

Nam Ngiep 1 Hydropower Project

Environmental Management Monthly Monitoring Report

November 2018

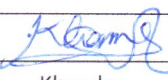
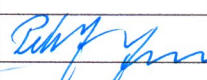
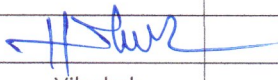
					
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BBREVIATIONS / ACRONYMS

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
EOCD	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
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
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

In November 2018, the Environmental Management Office (EMO) of Nam Ngiep 1 Power Company (NNP1PC) received two Site Specific Environmental and Social Management and Monitoring Plans (SS-ESMMPs) and one Site Decommissioning and Rehabilitation Plan for review and approval.

The monthly inspection by the Environmental Management Unit (EMU) of Bolikhamxay Province was conducted during 27-28 November 2018 and the inspection report will be submitted to EMO by early December 2018.

The effluent monitoring results for the camps in November 2018 indicate that the measurements of BOD₅, COD, faecal coliform and total coliform comply with the relevant effluent standards, except for Owner's Site Office and Village, Zhefu Camp, HM Main Camp and IHI Field Shop 276 Camp. EMO discontinued the water sampling at RCC Plant, Aggregate Crushing Plant, Sino Hydro Camp and Kenber Camp because these sites were decommissioned in November 2018 and therefore no longer in operation).

The dissolved oxygen (DO) concentrations at the surface of Nam Ngiep River in R1, R3, R4 and R5 (upstream of the main dam some 50 km, 21 km, 13 km and 0.5 km respectively) were generally above the Standard at 6 mg/L in November 2018. The DO measurements in R6 and R7 (re-regulation reservoir) were generally above 6.6 mg/L, and the DO in NNG05 downstream the re-regulation dam has remained above 8 mg/L.

A total of 92.7 m³ of solid waste was disposed of at the NNP1 Project Landfill, a decrease of 27.7 m³ compared to October 2018. The closure of NNP1PC Project landfill's pit No.1 was completed in November 2018. Main work components included waste compaction soil and HDPE sheet covering and grass planting. A total of 2,345 kg of recyclable waste was sold to Khounmixay Processing Factory. A total of 121 m³ of solid waste from Phouhomxay, Thahuea and Hat Gniun villages was disposed of at the Houay Soup Landfill.

NNP1PC revised and re-submitted the final draft Watershed Management Plan to ADB on 5 November 2018 and received feedback on 22 November 2018. The plan is being further improved by NNP1 EMO. The deadline for final approval by ADB will be discussed and agreed during the upcoming ADB and IAP mission scheduled during 10-15 December 2018.

Xaysomboun Provincial Authority and the Department of Forestry (DOF), Ministry of Agriculture and Forestry (MAF) held a meeting on 23 November 2018 and the chair of the meeting urged the new WRPO-PAFO to quickly improve the draft watershed management regulations and submit the regulations to the Provincial Assembly for further review followed by approval by the Governor by mid-December 2018.

The Governor of Xaysomboun Province issued an Agreement (No. 1134) re-structuring the Watershed and Reservoir Protection Committee (WRPC) and its secretariat (WRPO) on 29 November 2018. In the new structure, PAFO will lead the WRPO. The formulation of the Annual Implementation Plan 2019 by Xaysomboun WRPO will continue in December 2018.

The Bolikhamxay WRPO submitted a draft Annual Implementation Plan 2019 to EMO on 30 October 2018 and is being reviewed.

The Xaysomboun WRPO completed a field verification survey of the boundary of the Total Protection Zone 1 (TPZ Phou Samsao) and land uses in Hom District in the second week of

November 2018. The survey in TPZ1 (TPZ Phou Samsao) at Anouvong District and TPZ2 (TPZ Phou Khata) at Hom District was postponed until the completion of the re-structuring of Xaysomboun WRPC and WRPO. The survey will be continued in January 2019.

The improved first draft of NNP1 Biodiversity Offset Management Plan for Nam Chouane-Nam Xang (NCNX) Biodiversity Offset Site was submitted to ADB on 14 September 2018 for further review. ADB provided comments on 20 and 23 November 2018 whilst IAP provided comments on 28 November 2018. NNP1PC-EMO expects to discuss the schedule of Plan finalization and approval during the upcoming ADB and IAP mission planned during 10-15 December 2018.

The Biodiversity Offset Management Regulation was approved by Bolikhamxay Provincial Governor on 31 October 2018. BOMC Secretariat disseminated the regulation in six villages in the Offset Site during 21-30 November 2018.

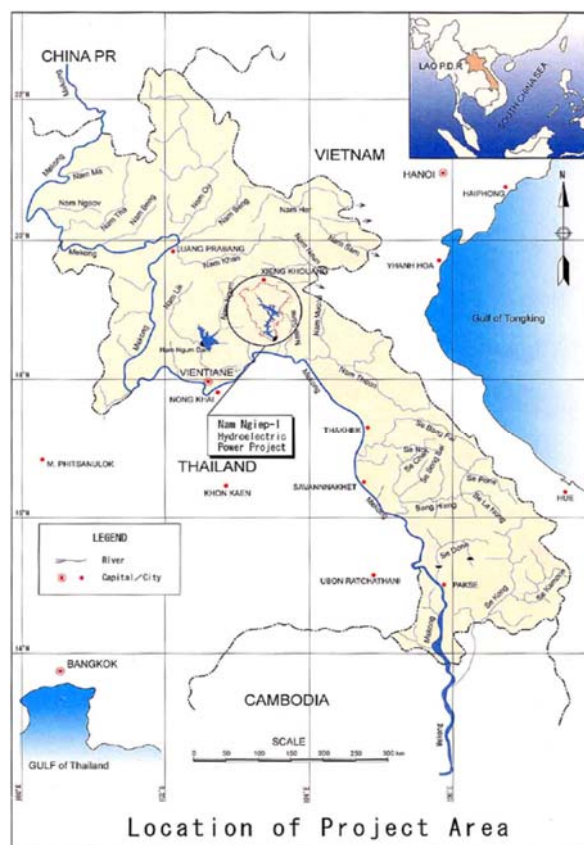
The fish catch monitoring for October 2018 in Nam Ngiep watershed was dominated by four species groups and one species which are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species, except *Hemibagrus filamentus* is classified as Data Deficient (DD). The recorded catch of Threatened and Near Threatened species (IUCN Red List classification) in October 2018 included two species that is classified as Endangered (EN), three Vulnerable (VU) species, and seven Near Threatened (NT) species.

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 Bolikhan 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 Bolikhan 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.

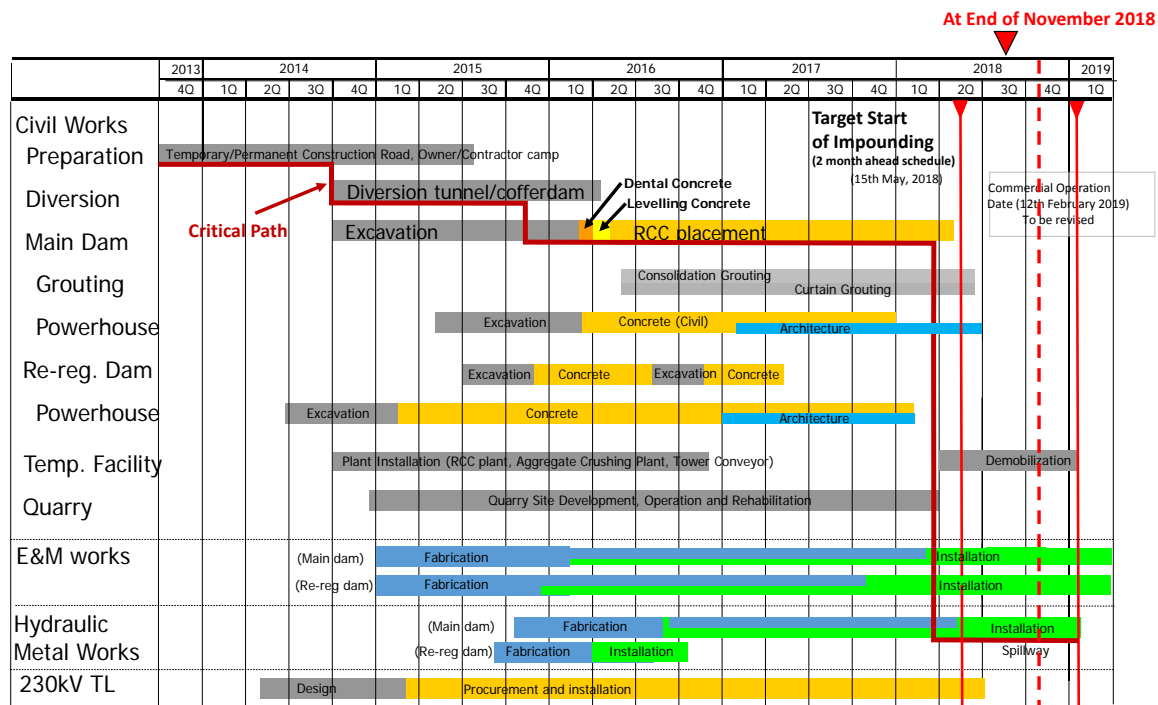
2. WORK PROGRESS OF PRINCIPAL CONTRACTORS

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 November 2018 was 97.5 %¹ (compared to planned progress of 98.3 %), 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 **Figure 2-1**.

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

¹ 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.

² 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 November 2018 was 98.6 % (compared to planned progress of 99.7 %) 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.

Table 2-1: Progress of Main Powerhouse Sub-Structure Concrete Works to as 30 November 2018.

Location	Total Anticipated Volume (m ³)	Completed (m ³)	Progress (%)
Main Powerhouse	34,800	34,800	100
Penstock Embedment	11,885	11,885	100
Spillway	35,500	35,000	99

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 2-2** below:

Figure 2-2: Completed Re-regulation Dam and Powerhouse at the End of June 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.

The second diversion to divert the river from the diversion tunnel through the bottom outlet or conduit in the dam was implemented on 13 January 2018.

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 November 2018 was 98.8 % (compared to planned progress of 98.8 %).



Figure 4.2-1: Upper shaft levelling measurement for Unit 1



Figure 4.2-2: Lower shaft inclination measurement for Unit 1



Figure 4.2-3: Turbine shaft inclination measurement for Unit 1



Figure 4.2-4: Turbine bottom cover levelness measurement for Unit 1



Figure 4.2-5: Upper shaft levelling measurement for Unit 2



Figure 4.2-6: Assembly of platform for turbine pit for Unit 2



Figure 4.2-7: Disassembly of loose flange for Unit 2



Figure 4.2-8: Backfilling with gravel in transformer oil pit



Figure 4.2-9: Parameter values setting for AVR and excitation system



Figure 4.2-10: Displaying of SCADA on large screen monitor



Figure 4.2-11: Operation test of dehumidifier for generator



Figure 4.2-12: Megger test of high volt cable after proceeding dried condition for generator



Figure 4.2-13: Assembly of oil head equipment and oil pipe system



Figure 4.2-14: Operation test of servomotor stroke relationship with guide van with close & open

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 November 2018 was 90 % (compared to planned progress of 90 %). The main activities carried out during this month are described below:

Figure 2-3: Progress of Spillway Gate Erection at the Main Dam at the End of November 2018.

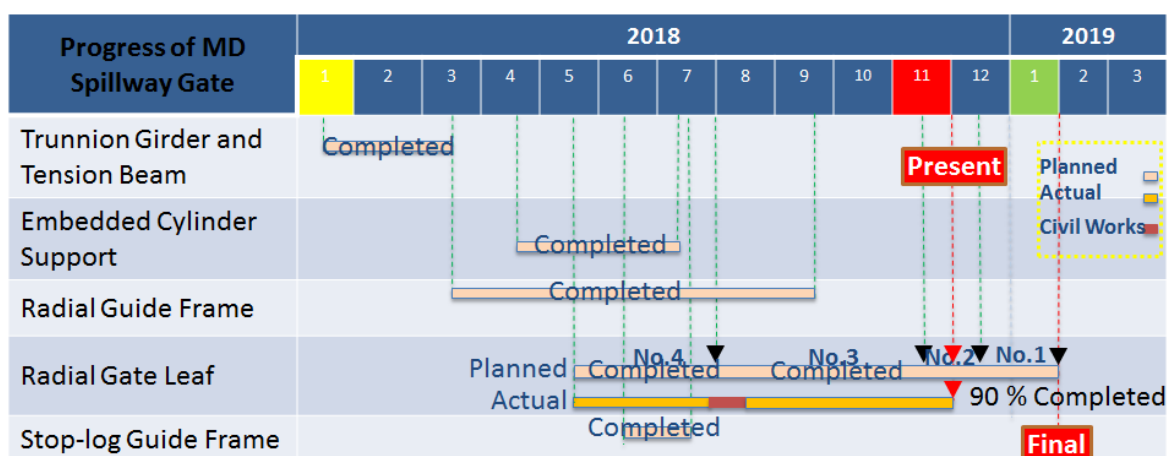


Figure 2-4: Progress of Spillway Gate Erection at the Main Dam in November 2018



Figure 2-5: Spillway used for discharge over stop-logs from the Spillway Gate No. 4 at the Main Dam in November 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 June 2018 was 100 % (compared to planned progress of 100 %).

Figure 2-6: Tower No. 3



Figure 2-7: Preparation for Megger Test Section PWH-T3 & Visual Check along the Line Route before the Energization Test

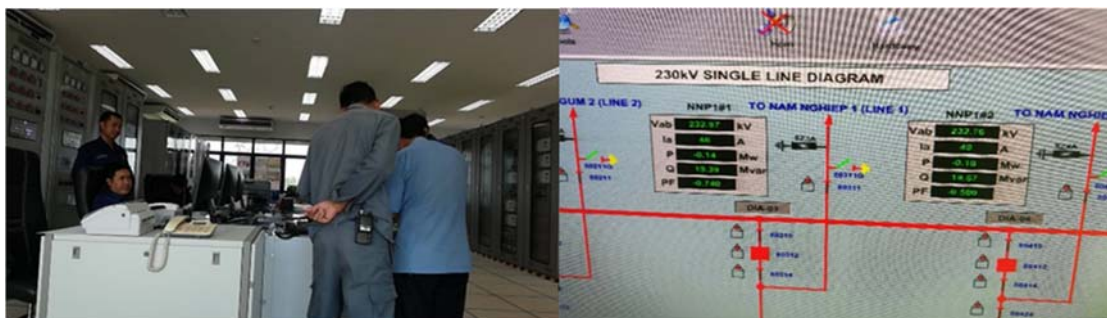
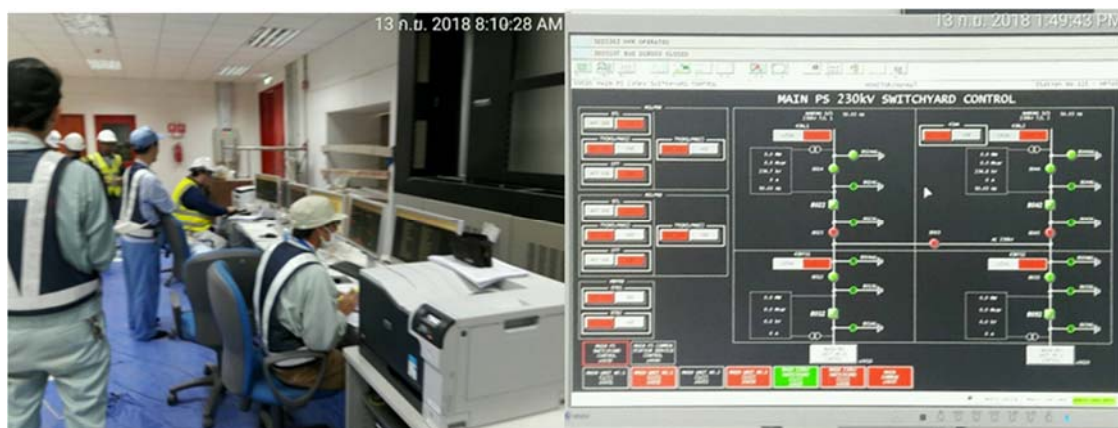


Figure 2-8: The energization work for the 230 kV Transmission Line from Nabong Substation to Main Power House NNP1



3. ENVIRONMENTAL MANAGEMENT MONITORING

3.1 Compliance Management

3.1.1 Site Specific Environmental and Social Management and Monitoring Plans

In November 2018, the Environmental Management Office (EMO) of Nam Ngiep 1 Power Company (NNP1PC) received two Site Specific Environmental & Social Management and Monitoring (SS-ESMMPs) and one Site Decommissioning and Rehabilitation Plan for review and approval.

Table 3-1: SS-ESMMP review status in November 2018

Title	Date Received	Status
Site Decommissioning and Rehabilitation Plan for KENBER Camp	02 November 2018 (1 st submission)	EMO has instructed the contractor to strictly comply with the overall Construction Site Decommissioning and Rehabilitation Plan issued on 26 September 2018. EMO will continue to inspect weekly and instruct the contractor as necessary
Site Specific Environmental & Social Management and Monitoring Plan (SS-ESMMP) for Main Dam Excavation	21 November 2018 (Revision A2)	The revised documents addressing NNP1PC comments were submitted on 30 November 2018. They are under review.
SS-ESMMP for Spoil Disposal on the Left Bank	21 November 2018 (Revision A3)	

3.1.2 Compliance Report

The status of compliance reports (Observation of Non-Compliance, ONC, Non-Compliance Report, NCR) issued by NNP1PC to the contractors is summarized in

Table 3-2 below.

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

Items	ONC	NCR-1	NCR-2	NCR-3
Carried over from October 2018	3	0	0	0
Newly Opened in November 2018	1	1	1	0
Total in November 2018	4	0	1	0
Resolved in November 2018	4	0	0	0
Carried over to December 2018	0	1	1	0
Unsolved Exceeding Deadlines	0	1	1	0

3.1.3 Inspection by Environment Management Unit

The monthly site inspection by the Environmental Management Unit (EMU) of Bolikhamxay Province was carried out during 27 - 28 November 2018. The inspection report will be submitted to EMO by early December 2018.

3.2 Environmental Quality Monitoring

The analyses of Total Suspended Solids (TSS), Biochemical Oxygen Demand (BOD₅), faecal coliform, E. Coli bacteria and total coliform have been carried out by NNP1PC Environmental Laboratory since August 2017.

All data are reported to the Ministry of Natural Resources and Environment (MONRE) and the Project Lenders on a monthly and quarterly basis and published on the Company website <https://namngiep1.com/resources/monitoring-reports/>.

3.2.1 Effluent Discharge from Camps and Construction Sites

Detailed monitoring results are provided in **Annex B** of this Report. The effluent monitoring results for the camps in November 2018 indicate that the measurements of BOD₅, COD, faecal coliform and total coliform comply with the relevant effluent standards, except for Owner's Site Office and Village, Zhefu Camp, HM Main Camp and IHI Field Shop 276 Camp. Most of the camps struggle compliance with total nitrogen and ammonia nitrogen, except IHI Camp.

Following the completion of the RCC placement work at the Main Dam by the end of April 2018, the production at the aggregate crushing plant and the RCC plant has stopped and the associated sediment retention ponds are therefore no longer in operation.

EMO discontinued the water sampling at RCC Plant, Aggregate Crushing Plant, Sino Hydro Camp and Kenber Camp due to these sites were decommissioned in November 2018.

The results of effluent monitoring of the camps and the construction sites are presented in **Table 3-3**.

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

Site	Sampling ID	Status	Corrective Actions
Owner's Site Office and Village (OSOV)	EF01	Non-compliance for total coliform, faecal coliform, total nitrogen, ammonia-nitrogen and total coliform.	A discussion meeting with NNP1PC-Admin Department was conducted in August, October and November 2018 on the corrective actions. The maintenance of the WWTS is underway and expected to be completed by mid-December 2018.
Obayashi Corporation Camp	EF02	Non-compliance for total nitrogen and ammonia-nitrogen.	In the October 2018 monthly progress meeting, NNP1PC instructed OC to improve the operation and maintenance of the WWTS. On 02 November 2018, the Site Inspection Report was also issued to the Contractor to improve the wastewater piping system, reeds and water circulation system.
SongDa5 Camp No. 1	EF07	Non-compliance for ammonia nitrogen and total nitrogen.	The Site Inspection Report was issued to the contractor on 02 November 2018 to improve the maintenance of the wetland and improve chlorination and the water mixing system.
Song Da 5 Camp No. 2	EF08	Non-compliance for ammonia nitrogen and total nitrogen.	The effluent monitoring result were provided to the Contractor to improve the operation of the WWTS.
Zhefu Camp (Subcontractor of Hitachi-Mitsubishi Hydro)	EF09	Non-compliance for BOD ₅ , COD, total coliform, faecal coliform, ammonia nitrogen and total nitrogen. However,	As above

Site	Sampling ID	Status	Corrective Actions
		BOD ₅ , total coliform and faecal coliform were complied with the standard in second fortnightly mission.	
V&K Camp	EF10	Non-compliance for total nitrogen.	As above
HMH Main Camp (WWTS)	EF13	Non-compliance for BOD ₅ , COD, total coliform, faecal coliform, ammonia nitrogen and total nitrogen. However, BOD ₅ , total coliform and faecal coliform were complied with the standard in second fortnightly mission.	Following NNP1PC's instructions made during the October 2018 monthly progress meeting, in November, the wetland reeds were replanted and sludge from chlorination system was cleaned up.
IHI Main Camp	EF14	Non-compliance for COD in the second fortnight mission.	As above
Lilama10 Camp	EF17	No discharge during the sampling mission.	
IHI Field Shop 276 Camp	EF18	Non-compliance for BOD ₅ , COD, total coliform, faecal coliform, ammonia nitrogen and total nitrogen. However, they all were complied with the standard in second fortnightly mission.	The effluent monitoring result were provided to the Contractor to improve the operation of the WWTS.
Spoil Disposal Area No.2 (SongDa 5 Workshop)	DS04	Minor non-compliance for pH on 14 November 2018.	The upstream monitoring point will be included from December 2018
CVC Plant	DS03	No waste water discharge during the sampling missions.	

3.2.2 Ambient Surface Water Quality Monitoring

The ambient surface water quality monitoring programme comprises of 5 monitoring stations in the main reservoir (R1-R5), 2 stations in the re-regulation reservoir (R6 and R7), 5 stations in the mainstream Nam Ngiep (NNG01 and NNG05-NNG08) and 4 stations in the main tributaries to Nam Ngiep (Nam Chiane, Nam Phouan, Nam Xao and Nam Houay Soup). Since September 2018, there has been no water quality data for Nam Phouan (NPH01) due to the blockage of access to the sampling station by floating debris. EMO already requested a debris removal Contractor

In addition, the weekly depth profile monitoring (pH, DO, Conductivity, TDS and Temperature) was started on 18 September 2018 for stations located in the re-regulation and main reservoirs. The October 2018 programme is summarized in **Table 3-4** and the location of the monitoring stations are shown in **Figure 3-1**.

Table 3-4: Monitoring Frequency for Surface Water Quality Parameters

Frequency of Monitoring	Parameters (Unit)	Monitoring Sites
Saturday	pH, DO (%), DO (mg/l), Conductivity ($\mu\text{S/cm}$), TDS (mg/l), Temperature ($^{\circ}\text{C}$) and Turbidity (NTU)	<ul style="list-style-type: none"> - R5, main reservoir immediately upstream the main dam; - NNG05, Nam Ngiep downstream the re-regulation dam at Hat Gniun Village
Weekly	pH, DO (%), DO (mg/l), Conductivity ($\mu\text{S/cm}$), TDS (mg/l), Temperature ($^{\circ}\text{C}$), Turbidity (NTU), TSS (mg/l), BOD ₅ (mg/l), Faecal coliform (MPN/100 ml), Total coliform (MPN/100 ml) and Hydrogen sulphide (mg/l)	<ul style="list-style-type: none"> - Main Reservoir: R1, R2, R3, R4, R5 - Re-regulation Reservoir: R6, R7 - Nam Ngiep downstream: NNG05 - Tributaries: NPH01, Nam Phouan
Fortnightly	pH, DO (%), DO (mg/l), Conductivity ($\mu\text{S/cm}$), TDS (mg/l), Temperature ($^{\circ}\text{C}$), Turbidity (NTU)	All stations
Monthly	TSS (mg/l), BOD ₅ (mg/l), COD (mg/l), NH ₃ -N (mg/l), NO ₃ -N (mg/l), total coliform (MPN/100 ml), faecal coliform (MPN/100 ml)	All stations

The monitoring results for key parameters (dissolved oxygen, Total Suspended Solids and BOD) since the start of impounding are presented in **Table 3-5**, **Table 3-6**, and **Table 3-7** and the full set of data for October 2018 is attached in Annex A. In addition, the results for dissolved oxygen are presented as line graphs in **Figure 3-2**.

Re-regulation Reservoir

The level of dissolved oxygen (DO) in both R6 and R7 have remained well above 6.3 mg/L in the whole water column and with water temperatures unchanged from the surface to the bottom of the reservoir. There are no indications of a thermocline.

Main Reservoir

At R5, the DO level in the upper 7.0 m fluctuated from about 5.57 mg/L to 8.17 mg/L. The entire water column below 8.5 m until the bottom had DO levels below 1.36 mg/L. The DO concentrations at R3 and R4 were between 6.19 mg/L to 9.12 mg/L in the upper 4.0 m and decreased to less than 2.53 mg/L below 8.0 m until the bottom. The DO concentrations at R1 was about 7 mg/L for the entire water column.

The temperature measurements indicate the start of formation of a thermocline in R3-R5, but not yet in R1.

As expected, the TSS concentrations in the main reservoir have been consistently very low since the start of impounding with a mean in R4 and R5 of 5 mg/L compared to high flow season means of about 100 mg/L – 250 mg/L and low flow season means of 20 mg/L - 50 mg/L.

The BOD₅ measurements show – as expected – increasing levels in R3, R4 and R5 in the main reservoir since about one month into impounding.

Figure 3-1: Surface Water and Re-Regulation Reservoir Water Quality Monitoring Stations

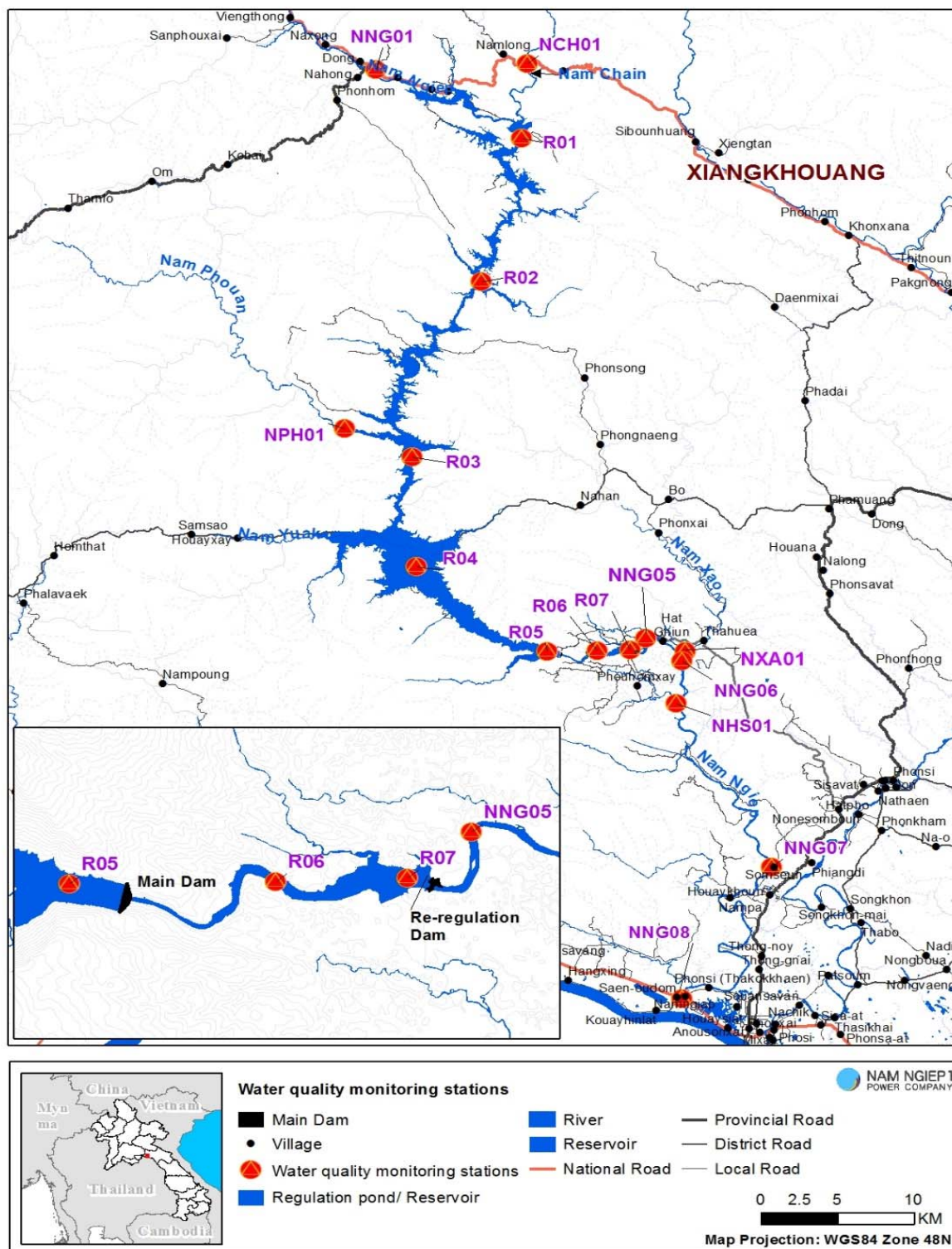


Figure 3-2: Concentration of Dissolved Oxygen since the Start of Impounding

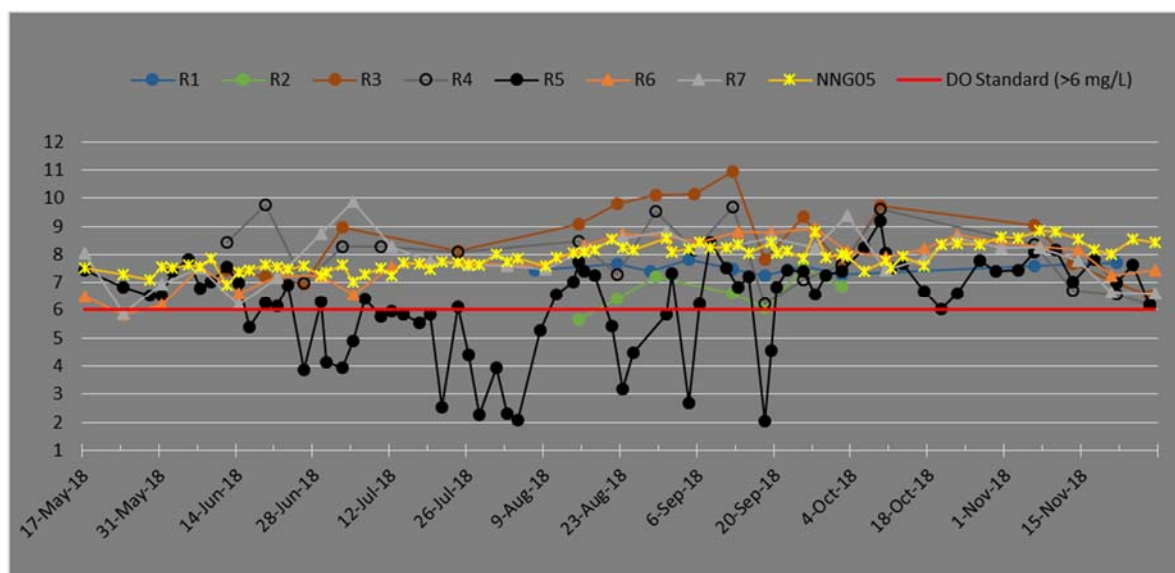


Table 3-5: Results of Surface Water Quality Monitoring for Dissolved Oxygen (mg/L) - in the upper 0.5 m - Water Quality Standard: > 6.0 mg/L

Dissolved Oxygen (mg/L)	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
3-Nov-18						7.45			8.57							
6-Nov-18	8.19	7.61		9.03	8.36	8.1							8.51			
7-Nov-18							8.29	8.25	8.87	8.33	8.15	8.16			7.43	7.76
10-Nov-18						8.15			8.82							
13-Nov-18				7.69	6.73	7.01										
14-Nov-18							8.18	7.79	8.55							
17-Nov-18						7.84			8.18							
20-Nov-18							7.25	6.66	8.02	7.58	7.7	7.63			7.49	7.13
21-Nov-18	8.3	7.72		6.97	6.56	7							8.92			
24-Nov-18						7.64			8.53							
27-Nov-18				6.54	6.19	6.2										
28-Nov-18							7.46	6.6	8.44							

Table 3-6: Results of Surface Water Quality Monitoring for Total Suspended Solids (mg/L) - Water Quality Standard: No Standard

Total Suspended Solids (mg/L)	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
6-Nov-18	54.03	<5		<5	<5	<5							8.23			
7-Nov-18							6.59	6.57	9.79	13.11	19.14	7.64			<5	6.84
13-Nov-18						<5										
14-Nov-18							26.35	9.83	14.66							
20-Nov-18							12.19	8.43	9.35							
21-Nov-18						<5										

Total Suspended Solids (mg/L)	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
27-Nov-18						<5										
28-Nov-18							14.28	13.22	7.9							

Table 3-7 Results of Surface Water Quality Monitoring for BOD5 (mg/L) - Water Quality Standard: < 1.5 mg/L

BOD5 (mg/L)	NNG01	R1	R2	R3 (NNG02)	R4 (NNG03)	R5 (NNG09)	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
6-Nov-18	2.11	1.1		<1.0	<1.0	<1.0							<1.0			
7-Nov-18							<1.0	<1.0	<1.0	<1.0	<1.0	<1.0			<1.0	<1.0
13-Nov-18						<1.0										
14-Nov-18							<1.0	<1.0	<1.0							
20-Nov-18							<1.0	<1.0	<1.0							
21-Nov-18						<1.0										

3.2.3 Groundwater Quality Monitoring

During November 2018, community groundwater quality analysis was carried out for four water-wells located in Somseun Village, Nam Pa Village, Thong Noi Village and Pou Village.

All results of community groundwater complied with the groundwater quality standards for water supply purposes.

Table 3-8: Groundwater Quality Monitoring Results, Somsuen, Nam Pa, Thongnoi and Pou Villages

	Site Name	Somseun Village	NamPa Village	ThongNoy Village	Pou Village
	Station	GSXN01	GNPA01	GTHN01	GPOU01
Parameter (Unit)	Guideline				
pH	6.5 - 9.2	7.39	7.63	7.66	6.68
Sat. DO (%)		85.3	90.3	80.5	92.3
DO (mg/l)		6.44	70.5	6.11	6.96
Conductivity (µS/cm)		261	365	326	17.52
TDS (mg/l)		130.5	182.5	163	8.76
Temperature (°C)		28.6	26.8	28.3	27.8
Turbidity (NTU)	<20	0.65	0.73	0.6	2.58
Fecal coliform (MPN/100 ml)	0	0	0	0	0
E.coli Bacteria (MPN/100 ml)	0	0	0	0	0

3.2.4 Gravity Fed Water Supply (GFWS) Quality Monitoring

During November 2018, water samples from water taps at Thahuea Village, Hat Gniun Village and Phouhomxay Village were analysed. The WPHX01 sample was collected from the intake of the GFWS.

The results of the water quality analyses are presented in **Table 3-9**. All parameters complied with the National Drinking Water Standards except for faecal coliforms and E.Coli at WTHH02, WHGN02, WPHX01 and WPHX02 stations. The villagers were informed about the results and encouraged to boil the water before drinking.

Table 3-9: Result Gravity Fed Water Supply (GFWS) Quality Monitoring

		Site Name	Thaheau Village	Hat Gnuin Village	Phouhomsay Village		
		Station	WTHH02	WHGN02	WPHX01	WPHX02	WPHX03
Date	Parameter (Unit)	Guideline					
19-Nov-18	pH	6.5 - 8.6	7.76	7.6	8.02	8.14	7.83
19-Nov-18	Sat. DO (%)		102.2	101.3	102.5	101.5	96.2
19-Nov-18	DO (mg/l)		7.85	7.86	8.29	7.56	7.28
19-Nov-18	Conductivity (µS/cm)	<1,000	43.8	59.8	7.02	9.57	8.7
19-Nov-18	TDS (mg/l)	<600	21.8	29.4	3.5	4.7	4.3
19-Nov-18	Temperature (°C)	<35	27.3	27.2	24.8	28.9	28.2
19-Nov-18	Turbidity (NTU)	<10	1.59	2.07	0.83	0.86	0.74
19-Nov-18	Faecal Coliform (MPN/100 ml)	0	7.8	7.8	4.5	2	0
19-Nov-18	E.coli Bacteria (MPN/100 ml)	0	4.5	4.5	4.5	2	0

3.2.5 Landfill Leachate Monitoring

During November 2018, the landfill leachate monitoring was conducted at NNP1 Project Landfill (last pond – LL4) and at Houay Soup Solid Waste Landfill (last pond – LL6).

The results indicate that the treated leachate of both landfills complies with the relevant effluent standards.

Table 3-10: Landfill Leachate Monitoring Results

	Site Name	NNP1 Landfill Leachate	Houay Soup Landfill
	Location	Pond No.04	Last Pond
	Station	LL4	LL6
	Date	16-Nov-18	16-Nov-18
Parameter (Unit)	Guideline		
pH	6.0-9.0	8.12	8.09
Sat. DO (%)		125.8	119.8
DO (mg/l)		9.17	8.62
Conductivity (µS/cm)		152.1	214.5
TDS (mg/l)		76	107

	Site Name	NNP1 Landfill Leachate	Houay Soup Landfill
	Location	Pond No.04	Last Pond
	Station	LL4	LL6
	Date	16-Nov-18	16-Nov-18
Parameter (Unit)	Guideline		
Temperature (°C)		30.4	31.2
Turbidity (NTU)		4.93	6.24
BOD (mg/l)	<30	7.5	7.68
COD (mg/l)	<125	46.4	42.7
Faecal Coliform (MPN/100 ml)	<400	0	0
Total Coliform (MPN/100 ml)	<400	33	23

3.2.6 Dust Monitoring

The results indicate that the dust levels at all monitoring stations complied with the National Standard. The results were shared with EMO-compliance and TD-safety teams as a reference for inspection to ensure proper establishment of health and safety procedures (traffic access restriction, wear proper personal protective equipment including masks and eye protection).

3.2.7 Noise Monitoring

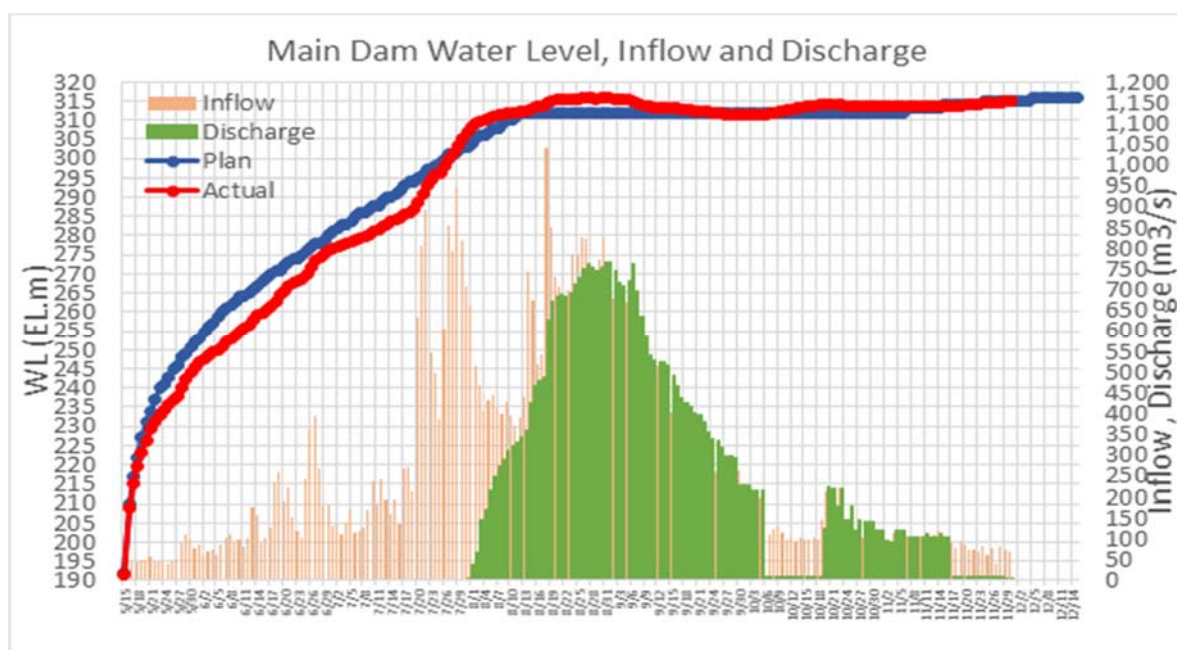
During November 2018, noise monitoring was conducted for 72 consecutive hours at Hat Gniun Village and Phouhomxay Village, and for 24 consecutive hours at the Main Dam, Lilama 10 Camp, and the Main Powerhouse.

The results indicate that the recorded maximum noise levels complied with the standard for all stations.

Due to windy conditions during the monitoring periods, the average night-time noise levels exceeded the relevant noise standard at Phouhomxay Village and Lilama 10 Camp; and due to a community ceremony held on 13-14 November 2018 in Hat Gniun Village nearby the monitoring station, the average evening-time noise level at exceeded the standard. At the Main Powerhouse, the noise generated by the plunging water from the spillway contributed to average daytime noise levels exceed the standard.

3.2.8 Discharge Monitoring

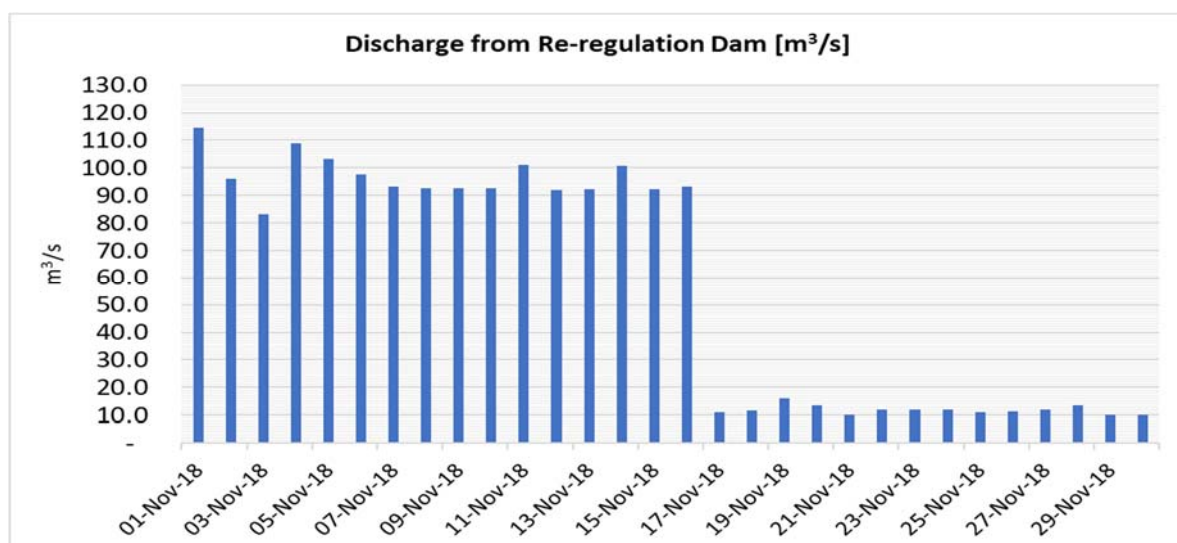
The progress of impounding from 15 May 2018 to 31 October 2018 is presented on the graph in **Figure 3-3** indicating the water level in the main reservoir, the inflow to the main reservoir and the discharge from the main reservoir into the re-regulation reservoir. The inflow data shows the gradual reduction in flows towards the end of the wet season from about 215 m³/s at the beginning of October 2018 to about 68 m³/s at the end of November 2018.

Figure 3-3: Progress of Impounding the Main Reservoir

On 17 November 2018 the impounding of the main reservoir was restarted and the water level in the reservoir has since then risen with 1.4 m from 312.6 masl to 314.9 masl. In the same period, the discharges from the main dam and the re-regulation dam were reduced (see **Figure 3-4**) and maintained at about 8 m³/s - 10 m³/s, which is well above the minimum flow requirement of 5.5 m³/s.

The changes in the discharge from the re-regulation dam were informed in advance to the RMU and to the heads of the downstream villages, who then announced the changes to the communities over the village speaker systems.

During the restarted impounding, the water level in the re-regulation reservoir was lowered to about 173 masl (Normal Water Level is 179 masl) and this combined with the reduced spillway discharge has enabled various construction works and plunge pool excavations near the main dam to be undertaken

Figure 3-4: Discharge Monitoring at the Re-regulation Dam.

3.2.9 Nam Ngiep Downstream Water Depth Monitoring

In November 2018, EMO carried out five boat missions to monitor the water depth in Nam Ngiep downstream of the re-regulation dam. EMO has currently identified 19 sites with potential shallow water depths. The monitoring showed that all these sites had water depths from 0.15 – 2.95 m and some difficulties navigating the river were recorded for 5 sites on 22 November 2018 and 9 sites on 29 November 2018 due to the reduced discharge from the re-regulation dam as mentioned in Section 1.3 above.

3.3 PROJECT WASTE MANAGEMENT

3.3.1 Solid Waste Management

In November 2018, a total of 92.7 m³ of solid waste was disposed of at the NNP1 Project Landfill, a decrease of 27.7 m³ compared to October 2018. During November 2018, EMO conducted three waste spot checks at the NNP1 Project Landfill, construction sites and the camps. It was found that waste management of the construction sites and camps was improved. The closure of NNP1PC Project landfill pit No.1 was completed in November 2018, the main work components include waste compaction, soil and HDPE sheet cover and grass planting.

A total of 2,345 kg of recyclable waste was sold to Khounmixay Processing Factory by the Contractors.

Table 3-11: Amounts of Recyclable Waste Sold

Source and Type of Recycled Waste		Unit	Sold	Cumulative Total by 30 November 2018
Construction Activity				
1	Scrap metal	kg	2,055	38,113
Sub-Total 1		kg	2,055	38,113
Camp Operations				
2	Glass bottles	kg	72	146
3	Plastic bottles	kg	113	67
4	Paper/Cardboard	kg	61	90
5	Aluminium cans	kg	44	26.5
Sub-Total 2		kg	290	329.5
Grand Total 1+2		kg	2,345	38,442.5

The villagers of Phouhomsay Village collected a total of 4,048 kg of food waste from selected camps, an increase of 2,723 kg compared to October 2018, for animal feeding in November 2018.

Table 3-12 Amounts of Food Waste Collected by Villagers

No.	Site Name	Unit	Total
1	Song Da5 Camp No. 2	kg	690
2	Song Da5 Camp No. 1	kg	373
3	Obayashi Corporation Camp	kg	656
4	Owner's Village and Site Office (OSOV)	kg	1,360
5	LILAMA 10 Camp	kg	958
6	Kenber Camp	kg	11
Total		kg	4,048

3.3.2 Hazardous Materials and Waste Management

The types and amounts of hazardous waste collected and transported for offsite treatment and final disposed at Khounmixay processing factory in November 2018.

Table 3-13: Results of Hazardous Material Inventory

No.	Hazardous Waste Type	Unit	Total in 11-18(A)	Disposed (B)	Remainder (A - B)
1	Used hydraulic and engine oil	Litre	6,100	1,230	4,870
2	Contaminated soil, sawdust and concrete	bag	515	0	515
3	Used oil filters	Piece	202	0	202
4	Used oil mixed with water	Litre	200	0	200
5	Used tyre	Piece	196	0	196
6	Ink cartridge	unit	177	0	177
7	Halogen/fluorescent bulbs	unit	145	0	145
8	Empty paint and spray cans	ca	114	0	114
9	Empty used chemical drum/container	Drum (200L)	52	0	52
10	Empty contaminated bitumen drum/container	Drum (200L)	93	48	45
11	Contaminated textile and material	kg	27	0	27
12	Lead acid batteries	unit	22	0	22
13	Empty used oil drum/container	Drum (20 L)	47	31	16
14	Lithium-ion batteries	unit	7	0	7
15	Clinic Waste	Kg	4.4	0	4.4
16	Empty used oil drum/container	Drum (200 L)	4	0	4
17	Empty used chemical drum/container	Drum (20 L)	0	0	0
18	Acid and caustic cleaners	Bottle	0	0	0
19	cement bag	bag	0	0	0

3.4 Community Waste Management

3.4.1 Community Recycling Programme

In November 2018, a total of 2,116 kg of recyclable waste was recorded at the Community Waste Bank, an increase of 451 kg compared to October 2018.

Table 3-14: Types and Amounts of Recyclable Waste Traded at the Community Waste Bank

Types of Waste	Unit	Remaining in Oct 2018	Additions in Nov 2018	Sold	Remaining in Nov 2018
Scrap metal	kg	0	0	0	0
Glass bottles	kg	1,611.5	141	0	1,752.5
Paper/cardboard	kg	33	247.5	0	280.5
Aluminium cans	kg	10.5	0	0	10.5
Plastic bottles	kg	9.5	62.5	0	72
Total	kg	1,664.5	451	0	2,115.5

3.4.2 Community Solid Waste Management

In November 2018, approximately 121 m³ of solid waste was collected from Phouhomxay, Thahuea and Hat Gniun villages. The solid waste was transported to Houay Soup Landfill where recyclable materials were segregated before being disposed of at the landfill.

3.5 Watershed and Biodiversity Management

3.5.1 Watershed Management

3.5.1.1 Preparation of the Watershed Management Plan

NNP1PC re-submitted the improved final Watershed Management Plan (WMP) to ADB on 5 November 2018 and received feedback on 22 November 2018. The Plan is being further improved by EMO. The comments provided by ADB and IAP including the deadlines for final approval by ADB will be discussed and agreed during the upcoming ADB and IAP mission scheduled during 10-15 December 2018.

A meeting between Xaysomboun Provincial Authority and Department of Forestry (DOF), Ministry of Agriculture and Forestry (MAF) on 23 November 2018 concluded that Xaysomboun WRPC and WRPO will be under the leadership of Xaysomboun Provincial Agriculture and Forestry (PAFO). In addition, the meeting also agreed that NNP1 WMP will be approved by the Minister of MAF while the Annual Implementation Plan (AIP) will be approved by each Provincial Governor separately. In accordance with the resolution of the meeting, the Governor of Xaysomboun Province signed and issued an Agreement (No. 1134) on the re-structuring of the WRPC and WRPO on 29 November 2018.

The Bolikhamxay WRPO submitted the draft AIP 2019 to NNP1 EMO on 30 October 2018. The draft is being reviewed by NNP1 EMO. The formulation of AIP 2019 by the Xaysomboun Province will be continued in December 2018.

The Xaysomboun WRPO completed a field verification survey of the boundary for the Total Protection Zone 1 (TPZ Phou Samsao) and land uses in Hom District at the end of October 2018. The remaining surveys in TPZ1 (TPZ Phou Samsao) at Anouvong District and TPZ2 (TPZ Phou Khata) at Hom District was postponed until completion of the re-structuring of Xaysomboun WRPC and WRPO on 29 November 2018. The survey will be continued in January 2018 after completing the hand-over of tasks between the old and new departments.

The operation of checkpoint in Nahan Village (Bolikhan District, Bolikhamxay Province) continued in November 2018 while the operation of two checkpoints in Xaysomboun Province (Houaxay Village, Hom District and Pou Village, Thathom District) was postponed

pending fund disbursement that is related to the re-structuring of WRPC and WRPO. The checkpoint in Nahan Village made 78 records of people accessing the main reservoir. The main reasons found include fishing and hunting (17 records), agriculture (31 records), livestock raising (13 records) and other purpose (17 records).

A joint inspection between NNP1 EMO and Hom District authority (DAFO and DONRE) in NNP1 reservoir was conducted during 20-21 November 2018. Based on the inspection the parties agreed on the following key actions:

- DAFO and DONRE will request District Governor of Hom to issue a notification on preservation of the reservoir riparian buffer at 320-322 masl and that no structures will be allowed below 322 masl;
- Fisheries camps will be required to move to Vang Khiew port in Houayxay area (Hom District) and the camp's worker of (the salvage logging Contractor GOL will be required to move to land near port in Nahan side (Bolikhann District). The fishing group will be required to register themselves at Xaysomboun DAFO.
- It is necessary to install signage on the preservation of the reservoir riparian buffer (no structures below 322 masl, no littering in reservoir) at Vang Khiew in Hom District and Nahan port in Bolikhann District.

In connection to this, Xaysomboun WRPC have issued an official notification (No. 001) on 26 November 2018 to three districts in Xaysomboun (Anouvong, Hom, Tathom) to immediately stop all unauthorized activities (hunting camps, salvage logging boat, fishing camps, etc. from the reservoir area by 15 December 2018.

3.5.1.2 PREPARATION OF PROVINCIAL REGULATION FOR THE WATERSHED MANAGEMENT

Xaysomboun Provincial Authority and the Department of Forestry (DOF), Ministry of Agriculture and Forestry (MAF) held a meeting on 23 November 2018 and the chair of the meeting urged WRPO-PAFO to quickly improve the draft watershed management regulations and submit the regulations to the Provincial Assembly for endorsement followed by approval by the provincial Governor.

3.5.2 Biodiversity Offset Management

3.5.2.1 PREPARATION OF BIODIVERSITY OFFSET MANAGEMENT PLAN

The improved first draft of NNP1 Biodiversity Offset Management Plan (BOMP) for Nam Chouane-Nam Xang (NCNX) Biodiversity Offset Site was submitted to ADB and IAP on 14 September 2018 for further review. ADB provided comments during 20-23 November 2018 and IAP provided comments on 28 November 2018.

The comments and necessary revisions will be discussed and agreed during the upcoming IAP and ADB mission in December 2018.

3.5.2.2 PREPARATION OF PROVINCIAL REGULATION FOR BIODIVERSITY OFFSET MANAGEMENT IN NC-NX

The Biodiversity Offset Management Regulations was approved by Bolikhamxay Provincial Governor on 31 October 2018. The Biodiversity Offset Management Committee's (BOMC) Secretariat is disseminating this Regulation in six villages in the Offset Site during 21-30 November 2018.

3.5.2.3 Implementation of pre-Biodiversity Offset Management Plan

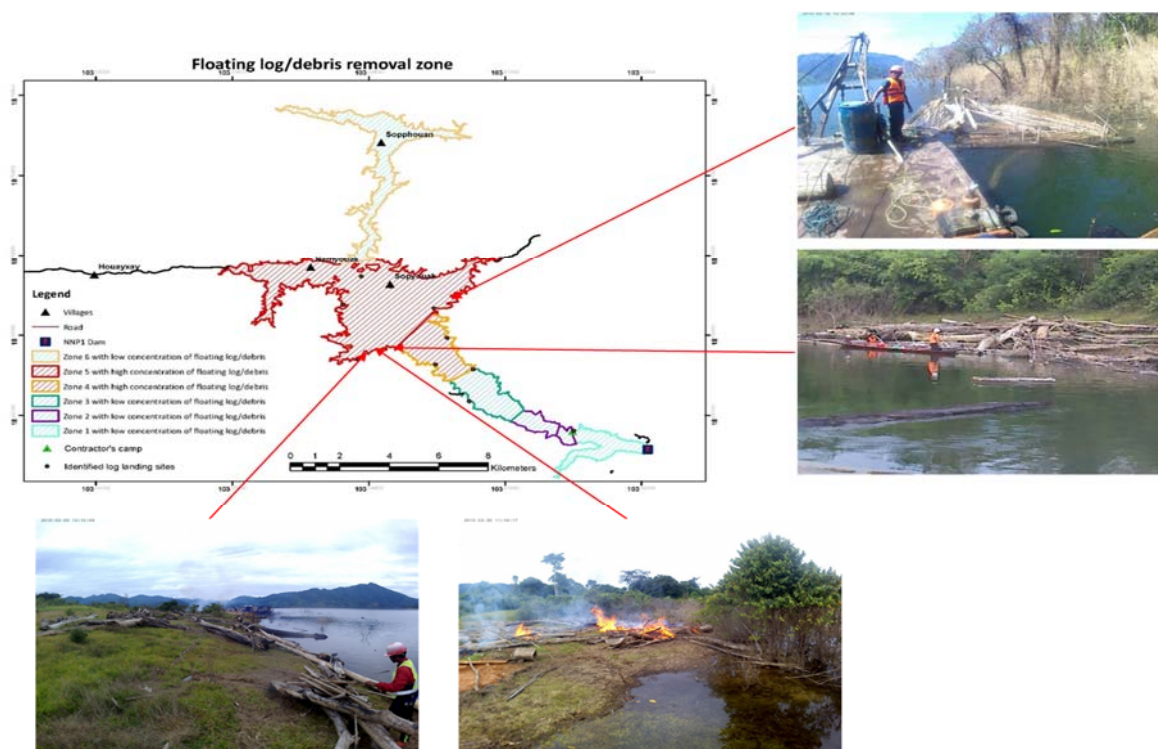
The Pre-BOMP-2B proposal was approved by ADB and agreed by BOMC at the end of September 2018. The fund was disbursed in October 2018 for the continuation of the activities especially the patrolling.

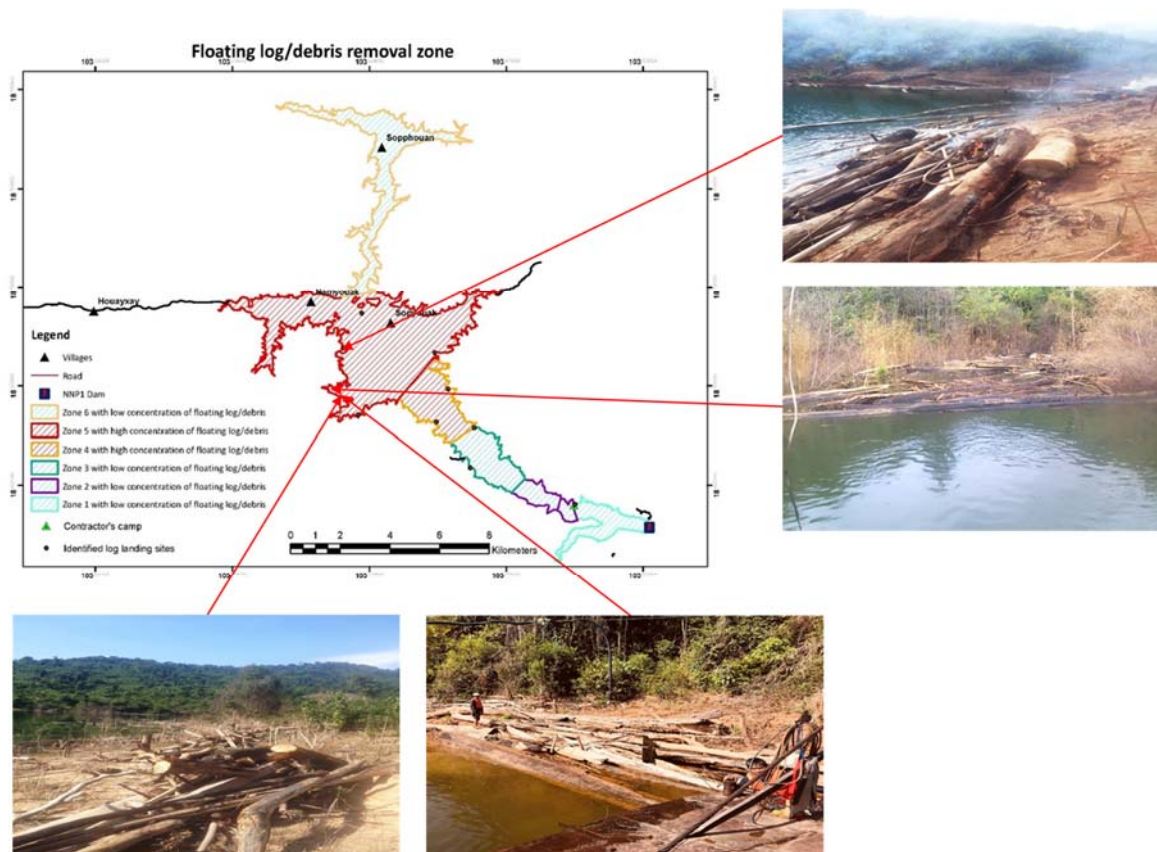
Two patrolling teams with a total of 18 people conducted forest patrolling for 16 days in both Viengthong and Xaychamphone District. The patrolling covered 10 small but significant biodiversity areas within the NC-NX Offset Site. The main threats found in the area are wildlife hunting and wire snares by local villagers. Nine temporary hunting camps and 165 small wire snares were recorded by Viengthong District's patrolling team whilst a total of 10 temporary hunting camps and 6 small wire snares were recorded by Xaychamphone District's patrolling team.

3.6 FLOATING DEBRIS REMOVAL

Floating debris removal work continued in November 2018 in the middle of reservoir in Zone 5. The field work focuses on capturing, tying and maintaining the floating debris/logs at the creeks within Zone 5 by a main team comprising of six staff using one big and one small boats. The burning of dried debris/log is being carried out in daily basis by two staff on land.

Figure 3-5: Representative photographs of floating debris and logs removal operation in Zone 5 in October 2018





4. FISHERY MONITORING

Three species groups and two species dominated the fish catch by weight in October 2018 as listed in *Error! Reference source not found.*. These species are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species², except *Hemibagrus filamentus* which is classified as Data Deficient.

The recorded catch of Threatened and Near Threatened species (IUCN Red List classification) in October 2018 is presented in **Table 4-2**. The list includes two species that is classified as Endangered (EN), three Vulnerable (VU) species, and seven Near Threatened (NT) species.

² The IUCN Red List of Threatened Species is the world's most comprehensive inventory and classification of threatened species. The Red List classifies species into nine groups: Extinct (EX), Extinct in the wild (EW), Critically endangered (CR), Endangered (EN), Vulnerable (VU), Near threatened (NT), Least concern (LC), Data deficient (DD), and Not evaluated (NE). The term "Threatened" includes Critically Endangered, Endangered, and Vulnerable.

Table 4-1: Fish Species dominating the Fish Catch in October 2018

Species	Fish Catch 10-18 (kg)	IUCN Red List Classification
<i>Poropuntius normani</i> , <i>Poropuntius laoensis</i>	652.8	LC
<i>Hampala dispar</i> , <i>Hampala macrolepidota</i>	390.5	LC
<i>Hemibagrus nemurus</i> , <i>Hemibagrus filamentus</i>	375.6	LC, DD
<i>Sikukia gudgeri</i> , <i>Amblyrhynchichthys truncatus</i>	324	LC, NE
<i>Channa striata</i>	299.7	LC

The recorded catch of Threatened and Near Threatened species (IUCN Red List classification) in October 2018 is presented in **Table 4-2**. The list includes one species that is classified as Critically Endangered (CR), one Endangered (EN), three Vulnerable (VU) species, and seven Near Threatened (NT) species.

Table 4-2: Threatened Species of September 2018 Fish Catch

Species	Fish Catch (kg)	IUCN Red List Classification
<i>Scaphognathops bandanensis</i>	46.9	VU
<i>Cirrhinus molitorella</i>	32.5	NT
<i>Ompok bimaculatus</i>	29.1	NT
<i>Bagarius bagarius</i>	22.5	NT
<i>Bangana behri</i>	21.9	VU
<i>Onychostoma gerlachi</i>	11.5	NT
<i>Probarbus jullieni</i>	6.1	EN
<i>Cyprinus carpio</i>	5.4	VU
<i>Bagarius yarrelli</i>	3.2	NT
<i>Neolissochilus stracheyi</i>	2.6	NT
<i>Luciocyprinus striolatus</i>	2.3	EN
<i>Syncrossus beauforti</i>	0.2	NT

The total recorded monthly fish catch for the downstream and upstream fishing households and the Mekong control group involved in the monitoring programme from July 2015 to October 2018 is presented in **Figure 4-1**. Note that the upstream fish catch excludes the fish catch from the fishing households in Zone 2LR because these households were resettled during Q4-2017.

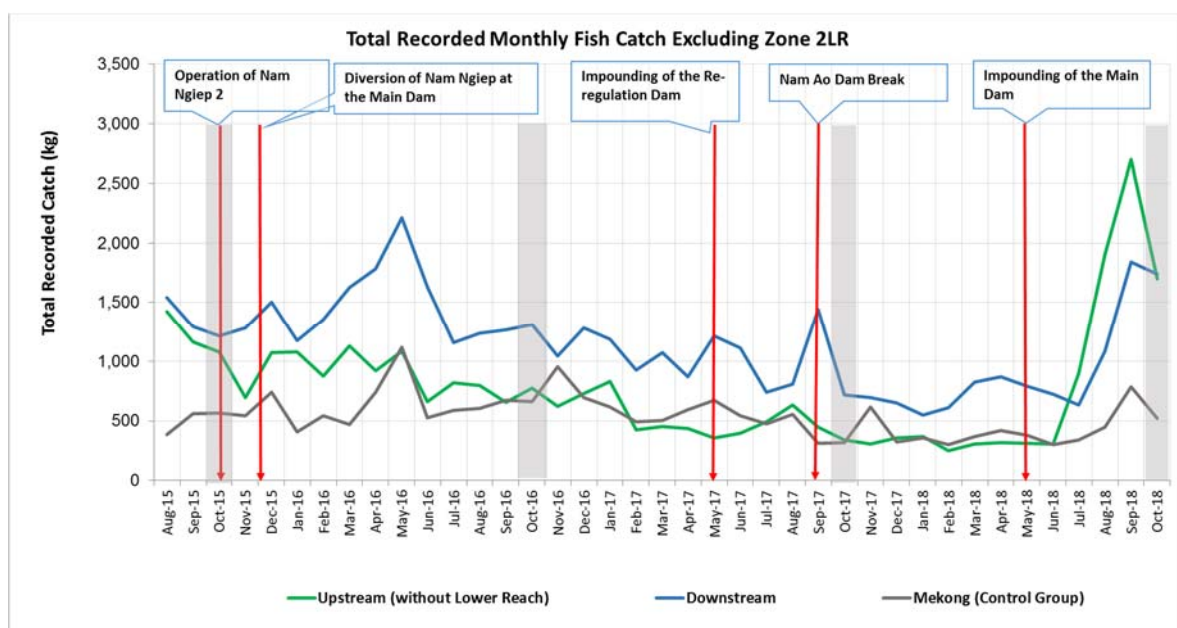
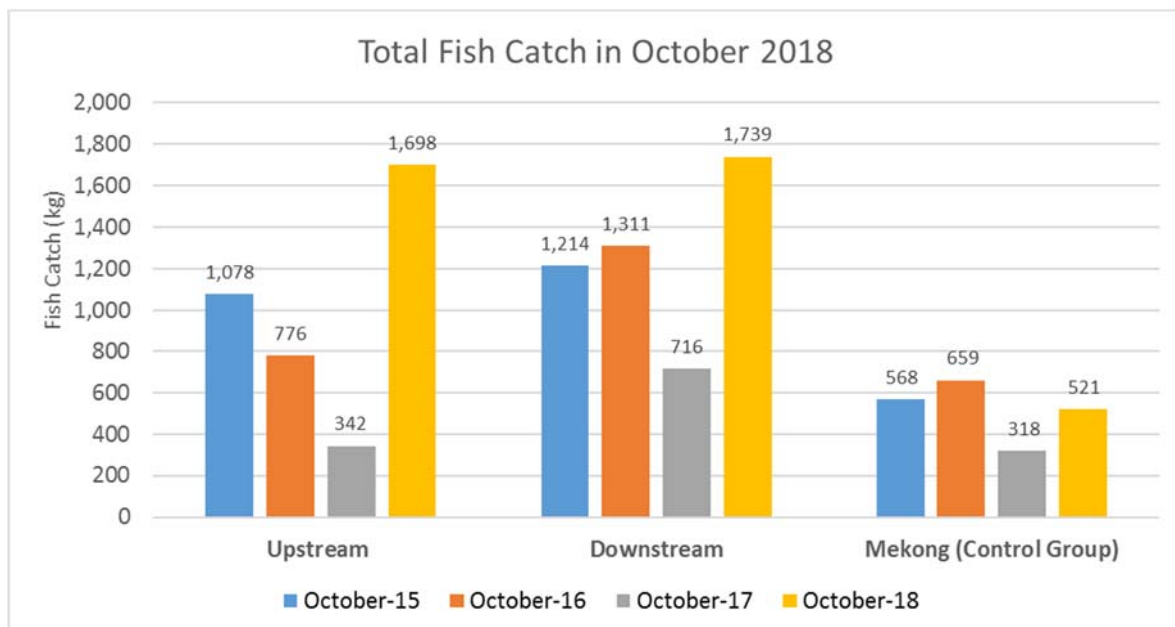
Figure 4-1: Total Recorded Monthly Fish Catch July 2015-October 2018

Table 4-3 and **Figure 4-2** show the total recorded fish catch for October 2015, October 2016, October 2017 and October 2018 in the upstream (excluding Zone 2LR) and downstream communities and the Mekong control group. The total fish catch data represents the total fish supply provided by the involved fishing households.

Table 4-3: Total Recorded Fish Catch by Upstream (Excluding Zone 2LR), Downstream and Mekong Control Group Fishing Households in October 2015, October 2016, October 2017 and October 2018

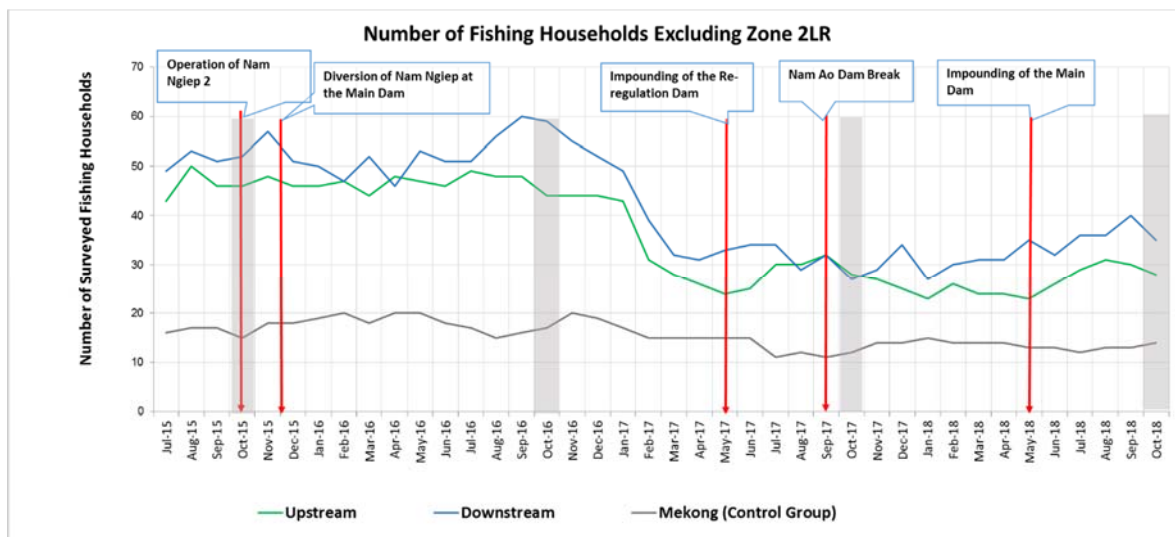
Fishing Zone	October 2015(kg)	October 2016 (kg)	October 2017 (kg)	October 2018 (kg)
Upstream	1,078	776	342	1,698
Downstream	1,214	1,311	716	1,739
Mekong Control Group	568	659	318	521

Figure 4-2: Total Recorded Fish Catch in July by Upstream (Excluding Zone 2LR), Downstream and Mekong Control Group Fishing Households

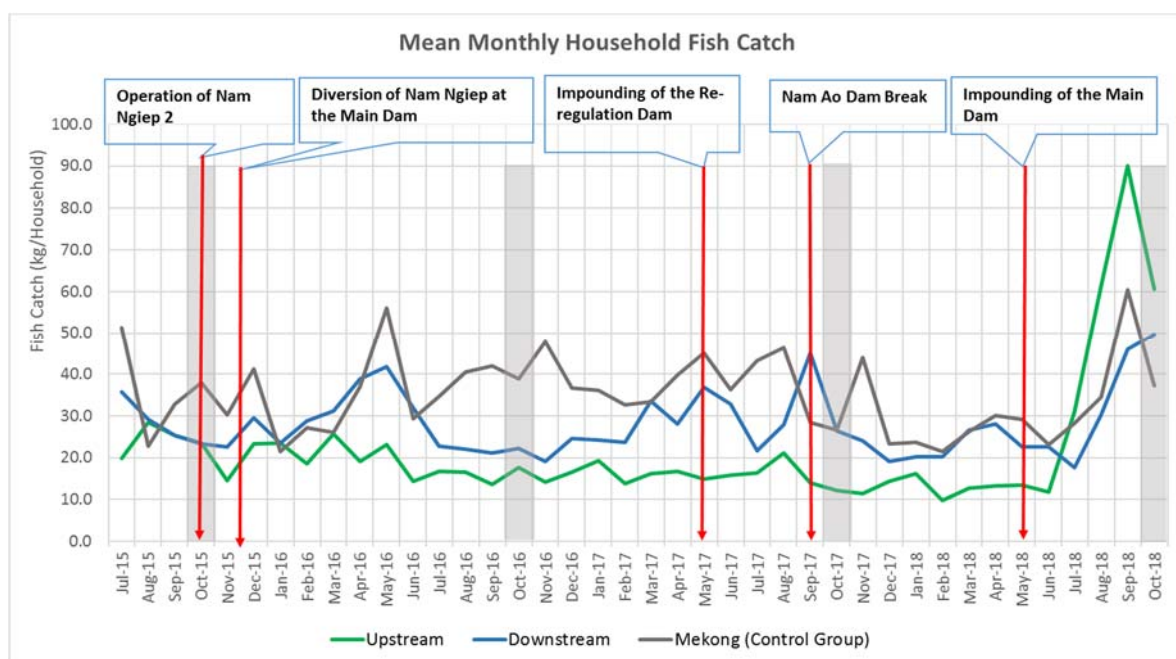


The numbers of fishing households involved in the fish catch monitoring programme are displayed in **Figure 4-3**.

Figure 4-3: Number of Fishing Households Involved in the Fish Catch Monitoring Programme



The mean monthly household fish catch from July 2015 to October 2018 for the upstream (excluding Zone 2LR) and downstream communities, and the Mekong control group are presented in **Figure 4-4**.

Figure 4-4: Mean Monthly Household Fish Catch without Zone 2LR

The mean household fish catch for October 2015, October 2016, October 2017 and October 2018 in the upstream (excluding Zone 2LR) and downstream communities, and the Mekong control group are displayed in **Table 4-4**.

Table 4-4: Mean Monthly Household Fish Catch in the Upstream and Downstream Communities Excluding Zone 2LR

Fishing Zone	October 2015 (kg)	October 2016 (kg)	October 2017 (kg)	October 2018 (kg)
Upstream	23.4	17.6	12.2	60.6
Downstream	23.4	22.2	26.5	49.7
Mekong Control Group	37.9	38.8	26.5	37.2

The mean monthly fish catch per household per fishing day are displayed, and the mean fish catch per household per fishing day for October 2015, October 2016, October 2017 and October 2018 are shown in **Figure 4-5**.

Figure 4-5: Mean Household Fish Catch per Fishing Day

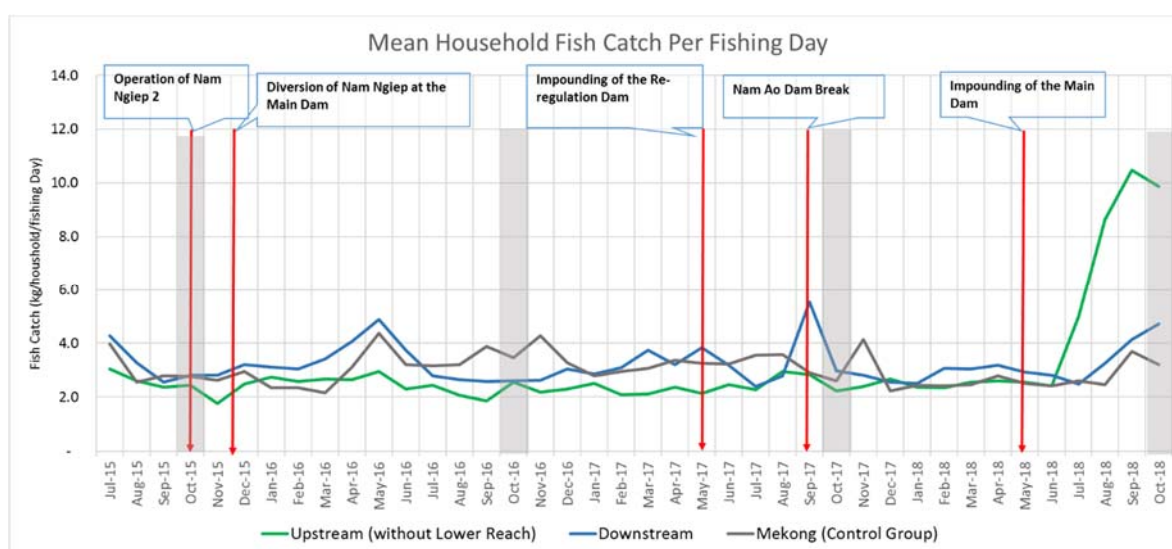


Table 4-5: Mean Household Fish Catch per Fishing Day in October

Fishing Zone	October 2015 (kg)	October 2016 (kg)	October 2017 (kg)	October 2018 (kg)
Upstream (Excluding Zone 2LR)	2.43	2.54	2.24	9.87
Downstream	2.80	2.61	2.98	4.71
Mekong (Control Group)	2.77	3.47	2.59	3.21

ANNEXES

ANNEX A: Results of Surface Water Quality Analyses

Table A- 1: Results of Main Reservoir, Re-regulation Reservoir and Surface Water (Nam Ngiep River) Quality Monitoring

Date	Parameters (Unit)	Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08
		Guideline												
3-Nov-18	pH	5.0 - 9.0						7.81			7.93			
6-Nov-18	pH	5.0 - 9.0	8.00	7.56		7.58	7.82	7.65						
7-Nov-18	pH	5.0 - 9.0							7.65	7.8	7.84	7.99	7.94	7.68
10-Nov-18	pH	5.0 - 9.0						8.06			8			
13-Nov-18	pH	5.0 - 9.0				8.79	7.54	7.89						
14-Nov-18	pH	5.0 - 9.0							7.52	7.89	7.98			
17-Nov-18	pH	5.0 - 9.0						7.52			7.74			
20-Nov-18	pH	5.0 - 9.0							7.48	7.64	7.47	8.07	7.83	7.96
21-Nov-18	pH	5.0 - 9.0	8.01	7.88		8.01	7.97	8.06						
24-Nov-18	pH	5.0 - 9.0						7.96			7.67			
27-Nov-18	pH	5.0 - 9.0				8.03	7.89	7.66						
28-Nov-18	pH	5.0 - 9.0							7.91	7.87	7.93			
3-Nov-18	Sat. DO (%)							99.8			109.1			
6-Nov-18	Sat. DO (%)		105.4	102.1		114.3	103.4	101.5						
7-Nov-18	Sat. DO (%)								101.9	101.8	110.7	107.7	104.4	104.2
10-Nov-18	Sat. DO (%)							104.9			111.5			
13-Nov-18	Sat. DO (%)					97.1	84.5	86.5						
14-Nov-18	Sat. DO (%)								99.9	95.3	107.5			
17-Nov-18	Sat. DO (%)							104.9			106.4			
20-Nov-18	Sat. DO (%)								90.8	84.4	102.3	95.7	100.3	100.9
21-Nov-18	Sat. DO (%)		104	101.6		87.3	81.7	87.2						
24-Nov-18	Sat. DO (%)							98.6			109.8			
27-Nov-18	Sat. DO (%)					82.2	76.9	76.8						
28-Nov-18	Sat. DO (%)								90.3	79.1	103.5			
3-Nov-18	DO (mg/l)	<6.0						7.45			8.57			
6-Nov-18	DO (mg/l)	<6.0	8.19	7.61		9.03	8.36	8.1						
7-Nov-18	DO (mg/l)	<6.0							8.29	8.25	8.87	8.33	8.15	8.16
10-Nov-18	DO (mg/l)	<6.0						8.15			8.82			
13-Nov-18	DO (mg/l)	<6.0				7.69	6.73	7.01						
14-Nov-18	DO (mg/l)	<6.0							8.18	7.79	8.55			
17-Nov-18	DO (mg/l)	<6.0						7.84			8.18			
20-Nov-18	DO (mg/l)	<6.0							7.25	6.66	8.02	7.58	7.7	7.63
21-Nov-18	DO (mg/l)	<6.0	8.3	7.72		6.97	6.56	7						
24-Nov-18	DO (mg/l)	<6.0						7.64			8.53			
27-Nov-18	DO (mg/l)	<6.0				6.54	6.19	6.2						
28-Nov-18	DO (mg/l)	<6.0							7.46	6.6	8.44			
3-Nov-18	Conductivity (µs/cm)							53.1			53.4			
6-Nov-18	Conductivity (µs/cm)		75.6	114		77	67	65						
7-Nov-18	Conductivity (µs/cm)								59	59	52.4	52.2	54.3	54.4
10-Nov-18	Conductivity (µs/cm)							53.1			53.6			
13-Nov-18	Conductivity (µs/cm)					78	68	67						
14-Nov-18	Conductivity (µs/cm)								67	67	52.3			
17-Nov-18	Conductivity (µs/cm)							51.9			53.9			
20-Nov-18	Conductivity (µs/cm)								73	79	57.4	65.2	67.2	68.5

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08
Date	Parameters (Unit)	Guideline												
21-Nov-18	Conductivity (µs/cm)		85	66.9		74	68	67						
24-Nov-18	Conductivity (µs/cm)							53.1			57.9			
27-Nov-18	Conductivity (µs/cm)					76	68	68						
28-Nov-18	Conductivity (µs/cm)								72	74	57.9			
3-Nov-18	TDS (mg/l)							26.55			26.7			
6-Nov-18	TDS (mg/l)		38	57		38.5	33.5	32.5						
7-Nov-18	TDS (mg/l)								29.5	29.5	26.2	26.2	27.1	27.2
10-Nov-18	TDS (mg/l)							26.55			26.8			
13-Nov-18	TDS (mg/l)					39	34	33.5						
14-Nov-18	TDS (mg/l)								33.5	33.5	26			
17-Nov-18	TDS (mg/l)							25.9			26.9			
20-Nov-18	TDS (mg/l)								36.5	39.5	28.7	32.6	33.5	34.2
21-Nov-18	TDS (mg/l)		42.5	33.5		37	34	33.5						
24-Nov-18	TDS (mg/l)							26.55			29.5			
27-Nov-18	TDS (mg/l)					38	34	34						
28-Nov-18	TDS (mg/l)								36	37	29			
3-Nov-18	Temperature (°C)							28.4			26			
6-Nov-18	Temperature (°C)		26.1	28.7		28.78	27.37	26.59						
7-Nov-18	Temperature (°C)								25.23	25.28	25.6	27.6	26.3	26.9
10-Nov-18	Temperature (°C)							26.4			26.2			
13-Nov-18	Temperature (°C)					27.21	27.1	26.41						
14-Nov-18	Temperature (°C)								25.44	25.44	25.9			
17-Nov-18	Temperature (°C)							28.4			27.6			
20-Nov-18	Temperature (°C)								26.49	28	26.8	26.3	27.6	28.5
21-Nov-18	Temperature (°C)		24.7	27.4		27.69	27.14	26.79						
24-Nov-18	Temperature (°C)							26.6			27.4			
27-Nov-18	Temperature (°C)					27.25	26.75	26.13						
28-Nov-18	Temperature (°C)								24.99	24.75	24.8			
3-Nov-18	Turbidity (NTU)							2.12			7.51			
6-Nov-18	Turbidity (NTU)		27.83	2.17		0.57	0.82	0.79						
7-Nov-18	Turbidity (NTU)								4.86	3.11	5.31	6.06	10.14	7.78
10-Nov-18	Turbidity (NTU)							1.52			4.58			
13-Nov-18	Turbidity (NTU)					1.28	1.13	1.21						
14-Nov-18	Turbidity (NTU)								9.28	5.29	6.08			

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08
Date	Parameters (Unit)	Guideline												
17-Nov-18	Turbidity (NTU)							1.67			7.37			
20-Nov-18	Turbidity (NTU)								6.79	8.88	5.82	5.93	5.42	6.76
21-Nov-18	Turbidity (NTU)		66.26	2.42		1.67	1.13	1.17						
24-Nov-18	Turbidity (NTU)							2.45			4.76			
27-Nov-18	Turbidity (NTU)					1.76	1.66	1.89						
28-Nov-18	Turbidity (NTU)								5.5	11.47	7.41			
6-Nov-18	TSS (mg/l)		54.03	<5		<5	<5	<5						
7-Nov-18	TSS (mg/l)								6.59	6.57	9.79	13.11	19.14	7.64
13-Nov-18	TSS (mg/l)							<5						
14-Nov-18	TSS (mg/l)								26.35	9.83	14.66			
20-Nov-18	TSS (mg/l)								12.19	8.43	9.35			
21-Nov-18	TSS (mg/l)							<5						
27-Nov-18	TSS (mg/l)							<5						
28-Nov-18	TSS (mg/l)								14.28	13.22	7.9			
6-Nov-18	BOD5 (mg/l)	<1.5	2.11	1.1		<1.0	<1.0	<1.0						
7-Nov-18	BOD5 (mg/l)	<1.5							<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
13-Nov-18	BOD5 (mg/l)	<1.5						<1.0						
14-Nov-18	BOD5 (mg/l)	<1.5							<1.0	<1.0	<1.0			
20-Nov-18	BOD5 (mg/l)	<1.5							<1.0	<1.0	<1.0			
21-Nov-18	BOD5 (mg/l)	<1.5						<1.0						
6-Nov-18	COD (mg/l)	<5	<5.0	<5.0		<5.0	6	6.5						
7-Nov-18	COD (mg/l)	<5							6.9	<5.0	5	<5.0	<5.0	7.3
6-Nov-18	NH3-N (mg/l)	<0.2	<0.2	<0.2		0.7	<0.2	<0.2						
7-Nov-18	NH3-N (mg/l)	<0.2							<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
6-Nov-18	NO3-N (mg/l)	<5	0.13	<0.02		<0.02	<0.02	<0.02						
7-Nov-18	NO3-N (mg/l)	<5							<0.02	0.02	<0.02	<0.02	<0.02	<0.02
6-Nov-18	Faecal coliform (MPN/100ml)	<1,000	170	2		0	0	0						
7-Nov-18	Faecal coliform (MPN/100ml)	<1,000							0	0	5	5	8	9
6-Nov-18	Total Coliform (MPN/100ml)	<5,000	540	7		0	0	0						
7-Nov-18	Total Coliform (MPN/100ml)	<5,000							5	11	22	79	33	94
6-Nov-18	Phytoplankton Biomass (g dry wt/m3)			8		8.4	4.9	8.7						
7-Nov-18	Phytoplankton Biomass (g dry wt/m3)								11.8	10.7				
6-Nov-18	Total Phosphorus (mg/l)			0.02		<0.01	0.02	0.02						
7-Nov-18	Total Phosphorus (mg/l)								0.02	0.02				
6-Nov-18	Total Dissolved Phosphorus (mg/l)			<0.01		<0.02	<0.02	<0.02						

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08
Date	Parameters (Unit)	Guideline												
7-Nov-18	Total Dissolved Phosphorus (mg/l)								0.01	<0.01				
6-Nov-18	TOC (mg/l)			1.8		2.08	2.54	3						
7-Nov-18	TOC (mg/l)								1.81	1.78				
6-Nov-18	Hydrogen Sulfide (mg/l)							<0.02						
7-Nov-18	Hydrogen Sulfide (mg/l)									<0.02	<0.02			
13-Nov-18	Hydrogen Sulfide (mg/l)							<0.02						
14-Nov-18	Hydrogen Sulfide (mg/l)									<0.02	<0.02			
6-Nov-18	Total nitrogen (mg/l)		0.53	0.34		0.75	0.56	0.51						
7-Nov-18	Total nitrogen (mg/l)								0.38	0.41	0.27	0.28	0.5	0.3

Table A- 1: RESULTS OF SURFACE WATER QUALITY MONITORING IN NAM CHIAN, NAM PHOUAN, NAM XAO AND NAM HOUAY SOUP

		Station Code	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline				
6-Nov-18	pH	5.0 - 9.0	8.65			
7-Nov-18	pH	5.0 - 9.0			7.86	7.96
20-Nov-18	pH	5.0 - 9.0			7.79	7.9
21-Nov-18	pH	5.0 - 9.0	7.87			
6-Nov-18	Sat. DO (%)		105			
7-Nov-18	Sat. DO (%)				94.9	97
20-Nov-18	Sat. DO (%)				94.8	90.8
21-Nov-18	Sat. DO (%)		106.2			
6-Nov-18	DO (mg/l)	<6.0	8.51			
7-Nov-18	DO (mg/l)	<6.0			7.43	7.76
20-Nov-18	DO (mg/l)	<6.0			7.49	7.13
21-Nov-18	DO (mg/l)	<6.0	8.92			
6-Nov-18	Conductivity (µs/cm)		22.7			
7-Nov-18	Conductivity (µs/cm)				91.2	45.9
20-Nov-18	Conductivity (µs/cm)				98.4	43.7
21-Nov-18	Conductivity (µs/cm)		23.9			
6-Nov-18	TDS (mg/l)		11			
7-Nov-18	TDS (mg/l)				45.6	23
20-Nov-18	TDS (mg/l)				49.2	21.85
21-Nov-18	TDS (mg/l)		12			
6-Nov-18	Temperature (°C)		26.3			
7-Nov-18	Temperature (°C)				26.2	25.8
20-Nov-18	Temperature (°C)				26.5	26.8
21-Nov-18	Temperature (°C)		22			
6-Nov-18	Turbidity (NTU)		7.01			
7-Nov-18	Turbidity (NTU)				4.3	5.7
20-Nov-18	Turbidity (NTU)				4.33	4.46
21-Nov-18	Turbidity (NTU)		6.58			
6-Nov-18	TSS (mg/l)		8.23			
7-Nov-18	TSS (mg/l)				<5	6.84
6-Nov-18	BOD5 (mg/l)	<1.5	<1.0			
7-Nov-18	BOD5 (mg/l)	<1.5			<1.0	<1.0

		Station Code	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline				
6-Nov-18	COD (mg/l)	<5	<5.0			
7-Nov-18	COD (mg/l)	<5			<5.0	6.9
6-Nov-18	NH3-N (mg/l)	<0.2	<0.2			
7-Nov-18	NH3-N (mg/l)	<0.2			<0.2	<0.2
6-Nov-18	NO3-N (mg/l)	<5	0.14			
7-Nov-18	NO3-N (mg/l)	<5			0.13	0.07
6-Nov-18	Faecal coliform (MPN/100ml)	<1,000	540			
7-Nov-18	Faecal coliform (MPN/100ml)	<1,000			32	17
6-Nov-18	Total Coliform (MPN/100ml)	<5,000	1,600			
7-Nov-18	Total Coliform (MPN/100ml)	<5,000			540	
6-Nov-18	Total nitrogen (mg/l)		0.37			
7-Nov-18	Total nitrogen (mg/l)				0.51	0.35

ANNEX B: Results of Effluent Analyses

Table B- 1: Results of Camp Effluents in November 2018

	Site Name	Owner's Site Office and Village		Obayashi Camp		SongDa5 Camp No.1	
	Station Code	EF01		EF02		EF07	
	Date	02-Nov-18	16-Nov-18	02-Nov-18	16-Nov-18	02-Nov-18	16-Nov-18
Parameters (Unit)	Guideline						
pH	6.0 - 9.0	7.15	7.41	7.69	7.58	7.57	7.45
Sat. DO (%)		53.2	84.1	78.7	83.2	96.3	35.6
DO (mg/l)		4.1	6.19	6.18	6.31	7.71	2.76
Conductivity (µs/cm)		441	435	434	436	991	1,138
TDS (mg/l)		220.5	217	217	218	495.5	568
Temperature (°C)		27.4	29.8	26.6	28.5	25.7	27.5
Turbidity (NTU)		1.52	1.03	12.45	6.05	9.79	11.81
TSS (mg/l)	<50	<5	<5	<5	<5	12.31	8.78
BOD5 (mg/l)	<30	<6	12.09	<6	<6	<6	<6
COD (mg/l)	<125	<25	<25	27.2	25.6	37.8	54
NH3-N (mg/l)	<10.0	8.4	10	16	13	14.3	25.7
Total Nitrogen (mg/l)	<10.0	10.5	21.1	18.9	14.6	15.9	32.9
Total Phosphorus (mg/l)	<2	1.16	1.21	1.09	1.11	0.88	1.23
Oil & Grease (mg/l)	<10.0	<1		<1		<1	
Total coliform (MPN/100ml)	<400	540	35,000	0	0	0	4.5
Faecal Coliform (MPN/100ml)	<400	350	16,000	0	0	0	0
Effluent Discharge Volume (L/mn)		12	12	12	6	60	20
Chlorination Dosing Rate (ml/mn)		n/a	n/a	180	320	50	300
Residual Chlorine (mg/l)	<1.0	n/a	n/a	0.5	0.5	0.52	0.46

	Site Name	SongDa5 Camp No.2		Zhefu Camp		V&K Camp	
	Station Code	EF08		EF09		EF10	
	Date	02-Nov-18	16-Nov-18	02-Nov-18	16-Nov-18	02-Nov-18	16-Nov-18
Parameters (Unit)	Guideline						
pH	6.0 - 9.0	7.69	7.29	7.21	7.25	7.43	7.43
Sat. DO (%)		79.8	71.5	6.6	26.4	42.4	42.1
DO (mg/l)		6.37	5.38	0.51	1.97	3.44	3.3
Conductivity (µs/cm)		578	765	541	946	370	372
TDS (mg/l)		289	382	270.5	473	185	186
Temperature (°C)		25.8	29	27.1	29.2	25	27
Turbidity (NTU)		18.4	10.86	30.14	25.94	6.52	3.81
TSS (mg/l)	<50	20.9	14.19	32.98	38.94	12.67	5.88
BOD5 (mg/l)	<30	<6	<6	105.53	<6	<6	<0
COD (mg/l)	<125	46.4	42.7	132	129	28.9	<25
NH3-N (mg/l)	<10.0	19.6	10.4	44.2	39.7	7.5	7.1
Total Nitrogen (mg/l)	<10.0	22.3	11.6	49.7	42.6	13.3	10.9
Total Phosphorus (mg/l)	<2	1.1	1.07	1.48	1.57	0.83	0.93
Oil & Grease (mg/l)	<10.0	<1		4		<1	
Total coliform (MPN/100ml)	<400	0	0	35,000	79	2	0
Faecal Coliform (MPN/100ml)	<400	0	0	3,500	49	2	0
Effluent Discharge Volume (L/mn)		20	12	4.2	4.2	3	6
Chlorination Dosing Rate (ml/mn)		260	160	0	0	30	26
Residual Chlorine (mg/l)	<1.0	1.95	1.12	0	1.34	0.6	0.26

	Site Name	HM Main Camp		IHI Main Camp		Lilama10 Camp		IHI Field Shop 276 Camp	
	Station Code	EF13		EF14		EF17		EF18	
	Date	02-Nov-18	16-Nov-18	02-Nov-18	16-Nov-18	02-Nov-18	16-Nov-18	02-Nov-18	16-Nov-18
Parameters (Unit)	Guideline								
pH	6.0 - 9.0	7.07	7.16	7.04	7.05			6.83	6.72
Sat. DO (%)		53.6	67	51.2	32.6	No discharge		42.1	60.4
DO (mg/l)		4.24	4.37	4.01	2.57			3.3	4.61
Conductivity (µs/cm)		734	979	911	1,147			358	302
TDS (mg/l)		367	459	455.5	573			179	151
Temperature (°C)		26.1	28	26.7	27.6			26.5	28.8
Turbidity (NTU)		39.3	27.82	16.85	18.6			15.75	10.1
TSS (mg/l)	<50	21.06	26.24	31.14	19.42			82.9	24.49
BOD5 (mg/l)	<30	171	<6	<6	<6			214	<6
COD (mg/l)	<125	172	132	12.1	134			203	34
NH3-N (mg/l)	<10.0	28.2	13.9	<0.2	6.4			16.8	<0.2
Total Nitrogen (mg/l)	<10.0	30	14.8	0.78	7.23			20.4	0.81

	Site Name	HM Main Camp		IHI Main Camp		Lilama10 Camp		IHI Field Shop 276 Camp	
	Station Code	EF13		EF14		EF17		EF18	
	Date	02-Nov-18	16-Nov-18	02-Nov-18	16-Nov-18	02-Nov-18	16-Nov-18	02-Nov-18	16-Nov-18
Parameters (Unit)	Guideline								
Total Phosphorus (mg/l)	<2	1.25	1.19	0.76	1.05			1.14	0.24
Oil & Grease (mg/l)	<10.0	4		4				3	
Total coliform (MPN/100ml)	<400	54,000	0	0	0			54,000	0
Faecal Coliform (MPN/100ml)	<400	54,000	0	0	0			16,000	0
Effluent Discharge Volume (L/mn)		4.2	4.2	4.2	3.1			3	0
Chlorination Dosing Rate (ml/mn)		0	3.1	3.1	3.1			0	29
Residual Chlorine (mg/l)	<1.0	0	0.78	0.42	1.7			0	0.5

Table B- 2: Results of the Construction Area Discharge in November 2018

	Site Name	Spoil Disposal No.2			
	Station Code	DS04			
	Date	07-Nov-18	14-Nov-18	20-Nov-18	28-Nov-18
Parameter (Unit)	Guideline				
pH	6.0 - 9.0	6.49	5.98	6.15	6.97
Sat. DO (%)		73	43.3	55.7	46.4
DO (mg/l)		5.87	5.1	4.44	3.79
Conductivity (µs/cm)		32.7	33.7	36.7	43.3
TDS (mg/l)		16.3	16.8	18.3	21.65
Temperature (°C)		25.6	25.1	26.3	24.5
Turbidity (NTU)		3.85	4.26	9.74	8.13
TSS (mg/l)	<50	6.91	4.7	7.28	6.78
Oil & Grease (mg/l)	<10	<1			

ANNEX C: Ambient Dust Quality

Table C- 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	15-Oct-18 18:00	16-Oct-18 18:01	17-Oct-18 18:01
End Time	16-Oct-18 18:00	17-Oct-18 18:00	18-Oct-18 18:00
Average Data Record in 24h (mg/m3)	0.042	0.038	0.037
Guideline Average in 24h (mg/m3)	0.12	0.12	0.12

Table C- 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	03-Oct-18 18:00	04-Oct-18 18:01	05-Oct-18 18:01
End Time	04-Oct-18 18:00	05-Oct-18 18:00	06-Oct-18 18:00
Average Data Record in 24h (mg/m3)	0.081	0.079	0.075
Guideline Average in 24h (mg/m3)	0.12	0.12	0.12

Table B-3 and Table B-4: Average Results of Dust Monitoring at Song Da5 Camp No. 2 and Lilama10 Camp in November 2018

Song Da5 Camp No.2 - Dust Emission Average in 24 hours		Lilama10 Camp - Dust Emission Average in 24 hours	
Period	24 Hours	Period	24 Hours
Start Time	12-10-18 18:00	Start Time	09-10-18 18:00
End Time	13-10-18 18:00	End Time	10-10-18 18:00
Average Data Record -24h	0.030	Average Data Record -24h	0.064
Guideline Average - 24h	0.12	Guideline Average - 24h	0.12

Table B-5 and Table B-6: Average Results of Dust Monitoring at Main Dam, and Main Powerhouse in November 2018

Main Dam - Dust Emission Average in 24 hours		Main Powerhouse - Dust Emission Average in 24 hours	
Period	24 Hours	Period	24 Hours
Start Time	29-10-18 18:00	Start Time	22-10-18 18:00
End Time	30-10-18 18:00	End Time	23-10-18 18:00
Average Data Record -24h	0.044	Average Data Record -24h	0.027
Guideline Average - 24h	0.12	Guideline Average - 24h	0.12

ANNEX D: AMBIENT NOISE DATA

Table D- 1: Average Results of Noise Monitoring at Ban Hat Gniun in November 2018

Noise Level (dB)	15-16/October/18			16-17/October/18			17-18/October/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	75.50	61.10	79.90	63.00	58.20	78.80	61.00	61.40	73.70
Guideline Max	115	115	115	115	115	115	115	115	115
Average Data Recorded	53.53	48.58	48.20	50.28	47.59	49.44	53.10	47.81	48.70
Guideline Averaged	55	45	55	55	45	55	55	45	55

Table D- 2: Average Results of Noise Monitoring at Phouhomxay Village in November 2018

Noise Level (dB)	03-04/October/18			04-05/October/18			05-06/October/18		
	18:30-22:00	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	67.10	71.60	66.70	68.50	68.50	78.70	56.90	65.90	73.80
Guideline Max	115	115	115	115	115	115	115	115	115
Average Data Recorded	49.41	49.73	43.68	49.45	50.10	44.09	50.17	50.09	47.26
Guideline Averaged	55	45	55	55	45	55	55	45	55

Table D- 3 and Table D- 4: Average Results of Noise Monitoring at Song Da5 Camp No. 2 and Sino Hydro Camp in November 2018

Song Da5 Camp No.2

Noise Level (dB)	12-13/October/18		13/October/18
	18:00 – 22:00	22:01 – 06:00	06:01-18:00
Maximum Value Recorded	47.1	51.6	64
Guideline Max	115	115	115
Average Data Recorded	39.89	43.73	41.11
Guideline Averaged	70	50	70

Lilama10 Camp

Noise Level (dB)	09-10/October/18		10/October/18
	18:00 – 22:00	22:01 – 06:00	06:00-18:00
Maximum Value Recorded	64	65.2	70.6
Guideline Max	115	115	115
Average Data Recorded	54.37	56.87	44.56
Guideline Averaged	70	50	70

Table D- 5 and Table D- 6: Average Results of Noise Monitoring at Main Dam, and Main Powerhouse in November 2018

Main Dam

Noise Level (dB)	29-30/October/18		30/October/18
	18:30 – 22:00	22:01 – 06:00	06:01-18:00
Data Record Max	66.7	63.6	69.1
Guideline Max	115	115	115
Data Record Average	61.04	61.02	59.47
Guideline Averaged	70	70	70

Main Powerhouse

Noise Level (dB)	22-23/October/18		23/October/18
	18:00 – 22:00	22:01 – 06:00	06:01-18:00
Data Record Max	69.4	69.4	85.5
Guideline Max	115	115	115
Data Record Average	68.77	68.75	69.82
Guideline Averaged	70	70	70