

Environmental Monitoring Report

Quarterly Report (1st Quarter 2014)
April 2014

VIE: Ho Chi Minh City-LongThanh-Dau Giay Expressway

Package No. 5A

Prepared by Posco Engineering & Construction Co., Ltd. and Center of Environment and Applied Ecology for the Vietnam Expressway Corporation, the Ministry of Transport of Vietnam, and the Asian Development Bank.

CURRENCY EQUIVALENTS

(as of 1 April 2014)

Currency unit	–	dong (D)
D1.00	=	\$0.00004744
\$1.00	=	D21,080

NOTE

In this report, "\$" refers to US dollars unless otherwise stated.

This environmental monitoring report is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature.

**MINISTRY OF TRANSPORT
VIET NAM EXPRESSWAY CORPORATION (VEC)
HO CHI MINH CITY – LONG THANH – DAU GIAY EXPRESSWAY
PROJECTS MANAGEMENT UNIT (EPMU HLD)**

HO CHI MINH CITY – LONG THANH – DAU GIAY EXPRESSWAY PROJECT

**QUARTERLY ENVIRONMENTAL MONITORING REPORT
FOR QUARTER 1 – 2014**

PACKAGE No.5A



**MINISTRY OF TRANSPORT
VIET NAM EXPRESSWAY CORPORATION (VEC)
HO CHI MINH CITY – LONG THANH – DAU GIAY EXPRESSWAY
PROJECTS MANAGEMENT UNIT (EPMU HLD)**

HO CHI MINH CITY – LONG THANH – DAU GIAY EXPRESSWAY PROJECT

**QUARTERLY ENVIRONMENTAL MONITORING REPORT
FOR QUARTER 1 – 2014**

PACKAGE No.5A

Implementing Agency:
**CENTER OF ENVIRONMENT AND
APPLIED ECOLOGY**

Contractor:
**POSCO ENGINEERING &
CONSTRUCTION CO., LTD**

**POSCO ENGINEERING & CONSTRUCTION CO., LTD
CENTER OF ENVIRONMENT AND APPLIED ECOLOGY (CEEEO)**

ABBREVIATIONS

	CEECO	:	Center of Environment and Applied Ecology
	SEMP	:	Site Environmental Management Plan
	UEMP	:	Update Environmental Management Plan
	NDT	:	Not Detected
	PMU	:	Project Management Unit
	THC	:	Total Hydrocarbon
	T-N	:	Total nitrogen
	T-P	:	Total phosphorus
	TSP	:	Total Suspended Particulates
	TORs	:	Terms of References
	QCVN	:	Regulation Vietnamese
	TCVN	:	Standard Vietnamese
	BTNMT	:	Ministry of Natural resources and Environment
	BOD	:	Biochemical oxygen Demand
	COD	:	Chemical Oxygen Demand
	TSS	:	Total Suspended solid
	DO	:	Oxy hòa tan
	WMS		Work Method Statement
	EPMU		Expressway Project Management Unit

DEFINITIONS

	Contractor	:	POSCO ENGINEERING & CONSTRUCTION CO., LTD
	Employer	:	VIET NAM EXPRESSWAY CORPORATION
	Environmental Staff	:	Health, Safety and Environment Office. In the context of this Plan, the Environmental Staff is directly responsible for the management of environmental issues

CONTENT

Page

SUMMARY

PART I

1.1	GENERAL INTRODUCTION	1-1
1.1.1	Project name	1-1
1.1.2	Implementing Agency	1-1
1.1.3	Overview of HCMC-Long Thanh – Dau Giay Expressway Construction Project	1-1
1.1.4	Overview of Package 5A	1-2
1.2	ENVIRONMENTAL MONITORING PLAN FOR HCMC – LONG THANH – DAU GIAY EXPRESSWAY CONSTRUCTION PROJECT – PACKAGE 5A	1-2
1.2.1	Key Environment Aspects	1-2
1.2.2	Scope of the Manage Plan	1-3
1.2.3	References	1-3
1.2.4	Compliance	1-3
1.2.5	Commitment	1-4
1.3	MONITORING PROGRAM	1-4
1.3.1	Air Quality Monitoring	1-5
1.3.2	Noise monitoring	1-6
1.3.3	Vibration monitoring	1-7
1.3.4	Surface water quality	1-8
1.3.5	Ground water quality	1-9
1.3.6	Soil quality	1-10
1.4	ORGANIZATION AND PERTINENT AGENCIES	1-11
1.4.1	Organization	1-11
1.4.2	Pertinent agencies	1-12
1.5	TERM OF REFERENCES (TORs)	1-12
1.6	REPORT	1-13
1.7	INDISPENSABLE MANPOWER	1-14
PART II	RESULTS OF ENVIRONMENTAL MONITORING IN PRE-CONSTRUCTION PHASE	2-1
2.1	OBJECT	2-1
2.2	SCOPE	2-1
2.3	MONITORING LOCATION	2-1
2.4	MONITORING SCHEDULE	2-4
2.4.1	Noise, vibration and air quality sampling	2-4
2.4.2	Surface Water, soil and Ground water sampling	2-4
2.5	SAMPLING METHODS, FIELD-QUIPMENTS' SPECIFICATION AND ANALYSIS METHODS	2-5

2.6	ENVIRONMENTAL MONITORING RESULTS	2-11
2.6.1	Air monitoring results	2-11
2.6.2	Noise monitoring results	2-19
2.6.3	Vibration monitoring results	2-23
2.6.4	Results of surface water quality in project area	2-25
2.6.5	Results of ground water quality in project area	2-33
2.6.6	Results of soil quality	2-34
APPENDIX		3-1
	Appendix 1: QCVN 05:2013/BTNMT – National technical Regulation on ambient air quality	3-2
	Appendix 2: QCVN 06:2009/BTNMT National Technical Regulation on hazardous substances in ambient air	3-3
	Appendix 3: QCVN 26:2010/BTNMT – National Technical Regulation on Noise	3-5
	Appendix 4: QCVN 27:2010/BTNMT – National Technical Regulation on Vibration	3-5
	Appendix 5: QCVN 08:2008/BTNMT - Technical Regulation on surface water quality	3-6
	Appendix 6: QCVN 09:2008/BTNMT - National technical regulation on underground water quality	3-8
	Appendix 7: QCVN 03:2008/BTNMT - National technical regulation on the allowable limits of heavy metals in the soils	3-9
	Appendix 8: Results of measurement and analysis of environmental quality	3-10
	Appendix 9: Some pictures taken during report performing	3-11

SUMMARY

Objective and overview

The monitoring program has the following purposes:

- Assessment of the environmental quality status in project area in the pre-construction phase
- Provision of necessary data for environmental management as well as evaluation of the changes in environmental quality caused by construction activities during the construction phase;
- Provision of data for the further monitoring programs in the operation phase

The objective of this plan is to monitor environment changes with following items at the construction:

- Air Quality
- Noise
- Vibration
- Surface Water Quality
- Ground Water Quality
- Soil quality

Air monitoring results

In general, air environment quality in project area is rather good. The concentrations of pollution parameters such as TSP, SO₂, NO₂, CO, HC monitored in 3 sampling positions in 8 times in March 2014 are around values in baseline and still fully satisfy the limited values in National Technical Regulation on ambient air quality QCVN 05:2013/BTNMT and QCVN06:2009/BTNMT.

Noise level monitoring results

The results of noise levels measured in 3 sampling positions in March 2014 vary within the range of 49.8 – 67.9 dBA, this result is a bit higher than result in baseline (48.6 – 66.2 dBA). Highest noise level in this month at location A3, due to influence by traffic on road DT769. However, all values completely satisfy the limited value of the standard QCVN 26:2010/BTNMT (70 dBA)

The changes in noise level in 3 monitoring positions at 8 times are as follows:

- **Time 1:** noise levels at 3 sampling points are in range of 58.4 – 65.1 dBA, totally meet the limited value of QCVN 26:2010/BTNMT (70dBA). The highest noise level is at A1 and the lowest at A2.
- **Time 2:** noise levels measured at 3 points vary from 57.9 – 64.5 dBA, These values completely satisfy the limited value of the standard QCVN 26:2010/BTNMT (70 dBA). The noise level is highest at A3 and lowest at A2.
- **Time 3:** noise levels monitored at 3 points range 50.1 – 65.5 dBA. They are fully under the limited value 26:2010/BTNMT (70 dBA). The highest noise level is at A3 and the lowest at A1.
- **Time 4:** noise levels monitored at 3 points range 50.5 – 63.8 dBA. They are fully under the limited value 26:2010/BTNMT (70 dBA). The highest noise level is at A3 and the lowest at A2.
- **Time 5:** noise levels monitored at 3 points range 59.2– 61.5 dBA. They are fully under the limited value 26:2010/BTNMT (70 dBA). The highest noise level is at A1 and the lowest at A2.
- **Time 6:** noise levels monitored at 3 points range 58.8 – 64.4 dBA. They are fully under the limited value 26:2010/BTNMT (70 dBA). The highest noise level is at A3 and the lowest at A2.

- **Time 7:** noise levels monitored at 3 points range 49.8 – 67.9 dBA. They are fully under the limited value 26:2010/BTNMT (70 dBA). The highest noise level is at A3 and the lowest at A1.
- **Time 8:** noise levels monitored at 3 points range 66.2 – 51.5 dBA. They are fully under the limited value 26:2010/BTNMT (70 dBA). The highest noise level is at A3 and the lowest at A2.

Vibration level monitoring results

The results of vibration level at 3 monitoring location A1, A2, A3 in 8 times in March 2014 are in range of 30.4 – 47.4 dB. This result is around result in baseline (31.5 – 48.8dB). All values completely satisfy the limited value of the standard QCVN 27:2010/BTNMT (75dB). Details are as follows:

- **Time 1:** The vibration results measured in three monitoring positions A1, A2, A3, are 36.8dB, 31.4dB, 43.8dB.
- **Time 2:** The results of vibration in 3 monitoring positions A1, A2, A3, are 41.5dB, 40.6dB, 39.5dB.
- **Time 3:** The vibration results measured at 3 locations range from 41.4 – 42.7dB. Detail are A1: 42.7 dB; A2: 41.4 dB; A3: 41.4 dB.
- **Time 4:** The vibration results measured at 3 locations range from 38.6 – 44.2dB. Detail are A1: 40.9 dB; A2: 38.6 dB; A3: 44.2 dB.
- **Time 5:** The results of vibration in 3 monitoring positions A1, A2, A3, are 37.4dB, 34.2dB, 45.1dB.
- **Time 6:** The results of vibration in 3 monitoring positions A1, A2, A3, are 38.5dB, 36.5dB, 47.4dB.
- **Time 7:** The results of vibration in 3 monitoring positions A1, A2, A3, are 35.3dB, 32.7dB, 46.3dB.
- **Time 8:** The results of vibration in 3 monitoring positions A1, A2, A3, are 33.6dB, 30.4dB, 43.2dB.

Surface water quality monitoring results

Summary, monitoring results show that surface water quality in project area in March 2014 is rather good. Most of monitoring results of pH, DO, BOD₅, COD, NH₄⁺ and heavy metal in March 2014 are around measured results in baseline. In conclusion, monitoring results in March 2014 are under the limited values of QCVN 08:2008/BTNMT-Column B1. Except at location Bung Mon Bridge (downstream), oil concentrations (0.13mg/l) is a bit higher than limited value (0.1mg/l).

Ground water quality monitoring results

Groundwater quality in the project area is very well. Most of the measured parameters of groundwater quality limit values are reached by the national technical standards QCVN 09:2008/BTNMT on groundwater quality.

Soil quality monitoring results

All these results of soil monitoring in March 2014 are lower than the limited values in the Regulation QCVN 03:2008/BTNMT.

PART I

1.1 GENERAL INTRODUCTION

1.1.1. Project name: HO CHI MINH – LONG THANH – DAU GIAY EXPRESSWAY CONSTRUCTION PROJECT – PACKAGE NO.5A

1.1.2 Investor

VIET NAM EXPRESSWAY CORPORATION
SOUTHERN EXPRESSWAY PROJECTS MANAGEMENT UNIT (SEPMU)

1.1.3 Overview of HCMC-Long Thanh – Dau Giay Expressway Construction Project

In the surrounding area of Ho Chi Minh City (HCMC), the traffic volume has long been over the capacity of road. It is foreseen that the demand of traffic in HCMC and Dong Nai area where industrial development has been recently significant with the planned development of industrial zones and the international airport will increase significantly.

The Government of Vietnam (GOV) has decided to construct the HCMC – Long Thanh - Dau Giay Expressway (HLD Expressway) with the assistance from Asian Development Bank (ADB) and Japan International Cooperation Genecy (JICA).

Vietnam Expressway Corporation (VEC) was established as a state-owned enterprise under the Ministry of Transports. Under the HLD Expressway Construction project, VEC has the overall responsibility for project implementation and formal correspondence with the line ministries, provincial authorities, JICA and ADB. VEC will delegate responsibility for day-to-day project implementation to the Southern Expressway Project Management Unit (SEPMU).

HLD Expressway construction project with total length of about 55km (From Km 4+000 to Km 54+982), is divided into 2 parts;

Part 1: From Ring Road 2 Intersection (beginning point of Package 1a; Km 4+000) to NH-51 interchange (end point of Package 3; KM 23+900).

Part 2; From NH-51 interchange (end point of Package 3/ beginning point of Package 5A; KM 23+900) to Dau Giay interchange (end point of Package 6; KM 54+982).

1.1.4 Overview of Package No.5A

Overview of package No.5A is as follows:

- Package No.5A is one of 6 ones of the whole projects (Package 1A, 1B, 2, 3, 5A, 6) with a total length of 13.9 km. The starting point is at from km23+900 to km37+800 and includes three bridges (Bung Mon, Suoi Trau and Cau Mon) and seven underpasses and one overpass.
- The Contractor is Posco Engineering & Construction Co., Ltd.

Many activities of the project in construction phase and operation phase will certainly cause adverse impacts on environment such as air, noise, vibration, and aquatic status. So, it is necessary to applied appropriate site environmental

management plan (SEMP) from pre-construction phase to construction phase in the future for sustainable development.

1.2 ENVIRONMENTAL MANAGEMENT PLAN FOR HCMC – LONG THANH – DAU GIAY EXPRESSWAY CONSTRUCTION PROJECT – PACKAGE NO.5A

1.2.1 Key Environment Aspects

An initial evaluation of identified potential impacts was undertaken to determine the most important or “significant” environmental issues.

A number of interactions were identified as having the potential to generate impacts that required further mitigation and management. These included:

- *Increased noise and vibration levels and associated disturbance to local communities, surrounding manufacturers and aquatic ecosystems: Construction activities;*
- *Air quality: the generation of dust; and*
- *Impacts on water quality, public health and safety as a result of the management and disposal of waste, handling and storage of hazardous materials, and dredging.*

The above environmental aspects/ hazards and issues (in both normal and emergency situations) will be systematically assessed and their management will be established under the framework of this management system.

1.2.2 Scope of the Management Plan

The scope of the EMP covers construction aspects and activities that have the potential to affect, positively or negatively, the environment in which the Contractor operates.

The Site Environmental Management Plan (SEMP) addresses the requirements for Environmental Management, outlining how the scope, as described by the Conditions of Contract, will be implemented to achieve the key objectives for HCMC – Long Thanh – Dau Giay Expressway Construction Project, and has been designed to comply with the intent of ISO 14001:2004.

Built into this operating system will be Specification requirements, as defined in the Contract. This Site Environmental Management Plan will incorporate work method statements, inspection and test plans, and check sheets which are developed to cover the particular requirements of this project.

1.2.3 References

Vietnamese Safety and Environmental Rules and Regulation

- QCVN 05:2013/BTNMT - National Technical Regulation on ambient air quality.

Construction phase

- QCVN 06:2009/BTNMT - National Technical Regulation on hazardous substances in ambient air.
- QCVN 26:2010/BTNMT - National Technical Regulation on noise.
- QCVN 27:2010/BTNMT - National Technical Regulation on vibration.
- QCVN 08:2008/BTNMT - National Technical Regulation on surface water quality.
- QCVN 09:2008/BTNMT - National Technical Regulation on groundwater quality.
- QCVN 03:2008/BTNMT - National Technical Regulation on soil quality.
- QCVN 14:2008/BTNMT - National Technical Regulation on domestic waste water.

1.2.4 Compliance

The Contractor, the Engineer, subcontractors and visitors to the Project shall comply with:

- This Environmental Management Plan
- Regulatory requirements of the Socialist Republic of Vietnam that are related to the work scope
- Current standards, regulations

1.2.5 Commitment

The Contractor is fully committed for protecting environment and maintaining a safe workplace.

This Plan shall be provided to subcontractors to increase the communication of environmental information to the Employer's property and to outline the contractor's environmental procedures. The Contractor's Project Manager shall help ensure subcontractor compliance with all of the policies set forth by this program by including this Plan to subcontract specification and communicating problems to the Contractor when they are identified.

All project personnel are required to be involved with and participate in the implementation monitoring and continuous improvement of the environmental management performance of this project.

1.3 MONITORING PROGRAM

The Contractor shall appoint Center of Environment and Applied Ecology (CEEEO) during the execution of the Works. CEEEO will carry out the programme to verify that the Contractor does not cause negative environmental impact exceeding permissible limits. *(The legal document of CEEEO is attached in the appendix)*

The monitoring firm will transmit the data to contractor and latter to provide the same to the Engineer and Employer for their information regarding the effects of the works.

The scope of environmental monitoring work for Package 5A of HCMC- Long Thanh – Dau Giay expressway Construction project will be limited to:

- (1) Air Quality
- (2) Noise
- (3) Vibration

Construction phase

- (4) Surface Water Quality
- (5) Ground Water Quality
- (6) Soil quality

1.3.1 Air Quality Monitoring

The required monitoring program for air quality is tabulated below:

Table 1

No.	Parameter	Baseline Monitoring (Pre-construction phase)			Impact Monitoring (During construction phase)			Remarks	Request of UEMP		
		Frequency	Monitoring stations	Duration	Frequency	Monitoring stations	Duration		Parameter	Frequency	Monitoring stations
1	TSP	1 times	4 points - Site 1: Km 24+100 - Site 2 : Km 25+500 - Site 3: Km 31+800 - Site 4: nearby batching plant area	Within 2 days	4 times/year	4 points - Site 1: Km 24+100 - Site 2: Km 25+500 - Site 3: Km 31+800 - Site 4: nearby batching plant area	Within 2 days	Reference Standard: QCVN 05:2013/BTN MT	1.TSP	8 samples/point (06:00am to 10:00pm, 1 time/2 hours)	1 Point: - Site 1: km 24+100
2	Humidity, temperature, wind speed								2.Humidity, temperature, wind speed		
3	CO								3. CO		
4	SO ₂								4. SO ₂		
5	NO ₂								5. NO ₂		
6	HC								6.HC		

Note:

- Sample shall be taken at 8 time points in day (06:00 – 08:00; 08:00 – 10:00; 10:00 – 12:00; 12:00- 14:00; 14:00 – 16:00; 16:00 – 18:00; 18:00 – 20:00; 20:00 – 22:00)
- The National Technical Regulation QCVN 05:2013/BTNMT and QCVN 06:2009/BTNMT specify ambient air quality and maximum allowable concentration of hazardous substances in ambient air summarized in Appendix 1 and Appendix 2.

1.3.2 Noise Monitoring

The required monitoring program for noise is tabulated below:

Table 2

No.	Parameter	Baseline Monitoring (Pre-construction phase)			Impact Monitoring (During construction phase)			Remarks	Request of UEMP		
		Frequency	Monitoring stations	Duration	Frequency	Monitoring stations	Duration		Parameter	Frequency	Monitoring stations
1	L_{EQ} , L_{10} & L_{90}	1 times	4 points - Site 1: Km 24+100 - Site 2 : Km 25+500 - Site 3: Km 31+800 - Site 4: nearby batching plant area	Within 2 days	4 times/year	4 points - Site 1: Km 24+100 - Site 2 : Km 25+500 - Site 3: Km 31+800 - Site 4: nearby batching plant area	Within 2 days	Reference Standard: QCVN 26:2010/BTN MT	L_{EQ} , L_{10} & L_{90}	17 times/point (06:00am to 10:00pm) Total No. of sample = 1 points * 17 samples/point = 17 samples	1 Point: - Site 1: km 24+100

Note:

- Sample shall be taken at time points in day ((06:00 – 08:00; 08:00 – 10:00; 10:00 – 12:00; 12:00- 14:00; 14:00 – 16:00; 16:00 – 18:00; 18:00 – 20:00; 20:00 – 22:00)
- The maximum permitted noise level during construction in regional normal are specified in QCVN 26:2010/BTNMT in Appendix 3.

1.3.3 Vibration Monitoring

The required monitoring program for vibration is tabulated below:

Table 3

No.	Parameter	Baseline Monitoring (Pre-construction phase)			Impact Monitoring (During construction phase)			Remarks	Request of UEMP		
		Frequency	Monitoring stations	Duration	Frequency	Monitoring stations	Duration		Parameter	Frequency	Monitoring stations
1	Vibration level	1 times	4 points - Site 1: Km 24+100 - Site 2 : Km 25+500 - Site 3: Km 31+800 - Site 4: nearby batching plant area	Within 2 days	4 times/year	4 points - Site 1: Km 24+100 - Site 2 : Km 25+500 - Site 3: Km 31+800 - Site 4: nearby batching plant area	Within 2 days	Reference Standard: QCVN 27:2010/BTN MT	Lvep, Leq	17 times/point (06:00am to 10:00pm) Total No. of sample = 1 points * 17 samples/point = 17 samples	1 Point: - Site 1: km 24+100

Note:

- Sample shall be taken at time points in day (06:00 – 08:00; 08:00 – 10:00; 10:00 – 12:00; 12:00- 14:00; 14:00 – 16:00; 16:00 – 18:00; 18:00 – 20:00; 20:00 – 22:00)
- The maximum permitted vibration level during construction in normal area in QCVN 27:2010/BTNMT in Appendix 4.

1.3.4 Surface Water Monitoring

The required monitoring program for surface water quality is tabulated below:

Table 4

No.	Parameter	Baseline Monitoring (Pre-construction phase)			Impact Monitoring (During construction phase)			Remarks	Request of UEMP		
		Frequency	Monitoring stations	Duration	Frequency	Monitoring stations	Duration		Parameter	Frequency	Monitoring stations
1	pH	1 time	2 points - Site 1: Km25+080-Bung Mon Bridge (2 samples: Upstream and downstream) - Site 2: Km35+500-Suoi Trau Bridge (2 samples: Upstream and downstream)	Within 1 day	4 times/year (1 sample per 1 point)	2 points - Site 1: Km25+080-Bung Mon Bridge (2 samples: Upstream and downstream) - Site 2: Km35+500-Suoi Trau Bridge (2 samples: Upstream and downstream)	Within 1 day	Reference Standard: QCVN 08:2008/BTNMT	1. pH	2 samples/point	1 Point : - Site 1: Bung Môn Bridge (Km25+80)
2	temperature								2. BOD		
3	BOD								3. COD		
4	COD								4. DO		
5	DO								5. SS		
6	SS								6. As		
7	As								7. Cd		
8	Cd								8. Pb		
9	Pb								9. Cu		
10	Cu								10. Zn		
11	Zn								11. Hg		
12	Hg								12. NH ₄ ⁺		
13	NH ₄ ⁺								13. ΣN		
14	ΣN								14. ΣP		
15	ΣP								15. Dầu mỡ		
16	Lubricant								16. coliform		
17	E.coli										
18	Coliform										

Note:

Construction phase

The maximum allowable Concentrations of Contaminants in water of River are specified in QCVN 08:2008/BTNMT summarized in Appendix 5. If baseline values indicating status of air quality at monitoring locations are higher than that of the National Technical Regulation, maximum allowable concentrations of monitoring indicators are set up based on worst case of current situation instead of the standards.

1.3.5 Ground Water Monitoring

The required monitoring program for ground water quality is tabulated below:

Table 5

No.	Parameter	Baseline Monitoring (Pre-construction phase)			Impact Monitoring (During construction phase)			Remarks	Request of UEMP		
		Frequency	Monitoring stations	Duration	Frequency	Monitoring stations	Duration		Parameter	Frequency	Monitoring stations
1	pH	1 time	2 points - GW1: km 23+700 - GW 2: Km 37+300	Within 1 day	Once per quarter	2 points -GW1: km 23+700 -GW2: Km 37+300	Within 1 day	Reference Standard: QCVN 09:2008/BTN MT	1. pH	3 samples/point	1 Point: -Site 1: Km 37+300
2	DO								2. Color		
3	Odor								3. Temperature		
4	Temperature								4. Odor		
5	Color								5. TDS		
6	TDS								6. Hardness		
7	Hardness level								7. Conductivity		
8	Conductivity								8. Turbidity		
9	Turbidity								9. CN ⁻		
10	CN ⁻								10. Cl ⁻		
11	Cl ⁻								11. SO ₄ ²⁻		
12	NO ₃ ⁻								12. Mn		
13	SO ₄ ²⁻								13. Fe		
14	Mn								14. Cd		
15	Fe								15. Pb		
16	Cd								16. As		
17	Pb								17. F. Coliform		
									18. T. coliform		

Construction phase

18	As										
19	Fecal Coliform										
20	Total coliform										

Note:

The maximum allowable Concentrations of Contaminants in groundwater are specified in QCVN 09:2008/BTNMT summarised in Appendix 6.

1.3.6 Soil Quality Monitoring

The required monitoring program for soil quality is tabulated below:

Table 6

No.	Parameter	Baseline Monitoring (Pre-construction phase)			Impact Monitoring (During construction phase)			Remarks	Request of UEMP		
		Frequency	Monitoring stations	Duration	Frequency	Monitoring stations	Duration		Parameter	Frequency	Monitoring stations
1	pH	1 time	2 points - S1: Km 28+400 - S2: Km 37+300	Within 1 day	Once per quarter	2 points - S1: Km 28+400 - S2: Km 37+300	Within 1 day	Reference Standard: QCVN 03:2008/BTN MT	1. pH	3 samples/ point	1 Point: -Site 1: Km 37+300
2	Organic matter								2. Chất hữu cơ		
3	Total N								3. Tổng N		
4	Total P								4. Tổng P		
5	Cl ⁻								5. Cl ⁻		
6	SO ₄ ²⁻								6. SO ₄ ²⁻		
7	Cu								7. Cu		
8	Zn								8. Zn		
9	Cd								9. Cd		
10	Pb								10. Pb		
11	Hg								11. Hg		
12	As								12. As		

Construction phase

13	Fe								13. Fe		
----	----	--	--	--	--	--	--	--	--------	--	--

Note:

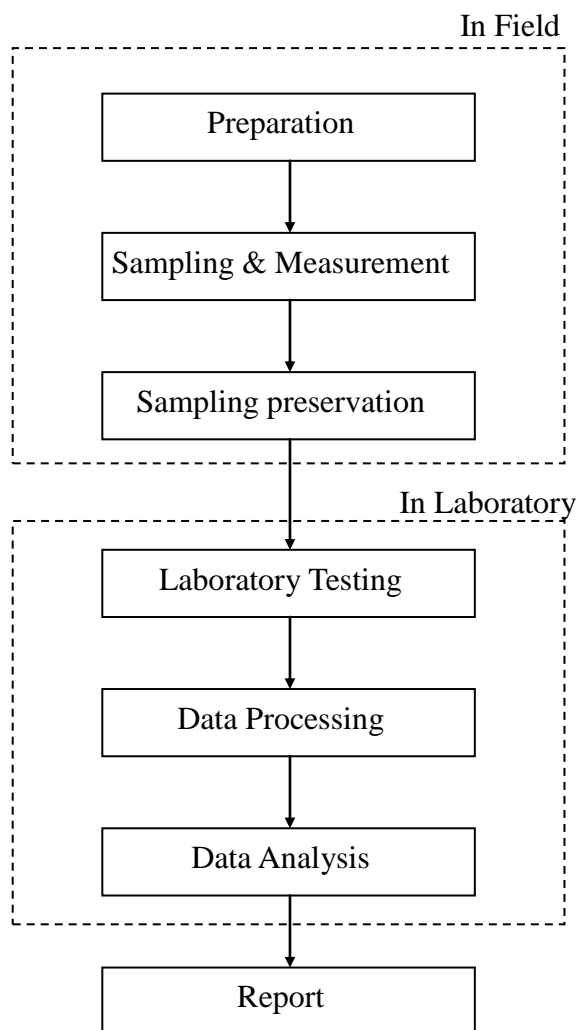
The maximum allowable Concentrations of Contaminants in soil are specified in QCVN 03:2008/BTNMT summarised in Appendix 7.

1.4.2 Pertinent agencies

The contractor must achieve the necessary permits for environmental monitoring and cooperate the pertinent agencies when required, such as the following ones;

- (i) Relevant authorities (Department of Natural Resources and Environment of Dong Nai Province; Part of Natural Resources and Environment of Long Thanh district)
- (ii) Relevant Government authorities.

1.5 TERM OF REFERENCES (TORs)



Construction phase

The tasks, name and contact details of the individuals/entities in the organizational chart

Individual/entities	Responsibility	Name	Contact
Contractor			
Project Director	Manage entire work of package 5A and guide under-position to do their duty	Mr. LEE, SANG HOON	HP: 012 6918 2356 Email:sanglee@poscoenc.com
Construction Manager	Control all of the works on site	Mr. CHO, YONG KOOK	HP: 012 7986 3073 E: choyse@poscoenc.com
Safety Specialist	Manage safe issues on the site during construction	Mr. Ngo Quang Ngai	HP: 0903 882 211 E: quangngai1968@gmail.com
Environmental Specialist	Manage environmental issues on the site and the office to ensure the environment protected during construction	Ms. To Thi Thuy Hang	HP: 0913 613 712 E: thuyhang.phap@yahoo.com
Site Engineer	Check and Survey the site	Mr. Pham Quy Thuan	HP: 0986 330 092 E: thuanbkld@yahoo.com
Specialized Monitoring Sub-contractor	Monitor the environment on site and make the environmental report based on environmental monitoring result	Mr. Pham Thanh Toan	HP: 093 812 5122 E: tuvanceeco@gmail.com
Pertinent Agencies Regarding Environment Issue	Check the environment on site to ensure they meet EIA and SEMP	+Natural Resources and Environment Department of Long Thanh District +Natural Resources and Environment of	Address: +Long Thanh District, Long Thanh Town, Dong Nai Province +Dong Khoi St., Tan Hiep Ward,

Construction phase			
		Dong Nai Province	Bien Hoa City, Dong Nai Province
The Engineer	Check , review and guide all of the environment issues of Contractor	Mr. Pham Vu Loi	HP: 0983 568 512 E: loipv04@gmail.com
The Employer (EPMU)	Supervise and check the EMP implementation and the environmental issues of Contractor	Mr. Le Manh Hung	HP: 0909 726 363

1.6 REPORT

Monitoring report should include the following items:

- Assessment of impacts on current environmental status based on the collected data and the comparison with baseline and reference regulation as well as monthly results to find out the trend of environmental changes;
- Assessment of impact levels in the project area during the construction stage;
- Proposal of the mitigation measures (if needed),
- Conclusion and recommendation,
- Photos of monitoring activities, and
- Maps of sampling locations

1.7 INDISPENSABLE MANPOWER

Engineer and labours necessary for the environmental monitoring work are listed below:

No.	Description	Detail	Q'ty	Remarks
1	Site Engineer	Contractor	1	
2	Supervisor	Subcontractor	2	CEECO
3	Technician	Subcontractor	8	3 for air sampling, 1 for noise measuring, 1 for vibration measuring,

Construction phase				
				2 for water sampling 1 for soil sampling
4	Lab Technician	Subcontractor	2-3	as required

PART II

RESULTS OF ENVIRONMENTAL MONITORING IN CONSTRUCTION PHASE

2.1 OBJECT

The purposes of the monitoring program are: (a) to evaluate the current environmental quality in the project area in the pre-construction phase; (b) to provide data for environmental management and to evaluate the changes in environmental quality caused by construction activities during the construction phase; and (c) to provide data for the further monitoring programs in the operation phase.

2.2 SCOPE

The scope of work for the firm on HCMC – Long Thanh – Dau Giay Expressway Construction Project – Package 5A will be limited to:

- (7) Air Quality
- (8) Noise
- (9) Vibration
- (10) Surface Water Quality
- (11) Ground Water Quality
- (12) Soil quality

2.3 MONITORING LOCATION

- **Noise and vibration measurement and air sampling locations**

Noise and vibration measurement and air sampling locations are carried out at 4 points:

- A1: Km 24 + 100
- A2: Km 25+500
- A3: Km 31+800
- A4: nearby batching plant area

- **Water sampling locations**

- **Sample of surface water: 2 points:**
 - + W1: Km 25+080 - Bung Mon bridge (02 samples: Upstream and downstream)
 - + W2: Km 35+500 – Suoi Trau bridge (02 samples: Upstream and downstream)
- **Sample of ground water: 2 points:**
 - + GW1: Km 23 + 700
 - + GW2: Km 37 + 300
- **Soil sampling location: 2 points:**
 - + S1: Km 24+400
 - + S2: Km 37+300

Project position is illustrated in Fig 1 and monitoring locations are shown in Fig 2

Figure 1: The position of package 5A

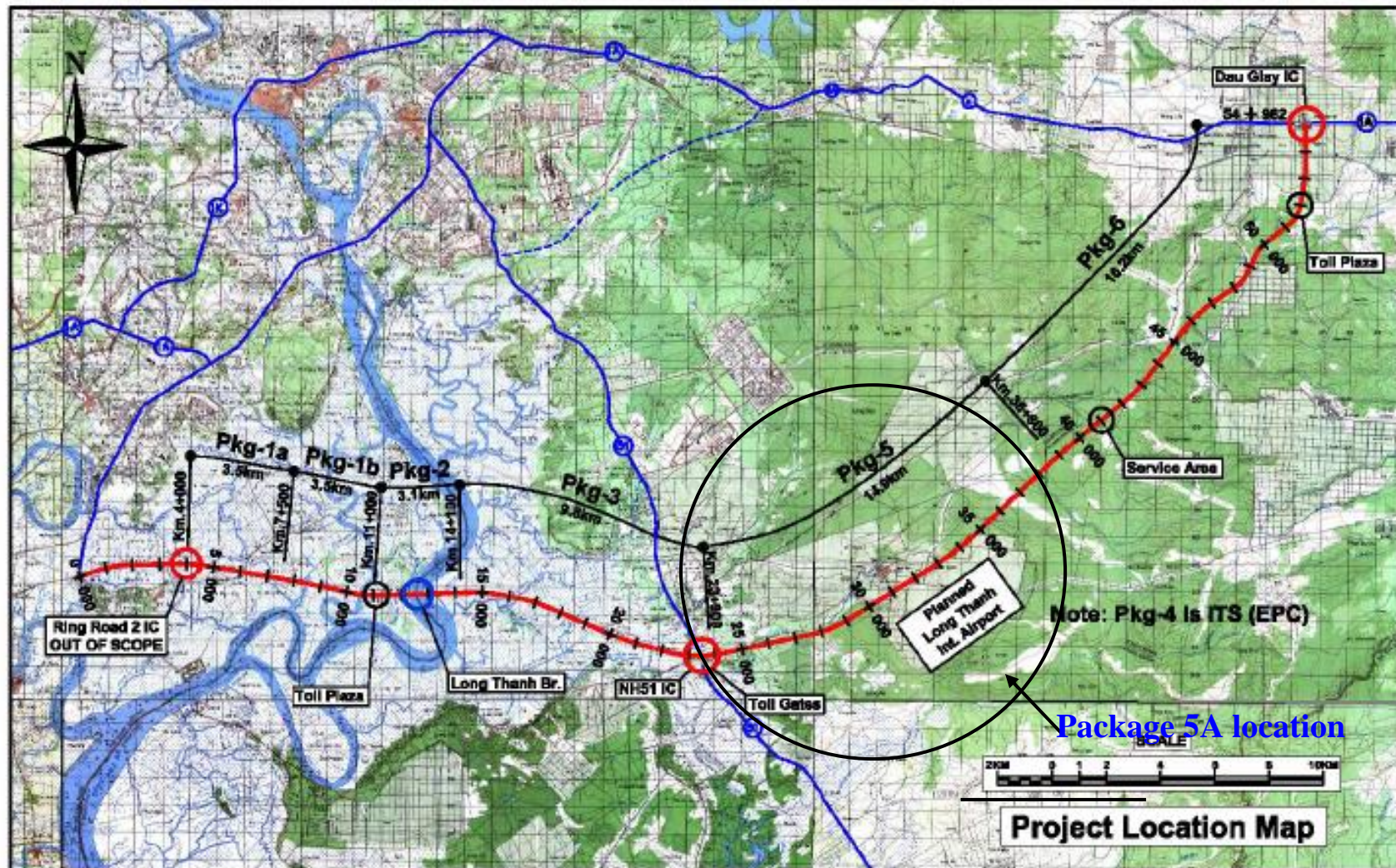
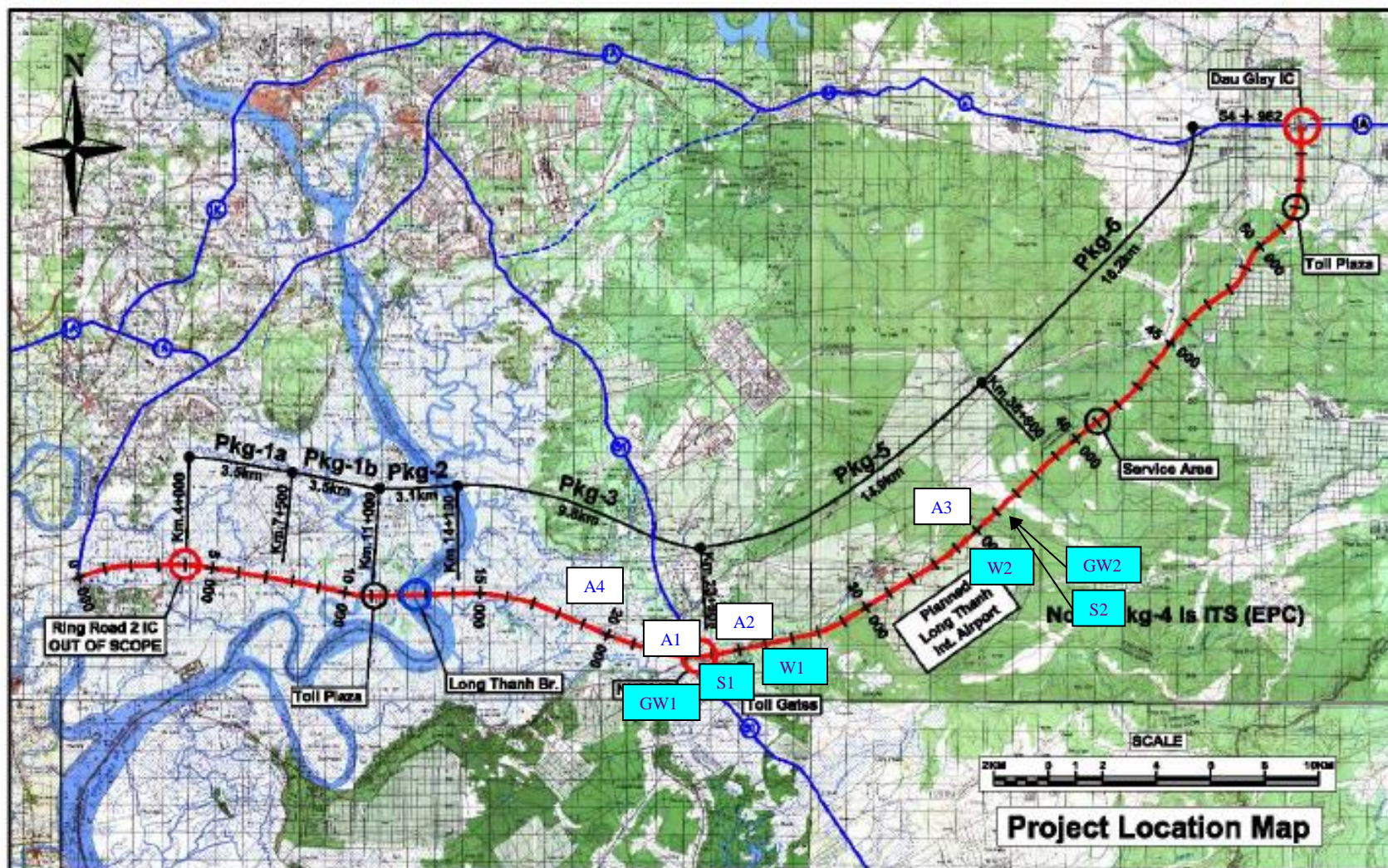


Figure 2: The environment monitoring locations



2.4 MONITORING SCHEDULE

Schedule for the environmental monitoring program

Contents	March 2014												April 2014						
	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7
Air sampling																			
Water sampling																			
Noise sampling																			
Vibration																			
Ground sampling																			
Soil sampling																			
Sample analyzing																			
Data processing																			
Data analysis																			
Final report																			

2.4.1. Noise, vibration and air quality sampling

• On March 20, 2014

LOCATION OF MONITORING	HOURS							
	Time 1	Time 2	Time 3	Time 4	Time 5	Time 6	Time 7	Time 8
A3: Km31+800	06:00 – 08:00	08:00 – 10:00	10:00 – 12:00	12:00 – 14:00	14:00 – 16:00	16:00 – 18:00	18:00-20:00	20:00-22:00
A4: nearby batching plant area	Batching plants have not been operation implemented, so no environmental monitoring, will be monitoring later.							

• On March 21, 2014

LOCATION OF MONITORING	HOURS							
	Time 1	Time 2	Time 3	Time 4	Time 5	Time 6	Time 7	Time 8
A1: Km24+100	06:00 – 08:00	08:00 – 10:00	10:00 – 12:00	12:00 – 14:00	14:00 – 16:00	16:00 – 18:00	18:00-20:00	20:00-22:00
A2: Km25+500								

2.4.2. Surface Water, Soil and Ground water sampling

LOCATION OF MONITORING	On March 20, 2014	On March 21, 2014
W2: Suoi Trau Bridge (Km 35+500)	14:00 – 16:00	
GW2: Km 37+300		

S2: Km 37+300		
W1: Bung Mon Bridge (Km 25+080)		14:00 – 16:00
GW1: Km 23 + 700		
S1: Km 24+400		

Note: **A** Noise, vibration and air quality, **W** Surface Water, **S** Soil, **GW** Ground water

GW1: (Km 23+700): Householder: Tran Quyet Thang

Address: 14/19 Hamlet 2, Long An commune, Long Thanh District, Dong Nai province

GW2: (Km 37+300): Householder: Bui Thanh Lam

Address: 64 Bau Tre hamlet, Binh Son commune, Long Thanh District, Dong Nai province.

2.5 SAMPLING METHODS, FIELD-EQUIPMENTS' SPECIFICATION AND ANALYSIS METHODS

• Noise, vibration, and ambient air samples

No.	Parameters	Field-equipments' specification	Sampling methods		Analysis methods	
			TCVN	Methods	TCVN	Methods
1	Noise	Quest 2900 (USA) Range: 20dB to 140dB	5964-1995 5965-1995	- Measuring time: 10 minutes - Noise values is automatically recorded according to analysis methods.	5949-1998	Print the result by the way of connection between Noise-measuring machine Quest 2900 and printer.
2	Vibration	Rion VM-83 (JAPAN) Range: 0.0001 to 1000m/s ² Frequency: 1Hz to 10kHz	6963-2001	- Measuring time: 10 minutes - Value is collected by observation, the chosen value is the average acceleration of the ten highest values of 100 measured ones (the total measuring time per value is about 5 seconds)	6962-2001 6963-2001	Read and calculate the measured values according with TCVN 6963-2001
3	Microclimate	EM 9000 (Taiwan)	In-field measurement	Specialized machine	In-field measurement	Specialized machine
4	Particles	Staplex (USA) High volume air samplers Flow rate: 0 to 2 CMM	5067-1995	- Sampling time: 10 minutes - Sampling volume: 0,5 m ³ /minute - Filter paper GC-50 - Size 100 mm	5067:1995	TSP concentration in air environment is calculated according to weigh method

No.	Parameters	Field-equipments' specification	Sampling methods		Analysis methods	
			TCVN	Methods	TCVN	Methods
5	SO ₂	SKC 224-PCXR8 (USA) Universal sample pump Flow rate: 0 to 5 l/m Time display: LCD shows sampler run time	5971-1995	- Sampling time: 30 minutes - Sampling volume: 1 L/minute - Absorbing solution TCM (HgCl ₂ , KCl, EDTA)	5971-1995	The method of Tetrachloromercurat (TCM)/ Pararosanilin is used to calculate the concentration Sulfur dioxide in air environment.
6	NO ₂		6137-1996	- Sampling time: 30 minutes - Sampling volume: 1 L/minute - Absorbing solution: NH ₂ C ₆ H ₄ SO ₂ .2HCl + HOOC(CHOH) ₂ COOH + (HOOCCH ₂)N(CH ₂) ₂ N(CH ₂ COONa) ₂ .2H ₂ O	6137-1996	The analyzed method basing on the Griess-Saltman method.
7	CO		Health Ministry 52 TCN 352-89	- Sampling time: 10 minutes - Sampling volume: 5 L/minute - Absorbing solution: PdCl ₂	Health Ministry 52 TCN 352-89	The method of PdCl ₂ solution –using absorbtion/Colourimetry
8	HC		Standard test	- Sampling time: 10 minutes - Sampling volume: 1 L/minute - Test Solution: Activated Carbon	Standard test	The method of Gas chromatography

• Surface water samples

Sampling methods were based on TCVN 5993-1995.

Professional sampling tool, manufactured by KC Denmark and able to measure the depth and collect water at a desired water level, was used for sampling.

Determining water sampling points relies on cross section of river or sea. At each cross section, sample positions were collected at the calculated location and at depth level: For river water, sampling depths were at 1m from the surface and in the middle of water column.

The technique, equipment and methods used for sampling and analysis are briefly described in the following table:

No.	Parameters	Equipments	Applied standard Codes
1	pH	Sper scientific 850081 (USA) Range: 0 – 14 Resolution: 0.01 Accuracy: +/- (0.02PH+2d)	In-field measurement

No.	Parameters	Equipments	Applied standard Codes
2	BOD ₅ ²⁰	Incubation and Manometer method by using professional equipment named BOD Trak.	TCVN 6001-1998
3	COD	Oxygenation methods using K ₂ Cr ₂ O ₇ in acid environment and titration with Ferrous Ammonium Sulfate; using Hg ₂ SO ₄ to eliminate the impact of Cl ⁻ in case of low COD concentration and high chloride.	TCVN 6491-1999
4	Dissolved Oxygen (DO)	Hanna – HI9147-04 (ITALY) Range: 0.0 to 50 mg/L Resolution: 0.1 mg/L Accuracy: +/- 2% F.S	In-field measurement
5	Suspended solids (SS)	Weight method	TCVN 6625-2000
6	Arsenic (As)	Atomic Absorption Spectrometer SHIMADZU AA-6300	SMEWW3500-As-2000
7	Cadmium (Cd)	Atomic Absorption Spectrometer SHIMADZU AA-6300	SMEWW3500-Cd-2000
8	Lead (Pb)	Atomic Absorption Spectrometer SHIMADZU AA-6300	SMEWW3500-Pb-2000
9	Copper (Cu)	Atomic Absorption Spectrometer SHIMADZU AA-6300	SMEWW3500-Cu-2000
10	Zinc (Zn)	Atomic Absorption Spectrometer SHIMADZU AA-6300	SMEWW3500-Zn-2000
11	Mercury (Hg)	Atomic Absorption Spectrometer SHIMADZU AA-6300	SMEWW3500-Hg-2000
12	Ammonia (NH ₄ ⁺)	Ultra Violet Spectrometer	TCVN 6179 – 1996
13	Total N	Kjeldalh Method	TCVN 5987 – 1995
14	Total P	Ultra Violet Spectrometer	TCVN 6202 – 1996
15	Lubricant	Weight Method	TCVN 5070 – 1995
16	Coliform	Test tube	ISO93081:2000

Note: - TCVN: Vietnam Standard

- APHA: American Public Health Association

- AOAC: Association of Official Analytical Chemists; - SMEWW: Standard Method Examination of Water and Wastewater

• Ground water sample

No.	Parameters	Equipments	Applied standard Codes
1	pH	Sper scientific 850081 (USA) Range: 0 – 14 Resolution: 0.01 Accuracy: +/- (0.02PH+2d)	In-field measurement
2	Color	Pt-Co Colourimetric	
3	Temperature	Hanna – HI991300 (ITALY) Range: 0.0 đến 60.0 °C Resolution: 0.1 °C Accuracy: +/- 0.5 °C	In-field measurement
4	Odor	Sense	
5	Total dissolved solid (TDS)	Hanna – HI991300 (ITALY) Range: 0 to 2000 ppm Resolution: 1 ppm Accuracy: +/- 2% F.S	In-field measurement
6	Hardness	Titration method	TCVN 6660:2000
7	EC	Hanna – HI991300 (ITALY) Range: up to 3999 µS/cm Resolution: 1 µS/cm Accuracy: +/- 2% F.S	In-field measurement
8	Turbidity	Hanna – HI93703 (ITALY) Range: 0.00 to 50.00FTU/ 50 to 1000 FTU Resolution: 0.01/FTU Accuracy: +/- 0.5 FTU or +/- 5%	In-field measurement

No.	Parameters	Equipments	Applied standard Codes
9	Xyanua (CN ⁻)	Analytic Method	TCVN 6181-1996
10	Clorua (Cl ⁻)	Ultra Violet Spectrometer	TCVN 6194-1996
11	Sulphat (SO ₄ ²⁻)	Weight Method	TCVN 6660-2000
12	Nitrate (NO ₃ ⁻)	Ultra Violet Spectrometer	TCVN 6180-96
13	Mangan (Mn)	Atomic Absorption Spectrometer SHIMADZU AA-6300	SMEWW3500-Mn-2000
14	Iron (Fe)	Atomic Absorption Spectrometer SHIMADZU AA-6300	SMEWW3500-Fe-2000
15	Cadmium (Cd)	Atomic Absorption Spectrometer SHIMADZU AA-6300	SMEWW3500-Cd-2000
16	Lead (Pb)	Atomic Absorption Spectrometer SHIMADZU AA-6300	SMEWW3500-Pb-2000
17	Arsenic (As)	Atomic Absorption Spectrometer SHIMADZU AA-6300	SMEWW3500-As-2000
18	Mercury (Hg)	Atomic Absorption Spectrometer SHIMADZU AA-6300	SMEWW3500-Hg-2000
19	Fecal Coliform	Test tube	ISO9308-2:1990
20	T.Coliform	Test tube	ISO9308-2:1990

Soil and excavated soil sample

No.	Parameter	Field – equipment's specification and Analysis method	Comparative Standard
1	pH	Breaking with solution (10% KCl)	TCVN 5979-1995
2	Organic	Breaking and titration method	TCVN 7572-16:2006
3	Total N	Breaking and Kjeldalh method	TCVN 4052-1985
4	Total P	Breaking and clourimetric method	TCVN 4052-1985
5	Cl ⁻	Breaking and titration method	TCVN 7572-16:2006
6	SO ₄ ²⁻	Breaking and titration method	TCVN 7572-16:2006
7	Cu	Atomic Absorption Spectrometer SHIMADZU AA-6300	TCVN 6496-1999
8	Zn	Atomic Absorption Spectrometer SHIMADZU AA-6300	TCVN 6496-1999
9	Cd	Atomic Absorption Spectrometer SHIMADZU AA-6300	TCVN 6496-1999
10	Pb	Atomic Absorption Spectrometer SHIMADZU AA-6300	TCVN 6496-1999
11	Hg	Atomic Absorption Spectrometer SHIMADZU AA-6300	TCVN 6496-1999
12	As	Atomic Absorption Spectrometer SHIMADZU AA-6300	TCVN 6496-1999
13	Fe	Atomic Absorption Spectrometer SHIMADZU AA-6300	TCVN 6496-1999

2.6 ENVIRONMENTAL MONITORING RESULTS

In order to assess the potential impacts of construction activities on the ambient environment in construction phase, CEECO carried out the monitoring of air quality, a actual state of noise, vibration, river water, ground water, and soil in pre-construction phase. This collected data will be used as baseline data to evaluate any change of environmental quality during construction phase.

2.6.1 Air monitoring results

The result of measured and analyzed air quality at sampling locations is specifically presented in the following table.

Table 2.1 – Monitoring results of air quality in project area

Time/Location		Temperature (°C)	Humid (%)	Wind velocity (m/s)	TSP (mg/m ³)	SO ₂ (mg/m ³)	NO ₂ (mg/m ³)	CO (mg/m ³)	HC (mg/m ³)
Time 1 (06:00-08:00)	A1-1	28.7	77.2	0.1-0.2	0.147	0.055	0.042	3.74	NDT
	A2-1	30.6	68.7	0.1-0.8	0.122	0.038	0.027	1.25	NDT
	A3-1	29.7	70.5	0.1-0.8	0.215	0.069	0.055	5.18	0.28
Time 2 (08:00-10:00)	A1-2	32.3	58.9	0.2-0.8	0.194	0.058	0.045	3.97	0.31
	A2-2	31.6	66.9	0.1-0.6	0.157	0.042	0.038	2.28	0.19
	A3-2	30.4	66.5	0.2-1.1	0.248	0.072	0.059	5.74	0.44
Time 3 (10:00-12:00)	A1-3	34.2	50.1	0.2-1.2	0.205	0.064	0.049	4.83	0.35
	A2-3	31.9	65.2	0.4-1.9	0.189	0.052	0.046	2.72	0.26
	A3-3	32.4	62.8	0.3-1.4	0.227	0.067	0.052	4.89	0.36
Time 4 (12:00-14:00)	A1-4	34.3	44.8	0.1-1.6	0.178	0.059	0.041	3.62	0.34
	A2-4	32.8	61.3	0.3-1.4	0.193	0.056	0.041	2.57	0.33
	A3-4	33.1	56.8	0.2-0.9	0.264	0.083	0.067	5.64	0.27
Time 5 (14:00-16:00)	A1-5	32.7	52.4	0.2-1.8	0.214	0.068	0.057	5.42	0.49
	A2-5	31.9	62.7	0.2-1.6	0.247	0.052	0.044	3.28	0.21
	A3-5	34.0	50.8	0.2-0.5	0.263	0.085	0.071	6.14	0.39
Time 6 (16:00-18:00)	A1-6	30.6	64.2	0.2-0.8	0.195	0.061	0.044	3.82	0.44
	A2-6	30.2	67.5	0.6-2.8	0.134	0.049	0.035	2.86	0.15
	A3-6	31.6	55.2	0.2-1.4	0.235	0.073	0.056	5.43	0.24
Time 7 (18:00-20:00)	A1-7	29.6	69.2	0.1-0.6	0.207	0.053	0.042	2.92	0.28
	A2-7	29.2	69.8	0.3-1.1	0.106	0.038	0.026	1.49	NDT
	A3-7	29.6	65.4	0.1-0.9	0.204	0.067	0.052	4.65	0.18
Time 8 (20:00-22:00)	A1-8	27.4	74.8	0.1-0.5	0.186	0.044	0.036	2.57	0.25
	A2-8	28.7	71.8	0.2-1.0	0.109	0.036	0.029	1.54	NDT
	A3-8	27.5	71.6	0.1-0.5	0.204	0.062	0.044	4.36	NDT
QCVN 05:2013/BTNMT		-	-	-	0.30	0.200	0.350	30	-
QCVN 06:2009/BTNMT		-	-	-	-	-	-	-	5.00

Note:- NDT: Not detected.

Comparison with the monitoring results of TSP in the pre-construction phase

Time/Location		Pre-construction phase	Construction phase
		January 2014	March 2014
Time 1 (06:00-08:00)	A1-1	0.117	0.147
	A2-1	0.062	0.122
	A3-1	0.217	0.215
Time 2 (08:00-10:00)	A1-2	0.121	0.194
	A2-2	0.074	0.157
	A3-2	0.238	0.248
Time 3 (10:00-12:00)	A1-3	0.227	0.205
	A2-3	0.109	0.189
	A3-3	0.287	0.227
Time 4 (12:00-14:00)	A1-4	0.173	0.178
	A2-4	0.087	0.193
	A3-4	0.248	0.264
Time 5 (14:00-16:00)	A1-5	0.254	0.214
	A2-5	0.094	0.247
	A3-5	0.273	0.263
Time 6 (16:00-18:00)	A1-6	0.247	0.195
	A2-6	0.073	0.134
	A3-6	0.268	0.235
Time 7 (18:00-20:00)	A1-7	0.196	0.207
	A2-7	0.068	0.106
	A3-7	0.247	0.204
Time 8 (20:00-22:00)	A1-8	0.154	0.186
	A2-8	0.062	0.109
	A3-8	0.197	0.204
QCVN 05:2013/BTNMT		0.30	0.30

Comparison with the monitoring results of SO₂ in the pre-construction phase

Time/Location		Pre-construction phase	Construction phase
		January 2014	March 2014
Time 1 (06:00-08:00)	A1-1	0.052	0.055
	A2-1	0.034	0.038
	A3-1	0.064	0.069
Time 2 (08:00-10:00)	A1-2	0.054	0.058
	A2-2	0.038	0.042
	A3-2	0.078	0.072
Time 3 (10:00-12:00)	A1-3	0.062	0.064
	A2-3	0.042	0.052
	A3-3	0.075	0.067
Time 4 (12:00-14:00)	A1-4	0.055	0.059
	A2-4	0.036	0.056
	A3-4	0.075	0.083
Time 5 (14:00-16:00)	A1-5	0.078	0.068
	A2-5	0.045	0.052
	A3-5	0.080	0.085
Time 6 (16:00-18:00)	A1-6	0.068	0.061
	A2-6	0.033	0.049
	A3-6	0.077	0.073
Time 7 (18:00-20:00)	A1-7	0.051	0.053
	A2-7	0.031	0.038
	A3-7	0.072	0.067
Time 8 (20:00-22:00)	A1-8	0.048	0.044
	A2-8	0.027	0.036
	A3-8	0.065	0.062
QCVN 05:2013/BTNMT		0.200	0.200

Comparison with the monitoring results of NO₂ in the pre-construction phase

Time/Location		Pre-construction phase	Construction phase
		January 2014	March 2014
Time 1 (06:00-08:00)	A1-1	0.040	0.042
	A2-1	0.028	0.027
	A3-1	0.052	0.055
Time 2 (08:00-10:00)	A1-2	0.044	0.045
	A2-2	0.032	0.038
	A3-2	0.063	0.059
Time 3 (10:00-12:00)	A1-3	0.053	0.049
	A2-3	0.035	0.046
	A3-3	0.060	0.052
Time 4 (12:00-14:00)	A1-4	0.046	0.041
	A2-4	0.029	0.041
	A3-4	0.059	0.067
Time 5 (14:00-16:00)	A1-5	0.062	0.057
	A2-5	0.032	0.044
	A3-5	0.065	0.071
Time 6 (16:00-18:00)	A1-6	0.054	0.044
	A2-6	0.025	0.035
	A3-6	0.061	0.056
Time 7 (18:00-20:00)	A1-7	0.042	0.042
	A2-7	0.022	0.026
	A3-7	0.055	0.052
Time 8 (20:00-22:00)	A1-8	0.039	0.036
	A2-8	0.023	0.029
	A3-8	0.048	0.044
QCVN 05:2013/BTNMT		0.350	0.350

Comparison with the monitoring results of CO in the pre-construction phase

Time/Location		Pre-construction phase	Construction phase
		January 2014	March 2014
Time 1 (06:00-08:00)	A1-1	2.24	3.74
	A2-1	1.92	1.25
	A3-1	4.76	5.18
Time 2 (08:00-10:00)	A1-2	3.67	3.97
	A2-2	2.47	2.28
	A3-2	6.24	5.74
Time 3 (10:00-12:00)	A1-3	4.64	4.83
	A2-3	2.75	2.72
	A3-3	5.79	4.89
Time 4 (12:00-14:00)	A1-4	4.12	3.62
	A2-4	1.42	2.57
	A3-4	5.72	5.64
Time 5 (14:00-16:00)	A1-5	5.41	5.42
	A2-5	2.07	3.28
	A3-5	6.68	6.14
Time 6 (16:00-18:00)	A1-6	4.72	3.82
	A2-6	1.74	2.86
	A3-6	6.27	5.43
Time 7 (18:00-20:00)	A1-7	3.47	2.92
	A2-7	1.27	1.49
	A3-7	5.49	4.65
Time 8 (20:00-22:00)	A1-8	2.54	2.57
	A2-8	1.16	1.54
	A3-8	4.68	4.36
QCVN 05:2013/BTNMT		30	30

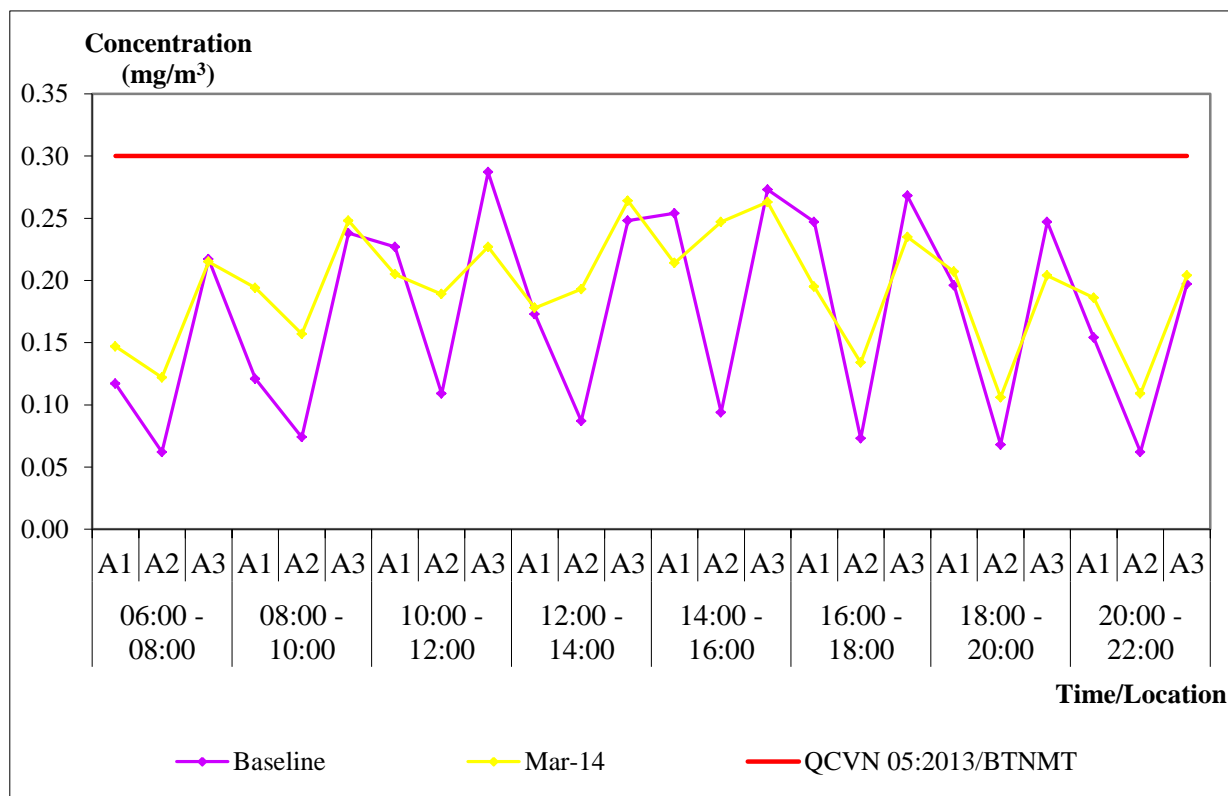


Figure 3. The concentration of TSP in monitoring locations at 8 times

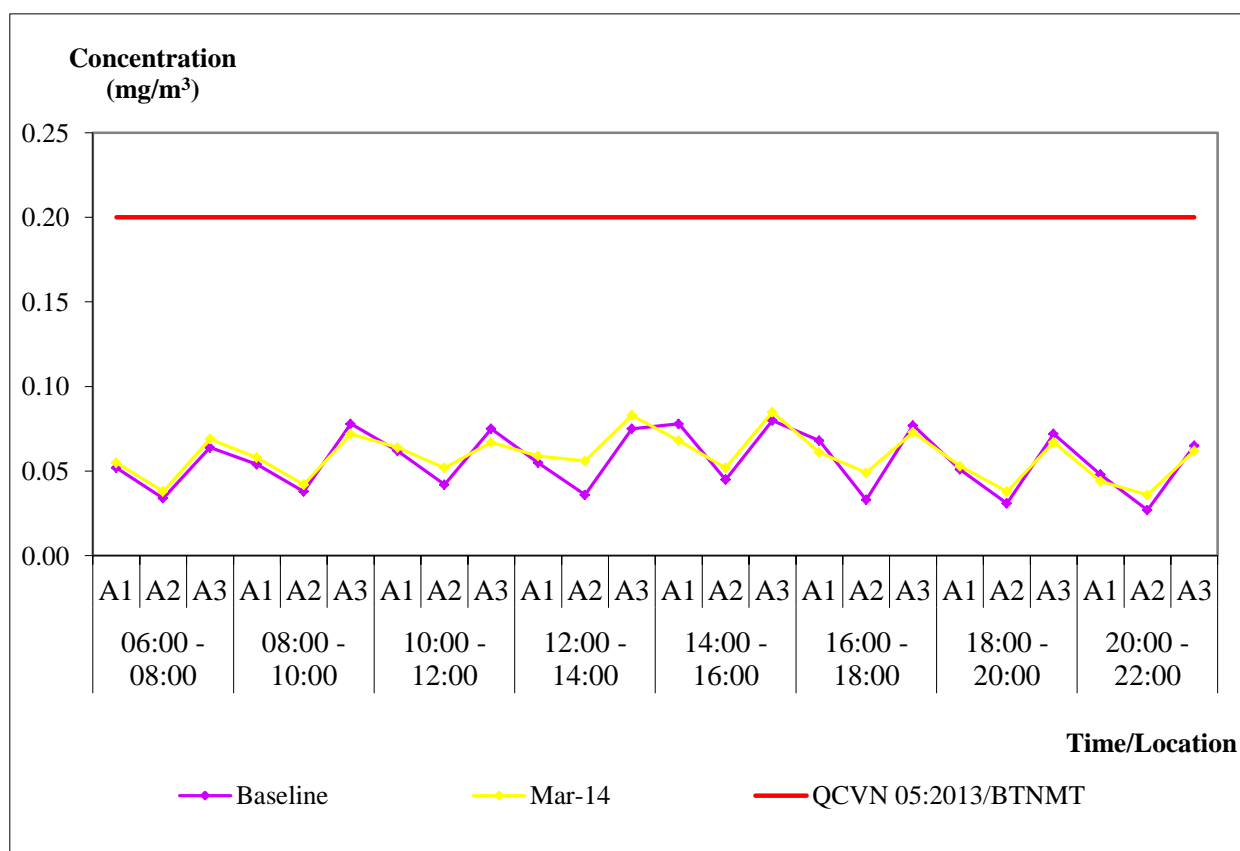


Figure 4. The concentration of SO₂ in monitoring locations at 8 times

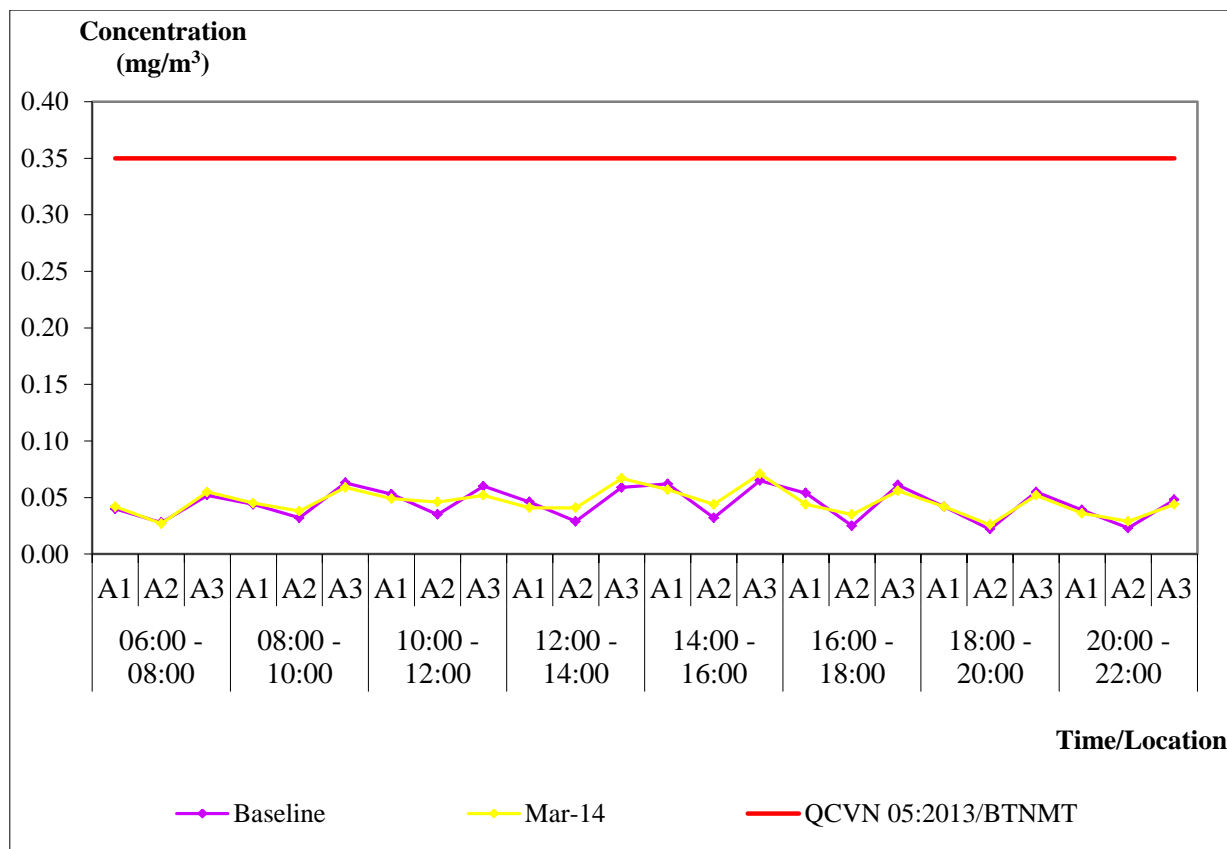


Figure 5. The concentration of NO₂ in monitoring locations at 8 times

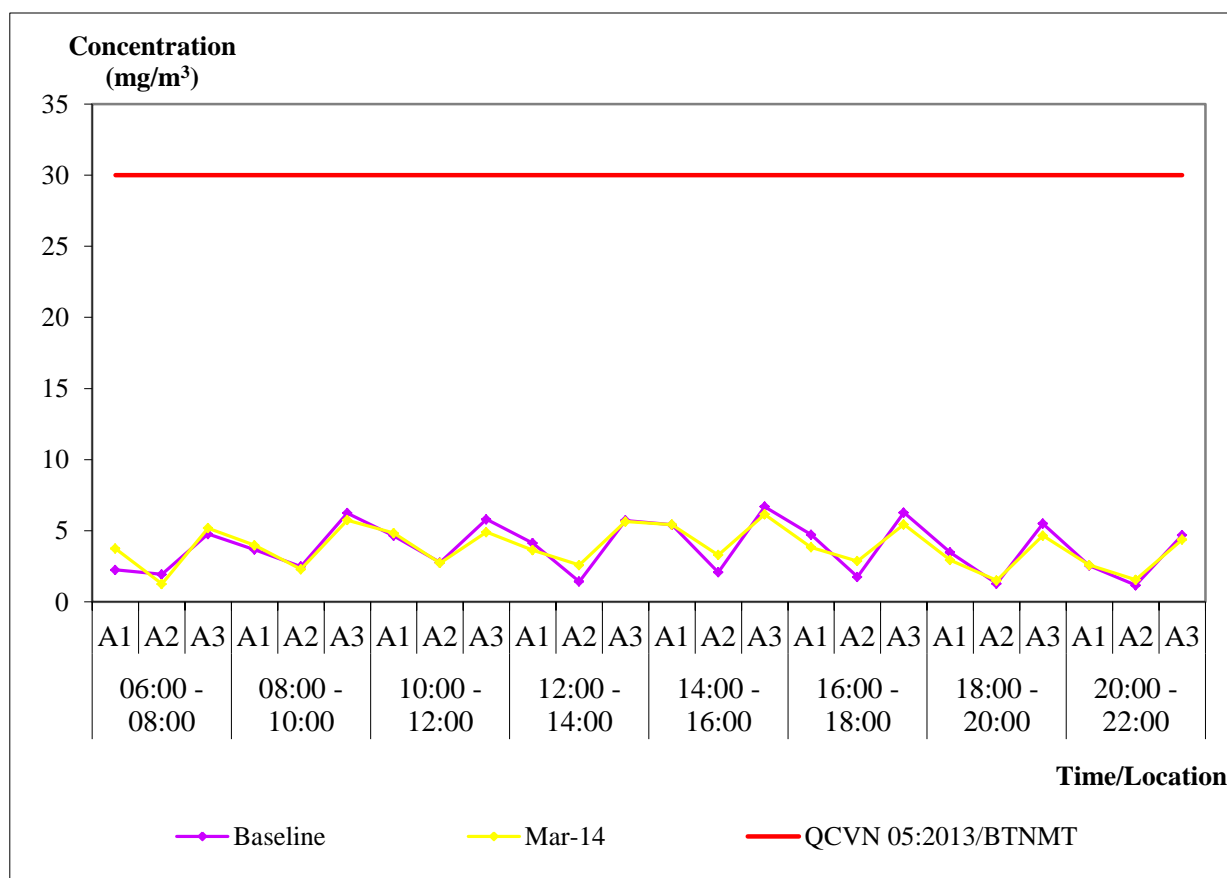


Figure 6. The concentration of CO in monitoring locations at 8 times**Remarks**

- **Particulates (TSP)**

Total suspended particulates concentrations at 3 sampling points A1 to A3 in eight monitoring times in March 2014 fluctuate within 0.106 - 0.264mg/m³. Average value in March 2014 (0.193 mg/m³) is higher than average value in baseline (0.170mg/m³). Results in March 2014 shows that at location A3 is higher than remaining locations, due to the impact of traffic on road DT769. However, all these values are well satisfactory with the limited value of 0.30 mg/m³ in the National Technical Regulation on ambient air quality QCVN 05: 2013/BTNMT.

- **SO₂**

The values of SO₂ concentration in 3 sampling positions in 8 times in March 2014 vary between 0.036 – 0.085mg/m³. This result is a bit higher than result in baseline (0.027 – 0.080mg/m³) but all obtained values also clearly meet the limited value of 0.2 mg/m³ in the National Technical Regulation on ambient air quality QCVN 05: 2013/BTNMT.

- **NO₂**

The analyzed values of NO₂ range from 0.026 mg/m³ to 0.071mg/m³. This result is around result in baseline. They are significantly lower than the limitation value of 0.35 mg/m³ in the Regulation QCVN 05:2013/BTNMT.

- **CO**

The results of CO concentration measured in 3 sampling positions in March 2014 vary within the range of 1.25 – 6.14mg/m³. These values are around values in baseline (1.16 – 6.68mg/m³). Hence, they are still many times as low as the limited value of 30 mg/m³ in the National Technical Regulation on ambient air quality.

- **HC**

Concentration of HC measured at 3 sampling points in 8 times in March 2014 vary within the range of not detected – 0.49mg/m³. These values are around value in baseline (not detected – 0.62mg/m³). Hence, they are still many times as low as the limited value of 5.0 mg/m³ in the Regulation QCVN 06:2009/BTNMT.

In general, air environment quality in project area is rather good. The concentrations of pollution parameters such as TSP, SO₂, NO₂, CO, HC monitored in 3 sampling positions in 8 times in March 2014 are around values in baseline and still fully satisfy the limited values in National Technical Regulation on ambient air quality QCVN 05:2013/BTNMT and QCVN06:2009/BTNMT.

2.6.2. Noise monitoring results

The result of measured noise level in three monitoring locations at eight times in construction phase is presented in the following table.

Table 2.2 Results of noise level in three monitoring locations

Time/Location		Result			QCVN 26:2010/BTNMT L _{EQ}
		L _{EQ}	L ₁₀	L ₉₀	
Time 1 (06:00-08:00)	A1-1	65,1	67,9	58,1	70
	A2-1	58,4	63,1	46,7	70
	A3-1	61,6	63,2	56,8	70
Time 2 (08:00-10:00)	A1-2	63,4	66,8	59,8	70
	A2-2	57,9	61,4	50,4	70
	A3-2	64,5	68,1	55,3	70
Time 3 (10:00-12:00)	A1-3	50,1	53,4	48,2	70
	A2-3	54,4	58,4	43,8	70
	A3-3	65,5	67,7	52,6	70
Time 4 (12:00-14:00)	A1-4	53,9	62,8	54,3	70
	A2-4	50,5	54,5	42,6	70
	A3-4	63,8	65,6	54,1	70
Time 5 (14:00-16:00)	A1-5	61,5	67,9	52,4	70
	A2-5	59,2	62,4	53,4	70
	A3-5	61,2	64,8	54,7	70
Time 6 (16:00-18:00)	A1-6	59,4	61,3	55,9	70
	A2-6	58,8	60,2	53,5	70
	A3-6	64,4	67,8	56,3	70
Time 7 (18:00-20:00)	A1-7	49,8	51,5	44,8	70
	A2-7	60,1	64,5	51,2	70
	A3-7	67,9	69,9	61,4	70
Time 8 (20:00-22:00)	A1-8	52,0	54,3	45,1	70
	A2-8	51,5	52,8	49,1	70
	A3-8	66,2	69,1	56,8	70

Comparison with the monitoring results of Noise in the pre-construction stage

Time/Location		Pre-construction phase	Construction phase	QCVN 26:2010/BTNMT L _{EQ}
		January 2014	March 2014	
		L _{EQ}	L _{EQ}	
Time 1 (06:00-08:00)	A1-1	57.1	65.1	70
	A2-1	54.8	58.4	70
	A3-1	58.7	61.6	70
Time 2 (08:00-10:00)	A1-2	64.5	63.4	70
	A2-2	57.6	57.9	70
	A3-2	62.2	64.5	70
Time 3 (10:00-12:00)	A1-3	62.6	50.1	70
	A2-3	61.1	54.4	70
	A3-3	62.3	65.5	70
Time 4 (12:00-14:00)	A1-4	54.7	53.9	70
	A2-4	56.9	50.5	70
	A3-4	65.2	63.8	70
Time 5 (14:00-16:00)	A1-5	58.4	61.5	70
	A2-5	55.7	59.2	70
	A3-5	66.1	61.2	70
Time 6 (16:00-18:00)	A1-6	58.2	59.4	70
	A2-6	60.7	58.8	70
	A3-6	66.2	64.4	70
Time 7 (18:00-20:00)	A1-7	50.3	49.8	70
	A2-7	52.4	60.1	70
	A3-7	60.4	67.9	70
Time 8	A1-8	48.6	52.0	70

(20:00-22:00)	A2-8	50.5	51.5	70
	A3-8	57.6	66.2	70

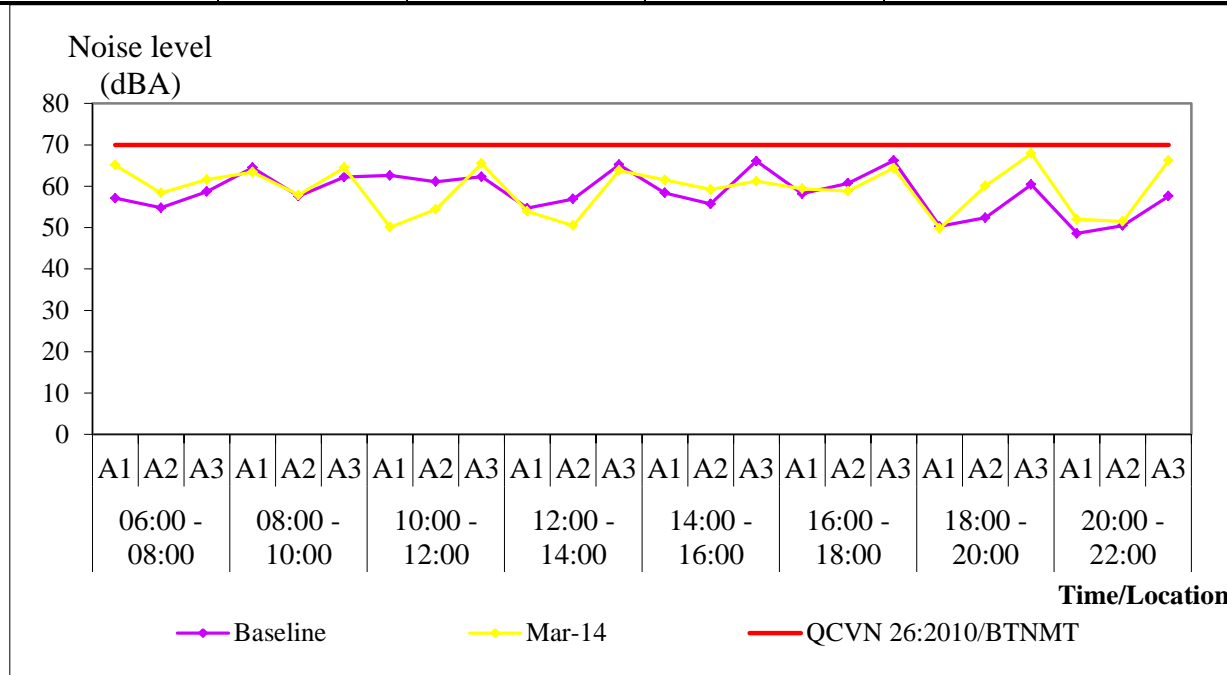


Figure 7. The noise level in monitoring locations at eight times

Remarks:

The results of noise levels measured in 3 sampling positions in March 2014 vary within the range of 49.8 – 67.9 dBA, this result is a bit higher than result in baseline (48.6 – 66.2 dBA). Highest noise level in this month at location A3, due to influence by traffic on road DT769. However, all values completely satisfy the limited value of the standard QCVN 26:2010/BTNMT (70 dBA)

The changes in noise level in 3 monitoring positions at 8 times are as follows:

- **Time 1:** noise levels at 3 sampling points are in range of 58.4 – 65.1 dBA, totally meet the limited value of QCVN 26:2010/BTNMT (70dBA). The highest noise level is at A1 and the lowest at A2.
- **Time 2:** noise levels measured at 3 points vary from 57.9 – 64.5 dBA, These values completely satisfy the limited value of the standard QCVN 26:2010/BTNMT (70 dBA). The noise level is highest at A3 and lowest at A2.
- **Time 3:** noise levels monitored at 3 points range 50.1 – 65.5 dBA. They are fully under the limited value 26:2010/BTNMT (70 dBA). The highest noise level is at A3 and the lowest at A1.
- **Time 4:** noise levels monitored at 3 points range 50.5 – 63.8 dBA. They are fully under the limited value 26:2010/BTNMT (70 dBA). The highest noise level is at A3 and the lowest at A2.

- **Time 5:** noise levels monitored at 3 points range 59.2– 61.5 dBA. They are fully under the limited value 26:2010/BTNMT (70 dBA). The highest noise level is at A1 and the lowest at A2.
- **Time 6:** noise levels monitored at 3 points range 58.8 – 64.4 dBA. They are fully under the limited value 26:2010/BTNMT (70 dBA). The highest noise level is at A3 and the lowest at A2.
- **Time 7:** noise levels monitored at 3 points range 49.8 – 67.9 dBA. They are fully under the limited value 26:2010/BTNMT (70 dBA). The highest noise level is at A3 and the lowest at A1.
- **Time 8:** noise levels monitored at 3 points range 66.2 – 51.5 dBA. They are fully under the limited value 26:2010/BTNMT (70 dBA). The highest noise level is at A3 and the lowest at A2.

2.6.3 Vibration monitoring results

The result of measured vibration level in sampling locations in eight periods in construction phase is presented in the following table.

Table 2.3 Results of vibration level in three monitoring locations

Time/Location		Result		QCVN 27:2010/BTNMT (dB)
		La _{eq} (dB)	Lv _{eq} (mm/s)	
Time 1 (06:00-08:00)	A1-1	36,8	0,0028	75
	A2-1	31,4	0,0015	75
	A3-1	43,8	0,0057	75
Time 2 (08:00-10:00)	A1-2	41,5	0,0045	75
	A2-2	40,6	0,0047	75
	A3-2	39,5	0,0042	75
Time 3 (10:00-12:00)	A1-3	42,7	0,0056	75
	A2-3	41,4	0,0056	75
	A3-3	41,4	0,0053	75
Time 4 (12:00-14:00)	A1-4	40,9	0,0043	75
	A2-4	38,6	0,0043	75
	A3-4	44,2	0,0058	75
Time 5 (14:00-16:00)	A1-5	37,4	0,0036	75
	A2-5	34,2	0,0034	75
	A3-5	45,1	0,0074	75
Time 6 (16:00-18:00)	A1-6	38,5	0,0039	75
	A2-6	36,5	0,0033	75
	A3-6	47,4	0,0062	75
Time 7 (18:00-20:00)	A1-7	35,3	0,0025	75
	A2-7	32,7	0,0026	75
	A3-7	46,3	0,0059	75
Time 8	A1-8	33,6	0,0022	75

Time/Location		Result		QCVN 27:2010/BTNMT (dB)
		La _{eq} (dB)	L _v _{eq} (mm/s)	
(20:00-22:00)	A2-8	30,4	0,0014	75
	A3-8	43,2	0,0051	75

Comparison with the monitoring results of Vibration in the pre-construction stage

Time/Location		Pre-construction phase	Construction phase	QCVN 27:2010/BTNMT (dB)
		January 2014	March 2014	
		La _{eq} (dB)	La _{eq} (dB)	
Time 1 (06:00-08:00)	A1-1	35.5	36.8	75
	A2-1	33.8	31.4	75
	A3-1	38.2	43.8	75
Time 2 (08:00-10:00)	A1-2	37.4	41.5	75
	A2-2	36.5	40.6	75
	A3-2	41.6	39.5	75
Time 3 (10:00-12:00)	A1-3	40.3	42.7	75
	A2-3	38.7	41.4	75
	A3-3	42.5	41.4	75
Time 4 (12:00-14:00)	A1-4	36.1	40.9	75
	A2-4	35.4	38.6	75
	A3-4	43.7	44.2	75
Time 5 (14:00-16:00)	A1-5	38.8	37.4	75
	A2-5	35.1	34.2	75
	A3-5	46.3	45.1	75
Time 6 (16:00-18:00)	A1-6	37.6	38.5	75
	A2-6	37.9	36.5	75
	A3-6	48.8	47.4	75
Time 7 (18:00-20:00)	A1-7	34.5	35.3	75
	A2-7	31.2	32.7	75
	A3-7	39.5	46.3	75
Time 8 (20:00-22:00)	A1-8	32.7	33.6	75
	A2-8	31.5	30.4	75
	A3-8	37.4	43.2	75

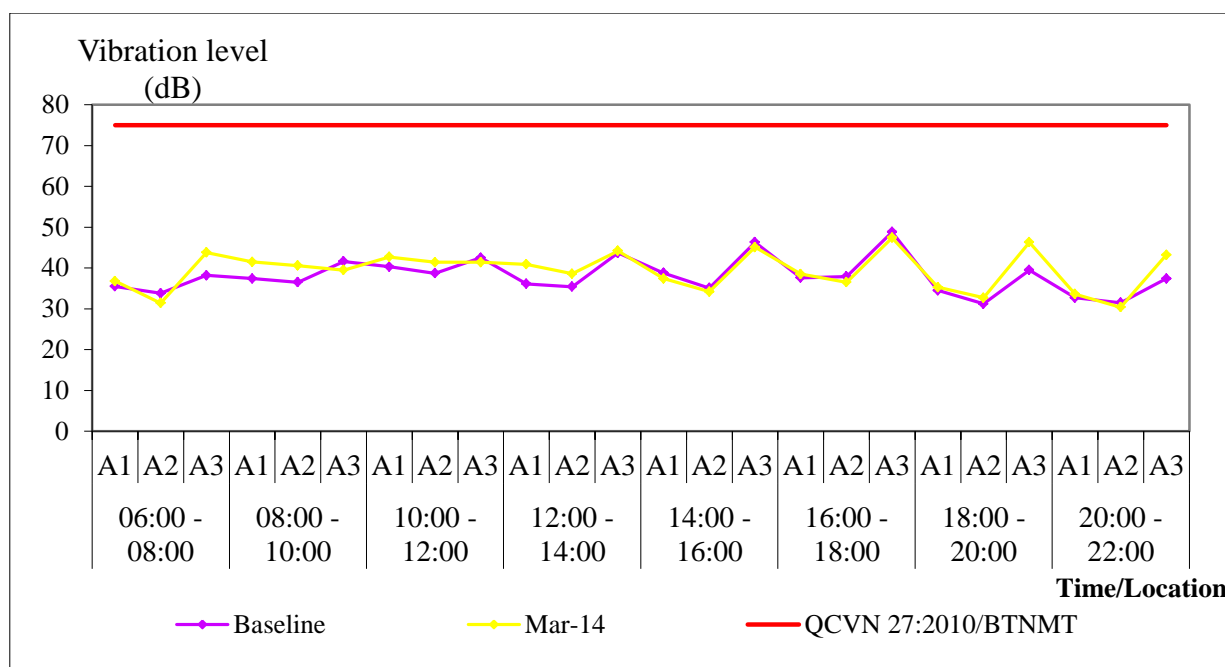


Figure 8. The vibration level in monitoring locations at eight times

Remarks:

The results of vibration level at 3 monitoring location A1, A2, A3 in 8 times in March 2014 are in range of 30.4 – 47.4 dB. This result is around result in baseline (31.5 – 48.8dB). All values completely satisfy the limited value of the standard QCVN 27:2010/BTNMT (75dB). Details are as follows:

- **Time 1:** The vibration results measured in three monitoring positions A1, A2, A3, are 36.8dB, 31.4dB, 43.8dB.
- **Time 2:** The results of vibration in 3 monitoring positions A1, A2, A3, are 41.5dB, 40.6dB, 39.5dB.
- **Time 3:** The vibration results measured at 3 locations range from 41.4 – 42.7dB. Detail are A1: 42.7 dB; A2: 41.4 dB; A3: 41.4 dB.
- **Time 4:** The vibration results measured at 3 locations range from 38.6 – 44.2dB. Detail are A1: 40.9 dB; A2: 38.6 dB; A3: 44.2 dB.
- **Time 5:** The results of vibration in 3 monitoring positions A1, A2, A3, are 37.4dB, 34.2dB, 45.1dB.
- **Time 6:** The results of vibration in 3 monitoring positions A1, A2, A3, are 38.5dB, 36.5dB, 47.4dB.
- **Time 7:** The results of vibration in 3 monitoring positions A1, A2, A3, are 35.3dB, 32.7dB, 46.3dB.
- **Time 8:** The results of vibration in 3 monitoring positions A1, A2, A3, are 33.6dB, 30.4dB, 43.2dB.

2.6.4 Results of surface water quality in project area

In order to assess actual water quality within project area in construction phase, the project established two sampling positions along project area symbol from W1 to W2 at 2 times (Upstream and downstream) as illustrated in *figure 2*.

The monitoring results of water quality at project area are described in Table 24.

Table 2.4 Monitoring result of water quality

No.	Parameters	Unit	Results				QCVN 08:2008/BTNMT- B1
			W1-1	W1-2	W2-1	W2-2	
1	pH	-	6.28	6.31	6.34	6.50	5.5-9
2	Temperature	°C	29.9	30.6	30.2	30.5	-
3	DO	mg/L	5.30	5.50	5.21	5.48	≥ 4
4	TSS	mg/L	22	25	20	32	50
5	BOD ₅	mg/L	10	8	11	9	15
6	COD	mg/L	19	16	22	17	30
7	Cu	mg/L	0.017	0.021	0.028	0.023	0.5
8	Zn	mg/L	0.045	0.042	0.044	0.036	1.5
9	As	mg/L	0.0028	0.0025	0.0023	0.0021	0.05
10	Cd	mg/L	NDT	NDT	NDT	NDT	0.01
11	Pb	mg/L	<0.001	0.0019	0.0025	0.0019	0.05
12	Hg	mg/L	NDT	NDT	NDT	NDT	0.001
13	NH ₄ ⁺ (as N)	mg/L	0.45	0.31	0.17	0.19	0.5
14	Total N	mg/L	3.87	3.44	3.26	3.43	-
15	Total P	mg/L	0.34	0.37	0.28	0.24	-
16	Lubricant	mg/L	0.07	0.13	NDT	0.07	0.1
17	E.Coli	MPN/100mL	NDT	NDT	NDT	NDT	100
18	Coliform	MPN/100mL	40	230	90	430	7500

Note: - NDT: Not detected.

W1-1: Bung Mon bridge (Upstream); W1-2: Bung Mon bridge (downstream)

W2-1: Suoi Trau bridge (Upstream); W2-2: Suoi Trau bridge (downstream)

Comparison with the monitoring results of surface water in the pre-construction phase

Location at Bung Mon Bridge

No.	Parameters	Unit	Pre-construction phase		Construction phase		QCVN 08:2008/BTNMT- B1
			January 2014		March 2014		
			W1-1	W1-2	W1-1	W1-2	
1	pH	-	6.90	6.83	6.28	6.31	5.5-9
2	Temperature	°C	30.2	29.9	29.9	30.6	-
3	DO	mg/L	5.63	5.54	5.30	5.50	≥ 4
4	TSS	mg/L	14	6	22	25	50
5	BOD ₅	mg/L	14	13	10	8	15
6	COD	mg/L	25	22	19	16	30
7	Cu	mg/L	0.044	0.048	0.017	0.021	0.5
8	Zn	mg/L	0.031	0.037	0.045	0.042	1.5
9	As	mg/L	0.0024	0.0018	0.0028	0.0025	0.05
10	Cd	mg/L	NDT	NDT	NDT	NDT	0.01
11	Pb	mg/L	0.0032	0.0026	<0.001	0.0019	0.05
12	Hg	mg/L	NDT	NDT	NDT	NDT	0.001
13	NH ₄ ⁺ (as N)	mg/L	0.32	0.58	0.45	0.31	0.5
14	Total N	mg/L	4.16	4.56	3.87	3.44	-
15	Total P	mg/L	0.47	0.52	0.34	0.37	-
16	Lubricant	mg/L	0.08	0.10	0.07	0.13	0.1
17	E.Coli	MPN/100mL	NDT	NDT	NDT	NDT	100
18	Coliform	MPN/100mL	460	930	40	230	7500

Note:

NDT: Not detected.

W1-1: Bung Mon bridge (Upstream); W1-2: Bung Mon bridge (downstream)

Comparison with the monitoring results of surface water in the pre-construction phase

Location at Suoi Trau Bridge

No.	Parameters	Unit	Pre-construction phase		Construction phase		QCVN 08:2008/BTNMT- B1
			January 2014		March 2014		
			W2-1	W2-2	W2-1	W2-2	
1	pH	-	6.79	6.76	6.34	6.50	5.5-9
2	Temperature	°C	30.6	30.8	30.2	30.5	-
3	DO	mg/L	5.46	5.42	5.21	5.48	≥ 4
4	TSS	mg/L	12	8	20	32	50
5	BOD ₅	mg/L	12	10	11	9	15
6	COD	mg/L	21	18	22	17	30
7	Cu	mg/L	0.071	0.041	0.028	0.023	0.5
8	Zn	mg/L	0.039	0.035	0.044	0.036	1.5
9	As	mg/L	0.0014	0.0021	0.0023	0.0021	0.05
10	Cd	mg/L	NDT	NDT	NDT	NDT	0.01
11	Pb	mg/L	0.0035	0.0027	0.0025	0.0019	0.05
12	Hg	mg/L	NDT	NDT	NDT	NDT	0.001
13	NH ₄ ⁺ (as N)	mg/L	0.25	0.29	0.17	0.19	0.5
14	Total N	mg/L	3.64	3.58	3.26	3.43	-
15	Total P	mg/L	0.31	0.36	0.28	0.24	-
16	Lubricant	mg/L	0.06	0.05	NDT	0.07	0.1
17	E.Coli	MPN/100mL	NDT	NDT	NDT	NDT	100

18	Coliform	MPN/100mL	430	270	90	430	7500
----	----------	-----------	-----	-----	----	-----	-------------

Note : - *NDT* : Not detected.

W2-1: Suoi Trau bridge (Upstream); *W2-2*: Suoi Trau bridge (downstream)

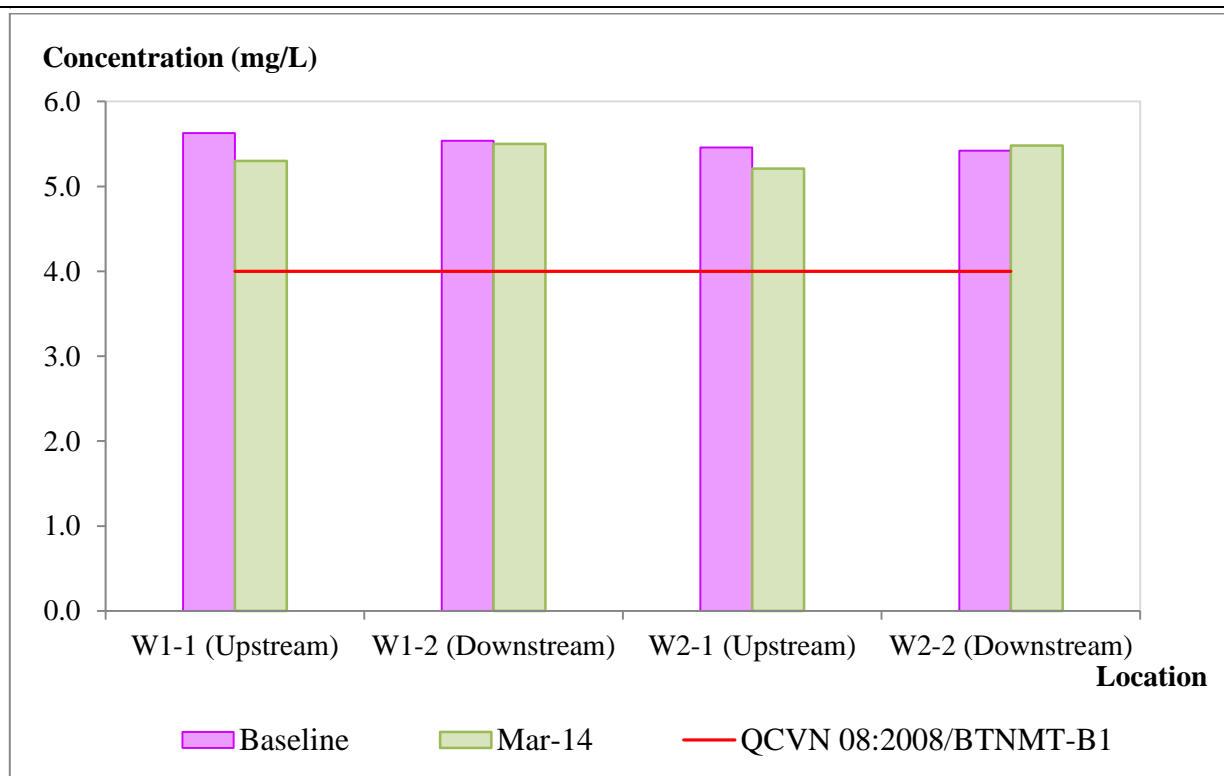


Figure 9. Concentration of DO at monitoring locations

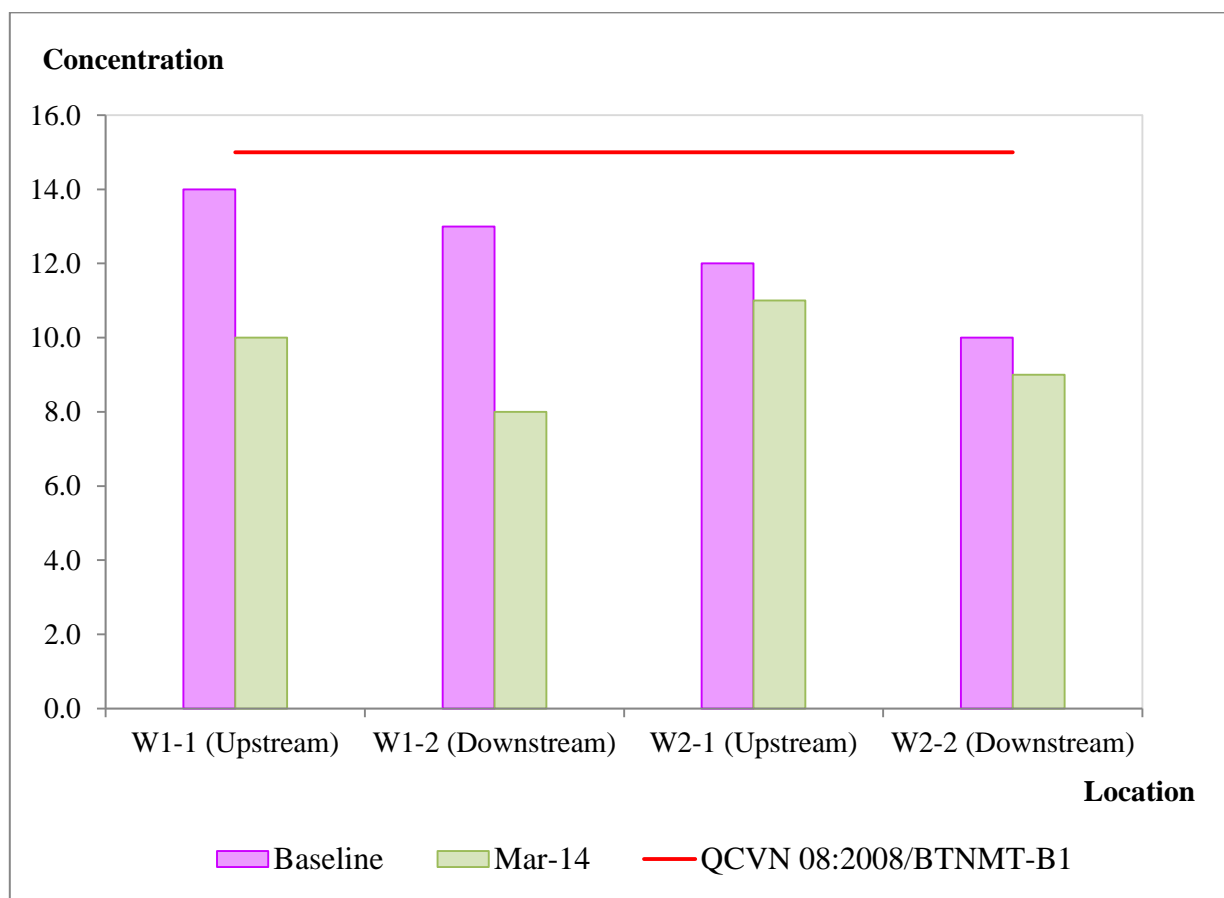


Figure 10. Concentration of BOD₅ at monitoring locations

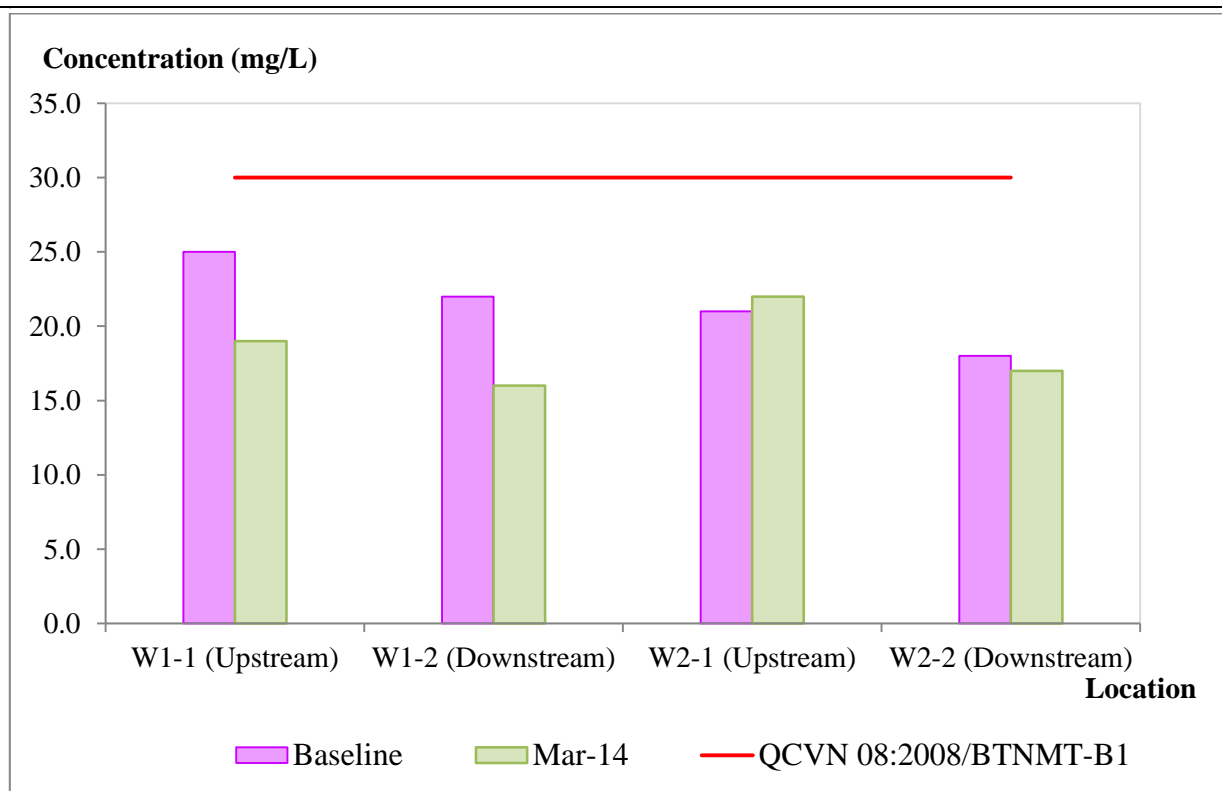


Figure 11. Concentration of COD at monitoring locations

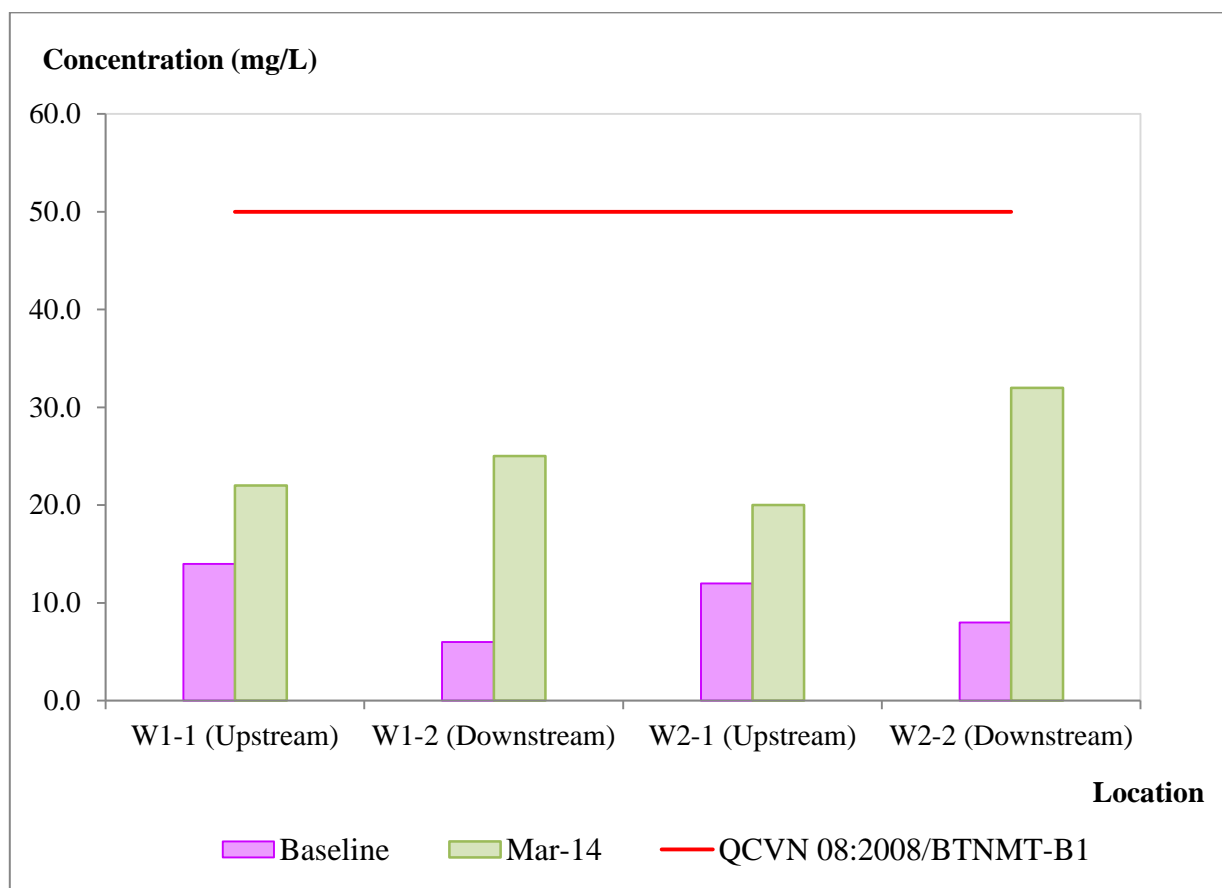


Figure 12. Concentration of TSS at monitoring locations

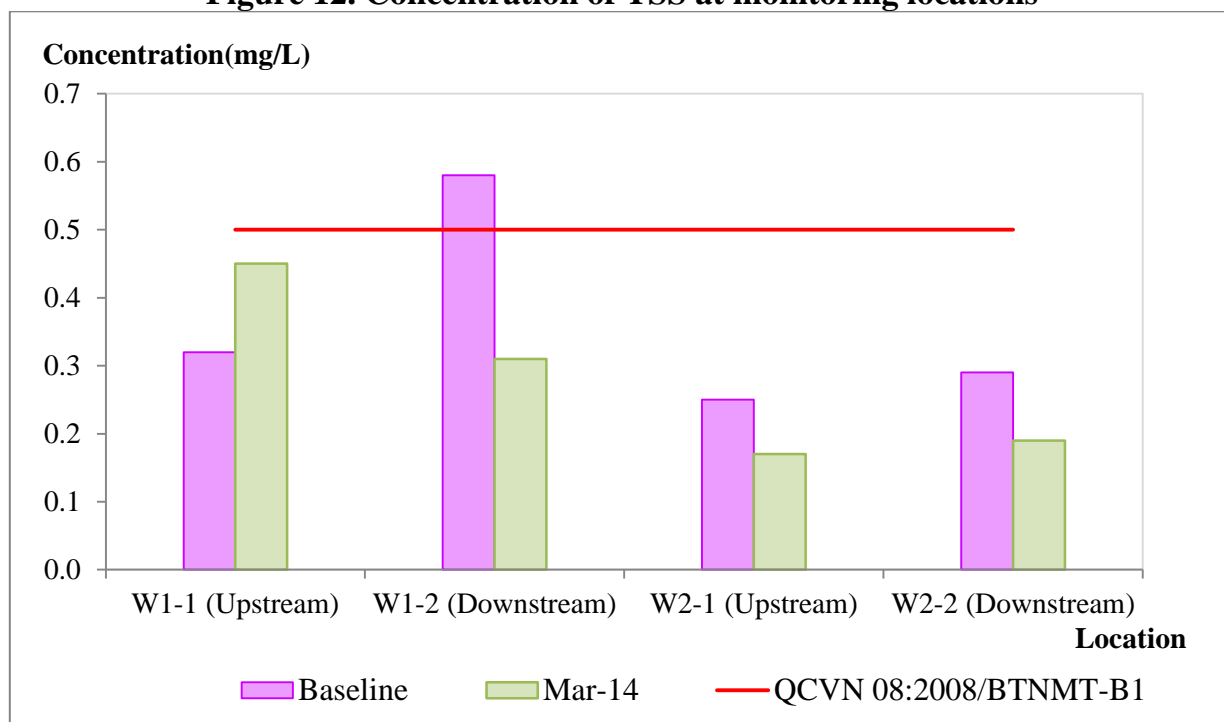


Figure 13. Concentration of NH_4^+ at monitoring locations

Remark:

- **pH**

The monitoring results of pH obtained in 2 sampling positions in March 2014 range between 6.28 – 6.50 and diametrically keep the limited value of National technical regulation on QCVN 08:2008/BTNMT-Column B1 (5.5-9).

- **Organic pollution (DO, BOD, COD)**

- *DO*

Dissolved Oxygen (DO) is an indirectly useful indicator showing the organic pollution level. The measured results of DO vary within 5.21 mg/l – 5.50 mg/l. All are satisfactory the limited value of National technical regulation on QCVN 08:2008/BTNMT-Column B1 ($\geq 4 \text{ mgO}_2/\text{L}$).

- *BOD*

Biological Oxygen Demand (BOD) is one of the most important parameters to determine pollution caused by readily bio-degradable organic compounds in water body. Organic compounds existing in water body is from many pollution sources: natural decomposition of microorganism, industrial wastewater, agricultural wastewater, surface runoff flow, and residential and municipal wastewater in the watershed.

The values of BOD concentration range from 8 mg/l to 11 mg/l. This result is lower than result in baseline (10 – 14mg/l). All the results are satisfactory the limited value of National technical regulation on QCVN 08:2008/BTNMT-Column B1 (15 mgO₂/L).

- *COD*

COD concentrations in three sampling positions in March 2014 vary within 16mg/l - 22 mg/l. This result is lower than result in baseline (18mg/l – 25mg/l). Most of values are under the limited value (30 mg/l) in National technical regulation on QCVN 08:2008/BTNMT-Column B1.

- **Nutrient pollution (NH₄⁺, T-N, T-P)**

The values of NH₄⁺ concentration range from 0.17 mg/l to 0.45 mg/l. The measured results in March 2014 are lower than measured result in baseline (0.25mg/l – 0.58mg/l) and lower than the limited value (0.5mg/l) in National technical regulation on QCVN08:2008/BTNMT – column B1.

The concentration of Total Phosphorus T-P in water body in project area vary within the range of 0.24mg/l – 0.37 mg/l. This value is lower than values of baseline (0.31mg/l – 0.52mg/l).

Total Nitrogen T-N concentrations range between 3.26 mg/l – 3.87mg/l. This value is lower than values of baseline (3.58mg/l – 4.56mg/l).

The QCVN 08:2008 / BTNMT do not defined levels for the parameters total N and total P. When compared to the results of total N and total P in the other canals of the Dong Nai river system, results of total P are still lower and total N the same. (the survey results in package 3 – Ho Chi Minh city-Long Thanh-Dau Giay expressway in October / 2013: total P range from 0.14 to 0.29 mg/l and total N range from 3.21 to 4.67 mg/l)

- **Suspended solids (SS)**

The concentrations of SS in water body in project area are in the range of 20 mg/l - 32mg/l. This result is higher than measured result in baseline (6mg/l – 14mg/l). Most of SS values are under the limited value of National technical regulation on QCVN 08:2008/BTNMT-Column B1 (50 mg/L).

- **Oil pollution**

The measured oil concentrations in project area are in the range of Not Detected – 0.13mg/l. At location Bung Mon bridge (downstream), oil concentrations (0.13mg/l) is a bit higher than limited value of National technical regulation on QCVN 08:2008/BTNMT-Column B1 (0.1 mg/L). Remaining locations totally meet the limited value of National technical regulation on QCVN 08:2008/BTNMT-Column B1 (0.1 mg/L).

• Microorganism pollution

The concentration of Total coliforms range within 40 – 430 MPN/100 ml is lower than measured result in baseline (270 – 930 MPN/100ml). All these obtained values totally meet the limited value (7500 MPN/100ml) in National technical regulation on QCVN 08:2008/BTNMT-Column B1.

• Heavy metals

Because heavy metals, with high toxicity, can make significant impacts on human health and habitat of aquatic animals, such as fish, shrimp, etc., National technical regulation QCVN 08:2008/BTNMT, Column B1 requires the concentrations of Cu, Zn, As, Cd, Hg, Pb are 0.5 mg/l, 1.5 mg/l, 0.05 mg/l, 0.01 mg/l, 0.001 mg/l, 0.05 mg/l, respectively.

The monitoring results of heavy metals in water body of project area generally significantly below the limited values in the National technical regulation QCVN 08:2008/BTNMT, Column B1. Therefore, water body has no sign of pollution of heavy metal.

Summary, monitoring results show that surface water quality in project area in March 2014 is rather good. Most of monitoring results of pH, DO, BOD₅, COD, NH₄⁺ and heavy metal in March 2014 are around measured results in baseline. In conclusion, monitoring results in March 2014 are under the limited values of QCVN 08:2008/BTNMT-Column B1. Except at location Bung Mon Bridge (downstream), oil concentrations (0.13mg/l) is a bit higher than limited value (0.1mg/l).

2.6.5 Results of ground water quality in project area

The monitoring results of ground water quality within the project area are described in Table 2.5.

Table 2.5 Monitoring result of ground water quality (GW)

No.	Parameters	Unit	Result		QCVN 09:2008/BTNMT
			GW1	GW2	
1	pH	-	5.64	5.73	5.5 – 8.5
2	Temperature	°C	29.8	30.1	-
3	Color	Co-Pt	4.28	5.31	-
4	Odor	-	Odorless	Odorless	-
5	TDS	mg/L	12	21	-
6	Conductivity (EC)	μS/cm	27	39	-
7	Hardness level	mgCaCO ₃ /L	6.8	4.5	500
8	DO	mg/L	4.56	4.22	-
9	Turbidity	NTU	0.27	0.31	-
10	CN ⁻	mg/L	NDT	NDT	0.01
11	Cl ⁻	mg/L	4.7	7.6	250
12	SO ₄ ²⁻	mg/L	NDT	NDT	400

No.	Parameters	Unit	Result		QCVN 09:2008/BTNMT
			GW1	GW2	
13	NO ₃ ⁻ (as N)	mg/L	0.53	0.29	15
14	Mn	mg/L	0.046	0.035	0.5
15	Fe	mg/L	0.038	0.12	5
16	As	mg/L	<0.001	NDT	0.05
17	Cd	mg/L	NDT	NDT	0.005
18	Pb	mg/L	NDT	NDT	0.01
19	F.Coliform	MPN/100mL	NDT	NDT	-
20	T.Coliform	MPN/100mL	NDT	NDT	3

Note:

- NDT: Not detected.

- GW1: (Km 23+700): Householder: Tran Quyet Thang

Address: 14/19 Hamlet 2, Long An commune, Long Thanh District, Dong Nai province

- GW2: (Km 37+300): Householder: Bui Thanh Lam

Address: 64 Bau Tre hamlet, Binh Son commune, Long Thanh District, Dong Nai province.

Remark:

Groundwater quality in the project area is very well. Most of the measured parameters of groundwater quality limit values are reached by the national technical standards QCVN 09:2008/BTNMT on groundwater quality.

2.6.6 Soil quality

The monitoring result of soil quality in the project area is described in Table 2.6.

Table 2.6 Monitoring result of soil quality

No.	Parameter	Unit	Result		QCVN 03:2008/BTNMT
			S1	S2	
1	pH	-	5.17	5.46	-
2	Organic matter	%	1.46	0.94	-
3	Total N	g/Kg	20.8	14.5	-
4	Total P	g/Kg	4.59	3.78	-
5	Cl ⁻	g/Kg	2.04	1.64	-
6	SO ₄ ²⁻	g/Kg	0.68	0.93	-
7	Cu	mg/Kg	4.76	3.82	50
8	Zn	mg/Kg	34.52	35.78	200
9	Cd	mg/Kg	NDT	NDT	2
10	Pb	mg/Kg	9.73	10.14	70
11	Hg	mg/Kg	NDT	NDT	-
12	As	mg/Kg	0.47	0.51	12
13	Fe	mg/Kg	37.25	35.43	-

Note:

- *NDT: Not detected; S1: Km 24+400; S2: Km 37+300*

Remarks:

All these results of soil monitoring in March 2014 are lower than the limited values in the Regulation QCVN 03:2008/BTNMT.

Appendix

Appendix 01: National Technical Regulation on Ambient Air Quality (QCVN 05:2013/BTNTMT)

Parameter	1-hour average	8-hours average	24-hours average	Annual average (arithmetic average)
SO ₂ (µg/l)	350	-	125	50
CO (µg/l)	30000	10000	-	-
NO ₂ (µg/l)	200	-	-	40
O ₃ (µg/l)	180	120	80	-
Total suspended particles (TSP) (µg/l)	300	-	200	140
Particles ≤10µm (PM10) (µg/l)	-	-	150	50
Particles ≤2.5µm (PM2.5) (µg/l)	-	-	50	25
Pb (µg/l)	-	-	1,5	0,5

Appendix 02: National Technical Regulation on hazardous substances in ambient air (QCVN 06:2009/BTNTMT)

Unit: microgram per cubic meter ($\mu\text{g}/\text{m}^3$)

No	Parameter	Chemical formula	Duration average	Allowable concentration
Inorganic substance				
1	Arsenic (inorganic compound as As)	As	1 hour	0,033
			Year	0,005
2	Arsenic hydride (Asin)	AsH_3	1 hour	0,33
			Year	0,055
3	Acid chlohydric	HCl	24 hours	60
4	Acid nitric	HNO_3	1 hour	400
			24 hours	150
5	Acid sulfuric	H_2SO_4	1 hour	300
			24 hours	50
			Year	3
6	Dust consisting of oxide silic > 50%		1 hour	150
			24 hours	50
7	Dust consisting of amiang: Chrysotil		8 hours	1 fibril/ m^3
8	Cadmium (smoke consisting of acid and metal) as Cd.	Cd	1 hour	0,4
			8 hours	0,17
			Year	0,005
9	Chloride	Cl_2	1 hour	100
			24 hours	30
10	Chromium VI	Cr	1 hour	0,0067
			24 hours	0,003
			Year	0,0023
11	Hydrofluoride	HF	1 hour	20
			24 hours	5
			Year	1
12	Hydrocyanide	HCN	1 hour	10
			24 hours	10
13	Manganese and compound (as MnO_2)	Mn/ MnO_2	1 hour	10
			24 hours	8
			Year	0,15
14	Nickel (metal and compound)	Ni	24 hours	1
15	Mercury (metal and compound)	Hg	24 hours	0,3
			Year	0,3
16	Acrolein	$\text{CH}_2=\text{CHCHO}$	1 hour	50
17	Acrylonitril	$\text{CH}_2=\text{CHCN}$	24 hours	45
			Year	22,5

18	Aniline	$C_6H_5NH_2$	1 hour	50
			24 hours	30
19	Acid acrylic	C_2H_3COOH	Year	54
20	Benzene	C_6H_6	1 hour	22
			Year	10
21	Benzidin	$NH_2C_6H_4C_6H_4NH_2$	1 hour	NDT
			8 hours	NDT
			24 hours	NDT
			Year	NDT
22	Chloroform	$CHCl_3$	24 hours	16
			Year	0,043
23	Hydrocarbon (Gasoline)	C_nH_m	1 hour	5000
			24 hours	1500
24	Formaldehyde	$HCHO$	1 hour	20
			Year	15
25	Naphthalene	$C_{10}H_8$	8 hours	500
			24 hours	120
26	Phenol	C_6H_5OH	1 hour	10
			24 hours	10
27	Tetrachloethylene	C_2Cl_4	24 hours	100
28	Vinyl chloride	$ClCH=CH_2$	24 hours	26
Substances bringing about unpleasant smell				
29	Amoniac	NH_3	1 hour	200
			24 hours	200
30	Acetaldehyde	CH_3CHO	1 hour	45
			Year	30
31	Acid propionic	CH_3CH_2COOH	8 hours	300
32	Hydrosulfide	H_2S	1 hour	42
33	Methyl mecarptan	CH_3SH	1 hour	50
			24 hours	20
34	Styrene	$C_6H_5CH=CH_2$	1 week	260
			Year	190
35	Toluene	$C_6H_5CH_3$	30 minutes	1000
			1 hour	500
			Year	190
36	Xylene	$C_6H_4(CH_3)_2$	1 hour	1000
			Year	950
Note: the annual average value is the arithmetic average in this case. NDT: Not detected				

Appendix 03: QCVN 26:2010/BTNMT – National Technical Regulation on Noise

Limit maximum allowed to noise

No.	Area	06:00 – 21:00 hours	21:00 – 06:00 hours
1	Special area	55 dBA	45 dBA
2	Regional normal	70 dBA	55 dBA

Appendix 04: QCVN 27:2010/BTNMT – National Technical Regulation on vibration

a)

No.	Area	Applicable time of day	Standard, dB
1	Special area	06:00 – 18:00	75
		18:00 - 06:00	Background level
2	Special area	06:00 – 21:00	75
		21:00 – 06:00	Background level

Conversion of vibration decibels to acceleration

Decibels (dB)	55	60	65	70	75
ms^{-2}	0.006	0.010	0.018	0.030	0.055

The methodology for carrying out vibration monitoring is defined in the specific TCVN 6963:2001 in which step by step procedures are set out.

The formula used to convert the unit dBA in to m/s^2 is $L_a = 20 \cdot \text{Log}(A/A_0)$ (dB)
where:

- A: vibration acceleration (m/s^2);
- A_0 : 10^{-5} m/s^2

Appendix 05: Technical Regulation on surface water quality (QCVN 08:2008/BTNMT)

N ^o	Parameters	Unit	Limitation value			
			A1	A2	B1	B2
1	pH	-	6÷8.5	6÷8.5	5.5÷9	5.5÷9
2	Dissolved oxygen	mg/l	≥ 6	≥ 5	≥ 4	≥ 2
3	Suspended solids	mg/l	20	30	50	100
4	COD	mg/l	10	15	35	50
5	BOD ₅ (20°C)	mg/l	4	6	15	25
6	Ammonia (as N)	mg/l	0.1	0.2	0.5	1
7	Chloride	mg/l	250	400	600	-
8	Fluoride	mg/l	1	1.5	1.5	2
9	Nitrite (as N)	mg/l	0.01	0.02	0.04	0.05
10	Nitrate (as N)	mg/l	2	5	10	15
11	Phosphate (as P)	mg/l	0.1	0.2	0.3	0.5
12	Cyanide	mg/l	0.005	0.01	0.05	0.1
13	Arsenic	mg/l	0.01	0.02	0.05	0.1
14	Cadmium	mg/l	0.005	0.005	0.01	0.01
15	Lead	mg/l	0.02	0.02	0.05	0.05
16	Chromium (Trivalent)	mg/l	0.05	0.1	0.5	1
17	Chromium (Hexavalent)	mg/l	0.01	0.02	0.04	0.05
18	Copper	mg/l	0.1	0.2	0.5	1
19	Zinc	mg/l	0.5	1	1.5	2
20	Nickel	mg/l	0.1	0.1	0.1	0.1
21	Iron	mg/l	0.5	1	1.5	2
22	Mercury	mg/l	0.001	0.001	0.001	0.002
23	Surface active substances	mg/l	0.1	0.2	0.4	0.5
24	Oil and grease	mg/l	0.01	0.02	0.1	0.3
25	Total Phenol	mg/l	0.005	0.005	0.01	0.02
26	Organic Chloro Pesticide					
	Aldrin+Dieldrin	µg/l	0.002	0.004	0.008	0.01
	Endrin	µg/l	0.01	0.012	0.014	0.02
	BHC	µg/l	0.05	0.1	0.13	0.015
	DDT	µg/l	0.001	0.002	0.004	0.005
	Thiodan	µg/l	0.005	0.01	0.01	0.02
	Lindan	µg/l	0.3	0.35	0.38	0.4
	Chlordane	µg/l	0.01	0.02	0.02	0.03
27	Heptachlor	µg/l	0.01	0.02	0.02	0.05
	Organic Phosphorus Pesticides					
	Paration	µg/l	0.1	0.2	0.4	0.5
	Malation	µg/l	0.1	0.32	0.32	0.4

28	Herbicides 2,4D 2,4,5T Paraquat	$\mu\text{g/l}$ $\mu\text{g/l}$ $\mu\text{g/l}$	100 80 900	200 100 1200	450 160 1800	500 200 2000
29	Gross alpha activity	Bq/l	0.1	0.1	0.1	0.1
30	Gross beta activity	Bq/l	1.0	1.0	1.0	1.0
31	E. Coli	MPN/100 ml	20	50	100	200
32	Total Coliform	MPN/100 ml	2500	5000	7500	10000

Note:

A1: Safety use for domestic water supply and other uses as in A2, B1, and B2 categories.

A2: Use for domestic water supply by applying appropriate treating technique; preservation of aquatic organisms, or other uses as in B1 and B2 categories.

B1: use for irrigational purposes or other uses required approximate water quality or other uses as in B2 category.

B2: Waterway traffic and other uses required low water quality.

Appendix 06: National technical regulation on underground water quality (QCVN 09:2008/BTNMT)

N ^o	Parameters	Unit	Limitation value
1	pH	-	5.5 - 8.5
2	Hardness (as CaCO ₃)	mg/l	500
3	Total solid	mg/l	1500
4	COD (KMnO ₄)	mg/l	4
5	Ammonia (as N)	mg/l	0.1
6	Chloride (Cl ⁻)	mg/l	250
7	Fluoride (F ⁻)	mg/l	1.0
8	Nitrite (NO ₂ ⁻) (as N)	mg/l	1.0
9	Nitrate (NO ₃ ⁻) (as N)	mg/l	15
10	Sulfate (SO ₄ ²⁻)	mg/l	400
11	Cyanide (CN ⁻)	mg/l	0.01
12	Phenol	mg/l	0.001
13	Arsenics (As)	mg/l	0.05
14	Cadimium (Cd)	mg/l	0.005
15	Lead (Pb)	mg/l	0.01
16	Chromium VI (Cr ⁶⁺)	mg/l	0.05
17	Copper (Cu)	mg/l	1.0
18	Zinc (Zn)	mg/l	3.0
19	Manganese (Mn)	mg/l	0.5
20	Mercury (Hg)	mg/l	0.001
21	Iron (Fe)	mg/l	5
22	Selen (Se)	mg/l	0.01
23	Cross alpha activity	Bq/l	0.1
24	Cross beta activity	Bq/l	1.0
25	E.Coli	MPN/100ml	None
26	Coliform	MPN/100ml	3

Appendix 07: National technical regulation on the allowable limits of heavy metals in the soils (QCVN 03:2008/BTNMT)

Unit: mg/kg dry soil

Parameter	Agriculture Soil	Forestry soil	Living soil	Trade soil	Industry soil
1. Arsenic (As)	12	12	12	12	12
2. Cadmium (Cd)	2	2	5	5	10
3. Copper (Cu)	50	70	70	100	100
4. Lead (Pb)	70	100	120	200	300
5. Zinc (Zn)	200	200	200	300	300

APPENDIX 8

RESULTS OF MEASUREMENT AND ANALYSIS OF ENVIRONMENTAL QUALITY

APPENDIX 9

SOME PICTURES TAKEN DURING REPORT PERFORMING



Air sampling at A-1 (06:00 – 08:00)



Air sampling at A-1 (08:00 – 10:00)



Air sampling at A-1 (18:00 – 20:00)



Air sampling at A-1(20:00 – 22:00)



Air sampling at A-2 (06:00 – 08:00)



Air sampling at A-2 (08:00 – 10:00)



Air sampling at A-2 (18:00 – 20:00)



Air sampling at A-2 (20:00 – 22:00)



Air sampling at A-3 (06:00 – 08:00)



Air sampling at A-3 (08:00 – 10:00)



Air sampling at A-3 (18:00 – 20:00)



Air sampling at A-3 (20:00 – 22:00)



Surface water sampling at W1



Surface water sampling at W2



Ground water sampling



Soil sampling

APPENDIX 10

THE LEGAL DOCUMENTS