NAM NGIEP 1
POWER COMPANY

Nam Ngiep 1 Hydropower Project

Environmental Management
Monthly Monitoring Report

May 2020

					
					
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ABBREVIATIONS / 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
ECOCD	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
PPA	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 May 2020, the Environmental Management Office (EMO) of Nam Ngiep 1 Power Company (NNP1PC) did not receive any document for review and approval due to the continue suspension of Project activities during the COVID-19 lockdown imposed by the Prime Minister's Order no. 06 during 29 March 2020 to 03 May and extended from 03 – 17 May 2020.

Due to the COVID-19 preventative measures imposed by the Thai and Lao Governments since mid-March 2020 until 31 May 2020, the water samples were analysed at the NNP1 Project Environmental Laboratory for TSS, BOD_5, faecal coliform and total coliform and no water samples were shipped to the UAE Lab in Thailand.

The effluent monitoring results for the remaining camps indicate non-compliance with the standards for BOD_5, total coliform and faecal coliform. The external consultant contract was signed to assess and evaluate the design and operation of the existing WWTS at the OSOV2 and other sites as well as to provide an improved design using a more permanent technology. It is expected that site visit by the external consultant will be carried out after the country lockdown is lifted. In the meantime, NNP1PC-EMO has provided all relevant designs, drawings and results of the water quality to the consultant for a desk review during the lockdown period.

The Dissolved Oxygen (DO) levels at the surface of the Main Reservoir (R1, R2, R3, R4 and R5) were generally between 6 mg/L and 9 mg/L. In the Re-regulation Reservoir (R6 and R7), the DO was generally below 3.7 mg/L this month.

The discharge from the re-regulation dam alternated between discharges from the gate and turbine. Similarly, to April 2020, all DO concentrations were below 6 mg/L at Nam Ngiep downstream stations. However, same as for previous months with similar DO levels, no dead fish was observed during this monitoring period. NNP1PC is in the process of hiring an international consulting company to assist with the design of additional aeration systems to improve the DO level downstream.

A total of 16.6 m^3 of solid waste was disposed of at the NNP1 Project Landfill, a decrease of 2.4 m^3 compared to April 2020. A total of 3,122 kg of recyclable waste was recorded at the Community Recycle Waste Bank. A total of 17.1 m^3 of solid waste from Phouhomxay, Thahuea and Hat Gniun Villages was disposed of at the Houay Soup Landfill.

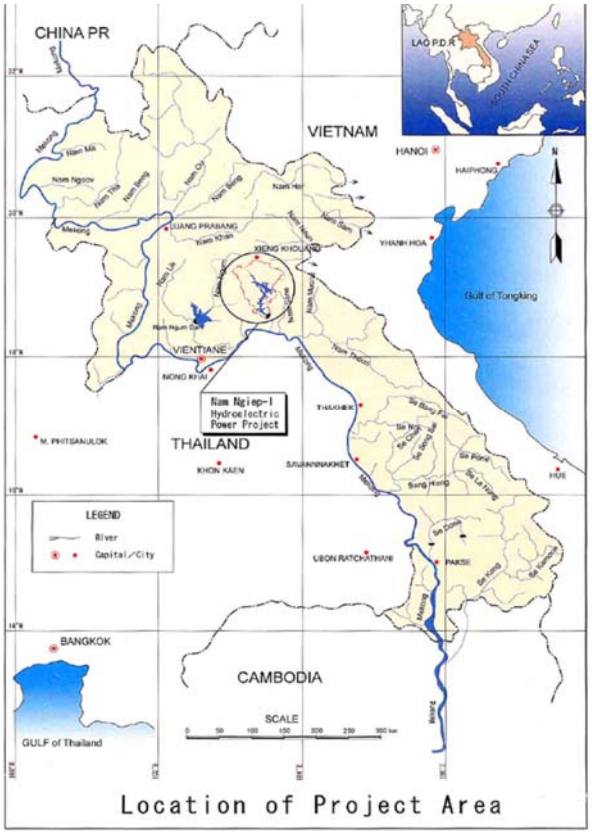
Official handover ceremonies of the procured office and field equipment under NNP1PC additional No Net Loss (NNL) commitment to support the WRPO of Xaysomboun and Bolikhamxay Provinces in implementing their AIP2019 activities were organized on 08 May 2020 in Bolikhamxay Province and 20 May 2020 in Xaysomboun Province respectively. The Xaysomboun Provincial WRPO submitted the budget plan of AIP2020 to NNP1PC in the middle of May 2020 for NNP1PC review. The final technical consultation with relevant GOL offices on a final draft of NNP1 Reservoir Fishery Co-Management Plan (RFCM), a draft Xaysomboun regulation on the fishery management and a draft sustainable livelihood assessment report was organized on 21-22 May 2020.

Biodiversity offset related activities under the components of law enforcement and conservation linked livelihood continued in May 2020 with some restrictions as imposed by the GOL (i.e. maintaining social distancing, no gathering and working of more than 10 people, etc.).

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 have been 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. Each Contract is in its Defects Notification Period all ending variously in 2020 or 2021 following the issue of Taking-over Certificates in 2018 and 2019.

Figure 2-1 shows the progress of the minor outstanding work and defects that comprise the Punch List of work items completed for each of these four principal Contracts for the Project. An addendum to the Punch List is maintained for each Contract for any and all defects list that are discovered during the Defects Notification Period with relevant tabular records made of the date of the discovery, the nature of the defects and by what date the defect was remedied.

FIGURE 2-1: SUMMARY PROGRESS OF MINOR OUTSTANDING WORK AND DEFECTS AT 31 March 2020

Type of Contract Works		Total Items	Items Completed	Completion by No. of Items	Total Value of Items	Value Completed	Completion by Value	Taking-Over
		(No.)	(No,)	(%)	(USD)	(USD)	(%)	(Date)
Civil	RR Power Station	74	74	100	108,890	108,890	100	31-Jan-19
	Main Power Station	482	481	99	5,507,375	5,407,375	98	31-Jan-19
Electro-Mechanical	RRPS	170	170	100	6,515	6,515	100	16-Mar-19
	MPS	95	95	100	10,950	10,950	100	27-Aug-19
Hydro-Mechanical	RRPS	39	39	100	8,825	8,825	100	16-Mar-19
	MPS	174	174	100	13,775	13,775	100	31-Mar-19
230 kV Transmission Line		301	301	100	150,000	150,000	100	31-Jul-18

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 Notice to Proceed was issued on 03 October 2014. Excavation works of the main dam, the diversion tunnel and the re-regulation dam 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 March 2019 was 100 % (compared to planned progress of 100 %) calculated as the value of achieved Interim Milestone Payments excluding advance payment.

The Civil Works overall was always on or ahead of schedule despite increased quantities of dam excavation and slope stabilisation and additional RCC placed in the shear key. During the initial dam excavation and since, it has been written in each Monthly Report, *'the complex bedding of hard over soft layers of rock and the folding nature of these layers in the foundation rock of the main dam below the old river bed had created difficulty to finalise the foundation design to the satisfaction of the Dam Safety Review Panel in all respects'.*

Accordingly, further review of the dam foundation design was carried out to create sufficient safety factor for stability against sliding of the dam on the weak zones. This resulted in further excavation and concreting of a shear key structure in the old river bed, taking the dam height to 167 m, measured from the deepest excavation level to the crest level, some 19 m higher than anticipated. The original schedule is maintained as a result of the combined efforts of the Owner, the Owner's Engineer and all the principal Contractors and their Subcontractors. The additional excavation works were completed at the end of February 2016 and RCC consolidation grouting and RCC placement for the main dam were commenced on 10 May and

19 April 2016 respectively. The concrete level at the main dam reached El. 321.9 m at the left bank on 29 April 2018 and at the right bank at the end of March 2018. The placed volume of RCC was achieved in close to the planned schedule despite the losses of time resulting from the additional excavation and concreting in the foundation, the loss of fly-ash supply in December 2016, and the fatal accident.

Since the impounding of the Main Dam started on 15 May 2018, monitoring has been carried out to confirm the dam stability, especially to the right abutment where some anomalous results had been noted. Dam monitoring results are shown in a separate 'Monthly Report on Main Dam Instrumentation and Monitoring'. Many of the original concerns have been explained or are better understood. The unforeseen consequences which are considered likely to have been caused by the closing of bedding plane openings, as one of the possible causes considered, began unfolding with events in August 2018 when loading of the dam toe appeared to have caused an inclination of the main powerhouse to upstream and towards the old river bed such that the setting and fixing vertically of both turbine generating units within the required tolerances was not possible. This movement of the powerhouse also affected associated structures such as the penstocks and the intake valve. After the occurrence of this inclination issue, it has been found that artesian aquifer, which was not pressurized before initial impounding, exists under the main powerhouse foundation. Drainage to relieve the pressure is an important means of controlling the artesian aquifer. All current information and opinion are contained in the separate 'Root Cause Assessment of the Main Powerhouse Inclination' which was endorsed by academic authorities. This Report was sent to the insurance company in support of the insurance claim on this issue.

Monitoring of the instruments initially installed continues, more instruments were installed, further drainage drilling was carried out. As related above, all current information and opinion is contained in the separate September Monthly Report on Main Dam Instrumentation and Monitoring. This Report was sent to the Dam Safety Review Panel for review and comment. The reservoir water level of the main reservoir finally reached Full Supply Level of El. 320 m on 17 August 2019 whilst achieving dam safety. At the 19th DSRP Meeting which was held in October 2019, DSRP included in their Report a 'Dam Safety Endorsement' stating that the main dam, re-regulation dam and dyke are safe and fit for purpose, subject to a continued programme of appropriate monitoring, safe project operation and satisfactory resolution of the outstanding issues.

The leakage through drainage pipes from the Bottom Conduit Gate decreased from around 30 m3/min in June 2019 to 1 m3/min in September 2019 thanks to additional grouting using holes drilled from the main dam foundation gallery, a manageable amount, and the permanent concrete plug in this Conduit had been placed since 08 November 2018 after obtaining agreement of the DSRP and completed in 21 January 2019. NNP1PC will study various options to ensure that the reservoir water pressure is safely confined in the long term based on the recommendations of the DSRP.

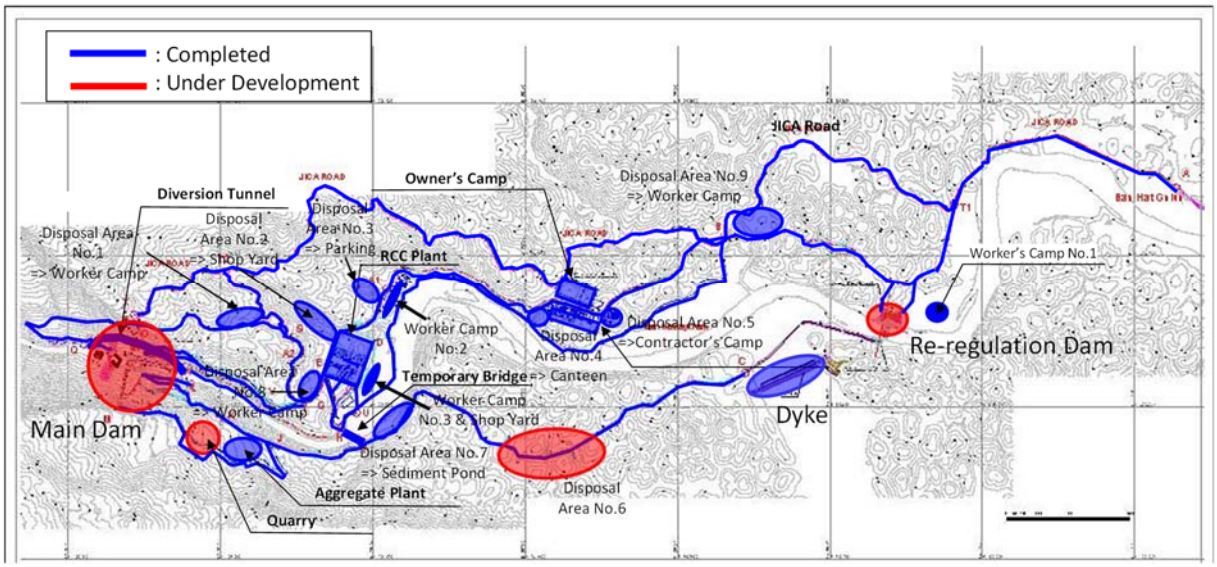
The repairs to the foundation of leg 4 of 230 kV TL Tower No.1 were completed in February 2019. The remaining excavation of the plunge pool was finished in January 2019. The reinforced concrete parapet wall was completed in December 2018 and road deck to the main dam crest and the concrete spillway chutes and piers completed in January 2019.

The issue of a Taking-over Certificate for the Civil Works for both the Re-regulation Power Station and the Main Dam and Main Powerhouse dated 31 January 2019 was made on 19 August 2019 and 22 October 2019, respectively.

2.1.1 Access Road Construction

All main access road construction works were completed following an early December 2013 start, and maintenance of these will continue until the anticipated commissioning date in August 2019, six months after when the Civil Contract Time for Completion is reached. Temporary access roads are constructed to reach the various construction activities and others will be developed or modified as is necessary as activities change to reach current or new areas of dam concreting and consolidation grouting, the upstream and downstream cofferdams and the main powerhouse and belt conveyor support tower foundations. The layout of the access road system is as shown in ***Figure 2-2*** below. The Civil Contractor is responsible for decommissioning and rehabilitating the temporary roads as they become redundant.

Figure 2-2: Plan of Site Access Roads with Major Work Area and Temporary Facilities



2.1.2 Main dam and power house

After starting the main dam excavation in October 2014 on the left bank, these 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 in total than expected and part of this additional work was necessary to construct a 'shear key' structure due to the weak layers of rock encountered in the dam foundation. Following significant efforts on Site, the additional excavation work was completed at the end of February 2016. The cost of the additional excavation and RCC concrete placement necessitated expenditure of contingency amounts provided exactly for such eventualities. The dental concreting works were commenced in March 2016, and conventional levelling concrete placement for the main dam in the 'shear key' structure up to El. 170.5 m was completed in the middle of April 2016. Consolidation grouting at the main dam area was commenced on 10 May 2016 and RCC concrete placement for the main dam body was commenced on 19 April 2016. Consolidation grouting covers the whole footprint of the main dam and RCC concrete placement and consolidation grouting are implemented in parallel, section by section. The progress of RCC

concrete placement is 100 % complete. The dam height has reached crest level at El. 321.9 m at both left bank and right bank. The plunge pool excavation was started after main dam impounding and this work has been suspended because of spilling water from spillway gate during rainy season in 2018. It has resumed from the end of October when the amount of inflow has decreased to around 100 m3/s and around 121,000 m3 or 100 % of total excavation has now been completed.

The diversion conduit gate of the main dam body has some leakage of water initially and the casting of the temporary concrete plug behind it was completed in the conduit in June 2018. The permanent concrete plug had been placed since 08 November 2018 after DSRP permission was granted.

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. The powerhouse concreting works has been completed in January 2019.

2.1.3 Re-regulation dam, Powerhouse and Dyke

The re-regulation powerhouse excavation and cofferdam works for the first 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 overall re-regulating dam and powerhouse works at the left bank section and the right bank and labyrinth weir are shown in ***Figure*** below. After the completion of the re-regulation dam above, impounding of the reservoir has been carried out having been commenced on 15 May and been completed on 24 May 2017. After Main Dam impounding started, the reservoir storage of the re-regulation dam has been used for the riparian discharge to downstream in accordance with the Concession Agreement.

FIGURE 2-3: COMPLETED RE-REGULATION DAM AND POWERHOUSE AT THE END OF JUNE 2018

2.1.4 Temporary work facility

2.1.4.1 Diversion Tunnel Inlet and Outlet

The diversion tunnel, excavated over 600 m in length and 10 m in diameter, was commenced in October 2014 by drill and blast techniques and completed in late September 2015. The river diversion took place on 31 October 2015 after completion of inlet and outlet structures 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. Dewatering of the diversion tunnel and construction of the concrete plug was commenced during January 2018. Concrete works and the valve installation for discharge was completed before the start of main dam impounding. On 22 May 2018, the valve discharge commenced by using 3 valves with around 5 m^3/s discharge in total. Construction of concrete plug including valve was completed on 27 January 2019.

2.1.4.2 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 for this cofferdam were completed on 02 April 2016.

2.1.4.3 Plant Yards

Demobilization of plant facilities for both RCC and CVC plants was completed in December 2019. The vegetation improvement for rehabilitation of those areas is ongoing.

***Figure 2-4**: Re-vegetation of RCC Plant Yard*

***Figure 2-5**: Re-vegetation of CVC Plant Yard*

2.1.4.4 Quarry

The final blasting was carried out 27 March 2018. GOL have acknowledged that the quarry operation is complete. After several inspections by GOL and ADB for the Lenders, the quarry site has been improved by such as partial levelling, vegetation at the berms of slopes and large rock installation at top of slopes from an environmental and a safety point of view. Fence for safety was installed at top slope at right side. The grading at the quarry bottom and spreading of top soil was completed in January 2020.

Figure 2-6: Quarry Area View Showing Re-Vegetation and Safety Fence Installation

2.1.4.5 Disposal Areas

The operation of both HSRA and Project landfills is ongoing with collection waste material from Resettlement "Phouhomxay", neighbour villages and the Owner Site Office and Village.

Figure 2-7: Phase 2 of Project Landfill Development on 8 June 2017

Current condition of landfill

2.2 ELECTRICAL AND MECHANICAL WORKS

The EMW Contract was executed between Hitachi-Mitsubishi Hydro Corporation and NNP1PC on 13 June 2014 and the Notice to Proceed was issued in 3 October 2014. The cumulative work progress of the Electrical and Mechanical Works by value at the end of November 2019.

2.3 HYDRO-MECHANICAL WORKS

The HMW Contract was executed between IHI Infrastructure Systems (IIS) and NNP1PC on 18 April 2014 and the NTP was issued to the Contractor on 3 October 2014. The actual cumulative work progress of the Hydro-Mechanical Works until the end of March 2019 was 100 % (compared to planned progress of 100 %). NNP1PC issued the Taking Over Certification for the main powerhouse and the re-regulation powerhouse, which was dated on 31 March 2019 for

the main powerhouse and 16 March 2019 for the re-regulation powerhouse, to IIS on 30 September 2019 and 16 August 2019, respectively.

2.4 TRANSMISSION SYSTEM

2.4.1 Tower No.1 of 230 kV TL Replacement and Dismantling

The Tower No.1 was damaged due to the slope failure of approximately 150 m3 volume of material above and behind Tower No.1 that occurred overnight on 17 to 18 of August 2019. Some of the structural steel members of the Tower No.1 were deformed. Tower No.1 did not move significantly but remained an unsafe structure. Movement of the upper part of the steel structure of the tower was observed.

Therefore, a Temporary Tower No.1 was constructed and the transmission line was moved to it from the damaged tower over the period 06 to 24 September 2019. The construction of the permanent Replacement Tower No.1, disassembly of existing Tower No.1 was contracted in late December 2019. The foundation excavation of legs for new Tower No.1 started in the middle of January 2020 and was completed on February 2020; the damaged Tower No.1 was almost dismantled in January 2020. The installation of gantry structure and new Tower No.1 was completed in the beginning of April 2020. Energization test was completed on 30 April. Remaining works including slope protection around the Tower will be completed by the end of July 2020.

3. ENVIRONMENTAL MANAGEMENT MONITORING

3.1 COMPLIANCE MANAGEMENT

In May 2020, the Environmental Management Office (EMO) of Nam Ngiep 1 Power Company (NNP1PC) did not receive any document for review and approval due to the continued suspension of Project activities during the COVID-19 lockdown imposed by the Prime Minister Order no. 06 during 29 March 2020 to 03 May then extended from 03 – 17 May 2020. The lockdown was relaxed by GOL from 17 – 31 May 2020 but some limitation remained especially in terms of limiting the number of participants at the workshop of not more than 10 people and continued practicing social distancing. Referring to this PM Order, NNP1PC camp lockdown was continued until 31 May 2020.

The status of compliance reports (Observation of Non-Compliance or ONC, Non-Compliance Report or NCR) issued by NNP1PC to the Contractors is summarized in ***Table 3-2***. The NCR1 is related to the ongoing site rehabilitation requirement at the former Lilama10 camp. Because of the country lockdown, the Japanese Contractor cannot come back to site for checking the site condition and doing revegetation work as required. These pending ONCs and NCR issues will be followed up and reported in the next MPR.

TABLE 3-1: SUMMARY OF ONCS AND NCRS

Items	ONC	NCR-1	NCR-2	NCR-3
Carried over from April 2020	6	1	0	0
Newly Opened in May 2020	0	0	0	0
Total in May 2020	**8**	**0**	**0**	**0**
Resolved in May 2020	2	0	0	0
Carried over to June 2020	4	**1**	0	0
Unsolved Exceeding Deadlines	**4**	**1**	**0**	**0**

3.1.1 Inspection by Environment Management Unit

The proposed joint site visit by the Ministry of Natural Resources and Environment (MONRE), Bolikhamxay Provincial Office of Environmental and Natural Resources (PONRE), Bolikhan District Environmental and Natural Resources (DONRE) EMU (Bolikhamxay Province) and; Xaysomboun PONRE and Thathom Districts at the end of March was postponed to June 2020 due to the extended Project site lockdown until 31 May 2020 to prevent the spread of COVID-19.

3.2 ENVIRONMENTAL QUALITY MONITORING

The analyses of Total Suspended Solids (TSS), Biochemical Oxygen Demand (BOD), faecal coliforms, E.Coli bacteria and total coliforms have been carried out by NNP1PC's environmental laboratory since August 2017.

All data are reported to the Ministry of Natural Resources and Environment (MONRE) monthly and quarterly to the ADB. The reports are also published on the Company's website at https://namngiep1.com/resources/monitoring-reports/

Due to the COVID-19 preventative measures imposed by the Thai and Lao Governments since mid-March 2020 until 31 May 2020, the water samples were analysed at the NNP1 Project Environmental Laboratory only for TSS, BOD_5, faecal coliform and total coliform and no water samples were shipped to the UAE Lab in Thailand. Therefore, there are no results for COD, ammonia-nitrogen, total nitrogen, total phosphorus and oil and grease in this reporting month.

3.2.1 Effluent Discharge from Camps and Construction Sites

Detailed monitoring results are provided in the ***Annex B*** of this Report. The effluent monitoring results for the camps in May 2020 indicate non-compliances for BOD_5, total coliform and faecal coliform.

The status of the implementation of the corrective actions addressing non-compliances at the camps and key project facilities that continue to have non-compliances is summarized in below.

TABLE 3-2: STATUS OF CORRECTIVE ACTIONS FOR NON-COMPLIANCES AT CAMPS AND CONSTRUCTION SITES

Site	Sampling ID	Status	Corrective Actions
OSOV1	EF01	Non-compliance for faecal coliform and total coliform.	- It is expected that the external consultant will visit the site after the country lockdown is over to evaluate the design and operation of the existing remaining WWTS and to provide an improved design using a more permanent technology. So far, EMO provided the design drawing and water quality results to the Consultant for doing a desk review. - The site admin was instructed to harvest the wetland reeds and clean up wetland ponds to help improving the effluent discharge quality.
OSOV2 (ESD Camp)	EF13	Non-compliance for BOD_5 (first fortnight sampling), faecal coliform and total coliform.	- As above. - No regular dosing of chlorine was observed. An ONC was issued and reported to the site admin team for the WWTS operation improvement.
	EF14	Non-compliance for faecal coliform and total coliform.	
Main Powerhouse	EF19	Non-compliance for TSS, BOD_5, faecal coliform and total coliform.	- As above. - No regular dosing of chlorine was observed. This was reported to the Operation and maintenance Team of TD for WWTS operation improvement. Repeated occurrence found will lead to the issuance of the NCR1.

3.2.2 Ambient Surface Water Quality Monitoring

The ambient surface water quality monitoring programme comprises five monitoring stations in the main reservoir (R1-R5), two stations in the re-regulation reservoir (R6 and R7), five stations in the mainstream Nam Ngiep (NNG01 and NNG05 to NNG08) and four stations in the main tributaries to Nam Ngiep (Nam Chiane [NCH01], Nam Phouane [NPH01], Nam Xao [NXA01] and Nam Houay Soup [NHS01]).

In addition, weekly depth profile monitoring (pH, DO, conductivity, TDS and temperature) has been undertaken since 18 September 2018 for stations located in the re-regulation and main reservoirs. The location of the monitoring stations is shown in Figure 3-1.

Due to the country and site lockdown, only pH, DO, Conductivity, Temperature, Turbidity, TSS, BOD_5, Faecal Coliform and Total Coliform were measured and analysed in May 2020.

The monitoring results for key parameters (DO, TSS and BOD_5) during May 2020 are presented in ***Table 3-5, 3-6*** *and* ***3-7***. The full set of data for May 2020 is attached in ***Annex A***. In addition, the results for DO are presented as line graphs in ***Figure 3-2.***

Main Reservoir

During May 2020, the water level in the main reservoir decreased from El. 301.5 m asl to El. 298.2 m asl.

Due to the country and site lockdown, the depth profile water quality monitoring at R1, R2, R3, R4, R6 and R7 were implemented only one time as the team could not use a local boat driver for the main reservoir and re-regulation reservoir water sampling during the lockdown.

At R5, during May 2020, the DO level in the upper 7.5 m was generally between 6 mg/L and 8 mg/L, and an oxycline had formed at a depth between 5.5 m and 9.0 m corresponding to El. 292 m asl – 293 m asl. The entire water column below 11.0 m had a DO level of less than 1 mg/L.

At R4, the DO concentrations in the upper 6.0 m was generally about 6 mg/L, and in the entire water column below 8.5 m, the DO concentration was less than 1 mg/L.

The DO concentrations at R3 were recorded between 6 mg/L and 9 mg/L in the upper 5.0 m. The concentration of DO in the entire water column below 11.0 m was generally less than 1 mg/L.

At R2, the DO concentrations in the upper 3.5 m was generally between 5 mg/L and 9 mg/L, and in the entire water column below 8.5 m, the DO concentration was less than 4 mg/L.

At R1, the DO level was generally about 6 mg/L in the entire water column.

The measurements indicate the formation of oxyclines in R2, R3, R4 and R5.

As expected, the TSS concentrations in the main reservoir have been consistently low since the start of impounding with a mean 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 BOD_5 measurement at R3, R4 and R5 in the epilimnion were within the standard, but in the hypolimnion, BOD_5 was recorded at 6.34 mg/L, 3.15 mg/L and 6.03 mg/L respectively, exceeding the standard.

Re-regulation Reservoir

In May 2020, the turbine discharge from the main dam varied between 140 m^3/s and 220 m^3/s interrupted by usually night-time periods with no discharge.

The DO measurements at R6 and R7 representing turbine discharges from the main dam generally had DO concentrations below 2 mg/L in the entire water column.

The BOD_5 concentration in R6 and R7 were between 5.9 mg/L and 3.7 mg/L respectively.

Downstream

During May 2020, the discharge from the re-regulation dam alternated between discharges from the gate and turbine. All DO concentrations were less than 6 mg/L at the Nam Ngiep Downstream stations and thus are non-compliant with the National Standard. No dead fish were observed in Nam Ngiep downstream during the periods with low DO. NNP1PC is in the process of hiring an international consulting company to assist with the design of additional aeration system to improve the DO level downstream.

The BOD_5 in the downstream stations were between 1.0 mg/L and 3.54 mg/L.

FIGURE 3-1: SURFACE WATER AND RE-REGULATION RESERVOIR WATER QUALITY MONITORING STATIONS

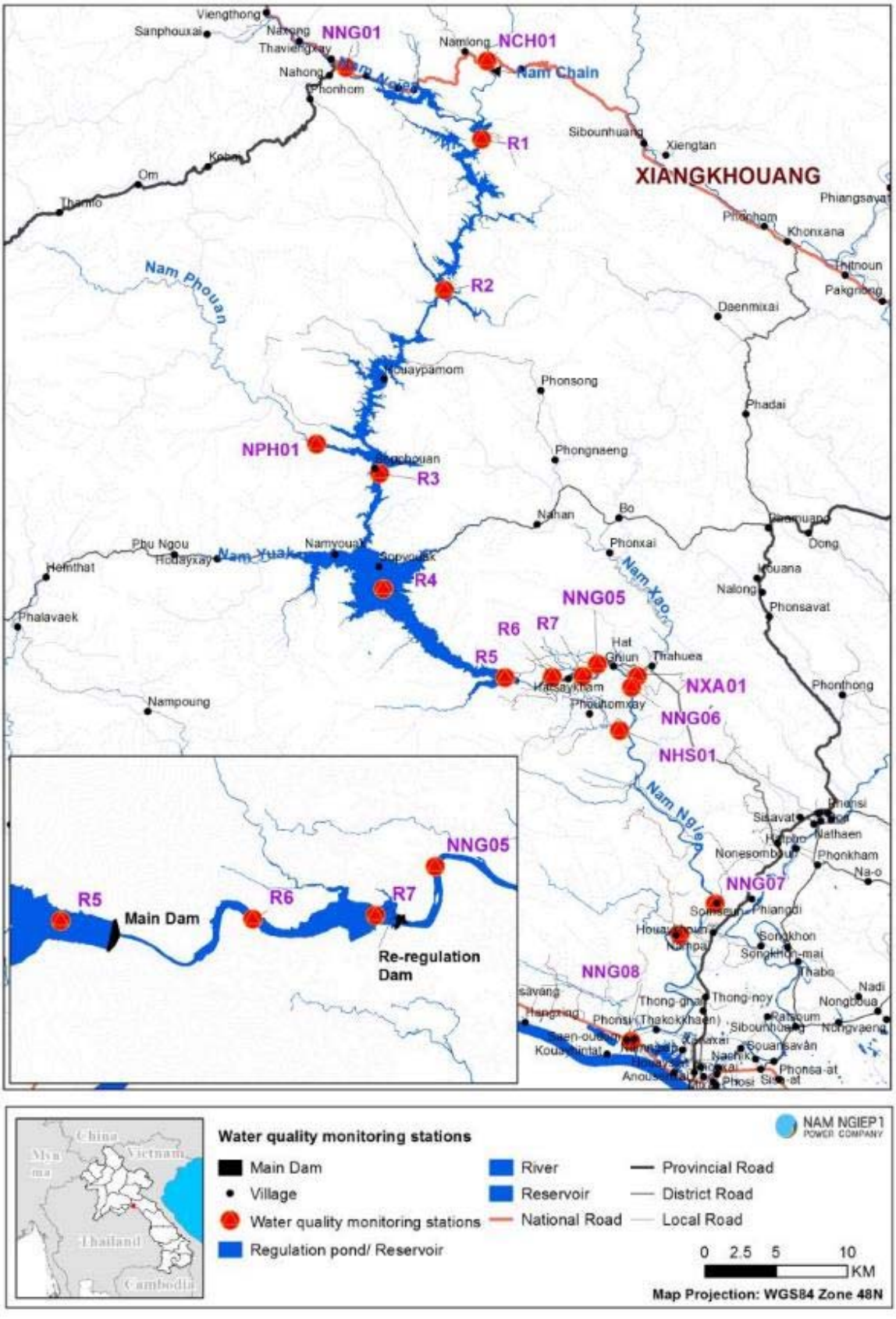


FIGURE 3-2: CONCENTRATION OF DISSOLVED OXYGEN IN THE UPPER 0.2 M SINCE SEPTEMBER 2019 TO MAY 2020

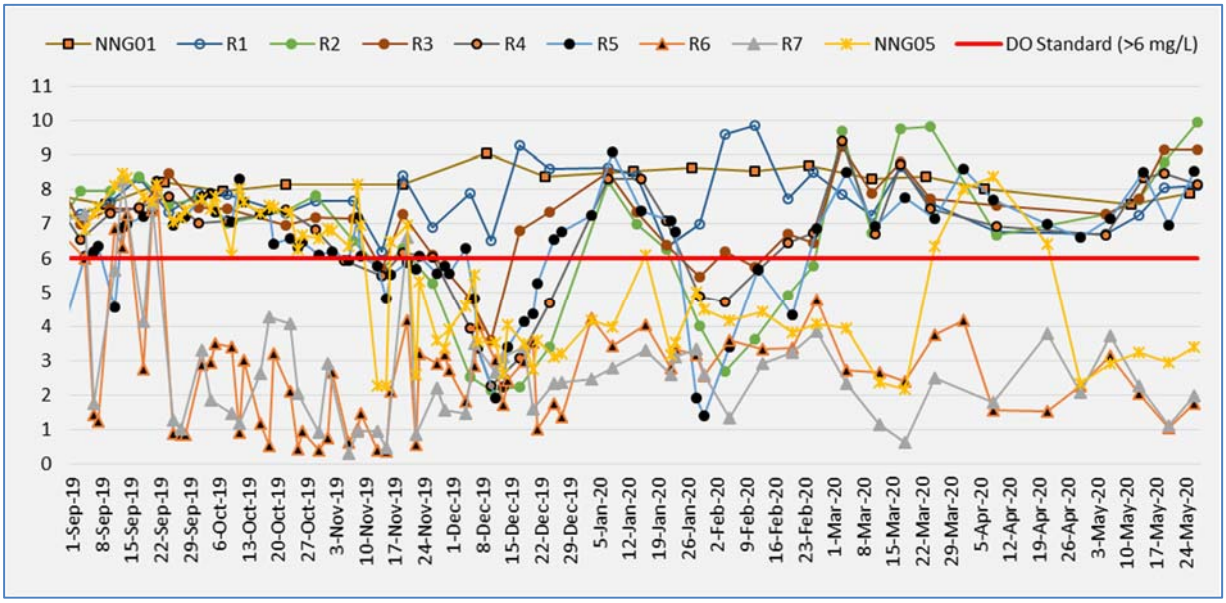


TABLE 3-3: *RESULTS OF SURFACE WATER QUALITY MONITORING FOR DISSOLVED OXYGEN (MG/L) IN THE UPPER 0.2 M, WATER QUALITY STANDARD: >6.0 MG/L*

DO (mg/L)	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
5-May-20		6.7	7.3	7.3	6.67											
6-May-20						7.15	3.13	3.71	2.91	2.25	4.44	4.41		6.63	6.52	6.1
11-May-20	7.59												7.23			
12-May-20														7.57		
13-May-20		7.2	7.71	7.74			2.04	2.27	3.23	3.08	4.42	5.43			5.14	5.79
14-May-20					8.35	8.51										
19-May-20		8.1	8.81	9.14	8.47									7.82		
20-May-20						6.95	1.04	1.12	2.93	3.16	4.91	5.37			5.16	6.67
25-May-20	7.91												8.16			
26-May-20						8.55	1.75	1.98	3.38	3.78	5.1	6.71			6.92	7.63
27-May-20		8.1	9.95	9.14	8.15									8.47		

TABLE 3-4: *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
11-May-20	26.5												10.97			

Total Suspended Solids (mg/L)	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
12-May-20		202		6.66										635.6		
12-May-20 Hypolimnion				19.48												
13-May-20							<5	<5	<5	<5	5.32	18.54			8.2	<5
14-May-20					<5	<5										
14-May-20 Hypolimnion					7.6	<5										

TABLE 3-5: *RESULTS OF SURFACE WATER QUALITY MONITORING FOR BOD_5 (MG/L) - WATER QUALITY STANDARD: < 1.5 MG/L*

BOD_5 (mg/L)	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
11-May-20	<1												<1			
12-May-20		<1		1.01										1.26		
12-May-20 Hypolimnion				6.34												
13-May-20							1.66	2.14	2.62	3.54	<1	<1			6.51	1.54
14-May-20					1.18	<1										
14-May-20 Hypolimnion					3.15	6.03										

3.2.3 Groundwater Quality Monitoring

During May 2020, community groundwater quality analyses were carried out for three wells located in Somseun Village, Nam Pa Village, Thong Noy Village and Pou Village.

The results indicated compliance with the groundwater quality standards for water supply purposes, except for faecal coliform and E.Coli bacteria as presented in Table below.

TABLE 3-6: GROUNDWATER QUALITY MONITORING RESULTS IN SOMSUEN, NAM PA, THONGNOY AND POU VILLAGES

Parameter (Unit)	Site Name	Somseun Village	Nam Pa Village	Thong Noy Village	Pou Village
	Station	GSXN01	GNPA01	GTHN01	GPOU01
	Guideline				
pH	6.5 - 9.2	7.27	7.33	7.11	6.66
Sat. DO (%)		84.3	93.3	35.9	87.3

Parameter (Unit)	Site Name	Somseun Village	Nam Pa Village	Thong Noy Village	Pou Village
	Station	GSXN01	GNPA01	GTHN01	GPOU01
	Guideline				
DO (mg/l)		6.3	6.87	2.55	6.16
Conductivity (µS/cm)		319	348	259	22
Temperature (°C)		28.9	29.8	31.4	31.2
Turbidity (NTU)	<20	2.15	1.69	1.94	2.95
Fecal coliform (MPN/100 mL)	0	6.8	4.5	1,600	2
E.coli Bacteria (MPN/100 mL)	0	4	4.5	350	2

3.2.4 Gravity Fed Water Supply (GFWS) Quality Monitoring

During May 2020, water samples from water taps at Hat Gniun Village and Phouhomxay Village were analysed. The WPHX01 represents raw water in the head tank before the filtration system.

The results of the water quality analyses are presented in Table 3-7. All parameters complied with the National Drinking Water Standards except for faecal coliforms and E. Coli at WTHH02, WHGN02, WPHX01 (intake), WPHX02 (tap water at the primary school in Phouhomxay Village) and WPHX03 (tap water at a house in Phouhomxay Village). The villagers generally use tap water for washing and cleaning. They were informed about the results and were encouraged to boil the water before drinking.

TABLE 3-7: RESULTS OF THE GRAVITY FED WATER SUPPLY QUALITY MONITORING

		Site Name	Tha heau Village	Hat Gnuin Village	Phouhomxay Village		
		Station	WTHH02	WHGN02	WPHX01	WPHX02	WPHX03
Date	Parameter (Unit)	Guideline					
22-May-20	pH	6.5 - 8.6	8.6	7.18	8.49	8.79	8.95
22-May-20	Sat. DO (%)		99.6	96	96.1	97	93.8
22-May-20	DO (mg/L)		7.18	6.92	7.4	6.92	6.8
22-May-20	Conductivity (µS/cm)	<1,000	53	71.1	10.37	9.34	8.78
22-May-20	Temperature (°C)	<35	30.9	30.9	27	31.4	30.4
22-May-20	Turbidity (NTU)	<10	2.14	3.66	1.75	2.11	1.92
22-May-20	Faecal Coliform (MPN/100 mL)	0	4.5	33	46	7.8	17
22-May-20	E.Coli Bacteria (MPN/100 mL)	0	2	33	33	7.8	11

3.2.5 Landfill Leachate Monitoring

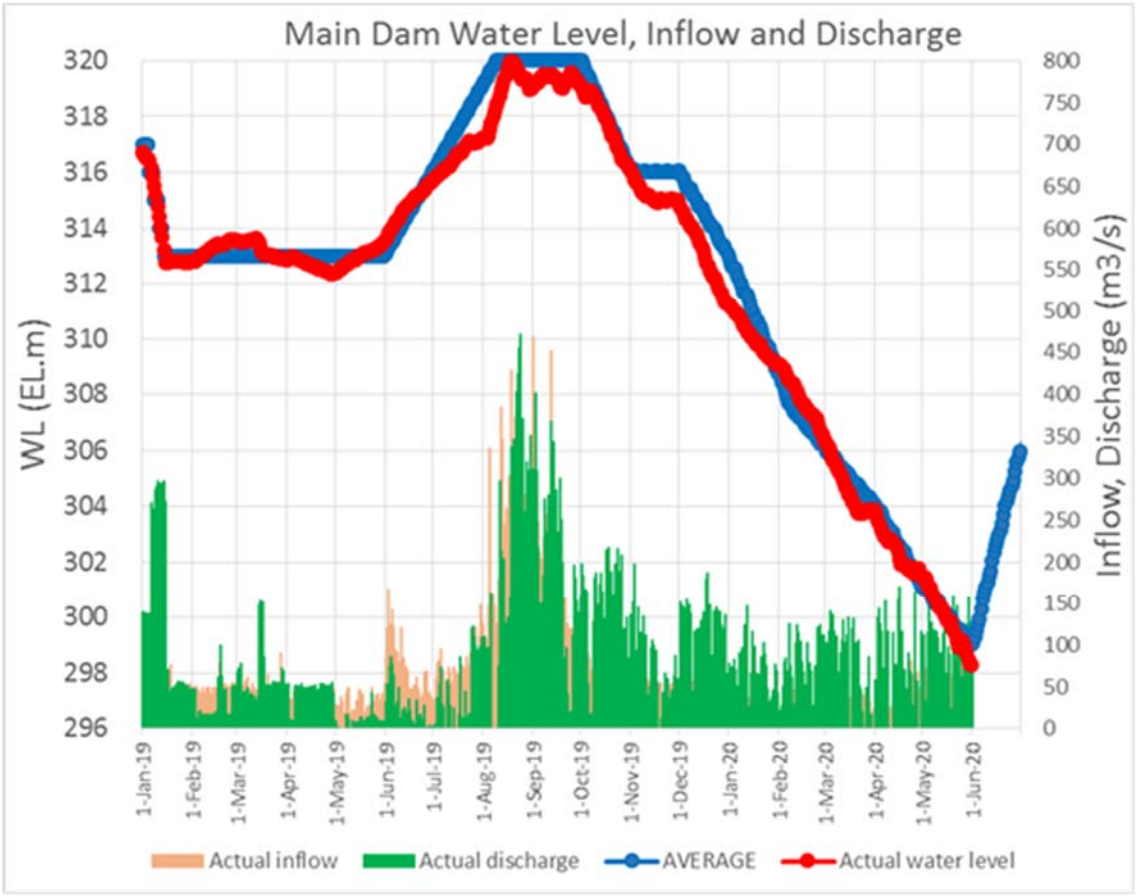
During May 2020, water sampling from NNP1 Project Landfill and Houay Soup Solid Waste Landfill were not carried out because there was no inflow of leachate into the ponds and the last pond in both landfills had almost dried-up.

3.2.6 Discharge Monitoring

The water level in the main reservoir, inflow to the reservoir and discharge from the reservoir since the start of the impounding on 15 May 2018 is presented in the graph in Figure 1-3.

During May 2020, the mean inflow to the main reservoir was 52 m3/s (min 24 m3/s and max 84 m3/s). During May 2020, the water level in the main reservoir decreased with 3.0 m from El. 301.5 m asl. to El. 298.5 m asl.

FIGURE 3-3: WATER LEVEL, INFLOW AND DISCHARGE FOR THE MAIN RESERVOIR

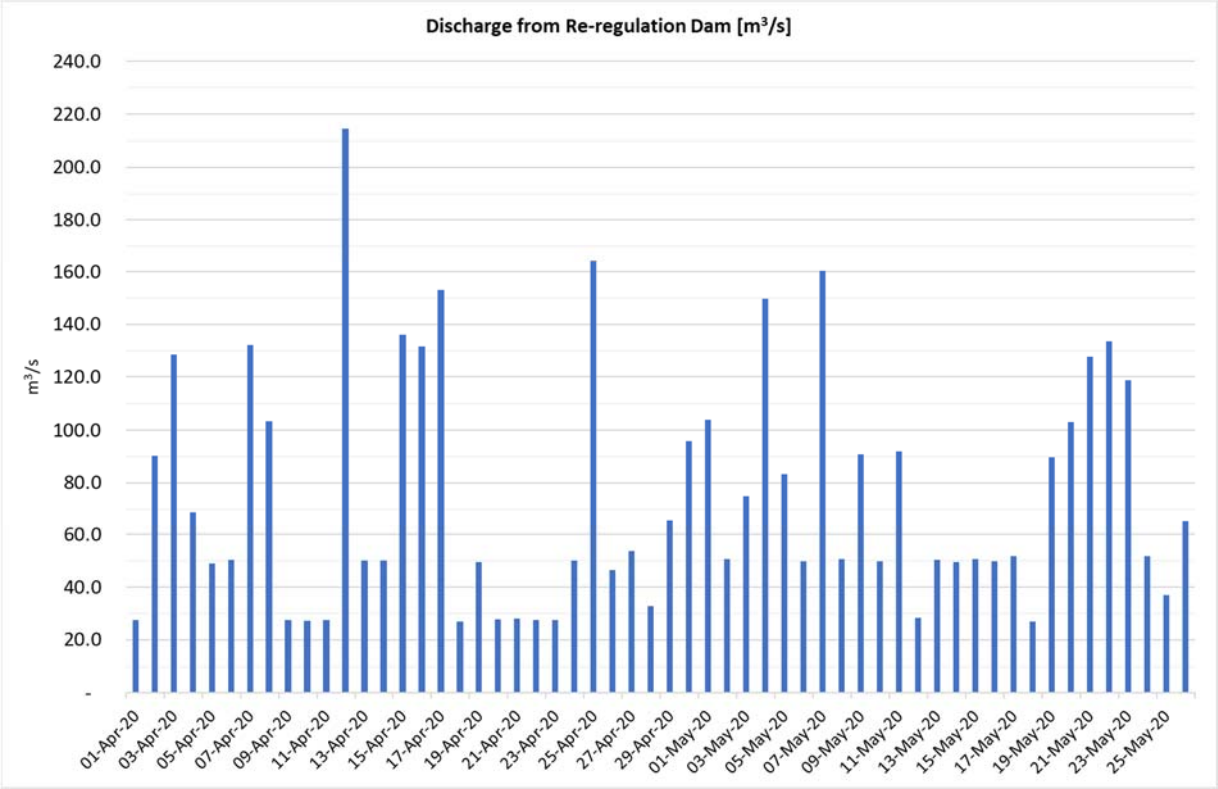


The discharge monitoring data for the re-regulation dam during April 2020 and May 2020 is presented in Figure 3-4.

During May 2020, the mean discharge from the re-regulation dam was about 77 m3/s with turbine discharges varying between 50 m3/s and 160 m3/s interrupted by periods with gate discharge of about 28 m3/s. The discharge was kept above the minimum flow requirement of 27 m3/s at all times.

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.

FIGURE 3-4: DISCHARGE MONITORING AT THE RE-REGULATION DAM IN APRIL 2020 AND MAY 2020



3.2.7 Nam Ngiep Downstream Water Depth Monitoring

In May 2020, EMO carried out only one boat mission to monitor the water depth in the Nam Ngiep downstream of the re-regulation dam. A total of 19 sites have been identified with potential shallow water depths but none of them were found to be difficult to navigate.

3.3 PROJECT WASTE MANAGEMENT

3.3.1 Solid Waste Management

In May 2020, a total of 16.6 m3 of solid waste was disposed of at the NNP1 Project Landfill, a decrease of 2.4 m3 compared to April 2020.

During May 2020, the local waste collection Contractor continued with the routine waste disposal and maintenance activities which included a bi-weekly waste covering, perimeter fence maintenance and cleaning-up sediment from the ditch surrounding the leachate ponds to prevent the run-off from entering into the leachate ponds.

TABLE 3-8: AMOUNTS OF RECYCLABLE WASTE SOLD

Source and Type of Recycled Waste		Unit	Sold	Cumulative Total by May 2020
1	Glass bottles	kg	0	53
2	Plastic bottles	kg	0	46
3	Paper/Cardboard	kg	0	17
4	Aluminium cans	kg	0	46
Total		**kg**	**0**	**182**

The villagers from Phouhomxay Village collected a total of 990 kg of food waste from the OSOV1 canteen for animal feed in May 2020, an increase of 80 kg compared to April 2020 because most staff stayed on site during the COVID-19 outbreak prevention period.

3.3.2 Hazardous Materials and Waste Management

The types and amounts of hazardous material and hazardous waste stored on site in May 2020 are shown in Table 3-9 and Table 3-10.

TABLE 3-9: RESULTS OF HAZARDOUS MATERIAL INVENTORY

No.	Type of Hazardous Material	Unit	Total in May 2020 (A)	Used (B)	Remainder (A - B)
1	Diesel (fuel)	Litre	15130	10143	5161
2	Gasoline (petroleum)	Litre	1000	0	1000
3	Gear Lubricant	Litre	646	0	646
4	Liquid Chlorine	Litre	38	38	0
5	Grease	Drum (25 L)	29	0	29
6	Chlorine Powder	Kg	23	3	20
7	Sika	Can	7	0	7
8	Colour paint	Drum (20L)	3	0	3
9	Thinner	Drum (3 L)	1	0	1

TABLE 3-10: RESULTS OF HAZARDOUS WASTE INVENTORY

No.	Hazardous Waste Type	Unit	Total in May 2020 (A)	Dispose (B)	Remainder (A - B)
1	Used oil	Litre	72	0	72
2	Ink cartridge	Unit	134	0	134
3	Halogen/fluorescent bulbs	Unit	191	0	191
4	Empty spray can	Can	95	0	95
5	Contaminated soil/sand	Cubic Metre (m^3)	0.34	0	0.34
6	Clinic waste	kg	5.6	0	5.6

3.4 COMMUNITY WASTE MANAGEMENT

3.4.1 Community Recycling Programme

In May 2020, the Community Recycle Waste Bank received no recyclables from Phouhomxay Village and the two host villages due to the village lockdown for COVID-19 prevention. A total of 442 Kg of glasses was moved from the Houy Soup landfill recycling centre to the Community Recycle Waste Bank so the total amount of recyclable waste stored in the waste bank is 3,122 Kg.

TABLE 3-11: TYPES AND AMOUNTS OF RECYCLABLE WASTE TRADED AT THE COMMUNITY RECYCLE WASTE BANK

Types of Waste	Unit	Remaining in April 2020	Additional in May 2020	Sold/ dispose	Remaining in April 2020
Glass bottles	kg	1,792	0	0	1,792
Paper/cardboard	kg	852.5	0	0	852.5
Plastic bottles	kg	35.5	0	0	35.5
Aluminium cans	kg	0	0	0	0
Scrap metal	kg	0	0	0	0
Total	**kg**	**2,680**	**442**	**0**	**3,122**

3.4.2 Community Solid Waste Management

Approximately 17.1 m3 of solid waste was collected from the host and Phouhomxay Villages for disposal at Houay Soup landfill, a decrease of 6.4 m3 compared to April 2020.

3.5 WATERSHED AND BIODIVERSITY MANAGEMENT

3.5.1 Watershed Management

3.5.1.1 Implementation of Annual Implementation Plan (AIP) 2019

As a result of the lockdown to prevent COVID-19, the delivery of three patrol boats is expected to be in June or July 2020. Official handover ceremonies of the procured office and field equipment under the NNP1PC additional No Loss (NNL) commitment to support the WRPO of Xaysomboun and Bolikhamxay Provinces for implementing the AIP2019 activities were organized on 08 May 2020 in Bolikhamxay Province and on 20 May 2020 in Xaysomboun Province respectively.

DOF-MAF and Xaysomboun Provincial WRPO submitted their Monthly Progress Reports for January to March 2020 under the AIP2019 implementation. There were no further updates on the activities implementation under AIP2019 in Xaysomboun and Bolikhamxay Provinces during this reporting period.

NNP1PC organized a final consultation meeting on the final draft of Fishery Co-Management Plan (FCMP) and Fishery Regulation for NNP1 main Reservoir on 21 May 2020 at Xaysomboun PAFO in Anouvong District, Xaysomboun Province. The meeting was chaired by the Head of

Xaysomboun PAFO/Vice Chairperson of Xaysomboun WRPC and attended by 23 people which comprised of representatives from Xaysomboun WRPO, Bolikhamxay Provincial WRPO, DAFO of Thathom District and Hom District, provincial and district levels of Fishery Sections of both Bolikhamxay and Xaysomboun Provinces, as well as NNP1PC staff. The results could be summarized as below:

- The meeting agreed in principle on the final draft of FCMP and Fishery Regulation.
- The institutional arrangement for fishery management should follow the Lao Fishery Law and will consist of PAFO (WRPC/WRPO), DAFO, Reservoir Fishery Management Committee, and village fishery groups.
- The actual total area of the proposed Fishery Conservation Zone (FCZ) in the Zone 2 and Zone 4 of the reservoir will be resurveyed as part of the management Plan implementation.
- Local fishers and fish traders particularly the Project Affected People (PAP) should be given a priority for fishing in the reservoir for self-consumption or commercial purposes. This is in line with the NNP1 watershed management objectives and the NNP1 livelihood restoration program.
- Fishers from villages in Bolikhamxay Province can register and obtain their fishing license and fish in Xaysomboun Province.
- Reservoir fish catch should be surveyed as a reference for the Provincial Authorities to establish the tariff for fishing concession.
- The final draft FCMP and Regulation will be revised based on the comments and submitted to Xaysomboun PAFO (WRPC/WRPO) for final review and approval in June 2020.

NNP1PC organized a technical meeting on the result of an assessment on sustainable livelihood opportunities for NNP1 watershed communities on 22 May 2020 at Xaysomboun PAFO. The meeting was attended by three relevant representatives from Xaysomboun PAFO/WRPO and four representatives from NNP1PC including the Consultant. There were minor comments received from the technical staff of PAFO on the reports: a) the additional information on the agriculture activities funded by other and previous Projects should be elaborated in the final report and; b) the proposed action plan of each community shall be prioritized. The final report is expected to be ready for Provincial WRPC/WRO consideration in June 2020.

3.5.2 Biodiversity Offset Management

3.5.2.1 Engagement of Biodiversity Service Provider (BSP)

NNP1PC finalized the fourth draft of Memorandum of Understanding (MOU) to be signed between ADB-WCS-NNP1PC on 18 May 2020. The ADB agreed with the revised draft on 19 May 2020 whilst the WCS (Wildlife Conservation Society as a Biodiversity Service Provider hired by ADB to support NNP1 Project) is still reviewing it until the end of May 2020.

NNP1PC organized and hosted a kick-off meeting for the BSP to meet and get introduced with Bolikhamxay Provincial BOMU and WRPO teams on 15 May 2020. At this meeting, the overall BSP team introduction, role and responsibility, as well as mechanisms for reporting and monitoring by relevant agencies (GOL, NNP1PC and BSP) were discussed in detail. The kick-off meeting with Xaysomboun Provincial WRPO will be organized in early June 2020 pending their availability.

NNP1PC-EMO and the BSP continued to make progress by having many unofficial discussions via phone calls and emails on several topics such as the preparation of a Law Enforcement

Strategy document for NC-NX offset site, the future biological monitoring focussing on the design of camera traps and listening post survey for the NC-NX Offset Site and NNP1 sub-catchment, community outreach program, conservation linked livelihood and the training on patrolling and SMART.

3.5.2.2 Implementation of BOMP Annual Implementation Plan (AIP) 2019 and 2020

Bolikhamxay Provincial Biodiversity Offset Management Unit (BOMU) has continued implementing the planned activities using the remaining budget of AIP2019. NNP1PC already transferred the fund to the central account of DOF-MAF on 08 May 2020 for the implementation of activities under the first and second quarters of AIP2020. The fund is expected to reach the Provincial BOMU account in the first week of June 2020.

Progresses on the implementation of key activities by Component in May 2020 are described below:

a. Component 1 - Spatial Planning and Regulation

The signage installation in the remaining villages will be continued in July 2020.

b. Component 2 – Law Enforcement

In line with the GOL preventive measures for COVID-19 outbreak, the four patrol teams continued the patrolling between 08 to 29 May 2020 with the focus on TPZ highest priority area around Thongnachang and Nam San, Nam Ma TPZ higher priority area, Nam Houng TPZ priority area including Nam Sik and Nam Somfad in Natan and Na Gnang Village area, and Nam Chamhang in Xaychamphone District. The result of May 2020 patrolling will be presented and discussed in June 2020.

The data presented here is the results of patrolling activity in April 2020.

In April 2020, the first team carried out patrolling at TPZ highest priority area including Nam Sone, Nam Chang, Nam San, Houy Patao and Houy Phalai. They spent 16 days covering a distance of 50 km on forest patrolling and 34 km on road patrolling. The team made a total of two direct observations and three indirect observations of the following wildlife: Black Giant Squirrel, Phayre's leaf monkey, Brown Hornbills, White-cheeked Gibbons and wild pigs. The team also encountered with a number of threats such as three small active camps, two groups of people with the total of 10 people with motorbikes, five spear guns, three fishing nets and other fishing gears. The camps were destroyed by the patrolling team. Also, there were two plots of land clearing around 0.5 ha/plot likely for livestock raising observed around Houay Patao outside the TPZ area.

In April 2020, the second team carried out patrolling at Nam Ma TPZ high priority area which include Nam Ma, Nam Pang and Nam Kapong. They spent 15 days covering a distance of 66 km on forest patrolling and 91 km on road patrolling. The team made a total of three direct observations and four indirect observations of the following wildlife: Macaques, Otter, Black Giant Squirrels, White-cheeked Gibbons, Sambars and Civet. The team did not encounter any threats during the patrolling.

In April 2020, the third team carried out patrolling at Xaychamphone District area including Nam Tan, Nam Houng, Houy Tong, Houy Mouang, Houy Wod-wod and Houy Chok. They spent 16 days covering a distance of 55 km on forest patrolling and 24 km on road patrolling. The team made a total of seven direct observations and two indirect observations of the following

wildlife: White-cheeked Gibbon, Muntjac, Macaque, Impressed Tortoise, Black Giant Squirrels and Wild Pig. The team also encountered a number of threats such as two small inactive camps, 250 small wire snares and 150 large wire snares. The camps were destroyed by patrolling team.

In April 2020, the fourth team carried out patrolling at Nam houng TPZ high priority area including Nam Houng, Nam Tan and Nam Kha Gna. They spent 15 days covering a distance of 66 km on forest patrolling and 68 km on road patrolling. The team made a total of one direct observation and two indirect observations of the following wildlife: Eagle, Wild Pig and Civet. The team also observed one land clearing around 1 ha at Houay Nam Touk outside the TPZ area.

FIGURE 3-5: MAP OF THREATS RECORDED BY PATROLLING TEAMS IN MAY 2020

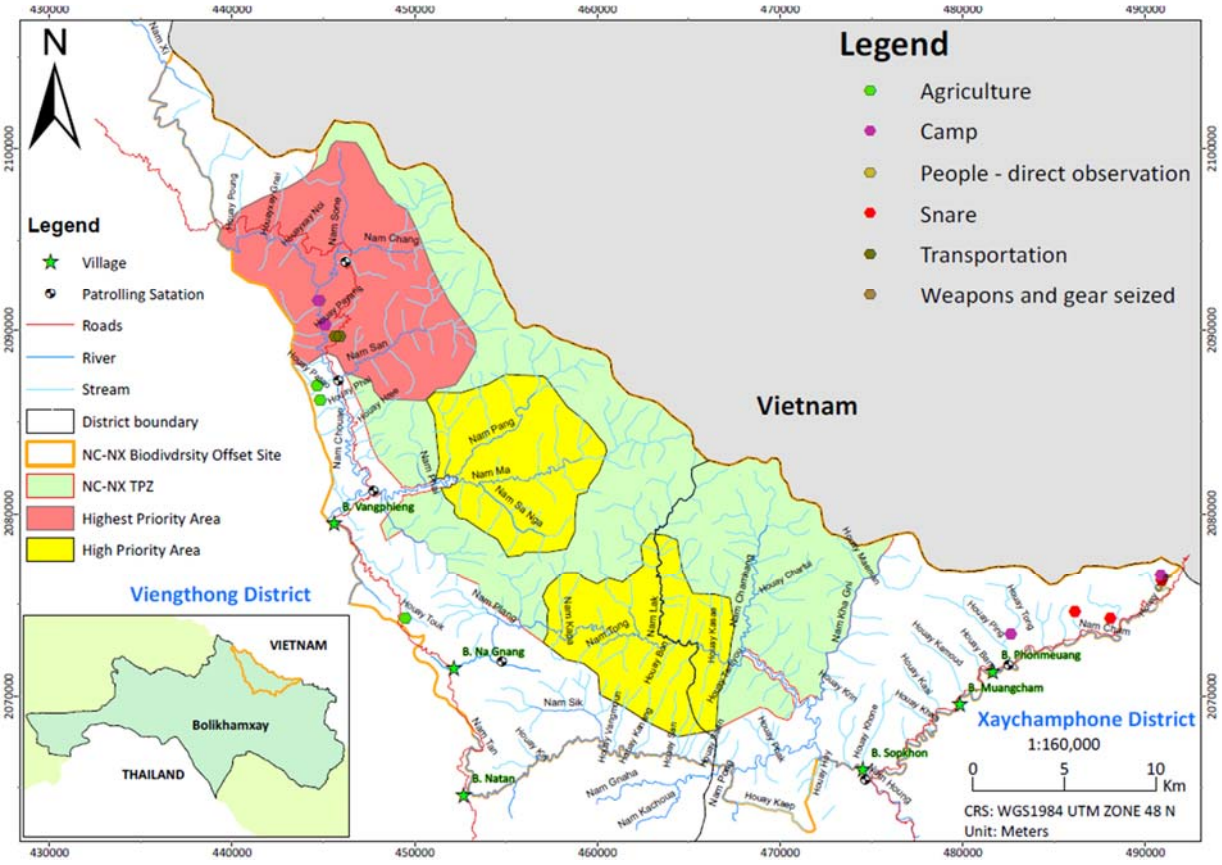


FIGURE 3-6: MAP OF WILDLIFE SIGNS RECORDED BY TWO PATROLLING TEAMS IN MAY 2020

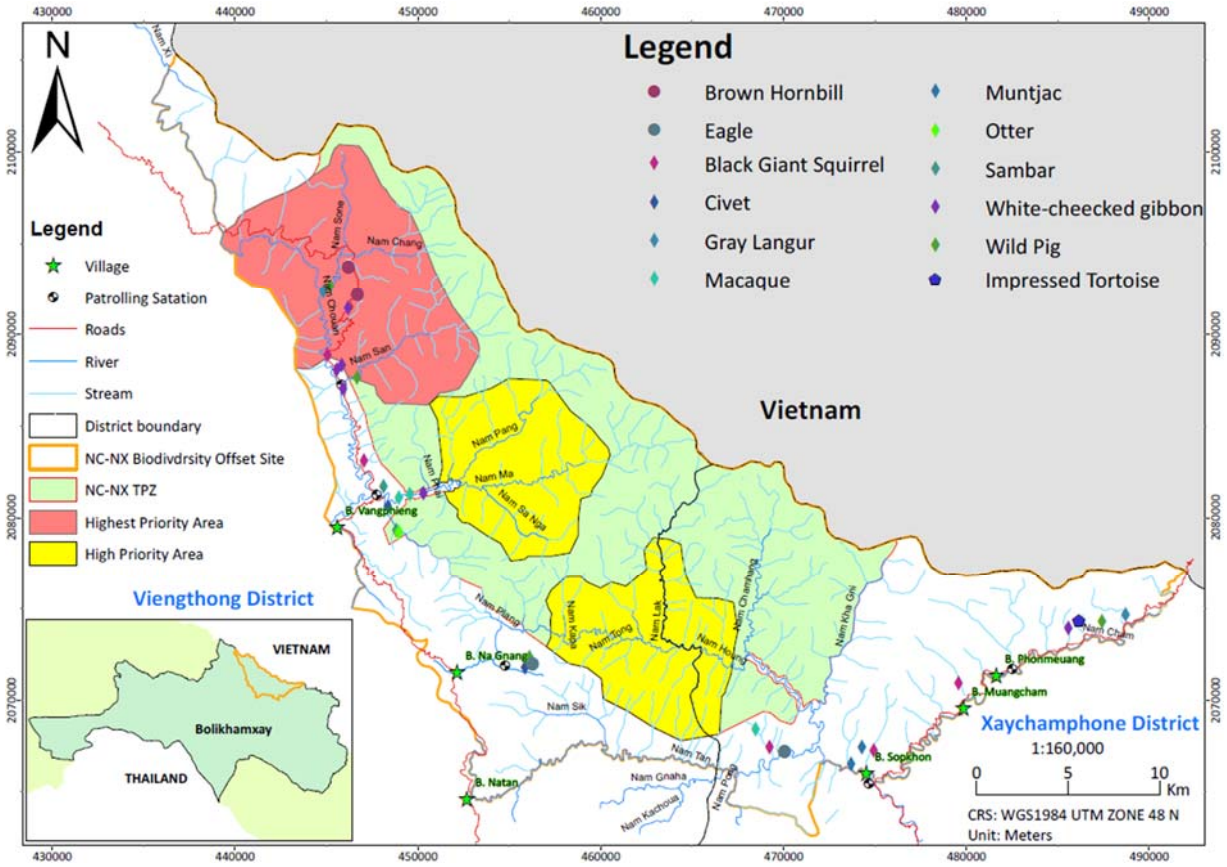


Figure 3-7: Fishing camp observed at Nam Chouane, Viengthong District

Figure 3-8: A group of people fishing was observed by the patrol team at Nam Chouane, Viengthong District

Figure 3-9: Patrol team removing the snare at Houy Wod-Wod, Xaychamphone District

Figure 3-10: Inactive hunting camp was observed at Houy Tong, Xaychamphone District

Figure 3-11: Impressed Tortoise observed at Houy Moung, Xaychamphone District

Figure 3-12: Patrol team removing the snare at Houy Chok, Xaychamphone District

c. Component 4 – Conservation linked livelihood development

NNP1PC and the CDP consultant conducted a field assessment in the six NC-NX villages between 25 May – 11 June 2020 with the participation of the BSP team.

3.6 FLOATING DEBRIS REMOVAL

There was no field works carried out in May 2020 due to the camp lockdown.

4. FISHERY MONITORING

The results of fishery monitoring for April and May 2020 will be reported in June 2020 due to late completion in data collection related with the COVID-19 lockdown.

ANNEXES

ANNEX A: RESULTS OF WATER QUALITY MONITORING

TABLE A- 1: ***RESULTS OF MAIN RESERVOIR, RE-REGULATION RESERVOIR AND SURFACE WATER (NAM NGIEP RIVER) QUALITY MONITORING***

		River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream			
		Station Code	NNG 01	R1	R2	R3	R4	R5	R6	R7	NNG 05	NNG 06	NNG 07	NNG 08
Date	Parameters (Unit)	Guideline												
5-May-20	pH	5.0 - 9.0		8.2	7.59	8.62	7.05							
6-May-20	pH	5.0 - 9.0						6.45	5.6	5.56	6.12	6.46	6.35	6.22
11-May-20	pH	5.0 - 9.0	6.91											
12-May-20	pH	5.0 - 9.0												
13-May-20	pH	5.0 - 9.0		6.6	6.27	7.82			6.52	6.1	6.13	6.16	6.36	6.33
14-May-20	pH	5.0 - 9.0					7.46	7.23						
19-May-20	pH	5.0 - 9.0		6.5	6.59	8.05	6.36							
20-May-20	pH	5.0 - 9.0						7.28	6.6	6.65	6.22	6.3	7.1	7.28
25-May-20	pH	5.0 - 9.0	7.12											
26-May-20	pH	5.0 - 9.0						7.02	6.79	6.8	6.2	6.46	6.58	6.74
27-May-20	pH	5.0 - 9.0		6.8	7.07	7.71	7.61							
5-May-20	Sat. DO (%)			83	98.5	97.9	87.6							
6-May-20	Sat. DO (%)							92.9	38	45.6	36.1	30.8	56.9	56.5
11-May-20	Sat. DO (%)		104											
12-May-20	Sat. DO (%)													
13-May-20	Sat. DO (%)			94	103	105			24.3	27.2	39.8	37.7	55.8	68.8
14-May-20	Sat. DO (%)						111	112.5						
19-May-20	Sat. DO (%)			103	117	124.2	114.6							
20-May-20	Sat. DO (%)							92	12.2	13.6	35.7	38.4	62.2	68.5
25-May-20	Sat. DO (%)		103											
26-May-20	Sat. DO (%)							112.1	20.9	23.8	41.5	46.8	63.9	84.3
27-May-20	Sat. DO (%)			109	133	123.5	109.6							
5-May-20	DO (mg/L)	>6.0		6.7	7.3	7.3	6.67							
6-May-20	DO (mg/L)	>6.0						7.15	3.13	3.71	2.91	2.25	4.44	4.41
11-May-20	DO (mg/L)	>6.0	7.59											
12-May-20	DO (mg/L)	>6.0												
13-May-20	DO (mg/L)	>6.0		7.2	7.71	7.74			2.04	2.27	3.23	3.08	4.42	5.43
14-May-20	DO (mg/L)	>6.0					8.35	8.51						
19-May-20	DO (mg/L)	>6.0		8.1	8.81	9.14	8.47							

		River Name	Nam Ngiep										
		Zone	Location Refer to Construction Sites										
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream		
		Station Code	NNG 01	R1	R2	R3	R4	R5	R6	R7	NNG 05	NNG 06	NNG 07	NNG 08
Date	Parameters (Unit)	Guideline												
20-May-20	DO (mg/L)	>6.0						6.95	1.04	1.12	2.93	3.16	4.91	5.37
25-May-20	DO (mg/L)	>6.0	7.91											
26-May-20	DO (mg/L)	>6.0						8.55	1.75	1.98	3.38	3.78	5.1	6.71
27-May-20	DO (mg/L)	>6.0		8.1	9.95	9.14	8.15							
5-May-20	Conductivity (µs/cm)			78	96	80	77							
6-May-20	Conductivity (µs/cm)							75	93	87	91	92	91	86
11-May-20	Conductivity (µs/cm)		54.3											
12-May-20	Conductivity (µs/cm)													
13-May-20	Conductivity (µs/cm)			68	94	80			93	90	91	92	87	86
14-May-20	Conductivity (µs/cm)						77	75						
19-May-20	Conductivity (µs/cm)			98	89	82	77							
20-May-20	Conductivity (µs/cm)							75	96	90	91	91	89	82
25-May-20	Conductivity (µs/cm)		115											
26-May-20	Conductivity (µs/cm)							72	92	92	93	91	85	63
27-May-20	Conductivity (µs/cm)			89	90	77	74							
5-May-20	Temperature (°C)			28	31.3	30.78	29.67							
6-May-20	Temperature (°C)							28.99	25.25	26.01	26.22	26.65	28.15	28.13
11-May-20	Temperature (°C)		29.2											
12-May-20	Temperature (°C)													
13-May-20	Temperature (°C)			29	30.9	31.29			24.18	24.96	25.32	25.08	27.32	27.68
14-May-20	Temperature (°C)						30.45	29.87						
19-May-20	Temperature (°C)			28	30.2	31.59	31.25							
20-May-20	Temperature (°C)							30.02	24.63	25.17	25.51	25.42	27.37	28.11
25-May-20	Temperature (°C)		26.5											
26-May-20	Temperature (°C)							29.44	24.86	24.88	25.66	25.68	26.59	27.12

		River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream			
		Station Code	NNG 01	R1	R2	R3	R4	R5	R6	R7	NNG 05	NNG 06	NNG 07	NNG 08
Date	Parameters (Unit)	Guideline												
27-May-20	Temperature (°C)			31	30.7	31.38	30.94							
5-May-20	Turbidity (NTU)			38	4.14	2.33	2.52							
6-May-20	Turbidity (NTU)							2.56	3.45	4.09	5.38	5.91	5.4	6.98
11-May-20	Turbidity (NTU)		18.3											
12-May-20	Turbidity (NTU)													
12-May-20	Turbidity (NTU) -Hypolimnion					2.12								
13-May-20	Turbidity (NTU)			38	4.76	3.01			2.53	4.55	3.34	3.59	4.94	6.36
14-May-20	Turbidity (NTU)						2.78	2.91						
14-May-20	Turbidity (NTU) -Hypolimnion						2.19	2.15						
19-May-20	Turbidity (NTU)			69	3.55	2.08	2.45							
20-May-20	Turbidity (NTU)							3.9	3.06	5.46	5.08	5.14	5.57	6.73
25-May-20	Turbidity (NTU)		22.2											
26-May-20	Turbidity (NTU)							3.05	2.72	4.65	3.82	5.63	8.39	12.28
27-May-20	Turbidity (NTU)			60	5.31	2.8	2.81							
11-May-20	TSS (mg/L)		26.5											
12-May-20	TSS (mg/L)			202		6.66								
12-May-20	TSS (mg/L) - Hypolimnion					19.48								
13-May-20	TSS (mg/L)								<5	<5	<5	<5	5.32	18.54
14-May-20	TSS (mg/L)						<5	<5						
14-May-20	TSS (mg/L)- Hypolimnion						7.6	<5						
11-May-20	BOD_5 (mg/L)	<1.5	<1.0											
12-May-20	BOD_5 (mg/L)	<1.5		<1		1.01								
12-May-20	BOD_5 (mg/L) - Hypolimnion	<1.5				6.34								
13-May-20	BOD_5 (mg/L)	<1.5							1.66	2.14	2.62	3.54	<1	<1
14-May-20	BOD_5 (mg/L)	<1.5					1.18	<1						
14-May-20	BOD_5 (mg/L) - Hypolimnion	<1.5					3.15	6.03						
11-May-20	Faecal coliform (MPN/100 mL)	<1,000	240											
12-May-20	Faecal coliform (MPN/100 mL)	<1,000		110		2								
12-May-20	Faecal coliform (MPN/100 mL) - Hypolimnion	<1,000				0								
13-May-20	Faecal coliform (MPN/100 mL)	<1,000							2	23	13	26	130	110

		River Name	Nam Ngiep											
		Zone	Location Refer to Construction Sites											
			Upstream/Main Reservoir						Within / Re-regulation Reservoir		Downstream			
		Station Code	NNG 01	R1	R2	R3	R4	R5	R6	R7	NNG 05	NNG 06	NNG 07	NNG 08
Date	Parameters (Unit)	Guideline												
14-May-20	Faecal coliform (MPN/100 mL)	<1,000					4	2						
14-May-20	Faecal coliform (MPN/100 mL)- Hypolimnion	<1,000					0	9.3						
11-May-20	Total Coliform (MPN/100 mL)	<5,000	1,600											
12-May-20	Total Coliform (MPN/100 mL)	<5,000		1,600		170								
12-May-20	Total Coliform (MPN/100 mL) - Hypolimnion	<5,000				27								
13-May-20	Total Coliform (MPN/100 mL)	<5,000							170	110	220	920	920	350
14-May-20	Total Coliform (MPN/100 mL)	<5,000					1,600	110						
14-May-20	Total Coliform (MPN/100 mL) - Hypolimnion	<5,000					130	79						

TABLE A- 2: ***RESULTS OF SURFACE WATER QUALITY MONITORING IN NAM CHIAN, NAM PHOUAN, NAM XAO AND NAM HOUAY SOUP***

		River Name	Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites			
			Tributaries Upstream		Tributaries Downstream	
		Station Code	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline				
6-May-20	pH	5.0 - 9.0		8.23	6.78	6.21
11-May-20	pH	5.0 - 9.0	7.73			
12-May-20	pH	5.0 - 9.0		6.6		
13-May-20	pH	5.0 - 9.0			3.62	6.61
19-May-20	pH	5.0 - 9.0		6.54		
20-May-20	pH	5.0 - 9.0			6.37	7.05
25-May-20	pH	5.0 - 9.0	7.99			
26-May-20	pH	5.0 - 9.0			6.82	7.16
27-May-20	pH	5.0 - 9.0		7.01		
6-May-20	Sat. DO (%)			85.4	91.6	80.9
11-May-20	Sat. DO (%)		98.6			
12-May-20	Sat. DO (%)			93.5		
13-May-20	Sat. DO (%)				64.6	77.4
19-May-20	Sat. DO (%)			94.8		
20-May-20	Sat. DO (%)				69	85.1
25-May-20	Sat. DO (%)		107.1			
26-May-20	Sat. DO (%)				90.5	96.7
27-May-20	Sat. DO (%)			109.1		
6-May-20	DO (mg/L)	>6.0		6.63	6.52	6.1
11-May-20	DO (mg/L)	>6.0	7.23			
12-May-20	DO (mg/L)	>6.0		7.57		
13-May-20	DO (mg/L)	>6.0			5.14	5.79
19-May-20	DO (mg/L)	>6.0		7.82		
20-May-20	DO (mg/L)	>6.0			5.16	6.67
25-May-20	DO (mg/L)	>6.0	8.16			
26-May-20	DO (mg/L)	>6.0			6.92	7.63
27-May-20	DO (mg/L)	>6.0		8.47		
6-May-20	Conductivity (µs/cm)			88	184	41
11-May-20	Conductivity (µs/cm)		27.8			
12-May-20	Conductivity (µs/cm)			88		
13-May-20	Conductivity (µs/cm)				127	40
19-May-20	Conductivity (µs/cm)			86		
20-May-20	Conductivity (µs/cm)				183	33

		River Name	Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites			
			Tributaries Upstream		Tributaries Downstream	
		Station Code	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline				
25-May-20	Conductivity (µs/cm)		149			
26-May-20	Conductivity (µs/cm)				100	30
27-May-20	Conductivity (µs/cm)			94		
6-May-20	Temperature (°C)			27.91	30.44	30.23
11-May-20	Temperature (°C)		28.7			
12-May-20	Temperature (°C)			26.84		
13-May-20	Temperature (°C)				29.79	30.71
19-May-20	Temperature (°C)			27		
20-May-20	Temperature (°C)				30.17	28.11
25-May-20	Temperature (°C)		26.9			
26-May-20	Temperature (°C)				29.29	27.44
27-May-20	Temperature (°C)			28.5		
6-May-20	Turbidity (NTU)			13.82	4.77	12.25
11-May-20	Turbidity (NTU)		13.4			
12-May-20	Turbidity (NTU)			49.34		
13-May-20	Turbidity (NTU)				5.4	6.29
19-May-20	Turbidity (NTU)			42.06		
20-May-20	Turbidity (NTU)				6.64	10.84
25-May-20	Turbidity (NTU)		7.58			
26-May-20	Turbidity (NTU)				22.13	5.98
27-May-20	Turbidity (NTU)			25.68		
11-May-20	TSS (mg/L)		10.97			
12-May-20	TSS (mg/L)			635.65		
13-May-20	TSS (mg/L)				8.2	<5
11-May-20	BOD_5 (mg/L)	<1.5	<1.0			
12-May-20	BOD_5 (mg/L)	<1.5		1.26		
13-May-20	BOD_5 (mg/L)	<1.5			6.51	1.54
11-May-20	Faecal coliform (MPN/100 mL)	<1,000	220			
12-May-20	Faecal coliform (MPN/100 mL)	<1,000		1600		
13-May-20	Faecal coliform (MPN/100 mL)	<1,000			14	280
11-May-20	Total Coliform (MPN/100 mL)	<5,000	1,600			
12-May-20	Total Coliform (MPN/100 mL)	<5,000		1,600		
13-May-20	Total Coliform (MPN/100 mL)	<5,000			920	1,600

ANNEX B: RESULTS OF EFFLUENT ANALYSES

TABLE B-1: *RESULTS OF CAMP EFFLUENTS IN MAY 2020*

	Site Name	Owner's Site Office and Village (OSOV1)		OSOV2 (ESD Camp No.2)		OSOV2 (ESD Camp 1)		Main Powerhouse
	Station Code	EF01		EF13		EF14		EF19
	Date	07-May-20	18-May-20	07-May-20	18-May-20	07-May-20	18-May-20	11-May-20
Parameters (Unit)	**Guideline**							
pH	6.0 - 9.0	6.5	6.1	6.27	6.49	5.93	6.25	7.59
Sat. DO (%)		44.2	40.6	13.9	7.7	8.5	30.3	0.84
DO (mg/L)		3.31	2.9	0.97	0.55	0.63	2.84	1.42
Conductivity (µs/cm)		348	338	325	404	182.8	190	1650
TDS (mg/L)		174	169	162.5	202	91.4	95	825
Temperature (°C)		28.6	31.2	30.6	30.2	28.9	30.4	25.96
Turbidity (NTU)		1.75	2.32	13.29	21.94	6.24	6.97	9.82
TSS (mg/L)	<50	<5	<5	23.6	23.7	9.27	9.0	91.8
BOD_5 (mg/L)	<30	<6	<6	40	<6	14.7	15.36	40.03
COD (mg/L)	<125	n/a	n/a	n/a	n/a	n/a	n/a	n/a
NH_3-N (mg/L)	<10.0	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total Nitrogen (mg/L)	<10.0	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total Phosphorus (mg/L)	<2	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Oil & Grease (mg/L)	<10.0	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total coliform (MPN/100 mL)	<400	1,600	1,600	35,000	16,000	16,000	35,000	16,000
Faecal Coliform (MPN/100 mL)	<400	170	1,600	35,000	16,000	16,000	16,000	16,000
Effluent Discharge Volume (L/mn)		7.5	6	2.4	4	3		
Chlorination Dosing Rate (mL/mn)		n/a	n/a	0	0.08	0.8		
Residual Chlorine (mg/L)	<1.0	n/a	n/a	0.0	0.1	0.06	0.14	0.12