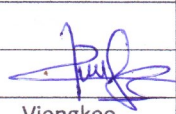
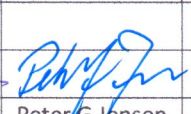
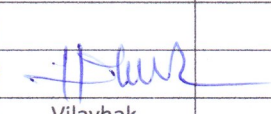


## Nam Ngiep 1 Hydropower Project

# Environmental Management Monthly Monitoring Report

May 2018

					
A	27 June 2018	Viengkeo Phetnavongxay	Peter G Jensen	Vilayhak Somsoulivong	
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**BBREVIATIONS / ACRONYMS**

AIP	Annual Implementation Plan
ADB	Asian Development Bank
BBS	Biodiversity Baseline Survey
BAC	Biodiversity Advisory Committee
BOF	Biodiversity Offset Framework
BOMC	Biodiversity Offset Management Committee
BOMP	Biodiversity Offset Management Plan
CA	Concession Agreement between the NNP1PC and GOL,
CAP	Corrective Action Plan
COD	Commercial Operation Date
CVC	Conventional Vibrated Concrete
CWC	Civil Works Contract
CTA	Common Terms Agreement
DEB	Department of Energy Business, MEM
DEPP	Department of Energy Policy and Planning, MEM
DEQP	Department of Environment and Quality Promotion, MONRE
DESIA	Department of Environmental and Social Impact Assessment, MONRE
DFRM	Department of Forest Resources Management, MONRE
DLA	Department of Land Administration, MONRE
DSRP	Dam Safety Review Panel
EC	Electrolytic Conductivity
EC OCD	EGAT Construction Obligation Commencement Date
EDL	Electricite du Laos
EDL PPA	Power Purchase Agreement between NNP1PC and EDL
EGAT	Electricity Generating Authority of Thailand
EGATi	EGAT International Company Limited
EIA	Environmental Impact Assessment
EMMR	Environmental Management and Monitoring Reports
EMO	Environmental Management Office of ESD within NNP1PC
EMU	Environmental Monitoring Unit
EMWC	Electrical-Mechanical Works Contract
EPF	Environmental Protection Fund
ERIC	Environmental Research Institute Chulalongkhorn University

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ERM	Environmental Resource Management
ESD	Environmental and Social Division of NNP1PC
ESMMP	Environmental and Social Monitoring and Management Plan
FY	Fiscal Year
GOL	Government of Lao PDR
GIS	Geographic Information Systems
HH	Household
HMWC	Hydraulic Metal Works Contract
HR	Human Resources
IEE	Initial Environmental Examination
IMA	Independent Monitoring Agency
INRMP	Integrated Natural Resources Management Plan
ISP	Intergraded Spatial Planning
km	kilometre
kV	kilo-Volt
LEPTS	Lao Electric Power Technical Standard
LHSE	Lao Holding State Enterprise
LTA	Lender's Technical Advisor
M	million
m	metre
MAF	Ministry of Agriculture and Forestry
MEM	Ministry of Energy and Mines, Lao PDR
MOF	Ministry of Finance, Lao PDR
MOM	Minutes of Meeting
MONRE	Ministry of Natural Resource and Environment, Lao PDR
MOU	Memorandum of Understanding
NBCA	National Biodiversity Conservation Area
NCI	Non-Compliance Issue
NCR	Non-Compliance Report
NN2	Nam Ngum 2 Power Company Limited
NNP1PC	Nam Ngiep 1 Power Company Limited
NPF	National Protection Forest
NTFP	Non-Timber Forest Products
NT2	Nam Theun 2 Hydropower Project
OC	Obayashi Corporation
ONC	Observation of Non-Compliance
PAFO	Provincial Department of Agriculture and Forestry

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PAP	Project Affected People
PD	Property Damage
PONRE	Provincial Department of Natural Resource and Environment, MONRE
PvPA	Provincial Protection Area
RCC	Roller Compacted Concrete
SIR	Site Inspection Report
SLBMP	Salvage Logging Biomass Management Plan
SOP	Standard Operating Procedure
SMO	Social Management Office of ESD within NNP1PC
SS-ESMMP	Site Specific Environmental and Social Monitoring and Management Plan
TD	Technical Division of NNP1PC
TOR	Terms of Reference
TSS	Total Suspended Solids
UAE	United Analysis and Engineering Consultant Company Ltd.
UXO	Unexploded Ordinance
WMF	Watershed Management Fund
WMP	Watershed Management Plan
WRPC	Watershed and Reservoir Protection Committee
WRPO	Watershed and Reservoir Protection Office
WWTS	Waste Water Treatment System

## EXECUTIVE SUMMARY

The Environment Management Office (EMO) received and cleared one SS-ESMMP for the Main Dam impounding in May 2018 and three SS-ESMMP received in February and March 2018 related to site rehabilitation. These are pending receipt of additional information. They are expected to be cleared in June 2018.

On 03 May 2018, the Environmental Management Unit (EMU) of Bolikhamxay Province carried out their regular monthly visit to the construction sites, and the EMU of Xaysomboun Province carried out their visit to Zone 2LR and Zone 2UR during 28 to 31 May 2018. The EMU mission reports for March and April 2018 were issued on 09 May 2018, and the May mission reports will be submitted to EMO for comments in June 2018.

The camps' effluent monitoring results for May 2018 indicate that BOD5 and total coliform are in compliance with the relevant effluent standards, except at HMM Main Camp, IHI Camp (for BOD5 on 21 May 2018) and Song Da 5 Camp No.2. The discharge from the sedimentation ponds at the Aggregate Crushing Plant continues to be in compliance with the relevant effluent limit values. The discharge from the sedimentation pond system at the RCC Plant exceeded the effluent limit for TSS on 03 May 2018.

Surface water samples were collected and analysed during the reported month at 10 stations in Nam Ngiep and four stations in the main tributaries including the lower Nam Chian, Nam Phouane, Nam Xao and Houay Soup. The surface water quality data for May 2018 indicates that the levels of dissolved oxygen (DO) may be affected by the impounding of the main reservoir which started on 15 May 2018. NNP1PC observed high turbidity in Nam Siem – a right-bank tributary to Nam Ngiep upstream of the reservoir. Therefore, on 16 May 2018, the EMO undertook a water quality investigation of Nam Ngeip and its tributaries upstream of the main reservoir. It was confirmed that the source of Nam Ngiep turbidity is the water release from the Nam Ao dam construction site.

In May 2018, a total of 204.4 m<sup>3</sup> solid waste was disposed at the NNP1 Project Landfill, an increasing of 35.5 m<sup>3</sup> compared to April 2018. The contractors sold a total of 33.2 kg of recyclable waste to Khounmixay processing factory.

The PKC Contractor started the operation of Houay Soup Landfill on 01 December 2017, and in May 2018, a total of 40.5 m<sup>3</sup> solid waste from Phouhomxay, Thahuea and Hat Gniun villages was disposed at the Houay Soup Landfill.

The approval workshop for the Nam Ngiep 1 Watershed Management Plan (WMP) was held on 29-30 May 2018 with the key conclusions:

- (1) The meeting agreed in principle with the plan;
- (2) The plan will be further improved based on the additional comments received during the meeting as well as for its Lao language proficiency;
- (3) The improved plan will be submitted by Bolikhamxay WRPO and to the Chairman of WRPC for final review and signing;
- (4) The annual implementation plan for the period of 2018-2019 needs to be developed and implemented as soon as possible.

Several studies/surveys as part of the preparation of Biodiversity Offset Management Plans have been undertaken since January 2018 and completed in April 2018. The first draft table of content was prepared and discussed during the ADB-IAP Mission in the third week of May 2018. The mission strongly recommended that the plan should be simple, practical, and implementable for the GOL.

The draft provincial regulations for biodiversity offset management in Nam Chouan – Nam Xang were drafted by BOMC in discussion with NNP1PC. The Bolikhamxay Provincial Regulation Committee was established at the end of May 2018 and the first technical workshop followed by community consultation at district and village level will be started in the first week of June 2018.

NNP1PC is in the process of procuring a contractor for the removal of floating debris from the Nam Ngiep 1 reservoir during and after impounding. As of 15 May 2018, NNP1PC has received four proposals, and the technical evaluation was concluded on 30 May 2018. The contractor is expected to be engaged in June 2018.

The fishery monitoring programme has continued according to plan. The data from the daily fish catch logbook monitoring indicates that the mean daily fish catch in Nam Ngiep River was 1.9 kg/household/day in April 2018. The estimated total fish catch in Nam Ngiep basin for April 2018 is 49,500 kg. Around 35 % of the catch was sold, 54 % was consumed fresh, 8 % processed and approximately 3 % was used for other purposes.



## 1. INTRODUCTION

The Nam Ngiep originates in the mountains of Xieng Khouang Province, flowing through Khoun District into Thathom District of Xaysomboun Province, through Hom District and into Bolikham District of Bolikhamxay Province. The Nam Ngiep meets the Mekong River just upstream from Pakxan in Bolikhamxay Province (Fig. 1-1).

**Figure 1-1: Location Map**

The project will consist of two dams. The main dam which is located 9.0 km upstream of Hat Gnuin Village in Bolikham District, will create a 70-km-long, narrow reservoir that extends up the Ngiep Valley as far as Thathom District. At almost 150 m high, the main dam will be the second largest in Lao PDR. The Power Station at this dam will generate up to 272 MW of electricity for export to Thailand. With a combined capacity of 290 MW, Nam Ngiep 1 will generate around 1,620 GWh of electricity annually. Two transmission lines will be required to transport the electricity generated by the project. From the main power station, a 230-kV line will run for 125 km to the Nabong outside Vientiane Capital. A 115-kV transmission line will be constructed by EDL from the Re-regulation Power Station to Pakxan substation over a distance of 40 km.

This Environmental Monthly Monitoring Report (EMMR) provides a summary of environmental monitoring activities and mitigation actions in January 2017. The EMMR was prepared by the Project's Environmental Management Office (EMO). It has been internally reviewed and cleared by EMO senior technical staff and management prior to submitting the report to the Government of Lao PDR (GoL) related agencies.

The EMMR and other related reports including related construction Site Specific Environmental and Social Monitoring and Management Plans (SS-ESMMPs) are publicly disclosed on the Project website in line with the ADB and GoL Public Disclosure Policies. Hard copies of the final reports will also be available upon requests at the Project's main office in Vientiane Capital and field office in Pakxan, Bolikhamxay Province.



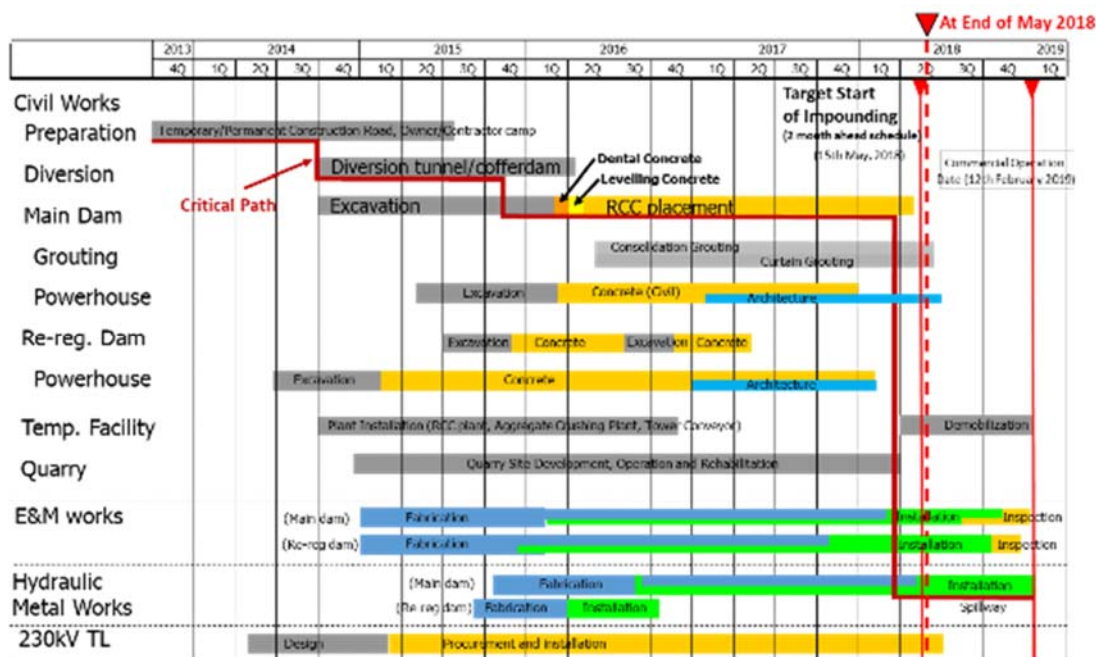
## 2. WORK PROGRESS OF PRINCIPAL CONTRACTORS

Construction Works for the Project are being carried out through four separate main construction contracts under the supervision of the Technical Division of NNP1PC. The four contracts are the Civil Works, the Electrical and Mechanical Works, the Hydraulic Metal or Hydro-mechanical Works and the 230 kV Transmission Line Works. Actual overall

cumulative work progress until the end of May 2018 was 95.5 %<sup>1</sup> (compared to planned progress of 97.2 %), based on achieved Interim Milestone Payments for all Contracts excluding the value of Advance Payments, varied works and other adjustments allowed under each Contract. In terms of the value of actual work done the percentage is understated since work completed, but not paid, is not included.

The overall construction schedule and progress curve (by achieved Milestone Payments) are shown in *Error! Reference source not found.*

**Figure 2-1: Overall Construction Schedule**



## 2.1 Civil Work

The Civil Works Contract was executed between Obayashi Corporation and the Nam Ngiep 1 Power Company on 30 September 2013 and the NTP was issued on 03 October 2014. Excavation works of the main dam, the diversion tunnel and the re-regulation dam

<sup>1</sup> The progress to-date is calculated as (Cumulative Amount of Achieved Interim Milestone Payments) / (Total Agreed Original Price of Construction Contracts) and expressed as a percentage. These totals exclude varied works and other adjustments allowed under each Contract.

<sup>2</sup> The progress to-date is calculated as (Cumulative Value Achieved for Completed Work by Variation Order or Other Adjustment) / (Total Budget Contingency Amount)

were commenced in October 2014 and completed in February 2016, following which the concreting works were commenced.

The cumulative actual work progress of the Civil Works until the end of May 2018 was 96.8 % (compared to planned progress of 95.5 %) calculated in the same manner as described above for the value of achieved Interim Milestone Payments excluding advance payment.

### 2.1.1 Main dam and power house

After starting the main dam excavation works in October 2014 on the left bank, the works were about one month advanced when diversion of the Nam Ngiep River was achieved at the end of October 2015. However, excavated volumes were 20% greater than expected and part of this additional work is necessary to construct a 'shear key' structure due to the weak layers of rock encountered in the dam foundation. Following the efforts on Site, the additional excavation work was completed at the end of February 2016.

*Figure 2-2: Main Dam and Powerhouse from Overhead Looking Upstream*



The consolidation drilling and grouting for the main dam started in May 2016 and is ongoing. The progress is 99 % by achievement of total anticipated drilled length as of the end of May 2018 as a proportion of the total expected drilling

*Table 2-1: Progress of consolidation and curtain drilling for grouting at the end of May 2018*

Item	Description	Total Drilling (m)	Completed (m)	Progress (%)
Consolidation Grouting	Anticipated Quantity	17,769	17,738	99
Curtain Grouting	Original Design Quantity	27,945	58,120	208
	Anticipated Final Quantity	58,400	58,120	99

\*The linear metres 'completed' are drilled and grouted.



Main powerhouse sub-structure excavation works were completed in January 2016 and levelling concrete works were started in coordination with installation of the grounding system and the penstock concrete encasement. Major concrete of the main powerhouse was substantially completed in December 2017 and Progress of the powerhouse concreting works is shown in **Table 2-2** below. Dam Control Centre works is ongoing in May 2018

**Table 2-2: Progress of Main Powerhouse Sub-Structure Concrete Works to as of the end of May 2018.**

Location	Total Anticipated Volume (m <sup>3</sup> )	Completed (m <sup>3</sup> )	Progress (%)
Main Powerhouse	34,800	34,500	99
Penstock Embedment	11,885	11,885	100
Spillway	35,500	27,350	77

### 2.1.2 Re-regulation dam and powerhouse

The re-regulation powerhouse excavation and cofferdam works for river diversion were commenced in early October 2014. The excavation works for the powerhouse on the left bank were fully completed down to El. 146.7 m at the end of February 2015.

Structural concrete works were commenced in March 2015, in coordination with installation of the grounding system. The progress of structural concrete works is shown in **Figure 2-3** below

*Figure 2-3: Progress of Re-regulation Dam Powerhouse Works at the end of May 2018*



### 2.1.3 Temporary work facility

#### 2.1.3.1 DIVERSION TUNNEL INLET AND OUTLET

The diversion tunnel works which is over 600 m in length and 10 m in diameter were commenced in October 2014 by drill and blast techniques and completed in late September 2015. The river diversion took place on 31 October 2015 together with construction of earth-fill cofferdams upstream and downstream.

#### **2.1.3.2 SECONDARY UPSTREAM COFFERDAM**

The concrete placement works in both conventional and roller compacted concrete (CVC and RCC respectively) for the secondary upstream cofferdam were started in November 2015 and completed ahead of construction schedule in the middle of February 2016. The grout curtain works were completed on 02 April 2016.

#### **2.1.3.3 PLANT YARDS**

These comprise the Aggregate Crushing Plant, the CVC Batching Plant and the RCC Batching Plant.

Foundation work and installation of equipment were completed at all the plant yards and the belt conveyor system from the RCC plant to the main dam was completed in early April 2016.

#### **2.1.3.4 QUARRY**

After removal of overburden the excavation of raw materials for aggregate crushing were started in July 2015. The nature and type of the rock being exploited is acceptable though unsuitable soil layers are removed to spoil disposal areas, and good quarry management continues.

#### **2.1.3.5 DISPOSAL AREAS**

The disposal area on the right bank has been available for operation since January 2015, as was the adjacent waste disposal area. The Disposal Area No.9 along Road P1 near the entrance of Road T5 started operation in April 2015. Unsuitable material from the quarry continues to be hauled to Disposal Area No.6 and Disposal Area No.9 is being developed by the E&M Contractor as stated above.

### **2.2 Electrical and Mechanical Works**

The EMWC was executed between Hitachi-Mitsubishi Hydro Corporation and NNP1PC on 13 June 2014 and the NTP was issued on 03 October 2014. The cumulative work progress of the Electrical and Mechanical Works by value at the end of May 2018 was 98.3 % (compared to planned progress of 98.3 %).

**Figure 2-4: Preparation for installation of stay ring of Stay Cone at the re-regulation powerhouse**



*Figure 4.2-1: Lowering for installation of rotor for Unit 1*



*Figure 4.2-2: Lowering for installation of upper shaft and upper bracket for Unit 1*



*Figure 4.2-3: Lowering for installation of collector ring for Unit 1*



*Figure 4.2-4: Inspection of verticality of coupled shaft for Unit 1*



*Figure 4.2-5: Current progress of rotor work for Unit 2*



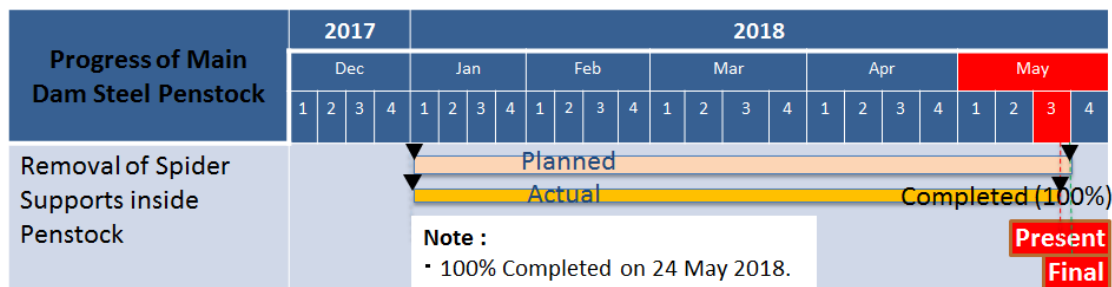
*Figure 4.2-6: Current progress generator pit for Unit 2*

## 2.3 Hydro-Mechanical Works

The HMWC was executed between IHI Infrastructure Systems (IIS) and NNP1PC on 18 April 2014 and the NTP was issued to the Contractor on 03 October 2014. The actual cumulative work progress of the Hydro-Mechanical Works until the end of May 2018 was 66.9 % (compared to planned progress of 77.1 %).

The latest progress of penstock pipe fabrication at IHI field shop and erection at main dam as of the end of November 2017 in **Figure 2-5** below:

*Figure 2-5: Progress of the penstock pipe fabrication at the IHI field shop as at the end of May 2018*

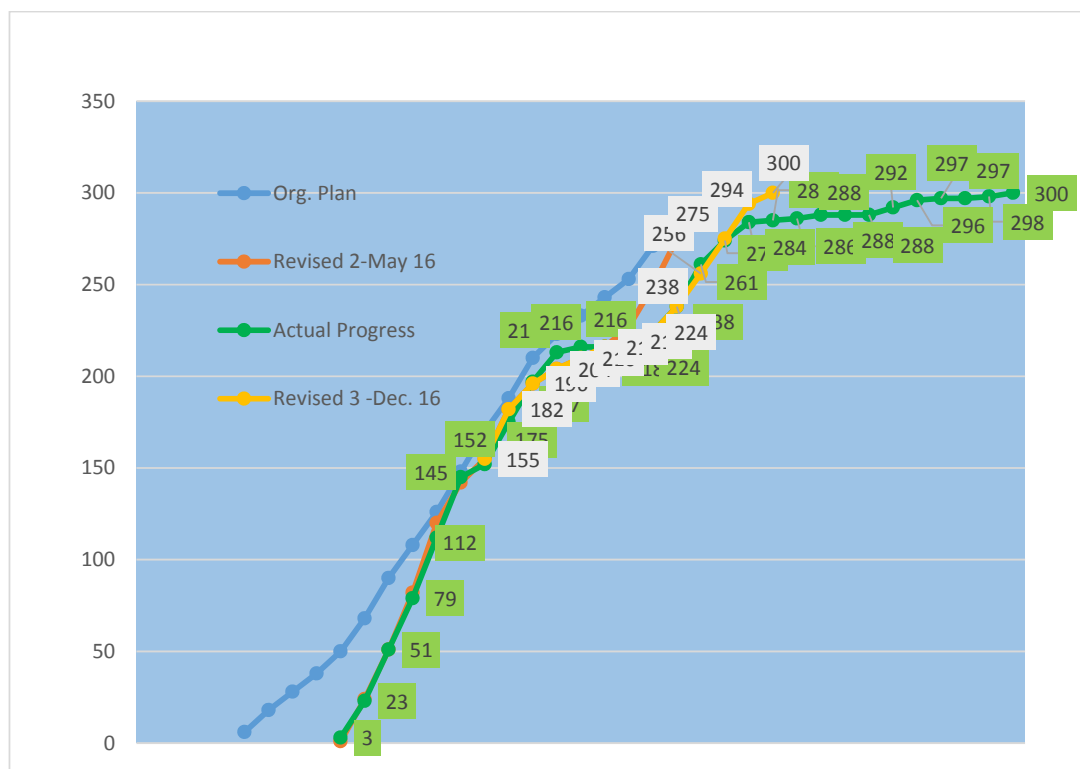


## 2.4 230kV Transmission Line Works

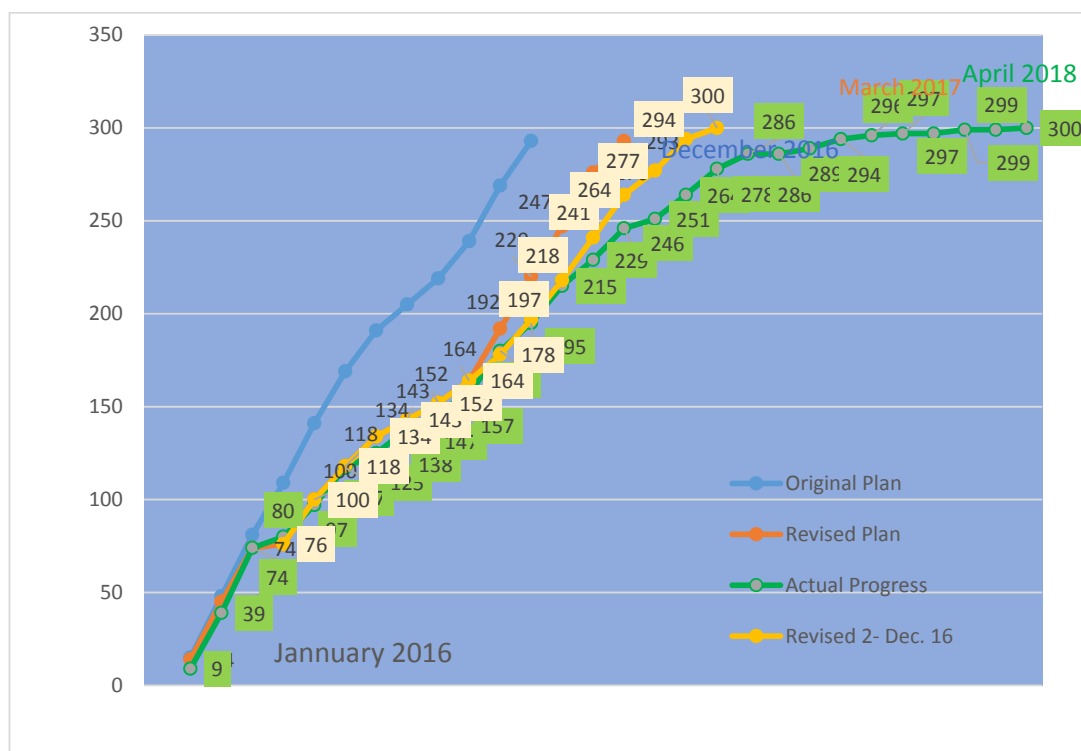
The TLW Contract was executed between Loxley-Sri Consortium and NNP1PC on 11 July 2014 and the NTP was issued to the 230 kV TL Contractor on 03 October 2014. The cumulative work progress of the Transmission Line Works until the end of May 2018 was 99.8 % (compared to planned progress of 100 %).

In respect of the delay to commencement of most works the Contractor is studying its programme to ensure that sufficient resources are committed as the works progress to ensure that completion is achieved in good time. Onset of daily rains has made access to all areas difficult but the Contractor follows its revised acceleration schedule, after the progress for the construction of tower foundations slowed after May, 2016 (See **Figure 2-6** below)

**Figure 2-6: Cumulative Work Progress of Tower Foundation (Original, Revised Planned and Actual)**



**Figure 2-7: Revised Cumulative Work Progress of Tower Erection (Planned and Actual)**



**Figure 2-8: Cumulative Progress of Stringing Works (Planned & Actual)**





### 3. ENVIRONMENTAL MANAGEMENT MONITORING

#### 3.1 Compliance Management

##### 3.1.1 Site Specific Environmental and Social Management and Monitoring Plans

During May 2018, EMO received one SS-ESMMP for review. It is the SS-ESMMP for the Main Dam impounding and it was cleared with comments. Three SS-ESMMP received in February and March 2018 were on hold pending additional information related to site rehabilitation.

**Table 3-1: SS-ESMMP review status in May 2018**

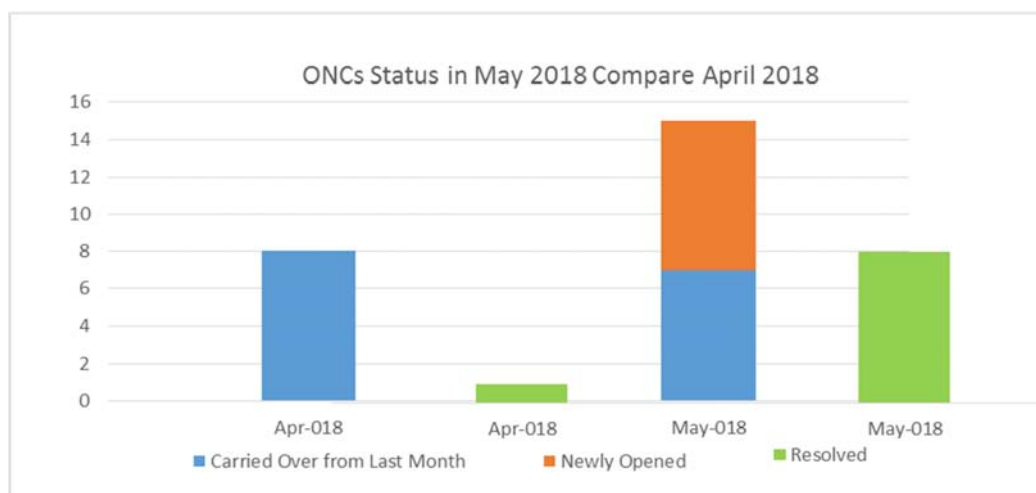
Title	Date Received	Status
<b>SS-ESMMP for Construction of Quarry Site</b>	17 March 2018 (Version A6)	Pending additional information related to site decommissioning and rehabilitation.
<b>SS-ESMMP for Closing of the Dyke at Borrow Pit No.7</b>	03 February 2018 (Reply to Owner's comment)	Pending additional information related to site decommissioning and rehabilitation.
<b>SS-ESMMP–RRPS for Closing of Borrow Pit at the Corner of Road P1 &amp; P1A</b>	03 February 2018 (Reply to Owner's comment)	Pending additional information related to site decommissioning and rehabilitation.
<b>DWP and SS-ESMMP for Preparation and monitoring Works of Main Dam Impounding Monitoring</b>	07 May 2018 (1 <sup>st</sup> submission)	Cleared with comments

##### 3.1.2 Compliance Report

The Observation of Non-Compliance (ONC) and Non-Compliance Report (NCR) are summarized in **Table 3-2**, **Table 3-3** and **Table 3-3** below.

**Table 3-2: Summary of ONC and NCR**

Items	ONC	NCR-1	NCR-2	NCR-3
Carried over from April 2018	07	01	01	0
Newly Opened in May 2018	08	0	0	0
<b>Total in May 2018</b>	<b>15</b>	<b>1</b>	<b>1</b>	<b>0</b>
Resolved in May 2018	08	01	01	0
Carried over into June 2018	07	0	0	0
Unsolved Exceeding Deadlines	<b>03</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Figure 3-1: Summary of ONC and NCR****Table 3-3: Carried-Over ONC and NCR from May 2018 into June 2018**

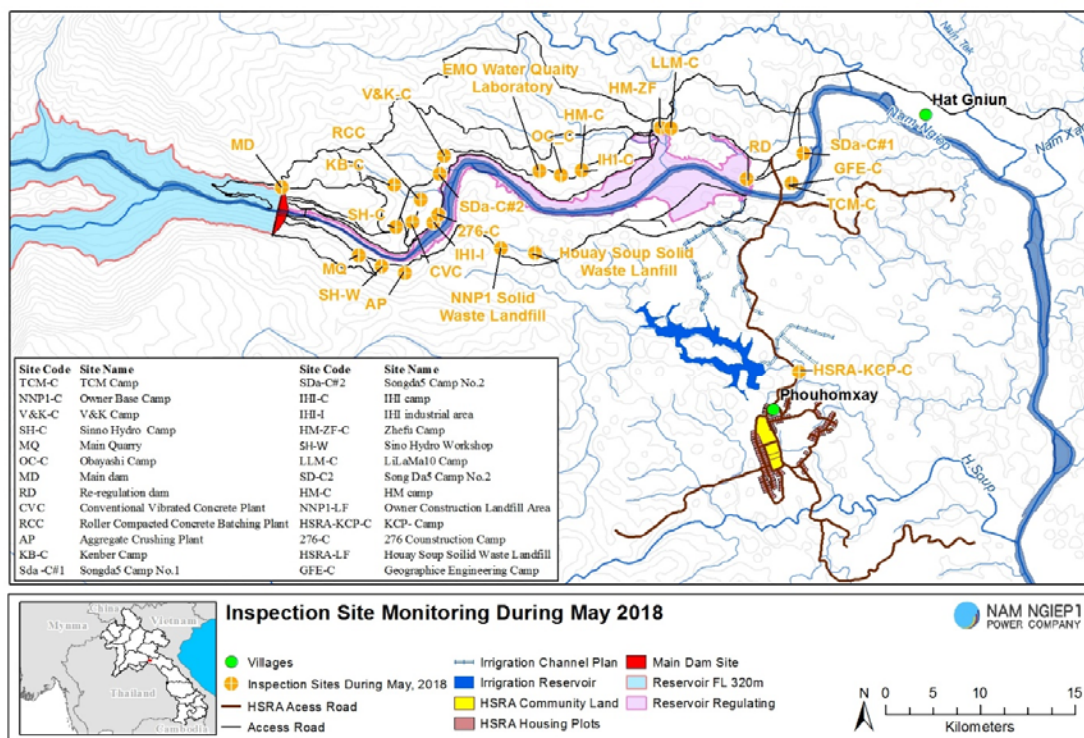
Site ID	Issues	Reporting	Actions
<b>Re-regulation Dam (Borrow Pit Area at Corner of P1 &amp; P1A Road)</b>	The borrow pit slopes had no berm and cut-off drains. Lack of closure plan for the borrow pit. First inspection: 30 August 2016 Latest inspection: 15 February 2018	ONC (Closure Pending)	A Response to the Owner's comment was submitted on 03 March 2018 and the actual work did not properly reflect the Owner's comments. This reply was therefore, on hold for additional information on site closure. It is expected to be reviewed by middle of June 2018 by referring to the site decommissioning plan.
<b>Main Quarry Site</b>	<ul style="list-style-type: none"> <li>- Waste rock had been pushed down the slope towards Nam Ngiep. The operation has damaged riparian vegetation;</li> <li>- The revised DWP &amp; SSES MMP submitted on 16 March 2018 did not fully address the comments of EMO on erosion control and site decommissioning (ONC_OC-0273)</li> </ul> First inspection:	ONC (Closure Pending)	<p>Removal of loose rock materials from the slope is not practically possible and would likely only increase the risk of damage to vegetation and materials being pushed into the reservoir;</p> <p>The revised DWP &amp; SSES MMP submitted on 16 March 2018 is pending additional information on site closure. It is expected to be reviewed by the middle of June 2018.</p>

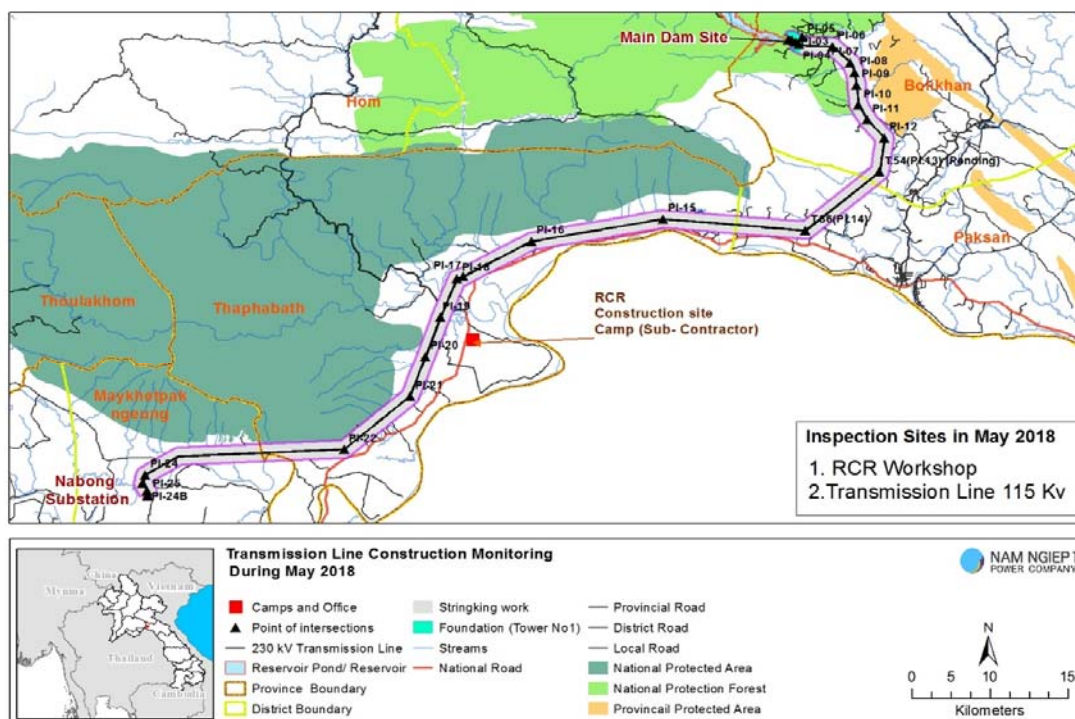
Site ID	Issues	Reporting	Actions
	13 February 2018 Latest inspection: 05 May 2018		
<b>HM Hydro Worker Camp No.2 (LILAMA10 Camp)</b>	A food waste trap/ oil trap at the canteen was damaged. As a result, food waste was flushed and accumulated in the wetland pond. (ONC_HM-0015) First inspection: 15 May 2018 Latest inspection: 29 May 2018	ONC (New)	The following action was fully completed on 23 May 2018 with two weeks verification period prior to closing the ONC: <ul style="list-style-type: none"><li>- Repaired the food waste trap/oil trap;</li><li>- Cleaned up the food waste regularly and disposed at NNP1 Project Landfill.</li></ul>
<b>Spoil Disposal No.6</b>	There was evidence of uncontrolled dumping of construction waste at spoil disposal Area No. 6. A mixture of some general, hazardous and construction waste was observed (ONC_OC-0278) First inspection: 29 May 2018	ONC (New)	During the NNP1PC-OC monthly progress meeting on 01 June 2018, the OC promised to accomplish the following actions by 10 June 2018: <ul style="list-style-type: none"><li>- Segregate the disposed waste</li><li>- Only inert construction waste is allowed to be disposed at the Spoil Disposal Area, and the inert waste shall be crushed and buried at least 0.6 m below the surface;</li><li>- Dispose recyclable waste to recycling companies;</li><li>- Dispose the non-recyclable waste at the NNP1 Project landfill according to the waste management procedures;</li><li>- All steps of the corrective activities will be closely supervised by OC-EMO-TD;</li><li>- OC needs to submit report to NNP1PC following</li></ul>

Site ID	Issues	Reporting	Actions
			completion of the corrective actions.
<b>Aggregate Crushing Plant Yard</b>	<p>Indicative timeframe of site removal and rehabilitation provided by CWC's contractors (<i>Camps and Facilities Decommissioning ref: rev.0, 16th March 2018</i>) was behind the actual work on site, some decommissioning of conveyor belts, crusher has started, but some facilities were not included in the site removal list (ONC_OC-0279)</p> <p>First inspection: 29 May 2018</p>	ONC (New)	<p>The following actions shall be done by 07 June 2018</p> <ul style="list-style-type: none"> <li>- Revise the indicative dates of decommissioning and rehabilitation to be consistent with the actual work on site;</li> <li>- Sino Hydro main camp &amp; office and Sino hydro magazine (at Spoil disposal Area No.6), need to be added onto the list.</li> </ul>
<b>KENBER Camp</b>	<p>Poor operation of workshop and hazardous storage areas:</p> <ul style="list-style-type: none"> <li>- Oily equipment and machines are stored on the bare ground without spill protection. This resulted in oil spill on the ground next to the workshop and stock yard;</li> <li>- Hydraulic oil spill inside the bunded area, but no clean-up;</li> <li>- EMO observed that some bags with contaminated soil / sand had disappeared from the storage compared with the record and previous inspection photos (ONC_OC-0280)</li> </ul> <p>First inspection: 29 May 2018</p>	ONC (New)	<p>The Contractor is required to take the following actions by 07 June 2018:</p> <ul style="list-style-type: none"> <li>- Collect and clean-up hazardous waste,</li> <li>- store hazardous materials at facility with impermeable floor, bund and roof;</li> <li>- Take proper mitigation measures to manage oily equipment/machines;</li> <li>- Move oily rags and / or oil containers into the designated hazardous waste storage.</li> <li>- Investigate the cause of disappearance of some bags with contaminated soil / sand.</li> </ul>

Site ID	Issues	Reporting	Actions
TCM Camp	<p>In March 2018, NNP1PC-EMO provided no objection with comments to a site decommissioning plan submitted by OC, currently it was noted that some parts of camp facilities were decommissioned without submission of the required revised decommissioning plan (ONC_OC-0281)</p> <p>First inspection: 29 May 2018</p>	ONC (New)	The Contractor is required to revise and resubmit the site decommissioning plan for NNP1PC review and approval by 10 June 2018.

Figure 3-2: Site Inspection Locations



**Figure 3-3: 230 kV Transmission Line Construction Monitoring**

### 3.1.3 Inspection by Environment Management Unit

On 03 May 2018, the Environmental Management Unit (EMU) of Bolikhamxay Province carried out a site visit to the site. The EMU mission reports of March and April 2018 were issued for EMO's comments on 09 May 2018 with the following findings:

- Improper waste cover at Houay Soup Landfill causing exposure of solid waste;
- Livestock was observed next to the Sino Hydro Camp;
- Poultry raising at LILAMA 10 Camp;
- Improper storage of oil drums at LILAMA 10 Camp;
- A potential overflowing of waste water from the wet land pond of LILAMA 10 Camp in the event of heavy rain (low bund); and
- Excavated soil materials were disposed at the quarry, but a site closure plan has not been presented and agreed with the Government.

On 28-31 May 2018, the Environmental Management Unit (EMU) of Xaysomboun Province carried out their second quarterly site visit to Zone 2LR and Zone 2UR. A mission report will be issued for EMO's comment in June 2018. The mission acknowledges the following completed works:

- 100% completion of biomass clearance;
- 100% completion of waste clean-up in the four villages of Zone2LR; and
- 100% completion of waste clean-up of seven relocated households at Zone 2UR.

The EMU informed that they will review the social aspects in the next EMU mission.





**Table 3-4: Status of Corrective Actions at Camps and Construction Sites**

Site	Sampling ID	Status	Corrective Actions
<b>Owner's Site Office and Village (OSOV)</b>	EF01	Non-compliances for ammonia nitrogen (NH <sub>3</sub> -N) and total nitrogen.	The effluent monitoring result is being shared with TD and the contractors to improve the operation of the WWTS.
<b>Obayashi Corporation Camp</b>	EF02	Non-compliances for ammonia nitrogen (NH <sub>3</sub> -N) and total nitrogen.	As above.
<b>Sino Hydro Camp</b>	EF06	Non-compliances for ammonia nitrogen (NH <sub>3</sub> -N) and total nitrogen.	As above.
<b>Song Da 5 Camp No. 1</b>	EF07	Non-compliances for ammonia nitrogen (NH <sub>3</sub> -N) and total nitrogen.	As above.
<b>Song Da 5 Camp No. 2</b>	EF08	Non-compliance for BOD <sub>5</sub> , ammonia nitrogen, total nitrogen and total coliform.	As above.
<b>Zhefu Camp (Subcontractor of Hitachi-Mitsubishi Hydro)</b>	EF09	Non-compliance for NH <sub>3</sub> -N and total nitrogen.	As above.
<b>V&amp;K Camp</b>	EF10	Full compliance.	
<b>H-MH Main Camp (WWTS)</b>	EF13	Non-compliance for BOD <sub>5</sub> , COD, NH <sub>3</sub> -N and total nitrogen.	
<b>IHI Main Camp</b>	EF14	Non-compliance for BOD <sub>5</sub> , COD, total nitrogen and ammonia-nitrogen.	As above.
<b>Kenber Camp</b>	EF16	Non-compliance for NH <sub>3</sub> -N and total nitrogen.	As above.
<b>Lilama10 Camp</b>	EF17	Non-compliances for total nitrogen.	As above.
<b>Main Dam Construction Area (Waste Water Treatment Plant No.1)</b>	DS11	No discharge during the missions.	
<b>Main Dam Construction Area (Waste Water Treatment Plant No.2)</b>	DS12	Full compliance.	



Site	Sampling ID	Status	Corrective Actions
Main Dam Construction Area (Waste Water Treatment Plant No.3)	DS14	Non-compliance for TSS on 17 May 2018.	As above.
Spoil Disposal Area No.2 (Song Da 5 Workshop)	DS04	Non-compliance for TSS on 03 May 2018.	As above.
CVC Plant	DS03	No discharge during the sampling.	
RCC Plant (discharge point at the weirs)	DS09	Non-compliance for TSS on 03 May 2018.	As above.
Aggregate Crushing Plant	DS02	Full compliance.	

### 3.2.2 Ambient Surface Water Quality Monitoring

The surface water quality monitoring programme comprises 14 monitoring stations. The May 2018 programme is summarized in **Table 3-5** and the location of the monitoring stations are shown in **Table 3-5: Monitoring Frequency for Surface Water Quality Parameters**

Frequency of Monitoring	Parameters (Unit)	Monitoring Sites
Weekly	pH, DO (%), DO (mg/l), Conductivity (µs/cm), TDS (mg/l), Temperature (°C), Turbidity (NTU), TSS (mg/l), BOD5 (mg/l), Faecal coliform (MPN/100 ml) and Total coliform (MPN/100 ml)	<ul style="list-style-type: none"> <li>- NNG09, Nam Ngiep Upstream Main Dam (NNG09);</li> <li>- R6, Re-regulation Reservoir;</li> <li>- R7, Re-regulation Reservoir 0.3 km Upstream the Re-Regulation Dam;</li> <li>- NNG05, Nam Ngiep Downstream the Re-regulation Dam at Ban Hat Gniun.</li> </ul>
Fortnightly	pH, DO (%), DO (mg/l), Conductivity (µs/cm), TDS (mg/l), Temperature (°C), Turbidity (NTU)	All 14 stations.
Monthly	TSS (mg/l), BOD5 (mg/l), COD (mg/l), NH3-N (mg/l), NO3-N (mg/l), total coliform (MPN/100 ml), faecal coliform (MPN/100 ml)	All 14 stations.

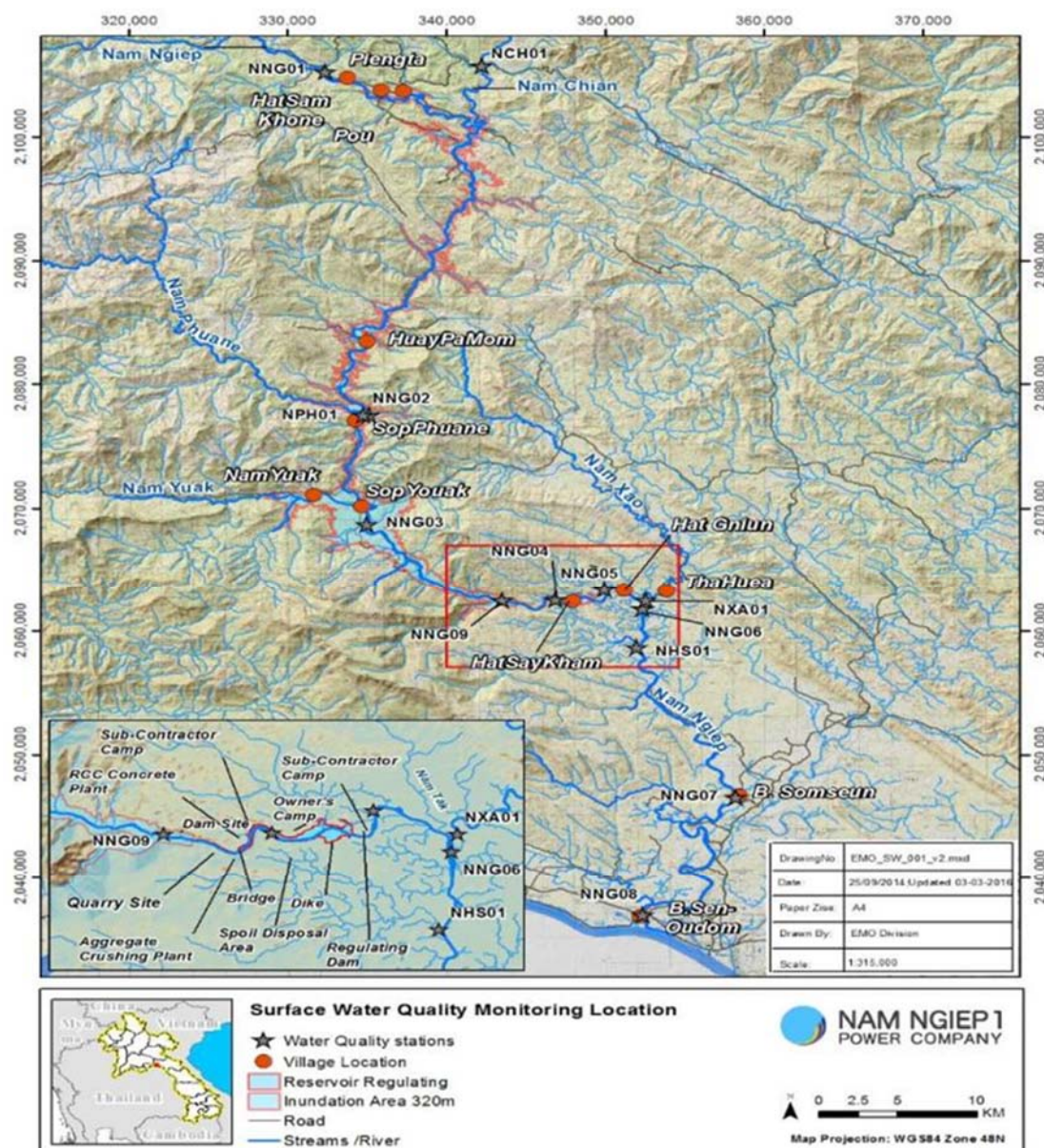
Figure 3-5 below.

In addition, on 16 May 2018, EMO conducted a water quality investigation of Nam Ngiep and its tributaries upstream of main reservoir (Nam Chian and Nam Siem [Nam Siem and Nam Ao]) to identify the source of highly turbid water in Nam Ngiep.

**Table 3-5: Monitoring Frequency for Surface Water Quality Parameters**

Frequency of Monitoring	Parameters (Unit)	Monitoring Sites
Weekly	pH, DO (%), DO (mg/l), Conductivity ( $\mu\text{S}/\text{cm}$ ), TDS (mg/l), Temperature ( $^{\circ}\text{C}$ ), Turbidity (NTU), TSS (mg/l), BOD <sub>5</sub> (mg/l), Faecal coliform (MPN/100 ml) and Total coliform (MPN/100 ml)	<ul style="list-style-type: none"> <li>- NNG09, Nam Ngiep Upstream Main Dam (NNG09);</li> <li>- R6, Re-regulation Reservoir;</li> <li>- R7, Re-regulation Reservoir 0.3 km Upstream the Re-Regulation Dam;</li> <li>- NNG05, Nam Ngiep Downstream the Re-regulation Dam at Ban Hat Gniun.</li> </ul>
Fortnightly	pH, DO (%), DO (mg/l), Conductivity ( $\mu\text{S}/\text{cm}$ ), TDS (mg/l), Temperature ( $^{\circ}\text{C}$ ), Turbidity (NTU)	All 14 stations.
Monthly	TSS (mg/l), BOD <sub>5</sub> (mg/l), COD (mg/l), NH <sub>3</sub> -N (mg/l), NO <sub>3</sub> -N (mg/l), total coliform (MPN/100 ml), faecal coliform (MPN/100 ml)	All 14 stations.

**Figure 3-5: Surface Water and Re-Regulation Reservoir Water Quality Monitoring Stations**



The surface water quality data for May 2018 indicates that the levels of dissolved oxygen (DO) may be affected by the impounding of the main reservoir which started on 15 May 2018. Following the start of impounding, the DO levels in NNG09 immediately upstream the main dam have dropped from above 7 mg/L to between 6.5 and 7 mg/L, and the DO measurements in R6 and R7 (re-regulation reservoir) have shown values from just below 6 mg/L to close to 7 mg/L. However, the DO in NNG05 downstream the re-regulation dam has remained above 7 mg/L.

Somewhat unexplainable and unusual are the elevated levels of ammonia nitrogen slightly exceeding the water quality standard in all stations measured during the first week of May 2018 before start of impounding.

In addition, monitoring frequency for four surface water stations (NNG09, R6, R7 and NNG05) is increased from weekly basis to three times/week starting from 29 May 2018 to closer look at water quality released from main dam and re-regulation dam during and after the impounding of the main reservoir.

**Table 3-6: Results of the Physical and Chemical Parameters of Nam Ngiep Surface Water Quality Monitoring**

	Station Code	NNG01	NNG02	NNG03	NNG09	NNG04 / R6	R7	NNG05	NNG06	NNG07	NNG08
	Date	01-May-18	02-May-18	02-May-18	03-May-18	03-May-18	03-May-18	03-May-18	03-May-18	03-May-18	03-May-18
Parameters (Unit)	Guideline										
pH	5.0 - 9.0	7.72		7.62	7.62	7.32	7.62	7.79	7.65	7.84	7.49
Sat. DO (%)		94.9		100.6	103.6	102.4	104	104.4	102.6	99.3	99.5
DO (mg/l)	>6.0	7.88		8.02	8.15	7.53	7.64	8.03	7.91	7.93	7.8
Conductivity (µs/cm)		78.4		71.2	72.9	64.9	70.6	71.9	72.5	73.9	72.4
TDS (mg/l)		39		35.6	36.4	32	35	36	12.3	36.5	36.2
Temperature (°C)		22.7		25.3	26.5	30.2	30.3	27.9	27.6	26.2	26.8
Turbidity (NTU)		52.4		27	23.3	23.63	16.86	17.8	16.6	17.9	15.7
TSS (mg/l)		208.57		67.03	54.65	31.35	21.27	34.72	31.82	34.98	26.58
BOD <sub>5</sub> (mg/l)	<1.5	<1		<1	<1	<1	<1	<1	<1	<1	<1
COD (mg/l)	<5	11.3		9	12.6	15.5	6.9	7.3	6.5	16.3	12
NH <sub>3</sub> -N (mg/l)	<0.2	0.27		0.37	0.37	0.25	0.26	0.37	0.35	0.27	0.25
NO <sub>3</sub> -N (mg/l)	<5	0.07		0.13	0.08	0.09	0.08	0.1	0.08	0.1	0.08
Faecal coliform (MPN/100ml)	<1,000	540		920	1,600	350	170	920	1,600	1,600	1,600
Total Coliform (MPN/100ml)	<5,000	1,100		1,600	1,600	920	350	1,600	1,600	1,600	1,600

**Table 3-7: Results of Nam Ngiep Surface Water Quality Monitoring**

	Station Code	NNG09	R6	R7	NNG05
	Date	10-May-18	10-May-18	10-May-18	10-May-18
Parameters (Unit)	Guideline				
pH	5.0 - 9.0	7.91	7.96	7.77	7.69
Sat. DO (%)		101.3	106.6	122.7	100.6
DO (mg/l)	>6.0	7.78	7.48	8.7	7.38
Conductivity (µs/cm)		66.4	71.7	72.4	70.1
TDS (mg/l)		33	35	36	35
Temperature (°C)		27.6	30.9	31.1	30.2
Turbidity (NTU)		1,007	41	21.9	34.8
TSS (mg/l)		448.28	83.78	24.32	51.53
BOD <sub>5</sub> (mg/l)	<1.5	<1.0	<1.0	1.31	<1.0
Faecal coliform (MPN/100ml)	<1,000	1,700	920	540	350

	Station Code	NNG09	R6	R7	NNG05
	Date	10-May-18	10-May-18	10-May-18	10-May-18
Parameters (Unit)	Guideline				
Total Coliform (MPN/100ml)	<5,000	5,400	1,600	920	920

	Station Code	NNG09	NNG04 / R6	R7	NNG05
	Date	24-May-18	24-May-18	24-May-18	24-May-18
Parameters (Unit)	Guideline				
pH	5.0 - 9.0	7.65	7.28	6.86	7.63
Sat. DO (%)		92	80.4	80.2	94.1
DO (mg/l)	>6.0	6.82	5.84	5.87	7.29
Conductivity (µs/cm)		74.6	87.8	80.5	90.7
TDS (mg/l)		37	49	40	45
Temperature (°C)		29.3	30.9	30.4	27.3
Turbidity (NTU)		6.54	12.3	8.6	17.7
TSS (mg/l)		8.51	12.35	8.99	8.99
BOD <sub>5</sub> (mg/l)	<1.5	1.36	<1.0	<1.0	<1.0
Faecal coliform (MPN/100ml)	<1,000	22	26	8	920
Total Coliform (MPN/100ml)	<5,000	1,600	170	49	3,500

	Station Code	NNG09	R6	R7	NNG05
	Date	29-May-18			29-May-18
Parameters (Unit)	Guideline				
pH	5.0 - 9.0	7.26	-	-	7.43
Sat. DO (%)		86.0	-	-	92.1
DO (mg/l)	>6.0	6.52	-	-	7.11
Conductivity (µs/cm)		71.2	-	-	55.5
TDS (mg/l)		35	-	-	27.25
Temperature (°C)		28.1	-	-	27.5
Turbidity (NTU)		3.79	-	-	37.3

	Station Code	NNG09	NNG04 / R6	R7	NNG05
	Date	31-May-18	31-May-18	31-May-18	31-May-18
Parameters (Unit)	Guideline				
pH	5.0 - 9.0	7.96	7.37	7.86	7.88
Sat. DO (%)		87.3	82.3	94.1	98.7
DO (mg/l)	>6.0	6.52	6.18	6.95	7.55
Conductivity (µs/cm)		70.1	73.8	75.2	54.5
TDS (mg/l)		35	36	36	27
Temperature (°C)		28.6	29	29.8	28
Turbidity (NTU)		2.25	11.6	15.1	29.6
TSS (mg/l)		4.3	20.86	24.13	56.6
BOD <sub>5</sub> (mg/l)	<1.5	<1.0	<1.0	<1.0	<1.0
Faecal coliform (MPN/100ml)	<1,000	13	23	13	350
Total Coliform (MPN/100ml)	<5,000	1,600	540	33	5,400

**Table 3-8 Results of Physical and Chemical Parameters of Nam Chian, Nam Phouan, Nam Xao and Nam Houay Soup**

	Station Code	NCH01	NPH01	NXA01	NHS01
	Date	01-May-18	02-May-18	03-May-18	03-May-18
Parameters (Unit)	Guideline				
pH	5.0 - 9.0	7.52	7.57	7.35	7.54
Sat. DO (%)		100.8	100.2	89	82.6
DO (mg/l)	>6.0	8.34	8.21	6.64	6.62
Conductivity (µs/cm)		26.8	68.2	134.9	24.6
TDS (mg/l)		13	34.1	67.4	12.3
Temperature (°C)		22.6	23.8	29.6	28
Turbidity (NTU)		12	16.5	4.43	70.9
TSS (mg/l)		37.07	45	3.55	114.66
BOD <sub>5</sub> (mg/l)	<1.5	<1	<1	<1	1.31
COD (mg/l)	<5	9.6	21.2	11.4	30.4
NH <sub>3</sub> -N (mg/l)	<0.2	0.3	0.48	0.32	0.28
NO <sub>3</sub> -N (mg/l)	<5	0.09	0.17	0.04	0.31
Faecal coliform (MPN/100ml)	<1,000	240	350	540	1,600
Total Coliform (MPN/100ml)	<5,000	450	920	3,500	3,500

**Table 3-9: Physical Parameters Results of Surface Water Quality – Nam Chian, Nam Phouan, Nam Xao and Nam Houay Soup (measured Every Fortnight)**



	Station Code	NCH01	NPH01	NXA01	NHS01
	Date	16-May-18	15-May-18	17-May-18	17-May-18
Parameters (Unit)	Guideline				
pH	5.0 - 9.0	8.32	7.76	7.63	Unable to access the sampling site by boat due a decrease in water level (<20 cm deep) in Nam Ngiep downstream after impounding
Sat. DO (%)		100.4	101.5	79.3	
DO (mg/l)	>6.0	8.47	8.01	5.85	
Conductivity (µs/cm)		33.1	69.8	99.9	
TDS (mg/l)		17	35	49.95	
Temperature (°C)		21.4	25.7	30	
Turbidity (NTU)		9.7	33.1	4.64	

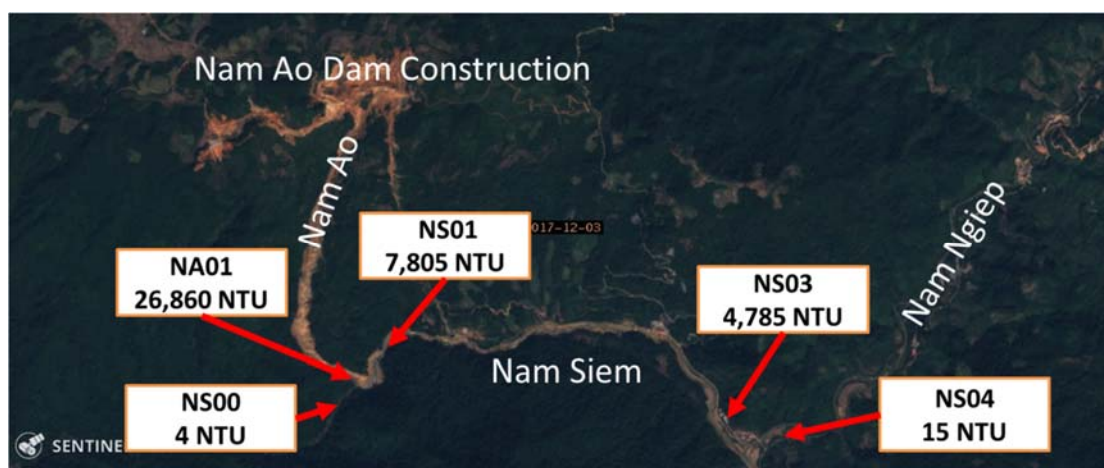
Table 3-10: Water Quality Results Tested During a Water Quality Investigation of Nam Ngeip and its Tributaries

	River Name	Nam Ao	Nam Siem upstream Nam Ao	Nam Siem downstream Nam Ao	Nam Siem	Nam Ngiep Upstream Nam Siem	Nam Ngiep	Nam Chian
	Code	NAO1	NS00	NS01	NS02	NNG00	NNG01	NCH01
	Date	16-May-18	16-May-18	16-May-18	16-May-18	16-May-18	16-May-18	16-May-18
Parameter (Unit)	Standard							
pH	5.0 - 9.0	8.71	7.76	7.7	7.89	7.99	8.12	8.32
Sat.DO (%)		98.9	104.1	100.6	94.7	102.2	97.1	100.4
DO (mg/l)	>6.0	7.4	7.41	7.23	7.03	7.62	7.43	8.47
Conductivity (µS/cm)		10.48	125.7	80.9	65.1	43.3	78.1	33.1
TDS (mg/l)		5	63	40	32	22	39	17
Temperature (°C)		27.1	29.8	29.7	28.2	28	26.8	21.4
Turbidity (NTU)		26,860	4.4	7,805	4,785	15	787	9.7
TSS (mg/l)		44,938.64	13.79	6,315.70	3,141.51	31.00	600.96	50.6
Arsenic (mg/l)	<0.01	0.0116						

	River Name	Nam Ao	Nam Siem upstream Nam Ao	Nam Siem downstream Nam Ao	Nam Siem	Nam Ngiep Upstream Nam Siem	Nam Ngiep	Nam Chian
	Code	NAO1	NS00	NS01	NS02	NNG00	NNG01	NCH01
	Date	16-May-18	16-May-18	16-May-18	16-May-18	16-May-18	16-May-18	16-May-18
Manganese (mg/l)		2.94						
Mercury (mg/l)	<0.002	0.0006						
Zinc (mg/l)	<1.0	0.335						
Aluminium (mg/l)		175						
Cadmium (mg/l)	<0.05	<0.003						
Chromium	<0.05	0.384						
Copper (mg/l)	<0.1	0.244						
Lead (mg/l)	<0.05	0.148						
Nickel (mg/l)	<0.10	0.171						
Iron (mg/l)		209						
Total phosphorus		<0.01						

**Figure 3-6: Results of Turbidity measurements during the water Quality Investigation on 16 May 2018**





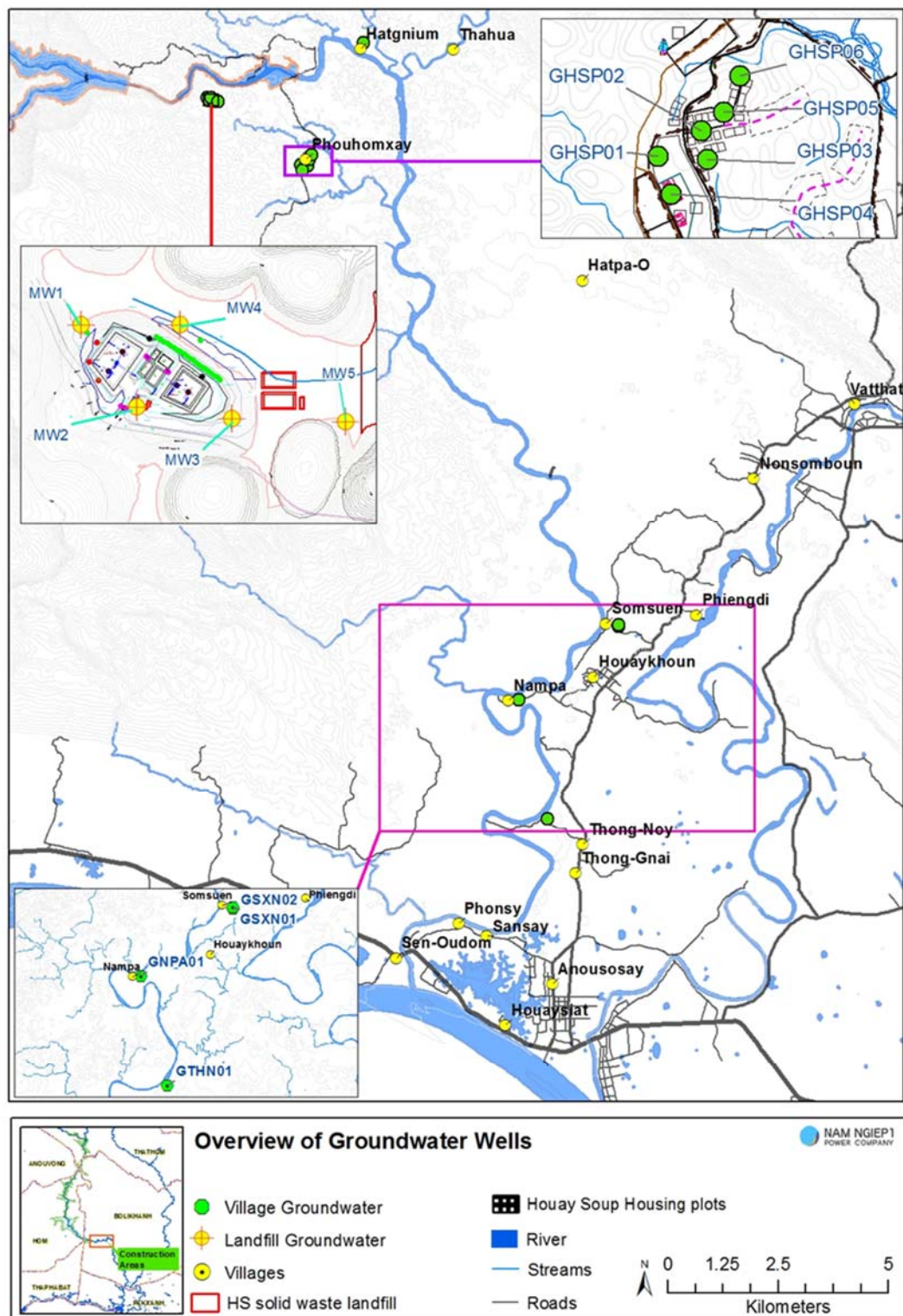
The results of the special water quality investigation to identify the likely sources of increase in turbidity of Nam Ngiep clearly show that the source of the turbidity is the release of water from the Nam Ao Dam construction site

### 3.2.3 Groundwater Quality Monitoring

During May 2018, groundwater quality analyses were carried out for two newly constructed boreholes at Somseun village, one at Nam Pa Village, and one at Thong Noi Village. The community groundwater (six boreholes) at Phouhomxay village have been permanently replaced with gravity fed water supply system.

All results complied with the community groundwater quality standards for water supply purposes, except a borehole (GTHN01) in Thong Noi Village for faecal coliform and Ecoli bacteria. The results of Somseun, NamPa and Thong Noi Villages' groundwater were communicated to villagers and the local health centre as part of NNP1PC public health programme.

*Figure 3-7: Groundwater Quality Monitoring Locations*



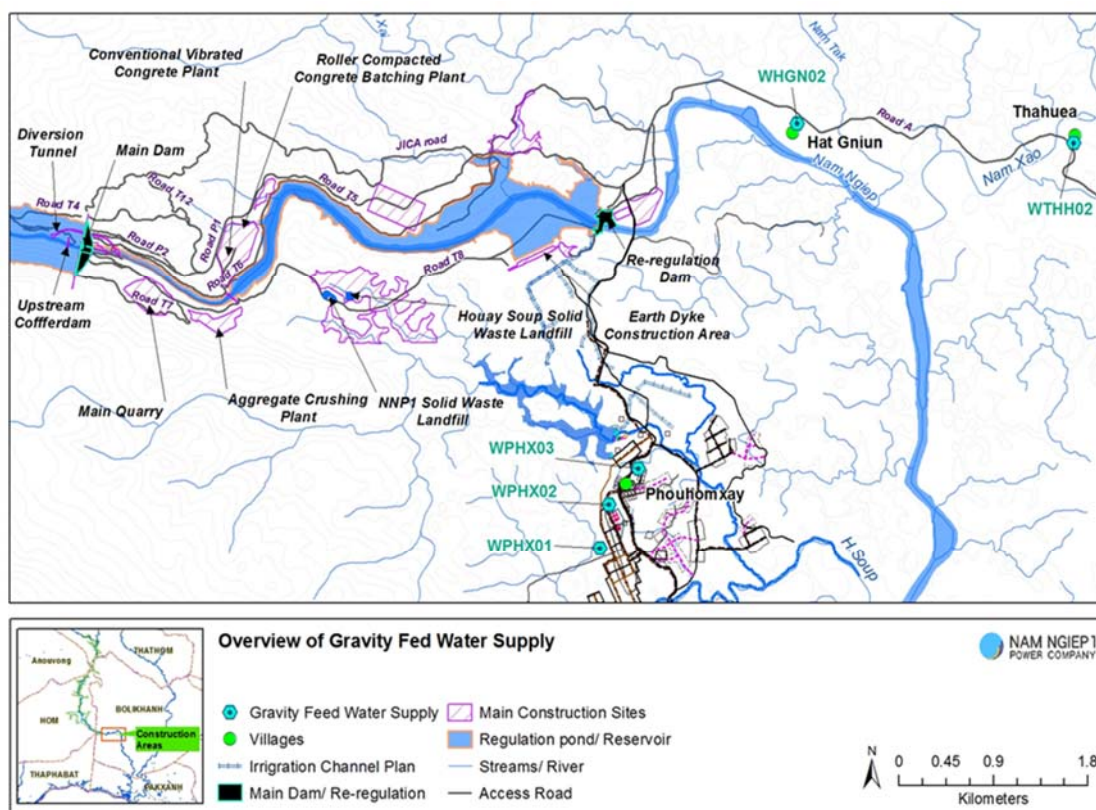
**Table 3-11: Groundwater Quality Monitoring Results, Somsuen, Nam Pa and Thongnoi Villages**

	Village Name	Somseun Village		NamPa Village	ThongNoi Village
	Station	GSXN01	GSXN02	GNPA01	GTHN01
	Date	14-May-18	14-May-18	14-May-18	14-May-18
Parameter (Unit)	Guideline				
pH	6.5 - 8.6	6.99	6.9	7.73	6.9
Sat. DO (%)		40.3	27.3	87.6	25.5
DO (mg/l)		3.02	2.03	6.51	1.92
Conductivity (µS/cm)	<1,000	106	255	323	226
TDS (mg/l)	<600	53	127	161	113
Temperature (°C)	<35	29	29.3	29.3	28.8
Turbidity (NTU)	<10	0.9	1.86	0.75	0.46
Faecal Coliform (MPN/100ml)	0	0	0	0	79
E.coli Bacteria (MPN/100ml)	0	0	0	0	22

### 3.2.4 Gravity Fed Water Supply (GFWS) Quality Monitoring

During May 2018, water samples were taken from water taps at Thahuea, Hat Gniun and Phouhomxay villages.

Figure 3-8 Gravity Fed Monitoring Locations



All parameters complied with the National Drinking Water Standards for Thahuea, Hat Gniun and Phouhomxay villages except for faecal coliforms and E.Coli. Presence of E.Coli in the GFWS system is a normal situation and it should be noted that according to the Law on Hygiene, Disease Prevention and Health Promotion No 01/NA of 10 April 2001, domestic

water supply for daily use is not required to be readily drinkable, but would normally have to boil or otherwise treated before drinking. The local villagers were informed about the results and encouraged to boil water before drinking.

**Table 3-12: Result Gravity Fed Water Supply (GFWS) Quality Monitoring**

	Village Name	Thahuea	Hat Gniun	Phouhomxay		
	Station	WTHH02	WHGN02	WPHX01	WPHX02	WPHX03
	Date	14-May-18	14-May-18	14-May-18	14-May-18	14-May-18
Parameter (Unit)	Guideline					
pH	6.5 - 8.6	7.73	7.58	7.9	7.52	7.81
Sat. DO (%)		93.4	87	99.5	99.2	100.6
DO (mg/l)		6.57	6.03	7.21	7.15	7.25
Conductivity (µS/cm)	<1,000	55.9	81.6	23.1	17	14.07
TDS (mg/l)	<600	22.5	40	11	8.5	7
Temperature (°C)	<35	32.6	30.6	30.8	31.2	31.1
Turbidity (NTU)	<10	0.75	0.8	0.49	0.5	0.52
Faecal Coliform (MPN/100ml)	0	33	240	170	11	13
E.coli Bacteria (MPN/100ml)	0	22	27	33	7.8	11

### 3.2.5 Landfill Groundwater Monitoring

During May 2018, the landfill leachate monitoring was conducted for NNP1 Solid Waste Landfill (last pond – LL4). Nonetheless, there is no water sampling at Houay Soup Solid Waste Landfill due to no discharge of leachate from the first to second pond.

The results indicated all parameters monitored at NNP1 Landfill were complied with the Standard.

**Figure 3-9 Landfill Leachate Monitoring Location**



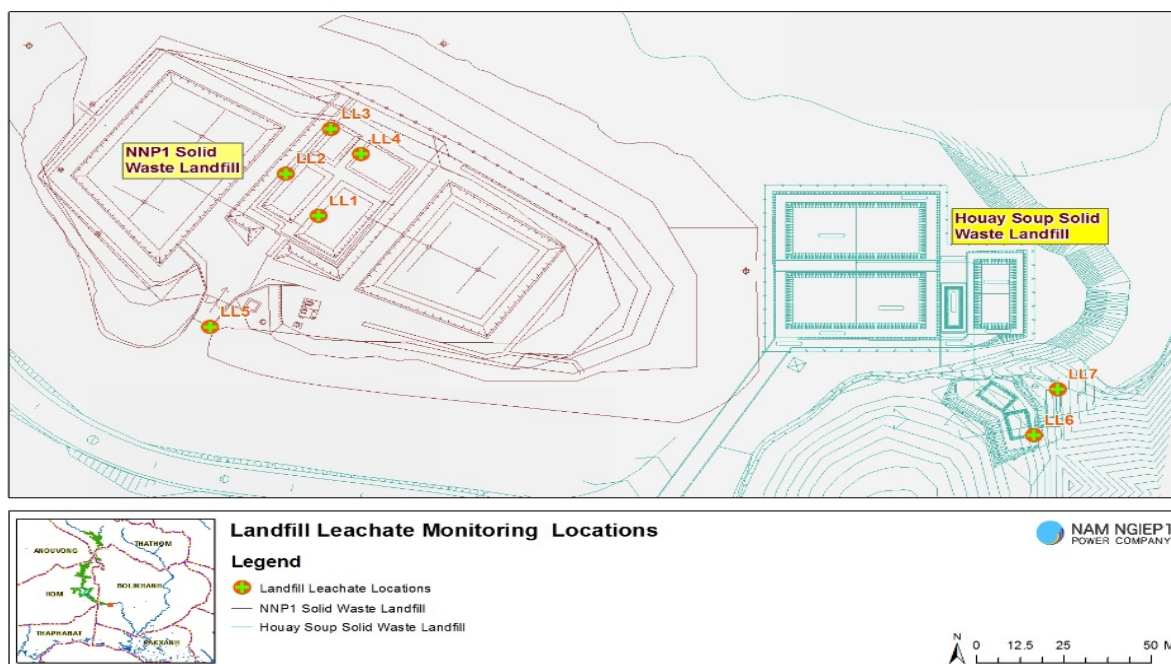


Table 3-13: Landfill Leachate Monitoring Results

	Site Name	NNP1 Landfill Leachate		Houay Soup Landfill Leachate	
	Location	Pond No. 4	Discharge Point	Last Pond	Discharge Point
	Station Code	LL4	LL5	LL6	LL7
	Date	30-May-18	30-May-18	30-May-18	30-May-18
Parameters (Unit)	Guideline				
pH	6.0 - 9.0	8.41	No water discharged.	No water in this pond	No water discharged.
Sat. DO (%)		134.7			
DO (mg/l)		9.30			
Conductivity (µs/cm)		196.7			
TDS (mg/l)		98			
Temperature (°C)		33.1			
Turbidity (NTU)		5.18			
BOD <sub>5</sub> (mg/l)	<30	3.81			
COD (mg/l)	<125	n/a			
Total Coliform (MPN/100ml)	<400	49			
Faecal Coliform (MPN/100ml)		2			

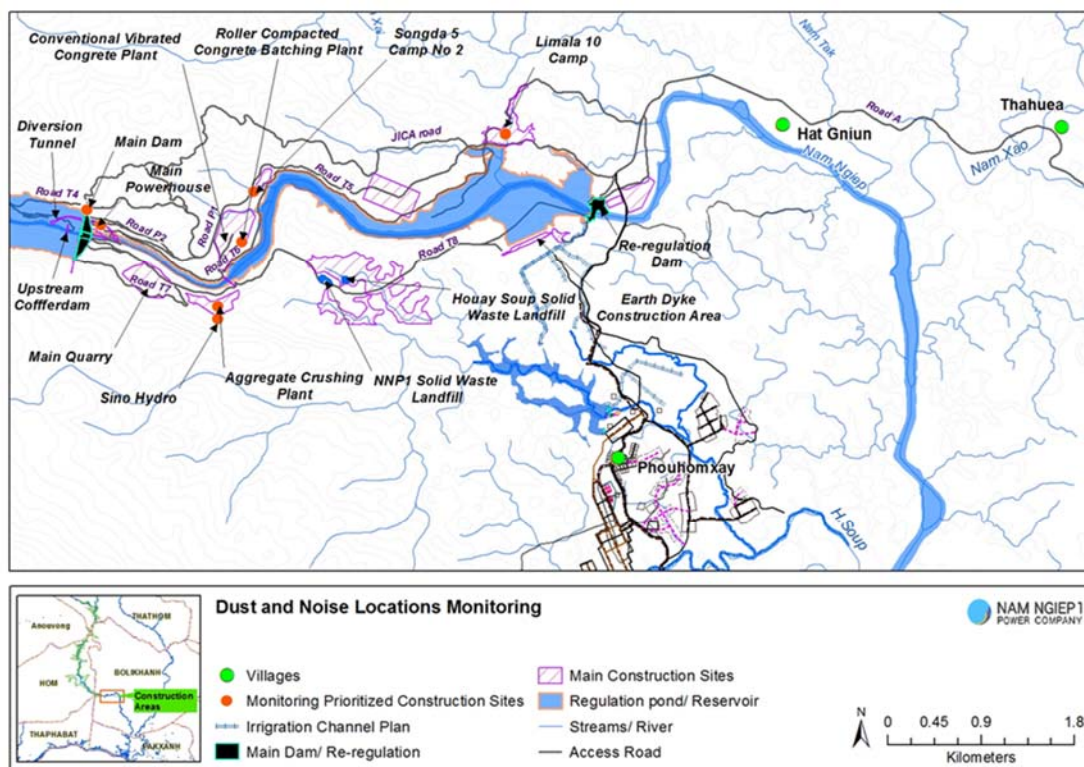
### 3.2.6 Dust Monitoring

The results indicated non-compliance with the National Standard at the main powerhouse. All staff were advised to wear dust masks while working in these areas. The results are presented in **Annex 2**.

### 3.2.7 Noise Monitoring

During May 2018, noise monitoring was conducted for 72 consecutive hours at Hat Gniun and Phouhomxay villages, and 24 consecutive hours at the Aggregate Crushing Plant, RCC Plant, Sino Hydro Main Camp, Sino Hydro Temporary Worker Camp, Main Dam, Lilama10 Camp, and the main powerhouse.

**Figure 3-10: Noise and Dust Emission Monitoring Locations**



The result at all stations indicated compliance with National Standard for the monitored period, except Phouhomxay village during 22:01-06:00. The exceedance of noise level at Phouhomxay caused from rain event.

## 3.3 PROJECT WASTE MANAGEMENT

### 3.3.1 Solid Waste Management

In May 2018, a total of 204.4 m<sup>3</sup> solid waste was disposed at the NNP1 Landfill, an increasing of 35.5 m<sup>3</sup> compared to April 2018. During May 2018, waste compaction and cover was not performed in a timely manner due to weather conditions and improper arrangement of machinery. EMO and TD have instructed the contractor to improve the landfill operation and maintenance.

A total of 33.2 kg of recyclable waste was sold to Khounmixay processing factory by the Contractors.

**Table 3-14: Amounts of Recyclable Waste Sold**

Source and Type of Recycled Waste		Unit	Sold	Cumulative Total by 31 May 2018
<b>Construction activity</b>				
1	Scrap metal	kg	32,000	41,217
<b>Sub-Total 1</b>		<b>kg</b>	<b>32,000</b>	<b>41,217</b>
<b>Operation camp</b>				
2	Glass bottles	kg	1,113	1,433
3	Plastic bottles	kg	20	170.5
4	Paper/Cardboard	kg	41	192
5	Aluminium can	kg	48	54.5
<b>Sub-Total 2</b>		<b>kg</b>	<b>1,222</b>	<b>1,850</b>
<b>Grand Total 1+2</b>		<b>kg</b>	<b>33,222</b>	<b>43,067</b>

A total of 7,129 kg food waste was collected in May 2018 from selected camps by villagers of Phouhomxay for animal feeding, it was increased 283 kg compared to April 2018.

**Table 3-15 Amounts of Food Waste Collected by Villagers**

NO.	SITE NAME	UNIT	TOTAL
1	Song Da 5 Camp No. 2	kg	2,406
2	Song Da 5 Camp No. 1	kg	1,643
3	Obayashi Corporation Camp	kg	1,386
4	Owner's Village and Site Office (OSOV)	kg	1,048
5	LILAMA 10 Camp	kg	367
6	Kenber Camp	kg	279
<b>Total</b>		<b>kg</b>	<b>6,846</b>

### 3.3.2 Hazardous Materials and Waste Management

The hazardous waste was collected and transported for offsite treatment and final disposed at Khounmixay processing factory for the reported period.

**Table 3-16: Results of Hazardous Material Inventory**

No.	Hazardous Waste Type	Unit	Total in May 2018 (A)	Disposed (B)	Remainder (A - B)
1	Used hydraulic and engine oil	litre (l)	9,970	1,200	8,770
2	Contaminated soil, sawdust and concrete	kg	775	0	775
3	Used oil filters	No.	324	0	324
4	Used tire	No.	324	0	324
5	Empty used chemical drum/container	Drum (20 litre)	180	0	180
6	Empty paint and spray cans	can	145	32	177
7	Halogen/fluorescent bulbs	No.	148	0	148
8	Empty used chemical drum/container	drum (200 l)	122	0	122

No.	Hazardous Waste Type	Unit	Total in May 2018 (A)	Disposed (B)	Remainder (A - B)
9	Ink cartridge	No.	111	0	111
10	Empty used oil drum/container	drum (20 l)	94	26	68
11	Empty used oil drum/container	drum (200 l)	72	27	45
12	Clinical waste	kg	33	0	33
13	Contaminated textile and material	kg	31	0	31
14	Lead acid batteries	No.	22	0	22
15	Empty contaminated bitumen drum/container	drum (200 l)	25	8	17
16	Lithium-ion batteries	No.	7	0	7
17	Acid and caustic cleaners	Bottle	0	0	0
18	Cement bag	bag	0	0	0
19	Used oil mixed with water	litre (l)	0	0	0

### 3.4 Community Waste Management

#### 3.4.1 Community Recycling Programme

In May 2018, a total of 679 kg of recyclable waste was recorded at the Community Waste Bank, an increasing of 493.5 kg compared to April 2018.

**Table 3-17: Types and Amounts of Recyclable Waste Traded at the Community Waste Bank**

Types of Waste	Unit	Remaining in April 2018	Additions in May 2018	Sold	Remaining in May 2018
Scrap metal	kg	16	0	0	16
Glass bottles	kg	1,651.5	285.5	285	1,652
Paper/cardboard	kg	148	267	0	415
Aluminium cans	kg	32	21	0	53
Plastic bottles	kg	119.5	105.5	0	225
<b>Total</b>	<b>kg</b>	<b>1,967</b>	<b>679</b>	<b>285</b>	<b>2,361</b>

In addition, on 10 May 2018, EMO conducted a community consultation on waste management for 15 camp followers at Hat Gnuin Village which including waste collection and segregation at their shops before transporting and disposing at Houay Soup Landfill

#### 3.4.2 Houay Soup Resettlement Area Waste Management

In May 2018, approximate of 40.5 m<sup>3</sup> of solid waste was collected from Phouhomxay, Thahuea and Hat Gnuin villages. The solid waste was collected and transported from Phouhomxay, Thahuea, Hat Gnuin villages to Houay Soup Landfill three days/week



(Mondays, Wednesdays and Fridays), and segregated before disposing at the Houay Soup Landfill.

### **3.4.3 Waste Clean-up in Four Villages at 2LR**

Waste clean-up in seven relocated households at Ban Pou and Hatsamkhone Villages was completed on 14 May 2018. A joint audit was conducted by NNP1PC-EMO, SMO, EMU and local villagers and an approval letter for work completion was issued by EMU Xaysomboun Province on 30 May 2018.

## **3.5 Watershed and Biodiversity Management**

### **3.5.1 Watershed Management**

The approval workshop for the Nam Ngiep 1 Watershed Management Plan (WMP) was held on 29-30 May 2018 with the participation of members of the Watershed and Reservoir Protection Committee (WRPC), Xaysomboun Watershed and Reservoir Protection Office (WRPO), Bolikhamxay Watershed and Reservoir Protection Office, and relevant GOL offices including Department of Water Resource of MONRE, Department of Forestry of MAF, PONRE, PAFO, and District Authorities.

The key conclusions from the meeting included:

- 1) The meeting agreed in principle to the plan.
- 2) The plan will be further improved based on the additional comments received during the meeting as well as in terms of Lao language proficiency.
- 3) The improved plan will be submitted by Bolikhamxay WRPO to the Chairman of the WRPC for final review and signing which is expected by end of July 2018.

The annual implementation plan for the period of 2018-2019 needs to be developed and implemented as soon as possible.

#### **3.5.1.1 PREPARATION OF PROVINCIAL REGULATION FOR THE WATERSHED MANAGEMENT**

The draft Provincial Regulations have been reviewed by Xaysomboun Provincial Justice Department and submitted to the Provincial Assembly for final review and approval.

### **3.5.2 Biodiversity Offset Management**

#### **3.5.2.1 PREPARATION OF BIODIVERSITY OFFSET MANAGEMENT PLAN**

Several studies and surveys as part of the preparation of biodiversity mitigation and offset Plans have been undertaken since January 2018 and completed in April 2018. The first draft of table of content was prepared and discussed during the ADB-IAP mission in the third week of May 2018. The mission strongly recommended that the plan should be simple, practical, and implementable for the GOL.

#### **3.5.2.2 IMPLEMENTATION OF PRE-BIODIVERSITY OFFSET MANAGEMENT PLAN**

The provincial regulations were drafted by BOMC in discussion with NNP1PC. The Bolikhamxay Provincial Regulation Committee was established at the end of May 2018 and the first technical workshop followed by community consultation at district and village level will be started in the first week of June 2018.

### **3.5.2.3 Implementation of pre-Biodiversity Offset Management Plan**

NNP1PC has disbursed funds on 16 March 2018 for the implementation of the second pre-BOMP until June 2018. Patrolling activity continues in May 2018 including the SMART data entry and monthly reporting related to the findings. Conservation awareness activity was also completed in the second week of May 2018.

### **3.5.3 Floating Debris Removal**

NNP1PC is in the process of procuring a contractor for removal of floating debris from the Nam Ngiep 1 Reservoir during and after impounding. NNP1PC received proposals from four bidders by 15 May 2018. NNP1PC bidding committee opened the proposals on 22 May 2018 and NNP1PC EMO completed the technical evaluation on 30 May 2018. The contractor is expected to be engaged in June 2018.

## **4. FISHERY MONITORING**

The fishery monitoring programme is progressing in May as planned with the daily catch logbook, gillnet survey, and sampling household interview. The gathered information is being put into the database system.

The data from the daily fish catch logbook monitoring indicates that the mean daily fish catch in Nam Ngiep River was 1.9 kg/household/day in April 2018. The estimated total fish catch in Nam Ngiep basin for April 2018 is 49,500 kg. Around 35 % of the catch was sold, 54 % was consumed fresh, 8 % processed and approximately 3 % was used for other purposes.

# ANNEXES

**ANNEX A: RESULTS OF EFFLUENT ANALYSES**

Table A- 1: Results of Camp Effluents in May 2018

	Site Name	Owner's Site Office and Village		Obayashi Camp		Sino Hydro Camp	
	Station Code	EF01		EF02		EF06	
		09-May-18	21-May-18	09-May-18	21-May-18	09-May-18	21-May-18
Parameter (Unit)	Guideline in the CA						
pH	6.0 - 9.0	7.28	6.87	7.55	7.48	7.38	7.45
Sat. DO (%)	-	72.6	43	73.9	70.8	113.3	132
DO (mg/l)	-	5.03	3.63	5.25	5.11	8.3	9.6
Conductivity (µs/cm)	-	312	386	604	620	401	432
TDS (mg/l)	-	156	193	302	315	200	216
Temperature (°C)	-	31.5	27.9	31.6	30.3	29.9	30.3
Turbidity (NTU)	-	1.18	0.58	10.08	5.58	9.97	3.29
TSS (mg/l)	<50	<5	<5	6.34	7.17	6.75	16.15
BOD (mg/l)	<30	<6	<6	<6	<6	<6	<6
COD (mg/l)	<125	<25	<25	38.1	32.6	32.5	38.6
NH <sub>3</sub> -N (mg/l)	<10.0	3.2	10.2	5.6	18	19.4	10.7
Total Nitrogen (mg/l)	<10	13.4	15.8	19.3	19.1	21.6	12.6
Total Phosphorus (mg/l)	<2	0.65	0.83	0.95	0.86	0.78	0.85
Oil & Grease (mg/l)	<10.0	<1		<1		<1	
Total coliform (MPN/100ml)	<400	110	33	0	7.8	0	130
Fecal Coliform (MPN/100ml)		17	4.5	0	4.5	0	17
Effluent Discharge Volume (L/mn)		30	12	20	30	12	3
Chlorination Dosing Rate (ml/mn)				290	135	195	33
Residual Chlorine (mg/l)	<1.0					0.23	0.21

	Site Name	Song Da 5 Camp No.1		Song Da 5 Camp No.2		V & K Camp	
	Station Code	EF07		EF08		EF10	
		09-May-18	21-May-18	09-May-18	21-May-18	09-May-18	21-May-18
Parameter (Unit)	Guideline in the CA						
pH	6.0 - 9.0	7.37	7.46	7.25	7.48	7.45	7.36
Sat. DO (%)	-	48.1	58.7	40.4	24.3	74.9	77.4
DO (mg/l)	-	3.42	4.23	2.93	1.8	5.5	5.61
Conductivity (µs/cm)	-	1,737	1,761	835	722	338	335
TDS (mg/l)	-	868.5	880	417.5	361	169	167
Temperature (°C)	-	31.8	31.2	30.8	29.1	29.9	30.6
Turbidity (NTU)	-	36.8	33.7	30.9	34.7	5.4	4.9
TSS (mg/l)	<50	26.11	39.02	20.18	18.92	7.23	10.68
BOD (mg/l)	<30	<6	<6	<6	47.88	7.08	27
COD (mg/l)	<125	96.8	113	80.7	95.2	27.9	28.4
NH <sub>3</sub> -N (mg/l)	<10.0	19.2	42.9	34.3	43.6	5.2	7.3
Total Nitrogen (mg/l)	<10	20.3	43.6	34.9	44.8	7.67	9.84
Total Phosphorus (mg/l)	<2	0.74	0.83	1.2	1.19	0.51	0.69
Oil & Grease (mg/l)	<10.0	<1		4		<1	

Final- 27 June 2018

Parameter (Unit)	Site Name	Song Da 5 Camp No.1		Song Da 5 Camp No.2		V & K Camp	
	Station Code	EF07		EF08		EF10	
		09-May-18	21-May-18	09-May-18	21-May-18	09-May-18	21-May-18
	Guideline in the CA						
Total coliform (MPN/100ml)	<400	0	0	0	1,600	11	240
Fecal Coliform (MPN/100ml)		0	0	0	1600	4.5	22
Effluent Discharge Volume (L/mn)		20	30	30	30	0	6
Chlorination Dosing Rate (ml/mn)		125	76	480	835	54	76
Residual Chlorine (mg/l)	<1.0	0.54	1.82	0.74	0.1	0.14	0.11

Parameter (Unit)	Site Name	HM Main Camp		IHI Camp		Kenber Camp	
	Station Code	EF13		EF14		EF16	
		09-May-18	21-May-18	09-May-18	21-May-18	09-May-18	21-May-18
	Guideline in the CA						
pH	6.0 - 9.0	7.00	7.22	7.15	6.99	6.84	7.07
Sat. DO (%)	-	64.6	39	25.7	19.5	88.3	95.2
DO (mg/l)	-	4.67	2.83	1.87	1.42	6.19	6.74
Conductivity (µs/cm)	-	1,042	837	761	692	271	255
TDS (mg/l)	-	521	418	380	346	135.5	127
Temperature (°C)	-	30.6	30.4	30.3	30.8	32.2	31.6
Turbidity (NTU)	-	22.9	30.6	9.68	37.6	6.39	6.59
TSS (mg/l)	<50	46.1	31.63	14.24	44.02	8.24	7.69
BOD (mg/l)	<30	<6	48.7	<6	45.06	<6	<6
COD (mg/l)	<125	160	276	53	242	<25	<25
NH <sub>3</sub> -N (mg/l)	<10.0	19.4	30.2	6.6	19.5	10.8	2.6
Total Nitrogen (mg/l)	<10	22.9	30.9	16	20.8	11.5	8.29
Total Phosphorus (mg/l)	<2	0.94	1.15	0.8	0.81	0.52	0.45
Oil & Grease (mg/l)	<10.0	8		<1		<1	
Total coliform (MPN/100ml)	<400	0	49	0	23	0	0
Fecal Coliform (MPN/100ml)		0	49	0	23	0	0
Effluent Discharge Volume (L/mn)		4.2	4.2		3	0	4
Chlorination Dosing Rate (ml/mn)		3.1	3.1			85	12
Residual Chlorine (mg/l)	<1.0	1.24	0.56	0.83	0.88	0.34	1.07

Parameter (Unit)	Site Name	Zhefu Camp		Lilama10 Camp	
	Station Code	EF09		EF17	
		09-May-18	21-May-18	09-May-18	21-May-18
	Guideline in the CA				
pH	6.0 - 9.0	7.56	7.67	6.95	7.03
Sat. DO (%)	-	49.9	51	27.6	55.6
DO (mg/l)	-	3.49	3.44	1.91	3.88
Conductivity (µs/cm)	-	709	709	570	570

	Site Name	Zhefu Camp		Lilama10 Camp	
	Station Code	EF09		EF17	
		09-May-18	21-May-18	09-May-18	21-May-18
Parameter (Unit)	Guideline in the CA				
TDS (mg/l)	-	354.5	354	275	285
Temperature (°C)	-	32.6	34.9	32.4	33
Turbidity (NTU)	-	22.8	15.1	13.4	38.5
TSS (mg/l)	<50	58.94	41.8	17.88	31.6
BOD (mg/l)	<30	<6	<6	<6	<6
COD (mg/l)	<125	100	103	33.8	34
NH <sub>3</sub> -N (mg/l)	<10	21.6	36.2	6.6	8.5
Total Nitrogen (mg/l)	<10	22.2	37.4	23.2	25
Total Phosphorus (mg/l)	<2	1	1.08	0.1	0.1
Oil & Grease (mg/l)	<10.0	<1		<1	
Total coliform (MPN/100ml)	<400	0	0	0	0
Fecal Coliform (MPN/100ml)		0	0	0	0
Effluent Discharge Volume (L/mn)		4.2		4.2	4.2
Chlorination Dosing Rate (ml/mn)		3.1		3.1	3.1
Residual Chlorine (mg/l)		1.53	2.1	0.73	1.32

Table A- 2: Results of the Construction Area Discharge in May 2018

	Site Name	Spoil Disposal No.2				
	Station Code	DS04				
	Date	03-May-18	10-May-18	17-May-18	24-May-18	31-May-18
Parameter (Unit)	Guideline					
pH	6.0 - 9.0	6.06	6.21	6.38	6.18	6.92
Sat. DO (%)		49.8	48.8	37.6	41.4	60.1
DO (mg/l)		3.77	3.66	2.91	3.13	4.78
Conductivity (µs/cm)		58.4	72.9	50.9	67	33
TDS (mg/l)		28.8	36	25	33	16
Temperature (°C)		28	28.5	26.8	28.1	25.4
Turbidity (NTU)		48.2	20.3	17.8	18.3	16.9
TSS (mg/l)	<50	72.64	34.02	40.38	24.41	23.57
Oil & Grease (mg/l)	<10	<1				



		Site Name	RCC Plant Discharge at lower ponds				
		Station Code	DS09				
		Date	03-May-18	10-May-18	17-May-18	24-May-18	31-May-18
Parameter (Unit)	Guideline						
pH	6.0 - 9.0	8.80	No water discharge				
Sat. DO (%)		167.2					
DO (mg/l)		10.97					
Conductivity (µs/cm)		216.1					
TDS (mg/l)		108					
Temperature (°C)		30.7					
Turbidity (NTU)		36.6					
TSS (mg/l)	<50	73.53					
Oil & Grease (mg/l)	<10	<1					

		Site Name	Aggregate Crushing Plant				
		Station Code	DS02				
		Date	03-May-18	10-May-18	17-May-18	24-May-18	31-May-18
Parameter (Unit)	Guideline						
pH	6.0 - 9.0	6.65	No water discharge				
Sat. DO (%)		115.3					
DO (mg/l)		7.93					
Conductivity (µs/cm)		267					
TDS (mg/l)		133.5					
Temperature (°C)		33.8					
Turbidity (NTU)		14.1					
TSS (mg/l)	<50	27.98					
Oil & Grease (mg/l)	<10	<1					

		Site Name	Main Dam Treatment Plant No.2 (DS12)				
		Station Code	DS12				
		Date	03-May-18	10-May-18	17-May-18	24-May-18	31-May-18
Parameter (Unit)	Guideline						
pH	6.0 - 9.0	7.04	6.42	No water discharge			
Sat. DO (%)		100.7	98.3				
DO (mg/l)		7.05	6.95				
Conductivity (µs/cm)		593	850				
TDS (mg/l)		296.5	425				
Temperature (°C)		32.8	32.0				
Turbidity (NTU)		9.66	11.07				
TSS (mg/l)	<50	47.8	24.05				
Oil & Grease (mg/l)	<10	<1					

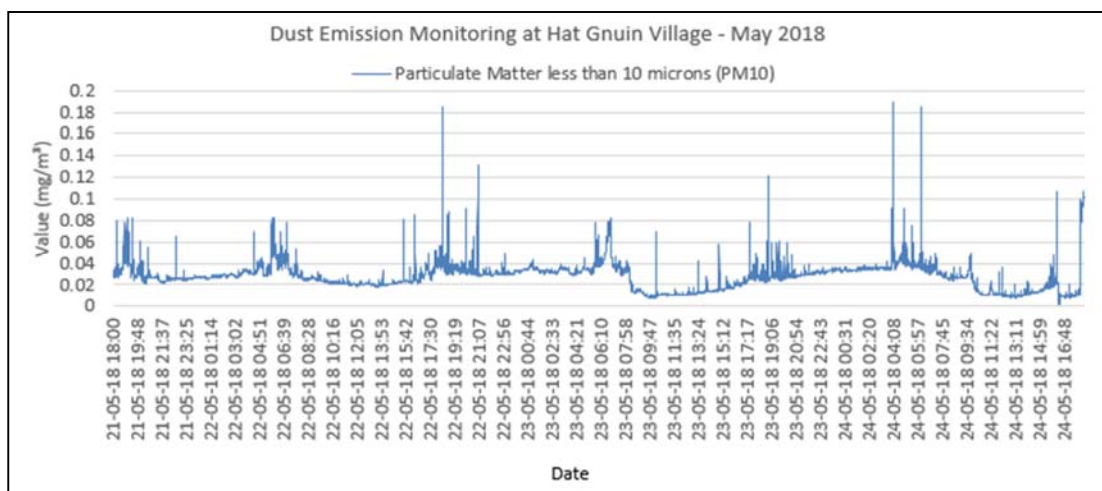
	Site Name	Main Dam's Waste Water Treatment Plant No.3				
	Station Code	DS14				
	Date	03-May-18	10-May-18	17-May-18	24-May-18	31-May-18
	Guideline					
Parameter (Unit)						
pH	6.0 - 9.0		7.65	7.55	8.01	7.59
Sat. DO (%)			94.6	95.9	109.3	101.6
DO (mg/l)			6.76	7.09	7.74	7.47
Conductivity (µs/cm)			223	983	164.5	249
TDS (mg/l)			111	491	82	124.5
Temperature (°C)			31.4	29.4	31.9	29.9
Turbidity (NTU)			12.87	20.8	5.41	6.84
TSS (mg/l)	<50		7.41	64.48	7.58	15.9
Oil & Grease (mg/l)	<10		<1			

## ANNEX B: AMBIENT DUST QUALITY

**Table B- 1: 24-hour Average Dust Concentrations Measured in Hat Gniun Village**

Hat Gnuin Village - 24 Hours Average Particulate Matter (PM10) Concentration			
Period	00 to 24 Hours	24 to 48 Hours	48 to 72 Hours
Start Time	21-May-18 18:00	22-May-18 18:01	23-May-18 18:01
End Time	22-May-18 18:00	23-May-18 18:01	05-Apr-18 18:00
Average Data Record in 24h (mg/m <sup>3</sup> )	0.029	0.028	0.027
Guideline Average in 24h (mg/m <sup>3</sup> )	<b>0.12</b>	<b>0.12</b>	<b>0.12</b>

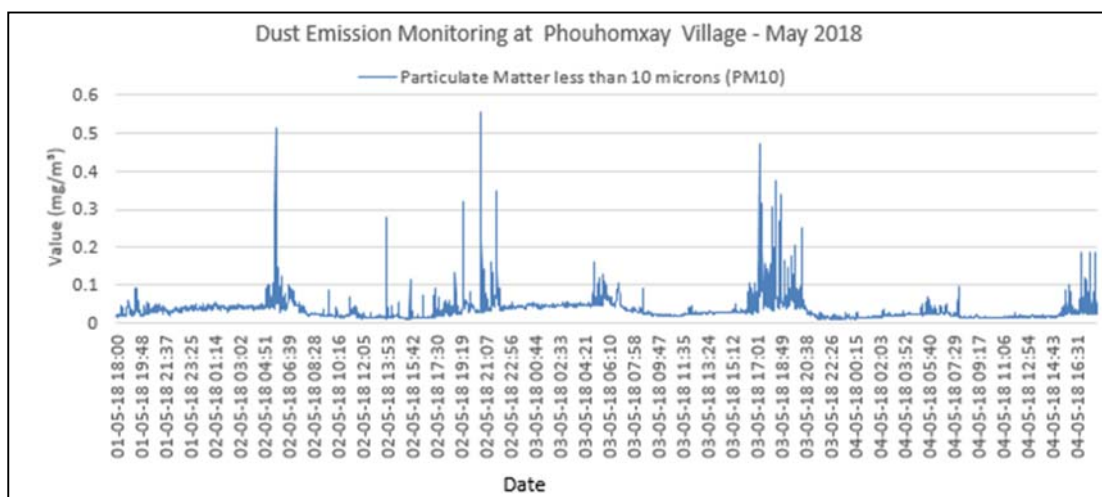
**Figure B- 1: Dust Monitoring Results at Ban Hat Gniun in May 2018**

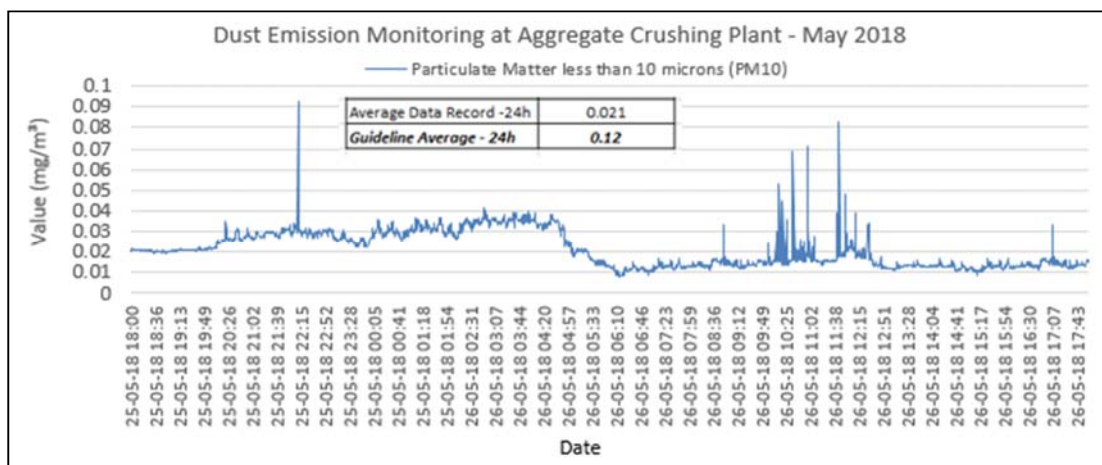
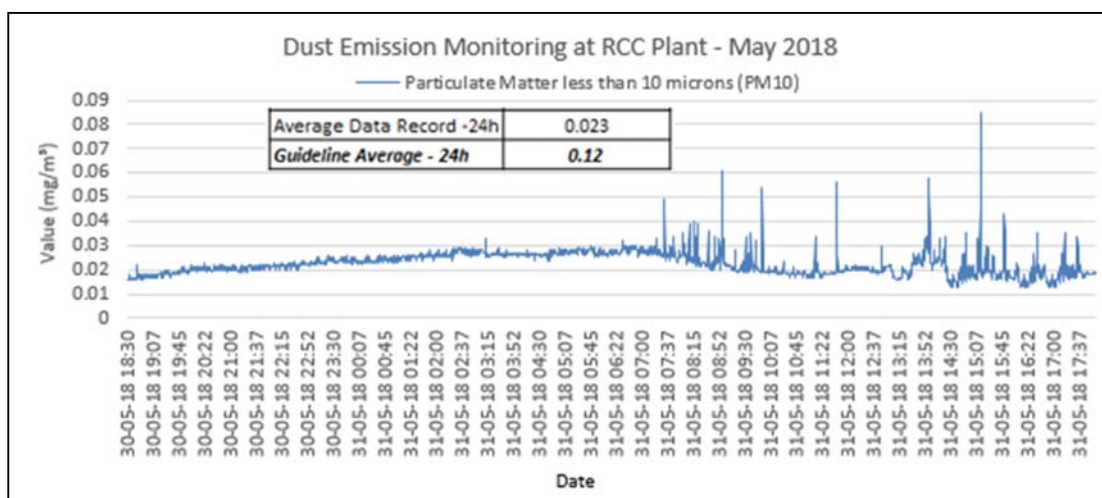
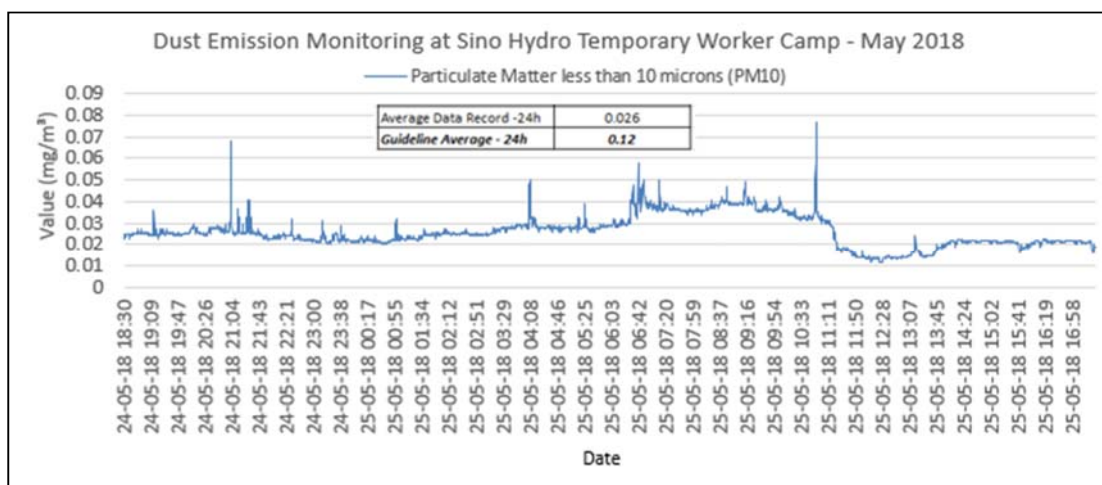


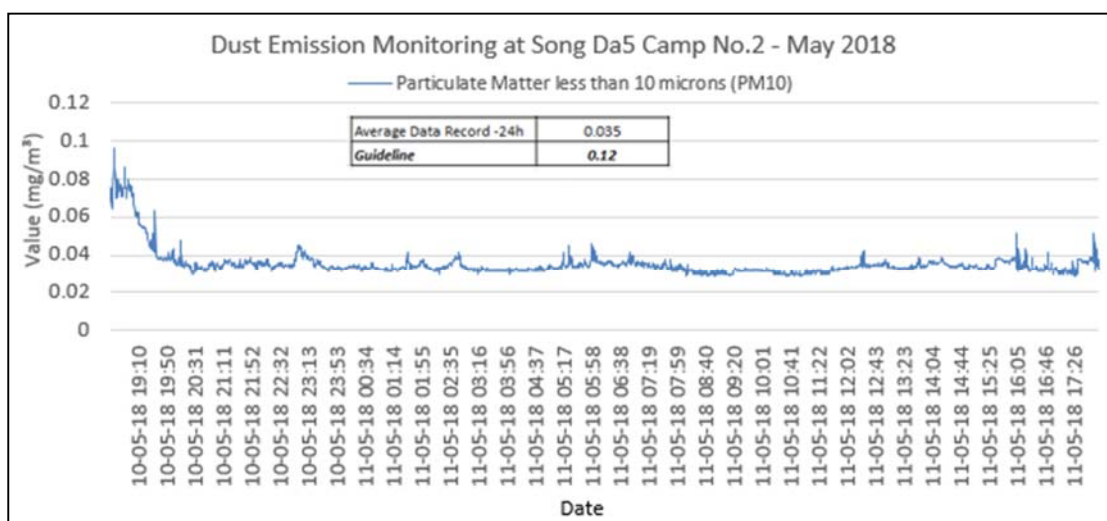
**Table B- 2: 24-hour Average Dust Concentrations Measured in Phouhomxay Village**

Phouhomxay village - 24 Hours Average Particulate Matter (PM10) Concentration			
Period	00 to 24 Hours	24 to 48 Hours	48 to 72 Hours
Start Time	01-May-18 18:00	02-May-18 18:00	03-May-18 18:00
End Time	02-May-18 18:00	03-May-18 18:00	04-May-18 18:00
Average Data Record in 24h (mg/m <sup>3</sup> )	0.032	0.043	0.027
Guideline Average in 24h (mg/m <sup>3</sup> )	<b>0.12</b>	<b>0.12</b>	<b>0.12</b>

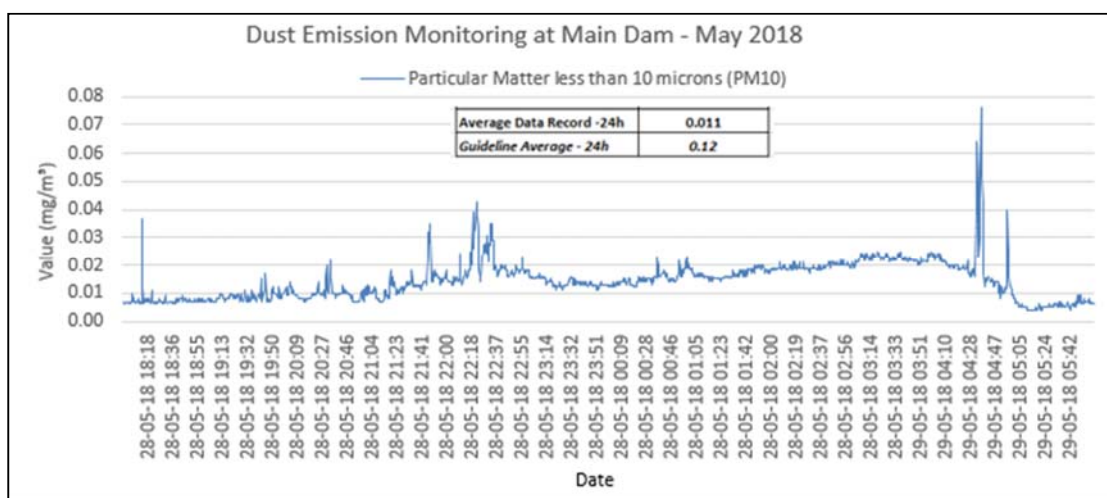
**Figure B- 2: Dust Monitoring at Phouhomxay Village in May 2018**



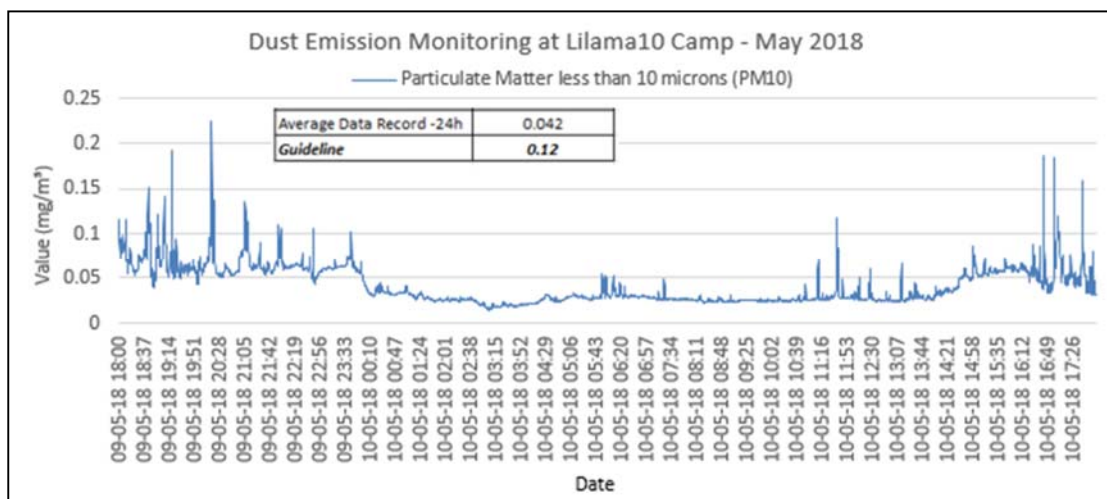
**Figure B- 3: Dust Monitoring Results at the Aggregate Crushing Plant in May 2018****Figure B- 4: Dust Monitoring Results at the RCC Plant in May 2018****Figure B- 5: Dust Monitoring Results at the Sino Hydro Temporary Camp in May 2018****Figure B- 6: Dust Monitoring Results at the SongDa5 No.2 Camp in May 2018**



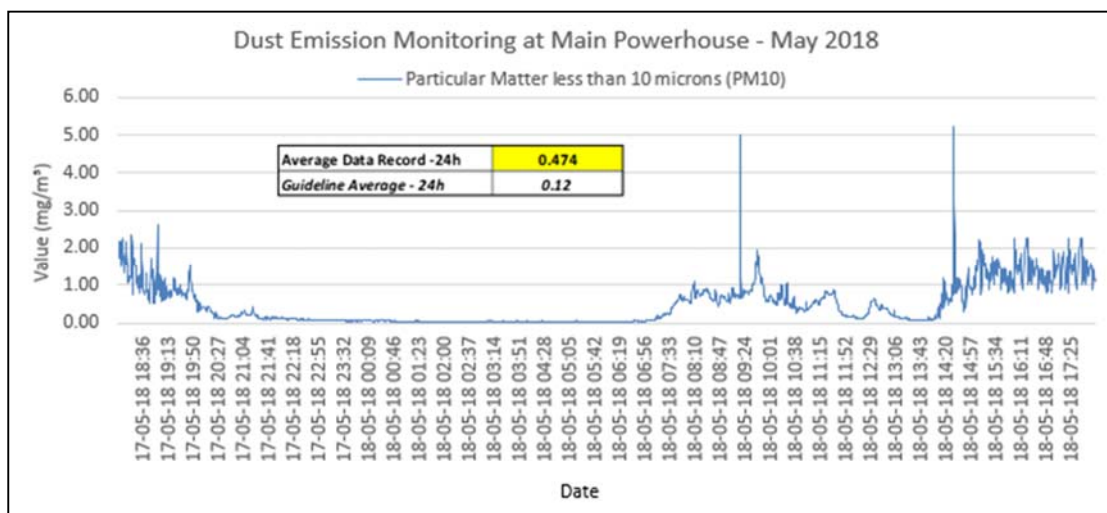
**Figure B- 7: Dust Monitoring Results at Main Dam (Top View Left Bank) in May 2018**



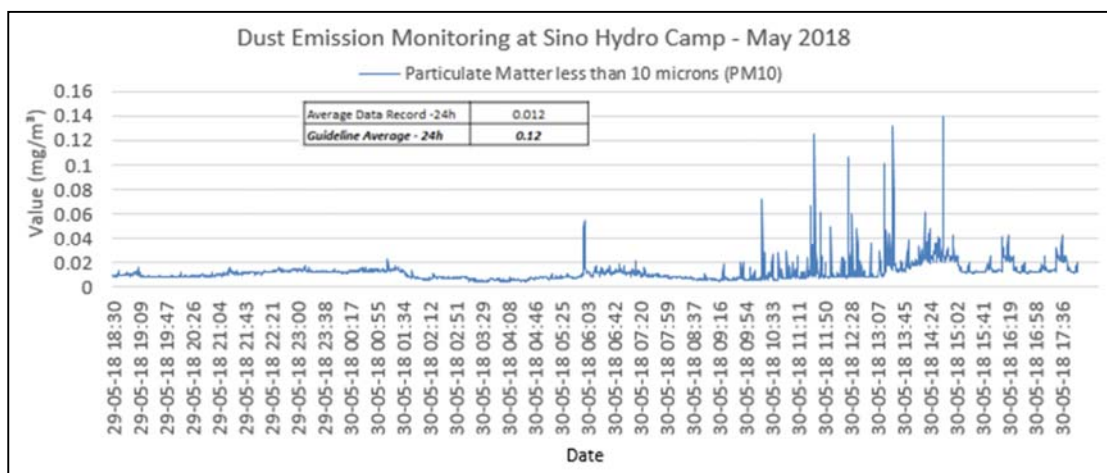
**Figure B-8: Dust Monitoring Results at the Lilama10 Camp in May 2018**



**Figure B- 9: Dust Monitoring Results at the Main Powerhouse in May 2018**



**Figure B-10: Dust Monitoring Results at the Sino Hydro Camp in May 2018**



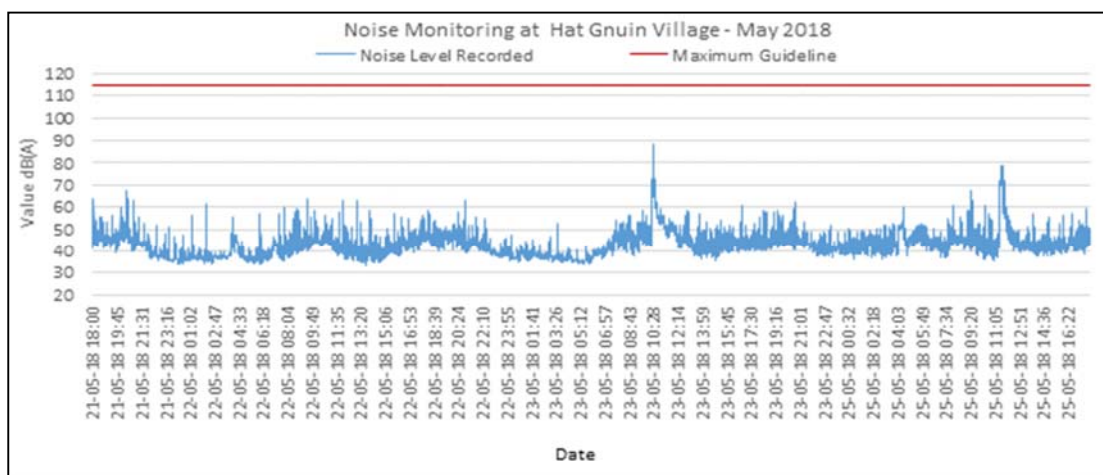


## ANNEX C: AMBIENT NOISE DATA

**Table C- 1: Average Results of Noise Monitoring at Ban Hat Gniun in May 2018**

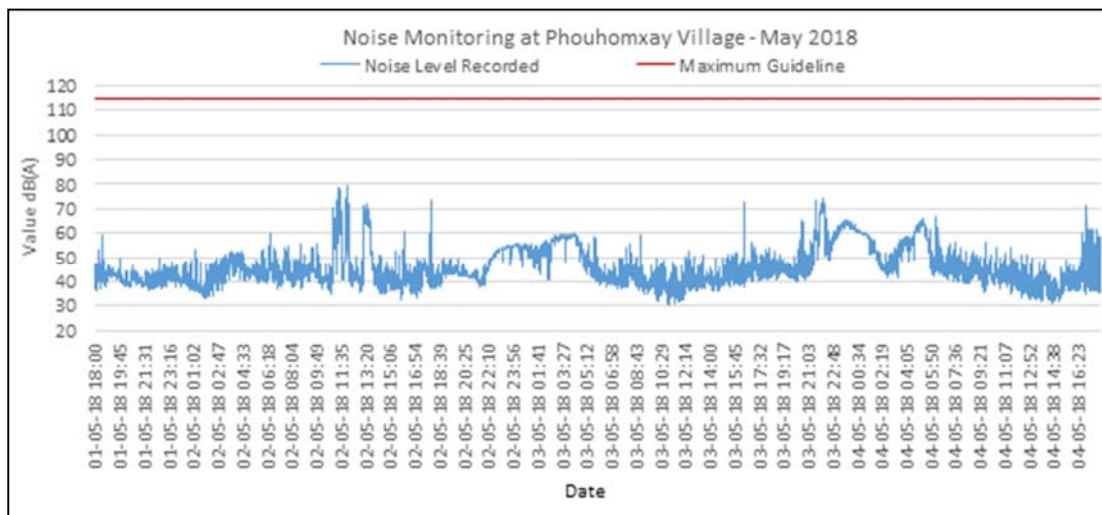
Noise Level (dB)	21-22/May/18			22-23/May/18			23-24/May/18		
	18:00-22:00	22:01-06:00	06:01-18:00	18:00-22:00	22:01-06:00	06:01-18:00	18:00-22:00	22:01-06:00	06:01-18:00
Maximum Value Recorded	67.70	61.40	64.00	63.10	54.70	88.80	62.40	60.10	78.80
<b>Guideline Max</b>	<b>115</b>	<b>115</b>	<b>115</b>	<b>115</b>	<b>115</b>	<b>115</b>	<b>115</b>	<b>115</b>	<b>115</b>
Average Data Recorded	45.58	37.78	41.69	45.72	37.71	44.67	44.61	43.41	44.50
<b>Guideline Averaged</b>	<b>55</b>	<b>45</b>	<b>55</b>	<b>55</b>	<b>45</b>	<b>55</b>	<b>55</b>	<b>45</b>	<b>55</b>

**Figure C- 1: Result of Noise Level Monitoring at Ban Hat Gniun in May 2018**



**Table C- 2 Average Results of Noise Monitoring at Phouhomxay Village in May 2018**

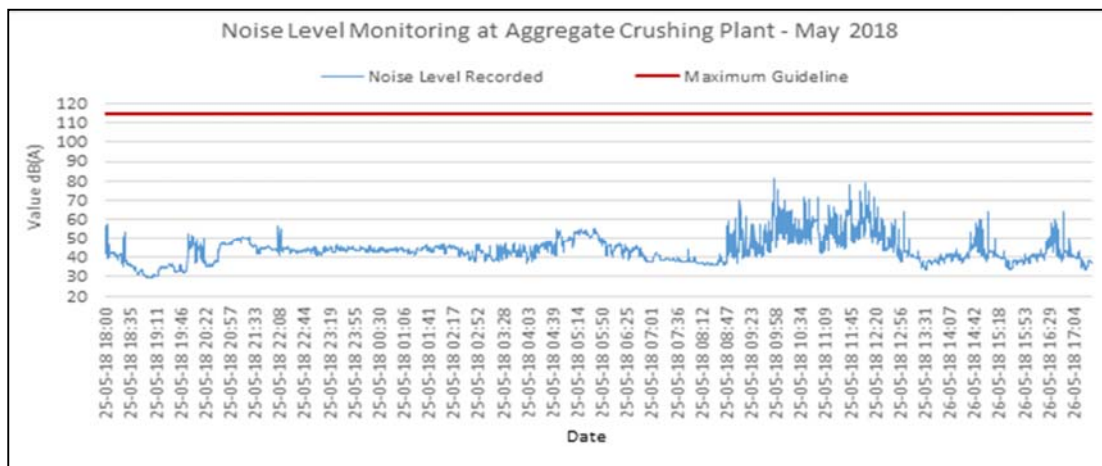
Noise Level (dB)	01-02/May/18			02-03/May/18			03-04/May/18		
	18:00-22:00	22:01-06:00	06:01-18:00	18:00-22:00	22:01-06:00	06:01-18:00	18:00-22:00	22:01-06:00	06:01-18:00
Maximum Value Recorded	59.50	53.20	79.60	73.70	60.50	73.00	73.40	74.70	74.70
<b>Guideline Max</b>	<b>115</b>	<b>115</b>	<b>115</b>	<b>115</b>	<b>115</b>	<b>115</b>	<b>115</b>	<b>115</b>	<b>115</b>
Average Data Recorded	41.23	42.32	45.23	42.38	53.05	40.93	46.51	53.69	47.86
<b>Guideline Averaged</b>	<b>55</b>	<b>45</b>	<b>55</b>	<b>55</b>	<b>45</b>	<b>55</b>	<b>55</b>	<b>45</b>	<b>55</b>

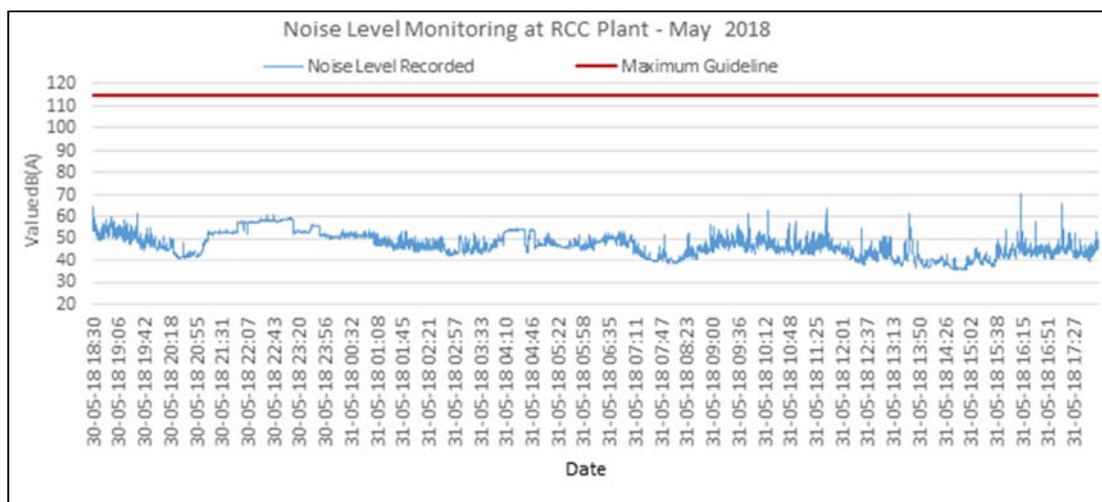
**Figure C- 2: Result of Noise Level Monitoring at Phouhomxay Village in May 2018****Table C-3 and Table C-4: Average Results of Noise Monitoring at Aggregate Crushing Plant and RCC Plant in May 2018****Aggregate Crushing Plant**

Noise Level (dB)	25-26/May/18		26/May/18
	18:00-22:00	22:01-06:00	06:01-18:00
Maximum Value Recorded	57.4	56.8	81.1
<b>Guideline Max</b>	<b>115</b>	<b>115</b>	<b>115</b>
Average Data Recorded	40.26	44.78	44.71
<b>Guideline Averaged</b>	<b>70</b>	<b>70</b>	<b>70</b>

**RCC Plant**

Noise Level (dB)	30-31/May/18		31/May/18
	18:30-22:00	22:01-06:00	06:01-18:00
Maximum Value Recorded	64.4	60.9	70.6
<b>Guideline Max</b>	<b>115</b>	<b>115</b>	<b>115</b>
Average Data Recorded	50.53	49.62	44.06
<b>Guideline Averaged</b>	<b>70</b>	<b>70</b>	<b>70</b>

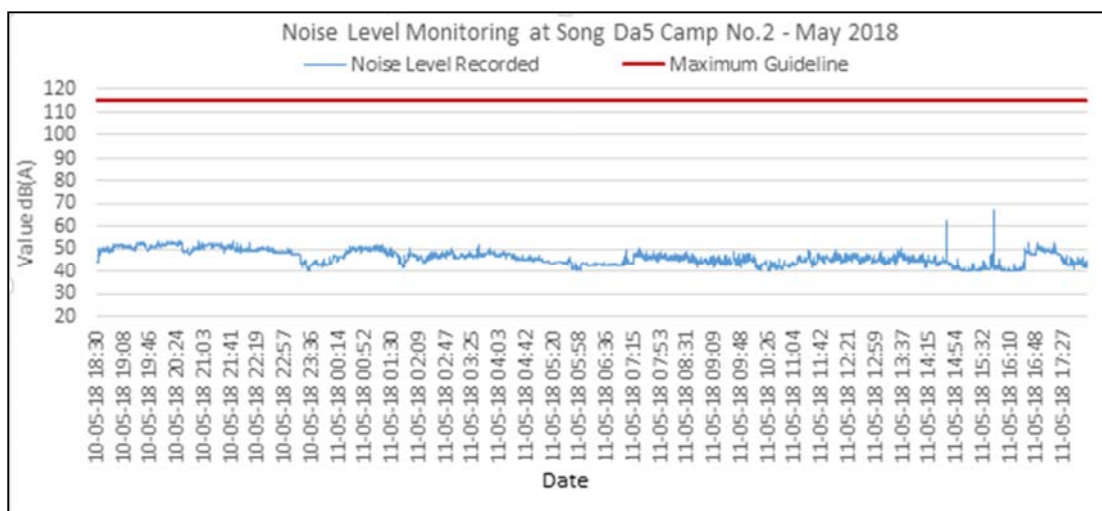
**Figure C- 3: Results of Noise Level Monitoring at the Aggregate Crushing Plant in May 2018**

**Figure C- 4: Results of Noise Level Monitoring at the RCC Plant in May 2018****Table C- 5 and Table C- 6: Average Results of Noise Monitoring at Song Da5 Camp No. 2 and Sino Hydro Camp in May 2018*****Song Da5 Camp No.2***

Noise Level (dB)	10-11/May/18		11/May/18
	18:30 – 22:00	22:01 – 06:00	06:01-18:00
Maximum Value Recorded	54	52.6	67.1
<b>Guideline Max</b>	<b>115</b>	<b>115</b>	<b>115</b>
Average Data Recorded	50.87	46.43	44.66
<b>Guideline Averaged</b>	<b>70</b>	<b>50</b>	<b>70</b>

***Sino Hydro Temporary Worker Camp***

Noise Level (dB)	24-25/May/18		25/May/18
	18:30 – 22:00	22:01 – 06:00	06:01-17:30
Maximum Value Recorded	54.6	53	65.2
<b>Guideline Max</b>	<b>115</b>	<b>115</b>	<b>115</b>
Average Data Recorded	47.45	43.77	40.00
<b>Guideline Averaged</b>	<b>70</b>	<b>50</b>	<b>70</b>

**Figure C- 5: Results of Noise Level Monitoring at Song Da5 Camp No.2 in May 2018****Figure C- 6: Results of Noise Level Monitoring at Sino Hydro Temporary Worker Camp in May 2018**

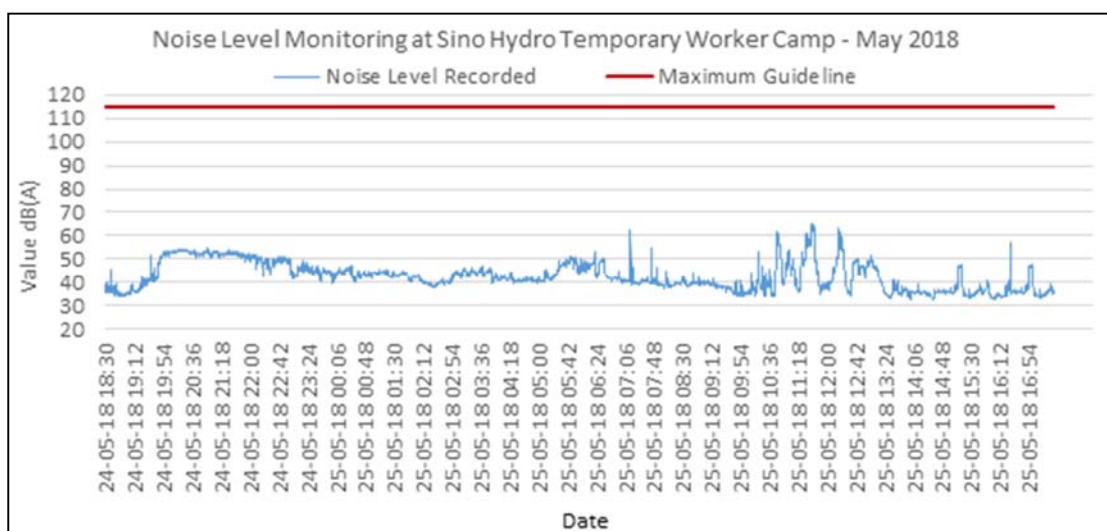


Table C- 8 and Table C- 9: *Average Results of Noise Monitoring at Main Dam, and Lilama 10 Camp in May 2018*

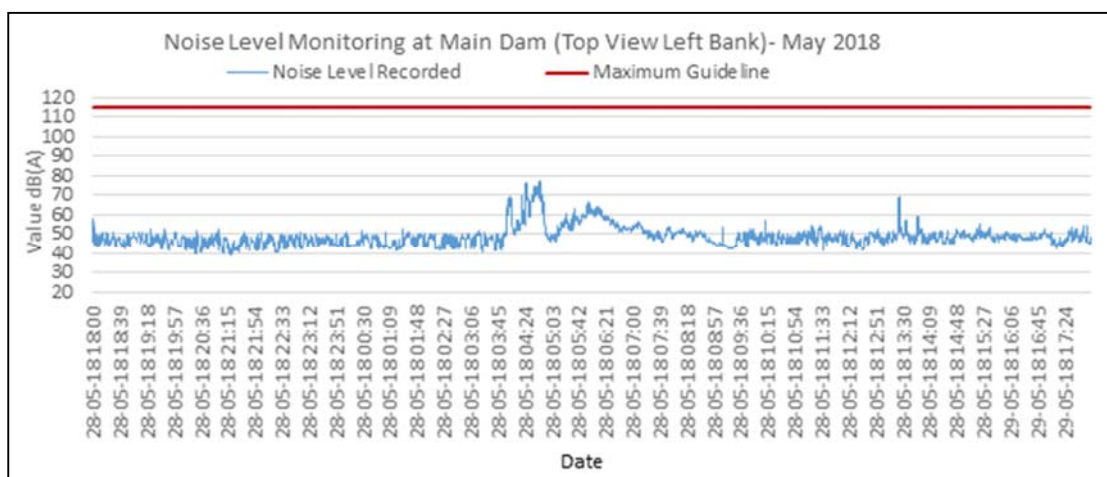
**Main Dam**

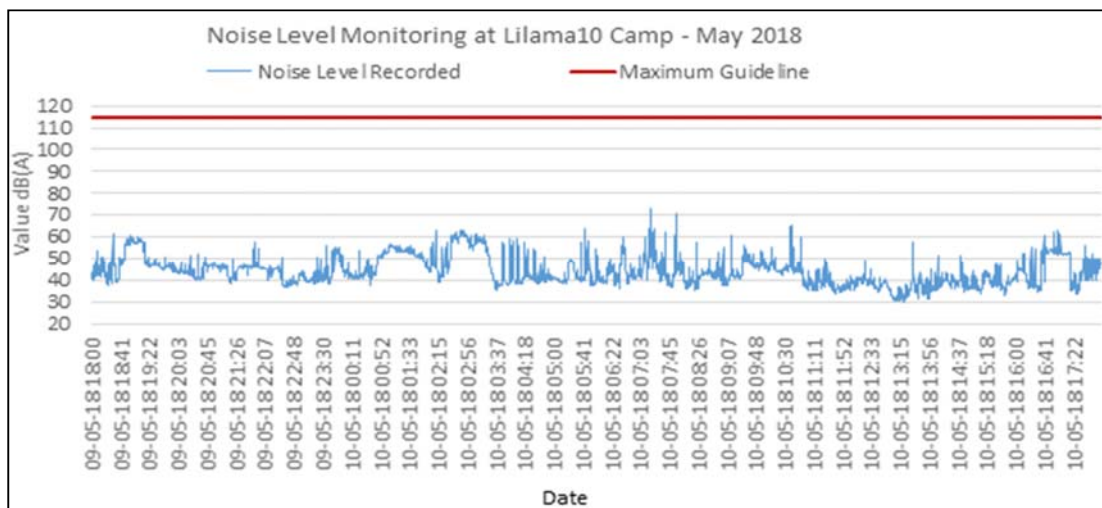
Noise Level (dB)	28-29/May/18		29/May/18
	18:00 – 22:00	22:01 – 06:00	06:01-18:00
Data Record Max	57.6	77.5	69.6
<b>Guideline Max</b>	<b>115</b>	<b>115</b>	<b>115</b>
Data Record Average	46.03	49.36	48.94
<b>Guideline Averaged</b>	<b>70</b>	<b>70</b>	<b>70</b>

**Lilama 10 Camp**

Noise Level (dB)	09-10/May/18		10/May/18
	18:00 – 22:00	22:01 – 06:00	06:00-18:00
Maximum Value Recorded	62.1	63.8	73.7
<b>Guideline Max</b>	<b>115</b>	<b>115</b>	<b>115</b>
Average Data Recorded	47.14	46.52	42.43
<b>Guideline Averaged</b>	<b>70</b>	<b>50</b>	<b>70</b>

Figure C-7: *Results of Noise Level Monitoring at Main Dam (Top View Left Bank) in May 2018*



**Figure C- 8: Results of Noise Level Monitoring at Lilama10 Camp in May 2018****Table C-9 and Table C-10: Average Results of Noise Monitoring at Main Powerhouse, and Sino Hydro Camp in May 2018****Main Powerhouse**

Noise Level (dB)	17-18/May/18		18/May/18
	18:00 – 22:00	22:01 – 06:00	06:01-18:00
Data Record Max	78.8	58	87
<b>Guideline Max</b>	<b>115</b>	<b>115</b>	<b>115</b>
Data Record Average	53.94	49.02	66.73
<b>Guideline Averaged</b>	<b>70</b>	<b>70</b>	<b>70</b>

**Sino Hydro Camp**

Noise Level (dB)	29-30/May/18		30/May/18
	18:30 – 22:00	22:01 – 06:00	06:01-18:00
Maximum Value Recorded	61.4	66.3	69
<b>Guideline Max</b>	<b>115</b>	<b>115</b>	<b>115</b>
Average Data Recorded	43.91	46.19	45.01
<b>Guideline Averaged</b>	<b>70</b>	<b>50</b>	<b>70</b>

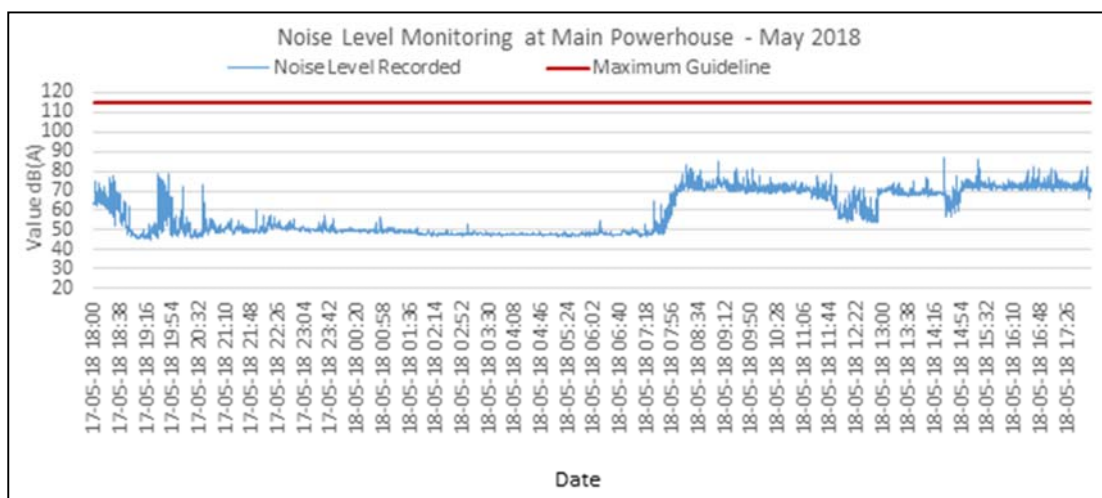
**Figure C- 9: Results of Noise Level Monitoring at Main Powerhouse in May 2018**



Figure C-10: Results of Noise Level Monitoring at Sino Hydro Camp in May 2018

