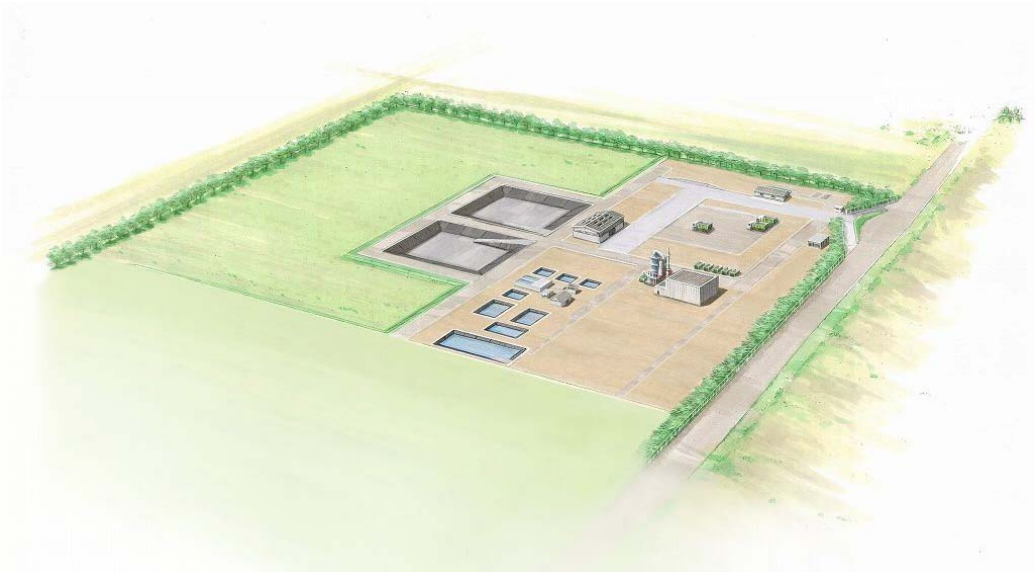
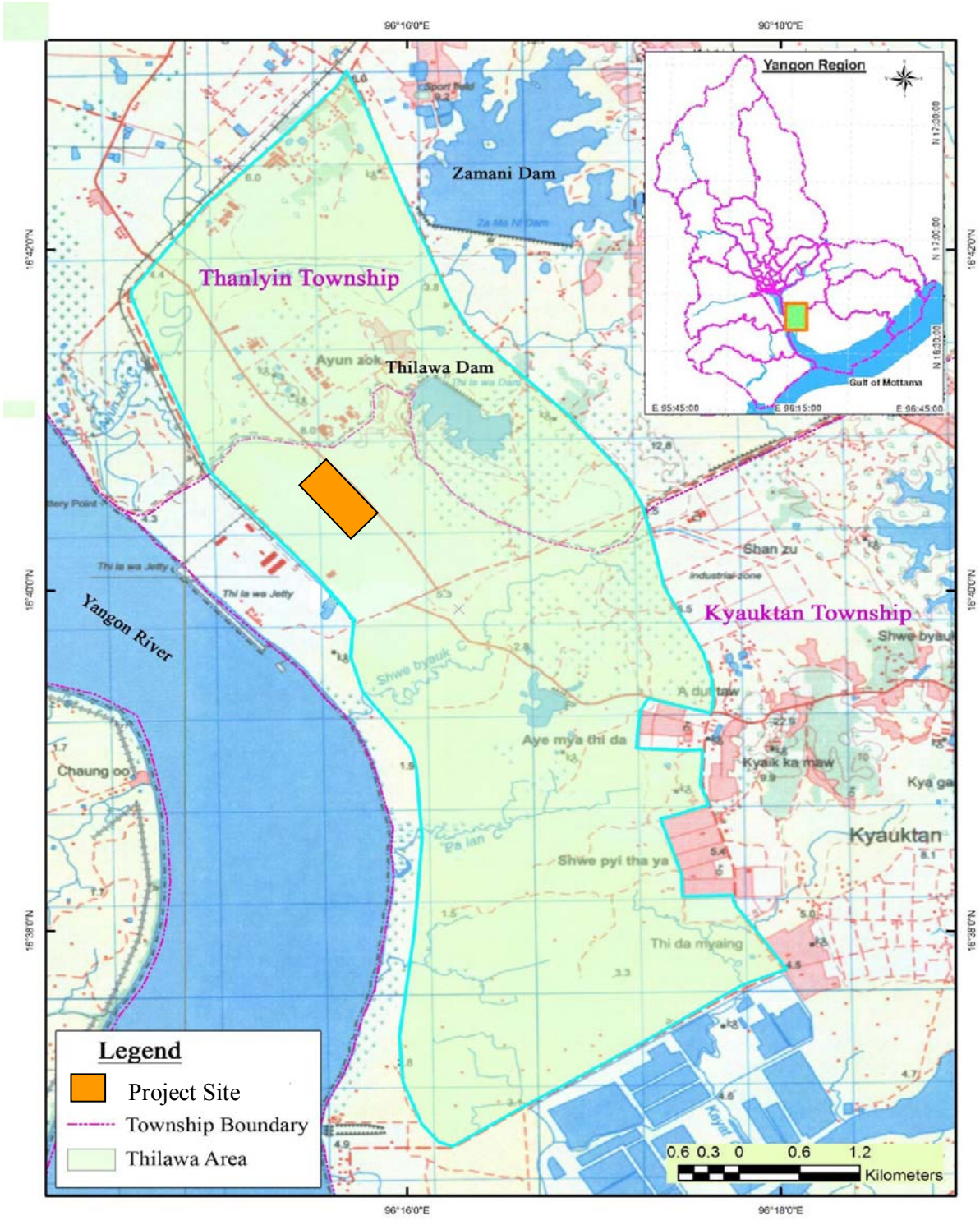
PROJECT ON CONSTRUCTION OF SOLID WASTE MANAGEMENT FACILITIES IN THE THILAWA SEZ ZONE A

FINAL ENVIRONMENTAL IMPACT ASSESSMENT REPORT



June 2015

GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD.



Project Location Map

Ministry of Environmental Conservation and Forestry
Office No. (28), Ottrathiri Township
Nay Pyi Taw, Myanmar

Attention: His Excellency Mr. Win Tun
Union Minister
Ministry of Environmental Conservation and Forestry

Subject: **Environmental Impact Assessment (EIA) Report in respect of the "Construction of Solid Waste Management Facilities in Thilawa SEZ Zone A" Project (the EIA report including Environmental Management Plan (EMP))**

Dear Sir,

We refer to the captioned EIA report, which was prepared and finalized by Nippon Koei Co., Ltd., which is an EIA consulting company as the third party, in accordance with Environmental Conservation Law, Rules and Procedures under the instruction of the Ministry of Environmental Conservation and Forestry and formally submitted to the Ministry of Environmental Conservation and Forestry.

Intending to be legally bound hereby and financially liable to the Ministry of Environmental Conservation and Forestry here under, we:

a. Endorse and confirm to the Ministry of Environmental Conservation and Forestry the accuracy and completeness of the EIA.
b. Confirm and undertake to the Ministry of Environmental Conservation and Forestry that the EIA has been prepared in strict compliance with applicable laws, rules, regulations and procedures including Environmental Conservation Law, Rules and Procedures.
c. Confirm and undertake to the Ministry of Environmental Conservation and Forestry that the project company established by Nippon Koei Co., Ltd. in respect of the "Construction of Solid Waste Management Facilities in Thilawa SEZ Zone A" project shall at all times comply fully with: (i) any and all commitments and obligations as set forth in the EIA, and (ii) any and all plans and the various components thereof, including without limitation, impact avoidance, mitigation, and remediation measures, and with respect to both (i) and (ii), including but not limited to such commitments,

obligations, plans and measures related to the development, construction, commissioning, operation and maintenance of the project, and any circumstance in which work done or to be done, or services performed or to be performed, in connection with the project's development, construction, commissioning, operation and maintenance is carried out or intended or required to be carried out by any contractor, subcontractor or other party.

The issuance of this confirmation has been duly authorized by granting singing authorization to Mr. Jun YAMAMOTO, Managing Director of GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD..

Jun YAMAMOTO (Mr.)

Managing Director

GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD.

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LIST OF ABBREVIATIONS

AIDS	Acquired Immunodeficiency Syndrome
As	Arsenic
B	Boron
Ba	Barium
BOD	Biochemical Oxygen Demand
CCTV	Closed-Circuit Television
Cd	Cadmium
CHS	Community Health and Safety
CN	Cyanide
CO	Carbon Monoxide
COD	Chemical Oxygen Demand
Cr	Chromium
Cu	Copper
dB	Decibel
DO	Dissolved Oxygen
DMH	Department of Meteorology and Hydrology
DXNs	Dioxins and Dioxin-like Compounds
EC	Electrical Conductivity
ECL	Environmental Conservation Law
ECRs	Environmental Conservation Rules
EHS	Environmental, Health, and Safety
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPAS	Environmental Perimeter Air Station
ERA	Emergency Risk Assessment
Fe	Iron
F/S	Feasibility Study

FDI	Foreign Direct Investment
HCL	Hydrochloric Acid
HCN	Hydrogen Cyanide
Hg	Mercury
HIA	Health Impact Assessment
HIV	Human Immunodeficiency Virus
H_2S	Hydrogen Sulfide
IEE	Initial Environmental Examination
IFC	International Finance Cooperation
ISO	International Organization for Standardization
IUCN	International Union for Conservation of Natural Resource
JICA	Japan International Cooperation Agency
La	Vibration as Accretion
L_{Aeq}	A-weighted Equivalent Sound Level
Lv	Vibration as Velocity
Mn	Manganese
MOECAF	Ministry of Environmental Conservation and Forestry
MOI	Ministry of Industry
MOT	Ministry of Transport
NH_4	Ammonium
Ni	Nickel
NO_2	Nitrite
NO_3	Nitrate
NO_x	Nitrogen Oxide
OHS	Occupational Health and Safety
ORP	Oxidoreduction Potential
Ox	Oxygen
Pb	Lead
PM_{10}	Particle Matter 10
$PM_{2.5}$	Particle Matter 2.5
PO_4	Phosphate

PPE	Personal Protective Equipment
ppm	parts per million
PR/CR	Public Relations/Company Relations
Se	Selenium
SEZ	Special Economic Zone
SIA	Social Impact Assessment
SO_2	Sulfur Dioxide
SPM	Suspended Particulate Matter
SWM	Solid Waste Management
TOR	Terms of Reference
TSMC	Thilawa SEZ Management Committee
TSP	Total Suspended Particulates
US.EPA	United States Environmental Protection Agency
WHO	World Health Organization
YCDC	Yangon City Development Committee
Zn	Zinc

CHAPTER 1: INTRODUCTION

1.1 Project Proponent/Owner

1.1.1 Project Proponent

GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD.

Address: Lot No. E1, Thilawa SEZ Zone A, Myanmar

1.1.2 Project Owner

DOWA ECO-SYSTEM CO., LTD.

Address: 14-1, Sotokanda 4-Chome Chiyoda-ku, Tokyo 101-0021 Japan

1.2 Type of Project and Initial Environmental Examination (IEE)/Environment Impact Assessment (EIA) Requirement

1) Type of Project: Construction of Solid Waste Treatment Facility

2) IEE/EIA Requirement: EIA is required in accordance with the draft EIA procedures because the proposed Project includes disposal of hazardous solid waste, as summarized in Table 1.2-1.

Table 1.2-1: Screening for IEE/EIA Requirement

Type of Investment Project	Size of Project which Require IEE	Size of Project Which Require EIA	Size of the Proposed Project	Screening Results
Disposal of non-hazardous waste	Landfilling <10 t/day, Waste < 25,000 t/day, Other waste substances < 50 t/day	Landfilling ≥ 10 t/day, Waste ≥ 25,000 t/day, Other waste substances ≥ 50 t/day	10,000-30,000 t/year (30-80 t/day) of non-hazardous and hazardous wastes will be received. Some of the waste will be disposed to landfill for non-hazardous waste.	EIA may be required.
Incinerator for non-hazardous waste	< 3 t/hour	≥ 3 t/hour	Capacity of incinerator will be 20 t/day (less than 1 t/hour)	IEE is required.
Recycling plant of non-hazardous waste (house use waste)	< 50 t/day	≥ 50 t/day	10,000-30,000 t/year (30-80 t/day) of non-hazardous and hazardous wastes will be received. Some of the waste will be disposed to landfill for non-hazardous waste.	EIA may be required.
Disposal of hazardous solid waste	-	All sizes	The proposed Project will receive hazardous waste.	EIA is required.
Recycling plant of hazardous waste	< 10 t/day	≥ 10 t/day	10,000-30,000 t/year (30-80 t/day) of non-hazardous and hazardous wastes will be received. Some of the waste will be disposed to landfill for non-hazardous waste.	EIA may be required.

Source: EIA Study Team

1.3 Implementing Organizations for Environmental Impact Assessment

The organizations in charge of implementation of EIA are presented in Table 1-3.1. Furthermore, the members of the EIA Study Team are listed in Table 1.3-2, and the curriculum vitae (CVs) of the experts for the EIA Study are attached in Appendix-1.

Table 1.3-1: Organizations in Charge of EIA Study

Organization	Name of Organization	Address	Responsibility
Leading organization	Nippon Koei Co., Ltd. (NK)	4, 5-chome, Chiyoda-ku Tokyo, Japan	Overall management and technical aspect of EIA
Supporting organization	Myanmar Koei International Co., Ltd. (MKI)	No.1A/28, Mya Thidar Housing Ward II, South Okkalapa Township, Yangon	Field survey and stakeholder meeting
	Resource and Environment Myanmar Ltd. (REM)	702 Delta Plaza, Shwegondaing Road, Bahan Township, Yangon	Field survey

Source: EIA Study Team

Table 1.3-2: Members of the EIA Study Team

Name of Organization	Position	Background	Years of Experience
Nippon Koei Co., Ltd.	Team Leader	M. Eng. (Global Architecture) B. Eng. (Naval Architecture and Ocean Engineering)	15 years
	Social Impact Assessment (SIA), Health Impact Assessment (HIA), Emergency Risk Assessments (ERA) and Solid Waste Management Expert	M. Eng. (Environmental Management) B. Eng. (Environmental Engineering)	12 years
	Solid Waste Management Expert	B. Eng. (Civil Engineering)	15 years
	EIA Expert (Air)	B. Eng. (Civil Engineering)	20 years
	EIA Expert (Noise and Vibration)	M. Eng. (Urban and Environmental Engineering) B. Eng. (Civil Engineering)	12 years
	EIA Expert (Groundwater)	M. Eng. (Chemical Engineering) B. Eng. (Chemical Engineering)	8 years
	EIA Expert (Offensive Odor)	M. Sc. (Frontier Science) B. Agr. (Agriculture)	2 years
Myanmar Koei International Co., Ltd.	Technical Manager	M. Sc. (Forest Science) B.Sc. (Biology)	19 years
	Coordinator/ Noise and Vibration Survey	Ph.D. (Agricultural Science) M.Sc. (Agricultural Science) B.Sc. (Forestry)	3 years
Resource and Environment Myanmar Ltd.	Team Leader of Water, Soil, Air Quality Baseline Survey	M.Sc. (Geology) B.Sc. (Geology)	19 years
	Water Quality and Soil Quality Survey	M.Sc. (Geology) B.Sc. (Geology)	11 years
	Air Quality Survey	B.Sc. (Geology)	5 years

Source: EIA Study Team

1.4 Overall Framework of Environmental Impact Assessment

As of May 2015, there is no enacted legislation on detailed legal process of EIA in Myanmar. However, the Ministry of Environmental Conservation and Forestry (MOECAF) has been developing EIA regulations which define the detailed legal process regarding EIA procedures including preparation of EIA/IEE report, environmental management plan (EMP), public involvement, approval of EIA/IEE report by MOECAF, and monitoring process after approval of EIA/IEE report. In this regard, the Project proponent decided to prepare an independent EIA report including EMP.

At the beginning of the EIA Study, the Project proponent had meetings with MOECAF in June 2014 and confirmed the EIA requirements and process of submission of documents related to EIA in the Thilawa Special Economic Zone (SEZ). Accordingly, the first stakeholder meeting was held on 29 August 2014 to introduce the draft project description, and general environmental and social conditions in the surrounding area.

The draft EIA report was prepared considering the scoping document, results of field surveys, detailed project description, EIA reports on solid waste treatment facility projects in Japan, technical guidelines such as the Environmental, Health and Safety Guidelines of the International Finance Corporation (IFC), and guidance from MOECAF. The draft EIA report was introduced in the second stakeholder meeting held on 1 October 2014, and disclosed to public for gathering comments for two weeks. The Project proponent received four comments which were incorporated into the draft EIA report. Then, the draft EIA report was finalized based on the comments from the stakeholders and submitted to MOECAF through Thilawa SEZ Management Committee (TSMC) on 14 October 2014.

On a parallel with reviewing the draft EIA Report by MOECAF, the Project proponent submitted Environmental Conservation and Protection Plan (ECPP), which is similar document as EMP and a requirement of commencement of the construction, to TSMC on 25 November 2014. Then, TSMC issued the approval letter of ECPP on 23 December 2014 (Reference No. TSEZ-EP-003) with a condition on submission of the Final EIA Report before the commencement of commercial operation with necessary modification based on the comments from MOECAF.

The final EIA Report is prepared and submitted to MOECAF through TSMC with some modification based on the MOECAF comments on 11 March 2015 (No. 2/220 (B) (6)/ (1800/2015)) and comments from communities and public. The overall schedule of EIA is shown in Table 1.4-1.

Table 1.4-1: Overall Schedule of Environmental Impact Assessment

Item	2014						
	May	June	July	August	September	October	November
1. Kick-off Meeting with MOECAF		▲					
2. Examination of EIA Framework							
Review of project description							
Analysis of latest legal documents							
Setting environmental target levels							
2. Scoping for EIA Investigation							
Preparation of draft scoping document							
Stakeholder meeting for scoping document				▲			
Wrap-up Meeting with MOECAF				▲			
3. EIA Investigation							
Metrology		▲	▲				
Air Quality		▲	▲				
Water Quality		▲	▲				
Soil Quality		▲					
Noise & Vibration			▲				
Documentary survey							
4. EIA Report Preparation							
Preparation of draft EIA report							
Stakeholder meeting for draft EIA report with public disclosure						▲	
Submission of draft EIA report to MOECAF							▲
Review of draft EIA report by MOECAF							

Item	2014	2015					
	December	January	February	March	April	May	June
Review of the draft EIA report by MOECAF				▲			
Community consultations	▲				▲	▲	
Finalization of the EIA report							
Public Disclosure							
Submission of the final EIA report to TSMC and MOECAF							▲
Approval of the final EIA report by the TSMC							▲

Source: EIA Study Team

CHAPTER 2: POLICY FOR ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

2.1 Project's Policy for Environmental and Social Considerations

2.1.1 Related Laws and Regulations

The protection and conservation of the natural environment is originally declared by the Constitution of the Republic of the Union of Myanmar (2008). The Environmental Conservation Law (ECL) as a fundamental environmental law was enacted in 2012. The ECL lays down the basic principles and gives guidance for systematic integration of matters on environmental conservation. It specifies that the Ministry of Environmental Conservation and Forestry (MOECAF) is responsible for the enforcement of environmental conservation policies, development of environmental management plans, implementation of environmental monitoring, setting of environmental standards, management of hazardous waste, and the development and implementation of a system for environmental impact assessment and social impact assessment, etc. In 2014, the Environmental Conservation Rules (ECRs) was issued as a bylaw of the ECL, and provided detailed rules on the enforcement of the requirements of the ECL.

Also, the conservation of each natural resource and the urban environment has been specified by each sector's laws and regulations, such as the Protection of Wildlife and Wild Plants and Conservation of Natural Areas Law (1994), National Environment Policy (1994), and Conservation of Water Resources and Rivers Law (2006). Table 2.1-1 summarizes the major environmental laws and regulations in Myanmar.

Table 2.1-1: List of Environmental Laws and Regulations Relevant to Environmental Conservation

No.	Name of Law	Note
1	Criminal Law (1891),	-
2	The Land Acquisition Act (1894),	-
3	Underground Water Act (1930)	-
4	Factories Act (1951)	-
5	Leave and Holidays Act (1951).	-
6	Public Health Law (1972)	-
7	Territorial Sea and Maritime Zone Law (1977)	-
8	Irrigation Law and Regulations (1982)	-
9	Law on Aquaculture (1989)	-
10	Marine Fisheries Law (1990)	-
11	Freshwater Fisheries Law (1991)	-
12	Forest Law (1992)	-
13	Myanmar Insurance Law (1993),	-
14	Protection of Wildlife and Wild Plants and Conservation of Natural Areas Law (1994)	-
15	National Environment Policy (1994)	-
16	Mines Law (1994)	-
17	Prevention of Hazard from Chemicals and Related Substances Law (2003)	-
18	Conservation of Water Resources and Rivers Law (2006)	-
19	Myanmar Special Economic Zone Law (2011)	-
20	Environmental Conservation Law (2012)	-
21	Farmland Law (2012)	-
22	Farmland Rules (2012)	-
23	Foreign Investment Law (2012)	-
24	Social Security Law (2012)	-
25	Minimum Wage Law (2013)	-

No.	Name of Law	Note
26	Foreign Investment Rules (2013)	-
27	Business for Ozone Depleting Substances: Notification No. 37/2014	-
28	Myanmar Investment Commission: Notification No.1/2013 and No.50/2014	-
29	Environmental Conservation Rules (2014)	-
30	Thilawa Special Economic Zone Law (2014)	-
31	Social Security Rules (2014)	-
32	Law on Standardization (2014)	-
33	Draft EIA Procedures	In process

Source: EIA Study Team

In principle, the Project proponent shall comply with the current laws, regulations, notifications, instructions and procedures enacted by Myanmar Government and relevant regional authorities as well as those related to the environmental conservation specified by MOECAF and other relevant authorities.

Specifically, Project proponent shall adhere to the following policies based on the ECL and ECRs regarding the environmental requirements for an industrial business owner in a special economic zone (SEZ):

- To carry out by contributing the stipulated cash or kind in the relevant combined scheme for the environmental conservation including the management and treatment of waste (Article 16 (a), ECL),
- To contribute the stipulated users charges or management fees for the environmental conservation according to the relevant industrial estate, special economic zone and business organization (Article 16 (b), ECL),
- To comply with the directives issued for environmental conservation according to the relevant industrial estate, special economic zone, or business (Article 16 (c), ECL),
- To prepare an environmental impact assessment system and submit to the MOECAF (Article 55, ECRs), and
- To implement and carry out an environmental management plan within the time stipulated by MOECAF and submit the performance situation to MOECAF (Article 55, ECRs).

2.2 Quantitative Target Levels for Consideration of Surrounding Environment

2.2.1 Necessity of Quantitative Target Levels

MOECAF is supposed to set the following environmental quality standards with the approval of the Union Government and the Environmental Conservation Committee, according to the ECL:

(a) Suitable surface water quality standards for rivers, streams, canals, springs, marshes, swamps, lakes, reservoirs, and other inland water sources of the public;
(b) Water quality standards for coastal and estuarine areas;
(c) Underground water quality standards;
(d) Atmospheric quality standards;
(e) Noise and vibration standards;
(f) Emissions standards;
(g) Effluent standards;
(h) Solid waste standards; and
(i) Other environmental quality standards stipulated by the Union Government.

Since these environmental quality standards have not been set yet by MOECAF as of December 2014, this EIA Study sets the quantitative target levels on the following parameters which might cause some negative impact on the surrounding environment as indicated in the scoping matrix in Chapter 5:

a) Ambient air quality
b) Emission gas from incineration plant
c) Effluent water quality
d) Noise
e) Vibration

The quantitative target levels were proposed referring to related international guidelines, similar standards of neighboring countries and Japan, and technical capacity such as availability of laboratory for analysis in Myanmar. When the environmental quality standards which shall be applied to this Project are specified by the relevant Ministry of Myanmar Government in the future, the target levels shall be updated with those standards.

2.2.2 Ambient Air Quality

This Project utilizes the target level of ambient air quality, which was adopted for the EIA report for the Thilawa Special Economic Zone (SEZ) (Zone A) Development Project. The current situation is that there is no ambient air quality standard to receptors in Myanmar. Therefore, the EIA report for the Thilawa SEZ Zone A project referred to the international standard, Environmental, Health, and Safety (EHS) Guidelines prepared by the International Finance Corporation (IFC), and other standards in Southeast Asian countries as shown in Table 2.1-2. Based on the reference values in Japan, Thailand, and Vietnam, and of IFC, as shown in Table 2.1-3, the target levels for ambient air quality, as shown in Table 2.1-3, have been set with the following considerations:

- Target parameters of ambient air quality level were decided based on available measurement equipment in Myanmar (SO_2, NO_2, CO, and PM_{10}).
- The averaging period adopted to 24 hours, which could be measured by the available equipment in Myanmar whereas currently it is impossible to implement continuous measure for one month at project site due to battery/ electrical capacities.
- Target ambient air quality levels are referred from the standards of Japan, basically because a huge amount of air quality monitoring data are available on Japan's website. The parameters of PM10 and TSP, which are not covered by standards of Japan, were referred from the standards of Thailand because the applied unit is the same as of Japan's.

Table 2.1-2: Ambient Air Quality Standards in Southeast Asian Countries Japan, and of IFC

Item	Averaging Period	Japan[*1]	Thailand[*2]	Vietnam[*3]	IFC[*4]
SO_2	10 min	-	-	-	0.5 mg/m^3
	1 hour	0.1 ppm	0.3 ppm	0.35 mg/m^3	0.125 mg/m^3(Interim Target-1) 0.05 mg/m^3(Interim Target-2) 0.02 mg/m^3(Guideline)
	24 hours	0.04 ppm	0.12 ppm	0.125 mg/m^3	-
	1 year	-		0.05 mg/m^3	-
NO2	1 hour	-	0.17 ppm	-	0.2 mg/m^3
	24 hours	0.04-0.06 ppm	-	-	-
	1 year	-	0.03 ppm	-	0.04 mg/m^3
NOx	1 hour	-	-	0.2 mg/m^3	
	24 hours	-	-	0.04 mg/m^3	
CO	1 hour	--	30 ppm	30 mg/m^3	-
	8 hours	20 ppm	-	10 mg/m^3	-
	24 hours	10 ppm	9 ppm	-	-
TSP	1 hour	-	-	0.3 mg/m^3	-
	24 hours	-	0.33 mg/m^3	0.2 mg/m^3	-
	1 year		0.10 mg/m^3	0.14 mg/m^3	-
PM_{10}	24 hours	-	0.12 mg/m^3	0.15 mg/m^3	0.15 mg/m^3(Interim Target-1) 0.10 mg/m^3(Interim Target-2)

Item	Averaging Period	Japan*1	Thailand*2	Vietnam*3	IFC*4
					0.07 mg/m^3(Interim Target-3) 0.05 mg/m^3(Guideline)
	1 year	-	0.05 mg/m^3	0.05 mg/m^3	0.07 mg/m^3(Interim Target-1) 0.05 mg/m^3(Interim Target-2) 0.03 mg/m^3(Interim Target-3) 0.02 mg/m^3(Guideline)
SPM	1 hour	0.2 mg/m^3	-	-	-
	24 hours	0.1 mg/m^3	-	-	-
$PM_{2.5}$	24 hours	0.035 mg/m^3	0.05 mg/m^3	-	0.075 mg/m^3(Interim Target-1) 0.05 mg/m^3(Interim Target-2) 0.0375 mg/m^3(Interim Target-3) 0.025 mg/m^3(Guideline)
	1 year	0.015 mg/m^3	0.025 mg/m^3	-	0.035 mg/m^3(Interim Target-1) 0.025 mg/m^3(Interim Target-2) 0.015 mg/m^3(Interim Target-3) 0.01 mg/m^3(Guideline)
Ozone	1 hour	-	0.10 ppm	0.3 mg/m^3	-
	8 hours daily maximum	-	0.07 ppm	0.2 mg/m^3	0.16 mg/m^3(Interim Target-1) 0.1 mg/m^3(Guideline)
	1 year	-	0.04 ppm	0.14 mg/m^3	-
Ox	1 hour	0.06 ppm	-	-	-
Pb	24 hours	-	-	0.0015 mg/m^3	
	1 month	-	0.0015 mg/m^3	-	
	1 year	-	-	0.0005 mg/m^3	

Source: EIA Report for the Thilawa Special Economic Zone Development Project (Zone A), 2013

*1) National Air Quality Standards in Japan (Circular No. 25, 1973, originally), Ministry of Environment, Japan

*2) Notifications of National Environmental Board No.10, 24, 28, 33, and 36, Ministry of Natural Resources and Environment, Thailand

*3) National Ambient Air Quality Standard (TCVN5973:2005), Ministry of Science and Technology in Vietnam

*4) Environmental, Health, and Safety Guidelines, General EHS Guidelines, IFC, 2007(originally cited from the Air Quality Guidelines of the World Health Organization)

Table 2.1-3: Target Levels for Ambient Air Quality

Parameters	Averaging Period	Value
SO_2	24 hours	0.04 ppm
NO_2	24 hours	0.06 ppm
CO	24 hours	10 ppm
PM_{10}	24 hours	0.12 mg/m^3

Source: EIA Report for the Thilawa Special Economic Zone Development Project (Zone A), 2013

2.2.3 Emission Gas from the Incineration Plant

Since there is no official standard for emission gas in Myanmar and the EIA report for the Thilawa SEZ Zone A project did not cover the quantitative target levels for emission gas in its scope, the environmental criteria for emission gas in Japan are referred to in this case in consideration of the following matters:

- The incinerator to be installed for this Project will be made by a Japanese manufacturer that usually complies with the Japanese government's requirements.
- The Japanese basic act regulating emission gas was established more than 40 years ago, and it has been well studied and substantiated. The environmental criteria for emission gas were set based on scientific knowledge about short-term and long-term effects on human health.
- Referring to the Japanese criteria will offer some advantages since the same parameter and unit of the standard value can be used and it is easy to be compared with a lot of existing monitoring data in Japan.

The target levels and their basis of selection are shown in Table 2.1-4.

Table 2.1-4: Target Levels for Gas Emission

Parameters	Target Level (O_2 12%)	Source/Reason
TSP	0.15 g/m^3 N	Air Pollution Control Law, Japan
NO_2	250 ppm	For NOx, Air Pollution Control Law, Japan
SO_2	116 ppm *	The standard value for SOx in Japan is calculated considering the total acceptable SOx amount in each area. If the incineration facility with the same specification is constructed in Japan and the strictest standard is used, this target level is applied.
HCL	700 mg/m^3 N	Air Pollution Control Law, Japan
DXNs	5 ng-TEQ/m3	Law Concerning Special Measures against Dioxins, Japan
CO	100 ppm	Waste Disposal and Public Cleansing Law, Japan

Note: *) Calculated by the incineration plant manufacturer
Source: EIA Study Team

2.2.4 Effluent Water Quality

The standard values for effluent water quality is established by the industrial wastewater effluent guideline of the Ministry of Industry (MOI). On the other hand, the Thilawa SEZ Zone A industrial zone plans to set internal regulations on receiving wastewater from tenants connected to the centralized water treatment system.

As the Project will treat wastewater by itself and discharge treated wastewater to the retention channel in the industrial zone and will not connect the wastewater to the central water treatment system, the proponent shall adopt the industrial wastewater effluent guideline of MOI, which is summarized in Table 2.1-5.

After the wastewater standards stipulated by the Government of Myanmar and/or internal standards for the Thilawa SEZ Zone A project are revised, this Project shall follow such regulations and adopt the new or revised standards for the target levels.

Table 2.1-5: Target Levels of Effluent Water Quality

No.	Parameter	Target Level (MOI Regulation)	Unit
1	BOD (5 days at 20 ºC)	max. 20-60	ppm
2	Suspended Solids	max. 30	ppm
3	Total Dissolved Solids	max. 2,000	ppm
4	pH Value	5-9	-
5	Permanganate Value	max. 60 *	ppm
6	Sulphide (as HS)	max. 1	ppm
7	Cyanide (as HCN)	max. 0.2	ppm
8	Oil and Grease	max. 5	ppm
10	Tar	None *	-
11	Formaldehyde	max. 1 *	ppm
12	Phenols and Cresols	max. 1	ppm
13	Free Chlorine	max. 1 *	ppm
14	Zinc	max. 5	ppm
15	Chromium	max. 0.5	ppm
16	Arsenic	max. 0.25	ppm
17	Copper	max. 1.0	ppm
18	Mercury	max. 0.005	ppm
19	Cadmium	max. 0.03	ppm
20	Barium	max. 1.0 *	ppm
21	Selenium	max. 0.02	ppm
22	Lead	max. 0.2	ppm
23	Nickel	max. 0.2	ppm
24	Insecticides	None *	-
25	Radioactive Materials	None *	-
26	Temperature	max. 40	ºC
27	Color	Not objectionable when mixed in receiver water	-

Note: *) Regarding the parameters annotated by asterisk (*), the analysis method is not specified in the regulation or there is no laboratory which can analyze them in Myanmar. Thus, these parameters are not examined in the EIA process. However, when their analysis become feasible in Myanmar in the future, they will be monitored and evaluated.
Source: EIA Study Team

2.2.5 Noise

Since any noise standard in Myanmar has not been established yet, the same target noise level as for the EIA of the Thilawa SEZ Zone A project will be used. The level was decided in reference to the standard in other foreign countries, and that of international organizations, as necessary.

(1) Construction Stage

Regarding the construction stage, only Singapore has a noise standard for construction activities to receptors among Southeast Asian countries as shown in Table 2.1-6. The target noise levels are set as shown in Table 2.1-7 with the following concepts from the experience of the existing EIA Study for the Thilawa SEZ Zone A project:

- Residential houses and monastery located less than 150 m from the construction site shall comply with the middle range of Singapore's standard (categorized as "Residential buildings located less than 150 m"), or
- Buildings other than residential houses and monastery located less than 150 m from the construction site shall comply with the moderate range of Singapore's standard (categorized as "Other buildings").

Table 2.1-6: Noise Standard at the Construction Stage in Various Countries

Items		Daytime (Leq)	Nighttime (Leq)
Japan *1	Using heavy equipment with high noise level (piling, excavation, etc.) at boundary of land	85 dB (Maximum)	-
Singapore*2	Hospitals, schools, institutions of higher learning, homes for the aged, sick, etc.	60 dB (7 a.m.-7 p.m., 12 hr)	50 dB (7:00 p.m.-7:00 a.m., 12 hr)
	Residential buildings located less than 150 m from the construction site where the noise is being emitted	75 dB (7 a.m.-7 p.m., 12 hr)	60 dB (7:00 p.m.-10:00 p.m., 3 hr) 55 dB (10:00 p.m.-7:00 a.m., 9 hr)
	Other buildings	75 dB (7 a.m.-7 p.m., 12 hr)	65 dB (7:00 p.m.-7:00 a.m., 12 hr)
UK*3	In rural, suburban and urban areas away from main road traffic and industrial noise	70 dB (8:00-18:00)	-
	Urban areas near main roads	72 dB (8:00-18:00)	-
USA*4	Residential	80 dB (8 hr)	70 dB (8 hr)
	Commercial	85 dB (8 hr)	85 dB (8 hr)
	Urban area with high ambient noise level (>65 dB)	Ambient Noise Level +10dB	

Note: The noise level for the construction stage by EHS Guidelines, IFC has not been established.
Source: EIA Report for the Thilawa Special Economic Zone Development Project (Zone A), 2013
*1) Noise Regulation Act, Japan (Law No.98, 1968, Amended No.33, 2006)
*2) Environmental Protection and Management Act in Singapore (Chapter 94A, Section 77, Revised in 2008)
*3) British Standard 5228: 1997 "Noise and vibration control on open and construction sites"
*4) Transit Noise and Vibration Impact Assessment, U.S. Department of Transportation in USA, 1995

Table 2.1-7: Target Noise Level at the Construction Phase

Category	Daytime (Leq) (7:00 a.m.-7:00 p.m.)	Evening Time (Leq) (7:00 p.m.-10:00 p.m.)	Nighttime (Leq) (10:00 p.m.-7:00 a.m.)
Residential houses and monastery located less than 150 m	75 dB	60 dB	55 dB
Other buildings	75 dB	65 dB	65 dB

Note) Evaluation point is at the boundary of a building
Source: EIA Report for the Thilawa Special Economic Zone Development Project (Zone A), 2013

(2) Operation Stage

Regarding the operation stage, generally the ambient noise standard has been set in most of the countries in Southeast Asia and it is categorized according to land use and/or environmental sensitivity or condition. It has also been set in Japan and in the EHS Guidelines of IFC. Based on the above

information and reference standards shown in Table 2.1-8, the target noise level is set, as given in Table 2.1-9, according to the following concepts taken from the EIA report for the Thilawa SEZ Zone A project:

- According to the existing EIA Study for the Thilawa SEZ Zone A project, the baseline data of the ambient noise level in this area are 53-60 dB in the daytime (6:00-22:00), and 44-58 dB in the nighttime (22:00-6:00), which were measured in the monastery in Thilawa SEZ (Zone A).
- Ambient noise standard for sensitive areas in Japan and of international organizations are relatively high especially during nighttime in comparison with the results of the baseline survey.
- Thus, the target ambient noise level for sensitive and residential areas is set in accordance with the noise standard in Singapore, which is similar to the ambient noise level of the baseline survey for the Thilawa SEZ Zone A project.

Table 2.1-8: Ambient Noise Standards at the Operation Stage in Southeast Asian Countries

Items		Daytime (Leq)	Nighttime (Leq)
Indonesia*1	Noise standard for sensitive areas such as residences, hospitals, schools, and places of religious worship	55 dB	
	Noise standard for office and commercial areas	65 dB	
	Noise standard for commercial and service areas	70 dB	
Malaysia*2	Sensitive areas/ low density residential areas	55 dB (7:00 a.m.-10:00 p.m., 15 hr)	50 dB (10:00 p.m.-7:00 a.m., 9 hr)
	Suburban residential	60 dB (7:00 a.m.-10:00 p.m., 15 hr)	55 dB (10:00 p.m.-7:00 a.m, 9 hr)
	Urban residential	65 dB (7:00 a.m.-10:00 p.m., 15 hr)	60 dB (10:00 p.m.-7:00 a.m, 9 hr)
	Commercial and business	70 dB (7:00 a.m.-10:00 p.m., 15 hr)	60 dB (10:00 p.m.-7:00 a.m., 9 hr)
Singapore*3	Sensitive areas	60 dB (7:00 a.m.-7:00 p.m., 12 hr)	55 dB (7:00 p.m.-10:00 p.m., 3 hr) 50 dB (10:00 p.m.-7:00 a.m., 9 hr)
	Residential areas	65 dB (7:00 a.m.-7:00 p.m., 12 hr)	60 dB (7:00 p.m.-10:00 p.m., 3 hr) 55 dB (10:00 p.m.-7:00 a.m., 9 hr)
	Commercial areas	70 dB (7:00 a.m.-7:00 p.m., 12 hr)	65 dB (7:00 p.m.-10:00 p.m., 3 hr) 60 dB (10:00 p.m.-7:00 a.m., 9 hr)
Thailand*4	Noise standard	70 dB (24 hr)	
Japan	Sensitive area (Class AA)	50 dB (6:00 a.m.-10:00 p.m., 16 hr)	40 dB (10:00 p.m.-6:00 p.m., 8 hr)
	Residential area (Class A and Class B)	55 dB (6:00 a.m.-10:00 p.m., 16 hr)	45 dB (10:00 p.m.-6:00 p.m., 8 hr)
	Commercial and industrial area (Class C)	60 dB (6:00 a.m.-10:00 p.m., 16 hr)	50 dB (10:00 p.m.-6:00 p.m., 8 hr)
IFC	Residential; institutional, educational	55 dB (7:00 a.m.-10:00 p.m., 15 hr)	45 dB (10:00 p.m.-7:00 a.m., 9 hr)
	Industrial; commercial	70 dB (7:00 a.m.-10:00 p.m., 15 hr)	70 dB (10:00 p.m.-7:00 a.m., 9 hr)

Source: EIA Report for the Thilawa Special Economic Zone Development Project (Zone A), 2013

*1) Nose Standard in Indonesia (KEP-48/MENLH/11/1996)

*2) Effect of Traffic Noise on Sleep: A Case Study in Serdang Raya, Selangor, Malaysia, Environment Asia, 2010

*3) Environmental Protection and Management Act in Singapore (Chapter 94A, Section 77, Revised in 2008)

*4) Notification of Environmental Board No. 15 B.E.2540 (1997) under the Conservation and Enhancement of National Environmental Quality Act B.E.2535 (1992) dated March 12, B.E.2540 (1997) and Notification of Pollution Control Department ; Subject: Calculation of Noise Level dated August 11, B.E. 2540 (1997) in Thailand

Table 2.1- 9: Target Ambient Noise Levels at the Operation Phase

Category	Daytime (Leq) (7:00 a.m.-7:00 p.m.)	Evening Time (Leq) (7:00 p.m.-10:00 p.m.)	Nighttime (Leq) (10:00 p.m.-7:00 a.m.)
Sensitive area such as monastery	60 dB	55 dB	50 dB
Residential houses	65 dB	60 dB	55 dB
Commercial and industrial areas	70 dB	65 dB	60 dB

Note) Evaluation point is at the boundary of a building
Source: EIA Report for the Thilawa Special Economic Zone Development Project (Zone A), 2013

2.2.6 Vibration

The target vibration levels are also referred from the EIA report for the Thilawa SEZ Zone A project and based on the standards in other countries.

(1) Construction Stage

There is no vibration standard for construction activity to receptors in Myanmar as well as in Southeast Asian countries and of international organizations, such as the World Health Organization (WHO) and IFC. Thus, the following policies were adopted referring to Table 2.1-10:

- Monasteries and residential houses, which need to be kept quiet especially during sleeping time, shall comply with the Japanese standard for residential areas.
- Offices, commercial facilities, and factories shall comply with the Japanese standard for mixed areas including residential and commercial and industrial areas.
- The categories were divided into three types in a manner consistent with the target noise level for construction.

As a result, the target vibration levels are proposed as shown in Table 2.1-11.

Table 2.1-10: Vibration Standards in the Construction Stage in Various Countries

Items		Category	Daytime (La)	Nighttime (La)
Japan*1	Residential areas and sensitive areas that need to be quiet at boundary of land	Near heavy equipment	65 dB	60 dB
	Mixed areas including residential and commercial and industrial areas at boundary of land	Near heavy equipment	70 dB	65 dB
	Using heavy equipment with high noise level (piling, excavation, etc.) at boundary of land	During construction	75 dB	-
USA*2	No cause to damage	During construction	75 dB (as Lv)	
	Residential area	During construction	55-63 dB (as Lv)	52-60 dB (as Lv)

Note: La: Vibration as accretion, Lv: Vibration as velocity
Source: EIA Report for the Thilawa Special Economic Zone Development Project (Zone A), 2013
*1) Vibration Regulation Act, Japan (Law No.64, 1976, Amended 2004)
*2) Transit Noise and Vibration Impact Assessment, U.S. Department of Transportation in USA, 1995

Table 2.1-11: Target Vibration Levels at the Construction Phase

Category	Daytime (La) (7:00 a.m.-7:00 p.m.)	Evening Time (La) (7;00 p.m.-10:00 p.m.)	Nighttime (La) (10:00 p.m.-7:00 a.m.)
Residential houses and monastery	65 dB	65 dB	60 dB
Office, commercial facilities, and factories	70 dB	70 dB	65 dB

Note: Evaluation point is at boundary of buildings
Source: EIA Study Team

(2) Operation Stage

As for vibration levels in the operation stage, the Japanese standard to receptor near factories (Table 2.1-12) was referred to, and the target levels from the EIA report for the Thilawa SEZ Zone A project were used, as shown in Table 2.1-13.

Table 2.1-12 Vibration Standard to Receptors near Factories in Japan

Category	Daytime (La) (e.g. 6 a.m.-22 p.m.)	Nighttime (La) (e.g. 22 p.m.- 6 a.m.)
Residential areas and sensitive areas that need to be quiet	60-65 dB	55-60 dB
Mixed areas including residential and commercial and industrial areas	65-70 dB	60-65 dB

Note: Standard and time of category can be set by the governor of prefecture and in specific cities
Source: Vibration Regulation for prevention of vibration impact from specific factories (Announcement of the Ministry of Environment, No.90, 1976, Amended 2000)

Table 2.1-13: Target Vibration Levels at the Operation Phase

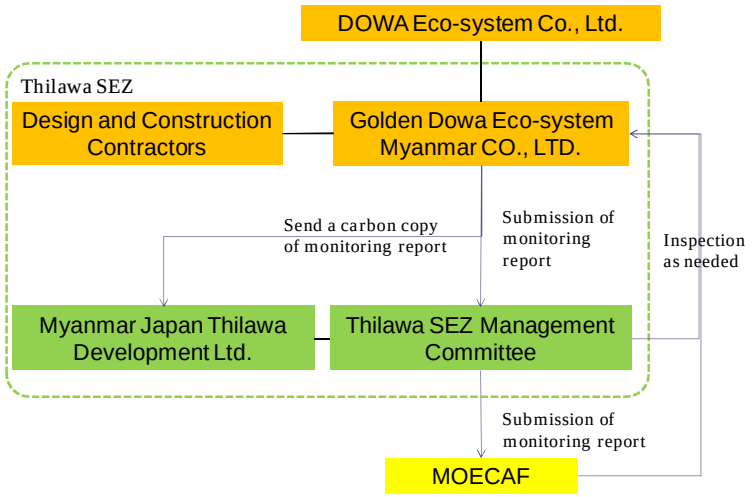
Category	Daytime (La) (7:00 a.m.-7:00 p.m.)	Evening Time (La) (7:00 p.m.-10:00 p.m.)	Nighttime (La) (10:00 p.m.-7:00 a.m.)
Residential houses and monastery	65 dB	60 dB	60 dB
Office, commercial facilities, and factories	70 dB	65 dB	65 dB

Note: Evaluation point is at boundary of buildings
Source: EIA Report for the Thilawa Special Economic Zone Development Project (Zone A), 2013

2.3 Institutional Arrangement

2.3.1 Institutional Arrangement at Pre-construction and Construction Stages

The key parties responsible for the implementation of environmental management plan (EMP) in the pre-construction and construction stages are proposed as shown in Figure 2.3-1. GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD., as the Project proponent, is wholly responsible for the implementation and supervision of the Project including its environmental aspect. The Project proponent will implement environmental monitoring, and submit the monitoring report to MOECAF through the Thilawa SEZ Management Committee (TSMC).

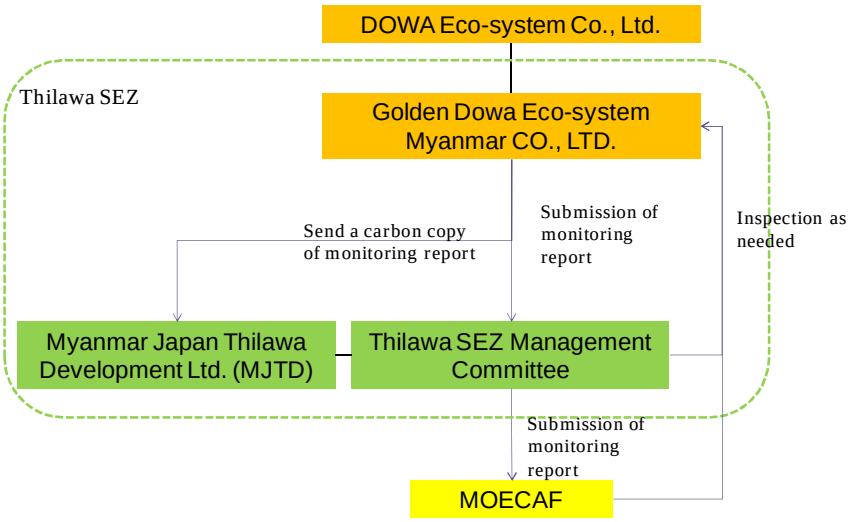


Source: EIA Study Team

Figure 2.3-1: Proposed Organizational Structure for Environmental Management of Industrial Waste Treatment Facilities in the Pre-construction and Construction Stages

2.3.2 Institutional Arrangement in the Operation Stage

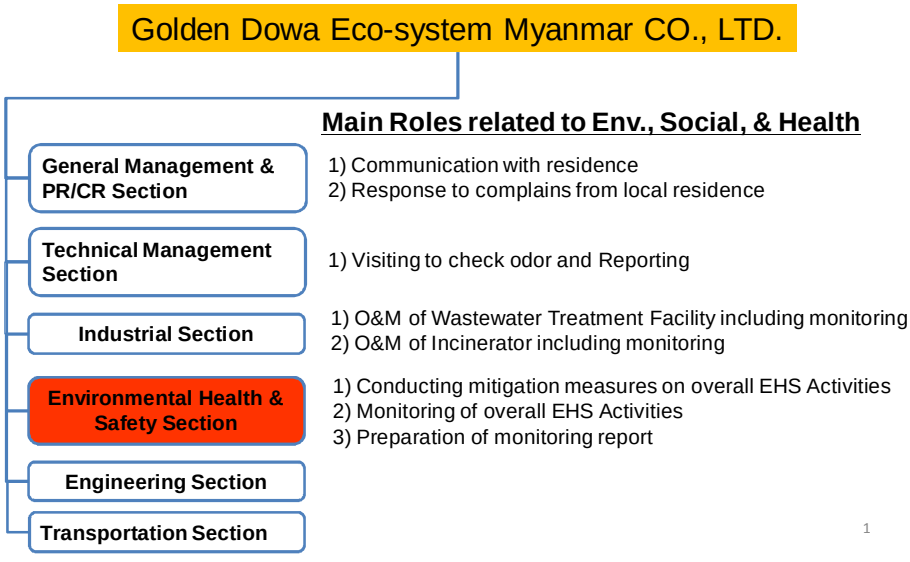
The institutional arrangement in the operation stage is shown in Figure 2.3-2. As for the operation stage, GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD., as management office for industrial waste treatment facilities, shall take care of all substantive work at the site.



Source: EIA Study Team

Figure 2.3-2: Proposed Organizational Structure for Environmental Management of Industrial Waste Treatment Facilities in the Operation Stage

Figure 2.3-3 shows the preliminary organizational structure of GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD. in the operation stage. Among the six sections in the company, the Environmental Health and Safety Section with three staff members will be the main section in charge of environmental, social, and health considerations. Other sections such as the General Management and PR/CR Section, Technical Management Section, and Industrial Section shall also implement their respective duties related to environmental, social, and health considerations.



Source: EIA Study Team

Figure 2.3-3: Preliminary Organizational Structure of the Project Management Body and Roles of the Environmental, Health and Safety Section

CHAPTER 3: PROJECT DESCRIPTION

3.1 Project Purpose

The Government of Myanmar places its priority on foreign direct investments (FDIs) in order to achieve economic development, especially in Thilawa as a special economic zone (SEZ). Under these circumstances, a Myanmar-Japan consortium has decided to develop the Thilawa SEZ Zone A and carried out a feasibility study (F/S) for this Project since September 2012.

Thilawa SEZ is located beside Thanlyin and Kyauktan towns, and about 20 km southeast of Yangon City. The Thilawa SEZ project will equip specific zones for the manufacturing industry, housing, commerce, and logistics. Many tenant companies from Japan, western countries, Myanmar, Asian countries, etc., are interested in the Thilawa SEZ project because the SEZ has various advantages for them, such as tax incentives, and moreover good access to Thilawa Port, and securing necessary infrastructure to be installed such as electricity, water, wastewater treatment facilities, and flood prevention system.

On the other hand, Yangon City, which is the largest city in Myanmar and has a population of about six million (equivalent to about 10% of the total population of Myanmar), is concerned with the large amount of waste generation from the municipal, industrial, medical, and construction sectors of the city because of expected population inflow and industrial development led by the abovementioned democratization and economic growth. At present, the Yangon City Development Committee (YCDC) is the responsible body for collection, transportation, and disposal of municipal solid waste generated in the city. YCDC is also responsible for handling industrial waste together with municipal waste as the amount of industrial waste generated in the city is still quite small. The situation of industrial waste management in the Yangon Region is the same as in Yangon City.

Under such situation, the Project aims to contribute for self-standing economic development and solid waste management in Myanmar by introducing appropriate solid waste treatment and disposal system, which is in accordance with the international standards, for industrial and business waste discharged inside and outside of Thilawa SEZ. To realize this objective, construction and operation of the Project shall be implemented so as to minimize environmental and social impacts and to guarantee the quality of life of the people in the surrounding area.

3.2 Alternatives for Achieving the Project Purpose

Alternative options for Project development were prepared as follows in order to analyze the advantages and disadvantages of each project scenario and to select the optimal project approach:

Option 1: Development of solid waste treatment facility in Thilawa SEZ

Option 2: Development of solid waste treatment facility outside Thilawa SEZ

Option 3: No development of solid waste treatment facility (zero option)

The advantages and disadvantages identified for each option are summarized in Table 3.2-1. Accordingly, Option 1 (development of solid waste treatment facility in Thilawa SEZ) was adopted as the optimum option for the Project.

Table 3.2-1: Comparison of Alternatives for Project Development

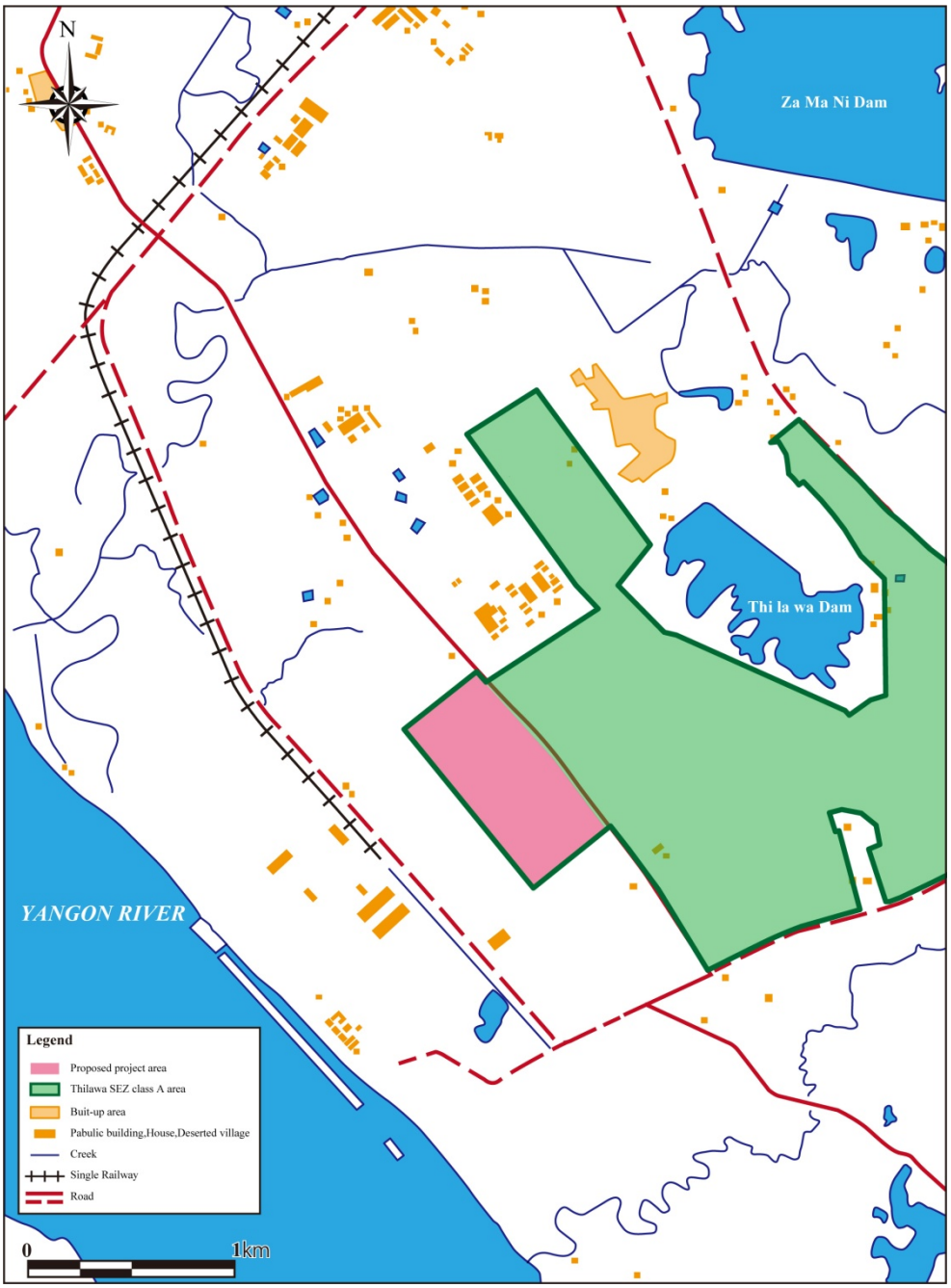
Option / Issue	Option 1: Development in Thilawa SEZ	Option 2: Development outside Thilawa SEZ	Option 3: Zero Option
Solid waste management (SWM) in Thilawa SEZ and Yangon City	Adequate and sufficient treatment and disposal of industrial waste generated from Thilawa SEZ will be achieved.	Same as Option 1.	Inadequate or insufficient treatment and disposal of industrial waste generated from Thilawa SEZ is an utmost concern as there is no SWM facility satisfying international standards for industrial waste treatment.
Transportation of industrial waste	Transportation of industrial waste from tenants to the SWM facility will be completed inside Thilawa SEZ and will not cause significant traffic jams due to the shorter distance as compared with Option 2.	It is concerned that transportation of industrial waste from Thilawa SEZ to the SWM facility may cause traffic jams due to the longer distance as compared with Option 1.	-
Infrastructure for SWM facility	Infrastructure such as electricity, water supply, and sewerage are already equipped in Thilawa SEZ and the SWM facility will provide SWM service for the tenants in Thilawa SEZ.	The Project may need to install infrastructure for operation of the SWM facility if the Project site is not equipped with such infrastructure at the moment. It will be difficult to provide appropriate SWM service if the facility will not have sufficient infrastructure.	-
Land use and urban planning	The area is allocated as per industrial area in the industrial zone of the Thilawa SEZ Zone A area.	It is necessary to find an appropriate location to install the SWM facility.	Lack of appropriate industrial waste treatment and disposal facility would cause significant environmental problems and restriction of economic growth.
Schedule	Adequate and sufficient industrial waste treatment and disposal facilities will be set up by 2015 when Thilawa SEZ starts its operation.	It is concerned that adequate and sufficient industrial waste treatment and disposal facilities will not be set up by 2015 when Thilawa SEZ starts its operation.	Inadequate or insufficient treatment and disposal of industrial waste generated from Thilawa SEZ is a concern as there is no SWM facility satisfying international standards for industrial waste treatment.
Evaluation	○	—	—

Source: EIA Study Team

3.3 Project Outline

3.3.1 Location

The Project site has an area of 40 ha and is located in the Thilawa Special Economic Zone (Zone A), at the corner of Thilawa Development Road and Dagon-Thilawa Port Road, Thanlyin Township. The location of the Project site is presented in Figure 3.3-1.



Source: EIA Study Team

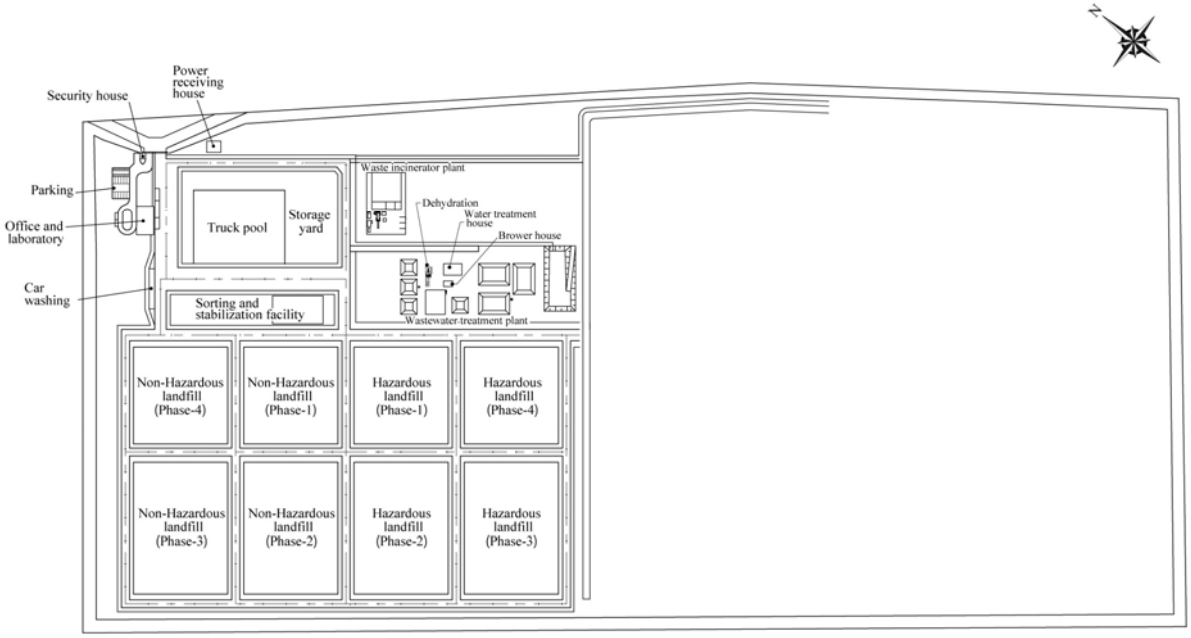
Figure 3.3-1: Location of the Project Site

3.3.2 Layout

Figure 3.3-2 shows the layout plan for the proposed Project, and Figure 3.3-3 shows the perspective images of the proposed Project at the start and completion of the operation stage. Brief descriptions of the main facilities are as follows:

1. Laboratory analysis (inspection) facility
   This facility is for analyzing waste for acceptance inspection; and leachate, wastewater, and exhaust gas for environmental monitoring and so on.

2. Sorting facility
   This facility receives and inspects waste from generators. After separating cleaning and segregating waste, valuables will be sold to demanders and non-valuables will be transferred to the other facilities for treatment and disposal considering characteristics of the waste.
3. Stabilization facility
   This facility mixes waste with agents such as cement so as to prevent elution of hazardous substances from waste. Besides, this facility has the function of moisture control for landfill waste with high water content.
4. Fuel conversion facility
   This facility mixes waste and adjusts the characteristics and concentration of hazardous substances so as to produce fuel for cement factories, etc.
5. Incineration facility
   This facility is for volume reduction, stabilization, and detoxification of waste. Exhaust gas treatment equipment (chemical baghouse filter) will be installed so as to satisfy the target level of emission gas.
6. Final disposal facility
   The landfill shall equip a liner facility to strictly intercept waste and leachate from entering the surrounding environment. Leachate discharged from the landfill shall be adequately treated by the wastewater treatment facility. During waste disposal, only a limited area will be open to activate disposal and another area will be covered by a sheet to prevent odor. After waste disposal, soil covering and liner covering shall be applied and landfill gas shall be captured and combusted to prevent air pollution and odor. At first, two landfill cells for non-hazardous and hazardous wastes will be constructed individually for the first ten years of operation. Each cell will be expanded after they get filled up. In total, eight landfill cells (four for non-hazardous waste and four for hazardous waste) will be constructed.
7. Wastewater treatment facility
   This facility is for neutralization, solid-liquid separation, and biological treatment of wastewater generated from the Project facilities. Effluent shall be discharged into the retention canal of the industrial park by satisfying the target level of wastewater quality.
8. Other facilities
   Other small-scale and supporting facilities such as office, security house, power receiving house, parking, car washing facility, and truck pool will be set up.



Source: DOWA Eco-System Co., Ltd.

Figure 3.3-2: Draft Layout Plan of the Project Facilities

Source: DOWA Eco-System Co., Ltd.

Figure 3.3-3: Perspective Images (Upper: Starting Operation, Lower: Completion of Operation)

3.3.3 Target Waste

The target waste of the Project is industrial and business waste which will be generated in Thilawa SEZ as primary and outside of Thilawa SEZ as secondary. The expected volume of waste is approximately 22,700 t/year, which is about 60% hazardous waste and 40% non-hazardous waste.

In terms of waste weight for each treatment process, approximately, 6,100 t/year for sorting, 6,600 t/year for incineration, 4,100 t/year for fuel conversion, 2,700 t/year for landfilling, 2,600 t/year for stabilization and tens of t/year for wastewater treatment are planned at this stage.

3.3.5 Project Schedule

The Project will be operated for 60 years based on the sublease contract between the proponent and Myanmar Japan Thilawa Development Ltd. (MJTD). The preliminary Project schedule is shown in Table 3.3-1. After completion of the operation period, all facilities and infrastructure on the ground will be removed. The landfill site shall be closed by completing necessary decommissioning measures so as not to cause any environmental pollution in and around the Project site.

Table 3.3-1: Preliminary Project Schedule

Year		2014	2015	2016	2017	2018	2023	2028	2038	2053	2063	2073
Activities		1st	2nd	3rd	4th	5th	10th	15th	25th	40th	50th	60th
EIA Study and Designing												
Landfill (Phase 1) Non-Haz + Haz Waste	Construction											
	Operation and Restoration											
	Aftercare (at least 10 years)											
Landfill (Phase 2-) Non-Haz + Haz Waste	Construction											
	Operation and Restoration											
	Aftercare (at least 10 years)											
Incinerator	Planning											
	Installation											
	Test Operation and Monitoring											
	Operation											
Transportation, Sorting, Stabilization, Wastewater Treatment, Fuel Blending for Cement Plant	Operation											

Source: DOWA Eco-System Co., Ltd.

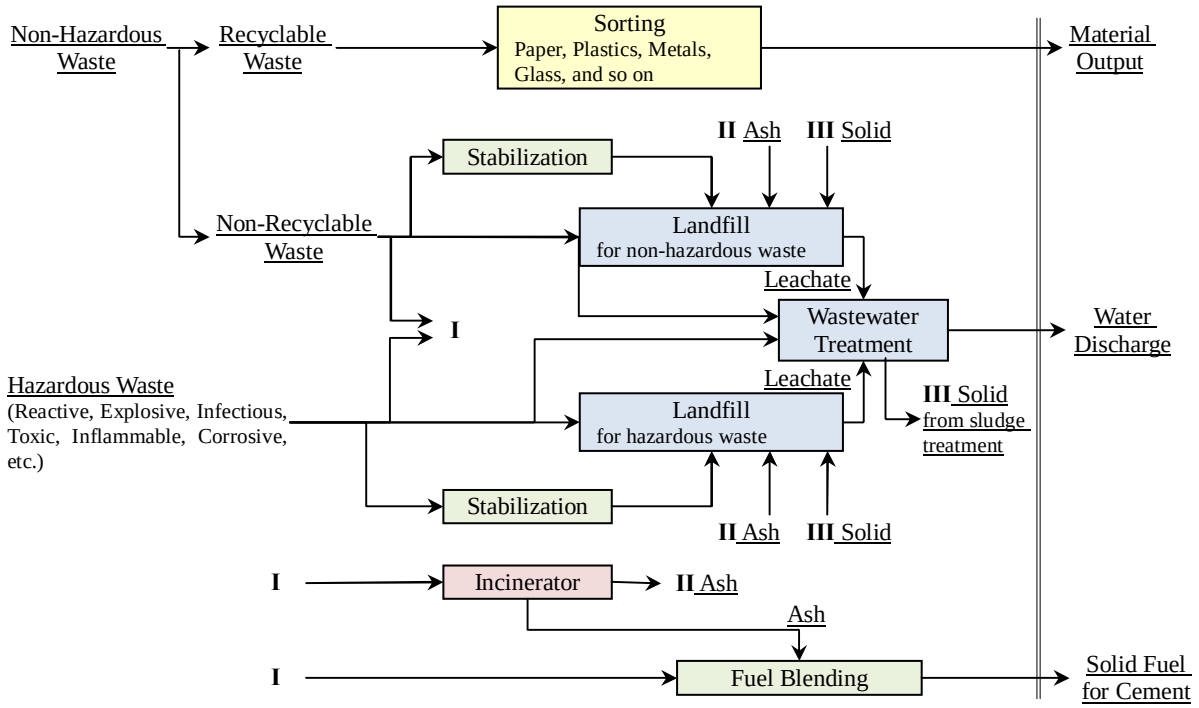
3.4 Description of Project Facilities

3.4.1 Process Flow of Solid Waste Management

The process flow of solid waste management is shown in Figure 3.4-1. It is a very detailed process for managing industrial waste properly from collection of recyclable materials, treatment and control of hazardous and non-hazardous wastes, and minimization of pollution discharge to the surrounding environment. Before reaching the process flow presented in Figure 3.4-1, hazardous and non-hazardous wastes will be separated by inspection after transportation of industrial waste. Waste from generators will be received from 9:00 a.m. to 5:00 p.m. as a rule in principle, and the Project facilities will be in operation from 9:00 a.m. to 5:00 p.m. also. Only wastewater treatment and incineration facilities will be continuously operated for 24 hours.

3.4.2 Transportation

The Project proponent will collect industrial waste from industrial park(s) and other facilities in Thilawa SEZ. The Project proponent will also receive industrial waste generated outside Thilawa SEZ should the landfills have enough capacity. All wastes to be collected will be checked for its general characteristics, including burnability, hazardous properties, and infectiveness in order to decide the treatment method in advance.



Note) I, II and III shows the on-page reference which indicates that next step with the same Roman Figure is somewhere else on the drawing.
Source: DOWA Eco-System Co., Ltd.

Figure 3.4-1: Process Flow of Solid Waste Management

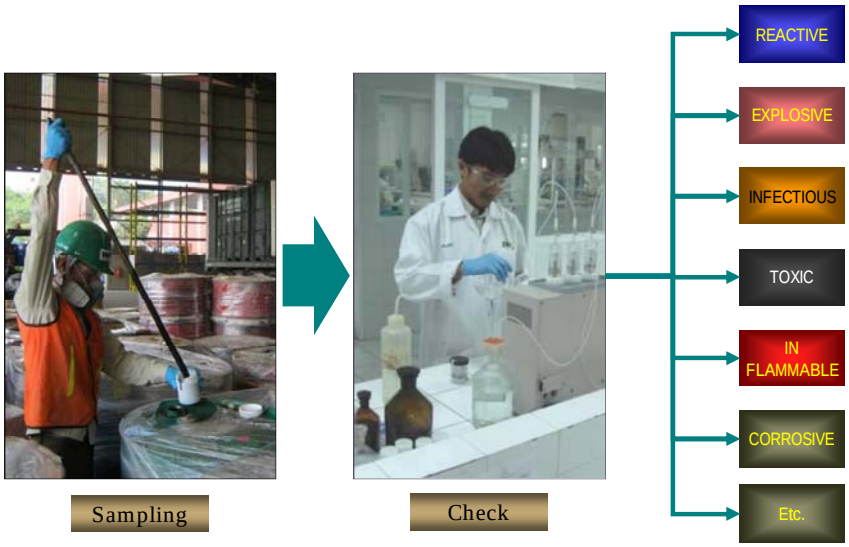
3.4.3 Laboratory Analysis (Inspection) Facility

A laboratory with an approximate area of 150 m^2 will be set up. The laboratory analysis facility has three main functions: first is inspection of received waste, second is checking performance of treatment, and third is environment monitoring.

As for inspection, at first each generator will provide a representative waste sample to be disposed, and the Project proponent will then check the waste sample the generator wants to dispose of and conduct sample analysis to evaluate whether the waste can be received and managed properly. At the same time, the Project proponent will also decide how to treat the waste. The first batch of waste from the generator will be checked carefully whether the waste characteristics are the same as in the sample analysis. After that, waste will be checked, as a kind of manifest examination, through fingerprint testing before its receipt and unloading. The treated waste and wastewater will also be analyzed to check whether or not the treatment processes are functioning properly. As for environmental monitoring, treated wastewater discharged to the water body and gas emitted from the incinerator will go through analyzing devices to check their conformity with the target environmental levels. Figure 3.4-2 shows a diagram on the classification of waste for treatment, and Figure 3.4-3 shows a diagram on the classification flow for usage of waste treatment facilities.

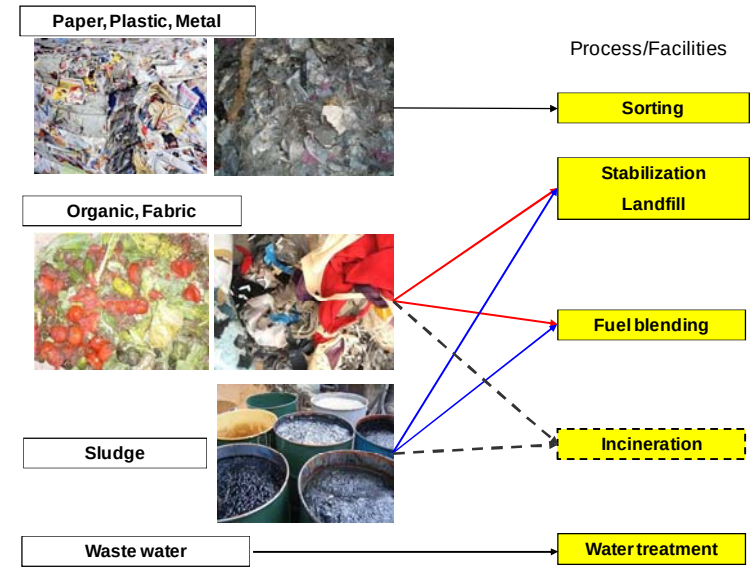
3.4.4 Storage Facility

The storage facility will be installed for storage of waste with functions that prevent spreading and leaking before treatment. The storage also has 6 m high concrete walls as a measure to restrain noise and odor. The upper part of the wall (4 m height) is of messed type to receive fresh air and sunlight into the facility and prevent fire and explosion.



Source: DOWA Eco-System Co., Ltd.

Figure 3.4-2: Classification of Waste for Treatment



Source: DOWA Eco-System Co., Ltd.

Figure 3.4-3: Classification Flow for Usage of Waste Treatment Facilities

3.4.5 Sorting Facility

The sorting facility for receiving and inspecting waste from generators, and for separating, cleaning, and segregating waste will be set up. After segregation of waste, valuables such as metal, paper, glass, and plastic will be sold to demanders, and non-valuables will be transferred to the other Project facilities for treatment and disposal considering the characteristics of the waste. Figure 3.4-4 shows a diagram on the sorting process.

Source: DOWA Eco-System Co., Ltd.

Figure 3.4-4: Example of Sorting Process

3.4.6 Stabilization Facility

The stabilization facility for mixing waste with agents such as cement so as to prevent elution of hazardous substances from waste as well for controlling the moisture content of waste with high water content will be set up in accordance with the standards of the United States Environmental Protection Agency (USEPA). Stabilized waste will be disposed to hazardous or non-hazardous disposal landfill cells in accordance with the waste characteristics after confirming that hazardous substances will not leak and slump test to check stability. Figure 3.4-5 shows pictures of the stabilization and solidification process.

Source: DOWA Eco-System Co., Ltd.

Figure 3.4-5: Example of Solidification Process

3.4.7 Fuel Conversion Facility

The fuel conversion facility for mixing waste and adjusting the characteristics and concentration of hazardous substances so as to produce fuel for cement factories will be installed. The converted fuel will be sold to cement factories in Myanmar. Figure 3.4-6 shows a picture of the fuel conversion facility.

Source: DOWA Eco-System Co., Ltd.

Figure 3.4-6: Example of Fuel Conversion Facility

3.4.8 Incineration Facility

The incineration facility consists of waste supply equipment, incineration equipment, and exhaust gas treatment equipment.

A vertical stoker type combustor with capacity of 20 t/day and comprising primary and secondary combustion chambers will be installed in the Project. Waste will be supplied from the upper part of the primary combustion chamber and stacked in the lower part. Here the waste will be dried and combusted by combustion air blown from the bottom of the furnace, and generated bottom ash will be pulled out from the furnace. The bottom ash will be disposed of to the landfill cells. Exhaust gas including flammable gas generated by the primary combustion chamber will be combusted in the upper part of the chamber by blowing combustion air, and unburned gas will be combusted in the secondary combustion chamber.

In the exhaust gas treatment equipment, exhaust gas will be cooled until 200 ˚C by water spraying in the gas cooling chamber. Then, after removing acid components, dust and pollutants by putting calcium hydroxide and passing through the filtration type dust collector with chemical baghouse filter, appropriately treated exhaust gas will be ejected from the stack. Bottom ash discharged from the combustion chambers and the gas cooling chamber as well as fly ash captured by the filtration type dust collector will be disposed of in the landfill cells.

The general specifications and the process flow of the incineration facility are presented in Table 3.4-1 and Figure 3.4-7, respectively, and the mitigation measures on air pollution by exhaust gas in the planning stage are summarized in Table 3.4-2. Figure 3.4-8 describes the equipment for environmental mitigation measures on exhaust gas and Figure 3.4-9 shows an illustration of a chemical baghouse filter.

Table 3.4-1: General Specification of the Incineration Facility (Tentative)

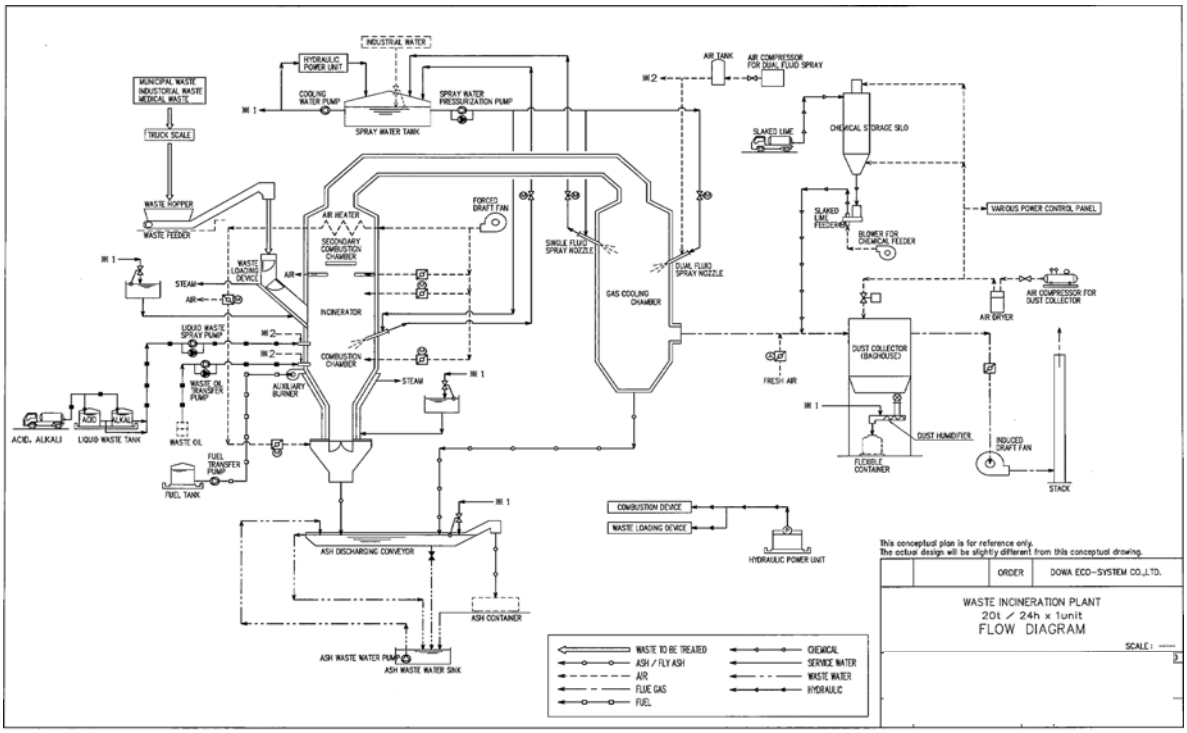
Item	Specification
Type	Vertical stoker type combustor
Capacity	20 t/day
Height of stack	19.5 m
Volume of exhaust gas	11,378 Nm^3/hr at maximum (Wet base) 6,270 Nm^3/hr at minimum (Dry base)
Temperature of exhaust gas	About 180 ˚C

Source: DOWA Eco-System Co., Ltd.

Table 3.4-2: Planned Mitigation Measures on Air Pollution by Exhaust Gas

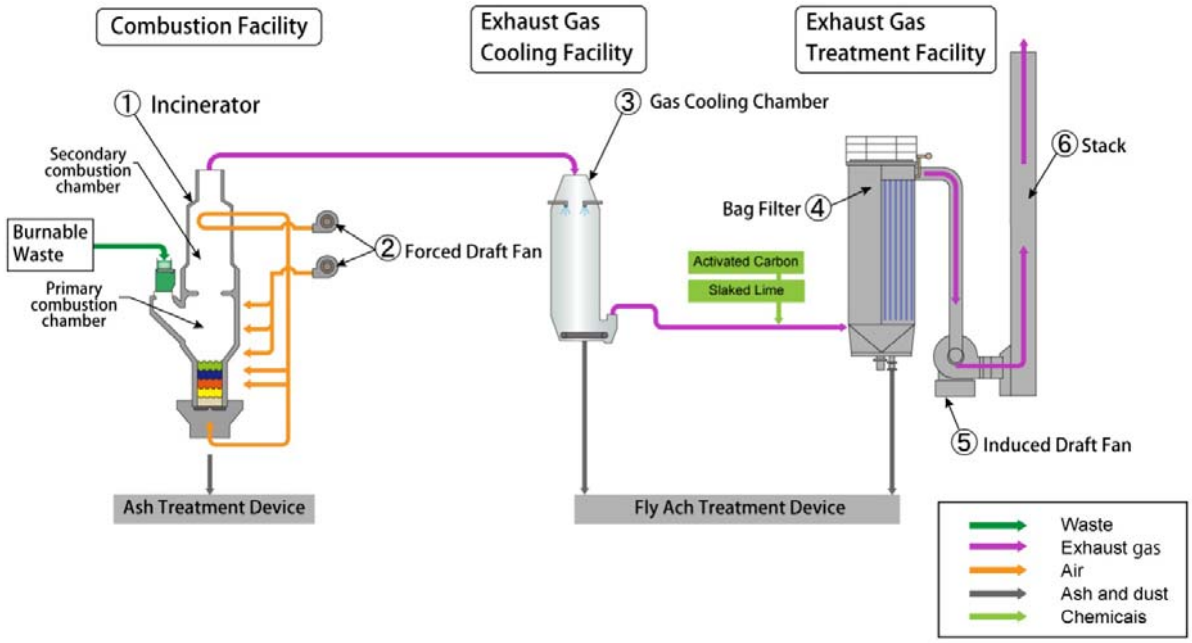
Air Pollutant	Planned Mitigation Measure
Dust	Dust will be collected and removed by the filtration type dust collection device.
Nitrogen dioxide (NO_2)	Generation of nitrogen dioxide will be suppressed by controlling the supplied air ratio properly.
Sulfur dioxide (SO_2)	Sulfur dioxide will be neutralized by calcium hydroxide, and neutralized product will be collected and removed by the filtration type dust collection device.
Hydrogen chloride (HCl)	Hydrogen chloride will be neutralized by calcium hydroxide, and neutralized product will be collected and removed by the filtration type dust collection device.
Heavy metals	Heavy metals will be collected and removed by the dust collection device with function of chemical baghouse filter.
Dioxins	Generation of dioxins will be suppressed by high-temperature combustion. Combustion gas will be quickly cooled to prevent recomposition of dioxins. Dioxins generated by the above treatments will be collected and removed by the filtration type dust collection device with function of chemical baghouse filter.

Source: EIA Study Team



Source: A website of Japanese manufacturer whose incineration facility will be installed in the Project

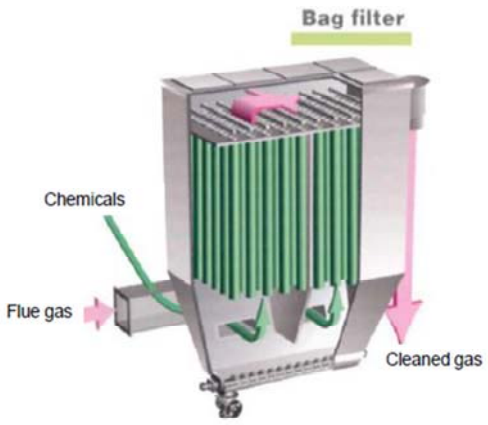
Figure 3.4-7: Process Flow Diagram of Incineration Facility



(1) Incinerator	Vertical stoker type combustor will be stable combustion by SLA combustion (Super Low Air ratio combustion) method. Dioxins and Nitrogen Oxides (NOx) will be suppressed by this method
(2) Forced Draft Fan	Forced draft fan sends air into the furnace.
(3) Gas Cooling Chamber	Cooling chamber cools high-temperature exhaust gas emitted from the incinerator to prevent re-composition of Dioxins.
(4) Bag Filter	Bag filter removes dust from the exhaust gas and also removes dioxins, sulfur dioxide (SO2), hydrogen chlorides (HCl) and Heavy Metals by dry-type chemical reaction bag filter.
(5) Induced Draft Fan	Induced draft fan sends the exhaust gas to the stack.
(6) Stack	Exhaust gas is released from top of the stack and is diffused.

Source: EIA Study Team quoted a website of Japanese manufacturer whose incineration facility will be installed in the Project

Figure 3.4-8: Environmental Countermeasure Equipment on Exhaust Gas

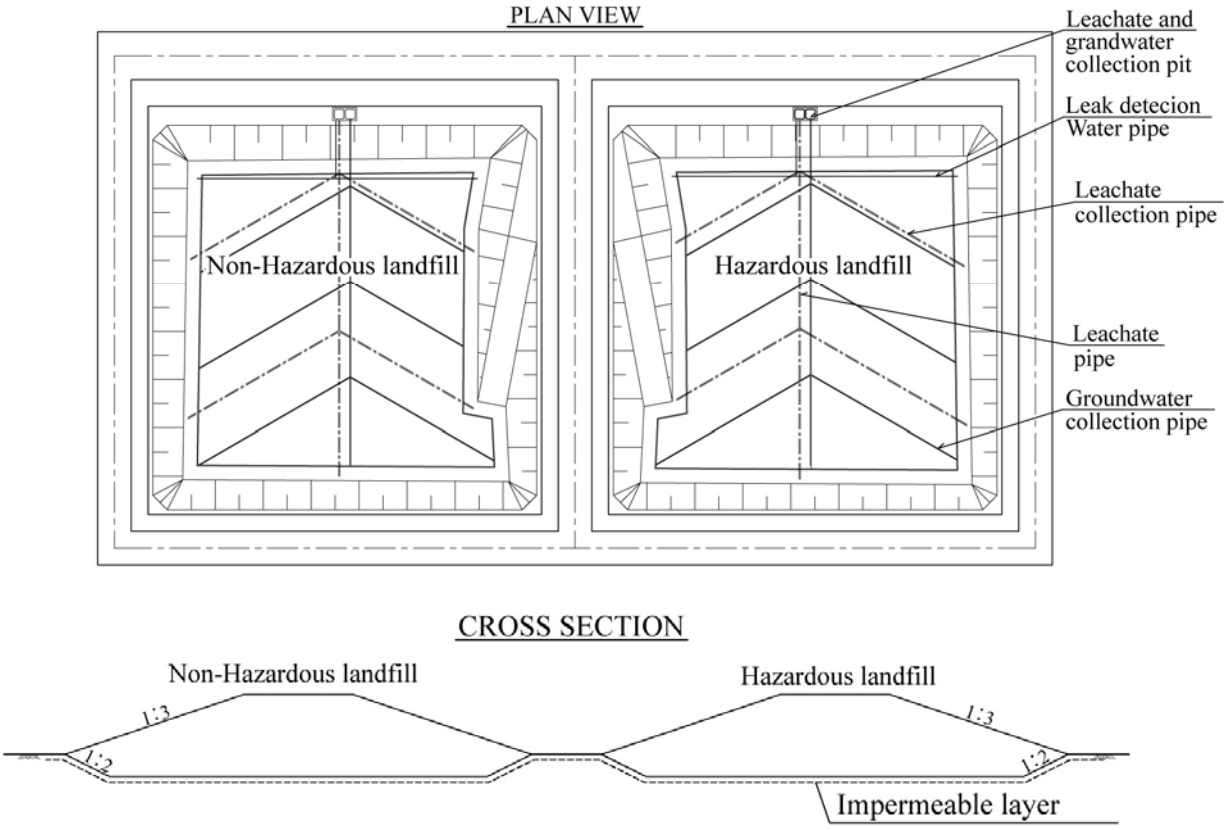


Source: A website of Japanese manufacturer whose incineration facility will be installed in the Project

Figure 3.4-9: Image of Chemical Baghouse Filter

3.4.9 Final Disposal Facility

As final disposal facilities, the landfill cells for non-hazardous and hazardous wastes will be constructed based on US-EPA's standards for hazardous and non-hazardous waste disposal. In the initial stage, approximately sanitary landfills of 100,000 m^3 area will be set up individually for non-hazardous disposal and hazardous disposal. The landfill, equipped with baseliner sheets, leachate collection system and landfill gas treatment system, will be constructed in the Project. Figure 3.4-10 shows the structure of landfill cells as disposal facilities.



Source: DOWA Eco-System Co., Ltd.

Figure 3.4-10: Structure of Landfill Facilities (Final Disposal Facilities)

(1) Operation of Landfill

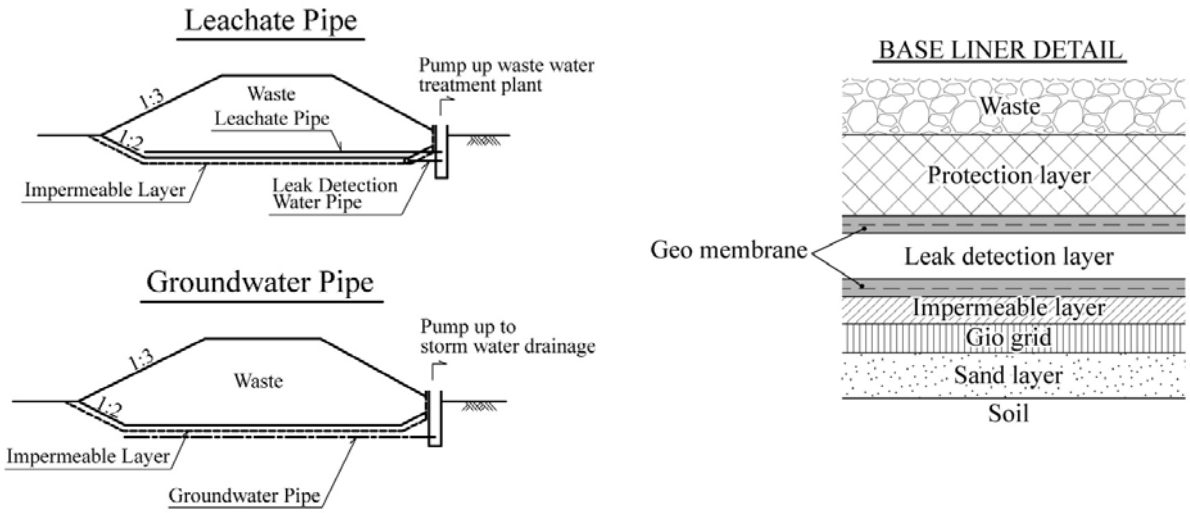
Landfilling work will be operated from 9:00 a.m. to 5:00 p.m. with various environmental consideration such as odor prevention, bird damage prevention, and prevention of groundwater and soil contamination.

Various mitigation measures for odor prevention and bird damage prevention, such as limitation of active area, covering sheet on the non-active area, collection of generated gas and its flaring, and covering soil after disposal, will be implemented. The covering sheet on the non-active area also functions to reduce leachate generation. Besides, daily monitoring to check odor and bird damage will be implemented in the surrounding area. Figure 3.4-11 shows the pictures of odor prevention measures.

Source: DOWA Eco-System Co., Ltd.

Figure 3.4-11: Example of Odor Prevention System

As for groundwater and soil contamination prevention, baseliner sheets and leachate collection system will be installed to prevent leachate from infiltrating into the soil and groundwater. The baseliner system consists of various layers, namely, protection layer, geomembrane layers, leak detection layer, impermeable layer, geo grid, and sand layer to isolate waste and prevent waste and leachate from leaking. To collect leachate, leachate collection pipes will be installed in the protection layer and collected wastewater will be pumped up and connected to the wastewater treatment facility. Groundwater collection system will be also installed within the sand layer under the impermeable layer to collect rising groundwater. The collected groundwater will then be pumped up and conveyed to retention ponds. Figure 3.4-12 shows the water collection system and structure of baseliner, and Figure 3.4-13 shows an example of installation of baseliner system.



Leachate and Groundwater Collection System **Baseliner**

Source: DOWA Eco-System Co., Ltd.

Figure 3.4-12: Water Collection System and Structure of Baseliner

Source: DOWA Eco-System Co., Ltd.

Figure 3.4-13: Example of Installation of Baseliner System

(2) Closure of Landfill

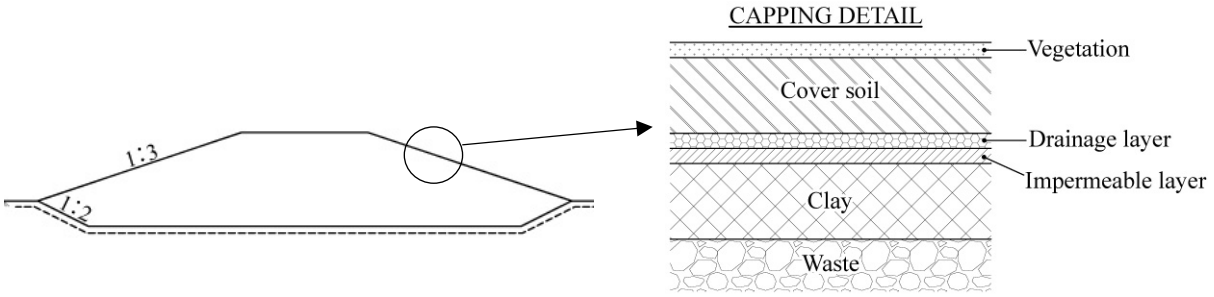
After completion of waste disposal, final covering of the landfill by means of clay soil, impermeable layer, drainage layer, cover soil, and vegetation will be installed on the top of landfill waste as shown in Figure 3.4-14.

After installation of final covering, the Project proponent will continuously conduct the post-closure care such as the following:

Maintaining the integrity and effectiveness of the final covering, including maintenance against anticipated settlement, subsidence, and erosion of landfill caused by decomposition and consolidation of waste and other damage;

- Maintaining and operating the leachate and gas collection systems; and
- Monitoring the groundwater quality and odor.

Maintenance and monitoring will be conducted for ten years at least after installation of the final covering, and then the Project proponent will close the landfill site if no environmental impact is observed for two years.



Cross Section of Landfill **Structure of Final Cover**

Source: DOWA Eco-System Co., Ltd.

Figure 3.4-14: Cross Section of Landfill and Structure of Final Cover

(3) After Completion of Closure of Landfill

After completion of closure of the landfill, various types of eco-friendly facilities will be developed such as a park and/or a mega solar park. Figure 3.4-15 shows examples of eco-friendly facilities and its usage.

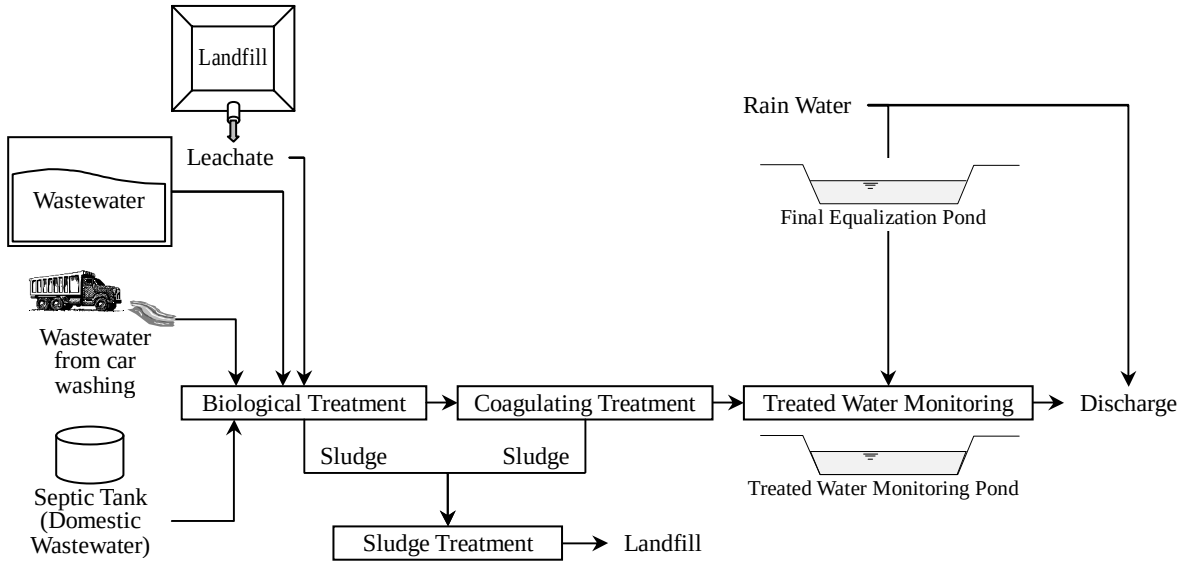
Park (Portland, USA) **Mega Solar Park (Akita, Japan)**

Source: DOWA Eco-System Co., Ltd.

Figure 3.4-15: Examples of Eco-friendly Facilities after Completion of Closure of Landfill

3.4.10 Wastewater Treatment Facilities

Wastewater treatment facilities will be installed for neutralization, solid-liquid separation, biological treatment, and coagulation treatment of wastewater generated from the Project facilities as shown in Figure 3.4-16. Effluent from the Project facilities shall be discharged outside of the Project area complying with the target levels. Treated sludge will be disposed to the landfill cell after dehydration. Table 3.4-3 shows the general specifications for the wastewater treatment facilities, and Figure 3.4-17 shows photos of examples of wastewater treatment facilities.



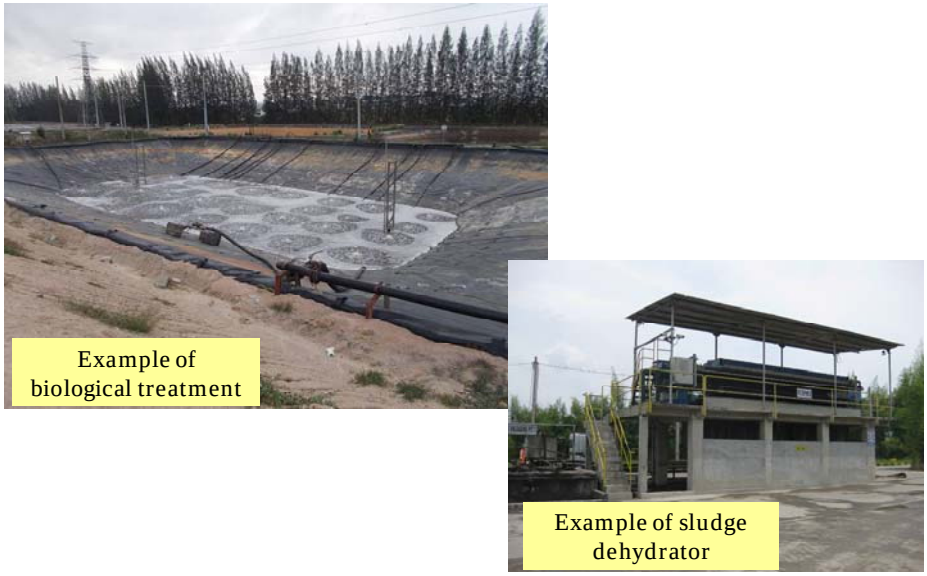
Source: DOWA Eco-System Co., Ltd.

Figure 3.4-16: Process Flow of Wastewater Treatment

Table 3.4-3: General Specifications for the Wastewater Treatment Facilities (Tentative)

Item	Specification
Size	approximately 8,000 m^2
Capacity	35 m^3/day at maximum
Main Wastewater Treatment System	- Neutralization and solid-liquid separation - Biological Treatment - Coagulation Treatment

Source: DOWA Eco-System Co., Ltd.



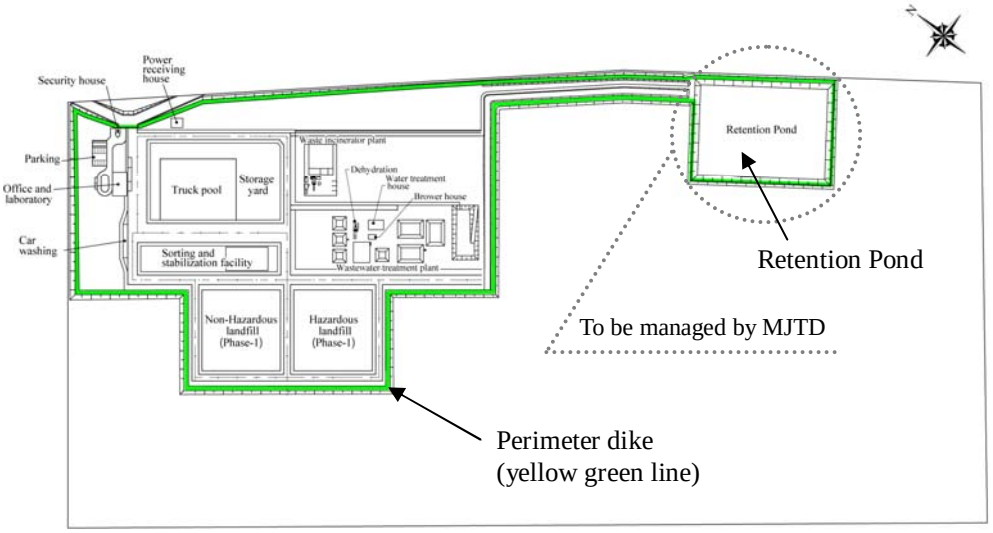
Source: DOWA Eco-System Co., Ltd.

Figure 3.4-17: Examples of Wastewater Treatment Facilities

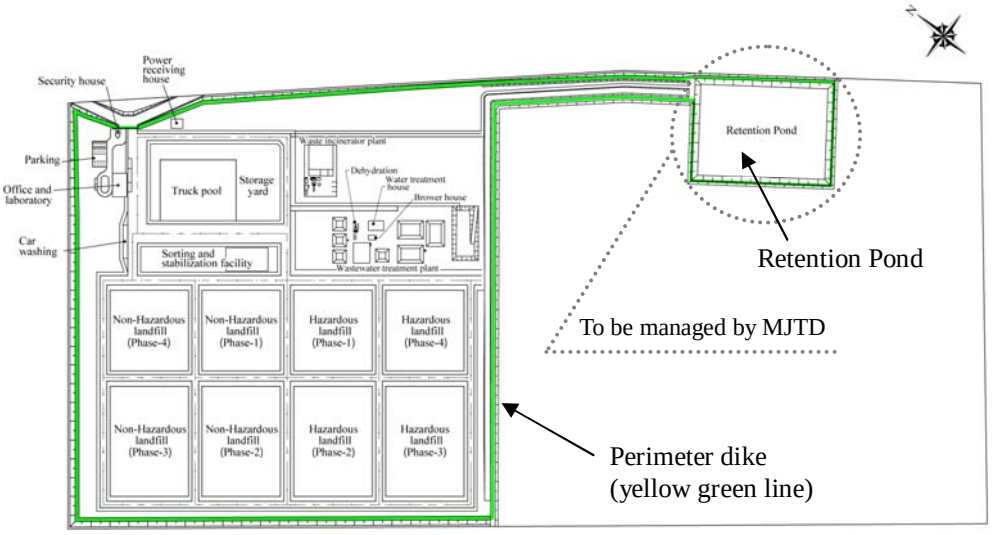
3.4.11 Flood Prevention Facilities

(1) Flood Prevention

The perimeter dike will be constructed to prevent flood from entering the Project site as shown in Figure 3.14-18. Since the proposed elevation of the perimeter dike in the EIA report for the Thilawa SEZ Zone A project was higher than EL +6.5 m based on the analysis of storm surge simulation in the Yangon River, hearing survey of flood disaster, and flood analysis on a 100-year return period, the height of the dike surrounding the Project site is designed to be more than EL +7.0 m. On the other hand, storm water runoff from the Project site can be stored in the retention pond to be constructed near the downstream side of the Project site as infrastructure of the Thilawa SEZ Zone A. Its capacity in the final phase is designed as 3,500 m^3 considering probable rainfall of ten years. The retention pond and its surrounding dike will be managed by MJTD, as these properties are planned to be located in the MJTD site.



(i) Initial Stage



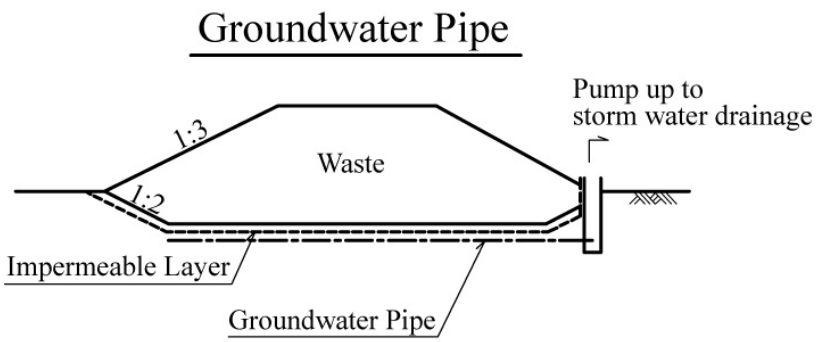
(ii) Final Phase

Source: DOWA Eco-System Co., Ltd.

Figure 3.4-18: Designed Dike Surrounding the Project Site and Retention Pond

(2) Prevention of Groundwater Inflow and Infiltration

The groundwater level at the Project site used for the design of landfill is set at EL +2.0 m based on the monitoring data at the site and surrounding measurement results. Therefore, the landfill will be constructed above EL +2.0 m. Also, the thickness of the protection layer at the bottom of the landfill will be constructed with low permeability ($k = 1 \times 10^{-5}$cm/s) in order to prevent physical contact between the waste or leachate and groundwater. In addition, the groundwater pipe will be installed below the protection layer and leak detection layer. The drainage capacity of the groundwater pipe is 18.1 m^3/day in order to prepare for the maximum flow volume in case that the groundwater level rises to the ground level. The collected drainage will flow into the drainage pit and pumped up to the stormwater drainage system as shown in Figure 3.14-19.



Source: DOWA Eco-System Co., Ltd.

Figure 3.4-19: Groundwater Collection Pipe (Typical Section of Landfill)

3.4.8 Other Facilities

Other small-scale and/or supporting facilities, as listed in Table 3.4-4 below, will be set up.

Table 3.4-4: Description of Other Facilities

Name	Size	Function
Security house	5 m x 5 m	Check vehicle and guest to enter the site
Power receiving house	12 m x 10 m	Receiving power
Blower house	5 m x 8 m	Blower for wastewater treatment facility

Source: DOWA Eco-System Co., Ltd.

CHAPTER 4: OVERALL CONDITIONS IN THE SURROUNDING AREA

4.1 Living Environment (Pollution Status)

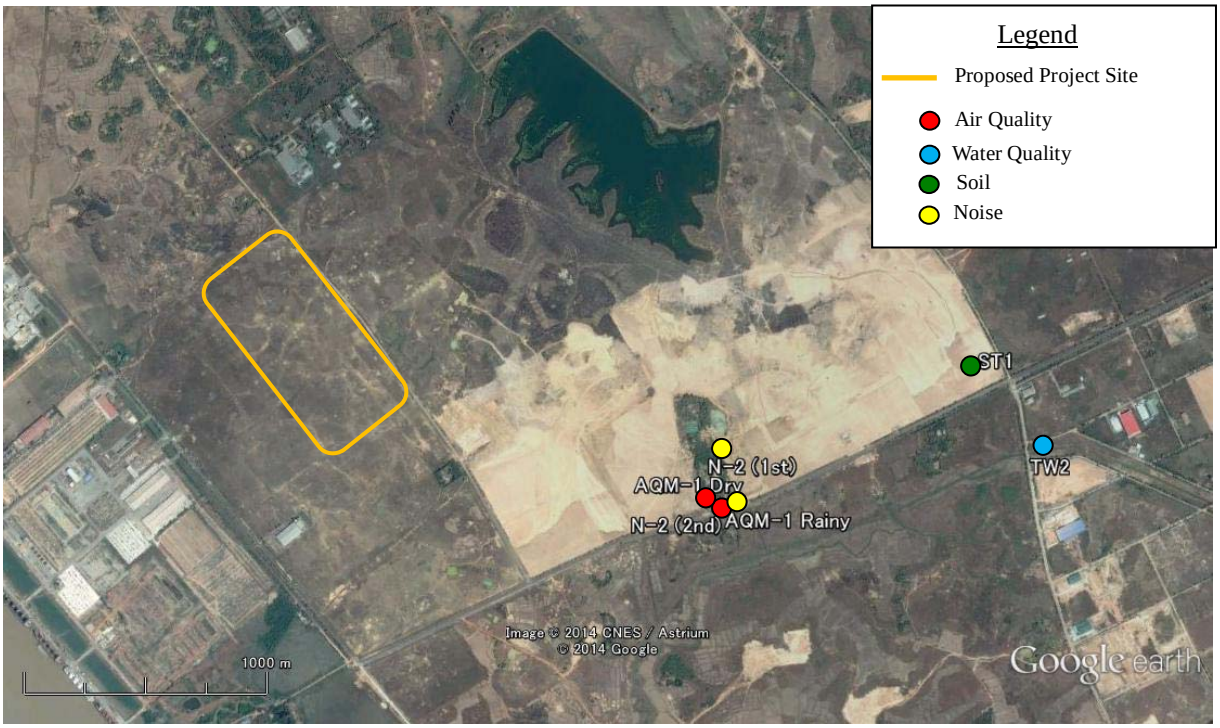
4.1.1 Outline of Environmental Survey in 2013

The overall conditions of air quality, water quality, soil quality, noise levels are quoted from the Environmental Impact Assessment (EIA) Report for the Thilawa Special Economic Zone (SEZ) Zone A Development Project by Myanmar and Japan Thilawa Development Ltd. (hereinafter referred to as the "Reference") which was approved by the Thilawa SEZ Management Committee (TSMC) based on the comments of the Ministry of Environmental Conservation and Forestry (MOECAF). The summary of the field survey for overall conditions is shown in Table 4.1-1. The location of the environmental survey for overall conditions is shown in Figure 4.1-1.

Table 4.1-1: Summary of Environmental Survey for Overall Conditions

Category	Item	Description	
Environmental Conditions (quoted from the existing data from EIA studies near the Project site)	Air Quality	Parameter	1) Sulfur dioxide (SO_2), 2) Carbon monoxide (CO), 3) Nitrogen dioxide (NO_2), 4) PM10
		Period	Two points for dry and rainy seasons (two samples in total)
		Location	Along the road
	Water Quality	Parameter	Thirty-one parameters for natural and living environment: 1) Temperature,2) Odor, 3) Color, 4) Electrical conductivity (EC), 5) Hardness, 6) pH, 7) Turbidity, 8) SS, 9) DO, 10) COD_{Cr}, 11) TOC, 12) BOD_5, 13) Oil and Grease, 14) Total Coliforms, 15) NH_4-N, 16) NO_2-N, 17) NO_3-N, 18) T-N, 19) T-P, 20) Cu, 21) Zn, 22) Cd, 23) Pb, 24) Hg, 25) Ni, 26) Mn, 27) Cr (VI), 28) Fe, 29) CN, 30) Sulfide, 31) Sulfate
		Frequency	Monthly (some main parameters sampled from March to August 2013 and all parameters sampled from June to August)
		Location	Surface water
	Soil Quality	Parameter	Total of 11 parameters: 1) Cadmium (Cd) 2) Chromium (Cr_{VI}) 3) pH 4) Mercury (Hg) 5) Lead (Pb) 6) Arsenic (As) 7) Zinc (Zn) 8) Nickel (Ni) 9) Manganese (Mn) 10) Iron (Fe) 11) Copper (Cu)
		Period	One time sampling at one point
		Location	Paddy field
	Noise Level	Parameter	LAeq (A-weighted loudness equivalent)
		Period	72 hour survey during weekday and weekend
		Location	Two locations

Source: EIA Report for the Thilawa SEZ Zone A Development Project



Source: Google Earth, EIA Report for Thilawa SEZ Zone A Development Project

Figure 4.1-1: Location of Environmental Survey for Overall Conditions

4.1.2 Air Quality

(1) Survey Condition

According to the Reference, the results of two survey points are available near the Project site. Table 4.1-2 summarizes the survey conditions such as season, period, parameters, and method for air quality survey. The on-site monitoring method was prepared referring to the recommendations of the United States Environmental Protection Agency (USEPA).

Table 4.1-2: Outline of Air Quality Survey

Survey Point	Season	Period	Parameter	Method
AQM-1 Dry (Living Environment)	Dry Season	3 Days (9–12 April 2013)	SO_2, CO, NO_2, PM_{10}	On-site monitoring (by Haz-Scanner EPAS Wireless Environmental Perimeter Air Station)
AQM-1 Rainy (Along the road)	Rainy Season	7 Days (22–29 June 2013)		

Source: EIA Report for the Thilawa SEZ Zone A Development Project

(2) Survey Location

The locations of survey points are shown in Table 4.1-3.

Table 4.1-3: Locations of Air Quality Survey

Sampling Point	Coordinates	Description of Survey Point
AQM-1 Dry	N 16°40'14.6", E 96°16'31.2"	West side of the Moekyoswun Monastery compound.
AQM-1 Rainy	N 16°40'11.7", E 96°16'36.4"	In front of Moekyoswun Monastery, about 11.2 m away from car road.

Source: EIA Report for Thilawa SEZ Zone A Development Project

(3) Survey Result

All of the results were below their respective target levels as shown in Table 4.1-4. Also all parameters in the rainy season were lower than in the dry season. It is assumed that the results of lower value were due to rainfall, which might have caught air pollutants.

Table 4.1-4: Results of Air Quality Survey in 2013

Parameter (Unit)	Date:	Sampling Point	Result		Target Level
SO_2 (ppm)	9 to 12 April 2013	AQM-1 Dry	AVG.	0.0164	0.04
			Minimum - Maximum	0.0147 - 0.0175	
	22 to 29 June 2013	AQM-1 Rainy	AVG.	0.0038	
			Minimum - Maximum	0.0005 - 0.0088	
CO (ppm)	9 to 12 April 2013	AQM-1 Dry	AVG.	0.4446	10
			Minimum - Maximum	0.4320 - 0.4636	
	22 to 29 June 2013	AQM-1 Rainy	AVG.	0.3144	
			Minimum - Maximum	0.2517 - 0.4219	
NO_2 (ppm)	9 to 12 April 2013	AQM-1 Dry	AVG.	0.0411	0.06
			Minimum - Maximum	0.0375 - 0.0482	
	22 to 29 June 2013	AQM-1 Rainy	AVG.	0.0347	
			Minimum - Maximum	0.0341 - 0.0349	
PM10 (mg/m^3)	9 to 12 April 2013	AQM-1 Dry	AVG.	0.0824	0.12
			Minimum - Maximum	0.0571 - 0.0997	
	22 to 29 June 2013	AQM-1 Rainy	AVG.	0.0482	
			Minimum - Maximum	0.0375 - 0.0600	

Source: EIA Report for the Thilawa SEZ Zone A Development Project

4.1.3 Water Quality

(1) Survey Condition

According to the Reference, one survey point relevant to the Project is available around the Project site. Table 4.1-5 summarizes the survey conditions such as season, month, parameters, and method for water quality survey.

Table 4.1-5: Outline of Water Quality Survey

Survey Point	Season	Month	Parameters	Method
TW2	Dry Season in 2013	March April May	Temperature, Odor, Color, EC, Hardness, pH, Turbidity, SS, DO, COD_{Cr}, TOC, BOD_5, Oil and Grease, Total Coliforms, NH_4-N, NO_2-N, NO_3-N, T-N, T-P, Cu, Zn, Cd, Pb, Hg, Ni, Mn, Cr (VI), Fe, CN, Sulfide, Sulfate	On-site measurement by water quality meter and analysis in laboratories
	Rainy Season in 2013	June July August		

Note: Parameters are different in each month.
Source: EIA Report for the Thilawa SEZ Zone A Development Project

(2) Survey Location

The location of sampling points is shown in Table 4.1-6.

Table 4.1-6: Location of Water Quality Survey

Category	Sampling Point	Coordinates	Description of Survey Point
Surface Water	TW-2	16°40'20.46"N, 96°17'18.72"E	At the creek which crosses the car road.

Source: EIA Report for the Thilawa SEZ Zone A Development Project

(3) Reference Standard

Since there is no official standard for surface water quality in Myanmar and the Reference did not cover quantitative target levels for surface water in its scope, the reference standards for surface water

quality related parameters, which the Project proponent surveyed, were taken from countries of the Association of Southeast Asian Nations (ASEAN) countries near Myanmar (such as Vietnam and Thailand) and Japan, as shown in Table 4.1-7.

Table 4.1-7: Reference Standards for Surface Water Quality

No.	Parameter	Unit	Japan	Vietnam	Thailand
1	Temperature	ºC	-	-	-
2	Water level	m	-	-	-
3	Flow rate	m/s	-	-	-
4	Odor	-	-	-	-
5	Color	-	-	-	-
6	Electrical conductivity	µS/cm	-	-	-
7	pH	-	6.0 - 8.5	5.5 – 9	5 – 9
8	BOD_5	-	8.0	15.0	2.0
9	COD_{Cr}	mg/L	5 as COD_{Mn}	30	-
10	SS	mg/L	100	50	-
11	Turbidity	NTU	-	-	-
12	Hardness	mg/L	-	-	-
13	TDS	mg/L	-	-	-
14	DO	mg/L	>=2	>4	>4
15	Total coliform	cfu/100mL	5,000 as MPN/100 mL	7,500 as MPN/100 mL	20,000 as MPN/100 mL
16	Total nitrogen (T- N)	mg/L	-	-	-
17	Nitrite-nitrogen (NO_2-N)	mg/L	10 (NO_2-N+NO_3-N)	0.04	-
18	Nitrate-nitrogen (NO_3-N)	mg/L		10	5
19	Ammonium nitrogen (NH_4-N)	mg/L	-	0.5	0.5 as NH_3-N
20	Total phosphorous (T-P)	mg/L	-	-	-
21	Phosphorous phosphate (PO_4-P)	mg/L	-	-	-
22	Oil and grease	mg/L	-	0.1	-
23	Phenol	mg/L	-	0.01	0.005
24	Sulfide	mg/L		-	-
25	Sulfate	mg/L	-	-	-
26	Hydrogen sulfide (H_2S)	mg/L	-	-	-
27	Formaldehyde	mg/L	-	-	-
28	Free chlorine	mg/L	-	-	-
29	Total organic carbon	mg/L	-	-	-
30	Cyanide (CN)	mg/L	ND	0.02	-
31	Mercury (Hg)	mg/L	0.0005	0.001	0.002
32	Lead (Pb)	mg/L	0.01	0.05	0.05
33	Cadmium (Cd)	mg/L	0.003	0.01	0.005 0.05*1
34	Arsenic (As)	mg/L	0.01	0.05	0.01
35	Trivalent chromium (Cr (III))	mg/L	-	0.5	-
36	Hexavalant chromium (Cr(VI))	mg/L	0.05	0.04	0.05
37	Total chromium (Cr)	mg/L	-	-	-
38	Copper (Cu)	mg/L	-	0.5	0.1
39	Zinc (Zn)	mg/L	-	1.5	1.0
40	Selenium (Se)	mg/L	0.01	-	-
41	Nickel (Ni)	mg/L	-	0.1	0.1
42	Manganese (Mn)	mg/L	-	-	1.0
43	Iron (Fe)	mg/L	-	1.5	-
44	Barium (Ba)	mg/L	-	-	-
45	Boron(B)	mg/L	0.8	-	-

*1) To be adopted to the water sample whose hardness is more than 100 mg/l as $Ca\ CO_3$

Source: Environmental quality standard 1971, Japan for conservation of the living environment (Class D for rivers: Industrial Water 2, Agricultural Water and Uses Listed E) and the protection of the human health
Surface Water Quality Standard, QCVN 08:2008/BTNMT, Vietnam (B1: Standard for Irrigation Purpose)
Surface Water Standards 2009 Thailand (Class 3: Standard for Agricultural Purpose)

Source: EIA Study Team

(4) Survey Results

Table 4.1-8 shows the results of the water quality survey at TW2. As for general parameters, the results of suspended solids (SS) exceeded the water quality standard in Japan and Vietnam. There are two possibilities for exceeding the environmental standards: 1) natural origin (e.g., soil condition), and 2) derived from human activity (e.g., construction, bare land, and unpaved road).

As for heavy metals, toxic, and other parameters, of all available water quality standards, only lead and cadmium in May and July, respectively, slightly exceeded their respective standard values. The results in the other months were below the standards. As for oil and grease, cyanide was not able to be analyzed to compare with its corresponding water quality standard due to capacity limitation of the laboratory at that time. The other parameters were far lower than their corresponding standards. Thus, the water quality of the survey point was not polluted and generally good.

Table 4.1-8: Results of Water Quality Survey at TW2

Parameters (Unit)	2013						Environmental Standard		
	March	April	May	June	July	August	Japan	Vietnam	Thailand
Temperature (^oC)	-	-	-	27.39	27.25	26.5	-	-	-
Odor	-	-	-	Not objectionable			-	-	-
Color	-	-	-	Clear	Clear	Clear	-	-	-
Electrical Conductivity (µS/cm)	-	-	-	48	53	62	-	-	-
pH	-	-	-	7.2	7.3	7.4	6.0-8.5	5.5-9.0	5.0-9.0
BOD_5 (mg/L)	-	-	-	3.0	2.5	2.5	8.0	15	2.0
COD_{Cr} (mg/L)	-	-	-	2.36	0.736	1.10	5 as COD_{Mn}	30	-
SS (mg/L)	-	-	-	91	73	270	100	50	-
Turbidity (NTU)	-	-	-	236	98.5	651	-	-	-
Hardness (mg/L)	-	-	-	120	100	20	-	-	-
DO (mg/L)	-	-	-	4	4.6	4.5	>=2	>4	>4
Total Coliforms (MPN/100ml)	-	-	-	1.7×10^3	-	4.0×10^2	5.0×10^3 as MPN/100 mL	7.5×10^3 as MPN/100 mL	2.0×10^4 as MPN/100 mL
Total Nitrogen (mg/L)	-	-	-	8.1	8.2	8.1	-	-	-
Nitrite (NO_2-N) (mg/L)	7.6	ND	13	15	13	13	10	0.04	-
Nitrates (NO_3-N) (mg/L)	ND	ND	ND	4.2	ND	ND		10	5
Ammonium Nitrogen (NH_4-N) (mg/L)	ND	ND	0.25	ND	ND	ND	-	0.5	0.5
Total Phosphorous (mg/L)	-	-	-	ND	ND	ND	-	-	-
Oil and Grease (mg/L)	<1	2	<1	<1	1	2	-	0.1	-
Sulfide (mg/L)	ND	ND	ND	ND	ND	ND	-	-	-
Sulfate (mg/L)	100	100	100	ND	5	40	-	-	-
Total Organic Carbon (mg/L)	-	-	-	4.9	5.3	4.1	-	-	-
Cyanide (CN) (mg/L)	<0.05	<0.005	<0.05	<0.05	<0.05	<0.05	ND	0.02	-
Mercury (Hg) (mg/L)	ND	0.0002	0.0011	0.0001	0.0009	0.0021	0.005	0.001	0.002
Lead (Pb) (mg/L)	0.003	ND	0.062	0.009	0.05	0.010	0.01	0.05	0.05
Cadmium (Cd) (mg/L)	0.0044	0.0007	ND	0.0013	0.0152	0.0004	0.003	0.01	0.005 0.05*1
Hexavalent Chromium (Cr(VI)) (mg/L)	ND	ND	ND	ND	ND	ND	0.05	0.04	0.05
Copper (Cu) (mg/L)	0.04	ND	0.28	0.18	ND	ND	-	0.5	0.1
Zinc (Zn) (mg/L)	ND	ND	ND	ND	ND	ND	-	1.5	1.0
Nickel (Ni) (mg/L)	<0.01	0.01	0.01	<0.01	0.01	<0.01	-	0.1	0.1
Manganese (Mn) (mg/L)	ND	0.1	0.1	ND	ND	ND	-	-	1.0
Iron (Fe) (mg/L)	0.001	5	0.094	0.05	0.05	4	-	1.5	-

*1) To be adopted to the water sample whose hardness is more than 100 mg/l as $Ca\ CO_3$

Note: The results were rounded up or rounded off using a appropriate number of significant figures for each parameter.

Source: Environmental quality standard 1971, Japan. It concerns the conservation of living environment for agricultural use and protection of human health.
Surface Water Quality Standard (QCVN 08:2008/BTNMT), Vietnam B1: Standard for Irrigation Purpose
Surface Water Standards 2009 Thailand Class 3: Standard for Agriculture Purpose
EIA Report for the Thilawa SEZ Zone A Development Project

4.1.4 Soil Quality

(1) Survey Condition

According to the Reference, one survey point relevant to the Project is available around the Project site. Table 4.1-9 summarizes the survey conditions such as date, parameters, and method for soil quality survey.

Table 4.1-9: Outline of Soil Quality Survey

Survey Point	Survey Date	Parameters	Method
ST-2	29 April 2013	pH, Cd, Cu, Zn, Mn, Pb, As, Fe, Cr, Hg, Ni	Standard operating procedure of U.S. EPA (SOP-2012, SOP2016, and SOP 2003)

Source: EIA Report for the Thilawa SEZ Zone A Development Project

(2) Survey Location

The location of the sampling points is shown in Table 4.1-10.

Table 4.1-10: Location of Soil Quality Survey

Sampling Point Name	Coordinates	Description of the Survey Point
ST-2	N 16°40'32.79",E 96°17'13.57"	Site in the paddy field in Thilawa SEZ. It is located about 20 m west of Thanlyin-Kyauktan Road.

Source: EIA Report for the Thilawa SEZ Zone A Development Project

(3) Reference Standard

Since there is no official standard on soil quality in Myanmar and the Reference did not cover the quantitative target levels for soil in its scope, the reference standards for soil quality related to the parameters the Project proponent surveyed are quoted from ASEAN countries near Myanmar (Vietnam and Thailand) and Japan as shown in Table 4.1-11.

Table 4.1-11: Reference Standards for Soil Quality

No.	Parameter	Unit	Environmental Standard		
			Japan[1)]	Thailand[3)]	Vietnam[4)]
1	pH	-	-	-	-
2	Cadmium (Cd)	mg/kg	150	37	2
3	Copper (Cu)	mg/kg	125[2)]	-	50
4	Zinc (Zn)	mg/kg	-	-	200
5	Manganese (Mn)	mg/kg	-	1,800	-
6	Lead (Pb)	mg/kg	150	400	70
7	Arsenic (As)	mg/kg	150	3.9	12
8	Iron (Fe)	mg/kg	-	-	-
9	Chromium (Cr)	mg/kg	250	300	-
10	Mercury (Hg)	mg/kg	15	23	-
11	Nickel (Ni)	mg/kg	-	1,600	-

Source: 1) Detailed Enforcement Regulations of Soil Contamination Countermeasures Act, 2002, Japan
2) Environmental Quality Standards for Soil Pollution, 1991, Japan
3) Soil Quality Standard for Other Purposes, 2004, Thailand
4)Regulation for Implementing the Law on Soil Contamination Countermeasures"
QCVN 03: 2008/BTNMT, Vietnam. It is applied as "farm land".

(4) Survey Results

The results of soil quality analysis are presented in Table 4.1-12. The results of copper and lead slightly exceeded the soil quality standards in Vietnam. However, these results were far below other countries' environmental standards. These results could be evaluated as no lead or copper contamination that could lead to environmental and health impacts. For the other parameters, the results shown in Table 4.1-12 were below their corresponding standards.

Table 4.1-12: Results of Soil Quality Analysis at ST2

No.	Parameter	Unit	Result	Environmental Standard		
			ST 2	Japan[1)]	Thailand[3)]	Vietnam[4)]
1	pH	-	6.2	-	-	-
2	Cadmium (Cd)	mg/kg	0.004	150	37	2
3	Copper (Cu)	mg/kg	80	125 [2)]	-	50
4	Zinc (Zn)	mg/kg	105	-	-	200
5	Manganese (Mn)	mg/kg	15	-	1,800	-
6	Lead (Pb)	mg/kg	80	150	400	70
7	Arsenic (As)	mg/kg	ND	150	3.9	12
8	Iron (Fe)	mg/kg	5,280	-	-	-
9	Chromium (VI)	mg/kg	ND	250	300	-
10	Mercury (Hg)	mg/kg	0.002	15	23	-
11	Nickel (Ni)	mg/kg	10	-	1,600	-

Remarks: ND: Not detected
Source: 1) Standard of Soil Contamination Countermeasures Act, 2002, Japan
2) Environmental Quality Standards for Soil Pollution, 1994, Japan
3) Soil Quality Standard for Other Purposes, 2004, Thailand
4) Regulation for Implementing the Law on Soil Contamination Countermeasures QCVN 03: 2008/BTNMT, Vietnam. It is applied as "farm land"

4.1.5 Noise Level

(1) Survey Condition

The measurement of noise levels was conducted in reference to the recommendation of the International Organization for Standardization (ISO) in ISO 1996-1:2003 and ISO 1996-2:2007. Noise level surveys were conducted in April and June 2013. The results of such are shown in Table 4.1-13 and Table 4.1-14.

Table 4.1-13: Survey Parameters and Related Standard for Noise Level

No.	Parameter	Period	A-Weighted Loudness Equivalent (LAeq) dB
1	Area adjacent to a road (Along the road)	Daytime (6:00-22:00)	70
		Nighttime (22:00-6:00)	65
2	Residential area (Living environment)	Daytime (6:00-22:00)	55
		Nighttime (22:00-6:00)	45

Source: Environmental Quality Standards for Noise, 1998, Japan

Table 4.1-14: Sampling Duration for Noise Level Survey

Sample Point	Duration	Date and Time
N-2	72 hr x 2 times	1st: 7 April 2013 (Sunday) to 10 April 2013(Wednesday) 2nd: 23June 2013 (Sunday) to 25 June 2013 (Tuesday)

Source: EIA Report for the Thilawa SEZ Zone A Development Project

(2) Survey Location

The locations of noise level survey point are shown in Table 4.1-15.

Table 4.1-15: Locations of Noise Survey

Sampling Point	Coordinates	Description of Sampling Point
N-2 (1st) (Living Environment)	N 16°40'15.54", E 96°16'33.83"	Near the Moegyoswun Monastery Compound. The location is an open area beside the monk houses and about 150 m from the road. The road is paved and has low traffic.
N-2 (2nd) (Along the Road)	N 16° 40' 11.5", E 96° 16'36.4"	In front of Moegyoswun Monastery. The location is an open area beside the road and about 6 m from the road. The road is paved and has low traffic.

Source: EIA Report for the Thilawa SEZ Zone A Development Project

(3) Survey Result

The results of noise levels in 2013 are shown in Table 4.1-16. In the living environment, only the daytime results on weekends were below the environmental standard. The other results exceeded the environmental standard. On the other hand, all results from along the road were below the environmental standard.

Table 4.1-16: Results of Noise Levels in 2013

Unit: dB(A)

Location	Weekdays		Weekends		Environmental Standard[1)]	
	Daytime (6:00–22:00)	Nighttime (22:00–6:00)	Daytime (6:00–22:00)	Nighttime (22:00–6:00)	Daytime (6:00–22:00)	Nighttime (22:00–6:00)
N-2 (1st) (Living Environment)	57	53	53	54	55	45
N-2 (2nd) (Along the Road)	67	55	68	51	70	65

Source: 1) Environmental Quality Standards for Noise, 1998, Japan
EIA Report for the Thilawa SEZ Zone A Development Project

4.2 Natural Environment

4.2.1 Flora, Fauna, and Biodiversity

Until 1998 there has been no reserved forest in Thanlyin Township. Since then, an area of about 2.3 km^2 (557 acres) have been demarcated as reserved forest. There is a low lateritic hill from north to south identified in Thanlyin Township. Small areas of mangroves are found in the south and southeastern parts of this township. The common species are Kanazo, Dhani, Tayaws, and some kinds of bamboo.

According to the Reference, there were 139 flora species in the dry season and 181 species in the rainy season in the Thilawa SEZ Zone A area and downstream nearby the Yangon River. The listed and recorded plant species were checked with the International Union for Conservation of Nature (IUCN) Red List of threatened species. However, none of those species were found in the IUCN Red List.

The fauna survey was also conducted in 2013 in and around the Thilawa SEZ Zone A. A total of 13 butterfly species were recorded in the study area during the survey period. All the recorded butterfly species were common species. A total of 18 bird species, which belong to 13 families, were recorded in the survey area. A total of four mammal species categorized as Lc (Least Concern) by IUCN Red List were recorded during the survey period. Some species such as the white-bellied rat, *Niviventer fulvscens*, and Greater bandicoot rat, *Bandicota indica*, were found mainly in rice fields, whereas the grey squirrel *Callosciurus pygerythrus* was found in both scattered trees and scrubland areas. Eighteen reptilian species and seven amphibian species were recorded in the survey area during the survey period and the total 18 species in dry season and 8 species in rainy season had the Lc status in the IUCN Red List. The reptile species *Calotes versicolor* was observed in areas with mixed vegetation

and scattered trees. Among the recorded species, the paddy frog *Fejervarya limnocharis* was found as very common species. The frog species *Holobatrachus tigerinus* was also common in the area and distributed in many parts of the area in the wet season. A total of 15 fish species were recorded during the survey period. The fishes are important for the ecosystem of the canal and rice field water body. The fish species *Mystus cavasius* and *Puntius chola* were found as very common species in the Thilawa SEZ Zone A. The fish species *Mystus bleekeri* and *Labeo calbasu* were also abundant in the aquatic habitat. As a result of survey, Endangered (EN) species, vulnerable (VU) species by IUCN Red List and prohibited species, which need to conserve and no hunting, trading and no disturb to them by Myanmar Law, were not identified by the Reference survey.

4.2.2 Groundwater and Hydrological Situations

The main river around the proposed Project area is the Yangon River, which is a large tidal river in the region. The Hmawwun River, Kondon Creek, and Kawdaun Creek flow into the Yangon River. The water from these water bodies is unsuitable for agricultural and fishing industries.

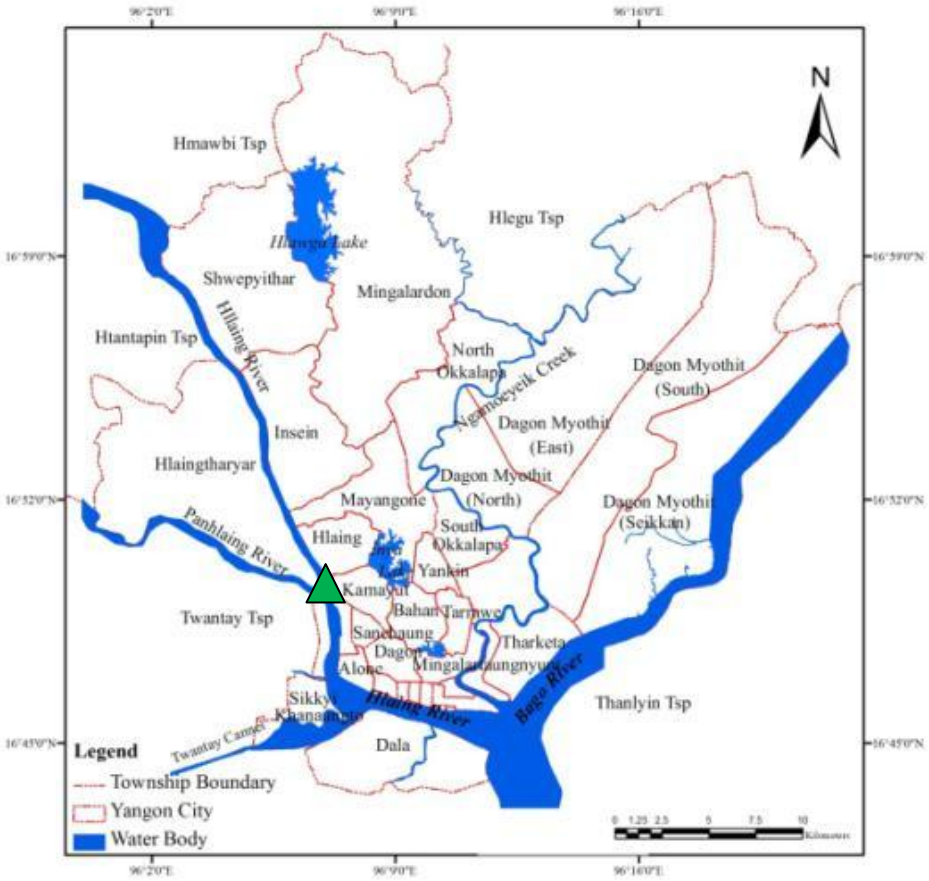
The western part of Thanlyn Township has a lot of tidal rivers and creeks. The main river is the Hmawwun River, which flows from east to west and reaches the Yangon River. Some creeks also flow into the Yangon River, some into the Hmawwun River, and some directly into the Gulf of Mottama (e.g., Kanaung, Myagaing, and Tummyaung).

Hydrology is the second element in determining groundwater occurrence and movement. Since groundwater is being studied here, hydrology is to be discussed only as it affects groundwater. Precipitation and stream flow are to be considered only in relationship with groundwater.

In the alluvial deposits along the major streams, there is a seasonal interchange of surface water and groundwater. During peak runoff or at high tide, water of the Yangon River percolates into the groundwater reservoir in the adjacent area, and as the stream level declines below the adjacent water table, groundwater percolates back into the channels.

4.2.3 Meteorology

Greater Yangon has a tropical monsoon climate characterized by three distinct seasons, namely, summer (March to middle of May), rainy (middle of May to middle of October), and cool (middle of October to February) seasons. The Kaba-aye Meteorological Station, which is managed by the Department of Meteorology and Hydrology (DMH) of the Ministry of Transport (MOT), has been observing meteorological conditions of Greater Yangon since 1968. The location of the Kaba-aye Station is shown in Figure 4.2-1.



Note: Scale is not applicable
Source: Data of Township (Government Administration)

Figure 4.2-1: Location of Meteorology Station in the Yangon Area

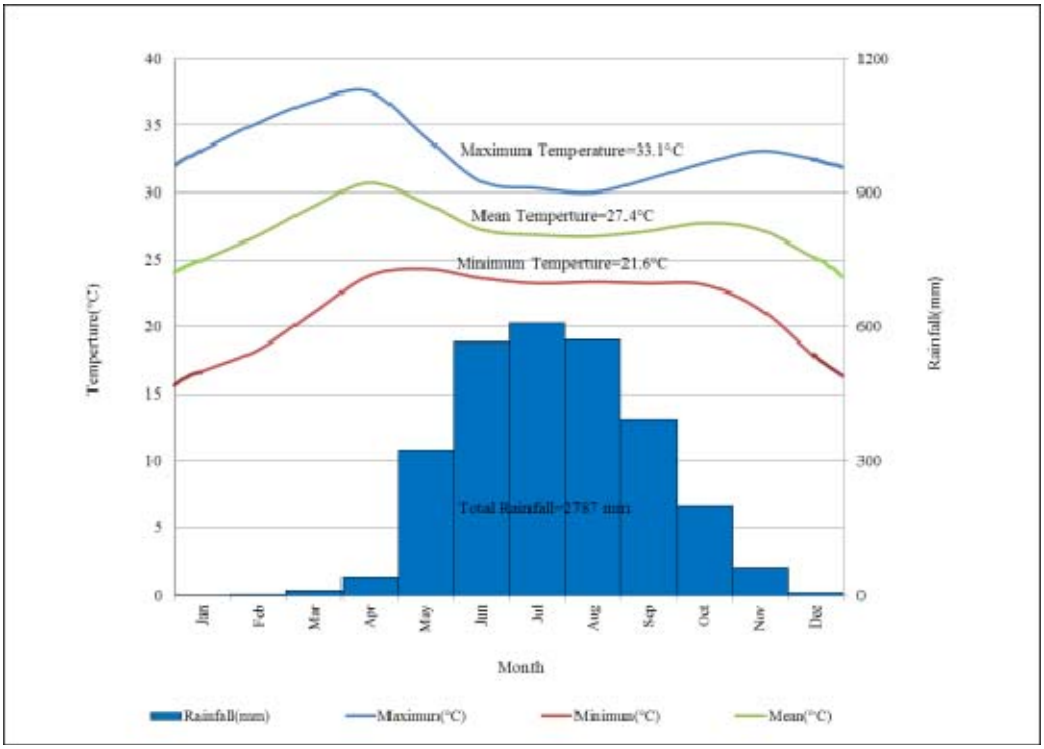
4.2.4 Temperature and Rainfall

From 1981 to 2010 the mean annual temperature is 27.4 °C. The mean monthly temperature is highest in April at 30.7 ℃ and lowest in January at 25.0℃. Except in December and January, the monthly temperatures are above 25.0 °C. The annual range of temperature is fairly small at 5.7 °C. The southwest monsoon wind is the main source of rain, and the Yangon area receives rain during the period from May to October. The average annual amount of rainfall is 2,787 mm. Rainfall sharply decreases from November and continues to be less than 10 mm from December to February as shown in Table 4.2-1 and Figure 4.2-2. According to Koppen's climate classification, the type of climate is Tropical Monsoon (am), which is characterized by alternating wet and dry seasons.

Table 4.2-1: Monthly Maximum, Minimum, Mean Temperatures and Rainfall at Kaba-Aye Station in Yangon City (1981-2010)

No.	1	2	3	4	5	6	7	8	9	10	11	12	Average/ Total
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Max. Temp. (°C)	33.2	35.2	36.8	37.5	34.1	30.8	30.3	30.0	31.0	32.2	33.1	32.5	33.1
Min. Temp. (°C)	16.7	18.3	21.1	23.8	24.3	23.6	23.2	23.3	23.2	23.1	21.3	17.7	21.6
Mean Temp. (°C)	25.0	26.8	29.0	30.7	29.2	27.2	26.8	26.7	27.1	27.7	27.2	25.1	27.4
Rainfall (mm)	1	4	12	38	325	566	608	571	393	201	61	7	2787

Source: Data of the Department of Meteorology and Hydrology, Kaba-aye Station, Yangon

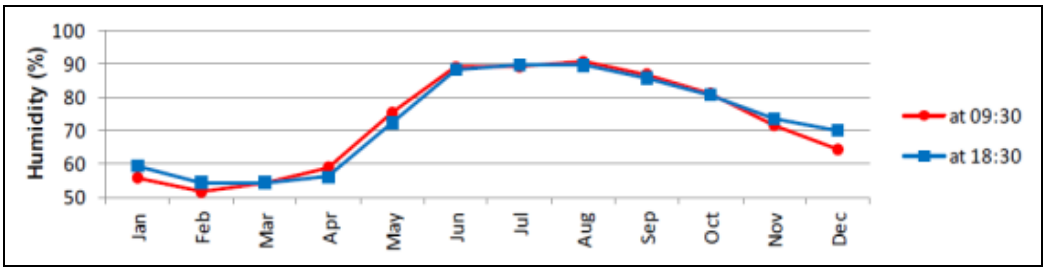


Source: Data of the Department of Meteorology and Hydrology Department, Kaba-aye Station, Yangon

Figure 4.2-2: Climograph of Kaba-aye Station in Yangon City (1981-2010)

4.2.5 Relative Humidity

Relative humidity have been recorded twice a day; at 9:30 and at 18:30. As shown in Figure 4.2-3 humidity difference between the morning and evening is quite small. The annual mean relative humidity at 9:30 and at 18:30 were 72.3% and 72.8%, respectively. The maximum mean monthly relative humidity is 90.6% in August, while the minimum mean monthly relative humidity is 51.4% in February.

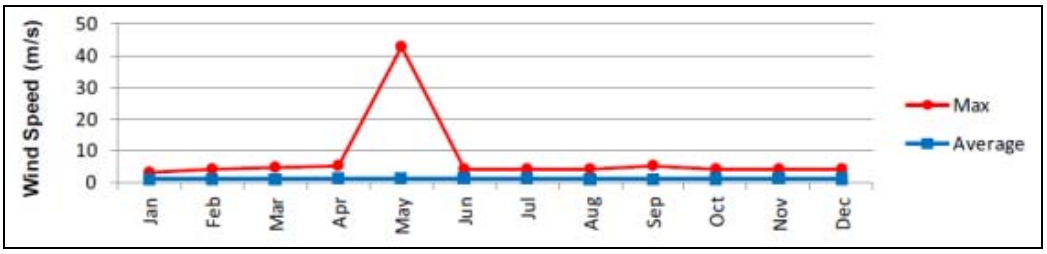


Source: The Strategic Urban Development Plan of the Greater Yangon, April 2013, JICA Study

Figure 4.2-3: Mean Monthly Relative Humidity at Kaba-Aye Station (1991-2000)

4.2.6 Wind Speed and Direction

The annual mean wind speed recorded at Kaba-aye Station was 1.1 m/s, while the maximum wind speed at 42.9 m/s was recorded in May 2008 at the time of Cyclone Nargis. Cyclones come to the country in April, May, and October, but as shown in Figure 4.2-4, Greater Yangon seldom experiences such cyclone winds. Winds are generally in the southwest direction during the summer (March to middle of May) and rainy (middle of May to middle of October) seasons, and in the northeast direction in the cool season (middle of October to February).



Source: The Strategic Urban Development Plan of the Greater Yangon, April 2013, JICA Study

Figure 4.2-4: Maximum Wind Speed and Mean Monthly Wind Speed at Kaba-Aye Station (1991-2008)

4.2.7 Topography

The Thilawa SEZ Zone A is part of the Ayeyarwaddy and Sittaung deltas. The ridges exist on both side of Thanlyin-Kyauktan Bridge and Thilawa Road.

The distinct physiographic units are as follows:

1. Ridges
2. Alluvial plain
3. Costal lowland

(1) Ridges

The dominant physical features of the region locating the project are three ridges with the Yangon ridge in the northern part, the Thanlyin anticlinal ridge in the eastern part, and the Kawhmu ridge in the western part of the region locating the project. Other parts are flat lowlands. These ridges are the southern continuation of the Pegu Yoma. The Yangon-Mingaladon ridge is an anticlinal ridge and morphologically it looks like a homoclinal ridge. The highest elevation is about 68 m above sea level with 30 m base height, and the regional slope is towards the south. The Thanlyin ridge is also an anticlinal ridge and covered with thick lateritic soil. The highest elevation of the entire region is about 50 m mean sea level (msl) and base height is about 21 m above sea level. The Kawhmu ridge is dome shaped and covered with thick lateritic soil. The highest point is about 60 m and the basement of this ridge is about 20 m. This ridge is wide at about 34 km from the north of Twentay Town to the south of Kawhmu Town. Further at the western part along Thanlyin-Kyauktan Highway and the western part of Nyaungwine Village Tract, Shwebyauk Village, Thanlyin Township and Kyauktan Township are situated. The elevation of the ridges are above 17 m, and are located at the border of Thanlyin Township and Kyauktan Township along the road between Ahle Village of Thanlyin Township and Thilawa Village of Kyauktan Hmawwun by the side of Thilawa Road. The ridges are covered with dense forest vegetation and boundaries, and are composed of laterite. These ridges are gently sloping southward.

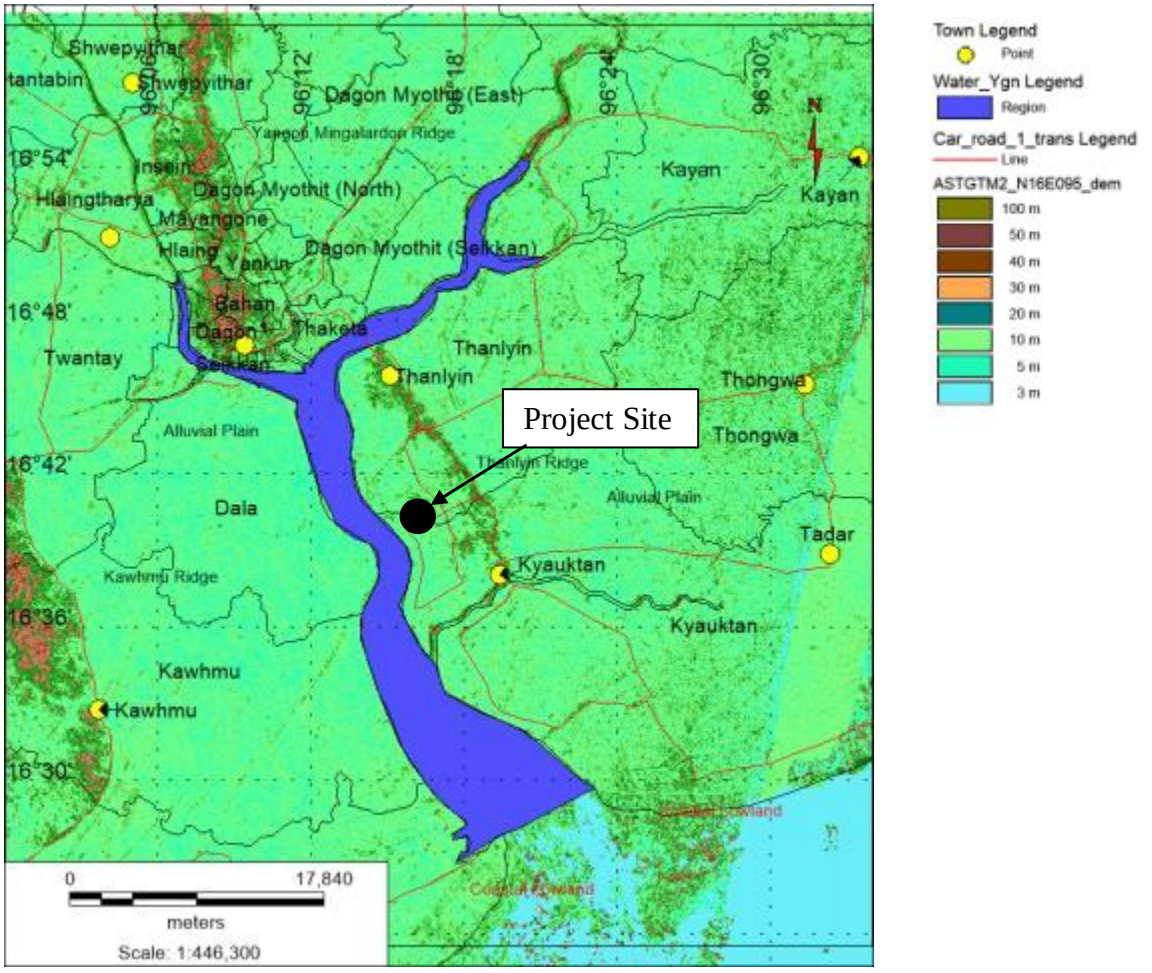
(2) Alluvial Plain

The alluvial plain is widespread, and a vast agricultural land found in the study area. This plain is built up with alluvial deposits from the Hlaing and Bago rivers. The general elevation of the alluvial plain is generally less than 6.6 m above mean sea level. In the rainy season the plain is usually flooded, thus it permits old alluvial soil to be deposited in its banks. The plain is rather swampy in some places.

(3) Costal Lowland

The coastal zone exists in the southern and southeastern parts of Thanlyin Township and Kyauktan Township. These coastal zone structures are from Mibya, Zwebagon, Shan Chaung, and Sinmakwe Village to the southern part up to the Mottama Sea. Large swampy lowlands are found in the lower

part of the coastal region where the Hmawwun River, Kondon Creek, and Kawdaun Creek flow into the Yangon River. The drain empties very slowly. Thus, this part is unsuitable for agriculture and fishing industries. The western portion of these townships is drained by a lot of tidal rivers and creeks. The main drainage is the Hmawwun River, which flows from east to west and drains into the Yangon River. Some creeks flow into the Yangon River, some into the Hmawwun River and some directly into the Gulf of Mottama (e.g., Kanaung, Myagaing, and Tummyaung).



Note: Scale is not applicable
Source: Resource Environmental Myanmar Ltd.

Figure 4.2-5: Physiographic Features in Yangon Area

4.2.8 Geographical Features

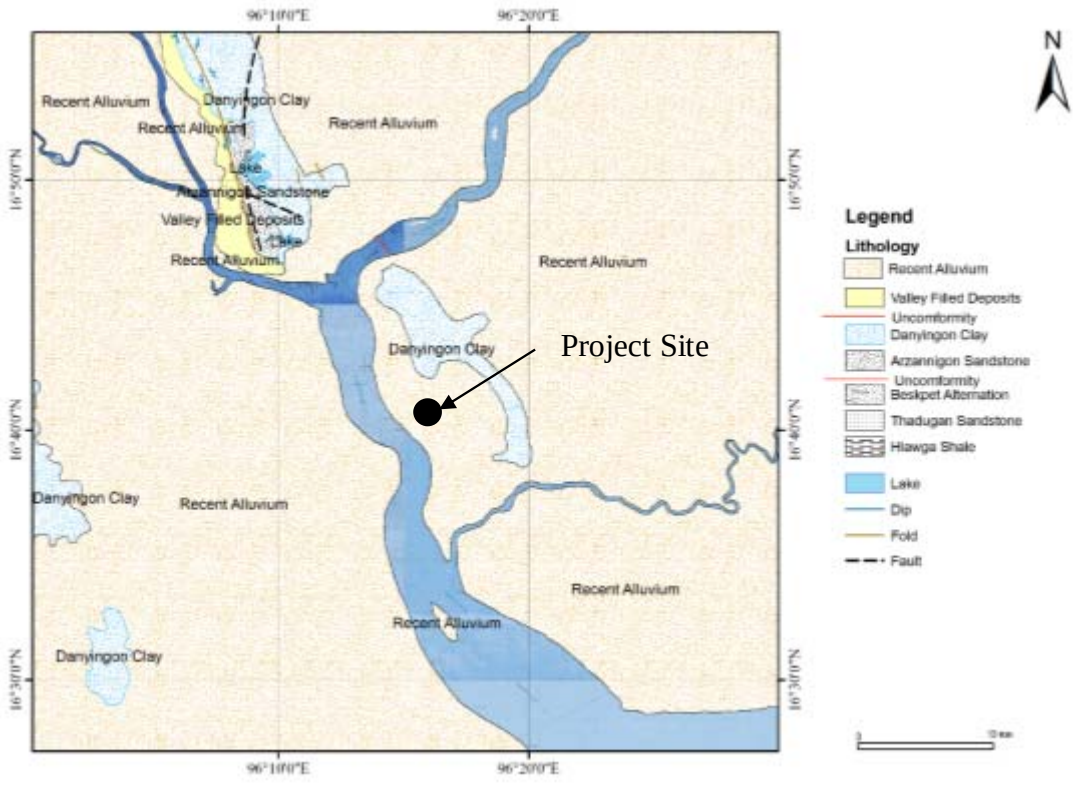
Regional geomorphic features of the entire area includes ridges and deltaic lands lying south of the Pegu Yoma between the Sittaung River in the east and the Irrawaddy River in the west. This area is in a north-south trending sedimentary basin containing thick sedimentary deposits from the Tertiary to Quaternary periods. The Tertiary deposits are strongly folded into narrow en echelon anticlinal folds such as the Yangon ridge, the Thanlyin-Kyauktan ridge, and the Twentay-Kawhmu ridge. All these ridges are trending south towards the Gulf or Martaban. Rocks of the Tertiary period contain well consolidated marine sandstone and shale of the Pegu Group and semi-consolidated, continental deltaic and marginal marine deposits of the Irrawaddy Formation. The synclinal valley or trough west of the Yangon anticlinal ridge is filled with unconsolidated deposits from the Quaternary period. There forms a wedge-shaped alluvial accumulation, ranging in thickness from a few feet near the ridge up to 100 m in the synclinal valley. The wedge-shaped form of these sediments extends both in the east-west and

north-south directions and shows thickening toward the south and west. These sediments include clay, silt, sand and very coarse-grained gravel.

Table 4.2-2: Geological Survey of the Region Locating in and around Project Site

Lithostratigraphic Units	Geological Age	Physical Parameter
Recent Alluvial	Recent	Clay and silt with trace sand.
Valley-filled deposits	Pleistocene	Clay, silt, sand and very coarse-grained gravel.
Danyingon clay	Pliocene	Reddish brown, grey to blue, laminated clays, with interbedded sand-rocks.
Arzanigon sand-rock		Yellowish grey to bluish grey sand-rock, fine to coarse-grained, sometimes very coarse-grained, sometimes very coarse to gritty with intercalated clay and mudstone/siltstone.
Besapet alternation	Miocene	Alternation of shale and argillaceous sandstone.
Thadugan sandstone		Well consolidated, jointed argillaceous sandstone.
Hlawga shale	Oligocene	Generally indurated shale.

Source: Data from the Geology Department

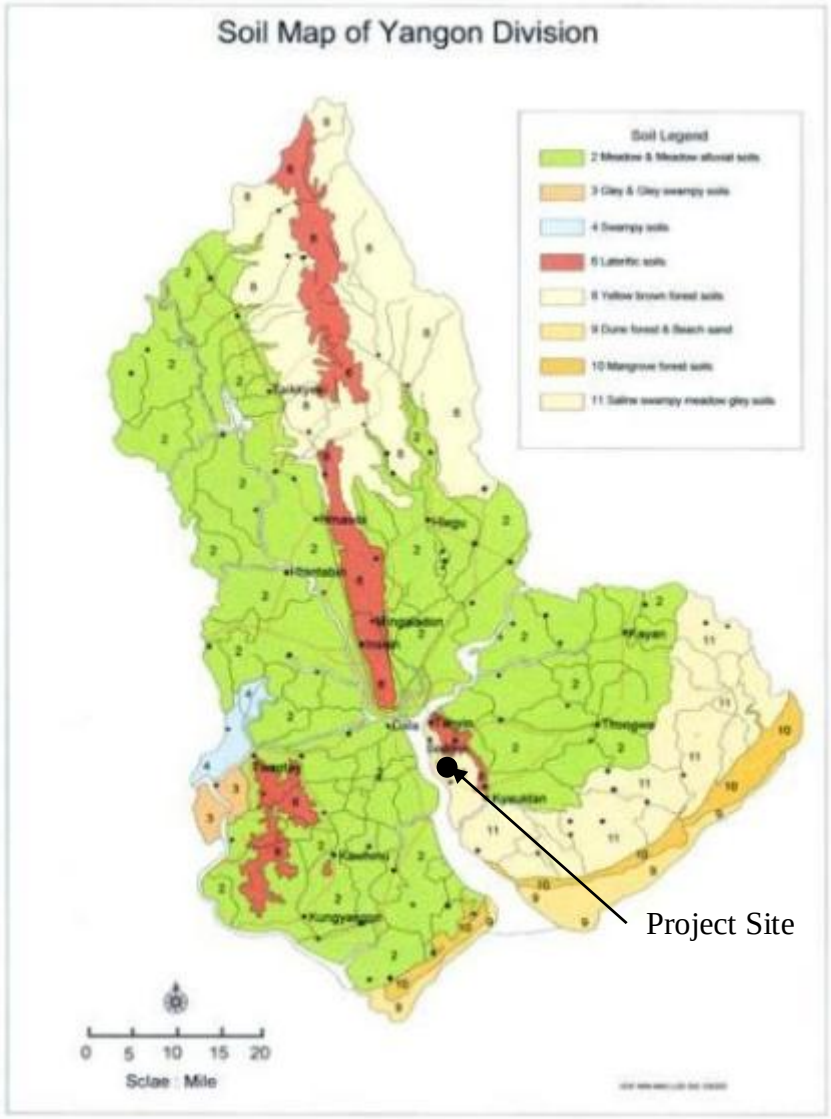


Note: Scale is not applicable
Source: Data from the Geology Department

Figure 4.2-6: Geological Map in and around the Project Site

4.2.9 Soil Erosion

The main types of soil are Ferrosols, Gleysols, Solovechaks, and Arenesols. Ferrosols (plinthic) or lateritic soils are found on low hills along Thanlyin-Kyauktan. The soil is good for growing rubber and vegetables, and for gardening. Gleysols (dystric) or meadow gley soils occupy much of the area in this township as shown in Figure 4.2-7. About 90% of these soils are composed of silt and clay, but humus content varies from place to place. These soils are favorable for paddy cultivation. The main problem, however, is poor drainage and water logged conditions. Meadow Solonchak are usually found in lowlands under impeded drainage. In the rainy season, they are covered with flood water. Because of the high content of clay, these soils become very dry and crack in the dry season. Solonchaks (gleyic) or saline swampy gluey soils are found along the coastal area. These soils develop from sediments transported and deposited at the estuaries of the Yangon River.



Note: Scale is not applicable
Source: Data from the Land Use Division, Myanmar

Figure 4.2-7: Soil Map of Yangon Division

4.3 Social Environment

4.3.1 Population

In 2011, the population in Myanmar was estimated at 48.3 million. Approximately 70% reside in rural areas and 30% in urban areas. The densest area is in Yangon Division wherein about 390 people live per km^2.

In 2014 there were about 212,000 in Thanlyin Township and 124,000 people and Kyauktan Township as shown in Table 4.3-1.

Table 4.3-1: Total Population of Related Townships (2014)

Town ship	Houses	Households	Under 18 years			Over 18 years			Total		
			Male	Female	Total	Male	Female	Total	Male	Female	Total
Thanlyin	47,582	47,760	27,612	26,681	54,293	76,466	81,882	158,348	104,078	108,563	212,641
Kyauktan	26,420	30,428	17,883	16,237	34,120	43,266	47,536	90,802	61,149	63,773	124,922

Source: Thanlyin and Kyauktan Township Administrative Offices

4.3.2 Ethnicity

The races residing in Thanlyin and Kyauktan townships are shown in Table 4.3-2. Most of the people who live in the townships are Bamar, followed by Kayin, Rakhine, and Indian people. A small number of Pakistani and Bangladeshi live in Thanlyin Township.

Table 4.3-2: Races in Related Townships (2014)

No.	Race	Township	
		Thanlyin	Kyauktan
1	Kachin	52	3
2	Kayar	2	2
3	Kayin	1,573	224
4	Chin	224	12
5	Mon	415	8
6	Bamar	198,494	120,110
7	Rakhine	1,183	90
8	Shan	133	3
9	China	371	330
10	Indian	7,090	4,140
11	Pakistan	64	0
12	Bangladeshi	425	0
13	Others	2,615	0
Total		212,641	124,922

Source: Thanlyin and Kyauktan Township Administrative Offices

4.3.3 Religion

The religions present in Thanlyin and Kyauktan townships are shown in Table 4.3-3. More than 90% of the people living in the two townships are Buddhists. There are more Hindus and Muslims living in Kyauktan Township than in Thanlyin Township.

Table 4.3-3: Religion in Related Townships (2014)

Township	Religion	Buddhist	Christian	Hindu	Muslim	Total
Thanlyin	Number	120,110	1,220	3,232	360	124,922
	(%)	96.2	0.9	2.6	0.3	-
Kyauktan	Number	202,076	1,853	3,760	3,200	212,641
	(%)	93.7	0.9	2.8	2.4	-

Source: Thanlyin and Kyauktan Township Administrative Offices

4.3.4 Local Economy and Livelihood

The main sources of livelihood in the two townships are agriculture, fishing, and official employment in the government. In Thanlyin Township, other sources of earning are livestock breeding, fish farming, casual labor, and betel leaf and coconut plantations as well as small-to-medium-size businesses. In Kyauktan Township, other livelihood activities include livestock breeding, fish farming, and betel leaf and coconut plantations. Most of the casual labor is employed in the agricultural sector.

Table 4.3-4: Existing Status of Local Livelihoods in Related Townships (2014)

Township	Type of Workers							
	Government Staff	Service Staff	Agriculture	Livestock	Trader	Factory	Odd Job	Others
Thanlyin	7,436	2,675	6,650	175	21,003	6,230	41,972	21,623
Kyauktan	4,305	11,000	4,307	8,706	6,637	5,378	6,569	35,851

Source: Thanlyin and Kyauktan Township Administrative Offices

4.3.5 Social Infrastructure and Service

Public transportation modes in Thanlyin Township are bus, railway, and inland water transportation. As for the port sector, Thanlyin is an important township for ocean transportation, with three ports being operated thereat. In Thanlyin, total length of roads is 212.36 km and total length of railroads is 22.12 km. Inland water length is 178.51 km in which three harbors and 110 bridges are in running condition. The main sources of water are five streams and ten reservoirs. In this township, the sources of water for drinking and other uses of residents are river/stream and reservoir. As for the telecommunications sector, the percentage of households in the township with landlines is about 5%, and it represents a very low rate within the Yangon Region.

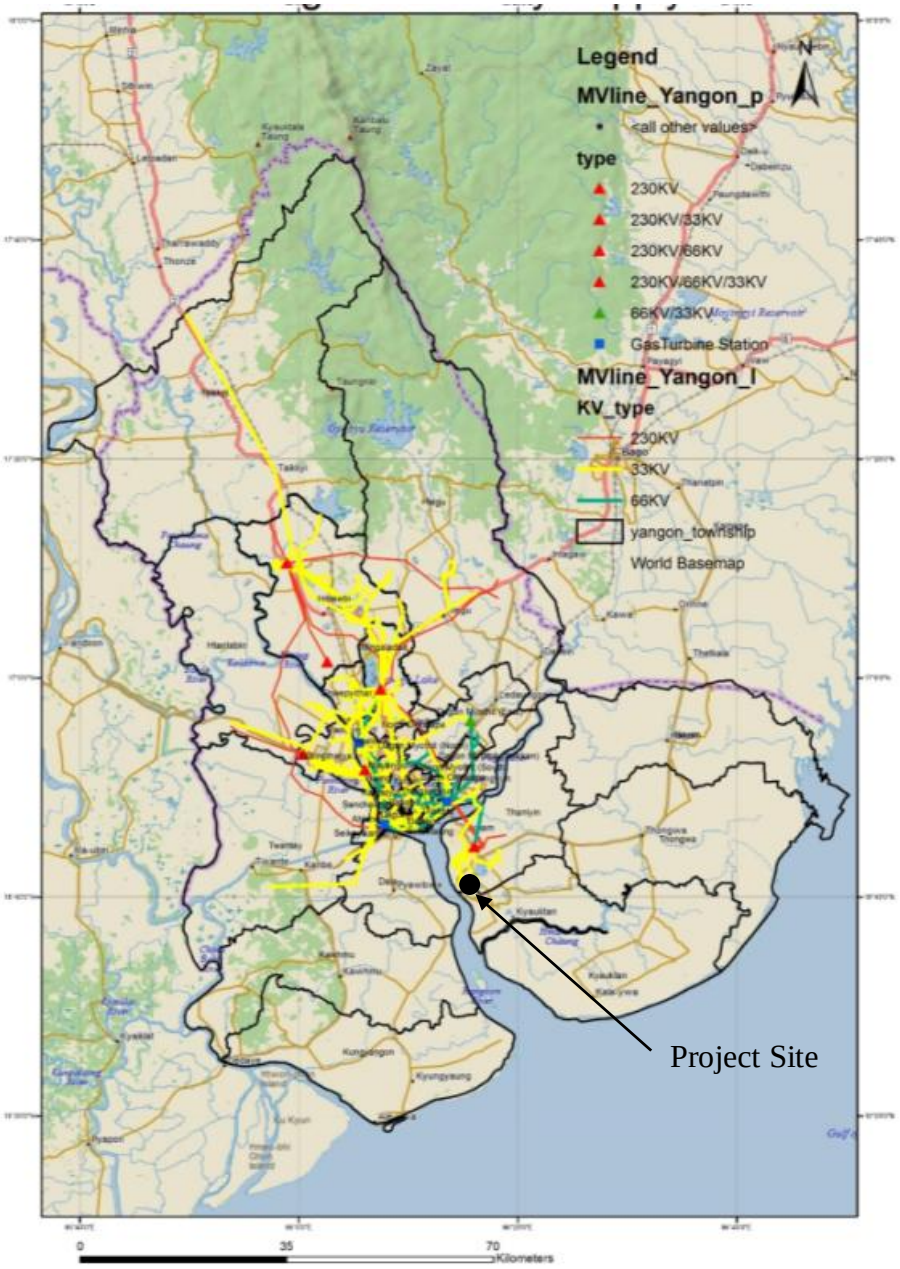
Public transportation modes in Kyauktan Township are bus and inland water transportation. There are three bus lines of 115 cars in Kyauktan Township. The main sources of water for drinking and other uses of residents are river and well/deep well and reservoir. As for the telecommunications sector, the percentage of households in the township with landlines and mobile phones is about 50%.

4.3.6 Water Source

For the townships, the sources of water for drinking and other uses of residents are river/stream and reservoir. It is bounded by the Bago River in the east, Thongwa and Kayan townships in the west, Kyauktan Township in the south, and the Bago River again in the north. Thanlyin Township is situated in the southern part of the Yangon Region. Some small hills over 100 ft (30 m) can be seen along Thanlyin-Kyauktan Road, but most of the township area is flat. The drainage system of the region locating the project and surrounding area includes three main rivers, namely, the Yangon River, the Bago River, and the Hlaing River, and their tributaries. These tributaries are mostly the alluvial stream and show dendritic pattern whereas combination of dendritic pattern and braided stream system are observed in some low-lying areas. Thus, tidal channels collectively form a special drainage pattern known as tidal flat. The main river in the study area is the Yangon River, which is a large tidal river. The Hmawwun River, Kondon Creek, and Kawdaun Creek flow into the Yangon River. The drainage pattern is very poor. Thus, this part is unsuitable for agriculture and fishing industries.

4.3.7 Electric Power System in Yangon

By the end of 2011, there were a total of eight power plants connected to the Yangon Power Grid and the total amount of installed capacity of their power supply, all of which are thermal power, is 471 MW. There are four gas turbine power plants with combined installed capacity of 318 MW, and four steam turbine units with combined installed capacity of 153 MW. Moreover, there are seven 230 kV substations in the Yangon Power Grid. The total capacity of the main transformers is 940 MVA, and the length of the 230 kV lines is 959.87 km. Yangon's power supply map is shown in Figure 4.3-1.



Note: Scale is not applicable
Source: Yangon Electric Supply Board

Figure 4.3-1: Yangon Electricity Supply Map

4.3.8 Cultural Heritage

Cultural heritage in Thanlyin and Kyauktan townships is summarized in Table 4.3-5. Many religious heritage sites related to Buddhism, i.e., 146 pagodas and 192 Buddhist temples, are located in Thanlyin Township.

Table 4.3-5: Cultural Heritage of Related Townships (2014)

Township	Type of Cultural Heritage						
	Pagoda	Buddhist Temple	Church	Mosque	Hindu Temple	Chinese Temple	Total
Thanlyin	146	192	6	10	31	3	388
Kyauktan	57	153	2	2	3	1	218

Source: Thanlyin and Kyauktan Township Administrative Office

There are two typical monasteries near the Project site. The Mogyo-swan Seated Buddha Monastery is located in the west side of the study area. There is one seated Buddha statute of unknown time period called "Mogyo-swan yoke-shin-taw Myat", as shown in Figure 4.3-2. In addition, Kyaikkhauk Pagoda is located in the northern area of Thilawa Lake. This pagoda is believed to be built in 397 B.C.

Source: EIA Report for Thilawa SEZ Zone A Development Project

Figure 4.3-2: Picture of Seated Buddha Statue in Mongyo-swan Monastery

4.3.9 Landscape

No specific landscape was identified during the field visit in the region locating the project. The project site and its surrounding area is composed of flat plains and typical rural landscapes of urban neighborhood.

4.3.10 Emergency Risk

(1) Natural Hazard

The "Hazard Profile of Myanmar" prepared by five government ministries and departments of Myanmar and four non-governmental agencies in July 2009 describes nine types of disasters in Myanmar: 1) Cyclone, 2) Drought/Dry zone, 3) Earthquake, 4) Fire, 5) Flood, 6) Forest Fire, 7) Landslide, 8) Storm, and 9) Tsunami. Among these, some notable natural hazards are described as follows:

(2) Flood

Floods in Greater Yangon can be classified into three types: i) river flood; ii) localized flood inundation in urban areas due to a combination of factors such as cloudburst, poor infiltration rate, poor drainage infrastructure (possibly due to climate change, heat island phenomenon); and in rural areas due to decrepit dams, dikes and levees, and iii) floods due to cyclone and storm surge.

Past major flood events from 1997 to 2007 are described in the "Hazard Profile of Myanmar", but there are only a few flood events in and around Greater Yangon as shown in Table 4.3-6.

Table 4.3-6: Past Major Floods in Yangon Region (1997-2007)

Location	Date	No. of affected households	Affected population	Deaths	Remark
Kayan Township	7 June 1997	1,189	5,878	0	North part of the region
Hta/16 Ward, Shwe Pyi Thar Township	8 September 2002	886	4,541	0	Along the left bank of the Hlaing River in Greater Yangon

Source: Hazard Profile of Myanmar, July 2009

(3) Cyclone

Cyclones that originate from the Bay of Bengal generally move westward to India and then turn toward Bangladesh and Myanmar. Severe cyclones tend to occur either during the pre-monsoon season from April to May or the post-monsoon season from October to November.

Cyclones have three destructive forces, namely: i) storm surge, ii) heavy rainfall, and iii) strong winds. According to the "Hazard Profile of Myanmar", 1,248 tropical storms formed in the Bay of Bengal during the period from 1887 to 2005, of which 80 storms (6.4% of the total) hit Myanmar's coast. In total, 12 cyclones caused severe damage in Myanmar mainly due to the accompanying storm surge, and the highest death or missing toll was at 138,373 caused by Cyclone Nargis in May 2008.

Cyclone Nargis also hit Greater Yangon and floodwater spread on a number of townships around Yangon City. Most of the inundated area during Cyclone Nargis were the Dala, Twantay, Htantabin and Hlegu areas.

(4) Earthquake

In the Bay of Bengal west of Myanmar, there is the Andaman Trench, where the Indian Plate is moving northward and subducting underneath the Burma Plate from west to east. In east Myanmar, there is the Sagaing Fault, which is the boundary between the Burma Plate and Sunda Plate. Hence, a magnitude 7.0+ earthquake has occurred more than 16 times, and six earthquakes of around magnitude 7.0 hit the main cities along the Sagaing Fault such as Yangon, Bago and Mandalay from 1930 to 1956. Significantly, Yangon experienced six huge earthquakes around the 1930s.

4.3.11 Climate Change

The Republic of the Union of Myanmar is relatively underdeveloped. Large parts of the country have irregular use of electricity. Myanmar has a very low rate of carbon dioxide emissions per capita, at 0.1 metric tons per person in 1990, and rising gradually to 0.21 metric tons per person in 2004. This is in spite of the tropical climate, and the heavy use of air conditioners in the cities. Myanmar has its own oil industry, with petrol and gas used to generate electricity. Approximately 83% of the country's electricity comes from fossil fuels, with the remainder from hydropower. As a result, liquid fuels make up 57% of carbon dioxide emissions, and gaseous fuels make up another 39%. The remainder comes from solid fuels and from the manufacture of cement. About 36% of the carbon dioxide emissions in the country come from transportation, 30% from the generation of electricity, and 15% from manufacturing and construction. The main effect of global warming and climate change in Myanmar has been the increased risk of flooding, especially at the mouth of the Irrawaddy River. The Boxing Day Tsunami in 2004 led to serious flooding of this region. The Myanmar government took part in the United Nations (UN) Framework Convention on Climate Change signed in Rio de Janeiro in May 1992. They adopted the Kyoto Protocol to the UN Framework Convention on Climate Change on 13 August 2003, and it was ratified on 16 February 2005.

CHAPTER 5: SCOPING AND TERMS OF REFERENCE FOR INVESTIGATION OF ENVIRONMENTAL, SOCIAL, AND HEALTH IMPACTS AND EMERGENCY RISK ASSESSMENTS

5.1 Scoping for Environmental, Social, and Health Impacts and Emergency Risk Assessments

In order to assess the likely significant environmental, social, and health impacts, and emergency risks, the conceivable adverse impacts and risks of the Project were initially indentified based on the Project description and overall environmental and social conditions in the surrounding area. As a result of the identification, the scoping matrix for each impact factor in the construction, operation, and closure stages were prepared as shown in Table 5.1-1. The impact items were classified based on the "Japan International Cooperation Agency Guidelines (JICA) for Environmental and Social Considerations (hereafter referred to as JICA guideline)" and International Finance Corporation (IFC) Environmental, Health, and Safety Guidelines for Waste Management Facilities (IFC guidelines), draft environmental impact assessment (EIA) procedures, and past EIA/initial environmental examination (IEE) reports in Myanmar.

The reasons behind the selection of the impact items with its corresponding rating are summarized in Table 5.1-2. The ratings of the impacts on pollution, natural environment, social environment, health and safety, and the emergency risks were classified as A to D in accordance with JICA guidelines. In addition, each item of scoping matrix is categorized as direct impact or indirect impact as shown in Table 5.1-3.

Table 5.1-1: Scoping Matrix for Impact Factor

Items		Construction Stage (CS)		Operation Stage (OS)					Closing Stage (ClS)		
		Land preparation and operation of construction machineries	Vehicle traffic around construction sites	Existence of final disposal site and its operation	Existence of incineration plant and its operation	Existence of waste water facility and its operation	Existence of other facilities and its operation	Vehicle traffic around Project sites	Demolition activities	Vehicle traffic around closing sites	Existence of final disposal site and land use after closure of landfill
Pollution	Air Pollution	-		-	-			(-)*1	-		
	Water Pollution	-		-					-		-
	Solid Waste			+	+	+	+				
	Soil Contamination	+/-									
	Noise and Vibration	-		-		-		(-)*1	-		
	Ground Subsidence										
	Offensive Odor			-			-				-
	Bottom Sediment										
Natural environment	Protected Area										
	Flora and Fauna Ecosystem	*1									
	Hydrology										
	Topography and Geography										
	Climate Change			+	-	+					
Social environment	Involuntary Resettlement	*2									
	Poor People										
	Indigenous and Ethnic People										
	Local Economy such as Employment and Livelihood	+		+	+	+	+		+		+

Items		Construction Stage (CS)		Operation Stage (OS)					Closing Stage (ClS)		
		Land preparation and operation of construction machineries	Vehicle traffic around construction sites	Existence of final disposal site and its operation	Existence of incineration plant and its operation	Existence of waste water facility and its operation	Existence of other facilities and its operation	Vehicle traffic around Project sites	Demolition activities	Vehicle traffic around closing sites	Existence of final disposal site and land use after closure of landfill
	Land Use and Local Resources										
	Water Usage			-							-
	Existing Social Infrastructures and Services										
	Social Institutions such as Regional Severance										
	Misdistribution of Benefits and Damages										
	Conflict of Interest Within the Region										
	Cultural Heritage	*1									
	Landscape			-							-
	Gender										
	Children's Rights										
Health and Safety	Occupational Health and Safety	-									
	Community Health and Safety Including Accidents	-									
	Infectious Diseases such as HIV/AIDS	-	-						-	-	
Emergency Risk	Flood Risk	-									
	Risk for Fire	-									

*1: Already evaluated in EIA for the Thilawa Zone A Development prepared by the Myanmar Japan Thilawa Development Company (MJTD)
*2: Already evaluated in Resettlement Work Plan Thilawa Zone A Development prepared by the Yangon Region Government
Note: CS: Construction Stage, OS: Operation Stage, ClS: Closure Stage

[+] : Positive impact [-] : Negative impact [(+/-)] : Impact is not clear [ ] : No impact

Source: EIA Study Team

Table 5.1-2: Results of Scoping for Environmental, Social, and Health Impacts and Emergency Risk Assessments

Category	Impact Item	Rating			Reasons
		Construction Stage (CS)	Operation Stage (OS)	Closure Stage (ClS)	
Pollution	Air Pollution	B-	B-	B-	**CS/ClS:** Deterioration of ambient air quality caused by construction machineries would temporarily occur during construction and closure phases. Impact on air quality by vehicle traffic caused by the Project in the construction and closure stages will be negligible as the number of vehicles required for the works is quite limited. **OS:** Deterioration of ambient air quality due to operation of the incineration plant and landfill works would occur in the operation phase. Impact on air quality due to vehicle traffic caused by the Project in the operation phase is already assessed by the EIA Report for the Thilawa Special Economic Zone Development Project (Zone A) (2013). Thus, this impact is not addressed because the Project proponent will implement the mitigation measures based on the results of the EIA.

Category	Impact Item	Rating			Reasons
		Construction Stage (CS)	Operation Stage (OS)	Closure Stage (ClS)	
	Water Pollution	B-	B-	B-	**CS/ClS:** Muddy water inflows to the river from the bare land of the construction site and drainage from the lodging of construction may deteriorate the water quality. **OS/CIS:** Inadequate treatment and disposal of leachate from the landfill in the operation stage would cause water pollution in the surrounding surfaces and underground water.
	Solid Waste	D	B+	D	**CS/ClS:** The impact of solid waste in the construction and closure stages will be negligible as no hazardous waste will be discharged and little volume of solid waste will be discharged due to the works. **OS:** The Project itself aims to improve solid waste management in Thilawa SEZ and Greater Yangon Region.
	Soil Contamination	C	D	D	**CS:** Soil contamination might be diffused if the soil in the Project site is originally contaminated and not treated adequately. **OS/ClS:** Soil contamination in the operation and closure stages is not assumed as landfill waste and leachate is adequately intercepted by liner system equipped in the landfill as described in Chapter 3.
	Noise and Vibration	B-	B-	B-	**CS/ClS:** Increase of noise and vibration levels due to construction machineries would temporarily occur during the construction and closure stages. Impact on noise and vibration by vehicle traffic caused by the Project in the construction and closure stages will be negligible as the number of vehicles required for the works is quite limited. **OS:** Increase of noise and vibration levels due to the operation of the incineration plant and landfill works would occur in the operation phase. Impact on noise and vibration by vehicle traffic caused by the Project in the operation phase is already assessed by the EIA Report for the Thilawa Special Economic Zone Development Project (Zone A) (2013). Thus, this impact is not addressed because the Project proponent will implement the mitigation measures based on the results of the EIA.
	Ground Subsidence	D	D	D	Impact on ground subsidence will be negligible because the intake of groundwater is not planned.
	Offensive Odor	D	B-	B-	**CS:** Construction work causing offensive odor is not anticipated. **OS/CIS:** Inadequate operation and closure of landfill would cause offensive odor.
	Bottom Sediment	D	D	D	**CS:** Impact on bottom sediment contamination is not assumed as there is no work to change the bottom of the river. **OS/CIS:** Bottom sediment contamination in the operation and closure stages is not assumed as landfill waste and leachate will be adequately intercepted by the liner system equipped in the landfill as described in Chapter 3.
Natural Environment	Protected Area	D	D	D	No protected area exists in and around the Project site.
	Flora and Fauna, Ecosystem	D	D	D	Impact on flora, fauna, and the ecosystem is already assessed by the EIA Report for the Thilawa Special Economic Zone Development Project (Zone A) (2013). Thus, this impact is not addressed because the Project proponent will implement mitigation measures based on the results of the EIA.
	Hydrology	D	D	D	No impact on hydrology is anticipated as the Project does not make any changes to the water current or riverbed.
	Topography and Geography	D	D	D	No impact on topography and geography are anticipated as large scale excavation work is not planned.
	Climate Change	D	B+/ B-	D	**CS/ClS:** Impact of global warming due to the operation of construction machineries and vehicle traffic caused by the Project in the construction stage will be negligible as the number of machineries and vehicles required for construction work is quite limited. **OS:** Both the positive impact by avoiding open dumping and the negative impact by incineration are assumed.
Social Environment	Involuntary Resettlement	D	D	D	Impact on involuntary resettlement was already completed in accordance with the resettlement work plan developed by the Yangon Regional Government and was already approved in the Decision Clause 112 made at meeting No.51/2013 of the Yangon Region Government. At this moment, there is no residence in the Project site.
	Poor People	D	D	D	The Project will not cause negative impacts related to the poor because job opportunities for local people will be provided by the Project.
	Indigenous and Ethnic People	D	D	D	No indigenous and minority people are around the Project site.
	Local Economy	B+	B+	B+/D	**CS/ClS:** Job opportunity for local people will be provided and the

Category	Impact Item	Rating			Reasons
		Construction Stage (CS)	Operation Stage (OS)	Closure Stage (ClS)	
	such as Employment and Livelihood				regional economy will be boosted to some extent through the construction and closure works of the Project. After the closure stage, the local economy will be the same as before construction. **OS:** The local economy and employment will be boosted by the Project.
	Land Use and Local Resources	D	D	D	No impact on land use and local resources are anticipated as the Project will be placed in the Thilawa Special Economic Zone Zone A.
	Water Usage	D	B-	B-	**OS/ClS:** Impact on the daily life water use of local people around the Project site is expected due to the operation of solid waste management facilities including closing works.
	Existing Social Infrastructures and Services	D	D	D	No impact on social infrastructures and services are anticipated as the Project will be placed in the Thilawa Special Economic Zone Zone A.
	Social Institutions such as Regional Severance	D	D	D	No impact on social institutions is anticipated as the Project will be placed in the Thilawa Special Economic Zone Zone A.
	Misdistribution of Benefit and Damage	D	D	D	No impact on misdistribution of benefits and damages as the Project will be placed in the Thilawa Special Economic Zone Zone A.
	Conflict of Interests within the Region	D	D	D	No impact on conflict of interest within the region as the Project will be placed in the Thilawa Special Economic Zone Zone A.
	Cultural Heritage	D	D	D	It was confirmed that there is no cultural heritage in and around the Project site according to the EIA Report for the Thilawa Special Economic Zone Development Project (Zone A) (2013).
	Landscape	D	B-	B-	**CS/OS/CIS:** It was confirmed that there are no important landscape resources and scenic spots in and around the Project site according to the EIA Report for the Thilawa Special Economic Zone Development Project (Zone A) (2013). **OS/CIS:** On the other hand, the view from the road along the Project site might cause impact on the feeling of pressure due to the existence of a landfill site if the appropriate measures for the landscape will not be taken.
	Gender	D	D	D	The Project will not cause negative impacts related to gender.
	Children's Rights	D	D	D	The Project will not cause negative impacts related to children's rights.
Health and Safety	Occupational Health and Safety	B-	B-	B-	**CS/ClS/OS:** Impact on the working conditions of the workers is assumed if the appropriate measures to ensure working conditions and occupational safety will not be taken.
	Community Health and Safety	B-	B-	B-	**CS/ClS/OS:** Impact on community health and safety is assumed if the appropriate measures to ensure community health and safety will not be taken.
	Infectious Diseases such as HIV/AIDS	B-	D	B-	**CS/ClS:** Influx of labors who have infectious disease may cause the spread of disease. **OS:** No impact on infectious diseases in the operational stage is assumed because an intensive influx of laborers is not anticipated.
Emergency Risk	Flood Risk	B-	B-	B-	Flood risks brought by heavy rains, cyclones, and tsunamis are expected with a fixed probability.
	Risk for Fire	B-	B-	B-	Risks for fire are expected with a fixed probability.

Rating: A-: Significant negative impact A+: Significant positive impact
B-: Some negative impact B+: Some positive impact
C: Impact is not clear, need more investigation
D: No impact is negligible, no further study required

Source: EIA Study Team

Table 5.1-3: Direct and Indirect Impacts for the Result of Scoping

Category	Impact Item
Direct Impacts	Air Pollution, Water Pollution, Solid Waste, Soil Contamination, Noise and Vibration, Offensive Odor, Flora and Fauna, Ecosystem, Landscape,
Indirect Impacts	Climate Change, Water Usage, Infectious Diseases such as HIV/AIDS, Flood Risk
Direct and Indirect Impacts	Local Economy such as Employment and Livelihood, Occupational Health and Safety, Community Health and Safety including Accidents

Category	Impact Item
N/A	Ground Subsidence, Bottom Sediment, Protected Area, Hydrology, Topography and Geography, Involuntary Resettlement, Poor People, Indigenous and Ethnic People, Land Use and Local Resources, Existing Social Infrastructures and Services, Social Institutions such as Regional Severance, Misdistribution of Benefit and Damage, Conflict of Interests within the Region, Cultural Heritage, Gender, Children's Rights, Risk for Fire

N/A: No impact is expected in the scoping matrix.
Source: EIA Study Team

5.2 Terms of Reference for Investigation of Environmental and Social Conditions

The survey items and their methods for investigation of environmental and social conditions, of which impact items were rated as A, B, or C in the scoping described in Section 5.1, are shown in Table 5.2-1.

Among these impact items, baseline of air quality, water quality, soil quality, noise and vibration, shall be investigated by field measurements and laboratory analysis.

Table 5.2-1: Terms of Reference for Investigation of Environmental and Social Conditions

No.	Impact Item	Survey Item	Frequency	Point	Note
1	Air Pollution	Wind Direction, Wind Speed, Solar Radiation, Radiation Balance NO_2, NO, SO_2, TSP, CO, PM10	Twice (one week each in dry and rainy seasons)	One point in the Project site	Field measurements and laboratory analysis
2	Water Pollution	Parameters stipulated in the MOI Regulation, IFC EHS Guideline and MJTD internal rules (only parameters can be analyzed in Myanmar and Thailand)	Twice (one time each in dry and rainy season)	Two points (Project site and stream, which Zone A will discharge treated wastewater and rain water)	Field measurements and laboratory analysis
3	Soil Contamination	Cadmium (Cd), hexavalent chromium (Cr(VI)), mercury (Hg), selenium (Se), lead (Pb), arsenic (As)	Once	One point in the Project site	Laboratory analysis
4	Noise	L_{Aeq} (dB)	Two days (weekday and weekend)	One point in the Project site	Field measurements
5	Vibration	Lv (dB)	Two days (weekday and weekend)	One point in the Project site	Field measurements
6	Offensive Odor	Monitoring results of similar facilities	-	-	Document analysis
7	Climate Change	Measures to mitigate greenhouse gas emissions by the Project	-	-	Document analysis
8	Water Use	Hearing survey	Once	Around the Project site	Document analysis
9	Occupational Health and Safety	Measures to ensure occupational health and safety in the Project	-	-	Document analysis
10	Community Health and Safety	Measures to ensure community health and safety in the Project	-	-	Document analysis
11	Flood Risk	Confirmation of flood record	-	-	Document analysis
12	Risk for Fire	Measures to prevent fire by the Project	-	-	Document analysis

Source: EIA Study Team

CHAPTER 6: FIELD SURVEY

6.1 Outline

The summary of the environmental survey is shown in Table 6.1-1, and the sampling points for the environmental survey are shown in Figure 6.1-1.

Table 6.1-1: Summary of Environmental Survey

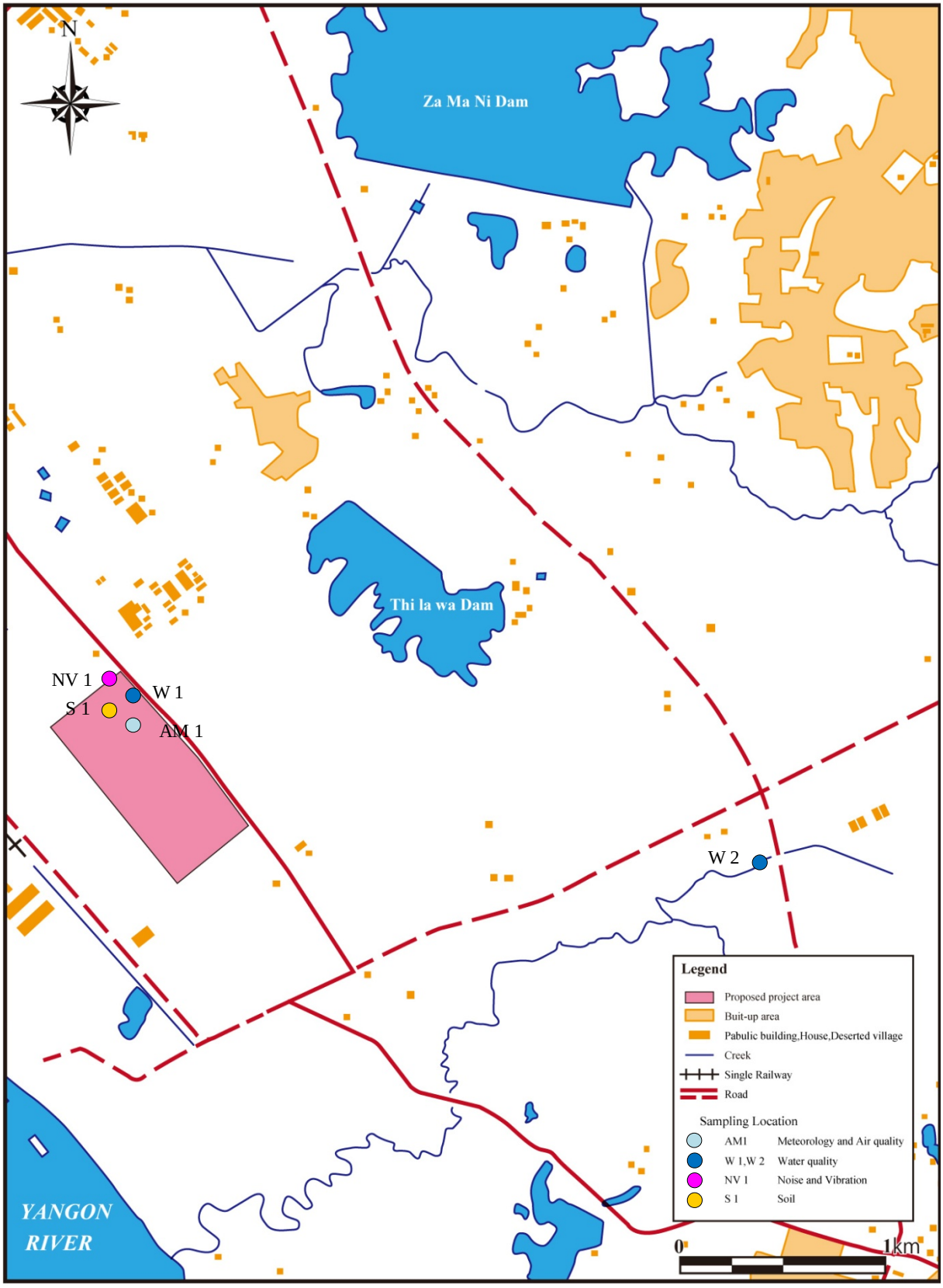
Item	Contents	Detailed Measurement Items
Air Quality and Meteorology	Parameter	Wind Speed, Wind Direction, Solar Radiation, Radiation Balance
	Period	First Period (16-23 May 2014) Second Period (16-23 June 2014)
	Location	AM 1 (Project Site in Thilawa SEZ Zone A)
Water Quality	Parameter	Temperature , Water Level (Flow Rate), Odor, Color, Electrical Conductivity, pH, BOD_5, COD_{Cr}, SS, Turbidity, Hardness, Total Dissolved Solids, DO, Total Coliform, Total Nitrogen, Nitrite-nitrogen ($N\text{-}NO_2$), Nitrate-nitrogen ($N\text{-}NO_3$), Ammonium Nitrogen ($NH_4\text{-}N$), Total Phosphorus, Phosphorous Phosphate ($P\text{-}PO_4$), Oil and Grease, Phenol, Sulfide, Sulfate, Hydrogen Sulfide (H_2S), Formaldehyde, Free Chlorine, Total Organic Carbon, Cyanide (CN), Mercury (Hg), Lead (Pb), Cadmium (Cd), Arsenic (As), Trivalent Chromium (Cr(III)), Hexavalant Chromium (Cr(VI)), Total Chromium (Cr), Copper (Cu), Zinc (Zn), Selenium (Se), Nickel (Ni), Manganese (Mn), Iron (Fe), Barium (Ba), Boron (B)
	Period	23 May 2014 (Dry Season), 18 June 2014 (Rainy Season)
	Location	W 1,W 2
Soil	Parameter	pH, Arsenic (As), Mercury (Hg), Copper (Cu), Lead (Pb), Zinc (Zn), Chromium (Cr), Nickel (Ni), Manganese (Mn), Iron (Fe), Selenium (Se), Calcium (Ca)
	Period	18 June 2014
	Location	S1
Noise and Vibration	Parameter	Noise level (L_{Aeq}), Vibration level (L_{V10})
	Period	Two 24 hr Duration (weekday: 23 July 2014, weekend: 10 August 2014)
	Location	NV 1 (Boundary of Project Site in Thilawa SEZ Zone A)

Source: EIA Study Team

Table 6.1-2: Name of Point for Field Survey

Name of Point	Point for Sampling
AM 1	Meteorology and air quality
W 1, W 2	Water quality
NV 1	Noise and vibration
S 1	Soil

Source: EIA Study Team



Source: EIA Study Team

Figure 6.1-1: Location of Environmental Baseline Data Sampling Points

6.2 Air Quality and Meteorology

6.2.1 Survey Items

The survey items of meteorology and air quality monitoring are shown in Table 6.2-1.

Table 6.2-1: Sampling Items for Meteorology and Air Quality Survey

	Items		Field Equipment
1	Meteorology	Wind Direction, Wind Speed, Solar Radiation, Radiation Balance	Environmental Perimeter Air Monitoring System (EPAS)
2	Air Quality	CO, NO_2, NO, SO_2, TSP , PM10	

Source: EIA Study Team

6.2.2 Survey Location

The survey location for meteorology and air quality monitoring is located in the Thilawa SEZ Zone A area that is about 15 km south of Yangon City.

(1) Summary of sampling point

The summary of sampling point is shown in Table 6.2-2. The details of one sampling point are described below.

Table 6.2-2: Sampling Point for Meteorology and Air Quality Survey

Sampling Point	Coordinates	Description of Sampling Point
AM 1	16°40'40"N, 96°15'32"E	Project Site in Thilawa SEZ Zone A

Source: EIA Study Team

AM 1 is in the Project site in Thilawa SEZ. The Project site is located in the west end of the Thilawa SEZ Zone A and the site is a flat field. The monitoring station is surrounded by a vacant grass field. The residential area (village) is located about 200 m to the north. There are no high buildings adjacent to the site. The location of AM 1 is shown in Figure 6.2-1.

Source: EIA Study Team

Figure 6.2-1: Location of Sampling Point

6.2.3 Survey Period

The first survey was conducted in the dry season from 16-23 May 2014.

The second survey was conducted in the rainy season from 16-23 June 2014.

6.2.4 Survey Method

The sampling and analysis of ambient air pollutants were conducted by referring to the recommendations of the United States Environmental Protection Agency (U.S. EPA). The Haz-Scanner Wireless Environmental Perimeter Air Station (EPAS) was used to collect ambient air monitoring data. The characteristics of the instrument are as follows:

- Portable direct reading,
- Configure up to 14 simultaneous air measurements including U.S. EPA criteria air pollutants, and
- Standard configuration measures particle matter 10 (PM10) or total suspended particulates (TSP), NO_2, NO, CO, temperature, and relative humidity.

Table 6.2-3: Sampling and Analysis Method for Air Quality

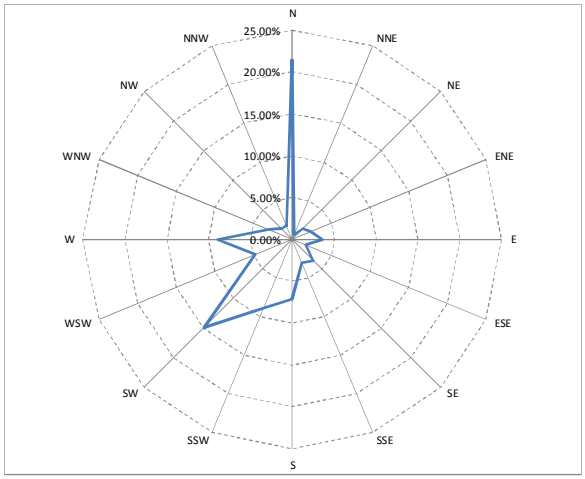
No.	Parameter	Analysis Method
1	Sulfur dioxide (SO_2)	On-site reading
2	Nitrogen dioxides (NO_2)	
3	Nitrogen monoxide (NO)	
4	Carbon monoxide (CO)	
5	Total suspended particulates (TSP)	
6	Particle matter 10 (PM10)	

Source: EIA Study Team

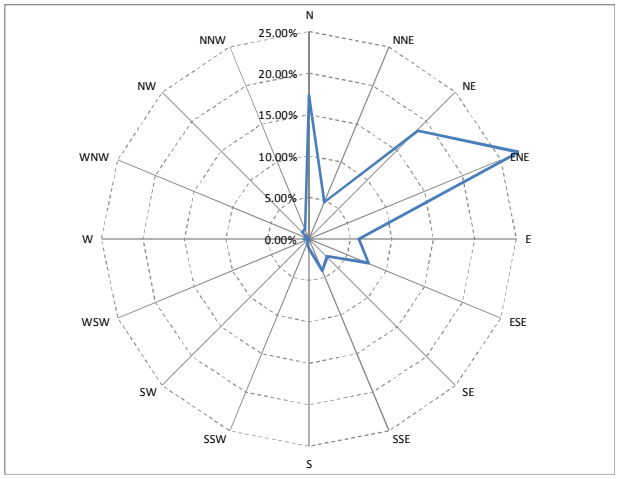
6.2.5 Survey Results

(1) Wind direction

The wind direction trend, which was monitored in the dry and rainy seasons, is shown in Figure 6.2-2 below. According to the survey results in the dry season, the prevailing wind directions are from north (N) and southwest (SW). On the other hand, the prevailing wind directions in the rainy season are from east-northeast (ENE) and north (N).



Dry Season (May)



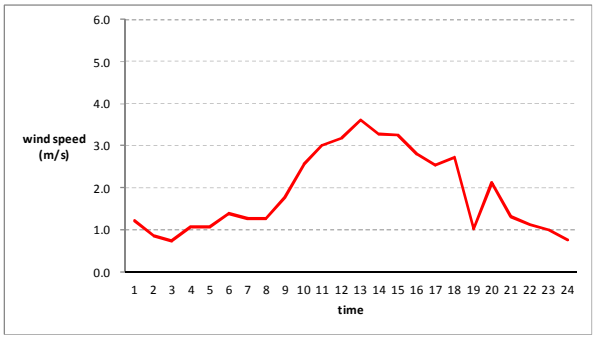
Rainy Season (June)

Source: EIA Study Team

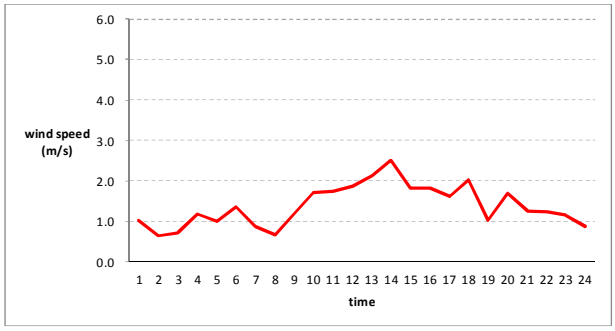
Figure 6.2-2: Wind Rose in the Project Area

(2) Wind speed

The average hourly wind speed, which was monitored in the dry and rainy seasons, is shown in Figure 6.2-3. The wind speed during the day is faster than at night for both seasons. Also, there is a tendency for the wind speed during the day in the dry season to be faster than the one in the rainy season.



Dry Season (May)



Rainy Season (June)

Source: EIA Study Team

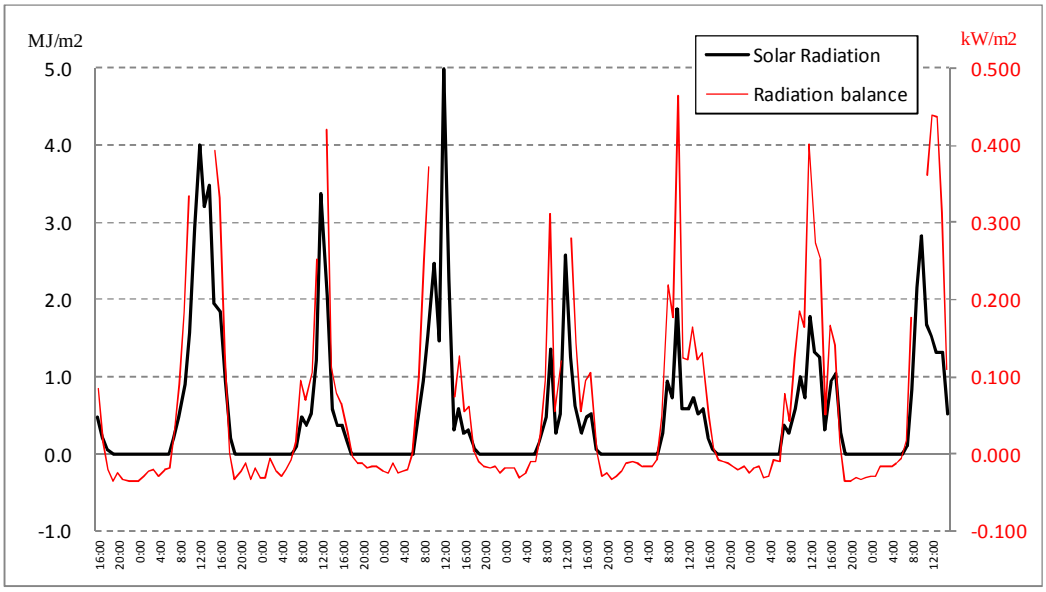
Figure 6.2-3: Wind Speed in the Project Area

(3) Solar radiation and radiation balance

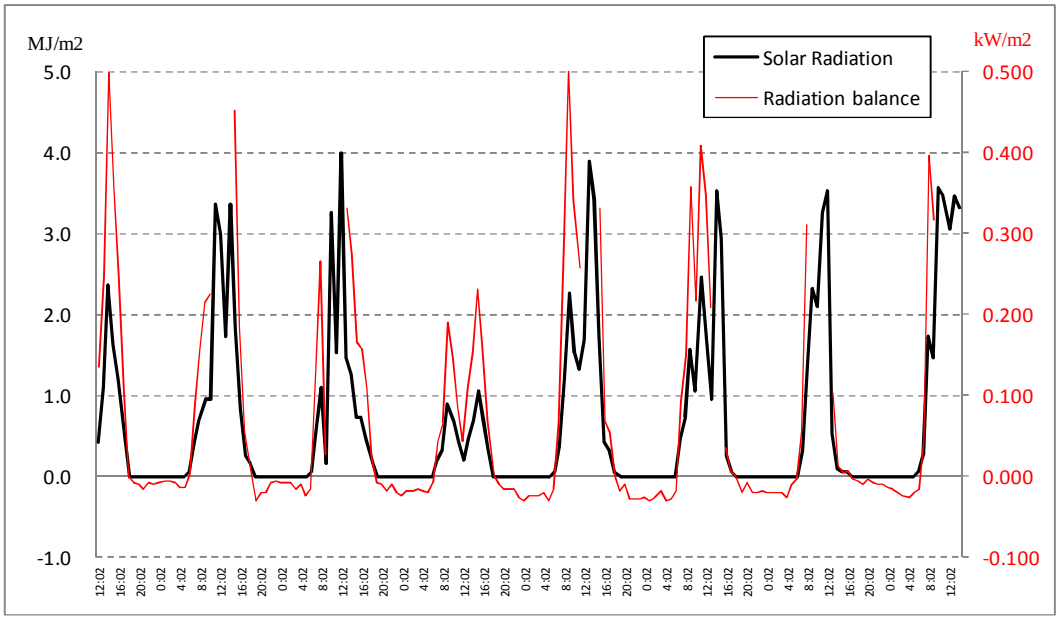
The hourly solar radiation and radiation balance, which was monitored in the dry and rainy seasons, are shown in Figure 6.2-4. The solar radiation in the dry season is a little higher than the one in the rainy season. Regarding the thermal radiation from the ground at night, there was not much difference between the dry and rainy seasons (radiation balance is an instantaneous value in this figure).

(4) Air quality

The results of the ambient air quality monitoring in the dry and rainy seasons are presented in Table 6.2-4 and Table 6.2-5 as well as in Figure 6.2-5 and Figure 6.2-6. The ambient nitrogen dioxide (NO_2) concentration exceeded the target value in the dry season in only one day. Substantially, the concentration of gas materials in the dry season such as CO, NO_2, NO, and SO_2 was higher than the concentrations in the rainy season.



Dry Season (May)



Rainy Season (June)

Source: EIA Study Team

Figure 6.2-4: Solar Radiation and Radiation Balance in the Project Area

Table 6.2-4: Results of the Ambient Air Quality Survey (Dry Season)

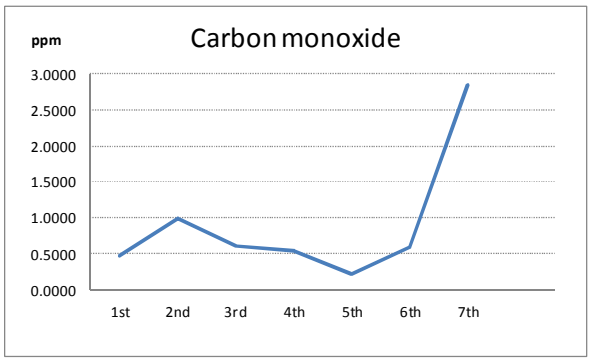
Date	CO	NO_2	NO	TSP	PM10	SO_2
	ppm	ppm	ppm	mg/m^3	mg/m^3	ppm
1st	0.4700	0.0403	0.0857	0.0395	0.0317	0.0247
2nd	0.9900	0.0358	0.0386	0.0287	0.0185	0.0048
3rd	0.6100	0.0930	0.0556	0.0299	0.0215	0.0072
4th	0.5500	0.0234	0.0470	0.0192	0.0114	0.0006
5th	0.2200	0.0201	0.0390	0.0253	0.0212	0.0001
6th	0.5800	0.0177	0.0416	0.0302	0.0227	0.0000
7th	2.8000	0.0125	0.0165	0.0408	0.0114	0.0001
Maximum	2.8000	0.0930	0.0857	0.0408	0.0317	0.0247
Average	0.8886	0.0347	0.0463	0.0305	0.0198	0.0054
Minimum	0.2200	0.0125	0.0165	0.0192	0.0114	0.0000
Target Value	10	0.06	-	0.33	0.12	0.04

Source: EIA Study Team

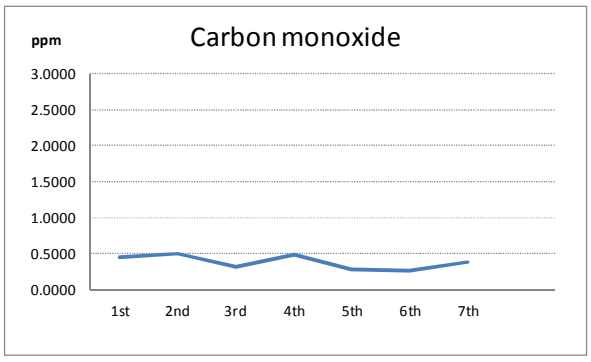
Table 6.2-5: Results of the Ambient Air Quality Survey (Rainy Season)

Date	CO	NO_2	NO	TSP	PM10	SO_2
	ppm	ppm	ppm	mg/m^3	mg/m^3	ppm
1st	0.4500	0.0350	0.0000	0.0469	0.0342	0.0004
2nd	0.5000	0.0349	0.0000	0.0493	0.0293	0.0017
3rd	0.3100	0.0349	0.0003	0.0552	0.0425	0.0025
4th	0.4800	0.0347	0.0152	0.0882	0.0619	0.0012
5th	0.2800	0.0349	0.0240	0.0702	0.0550	0.0014
6th	0.2700	0.0349	0.0279	0.0611	0.0496	0.0012
7th	0.3800	0.0350	0.0000	0.1110	0.0590	0.0015
Maximum	0.5000	0.0350	0.0279	0.1110	0.0619	0.0025
Average	0.3814	0.0349	0.0096	0.0688	0.0474	0.0014
Minimum	0.2700	0.0347	0.0000	0.0469	0.0293	0.0004
Target Value	10	0.06	-	0.33	0.12	0.04

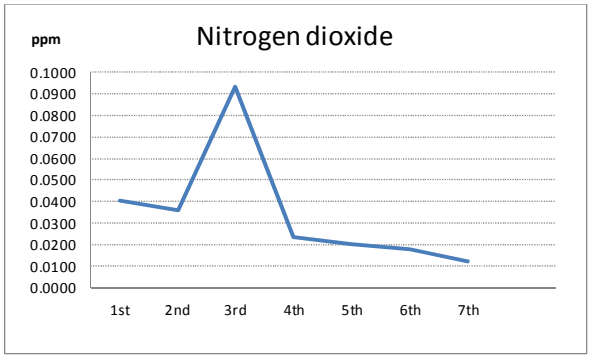
Source: EIA Study Team



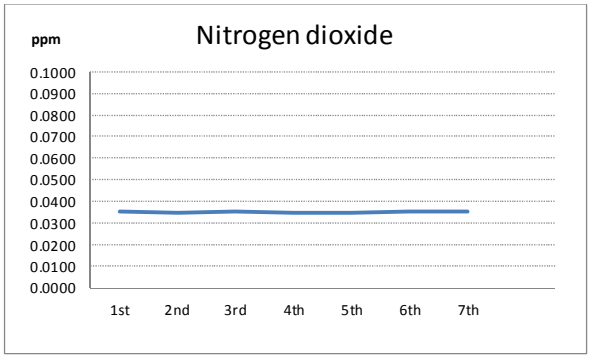
Dry Season (May)



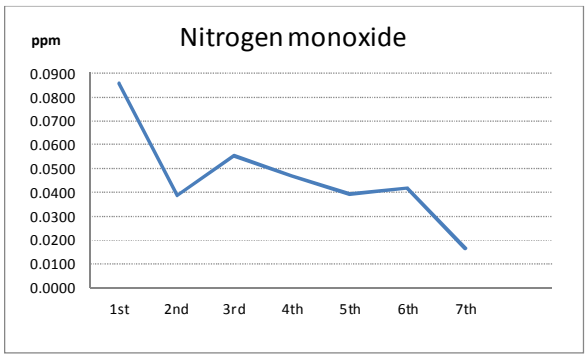
Rainy Season (June)



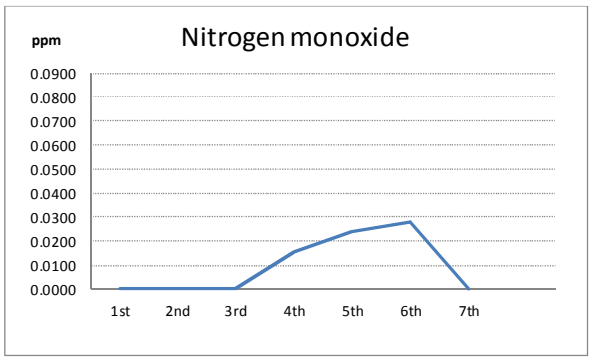
Dry Season (May)



Rainy Season (June)



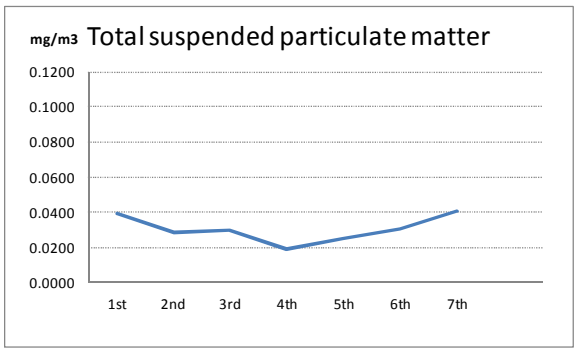
Dry Season (May)



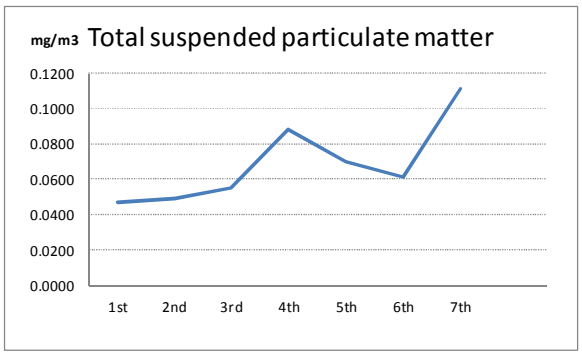
Rainy Season (June)

Source: EIA Study Team

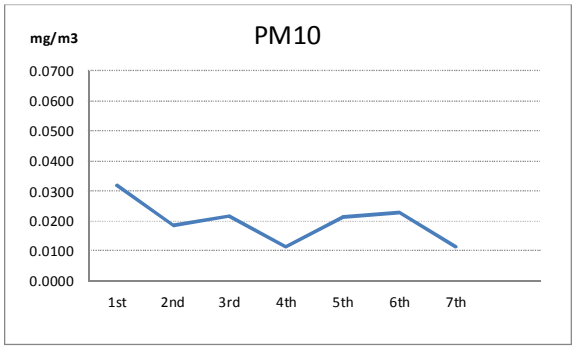
Figure 6.2-5: Results of the Ambient Air Quality Survey-1



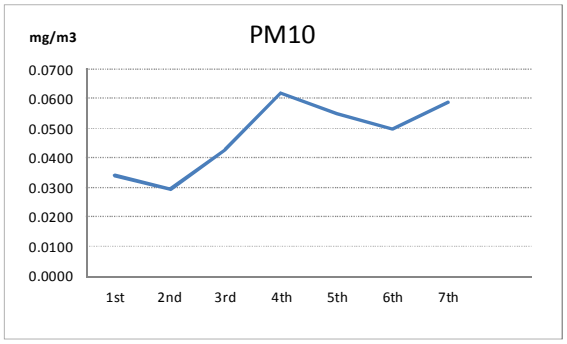
Dry Season (May)



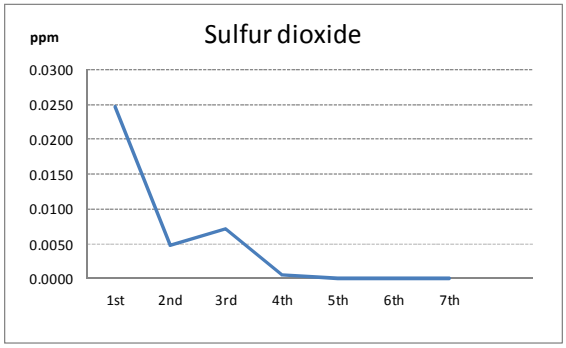
Rainy Season (June)



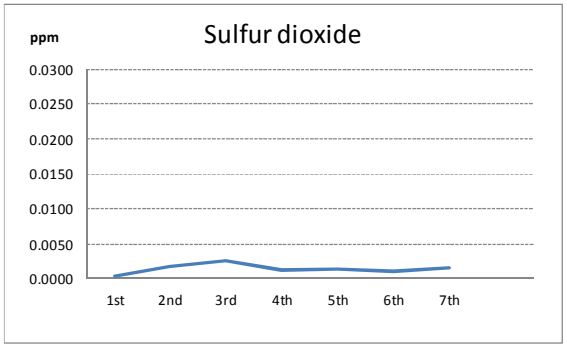
Dry Season (May)



Rainy Season (June)



Dry Season (May)



Rainy Season (June)

Source: EIA Study Team

Figure 6.2-6: Results of the Ambient Air Quality Survey-2

6.3 Water Quality

6.3.1 Survey Items

The analyzed parameters shown in Table 6.3-1 were selected based on the stipulation by the Ministry of Information (MOI) regulation, International Finance Corporation (IFC) environment, health, and safety (EHS) guidelines, and the Myanmar Japan Thilawa Development Ltd. (MJTD) internal regulations. The parameters can be analyzed in Myanmar and Thailand.

Table 6.3-1: Parameters for the Water Quality Survey

No.	Parameter	Note
1	Temperature	-
2	Water Level	For tube well
3	Flow Rate	For surface water
4	Odor	-
5	Color	-
6	Electrical Conductivity	-
7	pH	-
8	BOD5	-
9	COD	-
10	SS	-
11	Turbidity	-
12	Hardness	-
13	Total Dissolved Solids	-
14	DO	-
15	Total Coliform	-
16	Total Nitrogen	-
17	Nitrite-nitrogen ($N\text{-}NO_2$)	-
18	Nitrate-nitrogen ($N\text{-}NO_3$)	-
19	Ammonium Nitrogen ($NH_4\text{-}N$)	-
20	Total Phosphorous	-
21	Phosphorous Phosphate ($P\text{-}PO_4$)	-
22	Oil and Grease	-
23	Phenol	-
24	Sulfide	-
25	Sulfate	-
26	Hydrogen Sulfide (H_2S)	-
27	Formaldehyde	-
28	Free Chlorine	-
29	Total Organic Carbon	-
30	Cyanide (CN)	-
31	Mercury (Hg)	-
32	Lead (Pb)	-
33	Cadmium (Cd)	-
34	Arsenic (As)	-
35	Trivalent Chromium (Cr(III))	-
36	Hexavalant Chromium (Cr(VI))	-
37	Total Chromium (Cr)	-
38	Copper (Cu)	-
39	Zinc (Zn)	-
40	Selenium (Se)	-
41	Nickel (Ni)	-
42	Manganese (Mn)	-
43	Iron (Fe)	-
44	Barium (Ba)	-
45	Boron(B)	-

Source: EIA Study Team

6.3.2 Survey Location

The samples of the surface water were taken from the upstream of the drainage discharging river and the samples of the tube well water were taken from the monitoring well in the proposed Project site.

Table 6.3-2: Sampling Points for the Water Quality Survey

Sampling Point	Category	Coordinates	Description of Sampling Point
SEZW-1	Surface water (Shallow Tube well)	16°40'40"N, 96°15'32"E	Monitoring well in the proposed Project site
SEZW-2	Surface water (Stream)	16°40'20"N, 96°17'19"E	Upstream of discharge point from Thilawa Zone A

Source: EIA Study Team

6.3.3 Survey Period

The survey was implemented in 23 May 2014 for the dry season and 18 June 2014 for the rainy season.

6.3.4 Survey Method

(1) Sampling Method

Water samples were taken using the alpha horizontal water sampler or the tube well sampler and collected in sterilized sample containers in accordance with recognized standard procedures as shown in Table 6.3-3. The parameters of pH, temperature, dissolved oxygen (DO), and electrical conductivity (EC) were measured at each site concurrently with sample collection using the field equipment shown in Table 6.3-4. All samples were kept in iced boxes and were transported to the laboratory to store in 2-4 °C refrigerators.

Table 6.3-3: Container and Preservation Method for the Water Samples

No	Parameter	Container	Preservation
1	Oil and Grease	1000 ml glass bottle	Sulfuric acid, Refrigerate
2	COD	500 ml plastic bottle	Sulfuric acid, Refrigerate
3	BOD_5	1,800 ml plastic bottle	Refrigerate
4	Heavy Metals	500 ml plastic bottle	HNO_3 Refrigerate
5	Bacteria	200 ml glass bottle (sterilize)	Refrigerate
6	Others	1,800 ml polyethylene bottle	Refrigerate

Source: EIA Study Team

Table 6.3-4: Field Equipment for the Water Quality Survey

No.	Equipment	Manufacturer	Origin Country	Model
1	pH meter	HANNA	USA	HI7609829-1 pH Sensor
2	EC meter	HANNA	USA	HI7609829 EC Sensor
3	DO meter	HANNA	USA	HI7609829-2
4	Digital Water Velocity Meter	Global Water Flow Probe	USA	FP 211

Source: EIA Study Team

(2) Analysis Method

The water samples were analyzed using the methods shown in Table 6.3-5.

Table 6.3-5: Analysis Methods for Water Samples

No.	Parameter	Methods
1	Temperature	HI 7609829 temperature sensor, 0.01 °C
2	Water level	Digital water velocity meter and depth sensor
3	Flow rate	FP 211
4	Odor	Olfactory
5	Color	Visual method
6	Electrical conductivity	HI 7609829 EC sensor
7	pH	HI 7609829-1 pH sensor
8	BOD5	Direct inoculation method
9	COD	Dichromate method
10	SS	Gravimetric method
11	Turbidity	HI 7609829-2 turbidity sensor
12	Hardness	AAS
13	Total dissolved solids	APHA 2540D
14	DO	HI 7609829-2
15	Total coliform	AOAC petrifilm method
16	Total nitrogen	Kjeldahl distillation method
17	Nitrite-nitrogen (N-NO_2)	Hanna HI 83200 multiparameter bench photometer
18	Nitrate-nitrogen (N-NO_3)	Hanna HI 83200 multiparameter bench photometer
19	Ammonium nitrogen (NH_4-N)	The Nash reagent photometric method
20	Total phosphorous	Molybdenum antimony anti-spectrophotometric method
21	Phosphorous phosphate (P-PO_4)	Hanna HI 83200 multiparameter bench photometer
22	Oil and grease	Standard method for the examination of water and wastewater, APHA, etc.
23	Phenol	Standard method for the examination of water and wastewater, APHA, etc.
24	Sulfide	Potentiometric determination of sulfide
25	Sulfate	Hanna HI 83200 multiparameter bench photometer
26	Hydrogen sulfide (H_2S)	Standard method for the examination of water and wastewater, APHA etc.
27	Formaldehyde	Standard method for the examination of water and wastewater, APHA etc.
28	Free chlorine	Standard method for the examination of water and wastewater, APHA etc.
29	Total organic carbon	Standard method for the examination of water and wastewater, APHA etc.
30	Cyanide (CN)	Hanna HI 83200 multiparameter bench photometer
31	Mercury (Hg)	AAS–Graphite hydride method
32	Lead (Pb)	AAS–Graphite furnace method
33	Cadmium (Cd)	AAS–Graphite furnace method
34	Arsenic (As)	Hanna HI 83200 multiparameter bench photometer
35	Trivalent chromium (Cr(III))	Standard method for the examination of water and wastewater, APHA etc.
36	Hexavalant chromium (Cr(VI))	Standard method for the examination of water and wastewater, APHA etc.
37	Total chromium (Cr)	Standard method for the examination of water and wastewater, APHA etc.
38	Copper (Cu)	Hanna HI 83200 multiparameter bench photometer
39	Zinc (Zn)	Hanna HI 83200 multiparameter bench photometer
40	Selenium (Se)	Standard method for the examination of water and wastewater, APHA etc.
41	Nickel (Ni)	Hanna HI 83200 multiparameter bench photometer
42	Manganese (Mn)	AAS
43	Iron (Fe)	AAS
44	Barium (Ba)	Standard method for the examination of water and wastewater, APHA etc.
45	Boron (B)	Standard method for the examination of water and wastewater, APHA etc.

Source: EIA Study Team

6.3.5 Survey Result

The analysis results are shown in Table 6.3-6 below and compared with the environmental quality standards in Japan, Vietnam, and Thailand since the environmental standards in Myanmar have not been set yet. The surface water quality indicated the high COD, BOD, SS, turbidity, and nickel. Thus, these parameters will be investigated continuously before/during the construction stage. The other parameters dissolved in the water were lower than the applied environmental quality standards.

Table 6.3-6: Results of the Water Quality Survey

No.	Parameter	Unit	W 1 (River Water)		W 2 (Tube Well Water)		Standard		
			May 2014	June 2014	May 2014	June 2014	Japan	Vietnam	Thailand
1	Water temperature	ºC	27	23	25	25	-	-	-
2	Water level	m	-	-	0.4	0.5	-	-	-
3	Flow rate	m/s	-	-	0.3	0.2	-	-	-
4	Odor	-	Muddy	Muddy	Normal	Normal	-	-	-
5	Color	-	Grey	Grey	Light Brown	Light Brown	-	-	-
6	Electrical conductivity	µS/cm	3728	83	111	1344	-	-	-
7	pH	-	8.9	7.9	6.1	8.8	6.0 - 8.5	5.5 – 9	5 – 9
8	BOD_5	mg/l	24.9	19.8	9.3	3.4	8.0	15.0	2.0
9	COD	mg/l	62.3	49.5	23.2	8.6	5 as COD_{Mn}	30	-
10	SS	mg/l	4574	9541	257	231	100	50	-
11	Turbidity	mg/l	234	1000	1000	154	-	-	-
12	Hardness	mg/l	40	60	392	180	-	-	-
13	Total dissolved solids	mg/l	1864	42	61	671	-	-	-
14	DO	mg/l	6.5	5.2	4.7	5.4	>=2	>4	>4
15	Total coliform	cfu/100 mL	0	1.9×10^3	0	0	5,000 as MPN/100 mL	7,500 as MPN/100 mL	20,000 as MPN/100 mL
16	Total nitrogen	mg/l	1.68	ND (<0.6 mg/l)	ND (<0.6 mg/l)	ND (<0.6 mg/l)	-	-	-
17	Nitrite-nitrogen (N-NO_2)	mg/l	ND**	ND**	ND**	0.01	10 (NO_2-N+N O_3-N)	0.04	-
18	Nitrate-nitrogen (N-NO_3)	mg/l	0.2	0.02	0.2	0.03		10	5
19	Ammonium nitrogen (NH_4-N)	mg/l	0.00	0.00	0.00	0.00	-	0.5	0.5 as NH_3-N
20	Total phosphorous	mg/l	0.66	0.17	0.99	0.03	-	-	-
21	Phosphorous phosphate (P-PO_4)	mg/l	0.65	0.17	0.98	0.03	-	-	-
22	Oil and grease	mg/l	<2	10.8	<2	0.7*	-	0.1	-
23	Phenol	mg/l	0.008	<0.001	<0.001	<0.001	-	0.01	0.005
24	Sulfide	mg/l	ND**	ND**	ND**	ND**	-	-	-
25	Sulfate	mg/l	1.2	0.2	1.5	0.5	-	-	-
26	Hydrogen sulfide (H_2S)	mg/l	0.16	<0.01	<0.01	<0.01	-	-	-
27	Formaldehyde	mg/l	0.13	<0.01	<0.01	<0.01	-	-	-
28	Free chlorine	mg/l	0.10	<0.01	<0.01	0.07	-	-	-
29	Total organic carbon	mg/l	6.5	20.5	6.2	4.3	-	-	-
30	Cyanide (CN)	mg/l	<0.05	<0.05	<0.05	<0.05	ND	0.02	-

No.	Parameter	Unit	W 1 (River Water)		W 2 (Tube Well Water)		Standard		
			May 2014	June 2014	May 2014	June 2014	Japan	Vietnam	Thailand
31	Mercury (Hg)	mg/l	ND**	ND**	0.000013***	ND**	0.0005	0.001	0.002
32	Lead (Pb)	mg/l	ND**	ND**	ND**	ND**	0.01	0.05	0.05
33	Cadmium (Cd)	mg/l	ND**	ND**	ND**	ND**	0.003	0.01	0.005 0.05*1
34	Arsenic (As)	mg/l	ND**	ND**	ND**	ND**	0.01	0.05	0.01
35	Trivalent chromium (Cr(III))	mg/l	<0.02	0.05	<0.02	0.02	-	0.5	-
36	Hexavalant chromium (Cr(VI))	mg/l	<0.02	<0.02	<0.02	<0.02	0.05	0.04	0.05
37	Total chromium (Cr)	mg/l	<0.02	0.05	<0.02	0.05	-	-	-
38	Copper (Cu)	mg/l	0.02	0.03	ND**	ND**	-	0.5	0.1
39	Zinc (Zn)	mg/l	0.05	0.02	ND**	ND**	-	1.5	1.0
40	Selenium (Se)	mg/l	<0.01	<0.01	<0.01	<0.01	0.01	-	-
41	Nickel (Ni)	mg/l	0.254	0.103	0.001	0.003	-	0.1	0.1
42	Manganese (Mn)	mg/l	0.001	0.001	0.271	0.015	-	-	1.0
43	Iron (Fe)	mg/l	1.50	3.20	0.05	0.05	-	1.5	-
44	Barium (Ba)	mg/l	<0.1	0.2	<0.1	0.2	-	-	-
45	Boron(B)	mg/l	<0.5	<0.5	<0.5	<0.5	0.8	-	-

*) While the original result is 0.7 mg/l, it is considered to be lower than the quantitation limit (2 mg/l).
**) While the original laboratory results showed 0.00 or 0.000 mg/l, it is considered as "ND" though their quantitation limits could not be confirmed.
***) While the original result is 0.00013 mg/L, it is considered to be lower than the quantitation limit (0.001 mg/L or lower).
Note: Environmental quality standard concerning the conservation of the living environment for agricultural use and protection of human health
Source: Environmental Quality Standard 1971, Japan. It concerns the conservation of the living environment for agricultural use and protection of the human health.
Surface Water Quality Standard (QCVN 08:2008/BTNMT), Vietnam B1: Standard of irrigation purpose
Surface Water Standards 2009 Thailand Class 3: Standard of Agriculture purpose

6.4 Soil Quality

6.4.1 Survey Items

The soil quality was investigated for the parameters shown in Table 6.4-1 to check if the site is naturally contaminated by heavy metals.

Table 6.4-1: Parameters for Soil Quality Survey

No.	Parameter
1	pH
2	Arsenic (As)
3	Mercury (Hg)
4	Copper (Cu)
5	Lead (Pb)
6	Zinc (Zn)
7	Chromium (Cr)
8	Nickel (Ni)
9	Manganese (Mn)
10	Iron (Fe)
11	Selenium (Se)
12	Calcium (Ca)

Source: EIA Study Team

6.4.2 Survey Location

The survey location of the soil quality survey is shown in Table 6.4-2.

Table 6.4-2: Sampling Point for Soil Quality Survey

Sampling Point	Category	Coordinates	Description of Sampling Point
S 1	Surface soil	16°40'40"N, 96°15'32"E	In the proposed Project site

Source: EIA Study Team

6.4.3 Survey Period

The soil sample was taken on 18 June 2014 and analyzed immediately in the laboratory.

6.4.4 Survey Method

(1) Sampling Method

The soil sample was taken at 1.5 m depth from the ground surface.

(2) Analysis Method

The heavy metals in the soil sample were measured by the acid dissolution method.

6.4.5 Survey Results

The results were compared with environmental standard in Japan as a reference as shown in Table 6.4-3. It was confirmed that the soil in the proposed Project site was not originally contaminated as compared with the environmental standard in Japan.

Table6.4-3 Results of the Soil Quality Survey

No.	Parameter	Unit	Result	Environmental Standards		
				Japan[1]	Vietnam[2]	Thailand[3]
1	pH	mg/kg	6.7	-		
2	Arsenic (As)	mg/kg	0.009	150	12	27
3	Mercury (Hg)	mg/kg	N.D.	15	-	610
4	Copper (Cu)	mg/kg	110	125[2)]	100	-
5	Lead (Pb)	mg/kg	125	150	300	750
6	Zinc (Zn)	mg/kg	70	-	300	-
7	Chromium (Cr)	mg/kg	17	250 (as Cr(VI))	-	640 (as Cr(VI))
8	Nickel (Ni)	mg/kg	15	-	-	41,000
9	Manganese (Mn)	mg/kg	18	-	-	32,000
10	Iron (Fe)	mg/kg	5250	-	-	-
11	Selenium (Se)	mg/kg	7	150	-	10,000
12	Calcium (Ca)	mg/kg	35	-	-	-

N.D.: Not Detected

Source: 1) Detailed enforcement regulations of the Soil Contamination Countermeasures Act, 2002, Japan
2) Environmental Quality Standards for Soil Pollution, 1991, Japan
3) Regulation for implementing the Law on Soil Contamination Countermeasures
QVVN 03: 2008/BTNMT, Vietnam. It is applied as “industrial area”
4) Soil Quality Standard Soil Quality Standard for Other Purposes, 2004, Thailand

6.5 Noise and Vibration Level

6.5.1 Survey Items

Survey items of noise and vibration level are shown in Table 6.5-1.

Table 6.5-1: Survey Parameters for Noise Level

No.	Parameter	Note
1	A-weighted loudness equivalent (L_{Aeq})	-
2	Vibration level, vertical, percentile (L_{V10})	-

Source: EIA Study Team

6.5.2 Survey Location

The noise and vibration level were measured at the Project site as shown in Table 6.5-2. The Project site is a flat field and there is a road near the survey point, though traffic on the road was very little. There were no significant noise and vibration sources near the survey point. The location of NV 1 is shown in Figure 6.1-1.

Table 6.5-2: Survey Point for Noise and Vibration Level Measurement

Survey Point	Coordinates	Description of Survey Point
NV 1	16°40'46.54"N, 96°15'30.61"E	Project site in Thilawa SEZ

Source: EIA Study Team

6.5.3 Survey Period

Noise and vibration measurements were conducted for 24 hours each in weekday (Survey 1) and weekend (Survey 2). Measurements were conducted on 22-23 July 2014 and 9-10 August 2014, respectively.

6.5.4 Survey Method

Measurements of noise and vibration level were conducted by referring to the recommendation of the Japanese Industrial Standard (JIS) as shown in Table 6.5-3.

Table 6.5-3: Methods for Noise and Vibration Measurement

No.	Parameter	Manufacture
1	Noise level (L_{Aeq})	JIS Z 8731:1999
2	Vibration level (L_{v10})	JIS Z 8735:1981

Source: EIA Study Team

The instruments used for noise and vibration level are shown in Table 6.5-4.

Table 6.5-4: Field Equipment for Noise Survey

No.	Equipment	Manufacture	Originated Country	Model
1	Sound level meter	Rion Co., Ltd.	Japan	NL-42
2	Vibration level meter	Rion Co., Ltd.	Japan	VM-53A

Source: EIA Study Team

6.5.5 Survey Results

The results of the noise and vibration level measurement for Survey 1 (weekday) and Survey 2 (weekend) are summarized in Table 6.5-5 and Table 6.5-6, respectively.

The noise level was lower than the target level except for the noise level in nighttime in the weekend. All the vibration levels were found lower than the target levels.

Table 6.5-5: Results of the Noise Level Survey

No	Hour	Noise Level (L_{Aeq})		Day/Evening/ Night	Target Level(L_{Aeq})	
		Survey 1 (Weekday)	Survey 2 (Weekend)		Construction Stage (Residential houses and monastery located less than 150 m)	Operation Stage (Sensitive area such as Monastery)
1	7:00-19:00	49	48	Day	75	60
2	19:00-22:00	51	49	Evening	60	55
3	22:00-7:00	49	52	Night	55	50

Note: Evaluation point of the target level is at the receptor's building
Source: Myanmar and Japan Consortium for the Thilawa Special Economic Zone Development Project (Zone A), EIA Report for the Thilawa Special Economic Zone Development Project (Zone A), 2013

Table 6.5-6: Results of the Vibration Level Survey

No	Hour	Vibration Level (L_{V10})		Day/Evening/ Night	Target Level(L_{V10})	
		Survey 1 (Weekday)	Survey 2 (Weekend)		Construction Stage (Residential houses and monastery)	Operation Stage (Residential houses and monastery)
1	7:00-19:00	28	28	Day	65	65
2	19:00-22:00	36	30	Evening	65	60
3	22:00-7:00	26	25	Night	60	60

Note: Evaluation point of the target level is at the receptor's building
Source: Myanmar and Japan Consortium for the Thilawa Special Economic Zone Development Project (Zone A), EIA Report for the Thilawa Special Economic Zone Development Project (Zone A), 2013

CHAPTER 7: SUMMARY OF THE ENVIRONMENTAL, SOCIAL, AND HEALTH IMPACT ASSESSMENTS AND EMERGENCY RISK ASSESSMENT

The environmental impact assessment (EIA), social impact assessment (SIA), health impact assessment (HIA), and emergency risk assessment (ERA) of the Project are predicted and evaluated based on the Project description, results of baseline survey, and set target level. Table 7.1-1 shows the summary of assessments on the Project during construction and operation, until the closure stage.

Table 7.1-1: Results of the Environmental, Social, and Health Impacts and Emergency Risk Assessments

Category	Impact Item	Scoping			Evaluation			Reasons
		CS	OS	ClS	CS	OS	ClS	
EIA (Pollution, Natural Environment)	Air Pollution	B-	B-	B-	B-	B-	B-	**CS/ClS**: Impact on air quality is expected to be little because dust and representative emission gases are predicted to comply with the target level. **OS:** Impact on air pollution is expected to be little because ambient air quality level in the surrounding area in case that incinerator is under operation is predicted to comply with the target level based on the results of prediction by simulation model.
	Water Pollution	B-	B-	B-	B-	B-	B-	**CS:** Impact on water quality is expected to be limited because discharging muddy water from bare land of the construction site will be temporary events and wastewater from a construction camp will be treated by septic tanks. **OS:** Impact on water quality from landfill is expected to be limited because effluent water quality from landfill and other solid waste management facilities will be treated by treatment plant to comply with the industrial wastewater effluent guideline values stipulated by MOI and the internal regulation of Thilawa SEZ Zone A . **CIS:** Impact of demolition work is expected to be limited same as in the construction stage. Impact on water quality from landfill is expected to be limited because leachate from the capped landfill sites will be monitored and treated until water quality of leachate will be confirmed not polluted (at least ten years after closing operation).
	Soil Contamination	C	D	D	D	D	D	**CS:** Based on the baseline survey results, soil contamination including nature-derived inside the Project area was not confirmed. Thus, soil contamination by construction work will not arise.
	Noise and Vibration	B-	B-	B-	B-	B-	B-	**CS/CIS:** Impacts of noise and vibration by construction machineries are expected to be little because noise/vibration by the construction work might affect the surrounding area, which is site specific on a temporary basis, and noise/vibration level generated by the construction work shall be controlled and managed in order not to exceed the target level. **OS:** Impacts of noise and vibration from operation works are expected to be little because ambient noise and vibration level in the surrounding area is predicted to comply with the target level based on the results of prediction.
	Offensive Odor	D	B-	B-	D	B-	B-	**OS/CIS:** Impact of offensive odor is expected to be little because the generation of offensive odor from landfilling work will be controlled and managed by various mitigation measures such as limitation of

Category	Impact Item	Scoping			Evaluation			Reasons
		CS	OS	ClS	CS	OS	ClS	
								active area, covering sheet, collection of generated gas and its flaring, covering soil after disposal, and daily monitoring.
	Climate Change	D	B+/ B-	D	D	B+/ B-	D	**OS:** Both positive impact by avoiding open dumping and negative impact by incineration are assumed. However, impact of global warming caused by exhaust gas from the incinerator is expected to be minimized because various energy saving measures such as installation of good combustion system and using waste as fuel will be implemented.
SIA	Water Usage	D	B-	B-	D	B-	B-	**OS/ClS:** Impact on daily life water use of local people is expected to be little because the solid waste management facilities will not take water source from the surrounding area but from Zone A water supply system. The controlled landfill for industrial waste will be installed in order not to cause groundwater contamination in the surrounding water source.
	Landscape	D	B-	B-	D	B-	B-	**OS/ClS:** Impact on landscape is expected to be limited because the view angle of the landfill from the road is only 2.5 degree maximum at completion of landfilling. Besides, green area including trees shall be installed around the boundary as blindfold.
HIA	Occupational Health and Safety including Accidents and Infection Disease	B-	B-	B-	B-	B-	B-	**CS/OS/ClS:** Minor negative impacts on occupational health and safety (OHS) are inevitable to some extent. To minimize the negative impacts, the contractor/proponent shall take mitigation measures stipulated in the Environment, Health, and Safety (EHS) Guidelines by the International Finance Corporation (IFC).
	Community Health and Safety including Accidents and Infection Disease	B-	B-	B-	B-	B-	B-	**CS/OS/ClS:** Minor negative impacts on community health and safety (CHS) are inevitable to some extent. To minimize the negative impacts, the contractor/proponent shall take mitigation measures stipulated in the EHS Guidelines by the IFC.
ERA	Flood Risk	B-	B-	B-	B-	B-	B-	**CS/OS/ClS:** Flood risk such as heavy rain, cyclone, and high tide are expected to be limited because proper elevation level; EL +7.0 m which is 0.5 m above the most severe case will be set among 1) Storm surge simulation in the Yangon River (Cyclone Nargis case): EL +6.5 m, 2) Hearing survey of flood disaster: EL +5.5 m, and 3) Flood analysis of 100-year return rainfall: EL +4.9 m.
	Risk for Fire	B-	B-	B-	B-	B-	B-	**CS/OS/ClS:** Risks for fire is expected to be little because the storage of flammable liquid on site will be minimized and fire protection facilities such as fire hydrants and closed-circuit television (CCTV) security system will be installed.

Evaluation: A-: Significant negative impact A+: Significant positive impact
B-: Some negative impact B+: Some positive impact
C: Impacts are not clear, need more investigation
D: No impacts or impacts are negligible, no further study required

Note: CS: Construction Stage, OS: Operation Stage, ClS: Closure Stage including termination and after termination
Source: EIA Study Team

CHAPTER 8: ENVIRONMENTAL IMPACT ASSESSMENT

8.1 Air Pollution

8.1.1 Prediction Item

The items to be predicted are shown below:

- Impacts on air quality caused by construction work of the proposed Project.
- Impacts on air quality caused by operation of incinerator.
- Impacts on air quality caused by closing work of the proposed Project.

8.1.2 Prediction Area

The area where the impacts are to be predicted is set in and around the proposed Project site.

8.1.3 Prediction Period

The prediction period in the construction stage was set as the duration of construction work conduction.

The prediction period in the operation stage was set as the duration of operating incinerator.

The prediction period in the closure stage was set as the duration of closing work conduction.

8.1.4 Prediction Method

The impacts on air quality were predicted using the following methods:

- To estimate the nitrogen dioxide (NO_2) and particulate matter (PM)[1] discharged from construction machines by using a simulation model;
- To examine the dust effect from the construction work qualitatively based on general construction activities and proposed mitigation measures;
- To estimate the pollutant concentration emitted by operation of incinerator by using a simulation model, and to assess its impacts in and around the proposed Project site.

The methodology of the impact prediction in the operation stage is described below:

[1] Generally, it is more difficult to reduce the emission of nitrogen oxide (NOx) and particulate matter (PM) than other air pollutants/substances for an internal combustion of engine. Moreover, according to the field survey, it was confirmed that the concentrations of sulfur dioxide (SO_2) and carbon monoxide (CO) were relatively lower than NO_2 and PM10 in the ratio of the measured value with respect to the target value. Therefore, NO_2 and PM10 were selected as representative parameters to assess the environmental impact of the Project due to usage of construction machineries.

(1) Prediction conditions

1) Discharge conditions

a) Air pollutant discharged from construction machineries

Air pollutant emissions from construction machineries are shown in Table 8.1-1. This condition is the maximum annual discharge during construction stage and closure stage.

Table 8.1-1: Pollutant Emissions from Construction Machineries

Construction Equipment	Annual Emission of NOx (kg/year)	Annual Emission of PM (kg/year)
Bulldozer	5,822.2	188.5
Compaction roller	7,667.9	224.6
Crane	1,660.6	48.6
Excavator	16,613.4	486.5
Loader	295.6	9.6
Pile press equipment	332.7	9.7
TOTAL	32,392.5	967.5

Source: EIA Study Team

b) Air pollutant discharged from incinerator

Air pollutant emissions from the incinerator are described in Table 8.1-2. These conditions were calculated based on the specifications of incinerator designated in the Project description.

Table 8.1-2: Pollutant Emissions from Incinerator

Item		Unit	Value
Volume of exhaust gas		Nm^3/h	10,344
Temperature of exhaust gas		ºC	180
Amount of moisture		%	45
Emission concentration	SO_2	ppm	116
	NOx	ppm	250
	CO	ppm	100
	Dust	g/Nm^3	0.15

Source: EIA Study Team

c) Exhaust gas emission parameters

Exhaust gas emission parameters for the incinerator are shown in Table 8.1-3.

Table 8.1-3: Exhaust Gas Emission Parameters for the Incinerator

Item	Unit	Value
Diameter of the internal cylinder	M	0.5
Speed of exhaust gas	m/s	24.4
Height of the stack (GL+)	M	19.5

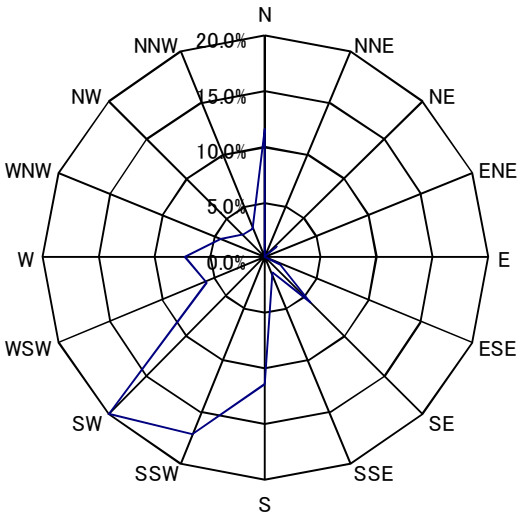
Source: EIA Study Team

2) Meteorological conditions

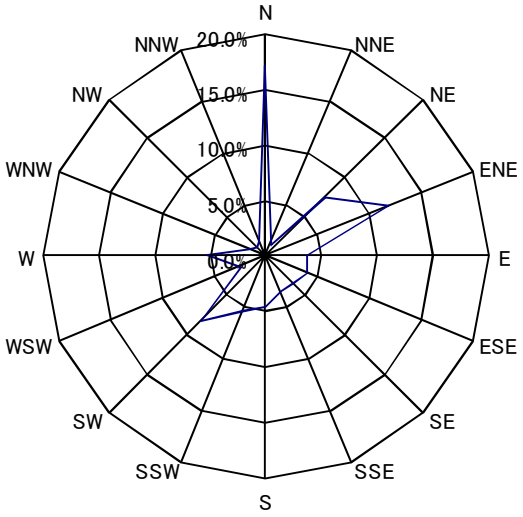
Meteorological conditions are basic information for the prediction of air quality. In this study, meteorological conditions are set based on the results of the field survey data in each season.

Wind direction and wind speed

Construction works will be conducted only during the dry season. That is the reason why wind conditions in the construction stage from the field survey data was set in the dry season. On the other hand, the incinerator will be operated 24 hours a day, seven days a week. The wind conditions for prediction in the operation stage from all time data was set in the dry and rainy seasons. Figure 8.1-1 and Figure 8.1-2 show the wind direction and wind speed for each prediction stage.



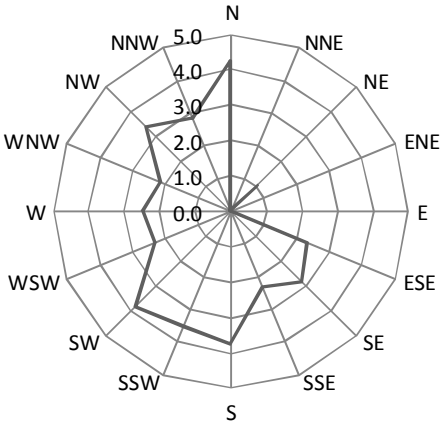
Wind direction in the construction stage (dry season)



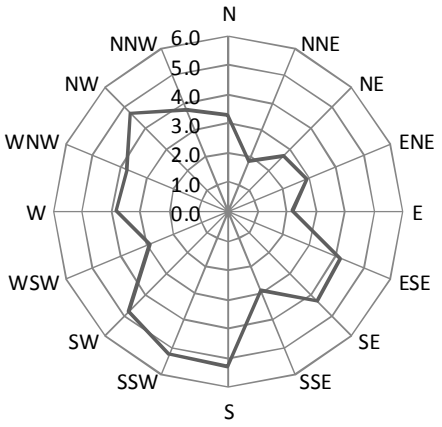
Wind direction in the operation stage (dry season + rainy season)

Source: EIA Study Team

Figure 8.1-1: Wind Direction for Each Prediction Stage



Wind speed (m/s) in the construction stage (dry season)



Wind speed (m/s) in the operation stage (dry season + rainy season)

Source: EIA Study Team

Figure 8.1-2: Average Wind Speed for Each Prediction Stage

Atmospheric stability

Atmospheric stability is an indicator used to describe the convective properties of an air mass. Table 8.1-4 and Table 8.1-5 show the classification of atmospheric stability.

Table 8.1-4: Atmospheric Stability and Corresponding Stability Condition

Atmospheric Stability	Stability Condition
A	Extremely unstable
B	Unstable

Atmospheric Stability	Stability Condition
C	Slightly unstable
D	Neutral
E	Slightly stable
F	Stable
G	Extremely stable

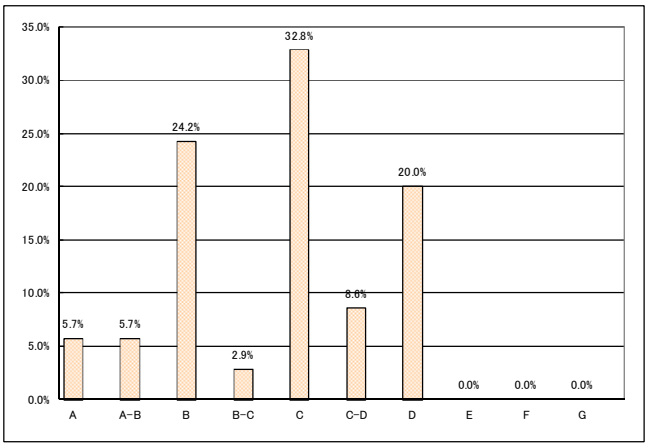
Source: EIA Study Team

Table 8.1-5: Classification of Atmospheric Stability

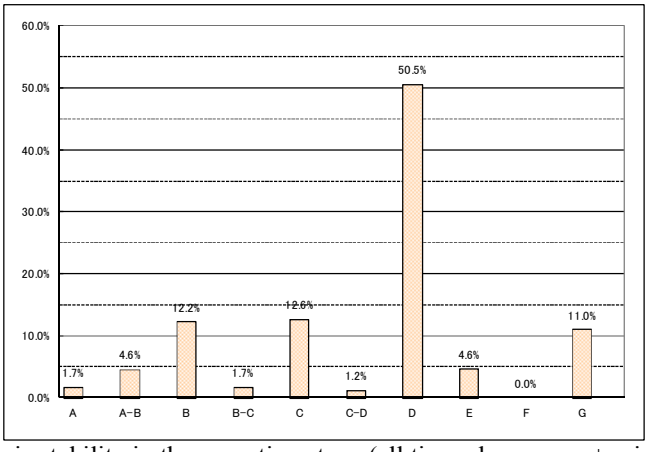
Wind Speed u (m/s)	Solar Radiation T (kW/m²)				Radiation Balance Q (kW/m²)		
	T≧0.60	0.60>T ≧0.30	0.30>T ≧0.15	0.15>T	Q≧-0.020	-0.020>Q≧-0.040	-0.040≧Q
u＜2	A	A-B	B	D	D	G	G
2≦u＜3	A-B	B	C	D	D	E	F
3≦u＜4	B	B-C	C	D	D	D	E
4≦u＜6	C	C-D	D	D	D	D	D
6≦u	C	D	D	D	D	D	D

Source: EIA Study Team

In this study, atmospheric stability was classified by each prediction condition same as what was done for wind conditions. Atmospheric stability for each prediction stage is shown in Figure 8.1-3.



Atmospheric stability in the construction stage (daytime, dry season)



Atmospheric stability in the operation stage (all time, dry season + rainy season)

Source: EIA Study Team

Figure 8.1-3: Appearance of Atmospheric Stability Condition for Each Prediction Stage

3) Background concentrations

Background concentration is used to forecast future concentration of air quality. In this simulation study, the additional concentration from this Project was calculated. To forecast future ambient air quality, it is necessary to add ordinal background concentration to analytic solution. Background concentration was set from the results of the field survey. Background concentrations were set from the rainy season survey because the survey result in the dry season may have been affected from the power generator exhaust gas caused by electricity supply to the Environmental Perimeter Air Station(EPAS). Background concentrations are shown in Table 8.1-6.

Table 8.1-6: Background Concentration

Item	Unit	Background Concentration
NO_2	ppm	0.035
PM_{10}	mg/m^3	0.0490
SO_2	ppm	0.00148
CO	ppm	0.361

Source: EIA Study Team

4) Mitigation measures

Construction Stage and Closure Stage

・Sprinkle water around the preservation area.

Operating Stage

・Appropriate design of incinerator, which realizes controlled and stable combustion, shall be applied to minimize the emission of air pollutants such as dioxins.

・Chemical baghouse filter (dry type using slaked lime) will be installed to reduce the amount of air pollution emission by complying with the Japanese emission standard.

(2) Prediction model

The prediction model applied in this study is the Gaussian Plume Model, which is an analysis solution of diffusion equation and it is commonly used for air pollution forecasting.

The formula for concentration of air pollutant is based on the Gaussian Plume Equation and Puff Model as follows:

1) Gaussian Plume Model (In the case of wind velocity more than 1 m/s)

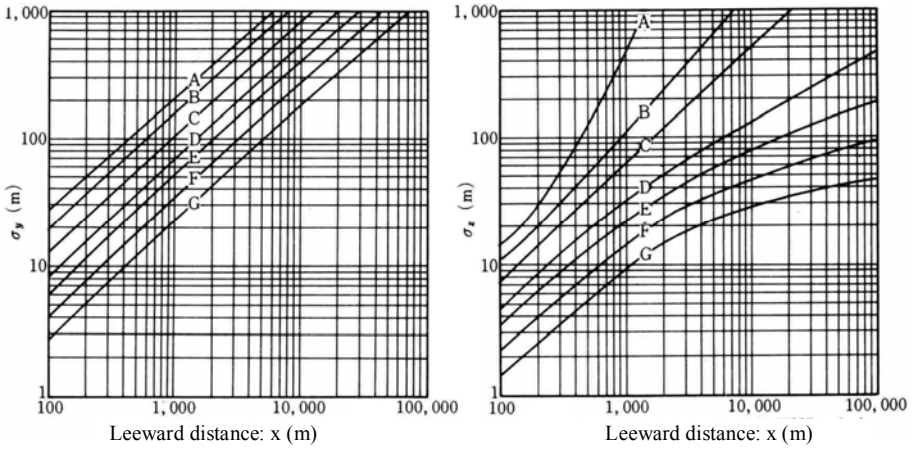
$$C = (x, y, z, T)$$

$$= \frac{Q}{2\pi U \sigma_y \sigma_z} \cdot \exp - \frac{y^2}{2\sigma_y^2} \left[\exp\left\{ -\frac{(z-H)^2}{2\sigma_z^2} \right\} + \exp\left\{ -\frac{(z+H)^2}{2\sigma_z^2} \right\} \right]$$

Where

C (x, y, z) : Predicted concentration at coordinates of (x, y, z)
Q : Discharge per unit time (ml/s or mg/s)
U : Wind velocity (m/s)
H : Height of discharge (m)

σy, σz :Diffusion coefficient of horizontal/vertical width (m) (See Figure 8.1-4)
x : Coordinate of downwind axis (m)
y : Coordinate of horizontal axis(m)
z : Coordinate of vertical axis (m)



Horizontal Width (σy) **Vertical Width (σz)**

Source: EIA Study Team

Figure 8.1-4: Diffusion Coefficient of Width

2) Weak Wind Puff Model (In the case of wind velocity more than 0.5 m/s and less than 0.9 m/s)

$$C = (x, y, z, T)$$

$$= \int_{t_o}^{T} \frac{Q}{(2\pi)^{3/2}\sigma_y(t)^2\,\sigma_z(t)} \cdot \exp\left\{-\frac{(x-ut)^2}{2\sigma_x(t)^2} - \frac{y^2}{2\sigma_y(t)^2}\right\}\left[\exp\left\{-\frac{(z-H)^2}{2\sigma_z(t)^2}\right\} + \exp\left\{-\frac{(z+H)^2}{2\sigma_z(t)^2}\right\}\right] dt$$

Where

C(x, y, z, T) : Predicted concentration at coordinates of (x, y, z) T: time
Q : Emission per unit time (ml/s or mg/s))
σy(t) : Diffusion coefficient of horizontal width at t-time later from discharge
(σx(t)=σy(t)=α • t)
σz(t) : Diffusion coefficient of vertical width at t-time later from discharge
(σz(t)=γ • t)
H : Height of discharge (m)
t0 : Time of reach to initial diffusion width from discharge
u : Wind velocity (m/s)
α, γ : Parameters for diffusion width (See Table 8.1-7)

Table 8.1-7: Parameters for Diffusion Width (α, γ)

Atmospheric Stability	Wind Velocity ≤ 0.4 m/s		0.5 < Wind Velocity < 0.9 m/s	
	α	γ	α	γ
A	0.948	1.569	0.748	1.569
A-B	0.859	0.862	0.659	0.862
B	0.781	0.474	0.581	0.474
B－C	0.702	0.314	0.502	0.314
C	0.635	0.208	0.435	0.208
C－D	0.542	0.153	0.342	0.153
D	0.470	0.113	0.270	0.113

Atmospheric Stability	Wind Velocity ≤ 0.4 m/s		0.5 < Wind Velocity < 0.9 m/s	
	α	γ	α	γ
E	0.439	0.067	0.239	0.067
F	0.439	0.048	0.239	0.048
G	0.439	0.029	0.239	0.029

Source: EIA Study Team

3) Puff Model (In the case of wind velocity under 0.5 m/s)

$$C(x,y,z,T)=\int_{t_o}^{T}\frac{Q}{(2\pi)^{3/2}\sigma_y(t)^2\,\sigma_z(t)}\cdot\exp\left\{-\frac{x^2+y^2}{2\sigma_y(t)^2}\right\}\left[\exp\left\{-\frac{(z-H)^2}{2\sigma_z(t)^2}\right\}+\exp\left\{-\frac{(z+H)^2}{2\sigma_z(t)^2}\right\}\right]dt$$

Where

C (x, y, z, T)	: Predicted concentration at coordinates of (x, y, z) T: time
Q	: discharge per unit time (ml/s or mg/s))
σy (t)	: Diffusion coefficient of horizontal width at t-time later from discharge (σx(t)＝σy(t)＝α･t)
σz(t)	: Diffusion coefficient of vertical width at t-time later from discharge (σz(t)＝γ･t)
H	: Height of discharge (m)
t0	: Time of reach to initial diffusion width from discharge (s)

4) Polymerized concentration of air pollutant

The calculation for annual mean concentration of pollutant is conducted by using the following formula:

[Polymerization Formula]

$$C=\Sigma k\,\Sigma j\,\Sigma i\,C1(Di,Vj,ak)\cdot f1(Di,Vj,ak)$$

$$+\Sigma k\,\Sigma j\,\Sigma i\,C2(Di,Vj,ak)\cdot f2(Di,Vj,ak)+\Sigma\,kC3(ak)\cdot f3(ak)$$

Where

C	: Polymerized concentration
C1(Di,Vj,ak)	: One hour concentration in the case of wind velocity more than 1 m/s
f1 (Di,Vj,ak)	: Incidence of wind blowing (more than 1 m/s)
C2 (Di,Vj,ak)	: One hour concentration in the case of weak wind blowing
f2 (Di,Vj,ak)	: Incidence of wind blowing (more than 0.5 m/s and less than 0.9 m/s)
C3 (ak)	: One hour concentration in the case of wind velocity under 0.5 m/s
f3 (ak)	: Incidence of wind blowing (under 0.5 m/s)

(4) Estimation of wind velocity at the discharging height

Wind velocity for prediction is estimated from the low height wind data of the site survey. The following formula is used for estimation of wind velocity.

$$U=U_0 \times (Z/Z_0)^{\alpha}$$

Where

U	: Estimated wind velocity at the height of Z (m)
U_0	: Surveyed wind velocity at the height of Z_0 (near ground level)
α	: Power index

Generally, the power index "α" is a variable corresponding to atmospheric stability as shown in Table 8.1-8.

Table 8.1-8: Power Index for Estimation

Atmospheric Stability	A	B	C	D	E	F, G
α	0.1	0.15	0.20	0.25	0.25	0.30

Source: EIA Study Team

(5) Calculation of effective stack height

Under a windy condition, CONCAWE Stack Height Formulation is used for calculation of the effective rising height. Briggs Formulation is used under the weak wind condition and calm condition.

1) CONCAWE Stack Height Formulation (In the case of wind velocity more than 1 m/s)

$$He=H_0+\Delta H$$
$$\Delta H=0.175\times Q_H^{1/2}\times u^{-3/4}$$

Where
He : Effective stack height
H_0 : Height of chimney
ΔH : Rising height of exhaust gas
Q_H : Calorific value of exhaust gas
u : Wind velocity

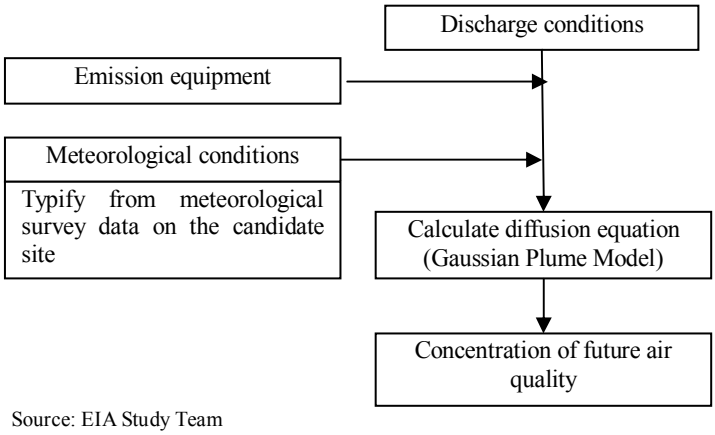
2) Briggs Formula (In the case of wind velocity under 1 m/s)

$$He=H_0+\Delta H$$
$$\Delta H=1.4\times Q_H^{1/4}\times(d\theta/dz)u^{-3/8}$$

Where
$d\theta/dz$: Gradient of atmospheric temperature
day 0.003 ºC/m, night 0.01 ºC/m

(6) Prediction flow

The prediction flow is shown in Figure 8.1-5.



Source: EIA Study Team

Figure 8.1-5: Prediction Procedure Flow

8.1.5 Prediction Results

(1) Prediction results in the construction and closure stages

The results of prediction in the construction stage and closure stage are shown in Table 8.1-9 below. Table 8.1-9 represents the prediction results at the nearest residence location in the north side of the proposed site. The dust occurring from the construction and demolition works shall be controlled and minimized by the Project proponent. Therefore, the impact on air quality is expected to be limited in these stages.

Table 8.1-9: Predicted Concentration of Ambient Air Quality

Item	Concentration added from this Project	Background Concentration	Future Concentration	Target Value		Contribution Rate for Future Air Quality (%)
				Target Value	Judgment	
NO_2	0.01563 ppm	0.035 ppm	0.051ppm	0.06 ppm	OK	30.9%
PM_{10}	0.00171 mg/m^3	0.049 mg/m^3	0.051 mg/m^3	0.12 mg/m^3	OK	3.4%

Source: EIA Study Team

(2) Prediction results in the operation stage

Maximum ground concentration point is 500 m in the south from emission point (stack of the incinerator). Concentration of air pollutants at the maximum point is shown in Table 8.1-10. It is predicted that the concentrations of NO_2, PM10, sulfur dioxide (SO_2), and carbon monoxide (CO) in this maximum point are less than the target ambient air quality level. The contours of concentration around the proposed Project site are also shown in Figure 8.1-6 to Figure 8.1-9.

Table 8.1-10: Predicted Concentration of Ambient Air Quality

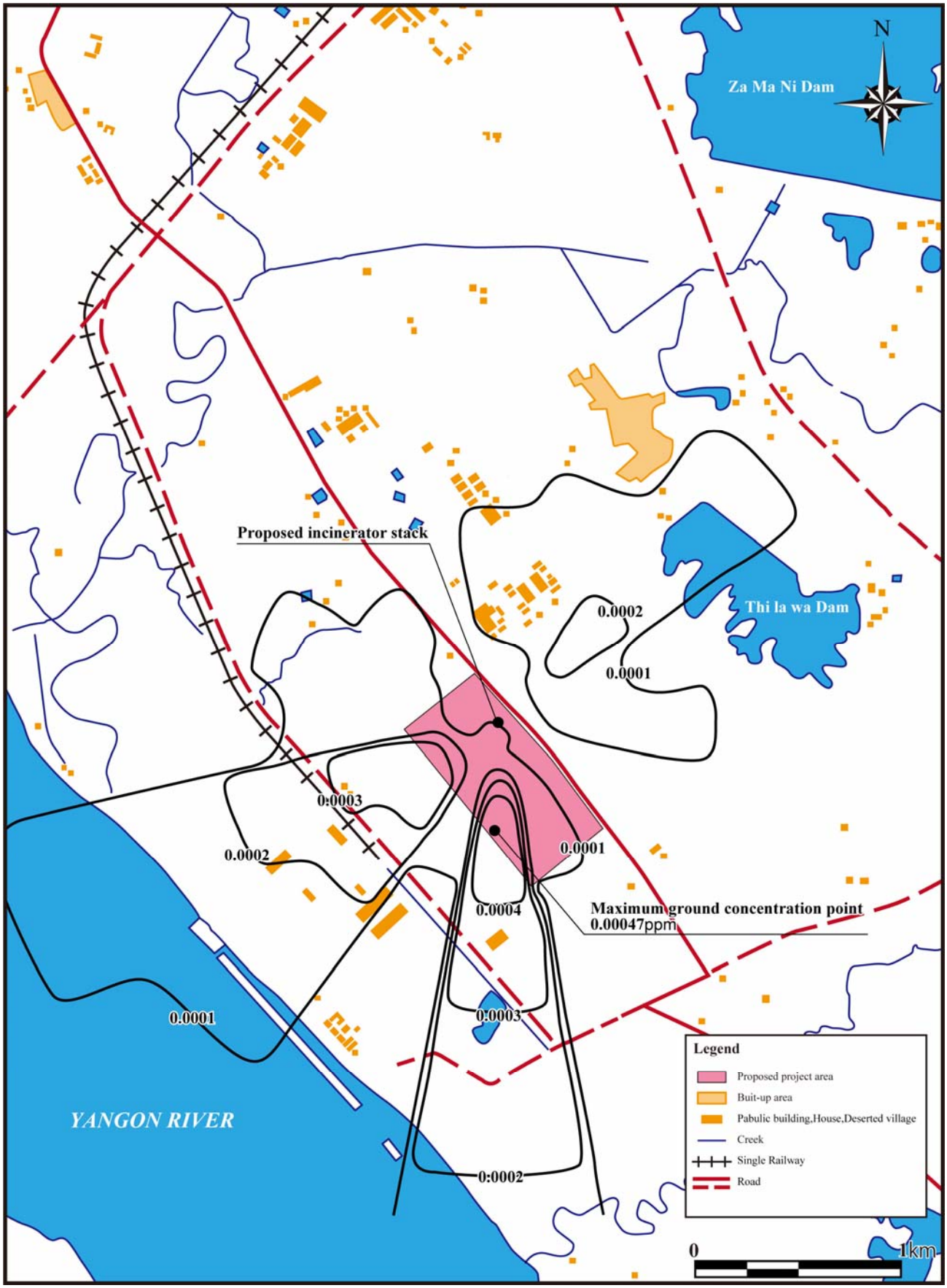
Item	Concentration added from this Project	Background Concentration	Future Concentration	Target Value		Contribution Rate for Future Air Quality (%)
				Target Value	Judgment	
NO_2	0.00047 ppm	0.035 ppm	0.0355 ppm	0.06 ppm	OK	1.3%
PM10	0.00028 mg/m^3	0.0490 mg/m^3	0.0493 mg/m^3	0.12 mg/m^3	OK	0.6%
SO_2	0.00023 ppm	0.00148 ppm	0.0017 ppm	0.04 ppm	OK	13.5%
CO	0.0002 ppm	0.361 ppm	0.3612 ppm	10 ppm	OK	0.1%

Source: EIA Study Team

The emission of hydrogen chloride (HCl), dioxins (DXNs), and heavy metals should be minimized by the Project proponent. In this Project, chemical baghouse filter (dry type using slaked lime) will be installed to reduce the amount of air pollutant emission by complying with the Japanese emission standard.

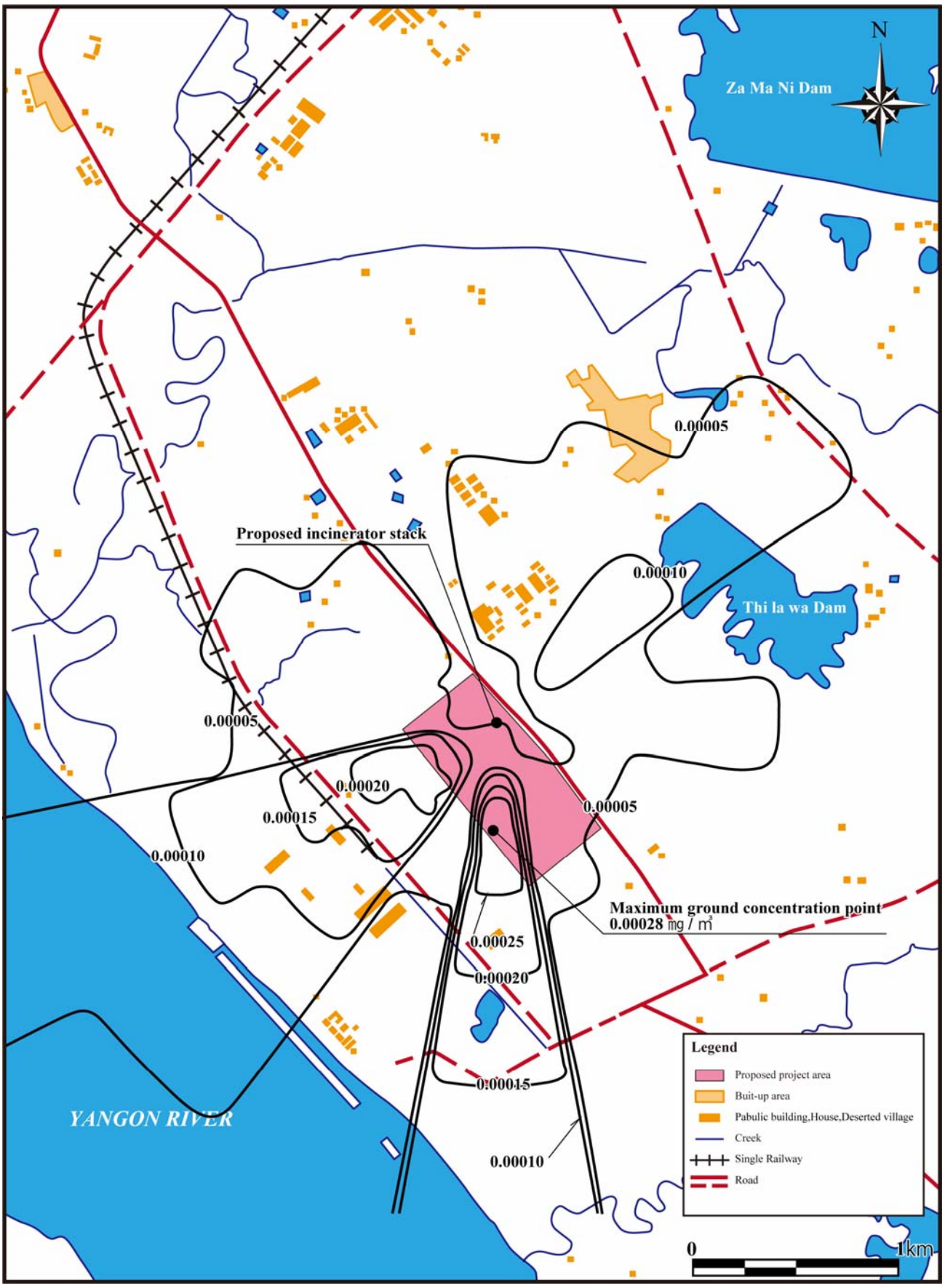
8.1.6 Evaluation

As a conclusion, it is evaluated that the air pollution caused by the proposed Project would be well controlled and managed, and would not cause any significant impacts on air quality in and around the proposed Project site.



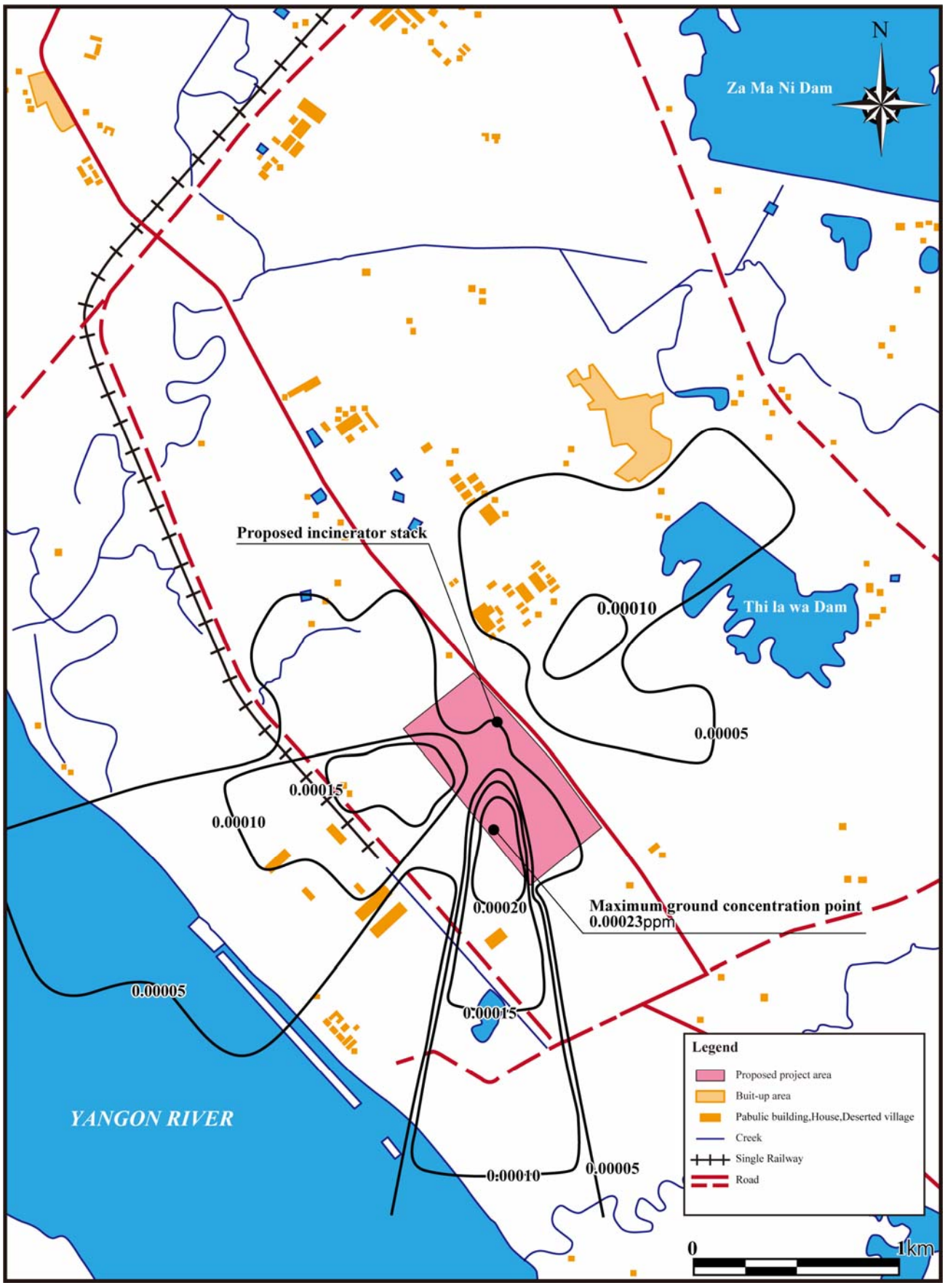
Source: EIA Study Team

Figure 8.1-6: Contour of Predicted NO_2 Concentration



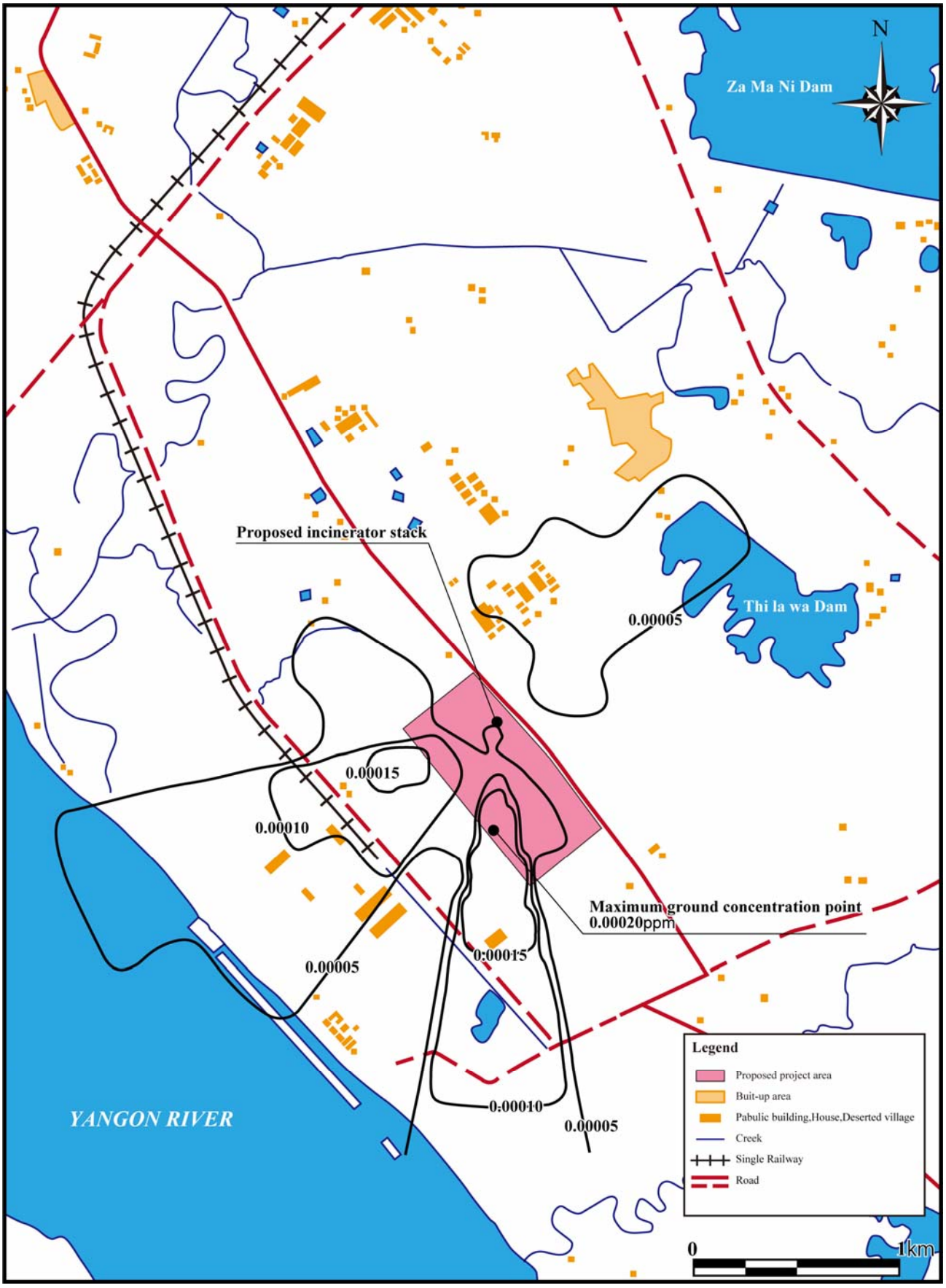
Source: EIA Study Team

Figure 8.1-7: Contour of Predicted PM10 Concentration



Source: EIA Study Team

Figure 8.1-8: Contour of Predicted SO_2 Concentration



Source: EIA Study Team

Figure 8.1-9: Contour of Predicted CO Concentration

8.2 Water Pollution

8.2.1 Prediction Items

The following items were examined to predict the impacts:

- Water pollutants generated by the construction and closing works of the proposed Project and
- Water pollutants discharged by the proposed Project site in the operation of the water treatment facilities.

8.2.2 Prediction Area

To forecast the impact, the examined area was set in and around the proposed Project area.

8.2.3 Prediction Period

The prediction periods in the construction and closure stages were set throughout the construction and closing works of the proposed Project.

The prediction period in the operation stage was set throughout the operation stage of the proposed Project.

8.2.4 Prediction Method

The impact forecast on water quality was conducted as follows:

- To examine the impact on the downstream area by the discharged muddy water in the construction and closing works of the proposed Project.
- To estimate the quality of wastewater discharged from the proposed Project in the operation and closure stages, by proposed wastewater treatment system for the Project.

8.2.5 Prediction Results

(1) Prediction results in the construction stage and closure stage related to demolition works

Muddy water would be temporarily discharged from the site for construction and demolition to the channel along the proposed Project site by the soil excavation work. However, the earthwork of the proposed Project will be mainly scheduled in the dry season so that the impact of muddy water is temporary and can be minimized by mitigation measures such as a settling basin.

(2) Prediction results in the operation stage and closure stage related to leachate treatment

1) Wastewater Treatment System of the Project

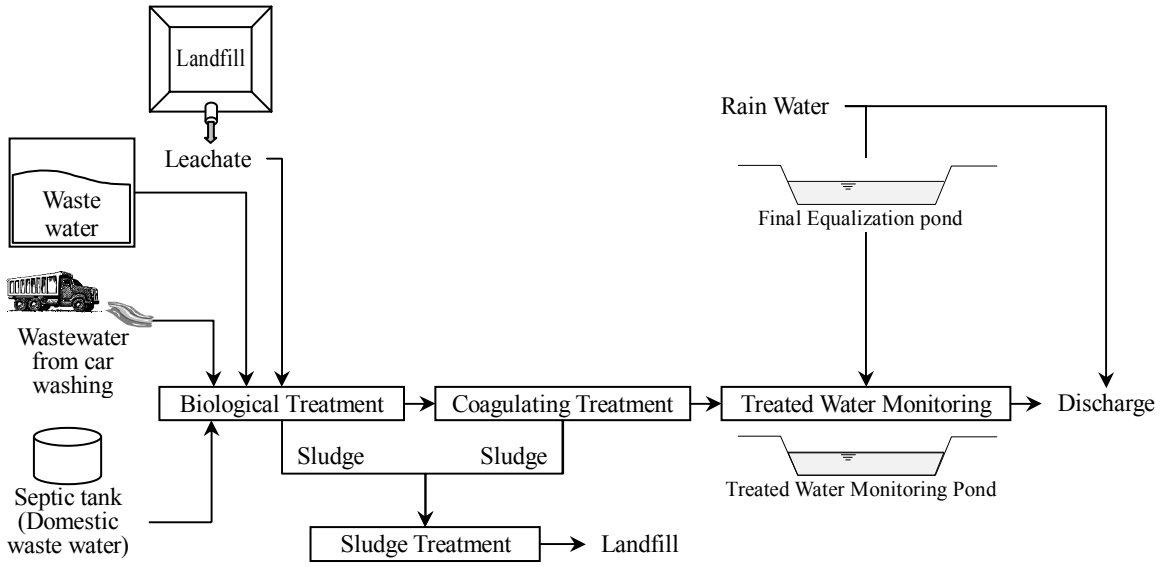
The leachate discharged from the landfill may contain organic substances (high levels of BOD, COD, etc.), nitrates, phosphorous, and other contaminants. However, the leachate shall be collected through leachate drainage system and will not leak into the groundwater and surface water system since the landfill has a liner system that has a secure barrier between the landfilled waste and natural subsoil/groundwater.

All the wastewater discharged from Project activities such as wastewater from car washing facilities and domestic wastewater (e.g., used water from the restrooms, showers, kitchen sinks), as well as the landfill leachate will be treated in the water treatment facility to be installed in the proposed Project,

which is mainly composed of biological treatment system and coagulating treatment system (see Figure 8.2-1). In the biological treatment, the biodegradable organic compounds and nitrogen can be degraded efficiently by anoxic tank and oxic tank with aeration by activated sludge, nitrification bacteria, and denitrifying bacteria. The primary treated wastewater is flowed to the coagulating treatment system so that the suspended solid matter can be eliminated in the flocculation and sedimentation tank by the addition of flocculants. The treated water, after its neutralization, is stored in the storage pond and discharged to the channel outside of the Project site after its water quality is monitored.

The design capacity of waste water treatment facility is 35 m^3/day and it secures that the treated water meets the target level at the drainage point to the public water body. The final equalization pond has a function of dilution to treat overload wastewater with enough capacity (900 m^3, almost equal to the treated wastewater volume for 25 days). The pond has also a function to buffer the emergency situation such as overflow of wastewater so as to serve as a safety net.

The sludge generated from the treatment facilities is disposed in the landfill after it is thickened and dehydrated.



Source: DOWA Eco-System Co., Ltd.

Figure 8.2-1: Process Flow of Wastewater Treatment

2) Impact on Water Quality during Operation of Landfill

The wastewater discharged from the Project site will flow into the wastewater treatment facility as mentioned above. Only the treated water whose water quality is satisfied with the required criteria shall be allowed to discharge to the public water body. The target level of effluent water quality is set based on the industrial wastewater effluent guideline values stipulated by the Ministry of Industry (MOI) as shown in Table 8.2-1. Therefore, the impact on water quality is limited within the allowable levels stipulated by the Government of Myanmar and related regulations.

This target levels shown in Table 8.2-1 can be updated or revised in accordance with the revision of Myanmar's regulations related to landfill or effluent water in the future.

Table 8.2-1: Target Levels of Effluent Water Quality Discharging to Water Body

No.	Parameter	Target Level (MOI Regulation)	Unit
1	BOD (5 days at 20 ºC)	max. 20-60	ppm
2	Suspended Solids	max. 30	ppm
3	Total Dissolved Solids	max. 2,000	ppm
4	pH Value	5-9	-
5	Permanganate Value	max. 60 *	ppm
6	Sulphide (as HS)	max. 1	ppm
7	Cyanide (as HCN)	max. 0.2	ppm
8	Oil and Grease	max. 5	ppm
10	Tar	None *	-
11	Formaldehyde	max. 1 *	ppm
12	Phenols and Cresols	max. 1	ppm
13	Free chlorine	max. 1 *	ppm
14	Zinc	max. 5	ppm
15	Chromium	max. 0.5	ppm
16	Arsenic	max. 0.25	ppm
17	Copper	max. 1.0	ppm
18	Mercury	max. 0.005	ppm
19	Cadmium	max. 0.03	ppm
20	Barium	max. 1.0 *	ppm
21	Selenium	max. 0.02	ppm
22	Lead	max. 0.2	ppm
23	Nickel	max. 0.2	ppm
24	Insecticides	None *	-
25	Radioactive Materials	None *	-
26	Temperature	max. 40	ºC
27	Color	Not objectionable when mixed in receiver water	-

*) Regarding these parameters annotated by an asterisk(*), the analysis method is not specified in the regulation or there is no laboratory which can analyze them in Myanmar. Thus, these parameters are not examined in the EIA process. However, when the analysis become feasible in Myanmar, these will be monitored and evaluated in the future.

Source: EIA Study Team

3) Wastewater Control until Stabilization of Landfill in the Closure Stage

The landfill requires long-term treatment of leachate and monitoring of water quality. The water quality shall be monitored for at least ten years after its closure. When it is confirmed that leachate water quality meets with the target level of effluent water quality and the landfill is stabilized, the operation of wastewater treatment facilities will be terminated.

The discharged water whose quality exceeds the required criteria will not be allowed to flow into the public water body even after the landfill's closure. Therefore, the impact on the surrounding water quality is limited within the allowable levels stipulated by the Myanmar regulation. This target level shown in Table8.2.1 can be updated or revised in accordance with the revision of Myanmar's regulation related to the landfill or effluent water in the future.

8.2.6 Evaluation

(1) Evaluation in the construction and closure stages related to demolition works

It is expected that impact on water quality is limited since the muddy water would be discharged on a temporary and controlled basis.

(2) Evaluation in the operation stage and closure stage related to leachate treatment

Impacts on water quality are expected to be limited since the effluent water from the landfill and operation facilities will be treated by the treatment plant so as to satisfy the target level equivalent to the industrial wastewater effluent guideline values stipulated by MOI. Thus, it is assessed that the water pollution caused by the operation activities of the Project would not cause significant impact on surrounding water bodies.

8.3 Noise and Vibration

8.3.1 Prediction Item

The items to be predicted are as follows:

- Noise and vibration caused by the construction and closure works of the proposed Project.
- Noise and vibration caused by the operation work of the proposed Project.

8.3.2 Prediction Area

The area, where the impacts are to be predicted, was set in and around the proposed Project site. The prediction point is the nearest residence from the proposed Project site.

8.3.3 Prediction Period

In the construction and closure stages, the prediction period was set when the maximum noise level is assumed from the construction machineries.

In the operation stage, the prediction period was set after starting the operation of the proposed Project.

8.3.4 Prediction Method

The impacts of noise and vibration were predicted by the following methods:

- To estimate the noise level from the proposed Project, sound propagation model was applied.
- To estimate the vibration level from proposed Project, vibration propagation model was applied.

The methodology of the impact prediction was described below:

(1) Method for noise prediction

1) Prediction formula

In order to predict the noise level caused by the proposed Project, the following formula is applied:

$$L_A = L_{A,reference} - 8 - 20\log_{10}\left(\frac{r}{r_0}\right)$$

L_A :Noise level at evaluation point [dB]
$L_{A,reference}$:Noise level at reference point [dB]
r_0 :Distance from source to reference point [m]
r :Distance from source to evaluation point [m]

2) Prediction condition

a) Source of noise

Construction and closure stages

Table 8.3-1 shows the conditions for construction and closure noise prediction. In order to predict the maximum impact of construction noise, prediction period was set at the maximum number of

construction machineries used (first month of the construction stage), and construction machineries were set at the nearest point from residence based on the existing construction plan.

Table 8.3-1: Conditions for Construction and Closure Noise Prediction

Kind of Construction	Equipment	Noise Level at Reference Point [dB]	Distance from Source to Reference Point [m]	Number of Equipment [Unit]
Earth Work (stripping)	Bulldozer	80	10	2
	Excavator	74	10	2
Earth Work (landfilling)	Bulldozer	80	10	5
	Excavator	74	10	5
	Compaction Roller	79	10	5
Excavation (waste lot)	Bulldozer	80	10	2
	Excavator	74	10	2
Excavation (pond)	Excavator	74	10	2
Pile Works	Excavator	74	10	1
	Pile press Equipment	76	10	1

Source: Construction Noise Prediction Model 'ASJ CN-Model 2007', The Acoustical Society of Japan, 2008

Operation stage

Table 8.3-2 shows the conditions for operation noise prediction. Sources of noise are set based on the proposed Project plan.

Table 8.3-2: Conditions for Operation Noise Prediction

Kind of Operation	Equipment	Noise Level at Reference Point [dB]	Distance from Source to Reference Point [m]	Number of Equipment [Unit]
Stabilization	Loader (less than1.1m^3)	74	10	1
Land fill	Excavator	74	10	2
	Loader (2.2m^3)	79	10	2
Waste Water Treatment	Blower for aeration	82	1	1
Incinerator	Fan for fuel gas circulation	70	1	1
	Blower for chemical feeding	81	1	1

Source: Construction Noise Prediction Model 'ASJ CN-Model 2007', The Acoustical Society of Japan, 2008
Rated value of the equipments which are assumed to be installed

b) Prediction point

Prediction point of noise and vibration is at the boundary of house which is nearest to the Project site as shown in Figure 8.3-1. The minimum distance between the house and the Project boundary is approximately 70 m.

Source: Google Earth

Figure 8.3-1: Prediction Point for Noise and Vibration

(2) Method for vibration prediction

1) Prediction formula

In order to predict the vibration level caused by the proposed Project, the following formula is applied:

$$L_V = L_{V,reference} - 15\log_{10}\left(\frac{r}{r_0}\right) - 8.68\alpha(r - r_0)$$

Lv: *Vibration Level at evaluation point [dB]*
$L_{V,reference}$: *Vibration Level at reference point [dB]*
r_0: *Distance from source to reference point [m]*
r: *Distance from source to evaluation point [m]*
α: *Internal reduction coefficient in ground (Normal: 0.01, Hard Rock: 0.001)*

2) Prediction condition

a) Source of vibration

Construction and Closure Stages

Table 8.3-3 shows the conditions for construction vibration prediction. In order to predict the maximum impact of construction vibration, construction machineries are set at the nearest point from residence based on the existing construction plan.

Table 8.3-3: Conditions for Construction and Closure Vibration Prediction

Kind of Construction	Equipment	Vibration Level at Reference Point [dB]	Distance from Source to Reference Point [m]
Earthwork (stripping)	Bulldozer	63	7
	Excavator	58	7
Earthwork (landfilling)	Bulldozer	63	5
	Excavator		
	Compaction roller		
Excavation (waste lot)	Bulldozer	63	7

Kind of Construction	Equipment	Vibration Level at Reference Point [dB]	Distance from Source to Reference Point [m]
	Excavator	58	7
Excavation (pond)	Excavator	58	7
Pile Works	Excavator	58	7
	Pile press equipment	54	7

Source: Data Book on Noise and Vibration of Construction Machinery, Public Works Research Institute of Japan, 1980
Environment Impact Assessment Technique for Road Project, National Institute for Land and Infrastructure Management and Public Works Research Institute, Japan, FY2012

Operation Stage

Table 8.3-4 shows the conditions for operation vibration prediction. Sources of vibration are set based on the proposed Project plan. The stabilization work and landfilling works will be implemented only at daytime (9:00-17:00)

Table 8.3-4: Conditions for Operation Vibration Prediction

Kind of Construction	Equipment	Vibration Level at Reference Point [dB]	Distance from Source to Reference Point [m
Stabilization	Loader	49	7
Landfill	Excavator	58	7
	Loader	49	7
Incinerator	Fan for fuel gas circulation	37	1
	Blower for chemical feeding	39	1

Source: Data Book on Noise and Vibration of Construction Machinery, Public Works Research Institute of Japan, 1980
Rated value of the equipments which are assumed to be installed

c) Mitigation measures

Trial and error exercises with mitigation measures were implemented to comply with the target level of noise and vibration. As a result of the exercises, the following mitigation measures for noise will be required in the first month in the construction stage:

- Installation of sound proofing sheet in the evening and nighttime;
- In evening time, construction work is not implemented in the area where its distance is less than 50 m from the Project site boundary facing the residential side; and
- At nighttime, construction work is not implemented in the area where its distance is less than 250 m from the Project site boundary facing the residential side.

From the second month, the distance, which the Project can implement construction work from the boundary, might be shortened as long as it complies with the target noise level in the construction stage.

As for the vibration during the construction stage, noise and vibration during the operation stage, mitigation measures are not required.

8.3.5 Prediction Results

(1) Prediction results in the construction and closure stages

1) Noise

Table 8.3-5 shows the results of noise level prediction in the construction and closure stages. It is predicted that the noise level would be less than the target noise level in the construction and closure

stages. Hence, it is evaluated that the noise caused by construction and closure works of the proposed Project would be well controlled and managed, and would not cause any significant impacts.

Table 8.3-5: Prediction Results of Noise in the Construction and Closure Stages

Parameter	Predicted Point	Predicted Noise Level	Target Level	Compliance with Target Level	Mitigation Measures
L_{Aeq}	Residence	61 dB	75 dB (7:00 a.m.-7:00 p.m.)	OK	- Installation of sound proof sheet (as necessary)
		60 dB	60 dB (7:00 p.m.-10:00 p.m.)	OK	- Installation of sound proof sheet - Construction work is not implemented in the area where its distance is less than 50 m from the Project site boundary facing the residential side
		55 dB	55 dB (10:00 p.m.-7:00 a.m.)	OK	- Installation of sound proof sheet - Construction work is not implemented in the area where its distance is less than 250 m from the Project site boundary facing the residential side

Source: EIA Study Team

2) Vibration

Table 8.3-6 shows the prediction results of vibration level in the construction and closure stages. It is predicted that the vibration level would be less than the target vibration level in the construction and closure stages. Hence, it is evaluated that the vibration caused by construction and closure works of the proposed Project would not cause any significant impacts.

Table 8.3-6: Prediction Results of Vibration in the Construction and Closure Stages

Parameter	Predicted Point	Predicted Vibration Level	Target Level	Compliance with Target Level	Mitigation Measures
L_{V10}	Residence	40 dB	65 dB (7:00 a.m.-7:00 p.m.)	OK	Not required
		32 dB	65 dB (7:00 p.m.-10:00 p.m.)	OK	Not required
		Less than 25 dB	60 dB (10:00 p.m.-7:00 a.m.)	OK	Not required

Source: EIA Study Team

(2) Prediction results in the operation stage

1) Noise

Table 8.3-7 shows the results of noise level prediction in the operation stage. It is predicted that the noise level would be less than the target noise level in the operation stage. Hence, it is evaluated that the noise caused by operation work of the proposed Project would not cause any significant impacts.

Table 8.3-7: Prediction Results of Noise in the Operation Stage

Parameter	Predicted Point	Predicted Noise Level	Target Level	Compliance with Target Level	Mitigation Measures
L_{Aeq}	Residence	52 dB	60 dB (7:00 a.m.-7:00 p.m.)	OK	Not required
		27 dB	55 dB (7:00 p.m.-10:00 p.m.)	OK	Not required
		27 dB	50 dB (10:00 p.m.-7:00 a.m.)	OK	Not required

Source: EIA Study Team

2) Vibration

Table 8.3-8 shows the results of vibration level prediction in the operation stage. It is predicted that the vibration level would be less than the target vibration level in the operation stage. Hence, it is evaluated that the vibration caused by operation work of the proposed Project would not cause any significant impacts.

Table 8.3-8: Prediction Results of Vibration in the Operation Stage

Parameter	Predicted Point	Predicted Vibration Level	Target Level	Compliance with Target Level	Mitigation Measures
L_{V10}	Residence	Less than 25 dB	65dB (7:00 a.m.-7:00 p.m.)	OK	Not required
		Less than 25 dB	60dB (7:00 p.m.-7:00 a.m.)	OK	Not required

Source: EIA Study Team

8.3.6 Evaluation

As a conclusion, it is evaluated that the noise and vibration caused by these activities related to the proposed Project would be well controlled and managed, and would not cause any significant environmental impacts in the surrounding area.

8.4 Offensive Odor

8.4.1 Prediction Item

The item to be predicted is as follows:

- The impact of offensive odor generated from the final disposal facility of the proposed Project in the operation stage.

8.4.2 Prediction Area

The area, where the impacts are to be predicted, was set in and around the proposed Project site.

8.4.3 Prediction Period

The prediction period was set throughout the operation stage of the proposed Project.

8.4.4 Prediction Method

(1) Prediction method

The impacts of offensive odor were predicted by the following methods:

- To examine the source of offensive odor from the proposed waste treatment system.
- To examine the management methods and mitigation measures to prevent diffusion of offensive odor substances.

(2) Prediction conditions

1) Source of offensive odor to be predicted

The source of offensive odor to be predicted is shown below:

- Landfill site (Landfilling work)

2) Mitigation measures

The mitigation measures to be taken against offensive odor are as follows:

- The landfill structure will be equipped with dual liner sheets on the base and leachate collection system as well as landfill gas treatment system.
- The gas collection pipes will be installed in the landfill and the collected gas shall be treated by the flare station.
- The landfill shall be covered with sheets to prevent leakage of landfill gas, as follows:
  - The active area of landfilling work shall be limited within the area less than 10-20 m x 10-20 m and it shall be covered with tarpaulin temporarily when landfilling work will not be conducted.
  - Non-active area of the landfill shall be covered with sheet.
- After completion of waste disposal, final covering of the landfill will be installed.
- Odor monitoring around the Project site will be conducted every day.
- Wind condition around the Project site will be monitored every day.

- If some complaints regarding the offensive odor would be received, the source of offensive odor shall be investigated and the mitigation measure shall be considered and implemented.

8.4.5 Prediction Results

As mentioned in the prediction conditions, the proper management method and mitigation measures would be conducted for each source of offensive odor in the proposed Project site. Therefore, offensive odor caused by the Project activities shall be suppressed at the minimum level.

Besides, according to an example shown in the reference below, it is anticipated that the offensive odor from the landfill might not be significantly recognizable in and around the household area near the proposed Project site because the nearest house is located 70 m far from the site boundary.

Reference

Investigation results of offensive odor conditions in the Haibara final disposal site in Tokushima Pref., Japan (2011, Mima Association for Environmental Management)

- In the landfill of the Haibara final disposal site, wherein industrial waste as well as organic residual have been disposed, the trial digging survey was conducted on several points to measure the odor intensity.
- The odor intensities* at the trial digging points were **Level 2.5 to 3**, but the odor intensity at a point 30 m far from the trial digging points was **Level 1**.

* Verbal description of an odor sensation using 6 odor intensity scales are shown below.
[0: no odor, 1: very weak (odor threshold), 2: weak, 3: distinct, 4: strong, 5: very strong, 6: intolerable]
Source: Jiang, J et al., Improvement of odor intensity measurement using dynamic olfactometry (1995)

8.4.6 Evaluation

As a conclusion, it is evaluated that offensive odor to occur due to the Project would be well controlled and managed, and would not cause any significant impacts in and around the proposed Project site.

8.5 Global Warming

8.5.1 Prediction Item

The item to be predicted is as follows:

- Greenhouse gas emission by the operation work of the proposed Project.

8.5.2 Prediction Area

The area, where the impacts are to be predicted, was set in the proposed Project site.

8.5.3 Prediction Period

The prediction period was set throughout the operation stage of the Project.

8.5.4 Prediction Method

The impact of global warming was predicted by the following method:

- To examine the greenhouse gas emission caused by the operation of the Project qualitatively, the description and characteristics of the proposed Project were referred to.

8.5.5 Prediction Results

As for the landfill, the Project will introduce semi-aerobic landfill system that drains out the leachate as quickly as possible, prevents leachate from stagnating in the waste material and makes it easier for fresh air to penetrate, thereby promoting aerobic condition in the waste layers. By promoting aerobic conditions, microbial activity is enhanced and the decomposition of waste is accelerated. The organic matter in the Project's landfill will be decomposed in more aerobic condition compared with the current open dumping landfill and it will be mainly converted to carbon dioxide (CO_2) by aerobic fermentation of the microorganism. On the other hand, the existing landfills in Yangon Region are the landfills with open dumping system and organic matter shall be converted mainly to methane (CH_4) by anaerobic fermentation. Therefore, it can be evaluated that the Project will contribute in reducing greenhouse gas emission from the landfill by converting landfill gas from methane to carbon dioxide.

As for the incinerator, it is inevitable that greenhouse gas will be discharged by combustion of non-biomass solid waste. However, the Project will install an incinerator supplied by a Japanese manufacturer which realizes efficient combustion of solid waste and minimize consumption of auxiliary fuel.

Besides, the fuel conversion facility will convert the waste into fuel and material to be utilized in the cement factories. The fuel and material produced in the fuel conversion facility will be able to substitute fossil fuel and raw material consumed in the cement factories, which contribute to the reduction of greenhouse gas emission.

8.5.6 Evaluation

As a conclusion, it is evaluated that the proposed Project would not cause any significant impacts on global warming in and around the proposed Project site.

CHAPTER 9: SOCIAL IMPACT ASSESSMENT

9.1 Landscape

9.1.1 Prediction Item

The item to be predicted is as follows:

- The impacts on landscape caused by the existence of the landfill.

9.1.2 Prediction Area

The area, where the impacts are to be predicted, was set in and around the proposed Project site.

9.1.3 Prediction Period

The prediction period was set throughout the operational stage and after closure stage of the Project.

9.1.4 Prediction Method

(1) Prediction method

The impacts on landscape were predicted by the following method:

- To examine the oppressive factors in the proposed Project site caused by the existence of landfill in consideration of the landscaping and greening plan of the proposed Project.

(2) Prediction conditions

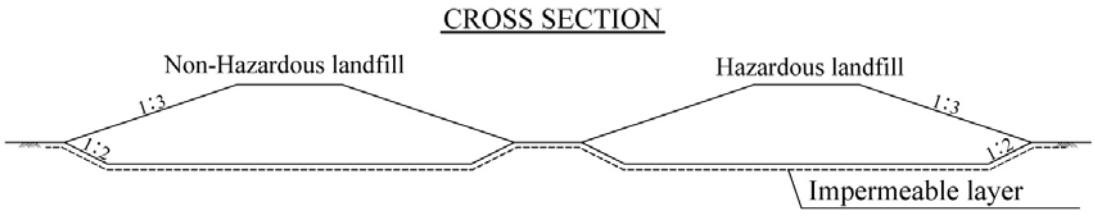
1) Outline of the landfill

The proposed landfill was designed in consideration of the views from the surrounding area. The position of the landfill was set approximately 200 m away from the road boundary. The outline of the landfill is shown in Table 9.1-1, and its cross section is shown in Figure 9.1-1.

Table 9.1-1: Outline of the Landfill

Item	Value
Height from site preparation	10 m
Size	83 m×83 m; 83 m×127 m (approximate)
Slope gradient	1 to 3.0

Source: DOWA Eco-System Co., Ltd.



Source: DOWA Eco-System Co., Ltd.

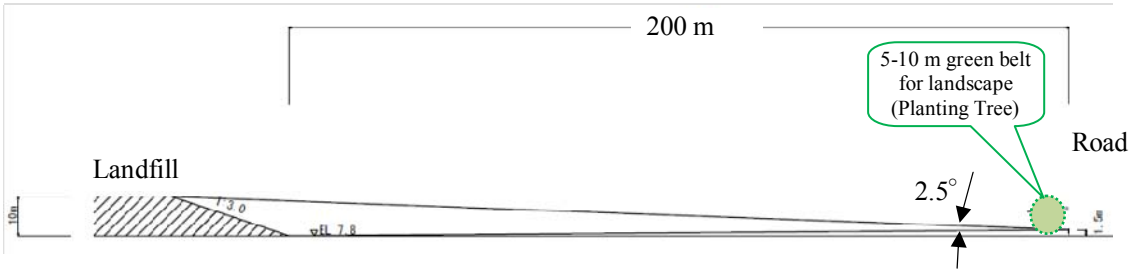
Figure 9.1-1: Cross Section of the Proposed Landfill

2) Mitigation measures

・Greening around the property boundary of the proposed site.

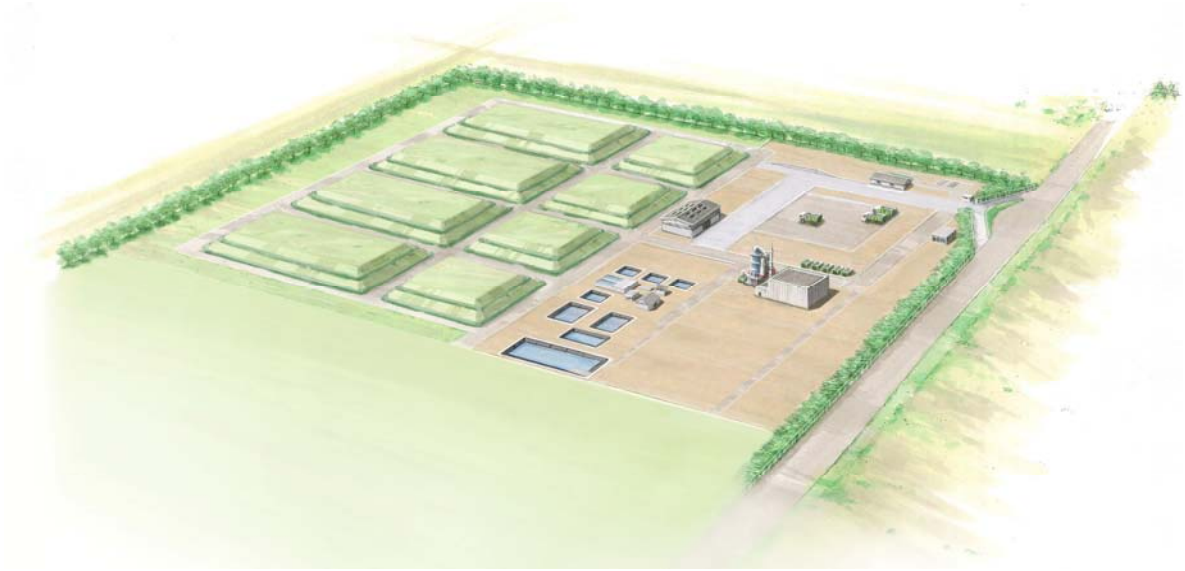
9.1.5 Prediction Results

The main factor that has potential to affect the landscape is landfilling of the waste. The landfill would be located approximately 200 m far from the contact road. The view angle of the landfill from the contact road is only 2.5 degree (see Figure 9.1-2). Moreover, 5-10 m greenbelt with trees with functions of landscape and blindfold will be installed around the boundary of the Project site as shown in Figure 9.1-2 and Figure 9.1-3. Therefore, the impact on landscape by the Project activities and existence of the Project facilities will be limited.



Source: DOWA Eco-System Co., Ltd.

Figure 9.1-2: View Angle from the Contact Road



Source: DOWA Eco-System Co., Ltd.

Figure 9.1-3: Perspective Drawing of the Proposed Site

9.1.6 Evaluation

As a conclusion, the impacts on landscape by the existence of the landfill constructed by the proposed Project is evaluated to be well controlled and managed, and it is expected that its existence would not cause any significant environmental impacts in and around the proposed Project site.

9.2 Water Use

9.2.1 Prediction Item

The item to be predicted is as follows:

- The impacts on water use caused by the existence of the landfill.

9.2.2 Prediction Area

The area, where the impacts are to be predicted, was set around the proposed Project site.

9.2.3 Prediction Period

The prediction period was set throughout the operational stage and after closure stage of the Project.

9.2.4 Prediction Method

(1) Prediction method

The impacts on landscape were predicted by the following method:

- To examine the impact on water usage of surrounding areas by the existence of landfill in consideration of mitigation measures on groundwater contaminations.

(2) Prediction Conditions

1) Description of water sources

There are three main water sources around the Project site, i.e.: Zamami Reservoir, the largest water source that supplies irrigation water to the agricultural area and industrial water to Thilawa SEZ Zone A area; Thilawa Dam, the second largest water source that supplies the industrial area where the factories are located in the north of the Project site, and lastly are the wells for domestic water use, which are located in the residential area in the north west of the Project site. According to an expert knowledgeable of the water use situation in and around the Thilawa SEZ area, villagers in the residential area near the Project site normally use domestic water from the well(s) and Thilawa Dam. Table 9.2-1 shows the description of water sources around the Project site.

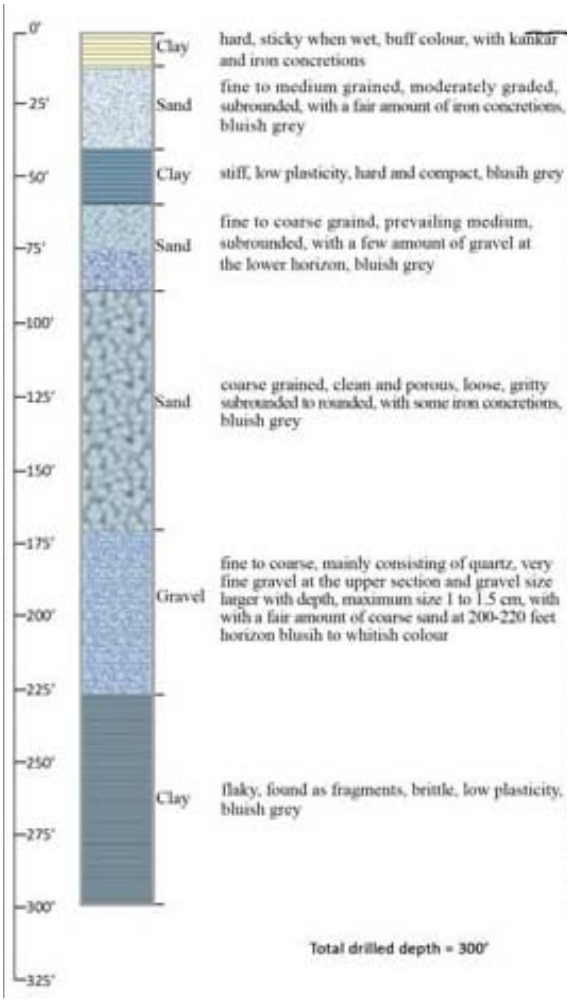
Table 9.2-1: Description of Water Sources around the Project Site

Water Sources	Purpose of Water Use	Minimum Distance from the Project Site	Note
Zamami Reservoir	Irrigation water Industrial water (for Thilawa Zone A)	Approx. 2,700 m (North East)	Distribution by canal to irrigation and by pipe to industrial zone (planned)
Thilawa Dam	Industrial water	Approx. 1,000 m (North East)	Distribution by pipe to factories
Well(s) in the residential area[1)]	Domestic water	Approx. 100 m (North to North West)	Intake water by hand and hand pump, etc.

Note: 1) Information on wells in the residential area are based on the interview with the expert who is familiar with the groundwater situation in and around the Thilawa SEZ area
Source: EIA Study Team

2) Geological conditions

According to the Final Report of the Preparatory Study on Thilawa Special Economic Zone Infrastructure Development (2014) funded by the Japan International Cooperation Agency (JICA), geographic log information at the center of Thilawa SEZ is available as shown in Figure 8.2-1. The clay layers are distributed around 50 feet (15 m) depth as first and 235 feet (70 m) depth as second. Thus it is assumed that the unconfined aquifer is on the first clay layer (15 m depth) and first confined aquifer is on the second clay layer (70 m depth).



Source: Final Report of the Preparatory Study on Thilawa Special Economic Zone Infrastructure Development (2014), JICA

Figure 9.2-1: Geographic Log around the Project Site

3) Water use for the Project

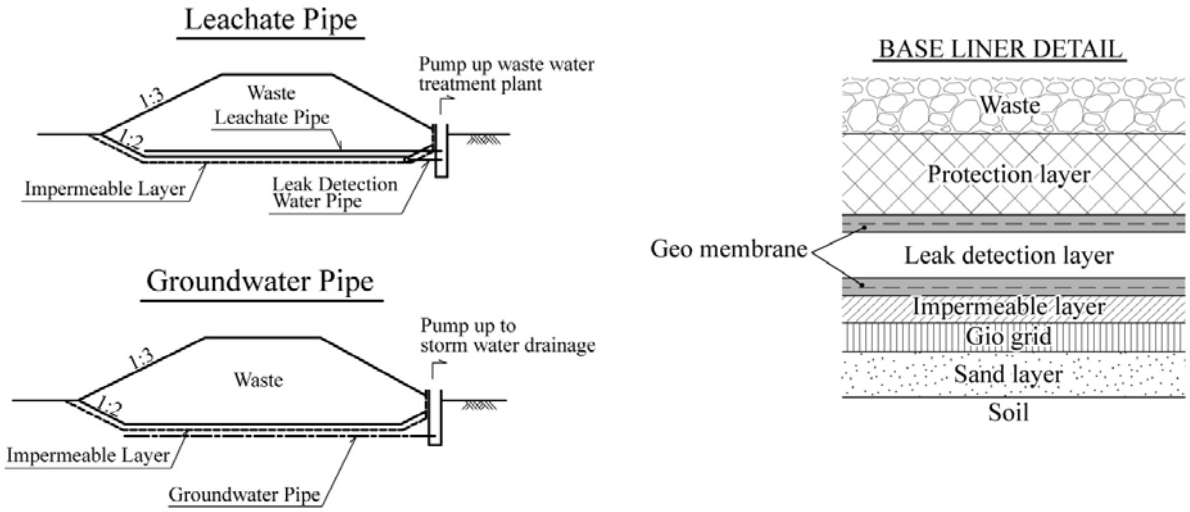
Water for the Project will be supplied by the Myanmar and Japan Thilawa Development Ltd. in accordance with a contract agreement.

4) Mitigation measures

As described in Section 3.4.9, baseliner sheets and leachate collection system will be installed to prevent leachate from infiltrating the soil and groundwater during the operation stage. Baseliner system consists of various layers, i.e.; protection layer, geomembrane layers, leak detection layer impermeable layer, geo grid, and sand layer to isolate waste and prevent waste and leachate from leaking. To collect leachate, leachate collection pipes will be installed in the protection layer and collected wastewater will be pumped to the wastewater treatment system.

Groundwater collection system will also be installed in the sand layer under the impermeable layer to collect rising groundwater and the collected groundwater will be pumped up and connected to the retention ponds. Figure 9.2-2 shows the water collection system and structure of baseliner.

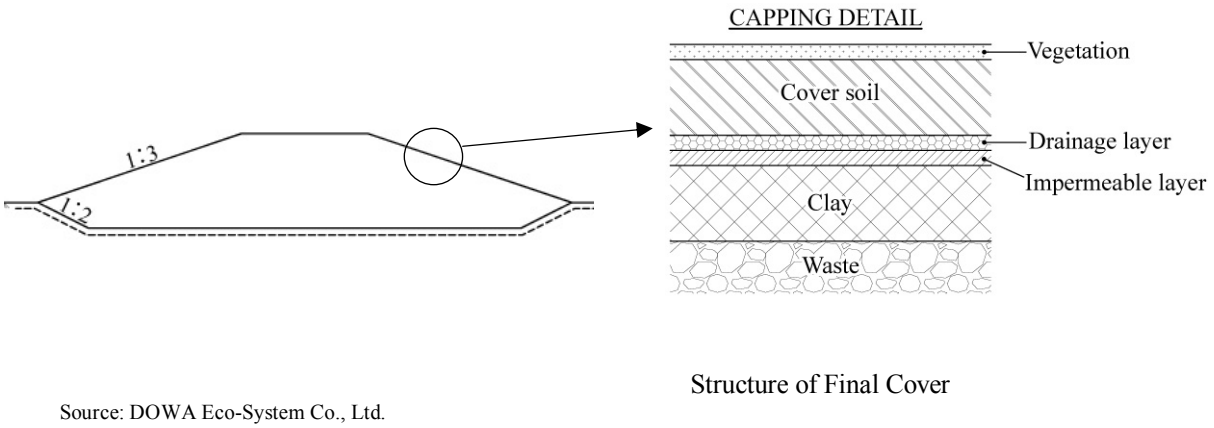
After completion of waste disposal, final covering of the landfill by means of clay soil, impermeable layer, drainage layer, cover soil, and vegetation will be installed on the top of landfill waste as shown in Figure 9.2-3. After installation of final covering, the proponent will continuously conduct leachate leakage and groundwater monitoring until abolishment of landfill, as well as landfill gas monitoring and treatment, ambient air quality monitoring, ground subsidence and slide monitoring. These monitoring will be conducted for ten years at least after installation of final covering, and the landfill will be abolished if no environmental impact is observed for two years.



Leachate and Groundwater Collection System **Baseliner**

Source: DOWA Eco-System Co., Ltd.

Figure 9.2-2: Water Collection System and Structure of Baseliner



Structure of Final Cover

Source: DOWA Eco-System Co., Ltd.

Figure 9.2-3: Cross Section of Landfill and Structure of Final Cover

9.2.5 Prediction Results

Among the water sources, two main big water sources, namely, Zamami Reservoir and Thilawa Dam, are not affected by the existence of the landfill because more than enough distance was secured and

considered. With respect to the well(s) in the residential area located around 100 m from the Project site at a minimum, it is relatively close compared with other water sources. However, the Project proponent will install controlled landfill system to prevent leachate from infiltrating the soil as well as groundwater with leak detection system and periodical monitoring will be done as mentioned above. Thus, impact on water use from well(s) in the residential area will not be assumed. Furthermore, the Project will implement monthly water quality monitoring at the well(s).This activity will be implemented with the combination of mitigation measures on community health and safety.

9.2.6 Evaluation

As a conclusion, the impacts on water use of the local people for their daily lives are expected to be minimal because the solid waste management facilities will not take water source from the surrounding area but from the Zone A area water supply system. The controlled landfill for industrial waste will be installed in order not to cause groundwater contamination in the surrounding water source.

CHAPTER 10: HEALTH IMPACT ASSESSMENT

10.1 Occupational Health and Safety including Accidents and Infectious Diseases

10.1.1 Prediction Item

The items to be predicted are as follows:

- The impacts on occupational health and safety caused by construction work of the proposed Project.
- The impacts on occupational health and safety caused by operation work of the proposed Project.
- The impacts on occupational health and safety caused by closing work of the proposed Project.

10.1.2 Prediction Area

The area, where the impacts are to be predicted, was set in the proposed Project site.

10.1.3 Prediction Period

The periods to be predicted are as follows:

- The prediction period in the construction stage was set throughout the construction stage of the Project.
- The prediction period in the operation stage was set throughout the operation stage of the proposed Project.
- The prediction period in the closure stage was set throughout the closure stage of the proposed Project.

10.1.4 Prediction Method

The impacts on occupational health and safety are predicted by the following methods:

- To examine the impact on occupational health and safety caused during the construction and closure stages by considering the construction and closure work plans for the proposed Project.
- To examine the impact on occupational health and safety caused during the operation stage by considering the operation work plan for the proposed Project.

10.1.5 Prediction Results

(1) Prediction results in the construction and closure stages

Minor negative impacts on occupational health and safety (OHS) including accidents are inevitable to some extent during construction and closure works. To minimize the negative impacts, working condition during construction should be managed by the contractor based on OHS training stipulated in international guidelines such as the EHS Guidelines by the IFC. Expected mitigation measures for

occupational health and safety related to construction of the proposed Project facilities are shown in Table 10.1-1.

Table 10.1-1: Expected Mitigation Measures against Negative Impact on Occupational Health and Safety (Construction and Closure Stages)

Negative Factors	Mitigation Measures
Over-exertion	Training of workers in lifting and materials handling techniques in construction and decommissioning projects, including the placement of weight limits above which mechanical assists or two-person lifts are necessary
	Implement administrative controls into work processes, such as job rotations and rest or stretch breaks
Slips and Falls	Implement good housekeeping practices, such as sorting and placing loose construction materials or demolition of debris in established areas away from foot paths
	Clean up excessive waste debris and liquid spills regularly
	Locate electrical cords and ropes in common areas and marked corridors
	Use of slip retardant footwear
Work in Heights	Use of control zones and safety monitoring systems to warn workers of their proximity to fall hazard zones, as well as securing, marking, and labeling covers for openings in floors, roofs, or walking surfaces
Struck By Objects	Use a designated and restricted waste drop or discharge zones, and/or a chute for safe movement of wastes from upper to lower levels
	Conduct sawing, cutting, grinding, sanding, chipping or chiseling with proper guards and anchoring as applicable
	Maintain clear traffic ways to avoid driving of heavy equipment over loose scrap
	Use of temporary fall protection measures in scaffolds and out edges of elevated work surfaces, such as hand rails and toe boards to prevent materials from being dislodged
	Wearing appropriate PPE, such as safety glasses with side shields, face shields, hard hats, and safety shoes
Moving Machinery	Plan and segregate the location of vehicle traffic, machine operation, and walking areas, and control vehicle traffic through the use of one-way traffic routes, establish speed limits, and on-site trained flag-people wearing high-visibility vests or outer clothing covering to direct traffic
	Ensure the visibility of personnel through their use of high visibility vests when working in or walking through heavy equipment operating areas, and train workers to verify eye contact with equipment operators before approaching the operating vehicle
	Ensure moving equipment is outfitted with audible back-up alarms
	Use inspected and well-maintained lifting devices that are appropriate for the load, such as cranes, and secure loads when lifting them to higher job-site elevations.
Dust	Dust suppression techniques should be implemented, such as applying water or non-toxic chemicals to minimize dust from vehicle movements
	PPE, such as dusk masks, should be used where dust levels are excessive
Confined Spaces and Excavations	Control site-specific factors which may contribute to excavation slope instability including, for example, the use of excavation dewatering, side wall support, and slope gradient adjustments that eliminate or minimize the risks of collapse, entrapment, or drowning
	Provide safety means of access and egress from excavations, such as graded slopes, graded access route, or stairs and ladders
	Avoid the operation of combustion equipment for prolonged periods inside the excavations areas where other workers are required to enter unless the area is actively ventilated
Other Site Hazards	Use of specially trained personnel to identify and remove waste materials from tanks, vessels, processing equipment or contaminated land as a first step in decommissioning activities to allow for safe excavation, construction, dismantling, or demolition
	Use of specially trained personnel to identify and selectively remove potentially hazardous materials in building elements prior to dismantling or demolition including, for example, insulation or structural elements containing asbestos and polychlorinated biphenyls (PCBs), electrical components containing mercury
	Use of waste-specific personal protective equipment (PPE) based on the results of occupational health and safety assessment, including respirators, clothing/protective suits, gloves and eye protection

Source: EIA Study Team

(2) Prediction results in the operation stage

Minor negative impacts on OHS including accidents are inevitable to some extent during operation work. To minimize the negative impacts, working condition during operation shall be managed by the Project proponent based on OHS training stipulated in international guidelines such as the EHS Guidelines by the IFC. Expected mitigation measures for occupational health and safety related to operation of the proposed Project facilities are shown in Table 10.1-2.

Table 10.1-2: Expected Mitigation Measures against Negative Impact on Occupational Health and Safety (Operation Stage)

Negative Factors	Mitigation Measures
Accidents and Injuries	In landfill, conduct compaction of wastes in thin layers using heavy equipment and place regular cover material over each compacted layer of waste, so that any underground fires within a waste cell are not able to spread throughout the landfill and lead to significant cave-ins;
	Provide workers with appropriate protective clothing, gloves, respiratory face masks, and slip-resistant shoes for waste transport workers and hard-soled safety shoes for all workers to avoid puncture wounds to the feet. For workers near loud equipment, include noise protection. For workers near heavy mobile equipment, buckets, cranes, and at the discharge location for collection trucks, include provision of hard hats;
	Design collection routes to minimize, or possibly eliminate, crossing traffic that is going in the opposite direction;
	Restrict access to disposal sites such that only safety-trained personnel with protective gear are permitted to high-risk areas;
	Segregate people from operating trucks in storage facility
Chemical Exposure	Control and characterize incoming waste (see waste receipt, unloading, processing, and storage);
	Provide adequate personnel facilities, including washing areas and areas to change clothes before and after work;
	Prohibit eating, smoking, and drinking except in designated areas;
Pathogens and Vectors	Provide and require use of suitable personal protective clothing and equipment;
	Provide worker immunization and health monitoring (e.g., Hepatitis B and tetanus);
	Maintain good housekeeping in waste processing and storage areas;
	Clean and wash with disinfectant the cabins of heavy mobile equipment used at regular intervals;
	Grade the area properly to prevent ponding (to minimize insect breeding areas);
	Provide and require use of dust masks or respirators under dry and dusty conditions. Charcoal-filled respirators also reduce odor perception;
	Provide prompt medical attention for cuts and bruises. Cover open wounds to prevent contact with the incoming loads or feedstock;

Source: EIA Study Team

10.1.6 Evaluation

As a conclusion, it is evaluated that the proposed Project would not cause any significant impacts on OHS in the proposed Project site in consideration of mitigation measures taken by the proponent.

10.2 Community Health and Safety including Accidents and Infectious Disease

10.2.1 Prediction Item

The items to be predicted are as follows:

- The impacts on community health and safety caused by construction work of the proposed Project.
- The impacts on community health and safety caused by operation work of the proposed Project.
- The impacts on community health and safety caused by closing work of the proposed Project.

10.2.2 Prediction Area

The area, where the impacts are to be predicted, was set in the proposed Project site.

10.2.3 Prediction Period

The periods to be predicted are as follows:

- The prediction period in the construction stage was set throughout the construction stage of the proposed Project.
- The prediction period in the operation stage was set throughout the operation stage of the proposed Project.
- The prediction period in the closure stage was set throughout the closing stage of the proposed Project.

10.2.4 Prediction Method

The impact on community health and safety are predicted by the following methods:

- To examine the impact on community health and safety caused during the construction and closure stages by considering the construction and closure work plans for the proposed Project.
- To examine the impact on community health and safety caused during the operation stage by considering the operation work plan for the proposed Project.

10.2.5 Prediction Results

(1) Prediction results in the construction and closure stages

Minor negative impacts on community health and safety (CHS) including accidents are inevitable to some extent during the construction and closure works. To minimize the negative impacts, health and safety conditions of the neighborhood during construction should be managed by the contractor based on CHS training stipulated in international guidelines such as the EHS Guidelines by the IFC. Expected mitigation measures for community health and safety related to construction of the proposed Project facilities are shown in Table 10.2-1.

Table 10.2-1: Expected Mitigation Measures against Negative Impact on Community Health and Safety (Construction and Closure Stages)

Negative Factors	Mitigation Measures
Common	Establish the plan of site security measures to communities and its implementation
	Educate the Project personnel and area residents on risks, prevention, and available treatment
General Site Hazards	Restrict access to the site, through a combination of institutional and administrative controls, with a focus on high risk structures or areas depending on site-specific situations, including fencing, signage, and communication of risks to the local community
	Remove hazardous conditions in the construction sites that cannot be controlled effectively with site access restrictions, such as covering openings to small confined spaces, ensuring means of escape for larger openings such as trenches or excavations, or locked the storage of hazardous materials
	Prevention of snake bite
Disease Prevention	Provide surveillance for worker's health
	Prevent illness among workers in local communities by conducting immunization programs for workers in local communities to improve health and guard against infection
	Provide treatment through standard case management in on-site or community health care facilities as necessary.
	Prevention of larval and adult propagation through sanitary improvements and elimination of breeding habitats close to human settlements
	Elimination of unusable impounded water
	Promote the use of repellents, clothing, netting, and other barriers to prevent insect bites
Traffic Safety	Adoption of best transport safety practices across all aspects of the Project operations with the goal of preventing traffic accidents and minimizing injuries suffered by the Project personnel and the public. Measures should include: o Emphasizing safety aspects among drivers o Improving driving skills and requiring licensing of drivers o Adopting limits for trip duration and arranging driver rosters to avoid overtiredness o Avoiding dangerous routes and times of day to reduce the risk of accidents

Source: EIA Study Team

(2) Prediction results in the operation stage

Minor negative impacts on CHS including accidents are inevitable to some extent during operation work. To minimize the negative impacts, health and safety conditions of the neighborhood during operation should be managed by the Project proponent based on CHS training stipulated in international guidelines such as the EHS Guidelines by the IFC. Expected mitigation measures for community health and safety related to operation of the proposed Project facilities are shown in Table 10.2-2. Especially, healthcare services, as one of corporate social responsibility (CSR) activities, such as medical check services and disinfection around the proposed Project site to prevent vector-borne diseases will be provided in accordance with the comments from the Department Health of Thanlyin Township in the first stakeholder meeting and public comments the from the General Administration Department of Thanlyin Township. Figure 10.2-3 shows photos of the expected healthcare services.

Table 10.2-2: Expected Mitigation Measures against Negative Impact on Community Health and Safety (Operation Stage)

Negative Factors	Mitigation Measures
Common	Establish the plan of site security measures to communities and its implementation.
	Educate the Project personnel and area residents on risks, prevention, and available treatment.
Physical, Chemical, and Biological Hazards	Lockable site access gate and buildings.
	Security cameras at key access points linked to recording equipment and remote access Closed Circuit Television (CCTV), where required.
	Review of site security measures annually or whenever a security breach is reported.
	Use of a site visitor registration.
	Immediate repair of fencing/access points if damaged.

Negative Factors	Mitigation Measures
	Lighting of site during nighttime where necessary. As this may cause light nuisance to neighbors, the lighting installations should be selected to minimize ambient light pollution.
Disease Prevention	Provide health care services, as one of CSR activities, such as medical check services and disinfection around the proposed Project site to prevent vector-borne diseases.
	Provide surveillance and active screening and treatment of workers
	Prevent illness among workers in local communities by conducting immunization programs for workers in local communities to improve health and guard against infection
	Provide treatment through standard case management in on-site or community health care facilities as necessary.
	Promote collaboration with local authorities to enhance access of workers families and the community to public health services and promote immunization
	Prevention of larval and adult propagation through sanitary improvements and elimination of breeding habitats close to human settlements
	Elimination of unusable impounded water
	Promote the use of repellents, clothing, netting, and other barriers to prevent insect bites

Source: EIA Study Team

Source: DOWA Eco-System Co., Ltd.

Figure 10.2-1: Image of Expected Health Care Services
(Left: Medical Check, Right: Disinfection)

10.2.6 Evaluation

As a conclusion, it is evaluated that the proposed Project would not cause any significant impacts on CHS in the proposed Project site in consideration of mitigation measures taken by the proponent.

CHAPTER 11: EMERGENCY RISK ASSESSMENT

11.1 Initial Risk Assessment

There are various risks on solid waste management as well as other large-scale infrastructure. With respect to the environmental impact risk, social impact risk, and health impact risk, there are certain impacts that might affect people living around the Project site and the habitat and natural conditions due to the construction, operation, closure, termination, and after termination of the proposed Project. But the order of magnitude of impacts might be small rather than of emergency incidents and could be managed with various mitigation measures. These impacts are already assessed in the previous chapters.

In this connection, this EIA study focuses on emergency risks such as flooding, fire, earthquake, and geological hazard effect, which have low probability of occurrence but have big impacts.

As for the initial emergency risk assessment, taking into consideration of the Project description, the following three main emergency risks are chosen and shall be considered:

- Risk for flooding
- Risk for fire
- Risk for earthquake and geological hazard effect

Among the above three risks, risk for earthquake and geological hazard effect has already been assessed in the stage of site selection. The plant site is located in a stable region, far away from the fault belt (especially active earthquake and geological hazard effect ones). As for the earthquake resistant of solid waste management facilities, the landfill site is accordingly based on the United States Environmental Protection Agency (USEPA) standards. Incinerator and other facilities are basically based on the Japanese Building Code. In response to this, risk for flooding and risk for fire are assessed in the following sections.

11.2 Flood Risk

11.2.1 Prediction Item

The items to be predicted are as follows:

- Flood risk, triggered by heavy rains, cyclone, or high tide water, which might be increased by construction/operation works of the proposed Project.

11.2.2 Prediction Area

The area, where the impacts are to be predicted, was set in and around the proposed Project site.

11.2.3 Prediction Period

The periods to be predicted are as follows:

- The prediction period in the construction stage was set throughout the construction stage of the proposed Project.
- The prediction period in the operation stage was set throughout the operation stage of the proposed Project.
- The prediction period in the closure stage was set throughout the closure stage of the proposed Project.

11.2.4 Prediction Method

The flood risk was predicted by the following method:

- To analyze the potential flood risk triggered by heavy rains, cyclone, or high tide water in and around the proposed Project site and confirm appropriate mitigation measures as precondition to the proposed Project planning.

11.2.5 Prediction Results

The proposed Project site is to be located in a flat and broad land adjacent to the east bank of the Yangon River. The natural terrain elevation (mean sea level or MSL) is about 5.0 m. Therefore, the area close to the river mouth has potential flood risk due to the topographical condition. So, the proponent referred to the flood prevention standards and analyzed flood conditions in the neighboring area in order to determine the reasonable elevations for the proposed Project facilities. As a result, the Project site shall be embanked up to 7.0 m so as to satisfy the requirement for flood prevention by referring the highest recorded flood level of 6.5 m MSL which is the highest case among 1) Storm surge simulation in the Yangon River (Cyclone Nargis case): 6.5 m, 2) Hearing survey of flood disaster: 5.5 m, and 3) Flood analysis of a 100-year return rainfall: 4.9 m.

Besides, Thilawa SEZ Zone A site shall equip the retention canals and ponds which correspond to a ten-year probability rainfall and it will be maintained until the closure of the Project facilities.

11.2.6 Evaluation

As a conclusion, flood risk is predicted to be minimal because the proponent shall control and minimize flood risk in the proposed Project site.

11.3 Risk for Fire

11.3.1 Prediction Item

The item to be predicted is as follows:

- Risk for potential fire accidents by the construction, operation, closing works of the proposed Project.

11.3.2 Prediction Area

The area, where the impacts are to be predicted, was set in and around the proposed Project site.

11.3.3 Prediction Period

The periods to be predicted are as follows:

- The prediction period in the construction stage was set throughout the construction stage of the proposed Project.
- The prediction period in the operation stage was set throughout the operation stage of the proposed Project.
- The prediction period in the closure stage was set throughout the closure stage of the proposed Project.

11.3.4 Prediction Method

The risk for potential fire accidents are predicted by the following methods:

- To examine risk for potential fire accidents during the construction and closure stages by considering the construction and closure work plans of the proposed Project.
- To examine risk for potential fire accidents in the operation stage by considering the operation plan of the proposed Project.

11.3.5 Prediction Results

(1) Prediction results in the construction and closure stages

Risk for fire accidents in the construction and closure stages is considered to be very little because construction and closure works for the proposed Project will not contain large-scale works using firearms. However, the risks are inevitable because some activities taken by the workers such as smoking and cooking could lead to fire accidents in the proposed Project site. To eliminate the risks for fire accidents, workers' behaviors shall be managed by the contractor through provision of safety education and training for workers by referring to Section 10.1 based on the OHS training stipulated in international guidelines such as the EHS Guidelines by the IFC.

(2) Prediction results in the operation stage

In the operation stage, there will be a risk for potential fire accidents in the facilities such as incinerator, landfill, stabilization and fuel conversion facility, and storage house. Therefore, adequate mitigation measures for fire accidents were examined as precondition to the proposed Project as shown below:

- Regular training and exercises for site staff regarding firefighting and other emergency responses;

- Manufacturing workshops, work places, auxiliary buildings, subsidiary buildings, hazardous areas, and fire compartment, fire prevention spaces, safe evacuation and fire passages of underground buildings of the proposed Project are designed in compliance with relevant rules and regulations;

- Buildings and structures are rationally arranged, with safe spacing retained as required;

- Fire prevention work of the incinerator plant adheres to the rule of "putting prevention first and combining prevention with elimination". Firefighting systems (mainly by water, aided by necessary foam fire extinguishers and portable fire extinguishers) are installed within the plant area;

- Suitable fire fighting measures are adopted based on the nature and features of fire that could possibly occur in different workshops and areas;

- Fire protection facilities such as fire hydrants will be installed at each building; and

- Closed Circuit Television (CCTV) security system will be installed. The CCTV system provides high performance monitoring and can be securely accessed locally on site and remotely anywhere in the world.

11.3.6 Evaluation

As a conclusion, the risk for fire accidents was predicted to be low because the proponent shall take necessary measures to control and minimize the risk for fire accidents in and around the proposed Project site.

CHAPTER 12: ENVIRONMENTAL MANAGEMENT PLAN

12.1 Outline of Environmental Management Plan

The environmental management plan consists of two components: 1) mitigation and consideration measures taken in the course of project implementation examined based on project description and results of the environmental impact assessment (EIA), social impact assessment (SIA), health impact assessment (HIA), and emergency risk assessment (ERA); and 2) monitoring plan to confirm if mitigation and consideration measures as well as the environmental levels were properly taken in the construction, operation, and closing stages through environmental measurement.

12.2 Mitigation and Consideration Measures

Table 12.2-1, Table 12.2-2, and Table 12.2-3 show the mitigation and consideration measures in the construction stage, operation stage, and closing stage, respectively. Mitigation measures in the construction and closing works will be implemented by the contractors except for works related to after care of landfill. Mitigation measures in the operation stage will be implemented by the Project proponent. All mitigation measures in all stages will be the responsibility of the Project proponent.

The implementation of the environmental rehabilitation activities including the capping of landfill will be secured by the Golden DOWA Eco-System Myanmar Co., Ltd. which is the subsidiary of the Project proponent under the Project owner; Dowa Eco-system Co., Ltd. The budget of 112,500 USD/ year on average is estimated for the capping works for as soil, sheeting and vegetative cap for the landfill period.

Table 12.2-1: Mitigation Measures in the Construction Stage

Category	Item	Mitigation and Consideration Measures in the Construction Stage	Implemented by
EIA	Air Pollution	- Sprinkle water around preservation area will be implemented as necessary - Prohibition of idling will be implemented. - Intensive operation of the construction machinery will be avoided.	Contractor
	Water Pollution	- Settling ponds or simple turbid water treatment will be installed as necessary. - Simple wastewater treatment facility from cement producing activity will be set up in the construction site as necessary. - Septic tanks will be set up in the construction site.	Contractor
	Solid Waste	- Construction waste will be utilized to embankment work as much as possible. - Scrap materials from the removal of the structure will be utilized as recyclable materials as much as possible. - Non-utilized waste will be disposed to the existing dumping sites.	Contractor
	Noise and Vibration	- Sound-proofing sheet near the residential area will be installed for prevention of noise by construction work in the evening and nighttime as necessary. - Advanced notice for construction work time near the residential area will be disseminated in cases that the contractor implements the construction work in the evening or nighttime. - Intensive operation of construction machinery will be avoided. - Speed limit will be observed by the driver.	Contractor
SIA	Local Economy such as Employment and Livelihood	- Job opportunity for local residents concerning construction works shall be provided within the limitation of the contractors' capability.	Contractor
HIA	Occupational Health and Safety including Accidents and Infectious Diseases	- Occupational health and safety including accidents and infectious diseases during construction will be managed by the contractor based on OHS training stipulated in the international guidelines such as Environmental, Health and Safety (EHS) Guidelines by the International Finance Corporation (IFC) as	Contractor

Category	Item	Mitigation and Consideration Measures in the Construction Stage	Implemented by
		follows: [Common] ✓ Provision of adequate health care facilities and first aid within construction sites; ✓ Training of all construction workers in basic sanitation and health care issues, general health and safety matters, and on the specific hazards of their work; [Safety measures including prevention of accident] ✓ Personal protection equipment for workers such as safety boots, helmets, gloves, protective clothing, spectacles, and ear protection; ✓ Adequate protection to the general public including safety barriers and marking of hazardous areas; ✓ Safe access across the construction site; ✓ Adequate preventive measures from negative factors such as over-exertion, slips and falls, work in heights, struck by objects, moving machinery, dust, confined spaces and excavations, and other site hazards; [Health measures including prevention of infectious diseases] ✓ Provision of toilets and septic tanks in the construction site. ✓ Provision of clean drinking water facilities for all workers; ✓ Adequate drainage throughout the camp to ensure that disease vectors such as stagnant water bodies and puddles do not form; ✓ Septic tank and garbage bins will be set up in the construction site, which will be regularly cleared by the contractors to prevent the outbreak of diseases; ✓ Where feasible the contractor will arrange the temporary integration of waste collection from work sites into existing waste collection systems and disposal facilities of nearby communities; and ✓ Lectures on infectious diseases such as AIDS/HIV to the construction workers.	
	Community Health and Safety including Accidents and Infectious Diseases	- Community health and safety will be managed by the contractor based on the international guidelines such as the EHS Guidelines by the IFC as follows: [Common] ✓ Establish a plan of site security measures to communities and its implementation. ✓ Educate project personnel and area residents on risks, prevention, and available treatment. [Safety measures including prevention of accident] ✓ Protection of community from physical, chemical, or other hazards associated with the sites. ✓ Avoid contact with hazardous materials, contaminated soils, and other environmental media, buildings that are vacant or under construction, or excavations and structures which may pose falling and entrapment hazards. ✓ The incidence of road accidents involving project vehicles during construction should be minimized through a combination of educational and awareness-raising activities. ✓ Emphasize safety aspects among drivers. ✓ Improve driving skills and require licensing of drivers. ✓ Adopt limits for trip duration and arrange driver rosters to avoid overtiredness. ✓ Avoid dangerous routes and times of day to reduce the risk of accidents. ✓ Employ safe traffic control measures including road signs and flag persons to warn incoming vehicles of dangerous conditions. [Health measures including prevention of infectious diseases] ✓ Secure access to water sources in the communities (to conduct water quality monitoring at the well in the community). ✓ Provide surveillance for worker's health. ✓ Prevent outbreak of illness among workers in the local communities. ✓ Lectures on infectious diseases such as AIDS/HIV to the construction workers in the communities. ✓ Prevention of larval and adult propagation through sanitary improvements and elimination of breeding habitats close to human settlements.	Contractor

Category	Item	Mitigation and Consideration Measures in the Construction Stage	Implemented by
		✓ Elimination of unusable impounded water. ✓ Promote the use of repellents, clothing, netting, and other barriers to prevent insect bites. ✓ Provide treatment through standard case management in on-site or community health care facilities as necessary.	
Emergency Risk	Flood Risk	- All construction activities will be stopped and area of evacuation for workers will be secured when weather forecast issued alerts of flooding. - Proper elevation level will be set to avoid flood risks (EL +7.0 m).	Contractor
	Risk for Fire	- Regular training and exercises for site staff regarding firefighting and other emergency responses.	Contractor

Source: EIA Study Team

Table 12.2-2: Mitigation Measures in the Operation Stage

Category	Item	Mitigation and Consideration Measures in the Operation Stage	Implemented by
EIA	Air Pollution	- Chemical Baghouse Filter (dry type using slaked lime) will be installed to reduce the amount of air pollution emission complying with the target level. - Continuous exhaust gas monitoring system shall be equipped in the incinerator.	Project Proponent
	Water Pollution	- Liner system for the landfill which satisfies the guidelines of the United States Environmental Protection Agency (USEPA) shall be installed and it will intercept disposed waste and leachate from the environment. - Installation of wastewater treatment plant complying with the target level. - Periodical monitoring of leachate discharged from the landfill and wells around landfill. - Regular maintenance such as removal of sludge and checking.	Project Proponent
	Soil Contamination	- Prevent and prohibit the infiltration of liquid waste into the ground.	Project Proponent
	Noise and Vibration	- Installation of high wall in storage yard, sorting and stabilization facilities to reduce noise in the surrounding area.	Project Proponent
	Offensive Odor	- Wastes will be kept in such containers to prevent exposure to outside air. - Active area will be minimized in the landfill. - Non-active area will be covered with sheets in the landfill. - Landfill will be covered with soil after operation of wastes disposal. - Gas gathering pipes and flare station will be installed. - If some complaints will be received, the source of offensive odor will be investigated and mitigation measures will be considered and implemented.	Project Proponent
	Flora, Fauna and Biodiversity	- Planting trees, vegetation, sodding to public spaces such as road, retention pond, and other open space in accordance with the internal regulations of the Thilawa SEZ Zone A.	Project Proponent
	Climate Change	- Methane gas generated from the landfill shall be captured and flamed. - Appropriate design for incinerator which realizes efficient combustion shall be applied to minimize greenhouse gas emissions.	Project Proponent
SIA	Local Economy such as Livelihood	- Job opportunity for local residents concerning operation works shall be provided as much as possible.	Project Proponent
	Water Use	- Installation of controlled landfill with base liner system in order not to cause groundwater contamination in the surrounding water source based on the USEPA regulations. - Regular monitoring of water quality at the well in the communities will be implemented.	Project Proponent
	Landscape	- Reduce the height of landfill site so as not to create an eyesore on the landscape from the road side. - Installation of greening area including trees around the boundary as cover.	Project Proponent
Health and Safety	Occupational Health and Safety (OHS)	- Occupational health and safety including accidents and infectious diseases during operation will be managed by the Project proponent based on OHS training stipulated in the international guidelines such as the EHS Guidelines by the IFC as follows: [Common] ✓ Provide and require use of suitable personal protective clothing and equipment; ✓ Regular training of workers;	Project Proponent

Category	Item	Mitigation and Consideration Measures in the Operation Stage	Implemented by
		[Accidents and injuries] ✓ In landfills, conduct compaction of wastes in thin layers using heavy equipment and place regular cover material over each compacted layer of waste, so that any underground fires within a waste cell are not able to spread throughout the landfill and lead to significant cave-ins; ✓ Design collection routes to minimize, or possibly eliminate, crossing traffic that is going in the opposite direction; ✓ Restrict access to disposal sites such that only safety-trained personnel with protective gear are permitted to high-risk areas; ✓ Separate the people from operating trucks in storage facility [Chemical exposure] ✓ Control and characterize incoming waste (see waste receipt, unloading, processing and storage); ✓ Provide adequate personnel facilities including washing areas and areas to change clothes before and after work; ✓ Prohibit eating, smoking, and drinking except in designated areas; [Pathogens and vectors] ✓ Provide worker immunization and health monitoring (e.g., for Hepatitis B and tetanus); ✓ Maintain good housekeeping in waste processing and storage areas; ✓ Clean and wash with disinfectant the cabins of heavy mobile equipment used at regular intervals; ✓ Grade the area properly to prevent ponding (to minimize insect breeding areas); ✓ Provide and require use of dust masks or respirators under dry and dusty conditions. Charcoal-filled respirators also reduce odor perception; and ✓ Provide prompt medical attention for cuts and bruises. Cover open wounds to prevent contact with the incoming loads or feedstock.	
	Community Health and Safety including accidents	- Community health and safety will be managed by the Project proponent based on the international guidelines such as the EHS Guidelines by the IFC as follows: [Common] ✓ Establish a plan of site security measures to communities and its implementation. ✓ Educate project personnel and area residents on risks, prevention, and available treatment. [Physical, Chemical, and Biological Hazards] ✓ Lockable site access gate and buildings. ✓ Security cameras at key access points linked to recording equipment and remote access Closed Circuit Television (CCTV), where required. ✓ Review of site security measures annually or whenever a security breach is reported. ✓ Use of a site visitor registration. ✓ Immediate repair of fencing/access points if damaged. ✓ Lighting of site during nighttime where necessary. As this may cause light nuisance to neighbors, the lighting installations should be selected to minimize ambient light pollution. [Disease Prevention] ✓ Provide health care services, as one of CSR activities, such as medical check services and disinfection around the proposed Project site to prevent vector-borne diseases. ✓ Provide surveillance and active screening and treatment of workers ✓ Prevent illness among workers in local communities by conducting immunization programs for workers in local communities to improve health and guard against infection ✓ Provide treatment through standard case management in on-site or community health care facilities as necessary. ✓ Promote collaboration with local authorities to enhance access of workers families and the community to public health services and promote immunization ✓ Prevention of larval and adult propagation through sanitary improvements and elimination of breeding habitats close to human settlements	Project Proponent

Category	Item	Mitigation and Consideration Measures in the Operation Stage	Implemented by
		✓ Elimination of unusable impounded water ✓ Promote the use of repellents, clothing, netting, and other barriers to prevent insect bites	
Emergency Risk	Flood Risk	- Regular training and exercises for site staff regarding emergency response for flooding. - Proper elevation level will be set to avoid flood risks (EL +7.0 m).	Project Proponent
	Risk for Fire	- Regular training and exercises for site staff regarding firefighting and other emergency response. - Fire protection facilities such as fire hydrants will be installed. Closed-Circuit Television (CCTV) security system will be installed.	Project Proponent

Source: EIA Study Team

Table 12.2-3: Mitigation and Consideration Measures in the Closure Stage

Category	Item	Mitigation and Consideration Measures in the Closing Stage	Implemented by
EIA	Air Pollution	- Same as construction stage	Contractor
	Water Pollution	[Demolition work] - Settling ponds or simple turbid water treatment will be installed as necessary. - Simple wastewater treatment facility from cement producing activity will be set up in the construction site as necessary. - Septic tanks will be set up in the construction site.	Contractor
		[After care] - Liner system for the landfill which satisfies USEPA's guidelines shall be installed and it will intercept disposed waste and leachate from the environment. - Operation of wastewater treatment plant complying with the target level until the water quality of leachate will be confirmed not polluted (at least ten years after closing operation). - Monitoring of leachate discharged from the landfill and wells around landfill (at least ten years after closing operation). - Regular maintenance such as removal of sludge and checking	Project Proponent
	Solid Waste	- Same as construction stage	Contractor
	Noise and Vibration	- Same as construction stage	Contractor
	Offensive Odor	- Same as operation stage	Project Proponent
SIA	Local Economy such as Livelihood	- Same as construction stage	Contractor
	Water Use	- Installation of controlled landfill with base liner system in order not to cause groundwater contamination in the surrounding water source based on USEPA regulations. - Regular monitoring of water quality at the well in the communities will be implemented until the water quality of leachate will be confirmed not polluted (at least ten years after closing operation).	Project Proponent
	Landscape	- Reduce the height of landfill site so as not to causing eyesore on the landscape from the road side. - Installation of capping system with multilayers based on USEPA regulations. - Development of various types of eco-friendly facilities such as park and solar power stations.	Project Proponent
HIA	Occupational Health and Safety including Accidents and Infectious Diseases	- Same as construction stage	Project Proponent
	Community Health and Safety including Accidents and Infectious Diseases	- Same as construction stage.	Project Proponent
ERA	Flood Risk	- Same as construction stage.	Project Proponent
	Risk for Fire	- Same as construction stage.	Project Proponent

Source: EIA Study Team

12.3 Environmental Monitoring Plan

The environmental monitoring plan including monitoring items and locations in the construction, operation, and closing stages are shown in Table 12.3-1, Table 12.3-2, and Table 12.3-3, respectively. Monitoring for the construction and closing works will be implemented by the contractors except for works related to after care of landfill. Monitoring for operation will be implemented by the Project proponent. The Project proponent will be responsible for the implementation of monitoring and summarization of its results and submission of the monitoring report to the Ministry of Environmental Conservation and Forestry (MOECAF) periodically through the Thilawa SEZ Management Committee (TSMC). The costs for monitoring are estimated as shown in Table 12.3-4.

Table 12.3-1: Monitoring Plan (Construction Stage)

Survey Item	Item	Method	Location	Frequency	Implemented by
Common	Monitoring of mitigation measures	Visual and record check	-	Once/month	Project proponent/ Contractor
Air Quality	Dust situation	Visual check	Project site (1 point)	Monthly	Contractor
Water Quality	Status of maintenance of septic tank	Visual check	Project site (1 point)	Monthly	Contractor
Solid Waste	(1) Amount of solid waste (hazardous and non-hazardous) (2) Status of recycling	Check of record	Project site	Monthly	Contractor
Noise and Vibration	Noise and vibration situation	On-site measurement	Residential area (1 point)	Once (24 hr on weekday at peak period)	Project proponent/ Contractor
Water Use	pH, EC, DO, ORP	On-site measurement	Well in the residential area near the Project site (1 point)	Monthly	Project proponent/ Contractor
Occupational Health and Safety including Accidents and Infectious Diseases	Record of accidents and infectious diseases	Check of record	Project site	Monthly	Contractor
Community Health and Safety including Accidents and Infectious Diseases	Record of accidents and infectious diseases related to the community	Check of record	Project site	Monthly	Project proponent/ Contractor
Flood Risk	Record of flood and its response	Check of record	Project site	Occasionally	Contractor
Risk for Fire	Record of fire and its response	Check of record	Project site	Occasionally	Contractor

Source: EIA Study Team

Table 12.3-2: Monitoring Plan (Operation Stage)

Survey Item	Item	Method	Location	Frequency	Responsible Organizations
Common	Monitoring of mitigation measures	Visual and record check	-	Once a month	Project proponent/ Contractor
Air Quality	[Emission gas from the incinerator] (1) NO_2, SO_2, HCL (2) Dust (3) Heavy metals, dioxin* * Monitoring of heavy metals in dust and dioxin will be started when the laboratory in Myanmar is ready to analyze the parameters	Measurement	Residential area (1 point)	(1) Bimonthly (2) Biannually (3) Annually	Project proponent
	[Ambient Air] NO_2, SO_2, CO, PM_{10}	Measurement	Residential area (1 point)	One week in dry and rainy seasons (First three years after	Project proponent

Survey Item	Item	Method	Location	Frequency	Responsible Organizations
				operation of the incinerator)	
Water Quality	[Treated wastewater] (1) pH, EC, DO, ORP (2) All parameters stipulated in the target level *Monitoring of heavy metals in dust and dioxin will be started when the laboratory in Myanmar is ready to analyze the parameters	On-site measurement and chemical analysis	Discharge point (1 point)	(1) Everyday (2) Biannually	Project proponent
	[Groundwater] (1) Pit for leak water checking pH, EC, water level (2) Well to monitor leaches collection pH, EC, color, odor (3) Well to monitor groundwater pH, EC, water level, color, odor	On-site measurement	Discharge point (1 point)	(1) Everyday (2) Monthly (3) Quarterly	Project proponent
Solid Waste	(1) Amount of solid waste (hazardous and non-hazardous) (2) Recording of management of final disposal site (3) Recoding of hazardous and chemical substance management	Check of record	Project site	Monthly	Project proponent
Noise and Vibration	Noise and vibration situation	On-site measurement	Residential area (1 point)	Once a year (24 hrs on weekday for the first three years after starting operation)	Project proponent
Offensive Odor	(1) Odor monitoring (2) Wind condition	On-site measurement	Around the Project site	Everyday	Project proponent
Climate Change	Energy and fuel consumption	Check of record	Project site	Yearly	Project proponent
Water Use	pH, EC, DO, ORP	On-site measurement	Well in the residential area near the Project site (1 point)	Monthly	Project proponent
Occupational Health and Safety	Record of accidents and infectious diseases	Check of record	Project site	Yearly	Project proponent
Community Health and Safety including Accidents	Record of accidents and infectious diseases related to the community	Check of record	Project site	Yearly	Project proponent
Flood Risk	Record of flood and its response	Check of record	Project site	Occasionally	Project proponent
Risk for Fire	Record of fire and its response	Check of record	Project site	Occasionally	Project proponent

Source: EIA Study Team

Table 12.3-3: Monitoring Plan (Closure Stage)

Survey Item	Item	Method	Location	Frequency	Responsible Organizations
Common	Monitoring of mitigation measures	Visual and record check	-	Once/month	Project proponent/ Contractor
Air Quality	Dust situation	Visual check	Project site (1 point)	Monthly	Contractor
Water Quality	[Treated wastewater] (1) pH, EC, DO, ORP (2)All parameters stipulated in the target level *Monitoring of heavy metals in dust and dioxin will start when the laboratory in Myanmar is ready to analyze the parameters	On-site measurement	Discharge point (1 point)	(1)Everyday (2) Biannually	Contractor
	[Groundwater] (1) Pit for leak water checking pH, EC, water level (2) Well to monitor leachate collection pH, EC, color, odor	On-site measurement	Discharge point (1 point)	(1) Everyday (2) Monthly (3) Quarterly	Project proponent

Survey Item	Item	Method	Location	Frequency	Responsible Organizations
	(3) Well to monitor groundwater pH, EC, water level, color, odor				
Noise and Vibration	Noise and vibration situation	On-site measurement	Residential area (1 point)	Once (peak period)	Contractor
Offensive Odor	(1) Odor monitoring (2) Wind condition	On-site measurement	Around Project site	Everyday	Project proponent
Water Use	pH, EC, DO, ORP	On-site measurement	Well in the residential area near the Project site (1 point)	Monthly	Project proponent
Land Use	Status of land use after capping	Visual check	Entire Project site	Once at the time of Closing	Project proponent/ Contractor
Occupational Health and Safety	Record of accidents and infectious diseases	Check of record	Project site	Monthly	Project proponent/ Contractor
Community Health and Safety including Accidents	Record of accidents and infectious diseases related to the community	Check of record	Project site	Monthly	Project proponent/ Contractor
Flood Risk	Record of flood and its response	Check of record	Project site	Occasionally	Contractor
Risk for Fire	Record of fire and its response	Check of record	Project site	Occasionally	Contractor

Source: EIA Study Team

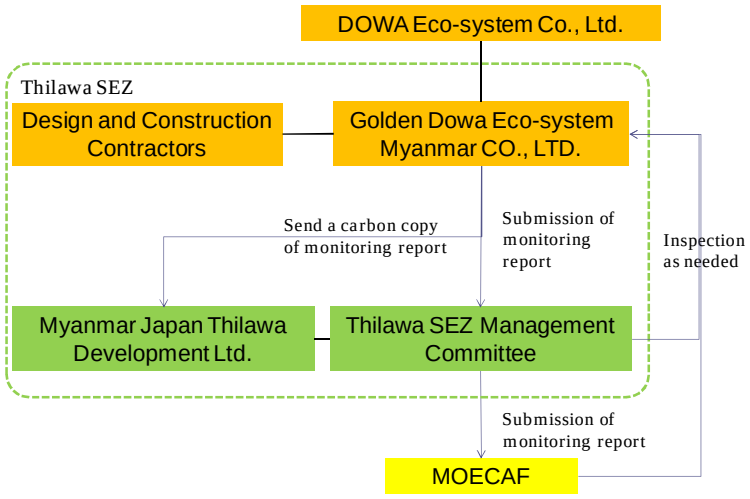
Table 12.3-4: Budget Plan for the Environmental Monitoring

Phase	Monitoring Items	Burden of Expense	Expected Cost (Tentative)	Remarks
Construction Stage	Monitoring of mitigation measures, Air Quality, Water Quality, Solid Waste, Noise and Vibration, Water Use, Occupational Health and Safety including Accidents and Infectious Diseases, Community Health and Safety including Accidents and Infectious Diseases, Flood Risk, Risk for Fire	Contractor	USD 10,000-/ During Construction	Only field measurement is included.
Operation Stage	Monitoring of mitigation measures, Air Quality, Water Quality, Solid Waste, Noise and Vibration, Offensive Odor , Climate Change, Water Use, Occupational Health and Safety including Accidents and Infectious Diseases, Community Health and Safety including Accidents and Infectious Diseases, Flood Risk, Risk for Fire	GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD.	USD 30,000-/year	Only field measurement is included.
Closure Stage	Air Quality, Water Quality, Noise and Vibration, Offensive Odor , Water Use, Land Use, Occupational Health and Safety including Accidents and Infectious Diseases, Community Health and Safety including Accidents and Infectious Diseases, Flood Risk, Risk for Fire	GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD.	USD 15,000/year	Only field measurement is included.

Source: EIA Study Team

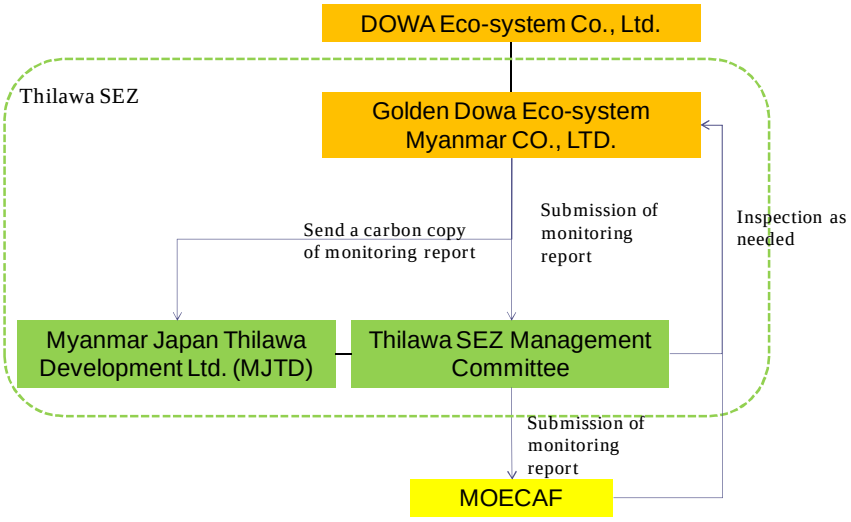
12.4 Institutional Arrangement

The organizational structure in the construction stage, operation stage and closure stage of the Project is proposed as shown in Figure 12.4-1, Figure 12.4-2 and Figure 12.4-3, respectively. A detailed description of institutional arrangement for environmental and social considerations is provided in Section 2.3.



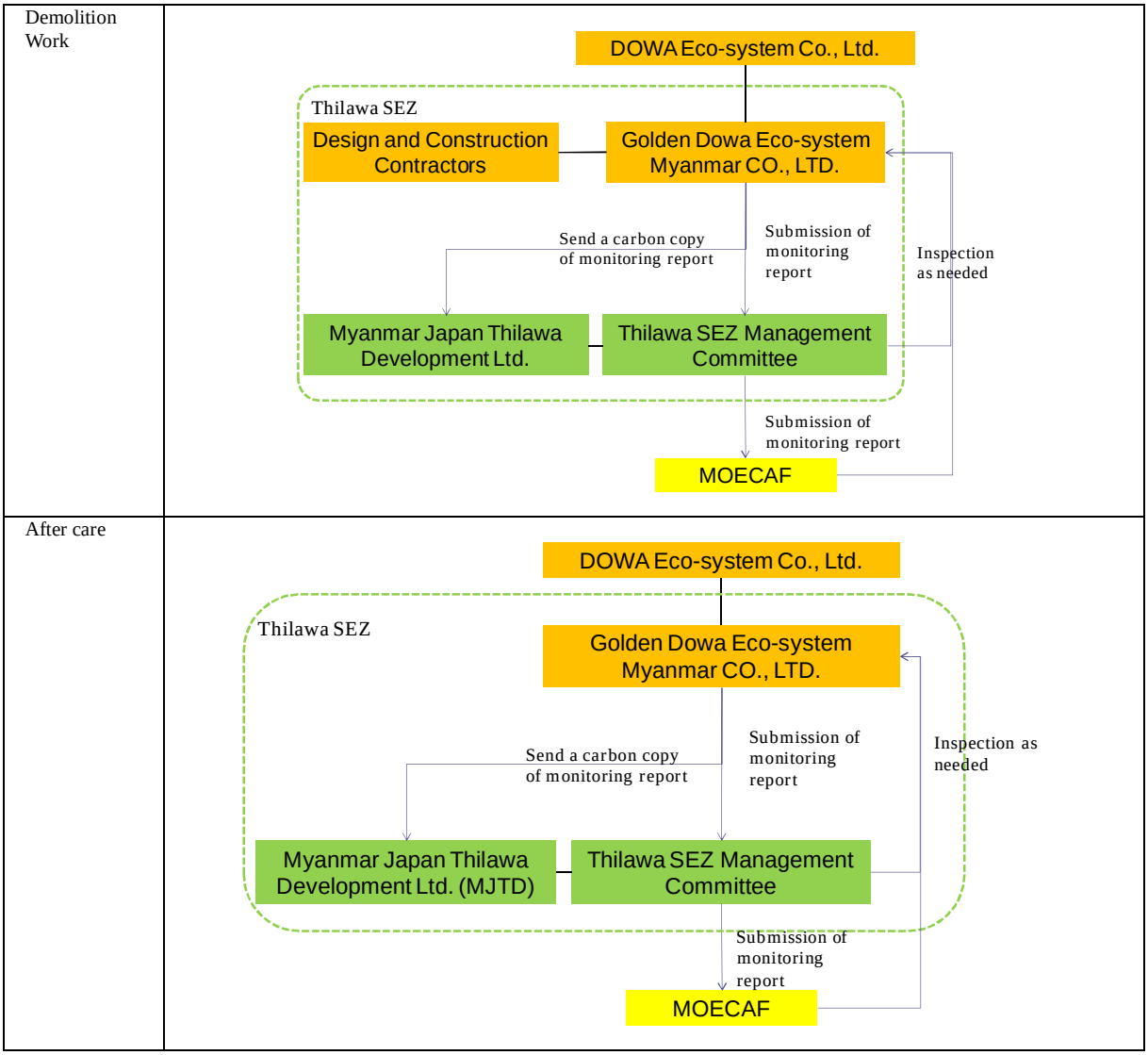
Source: EIA Study Team

Figure 12.4-1: Proposed Organizational Structure for Environmental Management of Industrial Waste Treatment Facilities in the Pre-construction and Construction Stages



Source: EIA Study Team

Figure 12.4-2: Proposed Organizational Structure for Environmental Management of Industrial Waste Treatment Facilities in the Operation Stage



Source: EIA Study Team

Figure 12.4-3: Proposed Organizational Structure for Environmental Management of Industrial Waste Treatment Facilities in the Closure Stage

CHAPTER 13: PUBLIC CONSULTATIONS

13.1 Outline of Public Consultations

As the actions of public disclosure, two stakeholder meetings, three community consultation meetings, and two public disclosures were organized/ implemented from August 2014 to June 2015. The outline of the public consultations is shown in Table 13.1-1.

Table 13.1-1: Outline of Public Consultation Meetings

Public Consultation Meeting	Outline	Date/ Period
Stakeholder Meeting at Scoping Stage	- Introduction and presentation about the project description on the construction of solid waste management facilities in the Thilawa SEZ Zone A - Current status of EIA study including scoping results	29 August 2014
Stakeholder Meeting regarding draft EIA Report	- Introduction and presentation about the project description on the construction of solid waste management facilities in the Thilawa SEZ Zone A - Presentation about the results of the environmental impact assessment (EIA) study - Explanation of the environmental management plan (EMP)	1 October 2014
1st Public Disclosure	- Gathering comments from public by displaying notice board in General Administration Office of Thanlyin Township, General Administration Office of Kyauktan Township, Thilawa Management Committee Office near Thilawa SEZ	1 to 10 October 2014
1st Community Consultation Meeting	- Organizing consultation with villagers in the community near the Project site to introduce the Project outline and mitigation measures in construction stage for the communities	25 December 2015
2nd Community Consultation Meeting	- Organizing consultation with villagers in the community near the Project site to explain actual activities on mitigation measures in construction stage and report results of environmental monitoring during January to March 2015	25 April 2015
3rd Community Consultation Meeting	- Organizing consultation with villagers in the community near the Project site to explain results of EIA study and gather comments from villagers.	30 May 2015
2nd Public Disclosure	- Gathering comments from public by displaying notice board in the Project site office, MJTD office, General Administration Office of Thanlyin Township, General Administration Office of Kyauktan Township, Village Tracts in Thanlyin and Kyauktan Townships, and Thilawa Management Committee Office near Thilawa SEZ	1 to 12 June 2015

Source: EIA Study Team

13.2 Summary of the Stakeholder Meeting at Scoping Stage

The stakeholder meeting at scoping stage was organized on 29 August 2014 at the Thilawa SEZ Management Committee Office in Thanlyin Township. The representatives from concerned quarters and villages, related personnel of Thanlyin Township and Kyauktan Township, project proponents, and the EIA Survey Team attended the meeting. The number of people present was 46 in total. The summary of participants who attended the meeting is as shown in Table 13.2-1.

Table 13.2-1: Summary of Participants of the First Stakeholder Meeting

No.	Organization	Number of Attendees
1.	Thilawa SEZ Management Committee	4
2.	Environmental Conservation Department of MOECAF	2
3.	General Administration Department of Related Townships	3

No.	Organization	Number of Attendees
4.	Ward Administration Office and Village Administration Office	14
5.	Development Committee of Related Townships	1
6.	Department of Human Settlement and Housing Development of Related Townships	1
7.	Department of Rural Development of Related Townships	2
8.	Department of Health of Related Townships	2
9.	Myanmar and Japan Thilawa Development Ltd	9
10.	Project Proponents and the EIA Study Team	8
	Total	46

Source: EIA Study Team

After explaining the project description and current status of the EIA study, including the scoping results, some issues were discussed. The following items were major responses and questions/answers. Appendix 3 shows the record of the first stakeholder meeting, and Figure 13.2-1 shows photos of the first stakeholder meeting.

- Detailed project description (e.g. size of project site, position of the site, and period of starting the operation)
- The land use for the landfill site after the closing

Source: EIA Study Team

Figure 13.2-1: Stakeholder Meeting at Scoping Stage

13.3 Summary of the Stakeholder Meeting regarding Draft EIA Report

The stakeholder meeting regarding draft EIA Report was organized on 1 October 2014 at the Thilawa SEZ Management Committee Office in Thanlyin Township. The number of people present was 22 in total. The summary of participants in the meeting is as shown in Table 13.3-1.

Table 13.3-1: Summary of Participants of the Second Stakeholder Meeting

No.	Organization	Number of Attendance
1.	Thilawa SEZ Management Committee	3
2.	General Administration Department of Related Townships	2
3.	Development Committee of Related Townships	1
4.	Department of Human Settlement and Housing Development of Related Townships	3
5.	Department of Rural Development of Related Townships	1
6.	Department of Health of Related Townships	3
7.	Myanmar and Japan Thilawa Development Ltd	1
8.	Project Proponent and the EIA Study Team	8
	Total	22

Source: EIA Study Team

After explaining the results of the EIA study and EMP, some issues were discussed. The following items are major responses and questions/answers. Appendix 4 shows the record of the first stakeholder meeting, and Figure 13.3-1 shows photos of the second stakeholder meeting.

- Maintenance method of landfill (e.g. flare combustion for the production of gas at the landfill site)
- The results of the water quality survey
- Detailed information on the landfill site (e.g. area and volume of a cell and drainage system)
- Region to perform the collection of solid waste

Source: EIA Study Team

Figure 13.3-1: Stakeholder Meeting regarding draft EIA Report

13.4 Comments from the Public of the First Public Disclosure

Ten days after organizing the second stakeholder meeting, the Project proponent had received comments from the public about the draft EIA report. The results consist of four comments received from Thanlyin Township (three comments), and Kyauktan Township (one comment). Table 13.4-1 shows the Project proponent's responses to the comments. All of the comments from the public are attached in Appendix 5.

Table 13.4-1: Public Comments and the Response the First Public Disclosure

No.	Comments	Category	Corresponds
1	About the impact of vibration to fauna such as reptiles Some dangerous animals for example snakes might come out due to vibration caused by the construction works. It might be harmful to construction workers and local villagers nearby. I would like to know the mitigation measures for occupational and community health and safety.	Occupational/ Community Health and Safety	The Project proponent will provide personal protection equipment for the construction workers to prevent snake bites and other animal-related risks. Besides, the Project proponent will also provide chemical detergents to prevent snakes from entering the houses around the Project site and the construction camp.
2	About the reaction of materials or chemicals in the landfill site In the presentation, you mentioned hazardous and nonhazardous wastes will be classified prior to its disposal in the landfill cell. I am just wondering if some waste materials cause chemical reactions and if it might be harmful to workers and	Occupational/ Community Health and Safety	The Project proponent will install stabilization facilities to prevent the elution of hazardous waste as described in Section 3.4.6. The stabilization facility will mix the waste with agents such as cement so as to prevent the elution of hazardous substances from the waste and will control moisture content of those with high water content. This will be set up in accordance with the standards of the United States Environmental Protection Agency (USEPA). Stabilized waste will be disposed to hazardous or non-hazardous disposal landfill cells

No.	Comments	Category	Corresponds
	local villagers nearby. My question is how will you manage or prevent such chemical reaction problems?		depending on the waste characteristics after confirmation that the waste is without leaking hazardous substances and a slump test to check its stability. In addition, the following measures on occupational health and safety will be implemented to prevent the elution of hazardous substances: · Control and characterize incoming waste (see waste receipt, unloading, processing, and storage); and · Provide adequate personnel facilities, including washing areas and areas to change clothes before and after work.
3	About leakage of wastewater during treatment/dehydration process In the presentation, you mentioned industrial wastewater will be treated in a wastewater treatment plant. I would like to know if some wastewater might leak and contaminate the underground water. My question is how will you manage or monitor this in order to prevent such leakage problems during the treatment/dehydration process.	Project Description and Environmental Monitoring Plan	In order to prevent groundwater and soil contamination, baseliner sheets and leachate collection systems will be installed to prevent leachate from infiltrating into the soil and groundwater. Baseliner systems consist of various layers; protection layer, geomembrane layers, leak detection layer, impermeable layer, geo grid, and sand layer to isolate waste and prevent waste and leachate from leaking as described in Section 3.4.9. To collect leachate, leachate collection pipes will be installed in the protection layer and collected wastewater will be pumped up and to the connected wastewater treatment plant. Groundwater collection systems will be also installed in the sand layer under the impermeable layer to collect rising groundwater that will be pumped up and transferred to the retention ponds. The water quality monitoring at the following: 1) pit for leak water checking; 2) well to monitor leachate collection; 3) well to monitor groundwater; and 4) well(s) in the residential area, will be implemented periodically. The maintenance and monitoring will be conducted during the operation and for at least ten years after the installation of the final covering, and then the Project proponent will close the landfill site if no environmental impact is observed for two years.
4	I agree with the proposed project.	-	-

Source: EIA Study Team

13.5 Summary of the First Community Consultation Meeting

The first community consultation meeting was organized on 25 December 2014 at the 100 Household head house in A-Lum-Sut Village, Thanlyin Township. The Project proponent invited villagers who lives around 500m from the boundary of the Project site and other persons who may interest the Project. The number of attendance from the village was 29 in total.

After explaining the project description, mitigation measures in construction stage for the communities, schedule of construction, some issues were discussed. Table 13.5-1 shows comments and answers. Figure 13.5-1 shows picture of the first community consultation.

Table 13.5-1: Comments and the Response at the First Community Consultation Meeting

No.	Comments	Category	Corresponds
1	If it doesn't affect our social, economic, and health conditions, we are fine.	General	The contractor and Project proponent will implement appropriate mitigation measures in accordance with EMP as well as comments from villagers.
2	Your mitigation measures are good.	General	
3	We want to establish communication between villagers and the Contractor	General	The contractor provided information on person in charge of environmental and social issues with his mobile phone.

Source: EIA Study Team

Source: EIA Study Team

Figure 13.5-1: Pictures of the First Community Consultation Meeting

13.6 Summary of the Second Community Consultation Meeting

The second community consultation meeting was organized on 24 April 2015 at the 100 Household head house in A-Lum-Sut Village, Thanlyin Township. The Project proponent invited villagers who lives around 500m from the boundary of the Project site and other persons who may interest the Project. Fourteen (14) from the villages and one person from a community organization were attended in the meeting.

After explaining actual activities on mitigation measures in construction stage, reporting results of environmental monitoring during January to March 2015 and schedule of construction, some issues were discussed. Table 13.6-1 shows comments and answers. Figure 13.6-1 shows picture of the second community consultation.

Table 13.6-1: Comments and the Response at the Second Community Consultation Meeting

No.	Comments	Category	Corresponds
1	What is the objective of organizing the workshop?	General	There are two main objectives as follows; - To explain the community what the mitigation measures were done during the last three months - To show the results of environmental monitoring during the last three months
2	Does the project have EIA? If yes, do you have a plan to disclose the EIA report?	General	The project prepared the draft EIA report that was summated to MOECAF through TSMC after public disclosure to receive comments from villagers. After getting comments from MOECAF, the final EIA report is going to finalize and then anyone can see the final EIA report at the Project site.
3	What kind of mitigation measures will be taken for pollution control?	Pollution Control	There are four (4) key mitigation measures of the Project. 1) For air pollution from incinerator, chemical bugfilter will be installed to comply with Japanese emission standard, 2) For odor from landfill site, basically only industrial waste will be disposed, active area will be minimized in the landfill, non-active area will be covered with sheets in the landfill cell, 3) For wastewater from leachate, industrial wastewater treatment system will be installed, 4) For groundwater and soil contamination, prevent and prohibit the infiltration of liquid waste into the ground by installation of baseliner system. And all of the pollution control activities will be monitored in accordance with EMP.
4	How can the project solve the problem as if there are some environmental impacts?	General	In the construction stage, the contractor has already established good communication system with 100 HH and villagers, In operation stage, the Project proponent will set a section to communicate with villagers and also establish good communication system with 100 HH and villagers. The contractor and the Project proponent will take immediate actions by themselves and in accordance with guidance of government authorities.

Source: EIA Study Team

Source: EIA Study Team

Figure 13.6-1: Pictures of the Second Community Consultation Meeting

13.7 Summary of the Third Community Consultation Meeting

The third community consultation meeting was organized on 30 May 2015 at the 100 Household head house in A-Lum-Sut Village, Thanlyin Township. The Project proponent invited villagers who lives around 500m from the boundary of the Project site and other persons who may interest the Project. nineteen (19) from the villages, two village tract administrator from A Lwan Sut Village and Shwe Pyi Thar Yar Village, two person from a community based organization, and three private companies were attended in the meeting.

After explaining results of EIA study and actual activities on mitigation measures in construction stage some issues were discussed. Table 13.7-1 shows comments and answers. Figure 13.7-1 shows picture of the third community consultation.

Table 13.7-1: Comments and the Response at the Third Community Consultation Meeting

No.	Comments	Category	Corresponds
1	We are worried about air pollution during project operation. How will the Project measures air pollution?	Air Pollution	Air quality monitoring will be carried out near the Project site for continuous seven days in each of dry and rainy season by using Environmental Perimeter Air Monitoring System (EPAS) in accordance with Environmental Monitoring Plan (EMoP)after starting operation of the incinerator.
2	What kind of mitigation measures will be taken for pollution control?	Pollution Control	As for pollution control, there are four (4) key mitigation measures of the Project. 1) For air pollution from incinerator, chemical bugfilter will be installed to comply with Japanese emission standard, 2) For odor from landfill site, basically only industrial waste will be disposed, active area will be minimized in the landfill, non-active area will be covered with sheets in the landfill cell, 3) For wastewater from leachate, industrial wastewater treatment system will be installed, 4) For groundwater and soil contamination, prevent and prohibit the infiltration of liquid waste into the ground by installation of baseliner system.
3	What actions will be taken if air quality, waster quality, noise, and vibration will exceed standards?	Pollution Control	In the EIA report, the target levels of air quality, waster quality, noise, and vibration were set based on the MJTD internal regulations, the standards of ASEAN countries, developed countries, and international organizations because the environmental standards in Myanmar are under preparation. If air quality, waster quality, noise, and vibration will exceed standards, the Project proponent will take action immediately and report to stakeholders.
4	A community based organizations will monitor the	Environmental Monitoring	The Project proponent will organize community consultation meetings periodically at the operation stage to report monitoring results by the Project proponent, actual

No.	Comments	Category	Corresponds
	projects in Thilawa about environmental and social situations. Does the Project share updated information with the stakeholders?		activities on mitigation measures, and to change opinions among stakeholders.
5	A community based organization would like to request the Project proponent to organize a meeting like today during the operating of the Project.	Public consultation	The Project proponent will organize community consultation meetings periodically at the operation stage to report monitoring results by the Project proponent, actual activities on mitigation measures, and to change opinions among stakeholders.
6	Is EIA report disclosed to any other environmental organization except MOECAF and TSMC?	Public disclosure	The Project proponent submitted EIA report to MOECAF through TSMC in October 2014 and MOECAF gave comments to disclose to local communities in March 2015. So the Project proponent organized PCM meetings, this time was the third meeting. In addition, the Project proponent had monthly meetings at 100 HH head's house and listens and reflects the local residents' voices about the project. Anyone who is interested our project can read the reports disclosed at 9 locations from 30 May to 12 June 2015 for 10 working days during office hours. Anyone can leave any comments or suggestions after browsing the documents. The Project proponent collects the comments, reflects the comments, and submits the final EIA report to TSMC.
7	School children could not access the road near project boundary during rainy season. How will the Project proponent manage it?	Accessibility	The Project proponent was informed by 100 HH and had already visited site to check accessibility. The Project proponent will construct temporary bridge(s) and pavement(s) to secure accessibility from community to the road during rainy season. The Project proponent has planned to construct a pavement near the boundary of the project for securing the accessibility during operation stage.

Source: EIA Study Team

Source: EIA Study Team

Figure 13.7-1: Pictures of the Third Community Consultation Meeting

13.8 Comments from the Public of the Second Public Disclosure

The Project proponent disclosed the final EIA report for ten working days from 1 to 10 June 2015 after organizing the third community consultation meeting on 30 May 2015. The final EIA report was disclosed at the following places.

1. Project Office in the Project site
2. MJTD Office
3. Thilawa Management Committee Office in Thilawa

4. Thanlyin Township General Administration Office
5. Kyauktan Township General Administration Office
6. A Lwan Sut Village Tract General Administration Office in Thanlyin Township
7. 100 Household Head's House in A Lwan Sut Village near the Project site
8. Aye Mya Thida Village Tract General Administration Office in Kyauktan Township
9. Shwe Pyi Tharyar Village Tract General Administration Office in Kyauktan Township

As the results of public disclosure, there was no comments from the public about the final EIA report. The final EIA report is disclosed continuously at the Project office in the Project Site.

CHAPTER 14: COMMENTS FROM MINISTRY OF ENVIRONMENTAL CONSERVATION AND FORESTRY AND ITS CORRESPONDS

MOECAF issued a notification ("Notification No. 2/220 (B)(6)/(1800/2015)" dated 11th March 2015) to the Thilawa SEZ Management Committee regarding the comments for the draft EIA Report. The Project Proponent finalized EIA report with corresponds to the comments as shown in Table 14.1-1 and Table 14.2-2.

Table 14.1-1: Responses to Comments from MOECAF (Clause 18)

No.	Comments from MOECAF	Category	Corresponds
a)	The draft EIA report did not mention Executive Summary of key findings	General	1) Executive Summary including key findings is added to the final EIA Report.
b)	The draft EIA report mentioned 20 laws and regulations related to the environmental conservation but it did not mention about Prevention of Hazard from Chemicals and Related Substances Law (2003), Foreign Investment Law (2012) and Foreign Investment Rules (2013).	Laws and regulations related to environmental conservation	2) In accordance with the comments, the said laws and rules are added in Section 2.2.1.
c)	The draft EIA report mentioned about mitigation measures and monitoring reports for Environmental, Health, and Safety (EHS) but it did not mention about EHS responsibility, detail tasks and amount of budget to be used for EHS operations and number of staff/employee for EHS operations.	Implementation structure of EMP	3) The detailed tasks for implementation of EHS and number of staff are described in Section 2.3-2. The amount of budget of implementation of EHS will be described in the monitoring report for implementation of EMP to be submitted to MOECAF through Thilawa SEZ Management Committee.
	Moreover, Figure (3.4.7) mentioned process flow diagram of incinerator but it did not mention about specification (size, type, capacity) of the incinerator.	Air quality management	4) The specification of incinerator was described in Table 3.4-1 of the draft EIA Report. The process flow diagram is attached in Section 3.4.8.
d)	Chapter 3.4.8 mentioned about incineration facility and table 3.4-2 mentioned about planned mitigation measures on air pollution by exhaust gas but it did not mention detail of mitigation measures and monitoring reports in chapter 12 under EMP.	Air quality management, EMP	5) In accordance with the comment, detailed mitigation measures on emission gas from the incinerator are added in Table 12.2-2. With respect to monitoring plan for emission gas from the incinerator was described in Table 12.3-2 of the draft EIA Report as well as the Final EIA Report.
e)	Chapter 3.4.10 mentioned about waste water treatment facility but it did not mention about mitigation measures and plans for offensive odor by those effluent and sludge to the nearest local residence (70 m distance) and nearest wells and ponds (100 m distance) from the project boundary.	Odor	6) The wastewater treatment is located at far from the nearest local residence (more than 350m distance) and nearest wells and ponds (more than 500 m distance). Thus odor impact to the local residence is not expected. With respect odor from sludge, the sludge will be disposed to hazardous land fill site and the hazardous land fill site will be covered sheet and will install gas collection pipe and flare station for odor prevention as described in Section 3.4.9.
f)	It is mentioned to install baseliner system which includes protection layer, leak detection layer and impermeable layer as for groundwater and soil contamination prevention, but it did not mention detail about size and type of layers to be installed for those protection layer, leak detection layer and	Project description/ groundwater and soil contamination control	7) The size of landfill is approximately 100 m x 100m of each cell. The detailed baseliner system was mentioned in Figure 3.4-11 in the draft EIA Report as well as the final EIA Report.

No.	Comments from MOECAF	Category	Corresponds
	impermeable layer.		
g)	It did not mention about flood analysis based on 100 years rainfall data of project surrounding area. It did not mention about simulation or calculation method for the height of the perimeter dyke (E.L. +7.0 m) that will be constructed in the project area to prove that the perimeter dyke is safe from flood risk for long term.	Emergency risks (Flood risk)	8) According to the EIA Report for Thilawa SEZ Zone A Development Project, elevation of the basement of Zone A was set as E.L. +6.5m based on storm surge simulation in Yangon River (Cyclone Nargis case) higher than E.L. 4.9m based on flood analysis for 100 years return period. The storm water drainage systems (retention pond, retention canal, and pumping) were designed taking into consideration of the flood of 100 years return period. The perimeter dyke of the Project (E.L. + 7.0m) is 0.5m higher than the basement of other areas in the Zone A (E.L. +6.5m). Thus it is enough height to prevent flood risk for long term.
h)	Chapter 4.3.10 mentioned about emergency risk and past major flood events during 1997-2007 are described in "Hazard Profile of Myanmar" and flood events in and around Yangon, but it did not mention about past flood record around proposed project area from metrological stations near the project area.	Emergency risks (Flood risk)	9) The nearest weather station around the Project site which the Zone A used for designing of storm water drainage system is the station in Yangon City (Kaba-Aye). In addition, according to the JICA Preparatory Study on Thilawa SEZ Infrastructure Development in the Republic of the Union of Myanmar, the rainfall intensity formula from 5 years return period (63 mm/hr) up to 100 years return period (109 mm/hr) was proposed by Yangon City Development Committee (YCDC) based on the Study on Drainage System of Mingalar Taung Nyunt Area. The reliability of the rainfall intensity formula was confirmed by comparing with Gambel formula and records of rainfall intensity in Ho Chi Minh City in Vietnam, Ayutthaya in Thailand, and Dhaka in Bangladesh.
i)	Chapter 5 mentioned about 'Scoping and TOR for Environmental, Social, and Health Impacts and Emergency Risk Assessments' but it not mention about direct and indirect impacts of the project.	Direct and indirect impacts	10) In accordance with the comment, direct and indirect impacts of the Project are categorized in the Table 5.1-3.
j)	It did not mention about cumulative impact assessment by the other projects nearby since the location of the proposed project is boundary between first phase (400 ha) and second phase (2000 ha).	Cumulative impact assessment	11) A JICA study is under preparation of land use plan for development of the second phase (2,000ha) in Thilawa SEZ. The scope of the study includes Strategic Environmental Assessment for development of 2,000ha. The project proponent will take actions in accordance with the results of cumulative impact assessment as necessary.
k)	It did not include local villagers (PAP) in public consultation meetings held in 29th August 2014 in Thilawa Management Committee Office.	Public consultation meeting	12) In addition to the stakeholder meetings on 29th August 2014 and on 1st October 2014, the Project proponent organized community consultations meetings in A-Lum-Sut Village for local villagers near the Project site on 25 December 2014 and 25 April 2015 to explain about project description, mitigation measures, and environmental management plan. 29 villagers in the first meeting, and 14 villages and 1 person from a community organization in the second meeting attended. The results of the meetings are described in the Chapter 13.
l)	Although draft EIA and EMP report is in both English and Myanmar languages, it did not include conclusions and recommendations.	General	13) In accordance with the comment, the conclusion of the EIA study is described in Chapter 15.
m)	Chapter 12 mentioned about Environmental Management Plan and Environmental Monitoring Plan and the contractor will implement air quality, noise and vibration but it did not mention and procedure and estimated cost for monitoring.	EMP and EMOP in construction and operation stages	14) The procedures and cost estimation for the Environmental Monitoring Plan (EMOP) is attached in Section 12.5 of the final EIA Report.
n)	Moreover, it did not mention what organization	EMOP in	15) The procedures and cost estimation for the Environmental

No.	Comments from MOECAF	Category	Corresponds
	will implement monitoring plan for closure stage, detail procedure and estimated cost for monitoring.	closure stage	Monitoring Plan (EMOP) is attached in Section 12.5 of the final EIA Report.
o)	It did not mention detail of annual budget plan, responsible organization and procedures for CSR activities under chapter 10.2.	CSR activities	16) CSR activity will be implemented by General Management and PR/CR Section. The annual budget plan will be described in the monitoring report for implementation of EMP to be submitted to MOECAF through Thilawa SEZ Management Committee.
p)	It did not mention detail of annual budget plan, responsible organization and procedures for environmental rehabilitation activities including capping, vegetation the landfill site.	Capping and vegetation of the landfill site	17) The approximate total budget for capping and vegetation of the land fill site is described in Section 12.5 of the final EIA Report.

Source: EIA Study Team

Table 14.1-2: Responses to Comments from MOECAF (Clause 19)

No.	Comments from MOECAF	Category	Corresponds
a)	To mention all the points of the above comment (18) in final EIA report in order to mitigate environmental impacts by the project.	General	1) The Project proponent will implement additional mitigation measures in accordance the correspondents.
b)	To mention the following laws and regulations related to the environmental conservation; Criminal Law (1891), Thilawa Special Economic Zone Law (2014), Foreign Investment Law (2012) and Foreign Investment Rules (2013) Myanmar Insurance Law (1993), Underground Water Act (1930) ,The Land Acquisition Act (1894), Factories Act (1951), The Minimum Wage Law (Draft) (2012), Prevention of Hazard from Chemicals and Related Substances Law (2003), Business for Ozone Depleting Substances: Notification No. (37/2014), Myanmar Investment Commission: Notification No. 1/2013 and (50/2014), Social Security Law (2012) and Social Security Rules (2014), Minimum Wage Law (2013), Law on Standardization (2014) and Leave and Holidays Act (1951)	Laws and regulations related to environmental conservation	2) In accordance with the comments, the said laws and rules are added in Section 2.2.1.
c)	To mention that the project will follow in accordance with the current laws, regulations, notifications, instructions and procedures by relevant Regional Government Authorities.	Laws and regulations related to environmental conservation	3) The Project proponent will follow current laws, regulations, notifications, instructions and procedures by relevant Regional Government Authorities.
d)	It will be more reliable if 100 years rainfall data from relevant Department is mentioned. It is necessary to mention simulation or calculation of the capacity of retention pond that can store storm water and the amount of annual waste water to be treated based on 50 years rainfall data (at least) and flood history from relevant Department.	Emergency risks (Flood risk)	4) According to the EIA Report for Thilawa SEZ Zone A Development Project, elevation of the basement of Zone A was set as E.L. +6.5m based on storm surge simulation in Yangon River (Cyclone Nargis case) higher than E.L. 4.9m based on flood analysis for 100 years return period. The storm water drainage systems (retention pond, retention canal, and pumping) were designed taking into consideration of the flood of 100 years return period. The perimeter dyke of the Project (E.L. + 7.0m) is 0.5m higher than the basement of other areas in the Zone A (E.L. +6.5m). Thus it is enough height to prevent flood risk for long term.
e)	Table 5.1.2 mentioned scoping rating for climate change at operation stage was (B+/ B-), and page	General	5) Scoping rating of climate change in Table 7.1-1 is changed from “C” to “B+/B-”. Target values for SO_2 and CO in

No.	Comments from MOECAF	Category	Corresponds
	7-2 mentioned scoping rating for climate change at operation stage page was (C); and there is discrepancy between target value for SO_2 and CO in Table (8-1-10) concentration of ambient air quality and Table (2-1-3) target levels for ambient air quality.		Table 8-1-10 are changed to the values in Table 2.1-3.
f)	To participate and get comments from local villagers (PAP) in future public consultation meetings since they were not included in the public consultation meetings held in 9th August 2014 and 1st October 2014.	Public consultation meeting	6) In addition to the stakeholder meetings on 29th August 2014 and on 1st October 2014, the Project proponent organized community consultations meetings in A-Lum-Sut Village for local villagers near the Project site on 25 December 2014 and 25 April 2015 to explain about project description, mitigation measures, and environmental management plan. 29 villagers in the first meeting, and 14 villages and 1 person from community organization in the second meeting attended. The results of the meetings are described in the Chapter 13.
g)	To mention commitment of project proponent to follow the facts mentioned in the report that is prepared by third party/ organization.	Commitment of the Project proponent	7) The commitment of Project Proponent basing on the facts founded by the third party is described in the final EIA Report.
h)	To follow environmental quality standards for Myanmar when the relevant Ministry issued environmental quality standards for Myanmar.	Environmental quality standard	8) The Project Proponent will follow the comments.
i)	To mention that the project will follow the laws, rules, regulations, and guidelines related to the environmental conservation imposed by Ministry of Environmental Conservation and Forestry (MOECAF) and other related Departments.	Laws and regulations related to environmental conservation	9) The Project Proponent will follow the comments.

Source: EIA Study Team

CHAPTER 15: KEY FINDINGS AND CONCLUSION

15.1 Key Findings

As the results of the EIA Study, the following items were founded as key findings.

1) The project is the first controlled solid waste management facilities including hazardous waste in Myanmar to meet with international standards.

2) As sensitive receptors around the Project site, there are a village, a reservoir, and individual wells. The village name is A-Lum-Sut village and the nearest house is located at 70m from the nearest boundary of the Project site. The reservoir name is Thilawa dam located at 1,000m from the nearest boundary of the Project site. Thilawa dam belongs to Ministry of Industry (MOI) and supplies water to factories and villagers in the northern part of the Project site. There are two individual wells in the A-Lun-Sut Village. One is a tube well with compressor for domestic water use mainly located at 600m from the boundary. The other one is a hand pump well for supplemental domestic water use located at 100m from the boundary of the Project site. Normally the villager uses domestic water from the public pond in the monastery located at 750m from the boundary.

3) In the construction phase, most of the impacts are temporary and limited within the Project site. As the results of the impact assessment from Chapter 7 to 12, the key impacts are occupational health and safety, safety for community, and air quality (dust). In order to manage and mitigate these impacts, it is confirmed that the contractor entrusted by the Project proponent will carry out guidance to worker and tool box meeting for occupational health and safety, not using the route across villages (north-west side) for safety control, and spraying water to bare areas for duct prevention in accordance with mitigation measures on stipulated in the Environmental Management Plan (EMP).

4) In the operation phase, most of the impacts are controlled and limited within the Project site. As the results of the impact assessment from Chapter 7 to 12, the key impacts are air quality from incinerator, odor, and leachate leaking to affect local water use. In order to manage and mitigate these impacts, the Project proponent will install chemical bughouse filter to comply with the target level of emission gas, installation of sheets to cover solid waste, gas collection pipe, and flare station to prevent odor dispersion, and install baseliner with leak detection layer to prevention leachate leaking in accordance with mitigation measures on stipulated in the EMP. The Project proponent will also implement monitoring in accordance with the plan stipulated in Environmental Monitoring Plan (EMoP).

5) In the closing phase, impacts related to demolish work are almost same as construction phase. The contractor to be entrusted by the Project proponent will carry out necessary mitigation measures in accordance with the EMP. Besides, mitigation measures on closure of landfill such as final covering and development of eco-friendly facilities are also key mitigation and management factors as well as confirmation of no environmental impact from closed landfill. The Project proponent will maintain and monitor for 10 years at least after installation of final covering and then will close land fill site if no environmental impact is observed for two years.

15.2 Conclusion

As the results of the conclusion of EIA Study, it was confirmed that the environmental impact assessment (EIA), social impact assessment (SIA), health impact assessment (HIA), and emergency risk assessment (ERA) of the Project are assessed properly as well as establishment of the Environmental Management Plan. It was also that the public involvement, comments from public and MOECAF were reflected into the final EIA Report. Thus, the EIA study was completed in accordance with requirement of the draft EIA Procedures in Myanmar properly in case that the Project proponent will follow EMP accordingly.

APPENDIX-1

CURRICULUM VITAE OF THE EXPERTS FOR EIA STUDY

(NOT DISCLOSED DUE TO PERSONAL INFORMATION PROTECTION)

APPENDIX-2

LABORATORY ANALYSIS RESULTS

MINISTRY OF LIVESTOCK, FISHERIES AND RURAL DEVELOPMENT
DEPARTMENT OF FISHERIES
AQUACULTURE DIVISION
FRESHWATER AQUACULTURE RESEARCH
WATER AND SOIL EXAMINATION LABORATORY

RESULT ON CHEMICAL EXAMINATION OF WATER

Sender's reference : Resource & Environment Myanmar Co., Ltd. **Collection Date : 23-5-2014**

Location : Thilawa **Arrival Date & Time : 28.5.2014 & 12:30**

Project Name : Solid Waste Management Project in Thilawa

Parameter	Unit	SEZW – 1	SEZW-2
Nitrate Nitrogen	mg/l	0.2	0.2
Ammonium Nitrogen	mg/l	0.00	000
Ortho Phosphate	mg/l	2.0	3.0
Sulfide	mg/l	0.00	0.00
Sulfate	mg/l	1.2	1.5
Phosphorus	mg/l	0.66	0.99

Analyzed by – San San Soe
Khaing Khaing Oo
Thin Thin Aye

Approved by

Aye Aye Thein

Head of Freshwater Aquaculture Research

MINISTRY OF LIVESTOCK, FISHERIES AND RURAL DEVELOPMENT
DEPARTMENT OF FISHERIES
AQUACULTURE DIVISION
FRESHWATER AQUACULTURE RESEARCH
WATER AND SOIL EXAMINATION LABORATORY

RESULT ON CHEMICAL EXAMINATION OF WATER

Sender's reference :Resource & Environment Myanmar Co.Ltd Collection Date :18.6.2014

Location : Thilawa Arrival Date & Time : 20.6.2014 &12:00

Project name : **Solid Waste Management Project in Thilawa (June)**

Parameter	Unit	SEZ-W1	SEZ-W2
Ammonium Nitrogen	mg/l	0.00	0.00
Nitrate Nitrogen	mg/l	0.02	0.03
Orth Phosphate	mg/l	0.5	0.1
Phosphorus	mg/l	0.165	0.033
Sulfate	mg/l	0.2	0.5
Sulfide	mg/l	0.00	0.00

Analyzed by - San San Soe

- Khaing Khaing Oo

- Thin Thin Aye

Approved by

Aye Aye Thein

Head of Freshwater Aquaculture Research

THE REPUBLIC OF THE UNION OF MYANMAR
MINISTRY OF LIVESTOCK , FISHERIES AND RURAL DEVELOPMENT
DEPARTMENT OF FISHERIES
FISH INSPECTION AND QUALITY CONTROL DIVISION
YANGON, MYANMAR
ANALYTICAL LABORATORY SECTION

Test Report for Microbiological Analysis

Name of Project : Solid Waste Management Project in Thilawa

Name of Company : Resource and Environment Myanmar Co., Ltd.

Date of Received : 23.6.2014

Date of Analysis : 23.6.2014

Test Method : AOAC Petrifilm Method

No	Date of Analysis	Detail of Samples (Water)	Total Coliforms cfu/100ml	Fecal Coliforms cfu/100ml	*E.coli* cfu/100ml	Remarks
1	23.6.14	SEZW-1 23.5.14 Surface Water	0	0	0	
2	23.6.14	SEZW-2 23.5.14 Surface Water	0	0	0	

Reference : The International Commission on Microbiological Specification for foods (ICMSF,1986) , 98/93 EC , Guidelines for drinking water quality WHO 1997 (2nd Edition) .

Analyzed by :

Than Than Myint
Micro Lab

Evaluated by:

Dr.Su Myo Thwe
Ph.D Japan
TM, Head of Micro Lab

Approved by :

Thet Naing (QMR)
B.Sc (Chemistry)
Assistant Director
Analytical Laboratory Section
Department of Fisheries

Remarks: This result is responsible for the sample in the lab.

THE REPUBLIC OF THE UNION OF MYANMAR
MINISTRY OF LIVESTOCK , FISHERIES AND RURAL DEVELOPMENT
DEPARTMENT OF FISHERIES
FISH INSPECTION AND QUALITY CONTROL DIVISION
YANGON, MYANMAR
ANALYTICAL LABORATORY SECTION

Test Report for Microbiological Analysis

Name of Project : Solid Waste Management Project in Thilawa (June)

Name of Company : Resource and Environment Myanmar Co., Ltd.

Date of Received : 23.6.2014

Date of Analysis : 23.6.2014

Test Method : AOAC Petrifilm Method

No	Date of Analysis	Detail of Samples (Water)	Total Coliforms cfu/100ml	Fecal Coliforms cfu/100ml	*E.coli* cfu/100ml	Remarks
1	23.6.14	SEZW-1 18.6.14 Tube Well	$1.9x10^3$	$1.9x10^3$	0	
2	23.6.14	SEZW-2 18.6.14 Surface Water	0	0	0	

Reference : The International Commission on Microbiological Specification for foods (ICMSF,1986) , 98/93 EC , Guidelines for drinking water quality WHO 1997 (2nd Edition) .

Analyzed by :

Than Than Myint
Micro Lab

Evaluated by:

Dr.Su Myo Thwe
Ph.D Japan
TM, Head of Micro Lab

Approved by :

Thet Naing (QMR)
B.Sc (Chemistry)
Assistant Director
Analytical Laboratory Section
Department of Fisheries

Remarks: This result is responsible for the sample in the lab.

Report No. : 2014-00637 / 001-1 (Page 1 of 1) **Issued date :** June 24, 2014

CLIENT : **RESOURCE AND ENVIRONMENT MYANMAR CO., LTD.**
CONTACT : Ms. Pwint Pwint
ADDRESS : B702 Delta Plaza, Shwegondaing Rd., Bahan, Yangon, Myanmar
Tel. +959-73013448 Fax. +951-552901
E-mail : pwint@enviromyanmar.net

Analysis Report

PROJECT NAME : Solid Waste Management Project in Thilawa
SAMPLE DESIGNATED AS : Water Quality **SAMPLING DATE** : May 23, 2014
SAMPLING LOCATION : Thilawa, Myanmar **SAMPLING BY** : Client

Parameters	Unit	LOQ	Stations	
			SEZW-1	SEZW-2
Oil & Grease	mg/L	2.0	< 2.0	< 2.0
Formaldehyde	mg/L	0.01	0.13	< 0.01
Phenols	mg/L	0.001	0.008	< 0.001
Free Chlorine (Cl_2)	mg/L	0.01	0.10	< 0.01
Chromium Hexavalent (Cr^{6+})	mg/L	0.02	< 0.02	< 0.02
Chromium Trivalent (Cr^{3+})	mg/L	0.02	< 0.02	< 0.02
Barium (Ba)	mg/L	0.1	< 0.1	< 0.1
Hydrogen Sulphide (H_2S)	mg/L	0.01	0.16	< 0.01
Selenium (Se)	mg/L	0.01	< 0.01	< 0.01
Boron (B)	mg/L	0.5	< 0.5	< 0.5
Total Chromium (Cr)	mg/L	0.02	< 0.02	< 0.02
Total Organic Carbon	mg/L	0.5	6.5	6.2

Remark :
- Analysis Methods followed *to the Standard Methods for the Examination of Water and Wastewater* endorsed by American Public Health Association (APHA), American Water Works Association (AWWA)and Water Environment Federation (WEF).
- LOQ = Limit of Quantitation

(Siriporn Imwilaiwan)
License ID : ๑-010-๓-1793

SGS (THAILAND) LIMITED

(Thepson Yommana)
License ID : ๑-010-๓-333

TY/Client/VV/Ws

SGS

Report No. : 2014-00705 / 001-1 (Page 1 of 1) **Issued date :** July 10, 2014

CLIENT : **RESOURCE AND ENVIRONMENT MYANMAR CO., LTD.**
CONTACT : Ms. Pwint Pwint
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Tel. +959-73013448 Fax. +951-552901
E-mail : pwint@enviromyanmar.net

Analysis Report

PROJECT NAME : Solid Waste Management Project in Thilawa (June)
SAMPLE DESIGNATED AS : Water Quality **SAMPLING DATE** : June 18, 2014
SAMPLING LOCATION : Thilawa, Myanmar **SAMPLING BY** : Client

Parameters	Unit	LOQ	Stations	
			SEZW-1	SEZW-2
Formaldehyde	mg/L	0.01	< 0.01	< 0.01
Phenols	mg/L	0.001	< 0.001	< 0.001
Free Chlorine (Cl_2)	mg/L	0.01	< 0.01	0.07
Chromium Hexavalent (Cr^{6+})	mg/L	0.02	< 0.02	< 0.02
Chromium Trivalent (Cr^{3+})	mg/L	0.02	0.05	0.02
Barium (Ba)	mg/L	0.1	0.2	0.2
Hydrogen Sulphide (H_2S)	mg/L	0.01	< 0.01	< 0.01
Selenium (Se)	mg/L	0.01	< 0.01	< 0.01
Boron (B)	mg/L	0.5	< 0.5	< 0.5
Total Chromium (Cr)	mg/L	0.02	0.05	0.02
Total Organic Carbon	mg/L	0.5	20.5	4.3

Remark :
- Analysis Methods followed *to the Standard Methods for the Examination of Water and Wastewater* endorsed by American Public Health Association (APHA), American Water Works Association (AWWA)and Water Environment Federation (WEF).
- LOQ = Limit of Quantitation

(Siriporn Imwilaiwan)
License ID : ๑-010-ค-1793

SGS (THAILAND) LIMITED

(Thepson Yommana)
License ID : ๑-010-ค-333

TY/Client/VV/Ws

ANALYSIS REPORT

ORIGINAL

Job Ref: 5049/2014
Date : 17.07.2014

Client Name	:	**RESOURCE AND ENVIRONMENT CO., LTD** B-702 Delta Plaza, Shwegondaing Rd, Bahan Township, Yangon, Myanmar
Project Name	:	SOLID WASTE MANAGEMENT PROJECT IN THILAWA (May)
Sample Brought By	:	Client
Sample Received Date	:	14.07.2014
Analysed Date	:	15.07.2014
Test Method	:	**APHA 2540 D**
Sampling Date	:	23.5.2014

Stations	Commodity Name	Lab Code	Results (mg/l)
			Total Suspended Solid
1. SEZW – 1	TUBE WELL WATER	130/14	4574
2. SEZW – 2	SURFACE WATER	131/14	257.3
Detection Limit			2

End Of Report

SGS (Myanmar) Limited

(Nu Nu Yi)
Manager

ANALYSIS REPORT

ORIGINAL

Job Ref: 5049/2014
Date : 17.07.2014

Client Name	:	**RESOURCE AND ENVIRONMENT CO., LTD** B-702 Delta Plaza, Shwegondaing Rd, Bahan Township, Yangon, Myanmar
Project Name	:	SOLID WASTE MANAGEMENT PROJECT IN THILAWA (June)
Sample Brought By	:	Client
Sample Received Date	:	14.07.2014
Analysed Date	:	15.07.2014
Test Method	:	**APHA 2540 D**
Sampling Date	:	18.6.2014

Stations	Commodity Name	Lab Code	Results (mg/l)
			Total Suspended Solid
1. SEZW – 1	TUBE WELL WATER	132/14	9541
2. SEZW – 2	SURFACE WATER	133/14	231
Detection Limit			2

End Of Report

SGS (Myanmar) Limited

(Nu Nu Yi)
Manager

The Government of the Republic of the Union of Myanmar
Ministry of Agriculture and Irrigation
Irrigation Department
Survey and Investigation Branch
Soil Survey Section
Soil and Water Analytical Laboratory

ANALYTICAL DATA FOR WATER SAMPLE

PROJECT NAME;Solid Waste Management Project in Thilawa(May)

SAMPLING DATE 23.5.2014
ISSUED DATE ; 18.7.2014
SAMPLING BY ; Client

SAMPLING LOCATION;Thilawa

Sr No	Station	Results (mg/l)										
		BOD 5	COD	Mercury (Hg)	Lead (Pb)	Cadmium (Cd)	Copper (Cu)	Zinc (Zn)	Nickel (Ni)	Manganese (Mn)	Iron (Fe)	Total Hardness
1	SEZW-1 Tube Well	24.9	62.3	0.000000	0.000000	0.000000	0.020443	0.047467	0.254259	0.001069	1.50	40
2	SEZW-2 Surface water	9.3	23.2	0.000013	0.000000	0.000000	0.000000	0.000000	0.000554	0.270924	0.05	392
Drinking Water Standard (WHO)	Highest desirable level	6mg/l	10mg/l	–	–	–	0.05 mg/l	5.0 mg/l	-	0.05 mg/l	0.1 mg/l	100mg/l
	Maximum permissible level	Concentration at maximum permissible pollution		0.001mg/l	0.05 mg/l	0.01 mg/l	1.0 mg/l	15.0 mg/l	0.02 mg/l	0.5 mg/l	1.0 mg/l	500mg/l

Remark: Analytical mentions are ppb unit by AAS. But this unit is changed as mg/L according to the standard of WHO unit.

(May Aye Lwin)
Staff Officer (Lab)
Soil Survey Section
Survey and Investigation Branch
Irrigation Department
Yangon

The Government of the Republic of the Union of Myanmar
Ministry of Agriculture and Irrigation
Irrigation Department
Survey and Investigation Branch
Soil Survey Section
Soil and Water Analytical Laboratory

ANALYTICAL DATA FOR WATER SAMPLE

PROJECT NAME;Solid Waste Management Project in Thilawa(June)

SAMPLING LOCATION;Thilawa

SAMPLING DATE 18.6.2014
ISSUED DATE ; 18.7.2014
SAMPLING BY ; Client

Sr No	Station	Results (mg/l)										
		BOD 5	COD	Mercury (Hg)	Lead (Pb)	Cadmium (Cd)	Copper (Cu)	Zinc (Zn)	Nickel (Ni)	Manganese (Mn)	Iron (Fe)	Total Hardness (TH)
1	SEZW-1 Tube Well	19.8	49.5	0.000000	0.000000	0.000000	0.027684	0.023581	0.102970	0.001163	3.20	60
2	SEZW-2 Surface water	3.4	8.6	0.000000	0.000000	0.000000	0.000000	0.000000	0.002518	0.014861	0.05	180
Drinking Water Standard (WHO)	Highest desirable level	6mg/l	10mg/l	_	_	_	0.05 mg/l	5.0 mg/l	-	0.05 mg/l	0.1 mg/l	100mg/l
	Maximum permissible level	Concentration at maximum permissible pollution		0.001mg/l	0.05 mg/l	0.01 mg/l	1.0 mg/l	15.0 mg/l	0.02 mg/l	0.5 mg/l	1.0 mg/l	500mg/l

Remark: Analytical mentions are ppb unit by AAS. But this unit is changed as mg/L according to the standard of WHO unit.

(May Aye Lwin)
Staff Officer (Lab)
Soil Survey Section
Survey and Investigation
Irrigation Department
Yangon

ANALYSIS REPORT

ORIGINAL

Job Ref: 4388/2014
Date : 12.06.2014

Client Name	:	**RESOURCE AND ENVIRONMENT CO., LTD** B-702 Delta Plaza, Shwegondaing Rd, Bahan Township, Yangon, Myanmar
Project Name	:	Solid Waste Management Project, Thilawa
Sample Brought By	:	Client
Sample Received Date	:	04.06.2014
Analysed Date	:	10.06.2014
Test Method	:	APHA 4500-N B

Stations	Commodity Name	Lab Code	Results (mg/l)
			Total Nitrogen
1. SEZ W – 1 (Alwan Sout Village)	TUBE WELL WATER	088/14	1.68
2. SEZ W – 2 (Creek)	SURFACE WATER	089/14	Not Detected
Detection Limit			0.6

End Of Report

SGS (Myanmar) Limited

(Nu Nu Yi)
Manager

SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 4718/2014
Date : 26.06.2014

Client Name	:	**RESOURCE AND ENVIRONMENT CO., LTD** B-702 Delta Plaza, Shwegondaing Rd, Bahan Township, Yangon, Myanmar
Project Name	:	Solid Waste Management In Thilawa
Sample Brought By	:	Client
Sample Received Date	:	20.06.2014
Analysed Date	:	24.06.2014

Results (mg/l)	Methods	Stations		Detection Limit
		SEZ W-1	SEZ W-2	
Lab Code	-	119/14	120/14	-
Commodity Name	-	TUBE WELL WATER	SURFACE WATER	-
Total Nitrogen	APHA 4500-N B	Not Detected	Not Detected	0.6
Oil & Grease	APHA 5520 B	10.8	0.7	0.2

End of Report

SGS (Myanmar) Limited

(Nu Nu Yi)
Manager

MYANMAR ENVIRONMENT INSTITUTE

B702, Delta Plaza, Shwegondaing Rd., Bahan,
Yangon, Myanmar

RESULT ON CHEMICAL EXAMINATION OF WATER

Location : Solid Waste Management Project in Thilawa
Date Received : 23.5.2014
Date Analysis : 15.7.2014
Test Method : Hanna HI 83200 Multiparameter Bench Photometer for Laboratories
Cyanide(CN^-) : Reagent HI 3855A-0, HI 3855B-0, HI 3855C-0
Range- 0- 0.30 mg/l (ppm)
Nitrite Nitrogen (NO_2^--N) : Reagent - HI 93707-0
Accuracy - ±0.06 mg/l ±4%

No	Parameter	SEZW-1	SEZW-2	Unit
1.	Arsenic	0	0	mg/l
2.	Cyanide	<0.05	<0.05	mg/l
3.	Nitrite Nitrogen	0.00	0.00	mg/l

(Toe Toe Hlaing)
B.Sc, D.A.G , M.Sc , M.Res (Geology)
Lab Technician

MYANMAR ENVIRONMENT INSTITUTE

B702, Delta Plaza, Shwegondaing Rd., Bahan,
Yangon, Myanmar

RESULT ON CHEMICAL EXAMINATION OF WATER

Location : Solid Waste Management Project in Thilawa
Date Received : 18.6.2014
Date Analysis : 15.7.2014
Test Method : Hanna HI 83200 Multiparameter Bench Photometer for Laboratories
Cyanide(CN^-) : Reagent HI 3855A-0, HI 3855B-0, HI 3855C-0
Range- 0- 0.30 mg/l (ppm)
Nitrite Nitrogen (NO_2^--N) : Reagent - HI 93707-0
Accuracy - ±0.06 mg/l ±4%

No	Parameter	SEZW-1	SEZW-2	Unit
1.	Arsenic	0	0	mg/l
2.	Cyanide	<0.05	<0.05	mg/l
3.	Nitrite Nitrogen	0.00	0.01	mg/l

(Toe Toe Hlaing)
B.Sc, D.A.G , M.Sc , M.Res (Geology)
Lab Technician

APPLIED GEOLOGY DEPT. GEOCHEMISTRY LABORATORY

Project- Solid Wastw Management in Thilawa Project
Page - 1 of 1
Date - 4.7.2014
Sampling Date - 23.5.2014

Method : Atomic Absorption Spectrophotometer

Sample No.	pH	As	Hg	Cu	Pb	Zn	Cr	Ni	Mn	Fe	Se	Ca
SOIL	6.7	0.009	ND	110	125	70	17	15	18	5250	7	35

Note : All data units in **ppm**
ND - Not Detected

APPENDIX-3

RECORD OF 1ST STAKEHOLDER MEETING

Official Meeting at Scoping Stage of EIA Study for Project on Construction of Solid Waste Management Facilities in Thilawa SEZ Class A Area

Meeting Record

Date and Time	29th August 2014 9:30-11:30	Venue	Thilawa SEZ Management Committee Office in Thanlyin Township, Yangon
Meeting organized by	DOWA ECO-SYSTEM Co., Ltd (Japan) and Nippon Koei Co., Ltd (Japan)		
Agenda :	See Attachment-1 for details		
Participants:	Totally 46 persons (see Attachment-2 for details) Thilawa SEZ Management Committee (TSMC) : 4, Environmental Conservation Department (ECD) : 2, General Administration Department (GAD) : 3, Ward Administration Office (WAO) and Village Administration Office (VAO): 14, Township Development Committee (TDC) :1, Department of Human Settlement and Housing Development (DHSHD) : 1, Department of Rural Development (DRD) : 2, Department of Health (DOH) : 2, Companies: 17		
Presenters:	Mr. Jun Yamamoto (Senior Manager, DOWA ECO-System Co., Ltd) Mr. Shunsuke Hieda (EIA Team Leader, Nippon Koei Co., Ltd)		

Opening Speech:

- Mr. Set Aung (Chairman, TSMC) gave an opening speech as follows.
  - From environmental point of view, existing industrial zones in Yangon Region except Mingalardon industrial zone do not fulfill international standard. For example, wastewater from factories directly discharges to the drains without any treatment. So, current waste management conditions in industrial zones are very poor.
  - Industrial zones with international standard in other countries (e.g. Thailand) possess systematic disposal methods, proper treatment techniques and monitoring process for both solid waste and wastewater.
  - Heretofore, there is no systematic industrial waste management in Myanmar not only by government organizations but also by private companies. Now, DOWA Eco-System Co., Ltd having much experiences of solid waste management in worldwide proposes this project. Thus, TSMC recommends for the plan of construction of solid waste management facilities in Thilawa SEZ Area by DOWA Eco System Co., Ltd.

Official Meeting at Scoping Stage of EIA Study for Project on Construction of Solid Waste Management Facilities in Thilawa SEZ Class A Area

Meeting Record

Presentation Topics:

- Introduction of DOWA Eco-System Co., Ltd and project description on construction of Solid Waste Management Facilities in Thilawa SEZ Class A Area were presented by Mr. Jun Yamamoto. The following topics are included.
  - What's DOWA ECO-SYSTEM doing?
  - Necessity of global standard waste treatment facilities
  - Location of Solid Waste Management Facilities (Tentative)
  - Type of waste in Thilawa SEZ (Estimation) and Our Plan in Thilawa
  - Waste treatment flow: Sorting, Stabilization and Solidification, Landfill structure and liner system, Effective usage of capped landfill, Fuel blending, Incinerator flow diagram
  - Expected environmental incident and measure

    Classification of wastes for treatments, For deodorization, Water treatment, Exhaust gas management from Incinerator, Waste storage house and CCTV security system
  - Contribution for the community and neighbors (in case of Indonesia)

- Current status of EIA Study including scoping results for Solid Waste Management Facilities Construction in Thilawa SEZ Class A Area was explained by Mr. Shunsuke Hieda. The following topics are included.
  - Screening: EIA/IEE Requirement (5th draft of EIA procedure dated January 2014)
  - Target levels: Concept to set the target levels, Target levels for ambient air quality, emission gas, effluent water quality, noise level and vibration level
  - Alternative analysis
  - Scoping: Items subject to EIA (pollution and social environment), Items not subject to EIA (pollution, natural environment, and social environment)
  - Investigation of environmental & social conditions
  - Prediction method of environmental & social impacts
  - Institutional arrangements: Pre-construction and construction stages, Operation stage
  - EIA study team
  - Expected schedule

Questions and Answers :

- Mr. Moe Myint (Administrator, General Administration Department (GAD), Thanlyin Township)

Question-1 According to presentation, 55 Hectare will be used for solid waste management (SWM) in 2400 Hectare of Thilawa SEZ area , hence, whether it means that approximately (1/50) of total area will be used only for solid waste management or not.

Answer-1 The indicated area (55 Hectare) is not the current project and it was one of the projects in Indonesia. In Thilawa SEZ area, firstly, only 20 Hectare will be planned for solid waste management facilities. Then, it will be extended as necessary. (Mr. Jun Yamamoto)

Question-2 What are the benefits of construction of SWM facilities inside of Thilawa SEZ Area and outside of Thilawa SEZ Area? Then, DOWA Co., Ltd will conduct SWM business whether inside or outside of Thilawa SEZ Area.

Answer-2 The tentative location of the project was shown again by the presentation. (Not fully answer the questions) (Mr. Jun Yamamoto)

Question-3 The crops and edible plants can be cultivated on landfill site or not. The reason why asking the above questions is that it is required to know how long it will take to start cultivation on landfill and after how many years later, the edible plants on landfill can be consumed.

Answer-3 Any type of the plants can grow in landfill due to the coverage of blue liner. It can start cultivation 12 or 13 years after operation of landfill. (Mr. Jun Yamamoto)

Question-4 The fuel produced at DOWA facilities will be used only by cement factory. So, can it be utilized in other factories or not?

Answer-4 In Thailand and Indonesia, it has been used by cement factories in which huge amount of fuel are used. (Mr. Jun Yamamoto)

Question-5 When does DOWA project start operation?

Answer-5 It will start in October 2015. (Mr. Jun Yamamoto)

- Dr. Cho Cho Lwin (Medical Superintendent, Department of Health (DOH), Thanlyin Township)

Question-1 What kind of infectious diseases will be caused by solid waste management processes?

Answer-1 During construction phase, a lot of construction workers will be worked in project sites and there are possibilities of the occurrence of diseases such as Dengue fever but it will be evaluated in EIA report. However, there are no specific diseases caused by solid waste management processes. For example, in Japan, medical waste from Hospitals and clinics are

controlled by automatic machine and there is no direct contact by humans/ workers. Here, the similar system will be applied. (Mr. Shunsuke Hieda)

- Mr. Zaw Min Tun (Administrator, General Administration Department (GAD), Kyauktan Township)

Question-1 In previous EIA and SIA discussion, it has been discussed that there may not have any factory which utilizes a lot of fuel in Thilawa SEZ Area like cement factory. If cement factory is constructed in Thilawa SEZ zone, raw materials for cement factory are not easily available in this area. So, should cement factory be targeted/selected in this project?

Answer-1 Currently construction of cement factory in Thilawa SEZ zone is not permitted. For example, SINMRDEV is only one factory which will conduct only packaging of cement into bag, it will not perform production of cement. TSMC will not consider to allow such factory which will cause large environmental impact in Thilawa SEZ area in future as well. Therefore, DOWA project should target to cement factory outside of Thilawa SEZ area. (Dr. Than Than Twe)

Closing Speech:

- Mr. Myo Lwin (Director, ECD) gave a closing speech. Updates in relation to Environmental Management in Myanmar were mainly provided as follows.
    - In 2012, Environmental Conservation Department was organized under Ministry of Environmental Conservation and Forestry that renamed from Ministry of Forestry in 2011. As of August 2014, ten local ECD offices were located in ten Regions and States. Activities in relating to environmental conservation such as environmental education program to local residents will be carried out by local ECD.
    - Recently, in Myanmar, Environmental Conservation Laws and Environmental Conservation Rules were enforced in 2012 and 2014, respectively.
    - For infrastructure development and investment projects, Myanmar Investment Committee (MIC) proposed the project proponent to submit Environmental Impact Assessment (EIA) report.
    - ECD is currently preparing EIA procedures and it is under 5th Draft stage. Depending on type of projects, EIA or IEE report is necessary to submit to ECD.
    - In Yangon Region, there are 29 industrial zones and among them, only Mingalardon industrial zone is under proper management system due to the cooperation between Yangon City Development Committee (YCDC) and Japanese Organization.
    - Other existing industrial zones are encountering pollution issues (e.g. odor, emission

gas, and wastewater) because long term impacts on environment were not considered in advance at the beginning stage of industrial zones. Therefore, according to the complaints from local residents, ECD in Yangon is proposing treatment methods (e.g., Biological Method) to industries.

- Therefore, after the enforcement of EIA procedure, existing industries need to prepare at least Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMoP).
- Regional Environmental Conservation/Monitoring Committee will also be organized soon in Regions and States.
- Existing open dumping sites in Yangon Region will also be improved by cooperation between YCDC and Korean/Japanese Companies.
- In conclusion, systematic solid waste management facilities such as DOWA Eco-System Co., Ltd are definitely required for Industrial Zones. Therefore, the investment in solid waste management facilities in Thilawa Special Economic Zone should be welcome. Thilawa Special Economic Zone will be a first industrial zone with international environmental standard in Myanmar.

Official Meeting at Scoping Stage of EIA Study for Project on Construction of Solid Waste Management Facilities in Thilawa SEZ Class A Area

Meeting Record

Attachment-1

Agenda

Time	Contents	Organization in Charge
09:00 ~ 09:30	Registration	-
09:30 ~ 09:45	Opening Remark	Thilawa SEZ Management Committee
09:45 ~ 10:45	Introduction of Project Outlines and Draft Scoping Results	DOWA Eco-system/ Nippon Koei
10:45 ~ 11:00	Tea Break	
11:00 ~ 11:30	Questions and Answers	Participants
11:30 ~ 11:35	Closing Remarks	MOECAF/ECD

Attachment-2

No.	Name	Position	Department/ Organization
1	Mr. Set Aung	Chairman	Thilawa SEZ Management Committee (TSMC)
2	Dr. Than Than Twe	Joint Secretary	Thilawa SEZ Management Committee (TSMC)
3	Ms. Mya Myat Chal	Member	Thilawa SEZ Management Committee (TSMC)
4	Mr. Myo Naing	Member	Thilawa SEZ Management Committee (TSMC)/ Department of Labor
5	Mr. Myo Lwin	Director	Environmental Conservation Department (ECD), Yangon
6	Mr. Nyan Lin Aung		Environmental Conservation Department (ECD), Yangon
7	Mr. Kyaw Zaya	Deputy Commissioner	General Administration Department (GAD), Yangon South District
8	Mr. Moe Myint	Administrator	General Administration Department (GAD), Thanlyin Township
9	Mr. Zaw Min Tun	Administrator	General Administration Department (GAD), Kyauktan Township
10	Ms. Thida Myint	Sub-Assistant Engineer	Township Development Committee (TDC), Kyauktan Township
11	Mr. Chit Nyein		Department of Human Settlement and Housing Development (DHSHD), Ministry of Construction, Thanlyin Township
12	Ms. Chaw Su Zan	Assistant Director	Department of Rural Development (DRD), Thanlyin Township
13	Mr. Tin Aung Than	Assistant Director	Department of Rural Development (DRD), Kyauktan Township
14	Dr. Cho Cho Lwin	Medical Superintendent	Department of Health (DOH), Thanlyin Township
15	Ms. Mya Win Mon	Health Assistant Instructor	Department of Health (DOH), Thanlyin Township
16	Mr. Toshiaki Oi	General Manager	Myanmar and Japan Thilawa Development Ltd (MJTD)
17	Ms. Ushio	Manager	Myanmar and Japan Thilawa Development Ltd (MJTD)
18	Mr. Hironeka	S&M Officer	Myanmar and Japan Thilawa Development Ltd (MJTD)
19	Mr. Tsuj		Myanmar and Japan Thilawa Development Ltd (MJTD)
20	Ms. Thwe Thwe	Assistant Manager	Myanmar and Japan Thilawa Development Ltd (MJTD)
21	Ms. Nang Kham Hkoung	Assistant Manager	Myanmar and Japan Thilawa Development Ltd (MJTD)
22	Ms. Aye Aye Aung		Myanmar and Japan Thilawa Development Ltd (MJTD)
23	Mr. Katsumata	Manager	Mizuho Bank
24	Ms. Tin Nwe Win	Manager	SINMRDEV
25	Mr. Tin Aung Tun	Administrator	Aung Chan Thar Ward, Ward Administration Office (WAO), Thanlyin Township
26	Mr. San Tint	Resident	Aung Chan Thar Ward, Ward Administration Office (WAO), Thanlyin Township

No.	Name	Position	Department/ Organization
27	Mr. Myint Hlaing	Administrator	Kyaung Kone Seik Gyi ,Village Administration Office (VAO), Thanlyin Township
28	Mr. Aye Cho		Kyaung Kone Seik Gyi ,Village Administration Office (VAO), Thanlyin Township
29	Mr. Win Htay	Administrator	Hpa Yar Kone Village, Village Administration Office (VAO), Thanlyin Township
30	Mr. Tun Tun Lwin	Staff-1	Hpa Yar Kone Village, Village Administration Office (VAO), Thanlyin Township
31	Mr. Htein Lin	Administrator	Ah Lun Soke Village, Village Administration Office (VAO), Thanlyin Township
32	Mr. Aye Kyu	Administrator	Let Yet San Village, Village Administration Office (VAO), Thanlyin Township
33	Mr. Tin Win	Staff	Let Yet San Village, Village Administration Office (VAO), Thanlyin Township
34	Mr. Myint Lwin	Administrator	Thi Tar Myaing Ward, Ward Administration Office (WAO), Kyauktan Township
35	Mr. Myint Thu		Thi Tar Myaing Ward, Ward Administration Office (WAO), Kyauktan Township
36	Mr. Aye Lwin	Administrator	Shwe Pyi Thar Yar Ward, Ward Administration Office (WAO), Kyauktan Township
37	Mr. Tin Latt Yee	Administrator	Shwe Pyauk Village, Village Administration Office (VAO), Kyauktan Township
38	Mr. Min Zaw	Administrator	Nyaung Waing Village, Village Administration Office (VAO), Kyauktan Township
39	Mr. Jun Yamamoto	Senior Manager	DOWA Eco-System Co., Ltd
40	Mr. Kei Nagata	Deputy Chief	DOWA Eco-System Co., Ltd
41	Mr. Shunsuke Hieda	EIA Team Leader	Nippon Koei Co., Ltd
42	Ms. Maki Ikuse	Env. Expert	Nippon Koei Co., Ltd
43	Mr. Tomohiro Shibayama	EIA Manager	Myanmar Koei International Ltd.
44	Ms. Ya Min Thant	EIA Coordinator	Myanmar Koei International Ltd.
45	Ms. Ei Ei Mon	Env. Expert	Myanmar Koei International Ltd.
46	Ms. Thandar	Office Coordinator	Myanmar Koei International Ltd.

End of Document

APPENDIX-4

RECORD OF 1ST STAKEHOLDER MEETING

Stakeholder Meeting for Introduction of Draft Environmental Impact Assessment (EIA) report of Project on Construction of Solid Waste Management Facilities in Thilawa Special Economic Zone Class A Area

Meeting Record

Date and Time	1st October 2014 10:00-12:00	Venue	Thilawa SEZ Management Committee Office in Thanlyin Township, Yangon
Meeting organized by	DOWA ECO-SYSTEM Co., Ltd (Japan) and Nippon Koei Co., Ltd (Japan)		
Agenda :	See Attachment-1 for details		
Participants:	Total 22 persons (see Attachment-2 for details) Thilawa SEZ Management Committee (TSMC) : 3, General Administration Department (GAD) : 2, Township Development Committee (TDC) :1, Department of Human Settlement and Housing Development (DHSHD) : 3, Department of Rural Development (DRD) : 1, Department of Health (DOH) : 3, Companies and others: 9		
Presenters:	Mr. Jun Yamamoto (Senior Manager, DOWA ECO-System Co., Ltd) Mr. Shunsuke Hieda (EIA Team Leader, Nippon Koei Co., Ltd)		

Opening Remark:

- Dr. Than Than Thwe (Joint Secretary, TSMC) gave an opening speech as follows.
  - The main objective of stakeholder meeting such as introduction of EIA report for construction of solid waste management (SWM) facilities in Thilawa SEZ was explained.
  - The absence of such SWM facilities in Myanmar was pointed out. The necessity of Environmental Impact Assessment Study for any project was described and the scope of EIA study (e.g. air pollution, water pollution, soil pollution, noise and vibration, etc.) was briefly defined.
  - The content of SHM presentation was briefly introduced as follows,
    - (i) Environmental Impact Assessment, Social Impact Assessment, Health Impact Assessment, and Emergency Impact Assessment for construction, operation and closing/termination stages would be explained.
    - (ii) Integrated Waste Management system in DOWA SWM facilities such as waste categorization, land fill, incineration, recycling, and reuse would be illustrated.
    - (iii) Mitigation measures for impacts would be described. This type of study for SWM facilities was a very first challenge in their country, Myanmar.
    - (iv) Just TSMC concerns about the management of kitchen garbage which may

have offensive odor impact on nearby environment. We have brief negotiation about this matter. As a result, kitchen garbage having high offensive odor will be taken outside with other way and only kitchen garbage having low offensive odor will be treated in Thilawa SEZ.

(v) Public notice, regarding this stakeholder meeting and disclosure of draft EIA report was also announced at Yangon South District Administration Office, Thanlyin Township General Administration Office, Kyauktan Township General Administration Office, and Thilawa SEZ Committee Office. In addition, feedbacks/comments from public regarding this project will be accepted until 10th October (during 10 days). Then, this team will reply answers for those comments.

Presentation Topics:

- Introduction of DOWA Eco-System Co., Ltd and project description on construction of Solid Waste Management Facilities in Thilawa SEZ Class A Area were presented by Mr. Jun Yamamoto. The following topics are included.
  - What's DOWA ECO-SYSTEM doing?
  - Necessity of global standard waste treatment facilities
  - Location of Solid Waste Management Facilities (Tentative)
  - Perspective Images (Start of Operation and Completion of Operation)
  - Type of waste in Thilawa SEZ (Estimation) and Our Plan in Thilawa
  - Waste treatment flow

    Sorting, Stabilization and Solidification, Landfill structure and liner system, Example of construction photo for Base liner system, Effective usage of capped landfill, Fuel blending, Incinerator flow diagram

- Draft EIA report for Solid Waste Management Facilities Construction in Thilawa SEZ Class A Area was explained by Mr. Shunsuke Hieda. The following topics are included.
  - Scoping matrix for selection of EIA items
  - Composition of EIA study team
  - Target levels of Environmental Quality Standards

    Concept to set the target levels, Target levels for ambient air quality, emission gas, effluent water quality, noise level and vibration level
  - Contents of EIA Investigations

- ✓ EIA investigations for Thilawa Class A Development,
- ✓ EIA investigation for this project : Results of air quality survey, Results of noise and vibration survey, Results of water quality survey (surface water and ground water), Results of soil quality survey

- Impact Assessments with EMP

Based on the results of EIA Investigations following Impacts were assessed and explained during the presentation.

- ✓ Environmental Impact Assessment with EMP
  1) Air Quality (Impact assessment for construction and closing stages, Impact assessment for operation stage)
  2) Water Quality (Impact assessment for construction stage, Impact assessment for operation and closing stages / termination stage)
  3) Noise (Impact assessment for construction and closing stages, Impact assessment for operation stage)
  4) Vibration (Impact assessment for construction and closing stages, Impact assessment for operation stage)
  5) Offensive Odor (Impact assessment for operation/closing stage, for deodorization)
- ✓ Social Impact Assessment with EMP
  1) Water use (Impact assessment for operation, closing, termination stages)
  2) Land use (Impact assessment for termination)
- ✓ Health and Safety Impact Assessment with EMP
  1) Occupational health & safety (Impact assessment for construction, operation, and closing stages)
  2) Community Health & Safety (Impact assessment for construction, operation, closing stages)
  3) Risk for infection diseases such as AIDS/HIV (Impact assessment for construction, operation, and closing stages)
- ✓ Emergency risk assessment and mitigation measures
  1) Flood risk (Impact assessment for construction, operation and closing stages)
  2) Risk for fire (Impact assessment for construction, operation and closing stages, Waste storage house & CCTV security system)
- ✓ Climate change (Impact assessment for operation stage)

- Other Arrangements and Plans in relation to EIA

Stakeholder Meeting for Introduction of Draft Environmental Impact Assessment (EIA) report of Project on Construction of Solid Waste Management Facilities in Thilawa Special Economic Zone Class A Area

Meeting Record

Following topics were covered during the presentation.

- ✓ Institutional arrangements (pre-construction stages, operation stage, preliminary organization and structure at operation stage)
- ✓ Schedule (Expected Schedule of EIA)
- ✓ Contact address (Public disclosure, contact address about EIA)

Questions and Answers :

❖ Mr. Kyaw Zin Wai (Executive Officer/ Executive Engineer, TDC of Kyauktan Township)

Question-1 In the survey results of ground water, the value of pH was so high. For example, pH around 7.9 is acceptable but 8.9 is so high for ground water. Hence, he would like to know the exact analysis conditions (where, how depth, number of places and how many samples).

Answer-1 Samples were taken from 6m depth observation well because the depth of land fill will be about 6m. (Mr. Shunsuke Hieda)

Question-2 So, it means that it is kind of surface water. It cannot be said as ground water. Turbidity measurement for ground water is also very high.

Answer-2 Yes. (Remark: It may be able to regard as surface water). But, this well is just an observation well to check water level. Water analysis was done for creek water and water from observation well. Turbidity measurement for ground water was conducted at same observation well. Due to inconsistency of the results of measurements, the measurements will be repeated again for those suspected parameters (turbidity and pH). (Mr. Shunsuke Hieda)

Comment-1 Mr. Kyaw Zin Wai understand the situation. He informed that normally, in Kyauktan and Thanlyin regions, the tube wells are dug to depth between 40 ft and 400 ft in order to get drinking water. So, about 6m (18 ft) depth of the observation well may not represent as ground water conditions.

Comment-2 In order to dispose waste from industrial zone, large area of land is required. Currently, garbage is a major problem for YCDC. He really appreciates the effort of this study and construction of DOWA SWM facilities. As the presenter mentioned in the slide no. 12, the estimated amount of waste is 10,000 tons per year. It means that around 80 tons of garbage will be disposed every month. According to his understanding, incineration will be done by mobile method.

(Remark: After listening audio record, it was noticed that Mr. Kyaw Zin Wai misunderstood a flare station, which burns emission gas from land fill with a mobile incinerator, which can incinerate various waste)

Question-3 He would like to know whether a mobile incinerator shown in this presentation will be used or not be used in the proposed project (Remark: He thought that a flare station shown in the presentation is a mobile incinerator). He also would like to know the burning capacity of the mobile incinerator. In addition, he asked how much gas is required to burn the garbage in a mobile incinerator. (Remark: He thought that a mobile incinerator needs gas to burn the garbage)

Answer-3 There are two types of flare station such as mobile type and immobile type. The mobile flare station shown in the presentation will be used in the proposed project. One mobile flare station is capable of burning emission gas from one land fill cell (100m length x 60m width x 6m depth). Various flare stations are available because there are many land fill cells in Thailand. At this moment, we have not confirmed the amount of emission gas burned by one mobile flare station. So, the amount of emission gas burned by the flare station will be evaluated. (Mr. Jun Yamamoto)

(Note: The presenter answered mainly about flare station because it was not noticed that Mr. Kyaw Zin Wai asked about a mobile incinerator. Complete answer could not be given to Mr. Kyaw Zin Wai at the meeting, but EIA study team contacted him by phone and explained about differences between the performance of a flare station and the performance of an incinerator after the meeting)

❖ Dr. Than Than Thwe (Joint Secretary, TSMC)

Comment-1 Rainfall in Myanmar is much greater as compared to other countries. So, proper drain area near land fill is necessary. The infiltration of rain water into land fill site is one of TSMC's concerns.

Comment-2 The water resource for Thilawa SEZ area is Zarmani Dam. The estimated amount of water usage is approximately about 6,000m^3/day. However, due to an increase in the numbers of factories in Thilawa SEZ area, there may have water supply problem. Hence, TSMC is considering to utilize ground water as one of water resources, approximately, about 1,000m^3/day before getting water supply from Lagone Eain Dam. Therefore, the impact to ground water is also one of TSMC's concerns.

Question-1 She would like to know the size of initial land fill cell (area or volume). Based on that information, the time for complete filling of one land fill cell can be estimated.

Answer-1 The size of two initial land fill cells, one for hazardous waste and one for non-hazardous waste, is 100m length x 60m width x 6m depth. So that the estimated time for filling

land fill with waste materials will be around 12 to 13 years. Then, DOWA will expand next land fill cell. (Mr. Jun Yamamoto)

Question-2 She would like to get information whether DOWA has a plan to collect waste from outside of Thilawa SEZ area.

Answer-2 DOWA plans to collect waste from outside of Thilawa SEZ area.
(Mr. Jun Yamamoto)

Question-3 There are mainly three standards to be referred (International Finance Corporation (IFC) standards, Japanese standards, and World Health Organization standards (WHO)). Among them, Environmental Conservation Department recommends IFC standards. For information, She would like to get suggestion which standard is recommended by Expert team for preparation of EIA report for 2000 Hectares Project. Nippon Koei Co., Ltd has prepared EIA report for 400 Hectares project using IFC standard.

Answer-3 Sometimes, IFC standards are used. It is better to explain history of Japanese standards or Vietnam standards or Malaysia standards. In Vietnam, Malaysia, firstly they set up strict rules and standards, but nobody can comply with the standards. Then, they changed and eased the standards. In Japan, like other developed countries, when national government set up strict rules and standards, all companies surely follow those rules and standards even strict. Thus, Japanese standards remain as strict rules and standards among Asian countries. Actually, moderate standards are better because it is difficult to comply with strict rules and standards for Asian developing countries. In case of Japan, health impacts such as cancers were evaluated and considered when it sets up standards. Based on health impact assessment, Japan set up standards and then standards were gradually getting strict. He suggested that performing of health impact assessment before setting up a standard is one of the better approaches.
(Mr. Shunsuke Hieda)

sing Remark:

- Dr. Than Than Thwe (Joint Secretary, TSMC) gave a closing remark as follows.
  - Appreciation to DOWA Co., Ltd and Nippon Koei Co., Ltd. Nippon Koei Co., Ltd is very well known for EIA studies for projects in Thilawa SEZ.
  - Selection of standards for EIA study is very important and IFC standard is recommended by MOECAF. Standard for industry wastewater enforced by Ministry of Industry (MOI) is also applicable for this study.
  - For information, there will be a group of environmental experts for Thilawa SEZ Development Project in the near future. The cooperation with that group will be

appreciated. • The final EIA report will be finalized in the middle of October. The six copies of EIA report is required. Because TSMC will submit EIA report to President Office, MOECAF's Minister and Director General, and will distribute it to other relevant departments. • Comment forms are already distributed to relevant Administration Offices. Comments and feedbacks from participants and public for this project are invited starting from 1st October, 2014 (10:00) to 10th October, 2014 (16:30).	
Photos of Public Disclosure at General Administration Offices:	See Attachment-3 for details
Photos of Stakeholder Meeting :	See Attachment-4 for details

Stakeholder Meeting for Introduction of Draft Environmental Impact Assessment (EIA) report of Project on Construction of Solid Waste Management Facilities in Thilawa Special Economic Zone Class A Area

Meeting Record

Attachment-1

Meeting Agenda

Time	Contents	Organization in Charge
09:30-10:00	Registration	-
10:00-10:10	Opening Remark	Dr. Than Than Thwe (Joint Secretary, Thilawa SEZ Management Committee)
10:10-11:10	Introduction of Project Outlines and Draft EIA report	DOWA Ecosystem/ Nippon Koei
11:10-11:30	Questions and Answers	Participants
11:30-11:35	Closing Remark	Dr. Than Than Thwe (Joint Secretary, Thilawa SEZ Management Committee)
11:35-12:00	Tea Break	

Stakeholder Meeting for Introduction of Draft Environmental Impact Assessment (EIA) report of Project on Construction of Solid Waste Management Facilities in Thilawa Special Economic Zone Class A Area

Meeting Record

Attachment-2

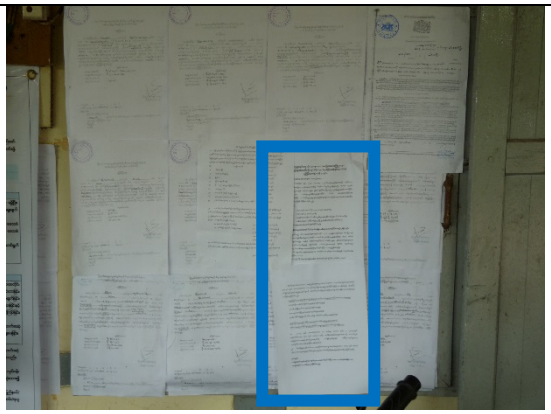
No.	Name	Position	Department/ Organization
1	Dr. Than Aung	Secretary	Thilawa SEZ Management Committee (TSMC)
2	Dr. Than Than Twe	Joint Secretary	Thilawa SEZ Management Committee (TSMC)
3	Ms. Khaing Cho Win	Member	Thilawa SEZ Management Committee (TSMC)
4	Ms. Ei Ei Khaing	Staff Officer	General Administration Department (GAD), Thanlyin Township
5	Mr. Aung Thu	Deputy Staff Officer	General Administration Department (GAD), Kyauktan Township
6	Mr. Kyaw Zin Wai	Executive Engineer	Township Development Committee (TDC), Kyauktan Township
7	Mr. Hla Myo Aung	Staff Officer	Department of Human Settlement and Housing Development (DHSHD), Ministry of Construction, Thanlyin Township
8	Mr. Myo Lwin	Staff	Department of Human Settlement and Housing Development (DHSHD), Ministry of Construction, Thanlyin Township
9	Mr. Win San	Staff	Department of Human Settlement and Housing Development (DHSHD), Ministry of Construction, Thanlyin Township
10	Ms. Chaw Su Zan	Assistant Director	Department of Rural Development (DRD), Thanlyin Township
11	Dr. Cho Cho Lwin	Medical Superintendent	Department of Health (DOH), Thanlyin Township
12	Ms. Mya Win Mon	Health Assistant Instructor	Department of Health (DOH), Thanlyin Township
13	Mr. Win Oo	Township Officer	Department of Health (DOH), Kyauktan Township
14	Ms. Thwe Thwe Myint Aung	Assistant Manager	Myanmar and Japan Thilawa Development Ltd (MJTD)
15	Mr. Hiroshi Ueda	Technician	Osumi Co., Ltd
16	Mr. Jun Yamamoto	Senior Manager	DOWA Eco-System Co., Ltd
17	Mr. Kei Nagata	Deputy Chief	DOWA Eco-System Co., Ltd
18	Mr. Shunsuke Hieda	EIA Team Leader	Nippon Koei Co., Ltd
19	Ms. Wah Wah Han Su Yin	Environmental Expert	Myanmar Koei International Ltd.
20	Ms. Ya Min Thant	EIA Coordinator	Myanmar Koei International Ltd.
21	Ms. Ei Ei Mon	Environmental Expert	Myanmar Koei International Ltd.
22	Ms. Thandar	Environmental Expert	Myanmar Koei International Ltd.

Stakeholder Meeting for Introduction of Draft Environmental Impact Assessment (EIA) report of Project on Construction of Solid Waste Management Facilities in Thilawa Special Economic Zone Class A Area

Meeting Record

Attachment-3

Thanlyin Township General Administration Office



Kyauktan Township General Administration Office

Stakeholder Meeting for Introduction of Draft Environmental Impact Assessment (EIA) report of Project on Construction of Solid Waste Management Facilities in Thilawa Special Economic Zone Class A Area

Meeting Record

Attachment-4

Opening Remark


Presented by Mr. Jun Yamamoto	
	

Presented by Mr. Shunsuke Hieda	
	

Stakeholder Meeting for Introduction of Draft Environmental Impact Assessment (EIA) report of Project on Construction of Solid Waste Management Facilities in Thilawa Special Economic Zone Class A Area

Meeting Record

Question and Answer Section	
	

Closing Remark


APPENDIX-5

COMMENTS IN THE FIRST PUBLIC DICLOSURE

Comment Form

1	Browsing Place (Circle)	1. Yangon South District General Administration Office ②. Thanlyin Township General Administration Office 3. Kyauktan Township General Administration Office 4. Thilawa SEZ Management Committee Office near Thilawa SEZ
2	Date	10.10.2014
3	Name	Mr. Hein Bo Bo
4	Contact Information (Optional)	Officer, Thanlyin Township General Administration Department Mobile: 09 4200-36991
5	Comment on Presentation material (in Myanmar) of the Stakeholder Meeting	<u>About impact of vibration to fauna such as reptiles</u> Some dangerous animals for example snakes might come out due to vibration of construction works. It might be harmful to construction workers and local villagers nearby. I would like to know the mitigation measures for occupational and community health and safety.

Comment Form

1	Browsing Place (Circle)	1. Yangon South District General Administration Office ②. Thanlyin Township General Administration Office 3. Kyauktan Township General Administration Office 4. Thilawa SEZ Management Committee Office near Thilawa SEZ
2	Date	10.10.2014
3	Name	Mr. Soe Yan Lin
4	Contact Information (Optional)	Officer, Thanlyin Township General Administration Department
5	Comment on Presentation material (in Myanmar) of the Stakeholder Meeting	<u>About reaction of materials or chemicals in landfill site</u> In the presentation, you mentioned hazardous and nonhazardous wastes will be classified prior to dispose in landfill cell. I am just wondering if some waste materials cause chemical reaction and it might be harmful to workers and local villagers nearby. My question is how will you manage or make treatment not to happen such reaction problems.

Comment Form

1	Browsing Place (Circle)	1. Yangon South District General Administration Office ②. Thanlyin Township General Administration Office 3. Kyauktan Township General Administration Office 4. Thilawa SEZ Management Committee Office near Thilawa SEZ
2	Date	10.10.2014
3	Name	Mr. Aung Min Ko Ko
4	Contact Information (Optional)	Officer, Thanlyin Township General Administration Department
5	Comment on Presentation material (in Myanmar) of the Stakeholder Meeting	<u>About leakage of wastewater during treatment/dehydration process</u> In the presentation, you mentioned industrial wastewater will be treated in wastewater treatment plant. I would like to know if some wastewater might leak and contaminate the underground water. My question is how will you manage or monitor not to happen such leakage problems during treatment/dehydration process.

Comment Form

1	Browsing Place (Circle)	1. Yangon South District General Administration Office 2. Thanlyin Township General Administration Office ③. Kyauktan Township General Administration Office 4. Thilawa SEZ Management Committee Office near Thilawa SEZ
2	Date	10.10.2014
3	Name	
4	Contact Information (Optional)	
5	Comment on Presentation material (in Myanmar) of the Stakeholder Meeting	I agree with the proposed project.