MJTD

Thilawa Special Economic Zone (ZONE A) Development

Environmental Monitoring Report (Construction Phase)

Myanmar Japan Thilawa Development Limited.

JUNE 2015

CONTENTS

Appendix

1. Executive Summary

The environmental inspection and compliance monitoring program will be implemented under the direction of Ministry of Environmental Conservation and Forestry with oversight by Thilawa SEZ Management Committee.

The monitoring record according to the Environment Monitoring Plan is submitted in conformity with the provision of Chapter 9.1, Table 9.1-2 and 9.2, Table 9.2-2 Content of the EIA Report of Thilawa SEZ Development Project (Zone A).

2. Summary of Monitoring Activities

a) **Progress made to date on the implementation of the EMP against the submitted implementation schedule;**
EMP for Pre-construction Phase was submitted on March 2014. EMP for Construction Phase First Report was submitted at June 2015, Second Report at September 2014, Third Report schedule to submit at December 2014 but submitted at March 2015 and fourth report was submitted at April 2015. The fifth implementation report during Construction Period is submitted this day attached with operation phase implementation schedule. Subsequent Operation Phase reports will be submitted on a bi-annually base.

b) **Difficulties encountered in implementing of the EMP and recommendations for remedying those difficulties and steps proposed to prevent or avoid similar future difficulties;**
None

c) **Number and type of non-compliance with the EMP and proposed remedial measures and timelines for completion of remediation;**
None

d) **Accidents or incidents relating to the occupational and community health and safety, and the environment;**
Neither accidents nor incidents happen during this monitoring period.

e) **Monitoring data on environmental parameters and conditions as committed in the EMP or otherwise required.**
Please refer to the attached Environmental Monitoring Form.

3. Construction Progress

Thilawa SEZ Zone A Development Project construction activities is submitted enclosed with monthly progress reports from contractor in Appendix A to C.

- Monthly Progress Report for March, 2015

  Monthly Progress Report for April, 2015

- Monthly Progress Report for May, 2015

- Monthly Progress Report for June,2015

4. Monitoring Result

Environmental Monitoring plan report for Construction Phase implemented according to the following table, reference on Table 4.2-2, Chapter 4, EIA report.

Monitoring Plan (Construction Phase)

Category	Item	Location	Frequency	Remark
Air Quality	No2, So2, Co, TSP, PM10	Construction site (1point)	Once/3month	May 2015, Monitoring Report
Water Quality	Water temperature, PH, SS, DO, BOD, COD, coliform count, oil and grease, chromium	Construction site (1point) Well in the Monastery (1 point)	Once/2month	April and June 2015 Monitoring Report
Waste	Amount of solid waste Management of solid waste of construction	Construction site	Once/3month	Monthly progress reports (March, April, May, June) 2015
Noise and Vibration	Noise and vibration level of construction	Preservation area such as residence around the proposed construction site (2 points)	Once/3month (peak period)	Noise and Vibration monitoring report May 2015
		Preservation site such as residence along the route for onsite vehicles (2points)	Once(peak period)	
Ground Subsidence Hydrology	Ground subsidence Consumption of ground water amount	Representative (1 point)	Every week	Monthly progress reports (March, April, May, June) 2015
Risk for infectious diseases such as AIDS/HIV	Status of measures of infectious disease	Construction site	Once/month	Monthly progress reports (March, April, May, June) 2015
Working conditions (including occupational safety)	Prohibition of condition of occupational safety and health Prohibition of infectious disease	Construction site	Once/month	
Accident	Existence of accident	Construction site	As occasion arise	

Thilawa Special Economic Zone (ZONE A)
Development Project –Phase 1

5. Environment Monitoring Form

Environment Monitoring Form

The latest results of the below monitoring items shall be submitted to Authorities on once at Pre-construction phase and on quarterly basis at Construction Phase, and on bi-annually base at Operation Phase. The items, standards to be applied, measurement points, and frequency for each monitoring parameter are established based on the EIA Report for Thilawa Special Economic Zone Development Project (Zone A). Should there be any changes to the original plan, such change shall be reviewed and evaluated by environmental expert.

(1) General

1) Phase of the Project

- Please mark the current phase.

□ Pre-Construction Phase ☑Construction Phase □ Operation Phase

2) Obtainment of Environmental Permits (No)

Name of permits	Expected issuance date	Actual issuance date	Concerned authority	Remarks (Conditions, etc.)
Attached approval letter				

3) Response/Actions to Comments and Guidance from Government Authorities and the Public (No)

Monitoring Item	Monitoring Results during Report Period	Duration of Report Period	Frequency
Number and contents of formal comments made by the public		Same timing of submission of Monitoring Report	Upon receipt of comments/complaints
Number and contents of responses from Government agencies			

(2) Monitoring Results

1) Ambient Air Quality –May 2015

NO_2, SO_2, CO, TSP, PM10

Location	Item	Unit	Measured Value (Mean)	Measured Value (Min~Max)	Country's Standard	Target value to be applied	*Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)
Construction Area Near Gate 2	NO_2	ppm	0.03	0.03-0.03	N/A	N/A	0.06	Once in three months	HAZSCANNER, EFAS	
	SO_2	ppm	0.00	0.00-0.01	N/A	N/A	0.04	Once in three months	HAZSCANNER, EFAS	
	CO	ppm	0.56	0.26-1.17	N/A	N/A	10	Once in three months	HAZSCANNER, EFAS	
	TSP	ppm	0.01	0.00-0.02	N/A	N/A	0.33	Once in three months	HAZSCANNER, EFAS	
	PM10	ppm	0.00	0.00-0.01	N/A	N/A	0.12	Once in three months	HAZSCANNER, EFAS	

*Remark: Referred to the Japan and Thailand Standard (EIA Report, Table 6.4-1)

Complains from Residents

- Are there any complains from residents regarding air quality in this monitoring period? □ Yes, ☑No

If yes, please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Complains from Residents	Countermeasures

2)(a) Water Quality - April 2015

Measurement Point: Effluent of Wastewater

- Are there any effluents to water body in this monitoring period? □ Yes ☑No

If yes, please attach "Analysis Record" and fill in the items not to comply with Refereed International Standard.

Location **	Item	Unit	Measured Value	Country's Standard	Target value to be applied	*Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)
GW-1	pH	mg/l	6.9	N/A	N/A	5.5~9.0	Once in two month	pH meter,HI7609829-1 pH Sensor	
	SS	mg/l	ND			50		Gravimetric method	
	DO	mg/l	4.74			>=4		HI7609829-2,DO Chemmet	
	COD	mg/l	23.8			50		Dichromate method	
	BOD	mg/l	8.7			15		Direct inoculation method	
	Oil and Grease	mg/l	ND			0.1		APHA-AWWA-WEF Method	
	Cr	mg/l	0.00			0.08		APHA-AWWA-WEF Method	
	Total coliforms	cfu/100ml	<1.1			7.5×10³		AOAC Petrifilm Method	

*Remark: Referred to the Vietnam Standard (EIA Report), Reference to the Monitoring Report, April 2015.

**Remark: Other locations (SW-2, SW-3, SW-4, SW-8) had no water for measurement.

(b)Water Quality –June 2015

Measurement Point: Effluent of Wastewater

- Are there any effluents to water body in this monitoring period? □ Yes ☑No

If yes, please attach "Analysis Record" and fill in the items not to comply with Refereed International Standard.

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Location	Item	Unit	Measured Value	Country's Standard	Target value to be applied	*Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)
SW-2	pH	mg/l	6.83	N/A	5.5-9.0		Once in two month	pH meter,HI7609829-1 pH Sensor	
	SS	mg/l	333		Max.50			Gravimetric method	
	DO	mg/l	5.25		-			HI7609829-2,DO Chemmet	
	COD	mg/l	18.9		Max. 40			Dichromate method	
	BOD	mg/l	8.6		Max. 20-40			Direct inoculation method	
	Oil and Grease	mg/l	0.6		Max. 5			APHA-AWWA-WEF Method	
	Cr	mg/l	0.00096		Max. 0.5			APHA-AWWA-WEF Method	
	Total coliforms	cfu/100ml	240		-			AOAC Petrifilm Method	
SW-5	pH	mg/l	6.96	N/A	5.5-9.0		Once in two month	pH meter,HI7609829-1 pH Sensor	
	SS	mg/l	380		Max.50			Gravimetric method	
	DO	mg/l	3.43		-			HI7609829-2,DO Chemmet	
	COD	mg/l	28.9		Max. 40			Dichromate method	
	BOD	mg/l	11.2		Max. 20-40			Direct inoculation method	
	Oil and Grease	mg/l	ND		Max. 5			APHA-AWWA-WEF Method	
	Cr	mg/l	0.000040		Max. 0.5			APHA-AWWA-WEF Method	
	Total coliforms	cfu/100ml	490		-			AOAC Petrifilm Method	
SW-4	pH	mg/l	6.58	N/A	5.5-9.0		Once in two month	pH meter,HI7609829-1 pH Sensor	
	SS	mg/l	214		Max.50			Gravimetric method	
	DO	mg/l	3.10		-			HI7609829-2,DO Chemmet	

Location	Item	Unit	Measured Value	Country's Standard	Target value to be applied	*Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)
	COD	mg/l	40.5		Max. 60			Dichromate method	
	BOD	mg/l	16.0		Max. 30-60			Direct inoculation method	
	Oil and Grease	mg/l	ND		Max. 5			APHA-AWWA-WEF Method	
	Cr	mg/l	0.000098		Max. 0.5			APHA-AWWA-WEF Method	
	Total coliforms	cfu/100ml	1100		-			AOAC Petrifilm Method	
SW-8	pH	mg/l	7.55		5.0-9.0			pH meter, ISO10523-1 pH Sensor	
	SS	mg/l	464		Max.50			Gravimetric method	
	DO	mg/l	3.54		-			ISO10523-2,DO Chemical	
	COD	mg/l	43.0	N/A	Max. 60		Once in two month	Dichromate method	
	BOD	mg/l	16.5		Max. 30-60			Direct inoculation method	
	Oil and Grease	mg/l	ND		Max. 5			APHA-AWWA-WEF Method	
	Cr	mg/l	0.000		Max. 0.5			APHA-AWWA-WEF Method	
	Total coliforms	cfu/100ml	3300		-			AOAC Petrifilm Method	
GW-1	pH	mg/l	7.45			5.5~9.0		pH meter, ISO10523-1 pH Sensor	
	SS	mg/l	157			50		Gravimetric method	
	DO	mg/l	2.82			>=4		ISO10523-2,DO Chemical	
	COD	mg/l	17.1	N/A	N/A	30	Once in two month	Dichromate method	
	BOD	mg/l	6.8			15		Direct inoculation method	
	Oil and Grease	mg/l	ND			0.1		APHA-AWWA-WEF Method	
	Cr	mg/l	0.000063			0.04		APHA-AWWA-WEF Method	

Location	Item	Unit	Measured Value	Country's Standard	Target value to be applied	*Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)
	Total coliforms	cfu/100ml	23			7.5×10³		AOAC Petrifilm Method	

*Remark: Referred to the Vietnam Standard (EIA Report), Reference to the Monitoring Report, June 2015.

*Remark: Total suspended solid has been exceeding the reference standard since before construction phase as reported in the result of EIA Monitoring report (Sep 2013).

Complains from Residents

- Are there any complains from residents regarding air quality in this monitoring period? □ Yes, ☑No

If yes, please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Complains from Residents	Countermeasures

3) Soil Contamination (only operation phase)

Situations environmental report from tenants

- Are there any serious issues regarding soil contamination in this monitoring period? □ Yes, ☑No

If yes, please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Issues on Soil Contamination	Countermeasures

4) Noise -May 2015

Noise Level (Along the Thilawa Development Road)

Location	Item	Unit	Measured Value (Mean)	Measured Value (Min-Max)	Country's Standard	Target value to be applied	*Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)
TNV-1	Leq (day)	dB(A)	57	43-77	N/A	N/A	75	Once /peak period	Sound Level Meter	
	Leq(eve)	dB(A)	50	48-54			70			

*Remark: Referred to the Japan Standard (EIA Report), Reference to the Noise and Vibration Report May 2015.

Noise Level (Living Environment-Near Monastery)

Location	Item	Unit	Measured Value (Mean)	Measured Value (Min-Max)	Country's Standard	Target value to be applied	*Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)
TNV-2	Leq (day)	dB(A)	56	46-65	N/A	75	Singapore	Once in 3 months	Sound Level Meter	
	Leq(eve)	dB(A)	58	57-59		60				
	Leq(night)	dB(A)	51	47-55		55				
TNV-3	Leq(day)	dB(A)	56	52-62	N/A	75	Singapore	Once in 3 months	Sound level Meter	
	Leq(eve)	dB(A)	48	47-49		60				
	Leq(night)	dB(A)	42	38-45		55				

*Remark: Referred to the Singapore Target Noise Standard (EIA Report), Reference to the Noise and Vibration Report May 2015.

Complains from Residents

- Are there any complains from residents regarding noise in this monitoring period? ☐ Yes, ☑ No

If yes, please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Complains from Residents	Countermeasures

5) Solid Waste

Measurement Point: Construction Site (Construction Phase), Storage for Sludge (Operation Phase)

- Are there any wastes of sludge in this monitoring period? ☑Yes, ☐ No

If yes, please report the amount of sludge and fill in the results of solid waste management Activities.

No.	Date	Description	No. of Loads	Remarks
1	14-Mar-15	Waste Disposal	01	YCDC
2	20-Mar-15	Waste Disposal	01	YCDC
3	3-May-15	Waste Disposal	01	YCDC
4	4-May-15	Waste Disposal(Sewage)	02	YCDC
5	13-May-15	Waste Disposal	01	YCDC
6	18-May-15	Waste Disposal(Sewage)	02	YCDC
7	19-Jun-15	Waste Disposal	05	YCDC

*Remark: Reference to the Monthly Progress Report March 2015, May 2015 and June 2015.

6) (a)i. Ground Subsidence and Hydrology-March 2015

Duration (Week)	Water Consumption		Ground Level		Frequency	Note
	Quantity	Unit	Quantity	Unit		
5-Mar-2015	190	m3/week	+7.005	m	Once a week	
12-Mar-2015	229	m3/week	+6.995	m		
19-Mar-2015	236	m3/week	+6.993	m		
26-Mar-2015	256	m3/week	+6.997	m		

*Reference to the Monthly Progress Report March 2015.

(a)ii. Ground Subsidence and Hydrology-April 2015

Duration (Week)	Water Consumption		Ground Level		Frequency	Note
	Quantity	Unit	Quantity	Unit		
2-Apr-2015	236	m3/week	+6.997	m	Once a week	
9-Apr-2015	230	m3/week	+6.993	m		
16-Apr-2015	141	m3/week	-	m		
23-Apr-2015	238	m3/week	+6.996	m		
30-Apr-2015	245	m3/week	+6.995	m		

*Reference to the Monthly Progress Report April 2015.

(a) iii. Ground Subsidence and Hydrology-May 2015

Duration (Week)	Water Consumption		Ground Level		Frequency	Note
	Quantity	Unit	Quantity	Unit		
7-May-2015	251	m3/week	+6.997	m	Once a week	
14-May-2015	261	m3/week	+6.994	m		
21-May-2015	223	m3/week	+6.994	m		
28-May-2015	188	m3/week	+6.995	m		

*Reference to the Monthly Progress Report May 2015.

(a)iv. Ground Subsidence and Hydrology-June 2015

Duration (Week)	Water Consumption		Ground Level		Frequency	Note
	Quantity	Unit	Quantity	Unit		
4-Jun-2015	205	m3/week	+6.992	m	Once a week	
11-Jun-2015	205	m3/week	+6.991	m		
18-Jun-2015	149	m3/week	+6.989	m		
25-Jun-2015	122	m3/week	+6.990	m		

*Reference to the Monthly Progress Report June 2015.

6) (b) Locator's Temporary Tube Well Water Consumption (March, April, May, June)(To stop using after water supply for MJTD starts)

Duration (Month)	Water Consumption		Frequency	Note
	Quantity	Unit		
March	17113.02	m³/week	Once a month	
April	25081.05	m³/week		
May	2436.86	m³/week		
June	2125.45	m³/week		

7) Offensive Odor (only operation phase) Not Applicable at Construction Phase Report.

Complains from Residents

- Are there any complains from residents regarding offensive odor in this monitoring period? □Yes, ☑No

If yes, please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Complains from Residents	Countermeasures

Situations environmental report from tenants Not Applicable at Construction Phase Report

- Are there any serious issues regarding offensive odor in this monitoring period? ☐ Yes, ☑No

If yes, please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Issues on Soil Contamination	Countermeasures

6) Infectious disease, Working Environment, Accident

Information from contractor (construction phase) or tenants (operation phase)

- Are there any incidents regarding Infectious disease, Working Environment, Accident in this monitoring period? ☐ Yes, ☑ No

If yes, please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Incidents	Countermeasures

Note: If emergency incidents are occurred, the information shall be reported to the relevant organizations and authorities immediately.

End of Document

Thilawa Special Economic Zone (ZONE A) Development Project –Phase 1

Appendix

Water and Waste Water Monitoring Report

April, 2015

And

Air Quality Monitoring Report

May, 2015

MJTD MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED

MONITORING REPORT

FOR

WATER QUALITY (APRIL 2015)

AND

AIR QUALITY (MAY 2015)

THILAWA SPECIAL ECONOMIC ZONE (ZONE A)

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RESULT OF AIR AND WATER QUALITY MONITORING

1. Introduction

Water samples were collected on 29th April, 2015 and air quality monitoring measurement was surveyed from 20th – 27th May, 2015 at Thilawa Special Economic Zone. This report sets out the environmental monitoring required throughout the construction of the Thilawa Special Economic Zone (Zone A). The terms of reference for monitoring are shown in Table 1. The location of air and water monitoring points are shown in Figure 1 and Table 1.

Terms of Reference for Monitoring

Table 1 Terms of reference for air and water quality monitoring at TSEZ.

Description	Items	Frequency	Location
Air Quality	TSP / PM10	1 time / 3months	At construction site (1point)
Underground water	pH, SS, DO, BOD, COD, Coliform count, oil and grease, chromium	1time /2months	Tube well inside of Moegyoswan Monastery (1 point)

Monitoring Instrument for Air and water

No.	Instrument	Brand & Model	Measurement/ Parameter	
1.	Environmental Perimeter Air Monitoring System	HAZ-SCANNER EPAS	CO, NO_2, NO, SO_2, PM (2.5), PM (10), VOCS, Relative Humidity, Temperature, Wind Speed, Wind Direction	
3	Alpha Bottle (Water Sampler)	Wildlife Supply Company* Indonesia		

So far, there is no environmental standard for ambient air quality in Republic of Myanmar, the survey result was evaluated by comparing with the standards in neighboring country like Thailand, Vietnam,

Japan and IFC (Table 2). The consultant will apply the air quality standard in Thailand, Vietnam, Japan and IFC as shown in Table 1.As for TSP and PM10, the standards in Thailand were applied and the others were compared with the standards in Japan.

Table 2 Ambient Air Quality Standard in Southeast Asia

Item	Averaging period	Japan	Thailand	Vietnam	IFC
SO_2	10 min	-	-		0.5mg/m³
	1hour	0.1ppm	0.3ppm	0.35mg/m³	0.125mg/m³(InterimTarget-3) 0.05mg/m³(InterimTarget-2) 0.02mg/m³(Guideline)
	24hours	0.04ppm	0.12ppm	0.125mg/m³	-
	1year			0.06mg/m³	-
NO_2	1hour	-	0.32ppm		0.2mg/m³
	24hours	0.04-0.06ppm	-	-	
	1year	-	0.03ppm	-	0.04mg/m³
NOx	1hour	-		0.2mg/m³	
	24hours	-	-	0.04mg/m³	
CO	1hour	-	30ppm	30mg/m³	-
	8hours	20ppm	-	10mg/m³	-
	24hours	10ppm	9ppm		
TSP	1hour	-	-	0.3mg/m³	-
	24hours	-	0.33mg/m³	0.2mg/m³	-
	1year		0.10mg/m³	0.14mg/m³	
PM_{10}	24hours	-	0.12mg/m³	0.15mg/m³	0.15mg/m³(InterimTarget-1) 0.10mg/m³(InterimTarget-2) 0.07mg/m³(InterimTarget-3)
	1year	-	0.05mg/m³	0.05mg/m³	0.07mg/m³(InterimTarget-1) 0.05mg/m³(InterimTarget-2) 0.03mg/m³(InterimTarget-3)
SPM	1hour	0.2mg/m³	-	-	-
	24hours	0.1mg/m³	-	-	-
$PM_{2.5}$	24hours	0.035mg/m³	0.05mg/m³	-	0.075mg/m³(InterimTarget-1) 0.05mg/m³(InterimTarget-2) 0.0375mg/m³(InterimTarget-3)
	1year	0.015mg/m³	0.025mg/m³	-	0.035mg/m³(InterimTarget-1) 0.025mg/m³(InterimTarget-2) 0.01mg/m³(InterimTarget-3)
Ozone	1hour	-	0.10ppm	0.3mg/m³	-
	8hourdaily maximum	-	0.07ppm	0.2mg/m³	0.16mg/m³(InterimTarget-1) 0.1mg/m³(Guideline)
	1year	-	0.04ppm	0.14mg/m³	-
Ox	1hour	0.06ppm		-	-
Pb	24hours	-		0.005mg/m³	
	1month	-	0.0015mg/m³	-	
	1year			0.0005mg/m³	

Source: National Air Quality Standard in Japan (Circular No.25,1973, original y), Ministry of Environment, Japan
Notifications of National Environmental Board No.10, 24,28,33, and 36, Ministry of Natural Resources and Environment, Thailand
National Ambient Air Quality Standard (TCVN5937:2005), Ministry of Science and Technology in Vietnam
Environmental, Health, and Safety Guidelines, General EHS Guidelines, IFC, 2007

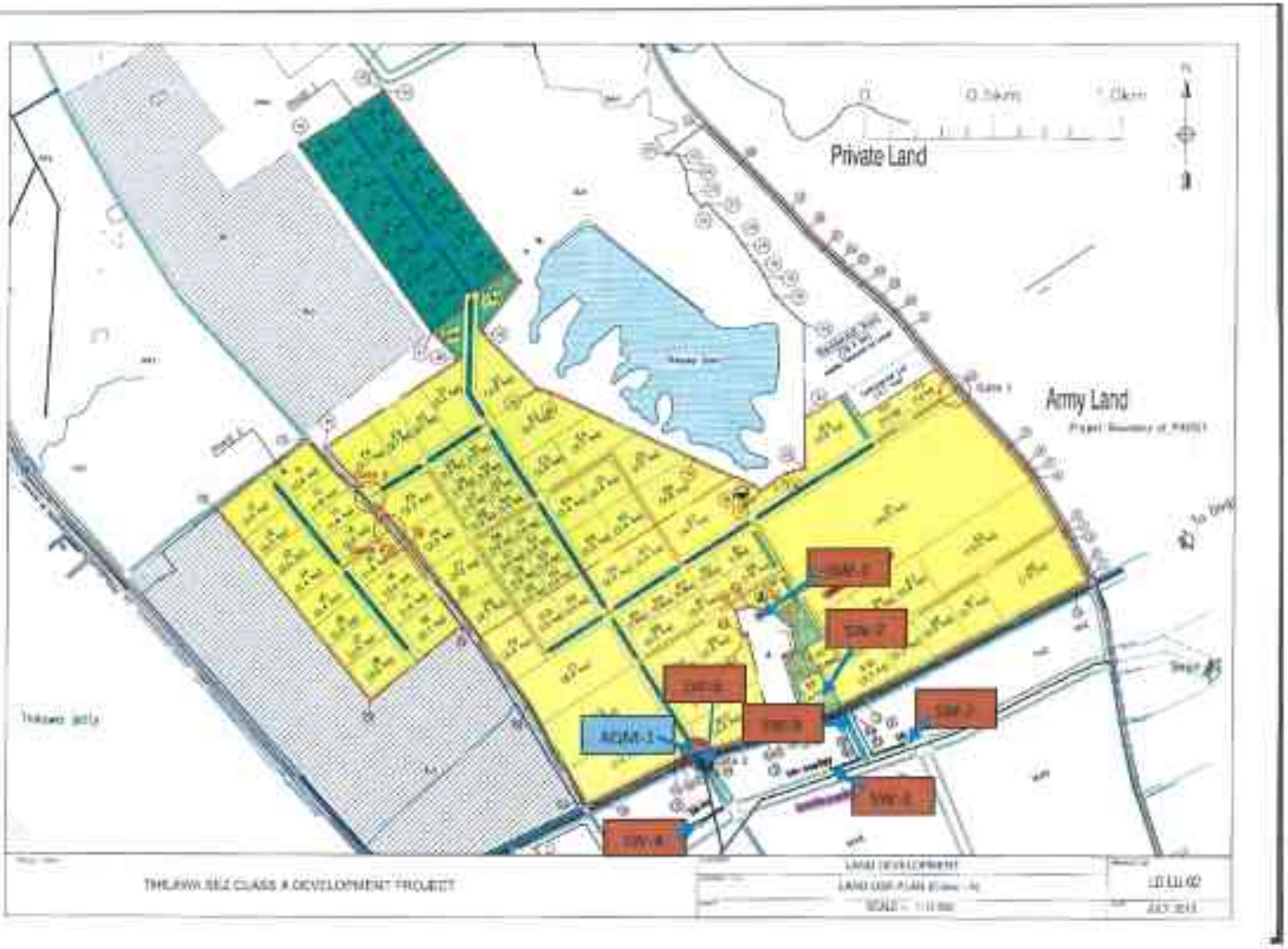

Figure 1 **Location of air and water monitoring points**

2. Description of the air quality monitoring station

Survey Period

Air quality survey was conducted once per 3 months as per specification provided by the client. The monitoring period was about 7 consecutive days. The sampling duration for each day is as shown in Table 3. Air quality monitoring location is shown in Figure 2.

Table 3 Sampling Duration for Air Quality Survey

Day	Fourth Survey (20th – 27th May, 2015)
Day 1	May 20th – 21st
Day 2	May 21st – 22nd
Day 3	May 22nd – 23rd
Day 4	May 23rd – 24
Day 5	May 24th – 25th
Day 6	May 25th – 26th
Day 7	May 26th – 27th

Source: Source: Resource & Environment Myanmar Co., Ltd.

Survey Method

Sampling and analysis of ambient air pollutants was conducted by referring to the recommendation of United States Environmental Protection Agency (U.S. EPA). The Haz-Scanner Environmental Perimeter Air Station (EPAS) was used to collect Ambient Air Monitoring data. The characteristics of the instrument are:

- Portable direct reading
- Configure up to 14 simultaneous air measurements including U.S. EPA criteria air pollutants

The basic specifications of the instrument are as follow.

Instrument	Brand	Model	Measurement/ Parameter
Environmental Perimeter Air Monitoring System	HAZ-SCANNER	EPAS	CO, NO_2, NO, SO_2, PM (2.5), PM (10), VOCS, Relative Humidity, Temperature, Wind Speed, Wind Direction

Figure 2 **Location and site condition of air quality monitoring station.**

Table 4 Sampling and Analysis Method for Air Quality

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

Source: Resource &Environment Myanmar Co., Ltd.

Table 5 Target Ambient Air Quality Level

Parameters	Averaging Period	Value
SO_2	24 hours	0.12 ppm[1]
CO	24 hours	9 ppm[1]
NO_2	24 hours	0.04 – 0.06 ppm[2]
TSP	24 hours	0.33 mg/m3[1]
PM10	24 hours	0.12g/m3[1]

1 Thailand Standard
2 Japan Standard

Survey Result

One day average concentration of CO, NO_2, TSP, PM 10 and SO_2 are shown in Table 5. Hourly average data are presented in Appendix -1.

Table 6 One day average concentration of CO, NO_2, TSP, PM10 and SO2

	Date	Time	CO	NO2	TSP	PM (10)	SO2
	D.M.Y	Hours	ppm	ppm	mg/m3	mg/m3	ppm
1	20th-21st May, 2015	24	0.26	0.03	0.01	0.00	0.00
2	21st-22nd May, 2015	24	0.31	0.03	0.01	0.00	0.00
3	22nd-23rd May, 2015	24	1.17	0.03	0.00	0.00	0.00
4	23rd-24th May, 2015	24	1.17	0.03	0.00	0.00	0.00
5	24th-25th May, 2015	24	0.39	0.03	0.01	0.01	0.00
6	25th-26th May, 2015	24	0.31	0.03	0.02	0.00	0.01
7	26th-27th May, 2015	24	0.29	0.03	0.02	0.01	0.00
Maximum		24	1.17	0.03	0.02	0.01	0.01
Average		24	0.56	0.03	0.01	0.00	0.00
Minimum		24	0.26	0.03	0.00	0.00	0.00
Target Value		24	10	<0.06	<0.33	<0.12	<0.04

Source: Resource & Environment Myanmar Co., Ltd

Concentration levels of all parameters are within the standard in this month.

3. Water Quality Monitoring

Methodology

Sampling and preservation method

Water samples were taken by Alpha horizontal water sampler and collected in sterilized sample containers. All sampling was in strict accordance with recognized standard procedures. The parameters pH, temperature, dissolved oxygen (DO), electrical conductivity (EC), were measured at each site concurrently with sample collection. All samples were kept in iced boxes and were transported to the laboratory and stored at 2-4 °C refrigerators.

Table 7 Field Equipment for Water Quality Survey

No.	Equipment	Manufacturer	Origin ate Country	Model
1	pH meter	HANNA	USA	HI7609829-1 pH Sensor
2	DO meter	HANNA	USA	HI7609829-2
3	Digital Water Velocity Meter	Global Water Flow Probe	USA	FP 211
4	Alpha Bottle (Water Sampler)	Wildlife Supply Company®	ndonesia	-

Table 8 Container and Preservation Method for 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

Test method

Table 9 The following table provides the test method for water quality.

No	Item	Analysis method
1	pH	HI7609829-1 pH Sensor
2	Suspended Solids	Gravimetric method
3	Dissolved Oxygen (DO)	HI7609829-2 Galvanic dissolved oxygen (D O) sensor
4	Chemical oxygen demand(COD)	Dichromate method
5	Biochemical oxygen demand(BOD_5)	Direct inoculation method
6	Oil & Grease	APHA-AWWA-WEF Method
7	Chemical (Cl) (mg/l)	APHA-AWWA-WEF Method
8	E. coliform, Fecal coliforms, total coliforms	AOAC Petrifilm Method

Monitoring Result (April 2015)

No	Item	GW 1	Standard	Unit
1	pH	6.50	5.9	-
2	Suspended Solids	ND	Max. 200	mg/L
3	Dissolved Oxygen (DO)	6.74	-	mg/L
4	Chemical oxygen demand(COD)	31.8	Max. 300	mg/L
5	Biochemical oxygen demand(BOD_5)	3.7	Max. 200	mg/l
6	Oil & Grease	ND	Max. 5	mg/l
7	Chromium (Cr) (mg/l)	0.00000	Max. 0.5	mg/l
8	E. coliform	<1.1		MPN/100ml
9	Fecal coliforms	<1.1		MPN/100ml
10	Total coliforms	<1.1	Max.400	MPN/100ml

Remark: ND is Not Detected.

Result of the Water Quality Monitoring

For this sampling time in May 2015, only ground water sample, GW-1 was surveyed and surface water, the rest of sampling points were missed in survey because the water in the stream was not enough to be collected for survey.

According to the Lab result of GW-1, all of parameters are not higher than the MOI standard.

Detailed of laboratory result data are provided in appendix.

Appendix 1

Hourly Air Quality Result

Resource & environment Myanmar Co., Ltd.

Client: Myanmar Japan Thilawa Development Ltd.

Issued Date : 20-05-2015

Analysis Report

Project Name : Thilawa Special Economic Zone (TSEZ)
Sample Designated as : Ambient Air Quality Analysis
Sampling Location : AQM 1 (May _TSEZ)

Date	Time	CO	NO2	TSP	PM10	SO2
D.M.Y	H.M.S	ppb	ppb	ug/m3	ug/m3	ppb
20.5.2015	11:00-12:00	979.25	34.36	6.68	3.85	0.00
20.5.2015	12:00-13:00	28.00	34.93	6.07	8.10	0.00
20.5.2015	13:00-14:00	36.67	35.15	5.37	3.00	0.00
20.5.2015	14:00-15:00	646.67	34.98	3.30	3.00	0.00
20.5.2015	15:00-16:00	341.86	35.19	5.58	3.00	0.00
20.5.2015	16:00-17:00	503.33	35.32	5.70	3.05	0.00
20.5.2015	17:00-18:00	26.67	35.00	6.52	3.48	0.00
20.5.2015	18:00-19:00	8.33	34.57	6.68	4.25	6.70
20.5.2015	19:00-20:00	116.67	34.53	6.47	3.45	1.05
20.5.2015	20:00-21:00	50.00	34.98	5.35	3.23	0.00
20.5.2015	21:00-22:00	40.00	34.97	5.93	4.15	0.53
20.5.2015	22:00-23:00	118.33	35.05	6.07	3.92	0.43
20.5.2015	23:00-00:00	123.33	34.72	6.15	3.90	0.00
21.5.2015	00:00-01:00	78.33	34.80	5.05	3.98	0.40
21.5.2015	01:00-02:00	130.00	34.93	5.90	3.82	0.00
21.5.2015	02:00-03:00	48.33	34.62	6.98	3.80	0.52
21.5.2015	03:00-04:00	53.33	34.30	6.33	3.88	0.30
21.5.2015	04:00-05:00	176.67	35.28	7.12	4.03	0.33
21.5.2015	05:00-06:00	135.00	35.03	7.87	4.82	3.00
21.5.2015	06:00-07:00	875.00	35.32	8.82	3.38	1.33
21.5.2015	07:00-08:00	850.00	34.52	9.03	3.58	0.43
21.5.2015	08:00-09:00	110.00	34.73	9.30	4.90	0.30
21.5.2015	09:00-10:00	116.67	35.18	7.18	4.87	8.25
21.5.2015	10:00-11:00	661.67	34.80	5.65	3.18	0.00
MAX	24hours	979.25	35.32	9.30	8.10	8.25
MIN	24hours	8.33	34.30	3.30	3.00	0.00
Average	24hours	260.59	34.89	6.46	3.95	0.98

		ppm	ppm	mg/m3	mg/m3	ppm
MAX	24hours	0.9792	0.0353	0.0093	0.0081	0.0083
MIN	24hours	0.0083	0.0343	0.0033	0.0030	0.0000
Average	24hours	0.2606	0.0349	0.0065	0.0039	0.0010

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Date	Time	CO	NO2	TSP	PM10	SO2
D.M.Y	H.M.S	ppb	ppb	ug/m3	ug/m3	ppb
21.5.2015	11:00-12:00	146.67	34.65	5.77	3.75	2.92
21.5.2015	12:00-13:00	226.67	34.75	4.88	4.37	16.00
21.5.2015	13:00-14:00	866.67	34.77	3.12	3.00	7.95
21.5.2015	14:00-15:00	31.67	34.95	8.32	5.62	0.43
21.5.2015	15:00-16:00	0.00	35.26	6.78	3.50	6.26
21.5.2015	16:00-17:00	42.31	34.88	8.92	3.15	0.00
21.5.2015	17:00-18:00	198.25	35.00	9.47	3.40	0.67
21.5.2015	18:00-19:00	905.00	33.88	4.77	3.00	0.00
21.5.2015	19:00-20:00	656.67	34.35	15.83	3.00	0.00
21.5.2015	20:00-21:00	330.00	35.83	4.23	3.00	0.00
21.5.2015	21:00-22:00	58.33	34.78	4.72	3.03	0.00
21.5.2015	22:00-23:00	29.73	34.84	13.19	3.95	0.00
21.5.2015	23:00-00:00	23.33	34.83	11.97	3.92	0.00
22.5.2015	00:00-01:00	11.67	34.92	9.50	3.60	0.00
22.5.2015	01:00-02:00	34.69	34.55	21.27	5.63	0.00
22.5.2015	02:00-03:00	85.42	34.44	10.33	4.52	0.00
22.5.2015	03:00-04:00	23.33	34.73	12.42	5.05	0.00
22.5.2015	04:00-05:00	70.59	32.65	9.65	4.41	0.00
22.5.2015	05:00-06:00	1080.00	32.60	8.20	3.00	0.00
22.5.2015	06:00-07:00	806.00	34.57	8.40	3.00	0.00
22.5.2015	07:00-08:00	961.67	34.63	6.75	3.00	0.00
22.5.2015	08:00-09:00	90.00	34.82	7.08	3.00	1.87
22.5.2015	09:00-10:00	58.33	34.93	5.63	3.13	3.60
22.5.2015	10:00-11:00	756.82	35.89	9.98	3.00	0.73
MAX	24hours	1080.00	35.83	21.27	5.63	16.00
MIN	24hours	0.00	32.60	3.12	3.00	0.00
Average	24hours	312.24	34.56	8.80	3.67	1.68

		ppm	ppm	mg/m3	mg/m3	ppm
MAX	24hours	1.0800	0.0358	0.0213	0.0056	0.0160
MIN	24hours	0.0000	0.0326	0.0031	0.0030	0.0000
Average	24hours	0.3122	0.0346	0.0088	0.0037	0.0017

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Date	Time	CO	NO2	TSP	PM10	SO2
D.M.Y	H.M.S	ppb	ppb	µg/m3	µg/m3	ppb
22.5.2015	11:00-12:00	1038.33	34.22	7.32	3.00	7.87
22.5.2015	12:00-13:00	116.67	40.77	7.30	3.00	4.28
22.5.2015	13:00-14:00	48.53	35.13	6.52	3.00	3.20
22.5.2015	14:00-15:00	315.00	34.40	8.27	3.00	0.00
22.5.2015	15:00-16:00	38.33	34.35	9.60	3.70	0.63
22.5.2015	16:00-17:00	16.67	34.27	7.15	4.07	5.07
22.5.2015	17:00-18:00	0.00	35.10	3.32	3.00	5.88
22.5.2015	18:00-19:00	0.00	34.50	4.83	3.00	10.77
22.5.2015	19:00-20:00	0.00	34.50	5.08	3.00	0.00
22.5.2015	20:00-21:00	9.09	34.32	4.50	3.00	0.00
22.5.2015	21:00-22:00	1386.36	32.32	2.09	3.00	0.00
22.5.2015	22:00-23:00	1004.11	33.99	4.19	3.00	0.00
22.5.2015	23:00-00:00	639.62	34.47	6.58	3.00	0.00
23.5.2015	00:00-01:00	50.00	33.98	5.36	3.00	0.00
23.5.2015	01:00-02:00	55.81	35.02	10.26	3.81	0.00
23.5.2015	02:00-03:00	66.67	34.53	7.07	3.48	0.00
23.5.2015	03:00-04:00	211.67	34.68	8.15	3.53	0.00
23.5.2015	04:00-05:00	73.53	34.91	6.65	3.68	0.00
23.5.2015	05:00-06:00	59.26	34.67	4.74	3.41	0.00
23.5.2015	06:00-07:00	1561.11	33.61	5.56	3.00	0.00
23.5.2015	07:00-08:00	1124.07	34.54	11.09	3.00	0.00
23.5.2015	08:00-09:00	762.00	34.22	4.76	3.00	9.80
23.5.2015	09:00-10:00	938.33	34.45	4.00	3.23	10.63
23.5.2015	10:00-11:00	10.00	34.17	11.53	6.20	39.60
MAX	24hours	1561.11	40.77	11.53	6.20	39.60
MIN	24hours	0.00	32.32	2.09	3.00	0.00
Average	24hours	396.87	34.63	6.50	3.34	4.07

		ppm	ppm	mg/m3	mg/m3	ppm
MAX	24hours	1.5611	0.0408	0.0115	0.0062	0.0396
MIN	24hours	0.0000	0.0323	0.0021	0.0030	0.0000
Average	24hours	0.3969	0.0346	0.0065	0.0033	0.0041

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Date	Time	CO	NO2	TSP	PM10	SO2
D.M.Y	H.M.S	ppb	ppb	µg/m3	µg/m3	ppb
23.5.2015	11:00-12:00	32.00	36.88	6.42	3.88	17.92
23.5.2015	12:00-13:00	438.33	35.02	4.73	3.00	7.62
23.5.2015	13:00-14:00	1166.67	34.95	4.22	3.32	3.87
23.5.2015	14:00-15:00	278.33	34.70	7.83	5.68	20.53
23.5.2015	15:00-16:00	698.33	34.53	14.03	3.92	18.08
23.5.2015	16:00-17:00	785.00	34.88	11.03	5.23	20.68
23.5.2015	17:00-18:00	101.67	34.90	29.95	8.62	39.72
23.5.2015	18:00-19:00	0.00	34.90	19.27	7.05	41.02
23.5.2015	19:00-20:00	0.00	34.87	25.75	5.43	18.43
23.5.2015	20:00-21:00	131.67	35.00	12.13	4.28	0.00
23.5.2015	21:00-22:00	93.33	34.73	7.30	4.00	0.00
23.5.2015	22:00-23:00	90.00	34.83	9.73	3.87	0.00
23.5.2015	23:00-00:00	33.33	34.97	13.33	3.87	0.03
24.5.2015	00:00-01:00	55.00	34.62	10.17	4.67	0.00
24.5.2015	01:00-02:00	152.63	34.37	5.61	3.24	0.05
24.5.2015	02:00-03:00	70.45	34.27	8.50	3.68	0.00
24.5.2015	03:00-04:00	85.71	34.55	11.00	4.67	0.00
24.5.2015	04:00-05:00	18.33	34.47	15.40	4.08	0.00
24.5.2015	05:00-06:00	66.67	34.42	12.57	4.13	0.00
24.5.2015	06:00-07:00	1486.67	34.72	11.97	3.20	0.00
24.5.2015	07:00-08:00	953.33	34.22	5.03	3.17	0.00
24.5.2015	08:00-09:00	611.63	33.93	5.53	4.02	0.00
24.5.2015	09:00-10:00	1095.00	34.85	7.80	3.40	6.07
24.5.2015	10:00-11:00	373.33	34.70	6.90	3.77	8.27
MAX	24hours	1486.67	36.88	29.95	8.62	41.02
MIN	24hours	0.00	33.93	4.22	3.00	0.00
Average	24hours	367.39	34.76	11.09	4.34	8.43

		ppm	ppm	mg/m3	mg/m3	ppm
MAX	24hours	0.0320	0.0369	0.0068	0.0039	0.0179
MIN	24hours	0.4383	0.0350	0.0047	0.0030	0.0076
Average	24hours	1.1667	0.0350	0.0042	0.0033	0.0039

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Analysis Report

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Date	Time	CO	NO2	TSP	PM10	SO2
D.M.Y	H.M.S	ppb	ppb	µg/m3	µg/m3	ppb
24.5.2015	11:00-12:00	480.00	34.65	5.73	3.63	15.25
24.5.2015	12:00-13:00	733.33	34.73	7.52	6.77	3.97
24.5.2015	13:00-14:00	1086.67	35.20	6.63	3.47	2.45
24.5.2015	14:00-15:00	451.67	34.20	10.98	6.67	0.07
24.5.2015	15:00-16:00	0.00	34.97	12.07	6.58	11.28
24.5.2015	16:00-17:00	61.67	34.33	8.03	6.22	10.78
24.5.2015	17:00-18:00	33.33	34.07	11.88	7.60	20.00
24.5.2015	18:00-19:00	1.85	34.13	41.43	11.28	26.61
24.5.2015	19:00-20:00	25.00	34.39	13.18	5.89	0.00
24.5.2015	20:00-21:00	225.00	30.50	18.50	5.25	0.00
24.5.2015	21:00-22:00	973.33	34.78	16.23	5.67	0.00
24.5.2015	22:00-23:00	410.94	34.53	28.55	6.03	0.00
24.5.2015	23:00-00:00	44.64	34.39	21.39	5.27	0.00
25.5.2015	00:00-01:00	36.36	34.18	15.45	4.43	0.00
25.5.2015	01:00-02:00	40.00	35.03	18.25	4.18	0.00
25.5.2015	02:00-03:00	221.67	34.53	7.07	3.48	0.00
25.5.2015	03:00-04:00	256.67	34.65	8.12	3.53	0.00
25.5.2015	04:00-05:00	70.00	35.02	8.70	3.85	0.00
25.5.2015	05:00-06:00	381.67	35.28	11.52	4.92	3.35
25.5.2015	06:00-07:00	485.00	34.92	16.25	4.87	4.00
25.5.2015	07:00-08:00	1075.00	35.10	12.75	3.75	0.00
25.5.2015	08:00-09:00	750.00	34.98	27.05	6.78	0.00
25.5.2015	09:00-10:00	640.00	40.50	17.05	5.80	2.25
25.5.2015	10:00-11:00	858.33	34.60	11.65	4.65	0.13
MAX	24hours	1086.67	40.50	41.43	11.28	26.61
MIN	24hours	0.00	30.50	5.73	3.47	0.00
Average	24hours	389.26	34.74	14.83	5.44	4.17

		ppm	ppm	mg/m3	mg/m3	ppm
MAX	24hours	1.0867	0.0405	0.0414	0.0113	0.0266
MIN	24hours	0.0000	0.0305	0.0057	0.0035	0.0000
Average	24hours	0.3893	0.0347	0.0148	0.0054	0.0042

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Sampling Location : AQM 1 (May _TSEZ)

Date	Time	CO	NO2	TSP	PM10	SO2
D.M.Y	H.M.S	376.67	34.63	15.33	3.75	0.00
25.5.2015	11:00-12:00	461.67	34.90	9.45	1.82	0.00
25.5.2015	12:00-13:00	15.00	34.32	14.30	4.53	0.00
25.5.2015	13:00-14:00	153.97	34.02	16.75	4.10	0.00
25.5.2015	14:00-15:00	14.04	34.95	18.44	8.19	3.05
25.5.2015	15:00-16:00	0.00	35.37	9.42	2.25	24.83
25.5.2015	16:00-17:00	270.00	34.98	13.68	3.32	4.27
25.5.2015	17:00-18:00	95.24	34.52	24.60	6.14	2.81
25.5.2015	18:00-19:00	62.96	34.56	28.74	5.11	7.04
25.5.2015	19:00-20:00	105.00	34.62	31.87	4.43	1.28
25.5.2015	20:00-21:00	216.67	34.87	39.80	5.77	0.00
25.5.2015	21:00-22:00	141.67	34.72	37.97	4.92	0.00
25.5.2015	22:00-23:00	59.09	34.09	35.55	2.82	0.00
25.5.2015	23:00-00:00	40.00	34.82	24.20	2.47	0.28
26.5.2015	00:00-01:00	51.67	34.87	11.28	3.28	1.87
26.5.2015	01:00-02:00	56.67	35.00	13.47	3.22	8.60
26.5.2015	02:00-03:00	33.33	34.75	11.78	3.65	11.18
26.5.2015	03:00-04:00	61.67	34.02	19.07	4.68	1.45
26.5.2015	04:00-05:00	211.67	33.95	20.75	6.33	29.53
26.5.2015	05:00-06:00	930.00	34.88	9.70	2.52	0.23
26.5.2015	06:00-07:00	275.00	34.33	8.43	2.53	0.00
26.5.2015	07:00-08:00	883.33	34.92	7.03	1.35	0.05
26.5.2015	08:00-09:00	1180.00	34.93	10.92	1.78	2.98
26.5.2015	09:00-10:00	971.67	34.10	8.08	1.08	0.00
26.5.2015	10:00-11:00	1180.00	35.37	39.80	8.19	29.53
MAX	24hours	0.00	33.95	7.03	1.08	0.00
MIN	24hours	277.79	34.63	18.36	3.75	4.14
Average	24hours	311.26	34.66	19.38	3.95	5.37

		ppm	ppm	mg/m3	mg/m3	ppm
MAX	24hours	0.0000	0.0340	0.0070	0.0011	0.0000
MIN	24hours	0.2778	0.0346	0.0184	0.0038	0.0041
Average	24hours	0.3113	0.0347	0.0194	0.0039	0.0054

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Date	Time	CO	NO2	TSP	PM10	SO2
D.M.Y	H.M.S	ppb	ppb	µg/m3	µg/m3	ppb
26.5.2015	11:00-12:00	488.33	34.90	8.83	3.75	0.00
26.5.2015	12:00-13:00	1058.33	35.58	6.93	3.18	0.00
26.5.2015	13:00-14:00	516.67	34.33	18.23	5.52	0.00
26.5.2015	14:00-15:00	276.67	34.75	16.82	5.18	0.00
26.5.2015	15:00-16:00	91.67	34.03	20.90	8.78	0.00
26.5.2015	16:00-17:00	0.00	33.57	21.30	10.77	0.58
26.5.2015	17:00-18:00	0.00	34.57	30.02	11.12	32.98
26.5.2015	18:00-19:00	0.00	34.38	22.12	8.02	27.98
26.5.2015	19:00-20:00	0.00	34.65	22.92	10.38	21.77
26.5.2015	20:00-21:00	0.00	34.98	24.91	14.65	10.77
26.5.2015	21:00-22:00	6.38	33.34	11.23	5.21	0.87
26.5.2015	22:00-23:00	100.00	34.85	10.62	4.93	2.32
26.5.2015	23:00-00:00	110.00	35.15	13.47	5.22	4.27
27.5.2015	00:00-01:00	98.33	34.72	13.38	5.13	0.00
27.5.2015	01:00-02:00	114.29	34.38	20.40	5.52	0.00
27.5.2015	02:00-03:00	94.74	34.09	12.42	5.00	0.02
27.5.2015	03:00-04:00	688.33	35.07	15.97	7.90	0.00
27.5.2015	04:00-05:00	0.00	34.32	12.38	6.82	8.35
27.5.2015	05:00-06:00	91.67	34.87	20.80	9.25	1.98
27.5.2015	06:00-07:00	190.20	34.90	18.98	8.61	0.41
27.5.2015	07:00-08:00	328.30	34.34	28.64	7.74	4.70
27.5.2015	08:00-09:00	1246.67	34.43	17.13	4.27	0.35
27.5.2015	09:00-10:00	1200.00	34.33	23.55	5.98	0.10
27.5.2015	10:00-11:00	345.16	35.06	33.58	7.29	0.35
MAX	24hours	1246.67	35.58	33.58	14.65	32.98
MIN	24hours	0.00	33.07	6.93	3.18	0.00
Average	24hours	293.57	34.48	18.56	7.09	4.91

		ppm	ppm	mg/m3	mg/m3	ppm
MAX	24hours	1.2467	0.0356	0.0336	0.0146	0.0330
MIN	24hours	0.0000	0.0331	0.0069	0.0032	0.0000
Average	24hours	0.2936	0.0345	0.0186	0.0071	0.0049

Resource & environment Myanmar Co., Ltd.

Client: Myanmar Japan Thilawa Development Ltd.

Issued Date : 29-05-2015

Analysis Report

Project Name : Thilawa Special Economic Zone (TSEZ)
Sample Designated as : Ambient Air Quality Analysis
Sampling Location : AQM 1 (May TSEZ)

	Date	Time	CO	NO2	TSP	PM (10)	SO2
	D.M.Y	Hours	ppm	ppm	mg/m3	mg/m3	ppm
1	20th-21st May, 2015	24	0.2606	0.0349	0.0065	0.0039	0.0010
2	21st-22nd May, 2015	24	0.3122	0.0346	0.0088	0.0037	0.0017
3	22nd-23rd May, 2015	24	1.1607	0.0350	0.0042	0.0033	0.0039
4	23rd-24th May, 2015	24	1.1667	0.0350	0.0042	0.0033	0.0039
5	24th-25th May, 2015	24	0.3893	0.0347	0.0148	0.0051	0.0042
6	25th-26th May, 2015	24	0.3113	0.0347	0.0194	0.0039	0.0054
7	26th-27th May, 2015	24	0.2956	0.0345	0.0186	0.0107	0.0049

	Date	Time	CO	NO2	TSP	PM (10)	SO2
	D.M.Y	Hours	ppm	ppm	mg/m3	mg/m3	ppm
1	20th-21st May, 2015	24	0.26	0.03	0.01	0.00	0.00
2	21st-22nd May, 2015	24	0.31	0.03	0.01	0.00	0.00
3	22nd-23rd May, 2015	24	1.17	0.03	0.00	0.00	0.00
4	23rd-24th May, 2015	24	1.17	0.03	0.00	0.00	0.00
5	24th-25th May, 2015	24	0.39	0.03	0.01	0.01	0.00
6	25th-26th May, 2015	24	0.3	0.03	0.02	0.00	0.01
7	26th-27th May, 2015	24	0.29	0.03	0.02	0.01	0.00
Maximum		24	1.17	0.03	0.02	0.01	0.01
Average		24	0.56	0.03	0.01	0.00	0.00
Minimum		24	0.26	0.03	0.00	0.00	0.00
Target Value		24	10	<0.06	<0.33	<0.12	<0.24

Appendix 2

Laboratory Result

ANALYSIS REPORT

ORIGINAL

Job Ref: 3119/2015
Date : 05.05.2015

Client Name	:	**RESOURCE AND ENVIRONMENT MYANMAR CO., LTD** B-702 Delta Plaza, Shwegondaing Rd, Bahan Township, Yangon, Myanmar
Project Name	:	Water Quality Monitoring in Thilawa SEZ (Near Thanlyin & Thilawa)
Sample Brought By	:	Client
Sample Received Date	:	30.04.2015
Analysed Date	:	30.04.2015

Stations	Commodity Name	Lab Code	Results (mg/l)	
			Total Suspended Solid	Oil & Grease
Method	-	-	Based on Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012; 2540 D	Based on Standard methods for the examination of water & waste water APHA ,AWWA & WEF ,22nd ed, 2012 ; 5520 B
GW-1 (29.4.2015)	Ground Water	034/15	Not Detected	Not Detected
Detection Limit			2	0.2

End Of Report

SGS (Myanmar) Limited

(Nu Nu Yi)
Manager

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; Monitoring in Thilawa SEZ

SAMPLING DATE; 29.4.2015
ISSUED DATE ; 8.5.2015

SAMPLE DESIGNATED AS; Water Quality

SAMPLING LOCATION; Near Thanlyin &Thilawa

Sr No	Station	Results (mg/l)		
		BOD_5	COD	Cr
1	GW-1 Thilawa SEZ 29.4.2015	8.7	21.8	0.000000
Drinking Water Standard (WHO)	Highest desirable level	6mg/l	10mg/l	-
	Maximum permissible level	Concentration at maximum permissible pollution		0.01mg/l

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

Report No. : 2015-00660 / 001 (Page 1 of 1) Issued date May 13, 2015

CLIENT : **RESOURCE AND ENVIRONMENT MYANMAR CO., LTD.**
CONTACT : Ms. Toe Toe Hlaing
ADDRESS : B702 Delta Plaza, Shwegondaing Rd., Bahan, Yangon, Myanmar
Tel. +959-73013446 Fax. +951-552901
E-mail : toetoehlainggeo@gmail.com

Analysis Report

PROJECT NAME : Water Quality Monitoring in Thilawa SEZ **SAMPLING DATE** : April 29, 2015
SAMPLE DESIGNATED AS : Groundwater Quality **SAMPLING BY** : Client
SAMPLING LOCATION : Thilawa, Myanmar

Parameters	Units	LOQ	GW-1
Total Coliform Bacteria	MPN/100mL	-	<1.1
Fecal Coliform Bacteria	MPN/100mL	-	<1.1
Escherichia Coli (E.Coli)	MPN/100mL	-	<1.1

Remarks : - 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 Imwisitwan)
Environmental Monitoring Manager

(Thepson Yomthana)
Technical Manager

SGS (THAILAND) LIMITED

TY/Client/PPT/C|

WARNING: The sample(s) to which the findings recorded herein (the "Findings") relate was (were) drawn and / or provided by the Client or by a third party acting at the Client's direction. The Findings constitute no warranty of the sample's representativeness of any goods and strictly relate to the sample(s). The Company accepts no liability with regard to the origin or source from which the sample(s) is/are said to be extracted.

Thilawa Special Economic Zone CLASS A Development Project –Phase 1

Appendix

Water and Waste Water Monitoring Report

June, 2015

RESULT OF AIR AND WATER QUALITY MONITORING

1. Introduction

This is the water quality monitoring report for June 2015 at Thilawa Special Economic Zone (TSEZ). This report sets out the environmental monitoring required throughout the construction of the Thilawa Special Economic Zone (Zone A). The terms of reference for monitoring are shown in Table 1. The location of air and water monitoring points are shown in Figure 1 and Table 1.

Terms of Reference for Monitoring

Table 1 Terms of reference for air and water quality monitoring at TSEZ.

Description	Items	Frequency	Location
Air Quality	TSP / PM10	1 time / 3months	At construction site (1point)
Waste water quality	pH, SS, DO, BOD, COD, Coliform count, oil and grease, chromium	1time / 2months	At the creek upstream and downstream which is crossed the car road (4 points)
Underground water	pH, SS, DO, BOD, COD, Coliform count, oil and grease, chromium	1time /2months	Tube well inside of Moegyoswen Monastery (1 point)

Monitoring Instrument for Air and water

No.	Instrument	Brand & Model	Measurement/ Parameter	
1.	Environmental Perimeter Air Monitoring System	HAZ-SCANNER EPAS	CO, NO_2, NO, SO_2, PM (2.5), PM (10), VOCS, Relative Humidity, Temperature, Wind Speed, Wind Direction	
3	Alpha Bottle (Water Sampler)	Wildlife Supply Company® Indonesia		

So far, there is no environmental standard for ambient air quality in Republic of Myanmar, the survey result was evaluated by comparing with the standards in neighboring country like Thailand, Vietnam, Japan and IFC (Table 2). The consultant will apply the air quality standard in Thailand, Vietnam, Japan and IFC as shown in Table 1. As for TSP and PM10, the standards in Thailand were applied and the others were compared with the standards in Japan.

Table 2 Ambient Air Quality Standard in Southeast Asia

Item	Averaging period	Japan	Thailand	Vietnam	IFC
SO_2	10 min	-	-	-	0.5mg/m³
	1hour	0.1ppm	0.3ppm	0.35mg/m³	0.125mg/m³(InterimTarget-1) 0.05mg/m³(InterimTarget-2) 0.02mg/m³(Guideline)
	24hours	0.04ppm	0.12ppm	0.125mg/m³	-
	1 year	-	-	0.05mg/m³	-
NO_2	1hour	-	0.17ppm	-	0.2mg/m³
	24hours	0.04-0.06ppm	-	-	-
	1 year	-	0.03ppm	-	0.04mg/m³
NOx	1hour	-	-	0.2mg/m³	-
	24hours			0.04mg/m³	
CO	1hour	-	30ppm	30mg/m³	-
	8hours	20ppm	-	10mg/m³	-
	24hours	10ppm	9ppm	-	-
TSP	1hour	-	-	0.3mg/m³	-
	24hours	-	0.33mg/m³	0.2mg/m³	-
	1 year		0.10mg/m³	0.14mg/m³	-
PM_{10}	24hours		0.12mg/m³	0.15mg/m³	0.15mg/m³(InterimTarget-1) 0.10mg/m³(InterimTarget-2) 0.07mg/m³(InterimTarget-3)
	1 year	-	0.05mg/m³	0.05mg/m³	0.07mg/m³(InterimTarget-1) 0.05mg/m³(InterimTarget-2) 0.03mg/m³(InterimTarget-3)
SPM	1hour	0.2mg/m³	-	-	-
	24hours	0.1mg/m³	-	-	-
$PM_{2.5}$	24hours	0.035mg/m³	0.05mg/m³		0.075mg/m³(InterimTarget-1) 0.05mg/m³(InterimTarget-2) 0.0375mg/m³(InterimTarget-3)
	1 year	0.015mg/m³	0.025mg/m³	-	0.035mg/m³(InterimTarget-1) 0.025mg/m³(InterimTarget-2) 0.015mg/m³(InterimTarget-3)
Ozone	1hour	-	0.10ppm	0.3mg/m³	-
	8hours daily maximum	-	0.07ppm	0.2mg/m³	0.16mg/m³(InterimTarget-1) 0.1mg/m³(Guideline)
	1 year		0.04ppm	0.14mg/m³	
Cd	1hour	0.06ppm	-	-	-
Pb	24hours	-	-	0.0025mg/m³	
	1 month		0.0015mg/m³		
	1 year			0.0005mg/m³	

Source: National Air Quality Standard in Japan (Circular No.25,1973, originally), Ministry of Environment, Japan
Notifications of National Environmental Board No.10, 24, 28, 33, and 36, Ministry of Natural Resources and Environment, Thailand
National Ambient Air Quality Standard (TCVN5937:2005), Ministry of Science and Technology in Vietnam
Environmental, Health, and Safety Guidelines, General EHS Guidelines, IFC, 2007

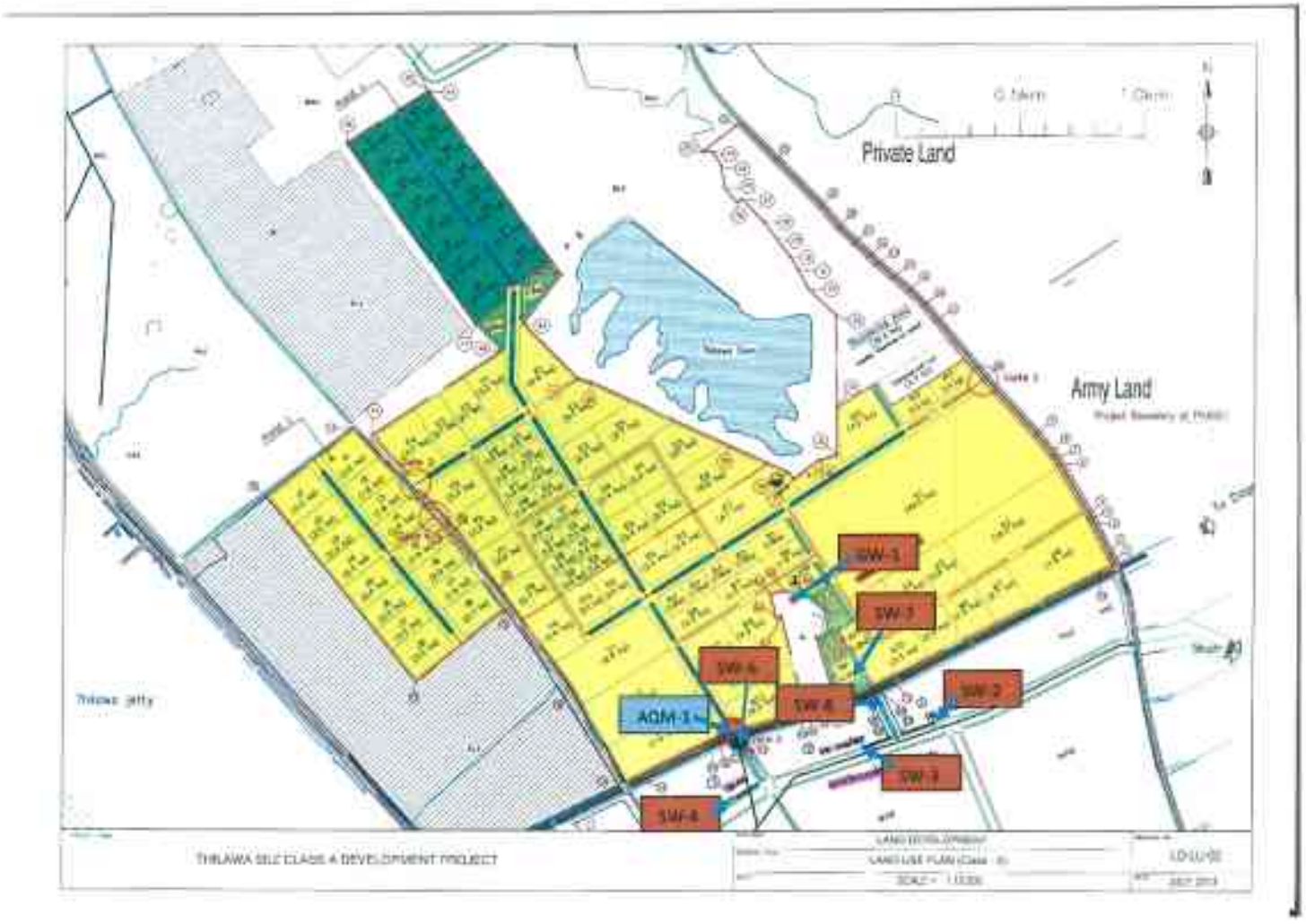

Figure 1 **Location of air and water monitoring points**

2. Water Quality Monitoring

Methodology

Sampling and preservation method

Water samples were taken by Alpha horizontal water sampler and collected in sterilized sample containers. All sampling was in strict accordance with recognized standard procedures. The parameters pH, temperature, dissolved oxygen (DO), electrical conductivity (EC), were measured at each site concurrently with sample collection. All samples were kept in iced boxes and were transported to the laboratory and stored at 2-4 °C refrigerators.

Table 7 Field Equipment for Water Quality Survey

No.	Equipment	Manufacturer	Originate Country	Model
1	pH meter	HANNA	USA	HI7609829-1 pH Sensor
2	DO meter	HANNA	USA	HI7609829-2
3	Digital Water Velocity Meter	Global Water Flow Probe	USA	FP 211
4	Alpha Bottle (Water Sampler)	Wildlife Supply Company®	Indonesia	-

Table 8 Container and Preservation Method for 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	2,800 ml plastic bottle	Refrigerate
4	Heavy metals	500 ml plastic bottle	HNO_3 Refrigerate
5	Bacteria	250 ml glass bottle (Sterilize)	Refrigerate
6	Others	1,500 ml polyethylene bottle	Refrigerate

Test method

The following table provides the test method for water quality.

No	Item	Analysis method
1	pH	H 7609829-1 pH Sensor
2	Suspended Solids	Gravimetric method
3	Dissolved Oxygen (DO)	HI7698X/9 Z Galvanic dissolved oxygen (DO) sensor
4	Chemical oxygen demand(COD)	Dichromate method
5	Biochemical oxygen demand(BOD_5)	Direct inoculation method
6	Oil & Grease	APHA-AWWA-WEF Method
7	Chromium (Cr) (mg/)	APHA-AWWA-WEF Method
8	E.coliform, fecal coliforms, total coliforms	ACAC Petrifilm Method

Monitoring Result (June 2015)

No	Item	GW-1	SW-2	SW- 3	SW- 4	SW-8	Standard	Unit
1	pH	7.65	6.43	6.96	6.39	7.65	5-9	
2	Suspended Solids	157	353	380	314	484	Max. 200	mg/l
3	Dissolved Oxygen (DO)	2.82	3.23	2.45	2.10	3.54	-	mg/l
4	Chemical oxygen demand(COD)	17.1	13.9	25.9	40.2	41.0	Max. 300	mg/l
5	Biochemical oxygen demand(BOD_5)	6.8	5.6	11.2	16.0	16.5	Max. 200	mg/l
6	Oil & Grease	ND	0.6	ND	ND	ND	Max. 5	mg/l
7	Chromium (Cr) (mg/l)	0.020242	0.020302	0.020240	0.020098	0.02020	Max. 0.5	mg/l
8	E. coli form	12	6.9	9.2	12	23	-	MPN/100ml
	Fecal coliforms	23	110	130	240	1300	-	MPN/100ml
	Total coliforms	23	240	490	1100	3500	Max.5000	MPN/100ml

Remark: ND is Not Detected.

Result of the Water Quality Monitoring (June 2015)

As the beginning of the rainy season, the total sampling points of water in project area, 5 points, were surveyed and were more than the dry season survey. According to the result of this time, the suspended solids of all sampling locations except GW-1 were still higher compared to the MOI standard as previous times. Moreover, total coliforms of SW-3, SW-4, SW-1 and SW-8 were higher than the standard.

Laboratory Result

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;Water Quality Monitoring in Thilawa SEZ
SAMPLE DESIGNATED AS; Water Quality
SAMPLING LOCATION; Near Thanlyin & Thilawa

SAMPLING DATE; 11.6.2015
ISSUED DATE ; 19.6.2015
SAMPLING BY ; Client

Sr No	Station	Results (mg/l)		Results (ppm)	Remark
		BOD_5	COD	Chromium (Cr)	
1	GW-1	6.8	17.1	0.000343	
2	SW-2	5.6	13.9	0.000368	
3	SW-3	11.2	28.9	0.000240	
4	SW-4	16.0	40.5	0.000098	
5	SW-8	16.5	41.0	0.000000	
Drinking WaterStandard (WHO)	Highest desirable level	6 mg/l	10 mg/l	—	
	Maximum permissible level	Concentration at maximum permissible pollution		0.01 mg/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

Report No. : 2015-00749 / 002 (Page 1 of 1) Issued date : June 30, 2015

CLIENT : **RESOURCE AND ENVIRONMENT MYANMAR CO., LTD.**
CONTACT : Ms. Toe Toe Hlaing
ADDRESS : B702 Delta Plaza, Shwegondaing Rd., Bahan, Yangon, Myanmar
Tel. +959-73013448 Fax. +951-552901
E-mail : toetoehlainggeo@gmail.com

Analysis Report

PROJECT NAME : Water Quality Monitoring in Thilawa SEZ **SAMPLING DATE** : June 11, 2015
SAMPLE DESIGNATED AS : Groundwater Quality **SAMPLING BY** : Client
SAMPLING LOCATION : Thilawa, Myanmar

Parameters	Units	LOQ	GW-1
Total Coliform Bacteria	MPN/100mL	-	23
Fecal Coliform Bacteria	MPN/100mL	-	23
Escherichia Coli (*E.Coli*)	MPN/100mL		12

Remarks :
- 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

(Sirikorn Inwiriahwan)
Environmental Monitoring Manager

(Thapson Yommana)
Technical Manager

SGS (THAILAND) LIMITED.

TY/Client/PPT/Cj

Report No. : 2015-00749 / 001 (Page 1 of 1) Issued date : June 30, 2015

CLIENT : RESOURCE AND ENVIRONMENT MYANMAR CO., LTD.
CONTACT : Ms. Toe Toe Hlaing
ADDRESS : B702 Delta Plaza, Shwegondaing Rd., Bahan, Yangon, Myanmar
Tel. +959-73013448 Fax. +951-552931
E-mail : toetoehlaingeo@gmail.com

Analysis Report

PROJECT NAME : Water Quality Monitoring in Thilawa SEZ **SAMPLING DATE** : June 11, 2015
SAMPLE DESIGNATED AS : Surface Water Quality **SAMPLING BY** : Client
SAMPLING LOCATION : Thilawa, Myanmar

Parameters	Units	LOQ	Results			
			SW-2	SW-3	SW-4	SW-5
Total Coliform Bacteria	MPN/100mL	-	240	1,400	1,100	3,300
Fecal Coliform Bacteria	MPN/100mL	-	130	130	240	3,300
Escherichia Coli (E.Coli)	MPN/100mL	-	6.3	5.2	12	23

Remarks : - 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 Inwilawan)
Environmental Monitoring Manager

(Thapakon Yammeng)
Technical Manager

SGS (THAILAND) LIMITED

TY/Client/PRTG

SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 4636/2015
Date : 18.06.2015

Client Name	:	**RESOURCE AND ENVIRONMENT MYANMAR CO., LTD** B-702 Delta Plaza, Shwegondaing Rd, Bahan Township, Yangon, Myanmar
Project Name	:	Water Quality Monitoring in Thilawa SEZ (Near Thanlyin & Thilawa)
Sample Brought By	:	Client
Sample Received Date	:	12.06.2015
Analysed Date	:	15.06.2015

Stations	Commodity Name	Lab Code	Results (mg/l)	
			Total Suspended Solid	Oil & Grease
Method	-	-	Based on Standard methods for the examination of water & waste water APHA ,AWWA & WEF ,22nd ed, 2012; 2540 D	Based on Standard methods for the examination of water & waste water APHA ,AWWA & WEF ,22nd ed, 2012 ; 5520 B
GW -1	Ground Water	065/15	157	ND
SW-2	Surface Water	066/15	353	0.6
SW-3	Surface Water	067/15	360	ND
SW-4	Surface Water	068/15	314	ND
SW-8	Surface Water	069/15	484	ND
Detection Limit			2	0.2

End Of Report

SGS (Myanmar) Limited

(Nu Nu Yi)
Manager

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Noise and Vibration Monitoring Report

1. Introduction

The monitoring points are located in the Thilawa SEZ class A area. The site location is shown in Figure 1. Thilawa SEZ is located beside the Thanlyin and Kyauktan towns, about 20 km southeast side of Yangon city as shown in Figure 3.1-1. Project area with 400ha is center of Thilawa SEZ with an area of about 2,400 ha. Thilawa SEZ is surrounded by ring road and accompanied with the container ports along the Yangon River.

There are 2 ways to access to Thilawa SEZ from Yangon city, which are the route passing through Thanlyin Bridge and the route passing through Dagon Bridge.

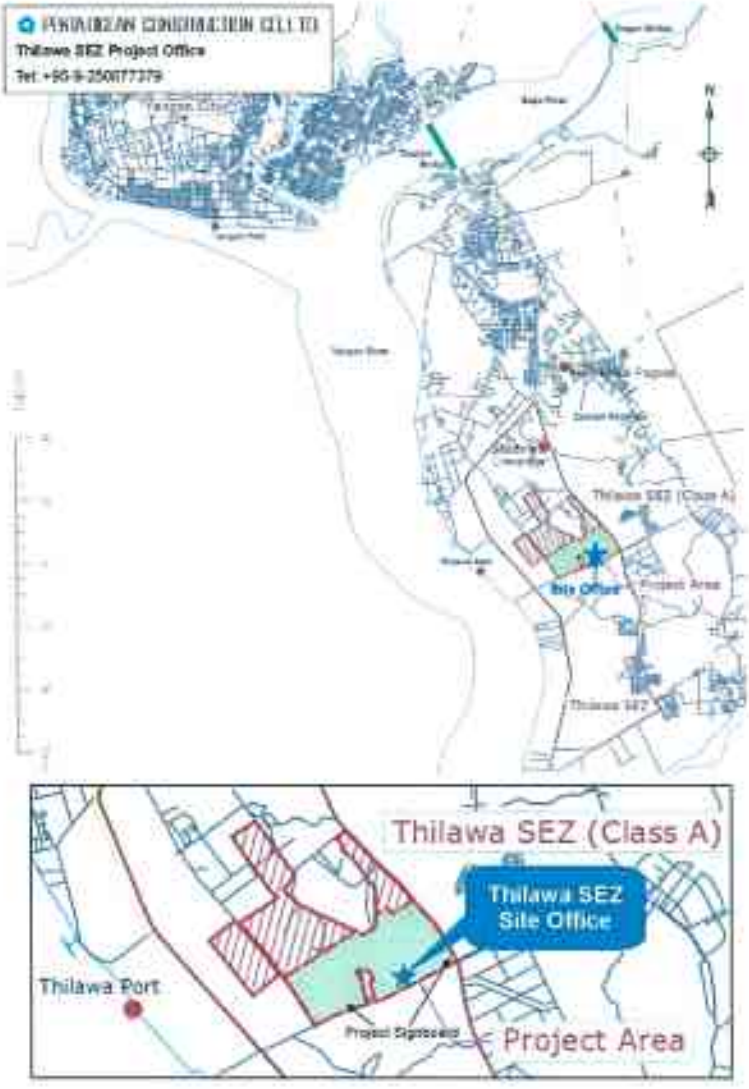

Figure 1 Location map of the Thilawa Special Economic Zone.

2. Environmental Standard

2.1 Noise

(1) Construction Phase

There is no noise standard of construction activities to receptors in Myanmar and International Organization's standards such as WHO and Environmental, Health, and Safety (EHS) Guidelines prepared by International Finance Cooperation (IFC) is a group member of World Bank, therefore the target noise level at construction stage is set based on the standard in the other foreign countries.

In the south-east Asia countries, only Singapore has the noise standard of construction activities to receptors categorized area to be quiet, residential area, and the other areas. On the basis of the above information, target noise level is set as following concept.

- Residential houses and monastery located less than 150m from the construction site comply with the middle range of the Singapore standard (categorized as "Residential buildings located less than 150m"); or
- Residential houses and monastery located more than 150m from the construction site, office, commercial facilities, and factories shall comply with the moderate range of standard Singapore standard (categorized as "Other buildings") or

This target noise level is shown in Table 1 and is not so much difference comparing with noise standard at construction stage in the other countries as shown in Table 2.

Table 1 Target Noise Level in Construction Phase

Category	Day time (Leq) (7am-7pm)	Evening Time (Leq) (7pm-10pm)	Night time (Leq) (10pm-7am)
Residential houses and monastery located less than 150m	75 dB	60 dB	55 dB
Residential houses and monastery located more than 150m from the construction site, office, commercial facilities, and factories	75 dB	65 dB	55 dB

Note) Evaluation point is at boundary of building

Table 2 Noise Standard at Construction Stage in the Various Countries

Items		Day time (Leq)	Night time (Leq)
Japan	Using heavy equipments with high noise (rolling, excavating etc.)	85 dB (Maximum)	-
Singapore	Hospitals, schools, institutions of higher learning, homes for the aged sick, etc.	60 dB (7am – 7pm, 12hrs)	50 dB (7pm – 7am, 12hrs)
	Residential buildings located less than 150m from the construction site where noise is being emitted	75 dB (7am – 7pm, 12hrs)	60 dB (7pm – 10pm, 3hrs) 55 dB (10pm – 7am, 9hrs)
	Other Buildings	75 dB (7am – 7pm, 12hrs)	65 dB (7pm – 7am, 12hrs)
U.K	In rural, suburban and urban areas away from main road traffic and industrial noise	70 dB (8:00- 8:00)	-
	Urban areas near main roads	72 db (8:00-16:00)	-
USA	Residential	90 dB (8hrs)	70 dB (8hrs)
	Commercial	85 dB (8hrs)	85 dB (8hrs)
	Urban Area with high ambient noise level (HCL 65)	Ambient Noise Level +3(dB)	

Source: Noise Regulation Act, Japan (Law No.98, 1968, Amended No.33, 2006);
Environmental Protection and Management Act in Singapore (Chap.94A, Section 77, revised in 2008);

British Standard 5228: 1997 "Noise and vibration control on open and construction sites"
Transit Noise and Vibration Impact Assessment U.S. Department of Transportation in USA, 1995

(2) Operation Phase

There is no ambient noise standard to receptors in Myanmar. However, most of the countries in south-east Asia have the ambient noise standard to receptors categorized land use or requirement of quiet as well as in Japan. International standard is also available in the EHS Guidelines prepared by IFC. On the basis of the above information, target noise level is set as following concept and target ambient noise level.

- According to baseline survey in the Project, ambient noise levels in the monastery in Thilawa SEZ (Class A) are 54-57 dB in the daytime (6:00-22:00) and 47-51 dB in the nighttime (22:00-6:00).
- Ambient noise standard for sensitive areas of Japan and International Organization, relatively high in comparison with the results of baseline survey especially during nighttime.
- Thus, the target ambient noise level for sensitive and residential area is set in accordance with the noise standard in Singapore which is similar to the ambient noise level of the baseline survey.

The target noise level is shown in Table 3 and the target noise level is not so much difference comparing with ambient noise standard as shown in Table 4.

Table 3 Target Ambient Noise Level in Operation Phase

Category	Day Time (Leq) (7am-7pm)	Evening Time (Leq) (7pm-10pm)	Night Time (Leq) (10pm-7am)
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 points is at boundary of building.

Table 4 Ambient Noise Standard at Operation Stage in South-East Countries

Items		Day time (Leq)	Night time (Leq)
Indonesia	Noise standard for sensitive areas such as residences, hospitals, schools, places of religious worships	55 dB	
	Noise standard for office and commercial	65 dB	
	Noise standard for commercial and service	70 dB	
Malaysia	Sensitive Areas/ Low Density Residential Areas	55 dB (7am – 10pm, 15hrs)	50 dB (10pm – 7am, 9hrs)
	Sub Urban Residential	60 dB (7am – 10pm, 15hrs)	55 dB (10pm – 7am, 9hrs)
	Urban Residential	65 dB (7am – 10pm, 15hrs)	60 dB (10pm – 7am, 9hrs)
	Commercial and Business	70 dB (7am – 10pm, 15hrs)	60 dB (10pm – 7am, 9hrs)
Singapore	Sensitive Areas	60 dB (7am – 7pm, 12hrs)	55 dB (7pm – 10pm, 3hr) 50 dB (10pm – 7am, 9hr)
	Residential Areas	65 dB (7am – 7pm, 12hrs)	60 dB (7pm – 10pm, 3hr) 55 dB (10pm – 7am, 9hr)
	Commercial Areas	70 dB (7am – 7pm, 12hrs)	65 dB (7pm – 10pm, 3hr) 60 dB (10pm – 7am, 9hr)
Thailand	Noise standard	70 dB (24hrs)	
Japan	Sensitive Area (Class AA)	50 dB (6am – 10pm, 16hrs)	40 dB (10pm – 6am, 8hrs)
	Residential Area (Class A and Class B)	55 dB (6am – 10pm, 16hrs)	45 dB (10pm – 6am, 8hrs)
	Commercial and Industrial Area (Class C)	60 dB (6am – 10pm, 16hrs)	50 dB (10pm – 6am, 8hrs)
IFC	Residential, institutional, educational	55 dB (7am – 10pm, 15hrs)	45 dB (10pm – 7am, 9hrs)
	Industrial, commercial	70 dB (7am – 10pm, 15hrs)	70 dB (10pm – 7am, 9hrs)

Source: Noise Standard in Indonesia (KEP-48/MENLH/11/1996)
El Sayed "Traffic Noise on Street: A Case Study in Seri Kembangan, Selangor, Malaysia, EnvironmentAsia, 2010
Environmental Protection and Management Act in Singapore (Cap.94A, Section 77, revised in 2008)
Notification of Environmental Board No. 15 B.E.2540 (1997) under the Enhancement and Conservation 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

2.2 Vibration

(3) Construction Phase

There is no vibration standard of construction activity to receptors in Myanmar as well as south east Asia and International Organizations such as WHO and IFC. Thus, the target vibration level at construction phase shall be set based on the standards in some foreign countries. Accordingly the target level of vibration in construction phase is set based on the following policies.

- Monastery and residential house where are necessary to keep quiet and sleep shall comply with the Japanese standard for residential area,

  Office, commercial facilities, and factories areas shall comply with the Japanese standard for mixed areas including residential and commercial and industrial areas, and
- The category of times divided into three types in a manner consistency with target noise level for construction.

3. Monitoring Result

Noise Level

Survey Item

Parameter for noise level survey was determined by referring the environmental quality standards in Japan as shown in Table 5.

As there are no environmental standards for noise level in Republic of Myanmar, the survey result was evaluated by comparing with the environmental standards and request limit for road noise in Japan.

Table 5 Survey Parameters for Noise Level

No	Parameter	Unit		Environmental Standard	Request Limit for road noise
				Japan	
				Living Environment	Along Road
1	A weighted loudness equivalent (LAeq)	dB	Daytime (6:00-22:00)	55	75
			Nighttime (22:00-6:00)	45	70

Note) Environmental Quality Standard for Noise (Category B: Residential Area) in Japan

Survey Location

Fifth Time Monitoring (20th – 23rd May, 2015)

Summary of sampling point

The locations of noise level points and vibration monitoring points are shown in Table 6. The detail of each sampling points are described below.

Table 6 Location of Noise and Vibration Monitoring Station

Sampling Point	Coordinates	Description of Sampling Point
ENV-1	16°42'15.8"N, 96°16'10.5"E	In front of Myanmar Maritime University; about 2 m east of car road
ENV-2	16°40'13.5"N, 96°19'34.0"E	In the Mockyeswar Monastery Compound; about 14 m away from main entrance
ENV-3	16°40'00.0"N, 96°19'35.5"E	In the Mockyeswar Monastery Compound; about 25 m away from main car road

TNV-1

The TNV-1 location was an open area in front of Myanmar Maritime University with about 2m from car road. The road was paved with low traffic volume and moderate speed. The nearest house is 20 meter away and no obstruction from trees. Dominant source of noise was vehicular traffic nearby the site. There was not any other noise source around the house. The location of TNV-1 is shown in Figure 2.

Figure 2 Location of TNV-1.

TNV-2

TNV-2 was sited at Moegyoswun Monastery Compound. The location was an open area beside monk houses with about 250m from the car road. The road was paved with low traffic. Dominant sources of noise were alarm song in the compound that ring thrice a day. There was not any other noise source around the monastery compound. The location of TNV-2 is shown in Figure 3.

Figure 3 Location of TNV-2.

TNV-3

TNV-3 was sited in front of Moegyoswun Monastery. The location was an open area beside the road

with about 260 m from the car road. The road was paved with low traffic. Dominant sources of noise were alarm song in the compound that ring thrice a day and vehicular traffic. The location of

TNV-3 is shown in Figure 4.

Figure 4 Location of TNV-3.

Survey Period

Sampling and monitoring of surrounding sound and vibration level at TNV-1, TNV-2 and TNV-3 were conducted during 20th – 23rd May, 2015.

Sampling Point	Survey Period
TNV-1	22nd – 23rd May, 2015 (24 hours)
TNV-2	20th – 21st May, 2015 (24 hours)
TNV-3	21st – 22nd May, 2015 (24 hours)

Survey Method

Sampling and monitoring of surrounding sound and vibration level were conducted by using following instrument for 24 hours/1 day measurement.

Instrument	Brand	Model	Measurement unit
Sound Level Meter	Lutron	SL-0423SD	dB
Vibration Meter	Lutron	VB-8206SD	mm/s, cm/s

a) Noise Survey

Frequency

- One time (24 hours monitoring in weekday)

Total Sample

- Three samples

Record Interval

- One record for 10 minute interval

b) Vibration Survey

Frequency

- One time (24 hours monitoring in weekday)

Total Sample

- Three samples

Record Interval

- One record for 5 seconds interval for 10 minutes during an hour

Survey Result

Noise levels (L_{Aeq}) of the monitoring points were presented in Table 7. One day L_{Aeq} was calculated by using the following array formula in the excel sheet. This formula is firstly used for hourly L_{Aeq} and then for the 24 hours L_{Aeq}.

10*LOG10(AVERGAE(10^(RANGE)/10))

By means of the calculated results, all of the noise levels found lower than the environmental standard (1-day) in Thailand. Noise level (LAeq) in present monitoring period was presented in Table 7 and Table 8. Table of observed hourly noise level in three monitoring stations is shown in Appendix 1.

Table 7 Hourly LAeq value in noise monitoring stations.

Unit: dBA

Time	TNV-1	TNV-2	TNV-3
	22nd - 23rd May	20th - 21st May	21st - 22nd May
6:00-7:00	43	52	52
7:00-8:00	54	58	55
8:00-9:00	56	58	62
9:00-10:00	58	53	57
10:00-11:00	57	46	52
11:00-12:00	77	51	50
12:00-13:00	62	51	63
13:00-14:00	52	50	56
14:00-15:00	51	59	61
15:00-16:00	48	58	62
16:00-17:00	47	63	55
17:00-18:00	62	63	55
18:00-19:00	77	63	53
19:00-20:00	56	59	49
20:00-21:00	48	59	47
21:00-22:00	48	57	47
22:00-23:00	45	51	43
23:00-24:00	50	52	40
24:00-1:00	41	50	42
1:00-2:00	36	53	44
2:00-3:00	41	58	41
3:00-4:00	48	47	38
4:00-5:00	39	50	41
5:00-6:00	41	52	45

Table 8 A-weighted Loudness Equivalent (LAeq) Level

Unit dB(A)

Date	TNV-1 22nd - 23rd May 2015			TNV-2 20th – 21st May 2015			TNV-3 21st – 22nd May 2015		
	Day Time	Evening Time	Night Time	Day Time	Evening Time	Night Time	Day Time	Evening Time	Night Time
	57	50	43	56	58	51	56	48	42
Target Noise Level	75	65	65	75	60	55	75	60	55

Vibration

Vibration can be defined as regularly repeated movement of a physical object about a fixed point. The parameter normally used to assess the ground vibration is the peak particle velocity (ppv) expressed in millimeters per second (mm/s).

Vibration can cause varying degrees of damage in buildings and affect vibration-sensitive machinery or equipment. Its effect on people may be to cause disturbance or annoyance or, at higher levels, to affect a person's ability to work.

Typical levels measured during construction activities are shown below:

Construction Activity	Typical Ground Vibration Level
Vibratory roller	Up to 1.5mm/s @ 25m
Hydraulic rock breakers	4.5 mm/s @ 5m, 0.4 @ 20m, 0.1 @ 50m
Compactor	30mm/s @ 5m, <0.3mm/s @30m
Pile driving	1-3m m/s @ 5m depending on soil conditions and driving technique
Bulldozer	1-2mm/s @ 5m, 0.1 @ 50m
Truck traffic (smooth surface) Truck traffic (rough surface)	<0.2mm/s @ 20m <2mm/s @ 20m

Survey location

- Three points (same location as noise survey)

Frequency

- One time (24 hours)

Methodology

- Vibration level (dB), Frequency, Velocity. Measurement of vibration level is conducted by International standard method.

Result

Vibration results were presented in Figure 5 to 7. Table of observed vibration level is presented in Appendix 2.

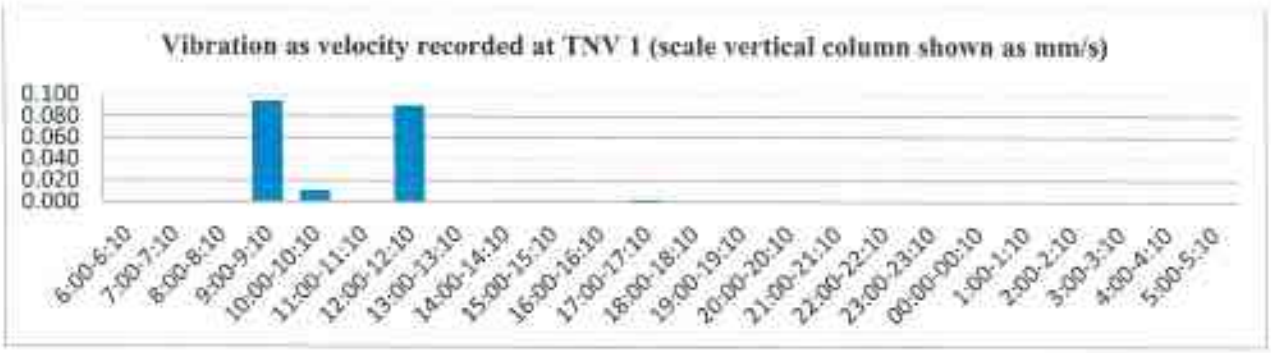

Figure 5 Vibration result of TNV 1.

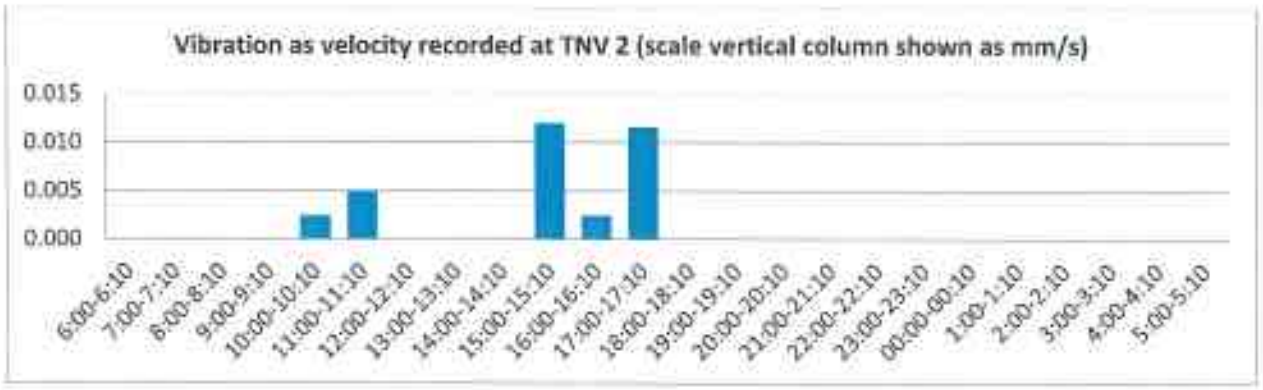

Figure 6 Vibration result of TNV 2.

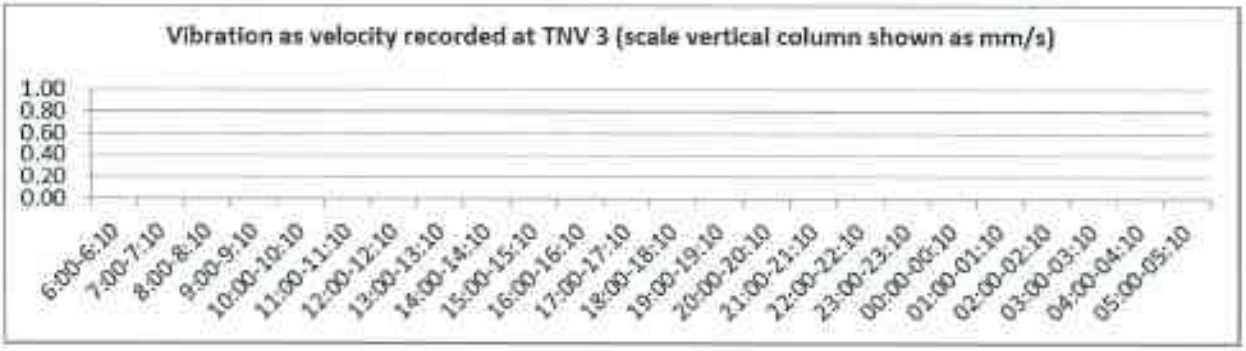

Figure 7 Vibration result of TNV 3.

4. Conclusion

The noise level monitoring results are compared with target noise level proposed in EIA report (See Table 1). Two noise receptors were designated in construction phase based on the baseline noise data.

There are :

1. Residential houses and monastery located less than 150m from the construction site comply with the middle range of the Singapore standard (categorized as "Residential buildings located less than 150m"), or
2. Residential houses and monastery located more than 150m from the construction site, office, commercial facilities, and factories shall comply with the moderate range of standard Singapore standard (categorized as "Other buildings")

The noise level monitoring at three sites in and near the project site are lower than the target noise level (See Table 8).

There is no standard relating to vibration during construction activities. Common practice in Myanmar has been to use guidance from internationally recognized standards. Vibration standards come in two varieties: those dealing with human comfort and those dealing with cosmetic or structural damage to buildings. In both instances, the magnitude of vibration is expressed in terms of Peak Particle Velocity (PPV) in millimeters per second (mm/s).

In the case of nominally continuous sources of vibration such as traffic, vibration is perceptible at around 0.5mm/s and may become disturbing or annoying at higher magnitudes. However, higher levels of vibration are typically tolerated for single events or events of short duration.

During the monitoring time there are some construction activities inside the Class A compound and the loading and unloading raw materials by small vehicles as well. The main noise and vibration source are largely road traffic noise and vibration. The observed noise and vibration in all monitoring points are lower than the target level in pre-construction phase.