MJTD

Thilawa Special Economic Zone (Zone A) Development

Environmental Monitoring Report Phase - 2(Construction Phase)

Myanmar Japan Thilawa Development Limited.

September 2016

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 from June 2016 to August 2016 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;**
We already summit EMP for Phase 2, Construction Phase Report (No.1, December 2015), Report (No.2, March 2016), Report (No3, June 2016) and Report (No.4) is submitted this day attached with Construction Phase implementation schedule.

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;**

We would like to inform that Suspended Solid at Thilawa SEZ retention pond discharge point (SW-1) and Retention Canal discharge point (SW-5) is higher than the standard. We are discussing with our environmental consultant to change the monitoring points for the SW-1 and SW-5 because that location is the mixing point of the water from the Thilawa SEZ treated water and rainwater. Rainwater includes high Suspended Solid as it is the natural surface water conditions around this area, similar to the outside of Thilawa SEZ such as SW-2, SW-3 and SW-4. After we confirmed the changed locations, we will apply to the relevant government authority to obtain approval for such change of monitoring points.

d) **Accidents or incidents relating to the occupational and community health and safety, and the environment:**
There is two case of minor accident happened and please refer to the attached Appendix (Accident Case)

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

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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.

A. Monthly Progress Report for June, 2016

B. Monthly Progress Report for July, 2016

C. Monthly Progress Report for August, 2016

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	NO_2, SO_2, CO, TSP, PM_{10}	Construction site (1point)	Once/ 3month	July 2016, Monitoring Report
Water Quality	Water temperature, pH, SS, DO, BOD, COD, coliform count, oil and grease, chromium	Construction site (6 points) Well in the Monastery (1 point)	Once/2 month	June 2016, Monitoring Report
Waste	Amount of solid waste Management of solid waste of construction	Construction site	Once/3month	Monthly Progress Reports (June, July, August) 2016
Noise and Vibration	Noise and vibration level of construction	Preservation area such as residence around the proposed construction site (2 points)	Once/3moth (peak period)	Noise and Vibration Monitoring Report July 2016
		Preservation site such as residence along the route for on-site vehicles (2points)	Once (peak period)	
Ground Subsidence	Ground elevation Consumption of ground water amount	Representative (1 point)	Every week	Monthly Progress Reports (June, July, August) 2016
Hydrology				
Risk for infectious disease such as AIDS/HIV	Status of measures of infectious disease	Construction site	Once/month	Monthly Progress Reports (June, July, August) 2016
Working conditions (including occupational safety)	Prehension of condition of occupational safety and health Prehension 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 2

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 (Not Applicable)

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 (Not Applicable)

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 - July 2016

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 Thilawa Dam	NO_2	ppm	0.036	0.029 - 0.054	N/A	N/A	0.06	Once in three months	HAZSCANNER, EPAS	
	SO_2	ppm	0.012	0.005 - 0.027	N/A	N/A	0.04		HAZSCANNER, EPAS	
	CO	ppm	0.163	0.136 - 0.188	N/A	N/A	10		HAZSCANNER, EPAS	
	TSP	ppm	0.017	0.013 - 0.028	N/A	N/A	0.33		HAZSCANNER, EPAS	
	PM10	ppm	0.029	0.021 - 0.053	N/A	N/A	0.12		HAZSCANNER, EPAS	

*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) Water Quality – June 2016

Measurement Point: Effluent of Wastewater (Thilawa SEZ's discharging point which need to be monitored according to EIA are SW-1, SW-5 and SW-6. SW-2, SW-3, SW-4 are attached as reference only for comparison to the discharging points and not necessary to monitor. They are natural creek water which are combine all the wastewater from the Local industrial water and domestic water from existing living environment. GW-1 is reference for monitoring of existing tube well located in the Monastery compound.

- 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*2	Item	Unit	Measured Value	Country's Standard	Target value to be applied	*1Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)
SW-1	pH	mg/l	6.55	None (Available Guideline Value determined by MOI)	5.0-9.0	>=4	Once in two month	pH meter,HI7609829-1 pH Sensor	
	SS*3	mg/l	138		Max.30			Gravimetric method	
	DO	mg/l	5.41		-			HI7609829-2,(D.O)sensor	
	COD_{Cr}	mg/l	11.5		Max. 70*5			Dichromate method	
	BOD	mg/l	1.3		Max. 20			Direct inoculation method	
	Oil and Grease	mg/l	<1		Max. 5			APHA-AWWA-WEF Method	
	Cr	mg/l	0.016		Max. 0.5			APHA-AWWA-WEF Method	
	Total coliforms	cfu/100ml	13		Max 400			AOAC Petrifilm Method	
SW-2 (Reference Point)	pH	mg/l	6.51	None (Available Guideline Value determined by MOI)	5.0-9.0	>=4	Once in two month	pH meter,HI7609829-1 pH Sensor	
	SS*3	mg/l	134		Max.30			Gravimetric method	
	DO	mg/l	3.75		-			HI7609829-2,(D.O)sensor	
	COD_{Cr}	mg/l	25.7		Max. 70*5			Dichromate method	
	BOD	mg/l	0.9		Max. 20			Direct inoculation method	
	Oil and Grease	mg/l	<1		Max. 5			APHA-AWWA-WEF Method	

Location*2	Item	Unit	Measured Value	Country's Standard	Target value to be applied	*1Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)
	Cr	mg/l	0.013		Max. 0.5			APHA-AWWA-WEF Method	
	Total coliforms	cfu/100ml	13		Max 400			AOAC Petrifilm Method	
SW-3 (Reference Point)	pH	mg/l	6.49	None (Available Guideline Value determined by MOI)	5.0-9.0	>=4	Once in two month	pH meter,HI7609829-1 pH Sensor	
	SS*3	mg/l	132		Max.30			Gravimetric method	
	DO	mg/l	4.78		-			HI7609829-2,(D.O)sensor	
	COD_{Cr}	mg/l	18.9		Max. 70*5			Dichromate method	
	BOD	mg/l	1.1		Max. 20			Direct inoculation method	
	Oil and Grease	mg/l	<1		Max. 5			APHA-AWWA-WEF Method	
	Cr	mg/l	0.01		Max. 0.5			APHA-AWWA-WEF Method	
	Total coliforms	cfu/100ml	790*4		Max 400			AOAC Petrifilm Method	
SW-4 (Reference Point)	pH	mg/l	6.55	None (Available Guideline Value determined by MOI)	5.0-9.0	>=4	Once in two month	pH meter,HI7609829-1 pH Sensor	
	SS*3	mg/l	183		Max.30			Gravimetric method	
	DO	mg/l	5.04		-			HI7609829-2,(D.O)sensor	
	COD	mg/l	20.1		Max. 70*5			Dichromate method	
	BOD	mg/l	1.2		Max. 20			Direct inoculation method	
	Oil and Grease	mg/l	<1		Max. 5			APHA-AWWA-WEF Method	
	Cr	mg/l	0.02		Max. 0.5			APHA-AWWA-WEF Method	
	Total coliforms	cfu/100ml	130		Max 400			AOAC Petrifilm Method	
SW-5	pH	mg/l	6.35	None (Available Guideline	5.0-9.0	>=4	Once in two month	pH meter,HI7609829-1 pH Sensor	
	SS*3	mg/l	40.5		Max.30			Gravimetric method	

Location*2	Item	Unit	Measured Value	Country's Standard	Target value to be applied	*1Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)
	DO	mg/l	5.38	Value determined by MOI)	-			HI7609829-2,(D.O)sensor	
	COD_{Cr}	mg/l	19.3		Max. 70*5			Dichromate method	
	BOD	mg/l	1.1		Max. 20			Direct inoculation method	
	Oil and Grease	mg/l	<1		Max. 5			APHA-AWWA-WEF Method	
	Cr	mg/l	0.034		Max. 0.5			APHA-AWWA-WEF Method	
	Total coliforms	cfu/100ml	79		Max 400			AOAC Petrifilm Method	
SW-6	pH	mg/l	6.47	None (Available Guideline Value determined by MOI)	5.0-9.0	>=4	Once in two month	pH meter,HI7609829-1 pH Sensor	
	SS*3	mg/l	48.2		Max.30			Gravimetric method	
	DO	mg/l	6.12		-			HI7609829-2,(D.O)sensor	
	COD	mg/l	6.4		Max. 70*5			Dichromate method	
	BOD	mg/l	0.8		Max. 20			Direct inoculation method	
	Oil and Grease	mg/l	<1		Max. 5			APHA-AWWA-WEF Method	
	Cr	mg/l	<0.01		Max. 0.5			APHA-AWWA-WEF Method	
	Total coliforms	cfu/100ml	330		Max 400			AOAC Petrifilm Method	
GW-1 (Reference Point)	pH	mg/l	6.73	N/A	None (Available Guideline Value determined by MOI)	5.5~9.0	Once in two month	pH meter,HI7609829-1 pH Sensor	
	SS	mg/l	<5			50		Gravimetric method	
	DO	mg/l	6.4			>=4		HI7609829-2,(D.O)sensor	
	COD_{Cr}	mg/l	19.5			60		Dichromate method	
	BOD	mg/l	<2			15		Direct inoculation method	
	Oil and Grease	mg/l	<1			0.1		APHA-AWWA-WEF Method	

Location*2	Item	Unit	Measured Value	Country's Standard	Target value to be applied	*1Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)
	Cr	mg/l	<0.01			0.04		APHA-AWWA-WEF Method	
	Total coliforms	cfu/100ml	2.2			7.5×10^3		AOAC Petrifilm Method	

*1Remark: Referred to the Vietnam Standard (EIA Report), Reference to the Water Quality Monitoring Report, June 2016.

*2Remark: Same locations with Phase (1) Operation Phase Water Quality monitoring because Thilawa SEZ Zone A has only two main discharging points: SW-1, SW-5 and SW-6 is wastewater discharge points from STP. SW-2, SW-3, SW-4 and GW-1 are reference for monitoring the situation of the outside of the Thilawa SEZ Zone A and not require to monitor.

*3Remark: Suspended solids concentration in SW-1 and SW-5 are higher than the standard and may be effect of the possible reason are (1) natural surface water condition around this area and (2) the reverse flow from the tide condition of the natural creek. SW-6 is also higher than the standard and it may be because of unexpected large amount of rain water is coming into Sewage Treatment Plant (STP) with high suspended solids during heavy rain of this raining reason.

*4Remark: Total Coliform content at SW-3 is higher than the standard but TSEZ discharging water from the SW-1 and SW-5 are within the standard.

*5Remark: According to the Letter Ref: No MJTD/O/15-01-105, we monitored COD by Dichromate values instead of COD by permanganate. Therefore, we have adopted target level of COD by Dichromate by Dichromate for effluent water quality discharging to the water body is 70 mg/L which is equivalent to 35mg/L COD by Permanganate from this EMP report.

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 -July 2016

Noise Level (Inside of the Thilawa Zone A expansion Area)

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)
NV-1	Leq (day)	dB(A)	60	49-67	N/A	N/A	75	Once (peak period)	Sound Level Meter	
	Leq(eve)	dB(A)	51	49-53			65			
	Leq(night)	dB(A)	48	44-50			65			

*Remark: Referred to the Noise Regulation Law- Japan (EIA Report), Reference to the Noise and Vibration Report July 2016.

Noise Level (In front of Administrative Building, Thilawa SEZ Zone A)

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)
NV-2	Leq (day)	dB(A)	66	52-71	N/A	N/A	75	Once (peak period)	Sound Level Meter	
	Leq(night)	dB(A)	52	43-57			70			

*Remark: Referred to the Noise Regulation Law- Japan (EIA Report), Reference to the Noise and Vibration Report July 2016.

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	29-July-2016	Waste Disposal	6	YCDC

Remark: Referred to Monthly Progress Report (June 2016, July 2016 and August 2016)

6) (a) Ground Subsidence and Hydrology- June 2016

Duration (Week)	Water Consumption		Ground Level		Frequency	Note
	Quantity	Unit	Quantity	Unit		
2-Jun-2016	124	m3/week	+ 6.997	m	Once a week	
9-Jun-2016	150	m3/week	+ 6.998	m		
16-Jun-2016	145	m3/week	+ 6.999	m		
23-Jun-2016	182	m3/week	+ 6.992	m		
30-Jun-2016	125	m3/week	+ 6.99	m		

*Reference to the Monthly Progress Report June 2016.

(b) Ground Subsidence and Hydrology- July 2016

Duration (Week)	Water Consumption		Ground Level		Frequency	Note
	Quantity	Unit	Quantity	Unit		
7-Jul-2016	118	m3/week	+ 6.994	m	Once a week	
14-Jul-2016	165	m3/week	+ 6.996	m		
21-Jul-2016	109	m3/week	+ 6.991	m		
28-Jul-2016	113	m3/week	+ 6.993	m		

*Reference to the Monthly Progress Report July 2016.

(c) Ground Subsidence and Hydrology- August 2016

Duration (Week)	Water Consumption		Ground Level		Frequency	Note
	Quantity	Unit	Quantity	Unit		
4-Aug-2016	123	m3/week	+ 6.994	m	Once a week	
11-Aug-2016	107	m3/week	+ 6.996	m		
18-Aug-2016	121	m3/week	+ 6.995	m		
25-Aug-2016	151	m3/week	+ 6.995	m		

*Reference to the Monthly Progress Report August 2016.

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

8) 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
An Accident was occurred on 11th July 2016 at Circle Junction area. The two vehicles were hit at the circular junction area. Nobody got injured and the two vehicles were damaged.	MJTD take the action as per following: - Negotiate between two parties - Remind to site manager and MD to reduce speed for all driver - Please refer to Attachment of Accident Report for detail.
An Accident was occurred on 9th August 2016 at near Circular Junction area. The car was hit by the motorcycle while taking circular turn at the roundabout first circular pond. The motorcyclist got knee injury and was send to clinic.	MJTD take the action as per following: - Negotiate between two parties - Remind to reduce speed and explained the traffic rules - Please refer to Attachment of Accident Report for detail.

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

The above accidents has been reported to One Stop Service Center (OSSC) and Thilawa SEZ Management Committee (TSMC).

End of Document

Thilawa Special Economic Zone (Zone A) Development Project –Phase 2

Appendix

Air Quality Monitoring Report

July, 2016

MJTD MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED

AIR QUALITY MONITORING IN THILAWA SEZ (PHASE 2, CONSTRUCTION STAGE)

July 2016

Resource & Environment Myanmar Ltd. B-702/401 Delta Plaza Building, Shwegondaing Rd., Bahan, Yangon. MYANMAR

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www.enviromyanmar.net

Survey Item

Parameters for air quality survey were determined by referring environmental air quality standard of Thailand and Japan as shown in following table.

As there is no environmental standard for ambient air quality in Republic of Myanmar, the survey result was evaluated by comparing with Japan and Thailand standards.

Table-1. Survey parameters and target levels for air quality

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	0.12 g/m3[1]

Summary of sampling points

Detail location of air quality monitoring point was shown below.

Table-2. Location of air quality monitoring station.

Sampling Point	Coordinates	Description of Sampling Point
AQ-1	16°41′13.4″N, 96°15′51.9″E	In the Zone A area, Thilawa SEZ

Figure-1 Location map of air quality monitoring point

AQ-1

This station was installed at the flat area, in the northern part of Thilawa SEZ Zone A. AQ-1 is surrounded by Thilawa dam in southeast, agricultural land and residential houses of Alwansok village in north and Garment factory in the west respectively. Possible emission source is from daily human activities in Alwansok village far about 400m from this monitoring location.

Figure-2 Air quality monitoring at AQ-1

Survey Period

Air quality monitoring was conducted seven consecutive days during July 2016. The measurement duration is shown in the following table.

Table-3 Sampling duration for air quality survey

Sampling Point	Period
AQ-1	11th- 18thJuly, 2016

Source: Resource & Environment Myanmar Co., Ltd.

Survey Method

Sampling and analysis of ambient air pollutant 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. Characteristics of the instrument are:

- Portable direct reading
- Configure up to 14 simultaneous air measurements including U.S. EPA criteria air pollutants
- Standard configuration measures PM2.5, PM10 or TSP particulates, CO, NO, NO_2, SO_2, temperature, and relative humidity
- Wind parameters are also measured by Haz-scanner EPAS and require data are analyzed by using the WRPLOT View of AERMOD View (ver. 7.0) in which calm wind is defined below 0.5 m/s.

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 Particle matter (TSP)	On site reading
5	Particle matter 10 (PM10)	On site reading

Source: Resource &Environment Myanmar Co., Ltd.

Survey Result

Daily average of ambient gases levels at AQ-1 for 7 consecutive days are presented in following tables. All ambient gases levels and particulate matters in each day are lower than the environmental standard (1-day) referred. Generally, it indicated the area had few emission sources and it was certainly to say the measured data were baseline level in the area.

Table-5. Ambient air quality at AQ-1

	Date	Time	Co	NO2	TSP	PM (10)	SO2
	D.M.Y	Hours	ppm	ppm	mg/m3	mg/m3	ppm
1	11- 12th July, 2016	Hours	0.185	0.054	0.02	0.036	0.005
2	12- 13th July, 2016	Hours	0.188	0.039	0.028	0.053	0.027
3	13- 14th July, 2016	Hours	0.16	0.042	0.014	0.023	0.005
4	14- 15th July, 2016	Hours	0.139	0.029	0.015	0.022	0.009
5	15- 16th July, 2016	Hours	0.148	0.03	0.013	0.021	0.012
6	16- 17th July, 2016	Hours	0.136	0.029	0.015	0.025	0.011
7	17- 18th July, 2016	Hours	0.183	0.031	0.016	0.022	0.013
Maximum		24	0.188	0.054	0.028	0.053	0.027
Average		24	0.163	0.036	0.017	0.029	0.012
Minimum		24	0.136	0.029	0.013	0.021	0.005
Target value		24	10	< 0.06	< 0.33	< 0.12	< 0.04

Source: Resource & Environment Myanmar Co., Ltd

Appendix

Hourly Air Results

Date	Time	CO	NO2	TSP	PM10	SO2
D.M.Y	H.M.S	ppb	ppb	µg/m3	µg/m3	ppb
11.7.2016	12:00-13:00	140.4500	68.3667	7.9833	7.7333	2.4833
11.7.2016	13:00-14:00	120.7667	33.6833	17.9333	2.8167	16.8667
11.7.2016	14:00-15:00	90.5667	47.1667	23.5833	19.3167	1.2833
11.7.2016	15:00-16:00	153.4833	44.9667	51.2167	40.7500	2.0500
11.7.2016	16:00-17:00	201.0667	52.9667	27.9500	11.2167	1.8500
11.7.2016	17:00-18:00	240.9833	38.9833	29.9333	22.4667	1.6500
11.7.2016	18:00-19:00	201.4667	75.6333	39.7167	28.2333	4.6667
11.7.2016	19:00-20:00	206.5500	59.2667	26.1500	16.5000	1.0000
11.7.2016	20:00-21:00	200.7833	62.3667	29.7667	16.6667	4.9500
11.7.2016	21:00-22:00	184.4833	60.3667	28.1500	15.4333	2.0167
11.7.2016	22:00-23:00	185.6667	61.2000	27.9333	17.9333	2.0500
11.7.2016	23:00-00:00	175.8167	65.4333	32.0000	22.8000	1.4833
12.7.2016	00:00-01:00	170.2000	64.1833	41.3167	29.1500	1.6000
12.7.2016	01:00-02:00	155.0000	64.4333	47.4833	33.5333	1.1667
12.7.2016	02:00-03:00	158.9833	55.4167	35.9833	21.3333	1.3500
12.7.2016	03:00-04:00	169.2333	36.1000	20.6833	8.6000	1.0833
12.7.2016	04:00-05:00	177.9000	58.4167	31.8333	23.4667	1.6167
12.7.2016	05:00-06:00	209.9333	48.3833	46.5833	26.2667	7.4000
12.7.2016	06:00-07:00	227.9833	60.9167	60.7333	30.0333	20.8667
12.7.2016	07:00-08:00	215.5167	54.8500	55.9833	33.0500	12.1500
12.7.2016	08:00-09:00	234.1667	49.9000	54.0500	33.8333	22.5500
12.7.2016	09:00-10:00	195.6500	50.8833	56.0667	33.7167	22.5667
12.7.2016	10:00-11:00	253.9667	73.6833	27.6500	11.3667	1.0000
12.7.2016	11:00-12:00	176.4333	26.3000	44.0833	22.2833	5.3667
MAX	24hours	253.9667	75.6333	60.7333	40.7500	22.5667
MIN	24hours	90.5667	26.3000	7.9833	2.8167	1.0000
AVERAGE	24hours	185.29	54.74	36.03	22.02	5.88

		ppm	ppm	mg/m3	mg/m3	ppm
MAX	24hours	0.253	0.075	0.06	0.04	0.02
MIN	24hours	0.09	0.026	0.007	0.002	0.001
AVERAGE	24hours	0.185	0.054	0.036	0.022	0.005

Date	Time	CO	NO2	TSP	PM10	SO2
D.M.Y	H.M.S	ppb	ppb	µg/m3	µg/m3	ppb
12.7.2016	12:00-13:00	139.0333	16.0667	52.0000	23.3333	8.2167
12.7.2016	13:00-14:00	121.6333	9.2167	44.2167	22.6167	26.6333
12.7.2016	14:00-15:00	152.9333	29.8500	66.8000	49.4167	3.7667
12.7.2016	15:00-16:00	146.8667	28.4667	70.1500	39.6500	6.9167
12.7.2016	16:00-17:00	178.2167	36.6000	34.9333	16.7000	7.5167
12.7.2016	17:00-18:00	216.7833	51.2000	12.8000	8.2500	2.9167
12.7.2016	18:00-19:00	245.3000	65.1167	44.6500	25.6167	1.6833
12.7.2016	19:00-20:00	119.6000	34.9833	53.4000	34.5333	2.6833
12.7.2016	20:00-21:00	152.0500	61.0333	42.8667	24.4167	1.8833
12.7.2016	21:00-22:00	203.4167	59.6500	53.4000	26.2000	1.1667
12.7.2016	22:00-23:00	188.3833	70.2167	57.5333	31.5833	4.7333
12.7.2016	23:00-00:00	173.7115	65.0192	57.3269	30.6346	2.6346
13.7.2016	00:00-01:00	256.5000	65.4333	16.5667	15.8333	1.0000
13.7.2016	01:00-02:00	200.4167	48.7500	59.2667	28.1167	1.0500
13.7.2016	02:00-03:00	150.0000	47.4000	62.2500	29.2167	13.2667
13.7.2016	03:00-04:00	166.6833	45.9000	63.8333	26.7500	6.2000
13.7.2016	04:00-05:00	166.8000	49.5667	67.6500	27.2500	12.6667
13.7.2016	05:00-06:00	375.5500	39.5167	67.5667	28.2333	30.3167
13.7.2016	06:00-07:00	306.0667	37.4667	75.1500	38.8500	25.2833
13.7.2016	07:00-08:00	387.4000	49.7667	66.7500	28.8833	48.6833
13.7.2016	08:00-09:00	167.8000	11.9000	44.6333	21.3333	12.7167
13.7.2016	09:00-10:00	93.8333	6.9833	53.5000	29.9000	8.6833
13.7.2016	10:00-11:00	104.1000	3.0333	38.0333	20.3167	17.6667
13.7.2016	11:00-12:00	111.1500	24.0000	75.5000	53.0500	16.1000
MAX	24hours	387.4000	70.2167	75.5000	53.0500	48.6833
MIN	24hours	93.8333	3.0333	12.8000	8.2500	1.0000
AVERAGE	24hours	188.51	39.88	53.37	28.36	11.02

		ppm	ppm	mg/m3	mg/m3	ppm
MAX	24hours	0.387	0.07	0.08	0.05	0.048
MIN	24hours	0.093	0.003	0.013	0.008	0.001
AVERAGE	24hours	0.188	0.039	0.053	0.03	0.01

Date	Time	CO	NO2	TSP	PM10	SO2
D.M.Y	H.M.S	ppb	ppb	µg/m3	µg/m3	ppb
13.7.2016	12:00-13:00	223.0833	51.6167	20.6000	8.8833	6.5500
13.7.2016	13:00-14:00	191.5833	52.3000	39.9500	25.0000	14.4833
13.7.2016	14:00-15:00	135.7833	43.2833	13.8333	5.2167	1.2167
13.7.2016	15:00-16:00	205.9667	56.0667	6.8833	4.0000	5.5333
13.7.2016	16:00-17:00	193.4500	38.2333	5.5333	3.5167	10.3833
13.7.2016	17:00-18:00	219.8167	41.1833	7.1833	5.6667	6.7833
13.7.2016	18:00-19:00	196.8000	48.1833	31.3833	18.9833	7.6667
13.7.2016	19:00-20:00	157.1667	49.5333	35.1000	22.3667	1.6333
13.7.2016	20:00-21:00	253.1833	37.8000	38.9000	18.0167	17.6333
13.7.2016	21:00-22:00	99.7333	36.2333	30.9333	11.3000	1.0167
13.7.2016	22:00-23:00	130.4833	55.4833	26.9500	16.6000	1.0167
13.7.2016	23:00-00:00	182.3500	39.6000	24.3000	11.4000	4.1833
14.7.2016	00:00-01:00	109.6667	38.9833	12.4833	5.7833	1.7167
14.7.2016	01:00-02:00	129.1000	38.8833	16.1167	11.4333	3.8500
14.7.2016	02:00-03:00	133.7833	40.7500	24.7333	16.8167	2.2333
14.7.2016	03:00-04:00	132.5833	47.7167	28.0333	19.6000	4.2167
14.7.2016	04:00-05:00	130.2667	52.0333	35.2333	24.0167	1.5667
14.7.2016	05:00-06:00	132.6333	38.5500	33.8833	26.3833	2.0500
14.7.2016	06:00-07:00	165.7500	31.1833	21.2833	9.1667	1.2333
14.7.2016	07:00-08:00	148.9500	37.3500	6.6167	1.8167	2.3833
14.7.2016	08:00-09:00	153.2000	39.2167	13.3333	8.1667	5.7833
14.7.2016	09:00-10:00	149.1167	30.3500	22.1167	18.4500	11.8333
14.7.2016	10:00-11:00	160.9000	39.8500	33.9333	30.3333	11.9500
14.7.2016	11:00-12:00	117.4333	40.1833	30.6333	19.6833	5.8667
MAX	24hours	253.1833	56.0667	39.9500	30.3333	17.6333
MIN	24hours	99.7333	30.3500	5.5333	1.8167	1.0167
AVERAGE	24hours	160.53	42.69	23.33	14.28	5.53

		ppm	ppm	mg/m3	mg/m3	ppm
MAX	24hours	0.253	0.056	0.039	0.030	0.018
MIN	24hours	0.099	0.030	0.006	0.002	0.001
AVERAGE	24hours	0.160	0.042	0.023	0.014	0.005

Date	Time	CO	NO2	TSP	PM10	SO2
D.M.Y	H.M.S	ppb	ppb	µg/m3	µg/m3	ppb
14.7.2016	12:00-13:00	134.7000	22.7500	4.8167	2.0000	7.7500
14.7.2016	13:00-14:00	153.4167	28.5333	8.1167	5.0333	8.9500
14.7.2016	14:00-15:00	145.8333	23.8333	9.6500	5.6667	12.9500
14.7.2016	15:00-16:00	116.7000	18.8167	20.3333	19.1167	11.5333
14.7.2016	16:00-17:00	145.4000	26.7667	31.2167	27.2167	7.2500
14.7.2016	17:00-18:00	167.3833	24.2667	30.1833	20.3000	4.7167
14.7.2016	18:00-19:00	125.6667	36.4167	23.5500	15.1833	1.0500
14.7.2016	19:00-20:00	135.5333	37.6167	22.0667	13.7833	5.1667
14.7.2016	20:00-21:00	154.3167	38.1167	17.1833	8.7667	7.6833
14.7.2016	21:00-22:00	182.2000	37.7667	16.1333	7.4833	14.4333
14.7.2016	22:00-23:00	184.2333	40.9500	18.7000	10.0500	5.8500
14.7.2016	23:00-00:00	176.7000	45.8333	17.9000	9.7333	4.2667
15.7.2016	00:00-01:00	105.1000	30.2833	30.5000	26.8333	3.6833
15.7.2016	01:00-02:00	110.0167	43.3667	13.4333	7.6333	27.7500
15.7.2016	02:00-03:00	125.4333	24.2333	18.3333	14.2667	5.3000
15.7.2016	03:00-04:00	121.2167	27.4333	19.4833	9.5000	5.2167
15.7.2016	04:00-05:00	141.1833	37.8500	33.2667	20.1167	11.5167
15.7.2016	05:00-06:00	189.7000	38.7000	40.0000	26.7833	12.8667
15.7.2016	06:00-07:00	166.1500	38.6500	26.2000	12.7167	6.6500
15.7.2016	07:00-08:00	138.1500	26.0833	23.3000	14.2833	17.5333
15.7.2016	08:00-09:00	148.1667	30.9667	24.4500	18.3500	2.7500
15.7.2016	09:00-10:00	127.5167	15.7500	21.0000	9.1500	22.3167
15.7.2016	10:00-11:00	84.4167	6.2833	19.0500	11.2833	3.5167
15.7.2016	11:00-12:00	81.7833	6.6000	30.7667	26.4167	3.2333
MAX	24hours	189.7000	45.8333	40.0000	27.2167	27.7500
MIN	24hours	81.78	6.28	4.82	2.00	1.05
AVERAGE	24hours	139.35	29.53	22.98	15.16	9.42

		ppm	ppm	mg/m3	mg/m3	ppm
MAX	24hours	0.189	0.045	0.040	0.027	0.028
MIN	24hours	0.081	0.006	0.004	0.002	0.001
AVERAGE	24hours	0.139	0.029	0.022	0.015	0.009

Date	Time	CO	NO2	TSP	PM10	SO2
D.M.Y	H.M.S	ppb	ppb	µg/m3	µg/m3	ppb
15.7.2016	12:00-13:00	100.9833	10.2000	21.1167	22.4667	3.9667
15.7.2016	13:00-14:00	113.2000	9.6167	11.2000	8.4000	9.0000
15.7.2016	14:00-15:00	125.3653	12.1787	12.3322	7.0281	16.5702
15.7.2016	15:00-16:00	121.5000	28.0167	29.4833	19.7833	5.1000
15.7.2016	16:00-17:00	177.2167	41.6167	13.0667	7.3000	1.6000
15.7.2016	17:00-18:00	148.0333	42.9167	22.5500	16.8500	1.0000
15.7.2016	18:00-19:00	143.4500	39.4000	3.2500	2.5667	1.0167
15.7.2016	19:00-20:00	197.7500	51.6500	15.2333	10.3667	11.0333
15.7.2016	20:00-21:00	280.1500	31.7833	32.6167	19.2500	35.2000
15.7.2016	21:00-22:00	199.5167	48.7167	29.8500	15.5167	1.7333
15.7.2016	22:00-23:00	203.3784	44.5946	25.7838	10.7838	1.4054
15.7.2016	23:00-00:00	240.0233	50.3488	25.5116	13.6512	17.5581
16.7.2016	00:00-01:00	204.1167	39.1667	47.3500	23.3167	32.8667
16.7.2016	01:00-02:00	139.3833	40.1500	31.6167	18.5500	5.4333
16.7.2016	02:00-03:00	137.7333	36.9000	17.1667	15.4833	12.3167
16.7.2016	03:00-04:00	124.0667	36.7667	19.4833	16.3167	8.1167
16.7.2016	04:00-05:00	144.3000	49.0167	25.6500	11.3500	6.6333
16.7.2016	05:00-06:00	149.5500	37.8333	25.4833	15.4333	8.8667
16.7.2016	06:00-07:00	181.0667	38.3833	25.2833	11.8000	5.0333
16.7.2016	07:00-08:00	183.2667	25.6500	17.2000	5.6333	5.2000
16.7.2016	08:00-09:00	107.6333	6.5667	16.5333	4.6333	28.2667
16.7.2016	09:00-10:00	55.6833	2.0000	8.6500	6.1167	37.9167
16.7.2016	10:00-11:00	38.6667	2.5500	24.2167	25.9500	16.5667
16.7.2016	11:00-12:00	47.8833	3.9000	27.2500	23.3667	24.1333
MAX	24hours	280.1500	51.6500	47.3500	25.9500	37.9167
MIN	24hours	38.6667	2.0000	3.2500	2.5667	1.0000
AVERAGE	24hours	148.50	30.41	21.99	13.83	12.36

		ppm	ppm	mg/m3	mg/m3	ppm
MAX	24hours	0.280	0.051	0.047	0.025	0.038
MIN	24hours	0.038	0.002	0.003	0.003	0.001
AVERAGE	24hours	0.148	0.030	0.021	0.013	0.012

Date	Time	CO	NO2	TSP	PM10	SO2
D.M.Y	H.M.S	ppb	ppb	µg/m3	µg/m3	ppb
16.7.2016	12:00-13:00	154.1000	17.0333	18.3000	12.1500	5.3833
16.7.2016	13:00-14:00	67.8333	5.2833	6.5667	5.6333	27.7167
16.7.2016	14:00-15:00	99.7000	2.4167	40.9333	31.4500	27.5000
16.7.2016	15:00-16:00	67.1833	2.0000	12.5333	13.4167	8.8000
16.7.2016	16:00-17:00	123.2333	3.4333	24.6833	25.7167	4.7167
16.7.2016	17:00-18:00	136.2667	8.6667	45.6500	30.1833	3.7833
16.7.2016	18:00-19:00	135.5667	23.7500	33.4000	32.8167	4.2333
16.7.2016	19:00-20:00	104.9500	18.0000	28.6333	19.7333	1.5000
16.7.2016	20:00-21:00	145.0667	32.3333	25.3667	11.6833	2.0000
16.7.2016	21:00-22:00	217.0167	56.4667	24.7667	11.6000	2.4500
16.7.2016	22:00-23:00	155.5333	62.5667	31.2500	15.8167	1.2833
16.7.2016	23:00-00:00	136.8667	57.0167	25.1000	16.5667	2.7500
17.7.2016	00:00-01:00	153.0167	64.3333	30.2333	12.7333	1.8167
17.7.2016	01:00-02:00	142.5500	55.9833	18.6833	7.0333	1.1667
17.7.2016	02:00-03:00	128.0833	40.8667	24.4500	11.7333	7.0500
17.7.2016	03:00-04:00	131.4167	53.8667	32.5500	17.1000	15.3000
17.7.2016	04:00-05:00	142.2500	63.5000	28.6167	18.0167	3.1167
17.7.2016	05:00-06:00	163.6500	40.6667	33.8167	16.7333	12.2333
17.7.2016	06:00-07:00	285.2833	37.2000	54.7333	24.5667	32.0333
17.7.2016	07:00-08:00	171.1000	35.2833	21.5167	13.4833	9.9833
17.7.2016	08:00-09:00	107.8833	22.5833	15.9500	7.9833	14.9667
17.7.2016	09:00-10:00	149.4667	11.4333	21.0167	8.1833	18.0500
17.7.2016	10:00-11:00	90.0833	2.2500	12.5333	5.8667	29.1667
17.7.2016	11:00-12:00	66.6833	2.0833	5.7333	7.7000	33.6500
MAX	24hours	285.2833	64.3333	54.7333	32.8167	33.6500
MIN	24hours	66.6833	2.0000	5.7333	5.6333	1.1667
AVERAGE	24hours	136.45	29.96	25.71	15.75	11.28

		ppm	ppm	mg/m3	mg/m3	ppm
MAX	24hours	0.285	0.064	0.054	0.033	0.034
MIN	24hours	0.067	0.002	0.006	0.006	0.001
AVERAGE	24hours	0.136	0.030	0.026	0.016	0.011

Date	Time	CO	NO2	TSP	PM10	SO2
D.M.Y	H.M.S	ppb	ppb	µg/m3	µg/m3	ppb
17.7.2016	12:00-13:00	20.6500	2.0000	3.3000	6.3000	26.1667
17.7.2016	13:00-14:00	0.0000	2.0000	13.8000	20.0500	5.5833
17.7.2016	14:00-15:00	0.4167	2.0000	3.4000	3.4667	24.1833
17.7.2016	15:00-16:00	62.9667	3.3167	37.9667	34.2500	15.3500
17.7.2016	16:00-17:00	165.9667	43.7167	27.4833	21.5833	2.1833
17.7.2016	17:00-18:00	206.2667	58.6333	19.4833	9.1833	6.2500
17.7.2016	18:00-19:00	242.4667	35.1833	9.7333	6.8000	2.9333
17.7.2016	19:00-20:00	285.4333	53.5500	14.5500	9.7000	8.7833
17.7.2016	20:00-21:00	317.7167	44.4833	18.5500	11.1167	4.1833
17.7.2016	21:00-22:00	424.4167	50.7833	33.7000	25.5833	26.5167
17.7.2016	22:00-23:00	560.8167	50.5000	66.6000	43.6667	22.1333
17.7.2016	23:00-00:00	305.2500	40.1500	59.0833	39.7167	5.9667
18.7.2016	00:00-01:00	191.6167	41.8333	33.3833	21.7667	2.2333
18.7.2016	01:00-02:00	144.8333	48.6833	25.1667	15.6667	1.7000
18.7.2016	02:00-03:00	164.0333	51.7833	21.2500	19.3333	4.1833
18.7.2016	03:00-04:00	164.4167	54.5667	23.5667	17.4333	2.0333
18.7.2016	04:00-05:00	164.9167	43.3167	22.7000	18.3333	2.3667
18.7.2016	05:00-06:00	195.1167	55.0833	39.8667	26.1333	14.2167
18.7.2016	06:00-07:00	254.7500	47.1333	26.5500	11.0333	21.7167
18.7.2016	07:00-08:00	161.2333	12.1000	10.6333	2.7333	14.7667
18.7.2016	08:00-09:00	93.9500	2.0000	5.3833	6.0500	32.4000
18.7.2016	09:00-10:00	57.2000	2.0000	10.6167	7.6333	32.6333
18.7.2016	10:00-11:00	162.5000	10.5833	15.7167	11.0833	15.8167
18.7.2016	11:00-12:00	47.4667	2.3333	8.4333	9.1833	24.3833
MAX	24hours	560.8167	58.6333	66.6000	43.6667	32.6333
MIN	24hours	0.0000	2.0000	3.3000	2.7333	1.7000
AVERAGE	24hours	183.10	31.57	22.95	16.58	13.28

		ppm	ppm	mg/m3	mg/m3	ppm
MAX	24hours	0.560	0.059	0.067	0.044	0.033
MIN	24hours	0.000	0.002	0.003	0.003	0.002
AVERAGE	24hours	0.183	0.032	0.023	0.017	0.013

Thilawa Special Economic Zone (Zone A) Development Project –Phase 2

Appendix

Water and Waste Water Monitoring Report

June, 2016

MJTD MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED

WATER QUALITY MONITORING IN THILAWA SEZ (PHASE 2, CONSTRUCTION STAGE)

(Bi-Monthly Monitoring)

June 2016

Resource & Environment Myanmar Ltd. B-702/401 Delta Plaza Building, Shwegondaing Rd., Bahan, Yangon. MYANMAR

Tel: (959) 7301 3448; Fax: (951) 552901

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1. INTRODUCTION

The water quality sampling points are in the Thilawa SEZ area, which is located in the Thanlyin and Kyauktan townships, about 20 km southeast of Yangon city (Figure 1). Thilawa SEZ is surrounded by ring road and accompanied with the container ports along the Yangon River.

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

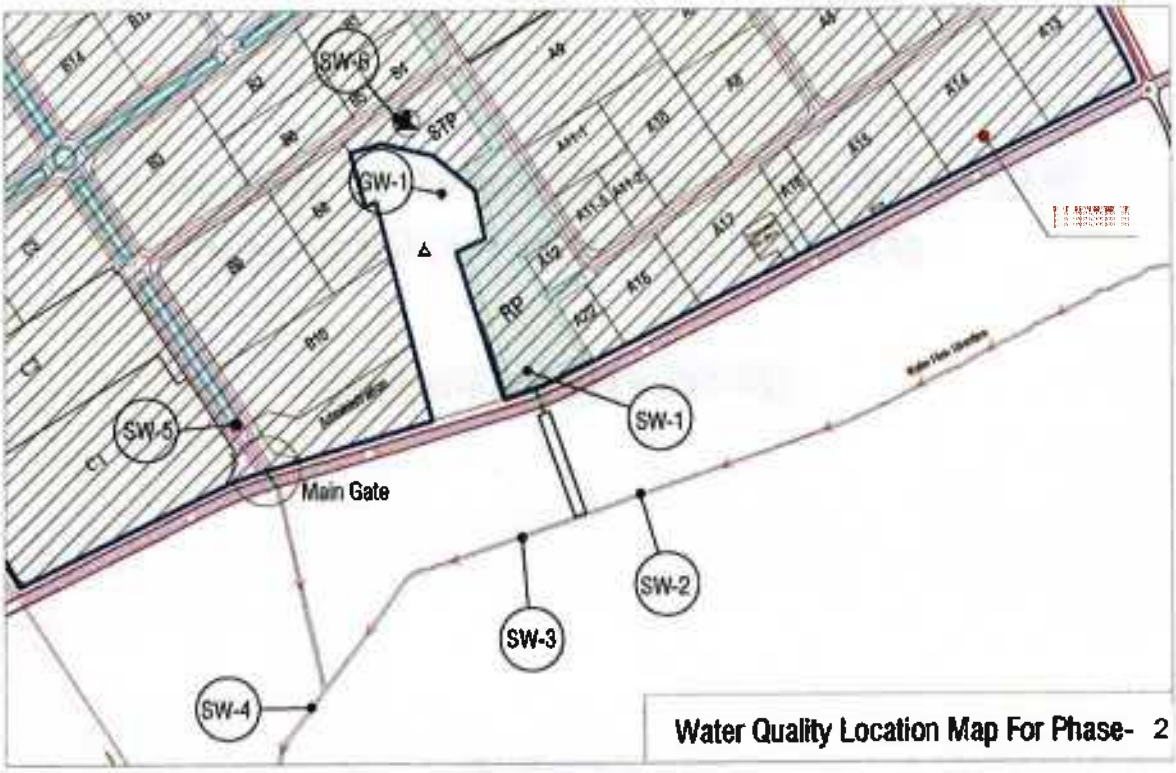

Figure 1. Location map of Thilawa SEZ area and water quality sampling locations

2. FIELD SURVEY

Water quality sampling for 21st June 2016 was conducted for proposed 7 locations.

Survey Item

Parameters for water quality survey are determined so as to cover the parameters of existing environmental standards.

Summary of sampling points

The detail of the locations of monitoring points are shown below.

Table 1. Locations of water quality sampling points

No.	Station	Type	Coordinate	Location
1.	SW-1	Surface Water	16° 40' 13.5" N 96° 16' 39.8" E	Drainage from the retention pond, Thilawa SEZ
2.	SW-2	Surface Water	16° 40' 06.0" N 96° 16' 43.1" E	Upstream of Shwe Byauk Creek, Thilawa SEZ
3.	SW-3	Surface Water	16° 40' 05.5" N 96° 16' 41.6" E	Upstream of Shwe Byauk Creek, Thilawa SEZ
4.	SW-4	Surface Water	16° 39' 54.6" N 96° 16' 26.4" E	Downstream of Shwe Byauk Creek, Thilawa SEZ
5.	SW-5	Surface Water	16° 40' 10.7" N 96° 16' 22.6" E	Drainage located in the west of MJTD main office compound
6.	SW-6	Surface Water	16° 40' 26.8" N 96° 16' 30.7" E	Drainage from the STP, Thilawa SEZ
7.	GW-1	Ground Water	16° 40' 25.1" N 96° 16' 31.7" E	In Moegyoe Swan Monastery, Thilawa SEZ

Figure 2. Location map of water quality sampling points

SW-1

SW-1 was collected at the drain from the retention pond, which is located in the east of Moegyoswan Monastery. This drainage is flowing from north to south and then connected to the Shwe Byauk Creek. The surrounding area is mostly occupied by the building.

Figure 3. Surface water sampling at SW-1

SW-2

SW-2 was collected at the upstream of Shwe Byauk Creek which is flowing generally form east to west and then entering into the Yangon River. This sampling point is also located at south of Zone A area and Dagon-Thilawa road. The surrounding area are Zone A in the north, industrial compound in the east and paddy field in the south and west respectively.

Figure 4. Surface water sampling at SW-2

SW-3

SW-3 was collected at the upstream of Shwe Byauk Creek which is flowing generally form east to west and then entering into the Yangon River. It is distanced about 60 m downstream of SW-2. This sampling point is also located at south of Zone A area and Dagon-Thilawa road. The surrounding area are Zone A in the north, industrial compound in the east and paddy field in the south and west respectively.

Figure 5. Surface water sampling at SW-3

SW-4

SW-4 was collected at the downstream of Shwe Byauk Creek, which is flowing generally form east to west and then entering into the Yangon River. It is distanced about 500 m downstream of SW-3. This sampling point is also located at south of Zone A area and Dagon-Thilawa road. The surrounding area are Zone A in the north, industrial compound in the east and paddy field in the south and west respectively.

Figure 6. Surface water sampling at SW-4

SW-5

SW-5 was collected at drain near the main gate of MJTD Administrative Building. Most of the water collected in this drain is rain water and waste water from surrounding. This drain is also connected to the Shwe Byauk Creek. The surrounding area is mostly occupied by the building.

Figure 7. Surface water sampling at SW-5

SW-6

SW-6 was collected from the outlet drain of Sewage Treatment Plant, which is located in the north of Administrative Building, distanced about 480 m. The surrounding is flat and most of the area is occupied by the building.

Figure 8. Ground water sampling at SW-6

GW-1

GW-1 was collected from tube well as ground water sample. It is located in the compound of Moegyoe Swan Monastery as well as in the Zone A area. The transparency of the ground water is high.

Figure 9. Ground water sampling at GW-1

Survey Period

Water quality survey was conducted on 21st June, 2016.

Sample Point	SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	GW-1
Sampling Time	12:22 AM	9:14 AM	9:55 AM	10:40 AM	12:46 PM	11:59 AM	1:22 PM

Survey 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 as pH, temperature, velocity, dissolved oxygen (DO), electrical conductivity (EC), and turbidity 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 2. Field Equipment for river flow measurement and water quality survey

No.	Equipment	Manufacturer	Originate Country	Model
1	Multi-parameter (Temp., pH, EC, ORP, DO, TDS, Turbidity)	HANNA	USA	HI7609829 (with 3 sensors)
2	SmarTROLL multi-parameter	In-situ Inc.	USA	-
3	Alpha Bottle (Water Sampler)	Wildlife Supply Company®	Indonesia	-

Table 3. Container and preservation method of water samples for laboratory analysis

No.	Parameter	Container	Preservation
1	BOD, COD	1000 ml glass bottle	Refrigerate
2	Suspended solid	1000 ml PE	Refrigerate
3	Coliform	1000 ml glass bottle	Refrigerate
4	Total Phosphorus	500 HDPE	Refrigerate
5	Oil and Grease	1000 ml glass bottle	Refrigerate
6	Total Chromium	500 ml HDPE	Refrigerate
7	Other	2000 ml plastic bottle	Refrigerate

The following table provides the test method for water quality.

Table 4. Analytical method for water quality

No.	Item	Analysis method	Sampling point
			SW-1, SW-2, SW-3, SW-4 SW-5, SW-6, GW-1
1	Water Temperature	SmarTROLL Sensor	✔
2	pH	HI7609829-1 Sensor	✔
3	Dissolved Oxygen (DO)	HI7609829-2 Sensor	✔
4	EC	SmarTROLL Sensor	✔
5	Salinity	SmarTROLL Sensor	✔
6	Suspended Solid	Total Suspended Solids Dried	✔
7	BOD	APHA-AWWA-WEF Method	✔
8	COD (Cr)	APHA-AWWA-WEF Method	✔
9	Color	APHA-AWWA-WEF Method	✔
10	Odor	APHA-AWWA-WEF Method	✔
11	Total Nitrogen	APHA-AWWA-WEF Method	✔
12	Total Phosphorus	Persulphated Digestion and Ascorbic Acid Method	✔
13	Total Coliform	APHA-AWWA-WEF Method	✔
14	Chromium	In-House Method	✔
15	Oil and grease	Partition-Gravimetric Method	✔

Survey Result

Water samples were sent to SGS Myanmar, SGS Thailand laboratories and UAE Thailand laboratories. Water quality results are shown in following table.

Discharging points (SW-1, SW-5 and SW-6) are mentioned according to EIA and the points SW-2, SW-3 and SW-4 are not required to monitor. They are natural creek water which are combine all the wastewater from the Local industrial water and domestic water from existing living environment. Among the results, suspended solids concentration in the surface water are higher than the standard as previous time. Consequence of the situation of rainy season as well as the influence of the tidal effect of Yangon river to Shwe Byauk Creek, the concentration of suspended solids in all sampling points of surface water are high. Moreover, Total Coliform content at SW-3 is also higher than the standard. It may also be affected by the tidal water along the Shwe Byauk Creek and seepage of the

organic solvent from the surrounding area especially from the agricultural and farming activities but SW-1 and SW-5 are within the standard. The excess parameter, suspended solids, is not relating to the Thilawa's SEZ discharging points and caused by natural surface water condition around the area.

Table 5. In-Situ Measurement and laboratory analysis of water quality

No.	Parameter	SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	GW-1	Standard
1	Water Temperature (°C)	36.47	30.69	31.56	32.59	37.35	31.84	35.18	40
2	pH	6.55	6.51	6.49	6.55	6.35	6.47	6.73	5 - 9
3	Suspended solid (mg/l)	138	134	132	183	40.5	48.2	<5	30
4	DO (mg/l)	5.41	3.75	4.78	5.04	5.38	6.12	6.40	-
5	EC (µs/cm)	405.4	181.3	236..4	263.8	197.6	632.7	3576.3	-
6	Salinity (psu)	0.2	0.1	0.1	0.1	0.1	0.3	1.6	-
7	BOD (mg/l)	1.3	0.9	1.1	1.2	1.1	0.8	<2	20
8	COD(Cr) (mg/l)	11.5	25.7	18.9	20.1	19.3	6.4	19.5	70
9	Color (Pt.Co)	Natural	Natural	Natural	Natural	Natural	Natural	Natural	-
10	Odor	Natural	Natural	Natural	Natural	Natural	Natural	Natural	-
11	Total nitrogen (mg/l)	<1	<1	<1	1.05	<1	1.68	1.12	-
12	Total phosphorus (mg/l)	0.03	0.01	0.01	0.02	0.02	0.05	0.03	-
13	Total Coliform (MPN/100ml)	13	13	790	130	79	330	2.2	400
14	Chromium (mg/l)	0.016	0.013	0.01	0.02	0.034	<0.01	<0.01	0.5
15	Oil and grease (mg/l)	<1	<1	<1	<1	<1	<1	<1	5

APPENDIX

LAB RESULTS

SGS

ANALYSIS REPORT

ORIGINAL

Job Ref: 4022/2016
Date : 01.07.2016

Client Name	:	**RESOURCE AND ENVIRONMENT MYANMAR CO., LTD** B-702 Delta Plaza, Shwegondaing Rd, Bahan Township, Yangon, Myanmar
Project Name	:	Environmental Monitoring in Thilawa SEZ, Zone A (Phase I)
Sample Brought By	:	Client
Sample Location	:	Thilawa
Sample Received Date	:	23.06.2016
Analysed Date	:	24.06.2016

Stations	Commodity Name	Lab Code	Results (mg/l)
			Total Nitrogen (organic)
Method	-	-	Standard methods for the examination of water & waste water APHA ,AWWA & WEF,22nd ed, 2012; 4500-N_{org} B.Macro Kjeldahl Method
GW-1 (21.6.16)	Ground Water	126/16	1.12
SW-1 (21.6.16)	Surface Water	120/16	<1
SW-2 (21.6.16)	Surface Water	121/16	<1
SW-3 (21.6.16)	Surface Water	122/16	<1
SW-4 (21.6.16)	Surface Water	123/16	1.05
SW-5 (21.6.16)	Surface Water	124/16	<1
SW-6 (21.6.16)	Surface Water	125/16	1.68
Detection Limit			1.0

End Of Report

SGS (Myanmar) Limited

(Nu Nu Yi)
Manager

SGS

Report No. : 2016-00869 / 001 (Page 1 of 1) Issued date: July 14, 2016

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 : Environmental Monitoring in Thilawa SEZ, Zone A (Phase I)
SAMPLE DESIGNATED AS : Surface Water Quality SAMPLING DATE : June 21, 2016
SAMPLING LOCATION : Thilawa, Myanmar SAMPLING BY : Client

Parameters	Units	LOQ	Results					
			SW-1	SW-2	SW-3	SW-4	SW-5	SW-6
Color	-	-	Natural	Natural	Natural	Natural	Natural	Natural
Odor	-	-	Natural	Natural	Natural	Natural	Natural	Natural
Biochemical Oxygen Demand (BOD_5)	mg/l	2	1.3	0.9	1.1	1.2	1.1	0.8
Total Coliform Bacteria	MPN/100mL	-	13	13	790	130	79	330

Remarks : - Analysis Methods follow 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) except parameters as follows :
- Odor is base on ISO 8588-1987.
- Color follows the visual method.
- LOQ = Limit of Quantitation

(Siripdm Imwilaiwan)
Environmental Monitoring Manager

(Thepson Yommana)
Technical Manager

SGS (THAILAND) LIMITED

TY/Client/JC/Cj

E 124141

SGS

Report No. : 2016-00869 / 002 (Page 1 of 1) **Issued date: July 14, 2016**

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 : Environmental Monitoring in Thilawa SEZ, Zone A (Phase I)
SAMPLE DESIGNATED AS : Ground Water Quality **SAMPLING DATE** : June 21, 2016
SAMPLING LOCATION : Thilawa, Myanmar **SAMPLING BY** : Client

Parameters	Units	LOQ	Results
			GW-1
Color	-	-	Natural
Odor	-	-	Natural
Biochemical Oxygen Demand (BOD_5)	mg/l	2	<2
Total Coliform Bacteria	MPN/100mL	-	2.2

Remarks :
- Analysis Methods follow 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) except parameters as follows :
  - Odor is base on ISO 6586-1987.
  - Color follows the visual method.
- LOQ = Limit of Quantitation

Siripom I.
(Siripom Imwilaiwan)
Environmental Monitoring Manager

Thepsan Y.
(Thepson Yommana)
Technical Manager

SGS (THAILAND) LIMITED

TY/Client/JC/Cj

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.

E 124142

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ANALYSIS REPORT

PROJECT	: ENVIRONMENTAL MONITORING IN THILAWA SEZ, ZONE A (PHASE I - SURFACE WATER ANALYSIS (JUNE 2016))		
CUSTOMER NAME	: RESOURCE & ENVIRONMENT MYANMAR LTD. (REM)		
ADDRESS	: B-702 DELTA PLAZA, SHWEGONDAING ROAD, BAHAN, YANGON, MYANMAR. TEL. 959 7301 3448 FAX 959 5196 758		
SAMPLING SOURCE	: -		
SAMPLE TYPE	: SURFACE WATER	RECEIVED DATE	: JULY 4, 2016
SAMPLING DATE	: JUNE 21, 2016	ANALYTICAL DATE	: JULY 4-20, 2016
SAMPLING TIME	: -	ANALYSIS NO.	: LAM081-LAM083/2016
SAMPLING METHOD	: -	WORK NO.	: LAB2301/2016
SAMPLING BY	: CUSTOMER	REPORT NO.	: L13015/2016
ANALYZED BY	: MISS CHOMTHANAN APHIPATPAPHA		

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT			DETECTION LIMIT
			SW-1 LAM081/2016	SW-2 LAM082/2016	SW-3 LAM083/2016	
CHEMICAL OXYGEN DEMAND	mg/L	OPEN REFLUX METHOD (SM 2012:5220 B)	11.5	25.7	18.9	5.0
TOTAL SUSPENDED SOLIDS	mg/L	TOTAL SUSPENDED SOLIDS DRIED AT 103-105 °C (SM 2012:2540 D)	138	134	132	5.0
FAT, OIL AND GREASE	mg/L	PARTITION-GRAVIMETRIC METHOD (SM 2012:5520 B)	ND	ND	ND	1
TOTAL CHROMIUM	mg/L Cr	IN-HOUSE METHOD UAE.TP.SW.01* (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM 2012:3030 E AND 3111 B	< LOQ	< LOQ	< LOQ	0.010
TOTAL PHOSPHORUS	mg/L P	PERSULPHATE DIGESTION AND ASCORBIC ACID METHOD (SM 2012:4500- P B AND 4500-P E)	0.03	0.01	0.01	0.01
SAMPLE CONDITION						
WATER'S COLOUR/TURBID			YELLOW/TURBID	YELLOW/TURBID	YELLOW/TURBID	
SEDIMENT			BROWN	BROWN	BROWN	

* : BASED ON STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 22ND EDITION, 2012.
SM : STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 22ND EDITION, 2012.
ND : NON-DETECTABLE
< LOQ : < LEVEL OF QUANTITATION (TOTAL CHROMIUM ≥ 0.010 AND < 0.050 mg/L).

(MRS MANIDA YAMYAI)
TECHNICAL MANAGEMENT
JULY 27, 2016

(MRS PIYAPAT SUTTAMANUTWONG)
LABORATORY SUPERVISOR
JULY 27, 2016

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ANALYSIS REPORT

PROJECT	: ENVIRONMENTAL MONITORING IN THILAWA SEZ, ZONE A [PHASE I - SURFACE WATER ANALYSIS (JUNE 2016)]		
CUSTOMER NAME	: RESOURCE & ENVIRONMENT MYANMAR LTD. (REM)		
ADDRESS	: B-702 DELTA PLAZA, SHWEGONDAING ROAD, BAHAN, YANGON, MYANMAR. TEL. 959 7301 3446 FAX 959 5196 758		
SAMPLING SOURCE	: -		
SAMPLE TYPE	: SURFACE WATER	RECEIVED DATE	: JULY 4, 2016
SAMPLING DATE	: JUNE 21, 2016	ANALYTICAL DATE	: JULY 4-20, 2016
SAMPLING TIME	: -	ANALYSIS NO.	: LAM084-LAM086/2016
SAMPLING METHOD	: -	WORK NO.	: LAB2301/2016
SAMPLING BY	: CUSTOMER	REPORT NO.	: L13016/2016
ANALYZED BY	: MISS CHOMTHANAN APHIPATPAPHA		

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT SW-4 LAM084/2016	SW-5 LAM085/2016	SW-6 LAM086/2016	DETECTION LIMIT
CHEMICAL OXYGEN DEMAND	mg/L	OPEN REFLUX METHOD (SM 2012:5220 B)	20.1	19.3	6.4	5.0
TOTAL SUSPENDED SOLIDS	mg/L	TOTAL SUSPENDED SOLIDS DRIED AT 103-105 °C (SM 2012:2540 D)	183	40.5	48.2	5.0
FAT, OIL AND GREASE	mg/L	PARTITION-GRAVIMETRIC METHOD (SM 2012:5520 B)	ND	ND	ND	1
TOTAL CHROMIUM	mg/L Cr	IN-HOUSE METHOD UAE.TP.SW.01* (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM 2012:3030 E AND 3111 B	< LOQ	< LOQ	ND	0.010
TOTAL PHOSPHORUS	mg/L P	PERSULPHATE DIGESTION AND ASCORBIC ACID METHOD (SM 2012:4500- P B AND 4500-P E)	0.02	0.02	0.05	0.01
SAMPLE CONDITION						
WATER'S COLOUR/TURBID			YELLOW/TURBID	YELLOW/TURBID	YELLOW/TURBID	
SEDIMENT			BROWN	BROWN	BROWN	

* BASED ON STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 22nd EDITION, 2012.
SM : STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 22nd EDITION, 2012.
ND : NON-DETECTABLE.
< LOQ : < LEVEL OF QUANTITATION (TOTAL CHROMIUM ≥ 0.010 AND < 0.050 mg/L).

(MRS MANIDA YAMYAI)
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JULY 27, 2016

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JULY 27, 2016

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ANALYSIS REPORT

PROJECT	: ENVIRONMENTAL MONITORING IN THILAWA SEZ, ZONE A (PHASE I - SURFACE WATER ANALYSIS (JUNE 2016))		
CUSTOMER NAME	: RESOURCE & ENVIRONMENT MYANMAR LTD. (REM)		
ADDRESS	: B-702 DELTA PLAZA, SHWEGONDAING ROAD, BAHAN, YANGON, MYANMAR. TEL. 959 7301 3448 FAX 959 5198 758		
SAMPLING SOURCE	: -		
SAMPLE TYPE	: GROUNDWATER	RECEIVED DATE	: JULY 4, 2016
SAMPLING DATE	: JUNE 21, 2016	ANALYTICAL DATE	: JULY 4-20, 2016
SAMPLING TIME	: -	ANALYSIS NO.	: LAM087/2016
SAMPLING METHOD	: -	WORK NO.	: LA82301/2016
SAMPLING BY	: CUSTOMER	REPORT NO.	: L13017/2016
ANALYZED BY	: MISS CHOMTHANAN APHIPATPAPHA		

PARAMETER	UNIT	METHOD OF ANALYSIS	RESULT GW-1 LAM087/2016	DETECTION LIMIT
CHEMICAL OXYGEN DEMAND	mg/L	OPEN REFLUX METHOD (SM 2012:5220 B)	19.5	5.0
TOTAL SUSPENDED SOLIDS	mg/L	TOTAL SUSPENDED SOLIDS DRIED AT 103-105 °C (SM 2012:2540 D)	ND	5.0
FAT, OIL AND GREASE	mg/L	PARTITION-GRAVIMETRIC METHOD (SM 2012:5520 B)	ND	1
TOTAL CHROMIUM	mg/L Cr	IN-HOUSE METHOD UAE.TP.GW.01* (NITRIC ACID DIGESTION AND DIRECT AIR ACETYLENE FLAME METHOD); SM 2012:3030 E AND 3111 B	ND	0.010
TOTAL PHOSPHORUS	mg/L P	PERSULPHATE DIGESTION AND ASCORBIC ACID METHOD (SM 2012:4500- P B AND 4500-P E)	0.03	0.01
SAMPLE CONDITION				
WATER'S COLOUR/TURBID			YELLOW/CLEAR	
SEDIMENT			BROWN	

* BASED ON STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 22ND EDITION, 2012.
SM STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, APHA, AWWA, WEF, 22ND EDITION, 2012.
ND NON-DETECTABLE

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JULY 27, 2016

Thilawa Special Economic Zone (Zone A) Development Project –Phase 2

Appendix

Noise and Vibration Monitoring Report

July, 2016

MJTD MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED

NOISE AND VIBRATION MONITORING IN THILAWA SEZ (PHASE 2, CONSTRUCTION STAGE)

July 2016

Resource & Environment Myanmar Ltd. B-702/401 Delta Plaza Building, Shwegondaing Rd., Bahan, Yangon. MYANMAR

Tel: (959) 7301 3448; Fax: (951) 552901

www.enviromyanmar.net

1. INTRODUCTION

The monitoring points are situated in Thilawa SEZ area, which is located in Thanlyin and Kyauktan townships, about 20 km southeast of Yangon city (Figure 1). Thilawa SEZ is surrounded by ring road and accompanied with the container ports along the Yangon River.

There are two ways to access Thilawa SEZ from Yangon city, which are the routes passing through Thanlyin Bridge and also through Dagon River.

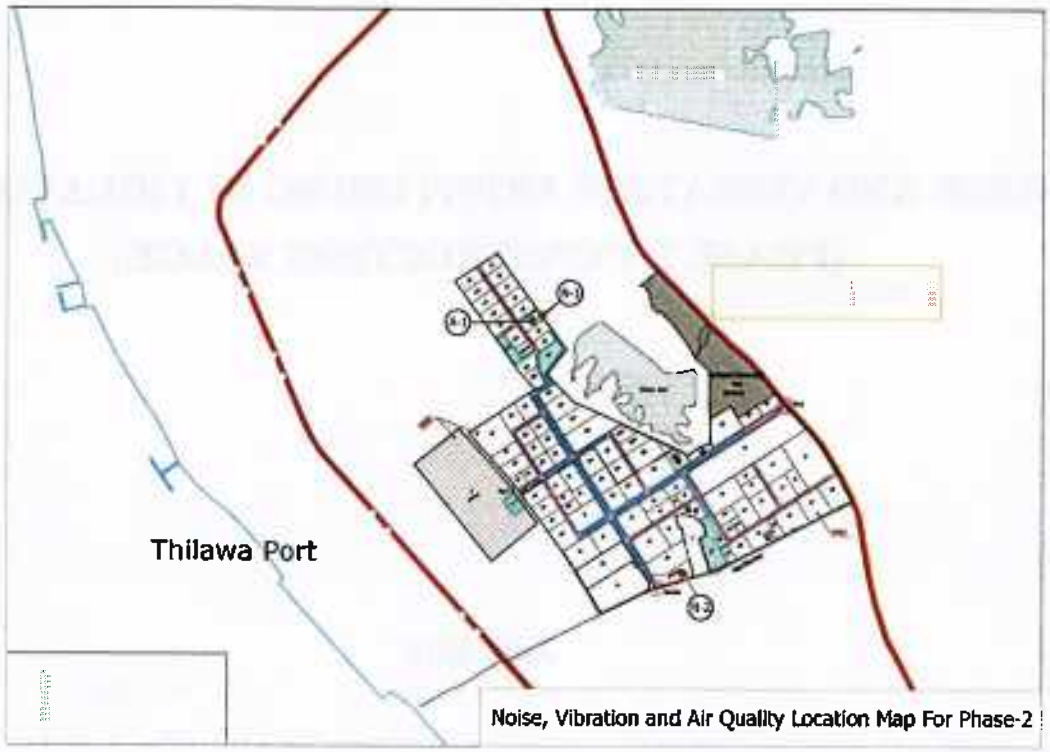

Figure 1. Location map of Thilawa SEZ area and monitoring locations

2. ENVIROMENTAL STANDARD

(A) Noise

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 Corporation (IFC) in a group member of World Bank, therefore target noise level at construction stage is set based on the standard of other foreign countries.

In the south-east Asia countries, only Singapore has the noise standard of construction activities to receptors categorized area are 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 were located less than 150m from the construction site comply with the middle range of the Singapore standard (categorized as "Residential buildings located

- Residential houses and monastery were 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").

- Noise level from traffic is different characteristic from ambient noise, and higher. Though the noise level for living area is set, there is no target level specified for traffic noise along the road. Therefore, tentative target levels for traffic noise along the road are set in accordance with the Japanese traffic noise target level.

This target noise level is shown in Table 1 and 2, and is not so much difference comparing with noise standard at construction stage in the other countries as shown in Table 3.

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	65 dB

Note) Evaluation point is at boundary of building

Table 2. Target traffic noise level in construction phase

Category	Day time (Leq) (6am-10pm)	Night Time (Leq) (10pm-6am)
Along the Four Lane road	75 dB	70 dB

Note: Applied "proximity to major arterial roads"

Source: Noise Regulation Law (Japan) (Law No.98 of 1986, latest Amendment by Law No.91 of 2000)

Table 3. Noise standard at construction stage in various countries

Items		Day time (Leq)	Night time (Leq)
Japan	Using heavy equipments with high noise level (piling, 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 the noise is being emitted	75 dB (7am – 7pm, 12hrs)	60 dB (7pm – 10pm, 3hr) 55 dB (10pm – 7am, 9hr)
	Other Buildings	75 dB (7am – 7pm, 12hrs)	65 dB (7pm – 7am, 12hrs)

Items		Day time (Leq)	Night time (Leq)
UK	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	Residential	80 dB (8hrs)	70 dB (8hrs)
	Commercial	85 dB (8hrs)	85 dB (8hrs)
	Urban Area with high ambient noise level (>65 dB)	Ambient Noise Level +10dB	

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

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.

- Ambient noise standard for sensitive areas of Japan and International Organization, relatively high in comparison with the results of baseline survey especially during night time.
- 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 4 and the target noise level is not so much difference comparing with ambient noise standard as shown in Table 5.

Table 4. Target 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 point is at boundary of building

Table 5.Noise standard at operation stage in South-East Asia 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 – 6pm, 8hrs)
	Residential Area (Class A and Class B)	55 dB (6am – 10pm, 16hrs)	45 dB (10pm – 6pm, 8hrs)
	Commercial and Industrial Area (Class C)	60 dB (6am – 10pm, 16hrs)	50 dB (10pm – 6pm, 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)
Effect of Traffic Noise on Sleep: A Case Study in Serdang Raya, Selangor, Malaysia, Environment Asia, 2010
Environmental Protection and Management Act in Singapore (Chap.94A, Section 77, revised in 2008)
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

(B) Vibration

As there is no vibration standard to receptors in Myanmar, the target vibration level at construction phase shall be set based on the standards in some foreign countries. Accordingly, the target level of vibration is set based on the following policies.

- Monastery and residential houses 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. FIELD SURVEY

The survey included noise and vibration monitoring for three locations in Thilawa SEZ area.

Survey Item

(A) Noise

Parameter for noise level survey was determined by referring the environmental quality standards in Japan and other countries for operation stage as shown in Table 6.

Table 6. Survey parameters for noise level

No.	Parameter	Category	Day Time (Leq) (7am-7pm)	Evening Time (Leq) (7pm-10pm)	Night Time (Leq) (10pm-7am)
1	A-weighted loudness equivalent (LAeq)	Residential houses and monastery located more than 150m from the construction site, office, commercial facilities, and factories	75 dB	65 dB	65 dB
2		Along the four lane road which was 15m distance from the Admin Compound	Day time (Leq) (6am-10pm)		Night Time (Leq) (10pm-6am)
			75 dB		70 dB

(B) 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 1.5mms @ 25m
Hydraulic rock breakers	4.5 mm/s @ 5m, 0.4 @ 20m, 0.1 @ 50m
Compactor	20mm/s @ 5m, <0.3mm/s @30m
Pile driving	1-3mm/s @ 50m depending on soil conditions and piling technique
Bulldozer	1-2mm/s @ 5m, 0.1 @ 50m
Truck traffic (smooth surface) Truck traffic (rough surface)	<0.2mm/s @ 20m <2mm/s @ 20m

Summary of sampling points

The details of the locations of monitoring points are shown below.

Table 7. Locations of noise and vibration monitoring stations

Sampling Point	Coordinates	Description of Sampling Point
NV-1	16° 41' 12.43" N 96° 15' 54.11" E	Inside of Thilawa Zone A expansion compound
NV-2	16° 40' 10.86" N 96° 16' 31.36" E	In front of Administrative Building, Thialwa SEZ Zone A (traffic noise concerned)

Figure 2. Location map of noise and vibration monitoring locations

NV-1

NV-1 was an open area, located within the Zone A expansion area, north of Zone A. It is surrounded by Thilawa dam in the south, residential area in the northeast and Garment factory in the west respectively. There is an access road was situated north of NV-1 and which is paved with moderately traffic volume. Dominant source of noise was vehicular traffic activity nearby the site. Noise and vibration monitoring at NV-1 is shown in figure 3.

Figure 3.Noise and vibration monitoring at NV-1.

NV-2

NV-2 was situated in front of the Administrative Building in Thilawa SEZ Zone A. It was an open area and closely to Dagon-Thilawa road, distanced about 15m away. This road was paved with moderate to highly traffic volume during not only the day time but also the night time, by passing of dump truck, loader vehicles and other construction machines. Dominant sources of noise were vehicle traffic during the day time. Noise and vibration monitoring at NV-2 is shown in figure 4.

Figure 4.Noise and vibration monitoring at NV-2.

Survey Period

Sampling and monitoring of surrounding sound and vibration level at NV-1 and NV-2 were conducted during 12th- 14th July, 2016.

Sampling Point	Survey Period
NV-1	12th - 13th July, 2016 (24 hours)
NV-2	13th - 14th July, 2016 (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

Survey Result

(A) Noise

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 noise levels found lower than the environmental standard (1-day) of the target value. Previously, the target noise level for NV-1 result is within the ambient noise level standard which was located within the Zone A expansion area, north of Zone A. Previously, target noise level for NV-2 was targeted the ambient noise level at the Phase 2, Construction Phase Report (No.1).

Table 8. Hourly L_{Aeq} value at NV-1 (Ambient noise)

Unit: dBA

Time	NV-1
	12th - 13th July, 2016
7:00-8:00	49
8:00:9:00	57
9:00-10:00	58
10:00-11:00	61
11:00-12:00	54
12:00-13:00	50
13:00-14:00	56
14:00-15:00	67
15:00-16:00	64
16:00-17:00	60
17:00-18:00	54
18:00-19:00	51
Day L_{Aeq}	60
19:00-20:00	53
20:00-21:00	51
21:00-22:00	49
Evening L_{Aeq}	51
22:00-23:00	50
23:00-24:00	50
24:00-1:00	48
1:00-2:00	45
2:00-3:00	47
3:00-4:00	44
4:00-5:00	47
5:00-6:00	48
6:00-7:00	49
Night L_{Aeq}	48

Table 9. Hourly L_{Aeq} value at NV-2 (Traffic noise)

Unit: dBA

Time	NV-2
	13th - 14th July, 2016
6:00-7:00	63
7:00-8:00	68
8:00:9:00	63
9:00-10:00	64
10:00-11:00	69
11:00-12:00	65
12:00-13:00	69
13:00-14:00	71
14:00-15:00	69
15:00-16:00	64
16:00-17:00	69
17:00-18:00	63
18:00-19:00	61
19:00-20:00	62
20:00-21:00	55
21:00-22:00	52
Day L_{Aeq}	66
22:00-23:00	57
23:00-24:00	43
24:00-1:00	47
1:00-2:00	43
2:00-3:00	46
3:00-4:00	44
4:00-5:00	57
5:00-6:00	48
Night L_{Aeq}	52

Table 10. A-weighted Loudness Equivalent (L_{Aeq}) Level of NV-1

Unit: dB(A)

Date	12th - 13th July 2016		
	NV-1 (Ambient Noise)		
	Day Time	Evening Time	Night Time
Average Result	**60**	**51**	**48**
Target Noise Level	75	65	65

Table 11. A-weighted Loudness Equivalent (L_{Aeq}) Level of NV-2

Unit: dB(A)

Date	13th - 14th July 2016	
	NV-2 (Traffic Noise)	
	Day Time	Night Time
Average Result	**66**	**52**
Target Noise Level from Traffic	75	70

(B) Vibration

Vibration results were presented in Figure 5 and 6. Table of observed vibration level is presented in Appendix.

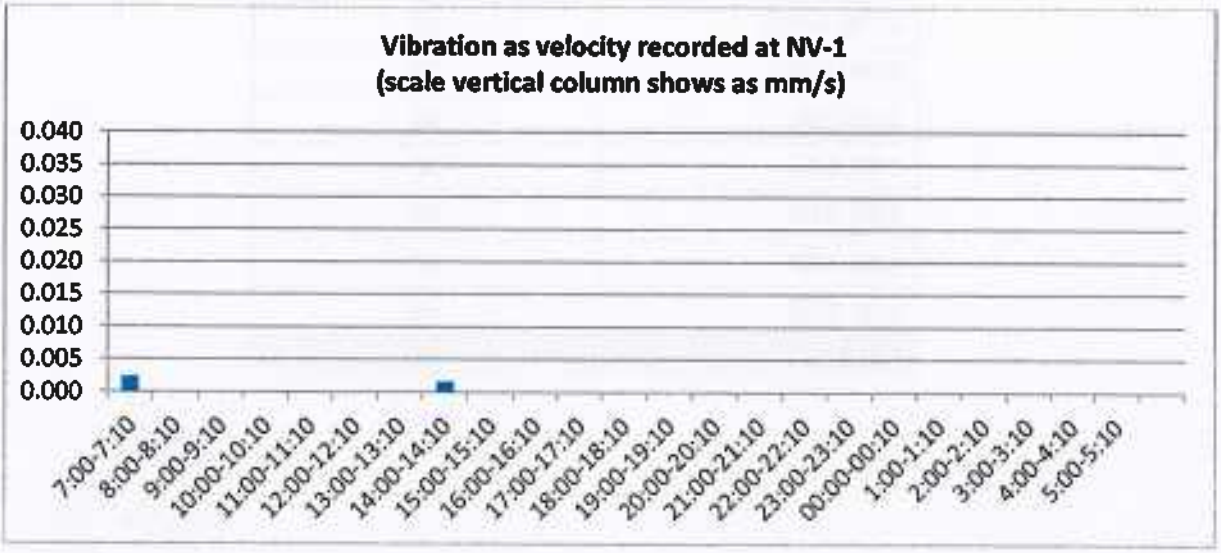

Figure 5. Vibration result of NV-1.

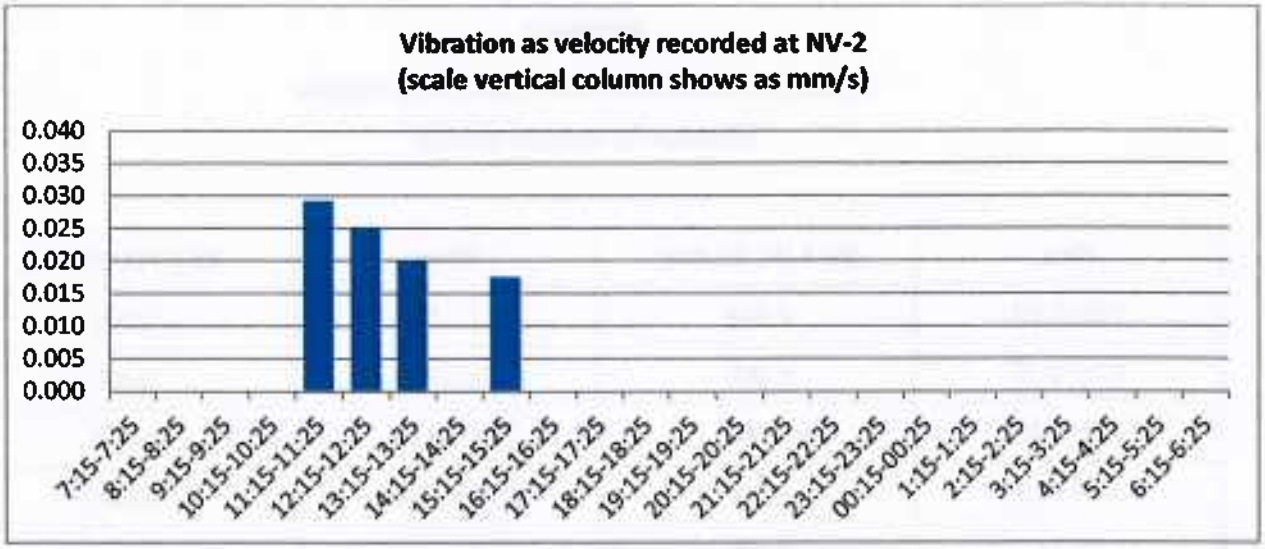

Figure 6. Vibration result of NV-2.

4. CONCLUSION

The noise level monitoring results are compared with target noise level proposed in this report (See Table 3). One noise receptor was designated in construction phase based on the baseline noise data.

All noise level monitoring points are lower than the target noise level (See Table 8 to 11).

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.

The observed noise and vibration in all monitoring points are lower than the target level.

APENDIX

Observed vibration level in 2 monitoring stations

Vibration as Velocity (mm/s)

Time	NV-1 (12-13 July)	Time	NV-2 (13-14 July)
7:00-7:10	0.003	7:15-7:25	0.000
8:00-8:10	0.000	8:15-8:25	0.000
9:00-9:10	0.000	9:15-9:25	0.000
10:00-10:10	0.000	10:15-10:25	0.000
11:00-11:10	0.000	11:15-11:25	0.029
12:00-12:10	0.000	12:15-12:25	0.025
13:00-13:10	0.000	13:15-13:25	0.020
14:00-14:10	0.002	14:15-14:25	0.000
15:00-15:10	0.000	15:15-15:25	0.018
16:00-16:10	0.000	16:15-16:25	0.000
17:00-17:10	0.000	17:15-17:25	0.000
18:00-18:10	0.000	18:15-18:25	0.000
19:00-19:10	0.000	19:15-19:25	0.000
20:00-20:10	0.000	20:15-20:25	0.000
21:00-21:10	0.000	21:15-21:25	0.000
22:00-22:10	0.000	22:15-22:25	0.000
23:00-23:10	0.000	23:15-23:25	0.000
00:00-00:10	0.000	00:15-00:25	0.000
1:00-1:10	0.000	1:15-1:25	0.000
2:00-2:10	0.000	2:15-2:25	0.000
3:00-3:10	0.000	3:15-3:25	0.000
4:00-4:10	0.000	4:15-4:25	0.000
5:00-5:10	0.000	5:15-5:25	0.000
6:00-6:10	0.000	6:15-6:25	0.000

Thilawa Special Economic Zone (Zone A) Development Project –Phase 2

Appendix

Accident Case

June, 2016 to September 2016

1. Time: 4: 35 (11th July 2016)

2. Place: TSEZ-circular pond (C3 side)

3. Vehicles: Alphard and Light Truck

4. Involved parties: Zifarm and Pro paragon (sub con of RK)

5. Detailed accident: Light truck come from the Ngu Wah road and hit the Alphard came from the Sein Pann road at the circular pond area.

6. Damage/ Injury: Alphard right side badly damage/ light truck head bulb broken

7. MJTD actions: Negotiate between two parties, settle by compansate all damage by pro-paragon. Remind to Pro paragon site manager and MD to reduce speed for all driver and submit accident report to MJTD.

Zifarm –C6 Car (Two foreigner inside, no injury)

Cleaning work for broken glass

Pro Paragon–C8 sub con Car

Cleaning work for broken glass

PRO PARAGON
CONSTRUCTION CO., LTD.

ACCIDENT/ INCIDENT REPORT FORM

Record No: *PP-IRF-001/16*

Personal details

1. Name : *U Myint Swe*

Occupation : *Driver in-charge*

Section/ Dept : *Admin*

Accident/ incident details

Date : *11.07.2016* Time: *16:20 Hr*

Location : Circle *Junction near the Foster Factory* (TSEZ)

Reported by : *U Thein Win*

Reported to : *U Myo Thet Naung (Safety Manager)*

Description of Accident

Pro Paragon's Nissan Atlas vehicle (Ygn-4J/5731) hit Zifam's Alphard vehicle (Ygn-2K/3197)

Injury – Nature of injury (N/A)

☐ Contusion/ crush	☐ Burn	☐ Dislocation	☐ Amputation
☐ Laceration/ open wound	☐ Superficial injury	☐ Foreign body	☐ Internal injury
☐ Concussion	☐ Sprain/ strain	☐ Fracture	☐ Dermatitis

Location of injury (N/A)

☐ Head/ face	☐ Eye	☐ Internal organs
☐ Hand/ fingers	☐ Shoulder/ arms	☐ Trunk (other than back)
☐ Hip/ leg	☐ Foot/ toes	☐ Back
☐ Other (state)		

Results of accident (N/A)

Lost time injury (LTI) _____ No. of days: _____ Worker's compensation _____

Treatment received: ☐ First aid ☐ Hospital

PRI PARAGON
CONSTRUCTION CO., LTD.

Category of Accident

☐ Minor ☑ Major ☐ Catastrophic

Full Accident Detail

The accident occurred around 16:20 Hr on 11.07.2016 at Circle Junction near Foster Factory at Thilawa SEZ. At that time, U Myint Swe was driving a pick-up vehicle (Ygn-4J/5731). When he arrived at Circle Junction near Foster Factory, his car hit another vehicle Alphard (Ygn-2K/3197) which is driving along the circle junction. The two vehicles were damaged. Nobody got injured.

Damage to equipment/buildings/vehicles etc.

- *Two vehicles damaged*
  1. *Ygn-4J/5731(Wind shield, Front light, Back mirror)*
  2. *Ygn-2K/3197(Front side body, Side glass, Front tyre)*

Immediate Causes:

- *Pick-up vehicle hit another vehicle*

Basic Causes: *1. Lack of concentration during driving*
2. Not follow the driving rules

Corrective actions

- To explain driving rules and regulations.
- To control driving permit.

Date by action is to be taken: *12.7.2016*

Preventive actions

- *To organize mass meeting to share information and discuss the preventive measures.*
- *To enforce people driving at the work site to follow discipline / regulation.*
- *To issue the notice letter that "Zero Tolerance Policy" applies for driving rules.*

PRO PARAGON
CONSTRUCTION CO., LTD.

Signatures

Reported by:

U Thein Win (PE)

Reported to:

(14.07.2016)

U Myo Thet Naung (Safety Manager)

To Follow Up-

Actions Completed on: Done 15.07.2016

Approved by HSE Manager:

PRO PARAGON CONSTRUCTION CO., LTD.

Tool Box Meeting

Project Name - RK Yangon Steel	Conducted by-	Myo Thet Naung.
RK (PPC Site Office)	Position -	Safety Manager.
2.07.2016	Signature -	[signature]

Description

Topic - Driving Safety

- Distraction occur any time you take your eye off the road, your hands off the wheel and your mind off your primary task.

All distraction endanger drivers safety. Do not do the following while driving.

- Using a mobile phone.
- Eating and drinking.
- Talking and sending.
- Watching a video.

Follow Rules and Regulation during driving. Especially -

- TSEZ speed limit
- Circle junction (give way and driving Rules).

Name	Sign
TIN Ko Oo	[signature]
Htike Aung	[signature]
Aung Myo Min	[signature]
[illegible]	[signature]
[illegible]	[signature]
U Zaw Min	[signature]
Aung Kyaw Tu	[signature]
Ang Hyu Moe	[signature]
Thein Khin	[signature]

PRO PARAGON
CONSTRUCTION CO., LTD.

Date: 13.07.2016

Notice for all drivers

For Vehicle Driver Guidelines and Safety Rules

- Company vehicles are to be driven by authorized driver only, in case of absent of authorized driver the Driver in-charge can assign equally competent driver.
- Any driver who has a driver's license revoked or suspended shall immediately notify the Driver in-charge and can not drive until the license is valid again.
- All accidents in company vehicles,driver must be reported immediately to Driver in-charge and office.
- Always put on seat belt during driving.
- Driver must respect the speed limits on public roads and within the construction site.
- Using mobile phones while driving is prohibited, even if a hand-free is available.
- Maintain vehicle in good condition. Check all indicators, Engine, Cables and Exhaust. This must be done before driving the vehicle.
- Obey all traffic signs
- Minimum PPE requirement are Safety Helmet, Safety Shoes, Visibility Clothes.
- The use of a company vehicle while under the influence of intoxicants and other alcohol and drugs is strictly forbidden and if this is not followed, the disciplinary actions up to termination of employment will be taken.

For Motorcycle Driver Guidelines and Safety Rules

- Driver and passenger to wear appropriate safety helmet.
- Using mobile phones while driving is prohibited, even if a hand-free is available.
- Obey all traffic signs
- Driver must respect the speed limits on public roads and within the construction site.
- Do not use umbrella while driving motocycle.

The above following procedure shall be followed by all drivers at all levels at all places.

Myo Thet Naung

Safety Manager

Pro Paragon Construction Co., Ltd.

MJTD

MJTD

Incident Report

1. Kinds of Incident : Traffic Accident

2. Incident Time : 13:20 PM (9th August 2016)

3. Location : Near around the first circular pond

4. Result / Action Taken : The car was hit by the motorcycle while taking circular turn at the roundabout first circular pond. The motorcyclist got knee injury and was sent to clinic. Supervisor explained them to follow the traffic rules and not to drive over 25km per hour as they drove the vehicles carelessly without following rules and the accident will not happen again in future.

5. Photo

JAPAN TANZANIA DEVELOPMENT PARTNERSHIP MJTD

End of Document