

Environmental Monitoring Report

August 2013

VIE: Song Bung 4 Hydropower Project

Prepared by Song Bung 4 Hydropower Project Management Board (SB4HPMB) for Vietnam Electricity and the Asian Development Bank.

SONG BUNG 4 HYDROPOWER PROJECT
Monitoring and Assessment of Environmental Quality



**THE 12th ENVIRONMENTAL MONITORING
REPORT**

Construction phase

Prepared by SOCIALCONSULT

August 2013

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ABBREVIATIONS

ADB	Asian Development Bank
BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
DARB	Division of Agriculture and Rural Development
DONRE	Division of Natural Resources and Environment
DPC	District People's Committee
EIA	Environmental Impact Assessment
EMC	Environmental Monitoring Consultant
EMP	Environmental Management Plan
EVN	Electricity of Vietnam
HPP	Hydro-power Project
MONRE/BTNMT	Ministry of Natural Resources and Environment
NR	Natural Reserve
PMU	Project Management Unit
PPC	Provincial People's Committee
QCVN	Vietnam Regulations
SB4	Song Bung 4
TSP	Total Suspended Particles
TSS	Total Suspended Solid



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EXECUTIVE SUMMARY

Song Bung 4 Hydropower Project is located in Vu Gia – Thu Bon hydropower cascade. The Plant, with 156MW in capacity will be put into operation by the end of 2014. The construction of the plant was commenced in June 2010.

The 12th environmental monitoring (construction phase) was carried out from 22 July to 28 July 2013. The outputs of the environmental monitoring included:

- (i) With regard to air quality: Content of CO, SO₂, NO_x is within the regulated limit as per the QCVN 05:2009/BTNMT. Content of TSP measured in the left abutment and the rock crushing plant –rock quarry is 1.06 to 1.77 times higher than the regulated limit as per the QCVN 05:2009/BTNMT. Noise in the rock crushing plant –rock quarry and the concrete mixing plant is 1.11 – 1.26 times higher than the regulated limit according to the QCVN 26:2010/BTNMT.*
- (ii) Regarding quality of surface water: Content of TSS in two sampling positions is higher than the regulated limit as per the QCVN 08:2008; content of TSS measured in the upstream area is 46.4 times higher than the regulated limit. Other indicators (BOD₅, COD, NH₄⁺-N, NO₃⁻ - N and PO₄³⁻ - P) are higher than the regulated limit as per QCVN 08:2008/BTNMT (exclusive of BOD₅ content of the surface water taken in the downstream of the construction site). Content of Coliforms in 02 surface water samples is 1.86 to 22 times higher than the regulated limit.*
- (iii) Domestic water: Colour of domestic water in both camp area at the surge tank and camp No. 45 is higher than the regulated limit as per the QCVN 02:2009/BYT. Content of Coliforms in domestic water in camp area at the surge tank is 1.86 times higher than the regulated limit. Other indicators in domestic water are within the regulated limit as per the QCVN 02:2009/BYT.*
- (iv) Quality of underground water: Almost of monitoring indicators are lower than the regulated limit of the QCVN 09:2008/BTNMT on quality of underground water and Column II of the QCVN 02:2009/BYT on quality of domestic water, exclusive of the turbidity content in sample NG_{1a}, NG_{3a} and NG_{6a} which is a little higher than the regulated limit of the QCVN 02 column II. Content of COD in sample NG_{1a} is higher than the regulated limit of the QCVN 09:2008/BTNMT.*
- (v) Quality of domestic wastewater: Almost all of monitoring indicators in three samples of domestic wastewater (NT_{1a}, NT_{2a} and NT_{3c}) meet the requirement on*

discharging into the environment exclusive of the indicator of Coliforms of all three samples and content of BOD₅ in sample NT_{2a}.

- (vi) Erosion and landslide: At the positions with high risk of erosion and landslide given in the 11th environmental monitoring report, the treatment measures against erosion and landslide have not yet been applied. Soil excavation caused by gold exploitation has made the erosion and landslide increase.*
- (vii) Ecological environment and biodiversity: Illegal exploitation and wild animal hunting have been kept happening; however, there are no violation cases caused by the project workers. Vegetation in the construction areas and reservoir bed has not been changed in comparison with that in the 11th environmental monitoring.*
- (viii) Labor safety: There was no occupational accident occurred in the construction site in the 2nd quarter of 2013. SinoHydro contractor has provided training on first aid and protective equipment (hard cap, protective clothing, boots and glasses,...) for construction workers. However, in the construction areas, using the protective equipment has not yet been implemented meaningfully by the construction workers.*
- (ix) Workers' health care: In the 2nd quarter of 2013, there has no serious health problem among the construction workers in the construction area.*

I. PROJECT IMPLEMENTATION PROGRESS

1.1. Introduction

Song Bung 4 Hydropower Project is located in the Vu Gia – Thu Bon hydropower cascade approved by the Ministry of Industry in Decision No. 875/QĐ-KHDT dated 2 May, 2003 and given priority for construction after A Vuong and Song Tranh 2 hydropower projects and financed by the Asian Development Bank (ADB).

Song Bung 4 Hydropower Project is located on Bung River – a branch of Vu Gia River in Nam Giang district, Quang Nam province. Basin area to the dam of Bung River 4 is 1,477 km²; length of the main river is about 106.6km. The headwork is located in area of Ta BHING and ZuoiH communes, Nam Giang district, Quang Nam province. The power house is located in Ta BHING commune, Nam Giang district, Quang Nam province.

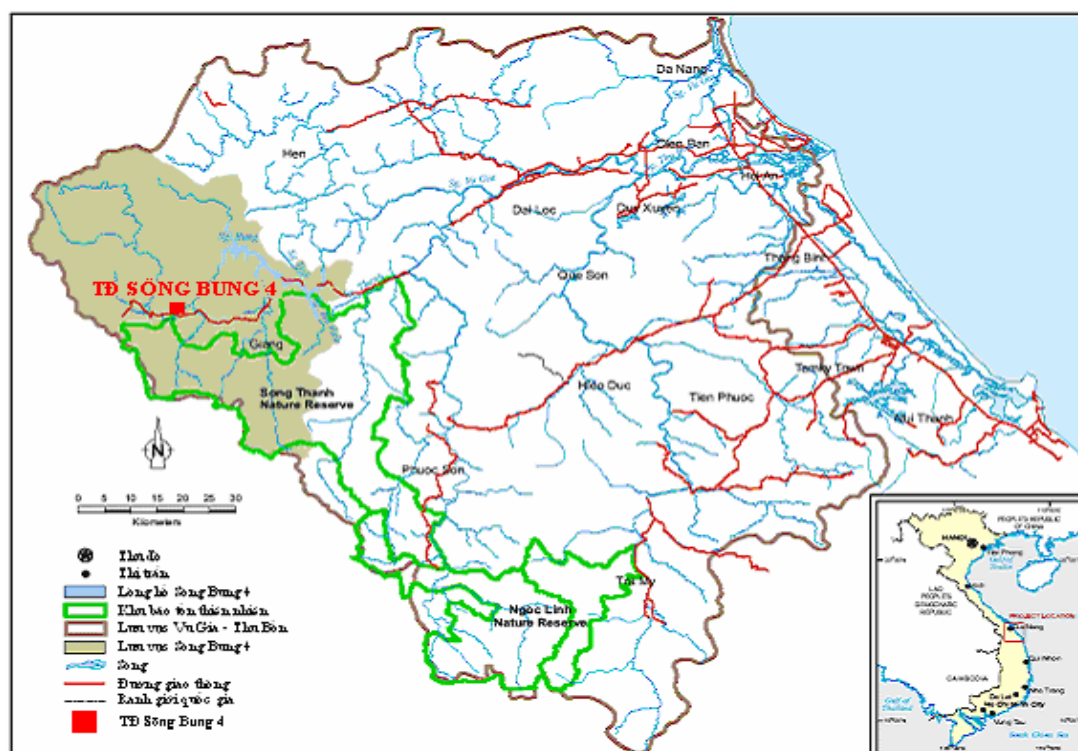


Figure 1: Location of Song Bung 4 Hydropower Project

The main duty of the project is power generation for the national power network with 156MW in capacity and average annual energy of 514.1 million KWh. Along with other hydropower projects in the region, the project will also be effective in flood control, water usage improvement. During construction phase, the project will create jobs for local inhabitants and develop service types in construction sites. After the

project is completed, Bung River region with population, culture, society will become the focused residential location with relatively completed infrastructure. The transport system for construction and its operation will create opportunities for economic and social exchange for the project area with local economic and social centre; at the same time, it is to improve the capacity of exploiting the potential inheritance in the left bank of Bung River.

According to designed techniques of the construction of the SB4 Hydropower Project plan approved by Board of Directors (BOD) in Decision 352/QĐ-EVN-HĐQT dated 03 July, 2009, the project consists of the following salient figures:

- Full supply level (FSL):	222.5m
- Minimum operating level:	205m
- Gross storage:	510.8 million m ³
- Active storage:	233.99 million m ³
- Reservoir area at FSL:	15.65km ²
- Installed capacity (N _{Lm}):	156MW
- Firm capacity (N _{db}):	35.93MW
- Mean annual Energy (E _o):	586.25 million kWh
- Gross investment (edited, planned/approved):	4,981.97 billion VND
<i>Overall progress of construction plan corrected by the Corporation:</i>	
- Kick-off activities:	June 2010.
+ Locked stream:	January 2012.
+ Water retain:	June 2014
+ Power operation 1:	September 2014.
- Power operation 2 and completed construction:	October 2014

Project general layout includes: dam; spillway; waterway; intake; headrace tunnel; surge tank; powerhouse and tailrace channel; discharge channel; 220kV switchyard and transmission line to the power system; and operation management area; access roads, roads to resettlement areas and to the national access road.

In addition to the main works, the Project also has auxiliary components to serve the construction.

1.2. Project implementation progress

The implementation progress of SB4 Hydropower Project at the time of the 12th environmental monitoring carried out (According to the Report on Implementation of SB4 Hydropower Project as of 25 July, 2013) is as follows:

1.2.1. Construction progress

- Main dam: The excavation of the left abutment has been completed. The main dam was concreted with the volume of 615,378m³/764,560.32m³ of concrete; the right abutment was concreted with RCC at 192.2m in height; the river bed was concreted at 174.6m in height; the left abutment was concreted at 174.6m in height.
- Intake gate: concrete pouring has been completed; package TB-05 has been handed over to the contractors to install equipment.
- Main tunnel: 883m³ of concrete (equivalent to 108m in length) have been placed for the tunnel. As of the monitoring time, 1,581m/3,049m of the tunnel have been completed. The three-pronged fork section has been concreted.
- Surge tank: The upper part (D=5) of the surge tank has been being concreted. Until now, 2,642m³/4,510 m³ of concrete have been poured to the tank; concrete placement has been conducted to the vertical shaft at the upper section (D=18) at 188m to 222.5m in height. The section from the surge tank to the tunnel has been concreted.
- Power-house and distribution station: As of the monitoring time, 28,375m³ of concrete have been placed, at the height of 121m in the downstream area, 118m in the upstream area and 126m in the erection floor.

General conclusion of the PMU: the progress has substantially met the proposed schedule and the progress of RCC construction has met the requirement on flood prevention campaign in 2013.

1.2.2. Progress of compensation, assistance and resettlement

a. Construction survey, design and resettlement-site lay-outs

- Access road to the resettlement sites:
 - + Access road to Parum B resettlement site (combination with the construction road of Song Bung 2 HPP): has been completed and handed over to the Song Bung 2 HPPMU.

- + Access road to Pa Pang resettlement site: has been handed over and put into operation.
- + Access road to PaDhi resettlement site: has been completed.
- Construction of resettlement sites:
 - + Pa Pang resettlement site: The PMU has handed over the site to the affected households to put into operation.
 - + Parum A resettlement site: has been fully completed.
 - + Parum B resettlement site: Construction of public works and concrete placement on access road have been being implemented by the contractors.
 - + PaDhi resettlement site: The contractors have been completing the concrete pouring for access road and constructing the public works.
 - + Administrative center in Zuoaih commune: office of the commune people's committee, conference room and health center have been handed over and put into operation while other public works and concrete face of the road have been being constructed.
- Power supply for the Resettlement sites:
 - + The 35kV TĐC-03 transmission line (combination with power supply for Song Bung 2 HPP) into Pa Pang resettlement site: has been handed over and electrified;
 - + The 35 kV transmission line supplying power for resettlement site of package 2 (TĐC-02): has been completed and electrified;
- Inundated by-road14D:
 - + Inundated by-road: (package GT4-01): The contractor has just cleaned the area surrounding the road but not asphalted on the road;
 - + Inundated by-bridge: (package GT4-02): Pillar T3 has been concreted; pillar T3 and abutment M2 have been joined; block K16 on pillar T2 have been concreted; construction of girder I33 and the connection of girder I33m with abutment M1 and pillar T1 have been completed.

b. Compensation and site clearance

- The detailed compensation for the reservoir bed from the dam to Khe Vinh has been being reviewed by the Department of Natural Resources and

Environment of Quang Nam province before being approved by Nam Giang DPC.

- The detailed compensation and assistance plan for land above inundated area in Parum B village: the affected land has been measured; the compensation documents have been being completed.

1.3. Implementation progress of the environmental monitoring

- August 2009: SB4 Hydropower Project Management Unit selected and signed a contract with the environmental monitoring consultant
- October 2009: EMP updating was completed.
- November 2009: The environmental monitoring consultant conducted the first field survey in the project area (including reservoir bed, access road, and other items of the project).
- May 2010: Environmental monitoring was carried out before construction activities started (1st environmental monitoring- pre-construction phase).
- August 2010: The 2nd environmental monitoring was conducted (construction phase).
- December 2010: The 3rd environmental monitoring was conducted (construction phase).
- April 2011: The 4th environmental monitoring was conducted (construction phase)
- August 2011: The 5th environmental monitoring was conducted (construction phase).
- January 2012: The 6th environmental monitoring was conducted (construction phase)
- April 2012: The 7th environmental monitoring was conducted (construction phase)
- July 2012: The 8th environmental monitoring was conducted (construction phase)
- October 2012: The 9th environmental monitoring was conducted (construction phase)
- January 2013: The 10th environmental monitoring was conducted (construction phase)



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- April 2013: The 11th environmental monitoring was conducted (construction phase)
- July 2013: The 12th environmental monitoring was conducted (construction phase)
- The contractors are assigned to monitor the surface water (once a month) and the regular hydrological regime of the Bung River.

II. METHODOLOGY AND ACTIVITIES IN THE 12th ENVIRONMENTAL MONITORING

2.1. Objectives and activities

2.2.1. Objectives

- To carry out periodic environmental monitoring in accordance with the proposed EMP
- To monitor and assess quality of the environment (water, air, ecosystem) and to monitor the implementation of mitigation measures by the contractors in the construction phase. The environmental monitoring and assessment aims to assess the quality of the environment in the project area during the construction phase.
- The environmental monitoring and assessment is seen as a basis for evaluation of the implementation of mitigation measures for the impacts on the environment.

2.2.2. Activities

- To monitor the implementation of the mitigation measures by the contractors
- To measure and take sample for the periodic environmental monitoring including: 3 samples of air, 5 samples of noise, 2 samples of surface water, 3 samples of domestic water, 3 samples of wastewater and 6 samples of underground water.
- Monitoring of changes in ecosystem in the project area
- Monitoring of waste control and treatment (including solid waste and hazardous waste)
- To monitor the compliance in the EMP implementation
- To carry out public consultations on the project environmental issues and the participation of local authorities in environmental protection and handling the project's environmental impacts
- To identify arisen environmental issues and recorded local peoples' opinions on these issues.

2.2. Methodology

To ensure the accuracy of monitoring results, both quantitative and qualitative methods were used by the consultant in the all environmental monitoring visits in general and in the 12th environmental monitoring in particular. These methods are as follows:

- To conduct field survey to assess the implementation of mitigation measures and to ensure that all the mitigation measures for the impacts on the environment and the society were applied in compliance with the EMP, EIA approved by the MONRE and Quang Nam PPC and EMP approved by the ADB
- To take sampling and analyzing of quality of air, noise, vibration, surface water, domestic water and underground water then compare the monitoring results with the National Environmental Technical Regulations
- To conduct public consultations via interviews and discussions

*Table1: Methodology for the 12th Environmental Monitoring*

<i>Methodology</i>	<i>Participants</i>	<i>Monitoring contents</i>
1. Information updating	-Division of Environment and Resettlement of the PMU - EMC	- Construction progress - Monitoring schedule -Updating of the information on arisen environmental issues
2. Monitoring of the construction areas	- PMU - Contractors - EMC	-Implementation of the mitigation measures for the environmental impacts - Sanitation and work safety - Workers' living conditions - Erosion and landslide
3. Measuring, sampling and analyzing of the quality of air, water, forest, fauna and flora	- Environmental monitoring consultant - PMU	- Quality of air and noise; - Quality of water; - Ecosystem, fauna and flora;
4. Consulting with the contractors, construction workers and local people	- Contractors and workers - Local people - EMC	- Impacts of the project - Compliance in the implementation of the mitigation measures by the PMU - Opinions on environmental issues
5. Collecting of data and reports	-Nam Giang District Health Center - Nam Giang District Division of Forest Protection - Nam Giang District Division of Natural	- Situation of some diseases in Zuoih, Tabhing, Cha Val, and Ta Poo commune. Situation of diseases surveillance and healthcare for workers in the second quarter of 2013.



<i>Methodology</i>	<i>Participants</i>	<i>Monitoring contents</i>
	Resources and Environment - Nam Giang District Division of Agriculture and Rural Development - Song Thanh Natural Reserve Management Board - Environmental monitoring consultant(Mott Macdonal) - Contractor SinoHydro and contractor Song Da 5	- Illegal logging and animal hunting in Nam Giang district area; propaganda and strengthening of the capacity of environmental management and protection in the second quarter of 2013 - Environmental issues arisen in the project communes and the project's impacts on the local environment - Situation of fauna and flora, illegal logging and hunting - Progress of replacement afforestation - The cooperation of the PMU of SB4 hydropower project and local authorities and agencies. - The implementation of environmental protection measures by the contractors
6. Data analyzing	EMC	- Updating of the information on environment in the project area
7. Analyzing of available data	EMC	- Referring to additional documents
8. Data processing	EMC	- Processing and analyzing of data
9. Consulting with environmental specialists	Specialists of environment, ecosystem, society and gender	Discussing on environmental issues in the project area Providing of recommendations on mitigation measures for the project's environmental impacts

2.2.1. Field survey and monitoring

The construction areas were monitored and supervised to illustrate environmental development and the implementation of the mitigation measures to make necessary adjustments to respond to potential environment problems.

2.2.2. Measurement, sampling, analyzing and comparison with Vietnam Regulations

The consultant conducted monitoring of samples of air, noise, vibration, water (surface water, domestic water and wastewater) and biodiversity. Results of the monitoring would be considered as a basis for assessment of quality of the environment by impacts of the project during the construction phase. Sampling positions will be changed based on the construction progress and the field survey.

a. Air environment

Based on the construction progress and the field survey, in the 12th environmental monitoring, there is a total of 5 samples of air of which 3 samples (KK_{1a}, KK₂, KK_{3b}) were monitored with all the indicators of CO, NO₂, SO₂, TPS, noise and vibration while 2 samples (KK₄, KK_{5b}) were monitored with noise and vibration only. The construction of sub-tunnels have been completed, at the monitoring time, the construction has been mainly implemented in main tunnel; therefore the sampling position of air in sub-tunnel 2 (KK_{3a}) has been replaced with the position in the main tunnel (KK_{3b}) | Position of the samples is presented in figure 2.

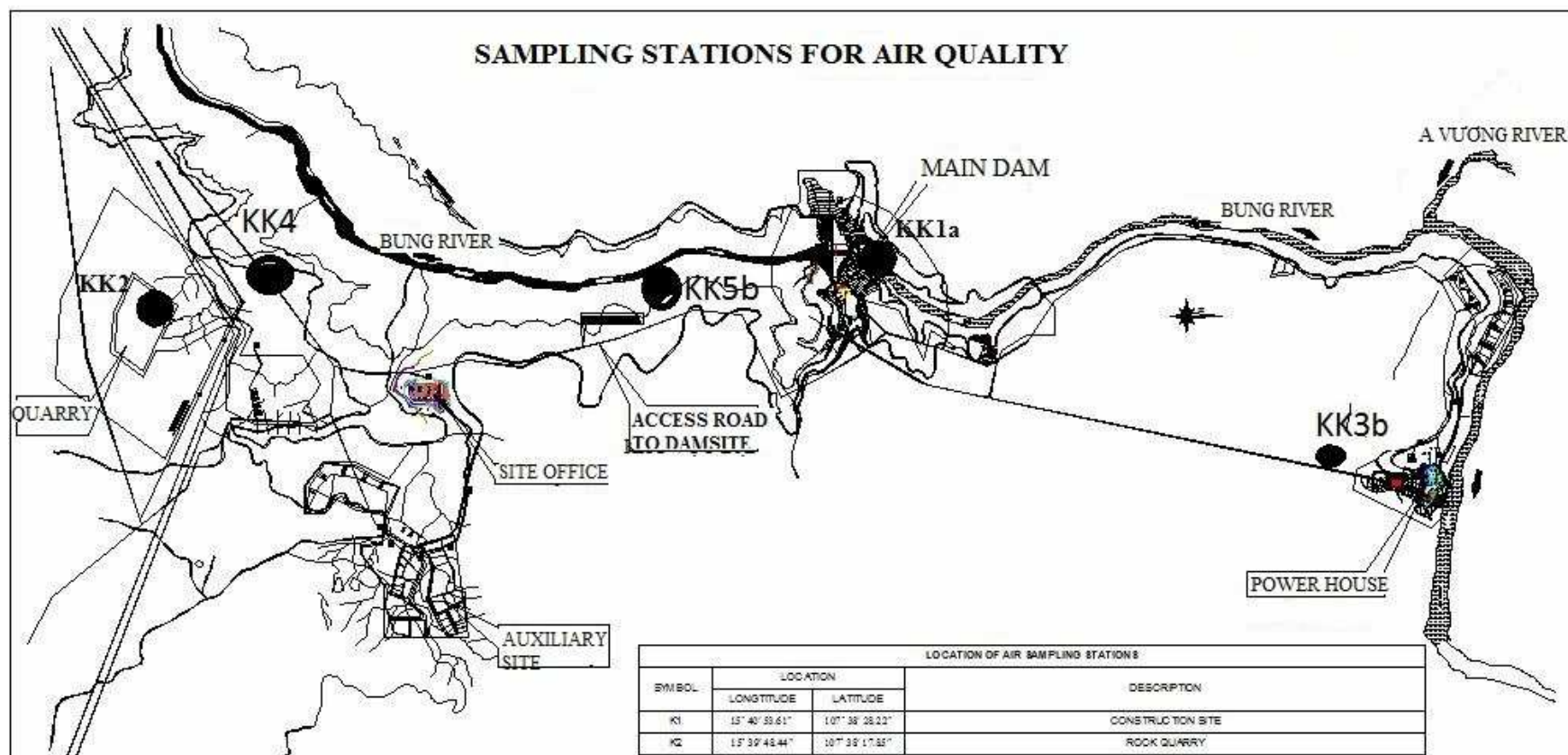


Figure2: Sampling positions for air quality

Table2: Positions, parameters and criteria for air quality analysis

No.	Monitoring contents	Parameters	Frequency	Methodology	Analysis Standard - Tools
Air					
1	Quantity of sample: 03 Sampling position: 03 - Construction area (left abutment): KK1a - Rock quarry – rock crushing plant: KK2 - Main tunnel: KK3b	CO	Quarterly	Dedicated equipment was used to measure the quality of air in the area. Analysis methodology was applied according to Vietnam Standards	TCVN 352 – 89
2		NO ₂			TCVN 6137 – 1996
3		SO ₂			TCVN 5971 – 1995
4		Total suspended particle (TSP)			TCVN 5067 – 1995
Noise					
1	Quantity of sample: 05 Sampling position: 05 - Construction area (left abutment): KK1a - Rock quarry – rock crushing plant (1 position): KK2 - Main tunnel (1 position): KK3b - Community house in Vinh village, Ta Poo commune (1 position): KK4	Leq	Quarterly	Dedicated equipment was used to measure the quality of air in the area. Analysis methodology was applied according to Vietnam Standards	QUEST
2		L90			QUEST
3		L50			QUEST
4		Vibration			Vibration meter VM83



<i>No.</i>	<i>Monitoring contents</i>	<i>Parameters</i>	<i>Frequency</i>	<i>Methodology</i>	<i>Analysis Standard - Tools</i>
	- Concrete mixing plant (1 position): KK5b				

Analysis results will be evaluated and compared with the QCVN 05:2008/BTNMT –Regulation on Ambient Air Quality; QCVN 26:2010/BTNMT – National TechnicalRegulationon Noise;QCVN 27:2010/BTNMT – National TechnicalRegulationon Vibration.

b. Water environment

The assessment of water quality was conducted to:

- Monitor water quality during the construction phase as well as identify the level of water pollution to take appropriate protection measures;
- Assess the quality of domestic water of workers and monitoring of the quality of wastewater before discharging into the environment
- Assess the quality of underground water in the project area;

(i) *Quality of surface water*

Two samples of surface water were taken in upstream and downstream of the construction area to assess the quality of surface water. Monitoring parameters and sampling methodology and analysis criteria are presented in the following table:

Table3: Positions, parameters and criteria for surface water analysis

No.	Parameter	Parameters	Frequency	Methodology	Analysis Criteria - Tools
1	Quantity of sample: 02	pH	quarterly	Water samples were individually taken in response to the characteristics of the river: the river in this area is large, shallow and the flow is strong. Therefore, composed samples were not required to be taken in depth according to the regulations of continental surface water monitoring because of its representative characteristics... Analysis methodology is based on the guiding criteria of the MONRE	TOA WQC 22A
2	Sampling position: 02	Temperature			TOA WQC 22A
3	- Upstream the construction area (50m far away from Khe Vinh toward the downstream area): NM1a	Conductivity			TOA WQC 22A
4		Turbidity			TOA WQC 22A
5		TSS			TCVN 6625-2000
6	- Downstream the construction area: NM2	BOD ₅			TCVN 6001-1: 2008
7		COD			HACH 8000
8		DO			TOA WQC 22A
9		PO ₄ ³⁻ -P (Content of Phosphate - PO ₄)			HACH 8048
10		NO ₃			HACH 8039
11		NH ₄			HACH 8038
12		Total Nitrogen			HACH 10071
13		Total Phosphorus			HACH 8190



<i>No.</i>	<i>Parameter</i>	<i>Parameters</i>	<i>Frequency</i>	<i>Methodology</i>	<i>Analysis Criteria - Tools</i>
14		Total Lubricant			APHA 5520 B
15		Total Coliform			TCVN 6187 – 2:96

Quality of water environment was assessed and compared to National Environmental Technical Regulations: Column A2 of the QCVN 08: 2008/BTNMT – National Technical Regulation on Surface Water.

SAMPLING STATIONS FOR SURFACE WATER

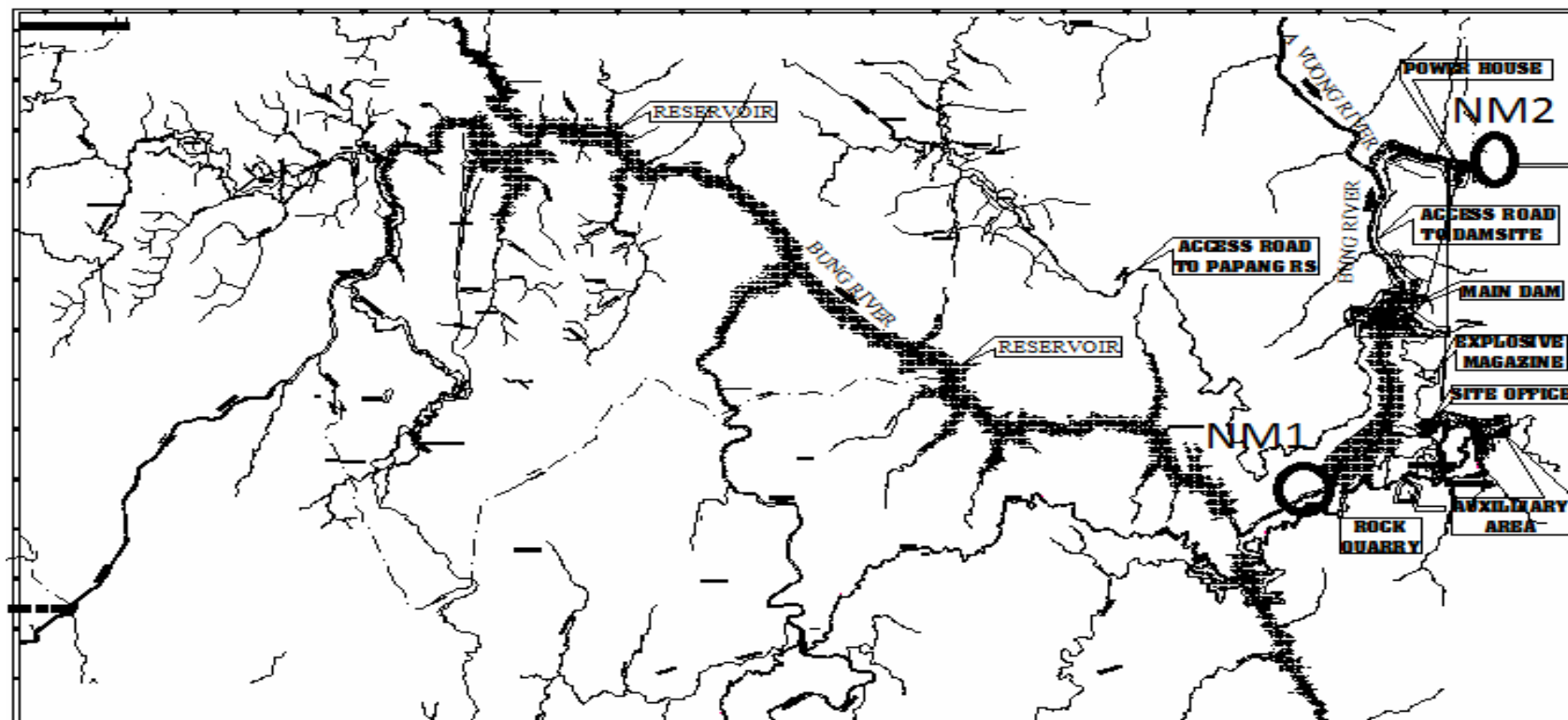


Figure3: Sampling positions for surface water

(ii) Quality of domestic water

Samples of domestic water were taken in 3 positions in the worker camps to monitor the quality of the domestic water. Based on the results of domestic water analysis in the 11th environmental monitoring, the EMC proposed to replace 03 sampling positions of domestic water (three monitoring samples were met the standard) including SH1a, SH2b, SH3b by other three samples of domestic water (SH1b, SH2c, SH3c) to monitor the quality of domestic water in different positions in the construction areas. Sampling positions, parameters and sampling methodology are given in the following table:

Table4: Positions, parameters and criteria for domestic water analysis

No.	Sampling positions in the 12 th environmental monitoring	Frequency	Methodology	Parameters	Analysis Criteria - Tools
1	Quantity of sample: 03	Quarterly	Analysis methodology was based on the guiding regulations of the MONRE Description: Domestic water used in the project area was mainly from streams	Colour	HACH 10068
2	Sampling position: 03			Odor	Organoleptic assessment
3	- Domestic water for the camp in the			Turbidity	TOA WQC 22A
4	surge tank area: SH1b			pH	TOA WQC 22A
5	- Domestic water			NH ₄ ⁺ - N	HACH 8038
6	for the camp area of contractor Song Da			Total Coliforms	TCVN 6187 - 2:96
7	5: SH2c - Domestic water in camp No.45 (in lower position): SH3c			Ecoli	TCVN 6187- 2:96

Quality of domestic water was assessed and compared with National Environmental Technical Regulations: Column II of QCVN 02:2009/BYT – National Technical Regulation on Quality of Domestic Water.

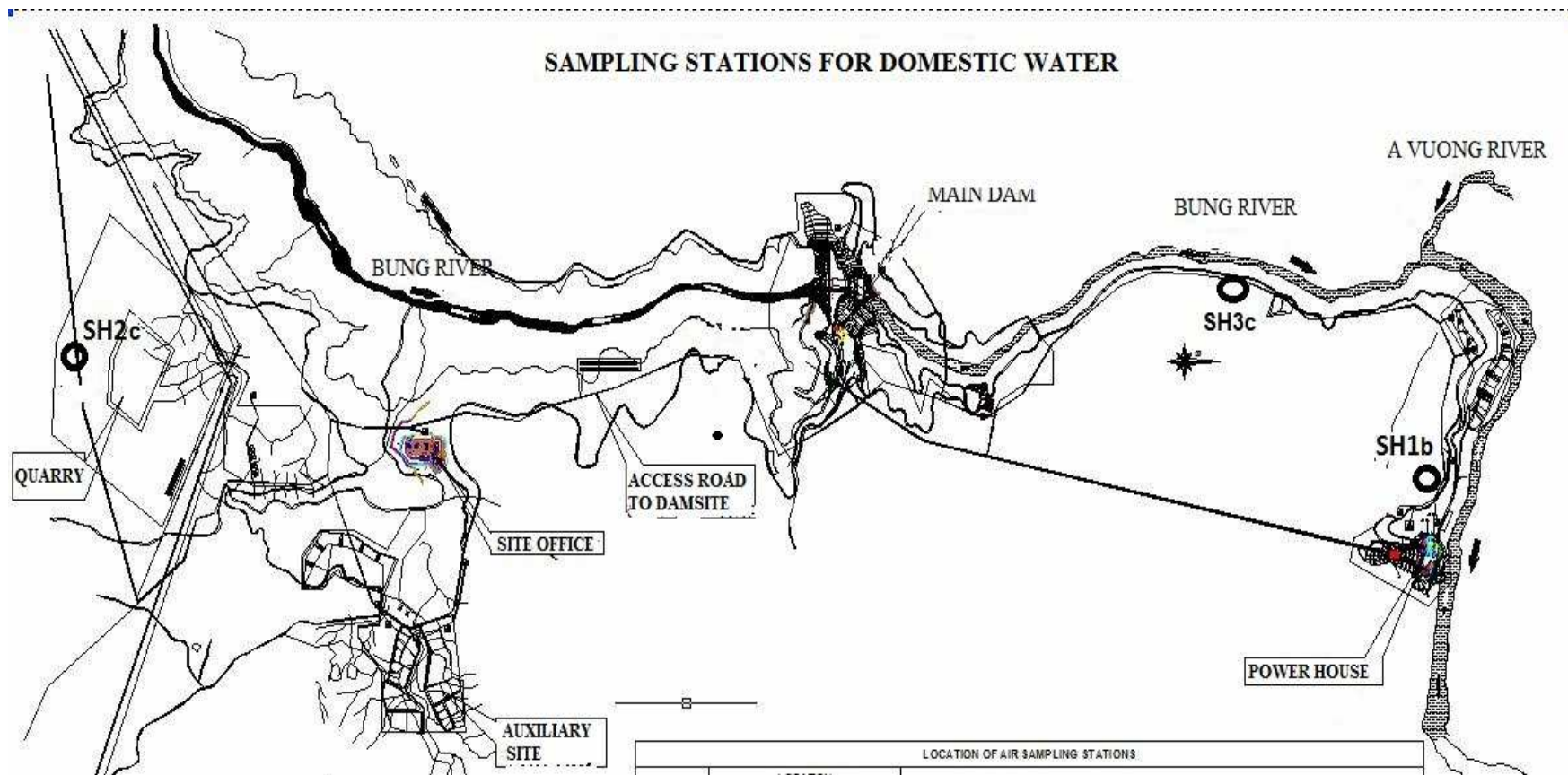


Figure4: Sampling positions for domestic water

(iii) Quality of underground water

Villagers and construction workers in the project area mainly used surface water (water from streams) for daily activities. There were some households using underground water for daily activities. Based on the analysis results of underground water quality in the 11th environmental monitoring, the EMC proposed to replace the samples of underground water (NG1, NG3, NG4, NG5, NG6) that met the standard by other underground water samples (NG1a, NG3a, NG4a, NG5a, NG6a) in order to monitor the quality of underground water in different positions in the project area.

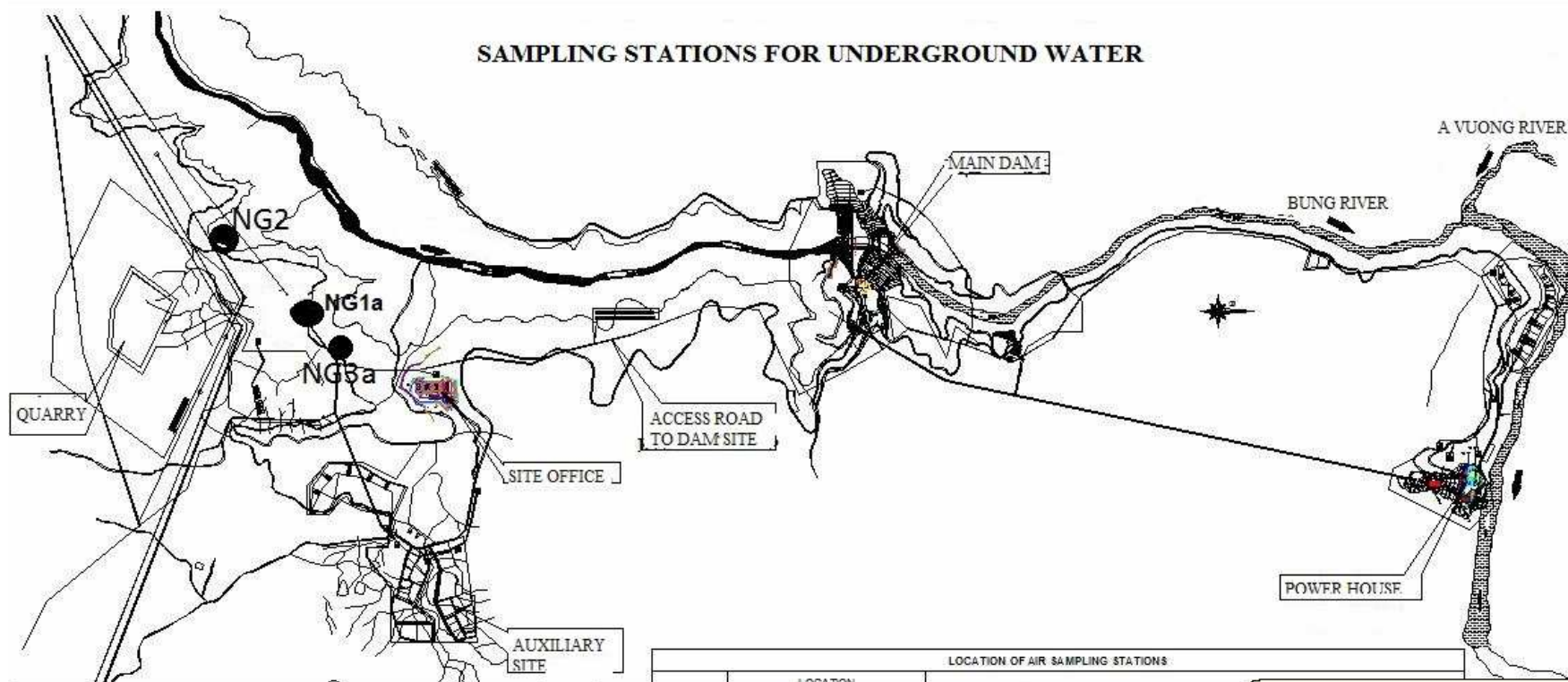
There is a total of 06 underground water samples taken in the project area in the field survey. Sampling positions, parameters and sampling methodology are shown in the table below.

Table 5: Sampling positions, parameters and criteria for underground water quality analysis

No.	Positions	Parameters	Test methods-Tools
1	Quantity of sample: 06	pH	TOA WQC 22A
2	Quantity of sampling position: 06	Turbidity	TOA WQC 22A
3	- Water from well of Mr. Nguyen Xuan Thieu, Vinh village, Ta Poo commune, Nam Giang district – NG1a	Cl ⁻	HACH 8113
4	- Water from well of Mr. Nguyen Van Hoa, Vinh village, Ta Poo commune, Nam Giang district – NG2	Hardness (as CaCO ₃)	HACH 8213
5	- Water from well of Mr. Phan Tan, Vinh village, Ta Poo commune, Nam Giang district – NG3a	TDS	HACH SENSION 5
6	- Water from well in Staff Area of Army People's Health Center, ChaVal commune, Nam Giang district – NG4a	TSS	TCVN 6625 - 2000
7	- Water from well in Patient Area of Army People's Health Center, ChaVal commune, Nam Giang district – NG5a	COD	HACH 8000
8	- Water from well of Mr. Le Trong Tuyen, A Bat village, ChaVal commune, Nam Giang district – NG6a	NH ₄ ⁺ - N	HACH 8038
9		NO ₂ ⁻ - N	HACH 8507
10		PO ₄ ³⁻ - P	HACH 8048
11		Fe	HACH 8008
12		SO ₄ ²⁻	HACH 8051
13		Coliforms	TCVN 6187-2:96



Quality of underground water was assessed and compared to the National Environmental Technical Regulations: the QCVN 09: 2008/BTNMT and Column II of the QCVN 02:2009/BYT – National Technical Regulation on Domestic Water.



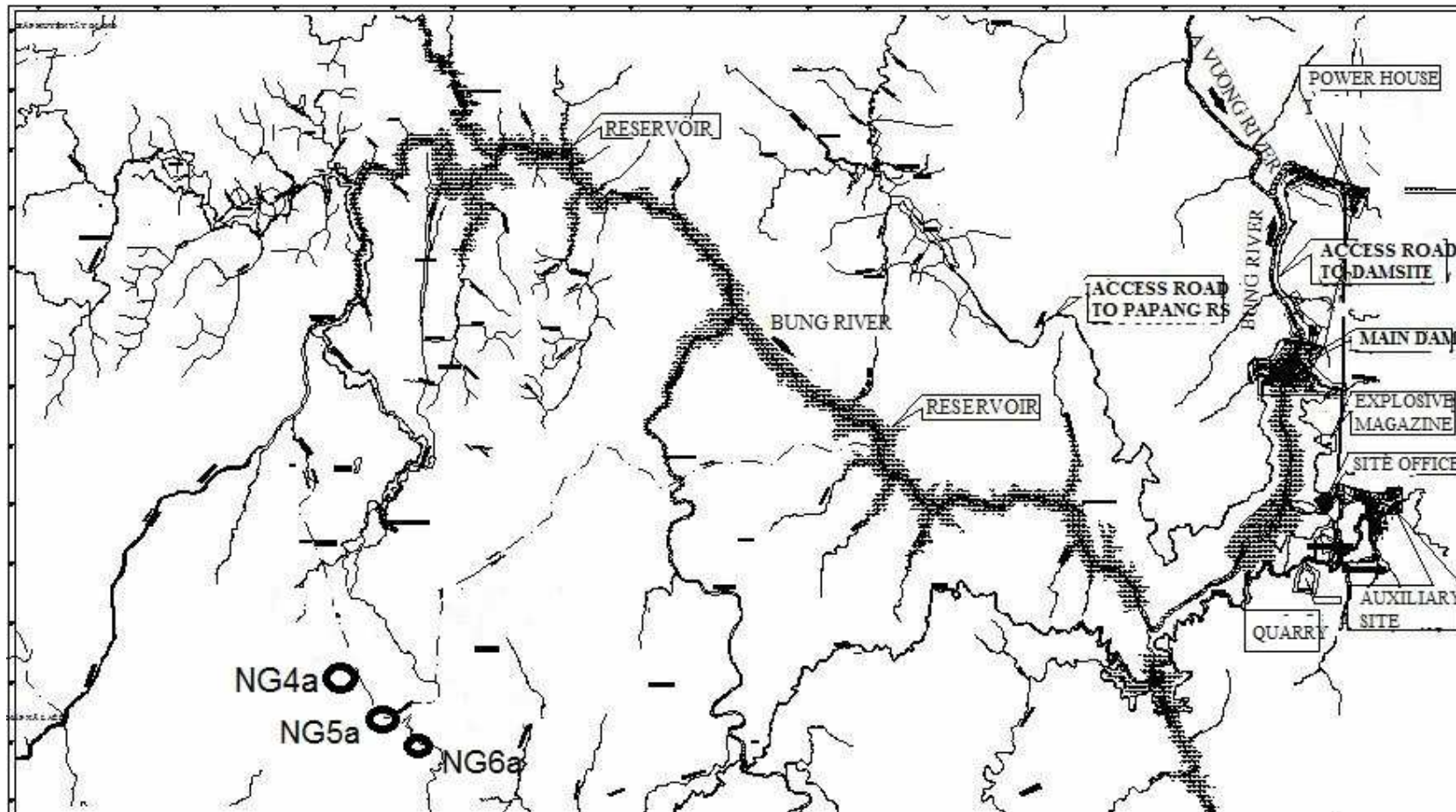


Figure5: Sampling positions for underground water

(iv) Quality of domestic wastewater

There are 3 samples of domestic wastewater in the construction areas taken in the field survey. Sampling positions, parameters and sampling methodology are shown in the table below.

Table6: Sampling positions, parameters and criteria for domestic wastewater analysis

No.	Positions in the 12 th monitoring	Parameters	Analysis Criteria - Tools
1	Quantity of sampling position: 03 - Wastewater in main camp area - in upper position: NT1a - Wastewater in camp and auxiliary area No. 13 (Big Bear Bridge): NT2a - Camp in camp area of contractor Song Da 5 - rock quarry: NT3c	pH	TOA WQC 22A
2		TSS	TCVN 6625 - 2000
3		BOD ₅	TCVN 6001 - 1:2008
4		NO ₃	HACH 8039
5		NH ₄	HACH 8038
6		PO ₄ ³⁻	HACH 8048
7		Total lubricant	APHA 5520 B
8		Coliforms	TCVN 6187-2-1996

Quality of domestic wastewater was assessed and compared with National Environmental Technical Regulations: Column B of QCVN 14: 2008/BTNMT - National Technical Regulation on Domestic Wastewater Quality.

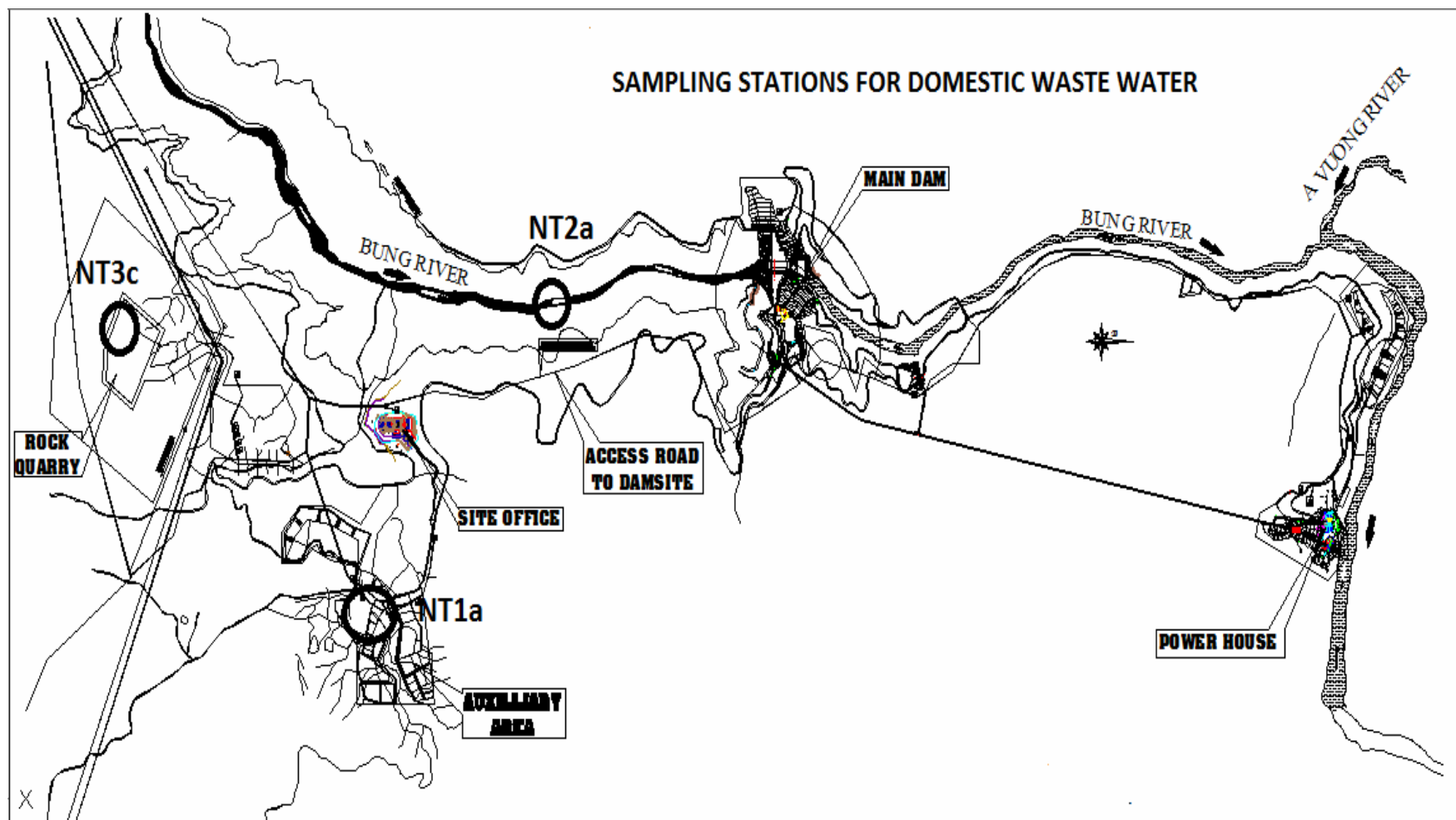


Figure6: Sampling positions for domestic wastewater quality

c. Solid waste and hazardous waste

Construction waste, especially hazardous waste (lubricants, gasoline, flammable materials, lubricant containers/tanks, broken bulbs, used batteries, etc.) generated during the construction process contain a lot of hazardous components, of which many components could be easily emitted into the environment, thereby threatening people's health and natural environment. Therefore, quantity, component and process of waste treatment (especially hazardous waste) need to be monitored regularly.

Sampling positions and parameters for hazardous waste that occurred during the construction phase are presented as follows:

Table 7: Positions and parameters for construction waste monitoring

<i>Positions</i>	<i>Parameters</i>
- Construction machines and equipment gathering areas - Parking area - Material storages - Waste gathering area - Explosive storage	- Component, volume and characteristic of construction waste (including hazardous waste) - Hazardous waste management and treatment were complied with the regulations and registered as per the Circular No. 12/2011/TT-BTNMT of the MONRE of 14 April 2011, regulating Hazardous Waste Management

The monitoring of construction waste aims to control solid and hazardous waste to prevent negative impacts on people's health and the environment.

Solid waste generated from domestic activities of project officers and workers would cause significantly negative impacts on people's health and the environment if it was not hygienically collected and managed. Therefore, the waste treatment process in the camp areas in the construction site should be strictly monitored.

d. Ecological environment

Monitoring of bio-diversity and ecological environment was conducted by ecological environment specialists through field survey, interviews with the local people and analyzing of available data.

Table8: Sampling positions and parameters for monitoring of ecological environment

No.	Contents	Positions	Parameters	Methodology
1	Terrestrial fauna and flora	<ul style="list-style-type: none"> - Construction site - Song Thanh Natural Reserve - Downstream area from the back of the dam to the powerhouse 	<ul style="list-style-type: none"> - Quantity of terrestrial fauna and flora - Changes of vegetation - Illegal hunting, logging, forestry exploitation, wild animal trafficking... 	<ul style="list-style-type: none"> - Using data available in the local - Interviews with local people and construction workers about wild animal hunting in the project area
2	Aquatic fauna and flora	In Bung River	<ul style="list-style-type: none"> - Quantity of fish and weed and diversity of their species - Illegal fishing 	Collecting data and interviewing local villagers
3	Changes of the vegetation	<ul style="list-style-type: none"> - Construction site - Song Thanh Natural Reserve - Downstream area from the back of the dam to the powerhouse 	<ul style="list-style-type: none"> - Area of logging trees - Changes of the vegetation 	<ul style="list-style-type: none"> - Using data available in the local - Interviews with local people and construction workers about wild animal hunting in the project area - Field observing

2.2.3. Consultations with local agencies and relevant stakeholders

To ensure that the environmental monitoring is meaningfully implemented, the environmental monitoring consultant (EMC) conducted consultations with representatives of relevant stakeholders (Division of Natural Resources and Environment, Division of Agriculture and Rural Development, Division of Forest Protection of Nam Giang district, Nam Giang District Health Center and Management Board of Song Thanh NR) and representatives of the contractors and construction workers and with local people.

The 12th Environmental Monitoring Report

- Discussed with officers of Nam Giang District Division of Natural Resources and Environment on the environmental issues in 4 project communes as well as the project impacts on the local natural and social environment
- Worked with the officers of the Division of Agriculture and Rural Development on the progress of replacement afforestation.
- Carried out consultation with Nam Giang District Health Center for the issues of infectious diseases in the 4 project communes (TaBhing, TaPoo, Zuoih and Chaval) and of diseases surveillance and of healthcare for project workers in the second quarter of 2013; examined coordination among Nam Giang District Health Center, the PMU and the contractors in healthcare for project workers and the affected communities.
- Consulted with Nam Giang District Division of Forest Protection and Management Board of Song Thanh NR to update data and information on the species and amount of fauna and flora in the project area, as well as on the situation of illegal forestry exploitation in the whole area in general and in project area in particular in the second quarter of 2013.
- Conducted consultations with representatives of contractor SinoHydro on the compliance in the implementing of the mitigation measures, worker management and healthcare and safety for workers; met and interviewed workers in the construction site about their living conditions, healthcare and worksafety conditions.
- Met and consulted with the local people on public health and about the project impacts on their natural and social environment. Through the consultation, EMC understood about their opinions and knowledge of the hydropower project and its impacts on the environment. Then the EMC monitored the implementation of the mitigation measures by the contractors.



III. MONITORING AND ASSESSMENT RESULTS

3.1. Summary of environmental issues and monitoring results of the previous monitoring (The 11th Monitoring)

Song Bung 4 Hydropower Project is located in the Vu Gia – Thu Bon hydropower cascade. The Plant, with 156MW in capacity will be put into operation by the end of 2014. The construction of the plant was commenced in June 2010.

The 11th environmental monitoring (construction phase) was carried out from 9 April to 13 April 2013 and the results of the monitoring are as follows:

- (i) The air environment in the project area has no significant sign of toxic emission pollution at the monitoring time. Indicators such as CO, SO₂, NO_x are within the regulated limit as per the QCVN 05:2009/BTNMT. Content of TSP in the left abutment (KK1a) and in the rock crushing plant – rock quarry (KK2) is higher than the regulated limit of the QCVN 05:2009/BTNMT: content of TSP in the rock crushing plant – rock quarry (KK2) is 7.3 times higher than the regulated limit as per the QCVN 05:2009/BTNMT.
- (ii) Noise in the dam area, the rock crushing plant – rock quarry and the concrete mixing plant is higher than the regulated limit of the QCVN 26:2010/BTNMT – 70dBA (noise level measured at the left abutment is 81.5 dBA; 95 dBA in the rock crushing plant – rock quarry and 86 dBA in the concrete mixing plant. Such big noise will affect workers and officers who work in the construction site.
- (iii) Quality of surface water: Content of turbidity and TSS in the surface water is very high (turbidity > 900 NTU). Content of NH₄⁺-N in sample NM1a and NM2 and content of TSS in sample NM1a are higher than the regulated limit (content of NH₄ in sample NM1a is 3.6 times higher than the regulated limit; content of NH₄ in sample NM2 is 4.25 times higher than the regulated limit; Content of TSS in sample NM1a is 1.77 times higher than the regulated limit). Other indicators are within the regulated limit as per the QCVN 08:2008/BTNMT.
- (iv) Quality of domestic water: Among the samples of domestic water, content of color in sample SH1a is 1.7 times higher than the regulated limit as per the QCVN 02:2009/BYT. Other indicators are within the regulated limit of the QCVN 02:2009/BYT.
- (v) Quality of underground water: Most of the indicators are lower than the regulated limit. Content of turbidity is little higher than the regulated limit of

the QCVN 02 Column II (1.2 – 1.6 higher than the regulated limit as per the QCVN 02:2009/BYT).

- (vi) Quality of domestic wastewater: Most of indicators are within the regulated limit as per the QCVN 14: pH, TSS, NO_3^- - N, PO_4^{3-} - P, total lubricant, Coliforms, NH_4^+ - N, except NH_4^+ - N in sample NT1a (content of NH_4^+ - N is 1.45 higher than the regulated limit) and content of NH_4^+ - N in sample NT3c (content of NH_4^+ - N is 3.9 times higher than the regulated limit). Content of BOD_5 in all three samples of domestic wastewater is higher than the regulated limit (from 1.04 to 2.32 times).
- (vii) Erosion and landslide: For the positions with high risks of erosion and landslide given in the 9th and the 10th environmental monitoring reports, mitigation measures for the erosion and landslide have not yet been applied (slides at the bridge km 8 + 909.61 and along PaPang road with coordinates: (i) Longitude: 15°41'18" - Latitude: 107°35'51"; (ii) Longitude: 15°41'21" - Latitude: 107°35'59"; (iii) Longitude: 15°42'47" - Latitude: 107°35'45"; (iv) Longitude: 15°42'09" - Latitude: 107°36'02").
- (viii) Ecological environment and biodiversity: In comparison with the 10th environmental monitoring, the ecosystem in the project has not been changed significantly. Activities impacted on biodiversity in the area such as illegal mining and hunting wild animals still occurred sporadically; however, there was no violation case due to the project workers.
- (ix) Labor safety: In the first quarter of 2013, there are no occupational accidents in the construction site. With respect to the protection equipment for workers, the contractors provided workers with hard caps, protection clothing and boots; however, the contractors have not yet provided noise-proof equipment for the workers.
- (x) Healthcare for project workers: In the first quarter of 2012, there has been no serious disease in the construction site.

3.2. Results of the monitoring of the contractors' compliance in implementation of the environmental mitigation measures in the 12th environmental monitoring

3.2.1. Implementation of mitigation measures for impacts on air environment

The 12th environmental monitoring has been carried out in the construction phase with the main activity of concrete placement in the dam with high intensity to meet the requirement of flood prevention in 2013. Rock exploitation and crushing, material transportation have been being conducted promptly to serve the concrete pouring in the dam. The activities have generated dust and emission gases (CO, SO₂ and NO_x) into the environment in the construction site.

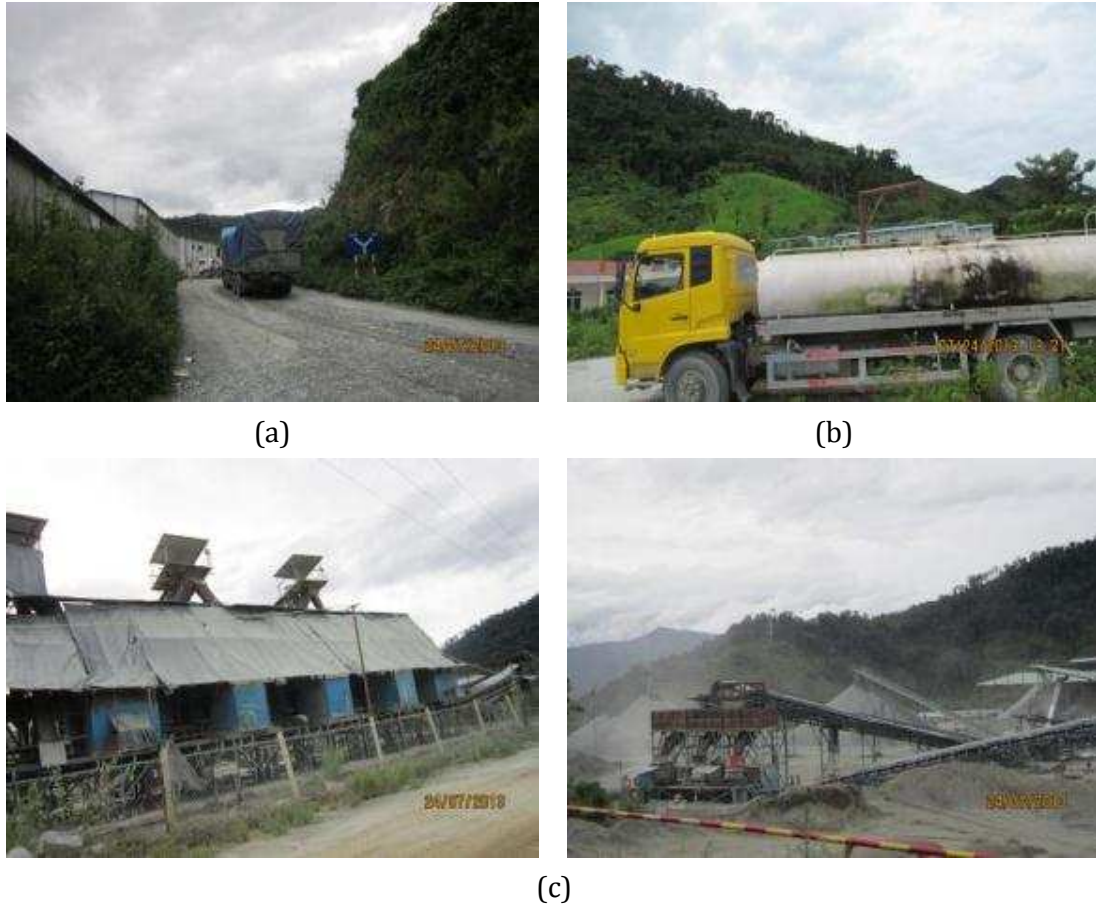
The mitigation measures for the impacts on the air environmental have been applied by the contractors. Results of the monitoring of the mitigation measure implementation are as follows:

a. Implementation of the mitigation measures for the impacts of dust

The main activities that have generated dust in the construction site are rock exploitation and crushing, concrete mixing and material transporting from the rock quarry to the rock crushing plant and from the crushing plant to the concrete mixing plant. Dust generated in the construction site affects the construction workers and some households along the road 14D from the rock quarry to the access road of the powerhouse.

Measures applied to minimize dust by the contractors include::

- To cover the vehicles that transport construction materials and refuse soil and rock to reduce dropping soil and rock on the transporting routes and mitigate dust as well;
- To water the transporting routes to minimize dust: Contractor SinoHydro conducts the watering 05 times/day in sunny days –each time includes one outward journey and one return journey; Contractor Song Da 5: the watering has been conducted by a home-made tank truck;
- To water the construction materials before crushing step and covering the crushing chutes to reduce dust.



*Figure 7: Compliance in the implementation of the mitigation measures for dust
a. Transporting truck with canvas covered; b. Watering the transporting routes; c.
Covering the crushing chutes*

The mitigation measures for dust have been implemented; however the implementation has not been strict.

- The vehicles transporting refuse soil and rock from the rock quarry to waste disposal site No. 1 have no canvas covered. According to contractor Song Da 5, the vehicles have not been provided with canvas sheets because of the near distance from the rock quarry to waste disposal site No. 1.



Figure8: Transporting truck without canvas covered

- Contractor Song Da 5 has conducted watering the transporting routes to mitigate dust. However, according to local people living along the routes and contractor SinoHydro, the watering by contractor Song Da 5 has not been carried out regularly.

Rock exploitation and transportation have generated a high content of dust on the transporting routes while the contractor does not water the route regularly so that dust affects the daily activities of the households living along road 14D from the rock quarry to the waste disposal site No. 1, especially those in Cay Cho area – Vinh village – Ta Poo commune. In the second quarter of 2013, 04 affected households (Nguyen Duc Xuong, Ngo Van Thich, Blup Alo, Nguyen Tien Luc) have lodged complaints on the issue to the local authorities. The PMU has coordinated with the local relevant agencies to examine and assess the level impacts on each household. The PMU has also assigned the consultant to monitor the issue and asked the contractors to overcome the outstanding issues by concrete pouring on road 14D- section in Cay Cho Bridge, water spraying in the crushing plant, increasing the frequency of watering the transporting route from the rock quarry to road 14D and waste disposal site No. 1, providing the transporting vehicles with canvas sheets; the transporting vehicles have been required to transport with the regulated load and speed;... As of the time of the 12th monitoring, the 04 affected households have been provided with cash assistance.

Conclusions: *Rock exploitation and crushing and material transporting generate dust into the air environment. However, the project area is spacious so dust generated from the construction activities just causes minor impacts on the construction areas but not affect the residential areas, exclusive of dust generated from the transporting that affects households along the transporting route. The impacts of dust last during the*

construction phase and affect the construction workers. The PMU and the contractors have provided cash assistance for the affected households and committed to implement the proposed mitigation measures.

b. Implementation of the mitigation measures for noise and vibration

Noise is generated mainly from the construction machines, the blasting, the rock exploitation and crushing and the transporting of construction materials and refuse soil and rock. Noise from the construction areas has affected the workers in the construction site. Some households along road 14D have also been affected by the noise from the transporting vehicles while other residential areas have hardly affected by the noise from the construction activities.

The mitigation measures for noise that have been maintained by the contractors include: (i) The activities such as the transporting, blasting and rock exploitation have been allowed to be conducted by day not by night. (ii) Construction machines with engine and mechanical vehicles in the construction site are ensured by the contractors that the machines and vehicles are all provided with legal operation permit during the project implementation period.

c. Mitigation measures for the impacts of gas emissions from the machines and vehicles

The 12th monitoring has been carried out when the construction activities have been being in prompt progress to meet the requirement on flood prevention. Construction machines and transporting vehicles have been all mobilized to complete the construction as per the proposed schedule. The operation of the construction machines and transporting vehicles emits exhaust gases such as CO₂, SO₂, and NO_x... Exhaust gases from the construction machines and transporting vehicles have been mitigated by maintenance and changing oil for the machines and vehicles.

✂Conclusions: *Main impacts on the air environment noticed in the 12th monitoring are dust, noise, vibration and gas emissions caused by the construction machines and transporting vehicles. The impacts are temporary and occur only in the working time. The contractors have applied the mitigation measures for the impacts on the air environment as specified in the EMP such as covering the transporting vehicles, watering the transporting road and the construction materials... However, the measures have not been implemented strictly. Covering the transporting vehicles and watering the roads have not been conducted regularly. The contractors need comply with all the proposed mitigation measures for the impacts on the air environment.*

3.2.2. Implementation of the mitigation measures for the impacts on water environment

In the 12th environmental monitoring, EMC recorded measures for the impacts on the water environment applied by the contractors as follows:

a. Construction wastewater

(i) Construction wastewater from the rock quarry:

- Wastewater from the refuelling area at the rock quarry is led into a three-compartment sedimentation tank before discharging into the environment. The tank has been provided with an oil screen to collect leaked oil in the wastewater.



Figure 9: Sedimentation tank in the refueling area at the rock quarry

- Wastewater from the rock crushing plant at the rock quarry: The contractors have not yet collected the whole wastewater from the crushing plant so that wastewater from the plant has still been discharged into the environment.



Figure 10: Wastewater from the rock crushing – rock quarry is not collected into the sedimentation tank

(ii) Construction wastewater from the powerhouse:

Wastewater from the plant has been led into a sedimentation tank in the bank of Bung River. The tank has a thick layer of sediment and has not been cleaned regularly so the capacity of sedimentation has reduced. As observed, the height of the tank does not meet the requirement because when the flood season comes, water in Bung River can overflow this tank. In addition, the pipe conducting construction wastewater from the plant area has been being broken, leaking wastewater into the environment. The contractors should apply corrective measures urgently.



(a) Sedimentation tank



(b) Broken wastewater pipe

Figure 11: Sedimentation tank in the plant area

(iii) Construction wastewater from the concrete mixing plant:

Wastewater from the concrete mixing plant has also been treated by the three-compartment sedimentation tank. However, the tank has not been cleaned regularly so that the wastewater after being treated by the tank has high content of turbidity. The contractors have been reminded of this issue by the construction monitoring consultant Mott MacDonald and the EMC through many monitoring visits; however, until now the tank has not yet been cleaned seriously.



Figure12: Sedimentation tank in the concrete mixing plant

❖Conclusions: Construction wastewater from the plant, the concrete mixing plant, the refueling area and the rock crushing plant at the rock quarry is treated by the preliminary sedimentation tanks before discharging into the environment. However, the tanks do not meet the requirement on capacity of sedimentation so that the wastewater after being treated has still been turbid. The sedimentation tank in the plant area should be located in a higher position and the broken wastewater pipe should be repaired promptly.

b. Domestic wastewater from the camp areas

Wastewater treatment system in the camp areas in the construction site has been established; however, the wastewater after being treated by the sedimentation tank has bad odor. Wastewater from the kitchens in the camp areas has not been treated strictly so the content of organic substances in the wastewater is high.

c. Pollution in Bung River

At time of the 12th monitoring, the project area has been being in the rainy season so the water level in Bung River is still high with high content of turbidity. turbidity measured in the upstream and downstream of construction areas is 1412 NTU and 996 NTU respectively. Similar to the previous monitoring, the content of turbidity in the upstream of construction areas is higher than that in the downstream of construction areas. The reason for this may be as follows: the water level in the downstream area is lower than that in the upstream area; the flow in the downstream area runs slowly and it is affected by the erosion of land along the river banks.



(a) Bung river in the upstream of construction area



(b) Bung river in the downstream of construction area

Figure 13: Quality of water in Bung River

At time of the 12th monitoring, the project area has been being in the rainy season. Main construction activities that have been being carried out are concrete placement in the dam area and a part of excavation and backfill. The main reasons that make the content of turbidity in surface water are illegal gold exploitation in Khe Vinh area, the construction in the upstream area (construction of Song Bung 2 Hydropower Project) and erosion and landslide along the river banks. Illegal gold exploitation has still been occurred in Khe Vinh area and some other areas in the upstream area. The illegal gold exploitation in waste disposal site No. 3 that was detected in the previous monitoring visits has stopped, leaving an area of turned and excavated soil along the river banks.



(a)



(b)

Figure 14: Illegal gold exploitation in Khe Vinh area (a) and the river bank has been excavated by the exploitation in the waste disposal site No. 3 (b)

Conclusions: Water in Bung River has high turbidity content and has been greatly affected by the illegal gold exploitation, the construction in the upstream area (construction of Song Bung 2 Hydropower Project) and the erosion and landslide along the river banks.

3.2.3. Implementation of the treatment measures for solid waste and hazardous waste

Results of the monitoring of the implementation of the treatment measures for solid waste (construction solid waste and domestic solid waste) applied by the contractors has been carried out in the construction site, camp areas and other auxiliary areas are as follows:

a. Construction solid waste

Construction solid waste generated in the construction site includes: Construction materials and excavation and backfill materials. Currently, excavation and backfill and

transportation of refuse soil and rock have been decreased. Transportation of surface soils from the rock quarry to the waste disposal site No.1 is the main activity. The solid waste is collected in the waste disposal sites along the construction roads. However, in some places in the construction site, construction solid waste has not yet been cleaned up after the construction completion such as the powerhouse area, access road to the intake gate, etc. The EMC suggested the contractors to clean the areas promptly.



Figure15: Construction waste near the intake gate construction area

b. Domestic solid waste

Domestic solid waste mainly originated from the workers' camp areas. On average, the amount of domestic solid waste in a day is $1200 \text{ workers} \times 0.3 \text{ kg waste/day/worker} = 360 \text{ kg/day}$. The EMC has conducted a survey on domestic solid waste management in the main camp area and other camp areas as well as domestic waste management in the construction site and results of the survey are given as follows:

Waste treatment process in the camps in the construction sites

(i) Collection of domestic waste:

Domestic waste of the camps area is collected into 150-litter mobile buckets which are arranged around the camp areas and a big iron bucket with the capacity of 12 m^3 to collect waste before transporting to the burial site.

All camps are provided with wastebaskets, yet some camps do not keep the environment clean. Throwing waste away scattered or collecting brimful of waste in the wastebaskets still occurred at the camps: main camp of contractor SinoHydro, camp No. 13 (near Big Bear Bridge) and camp in the surge tank construction area.



(a) Domestic waste in main camp area



(b) Brimful wastebasket in camp No. 13



(c) Domestic waste in the camp area in the surge tank construction area

Figure16: Camp areas in which the collection of waste has not been well-implemented

The classification of reusable things as food for animal breeding or used cans, cardboards, papers, etc... to sell. The camps in which the classification has been conducted include camp of contractor Song Da 5 in the rock quarry and main camp of contractor SinoHydro.



(a) Camp of contractor Song Da 5 – rock quarry



(b) Main camp of contractor SinoHydro

Figure17: Classification of reusable waste

(ii) Burying of domestic waste:

Burying of domestic waste in the main camp of contractor SinoHydro and other camps in the construction site is conducted in the waste disposal site No. 1. Domestic waste in the camp areas is collected to bury once or twice a week depending on the volume of waste. The EMC has monitored the burying of domestic waste in the waste disposal site No. 1. The EMC observed that the burying has not been well-implemented: the soil layer covering the waste is not thick enough so that the waste has still been exposed. Additionally, the waste for burying has not yet been classified so there are still many plastic boxes and other reusable things in the waste. The EMC proposed contractor SinoHydro to remind the workers to bury the waste in compliance with the regulated process. Reusable things should be classified and sold to the scrap dealers.



Figure18: Waste burying is not in compliance with the regulated process in the waste disposal site No.

The EMC noted that the burying of waste has been carried out near the camp area in the left abutment. In the area, the waste burying does not meet the requirement: the covering soil layer is not thick enough so that the waste causes bad odor.



Figure 19: Waste burying in the camp area in the left abutment

(iii) Burning of domestic waste:

In some camp areas, domestic waste has been treated by burning but environmentally the treatment has not met the requirement:

- In camp area of contractor Song Da 5 – rock quarry, waste burning has not been complied with the regulated requirements. Plastic bottles and nylon bags have still included in the waste for burning and the burning has been conducted in the area with the “Waste is not for burning” sign;
- Camp area of the Chinese contractor in the rock quarry: There are many nylon bags and oil filters that have been burned. The holes for waste burning have been waterlogged by stagnate water.



(a) Camp area of contractor Song Da 5 - rock quarry



(b) Camp area of the Chinese contractor – rock quarry

Figure 20: Waste burning is not complied with the regulated requirements

Domestic waste of the workers in the construction site:

The contractors have arranged wastebaskets to collect domestic waste that could be generated in the break time by the workers. However, due to the poor awareness of the workers, domestic waste has still been thrown in many places in the construction site such as the powerhouse area, the intake gate construction area, etc. The EMC proposes that the contractors should remind the workers of this issue and fine the offenders to keep the environmental sanitation in the construction site.



(a) Powerhouse area



(b) Intake gate area



(c) Vehicle repairing area in the left abutment



(d) Timber gathering area

Figure21: Domestic waste thrown by the workers in the construction site

Conclusions: Mitigation measures for domestic solid waste implemented by the contractors include: collection of domestic waste in the camp areas and burying of the waste in the waste disposal site No. 1; domestic waste was classified in some camp areas to reduce the volume of domestic waste. However, due to the weak awareness of the workers, waste has not yet been collected in the regulated places in some camp

areas and in the construction site. The contractors should clean up these places and enhance workers' awareness of keeping the living places and the working areas clean.

c. Hazardous solid waste

Amount of redundant lubricant in the second quarter of 2013

Since May 2012, SinoHydro has not yet transported the redundant lubricant for treatment. As estimation of contractor SinoHydro, the volume of the hazardous solid waste in the 2nd quarter of 2013 was about 100 liters of redundant lubricant, 50 kg of clouts and 50 kg of redundant battery.

Contractors' measures for collection and treatment of hazardous waste:

Results of the interview with contractor SinoHydro showed that: redundant lubricant, clouts and used batteries are collected in an area and treated by another unit in compliance with the requirement on hazardous waste treatment. However, there are some incompliant issues in the collection and treatment process as follows:

- (i) Although the collection of used batteries has been done, the EMC observed that the collecting area has no roof and there is stagnant water that cause risk of hazardous chemicals into the environment. The EMC advised that the contractors should place the used batteries in dry place with roof or covering canvas.



Figure 22: Battery collecting area with stagnant water

- (ii) Used lubricant containers have not yet been collected in the regulated places. The containers have still been thrown away in the construction area or burned together with domestic waste. Oil clouts have been collected in domestic wastebaskets and burned instead of being treated by the treatment unit.



(a) Oily hard cap, clouts and oil filters have been burned in an iron barrel—in the left abutment



(b) Oily clouts in domestic wastebasket – in the concrete mixing plant

Figure 23: Hazardous waste treatment has not been complied with the regulated requirement

- (iii) Vehicle repairing in the left abutment has caused lubricant leakage on the ground.



Figure 24: Lubricant on the ground in the vehicle repairing area in the left abutment

- (iv) Vehicle repairing of contractor Song Da 5 in the rock quarry has carried out in the open air while the vehicle gathering area has not yet been provided with a waterproof sheet; therefore, the lubricant has still been leaked into the environment.



Figure 25: Vehicle repairing area in the rock quarry of contractor Song Da 5

Measures for hazardous waste storage and management of the contractors:

(i) Vehicle repairing area in the left abutment:

Machine oil and redundant lubricant in the vehicle repairing area in the left abutment have still been restored in a special place with roof and waterproof cement floor and enclosed by wall to prevent oil spill. Monitoring of the refuse oil storage showed that the oil has still been leaked on the ground. Oil leakage in the gathering of refuse oil is unavoidable so to overcome the problem, the contractors should remind the workers not to drop or spill the lubricant onto the ground. In addition, lubricant collecting gutters have been provided with clouts to collect oil in wastewater.



(a) Machine oil storage



(b) Refuse oil storage

Figure 26: Machine oil storage and refuse oil storage in the vehicle repairing area in the left abutment

(ii) Machine oil storage and refuse oil storage in the camp area in the rock quarry:

The contractors have arranged lubricant storage with roof and wall at 10 cm in height to prevent oil spill. In the previous monitoring visits, the EMC advised the contractors to build the wall with the height of 30cm to prevent oil leaking in case of break-down. The floor of the storage is water-proof cement floor. In addition, the floor is covered with sand to prevent lubricant from leaking on the floor. According to the collecting workers, the volume of sand has been collected in adjacent cement tank and transported to the treatment area when the tank is full of sand.



Figure27: Lubricant storage in the camp area of Chinese contractor

Storage for refuse lubricant in the area has been being established by the contractor. It is expected that the storage will be completed and put into effect in August 2013.



Figure28: The refuse lubricant storage has been being constructed in the rock quarry

Conclusions: According to contractor SinoHydro, hazardous waste such as refuse lubricant, clouts and used batteries shall be collected and handed over to the treatment unit in compliance with the regulations on hazardous waste. However, the consultant observed some non-compliant issues: the area for collecting of used batteries has not met the requirement; the clouts and plastic lubricant containers have not yet been

collected and burned in the regulated places; lubricant has still been leaked in the vehicle repairing area;... Measures for storage of lubricant and refuse lubricant have been maintained. The EMC advises the contractors to remind the workers in repairing areas to collect and treat hazardous waste strictly.

3.2.4. Implementation of the mitigation measures for erosion and landslide

It is the rainy season in the project area at the time of the 12th environmental monitoring so erosion and landslide have still appeared along mountain slopes in the construction areas and Pa Pang road. There have not yet been mitigation measures for the erosion and landslide given in the 11th environmental monitoring including landslide at the bridge km 8 + 909.61 and along Pa Pang road. Soil excavation caused by the illegal gold exploitation along the river banks has made the erosion and washout increase, especially in waste disposal site No. 3.



Landslide at Km 8+909,61



Landslide in the river bed near waste disposal site No. 3



Landslide on Pa Pang road
Coordinate: Longitude: 15°41'47"



Landslide on Pa Pang road
Coordinate: Longitude: 15°42'09"

Latitude: 107°36'45"

Latitude: 107°36'02"

Figure29: Landslide in the project area

❖Conclusions: *The positions with high risks of erosion and landslide mentioned in the previous environmental monitoring have not yet been tackled. The contractors and the PMU have been suggested that the mitigation measures for the positions should be applied immediately to ensure the safety for the local people travelling in the areas and the project progress in rainy season.*

3.2.5. Implementation of the mitigation measures for explosion hazard

The areas with high risk of explosion are explosive storage, blasting area and petroleum and oil storage. The contractors have implemented the following mitigation measures:

- Warning signs, prohibition notice and explosion-proof and flame-proof equipment have been provided in the areas with high risk of explosion and fire.
- Explosive storage has been located far from residential area, camp areas and construction areas. The storage has been controlled strictly with protective fence and a guard at any time.
- Blasting area in the rock quarry: Management of the blasting activity in the rock quarry has been implemented strictly. The area has been provided with "restricted area" sign. At the time of blasting, the workers who have not involved in the operation of detonators would have to move into the safety area (500m far from the blasting area) and 30 minutes after blasting is finished, other activities are allowed to be continued.
- Warning signs such as "no smoking" or "no fire" and fire extinguisher have been maintained in the area. Petroleum and lubricant tanks have been kept in the storages with fence or wire door.



Figure30: Lubricant storage with fence and warning signs

Mitigation measures have not yet been implemented by the contractors:

- Gas and oxygen tanks in the vehicle repairing area near the rock quarry have been placed open- air without controlling or warning signs(Figure 31-a).
- In the storage of refuse lubricant in the left abutment, waste has been burned right near the storage. The EMC advises the contractor to remind the workers not to burn the waste as well as install warning sign in this area because the lubricant is flammable (Figure 31-b).



(a) Vehicle repairing area near the rock quarry



(b) Refuse lubricant storage in the left abutment

Figure31: Non-compliant issues in the implementation of the mitigation measures for explosion

Conclusions: The contractors have implemented the following mitigation measures for explosion: installation of warning signs and prohibition notice in the blasting area; installation of fire ban signs in the lubricant and petroleum storages and other areas with fire risk; providing of fire extinguishers;... However, there are some non-compliant measures such as placing of gas and oxygen tanks in the vehicle repairing

area near the rock quarry open-air and burning waste near the areas with fire risk (in the left abutment).

3.2.6. Implementation of measures for environmental sanitation and workers' health

a. Environmental sanitation

As observation of the EMC from the previous monitoring visits until this monitoring visit, septic tank latrines in the camp areas in the construction site have been substantially completed; waste disposal sites have been located far from the camp and the kitchens. Waste containers and mobile toilets have been provided in the construction sites. However, in the camp areas and the construction areas, waste sometimes has not been collected in the regulated places in (figure 16 and figure 21).

According to the representative of the Division of Work Safety and Environment of contractor SinoHydro, the construction workers concentrates mainly in the powerhouse and the dam area. The EMC observed that waste containers and mobile toilets have been arranged in the areas; however, the number of mobile toilets is small that does not meet the demand of a large number of construction workers. Additionally, the workers' awareness on keeping environmental sanitation are still poor. The EMC suggests that the contractors provide more mobile toilets and arrange them reasonably as well as improve the workers' awareness of keeping the camp areas and the construction site clean.



Figure 32: Waste container and mobile toilet in the powerhouse area

b. Work safety and healthcare for construction workers

- ***Work accident***

According to the representative of SinoHydro's Division of Work Safety, "In the first quarter, of 2013, there is not any work accident in the construction site" (the minutes of the interview is given in Appendices).

- **Work safety**

The representative of SinoHydro's Division of Work Safety admitted that: to improve the workers' awareness as well as to carry out the first aid in case of work accident effectively, contractor SinoHydro has provided the training on emergency aid for the construction workers in June 2013.



Figure33: Training on emergency aid for construction workers (photos provided by the contractor)

Protective equipment for workers includes protective clothing, hard cap, mask, gloves and boots. Additionally, the workers who work on high positions have been provided with protective belt. However, The EMC recorded that the equipment has sometimes not been used by the workers, for example: some workers in metal processing shop did not use gloves and hard cap during their working time or a worker did not wear protective glasses when welding.



Figure34: Workers working without protective equipment

Warning signs, prohibition notices and signs and propaganda signs on driving safety for workers have still been installed in the construction site. Convex mirrors are well-equipped along the road. Regulations on traffic safety have been posted in the camp areas: vehicles transport on the construction road and adjacent road in the project are allowed with limited speed 40 km/h. To ensure the traffic safety, the contractors have arrange workers to clean the dropping rock and soil on the transporting route and maintain degraded road sections as well.



Figure35: Workers are repairing the degraded road section

- **Healthcare for workers**

According to the representative of SinoHydro' Divison of Work Safety, in the 2nd quarter of 2013, there has no serious healthproblem among the construction workers in the construction area. The contractors have attached special importance to health care for the workers by the following activities: (i) Provide drugs for sunstroke for the workers in hot weather; (ii) Provide protective equipment such as mask, helmet, protective cap and belts... (iii) Arrange one health staff to be responsible for the healthcare and to give emergency aid in case of work accident.

3.3. Monitoring and assessment of quality of the air and water

3.3.1. Monitoring and assessment of quality of the air

Results of the air quality analysis are presented in the following table:

Table9: Results of the Air Quality Analysis

No.	Indicator s	Unit	Results					QCVN 05:2009/ BTNMT (in one hour on average)	QCVN 26:2010/B TNMT and QCVN 27:2010/B TNMT
			KK1a	KK2	KK3b	KK4	KK5b		
1	Noise L ₅₀	dBA	69.1	79.3	54.1	59.8	72.4	-	<=70
	Noise L ₉₀	dBA	65.2	76.4	50.8	52.8	69.8		
	Noise L _{eq}	dBA	79.8	88.2	60.4	62.4	77.5		
2	Vibration	m/s ²	0.0159	0.0177	0.0031	0.0056	0.0128	-	<=0.055
3	TSP	mg/m ³	0.53	0.32	0.08	-	-	<=0.3	-
4	CO	mg/m ³	1	2	1	-	-	<=30	-
5	NO _x	mg/m ³	< 0.01	< 0.01	< 0.01	-	-	<=0.2	-
6	SO ₂	mg/m ³	<0.007	0.011	<0.007	-	-	<=0.35	-

Notes:

- KK1a: Air quality in the waterway – in the left abutment; KK2 : Air quality in the rock quarry- the crushing plant; KK3b: Air quality in the main tunnel; KK4 : Noise sample taken in Vinh village – Ta Poo commune; KK5b: Noise sample taken in the concrete mixing plant.
- Noise is compared with the National Technical Regulation on Noise: QCVN 26:2010/BTNMT
- Vibration is compared with the National Technical Regulation on Vibration:QCVN 27:2010/BTNMT

- **Noise and vibration**

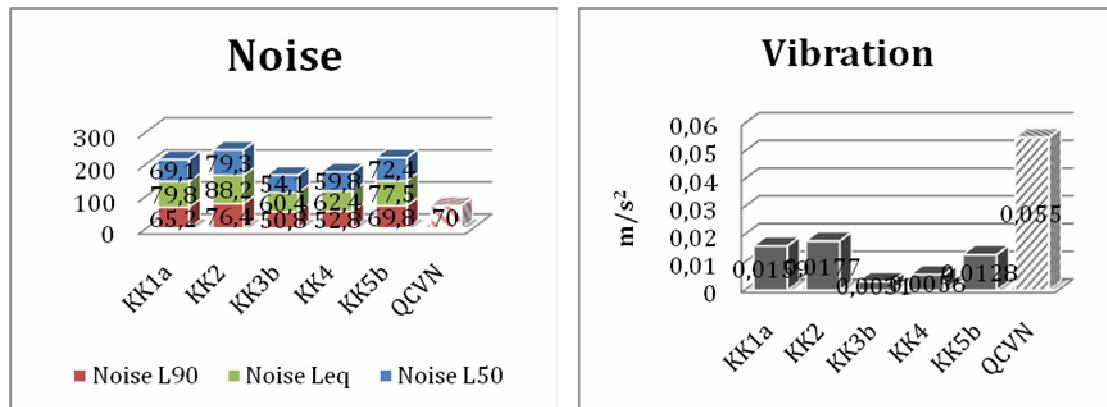


Figure36: Noise and vibration in the air environment

The highest level of noise measured is in the rock quarry –crushing plant, concrete mixing plant and the main construction area-the left abutment, because the construction of the dam is implemented with high intensity, the operation of crushing plant and concrete mixing plant are enhanced to meet the demand on materials. The position of sample KK4 is not directly affected by the construction activities but just affected by the local traffic activity.

Noise Leq measured in the construction site showed that: Noise Leq in the Dam area (KK1a); rock crushing plant in the rock quarry area (KK2) and concrete mixing plant (KK5b) is higher than the regulated limit respectively 1.14 times (KK1a); 1.26 times (KK2) and 1.11 times (KK5b). The operation of rock crusher, screener, concrete mixer and driller is the reason for relatively high level of noise in the areas.

Vibration in the sampling positions is from 0.0031m/s² to 0.0177 m/s². Vibration acceleration in all positions was within the regulated limit of QCVN 27:2010/BTNMT.

- **TSP, CO, NO₂, SO₂**

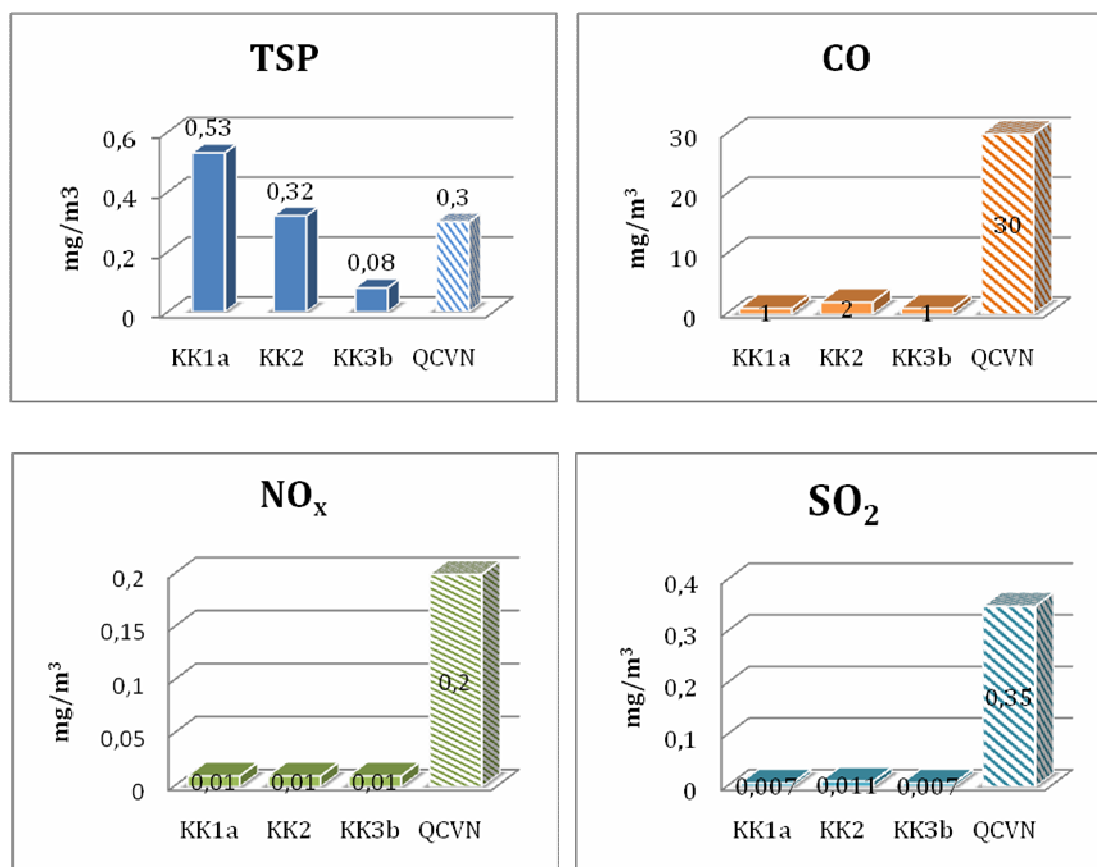


Figure37: Content of TSP, CO, NO_x and SO₂ in the air

Content of CO, NO_x, SO₂ is within the regulated limit as per the National Technical Regulations on quality of the ambient air - the QCVN 05:2009/BTNMT. Content of dust in sample KK3a is within the regulated limit while content of dust in sample KK1a and sample KK2 is higher than the regulated limit but it is not significant. (TSP in sample KK1a is 1.76 times higher; TSP in KK2 is 1.06 times higher than the regulated limit of QCVN 05:2009/BTNMT).

Conclusions: Air environment in the construction site is not polluted by toxic emission gas at the time of monitoring. Content of indicators (CO, SO₂, NO_x) is within the regulated limit of the QCVN 05:2009/BTNMT. Content of dust in the left abutment (KK1a) and rock crushing plant (KK2) is higher than the regulated limit of the QCVN 05:2009/BTNMT, but it is negligible especially content of TSP in the rock quarry (KK2) it is about 1.06-1.76 times higher than the limit. Noise in dam area, crushing plant – rock quarry and cement mixing plant is all higher than the regulated limit as per the QCVN 26:2010/BTNMT – 70 dBA (the value measured in the left abutment, the quarry screen and crushing, concrete mixing area is respectively 79.8 dBA, 88.2 and 77.5). Such big noise will lead to impacts on project officers and workers so the contractors have to

provide them with protective equipments. In addition, the contractors must set up regulations on working time to ensure reasonable rest time for workers in these areas and avoid long-hour working innoise.

Sampling positions and results of the air quality analysis are presented in Appendix 1.

3.3.2. Monitoring and assessment of surface water quality

Results of the surface water quality analysis are given in the following table:

Table10: Results of the surface waterquality analysis

No.	Indicators	Unit	Results		QCVN 08: 2008/BTNMT (A2)
			NM1a	NM2	
1	pH	-	7.1	7.2	6 – 8.5
2	DO	mg/l	7.59	6.9	>=5
3	Temperature	°C	25.0	26.3	-
4	EC	mS/m	13.20	15.46	-
5	Turbidity	NTU	1,412	996	-
6	TSS	mg/l	1,392	850	<=30
7	BOD ₅	mg/l	7	4	<=6
8	COD	mg/l	53	29	<=15
9	Total Nitrogen	mg/l	3.2	1.2	-
10	NO ₃ ⁻ - N	mg/l	7.0	9.5	<=5
11	NH ₄ ⁺ - N	mg/l	1.00	1.00	<=0.2
12	Total Phosphorus	mg/l	0.08	0.11	-
13	PO ₄ ³⁻ - P	mg/l	0.40	0.30	<=0.2
14	Total lubricant	mg/l	NA	NA	<=0.02
15	Coliforms	MPN/100ml	1100x10 ²	93x10 ²	<=5000

Notes:

NM1a:Quality of the surface waterin the upstream construction site; NM2: Quality of surface water in the downstream construction site.

A2 – Use for domestic water supply but apply to the suitable water treatment technology; preserve aquatic fauna and flora, or usage purposessuch as type B1 and B2

- **pH and temperature**

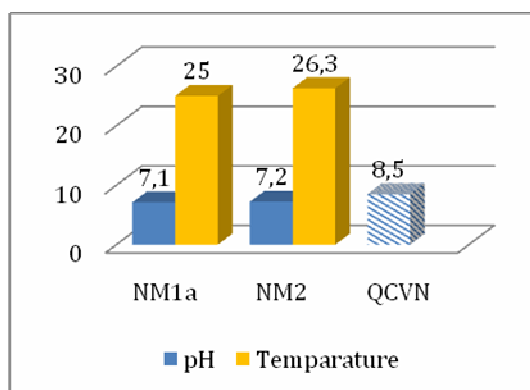


Figure38: Content of pH and temperature in the surface water

pH: Content of pH in surface water samples in the upstream and downstream construction site is within the regulated limit of the QCVN 08:2008/BTNMT (6 – 8.5). The content of pH in the two samples is insignificantly (7.1 and 7.2). Content of pH in NM1a and NM2 ensures development of aquatic fauna and flora.

Temperature: the temperature in two sampling positions NM1a and NM2 is respectively 24.4°C, 24.2°C.

- **Total suspended solid (TSS)**

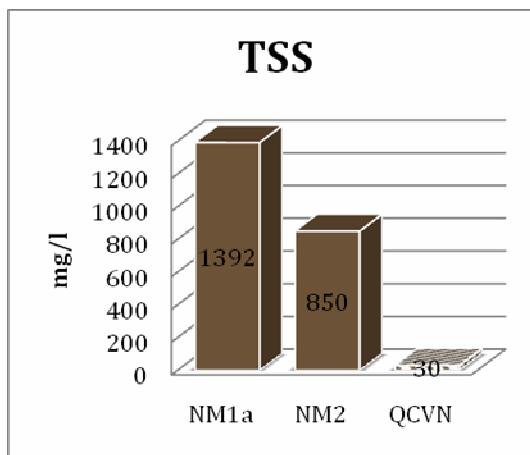


Figure39: Content of TSS in the surface water

Content of TSS of surface water samples in the upstream construction site and NM2a is respectively 46.4 times higher and 28.3 times higher than the regulated limit of the National Technical Regulations on quality of surface water – the QCVN 08:2008/BTNMT. Content of TSS in the upstream area is higher than that in downstream area because the water in the downstream area has smaller disorder. In addition, the illegal gold exploitation leads to this problem.

- **DO, COD and BOD₅**

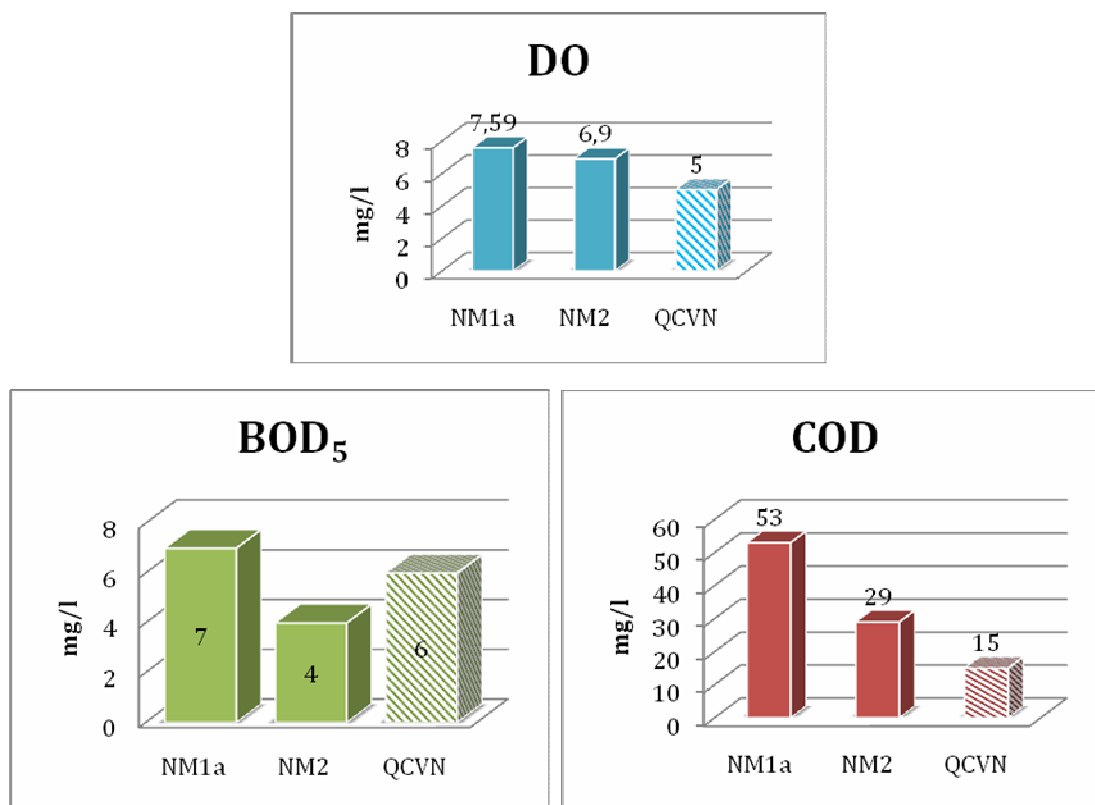


Figure40: Content of DO, BOD₅ and COD in the surface water

Content of DO in sample NM1a (7.59mg/l) and sample NM2 (6.9 mg/l) is higher than 5mg/l that is within the regulated limit of the QCVN 08:2008/BTNMT. Dissolved oxygen plays an important role in ensuring development of aquatic fauna and flora. The diffusion of oxygen into the water depends much on the temperature and the water flow.

Content of COD and BOD₅ in the upstream area (COD = 53 and BOD₅ =7mg/l) and in the downstream area (COD = 29) is higher than the regulated limit (COD ≤ 15 and BOD₅ ≤ 6mg/l).

- NO_3^- -N, NH_4^+ -N and PO_4^{3-} -P

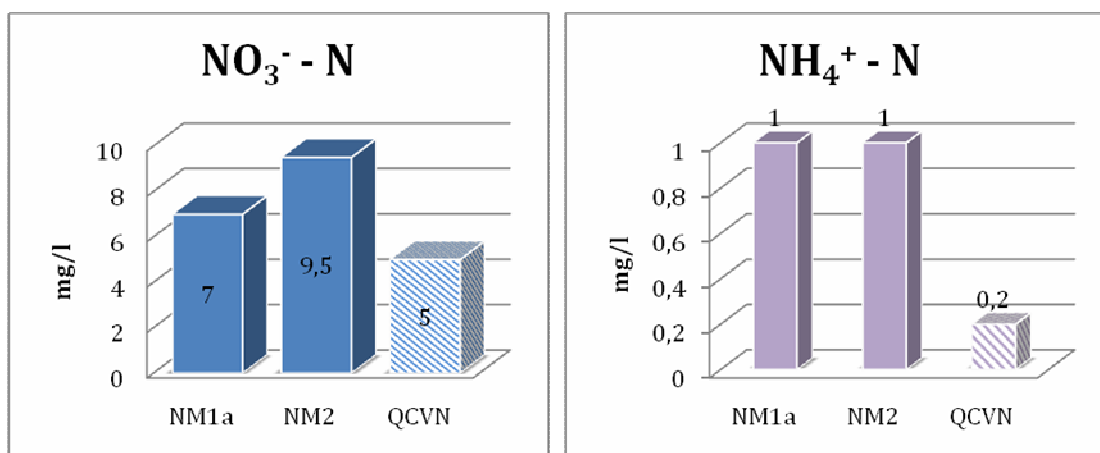


Figure 41: Content of $\text{NO}_3^- - \text{N}$ and $\text{NH}_4^+ - \text{N}$ in the surface water

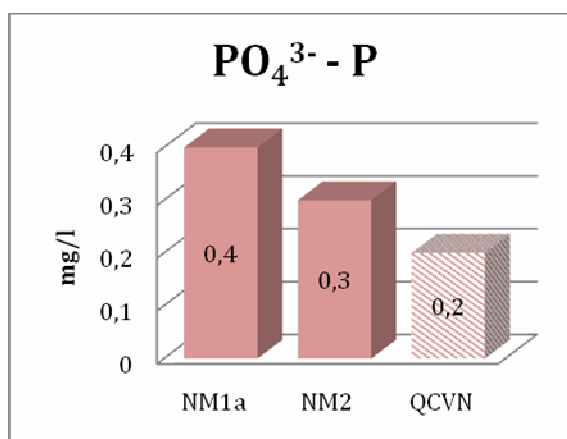


Figure 42: Content of $\text{PO}_4^{3-} - \text{P}$ in the surface water

Content of $\text{NO}_3^- - \text{N}$ in the two samples in the upstream area and downstream area was all higher than the regulated limit as per the QCVN 08:2008/BTNMT, of which content of $\text{NO}_3^- - \text{N}$ in the upstream area was 1.4 times higher and in the downstream area was 1.9 times higher than the regulated limit.

Content of $\text{NH}_4^+ - \text{N}$ in sample NM1a and NM2 is 5 times higher than the regulated limit as per the QCVN 08:2008/BTNMT. Content of $\text{NH}_4^+ - \text{N}$ in the surface water may be caused by the domestic wastewater from the worker camps that is not collected and treated strictly.

Content of $\text{PO}_4^{3-} - \text{P}$ of water surface samples in the two sampling positions is about 1.5-2 times higher than the regulated limit as per the QCVN 08:2008/BTNMT.

• Total lubricant and Coliforms

Results of the surface water monitoring indicated that: there is no lubricant found in the surface water.

Content of Coliforms in NM1a and NM2 is 1.86-22 times higher than the regulated limit as per the QCVN 08:2008/BTNMT.

Conclusion: Results of monitoring indicator analysis showed that: *Content of pH, DO, total lubricant is within the regulated limit of the QCVN 08:2008/BTNMT. However, the value of turbidity and TSS of two water surface samples measured is higher than limit. The content of BOD₅, COD, NH₄⁺-N, NO₃⁻ - N, PO₄³⁻ - P is all higher than regulated limit as per QCVN 08:2008/BTNMT (except the content of BOD₅ of the water surface in the construction downstream site). Also, the content of Coliforms in 02 water surface samples is 1.86-22 times higher than the regulated limit. The reason may be the ineffective operation of sanitation facilities or domestic waste from illegal gold exploitation groups.*

Sampling positions and results of the surface water quality analysis are presented in Appendix 2.

3.3.3. Monitoring and assessment of domestic water quality

Results of the domestic water quality analysis are presented in the following table:

Table 11: Results of domestic water analysis

No.	Indicators	Unit	Results			QCVN 02:2009 /BYT Column II
			SH1b	SH2c	SH3c	
1	pH	-	7.15	7.18	7.22	6.0 – 8.5
2	Turbidity	NTU	4	5	3	≤5
3	Color	Pt - Co APHA	26	8	38	≤15
4	Odor	-	No odor	No odor	No odor	No strange odor
5	NH ₄ ⁺ - N	mg/l	0.04	0.06	0.05	≤3
6	Coliforms	MPN/100ml	280	90	140	≤150
7	E.coli	MPN/100ml	4	0	0	≤20

Notes:

- Sh1b: Quality of domestic water in the camp in the surge tank construction area; SH2c: Quality of domestic water in the camp area of contractor Song Da 5 –rock quarry; SH3c: Quality of domestic water in the camp No. 45 (kitchen in lower position);
- Maximum regulated limit II: Applied to water exploitation forms of individuals and households (piped water supply just simply treated such as drilled well, deep well, rainwater tank, water trough and self-flowing pipe).

• pH

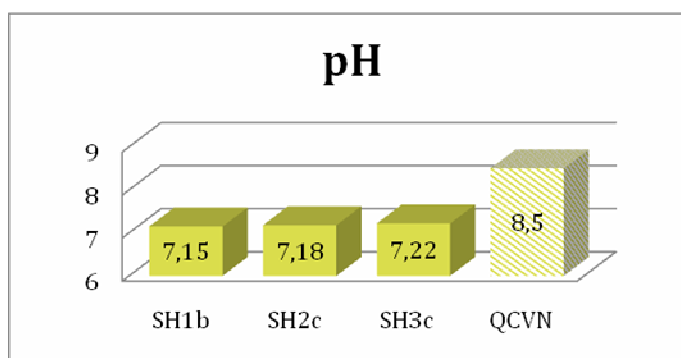


Figure 43: Content of pH in domestic water

Content of pH in three samples of domestic water is within the regulated limit as per the QCVN 02/BYT Column II regulated on quality of domestic water (pH: 6 – 8.5). pH in the domestic water was slightly alkaline (pH <7). The content of pH in all three samples completely meets the requirement on the quality of domestic water.

- Turbidity, colour and odor**

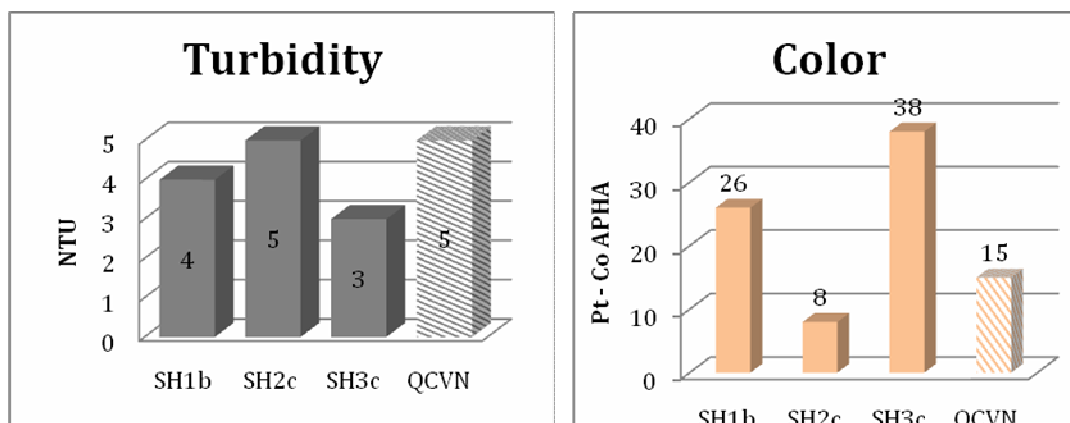


Figure44: Content of turbidity and color in domestic water

Turbidity in the three samples is within the regulated limit as per the QCVN 02:2009/BYT (≤ 5 NTU),

Colour: Content of colour in sample SH1b and SH3cis 1.06-1.6 times higher than the limit while content of colour in sample SH2cis within the limit.

Smell: According to the perceptible assessment the domestic water has no strange smell

- $\text{NH}_4^+ - \text{N}$**

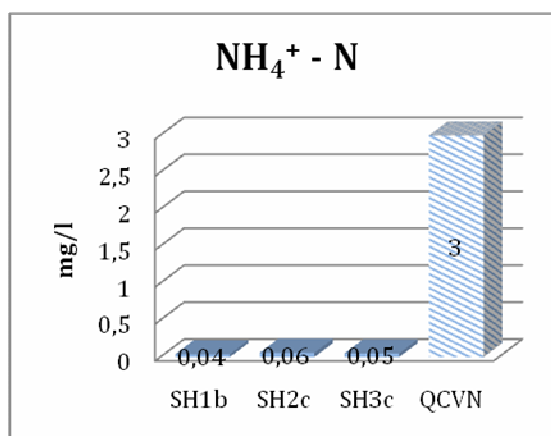


Figure45: Content of $\text{NH}_4^+ - \text{N}$ in domestic water

The content of $\text{NH}_4^+ - \text{N}$ in domestic water is much lower than the regulated limit as per the QCVN 02:2009/BYT. The analysis results showed that the domestic water source in the camp areas has no $\text{NH}_4^+ - \text{N}$ contamination and it is qualified enough for the domestic use.

- **Coliforms and Ecoli**

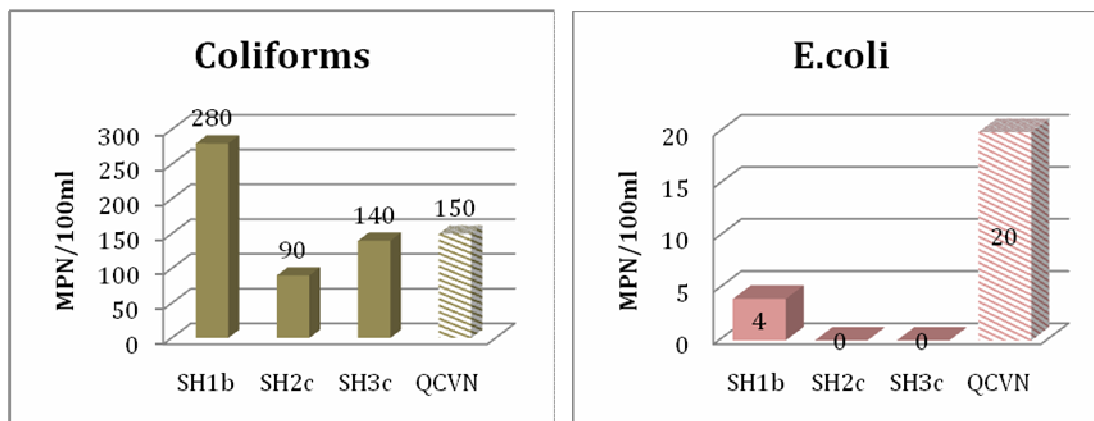


Figure 46: Content of Coliforms and Ecoli in domestic water

Conclusions: Among 3 samples of domestic water, colour of 02 samples SH1b and SH3c is 1.06-1.7 times higher than the regulated limit while content of colour in other samples is within the regulated limit of the QCVN 02:2009/BYT – National Technical Regulations on Domestic Water quality, exclusive of the content of Coliforms in the sample SH1b. In general, worker-serving domestic water in the camp area of Song Da 5 (SH2c) and the camp area No.45 (SH3c) relatively meets requirement on quality. Domestic water in the surge tank camp area (SH1b) need to be treated through filter and carefully boiled before being used for cooking.

Sampling positions and results of the domestic water quality analysis are presented in Appendix 3.

3.3.4. Monitoring and assessment of underground water quality

Results of the underground water quality analysis are revealed in the table below:

Table12: Results of the underground waterquality analysis

No.	Indicators	Unit	Results						QCVN 09/BTNMT	QCVN 02/BTY (Column II)
			NG _{1a}	NG ₂	NG _{3a}	NG _{4a}	NG _{5a}	NG _{6a}		
1	pH	-	6.84	6.95	7.05	6.68	6.63	6.82	5.5 – 8.5	6.5– 8.5
2	Turbidity	NTU	6	5	6	5	4	6	-	≤5
3	Cl ⁻	mg/L	41	18	21	54	44	65	-	-
4	Hardness (as CaCO ₃)	mg/L	128	100	85	110	75	60	≤500	-
5	TDS - Total dissolved solid	mg/L	167.3	102.2	94.1	194.7	153.7	103.6	-	-
6	TSS - Total suspended solid	mg/L	27	4	< 2	2	3	2	≤1500	-
7	COD	mg/L	14	3	4	2	3	1	≤4	-
8	NH ₄ ⁺ - N	mg/L	0.3	0.01	0.01	0.03	0.01	0.01	≤0.1	≤3
9	NO ₂ ⁻ - N	mg/L	<0.003	<0.003	<0.003	0.004	<0.003	<0.003	≤1.0	-
10	PO ₄ ³⁻ - P	mg/L	0.25	0.22	0.11	0.23	0.12	0.23	-	-
11	Fe	mg/L	0.58	0.08	0.09	0.11	0.18	0.04	≤5	≤0.5
12	SO ₄ ²⁻	mg/L	21	4	< 2.2	43	20	2	≤400	-
13	Coliforms	MPN/100mL	9	15	0	8	7	21	≤3	≤150

Notes:

- NG_{1a}: Water from well of Mr. Nguyen Xuan Thieu, Vinh village, Ta Poo commune; NG₂: Water from well of Mr. Nguyen Van Hoa, Vinh village, Ta Poo commune; NG_{3a}: Water from well of Mr. Phan Tan, Vinh village, Ta Poo commune.; NG_{4a}: Water from well in Staff Area of Army Health Center (National Economic Defense Division 207). NG_{5a}: Water from well in Patient Area of Army Health Center (National Economic Defense Division 207). .
- QCVN 09:2008/BTNMT – National technical regulation on quality of underground water;



- QCVN 02:2009/BYT – National technical regulation on quality of domestic water, Column II – QCVN 02:2009/BYT: Applied to water exploitation forms of individuals and households (the piped water supply just simply treated such as drilled well, deep well, rainwater tank, water trough and self-flowing pipe).

Assessment: Analysis results of 06 underground water samples in Vinh village – Ta Poo commune and A Bat village – ChaVal commune in the project area revealed that:

- Most of the monitoring indicators are lower than the regulated limit of the QCVN 09:2008/BTNMT and Column II of the QCVN 02:2009/BYT.
- Content of turbidity (in sample NG_{1a}, NG_{3a} and NG_{6a}) is higher than the regulated limit as per the QCVN 02 Column II, (1.2 times higher than the regulated of the QCVN 02:2009/BYT).
- Content of COD in sample NG_{1a} is higher than the regulated limit as per the QCVN 09:2008/BTNMT – regulation on underground water quality.

In general, quality of underground water in the project area meets the requirements of domestic water quality.

Sampling positions and analysis results of underground water quality are given in Appendix 4.

3.3.5. Monitoring and assessment of domestic wastewater

Results of the domestic wastewater quality analysis are presented in the following table:

Table 13: Results of domestic wastewater quality analysis

No.	Indicators	Unit	Results			QCVN 14/BTNMT
			NT1a	NT2a	NT3c	Column B Column II
1	pH	-	7.23	7.31	7.34	5-9
2	TSS	mg/l	38	43	20	≤100
3	BOD ₅	mg/l	16	71	14	≤50
4	NO ₃ ⁻ - N	mg/l	5.4	5.6	3.8	≤50
5	NH ₄ ⁺ - N	mg/l	0.45	3.6	0.76	≤10
6	PO ₄ ³⁻ - P	mg/l	0.23	0.40	0.47	≤10
7	Total lubricant	mg/l	2.0	3.6	0.4	≤20
8	Coliforms	MPN/100ml	240.10 ⁴	93.10 ⁴	150.10 ⁴	≤5000

Notes:

- NT1a: Domestic wastewater quality in the camp area of contractor SinoHydro in the upper position; NT2a: Domestic wastewater quality in the camp No.13 (in Big Bear Bridge); NT3c: Domestic wastewater quality in the camp area of contractor Song Da 5-Rock quarry area.
- Column B prescribed C value of the pollution parameters as a basis for calculating the regulated maximum value in the wastewater when being discharged into the water that is not used for domestic water supply (quality of wastewater equivalent to columns B1 and B2 of National Technical Regulations on the surface water quality or the coastal water).



- **pH and TSS**

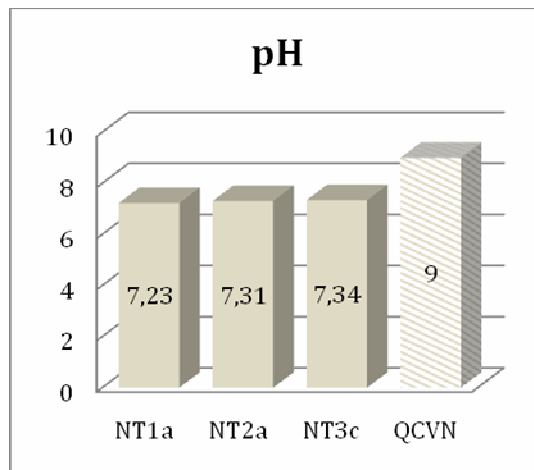


Figure47: Content of pH in domestic wastewater

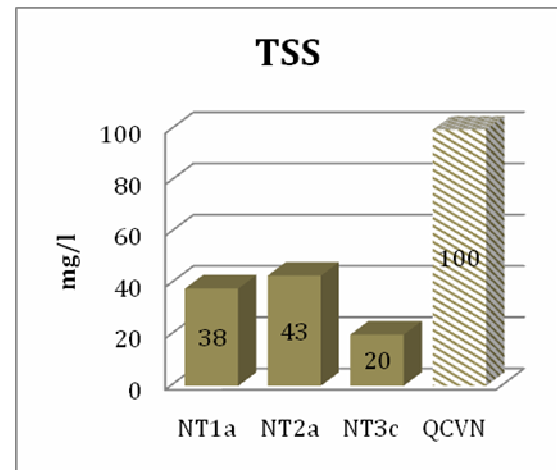


Figure48: Content of TSS in domestic wastewater

pH content was about from 6.6 to 6.7 and within the regulated limit (5 – 9) as per the QCVN 14:2008/BTNMT. The pH content in the domestic wastewater did not impact on the quality of receiving water.

Content of TSS in all 3 samples was all within the regulated limit as per the QCVN 14:2008/BTNMT, it fluctuated from 20 to 38 mg/l.

- **BOD₅, NO₃⁻ - N; NH₄⁺ - N and PO₄³⁻ - P**

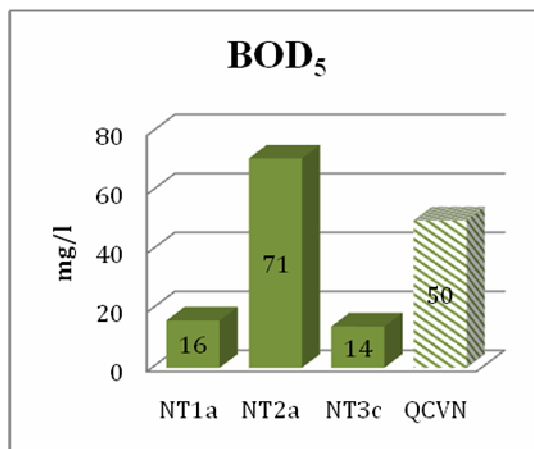


Figure49: Content of BOD₅ in domestic wastewater

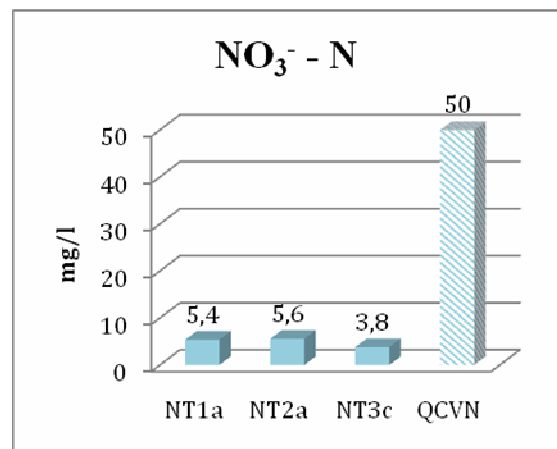


Figure50: Content of NO₃⁻ - N in domestic wastewater

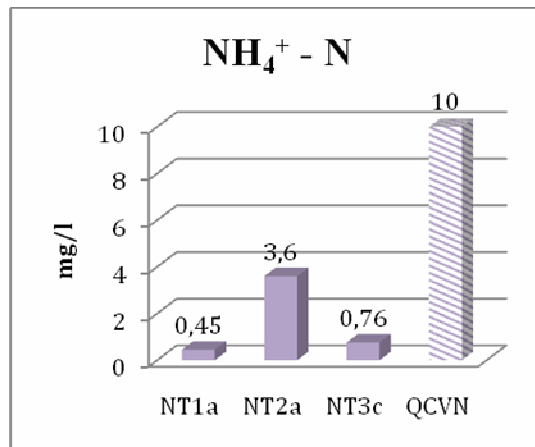


Figure51: Content of $\text{NH}_4^+ - \text{N}$ in domestic wastewater

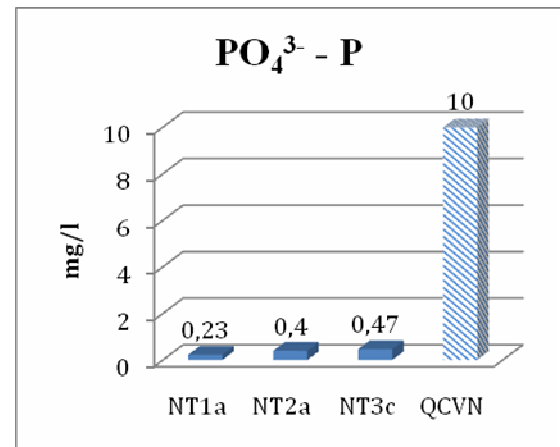


Figure52: Content of $\text{PO}_4^{3-} - \text{P}$ in domestic wastewater

The content of all samples NT1a and NT3c is within the regulated limit as per QCVN 14:2008/BTNMT, except NT2a.

Content of $\text{NO}_3^- - \text{N}$ and $\text{PO}_4^{3-} - \text{P}$ at the last-end section of domestic wastewater discharge- pipe was lower than the regulated limit. The reason is that the rich organic substances from kitchen are not led to the treatment tank. Only wastewater from toilets of the construction workers and officers is treated by the sedimentation tank.

- **Total lubricant and Coliforms**

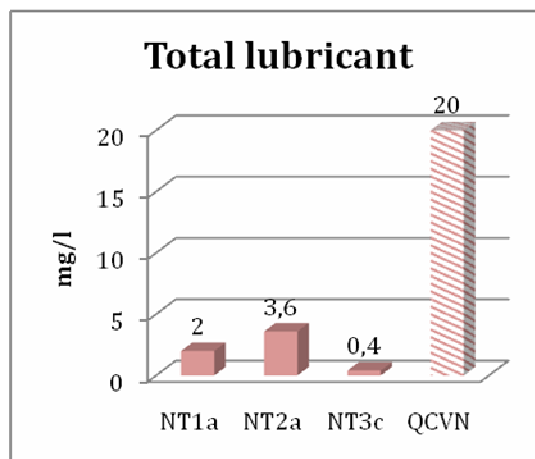


Figure53: Content of total lubricant in domestic wastewater

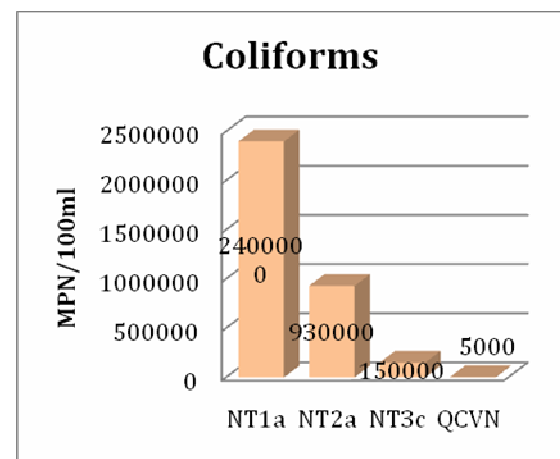


Figure54: Content of Coliforms in domestic wastewater

The content of lubricant in three sampling positions indicated that: before being discharged into the environment, the treated wastewater meets the requirement on content of total lubricant. Content of lubricant in three samples of wastewater is low

because the samples are taken at the last-end section of toilet waste pipe and contain no kitchen wastewater.

Monitoring results showed that content of Coliforms in wastewater samples in three worker camps is 30-480 times higher than the regulated limit as the QCVN 14:2008.

✂ **Conclusions:** Results of domestic wastewater quality analysis showed that analyzed indicators of three samples NT1a, NT2a and NT3c such as pH, TSS, $\text{NH}_4^+ - \text{N}$, $\text{NO}_3^- - \text{N}$, $\text{PO}_4^{3-} - \text{P}$, total lubricant all meet requirement on discharging into the environment. Content of BOD_5 in wastewater samples is within the limit except the BOD_5 content of sample NT2a (it is 1.42 times higher than limit). The content of Coliforms in all 03 samples is much higher than regulated limit. The contractors are supposed to examine the operation of septic treatment tanks.

Sampling positions and analysis results of domestic wastewater quality are given in Appendix 5.

3.4. Preliminary monitoring and assessment of ecological environment and biodiversity

3.4.1. Wild animals

Decline of habitat and source of food due to the conversion of forest land use purpose to serve the project construction and the demand of wild animal's meat of the project workers and officers has caused significant impacts on wild animals in the project area.

Some interviews and survey on restaurants in the project area showed that: "The number of wild animals has been significantly decreased compared to the previous years (before 2009 – when the project was commenced).

Some years ago, the villagers often catch wild animals such as porcupine, deer and weasel then sell them to Mrs Thu – Yen (a restaurant's owner); sometimes they catch boar or monkey... Lately, the villagers just catch wild boar only. There is not porcupine, deer or weasel.

Said Mr. Phan Tan, Vinh village, Ta Poo commune, Nam Giang district

The impacts on the biodiversity in the project area such as illegal animal hunting have been occurred; however, according to the results of the interview with the relevant stakeholders, the project workers have not caused the impacts directly.

According to the results of the interview with representative of Song Thanh Natural Reserve Management Board, in the second quarter of 2013, Song Thanh Division of forest protection has seized illegal hunters with 15kg of meat of wild animals and 05 White-rumped Shamas and 01 porcupine.

3.4.2. Aquatic fauna and flora

The results of the surface water monitoring in the 12th environmental monitoring are shown as follows: Content of dissolved oxygen in the surface water (Content of DO > 5 mg/L) was enough to ensure living demand of aquatic fauna and flora. However, their development still depends on many other factors such as temperature, turbidity...

Content of turbidity in the samples of surface water taken in the upstream and downstream construction site is respectively 1412 NTU and 996 NTU. Such high turbidity reduced the capacity of photosynthesis and respiration of aquatic fauna and flora and made some fish species blind. In addition, illegal gold exploitation increased the turbidity and narrowed some sections of the river and directly impacted on the source of water and source of food of aquatic fauna and flora.

3.4.3. Changes of the vegetation

The construction activities take place during this phase with medium intensity and scale and concentrate mainly in the dam and the power plant area (transportation of rock, sand and cement for concrete placement). Vegetation in the upstream area, the power plant, the rock quarry and the reservoir bed is hardly changed.

- **Ecosystem along Bung River**

The flow in the river is still normal and not be affected by the operation of the flow block and the other activities on the construction site. Inundated road (road 14D) and Khe Vinh bridge that have been being constructed caused land occupation and landslide, affecting an area of forest vegetation. There are some excavators, bulldozers and other gold exploitation equipment in the riverbed in the area that has raised the content of turbidity in the river area. Forest structure in the area is as follows:

- Closed broadleaf lowland evergreen tropical forest has been affected seriously
- Artificial forest
- Shrub layer
- Grass layer

- Ecosystem along river and streams



Figure55: Ecosystem along Bung River

- **Reservoir bed**

It is not necessary to clean up vegetation covering in the reservoir area which retains the water. So, there had no significant change of vegetation compared to the last monitoring. Structure of forest in the project area is as follows:

- Closed broadleaf lowland evergreen tropical forest has been affected seriously
- Artificial forest
- Shrub layer
- Grass layer
- Ecosystem along river and streams



Figure56: Vegetation in the reservoir bed

- **The main construction area (dam, powerhouse, concrete crushing plant)**

Structure of vegetation in the main construction site is as follows:

(i) *Marginally affected closed broadleaf lowland evergreen tropical forest*

This kind of forest distributes in the project area and along Bung River. The forest has 4 layers:

- *Layer A:* Includes some kind of plants that stand 25-30m in height namely Fabaceae, Combretaceae, Dipterocarpaceae, Lythraceae, Meliaceae...
- *Layer B:* Includes some kind of plants that stand 8-15m in height namely Anacardiaceae, Sapindaceae, Burseraceae, Apocynaceae...
- *Layer C:* Shrub layer includes plants that stand 2-8m in height namely Annonaceae, Rubiaceae, Myrsinaceae, Melastomataceae, Rutaceae...
- *Layer D:* Includes Poales, Zingiberaceae, Cyperaceae, Asteraceae,... In addition, there are some plant genres of the family Euphorbiaceae and the family Orchidaceae. Some kinds of liana are genus of the family Cucurbitaceae, Dioscoreaceae, Suzilacaceae), Araceae, Vitaceae)...

(ii) *Severely affected closed broadleaf lowland evergreen tropical forest*

This forest coverage is approximately 40%, however, there are still some big timber trees. This kind of forest is popular in the project area. It has four-layer structure as follows.

- *Layer A:* Includes plants that stand 25-30m in height namely Bombax malabaricum, Sagerotroemia calyculat, Ospermum chelonoides. Bombax malabaricum predominates in the area. Their tree-trunk are mostly 70-80cm or up to 100cm in diameter.
- *Layer B:* Includes some kinds of timber trees that stand 8-15m in height and are genres of the family Sterculiaceae, Meliaceae, Fabaceae, Dipterocarpaceae and Combretaceae...
- *Layer C:* Shrub layer that stands 2-8m in height including genres of the family Annonaceae, Rubiaceae, Apocynaceae, Myrsinaceae, Euphorbiaceae and Melastomataceae...

- *LayerD*: Grass layer stands 2m in height, including Poaceae, Cyperaceae, Zingiberaceae, Musaceae... Pueraria montana, Argyreia capitata.

(iii) *Artificial forest*

Ecosystem of artificial forest includes in the project area includes Acacia sp., Eucalyptus, Tectona grandis, Cassia siamea). Tectona grandis and Cassia siamea have been grown for 3 – 6 years, 8-10m in height. The artificial forest consists of 2 layer timber tree layer and shrub layer. Liana is scattered. Compared with natural forest, artificial forest is simple in structure and poor in type of plants.

(iv) *Shrub layer*

Shrub layer distributes scatteredly. Shrub layer appears because of consequence of excessive exploitation that made forest not to be recovered. This layer mainly includes timber trees that stand less than 8m in height, including Euphorbiaceae, Macaranga denticulata, Mallotus apelta, Trema orientalis; Some kind of Fabaceae such as Cassia minosoides, Baulrinia alba; Some kinds of Bignoniaceae such as Oroxyton indicum; and some kinds of Sterculiaceae. Apart from shrub, there are some genera of Poaceae such as Saccharum spontaneum, Themeda arundinacea; some genera of Asteraceae such as Eupatorium odoratum, Ageratum conyzoides, Crassocephalum crepidioides and Elephantopus... and some genera of liana such as Pueraria montana), Mimosa pudica, Argyreia capitata. In addition, there are Oxynanthera sp., Bambusa procera, Meohouzeana dulloo, etc... in the shrub layer.

(v) *Grass layer*

The layer is scattered in the project area, herb layer ecosystem is formed mainly by setting a forest on fire or barely deforestation to plant industrial trees or cultivate with 0.5 – 2m in height. After a certain period, due to different reasons, crop productivity and economic effective are reduced the area is left fallow. Herbaceous plants in the area includes Eupatorium odoratum, Uraria lagopodioides, Desmodium pulchellum... In addition, there are Mimosa pudica, Pueraria montana, Crassocephalum crepidioides, Imperata cylindrica and other kinds of shrub.

(vi) *Ecosystem along the streams*

Ecosystem along river and streams is characterized by some kinds of plant that can bear inundation during flood reason. The period of inundation is not too long (depending on the duration of floods), however, apart from capacity of bearing inundation, these kinds of plant have developed roots to avoid being swept away by

the flood waters. Among these kinds Homonoia riparia is a plant genus of the family Euphorbiaceae that distributes in most ecosystems along river and streams in the project area. Homonoia riparia has strong root and grow along streams or on alluvial ground. In addition, there are some kinds of plants genus of the family Commelonaceae that grow on rock along streams. The flow in the river is still normal; however, the content of turbidity is quite high because of the impacts of washout by rain water and the construction activities as well as the illegal gold exploitation in the streams of Bung River basin.



Figure57: Vegetation in the dam and the left abutment

- **Rock quarry and rock crushing plant**

Composition and structure of vegetation in the area are hardly changed. The vegetation is closed broadleaf lowland evergreen tropical forest that has been seriously affected. Coverage of the vegetation is approximate 40% including some genres of timber trees that stand 8-15m in height and belong to the family Sterculiaceae, Meliaceae, Fabaceae, Dipterocarpaceae, Combretaceae... Shrub layer includes plants that stand 2-8m in height, including Annonaceae, Rubiaceae, Apocynaceae, Myrsinaceae, Euphorbiaceae, and Melastomataceae... Herbaceous layer is 2m in height including Poaceae, Cyperaceae, Zingiberaceae, Musaceae... Liana includes Pueraria montana, Argyreia capitata.



Figure58: Vegetation in the rock quarry

- **Pa Pang resettlement site**

The residential area has been relatively stable. The logging for house building has been taken place under the supervision and regulation of Nam Giang district Division of Forest Protection. A part of the forest area next to the residential area has been burned to cultivate. The vegetation in this area has structure as follows:

- Marginally affected closed broadleaf lowland evergreen tropical forest;
- Severely affected closed broadleaf lowland evergreen tropical forest;
- Shrub layer;
- Grass layer;



Figure59: Vegetation in Pa Pang resettlement site

3.4.4. Wood exploitation

According to the representative of Nam Giang District Division of Forest Protection, illegal logging has still occurred in the second quarter of 2013. The Division has monitored and pursued the illegal loggers. It is founded that there are many groups of

illegal loggers; they have logged and transported timber by waterway. There are 33,019 m³ of timber seized by the Division. Among 32 cases of illegal logging cases, there is no case caused by the project workers.

3.4.5. Replacement afforestation plan

As of July 2013, the replacement afforestation has been implemented. Vegetation processing has been conducted. The afforestation shall be commenced when the clearance and preparation are completed. It is expected that the afforestation shall be commenced in September and October. At the present, the Division of Agriculture and Rural Development provide enough seedlings for the afforestation including two main types of tree, namely Chukrasia Velutina and Hopea Odorata.

1 - Protective forest plantation: an area of 141.5 ha

Protective forest plantation with an area of 141.5 ha in the contract is divided into 02 packages:

- Package 01: "Plantation and taking care of protective replacement forest – Phase 1 with an area of 59.4 ha in Woodlot 3 – Sector 284 in Ta Poo commune, Nam Giang district".

- Contractor: Song Tien Hydropower Investment Joint Stock Company

- Package 02: "Plantation and taking care of protective replacement forest – Phase 1 with an area of 82.1 ha in Woodlot 2 – Sector 284 in Ta Poo commune and Woodlot 1.3 – Sector 337 in ChaVal commune, Nam Giang district".

- Contractor: Management Board of Ba Na – Nui Chua special-used forest in Da Nang city

Seedling: Seedlings were prepared for the plantation of protective forest in 2013 by the contractors.

2 - Special-used forest and production forest plantation::

The proposed area of 128.5 ha (approved under Decision No. 517/QĐ-SNN&PTNT of Quang Nam Department of Agriculture and Rural Development, dated 19/7/2012) that was handed over to the Management Board of Song Thanh NR has not yet been planted.

The plantation of 182.9 ha of production forest (as per the Decision No. 2334/QĐ-UBND, of Quang Nam PPC, dated 26/7/2010) has not yet been prepared.

3.5. Monitoring of public health and public opinions on environment quality

3.5.1. Public health in the project area

The EMChas conducted consultation with officers of Nam Giang District Health Center on diseases situation and medical examination in the project communes in the 2nd quarter of 2013. Results of the consultations with Nam Giang District Health Center and local people living in the project area showed that: In the 2nd quarter of 2013, there is not any epidemic in the project communes; people mainly catch normal diseases such as flu, cough, stomachache.... In the first six months of 2013, there is no case of dengue fever while there are 14 cases of malaria occurred in ChaVal, Zuoih and TaBhing commune... The cases occurred among the people from outside (the project workers and illegal gold exploiters). The Health Center has provided the people in the area with mosquito-net soaked with mosquito killer in July 2013.

3.5.2. Public opinions on environment quality

The EMC has conducted interviews with the local people in the project area and Nam Giang District Division of Natural Resources and Environment to collect opinions on the quality of the environment in the project area.

Mr Nguyen Xuan Truong – Officer of Nam Giang District Division of Natural Resources and Environment admitted that:

“As of July 2013, there are some grievances on dust that caused by the transportation of soil and rock from the rock quarry to road 14D and waste disposal site No. 1 of households in Cay Cho area – Vinh village – Ta Poo commune. However, the lodging of the grievances has not complied with the regulated orders and procedures so the Division of Natural Resources and Environment did not receive the grievances and guided the households to lodge their grievances in compliance with the regulated orders and procedures.”

Opinions on environmental quality recorded in the interviews with the local people are as follows:

- **Dust and noise**

The EMC has carried out interview with 4 households in Cay Cho area – Vinh village – Ta Poo commune (along National Road 14D from the rock quarry to the construction site) and the interview showed that:

“Recently, the transportation of construction materials and equipment causes much dust but the contractors does not conduct watering regularly; therefore, households

have been affected by the dust. All households have member with bronchitis disease, especially children. In the 2nd quarter of 2013, the households have lodged a grievance on the issue to the local authorities. The PMU and the contractors have worked with the households and decided to provide cash assistance for the households (about 700,000 VND/ person/ year and commit to water the road to the rock quarry to the power plant regularly.”

Households who live in Vinh village and other villages admitted that the noise caused from the project activities does not affect their daily activities due to the far distance; however, the transportation of construction materials and equipment has still caused dust.

- **Water quality**

Quality of water in Bung River: All of the interviewed people confirmed that though the river flow has not been changed, the turbidity in Bung River is the main reason that causes difficulty for their fishing.

Quality of domestic water: The local people in the project area have no comment on the quality of their domestic water.

IV. SCHEDULE FOR THE NEXT MONITORING

4.1. Environmental monitoring schedule

Schedule for the environmental monitoring during the construction process (from the pre-construction phase to the end of construction phase) is presented in the table below:

Table 14: Environmental monitoring schedule

Activities	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
2009												
Field visit for inception report and the first monitoring												
2010												
Pre-construction phase												
1 st monitoring												
Construction phase												
Monitoring of quality of the surface water ^[1]												
2 nd monitoring												
3 rd monitoring												
2011												
Monitoring of quality of the surface water												
4 th monitoring												
5 th monitoring												
2012												
Monitoring of quality of the surface water												
6 th monitoring												
7 th monitoring												
8 th monitoring												
9 th monitoring												
2013												
Monitoring of quality of the surface water												
10 th monitoring												
11 th monitoring												

Activities	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
12 th monitoring												
13 th monitoring												
2014												
Monitoring of quality of the surface water												
14 th monitoring												
15 th monitoring												
16 th monitoring												

4.2. Schedule for the 13th environmental monitoring

Based on the construction progress and monitoring progress, the 13th environmental monitoring shall be carried out in October 2013.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Through the 12th environmental monitoring (from 22 to 28 July 2013) of SB4 HPP, there are some conclusions as follows:

Quality of air: Main issues for the air environment are dust and noise. The air environment in the construction site has no significant sign of toxic emission pollution at the monitoring time. Content of CO, NO_x and SO₂ is within the regulated limit as per the QCVN 05:2009/BTNMT. Content of TSP in the left abutment (KK1a) and the rock crushing plant – rock quarry (KK2) is higher than the regulated limit of the QCVN 05:2009/BTNMT, especially the content of TSP in the left abutment that is 1.77 times higher than the regulated limit. Level of noise in the dam, the crushing plant – rock quarry and the concrete mixing plant is 1.11 – 1.26 times higher than the regulated limit of the QCVN 26:2010/BTNMT, of which level of noise in the crushing plant is highest (88.2 dBA).

Mitigation measures for the impacts of dust that have been applied by the contractors include covering construction materials during the transporting process by canvas sheet, watering construction roads and materials before crushing step, establishing roof for crushing chutes. However, the mitigation measures have not yet been implemented strictly:

The vehicle that transports refuse soil and rock from the rock quarry to the waste disposal site No. 1 has not been covered; watering the transporting roads to reduce dust by contractor Song Da 5 has not been carried out regularly, causing great impact on the households along road 14D from the rock quarry to waste disposal site No. 1, especially those in Cay Cho area. Mitigation measures for the impacts of noise have been maintained by the contractors: (i) Activities that make big noise such as transporting, blasting or rock exploiting are not allowed to be conducted by night; (ii) Construction machines with engine and mechanical vehicles in the construction site are ensured by the contractors that the machines and vehicles are all provided with legal operation permit during the project implementation period.

Quality of surface water in the upstream and downstream the construction site: there is an insignificant difference between the value of temperature, EC, pH, DO and total lubricant in the samples of surface water in the upstream area and that in the downstream area and there is no unusual sign in the samples. Content of turbidity and TSS in 02 samples of surface water is high. Content of TSS in the 02 samples is higher

than the regulated limit as per the QCVN 08:2008, content of TSS in the upstream area is 46.4 times higher than the regulated limit. Content of BOD₅, COD, NH₄⁺-N, NO₃⁻ - N, and PO₄³⁻ - P is all higher than the regulated limit of the QCVN 08:2008/BTNMT (exclusive of the content of BOD₅ in surface water sample in the downstream area). Content of Coliforms in the 02 samples is 1.86 – 22 times higher than the regulated limit.

Mitigation measures for the impacts on the surface water quality: Wastewater from the construction activities in the powerhouse, the concrete mixing plant, the refueling area and the rock crushing – rock quarry has been treated by the preliminary sedimentation tank before discharging into the environment. However, the tanks have not met the capacity of sedimentation so that the wastewater after being treated by the tank has high content of turbidity. The sedimentation tank in the powerhouse area is located in the river bank and the height of the tank does not meet the requirement because when the flood season comes, the river water can overflow this tank. In addition, the pipe conducting construction wastewater from the plant area has been being broken, leaking wastewater into the environment. Domestic wastewater treatment system has been established in the main camp area in the construction site; however, through many monitoring visits; the wastewater after being treated by the system has bad odor and high content of turbidity Coliforms.

Quality of domestic wastewater in the camp areas: Most of analysis indicators of three samples of waste water (NT_{1a}, NT_{2a} and NT_{3c}) have met the requirement on discharging into the environment, except Coliforms. The indicators that are within the regulated limit of the QCVN 14:2008/BTNMT – National technical regulation on domestic wastewater quality include pH, TSS, NO₃⁻ - N, NH₄⁺ - N, PO₄³⁻ - P, total lubricant and BOD₅, exclusive of sample NT_{2a} (content of BOD₅ in the sample is 1.42 times higher than the regulated limit). Content of Coliforms in 03 samples of wastewater is 186 – 480 times higher than the regulated limit of the QCVN 14:2008/BTNMT. This proved that the operation of septic tanks has not been effective and that is also the reason for high content of Coliforms in surface water samples.

Quality of domestic water in the camp areas: Content of pH, odor, NH₄⁺ - N and E. coli of 03 samples of domestic water is within the regulated limit as per the QCVN 02:2009/BYT – National technical regulation on domestic water quality. The value of color in domestic water sample taken in the camp area in the surge tank and in camp No. 45 is higher than the regulated limit of the QCVN 02:2009/BYT. Content

of Coliforms in the sample taken in the camp area of contractor Song Da 5 and camp No. 45 is within the regulated limit as per the QCVN 02:2009 while content of Coliforms in the sample taken in the camp area in the surge tank is 1.86 times higher than the regulated limit. Monitoring results of domestic water in 03 sampling positions showed that domestic water in the camp area of contractor Song Da 5n – rock quarry and camp No. 45 has met the requirement on the quality. However, domestic water in the surge tank should be treated before using.

Quality of underground water: Most of monitoring indicators of underground water samples are lower than the regulated limit as per the QCVN 09:2008/BTNMT and Column II of the QCVN 02:2009/BYT. Content of turbidity in sample NG_{1a}, NG_{3a} and NG_{6a} is little higher than the regulated limit as per the QCVN 02 Column II (1.2 times higher than the regulated limit of the QCVN 02:2009/BYT). Content of COD in sample NG_{1a} is higher than the regulated limit of the QCVN 09:2008/BTNMT. In general, quality of underground water in the project area is ensured to use for daily activities.

Mitigation measures for the impacts of domestic solid waste: domestic waste in the camp areas has been collected and buried in waste disposal site No.1. In some camp areas, domestic waste has been classified to reduce a small volume of the waste (camp area of contractor Song Da 5 and main camp area of contractor SinoHydro). However, due to the poor awareness of the workers, domestic waste has still been thrown in many places in the camp areas (main camp of contractor SinoHydro, camp No. 13 and camp area in the surge tank) and the construction site (the powerhouse area, the intake gate, etc).

Mitigation measures for the impacts of hazardous waste: According to contractor SinoHydro, hazardous waste such as refuse lubricant, oil clouts and used batteries will be collected and handed over to the treatment unit in compliance with the regulations on hazardous waste. However, the consultant observed some non-compliant issues: the area for collecting of used batteries has not met the requirement; the clouts and plastic lubricant containers have not yet been collected and burned in the regulated places; lubricant has still been leaked in the vehicle repairing area;... Measures for storage of lubricant and refuse lubricant have been maintained.

Mitigation measures for the erosion and landslide have not yet been applied for the positions with high risks of erosion and landslide that were mentioned in the previous environmental monitoring (landslide at the bridge km 8 + 909.61 and along PaPang road). Soil excavation caused by the illegal gold exploitation along the river

banks has made the erosion and washout increase, especially in waste disposal site No. 3.

Ecological environment and biodiversity: Illegal exploitation and wild animal hunting have still been happened; however, according to the relevant agencies, there are no violation cases caused by the project workers. The vegetation in the construction areas and reservoir bed has not been changed in comparison with that in the 11th environmental monitoring.

Mitigation measures for explosion: The contractors have conducted the following measures to minimize the risks of explosion: installation of warning signs, prohibition sign in blasting area, fire limit sign in the lubricant storages and other places with high risk of explosion and provision of firefighting equipment;... However, there are still some non-compliant issues such as the storage of gas tanks and oxygen tanks in the vehicle repairing area near the rock quarry and the waste burning near the highly flammable areas (in the left abutment).

Labor safety: There is no occupational accident in the construction site in the 2nd quarter of 2013. Contractor SinoHydro has provided training on first aid for the construction workers in June 2013. The workers have also been provided with protective equipment including hard cap, protective clothing, boots and glasses... However, in the construction areas, using the protective equipment has not yet been implemented meaningfully by the construction workers. To ensure the traffic safety the contractors have arranged workers to collect soil and rock dropping on the transporting routes and maintain degraded routes.

Workers' health care: In the 2nd quarter of 2013, there has no serious health problem among the construction workers in the construction area. The contractors have attached special importance to health care for the workers by the following activities: (i) Provide drugs for sunstroke for the workers in hot weather; (ii) Provide protective equipment such as mask, helmet, protective cap and belts... (iii) Arrange one health staff to be responsible for the healthcare and to give emergency aid to the injured workers.

Recommendations

Bases on the conclusions on quality of the environment and the monitoring of the mitigation measure implementation, the EMC proposes some recommendations as follows:

- (i) High content of dust and high level of noise will affect the workers and officers working in the construction site; therefore, the contractors should provide protective equipment for the workers as well as arrange working time for the workers and officers in the areas with much dust and noise reasonably.
- (ii) Sedimentation tanks need to be cleaned regularly to improve the capacity of sedimentation. Construction wastewater pipe should be repaired promptly to avoid leaking wastewater into the environment. The sedimentation tanks should be located in higher positions to prevent from the overflow by the river water in the rainy season.
- (iii) The content of Coliforms in domestic water in the camp area in the surge tank has not met the requirement on domestic water quality. Domestic water used in the camp area has been taken from the streams. The source of water has been used for cooking after being treated carefully before by the filter system. Using of the water source contaminated by coliform bacteria during a long-term can cause diseases of the digestive system and other diseases. Therefore, the contractors should examine the operation of the domestic water filter system in the surge tank area to ensure that quality of the domestic water meets the regulated criteria of the QCVN 02:2009/BYT.
- (iv) The contractors examine the treatment efficiency of the septic tanks in the camp areas to ensure that domestic wastewater meets the requirement on discharging into the environment.
- (v) The contractors collect domestic waste in non-regulated places and improve the workers' awareness of keeping the camp areas and the construction site clean. The EMC advises the contractors to remind the workers in repairing areas to collect and treat hazardous waste strictly.
- (vi) The contractors and the PMU immediately apply mitigation measures for the areas with high risk of landslide to ensure the safety for the local people travelling in the areas and the project progress in rainy season.

APPENDICES

Appendix1: Monitoring and analysis of the air quality

Sampling positions and results of the air quality analysis

Air samples are taken in 5 positions in the project area, namely:

KK1a: Air quality in the main construction area of the left abutment

Description: Sampling position is in the construction area in the left abutment: Concreting and other construction activities are being carried out at the time of sampling. .

Monitoring time and the weather: Monitoring of air and noise was conducted at 13h30 on 24 July 2013; It was sunny.

Sampling co-ordinates:

Longitude 15⁰ 41' 55.5"

Latitude 107⁰ 38' 21.2"



Figure60: Air measurement and sampling in the dam area

KK2: Air quality in the rock quarry –crushing plant

Description: Rock crushing plant is operating; waste rock and soil generated from blasting activity and macadam are being transported.

Monitoring time and weather: Monitoring of air and noise was carried out at 15h30 on 24 July 2013; It was slightly sunny.

Sampling co-ordinates:

Longitude 15⁰ 40' 11.8"

Latitude 107° 38' 41"



Figure61: Air measurement and sampling in the rock quarry area

KK3b: Air quality in the main tunnel

Description: The sampling position is in the main tunnel. The concreting was being done inside the tunnel.

Monitoring time and weather: Monitoring of the air sample was conducted at 08h00 on 25July 2013; It was cool.

Sampling co-ordinate:

Longitude 15° 43' 32.3"

Latitude 107° 38' 54"



Figure62: Air measurement and sampling in the main tunnel area

KK4: Noise sample in Vinh village –Ta Poo commune

Description: This noise sample is taken near community house of Vinh village – Ta Poo commune. The air characterizes rural traffic in residential areas.

Sampling time and weather: The sample was taken at 17h10 on 25thJuly 2013; It was cool.

Sampling co-ordinates:

Longitude 15⁰ 40' 21.7"

Latitude 107⁰ 38' 57.5"



Figure 63: Noise measurement and sampling in Vinh village

KK5b: Noise sample in the concrete mixing plant

Description: Concrete mixing is being carried out in the noise sampling position. At the time of sampling, concrete transportation is being conducted.

Sampling time and weather: Noise sample KK5b was taken at 14h50 on 25July 2013; It was slightly sunny.

Sampling co-ordinates:


Longitude 15⁰ 54' 35.7"

Latitude 107⁰ 33' 34.5"



Figure64: Noise and vibration measurement in the concrete mixing plant

Results of the air quality analysis are presented as follows:



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Số/No: 414-DVK/TKM

Ngày/date: 06/8/2013

PHIẾU KẾT QUẢ THỬ NGHIỆM

(TEST REPORT)

(Phiếu kết quả này không được lập lại nếu không có sự đồng ý bằng văn bản của PTN)
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1. Tên mẫu (Name of sample): **KHÍ (AIR)**
2. Ký hiệu mẫu (Mark of sample): **KK_{1a}, KK₂, KK_{3b}, KK₄, KK_{5b}**
3. Số lượng mẫu (Quantity): **05**
4. Ngày nhận mẫu (Receiving date): **25/7/2013**
5. Ngày phân tích (Analysing date): **25/7-02/8/2013**
6. Khách hàng (Client): **Dự án thủy điện sông Bung 4-Cty TNHH Tư vấn Phát triển Xã hội Việt Nam
 Song Bung 4 Hydropower Plant Project-Social Consult Limited Co**
7. Địa chỉ (Address): **Huyện Nam Giang - Tỉnh Quảng Nam
 Nam Giang District - Quang Nam Province**
8. Kết quả thử nghiệm (Test results):

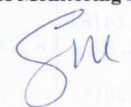
STT (Order)	Tên chỉ tiêu (Characteristics)	ĐV tính (Unit)	PP thử -Thị (Test methods)	Kết quả (Test results)				
				KK _{1a}	KK ₂	KK _{3b}	KK ₄	KK _{5b}
1	Độ ồn L ₅₀	dBA	LD 812	69,1	79,3	54,1	59,8	72,4
	Độ ồn L ₉₀	dBA	LD 812	65,2	76,4	50,8	52,8	69,8
	Độ ồn L _{eq}	dBA	LD 812	79,8	88,2	60,4	62,4	77,5
2	Độ rung	m/s ²	VB - 63	0,0159	0,0177	0,0031	0,0056	0,0128
3	Bụi tổng	mg/m ³	TCVN 5067-1995	0,53	0,32	0,08	-	-
4	CO	mg/m ³	TCVN 5972-1995	1	2	1	-	-
5	NO _x	mg/m ³	TCVN 6137-2009	< 0,01	< 0,01	< 0,01	-	-
6	SO ₂	mg/m ³	TCVN 7726-2007	< 0,007	0,011	< 0,007	-	-

Ghi chú/ Notes:

KK_{1a}: Mẫu lấy tại khu vực xây dựng chính (bờ trái vai đập).
 Sample taken at the main construction area (left abutment).
 KK₂: Mẫu lấy tại khu vực mỏ đá - Trạm nghiền.
 Sample taken at the quarry - rock crushing plant.
 KK_{3b}: Mẫu lấy tại đường hầm chính.
 Sample taken at the main tunnel.
 KK₄: Mẫu lấy tại khu vực nhà Rông, thôn Vinh, xã Tà Pơ.
 Sample taken at Communal house in Vinh village, Ta Poo commune
 KK_{5b}: Mẫu lấy tại khu vực trạm trộn bê tông, gần cống dẫn dòng.
 Sample taken at the concrete mixing plant - near the water way


- Thông tin chi tiết về tình trạng mẫu thể hiện trong Biên bản lấy mẫu kèm theo.
- Details of the sample are shown in the attached Minutes of Sampling.

TRẠM TRƯỞNG
TRẠM QUAN TRẮC VÀ PHÂN TÍCH
 Head of Monitoring Station.



Trần Đình Sơn

GIÁM ĐỐC
 V. Director



Nguyễn Văn Anh

Appendix 2: Monitoring and analysis of surface water quality

Sampling positions and results of surface water quality analysis

Samples of the surface water are taken in two positions - upstream and downstream construction site as follows:

NM1a: Surface water in the upstream construction site

Description: This sample of surface water is taken in the upstream construction site, about 50m from Khe Vinh forward downstream construction site. Water in the area is quite turbid and yellow. The water level is normal and the flow is strong.

Sampling time: at 08h30 on 24th July 2013

The weather: it was sunny

Sampling co-ordinates:

Longitude 15⁰ 41' 45.7"

Latitude 107⁰ 38' 24.3"



Figure 65: Surface water measurement and sampling at the upstream construction site

NM2: Quality of surface water in the downstream construction site

Description: The sample was taken in downstream construction site. Water in the area is quite muddy yellow.

Sampling time: 15h00 on 24 July 2013

The weather: It was sunny

Sampling co-ordinates:

Longitude 15⁰ 43' 34.1"

Latitude 107⁰ 39' 10.3"



Figure66: Surface water measurement and sampling in the downstream construction site

Results of surface water quality analysis



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Ngày/date: 06/8/2013

PHIẾU KẾT QUẢ THỬ NGHIỆM (TEST REPORT)

(Phiếu kết quả này không được lập lại nếu không có sự đồng ý bằng văn bản của PTN)
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1. Tên mẫu (Name of sample): **NƯỚC MẶT (SURFACE WATER)**
2. Ký hiệu mẫu (Mark of sample): **NM_{1a}, NM₂**
3. Số lượng mẫu (Quantity): **02**
4. Ngày nhận mẫu (Receiving date): **25/7/2013**
5. Ngày phân tích (Analysing date): **25/7-02/8/2013**
6. Khách hàng (Client): **Dự án thủy điện sông Bung 4-Cty TNHH Tư vấn Phát triển Xã hội Việt Nam
Song Bung 4 Hydropower Plant Project-Social Consult Limited Co.**
7. Địa chỉ (Address): **Huyện Nam Giang - Tỉnh Quảng Nam
Nam Giang District - Quang Nam Province**
8. Kết quả thử nghiệm (Test results):

STT (Order)	Tên chỉ tiêu (Characteristics)	ĐV tính (Unit)	PP thử -Tbj (Test methods)	Kết quả (Test results)	
				NM _{1a}	NM ₂
1	pH	-	TOA WQC 22A	7,1	7,2
2	DO	mg/L	TOA WQC 22A-	7,59	6,9
3	Nhiệt độ (Temperature)	°C	TOA WQC 22A	25,0	26,3
4	EC	mS/m	TOA WQC 22A	13,20	15,46
5	Độ đục (Turbidity)	NTU	TOA WQC 22A	1412	996
6	TSS(*)	mg/L	TCVN 6625 - 2000	1392	850
7	BOD ₅ (*)	mg/L	TCVN 6001-1:2008	7	4
8	COD(*)	mg/L	HACH 8000	53	29
9	Nitơ tổng (Total Nitrogen) (*)	mg/L	HACH 10071	3,2	1,2
10	NO ₃ ⁻ - N(*)	mg/L	TCVN 6180 - 1996	7,0	9,5
11	NH ₄ ⁺ - N(*)	mg/L	HACH 8038	1,00	1,00
12	Phospho tổng (Total Phosphorus) (*)	mg/L	HACH 8190	0,08	0,11
13	PO ₄ ³⁻ - P(*)	mg/L	HACH 8048	0,40	0,30
14	Tổng dầu mỡ (Total lubricant) (*)	mg/L	TCVN 5070 - 1995 APHA 5520 B	NA	NA
15	Coliforms(*)	MPN/100mL	TCVN 6187-2:96	1100.10 ²	93.10 ²

Ghi chú/ Notes:

NM_{1a}: Mẫu nước lấy tại thượng lưu khu vực xây dựng (Cách Khe Vinh 50m về phía hạ lưu).
Surface water sample taken at the upstream of the construction (50m from Khe Vinh toward downstream).

NM₂: Mẫu nước sông lấy tại hạ lưu khu vực xây dựng.

Surface water sample taken at the downstream of the construction.

(*): Các chỉ tiêu được công nhận theo ISO/IEC 17025:2005 (VILAS 222)

Criteria are approved as ISO/IEC 17025:2005 (VILAS 222).

- Thông tin chi tiết về tình trạng mẫu thể hiện trong Biên bản lấy mẫu kèm theo.
- *Details of the sample are shown in the attached Minutes of Sampling.*

P. TRẠM TRƯỞNG
TRẠM QUAN TRẮC VÀ PHÂN TÍCH
Head of Monitoring Station



Trần Đình Sơn

GIÁM ĐỐC
Director



Nguyễn Văn Anh

Appendix2: Monitoring and assessment of domestic water quality

Sampling positions and results of surface water quality analysis

Domestic water samples are taken in three positions in the project area as follows:

SH1b: Domestic water quality in the camp area of surge tank construction team

Description: This sample of domestic water is taken in the camp area in the surge tank.

Sampling time and the weather: 16h05' on 24 July 2013; It was cool.

Sampling co-ordinates:

Longitude 15⁰ 43' 41"

Latitude 107⁰ 38' 93"



Figure 67: Domestic water measurement and sampling in the camp of surge tank construction team

SH2b: Domestic water quality in the camp of Song Da 5

Description: This domestic water sample was taken from the water tap of Song Da 5's camp area.

Sampling time and the weather: 09h15' on 24 July 2013; It was sunny

Sampling co-ordinates:

Longitude 15⁰ 40' 11.8"

Latitude 107⁰ 38' 47.6"



Figure68: Domestic water measurement and sampling in the camp of Song Da 5

SH3b: Domestic water quality in the camp No.45

Description: This domestic water sample was taken from the water tap in the kitchen of the camp No. 45

Sampling time and the weather: 16h25' on 24July 2013;It was slightly sunny

Sampling co-ordinates:

Longitude 15⁰ 43' 13"

Latitude 107⁰ 38' 40"

Results of domestic water analysis



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Số/No: 414-DVN-7/TKM

Ngày/date: 06/8/2013

PHIẾU KẾT QUẢ THỬ NGHIỆM (TEST REPORT)

(Phiếu kết quả này không được lập lại nếu không có sự đồng ý bằng văn bản của PTN)
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- Tên mẫu (Name of sample): **NƯỚC SINH HOẠT (DOMESTIC WATER)**
- Ký hiệu mẫu (Mark of sample): **SH_{1b}, SH_{2c}, SH_{3c}**
- Số lượng mẫu (Quantity): **03**
- Ngày nhận mẫu (Receiving date): **25/7/2013**
- Ngày phân tích (Analysing date): **25/7-02/8/2013**
- Khách hàng (Client): **Dự án thủy điện sông Bung 4-Cty TNHH Tư vấn Phát triển Xã hội Việt Nam
Song Bung 4 Hydropower Plant Project-Social Consult Limited Co**
- Địa chỉ (Address): **Huyện Nam Giang - Tỉnh Quảng Nam/
Nam Giang District - Quang Nam Province**
- Kết quả thử nghiệm (Test results):

STT (Order)	Tên chỉ tiêu (Characteristics)	ĐV tính (Unit)	PP thử -Tbị (Test methods)	Kết quả (Test results)		
				SH _{1b}	SH _{2c}	SH _{3c}
1	pH	-	TOA WQC 22A	7,15	7,18	7,22
2	Độ đục (Turbidity)	NTU	TOA WQC 22A	4	5	3
3	Màu (Colour)	Pt - Co	HACH 8025	26	8	38
4	Mùi (Odor)	-	Perceptible test	No smell	No smell	No smell
5	NH ₄ ⁺ - N(*)	mg/L	HACH 8038	0,04	0,06	0,05
6	Coliforms(*)	MPN/100mL	TCVN 6187-2:96	280	90	140
7	E.coli(*)	MPN/100mL	TCVN 6187-2:96	4	0	0

Ghi chú/ Notes:

SH_{1b}: Mẫu nước sinh hoạt lấy tại khu vực lán trại đội thi công tháp điều áp.

Domestic water sample taken at the camp area of surge tank construction team

SH_{2c}: Mẫu nước sinh hoạt lấy tại lán trại Sông Đà 5 (khu vực mỏ đá).

Domestic water sample taken at the camp area of Song Da No. 5 contractor (the rock quarry)

SH_{3c}: Mẫu nước sinh hoạt lấy tại lán trại 45 (bếp ăn phía dưới).

Domestic water sample taken at camp No.45 (the kitchen located in low position)

(*): Các chỉ tiêu được công nhận theo ISO/IEC 17025:2005 (VILAS 222)

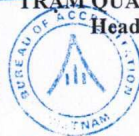
Criteria are approved as ISO/IEC 17025:2005 (VILAS 222).

- Thông tin chi tiết về tình trạng mẫu thể hiện trong Biên bản lấy mẫu kèm theo.

- Details of the sample are shown in the attached Minutes of Sampling.

TRẠM TRƯỞNG
TRẠM QUAN TRẮC VÀ PHÂN TÍCH
Head of Monitoring Station

GIÁM ĐỐC
Director



PTN.QID1-BM05-01/6/2012-7/8

VILAS 222

Trần Đình Sơn

Nguyễn Văn Anh



Appendix3: Monitoring and assessment of underground water quality**Sampling positions and results of underground water quality analysis**

Underground water samples are taken in 3 positions in the project area as follows:

NG1a: The water sample taken from the well of Mr Nguyen Xuan Thieu, Vinh village, Ta Poo commune

Description: The sample was taken at 09h30 on 25 July 2013 in 7m depth from well of Mr Nguyen Xuan Thieu.

Sampling co-ordinates:

Longitude 15⁰ 40' 19"

Latitude 107⁰ 39' 14"



Figure69: Water sampling in the well of Mr Thieu – Vinh Village- Ta Poo Commune

NG2: The water sample taken from the well of Mr Nguyen Van Hoa, Vinh village, Ta Poo commune

Description: This sample was taken in 06m depth at 09h10 on 25 July 2013, about 100m from the access road to the rock quarry.

Sampling co-ordinates:

Longitude 15⁰ 40' 12.8"

Latitude 107⁰ 38' 53.1"



*Hình 70: Water sampling from well in Mr Nguyen Van Hoa's House – Vinh Village
–Ta Poo Commune*

NG3: The water sample taken from the well of Mr Phan Tan, Vinh village, Ta Poo commune

Description: This sample was taken in 05 m depth at 09h40 on 25 July 2013

Sampling co-ordinates:

Longitude	15 ⁰	40'	10"
Latitude	107 ⁰	39'	19"



Figure71: Water sampling in Mr Phan Tan's House

NG4a: The water sample taken from well in the Staff Area of Army People's Health Center, A Bat village, ChaVal commune

Description: This sample was taken in 08 m depth at 11h00 on 24 July 2013. It was sunny.

Sampling co-ordinates:

Longitude 15⁰ 37' 25"

Latitude 107⁰ 30' 33"



Figure72: Water measurement and sampling in Staff Area of Army People's Health Center, ChaVal commune

NG5a: The water sample taken from well in the Patient Area of Army People's Health Center, in A Bat village, ChaVal commune

Description: This sample was taken in 07 m depth at 11h15on 24thJuly 2013. It was sunny.

Sampling co-ordinates:

Longitude 15⁰ 37' 23"

Latitude 107⁰ 30' 34"

NG6a: The water sample taken from the well of Mr Phan Trong Tuyen, A Bat village, ChaVal commune

Description: This sample was taken in 08 m depth at 11h15on 24 July 2013. It was sunny.

Sampling co-ordinates:

Longitude 15⁰ 37' 24"

Latitude 107⁰ 30' 39"



*Figure73: Measurement and sampling in Le Trong Tuyen's house in A Bat village,
ChaVal commune*

Results of underground water quality analysis



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Số/No: 414-DVN-1/TKM

Ngày/date: 06/8/2013

PHIẾU KẾT QUẢ THỬ NGHIỆM (TEST REPORT)

(Phiếu kết quả này không được lập lại nếu không có sự đồng ý bằng văn bản của PTN)
(This test report will not be reproduced without the written approval of Laboratory)

1. Tên mẫu (Name of sample): **NƯỚC NGẦM (GROUNDWATER)**
2. Ký hiệu mẫu (Mark of sample): **NG_{1a}, NG₂, NG_{3a}**
3. Số lượng mẫu (Quantity): **03**
4. Ngày nhận mẫu (Receiving date): **25/7/2013**
5. Ngày phân tích (Analysing date): **25/7-02/8/2013**
6. Khách hàng (Client): **Dự án thủy điện sông Bung 4-Cty TNHH Tư vấn Phát triển Xã hội Việt Nam
Song Bung 4 Hydropower Plant Project-Social Consult Limited Co**
7. Địa chỉ (Address): **Huyện Nam Giang - Tỉnh Quảng Nam
Nam Giang District - Quang Nam Province**
8. Kết quả thử nghiệm (Test results):

STT (Order)	Tên chỉ tiêu (Characteristics)	ĐV tính (Unit)	PP thử -Thị (Test methods)	Kết quả (Test results)		
				NG _{1a}	NG ₂	NG _{3a}
1	pH	-	TOA WQC 22A	6,84	6,95	7,05
2	Độ đục (Turbidity)	NTU	TOA WQC 22A	6	5	6
3	Cl ⁻	mg/L	TCVN 6194 - 1996	41	18	21
4	Độ cứng (Hardness) (as CaCO ₃)(*)	mg/L	TCVN 6224 - 1996	128	100	85
5	TDS	mg/L	HACH SENSION 5	167,3	102,2	94,1
6	TSS(*)	mg/L	TCVN 6625 - 2000	27	4	< 2
7	COD(*)	mg/L	HACH 8000	14	3	4
8	NH ₄ ⁺ - N(*)	mg/L	HACH 8038	0,3	0,01	0,01
9	NO ₂ ⁻ - N(*)	mg/L	TCVN 6178 - 1996	<0,003	<0,003	<0,003
10	PO ₄ ³⁻ - P(*)	mg/L	HACH 8048	0,25	0,22	0,11
11	Fe(*)	mg/L	HACH 8008	0,58	0,08	0,09
12	SO ₄ ²⁻ (*)	mg/L	SMEWW 4500E-2005	21	4	< 2,2
13	Coliforms(*)	MPN/100mL	TCVN 6187-2:96	9	15	0

Ghi chú/ Notes:




NG_{1a}: Mẫu nước giếng đào hộ ông Nguyễn Xuân Thiệu, thôn Vinh, xã Ta Pơ.
Water from well of Mr. Nguyen Xuan Thieu, Vinh village, Ta Poo Commune.
NG₂: Mẫu nước giếng hộ ông Nguyễn Văn Hòa, thôn Vinh, xã Ta Pơ.
Water from well of Mr. Nguyen Van Hoa, Vinh village, Ta Poo Commune.
NG_{3a}: Mẫu nước hộ ông Phan Tân, thôn Vinh, xã Ta Pơ.
Water from well of Mr. Phan Tan, Vinh village, Ta Poo Commune.



(*): Các chỉ tiêu được công nhận theo ISO/IEC 17025:2005 (VILAS 222)
Criteria are approved as ISO/IEC 17025:2005 (VILAS 222).

- Thông tin chi tiết về tình trạng mẫu thể hiện trong Biên bản lấy mẫu kèm theo.
- *Details of the sample are shown in the attached Minutes of Sampling.*

P. TRẠM TRƯỞNG
TRẠM QUAN TRẮC VÀ PHÂN TÍCH
Head of Monitoring Station.

P. GIÁM ĐỐC
V. Director

  
VILAS 222
Trần Đình Sơn

 
Nguyễn Văn Anh

STT	Chỉ tiêu	Đơn vị	Giá trị	Đơn vị	Giá trị	Đơn vị	Giá trị	Đơn vị	Giá trị
1	Độ đục (NTU)	mg/L	1.2	mg/L	1.2	mg/L	1.2	mg/L	1.2
2	Độ cứng (CaCO ₃)	mg/L	120	mg/L	120	mg/L	120	mg/L	120
3	TDS	mg/L	120	mg/L	120	mg/L	120	mg/L	120
4	CODCr	mg/L	120	mg/L	120	mg/L	120	mg/L	120
5	BOD ₅	mg/L	120	mg/L	120	mg/L	120	mg/L	120
6	Amo - NH ₃	mg/L	120	mg/L	120	mg/L	120	mg/L	120
7	Amo - NO ₂	mg/L	120	mg/L	120	mg/L	120	mg/L	120
8	Amo - NO ₃	mg/L	120	mg/L	120	mg/L	120	mg/L	120
9	Amo - PO ₄	mg/L	120	mg/L	120	mg/L	120	mg/L	120
10	Amo - Fe	mg/L	120	mg/L	120	mg/L	120	mg/L	120
11	Amo - Cu	mg/L	120	mg/L	120	mg/L	120	mg/L	120
12	Amo - Pb	mg/L	120	mg/L	120	mg/L	120	mg/L	120
13	Amo - Zn	mg/L	120	mg/L	120	mg/L	120	mg/L	120
14	Amo - Cd	mg/L	120	mg/L	120	mg/L	120	mg/L	120
15	Amo - Cr	mg/L	120	mg/L	120	mg/L	120	mg/L	120
16	Amo - Hg	mg/L	120	mg/L	120	mg/L	120	mg/L	120
17	Amo - Mn	mg/L	120	mg/L	120	mg/L	120	mg/L	120
18	Amo - Co	mg/L	120	mg/L	120	mg/L	120	mg/L	120
19	Amo - Ni	mg/L	120	mg/L	120	mg/L	120	mg/L	120
20	Amo - As	mg/L	120	mg/L	120	mg/L	120	mg/L	120
21	Amo - Se	mg/L	120	mg/L	120	mg/L	120	mg/L	120
22	Amo - Mo	mg/L	120	mg/L	120	mg/L	120	mg/L	120
23	Amo - V	mg/L	120	mg/L	120	mg/L	120	mg/L	120
24	Amo - Sb	mg/L	120	mg/L	120	mg/L	120	mg/L	120
25	Amo - Bi	mg/L	120	mg/L	120	mg/L	120	mg/L	120
26	Amo - Sn	mg/L	120	mg/L	120	mg/L	120	mg/L	120
27	Amo - W	mg/L	120	mg/L	120	mg/L	120	mg/L	120
28	Amo - Br	mg/L	120	mg/L	120	mg/L	120	mg/L	120
29	Amo - I	mg/L	120	mg/L	120	mg/L	120	mg/L	120
30	Amo - B	mg/L	120	mg/L	120	mg/L	120	mg/L	120
31	Amo - F	mg/L	120	mg/L	120	mg/L	120	mg/L	120
32	Amo - Cl	mg/L	120	mg/L	120	mg/L	120	mg/L	120
33	Amo - S	mg/L	120	mg/L	120	mg/L	120	mg/L	120
34	Amo - P	mg/L	120	mg/L	120	mg/L	120	mg/L	120
35	Amo - K	mg/L	120	mg/L	120	mg/L	120	mg/L	120
36	Amo - Na	mg/L	120	mg/L	120	mg/L	120	mg/L	120
37	Amo - Li	mg/L	120	mg/L	120	mg/L	120	mg/L	120
38	Amo - Ba	mg/L	120	mg/L	120	mg/L	120	mg/L	120
39	Amo - Sr	mg/L	120	mg/L	120	mg/L	120	mg/L	120
40	Amo - Ca	mg/L	120	mg/L	120	mg/L	120	mg/L	120
41	Amo - Mg	mg/L	120	mg/L	120	mg/L	120	mg/L	120
42	Amo - Al	mg/L	120	mg/L	120	mg/L	120	mg/L	120
43	Amo - Si	mg/L	120	mg/L	120	mg/L	120	mg/L	120
44	Amo - Ti	mg/L	120	mg/L	120	mg/L	120	mg/L	120
45	Amo - Zr	mg/L	120	mg/L	120	mg/L	120	mg/L	120
46	Amo - Hf	mg/L	120	mg/L	120	mg/L	120	mg/L	120
47	Amo - Ta	mg/L	120	mg/L	120	mg/L	120	mg/L	120
48	Amo - Nb	mg/L	120	mg/L	120	mg/L	120	mg/L	120
49	Amo - Mo	mg/L	120	mg/L	120	mg/L	120	mg/L	120
50	Amo - Cr	mg/L	120	mg/L	120	mg/L	120	mg/L	120
51	Amo - Mn	mg/L	120	mg/L	120	mg/L	120	mg/L	120
52	Amo - Fe	mg/L	120	mg/L	120	mg/L	120	mg/L	120
53	Amo - Co	mg/L	120	mg/L	120	mg/L	120	mg/L	120
54	Amo - Ni	mg/L	120	mg/L	120	mg/L	120	mg/L	120
55	Amo - Cu	mg/L	120	mg/L	120	mg/L	120	mg/L	120
56	Amo - Zn	mg/L	120	mg/L	120	mg/L	120	mg/L	120
57	Amo - Pb	mg/L	120	mg/L	120	mg/L	120	mg/L	120
58	Amo - Cd	mg/L	120	mg/L	120	mg/L	120	mg/L	120
59	Amo - Hg	mg/L	120	mg/L	120	mg/L	120	mg/L	120
60	Amo - As	mg/L	120	mg/L	120	mg/L	120	mg/L	120
61	Amo - Se	mg/L	120	mg/L	120	mg/L	120	mg/L	120
62	Amo - Mo	mg/L	120	mg/L	120	mg/L	120	mg/L	120
63	Amo - Cr	mg/L	120	mg/L	120	mg/L	120	mg/L	120
64	Amo - Mn	mg/L	120	mg/L	120	mg/L	120	mg/L	120
65	Amo - Fe	mg/L	120	mg/L	120	mg/L	120	mg/L	120
66	Amo - Co	mg/L	120	mg/L	120	mg/L	120	mg/L	120
67	Amo - Ni	mg/L	120	mg/L	120	mg/L	120	mg/L	120
68	Amo - Cu	mg/L	120	mg/L	120	mg/L	120	mg/L	120
69	Amo - Zn	mg/L	120	mg/L	120	mg/L	120	mg/L	120
70	Amo - Pb	mg/L	120	mg/L	120	mg/L	120	mg/L	120
71	Amo - Cd	mg/L	120	mg/L	120	mg/L	120	mg/L	120
72	Amo - Hg	mg/L	120	mg/L	120	mg/L	120	mg/L	120
73	Amo - As	mg/L	120	mg/L	120	mg/L	120	mg/L	120
74	Amo - Se	mg/L	120	mg/L	120	mg/L	120	mg/L	120
75	Amo - Mo	mg/L	120	mg/L	120	mg/L	120	mg/L	120
76	Amo - Cr	mg/L	120	mg/L	120	mg/L	120	mg/L	120
77	Amo - Mn	mg/L	120	mg/L	120	mg/L	120	mg/L	120
78	Amo - Fe	mg/L	120	mg/L	120	mg/L	120	mg/L	120
79	Amo - Co	mg/L	120	mg/L	120	mg/L	120	mg/L	120
80	Amo - Ni	mg/L	120	mg/L	120	mg/L	120	mg/L	120
81	Amo - Cu	mg/L	120	mg/L	120	mg/L	120	mg/L	120
82	Amo - Zn	mg/L	120	mg/L	120	mg/L	120	mg/L	120
83	Amo - Pb	mg/L	120	mg/L	120	mg/L	120	mg/L	120
84	Amo - Cd	mg/L	120	mg/L	120	mg/L	120	mg/L	120
85	Amo - Hg	mg/L	120	mg/L	120	mg/L	120	mg/L	120
86	Amo - As	mg/L	120	mg/L	120	mg/L	120	mg/L	120
87	Amo - Se	mg/L	120	mg/L	120	mg/L	120	mg/L	120
88	Amo - Mo	mg/L	120	mg/L	120	mg/L	120	mg/L	120
89	Amo - Cr	mg/L	120	mg/L	120	mg/L	120	mg/L	120
90	Amo - Mn	mg/L	120	mg/L	120	mg/L	120	mg/L	120
91	Amo - Fe	mg/L	120	mg/L	120	mg/L	120	mg/L	120
92	Amo - Co	mg/L	120	mg/L	120	mg/L	120	mg/L	120
93	Amo - Ni	mg/L	120	mg/L	120	mg/L	120	mg/L	120
94	Amo - Cu	mg/L	120	mg/L	120	mg/L	120	mg/L	120
95	Amo - Zn	mg/L	120	mg/L	120	mg/L	120	mg/L	120
96	Amo - Pb	mg/L	120	mg/L	120	mg/L	120	mg/L	120
97	Amo - Cd	mg/L	120	mg/L	120	mg/L	120	mg/L	120
98	Amo - Hg	mg/L	120	mg/L	120	mg/L	120	mg/L	120
99	Amo - As	mg/L	120	mg/L	120	mg/L	120	mg/L	120
100	Amo - Se	mg/L	120	mg/L	120	mg/L	120	mg/L	120

PTN.QT01.BM05 * 01/6/2012 * 2/8

(*): Các chỉ tiêu được công nhận theo ISO/IEC 17025:2005 (VILAS 222)
Criteria are approved as ISO/IEC 17025:2005 (VILAS 222).

- Thông tin chi tiết về tình trạng mẫu thể hiện trong Biên bản lấy mẫu kèm theo/
- *Details of the sample are shown in the attached Minutes of Sampling.*

P. TRẠM TRƯỞNG
TRẠM QUAN TRẮC VÀ PHÂN TÍCH
Head of Monitoring Station

GIÁM ĐỐC
V. Director



22 Trần Đình Sơn



Nguyễn Văn Anh

PTN.QT01.BM05 * 01/6/2012 * 4/8



SỞ TÀI NGUYÊN & MÔI TRƯỜNG THÀNH PHỐ ĐÀ NẴNG
TRUNG TÂM KỸ THUẬT MÔI TRƯỜNG

DANANG DEPARTMENT OF NATURAL RESOURCES & ENVIRONMENT
DANANG ENVIRONMENTAL ENGINEERING CENTER

Văn phòng: K408/18 Hoàng Diệu
Tel: 0511.3892820 - 3550969 - 3552247
Fax: 0511.3550977
Website: http://www.deec.vn

Số/No: 414-DVN-3/TKM

Ngày/date: 06/8/2013

PHIẾU KẾT QUẢ THỬ NGHIỆM (TEST REPORT)

(Phiếu kết quả này không được lập lại nếu không có sự đồng ý bằng văn bản của PTN)
(This test report will not be reproduced without the written approval of Laboratory)

1. Tên mẫu (Name of sample): **NƯỚC NGẦM (GROUNDWATER)**
2. Ký hiệu mẫu (Mark of sample): **NG_{4a}, NG_{5a}, NG_{6a}**
3. Số lượng mẫu (Quantity): **03**
4. Ngày nhận mẫu (Receiving date): **25/7/2013**
5. Ngày phân tích (Analysing date): **25/7-02/8/2013**
6. Khách hàng (Client): **Dự án thủy điện sông Bung 4-Cty TNHH Tư vấn Phát triển Xã hội Việt Nam
Song Bung 4 Hydropower Plant Project-Social Consult Limited Co.**
9. Địa chỉ (Address): **Huyện Nam Giang-Tỉnh Quảng Nam
Nam Giang District-Quang Nam Province**
7. Kết quả thử nghiệm (Test results):

STT (Order)	Tên chỉ tiêu (Characteristics)	ĐV tính (Unit)	PP thử -Tbị (Test methods)	Kết quả (Test results)		
				NG _{4a}	NG _{5a}	NG _{6a}
1	pH	-	TOA WQC 22A	6,68	6,63	6,82
2	Độ đục (Turbidity)	NTU	TOA WQC 22A	5	4	6
3	Cl ⁻	mg/L	TCVN 6194 - 1996	54	44	65
4	Độ cứng (Hardness) (as CaCO ₃)(*)	mg/L	TCVN 6224 - 1996	110	75	60
5	TDS	mg/L	HACH SENSION 5	194,7	153,7	103,6
6	TSS(*)	mg/L	TCVN 6625 - 2000	2	3	2
7	COD(*)	mg/L	HACH 8000	2	3	1
8	NH ₄ ⁺ - N(*)	mg/L	HACH 8038	0,03	0,01	0,01
9	NO ₂ ⁻ - N(*)	mg/L	TCVN 6178 - 1996	0,004	<0,003	<0,003
10	PO ₄ ³⁻ - P(*)	mg/L	HACH 8048	0,23	0,12	0,23
11	Fe(*)	mg/L	HACH 8008	0,11	0,18	0,04
12	SO ₄ ²⁻ (*)	mg/L	SMEWW 4500E-2005	43	20	2
13	Coliforms(*)	MPN/100mL	TCVN 6187-2:96	8	7	21

Ghi chú/ Notes:

NG_{4a}: Mẫu nước lấy tại khu cán bộ, bệnh xã Quân dân y (Đoàn kinh tế Quốc phòng 207).
Water from well in Staff Area of Army Health Center (National Economic Defense Division 207).
NG_{5a}: Mẫu nước lấy tại khu bệnh nhân, bệnh xã Quân dân y (Đoàn kinh tế Quốc phòng 207).
Water from well in Patient Area of Army Health Center (National Economic Defense Division 207).
NG_{6a}: Mẫu nước lấy tại hộ ông Lê Trọng Tuyển, thôn A Bát, Cha val.
Water from well of Mr. Le Trong Tuyen, A Bat village, Chal Val Commune



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(*): Các chỉ tiêu được công nhận theo ISO/IEC 17025:2005 (VILAS 222)
Criteria are approved as ISO/IEC 17025:2005 (VILAS 222).

- Thông tin chi tiết về tình trạng mẫu thể hiện trong Biên bản lấy mẫu kèm theo.
- *Details of the sample are shown in the attached Minutes of Sampling.*

P. TRẠM TRƯỞNG
TRẠM QUAN TRẮC VÀ PHÂN TÍCH
Head of Monitoring Station.

P. GIÁM ĐỐC
V. Director

 
Trần Đình Sơn

 
Nguyễn Văn Anh

STT	Chỉ tiêu	Đơn vị	Giá trị	Đơn vị	Giá trị	Đơn vị	Giá trị	Đơn vị	Giá trị
1	Độ đục (NTU)	NTU	1.2	Độ đục (NTU)	NTU	1.2	Độ đục (NTU)	NTU	1.2
2	Độ cứng (CaCO ₃)	mg/L	150	Độ cứng (CaCO ₃)	mg/L	150	Độ cứng (CaCO ₃)	mg/L	150
3	TDS	mg/L	150	TDS	mg/L	150	TDS	mg/L	150
4	CODMn	mg/L	1.2	CODMn	mg/L	1.2	CODMn	mg/L	1.2
5	Bi-PO ₄ -P	mg/L	0.01	Bi-PO ₄ -P	mg/L	0.01	Bi-PO ₄ -P	mg/L	0.01
6	Bi-PO ₄ -N	mg/L	0.01	Bi-PO ₄ -N	mg/L	0.01	Bi-PO ₄ -N	mg/L	0.01
7	Bi-PO ₄ -P	mg/L	0.01	Bi-PO ₄ -P	mg/L	0.01	Bi-PO ₄ -P	mg/L	0.01
8	Bi-PO ₄ -N	mg/L	0.01	Bi-PO ₄ -N	mg/L	0.01	Bi-PO ₄ -N	mg/L	0.01
9	Bi-PO ₄ -P	mg/L	0.01	Bi-PO ₄ -P	mg/L	0.01	Bi-PO ₄ -P	mg/L	0.01
10	Bi-PO ₄ -N	mg/L	0.01	Bi-PO ₄ -N	mg/L	0.01	Bi-PO ₄ -N	mg/L	0.01
11	Bi-PO ₄ -P	mg/L	0.01	Bi-PO ₄ -P	mg/L	0.01	Bi-PO ₄ -P	mg/L	0.01
12	Bi-PO ₄ -N	mg/L	0.01	Bi-PO ₄ -N	mg/L	0.01	Bi-PO ₄ -N	mg/L	0.01
13	Bi-PO ₄ -P	mg/L	0.01	Bi-PO ₄ -P	mg/L	0.01	Bi-PO ₄ -P	mg/L	0.01
14	Bi-PO ₄ -N	mg/L	0.01	Bi-PO ₄ -N	mg/L	0.01	Bi-PO ₄ -N	mg/L	0.01

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Appendix4: Monitoring and analysis of domestic wastewater quality

Domestic wastewater is taken in 3 positions in the project areas, as follows:

NT1a: Domestic wastewater quality in the camps of contractor SinoHydro in the high site

Description: The sample was taken from wastewater ditch before being discharged into the environment at 16h45 on 24 July 2013. It had slightly bad odor and turbidity.

The weather: It was cool.

Sampling co-ordinates:

Longitude	15°	40'	45.0"
Latitude	107°	39'	12.7"



Figure74: Position of domestic wastewater source – the main camp area of the high area

NT2a: Domestic wastewater sample in the camp 13 (Big Bear bridge)

Description: The sample was taken at the last-end section of domestic wastewater - discharging pipe at 15h40 on 24 July 2013. It had a slight turbidity and smell.

The weather: slightly sunny

Sampling co-ordinates:

Longitude	15°	18'	09.6"
Latitude	107°	37'	25.4"

NT3c: Domestic wastewater quality in the camps of Song Da 5 contractor – Rock quarry

Description: The sample was taken at the last-end section of domestic wastewater - discharging pipe of camps of Song Da 5 – rock quarry area at 15h20 on 11th April 2013. It had a slight turbidity and smell.

The weather: Sunny

Sampling co-ordinate:

Longitude 15⁰ 40' 11.8''

Latitude 107⁰ 38' 47.6''



Figure75: Domestic wastewater sampling in the camp of Song Da 5 – Rock quarry

Results of domestic wastewater quality analysis



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DANANG DEPARTMENT OF NATURAL RESOURCES & ENVIRONMENT
DANANG ENVIRONMENTAL ENGINEERING CENTER

Văn phòng: K408/18 Hoàng Diệu
Tel: 0511.3892820 - 3550969 - 3552247
Fax: 0511.3550977
Website: http://www.deec.vn

Số/No: 414-DVN-8/TKM

Ngày/date: 06/8/2013

PHIẾU KẾT QUẢ THỬ NGHIỆM (TEST REPORT)

(Phiếu kết quả này không được lập lại nếu không có sự đồng ý bằng văn bản của PTN)
(This test report will not be reproduced without the written approval of Laboratory)

- Tên mẫu (Name of sample): **NUỚC THẢI (WASTEWATER)**
- Ký hiệu mẫu (Mark of sample): **NT_{1a} NT_{2a} NT_{3c}**
- Số lượng mẫu (Quantity): **03**
- Ngày nhận mẫu (Receiving date): **25/7/2013**
- Ngày phân tích (Analysing date): **25/7-02/8/2013**
- Khách hàng (Client): **Dự án thủy điện sông Bung 4-Cty TNHH Tư vấn Phát triển Xã hội Việt Nam
Song Bung 4 Hydropower Plant Project-Social Consult Limited Co**
- Địa chỉ (Address): **Huyện Nam Giang - Tỉnh Quảng Nam/
Nam Giang District - Quang Nam Province**
- Kết quả thử nghiệm (Test results):

STT (Order)	Tên chỉ tiêu (Characteristics)	ĐV tính (Unit)	PP thử -Tbị (Test methods)	Kết quả (Test results)		
				NT _{1a}	NT _{2a}	NT _{3c}
1	pH	-	TOA WQC 22A	7,23	7,31	7,34
2	TSS(*)	mg/L	TCVN 6625 - 2000	38	43	20
3	BOD ₅ (*)	mg/L	TCVN 6001-1:2008	16	71	14
4	NO ₃ ⁻ - N(*)	mg/L	TCVN 6180 - 1996	5,4	5,6	3,8
5	NH ₄ ⁺ - N(*)	mg/L	HACH 8038	0,45	3,6	0,76
6	PO ₄ ³⁻ - P(*)	mg/L	HACH 8048	0,23	0,40	0,47
7	Tổng dầu mỡ (Total lubricant) (*)	mg/L	TCVN 5070 - 1995 APHA 5520 B	2,0	3,6	0,4
8	Coliforms(*)	MPN/100mL	TCVN 6187-2:96	240.10 ⁴	93.10 ⁴	150.10 ⁴

Ghi chú/ Notes:

- NT_{1a}: Mẫu nước thải khu vực lán trại chính phía trên cao.
Wastewater sample taken at the main camp area in the high position
NT_{2a}: Mẫu nước thải khu vực lán trại 13 (cầu gấu lớn)
Waste water sample taken at the camp No.13 (bridge named Big Bear)
NT_{3c}: Mẫu nước thải lán trại nhà thầu Sông Đà 5 (khu vực mỏ đá).
Wastewater sample taken at the camp area of Song Da No.5 contractor (the quarry area)
(*) : Các chỉ tiêu được công nhận theo ISO/IEC 17025:2005 (VILAS 222).
Criteria are approved as ISO/IEC 17025:2005 (VILAS 222).
- Thông tin chi tiết về tình trạng mẫu thể hiện trong Biên bản lấy mẫu kèm theo.
 - Details of the sample are shown in the attached Minutes of Sampling.

TRẠM TRƯỞNG
TRẠM QUAN TRẮC VÀ PHÂN TÍCH
Head of Monitoring Station.
VILAS 222
PTN:QT01.BM05 * 01/6/2012 * 8/8
Trần Đình Sơn

GIÁM ĐỐC
Director
Nguyễn Văn Anh



Appendix5: Minutes of working with contractor SinoHydro

Song Bung 4 Hydropower Project

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**SONG BUNG 4 HYDROPOWER PROJECT
INDEPENDENT ENVIRONMENTAL MONITORING****Minutes of In-depth interview**Date: 10 August 2013

Information of interviewee:

Name: Chen MingxinAge: 60 Gender: MalePosition: Director of Safety DepartmentAddress: Xã Tà Pao huyện Nam Giang tỉnh Quảng Nam

Subject: Consultation with representative of SINOHYDRO contractor on social and environmental issues of Song Bung 4 Hydropower Project.

INTERVIEW CONTENTS

1. Could you please tell us the prominent environmental issues in the construction site of Song Bung 4 Hydropower project in the period from April 2013 to July 2013?

Collection and treatment of waste oil and oil barrels
in subcontractors' maintenance workshop

2. Could you please tell us how environmental mitigation measures implemented by the contractor in the past 3 months (April 2013 to July 2013)?

a. Implementation of mitigation measures on air environment

1. Arrange three water tanks to spray water on roads
2. Test air quality in tunnel 2-3 times for a month (all satisfied)

Song Bung 4 Hydropower Project

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b. Implementation of mitigation measures on water environment

1. Clean up all sediment ponds regularly (about once for one week)
2. Build a new sediment pond in crushing plant for better sediment.
3. Collect and treat oil and rubbish, especially in rainy weather.

c. Implementation of mitigation measures to reduce erosion and landslide

1. Support the gully in Camp 13 twice to prevent erosion and landslide
2. Monitor the cracks in Camp 13 and left bank.

3. Could you please give us some more information about **waste treatment measures** on SINOHYDRO construction site in the past 3 months (April 2013 to July 2013)?

a. Domestic solid waste and Construction solid waste?

Send solid waste to the rubbish pond in Disposal Area No.1 and have them buried twice for one week.

b. Hazardous solid waste

Collect hazardous solid waste in SinoHydro's warehouse and ask related environmental authority to recycle and treat.

c. Domestic waste water from camp site

1. Discharge domestic wastewater after being settled by sediment pond.

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2. Test waste water once for three months.

d. Waste water from Vehicle maintain and repair area

1. Specific warehouse is prepared for oil collection in each maintain and repair area and is equipped with Sediment pond and drainage ditch to prevent oil pollution.
2. Use ~~sticker~~ cloth to absorb overflowing oil.

e. Construction waste water

Discharge waste water after settled by sediment ponds.

4. Could you please tell us on SINOHYDRO construction site, have any occupational accidents happened in the period from April 2013 to July 2013? If yes, please provide details.

No accident happened.

5. Could you please tell us on SINOHYDRO construction site, have any problems related to workers' health happened in the period from April 2013 to July 2013? If yes, please provide details.

No problem.

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6. Could you please tell us how **health care activities for workers** have been done in the period from April 2013 to July 2013?

1. Provide enough sunstroke medicine for workers in hot days.
2. Provide enough personal protective equipment, such as mask, helmet, safety belt, etc.

7. Could you please provide some statistic information in the table below:

No.	Items	Unit	Quantity
1	Number of Workers	people	1200
2	Number of Camp sites	each	10
3	Trucks	each	37
4	Excavators	each	4
5	Loaders	each	4
6	Pick-ups	each	27
7	Water tankers/Sprinkler	each	3
	Frequency	turn/day	5
8	Hazardous waste collected	-	
	+ Waste hydraulic oil	liters	100
	+ Lubricant clouts	kg	50
	+ Unused battery	each	50

The interviewing ended at hour of the same day. Representatives participating in the meeting unanimously read and agreed upon the contents of minutes and signed hereunder:

Interviewee

(sign and stamp)



Appendix6: Some pictures of consultations and field survey

Interview with representatives of Song Thanh NR Management Board



Interview with representative of Nam Giang District Health Center



Interview with representative of Nam Giang District DARD



Interview with representative of Nam Giang District DONRE



Field survey with participation of the PMU, EMC, Mott Macdonal and representatives of the contractors



Interviews with construction workers in the construction site



Interviews with villagers in the project area

Appendix7: List of consulted persons

No	Name	Ethnic group	Address
1	Do Tuan	Kinh	Head of Division of Forest Protection in Nam Giang district
2	Nguyen Xuan Truong	Kinh	Officer of Division of Natural Resources and Environment of Nam Giang district
3	To Ngol Vui	Cotu	Deputy director - Health centre of Nam Giang district
4	Phan Minh Tien	Kinh	Head of Division of Agriculture and Rural Development of Nam Giang district
5	Nguyen Tri	Kinh	Director of Song Thanh Natural Reserve Management Board
6	Pham Duy Minh	Kinh	Staff of Song Thanh Natural Reserve Management Board
7	Chen Ming Xin	Chinese	Head of Division of Work Safety and Environmental Sanitation - SinoHydro contractor
8	Vien Vien	Chinese	Interpreter of contractor SinoHydro
9	Fu Ling Ge	Chinese	Officer of Division of Work Safety and Environmental Sanitation - SinoHydro contractor
10	Bui Van Thang	Kinh	Head of rock exploitation team - contractor Song Da 5
11	Ho Ngoc Hoa	Kinh	Administrative personnel officer-contractor Song Da 5
12	Le Van Tuan	Kinh	Worker of contractor Song Da 5
13	Pham Vu Lam	Kinh	Worker of contractor Song Da 5
14	Tran Tuan Hai	Kinh	Worker of contractor Song Da 5
15	Lam Van Minh	Kinh	Worker of contractor Song Da 5
16	Nguyen Van Hai	Kinh	Worker in the surge tank construction area
17	Pham Van Son	Kinh	Worker in the surge tank construction area
18	Dinh Thi Hong Yen	Kinh	Vinh village, Ta Poo commune, Nam Giang district
19	Nguyen Van Hoa	Kinh	Vinh village, Ta Poo commune, Nam Giang district
20	Phan Tan	Kinh	Vinh village, Ta Poo commune, Nam Giang district



<i>No</i>	<i>Name</i>	<i>Ethnic group</i>	<i>Address</i>
			district
21	Le Trong Tuyen	Kinh	A Bat village, Cha Val commune
22	Nguyen Thi Tuyet	Kinh	Nurse of Army People's Health Center, Cha Val commune