	■		
Masonry and Concrete works		■	■			■	■	
Finishing works				■				■

2.2.3 Basic Plan of Landfill Operation

(1) Background of Change of Requests

Based on the request made by SAMVA in June 2019, the contents and their validities were examined by the Survey in 2021 and changed as shown in Table 2.30.

Table 2.30 Comparison of Requests

Facility Equipment	Required Quantity / Number		Background
	Initial Request	Preparatory Survey	
Bulldozer	2	2	-
Excavator	2	4	According to (i) below
Dump truck		3	According to (ii) below
Wheel loader	2	0	According to (iii) below
Floodlight	-	4	According to (iv) below
Flat-body truck	-	2	According to (v) below

(i) Excavator (Requested 2 units changed to 4 units)

Since it is necessary to maintain the site and excavate wastes over a wide area, it was judged that four (4) units are more appropriate.

(ii) Dump Truck (No Request changed to 3 units)

Dump trucks are indispensable for the maintenance of the carry-in road at the site; therefore, it was judged that three (3) units are more appropriate in consideration of efficiency.

(iii) Wheel Loader (Requested 2 units changed to Zero)

The wheel loader runs on wheels and it is suitable for work in places with high runnability such as paved yards. However, it needs to drive on the waste at the landfill site in the Project, so that it was judged that no unit will be provided (Zero unit) considering its early failure.

(iv) Floodlight (No Request changed to 4 units)

Floodlights are useful for landfill operation at night. It was judged that four (4) units is appropriate considering the operating space at the site.

(v) Flat-body Truck (No Request changed to 2 units)

Flat-body trucks are useful for carrying the floodlights. It was judged that two (2 units) is appropriate since 1 truck can carry 2 floodlights.

(2) Equipment Plan for Landfill Site

(a) Status of Equipment for Landfill Operation

A bulldozer is being used as maintenance equipment at the Andralanitra landfill site. The condition is not good and the damage is exposed due to the movement inside the landfill, but its use shall continue at the same location. In addition, there is no outdoor light in the landfill site, so that operation work is implemented under the light of heavy machinery at night. In addition, fires occur frequently in the landfill site, but since there is no water source for extinguishing fires,

firefighting sand is transported by hand to extinguish the fires. No fire truck or sprinkler truck is set.

(b) Selection of Equipment for Landfill Operation

(i) Bulldozer

A bulldozer is an indispensable equipment for the operation of a waste landfill site to level wastes and soil covering materials. It is also used daily at the Andralanitra landfill site and it is thought that continuous maintenance of equipment is possible. Therefore, it is judged that the procurement of two (2) bulldozers is appropriate due to a large amount of waste delivered.

Table 2.31 Specification for Bulldozer

Item	Selected Specification	Reason for Selection
Equipment Scale	21t class	21t class is used at the existing landfill site, and it is judged that it is an appropriate size for the work conditions such as leveling and compacting waste.

(ii) Excavator

An excavator is required for levelling soil covering material, movement, soil removal, loading of materials, and transportation of materials (crane transportation) of waste. It is judged that the procurement of four (4) excavators is appropriate because a wide range of excavation work is expected.

Table 2.32 Specification for Excavator

Item	Selected Specification	Reason for Selection
Bucket Capacity	0.8m ³	Excavation of waste for maintenance in other sites. The estimated amount of waste carried-in per day is about 4.2 m ³ or 150,000 m ³ per year. Since the excavation and loading work volume of 0.8 m ³ that piles up is about 250 m ³ /day, there is sufficient work capacity for daily landfill site maintenance work.

(iii) Dump Truck

Dump trucks can be used for efficient transportation of soil covering materials and various materials and equipment on the site. At the landfill site, it is necessary equipment for soil covering work during operation. In the landfill operation plan, new engineers (facility operators) will be assigned to take charge of maintenance, so that it is judged that the procurement of three (3) dump trucks is appropriate.

Table 2.33 Specification for Dump Truck

Item	Selected Specification	Reason for Selection
Load Capacity	12t	The estimated amount of soil works in the landfill site is about 60,000 m ³ in the landfill operation plan. According to this scale of soil works, the largest medium size of 12t loading class is appropriate to improve the efficiency of transportation.

(iv) Floodlight

For safe landfill works at night, floodlights equipped with a generator is selected since there is no power source in the landfill site. In addition, LED lamps with a life of 40,000 hours (about 20 years) and with a total luminous flux of 100,000 lm or more will be adopted, considering easy maintenance and the work environment.

Floodlights will be used at night for the dumping area (2 units) and the operation work area (2 units), so that it is appropriate to procure four (4) units.



Source: YANMAR HOLDINGS CO., LTD.

Figure 2.2 Example of a Floodlight

Table 2.34 Specifications of Floodlight

Item	Selected Equipment	Reasons for Selection
Power Source	Generator	Since there is no power source in the landfill site, a generator should be equipped.
Lamp	LED	Considering sustainable maintenance, LED lights with a life of 40,000 hours (about 20 years) should be adopted.
Brightness	Total luminous flux of 100,000 lm or more	Considering the night work environment, the total luminous flux should be 100,000 lm or more.

(v) Flat-body Truck

Flat body trucks are used for carrying the floodlights. Since they will run in the landfill site, they should be a 4-wheel drive (4WD) vehicle. In addition, since each vehicle will carry two (2) floodlights, the body size should be approximately 2,000 x 1,400 mm. Since four (4) floodlights are to be carried, it is appropriate to procure two (2) vehicles.

Table 2.35 Specifications of Flat-body Truck

Item	Selected Specifications	Reason for Selection
Drive	4WD	Since the vehicle runs in the landfill site, it will be a 4-wheel drive.
Body Size	2000 x 1400 mm	Since each vehicle will carry two floodlights, the body size will be approximately 2,000 x 1,400 mm.

(vi) Tools for Maintenance

As well as the equipment for waste collection and transportation, the minimum tools required for proper maintenance of equipment for the landfill operation by SMA were selected as shown in Table 2.36.

Table 2.36 Tools Necessary to Perform Minimum Maintenance

Items	Unit	Specifications
High-pressure washing machine	1	Engine type: >10.0 MPa
Air compressor	1	> 10 ps

(3) Landfill Management Plan (Emergency Management Measures)

The operation and maintenance of the Andralanitra landfill site will be carried out by SMA itself under the supervision of CUA using the landfill operation equipment procured by the Project. Here, the emergency landfill management plan of the future landfill site to be implemented on the Madagascar side is shown. This management plan should be updated separately based on the latest

data in a technical cooperation project considering the topographical and site conditions of the landfill site where garbage is brought in every day.

(a) Policy on the Management Plan

The Andralanitra landfill site is the only waste landfill site in Antananarivo that has been used since the 1960s. There is not enough maintenance equipment for the increasing amount of waste, and improper landfilling has caused collapse of piled-up wastes and fires. Since the landfill capacity is tight and there is no prospect of securing a new landfill site, extending the life of the landfill site has become an extremely important issue for the City of Antananarivo. These management plans are, therefore, prepared to extend the life of the landfill site and to develop a safe and efficient landfill site. Basic policies for this management plan are as follows.

- To improve the existing landfill site for safe and efficient embankment and landfilling;
- To create a stable slope (1: 1.5 or less) at steep slopes where there is a risk of collapse around the landfill area;
- To level the levee crown and to construct a road with crushed stone pavement;
- To keep the slope of on-site roads at the site within 10% in principle, considering the traffic of dump trucks and skip loaders;
- To install drainages (unsupported gutters) to prevent flooding due to the rainy season;
- To keep a stable slope (1: 1.5 or less) in the landfilling area to prevent collapsing in principle; and,
- To Install exhaust gas pipes in the landfill area to control fires.

(b) Emergency Management Plan

Table 2.37 shows tentative items of the emergency management plan and Figure 2.3 shows a management plan of the landfill site at the final stage. This management plan will be implemented in the daily operation of the landfill site, and since it is necessary to carry out this management continuously and sustainably in the future, SMA shall implement it directly. Therefore, it is desirable for SMA to carry out management using the equipment procured by the Project.

Table 2.37 Tentative Construction Items in the Emergency Management Plan

Item	Specifications	Unit	Q'ty
1. Earth Works of the landfill site			
1.1 Excavation	Excavation by bulldozers and excavators	m ³	170,000
1.2 Transportation	On-site transportation	m ³	60,000
1.3 Embankment	Leveling and compaction by bulldozers	m ³	20,000
1.4 Slope Work	Embankment slope shaping	m ²	20,000
2. On-site Road Construction			
2.1 Leveling and Compaction	Leveling at roadbed by bulldozers	m ³	5,000
2.2 Pavement Work	Pavement by crashed stones	m ²	9,000
3. Rainwater Collection Facility			
3.1 Soil Gutter Excavation	Excavation by excavators	m ³	700
3.2 Installation of Underdrain Pipes	Perforated polyethylene pipe φ300	m	200
4. Exhaust Gas Facility			
4.1 Excavation	Excavation by excavators	m ³	3,000
4.2 Installation of Pipes	Gas pipe (drum and crushed stone filling)	places	93
5. Leachate Pond			
5.1 Excavation	Excavation by excavators	m ³	200
5.2 Concrete Work	No reinforcement, t = 10cm, constructed on the slope of the leachate pond	m ²	50

Materials and equipment required for this management plan are estimated as follows. The materials can be procured in Madagascar and can be purchased from local suppliers. The material cost corresponds to the cost for this management plan, which is about 880 million MGA. The equipment maintenance cost and labor cost for maintenance are described in "2.6.2 (2) Operation and Maintenance Costs for Landfill Site" shown later.

<Material>	<ul style="list-style-type: none"> - Polyethylene pipe (perforated) $\phi 300$: 200m - PVC pipe $\phi 300$: 370m - Drum 200L: 370 drums - Crushed stone 200 ~ 300mm: 4,500m³ - Ready-mixed concrete: 45m³
<Equipment: Procured by the Project>	<ul style="list-style-type: none"> - Bulldozer 21t class: 2 units - Excavator with bucket capacity 0.8m³: 4 units - Dump truck 12t loading: 3 units

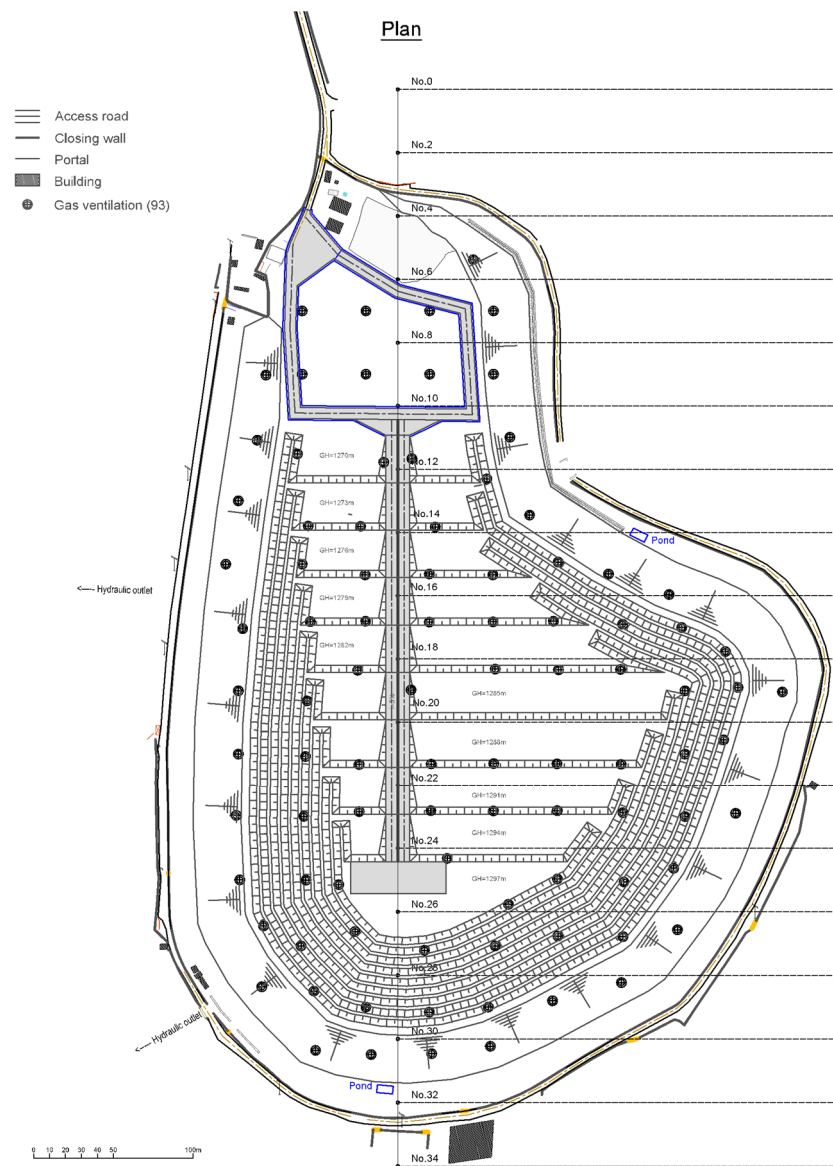


Figure 2.3 Operation Plan of the Landfill Site (Final Stage)

(c) Landfilling Capacity

In case the landfill site is operated according to the plan of the Project, it will be possible to secure an additional landfill capacity of approximately 800,000 m³, which is half of the amount of landfill waste from the 1960s (about 1.6 million m³).

Figure 2.4 shows the landfill capacity calculation chart at the final stage of landfill life extension.

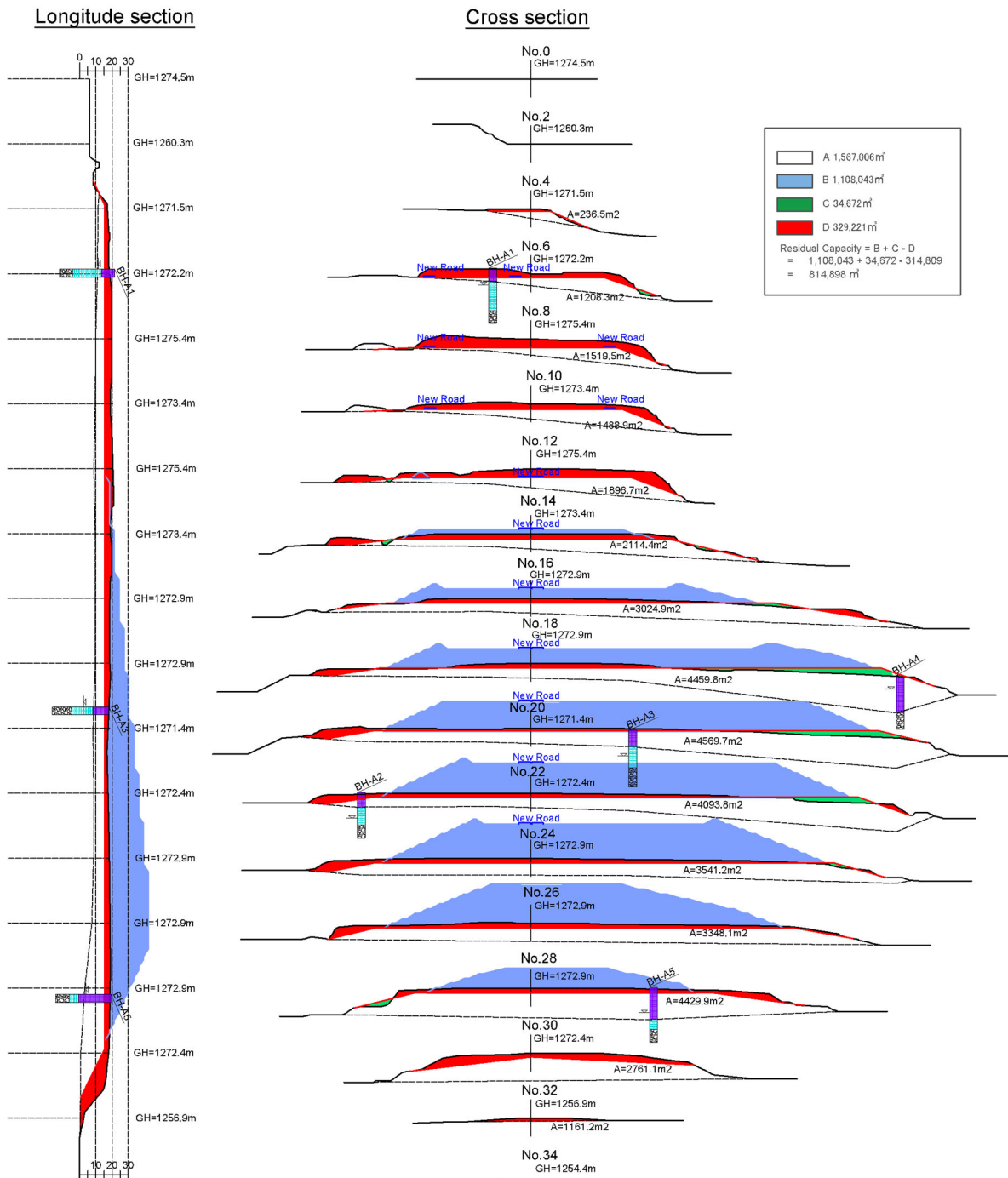


Figure 2.4 Cross Section of the Landfill Capacity

(d) Planning Design of the On-site Road

On-site roads are important facilities for efficient landfill work even in the rainy season. Currently, only the area near the entrance is maintained, which makes it difficult to deliver waste inside of the site.

A standard cross-section of an on-site road is shown in Figure 2.5. As measures against mud in the rainy season, crushed stone as pavement material shall be about 50 cm thick, and drainage channels with soil gutters shall be provided at the side of roads. The on-site roads shall be relocated at any time as the landfilling progress. When setting up a slope on the road, the slope shall be within 10% in principle, considering the traffic of dump trucks. In addition, in order to improve the efficiency of the on-site road construction which changes from time to time, the layout should be as straight as possible, in principle.

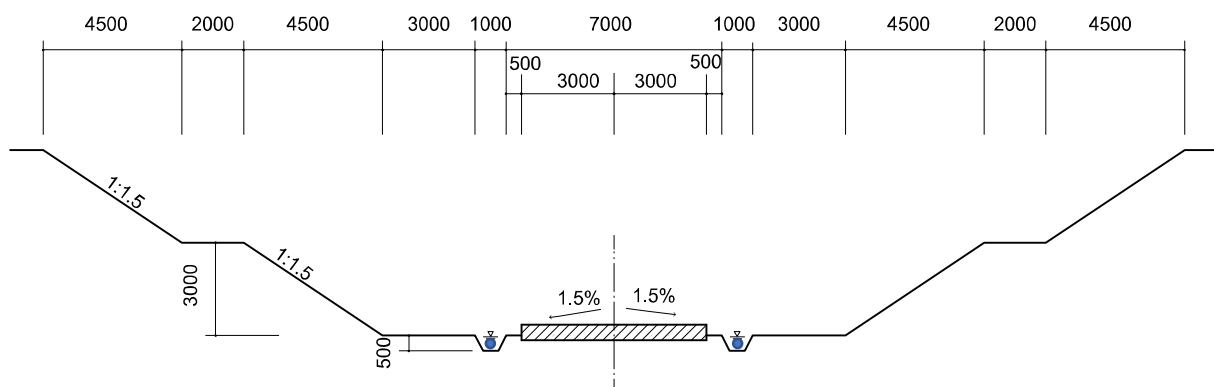


Figure 2.5 Standard Cross Section of On-site Road

(e) Exhaust Gas Facilities

Gas exhaust facilities discharge methane gas in the landfill to the outside and have the function of taking in outside air into the landfill. These functions are the basis of the Fukuoka method, which makes the landfill semi-aerobic. As shown in Figure 2.6, vertical gas pipes (single drums) will be installed in existing landfills. In this case, after excavating the existing waste for about 1 m, an additional perforated drum shall be installed, about 0.5 to 1.0 m above the ground. Vertical gas pipes shall be installed at every 2,000m² in area, so that a total of 93 pipes shall be installed in the landfilling area.

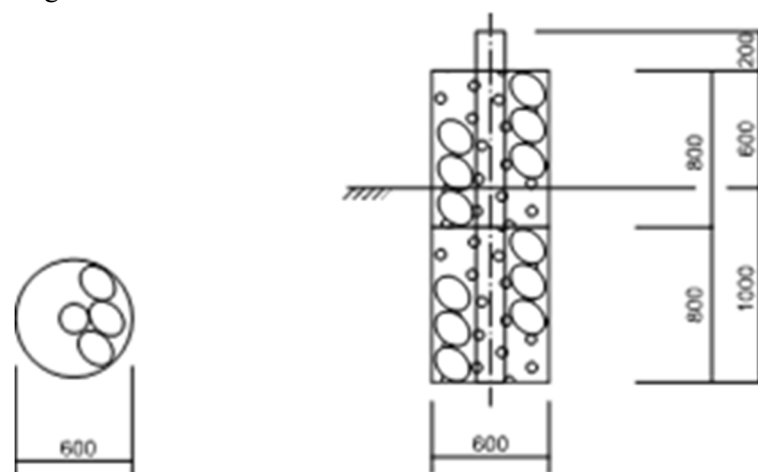


Figure 2.6 Structural Drawing of Vertical Degassing Pipes

2.2.4 Basic Plan of Sorting Facility

The construction of a sorting facility had been included in the request from SAMVA as an intermediate treatment facility, but it was decided not to implement it in the Project due to the situations below.

(1) Sorting Facility Planning by SAMVA/SMA

The construction of a sorting facility at the Andralanitra landfill site has been a priority project by SAMVA/SMA. Planning of the facility was as follows.

(a) Plan Outline

A sorting system with two (2) conveyors was required by SAMVA to sort, remove and compost the organic waste, as well as to reduce the amount of landfill waste and extend the life of the landfill site since approximately 60% of organic waste is included in the mixed waste carried into the landfill site. However, there are currently few detailed plans regarding the concept of a specific sorting facility, inspection of the operating capacity and quantity, quality control of manufactured compost, compost business planning, development of compost sales channels, and so on.

(b) Scale and Location of the Planned Sorting Facility

The scale and platform of the compost production plant project (ALISOTA project) in the Andralanitra landfill by SAMVA (SMA), Gret and Madacompost, are shown as follows:

- a) Location (Figure 2.7): The following compost production platform was planned and completed in 2018 in an area of approximately 3,300 m² at the north side of the landfill site.
 - Two existing huts (300 m²): Built in 2017 with financial support from AFD.
 - Mixed waste unloading yard (100m²) and Sorting work yard (100m²): In operation.
 - Organic waste fermentation yard (planned, 600m²): In operation
 - Organic waste fermentation/maturity yard (platform: 1,250m²): Most of them are in operation, some are planned.
 - Extension yard for compost maturation (1,250 m² during platform planning): at the planning stage
- b) The sorting facility was planned to be installed near the location shown in Figure 2.7 (red dotted line) by SMA.

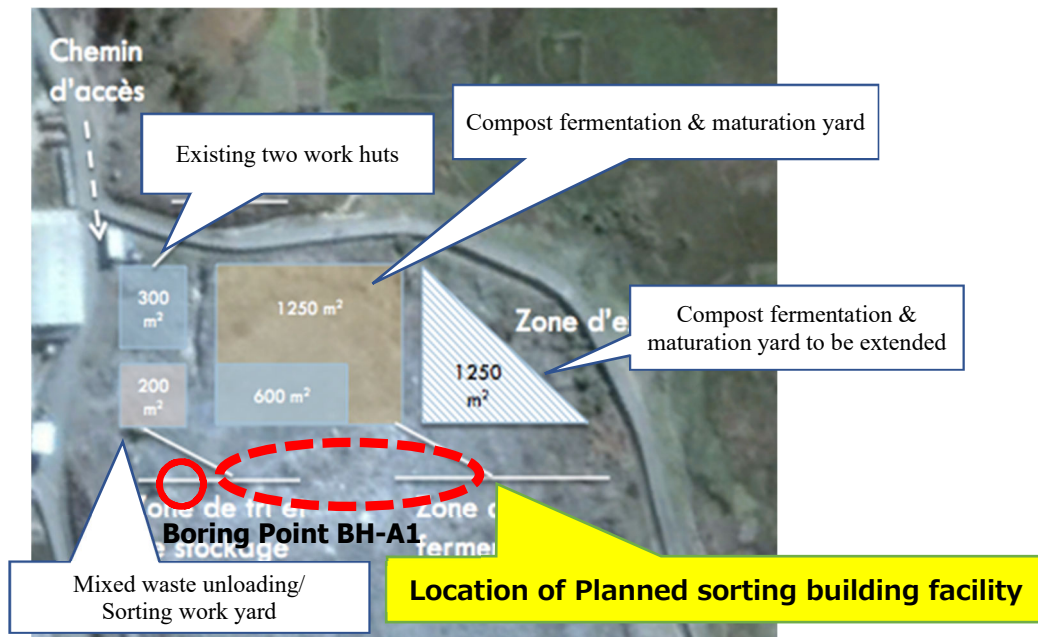
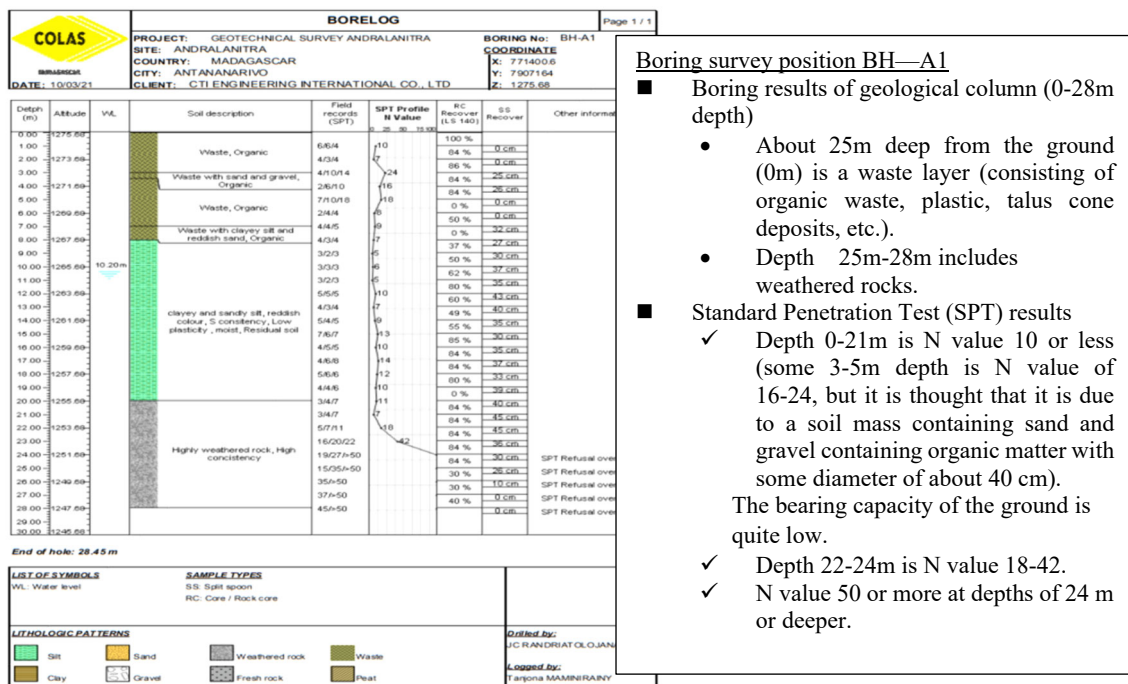


Figure 2.7 Layout Plan of Planned Sorting Facility

(c) Ground Foundation of the Sorting Facility

The results of the boring survey conducted by the Project at the boring point BH-A1 which is closest to the planned location of the sorting facility are shown in Figure 2.8.



- Boring survey position BH—A1**
- Boring results of geological column (0-28m depth)
 - About 25m deep from the ground (0m) is a waste layer (consisting of organic waste, plastic, talus cone deposits, etc.).
 - Depth 25m-28m includes weathered rocks.
 - Standard Penetration Test (SPT) results
 - ✓ Depth 0-21m is N value 10 or less (some 3-5m depth is N value of 16-24, but it is thought that it is due to a soil mass containing sand and gravel containing organic matter with some diameter of about 40 cm). The bearing capacity of the ground is quite low.
 - ✓ Depth 22-24m is N value 18-42.
 - ✓ N value 50 or more at depths of 24 m or deeper.

Figure 2.8 Results of the Boring Survey of BH-A1 (Ground Foundation of the Sorting Facility)

As a result of the boring survey, in case the sorting facility is constructed in the future, it is desirable to adopt the steel frame structure due to the following reasons. Alternatively, the planned sorting facility should be placed in another location with better foundation ground.

- The foundation ground at the proposed site has an N value of 10 or less, so that the weight of the building should be made as light as possible.
- There is a risk of subsidence, so foundation treatment work should be considered.
- In January 2017, there was the magnitude 5.9 earthquake near Antsirabe (about 120km south of Antananarivo), so that a steel structure as a structure capable of seismic design is desired.

(2) Examination of the Validity and Necessity of the Sorting Facility Plan

The construction of a sorting facility is not included in the Project, considering the validity and necessity as follows:

- The compost project currently underway is seen as a pilot project in terms of both quantity and quality. In order to improve the situation of the existing landfill site and extend the life of the landfill site, a large-scale sorting facility is required, but the space for its construction cannot be secured in the current situation where the landfill capacity is tight.
- To establish a recycling-based society in Madagascar including CUA, composting methods and plans by sorting waste should be discussed and studied continuously, such as compost quality analysis methods, the establishment of public certification bodies, and the development of related regulations.
- To realize the waste sorting facility plan, it is crucial for consumers, such as agricultural farmers, gardeners and horticulturists, to improve the safety and reliability of use of compost products. 3R (reduce, reuse, recycling) awareness activities, IEC (information, education, communication) campaigns, and environmental education to strengthen knowledge and awareness are also important to obtain safety and reliability for organic compost production.
- Furthermore, it is crucial to continuously improve production control and quality control for compost utilization using the PDCA (plan, do, check, act) cycle. Such activities include securing high-quality organic waste in the city, unifying compost production and quality inspection in the fermentation and maturity yard, the establishment of public certification system and related legislation, expansion of sales channels, follow-up of sales destinations and feedback to opinions and requests by farmers and gardeners regarding compost.
- According to the prediction by Madacompost, the amount of general waste used for composting will be about 11.1 tons per day while the average daily amount of general waste carried in will be 1,000 tons (waste collection and transportation will be promoted and the amount of landfilling waste will increase from 420 tons per day on average by the Project) at the time of planned landfill closing year in 2025. In other words, the amount of general waste is reduced by only about 1.1% (11.1 ton/1000 ton, see Table 2.38). It seems that the current method has hardly contributed to the reduction of the future amount of delivered waste.

Table 2.38 Ten-year Compost Production Plan in the Sorting Facility Plan in Andralanitra Landfill

Year	1	2	3	4	5	6	7	8	9	10
Compost product per year (ton/year)	147 t/y	160	320	640	640	640	960	960	960	960
Waste amount used for composting per year (ton/year)	1000 t/y	1000	2000	4000	4000	6000	6000	6000	6000	6000
Total waste amount per day (ton/day)	420 t/d	420	500	500	1000	1000	1000	1000	1000	1000
Waste amount per day (ton/day)	1000/12/30=2.8 t/d	1000/12/30=2.8 t/d	2000/12/30=5.5 t/d	4000/12/30=11.1 t/d	4000/12/30=11.1 t/d					6000/12/30=16.7 t/d
Compost amount per day (ton/day)	0.41 t/d	0.44 t/d	0.89 t/d	1.78 t/d	1.78 t/d					2.67 t/d

Source: Madacompost

2.2.5 Procurement Plan

(1) Procurement Policy

(a) Basic Information

The Project is to be implemented under the Japan's Grant Aid Scheme. Products and services are to be procured under the Japanese grant aid for the development project agreed under the Exchange of Notes (hereinafter referred to as "the E/N") between the GOJ and the GOM, and the subsequent grant agreement (hereinafter referred to as "the G/A") concluded between the GOM and JICA. Roles of each party is given as follows:

- The GOJ shall supply the grant aid to the GOM in accordance with Japanese laws and regulations;
- JICA supplies the grant aid in accordance with Japanese laws and regulations within the agreement in the E/N on the basis of securement of justification of the Project and accountability of the grant aid;
- The GOM is responsible for implementation of the Project. As a client, the GOM shall provide necessary products and work force for the project implementation by using the grant aid from JICA;
- The Consultant is a private firm or a consortium responsible for design, cost estimate, tender, procurement, and construction supervision of the Project under the contract with the GOM; and
- The Supplier is a private firm or a consortium responsible for supply of necessary products and work force for the Project under the contract with the GOM

(b) Implementation Framework in Madagascar Side:

The responsible agency for the Project is CUA and the implementation agency is SMA. For smooth implementation, CUA and SMA shall coordinate and hold meetings with the Japanese Consultant and the Supplier, select the person in charge who understands the SWM system and equipment, and implement the obligations of the Madagascar side.

In addition, Ministry of Water, Sanitation and Hygiene (Ministère de l'Eau de l'Assainissement et de l'Hygiène: hereinafter referred to as "MEAH") is the supervisory agency for waste management and the Project. MEAH will supervise CUA's waste management and implement the necessary measures to be taken by national agencies.

(c) Consultant

In order to implement the procurement of equipment, the Consultant in Japan executes a contract with CUA to carry out Detail Design and Procurement Supervision. In addition, the Japanese consultant will prepare the tender documents and carry out the tendering on behalf of CUA.

(d) Supplier

The Japanese Supplier selected by open tender will be responsible for the procurement of equipment. The Supplier shall fully keep contact, arrange, and conduct the required repair and maintenance of the equipment after completion of the Project.

(2) Procurement Condition

(a) Technical Transfer

Manufacturers of the procured equipment will provide initial operation guidance to engineers of the Madagascar side (operators, mechanics and their managers of collection vehicles and equipment for the operation of the landfill site) to transfer technology after the procurement of equipment.

(b) Tax Exemption and Customs Clearance Procedures

In case goods constitute state property or contribute to the implementation of sale programs, MEAH shall implement the request for tax exemption to the Ministry of Economy and Finance (hereinafter referred to as "MEF"). The required procedures are as follows:

- MEAH requests MEF to create a credit line in the annual budget for the customs duties and VAT.
- MEAH submits the Certificate of Destination (Attestation de Destination: AD) and Financial Commitment Title (Titre d'Engagement Financier: TEF) to MEF, together with the following documents:
 - Invoice, Bill of Lading or Air Waybill, Packing List
 - E/N and G/A.
 - Engagement letter

(3) Scope of Works

The scope of works between the Japan side and the Madagascar side is shown in Table 2.39. Procurement of equipment, transportation (including inland transportation), initial operation guidance, etc., will be implemented in the Project, and customs clearance procedures, tax exemption measures and securing of a storage site for procured equipment will be implemented by the Madagascar side.

Table 2.39 Scope of Works and Responsibility

Item No.	Items	By the Project	By Madagascar Side
1	Procurement of Equipment	●	
2	Improvement works for primary waste collection points	●	
3	Transportation from Japan, etc., to Madagascar	●	
4	Customs clearance and tax exemption measures at the time of landing of equipment		●
5	Inland transportation from the port of unloading to the site	●	
6	Securing equipment storage site in Antananarivo city		●
7	Initial operation guidance for procured equipment	●	

(4) Consultant Supervision

In compliance with the Japanese Grant Aid policy, the Madagascar side shall contract with the Consultant recommended by JICA, and the Consultant shall implement detailed design (hereinafter referred to as "D/D") and procurement supervision.

The Consultant shall dispatch specialist engineers in accordance with the progress of equipment inspection, initial operation guidance, etc., and shall implement safety management of the procurement. The personnel for procurement supervision of the Consultant is as shown in Table 2.40.

Table 2.40 Consultant's Personnel for Procurement Supervision

Position	Qty	In charge	Duration
Chief Consultant	1	Comprehensive Project Management	Spot
Equipment Engineer	1	Equipment planning, reviewing the specification, etc.	Spot
Supervisor for Procurement	1	Supervision for Electric and Mechanical Work	Spot
Engineer for Inspection	1	Inspection for Equipment	Spot

(5) Quality Control Plan

(a) Quality/Volume Management Plan

The Consultant shall carry out quality and volume supervision based on the following items for the quality and volume inspection specified in the contract document. As a result of confirmation and verification, when the quality and volume are not satisfied, the Consultant will immediately request the Supplier to make corrections and changes.

- Review the production drawings and specifications of the equipment
- Witness factory inspection and pre-shipment inspection
- Supervision of pre-shipment equipment conformity inspection by a third-party organization
- Verification of initial operation guidance, adjustment/test run, and operation guidance of procured equipment

(b) Process Control

The Consultant will require the Supplier to comply with the deadline specified in the contract and will supervise the monthly progress. When a delay of process is predicted, the Consultant reports to JICA, urges the Supplier to confirm and correct it, and requests the submission and implementation of countermeasures.

(6) Procurement Plan

(a) Country of Origin

The country of origin of equipment is as shown in Table 2.41.

Table 2.41 Country of Origin of Equipment

Item No.	Items	Q'ty	Country of Origin		
			Japan	Third Countries	Madagascar
1	Skip Loader	33	○		
2	Dump Truck1	6	○		
3	Dump Truck2	3	○		
4	Bulldozer	2	○	○	
5	Excavator	4	○	○	
6	Garbage Container	326			○
7	Pick-up Truck	2			○
8	Off-road Bike	8			○

Item No.	Items	Q'ty	Country of Origin		
			Japan	Third Countries	Madagascar
9	Improvement Work of Primary Waste Collection Point	8			○
10	Repair Tool for Vehicle	1	○		
11	Floodlight	4	○		○
12	Flat-body Truck	2			○

(b) Transportation Plan

Procured equipment will be shipped from Japan and/or third countries, and landed at Toamasina Port in Madagascar. After Customs clearance, it will be transported to Antananarivo City and handed over to the Madagascar side. Further, since the quantity of spare parts is small compared with the procured equipment body, they will be mounted on the equipment body.

Regarding marine transportation from Japan and the third countries, since it is not possible to load on a container ship due to restrictions on width and height of equipment, transportation by conventional ship will be applied. Regarding local inland transportation, the distance from the port to the city is more than 350km, so the equipment will be transported by trailer.

(c) Place for Hand-over and Storage of Equipment

The equipment procured in the Project will be handed over at SMA's land in Antananarivo after unloading at Toamasina Port in Madagascar. The equipment storage site will also be secured by the Madagascar side.

(7) Operational Guidance Plan

(a) Adjustment and Trial Operation Guidance

The adjustment and trial operation of equipment procured from Japan and the third countries, such as vehicle inspection, control board inspection and operational confirmation, are to be carried out by the engineers of each manufacturer of equipment. The adjustment and trial operation of equipment procured in Madagascar are not to be carried out since they are already highly disseminated.

(b) Initial Operational Guidance

Initial operational guidance of equipment procured from Japan and the third countries are to be carried out by the engineers of each manufacturer of equipment. Initial operational guidance of equipment procured in Madagascar is not to be carried out since they are already highly disseminated.

(c) Operational Guidance

Operational guidance of equipment procured from Japan and the third countries are to be carried out by the engineers of each manufacturer of equipment. Operational guidance of equipment procured in Madagascar is not to be carried out they are already highly disseminated.

(d) Inspection

For equipment inspections and pre-shipment inspections in Japan, inspection personnel of the Consultant and the Supplier shall be assigned to confirm equipment specifications and quantities, and to manage processes.

When conducting pre-shipment inspections, a third-party inspection organization will be outsourced to ensure fairness and neutrality, and contract procurement lists with shipping packing lists will be collated by it.

Contract procurement lists and the shipping packing lists will be collated by management personnel of the Supplier at the time of equipment arrival in Madagascar. After confirming that the procurement equipment satisfies their specifications and quantity, the Consultant will certify the delivery from the Supplier to the Madagascar side and accept it.

(8) Soft Component (Technical Assistance) Plan

Since the construction of large facilities is not included in the Project and procurement of disseminated equipment is a main component of the Project, the soft components of technology transfer related to equipment operation, landfill operation and formulation of a waste collection plan, etc., shall not be implemented in the Project. Instead, it will be implemented in a technical cooperation project that will be implemented in parallel with the Project.

(9) Implementation Schedule

The Implementation Schedule is as shown in Figure 2.9.

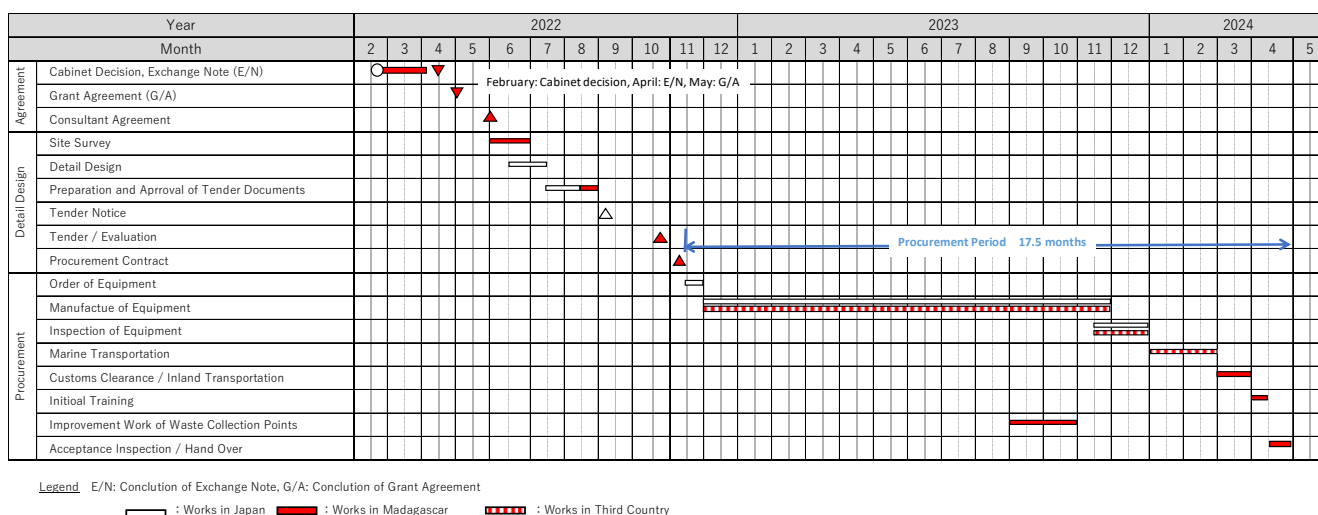


Figure 2.9 Implementation Schedule

2.3 Security Plan

According to the Ministry of Foreign Affairs of Japan, as of June 21, 2021, the general danger level of Madagascar is "Level 1, Sufficient Caution", and there is no particular danger regarding security. However, the risk level of COVID-19 infections is "Level 3, Travel Cancellation Recommendation (Infectious Diseases)", and it is necessary to judge whether or not to travel and take preventive measures when planning to travel in the Project. It is necessary to consider the cost of epidemic prevention measures for COVID-19, reflect the infection status at the D/D stage, thoroughly implement the necessary measures at the implementation stage, and change the plan as needed.

2.4 Obligations of Recipient Country

2.4.1 General Undertakings to be taken by the Madagascar Side

The undertakings required from the Madagascar side for the smooth implementation of the Project are as follows:

- To provide all data and information necessary for the Project;

- To ensure prompt unloading and customs clearance of the equipment procured under Japan's Grant Aid at the port/terminal of disembarkation in Madagascar;
- To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in Madagascar with respect to the procurement of products and services under the Project;
- To arrange the acquisition of visa and other formalities that may be necessary for the entry of Japanese nationals into Madagascar and stay therein for the performance of the work;
- To maintain and use the equipment properly and effectively with a suitable number of staff assigned for the O&M, and to bear all expenses other than those covered under the Grant Aid;
- To suspend issuance of all necessary permits such as environmental permits in the Project before the start of procurement;
- To bear the advising commission of the Authorization to Pay (A/P) and payment commission to the Japanese bank for banking services based upon the Banking Arrangement (B/A);
- To submit a project monitoring report (hereinafter referred to as "PMR") to JICA at three points: before bidding, during the Project and after the Project; and,
- To implement environmental management and environmental monitoring in accordance with the environmental monitoring plan, and submit the results of the environmental monitoring to JICA.

2.4.2 Specific Undertakings to be Taken by the Madagascar Side

The specific undertakings required from the Madagascar side for the smooth implementation of the Project are as described below.

(1) Securing the Storage Site for Procured Equipment

Procured equipment includes vehicles, heavy equipment and 326 waste containers. Securing the place for their storage is needed, which shall be implemented by the Madagascar side.

(2) Environmental Permit

The validity of the current environmental permit issued by ONE for the Andralanitra landfill site has already expired when the Survey started. Since the procured equipment will be used for the operation of the landfill site, it was essential to obtain an updated environmental permit for the landfill site. Based on the results of the environmental and social consideration survey conducted in the Survey, the procedure for environmental permit and the acquisition of permit from ONE were implemented under the responsibility of the Madagascar side and the permit was updated in January 2022.

2.5 Project Operation Plan

2.5.1 Operation and Maintenance Plan for Waste Collection and Transportation Equipment

(1) Operation and Maintenance System for Waste Collection and Transportation Equipment

The waste collection and transportation equipment will be managed by SMA, which is the Technical Service for the maintenance part and the Household Waste Service for the waste collection part, as currently practiced.

The Technical Service has a department head, chief mechanic, and mechanics including electricians and assistants. Except electrical maintenance done by the electricians, all mechanics are able to perform overall maintenance and can perform ordinary inspection and maintenance work. It is calculated that about 4 to 5 trucks need some services in any given day; whereas, the chief mechanic makes diagnostics for each vehicle, issue work orders and approve/verify results after the work. 1 to 4 mechanics and electricians/assistants will be working for a truck. The roles of maintenance staff are as shown in Table 2.42.

Table 2.42 Roles of Maintenance Staff

Staff	Q'ty	Roles
Technical Councilor	1	Oversees overall maintenance
Chief Mechanic	1	Diagnostics, give work instructions, confirm work after the maintenance, etc.
Mechanics	3	Repair breakdowns, give instructions to assistants/aid workers
Assistants/Aids	9	Perform inspection and other maintenance work based on the instructions given.
Electricians	2	Inspect and repair the electrical system
Total	16	

On the other hand, for collection work, matching the number of drivers and collection workers for dump trucks and skip loaders are required. A dump truck needs 1 driver and 6-7 collection workers while a skip loader needs 1 driver and 2-3 collection workers. The number of staff required for waste collection is as shown in Table 2.43.

Table 2.43 Number of Staff Required for Waste Collection

Vehicle Type	Q'ty of Vehicles (in operation)	Necessary No. of Staff		Necessary No. of New Staff	
		Driver	Collection Crew	Driver	Collection Crew
Dump truck	13	26	156~182	-	-
Skip loader	30	60	120~180	-	-
Total	43	86	Max. 362	43	11

(2) Spare Parts (Inventory System)

It is vital to replace parts and consumables at designated intervals. In other words, it is necessary for the Service Department to set up a proper spare-parts warehouse and implement a subsequent inventory system in order to provide those parts and consumables in a timely manner. It is strongly recommended to install a security gate (or lockable door) in the warehouse that SMA is setting up, and an inventory system to record inflow and outflow of the parts and consumables, along with an internal auditing system in place. Technical assistance on putting those systems may be necessary.

(3) Operation and Maintenance Method for Primary Collection Points

Of the primary collection points, the O&M of fixed points made of brick, masonry or concrete is handled by the Infrastructure & Structures Division, Technical Service of the SMA's Department of Operation.

In the division under the director of SMA, personnel will be dispatched to carry out the O&M work of fixed points, such as the site manager (1 person), brick/masonry technician (2 people), Support for assistants (8 people) and designers (3 people) from the Infrastructure & Structures Division, and related assistance from the Design Office Section of the Water and Sanitation Department.

2.5.2 Operation and Maintenance Plan for Landfill Site

(1) Operation and Maintenance System for Landfill Site

With regard to SMA's organizational structure, it is planned to increase the number of drivers at the landfill site to 17, i.e., 2 mechanics and some staff for maintenance of procured equipment, weighing of waste received, and safety management from the current organizational structure. The Organizational Structure for landfill operation after the Project is as shown in Figure 2.10.

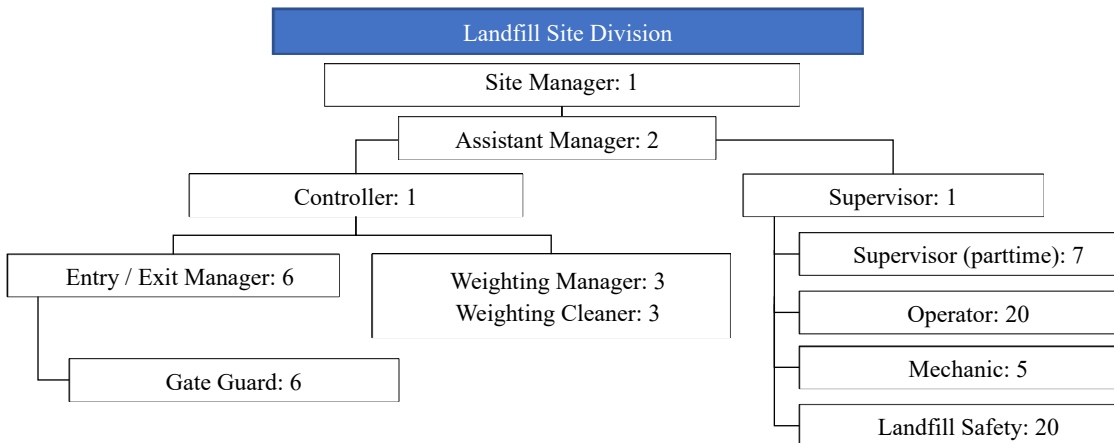


Figure 2.10 Organizational Structure for Landfill Operation after the Project

(2) Operation and Maintenance Method for Landfill Site

To properly operate the landfill site and use it safely, the following considerations are to be given.

(a) Carry-in Management of Received Waste

To landfill the received waste properly, it is necessary eliminate the hazardous waste that will adversely affect the surrounding groundwater and to grasp the amount of waste to be carried in.

The amount of waste to be carried in the landfill should be monitored by appropriately recording the number of vehicles. In addition, the acceptance and elimination of hazardous wastes should be addressed by checking the contents of the delivery vehicles. Guidance and enlightenment of local residents are also required for the management of hazardous wastes.

(b) Management of Landfilling Work

With regard to the landfill method of the existing landfill site, a work yard for dumping and deploying garbage shall be installed inside the landfilling area as much as possible, but if it cannot be installed in the landfilling area, it shall be installed along the carry-in road.

When the work yard is to be installed along the carry-in road where the installation of a large work yard is not feasible, it is better to rotate the work in three places (see Figure 2.11).

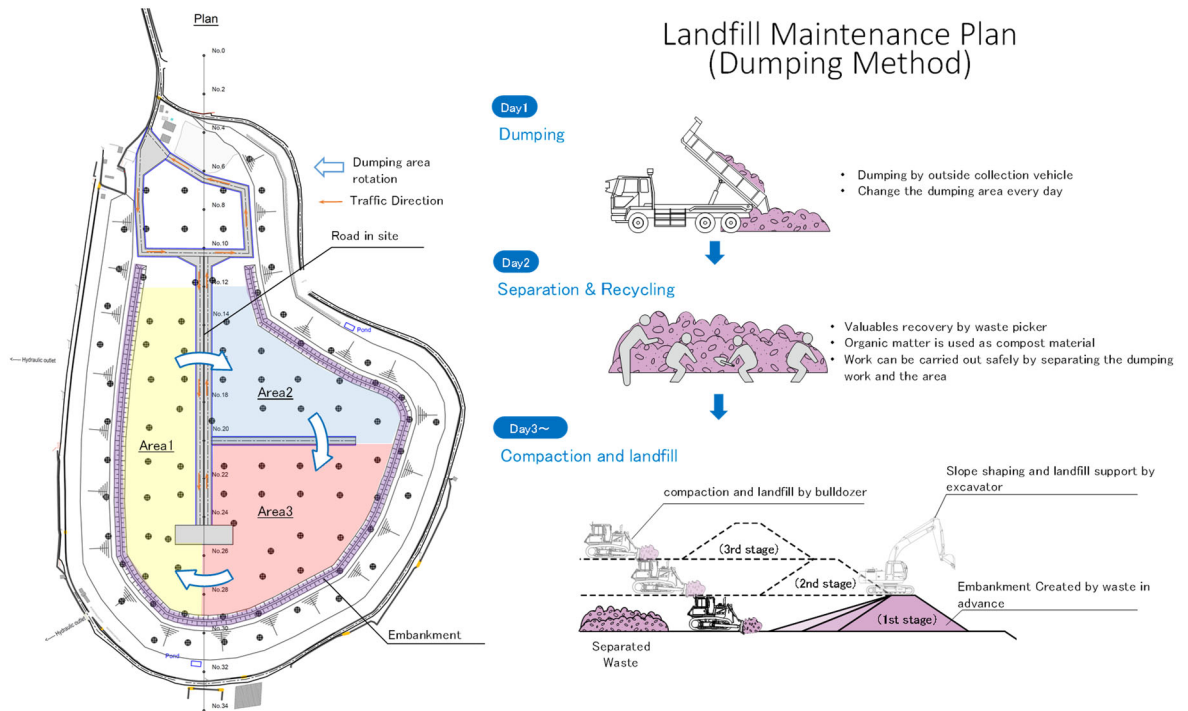
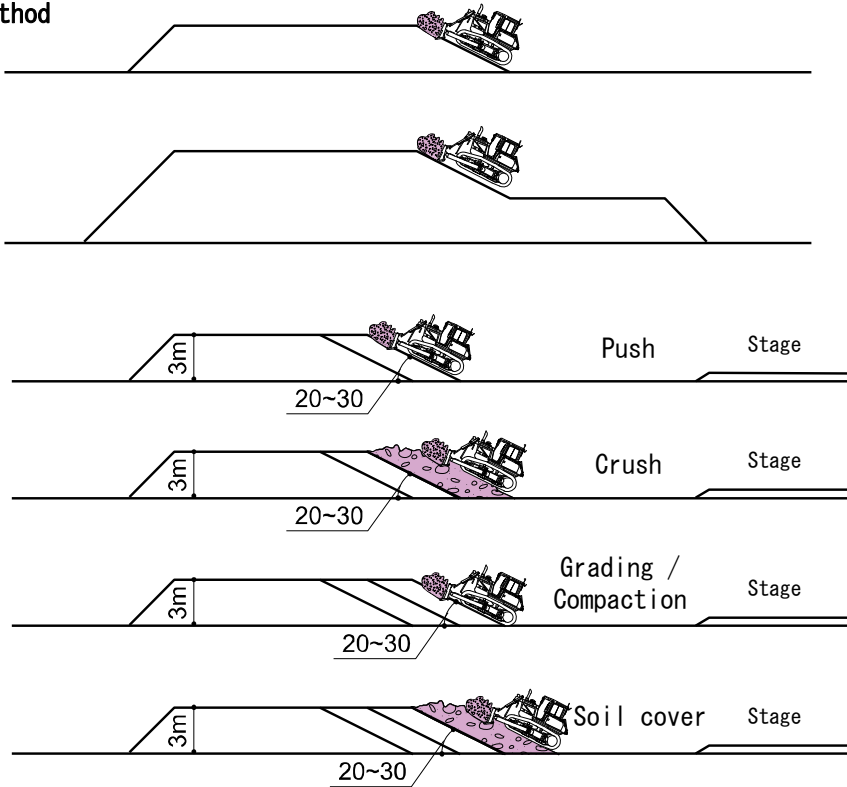


Figure 2.11 Landfill Work Procedure of Existing Landfill Site (Draft)

There are two types of landfill methods using a bulldozer, the push-up method and the drop-in method, depending on the position of the dumping stage. An excavator should be used with the method depending on the condition of the landfill waste (see Figure 2.12 and Figure 2.13).

Push-up method



Drop-in method

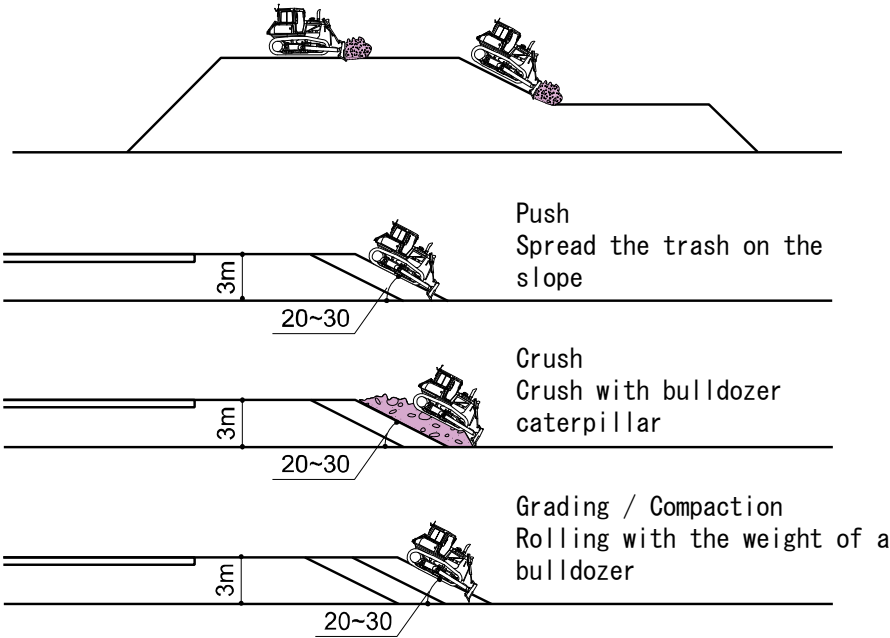
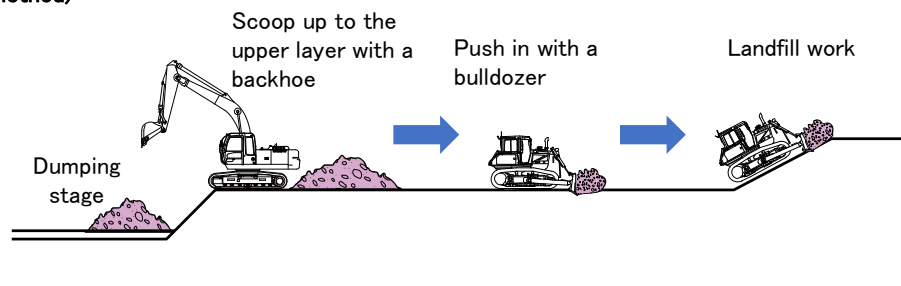


Figure 2.12 Waste Landfilling Method Drawing (1)

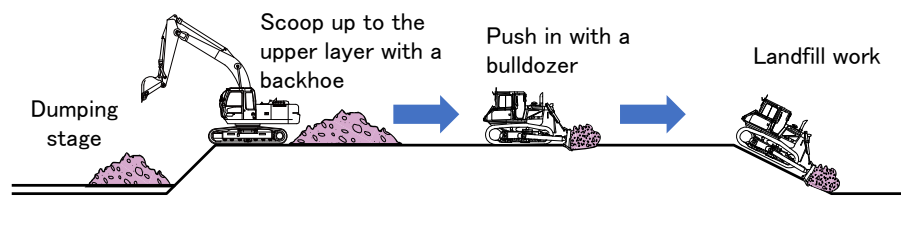
<Landfilling Method in Special Condition>

- 1) If a landfilling surface is one step higher than the dumping stage, waste should be scooped up to the upper layer by an excavator, and pushed up by a bulldozer for landfilling.
- 2) If there is landfilled waste between the landfill surface and the dumping stage, waste should be scooped up by the excavator to the upper layer, and pushed in by a bulldozer for landfilling.
- 3) On the slope area, waste should be rolled and landfilled by a bulldozer without advancing from the slope line, and the slope shall finally be shaped by a backhoe.

① When the landfill surface is one step higher than the abandoned stage (push-up method)



② When the landfill surface has landfill waste between the abandoned stages (drop-in method)



③ Construction method of slope

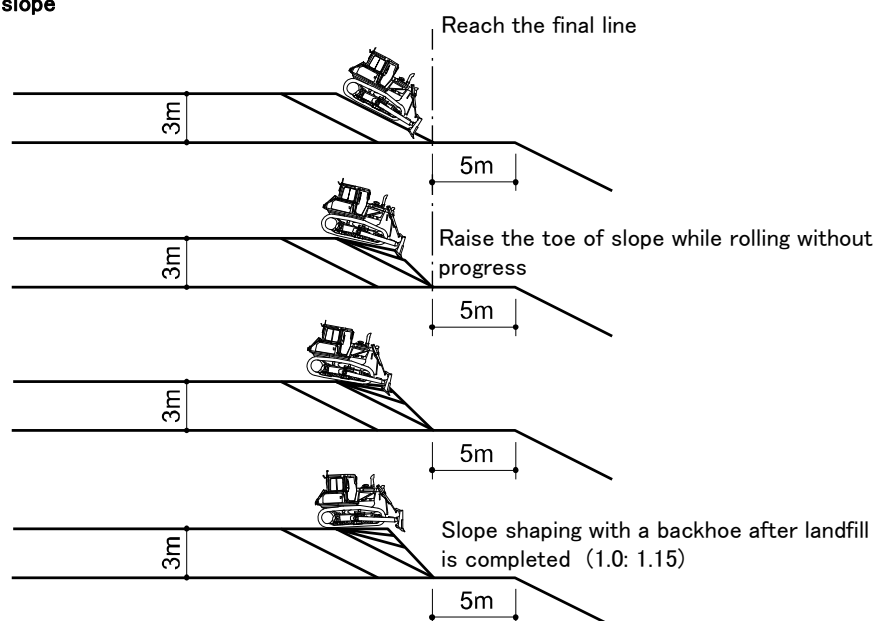


Figure 2.13 Waste Landfilling Method Drawing (2)

(3) Operation and Maintenance Plan of Equipment for Landfill Site

O&M of the procured equipment shall be managed by staff of SMA who shall be capable of maintaining all types of equipment. In addition, two (2) mechanics and two (2) facility maintenance managers shall be assigned, and a sufficient number of personnel is to be secured.

Heavy equipment will be stored basically in the heavy equipment garage. In addition, since a maintenance space will be set up in the heavy equipment garage, daily inspection and repairs will be carried out in this space.

2.5.3 Introduction of Preventive Maintenance

To avoid an avoidable breakdown, it is important to perform daily and other routine inspections/maintenance within designated intervals. To do this, it is necessary that inspection records are properly documented and kept. In addition, repair records can be used to analyze some breakdown tendencies for specific models or specific vehicles, (or even specific drivers), which will lead to inspection/maintenance work before the actual breakdown occurs. For these reasons, as a first step to realize preventive maintenance, the introduction of a system to document and keep the vehicle inspection/repair records should be considered.

2.6 Project Cost Estimation

2.6.1 Initial Cost Estimation

(1) Initial Cost Borne by the Japan Side

The cost borne by the Japan's Grant Aid is not shown in this report due to confidentiality.

(2) Initial Cost Borne by the Madagascar Side

The initial cost to be borne by the Madagascar side is as shown in Table 2.44.

Table 2.44 Initial Cost Borne by the Madagascar Side

Items	Amount (MGA)	Amount (JPY)
1) Banking fee to open a bank account for the Grant and commission for Authorization to Pay (A/P)	29 million	0.8 million
2) Environmental permit for the landfill	56 million	1.6 million
3) Leveling and reclaiming the sites for Improvement Work of Waste Collection Points	8 million	0.2 million
4) Customs duties, internal taxes and other fiscal levies	9,061 million	259.1 million
Total	9,154 million	261.7 million

2.6.2 Operation and Maintenance Cost

(1) Operation and Maintenance Costs for Waste Collection and Transportation Equipment

The operation and maintenance costs for the waste collection and transportation equipment shown in Table 2.45 are mainly composed of manpower (driver and collection crew), fuel cost, and maintenance cost. For equipment given at this time, the annual maintenance cost is around 3.2 billion MGA.

Table 2.45 O&M Cost for Procured Equipment (6 Dump Trucks and 33 Skip Loaders)

Unit: million MGA				
Driver	Collection Crew	Fuel	Maintenance	Total
504	576 ~ 792	1,727	172	2,980 ~ 3,196
JPY 15 mil	JPY 17~23 mil	JPY 51 mil	JPY 5 mil	JPY 88~94 mil
				(USD 802,000~861,000)

(2) Operation and Maintenance Costs for Landfill Site

The costs borne by the other party for the provision of equipment for the landfill site are as follows. Details are as shown in Table 2.46 and Table 2.47.

Equipment Expenses: Annual fuel cost + Annual maintenance cost = 2,467 million MGA/year

Additional Labor Cost: Mechanic + Operator = 80 million MGA/year

Equipment Expenses + additional Labor Cost = 2,547 million MGA/year

Table 2.46 Costs for the Provision of Equipment (Annual Fuel Cost, Annual Maintenance Fee)

Heavy Equipment Name	unit	Heavy Equipment Basic Unit Price ^{※1}		Fuel Consumption Rate (L/h)	Annual Fuel Cost ^{※2} (MGA)	Annual Maintenance Fee ^{※3} (MGA)
		JPY	MGA			
Bulldozer	2	28,200,000	217,308	23	604,440,000	95,560,827
Excavator	4	13,300,000	102,489	16	840,960,000	90,138,936
Dump truck	3	14,400,000	110,965	17	670,140,000	73,195,527
Flat-body Truck	2	1,670,000	12,869	3.7	16,206,000	5,659,099
Floodlight	4	1,100,000	8,477	1.2	63,072,000	7,455,100
Sub-total					2,194,818,000	272,009,489
Annual necessary expenses for landfill site maintenance						2,466,827,489

※1: Basic unit prices of equipment were calculated based on the standard unit price in Japan (1MGA=0.02951 JPY).

※2: Annual fuel cost formula: Number of units in operation x 12 hours (Floodlight: 2 hours) of operation x 365 days of operation x fuel consumption rate (L / h) x fuel cost (diesel, 3,000MGA/L)

※3: The annual maintenance cost is 5% of the equipment cost.

Table 2.47 Costs for the Provision of Equipment (Labor Cost)

Additional Staff	Monthly Rate	Annual Rate	Q'ty	Labor Cost
Mechanic	363,730 MGA	4,364,760 MGA	2	8,729,520 MGA
Operator	348,103 MGA	4,177,236 MGA	17	71,013,012 MGA
Total				79,742,532 MGA

(3) Budgeting

The new organization, SMA, has announced that it will budget the expenses required for operations, such as staffing and maintenance costs, in response to the introduction of equipment and facilities under the Project. Therefore, the revenue and expenditure of SMA over the next six (6) years from 2021 to 2026 are forecasted as shown in Table 2.48. According to this forecast, "Fees on household waste collected from municipal bins from CUA" is about 12.3 billion MGA (about 362 million yen) in 2026 and "Total expenditures on solid waste business" is about 15.5 billion MGA (about 458 million yen), of which "Total of JICA Project O&M cost" is about 6.3 billion MGA (about 187 million yen). Therefore, it can be said that "Total of JICA Project O&M cost" can be

sufficiently covered by “Fees on household waste” after the procurement of equipment by the Project.

As a whole, the business plan is such that even after the procurement of equipment by the Project in May 2024, the O&M costs can be covered and the balance is still in the black. Incidentally, starting from 2024, all the cost is assumed to increase by 5% every year. These revenue and expenditure forecasts will be finalized by SMA in the future.

Table 2.48 Tentative Forecast Revenue and Expenditures of SMA for 2021-2026

(Unit: MGA)

Year	2021 ⁽¹⁾	2022	2023	2024 ⁽⁴⁾	2025	2026
Forecast revenue						
Revenue from solid waste business						
Fees on household waste collected from municipal bins from CUA	7,263,060,480	7,626,213,504	10,562,305,703	11,090,420,988	11,667,122,880	12,262,146,146
Commercial recipe	403,680,000	476,360,000	720,000,000	780,000,000	840,000,000	900,000,000
Other revenue from solid waste business	1,107,924,480	1,163,320,704	1,611,199,175	1,691,759,134	1,779,730,609	1,870,496,870
<u>Total revenue from solid waste business</u>	8,774,664,960	9,265,894,208	12,893,504,878	13,562,180,122	14,286,853,488	15,032,643,016
Revenue from road sweeping ⁽²⁾	-	-	-	-	-	-
Revenue from liquid waste business						
Revenue from fecal sludge business	51,000,000	73,230,000	87,327,000	91,693,350	96,278,018	101,091,918
Charge on wastewater from JIRAMA	1,800,000,000	1,890,000,000	1,984,500,000	2,083,725,000	2,187,911,250	2,297,306,813
Other revenue from liquid waste business	8,310,693	2,122,785,521	2,191,675,560	2,301,259,338	2,416,322,305	2,537,138,420
<u>Total revenue from liquid waste business</u>	1,859,310,693	4,086,015,521	4,263,502,560	4,476,677,688	4,700,511,572	4,935,537,151
Revenue from Drainage control ⁽³⁾	-	-	-	-	-	-
Subsidies	-	-	-	-	-	-
Revenue from others	-	27,300,000	101,595,000	106,674,750	112,008,488	117,608,912
Total revenue (A)	10,633,975,653	13,379,209,729	17,258,602,438	18,145,532,560	19,099,373,548	20,085,789,079
Forecast expenditures						
Expenditures on solid waste business						
Expenditures on household waste collection and transfer	7,629,077,467	8,456,004,478	9,100,500,792	9,555,525,832	10,033,302,123	10,534,967,229
JICA Project O&M cost on solid waste collection and transfer	-	-	-	2,130,666,667	3,355,800,000	3,523,590,000
Other expenditures on solid waste collection and transfer	7,629,077,467	8,456,004,478	9,100,500,792	7,424,859,165	6,677,502,123	7,011,377,229
Expenditures on the disposal site	52,068,960	1,364,000,000	1,432,200,000	3,201,810,000	4,253,350,500	4,466,018,025

Year	2021 ⁽¹⁾	2022	2023	2024 ⁽⁴⁾	2025	2026
JICA Project O&M cost on the disposal site	-	-	-	1,698,000,000	2,674,350,000	2,808,067,500
Other expenditures on the disposal site	52,068,960	1,364,000,000	1,432,200,000	1,503,810,000	1,579,000,500	1,657,950,525
Other expenditures on solid waste business	150,000,000	382,300,000	449,400,000	471,870,000	495,463,500	520,236,675
Total expenditures on solid waste business	7,831,146,427	10,202,304,478	10,982,100,792	13,229,205,832	14,782,116,123	15,521,221,929
Total of JICA Project O&M cost	-	-	-	3,828,666,667	6,030,150,000	6,331,657,500
Expenditures on road sweeping ⁽²⁾	-	-	-	-	-	-
Expenditures on wastewater business		2,828,017,251	3,214,659,487	3,375,392,461	3,544,162,085	3,721,370,189
Expenditures on drainage control ⁽³⁾	-	-	-	-	-	-
Expenditures on others	912,141,067	7,050,000	9,700,000	10,185,000	10,694,250	11,228,963
Total expenditures (B)	10,308,415,653	13,037,371,729	14,206,460,279	16,614,783,293	18,336,972,458	19,253,821,081
Balance (A - B)	325,560,000	341,838,000	3,052,142,159	1,530,749,267	762,401,090	831,967,998
Corporate income tax (20%)	65,112,000	68,367,600	610,428,432	306,149,853	152,480,218	166,393,600
Balance after tax	260,448,000	273,470,400	2,441,713,727	1,224,599,413	609,920,872	665,574,399

Note 1: The amount for 9 months after the reorganization is converted into an annual amount for comparison for 2021.

Note 2: Road sweeping is carried out by CUA's budget management.

Note 3: Drainage control is not managed as an independent business sector.

Note 4: Since the introduction of equipment and facilities under the Project will start in May 2024, the O&M cost of them in 2024 has been adjusted to 8/12.

Source: SMA

CHAPTER 3. PROJECT EVALUATION

3.1 Preconditions

Preconditions for the implementation of the Project are as shown in Table 3.1.

Table 3.1 Preconditions for the Implementation of the Project

Item No.	Purpose	Deadline	In Charge
1	To sign the banking arrangement (B/A) with a bank in Japan (the Agent Bank) to open a bank account for the Grant	Within 1 month after the signing of G/A	CUA
2	To issue A/P to the Agent Bank for the payment to the consultant/supplier	within 1 month after the signing of each contract(s)	CUA
3	To obtain an environmental permit for the landfill site	January 2022 (completed)	CUA
4	To secure lands for procured equipment	Before notice of the bidding documents	CUA
5	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect to the purchase of the products and/or the services be exempted	During the Project	MEF/MEAH
6	To secure the O&M budget	Before the procurement of equipment	CUA/SMA
7	To secure personnel for O&M	Before the procurement of equipment	CUA/SMA
8	To keep ownership of procured equipment by CUA	During the Project	CUA
9	To use equipment for landfill operation at the Andralanitra landfill site	During the Project	CUA/SMA

3.2 Necessary Inputs by Recipient Country

Inputs of Recipient Country necessary to achieve the Project are as follows:

- Arrangement and operation of procured equipment in accordance with an appropriate collection and transportation plan and operation plan for the landfill site.
- Expenses required for O&M of procured equipment and allocation of workers.
- Thorough periodic inspection of procured equipment, appropriate maintenance and management of spare parts, etc.

3.3 Important Assumptions

The important assumptions of the Project are as follows:

- No major policy changes in the SWM administration and management system in Madagascar and Antananarivo City.
- No major changes (including closure) in the operation of the Andralanitra landfill site due to changes or cancellations of the policies of the existing and new landfill site.

3.4 Project Evaluation

3.4.1 Relevance

(1) Improvement of Urban Environment and Hygiene

The Project will improve the waste management of Madagascar with the procurement of equipment related to the waste management in Antananarivo, and will contribute to the maintenance of sanitary conditions. The validity of the Project is high.

(2) Waste Management in National Policy

The Government of Madagascar has prioritized urban waste management in the General State Policy (Politique Generale de l'Etat: PGE) and emergency initiative (Initiative Émergence Madagascar 2019-23: IEM). The Project will greatly contribute to the realization of these national policies by procuring equipment for improving waste management.

3.4.2 Effectiveness

(1) Quantitative Effect

“Waste collected amount” and “Waste collected rate” are set as indicators of the quantitative effect of the Project as shown in Table 3.2.

Table 3.2 Quantitative Effect of the Project

Indicator	Existing Value in 2021	Target Value in 2027 (3 years after the Completion of the Project)	Note
Waste collected amount	347 ton / day	596 ton / day	It is assumed that 8 of the existing trucks are still in operation 3 years after the completion of the Project.
Waste collected rate*	43% (Trucks owned by SMA)	66%	

Note: * The waste collected rate is calculated from "waste collected amount/waste discharged amount (tons/day)", and the target areas are the 6 districts of Antananarivo city and the area around the Andralanitra landfill site.

(2) Qualitative Effect

The qualitative effects of the Project are as follows:

- Improvement of the living environment of Antananarivo with the reduction of uncollected waste and illegally dumped waste.
- Mitigation of Environment Impacts, such as offensive odor, waste scattering, and fire prevention due to the improvement of operation and management of the Andralanitra landfill site.

Appendices

1. Member List of the Survey Team
2. Study Schedule
3. List of Parties Concerned in the Recipient Country
4. Minutes of Discussions
5. Drawings of Landfill Management Plan (Emergency Management Measures)

1. Member List of the Survey Team

(1) During the Site Survey on Explanation on Draft Preparatory Survey Report from November to December 2021

Name	Position	Organization
Mr. Tadayama YAMAMOTO	Solid Waste Management	Environmental Management Group, Global Environment Department, JICA
Mr. Masakazu MAEDA	Chief Consultant / Solid Waste Management (SWM) / Collection and Transport Plan	CTI Engineering International Co., Ltd.
Mr. Shinsuke OKAMOTO	Equipment Plan (Collection and Transport)	EX Research Institute Ltd.
Mr. Hirofumi MIYOSHI	Equipment Plan (Disposal Site)	CTI Engineering International Co., Ltd.
Mr. Shumpei ICHIKAWA	Procurement Plan and Cost Estimate / Finance and Economic Analysis ²	CTI Engineering International Co., Ltd.

(2) Member List of the Consultant

Name	Position	Organization
Mr. Masakazu MAEDA	Chief Consultant / Solid Waste Management (SWM) / Collection and Transport Plan	CTI Engineering International Co., Ltd.
Mr. Shinsuke OKAMOTO	Equipment Plan (Collection and Transport)	EX Research Institute Ltd.
Mr. Hirofumi MIYOSHI	Equipment Plan (Disposal Site)	CTI Engineering International Co., Ltd.
Mr. Keigo ITO	Equipment Plan (Disposal Site) ² / Facility Plan ¹	CTI Engineering International Co., Ltd.
Mr. Ikuo MORI	Institution, Legal and SWM Policies and Plans	EX Research Institute Ltd.
Mr. Makoto YAJIMA	Finance and Economic Analysis ¹	CTI Engineering International Co., Ltd.
Mr. Shumpei ICHIKAWA	Procurement Plan and Cost Estimate / Finance and Economic Analysis ²	CTI Engineering International Co., Ltd.
Ms. Tomoko MIZUYORI	Environment and Social Considerations	CTI Engineering International Co., Ltd.

2. Study Schedule

Due to the influence of the COVID-19, the travel for the outline design survey was canceled. The site survey was conducted once at the time of the explanation on Draft Preparatory Survey Report.

- (1) During the Site Survey on Explanation on Draft Preparatory Survey Report from November to December 2021

Date	Day	JICA Mr. Yamamoto	Consultant	
			Team 1	Team 2
21 November	Sun	-	Travel from Japan	
22 November	Mon	-	to Madagascar	
23 November	Tue	-	Quarantine	
24 November	Wed	Meeting with JICA HQ (online), Meeting with CUA (online)		
25 November	Thu	Kickoff meeting for the Survey, Meeting with SMA		
26 November	Fri	Meeting with MEF, Meeting with PRODUIRoffice		
27 November	Sat	Site inspection to primary collection points in Antananarivo and Andralanitra landfill site		
28 November	Sun	-	Site inspection to primary collection points in Antananarivo	
29 November	Mon	Meeting with MEF, Meeting with CUA		
30 November	Tue	Meeting with MEAH, Meeting with Mayor of CUA	Meeting with local contractors / suppliers	
1 December	Wed	Meeting with MATP	Meeting with local contractors / suppliers	
2 December	Thu	Meeting with AFD, Meeting with CUA		
3 December	Fri	M/D signing, Meeting with JICA office		
4 December	Sat	-	Reporting	
5 December	Sun	Travel from Madagascar		
6 December	Mon	to Japan		

CUA: Urban Commune of Antananarivo

MEF: Ministry of Economy and Finance

MEAH: Ministry of Water, Sanitation and Hygiene

MATP: Ministry of Territorial Planning and Public Works

AFD: French Development Agency

3. List of Parties Concerned in the Recipient Country

Organization	Name	Position
CUA: Commune Urbaine d'Antananarivo (Urban Commune of Antananarivo)	Mr. Naina ANDRIANTSITOHAINA	Mayor
	Mr. Martin RAKOTONOELY	Secretary General
	Mr. Mandresy RAKOTOARISON	Director of International Cooperation
	Ms. Sandrina RANDRIAMANANJARA	Director of Urban Planning
	Mr. RAKONOMBANA Allyre	Director of Water, Sanitation and Hygiene
	Mr. Ihaja L. RAJAONARISON	Director of Project Coordination
	Mr. Thimoléon RAKOTO	Director of Financial Management
	Mr. Rivo GODFRED	Director of Financial Resources
SMA: Société Municipale d'Assainissement (Municipal Sanitation Company)	Mrs. Hanitriniaina RAKOTOARISOA	Focal Point of RF2
	Mr. Jaona ANDRIANAIVO	Director General
	Mrs. Jocelyne Lalanirina RATAHIRIARIVONY	Project Coordinator
MEAH: Ministère de l'Eau de l'Assainissement et de l'Hygiène (Ministry of Water, Sanitation and Hygiene)	Mr. Bakoliarisoa RASOARIMISA	Chief of Research Service and Development
	Mr. Thiesry Emmenuel RATOVONIAINIA	Director General of Technic
	Ms. Voahirana RASOAMANANTENA	Director of Sanitation and Hygiene
	Ms. Jenny Olisoa RAZAKAMIHAJA	Chief of Waste Management Department
	Mr. Hojatiana Eric RAWDRIANOMENJANAHARY	Director of Communication and Partnership
	Ms. Erica Miora RAMANANTSOA	Chief of Communication Department
MEF: Ministère de l'Economie et des Finances (Ministry of Economy and Finance)	Mr. Jefaina Rado ANDRIANJANARA	Director of Legal Affairs
	Mr. Denivel GERMAIN	Director General of General Directorate of Tax
	Mr. Verohasina RAKOTOMANGA	Director of International Taxation
ONE: Office National pour l'Environnement (National Office for the Environment)	Dr. Zafivanona Ernest LAINKANA	Director General of General Directorate of Customs
	Mr. Riya Rakotoson	Directeur General
MATEP: Ministère de l'Aménagement du Territoire et des Travaux Publics (Ministry of Territorial Planning and Public Works)	Mr. Jean-Roger Rakotoarijaona	Department of Environmental Integration and Sustainable Development
	Mr. Rita RAVELOMANALINA	Director General of City Development
AFD: Agence Française de Développement (French Development Agency)		Ms. Lydia RAZAFINDRHONA Representative of Infrastructure and City Development
PRODUIR Office by World Bank	Mrs. Rita RAVELOMANALINA	Project Coordinator
	Mrs. Mirana RAKOTOMAVO	General Technical Assistant
	Mr. Andrianirina RAMANANDRAIBE	Environmental Safeguard Expert
	Mr. Jacob Gino ANDRIANJAFY	Technical Assistant on Sanitary
	Mr. Haja RASOLOFOJAONA	Technical Assistant on City Planning
JICA Madagascar Office	Kori TANAKA	Chief Representative
	Okie SUGIMOTO	Senior Representative
	Naoki MINE	Representative
	RAZAFIMAHEFA Manoela	Program Manager

4. Minutes of Discussions

(1) First M/D in October 2021

Minutes of Discussions
on the Preparatory Survey for the Project for the
Improvement of Solid Waste Management Equipment for Clean City
in Antananarivo

Based on the several preliminary discussions between the Government of Republic of Madagascar (hereinafter referred to as “Madagascar”) and Japan International Cooperation Agency (hereinafter referred to as “JICA”), JICA dispatched the Preparatory Survey Team for the Outline Design (hereinafter referred to as “the Team”) of the Project for the Improvement of Solid Waste Management Equipment for Clean City in Antananarivo (hereinafter referred to as “the Project”) to Madagascar. The Team held a series of discussions with the officials of the Government of Madagascar and conducted a field survey. In the course of the discussions, both sides have confirmed the main items described in the attached sheets.

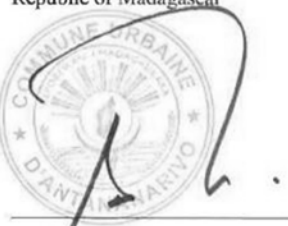
Antananarivo, 22 October, 2021


Ms. TANAKA Kaori
Chief Representative

Japan International Cooperation Agency
Madagascar Office


Mr. RAKOTONDRAZAKA Ladislas Adrien
Minister

Ministry of Water, Sanitation, and Hygiene
Republic of Madagascar


Mr. ANDRIANTSITOHAINA Naina
Mayor
Urban Commune of Antananarivo
Republic of Madagascar

ATTACHMENT

1. Objective of the Project

The objective of the Project is to strengthen the capacity of solid waste management in Antananarivo City by providing the equipment related with waste collection, transportation, and final disposal activities thereby contributing to improve the sanitation environment in the target area.

2. Title of the Preparatory Survey

Both sides confirmed the title of the Preparatory Survey as “the Preparatory Survey for the Project for the Improvement of Solid Waste Management Equipment for Clean City in Antananarivo”.

3. Project Site

Both sides confirmed that the site of the Project is a jurisdiction area of Commune Urbaine d'Antananarivo (hereinafter referred to as “CUA”) and the Andralanitra disposal site and other disposal sites which will be constructed and used by CUA.

4. Responsible Organization for the Project

Both sides confirmed the authorities responsible for the Project are as follows:

- 4-1. The CUA will be the executing agency for the Project (hereinafter referred to as “the Executing Agency”). The Executing Agency shall coordinate with all the relevant organizations to ensure smooth implementation of the Project and ensure that the undertakings for the Project shall be managed by relevant organizations properly and on time. The organization charts are shown in Annex 2.
- 4-2. Ministry of Water, Sanitation, and Hygiene shall be responsible for supervising the Executing Agency on behalf of the Government of Madagascar.

5. Items requested by the Government of Madagascar

As a result of discussions, both sides confirmed that the items requested by the Government of Madagascar are as follows:

1	Skip Loader
2	Dump Truck 1 (waste collection and transportation)
3	Dump Truck 2 (landfill operation)
4	Bulldozer
5	Excavator
6	Garbage Container
7	Pick-up Truck 1
8	Off-road Bike
9	Improvement Work of Waste Collection Points
10	Repair Tool for Vehicle
11	Floodlight
12	Pick-up Truck 2

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- 5-1. JICA will assess the feasibility of the above requested items through the survey and will report the findings to the Government of Japan. The final scope of the Project will be decided by the Government of Japan.
 - 5-2. The Government of Madagascar shall submit an official request to the Government of Japan through a diplomatic channel before the appraisal of the Project, which is scheduled from November to December 2021.
6. Procedures and Basic Principles of Japanese Grant
- 6-1. The Madagascar side agreed that the procedures and basic principles of Japanese Grant (hereinafter referred to as “the Grant”) as described in Annex 3 shall be applied to the Project. As for the monitoring of the implementation of the Project, JICA requires Madagascar side to submit the Project Monitoring Report with using the form as shown in Annex 4.
 - 6-2. The Madagascar side agreed to take the necessary measures, as described in Annex 5, for smooth implementation of the Project. The contents of the Annex 5 will be elaborated and refined during the Preparatory Survey and be agreed in the mission dispatched for explanation of the Draft Preparatory Survey Report.
The contents of Annex 5 will be updated as the Preparatory Survey progresses, and eventually, will be used as an attachment to the Grant Agreement.
7. Schedule of the Survey
- 7-1. An official request to the Government of Japan will be submitted in November 2021.
 - 7-2. JICA will prepare a draft Preparatory Survey Report in French and dispatch a mission to Madagascar in order to explain its contents from November to December 2021.
 - 7-3. If the contents of the draft Preparatory Survey Report are accepted and the undertakings for the Project are fully agreed by the Madagascar side, JICA will finalize the Preparatory Survey Report and send it to Madagascar in January 2022.
 - 7-4. The above schedule is tentative and subject to change.
8. Environmental and Social Considerations
- 8-1. The Madagascar side confirmed to give due environmental and social considerations during implementation, and after completion of the Project, in accordance with the JICA Guidelines for Environmental and Social Considerations (April 2010).
 - 8-2. The Project is categorized as “B” from the following considerations:
The project is not considered to be a large-scale waste management and disposal project, is not located in a sensitive area, and has none of the sensitive characteristics under the JICA guidelines for environmental and social considerations (April 2010), it is not likely to have a significant adverse impact on the environment. The Madagascar side confirmed to conduct the necessary procedures concerning the environmental assessment (including stakeholder meetings,

Environmental Impact Assessment (EIA) /Initial Environmental Examination (IEE) and information disclosure, etc.) and make EIA/IEE report of the Project. The EIA/IEE approval shall be received from the responsible authorities and submitted to JICA by December 2021.

- 8-3. The Madagascar side confirmed to conduct the necessary procedures concerning the environmental assessment (including Etude d'Impact Environnemental (EIE), etc.) and apply for a renewal of the environment permit with additional components in conjunction with the Project. An approval of the environment permit shall be received from the responsible authorities and submitted to JICA by December 2021.

9. Other Relevant Issues

9-1. Human Resources and Budget Allocation

The Madagascar side agreed to secure required human resources and budget needed for waste collection, transportation and final disposal, and Operation and Maintenance (O&M).

9-2. Both sides confirmed about the ownership and management of the equipment as follows:

The Team emphasized the responsibility of the Madagascar side for ensuring compliance with the items described in Item 5 and the Madagascar side agreed to it:

1) Proper operation and maintenance for equipment

The Madagascar side agreed that vehicles to be provided shall be operated and maintained in proper manner

2) Securing the necessary lands

The Madagascar side will secure the lands for the parking lots for the procured vehicles and equipment. The Madagascar side will submit a land certificate and/or a relevant document and map for securing the candidate land.

3) Ownership and exclusive use

The equipment procured by the Project shall be exclusively used for waste collection, transportation and disposal services carried out by CUA only in the project site described in Item 3, and CUA shall not transfer the ownership of the equipment procured by the Project.

4) Monitoring for appropriate management

Both sides confirmed that Ministry of Water, Sanitation and Hygiene will supervise and periodically monitor the progress status of the Project.

9-3. Synergy with the Technical Cooperation Project

The Team also explained that a Technical Cooperation project is planned to strengthen the capacity of solid waste management in Antananarivo, and requested the Madagascar side to make efforts to achieve the synergy effects of these Grant Aid and Technical Cooperation Projects.

9-4. Safety and Security

Both sides confirmed that Responsible Authority and Executing Agency shall take necessary measures to ensure and maintain the security of the Project site and the persons related to the implementation of the Project, in cooperation with relevant authorities during the Project period.

- Annex 1 Project Site
- Annex 2 Organization Chart
- Annex 3 Japanese Grant
- Annex 4 Project Monitoring Report (template)
- Annex 5 Major Undertakings to be taken by the Government of Madagascar

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Annex 5

Major Undertakings to be taken by the Government of Madagascar

1. Specific obligations of the Government of Madagascar which will not be funded with the Grant

(1) Before the Tender

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To sign the banking arrangement (B/A) with a bank in Japan (the Agent Bank) to open bank account for the Grant	within 1 month after the signing of the G/A	MOF		
2	To issue Authorization to pay (A/P) to the Agent Bank for the payment to the consultant	within 1 month after the signing of the contract(s)	MOF		
3	To bear the following commissions to the Agent Bank for the banking services based upon B/A:				
4	1) Advising commission of A/P	within 1 month after the signing of the contract(s)	CUA		
5	2) Payment commission for A/P	every payment	CUA		
6	To approve IEE/EIA (Conditions of approval should be fulfilled, if any) and secure the necessary budget for implementation for Environmental Management Plan (EMP) and Environmental Monitoring Plan(EMoP) (and fulfilling conditions of approval, if any).	within 1 month after the signing of the G/A	ONE		
7	To clear, level and reclaim the following sites: 1) leveling and reclaiming the sites for Improvement Work of Waste Collection Points	before notice of the bidding documents	CUA		
8	To secure lands for procured equipment	before notice of the bidding documents	CUA		
9	To submit Project Monitoring Report (with the result of Detailed Design)	before preparation of the bidding documents	CUA		

(2) During the Project Implementation

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To issue A/P to the Agent Bank for the payment to the supplier and the contractor	within 1 month after the signing of the contract(s)	MOF		
2	To bear the following commissions to the Agent Bank for the banking services based upon the B/A:				
3	1) Advising commission of A/P	within 1 month after the signing of the contract(s)	CUA		
4	2) Payment commission for A/P	every payment	CUA		
5	To ensure prompt unloading and customs clearance at ports of disembarkation in the country of the Recipient and to assist the Supplier(s) with internal transportation therein	during the Project	CUA		
6	To accord Japanese physical persons and/or physical persons of third countries whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the country of the Recipient and stay therein for the performance of their work	during the Project	CUA		
7	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect to the purchase of the products and/or the services be borne by its designated authority without using the Grant	during the Project To be discussed later			
8	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project	during the Project	CUA		
9	To notify JICA promptly of any incident or accident, which has, or is likely to have, a significant adverse effect on the environment, the affected communities, the public or workers.	during the construction	CUA		
10	To submit Project Monitoring Report after each work under the contract(s) such as shipping, hand over, installation and operational training	within 1 month after completion of each work	CUA		
11	To submit Project Monitoring Report (final) (including as-built drawings, equipment list, photographs, etc.)	within 1 month after issuance of Certificate of Completion for the works under the contract(s)	CUA		
12	To submit a report concerning completion of the Project	within 6 months after completion of the Project	CUA		
13	To ensure the safety of persons engaged in the implementation of the Project	during the Project	CUA		
14	To implement EMP and EMoP	during the construction			
15	To submit results of environmental monitoring to JICA, by using the monitoring form, on a quarterly basis as a part of Project Monitoring Report	during the construction			

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(3) After the Project

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To implement EMP and EMoP	for a period based on EMP and EMoP	CUA		
2	To submit results of environmental monitoring to JICA, by using the monitoring form, semiannually - The period of environmental monitoring may be extended if any significant negative impacts on the environment are found. The extension of environmental monitoring will be decided based on the agreement between CUA and JICA.	for 3 years after the Project	CUA		
3	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid 1) Allocation of personnel and budget for operation and maintenance 2) Operation and maintenance structure 3) Routine check/Periodic inspection	After completion of the construction	MOF, CUA		

2. Other obligations of the Government of Madagascar funded with the Grant

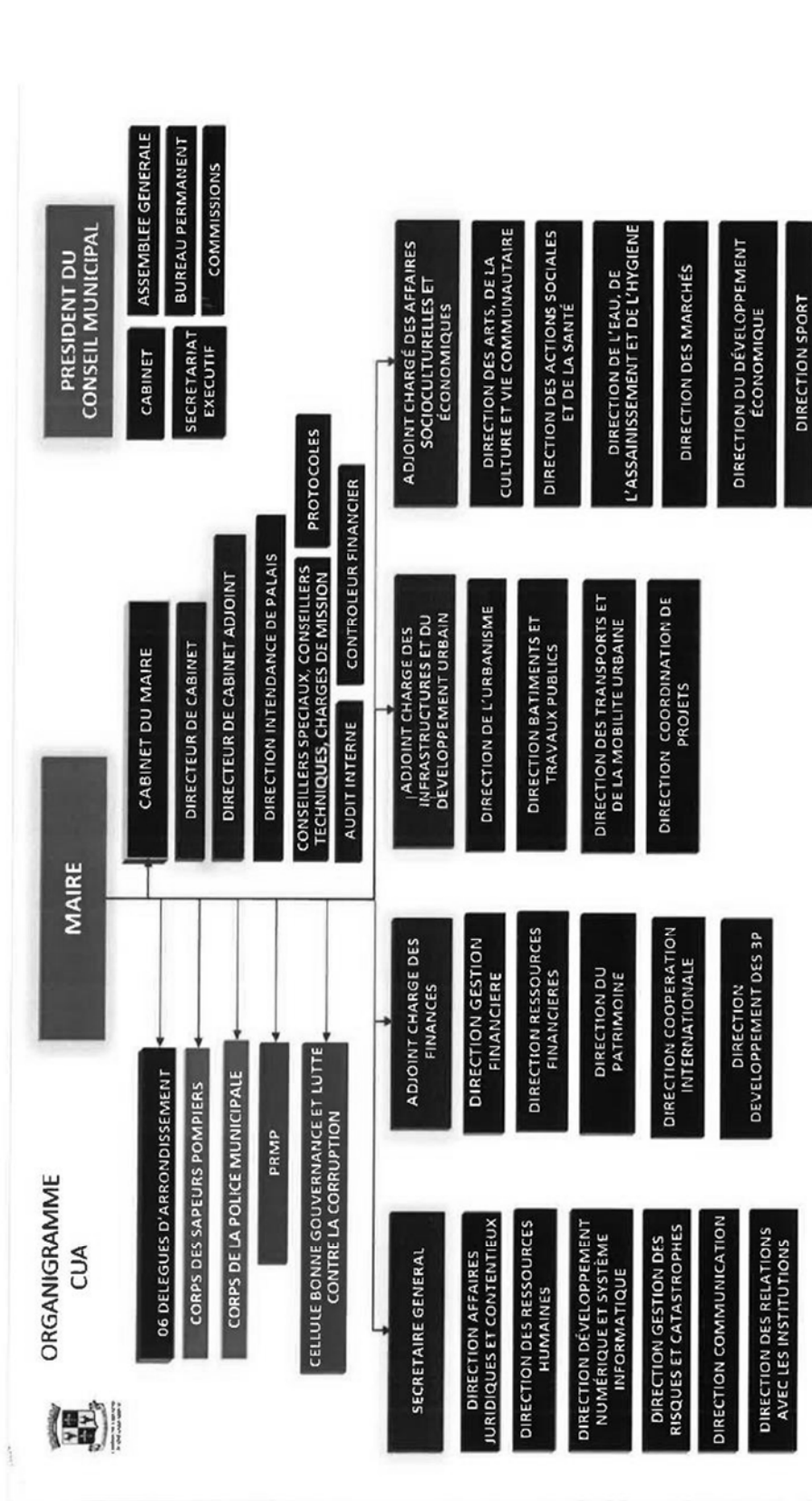
NO	Items	Deadline	Amount (Million Japanese Yen)*
1	To provide equipment 1) To conduct the following transportation: a) Marin (Air) transportation of the products from Japan to the country of the Recipient b) Internal transportation from the port of disembarkation to the project site		/
2	To implement detailed design, bidding support and procurement supervision (Consulting Service)		
	Total		

* The Amount is provisional. This is subject to the approval of the Government of Japan.

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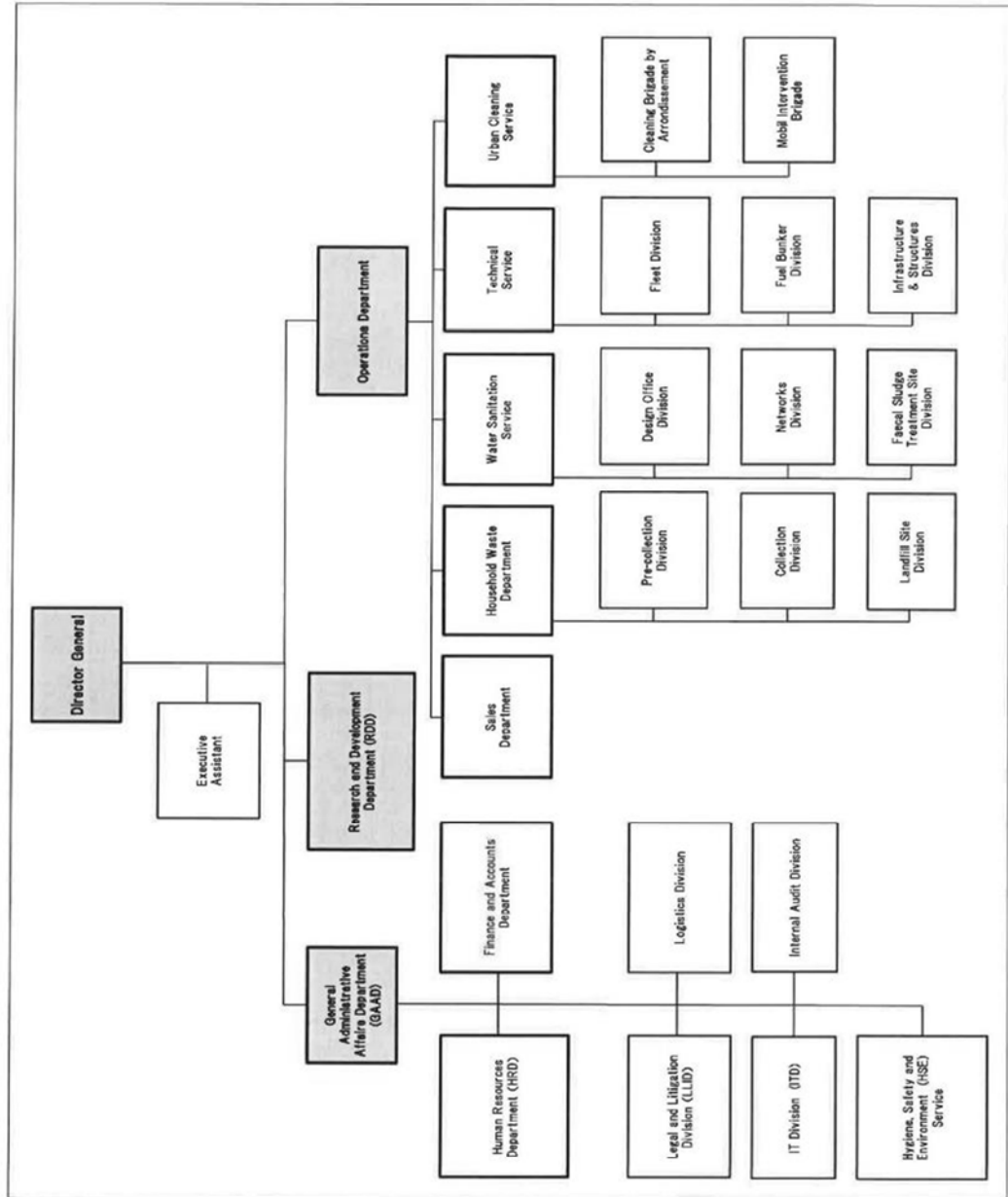
Annex 2-1



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JAPANESE GRANT

The Japanese Grant is non-reimbursable fund provided to a recipient country (hereinafter referred to as "the Recipient") to purchase the products and/or services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. Followings are the basic features of the project grants operated by JICA (hereinafter referred to as "Project Grants").

1. Procedures of Project Grants

Project Grants are conducted through following procedures (See "PROCEDURES OF JAPANESE GRANT" for details):

- (1) Preparation
 - The Preparatory Survey (hereinafter referred to as "the Survey") conducted by JICA
- (2) Appraisal
 - Appraisal by the government of Japan (hereinafter referred to as "GOJ") and JICA, and Approval by the Japanese Cabinet
- (3) Implementation
 - Exchange of Notes
 - The Notes exchanged between the GOJ and the government of the Recipient
 - Grant Agreement (hereinafter referred to as "the G/A")
 - Agreement concluded between JICA and the Recipient
 - Banking Arrangement (hereinafter referred to as "the B/A")
 - Opening of bank account by the Recipient in a bank in Japan (hereinafter referred to as "the Bank") to receive the grant
 - Construction works/procurement
 - Implementation of the project (hereinafter referred to as "the Project") on the basis of the G/A
- (4) Ex-post Monitoring and Evaluation
 - Monitoring and evaluation at post-implementation stage

2. Preparatory Survey

(1) Contents of the Survey

The aim of the Survey is to provide basic documents necessary for the appraisal of the the Project made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of

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relevant agencies of the Recipient necessary for the implementation of the Project.

- Evaluation of the feasibility of the Project to be implemented under the Japanese Grant from a technical, financial, social and economic point of view.
- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of an outline design of the Project.
- Estimation of costs of the Project.
- Confirmation of Environmental and Social Considerations

The contents of the original request by the Recipient are not necessarily approved in their initial form. The Outline Design of the Project is confirmed based on the guidelines of the Japanese Grant.

JICA requests the Recipient to take measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the executing agency of the Project. Therefore, the contents of the Project are confirmed by all relevant organizations of the Recipient based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA contracts with (a) consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

JICA reviews the report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the feasibility of the Project.

3. Basic Principles of Project Grants

(1) Implementation Stage

1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes (hereinafter referred to as "the E/N") will be signed between the GOJ and the Government of the Recipient to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Recipient to define the necessary articles, in accordance with the E/N, to implement the Project, such as conditions of disbursement, responsibilities of the Recipient, and procurement conditions. The terms and conditions generally applicable to the Japanese Grant are stipulated in the "General Terms and Conditions for Japanese Grant (January 2016)."

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2) Banking Arrangements (B/A) (See "Financial Flow of Japanese Grant (A/P Type)" for details)

a) The Recipient shall open an account or shall cause its designated authority to open an account under the name of the Recipient in the Bank, in principle. JICA will disburse the Japanese Grant in Japanese yen for the Recipient to cover the obligations incurred by the Recipient under the verified contracts.

b) The Japanese Grant will be disbursed when payment requests are submitted by the Bank to JICA under an Authorization to Pay (A/P) issued by the Recipient.

3) Procurement Procedure

The products and/or services necessary for the implementation of the Project shall be procured in accordance with JICA's procurement guidelines as stipulated in the G/A.

4) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the Recipient to continue to work on the Project's implementation after the E/N and G/A.

5) Eligible source country

In using the Japanese Grant disbursed by JICA for the purchase of products and/or services, the eligible source countries of such products and/or services shall be Japan and/or the Recipient. The Japanese Grant may be used for the purchase of the products and/or services of a third country as eligible, if necessary, taking into account the quality, competitiveness and economic rationality of products and/or services necessary for achieving the objective of the Project. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm, which enter into contracts with the Recipient, are limited to "Japanese nationals", in principle.

6) Contracts and Concurrence by JICA

The Recipient will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be concurred by JICA in order to be verified as eligible for using the Japanese Grant.

7) Monitoring

The Recipient is required to take their initiative to carefully monitor the progress of the Project in order to ensure its smooth implementation as part of their responsibility in the G/A, and to regularly report to JICA about its status by using the Project Monitoring Report (PMR).

8) Safety Measures

The Recipient must ensure that the safety is highly observed during the implementation of the Project.

9) Construction Quality Control Meeting

Construction Quality Control Meeting (hereinafter referred to as the "Meeting") will be held for quality assurance and smooth implementation of the Works at each stage of the Works. The member of the Meeting will be composed by the

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Recipient (or executing agency), the Consultant, the Contractor and JICA. The functions of the Meeting are as followings:

- a) Sharing information on the objective, concept and conditions of design from the Contractor, before start of construction.
- b) Discussing the issues affecting the Works such as modification of the design, test, inspection, safety control and the Client's obligation, during of construction.

(2) Ex-post Monitoring and Evaluation Stage

- 1) After the project completion, JICA will continue to keep in close contact with the Recipient in order to monitor that the outputs of the Project is used and maintained properly to attain its expected outcomes.
- 2) In principle, JICA will conduct ex-post evaluation of the Project after three years from the completion. It is required for the Recipient to furnish any necessary information as JICA may reasonably request.

(3) Others

1) Environmental and Social Considerations

The Recipient shall carefully consider environmental and social impacts by the Project and must comply with the environmental regulations of the Recipient and JICA Guidelines for Environmental and Social Considerations (April, 2010).

2) Major undertakings to be taken by the Government of the Recipient

For the smooth and proper implementation of the Project, the Recipient is required to undertake necessary measures including land acquisition, and bear an advising commission of the A/P and payment commissions paid to the Bank as agreed with the GOJ and/or JICA. The Government of the Recipient shall ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the Recipient with respect to the purchase of the Products and/or the Services be exempted or be borne by its designated authority without using the Grant and its accrued interest, since the grant fund comes from the Japanese taxpayers.

3) Proper Use

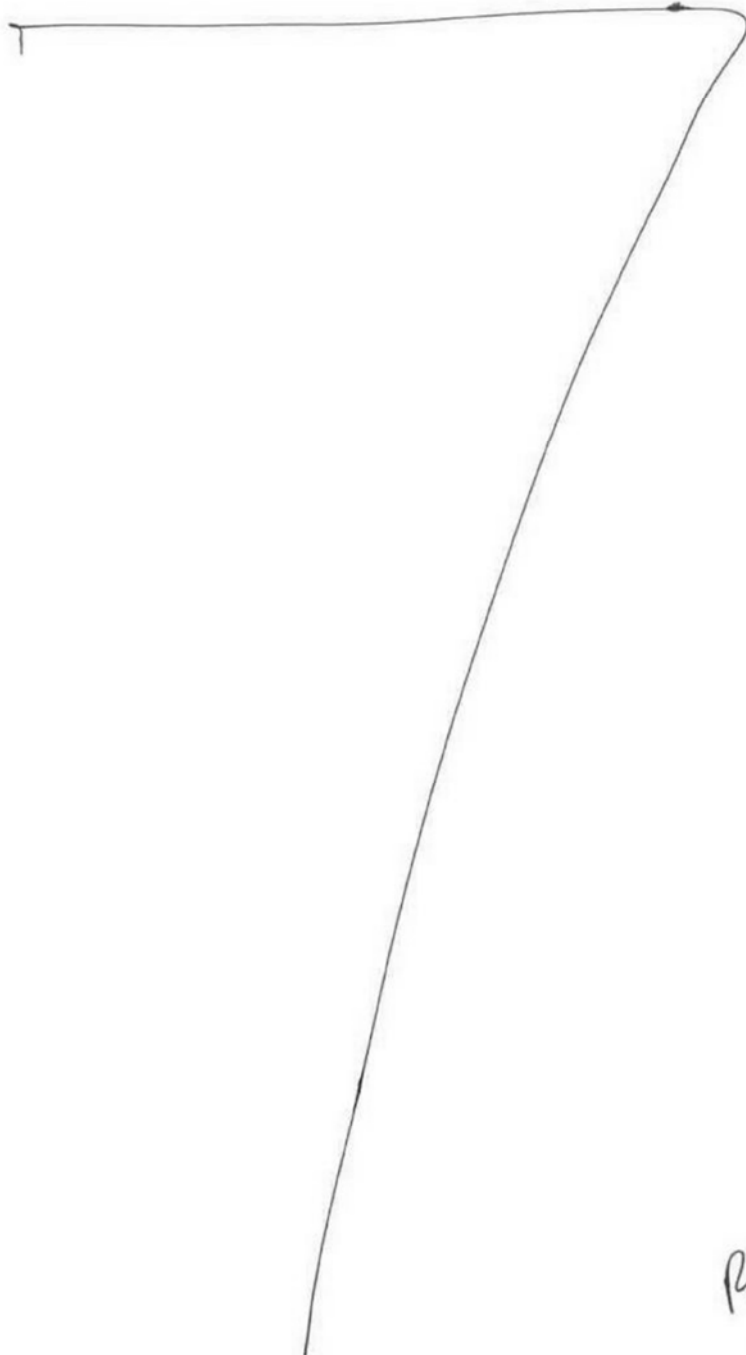
The Recipient is required to maintain and use properly and effectively the products and/or services under the Project (including the facilities constructed and the equipment purchased), to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Japanese Grant.

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4) Export and Re-export

The products purchased under the Japanese Grant should not be exported or re-exported from the Recipient.



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PROCEDURES OF JAPANESE GRANT

Stage	Procedures	Remarks	Recipient Government	Japanese Government	JICA	Consultants	Contractors	Agent Bank
Official Request	Request for grants through diplomatic channel	Request shall be submitted before appraisal stage.	x	x				
1. Preparation	(1) Preparatory Survey Preparation of outline design and cost estimate		x		x	x		
	(2) Preparatory Survey Explanation of draft outline design, including cost estimate, undertakings, etc.		x		x	x		
2. Appraisal	(3) Agreement on conditions for implementation	Conditions will be explained with the draft notes (E/N) and Grant Agreement (G/A) which will be signed before approval by Japanese government.	x	x (E/N)	x (G/A)			
	(4) Approval by the Japanese cabinet			x				
3. Implementation	(5) Exchange of Notes (E/N)		x	x				
	(6) Signing of Grant Agreement (G/A)		x		x			
	(7) Banking Arrangement (B/A)	Need to be informed to JICA	x					x
	(8) Contracting with consultant and issuance of Authorization to Pay (A/P)	Concurrence by JICA is required	x			x		x
	(9) Detail design (D/D)		x			x		
	(10) Preparation of bidding documents	Concurrence by JICA is required	x			x		
	(11) Bidding	Concurrence by JICA is required	x			x	x	
	(12) Contracting with contractor/supplier and issuance of A/P	Concurrence by JICA is required	x				x	x
4. Ex-post monitoring & evaluation	(13) Construction works/procurement	Concurrence by JICA is required for major modification of design and amendment of contracts.	x			x	x	
	(14) Completion certificate		x			x	x	
4. Ex-post monitoring & evaluation	(15) Ex-post monitoring	To be implemented generally after 1, 3, 10 years of completion, subject to change	x		x			
	(16) Ex-post evaluation	To be implemented basically after 3 years of completion	x		x			

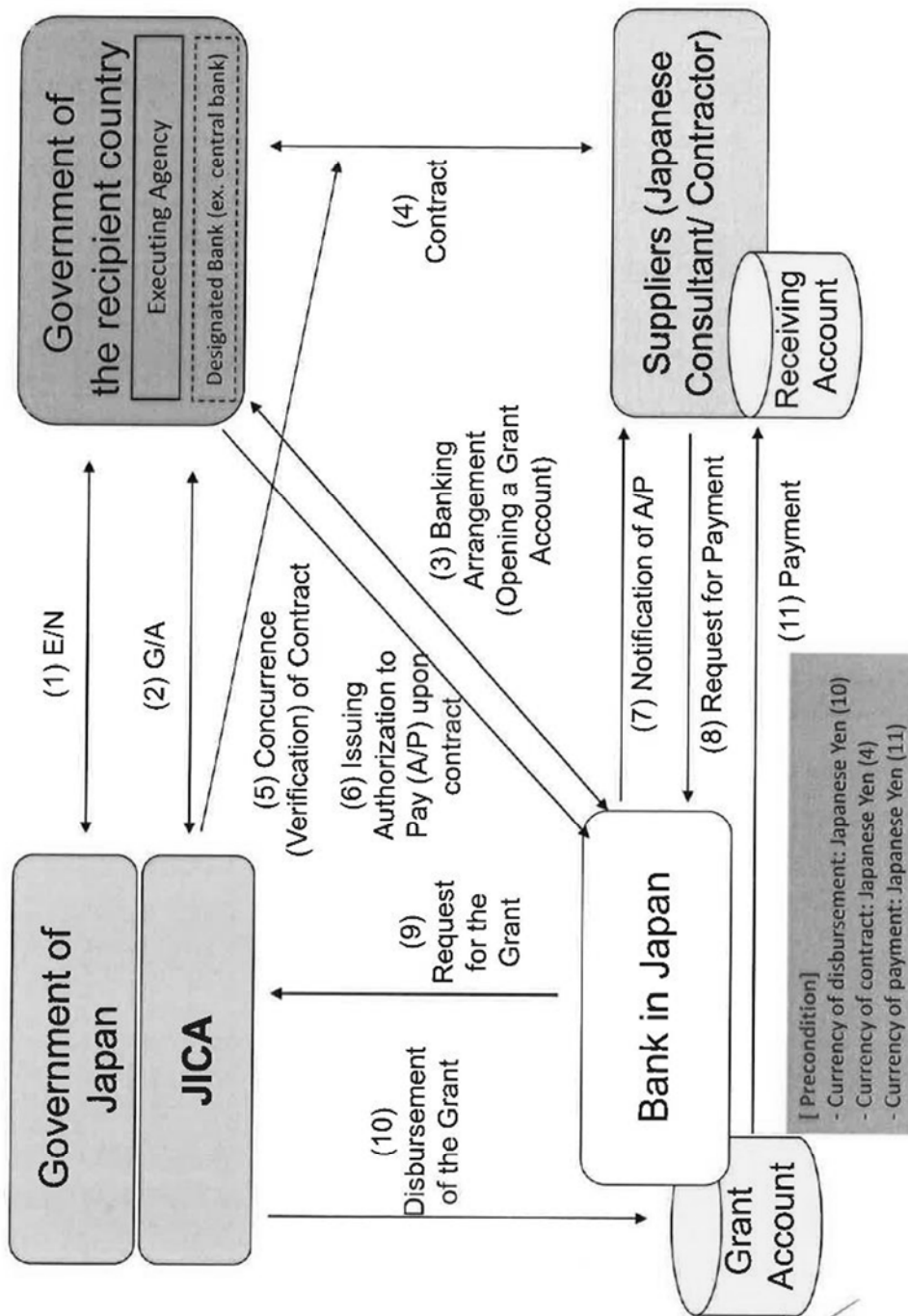
notes:

1. Project Monitoring Report and Report for Project Completion shall be submitted to JICA as agreed in the G/A.
2. Concurrence by JICA is required for allocation of grant for remaining amount and/or contingencies as agreed in the G/A.

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Financial Flow of Japanese Grant (A/P Type)



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Annex 4

<p><u>Project Monitoring Report</u> on <u>Project Name</u> Grant Agreement No. <u>XXXXXXXX</u> 20XX, Month</p>

Organizational Information

Signer of the G/A (Recipient)	Person in Charge (Designation) _____ Contacts Address: _____ Phone/FAX: _____ Email: _____
Executing Agency	Person in Charge (Designation) _____ Contacts Address: _____ Phone/FAX: _____ Email: _____
Line Ministry	Person in Charge (Designation) _____ Contacts Address: _____ Phone/FAX: _____ Email: _____

General Information:

Project Title	_____
E/N	Signed date: _____ Duration: _____
G/A	Signed date: _____ Duration: _____
Source of Finance	Government of Japan: Not exceeding JPY _____ mil. Government of (_____): _____

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G/A NO. XXXXXXX
PMR prepared on DD/MM/YY

1: Project Description	
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1-1 Project Objective

1-2 Project Rationale

- Higher-level objectives to which the project contributes (national/regional/sectoral policies and strategies)
- Situation of the target groups to which the project addresses

1-3 Indicators for measurement of "Effectiveness"

Quantitative indicators to measure the attainment of project objectives		
Indicators	Original (Yr)	Target (Yr)
Qualitative indicators to measure the attainment of project objectives		

2: Details of the Project

2-1 Location

Components	Original <i>(proposed in the outline design)</i>	Actual
1.		

2-2 Scope of the work

Components	Original* <i>(proposed in the outline design)</i>	Actual*
1.		

Reasons for modification of scope (if any).

(PMR)

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G/A NO. XXXXXXXX
PMR prepared on DD/MM/YY

2-3 Implementation Schedule

Items	Original		Actual
	(proposed in the outline design)	(at the time of signing the Grant Agreement)	

Reasons for any changes of the schedule, and their effects on the project (if any)

2-4 Obligations by the Recipient

2-4-1 Progress of Specific Obligations

See Attachment 2.

2-4-2 Activities

See Attachment 3.

2-4-3 Report on RD

See Attachment 11.

2-5 Project Cost

2-5-1 Cost borne by the Grant(Confidential until the Bidding)

Components			Cost (Million Yen)	
	Original (proposed in the outline design)	Actual (in case of any modification)	Original ^{1),2)} (proposed in the outline design)	Actual
1.				
Total				

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar = Yen

2-5-2 Cost borne by the Recipient

Components			Cost (1,000 Taka)	
	Original (proposed in the outline design)	Actual (in case of any modification)	Original ^{1),2)} (proposed in the outline design)	Actual
1.				

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G/A NO. XXXXXXXX
PMR prepared on DD/MM/YY

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar =

Reasons for the remarkable gaps between the original and actual cost, and the countermeasures (if any)

(PMR)

2-6 Executing Agency

- Organization's role, financial position, capacity, cost recovery etc,
- Organization Chart including the unit in charge of the implementation and number of employees.

Original (at the time of outline design) name: role: financial situation: institutional and organizational arrangement (organogram): human resources (number and ability of staff):
Actual (PMR)

2-7 Environmental and Social Impacts

- The results of environmental monitoring based on Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- The results of social monitoring based on in Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- Disclosed information related to results of environmental and social monitoring to local stakeholders (whenever applicable).

3: Operation and Maintenance (O&M)

3-1 Physical Arrangement

- Plan for O&M (number and skills of the staff in the responsible division or section, availability of manuals and guidelines, availability of spareparts, etc.)

Original (at the time of outline design)
Actual (PMR)

3-2 Budgetary Arrangement

- Required O&M cost and actual budget allocation for O&M

Original (at the time of outline design)

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G/A NO. XXXXXXXX
 PMR prepared on DD/MM/YY

Actual (PMR)

4: Potential Risks and Mitigation Measures

- Potential risks which may affect the project implementation, attainment of objectives, sustainability
- Mitigation measures corresponding to the potential risks

Assessment of Potential Risks (at the time of outline design)

Potential Risks	Assessment
1. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
2. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
3. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:

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G/A NO. XXXXXXXX
PMR prepared on DD/MM/YY

	Contingency Plan (if applicable):
Actual Situation and Countermeasures (PMR)	

5: Evaluation and Monitoring Plan (after the work completion)

5-1 Overall evaluation

Please describe your overall evaluation on the project.

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5-2 Lessons Learnt and Recommendations

Please raise any lessons learned from the project experience, which might be valuable for the future assistance or similar type of projects, as well as any recommendations, which might be beneficial for better realization of the project effect, impact and assurance of sustainability.

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5-3 Monitoring Plan of the Indicators for Post-Evaluation

Please describe monitoring methods, section(s)/department(s) in charge of monitoring, frequency, the term to monitor the indicators stipulated in 1-3.

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G/A NO. XXXXXXXX
PMR prepared on DD/MM/YY

Attachment

1. Project Location Map
2. Specific obligations of the Recipient which will not be funded with the Grant
3. Monthly Report submitted by the Consultant
Appendix - Photocopy of Contractor's Progress Report (if any)
 - Consultant Member List
 - Contractor's Main Staff List
4. Check list for the Contract (including Record of Amendment of the Contract/Agreement and Schedule of Payment)
5. Environmental Monitoring Form / Social Monitoring Form
6. Monitoring sheet on price of specified materials (Quarterly)
7. Report on Proportion of Procurement (Recipient Country, Japan and Third Countries) (PMR (final) only)
8. Pictures (by JPEG style by CD-R) (PMR (final) only)
9. Equipment List (PMR (final) only)
10. Drawing (PMR (final) only)
11. Report on RD (After project)

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Attachment 6

Monitoring sheet on price of specified materials

1. Initial Conditions (Confirmed)

Items of Specified Materials	Initial Volume A	Initial Unit Price (¥) B	Initial total Price C=A×B	1% of Contract Price D	Condition of payment Price (Increased) F=C+D
1 Item 1	●●t	●	●	●	●
2 Item 2	●●t	●	●	●	
3 Item 3					
4 Item 4					
5 Item 5					

2. Monitoring of the Unit Price of Specified Materials

(1) Method of Monitoring : ●●

(2) Result of the Monitoring Survey on Unit Price for each specified materials

Items of Specified Materials	1st month, 2015	2nd month, 2015	3rd month, 2015	4th	5th	6th
1 Item 1	●	●	●			
2 Item 2						
3 Item 3						
4 Item 4						
5 Item 5						

(3) Summary of Discussion with Contractor (if necessary)

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Attachment 7

Report on Proportion of Procurement (Recipient Country, Japan and Third Countries)
 (Actual Expenditure by Construction and Equipment each)

	Domestic Procurement (Recipient Country) A	Foreign Procurement (Japan) B	Foreign Procurement (Third Countries) C	Total D
Construction Cost	(A/D%)	(B/D%)	(C/D%)	
Direct Construction Cost	(A/D%)	(B/D%)	(C/D%)	
others	(A/D%)	(B/D%)	(C/D%)	
Equipment Cost	(A/D%)	(B/D%)	(C/D%)	
Design and Supervision Cost	(A/D%)	(B/D%)	(C/D%)	
Total	(A/D%)	(B/D%)	(C/D%)	

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(2) During the Explanation on Draft Preparatory Survey Report in December 2021

**Minutes of Discussions
on the Preparatory Survey for the Project for
the Improvement of Solid Waste Management Equipment for Clean City in
Antananarivo
(Explanation on Draft Preparatory Survey Report)**

With reference to the minutes of discussions signed between Ministry of Water, Sanitation and Hygiene (hereinafter referred to as "MEAH"), Urban Commune of Antananarivo (hereinafter referred to as "CUA") and the Japan International Cooperation Agency (hereinafter referred to as "JICA") on 22nd October, 2021 and in response to the request from the Government of Republic of Madagascar (hereinafter referred to as "Madagascar") dated 29th October, 2021, JICA dispatched the Preparatory Survey Team (hereinafter referred to as "the Team") for the explanation of Draft Preparatory Survey Report (hereinafter referred to as "the Draft Report") for the Project for the Improvement of Solid Waste Management Equipment for Clean City in Antananarivo (hereinafter referred to as "the Project").

As a result of the discussions, both sides agreed on the main items described in the attached sheets.

Antananarivo, 3rd December, 2021



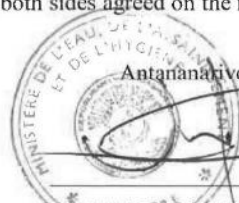
Ms. TANAKA Kaori

Chief Representative
Japan International Cooperation Agency
Madagascar Office



Mr. ANDRIANTSITOHAINA Naina


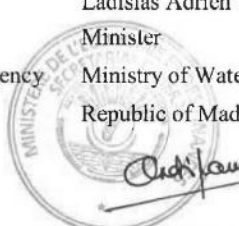
Mayor
Urban Commune of Antananarivo
Republic of Madagascar



Mr. RAKOTONDRAZAKA

Ladislav Adrien

Minister
Ministry of Water, Sanitation and Hygiene
Republic of Madagascar



Ms. RABARINIRINARISON Rindra

Hasimbelo
Minister
Ministry of Economy and Finances
Republic of Madagascar

Au nom et pour le compte de

ATTACHEMENT

1. Objective of the Project
The objective of the Project is to strengthen the capacity of solid waste management in Antananarivo City by providing the equipment related with waste collection, transportation, and final disposal activities thereby contributing to improve the sanitation environment in the target area.
2. Title of the Preparatory Survey
Both sides confirmed the title of the Preparatory Survey as “the Preparatory Survey for the Project for the Improvement of Solid Waste Management Equipment for Clean City in Antananarivo”.
3. Project Site
Both sides confirmed that the site of the Project is a jurisdiction area of CUA, the Andralanitra disposal site and other disposal sites which will be constructed and used by CUA.
4. Responsible Organization for the Project
Both sides confirmed the authorities responsible for the Project are as follows:
 - 4-1. The CUA will be the executing agency for the Project (hereinafter referred to as “the Executing Agency”). The Executing Agency shall coordinate with all the relevant organizations to ensure smooth implementation of the Project and ensure that the undertakings for the Project shall be managed by relevant organizations properly and on time. The organization charts are shown in Annex 2.
 - 4-2. MEAH shall be responsible for supervising the Executing Agency on behalf of the Government of Madagascar.
5. Contents of the Draft Report
After the explanation of the contents of the Draft Report by the Team, the Madagascar side agreed to its contents. JICA will finalize the Preparatory Survey Report based on the confirmed items. The report will be sent to the Madagascar side around February 2022.
6. Cost estimate
Both sides confirmed that the cost estimate explained by the Team is provisional and will be examined further by the Government of Japan for its approval.

7. Confidentiality of the cost estimate and technical specifications

Both sides confirmed that the cost estimate and technical specifications of the Project should never be disclosed to any third parties until all the contracts under the Project are concluded.

8. Procedures and Basic Principles of Japanese Grant

The Madagascar side agreed that the procedures and basic principles of Japanese Grant (hereinafter referred to as “the Grant”) as described in Annex 3 shall be applied to the Project. In addition, the Madagascar side agreed to take necessary measures according to the procedures.

9. Timeline for the project implementation

The Team explained to the Madagascar side that the expected timeline for the project implementation is as attached in Annex 4.

10. Expected outcomes and indicators

Both sides agreed that key indicators for expected outcomes are as follows. The Madagascar side will be responsible for the achievement of agreed key indicators targeted 6 months after the arrival of the equipment and shall monitor the progress for Ex-Post Evaluation based on those indicators.

[Quantitative indicators]

“Waste collected amount” and “Waste collected rate” are set as indicators of the quantitative effect of the Project as shown in Table 1.

Table 1 Quantitative Effect of the Project

Indicator	Existing Value in 2021	Target Value 3 years after the arrival of the equipment*	Note
Waste collected amount	347 ton / day	596 ton / day	
Waste collected rate	43%	66%	


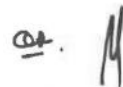
Note: *The assumption is made that the existing eight (8) dumptrucks will be still workable in 2027.

[Qualitative indicators]

The qualitative effects of the Project are as follows:

- Improvement of the hygiene environment of Antananarivo with the reduction of uncollected waste and illegally dumped waste.
- Mitigation of Environmental Impacts through preventing odor, waste scattering, and fires in Andralanitra landfill site by covering with soil, etc.

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11. Ex-Post Evaluation

JICA will conduct ex-post evaluation after three (3) years from the project completion, in principle, with respect to five evaluation criteria (Relevance, Effectiveness, Efficiency, Impact, Sustainability). The result of the evaluation will be publicized. The Madagascar side is required to provide necessary support for the data collection.

12. Undertakings of the Project

Both sides confirmed the undertakings of the Project as described in Annex 5. With regard to payment of customs duties, internal taxes and other fiscal levies as stipulated in (2) 8 of Annex 5, both sides confirmed that such customs duties, internal taxes and other fiscal levies shall be clarified in the bid documents by CUA during the implementation stage of the Project.

- Madagascar side stated that the taxes to be imposed on this project are Custom Duties, Value Added Tax and Tax on Public Procurement (hereinafter referred to as "IMP").
- The Custom Duties and Value Added Tax are borne by MEAH.
- Both sides agreed that special treatment on exemption or payment of IMP shall be taken in the government council as soon as possible.
- The result of the government council will be announced to Japanese side on or before 15th January 2022.

The Madagascar side assured to take the necessary measures and coordination including allocation of the necessary budget which are preconditions of implementation of the Project. It is further agreed that the costs are indicative, i.e. at Outline Design level. More accurate costs will be calculated at the Detailed Design stage.

Both sides also confirmed that the Annex 5 will be used as an attachment of Grant Agreement.

As shown in Annex 5, both sides confirmed that CUA shall take necessary measures to ensure and maintain the security of the Project site and the persons related to the implementation of the Project, in cooperation with relevant authorities such as police.

13. Monitoring during the implementation

The Project will be monitored by the Executing Agency and reported to JICA by using the form of Project Monitoring Report (PMR) attached as Annex 6. The timing of submission of the PMR is described in Annex 5.

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14. Project completion

Both sides confirmed that the Project completes when all the facilities constructed and equipment procured by the Grant are in operation. The completion of the Project will be reported to JICA promptly, but in any event not later than six months after completion of the Project.

15. Environmental and Social Considerations

The Team explained that 'JICA Guidelines for Environmental and Social Considerations (April 2010)' (hereinafter referred to as "the Guidelines") is applicable for the Project. The Project is categorized as "C" because the Project is likely to have minimal adverse impact on the environment under the Guidelines.

The Madagascar side confirmed to conduct the necessary procedures concerning the environmental assessment (including Etude d'Impact Environnemental (EIE), etc.) and apply for a renewal of the environment permit with additional components in conjunction with the Project. An approval of the environment permit shall be received from the responsible authorities and submitted to JICA by the end of January 2022.

16. Other Relevant Issues

16-1. Disclosure of Information

Both sides confirmed that the Preparatory Survey Report from which project cost is excluded will be disclosed to the public after completion of the Preparatory Survey. The comprehensive report including the project cost will be disclosed to the public after all the contracts under the Project are concluded.

16-2. Human Resources and Budget Allocation

The Madagascar side agreed to secure required human resources and budget needed for waste collection, transportation and final disposal, and Operation and Maintenance (O&M).

16-3. Proper operation and maintenance for equipment

The Madagascar side agreed that vehicles and equipment to be provided shall be operated and maintained in proper manner.

16-4. Securing the necessary lands

The Madagascar side will secure the lands for the parking lots for the procured vehicles and equipment. The Madagascar side will submit a land certificate and/or a relevant document and map for securing the candidate land before the tender notice.

16-5. Ownership and exclusive use

The equipment procured by the Project shall be employed exclusively for CUA's

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waste collection, transportation and final disposal services, and CUA shall not transfer the ownership of the equipment procured by the Project to any party.

16-6. Monitoring for appropriate management

Both sides confirmed that MEAH will supervise and periodically monitor the progress status of the Project. MEAH will periodically monitor the usage of the equipment after the Project.

Annex 1 Project Site

Annex 2 Organization Chart

Annex 3 Japanese Grant

Annex 4 Project Implementation Schedule

Annex 5 Major Undertakings to be taken by the Government of Madagascar

Annex 6 Project Monitoring Report (template)

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Annex 1

Project Site

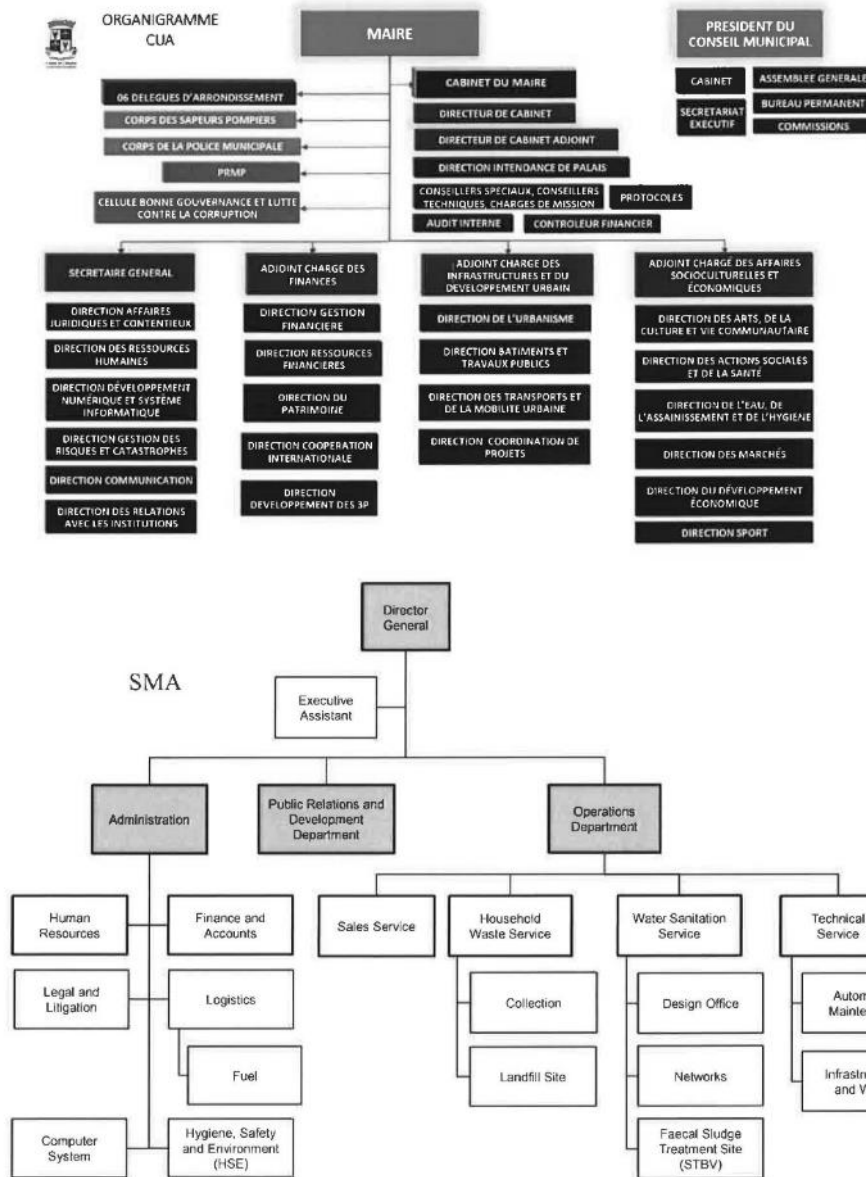


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Annex 2

Organization Chart



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Annex 3

JAPANESE GRANT

The Japanese Grant is non-reimbursable fund provided to a recipient country (hereinafter referred to as "the Recipient") to purchase the products and/or services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. Followings are the basic features of the project grants operated by JICA (hereinafter referred to as "Project Grants").

1. Procedures of Project Grants

Project Grants are conducted through following procedures (See "PROCEDURES OF JAPANESE GRANT" for details):

- (1) Preparation
 - The Preparatory Survey (hereinafter referred to as "the Survey") conducted by JICA
- (2) Appraisal
 - Appraisal by the government of Japan (hereinafter referred to as "GOJ") and JICA, and Approval by the Japanese Cabinet
- (3) Implementation
 - Exchange of Notes
 - The Notes exchanged between the GOJ and the government of the Recipient
 - Grant Agreement (hereinafter referred to as "the G/A")
 - Agreement concluded between JICA and the Recipient
 - Banking Arrangement (hereinafter referred to as "the B/A")
 - Opening of bank account by the Recipient in a bank in Japan (hereinafter referred to as "the Bank") to receive the grant
 - Construction works/procurement
 - Implementation of the project (hereinafter referred to as "the Project") on the basis of the G/A
- (4) Ex-post Monitoring and Evaluation
 - Monitoring and evaluation at post-implementation stage

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2. Preparatory Survey

(1) Contents of the Survey

The aim of the Survey is to provide basic documents necessary for the appraisal of the the Project made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies of the Recipient necessary for the implementation of the Project.
- Evaluation of the feasibility of the Project to be implemented under the Japanese Grant from a technical, financial, social and economic point of view.
- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of an outline design of the Project.
- Estimation of costs of the Project.
- Confirmation of Environmental and Social Considerations

The contents of the original request by the Recipient are not necessarily approved in their initial form. The Outline Design of the Project is confirmed based on the guidelines of the Japanese Grant.

JICA requests the Recipient to take measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the executing agency of the Project. Therefore, the contents of the Project are confirmed by all relevant organizations of the Recipient based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA contracts with (a) consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

JICA reviews the report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the feasibility of the Project.

3. Basic Principles of Project Grants

(1) Implementation Stage

1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes (hereinafter referred to as "the E/N") will be signed between the GOJ and the Government of the Recipient to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Recipient to define the necessary articles, in accordance with the E/N, to implement the Project, such as conditions of disbursement, responsibilities of the Recipient, and procurement conditions. The terms and conditions generally applicable to the Japanese Grant are stipulated in the "General Terms and Conditions for Japanese Grant (January 2016)."

2) Banking Arrangements (B/A) (See "Financial Flow of Japanese Grant (A/P Type)" for details)

- a) The Recipient shall open an account or shall cause its designated authority to open an account under the name of the Recipient in the Bank, in principle. JICA will disburse the Japanese Grant in Japanese yen for the Recipient to cover the obligations incurred by the Recipient under the verified contracts.
- b) The Japanese Grant will be disbursed when payment requests are submitted by the Bank to JICA under an Authorization to Pay (A/P) issued by the Recipient.

3) Procurement Procedure

The products and/or services necessary for the implementation of the Project shall be procured in accordance with JICA's procurement guidelines as stipulated in the G/A.

4) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the Recipient to continue to work on the Project's implementation after the E/N and G/A.

5) Eligible source country

In using the Japanese Grant disbursed by JICA for the purchase of products and/or services, the eligible source countries of such products and/or services shall be Japan and/or the Recipient. The Japanese Grant may be used for the purchase of the products and/or services of a third country as eligible, if necessary, taking into account the quality, competitiveness and economic rationality of products and/or services necessary for achieving the objective of the Project. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm, which enter into contracts with the Recipient, are

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limited to "Japanese nationals", in principle.

6) Contracts and Concurrence by JICA

The Recipient will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be concurred by JICA in order to be verified as eligible for using the Japanese Grant.

7) Monitoring

The Recipient is required to take their initiative to carefully monitor the progress of the Project in order to ensure its smooth implementation as part of their responsibility in the G/A, and to regularly report to JICA about its status by using the Project Monitoring Report (PMR).

8) Safety Measures

The Recipient must ensure that the safety is highly observed during the implementation of the Project.

9) Construction Quality Control Meeting

Construction Quality Control Meeting (hereinafter referred to as the "Meeting") will be held for quality assurance and smooth implementation of the Works at each stage of the Works. The member of the Meeting will be composed by the Recipient (or executing agency), the Consultant, the Contractor and JICA. The functions of the Meeting are as followings:

- a) Sharing information on the objective, concept and conditions of design from the Contractor, before start of construction.
- b) Discussing the issues affecting the Works such as modification of the design, test, inspection, safety control and the Client's obligation, during of construction.

(2) Ex-post Monitoring and Evaluation Stage

1) After the project completion, JICA will continue to keep in close contact with the Recipient in order to monitor that the outputs of the Project is used and maintained properly to attain its expected outcomes.

2) In principle, JICA will conduct ex-post evaluation of the Project after three years from the completion. It is required for the Recipient to furnish any necessary information as JICA may reasonably request.

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(3) Others

1) Environmental and Social Considerations

The Recipient shall carefully consider environmental and social impacts by the Project and must comply with the environmental regulations of the Recipient and JICA Guidelines for Environmental and Social Considerations (April, 2010).

2) Major undertakings to be taken by the Government of the Recipient

For the smooth and proper implementation of the Project, the Recipient is required to undertake necessary measures including land acquisition, and bear an advising commission of the A/P and payment commissions paid to the Bank as agreed with the GOJ and/or JICA. The Government of the Recipient shall ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the Recipient with respect to the purchase of the Products and/or the Services be exempted or be borne by its designated authority without using the Grant and its accrued interest, since the grant fund comes from the Japanese taxpayers.

3) Proper Use

The Recipient is required to maintain and use properly and effectively the products and/or services under the Project (including the facilities constructed and the equipment purchased), to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Japanese Grant.

4) Export and Re-export

The products purchased under the Japanese Grant should not be exported or re-exported from the Recipient.

Annex 5

Major Undertakings to be taken by the Government of Madagascar

1. Specific obligations of the Government of Madagascar which will not be funded with the Grant

(1) Before the Tender

No.	Items	Deadline	In charge	Estimated Cost	Ref.
1	To sign the banking arrangement (B/A) with a bank in Japan (the Agent Bank) to open bank account for the Grant	within 1 month after the signing of the G/A	CUA in collaboration with Central Bank of Madagascar	29 million MGA	
2	To issue Authorization to pay (A/P) to the Agent Bank for the payment to the consultant	within 1 month after the signing of the contract(s)	CUA in collaboration with Central Bank of Madagascar	Included in No.1	
3	To bear the following commissions to the Agent Bank for the banking services based upon B/A:			Included in No.1	
4	1) Advising commission of A/P	within 1 month after the signing of the contract(s)	CUA*	-	
5	2) Payment commission for A/P	every payment	CUA	-	
6	To approve IEE/EIA (Conditions of approval should be fulfilled, if any) and secure the necessary budget for implementation for Environmental Management Plan (EMP) and Environmental Monitoring Plan(EMoP) (and fulfilling conditions of approval, if any).	within 1 month after the signing of the G/A	MEAH*/ CUA	56 million MGA	
7	To secure lands for procured equipment	before notice of the bidding documents	CUA	-	
8	To submit Project Monitoring Report (with the result of Detailed Design)	before preparation of the bidding documents	CUA	-	

* MEF: Ministry of Economy and Finances (Ministère de l'Économie et des Finances)

* CUA: Urban Commune of Antananarivo (Commune Urbaine d'Antananarivo)

* MEAH: Ministry of Water, Sanitation and Hygiene (Ministère de l'Eau de l'Assainissement et de l'Hygiène)

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(2) During the Project Implementation

No.	Items	Deadline	In charge	Estimated Cost	Ref.
1	To issue A/P to the Agent Bank for the payment to the supplier	within 1 month after the signing of the contract(s)	MEF	Included in (1) No.1	
2	To bear the following commissions to the Agent Bank for the banking services based upon the B/A:			Included in (1) No.1	
3	1) Advising commission of A/P	within 1 month after the signing of the contract(s)	CUA	-	
4	2) Payment commission for A/P	every payment	CUA	-	
5	To clear, level and reclaim the following sites: 1) leveling and reclaiming the sites for Improvement Work of Waste Collection Points	1 month before the commencement of the construction	CUA	8 million MGA	
6	To ensure prompt unloading and customs clearance at ports of disembarkation in the country of the Recipient and to assist the Supplier(s) with internal transportation therein	during the Project	CUA	-	
7	To accord Japanese physical persons and/or physical persons of third countries whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the country of the Recipient and stay therein for the performance of their work	during the Project	CUA	-	
8	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect to the purchase of the products and/or the services be covered by its designated authority without using the Grant	during the Project	MEF/ME AH	9 061 million MGA	
9	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project	during the Project	CUA	To be determined as necessary	
10	To notify JICA promptly of any incident or accident, which has, or is likely to have, a significant adverse effect on the environment, the affected communities, the public or workers.	during the construction	CUA	-	
11	To submit Project Monitoring Report after each work under the contract(s) such as shipping, hand over, installation and operational training	within 1 month after completion of each work	CUA	-	
12	To submit Project Monitoring Report (final) (including as-built drawings, equipment list, photographs, etc.)	within 1 month after issuance of Certificate of Completion for the works under the contract(s)	CUA	-	
13	To submit a report concerning completion of the Project	within 6 months after completion of the Project	CUA	-	
14	To ensure the safety of persons engaged in the implementation of the Project	during the Project	CUA	-	
15	To implement EMP and EMoP	during the Improvement	CUA	-	

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		Work of Waste Collection Points			
16	To submit results of environmental monitoring to JICA, by using the monitoring form, on a quarterly basis as a part of Project Monitoring Report	during the Improvement Work of Waste Collection Points	CUA	-	

(3) After the Project

No.	Items	Deadline	In charge	Estimated Cost	Ref.
1	To implement EMP and EMoP	After completion of the procurement	CUA	-	
2	To submit results of environmental monitoring to JICA, by using the monitoring form, semiannually - The period of environmental monitoring may be extended if any significant negative impacts on the environment are found. The extension of environmental monitoring will be decided based on the agreement between CUA and JICA.	for 3 years after the Project	CUA	-	
3	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid 1) Allocation of personnel and budget for operation and maintenance 2) Operation and maintenance of equipment 3) Supervision of the concession contract for operation and maintenance 4) Monitoring of service implementation status and regular inspection	After completion of the procurement	CUA	5,770 million MGA/year	

2. Other obligations of the Government of Madagascar funded with the Grant

No.	Items	Deadline	Amount (Million Japanese Yen)*
1	To provide equipment 1) To conduct the following transportation: a) Marin (Air) transportation of the products from Japan to the country of the Recipient b) Internal transportation from the port of disembarkation to the project site		/
2	To implement detailed design, bidding support and procurement supervision (Consulting Service)		
	Total		

* The Amount is provisional. This is subject to the approval of the Government of Japan.

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Annex 6

<p><u>Project Monitoring Report</u> on <u>Project Name</u> Grant Agreement No. <u>XXXXXXX</u> 20XX, Month</p>

Organizational Information

Signer of the G/A (Recipient)	_____ Person in Charge (Designation) _____ _____ Contacts Address: _____ Phone/FAX: _____ Email: _____
Executing Agency	_____ Person in Charge (Designation) _____ _____ Contacts Address: _____ Phone/FAX: _____ Email: _____
Line Ministry	_____ Person in Charge (Designation) _____ _____ Contacts Address: _____ Phone/FAX: _____ Email: _____

General Information:

Project Title	
E/N	Signed date: Duration:
G/A	Signed date: Duration:
Source of Finance	Government of Japan: Not exceeding JPY _____ mil. Government of (_____): _____

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G/A NO. XXXXXXXX
PMR prepared on DD/MM/YY

1: Project Description

1-1 Project Objective

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1-2 Project Rationale

- Higher-level objectives to which the project contributes (national/regional/sectoral policies and strategies)
- Situation of the target groups to which the project addresses

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1-3 Indicators for measurement of "Effectiveness"

Quantitative indicators to measure the attainment of project objectives		
Indicators	Original (Yr)	Target (Yr)
Qualitative indicators to measure the attainment of project objectives		

2: Details of the Project

2-1 Location

Components	Original <i>(proposed in the outline design)</i>	Actual
1.		

2-2 Scope of the work

Components	Original* <i>(proposed in the outline design)</i>	Actual*
1.		

Reasons for modification of scope (if any).

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G/A NO. XXXXXXXX
 PMR prepared on DD/MM/YY

(PMR)

2-3 Implementation Schedule

Items	Original		Actual
	(proposed in the outline design)	(at the time of signing the Grant Agreement)	

Reasons for any changes of the schedule, and their effects on the project (if any)

2-4 Obligations by the Recipient

2-4-1 Progress of Specific Obligations
 See Attachment 2.

2-4-2 Activities
 See Attachment 3.

2-4-3 Report on RD
 See Attachment 11.

2-5 Project Cost

2-5-1 Cost borne by the Grant(Confidential until the Bidding)

Components			Cost (Million Yen)	
	Original (proposed in the outline design)	Actual (in case of any modification)	Original ^{1),2)} (proposed in the outline design)	Actual
1.				
Total				

Note: 1) Date of estimation:
 2) Exchange rate: 1 US Dollar = Yen

2-5-2 Cost borne by the Recipient

Components			Cost (1,000 Taka)	
	Original (proposed in the outline design)	Actual (in case of any modification)	Original ^{1),2)} (proposed in the outline design)	Actual

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G/A NO. XXXXXXXX
PMR prepared on DD/MM/YY

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Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar =

Reasons for the remarkable gaps between the original and actual cost, and the countermeasures (if any)

(PMR)

2-6 Executing Agency

- Organization's role, financial position, capacity, cost recovery etc,
- Organization Chart including the unit in charge of the implementation and number of employees.

Original (at the time of outline design)
name:
role:
financial situation:
institutional and organizational arrangement (organogram):
human resources (number and ability of staff):

Actual (PMR)

2-7 Environmental and Social Impacts

- The results of environmental monitoring based on Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- The results of social monitoring based on in Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- Disclosed information related to results of environmental and social monitoring to local stakeholders (whenever applicable).

3: Operation and Maintenance (O&M)

3-1 Physical Arrangement

- Plan for O&M (number and skills of the staff in the responsible division or section, availability of manuals and guidelines, availability of spareparts, etc.)

Original (at the time of outline design)

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G/A NO. XXXXXXXX
 PMR prepared on DD/MM/YY

Actual (PMR)

3-2 Budgetary Arrangement
 - Required O&M cost and actual budget allocation for O&M

Original (at the time of outline design)

Actual (PMR)

4: Potential Risks and Mitigation Measures

- Potential risks which may affect the project implementation, attainment of objectives, sustainability
- Mitigation measures corresponding to the potential risks

Assessment of Potential Risks (at the time of outline design)

Potential Risks	Assessment
1. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
2. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
3. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Contingency Plan (if applicable):

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G/A NO. XXXXXXX
PMR prepared on DD/MM/YY

	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
	Contingency Plan (if applicable):
Actual Situation and Countermeasures (PMR)	

5: Evaluation and Monitoring Plan (after the work completion)

5-1 Overall evaluation

Please describe your overall evaluation on the project.

5-2 Lessons Learnt and Recommendations

Please raise any lessons learned from the project experience, which might be valuable for the future assistance or similar type of projects, as well as any recommendations, which might be beneficial for better realization of the project effect, impact and assurance of sustainability.

5-3 Monitoring Plan of the Indicators for Post-Evaluation

Please describe monitoring methods, section(s)/department(s) in charge of monitoring, frequency, the term to monitor the indicators stipulated in 1-3.

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G/A NO. XXXXXXXX
PMR prepared on DD/MM/YY

Attachment

1. Project Location Map
2. Specific obligations of the Recipient which will not be funded with the Grant
3. Monthly Report submitted by the Consultant
Appendix - Photocopy of Contractor's Progress Report (if any)
 - Consultant Member List
 - Contractor's Main Staff List
4. Check list for the Contract (including Record of Amendment of the Contract/Agreement and Schedule of Payment)
5. Environmental Monitoring Form / Social Monitoring Form
6. Monitoring sheet on price of specified materials (Quarterly)
7. Report on Proportion of Procurement (Recipient Country, Japan and Third Countries) (PMR (final) only)
8. Pictures (by JPEG style by CD-R) (PMR (final) only)
9. Equipment List (PMR (final) only)
10. Drawing (PMR (final) only)
11. Report on RD (After project)

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Attachment 6

Monitoring sheet on price of specified materials

1. Initial Conditions (Confirmed)

Items of Specified Materials	Initial Volume A	Initial Unit Price (¥) B	Initial total Price C=A×B	1% of Contract Price D	Condition of payment Price (Decreased) E=C-D	Condition of payment Price (Increased) F=C+D
Item 1	●●t	●	●●	●	●	●
Item 2	●●t	●	●●	●	●	
Item 3						
Item 4						
Item 5						

2. Monitoring of the Unit Price of Specified Materials

(1) Method of Monitoring : ●●

(2) Result of the Monitoring Survey on Unit Price for each specified materials

Items of Specified Materials	1st month, 2015	2nd month, 2015	3rd month, 2015	4th	5th	6th
Item 1	●	●	●			
Item 2						
Item 3						
Item 4						
Item 5						

(3) Summary of Discussion with Contractor (if necessary)

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Attachment 6

Report on Proportion of Procurement (Recipient Country, Japan and Third Countries)
 (Actual Expenditure by Construction and Equipment each)

	Domestic Procurement (Recipient Country) A	Foreign Procurement (Japan) B	Foreign Procurement (Third Countries) C	Total D
Construction Cost	(A/D%)	(B/D%)	(C/D%)	
Direct Construction Cost	(A/D%)	(B/D%)	(C/D%)	
others	(A/D%)	(B/D%)	(C/D%)	
Equipment Cost	(A/D%)	(B/D%)	(C/D%)	
Design and Supervision Cost	(A/D%)	(B/D%)	(C/D%)	
Total	(A/D%)	(B/D%)	(C/D%)	

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5. Drawings of Landfill Management Plan (Emergency Management Measures)

Table below shows a list of schematic blueprints of the facilities to be cooperated. Each drawing is shown on the following pages.

Table List of Outline Design Drawing

Classification	Drawing Name	Drawing No.
Civil Engineering	Plan	Figure 1
	Plan & Section	Figure 2
	Construction Plan (Phase1)	Figure 3
	Construction Plan (Phase2)	Figure 4
	Construction Plan (Phase3)	Figure 5
	Construction Plan (Phase Last)	Figure 6
	Landfill Procedure Diagram	Figure 7
	Landfill Operation Method	Figure 8

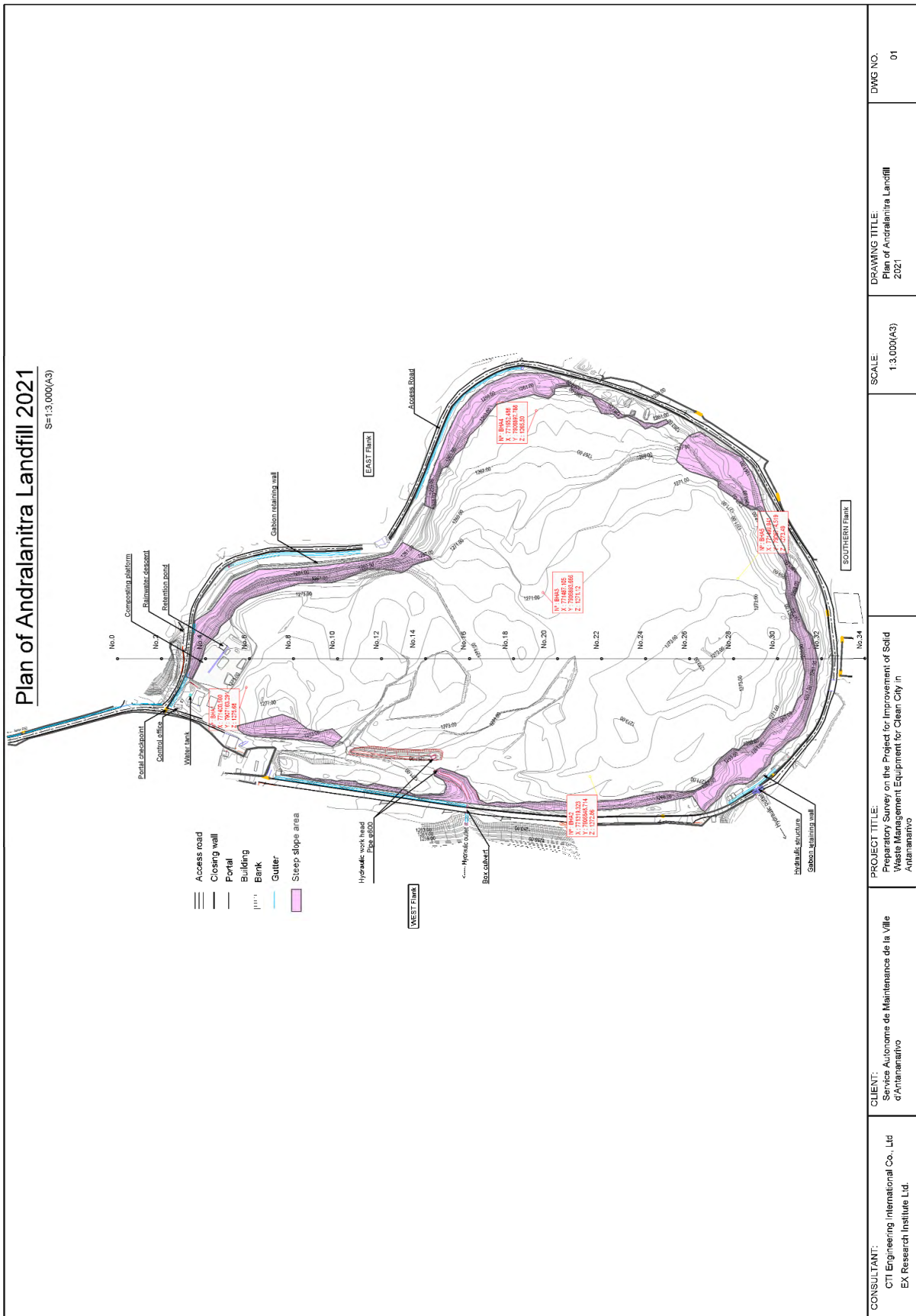


Figure 1 Plan

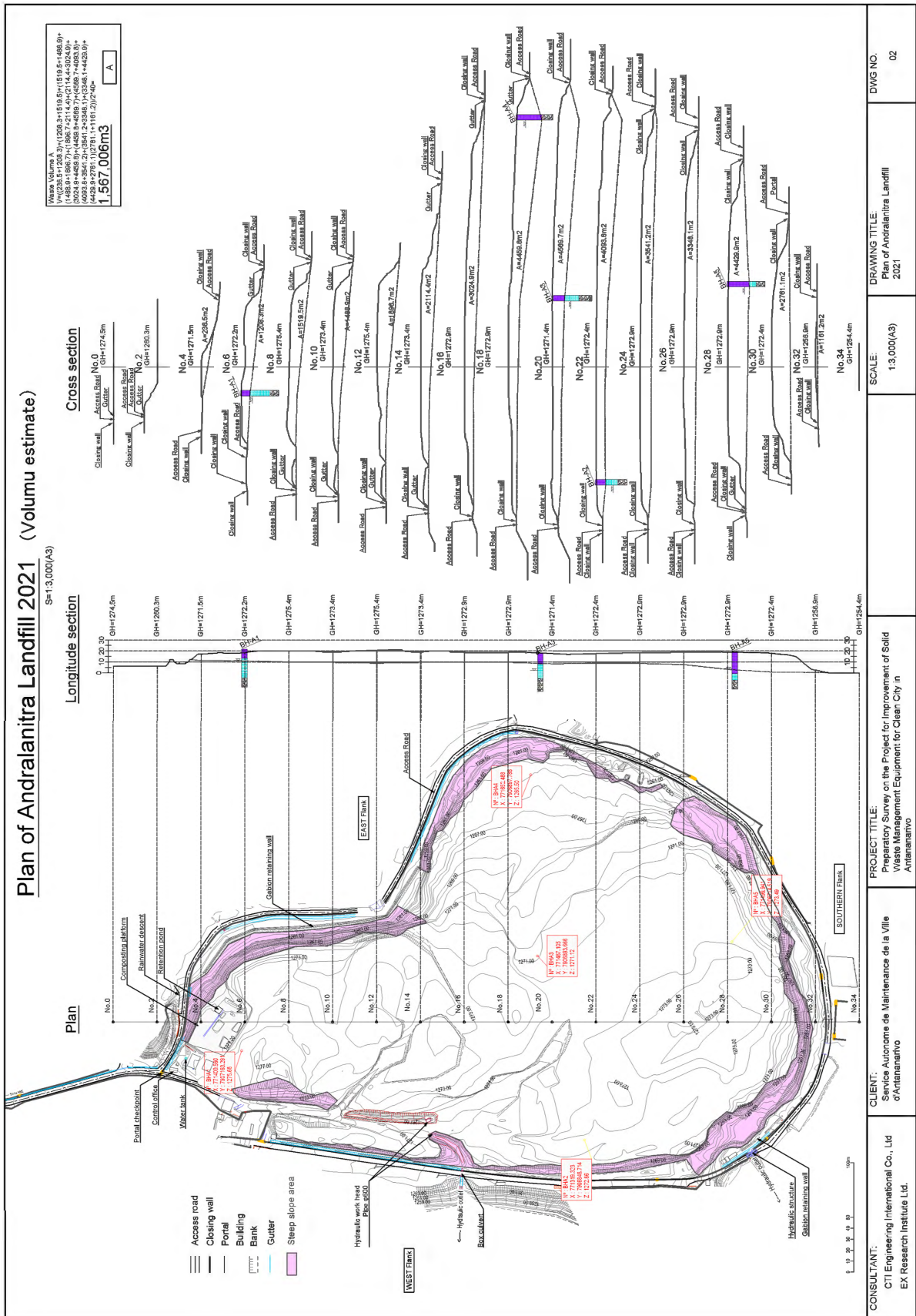


Figure 2 Plan & Section

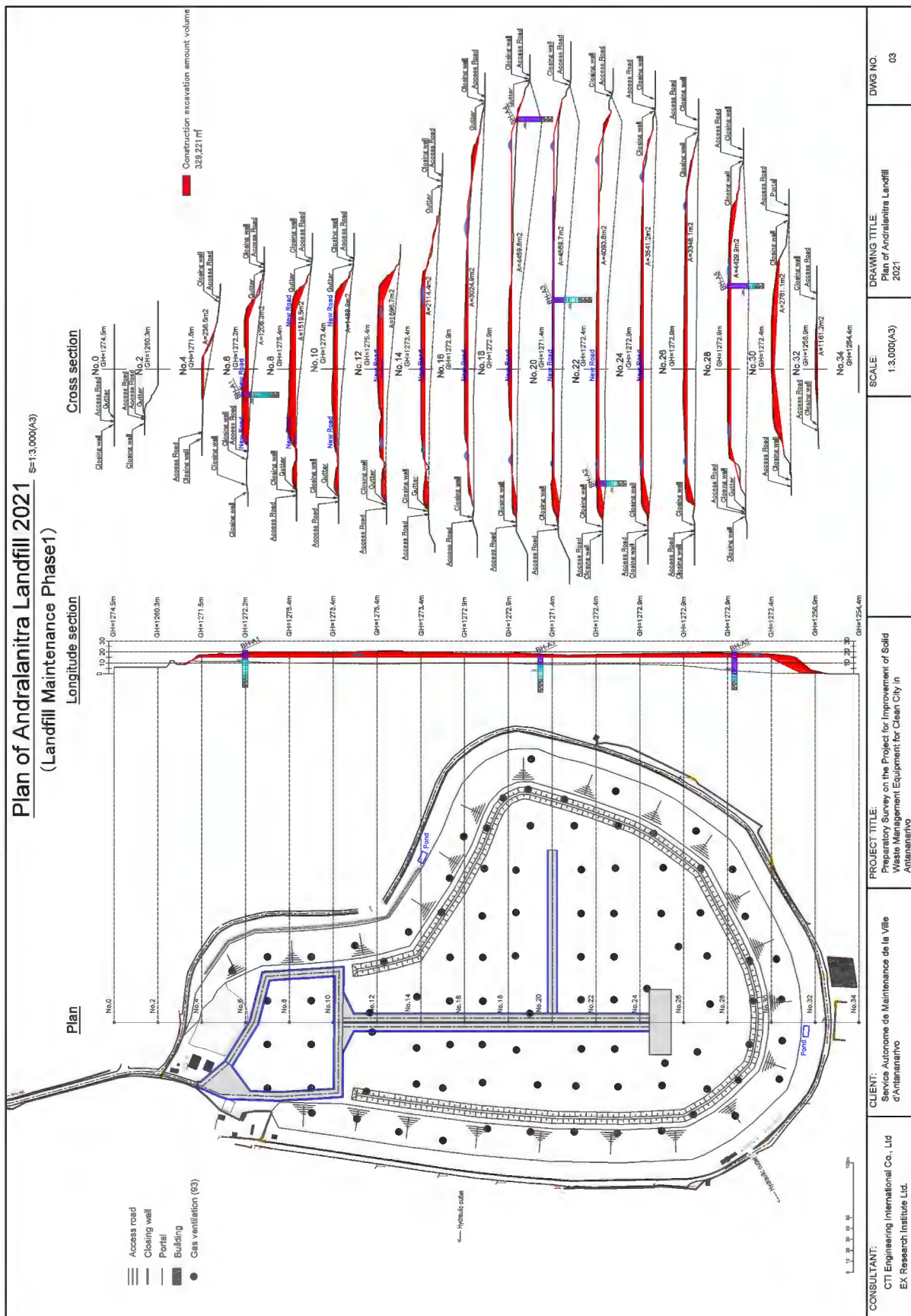


Figure 3 Construction Plan (Phase1)

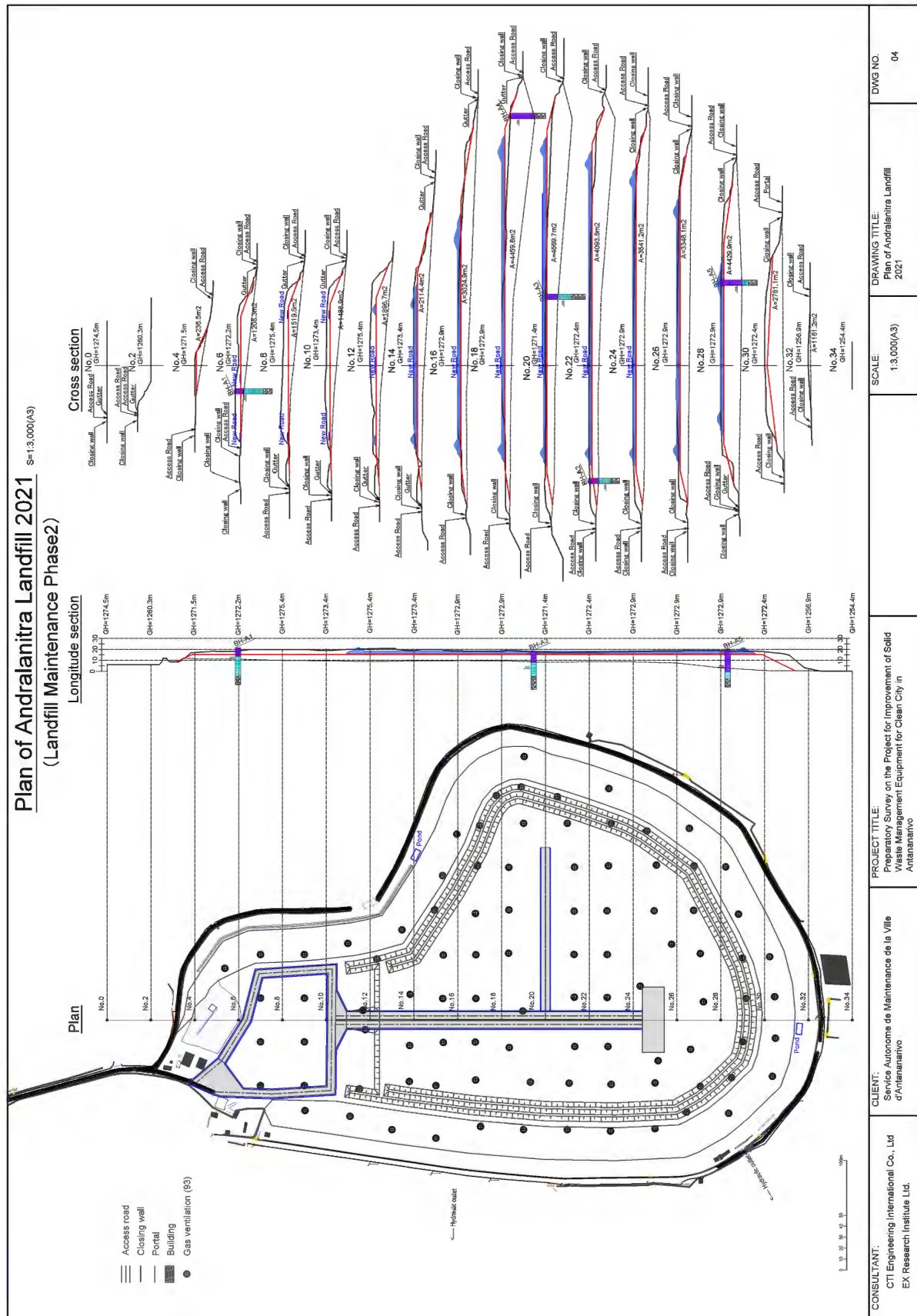
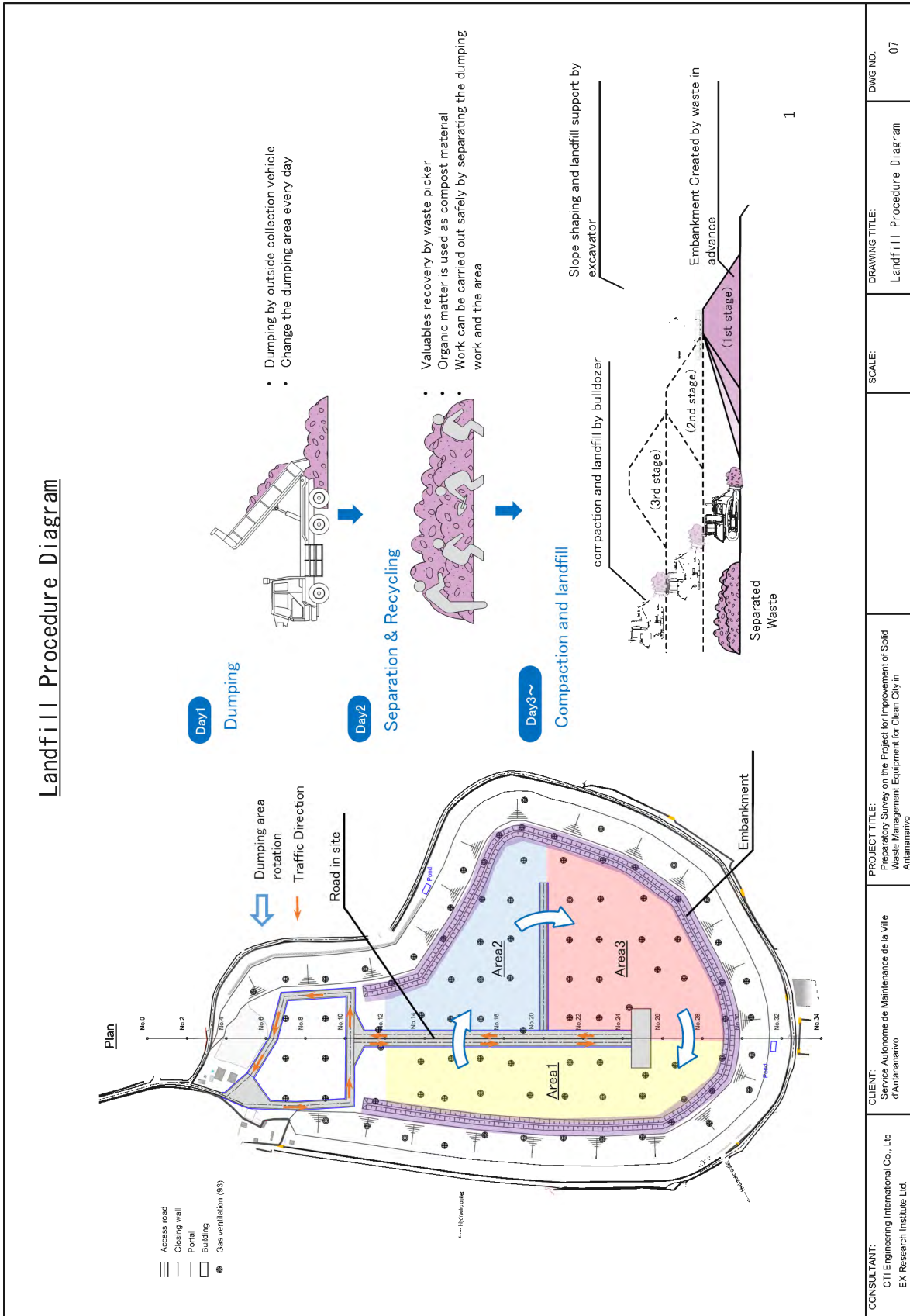


Figure 4 Construction Plan (Phase2)



CONSULTANT: CII Engineering International Co., Ltd EX Research Institute Ltd.	CLIENT: Services Autonomie de Maintenance de la Ville d'Antananarivo	PROJECT TITLE: Preparatory Survey on the Project for Improvement of Solid Waste Management Equipment for Clean City in Antananarivo	SCALE:	DRAWING TITLE: Landfill Procedure Diagram	DWG NO. 07
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Figure 7 Landfill Procedure Diagram

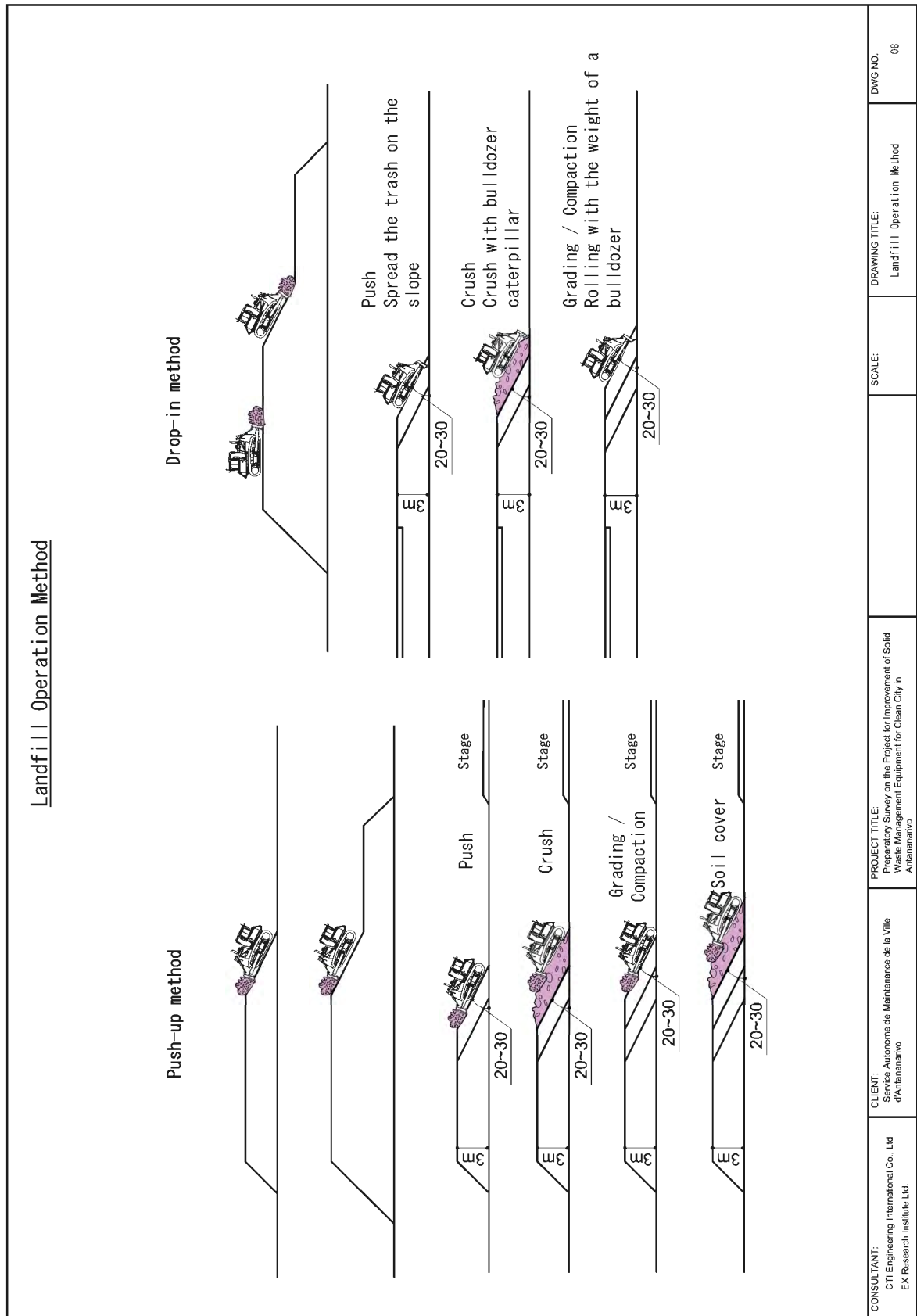


Figure 8 Landfill Operation Method