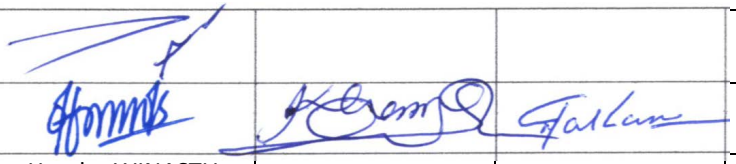
NAM NGIEP 1 POWER COMPANY

Nam Ngiep 1 Hydropower Project

Environmental Management Monthly Monitoring Report

March 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
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 March 2020, the Environmental Management Office (EMO) of Nam Ngiep 1 Power Company (NNP1PC) received two Site Specific Environmental and Social Management Plans (SS-ESMMPs) for review and approval. In addition, two carried over SS-ESMMPs (second submission) will be reviewed and cleared in April 2020.

The effluent monitoring results for the remaining camps of NNP1PC in March 2020 indicate that all the camps complied with the standards for BOD_5, COD, total coliform and faecal coliform. The results of ammonia nitrogen and total nitrogen continue to fluctuate over the month and did not comply with the relevant effluent standards for ESD camps (OSOV2). The effluent from Owner's Site Office and Village (OSOV1) fully complied with the standards. NNP1PC is concluding a price negotiation with the shortlisted external consultant to assess and evaluate the design and operation of the existing WWTS at the ESD camps (OSOV2) and to provide an improved design using a more permanent technology.

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 4 mg/L during this month.

The discharge from the re-regulation dam alternated between discharges from the gate and turbine. Similarly, to February 2020, all DO concentrations (except on 25 March 2020) were below 6 mg/L at Nam Ngiep downstream stations. However, 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 23.4 m^3 solid waste was disposed of at the NNP1 Project Landfill, a decrease of 13.2 m^3 compared to February 2020 due to an improvement of waste separation at camps and waste segregation at the landfill. A total of 2,680 kg of recyclable waste was recorded at the Community Waste Bank. A total of 30.5 m^3 of solid waste from Phouhomxay, Thahuea and Hat Gniun Villages was disposed of at the Houay Soup Landfill.

NNP1PChas issued a purchase order at the end of March 2020 for the procurement of office and field equipment under NNP1PC additional No Net Loss (NNL) commitment to support the WRPO of Xaysomboun and Bolikhamxay Provinces in implementing the activities under AIP2019. Due to a global pandemic of COVID-19 and GOL's imposed measures to prevent the outbreak in Lao PDR, the delivery of the boats that will be handed over to Bolikhamxay and Xasomboun Provincial WRPOs for reservoir patrolling will be delayed for more than 90 days. Bolikhamxay Provincial Watershed and Reservoir Protection Office (WRPO) confirmed that most of the implementation activities will be postponed until the Bolikhamxay provincial regulation for watershed management is ready. So far, they completed a village level consultation on the draft regulation in the third week of March 2020. There were no further updates on the implementation activities under AIP2019 by Xaysomboun Provincial WRPO. The draft AIP2020 of Bolikhamxay Provincial WRPO is being reviewed by EMO Management while the AIP2020 of Xaysomboun Provincial WRPO is still being prepared.

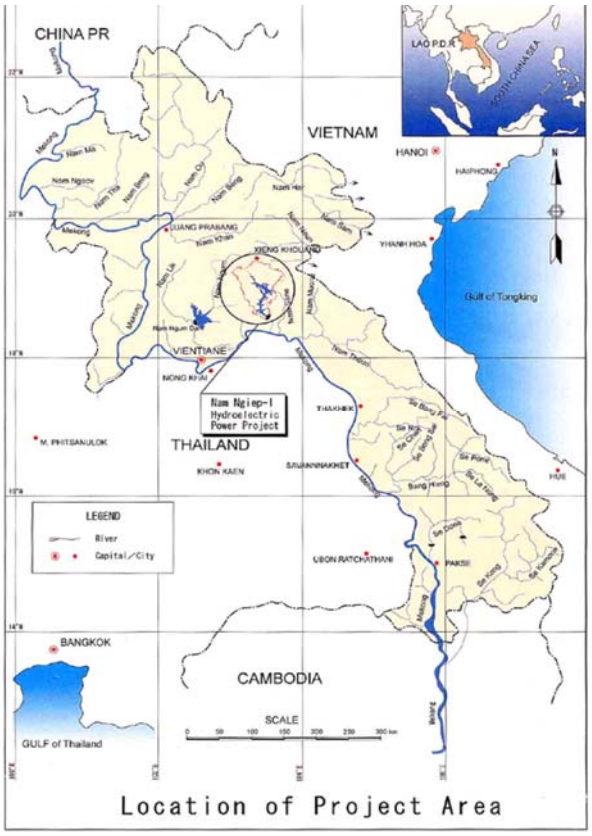
Biodiversity offset related activities under the components of spatial planning and regulation as well as law enforcement continued in March 2020. The AIP2020 was approved by ADB on 03 March 2020 and the first kick-off meeting between NNP1PC-EMO and the ADB's Biodiversity Service Provider (WCS) was organized during 4-6 March 2020.

The fish catch monitoring for February 2020 in Nam Ngiep watershed was dominated *Channa striata*,and species groups of Poropuntius, Hampala, *Barbonymus gonionotus* and Hypsibarbus, and *Sikukia gudgeri* and *Amblyrhynchichthys truncatus* that are classified as Least Concern (LC) according to the IUCN Red List, except *Sikukia gudgeri* is classified as Data Deficient (DD).

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.

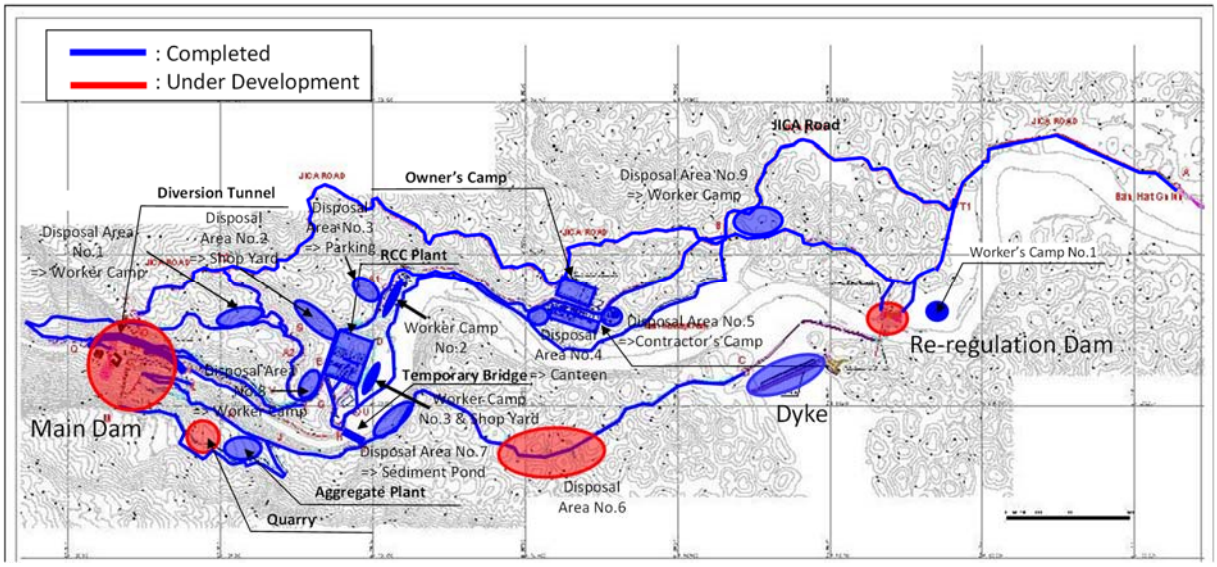
The repairs to the foundation of leg 4 of 230 kV TL Tower No.1 were completed in February 2019. The remaining excavation of the plunge pool was finished in January 2019. The reinforced concrete parapet wall was completed in December 2018 and road deck to the main dam crest and the concrete spillway chutes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

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. Decommissioning and rehabilitation is underway on all plants and is almost completed for the Quarry and the Aggregate Crushing Plant.

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

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 was acceptable though unsuitable soil layers were removed to spoil disposal areas, and good quarry management prevailed. It was considered that the quarry as originally conceived would not yield enough rock material of the required specification to complete all RCC and CVC concrete works for the Project. Permission was taken to extend the existing quarry within the boundaries already approved after a preliminary soil investigation confirmed that appropriate material could be exploited as below. The planned extension area of the quarry received approval from local government. (See ***Figure 2-4*** below)

The surface clearing, topsoil and overburden removal works at the extension area were completed in December 2016 and its development works was commenced in January 2017. 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. Furthermore, a fence around the pond, which is created at the quarry only during the rainy season and is dry during dry season, will be installed to prevent people and animals from entering the pond, subject to ADB approval. A gate near the steel bridge also a barrier to public access. Permanent fence installation around pond as shown in the below picture will not be installed and fence for road safety will be installed at the top of the right bank upper quarry roadside. The levelling of quarry bottom will be implemented from January 2020.

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

2.1.4.5 DISPOSAL AREAS

The disposal areas are on the right bank has been available for operation since January 2015, as was the adjacent waste Disposal Area No.9. Disposal Area No.9 along Road P1 near the start of Road T5 started operation in April 2015. Unsuitable material from the quarry has ceased to be hauled to Disposal Area No.6 and Disposal Area No.9 has been developed by the Electrical and Mechanical Works Contractor as stated above.

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 03 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 03 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.

2.4 230 kV Transmission Line Works

The 230 kV Transmission Line Contract was executed between Loxley-Sri Consortium and NNP1PC on 11 July 2014 and the NTP was issued to the 230 kV TL Works Contractor on 03 October 2014. The cumulative actual work progress of the Transmission Line Works at the end of July 2018 was 100 %, the same as planned progress. NNP1PC issued the Taking Over Certification, which was dated on 31 July 2018, to Loxley on 6 November 2018. The Defects Notification Period for this Contract expired on 31 July 2019.

3. ENVIRONMENTAL MANAGEMENT MONITORING

3.1 Compliance Management

In March 2020, the Environmental Management Office (EMO) of Nam Ngiep 1 Power Company (NNP1PC) received two Site Specific Environmental and Social Management Plans (SS-ESMMPs) for review and approval. In addition, two carried over SS-ESMMPs (second submission) will be reviewed in April 2020.

TABLE 3-1: SS-ESMMP AND DOCUMENTS REVIEW STATUS IN MARCH 2020

Title	Date Received	Status
DWP & SS-ESMMP for Remove Stump and Clean Irrigation at Main Canal the	13 March 2020 (1st submission)	No objection with comment on 17 March 2020
DWP & SS-ESMMP for the Construction of Irrigation Sub-Canal in Phouhomxay Resettlement Village	16 March 2020 (1st submission)	No objection with comment on 17 March 2020
DWP & SS-ESMMP for the Installation of Double Corrosion Protection Rock Bolts at the Left Bank Slope.	07 February 2020 (2nd submission)	Under review
DWP & SS-ESMMP for Supply and Installation of Log Booms at the Main Dam and Re-regulation Dam of Namgiep1 Hydropower Project	12 February 2020(2nd submission)	Under review

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 below

TABLE 3-2: SUMMARY OF ONCS AND NCRS

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

3.1.1 INSPECTION BY ENVIRONMENT MANAGEMENT UNIT

The proposed joint site visit by the MONRE; Bolikhamxay Provincial Office of Environmental and Natural Resources (PONRE), Bolikhan District EMU (Bolikhamxay Province) and; Xaysomboun PONRE and Thathom District was postponed until the COVID-19 outbreak is under control by the Government.

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/

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 February 2020 indicate that all the camps complied with the standards for total coliform and faecal coliform, except at the Main Powerhouse (EF19). However, the results of ammonia nitrogen and total nitrogen continue to fluctuate over the month and comply with the relevant effluent standards for some camps. The effluent from Owner's Site Office and Village (EF01) fully complied with the standards.

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

Table 3-3: Status of Corrective Actions for Non-Compliances at Camps and Construction Sites

Site	Sampling ID	Status	Corrective Actions
OSOV2 (ESD Camp)	EF13	Non-compliance for total nitrogen and ammonia-nitrogen.	An external expert's contract is being processed, the site visit is scheduled on 04 May 2020 subject to lifting of Corona virus related travel restrictions and lockdown to evaluate the design and operation of the existing WWTS and to provide an improved design using a more permanent technology.
OSOV2 (ESD Camp)	EF14	Non-compliance for total nitrogen and ammonia nitrogen during the first fortnight sampling. No discharge during the second fortnight schedule.	As above.
Main Powerhouse	EF19	Non-compliance for TSS, total nitrogen and ammonia nitrogen. No discharge during the	As above.

Site	Sampling ID	Status	Corrective Actions
		second fortnight schedule.	
Spoil Disposal Area No.2	DS04	Non-compliance for TSS (04 March 2020) and pH (12, 18 and 25 March 2020).	The low pH is a natural characteristic of the water that flows through this area during the dry season since the start of the Project. High TSS was due to the rain event which occurred prior to the sampling date.
Upstream Spoil Disposal Area No.2	DS04-US	Non-compliance for TSS (04 March 2020) and pH (12, 18 and 25 March 2020).	The low pH is a natural characteristic of the water which flows through this area during the dry season since the start of the Project. High TSS due to the rain event prior to sampling.
OSOV2 (ESD Camp)	EF13	Non-compliance for total nitrogen and ammonia-nitrogen.	An external expert's contract is being processed, the site visit is scheduled on 04 May 2020 subject to lifting of Corona virus related travel restrictions and lockdown to evaluate the design and operation of the existing WWTS and to provide an improved design using a more permanent technology.

The sampling of DS04 and DS04-US will be stopped starting from April 2020 as there is no activities at this Spoil Disposal Area.

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 water quality programme is summarized in Table 3-4 and the location of the monitoring stations are shown in below.

TABLE 3-4: MONITORING FREQUENCY FOR SURFACE WATER QUALITY PARAMETERS

Frequency of Monitoring	Parameters (Unit)	Monitoring Sites
Weekly	pH, DO (%), DO (mg/L), Conductivity (µs/cm), TDS (mg/L), Temperature (°C), Turbidity (NTU).	- Main Reservoir: R1, R2, R3, R4, R5; - Nam Ngiep downstream: NNG05, NNG06, NNG07 and NNG08; Tributaries: Nam Phouane [NPH01], Nam Xao [NXA01] and Nam Houay Soup [NHS01].
Fortnightly	pH, DO (%), DO (mg/L), Conductivity (µs/cm), TDS (mg/L), Temperature (°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), Hydrogen sulphide (mg/L), Phytoplankton biomass, TOC and TKN.	As per ESMMP-OP.

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

Main Reservoir

During March 2020, the water level in the main reservoir decreased from El. 306.4 m asl. to El. 303.9 m asl.

At R5, during March 2020, the DO level in the upper 9.5 m was generally between 5 mg/L and 9 mg/L, and an oxycline had formed at a depth of about 13 m corresponding to El. 293 m asl – 291 m asl. The entire water column below 19.0 m had a DO level of less than 1 mg/L.

At R4, the DO concentrations in the upper 7.0 m was generally between 6 mg/L and 10 mg/L, and in the entire water column below 18.0 m had a DO concentration of less than 1 mg/L.

The DO concentrations at R3 were recorded between 7 mg/L and 9 mg/L in the upper 4.5 m. The concentration of DO in the water column below 8.5 m was generally less than 1 mg/L.

The DO concentrations at R2 were recorded between 5 mg/L and 10 mg/L in the upper 4.0 m. The concentration of DO in the water column between 8.0 m and 9.5 m were generally less than 1 mg/L. And the DO concentration in the water column below 10.0 m fluctuated between 0.08 mg/L and 3.22 mg/L

At R1, the DO level was generally between 7 mg/L and 9 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 BOD5 measurements in the epilimnion were within the standard. The measurements in the hypolimnion at R3, R4 and R5 showed BOD concentrations of 2.2 mg/L, 5.0 mg/L and 4.3 mg/L respectively.

Re-regulation Reservoir

In March 2020, the turbine discharge from the main dam varied between 140 m3/s and 220 m3/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 from about 0.5 mg/L to about 3 mg/L in the entire water column.

The BOD5 concentration in R6 and R7 were between 5.3 mg/L and 6.7 mg/L respectively.

Downstream

During March 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 (except on 25 March 2020 due to aeration from gate discharge) 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 BOD5 in the downstream stations were below the limit of detection.

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

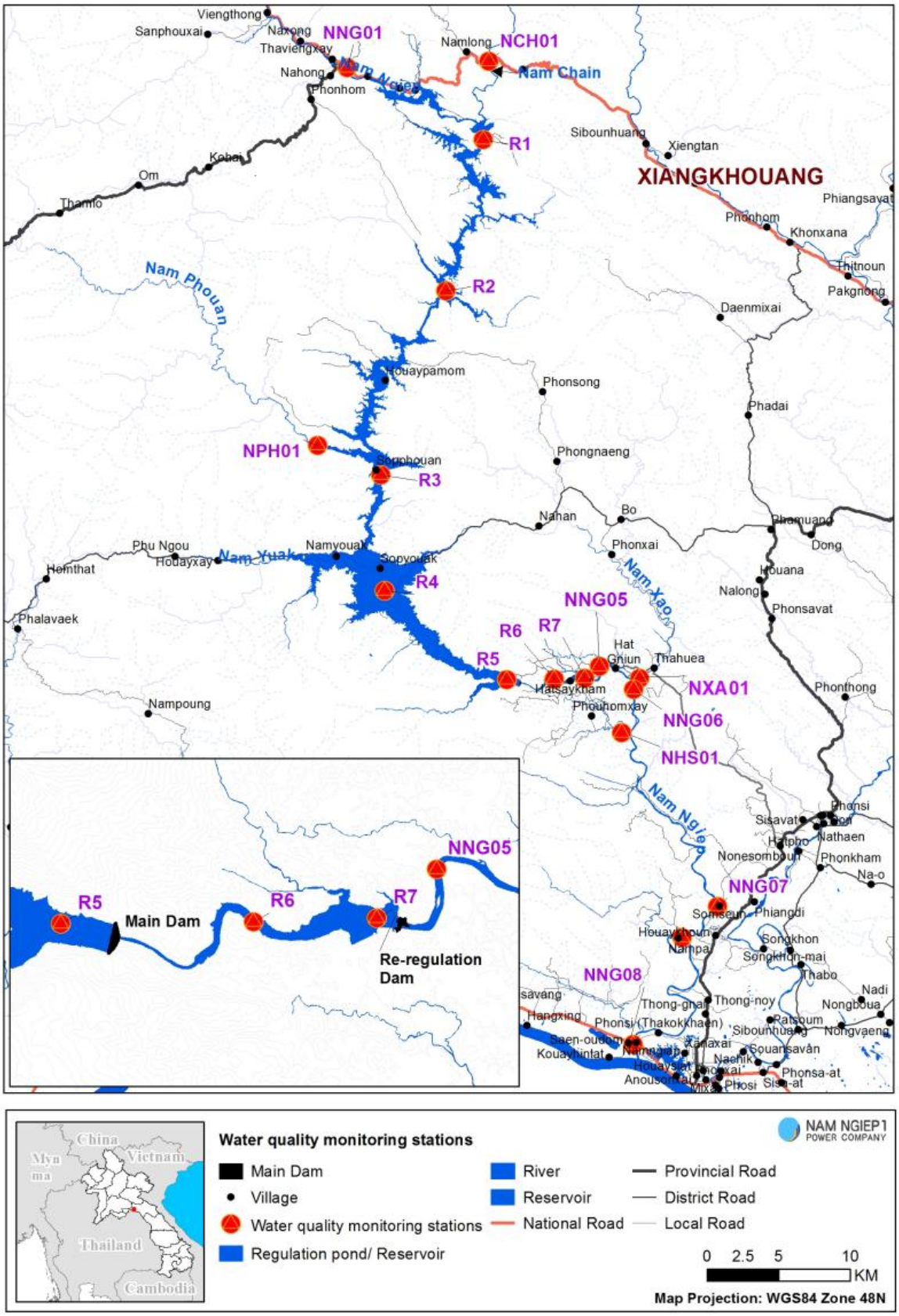


FIGURE 3-2: CONCENTRATION OF DISSOLVED OXYGEN IN THE UPPER 0.2 M SINCE THE START OF IMPOUNDING

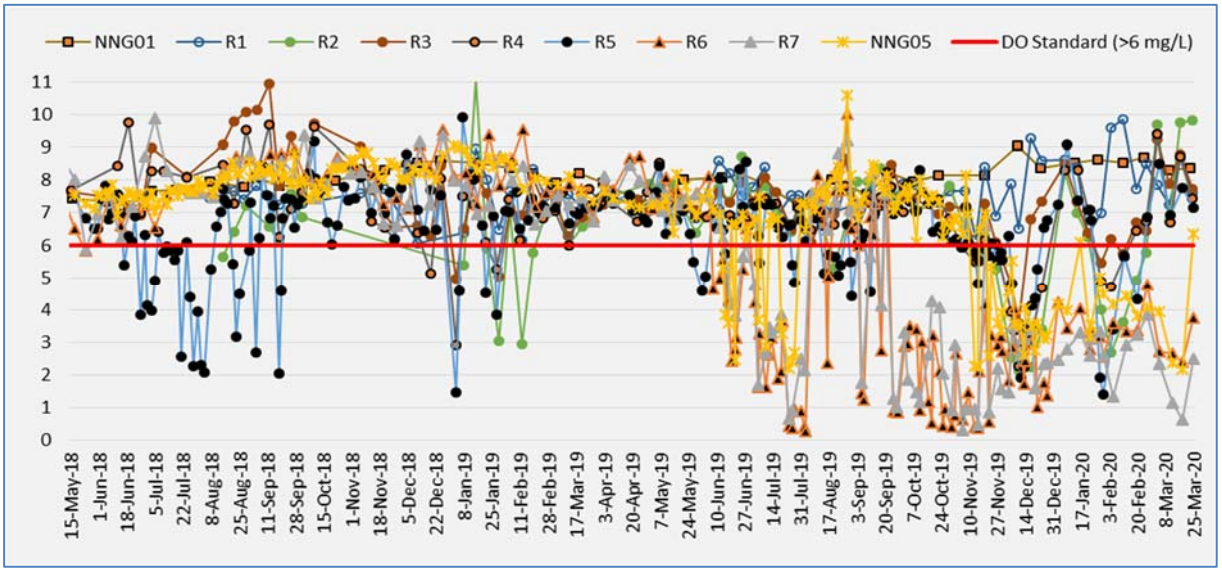


TABLE 3-5: *RESULTS OF SURFACE WATER QUALITY MONITORING FOR DISSOLVED OXYGEN (MG/L) IN THE UPPER 0.2 M, WATER QUALITY STANDARD: >6.0 MG/L*

DO (mg/L)	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
3-Mar-20		7.85	9.68	9.25	9.4									8.64		
4-Mar-20						8.5	2.71	2.34	3.94	4.8	5.12	5.76			6.28	6.4
10-Mar-20	8.3	7.25	6.74	7.89									8.22	9.07		
11-Mar-20					6.72	6.92										
12-Mar-20							2.67	1.14	2.38	2.62	4.85	5.54			4.75	6.98
17-Mar-20		8.66	9.75	8.78	8.74									7.85		
18-Mar-20						7.77	2.39	0.64	2.16	2.69	4.02	5.11			4.85	5.5
23-Mar-20	8.38												8.52			
24-Mar-20		7.62	9.83	7.75	7.45									8.37		
25-Mar-20						7.14	3.75	2.49	6.34	6.35	7.02	6.09			6.86	6.17

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
10-Mar-20	<5	71.2		<5									<5	49.49		
10-Mar-20 Hypolimnion				7.6												
11-Mar-20					<5	<5										
11-Mar-20 Hypolimnion					<5	5.2										
12-Mar-20							<5	6.27	5.06	<5	6.1	12.09			<5	<5

TABLE 3-7: *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
10-Mar-20	<1	<1		<1									<1	<1		
10-Mar-20 Hypolimnion				2.2												
11-Mar-20					<1	<1	5.32	6.72	<1	<1	<1	<1			<1	<1
11-Mar-20 Hypolimnion					5.0	4.3										

3.2.3 GROUNDWATER QUALITY MONITORING

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

Most results of community groundwater complied with the groundwater quality standards for water supply purposes, except some low content of faecal coliform and E.Coli bacteria as presented in below Table.

TABLE 3-8: GROUNDWATER QUALITY MONITORING RESULTS IN SOMSUEN, NAM PA, THONG NOI AND POU VILLAGES

Parameter (Unit)	Site Name	Somseun Village	NamPa Village	ThongNoy Village	Pou Village
	Station	GSXN01	GNPA01	GTHN01	GPOU01
	Guideline				
pH	6.5 - 9.2	7.11	7.16	7.24	7.66
Sat. DO (%)		80.3	89.6	70.4	84.8
DO (mg/l)		6.63	7.38	5.68	6.36
Conductivity (µS/cm)		283	398	294	22.5
Temperature (°C)		23.9	24.1	25.2	27.8
Turbidity (NTU)	<20	0.64	0.66	0.72	3.9
Fecal coliform (MPN/100 mL)	0	0	11	22	0
E.Coli Bacteria (MPN/100 mL)	0	0	6.8	11	0

In addition, on 16 March 2020, NNP1PC carried out landfill groundwater monitoring at NNP1 Solid Waste Landfill (three out of a total four wells were monitored due to water sampling equipment was stuck in monitoring well MW2) and at Houay Soup Solids Waste Landfill (1 monitoring well). Similar to previous monitoring results, the concentration of lead in the monitoring wells MW1, MW3, MW4 and MW5 exceeded the relevant groundwater quality standard. This is most likely the (natural) background level and is not attributed to the landfill. Lead has been detected in all wells from time to time both upstream and downstream the landfill. Furthermore, lead has not been detected in the leachate from landfill treatment ponds and the waste pits and all ponds of both landfills are lined with a HDPE liner protecting the groundwater against infiltration of leachate. These boreholes are more than 50 m deep and not used by staff or villagers.

TABLE 3-9: LANDFILL GROUNDWATER QUALITY MONITORING RESULTS IN NNP1 AND HOUAY SOUP LANDFILLS

Date	Parameter (Unit)	Site Name	NNP1 Landfill				Houay Soup Landfill
		Station	MW1	MW2	MW3	MW4	MW5
		Guideline					
16-Mar-20	pH		6.57		7.53	7.35	7.65
16-Mar-20	Sat. DO (%)		60.8		37.1	27.5	41
16-Mar-20	DO (mg/l)		4.37		2.72	2	2.94
16-Mar-20	Conductivity (µS/cm)		85		93.1	36.5	87
16-Mar-20	Temperature (°C)		30.9		29.8	30.4	31.2
16-Mar-20	Turbidity (NTU)		1.27		2.35	2.96	2.51
16-Mar-20	Total Nitrogen (mg/l)		0.48		0.61	0.85	0.7
16-Mar-20	Lead (mg/l)	<0.01	0.196		2.1	0.076	0.402
16-Mar-20	Faecal Coliform (MPN/100 ml)		0		2	0	0
16-Mar-20	Total Coliform (MPN/100 ml)		2		2	0	0
16-Mar-20	NH_3-N (mg/l)		0.05		0.07	0.12	0.13

		Site Name	NNP1 Landfill				Houay Soup Landfill
		Station	MW1	MW2	MW3	MW4	MW5
Date	Parameter (Unit)	Guideline					
16-Mar-20	Copper (mg/l)	<1	<0.003		0.024	ND	ND
16-Mar-20	Total Petroleum (mg/l)		<3		<3	<3	<3
16-Mar-20	Water level (m)		29.05		26.40	25.04	15.45

3.2.4 Gravity Fed Water Supply (GFWS) Quality Monitoring

During March 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 3-10. 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 3-10: Results of the Gravity Fed Water Supply Quality Monitoring

		Site Name	Thaheau Village	Hat Gnuin Village	Phouhomxay Village		
		Station	WTHH02	WHGN02	WPHX01	WPHX02	WPHX03
Date	Parameter (Unit)	Guideline					
06-Mar-20	pH	6.5 - 8.6	7.78	7.58	7.85	7.9	7.88
06-Mar-20	Sat. DO (%)		93.4	96.4	91.2	87.9	83
06-Mar-20	DO (mg/L)		7.82	8.17	7.86	7.49	7.05
06-Mar-20	Conductivity (µS/cm)	<1,000	48.2	79	24.4	26.8	21.18
06-Mar-20	Temperature (°C)	<35	23.3	22.7	21.8	22.3	22.4
06-Mar-20	Turbidity (NTU)	<10	0.87	1.32	1.37	1.14	1.17
06-Mar-20	Faecal Coliform (MPN/100 ml)	0	13	110	170	350	540
06-Mar-20	E. Coli Bacteria (MPN/100 ml)	0	7.8	110	34	130	170

3.2.5 Landfill Leachate Monitoring

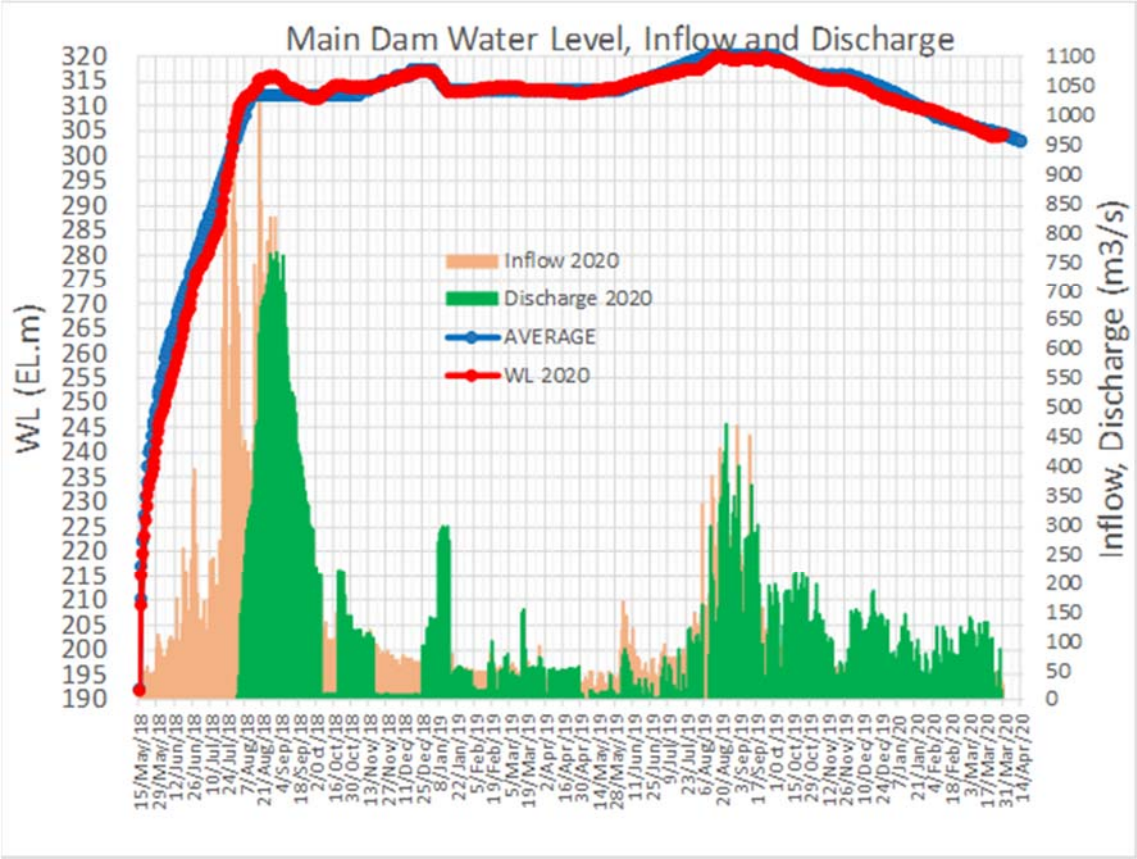
During March 2020, water sampling from NNP1 Project Landfill and at Houay Soup Solid Waste Landfill were not carried out because there was no inflow of leachate to the ponds and the last pond in both landfills had almost dried-up.

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 March 2020, the mean inflow to the main reservoir was 36 m^3/s (min 20 m^3/s and max 55 m^3/s). During March 2020, the water level in the main reservoir decreased with 2.5 m from El. 306.4 m asl. to El. 303.9 m asl.

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

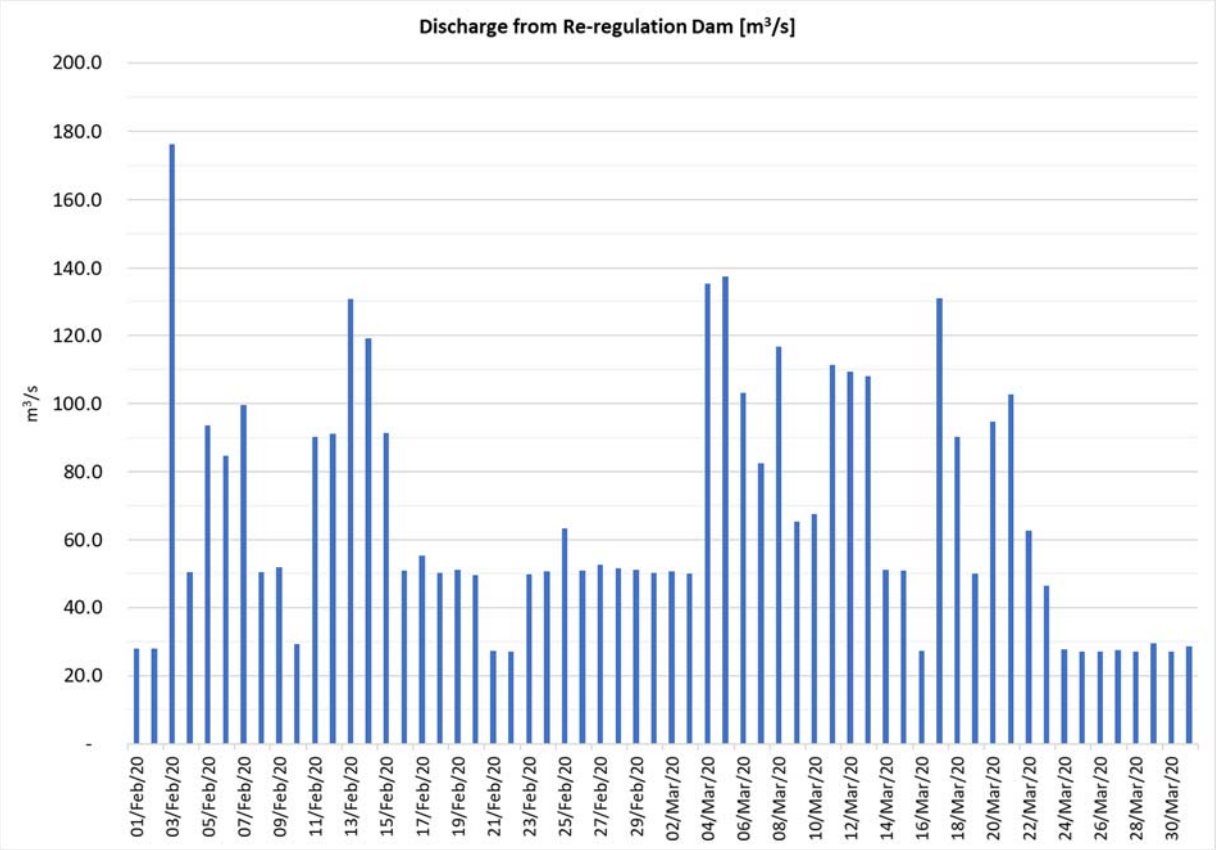


The discharge monitoring data for the re-regulation dam during February 2020 and March 2020 is presented in ***Figure 3-4***.

During March 2020, the mean discharge from the re-regulation dam was about 70 m^3/s with turbine discharges varying between 50 m^3/s and 150 m^3/s interrupted by periods with gate discharge of about 30 m^3/s including the period from 24 March until the end of the month due to maintenance work. The discharge was kept above the minimum flow requirement of 27 m^3/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 FEBRUARY 2020 AND MARCH 2020



3.2.7 NAM NGIEP DOWNSTREAM WATER DEPTH MONITORING

In March 2020, EMO carried out four boat missions 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. None of these sites were difficult to navigate.

3.3 PROJECT WASTE MANAGEMENT

3.3.1 SOLID WASTE MANAGEMENT

In March 2020, a total of 23.4 m^3 solid waste was disposed of at the NNP1 Project Landfill, a decrease of 13.2 m^3 compared to February 2020 due to an improvement of waste separation at camps and waste segregation at the landfill. EMO conducted a waste management assessment in both camps OSOV1 and OSOV2 (ESD camp). More standard waste bins and waste management awareness will be provided to the NNP1 staff and relevant contractors as well as the local community during May-June 2020.

The local waste collection contractor has completed repairing the damaged wooden fence at NNP1 Project landfill. The Semi-permanent fence installation is expected to be carried out from middle of May to August 2020 (awaiting wooden poles that were ordered from local villagers).

TABLE 3-11: AMOUNTS OF RECYCLABLE WASTE SOLD

Source and Type of Recycled Waste		Unit	Sold	Cumulative Total by March 2020
Camp Operations				
1	Glass bottles	kg	0	38
2	Plastic bottles	kg	0	41
3	Paper/Cardboard	kg	0	17
4	Aluminium cans	kg	0	39
Total		**kg**	**0**	**135**

The local villagers from Phouhomxay Village collected a total of 474 kg of food waste from the OSOV canteen for animal feed in March 2020, a decrease of 292 kg compared to February 2020.

TABLE 3-12: AMOUNTS OF FOOD WASTE COLLECTED BY VILLAGERS

No.	Site Name	Unit	Total
1	OSOV1 Canteen	kg	474
Total		**kg**	**474**

3.3.2 HAZARDOUS MATERIALS AND WASTE MANAGEMENT

The types and amounts of hazardous material and hazardous waste stored on site in March 2020 are shown in below**Error! Reference source not found.**

TABLE 3-13: RESULTS OF HAZARDOUS MATERIAL INVENTORY

No.	Hazardous Waste Type	Unit	Total in March 2020 (A)	Used (B)	Remainder (A - B)
1	Diesel	Litre	12,127	6,688	5,439
2	Gear Lubricant	Litre	646	0	646
3	Liquid Chlorine	Litre	28	10	18
4	Grease	Drum (25 L)	29	0	29
5	Chlorine Powder	Kg	24	1	23
6	Sika	Can	7	0	7
7	Colour paint	Drum (20L)	3	0	3
8	Thinner	Drum (3 L)	1	0	1

TABLE 3-14: RESULTS OF HAZARDOUS WASTE INVENTORY

No.	Hazardous Waste Type	Unit	Total in March 2020 (A)	Dispose (B)	Remainder (A - B)
1	Used oil	Litre	2,072	2,000	72
2	Ink cartridge	Unit	119	0	119

No.	Hazardous Waste Type	Unit	Total in March 2020 (A)	Dispose (B)	Remainder (A - B)
3	Halogen/fluorescent bulbs	Unit	78	0	78
4	Empty spray can	Can	80	0	80
5	Contaminated soil/sand	Cubic Metre (m^3)	0.17	0	0.17
6	Clinic waste	kg	3.4	0	3.4

3.4 COMMUNITY WASTE MANAGEMENT

3.4.1 COMMUNITY RECYCLING PROGRAMME

In March 2020, the Community Waste Bank received no recyclable waste from Phouhomxay Village and the two host villages. The cumulative total amount of recyclable waste stored in the waste bank is 2,680 kg, the same amount compared to February 2010.

TABLE 3-15: TYPES AND AMOUNTS OF RECYCLABLE WASTE TRADED AT THE COMMUNITY RECYCLE WASTE BANK

Types of Waste	Unit	Remaining in February 2019	Additional in March 2020	Sold/ dispose	Remaining in March 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**	**0**	**0**	**2,680**

3.4.2 COMMUNITY SOLID WASTE MANAGEMENT

Approximately 30.5 m^3 of solid waste was collected from the host and Phouhomxay villages for disposal at Houay Soup landfill. A decrease of 0.12 m^3 compared to February 2020. A general landfill maintenance was performed including grass cutting from the waste pits and surrounding areas, cleaning up the wetland pond and drainage ditches.

3.5 WATERSHED AND BIODIVERSITY MANAGEMENT

3.5.1 WATERSHED MANAGEMENT

3.5.1.1 IMPLEMENTATION OF ANNUAL IMPLEMENTATION PLAN (AIP) 2019

The boat supplier that will provide three aluminium boats to GOL (Bolikhamxay and Xaysomboun Provincial WRPOs) to conduct the NNP1 reservoir patrolling confirmed that due to the pandemic of COVID-19, the delivery of these boats will be delayed. The purchase order was issued by NNP1PC at the end of March 2020 for the procurement office and field equipment under NNP1PC additional No Net Loss (NNL) commitment to support the WRPO of Xaysomboun and Bolikhamxay Provinces in implementing the AIP2019 activities.

Bolikhamxay Provincial WRPO confirmed in the first week of March 2020 that most of implementation activities under AIP2019 will be postponed until the city lockdown for COVID-19 outbreak is over and the Bolikhamxay Provincial Regulation for Watershed Management is ready. Bolikhamxay Provincial WRPO conducted village level consultations on the draft Provincial Regulation between 16-23 March 2020. NNP1PC-EMO team had further discussed with the Xaysomboun Provincial WRPO on 26 March 2020 for the preparation of AIP2020 to encourage them to complete the plan. The team observed that there were some internal communication and supervision issues within the WRPO and advised that the detailed AIP should refer to the discussed activities in January 2020. NNP1PC-EMO Management proposed to the Chair of the Xaysomboun Provincial WRPC to have a workshop within GOL to brief all the WRPC-WRPO members on the planned activities approved including budget to avoid further delay in the implementation activities under the AIP2019.

NNP1PC-EMO together with a Consultant is finalising a Fishery Co-Management Plan (FMCP). The improved draft was submitted by the Consultant on 04 March 2020 for review. The Consultant also submitted a draft Fishery Regulation on 16 March 2020. The FCMP and draft Regulation are being reviewed by NNP1PC EMO management.

NNP1PC-EMO together with a Consultant is conducting an assessment of options for sustainable livelihood opportunities focussing on nine watershed villages in Xaysomboun Province. The field assessment was completed on 11 March 2020 and a draft report will be submitted in the first week of April 2020.

3.5.2 BIODIVERSITY OFFSET MANAGEMENT

3.5.2.1 ENGAGEMENT OF BIODIVERSITY SERVICE PROVIDER (BSP)

There has been no further feedback from ADB and WCS on the second draft of Memorandum of Understanding (MOU) shared by NNP1PC on 28 February 2020.

The Department of Forestry (DOF) of Ministry of Agriculture and Forestry (MAF) issued an official notification to Xaysomboun and Bolikhamxay Provincial Agriculture and Forestry Offices (PAFO) on 18 March 2020 to inform them on the WCS engagement under the ADB Project through MAF and request PAFOs to facilitate the attainment of necessary permits from relevant authorities for the WCS staff to work with NNP1PC staff and get access to the relevant sites. NNP1PC has not received any update from the PAFO by the end of March 2020.

NNP1PC-EMO and WCS also held a kick-off meeting between 04-06 March 2020 to further discuss the reporting protocol, priority activities that both can support GOL and other technical issues related to the No Net Loss recalculation as a result of a reduction of the NC-NX's TPZ area from the original BOM Plan based on GOL's consultations with the local villagers and ground truth surveys.

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. The AIP2020 was approved by ADB on 03 March 2020. The BOMU and NNP1PC-EMO have further refined the

AIP2020 in both languages on 11 March 2020 addressing the ADB comments. The BOMU is preparing an official document to request for fund disbursement at the end of March 2020.

Progresses on the implementation of key activities by Component in March 2019 are described below:

a. Component 1 - Spatial Planning and Regulation

Bolikhamxay Provincial BOMU installed the signage at Vangphieng Village during 23-30 March 2020. There is a total of 12 poles of TPZ boundary being installed around Vangphieng Village. The signage installation in other villages have to be postponed until the Government lifts the COVID-19 preventive measures.

b. Component 2 – Law Enforcement

The monthly patrolling was organized on 12 March 2020 to present and discuss the results of patrolling in February 2020 with the following key notes:

- The patrolling teams were advised to carefully do the data entry and utilization from SMART data base for the purpose of presentation and reporting;
- The patrolling teams were advised to obtain more information on the encountered threats in particular more information on snares such as type, age, activeness, the suspect (local or Vietnamese poachers). Such information will be helpful for future planning or patrolling strategy development;
- The patrol teams were encouraged to improve the identification and recording of the NNL target species;
- The patrol teams were advised to collect information related to past and current wildlife trading in parallel with working with the local authorities in order to resolve the illegal wildlife trading in Xaychamphone Area along the shared border with Vietnam;
- The patrol teams were advised to improve the law enforcement on the illegal fishing and follow-up with education/outreach within the villages;
- The patrol teams were advised to install warning signs in Vietnamese language along the identified tracks on the Vietnam side.

In March 2020, the first team carried out patrolling at TPZ High Priority Area in Xaychamphone District – Houay Ping, Houay Wod-Wod, Houay Choak, Houay Khone, Nam Kha Gni, Nam Xam Hang and Nam Chamtui. They spent 16 days covering a distance of 93 km on forest patrolling and 20 km on road patrolling. The team made a total of six direct observations and seven indirect observations of the following wildlife: black giant squirrel, otter, red-shanked douc langur, silver pheasant, white-cheeked gibbon, civet, Indochinese serow, macaque, muntjac, sambar, and wild pig. The team also encountered a number of threats such unregulated fishing sign, six hunting amps and 460 small wire snares. The patrol team noted that the threats in the area is similar with the previous month which is quite high. This is due to the fact that there were no patrol activity in the areas for a few months since the patrolling focused on the TPZ Highest Priority Area.

In February 2020, the second team carried out patrolling at TPZ High Priority Area around Ban Natan area including Nam Tan, Houay Kaengkouang, Houay Nongsen, Houay Hok, Houay San, Houay Ka Nang and Nam Sik. They spent 10 days covering a distance of 41 km on forest patrolling and 22 km on road patrolling. The team could not continue the patrolling further

because one of the patrol team members had severe stomachache and was transported to the hospital for immediate treatment. The remaining team members were able to improve the patrol sub-station located at Na Gnang village after sending the sick member.

The team made a total of eight direct observations and five indirect observations of the following wildlife: black giant squirrels, brown hornbills, drongo, great hornbills, hog badger, macaques, muntjac, wild pig, civet, and Indochinese serow. The team also encountered a number of threats such as 156 small wire snares, 82 large wire snares and four signs of land clearing.

In February 2020, the third team carried out patrolling at the TPZ Highest Priority Area around Nam Sone and the TPZ High Priority Area around Nam Ma and Nam Plang. They spent 16 days covering a distance of 84 km on forest patrolling. The team made a total of eleven direct observations and six indirect observations of the following wildlife: brown hornbills, eagle, great hornbills, hog badger, Indochinese serow, macaque, muntjac, Phayre's Leaf Monkey, Red-shanked Douc Langurs, white-cheeked gibbon, sambar, and wild pigs. The team also encountered a number of threats such as hunting track suspected to be accessed by Vietnamese poachers at Nam Sone area and six local people from Vangphieng Village doing the fishing and hunting at Nam Ma area with one fishing camp and one spare gun. The camp was destroyed, gun was confiscated, and six villagers were educated by the patrol team.

In February 2020, the fourth team carried out patrolling at the TPZ Highest Priority Area, around Thongnachang Area including Nam Sone, Nam San, Nam Xi, Nam Chang, Houay Xai Yai, Houay Xai Noi and Houay Poung. They spent 16 days covering a distance of 86 km on forest patrolling. The team made a total of eight direct observations and seven indirect observations of the following wildlife: great hornbill, muntjac, red junglefowls, silver pheasant, white-cheecked gibbon, civet, Indochinese serow, macaque, otter, sambar, and wild pig. The team also encountered one active fishing camp with the dry rack. This camp was later destroyed by the patrol team.

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

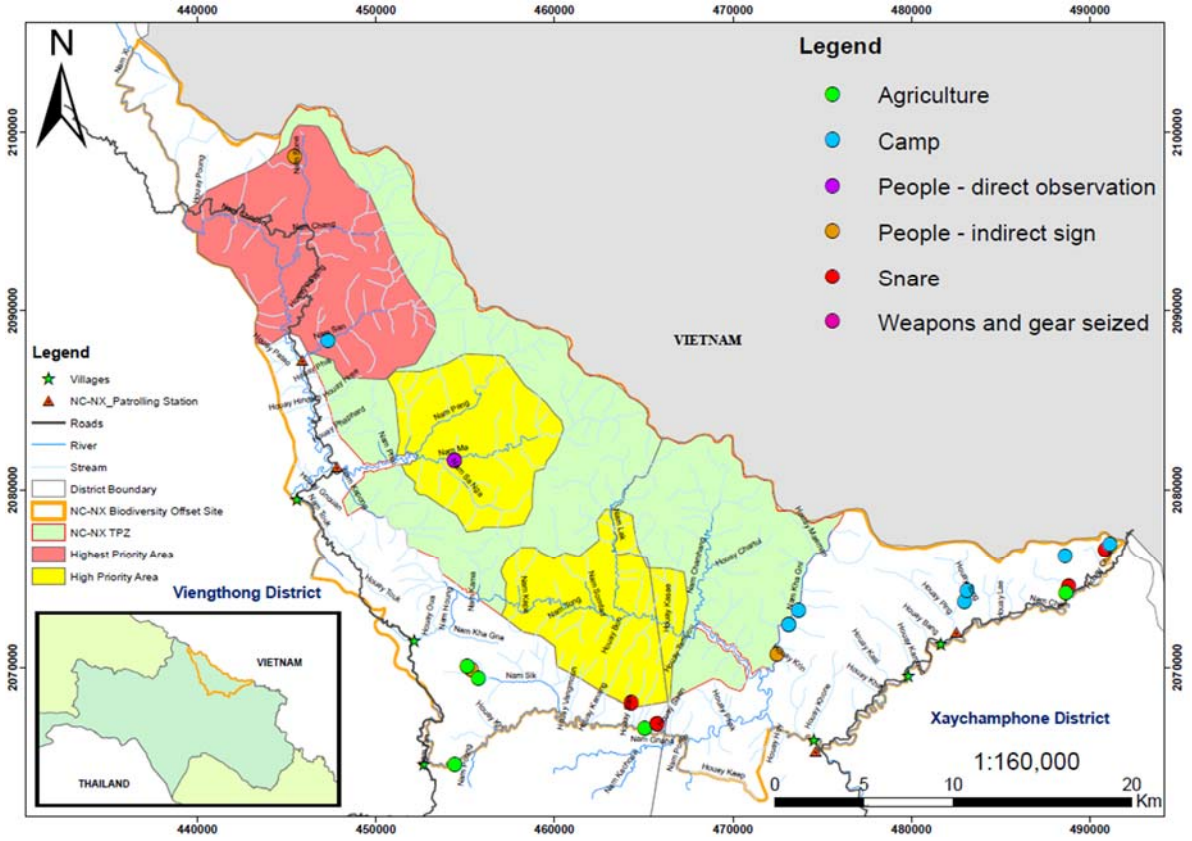


FIGURE 3-6: MAP OF WILDLIFE SIGNS RECORDED BY TWO PATROLLING TEAMS IN FEBRUARY 2020

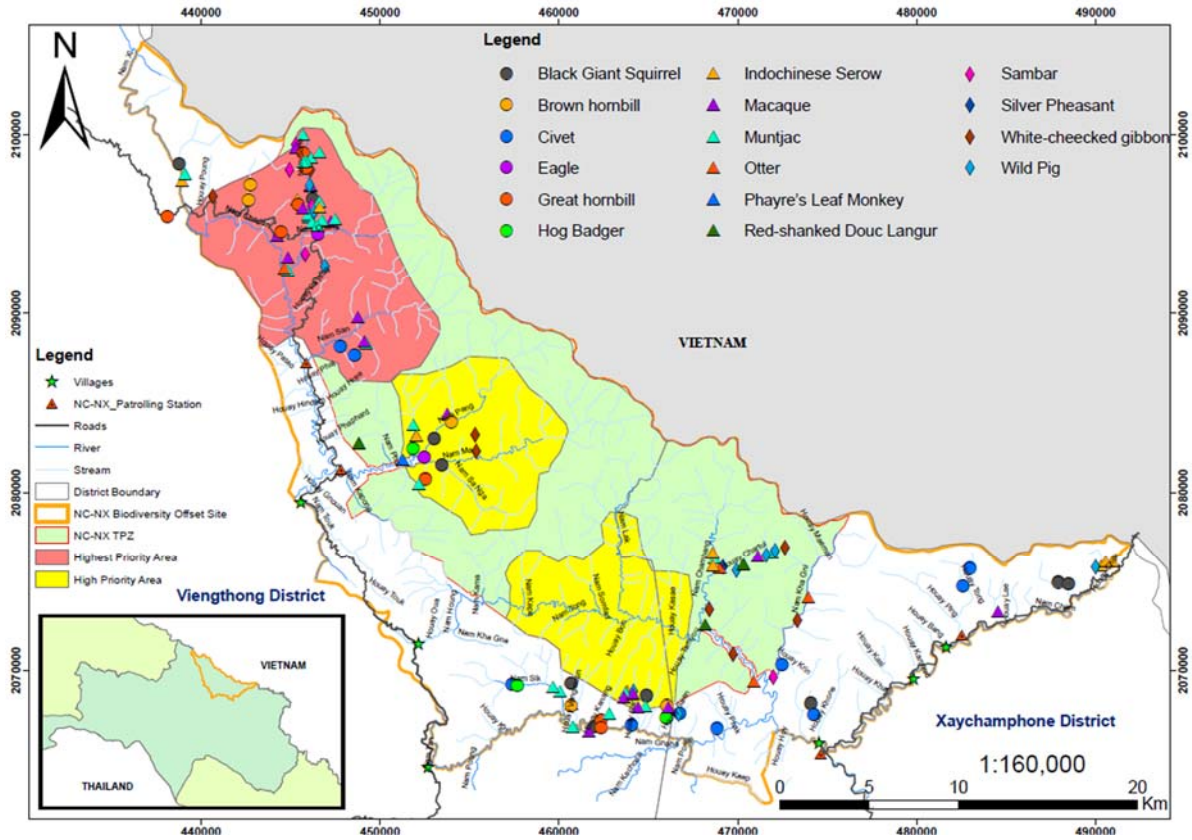


Figure 3-7: Small Wire Snares around Houay San at TPZ High Priority Area	***Figure 3-8: Land Clearance for Agriculture outside TPZ High Priority Area***
	
Figure 3-9: Fishing camp with the dry rack at Thongnachang area	***Figure 3-10: Tracking route with Vietnamese sign at Nam Sone area***
	
Figure 3-11: Great hornbill at Nam Ma	***Figure 3-12: Indochinese serow at Nam Sone***
	

c. Component 4 – Conservation linked livelihood development

NNP1PC-EMO has agreed with the Consultant on 03 March 2020 to discontinue the consulting service due to unsatisfactory result of their performance and the first deliverable (a draft inception report). NNP1PC-has processed another procurement with two potential candidates using a direct engagement method. NNP1PC-received technical and financial proposals from these candidates on 23 March 2020 and concluded the technical review on 26 March 2020. Based on the careful review and assessment of proposals submitted by the two companies, an existing company who has been working with the NNP1PC on sustainable livelihood assessment at NNP1 sub-catchment was found to be qualified for the assignment. A discussion with the selected Consultant was organized on 30 March 2020 to further clarify the scope of work and negotiate a draft contract which is expected to be settled in April 2020. Following the GOL instruction on the preventive measures for COVID-19 during April 2020, the work is expected to start from May 2020.

3.6 FLOATING DEBRIS REMOVAL

NNP1PC-EMO conducted a regular monitoring and removal of floating materials/logs from the temporary log-boom as needed. NNP1PC-EMO together with a local contractor piled and burned some debris/logs at log landing site near the temporary log-boom. Permanent log booms are being installed at the main dam and the re-regulation dam.

4. FISHERY MONITORING

Four species groups and one species dominated the fish catch by weight in February 2020 as listed in ***Table 4-1.*** All species are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species[1], except *Sikukia gudgeri* is classified as Data Deficient (DD).

TABLE 4-1: FISH SPECIES DOMINATING THE FISH CATCH IN FEBRUARY 2020

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
Poropuntius normani, Poropuntius laoensis, Poropuntius carinatus	ปาจาด	268.1	LC
Hampala dispar, Hampala macrolepidota	ปาสูด	131.9	LC
Channa striata	ปาถ่ำ	127.4	LC

[1] 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.

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
Barbonymus gonionotus, Hypsibarbus malcolmi, Hypsibarbus vernayi, Hypsibarbus wetmorei	ปาปาก	94.2	LC
Sikukia gudgeri, Amblyrhynchichthys truncatus	ปาขาวຊาย	87	DD, LC

The recorded catch of Threatened and Near Threatened species (IUCN Red List classification) in February 2020 is presented in ***Table 4-2***. The list includes three species that are classified as Vulnerable (VU) species and two Near Threatened (NT) species.

TABLE 4-2: THREATENED SPECIES OF FEBRUARY 2020 FISH CATCH

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
Cyprinus carpio	ปาไม	2	VU
Neolissochilus stracheyi	ปาสอง	0.4	NT
Onychostoma gerlachi	ปาถิง	8.9	NT
Scaphognathops bandanensis	ปาอวมไฟ/ปาป่วม	2	VU
Tor sinensis	ปาแดง	56.8	VU

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 February 2020 is presented in *Error! Not a valid bookmark self-reference.*. 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 – FEBRUARY 2020

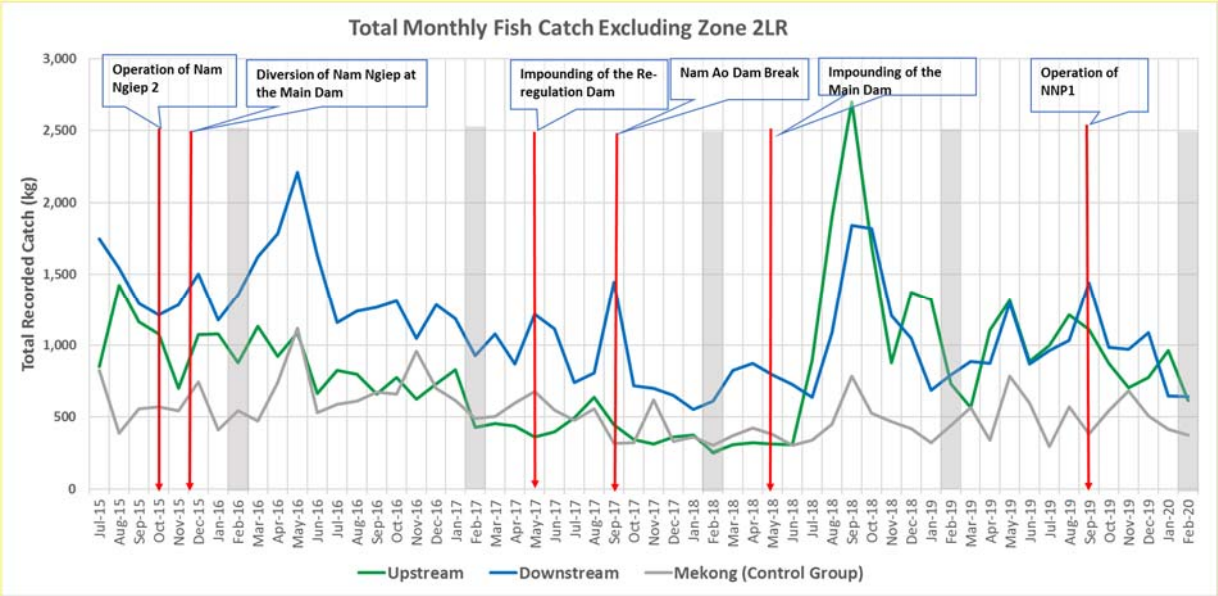
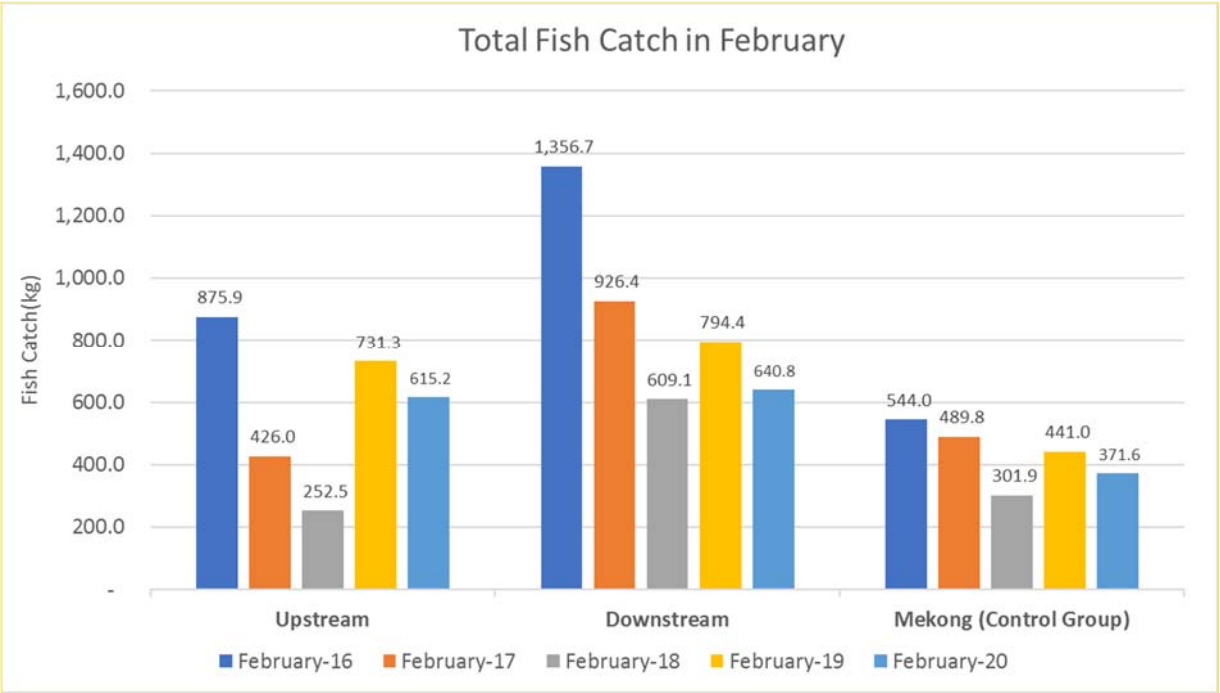


Table 4-3 and **Figure 4-2** show the total recorded fish catch for February 2016, February 2017, February 2018, February 2019 and February 2020 in the upstream (excluding Zone 2LR) and downstream communities and the Mekong control group. The total fish catch data represents the total fish supply provided by the involved fishing households.

Table 4-3: TOTAL FISH CATCH BY UPSTREAM (EXCLUDING ZONE 2LR), DOWNSTREAM AND MEKONG CONTROL GROUP FISHING HOUSEHOLDS IN FEBRUARY 2016, FEBRUARY 2017, FEBRUARY 2018, FEBRUARY 2019 AND FEBRUARY 2020

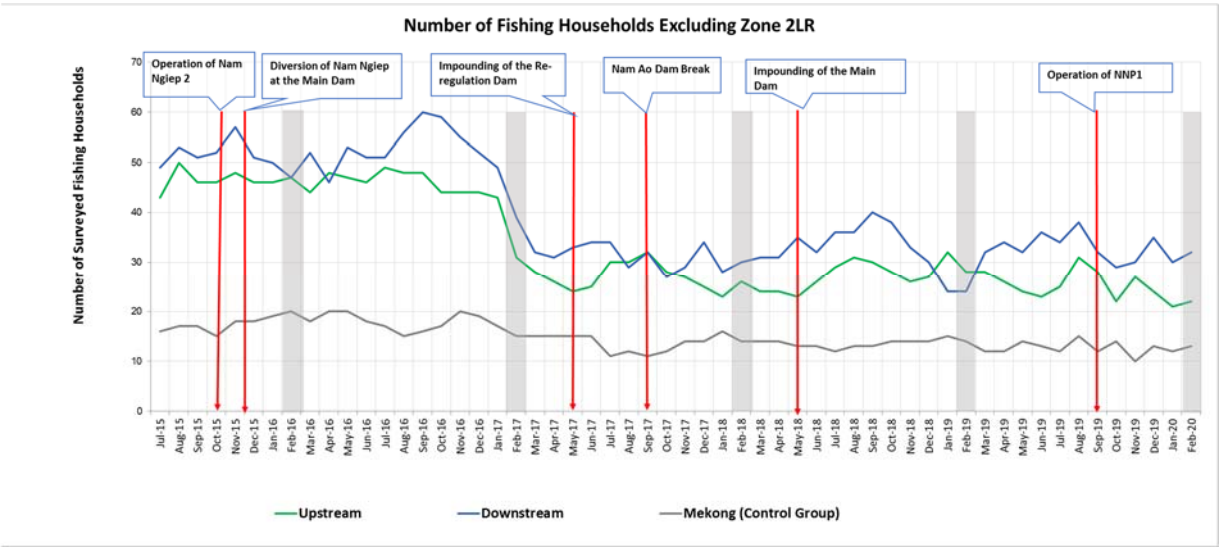
Fishing Zone	February 2016 (kg)	February 2017 (kg)	February 2018 (kg)	February 2019 (kg)	February 2020 (kg)
Upstream	875.9	426.0	252.5	731.3	615.2
Downstream	1,356.7	926.4	609.1	794.4	640.8
Mekong Control Group	544.0	489.8	301.9	441.0	371.6

FIGURE 4-2: TOTAL FISH CATCH BY UPSTREAM (EXCLUDING ZONE 2LR), DOWNSTREAM AND MEKONG CONTROL GROUP FISHING HOUSEHOLDS IN FEBRUARY 2016, FEBRUARY 2017, FEBRUARY 2018, FEBRUARY 2019 AND FEBRUARY 2020



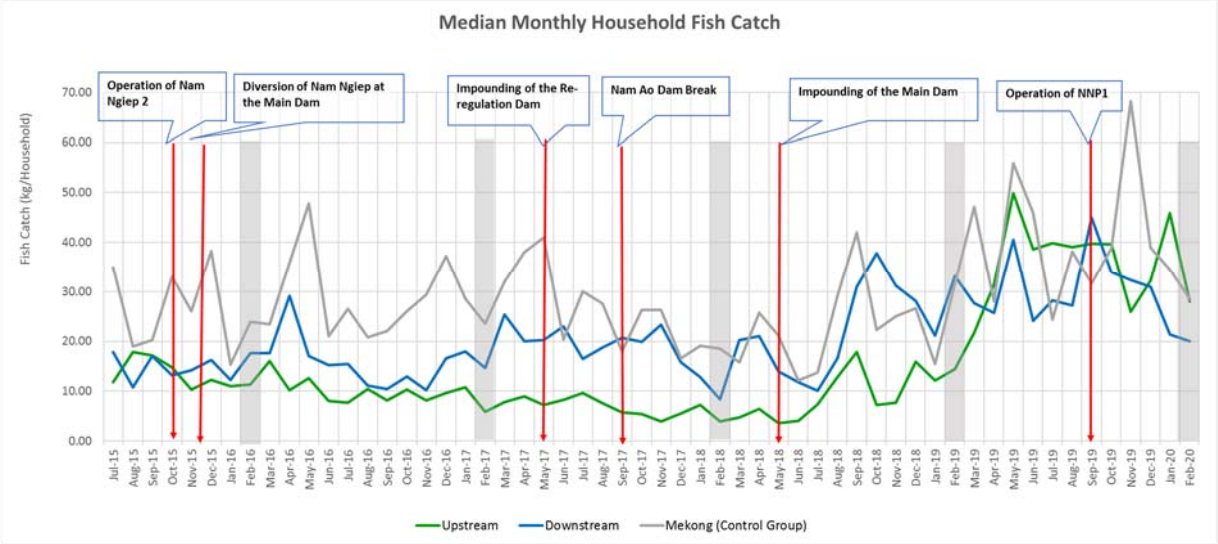
The numbers of fishing households involved in the fish catch monitoring programme are displayed in ***Figure 4-3***.

FIGURE 4-3: NUMBER OF FISHING HOUSEHOLDS INVOLVED IN THE FISH CATCH MONITORING PROGRAMME



The median monthly household fish catch from July 2015 to February 2020 for the upstream (excluding Zone 2LR) and downstream communities, and the Mekong control group are presented in ***Figure below***.

FIGURE 4-4: MEDIAN MONTHLY HOUSEHOLD FISH CATCH WITHOUT ZONE 2LR



The median household fish catch for February 2016, February 2017, February 2018, February 2019 and February 2020 in the upstream (excluding Zone 2LR) and downstream communities and the Mekong control group are displayed in Table below**;**

TABLE 4-4: MEDIAN MONTHLY HOUSEHOLD FISH CATCH IN THE UPSTREAM AND DOWNSTREAM COMMUNITIES EXCLUDING ZONE 2LR

Fishing Zone	February 2016 (kg)	February 2017 (kg)	February 2018 (kg)	February 2019 (kg)	February 2020 (kg)
Upstream	11.3	5.9	3.9	14.4	28.0
Downstream	17.6	14.7	8.4	33.1	20.0
Mekong Control Group	23.9	23.6	18.6	31.5	28.6

The median daily fish catch per household are displayed in *Error! Reference source not found.*, and the median fish catch per household per fishing day in February 2016, February 2017, February 2018, February 2019 and February 2020 are shown in Table below;

FIGURE 4-5: MEDIAN DAILY FISH CATCH PER HOUSEHOLD

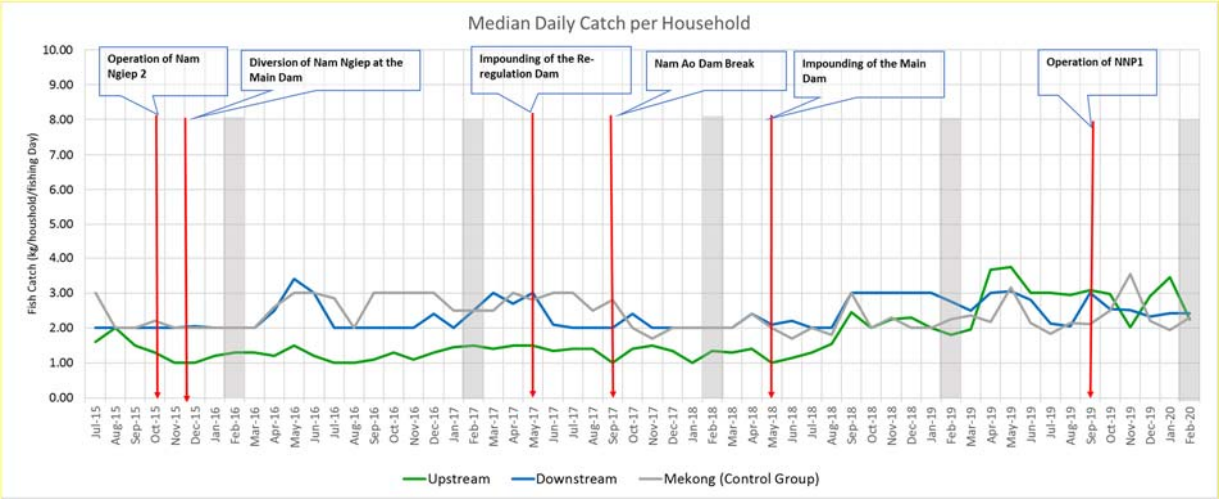


TABLE 4-5: MEDIAN DAILY FISH CATCH PER HOUSEHOLD IN FEBRUARY 2020

Fishing Zone	February 2016 (kg)	February 2017 (kg)	February 2018 (kg)	February 2019 (kg)	February 2020 (kg)
Upstream	1.30	1.50	1.35	1.80	2.25
Downstream	2.00	2.50	2.00	2.76	2.42
Mekong (Control Group)	2.00	2.50	2.00	2.25	2.30

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												
3-Mar-20	pH	5.0 - 9.0		7.22	7.28	7.33	6.9							
4-Mar-20	pH	5.0 - 9.0						6.98	6.58	6.6	6.57	6.88	7.03	7.16
10-Mar-20	pH	5.0 - 9.0	8.18	7.31	7.6	6.9								
11-Mar-20	pH	5.0 - 9.0					7.07	7.51						
12-Mar-20	pH	5.0 - 9.0							6.24	6.46	6.43	6.64	6.91	7.02
17-Mar-20	pH	5.0 - 9.0		6.86	6.89	6.8	6.48							
18-Mar-20	pH	5.0 - 9.0						6.69	6.46	6.36	6.38	6.76	7.1	7.3
23-Mar-20	pH	5.0 - 9.0	6.65											
24-Mar-20	pH	5.0 - 9.0		7.11	7.87	6.78	7.19							
25-Mar-20	pH	5.0 - 9.0						7.55	6.68	6.95	6.36	6.55	6.62	6.75
3-Mar-20	Sat. DO (%)			92.2	118.7	113.5	114.5							
4-Mar-20	Sat. DO (%)							103	32	27.3	46.4	58.4	60.8	69.1
10-Mar-20	Sat. DO (%)		108.7	85.4	85.3	97								
11-Mar-20	Sat. DO (%)						82.4	85.4						
12-Mar-20	Sat. DO (%)								31.4	13.3	28.3	31	58.9	67.8
17-Mar-20	Sat. DO (%)			113.2	123.6	110.3	108.5							
18-Mar-20	Sat. DO (%)							96.7	26.8	7.6	26.2	32.8	50.4	63.6
23-Mar-20	Sat. DO (%)		105.8											
24-Mar-20	Sat. DO (%)			90	116.2	97.1	93.2							
25-Mar-20	Sat. DO (%)							88.4	43.1	29.3	75.4	76.5	82	75.3
3-Mar-20	DO (mg/L)	>6.0		7.85	9.68	9.25	9.4							
4-Mar-20	DO (mg/L)	>6.0						8.5	2.71	2.34	3.94	4.8	5.12	5.76
10-Mar-20	DO (mg/L)	>6.0	8.3	7.25	6.74	7.89								
11-Mar-20	DO (mg/L)	>6.0					6.72	6.92						
12-Mar-20	DO (mg/L)	>6.0							2.67	1.14	2.38	2.62	4.85	5.54
17-Mar-20	DO (mg/L)	>6.0		8.66	9.75	8.78	8.74							
18-Mar-20	DO (mg/L)	>6.0						7.77	2.39	0.64	2.16	2.69	4.02	5.11

		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												
23-Mar-20	DO (mg/L)	>6.0	8.38											
24-Mar-20	DO (mg/L)	>6.0		7.62	9.83	7.75	7.45							
25-Mar-20	DO (mg/L)	>6.0						7.14	3.75	2.49	6.34	6.35	7.02	6.09
3-Mar-20	Conductivity (µs/cm)			103	89	85	79							
4-Mar-20	Conductivity (µs/cm)							79	97	94	93	95	89	88
10-Mar-20	Conductivity (µs/cm)		70.8	97	92	83								
11-Mar-20	Conductivity (µs/cm)						80	79						
12-Mar-20	Conductivity (µs/cm)								96	95	92	92	90	88
17-Mar-20	Conductivity (µs/cm)			99	92	81	79							
18-Mar-20	Conductivity (µs/cm)							78	94	93	101	96		
23-Mar-20	Conductivity (µs/cm)		61.5											
24-Mar-20	Conductivity (µs/cm)			89	98	82	79							
25-Mar-20	Conductivity (µs/cm)							78	98	91	92	90	89	88
3-Mar-20	Temperature (°C)			23.35	25.49	25.64	25.44							
4-Mar-20	Temperature (°C)							24.93	23.65	23.65	23.55	23.64	23.92	24.51
10-Mar-20	Temperature (°C)		26.9	24.36	27.22	25.86								
11-Mar-20	Temperature (°C)						25.57	25.93						
12-Mar-20	Temperature (°C)								23.73	23.66	24.17	24.26	25.06	25.81
17-Mar-20	Temperature (°C)			28.25	27.52	27.47	26.63							
18-Mar-20	Temperature (°C)							26.54	23.78	23.89	24.97	25.15	25.99	26.58
23-Mar-20	Temperature (°C)		25											
24-Mar-20	Temperature (°C)			23.8	23.88	27.24	26.98							
25-Mar-20	Temperature (°C)							26.33	22.58	24	24.32	24.89	23.78	26.27
3-Mar-20	Turbidity (NTU)			30.49	2.87	2.32	2.14							
4-Mar-20	Turbidity (NTU)							2.16	3.15	4.87	5.16	6.89	11.15	8.69

		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												
10-Mar-20	Turbidity (NTU)		2.76	33.2	3.08	2.59								
10-Mar-20	Turbidity (NTU)-bottom					1.65								
11-Mar-20	Turbidity (NTU)						1.65	2.18						
11-Mar-20	Turbidity (NTU)-bottom						2.1	2.02						
12-Mar-20	Turbidity (NTU)								2.67	5.84	6.99	6.31	6.41	9.83
17-Mar-20	Turbidity (NTU)			40.5	2.23	2.25	2.01							
18-Mar-20	Turbidity (NTU)							2.01	2.8	4.7	5.27	5.43	5.35	6.62
23-Mar-20	Turbidity (NTU)		3.52											
24-Mar-20	Turbidity (NTU)			32.07	3.16	2.33	2.73							
25-Mar-20	Turbidity (NTU)							2.66	6.37	7.96	7.52	6.56	17.19	45.57
10-Mar-20	TSS (mg/L)		<5	71.2		<5								
10-Mar-20	TSS (mg/L)-bottom					7.6								
11-Mar-20	TSS (mg/L)						<5	<5						
11-Mar-20	TSS (mg/L)-bottom						<5	5.2						
12-Mar-20	TSS (mg/L)								<5	6.27	5.06	<5	6.1	12.09
10-Mar-20	BOD_5 (mg/L)	<1.5	<1	<1		<1								
10-Mar-20	BOD_5 (mg/L)-bottom					2.2								
11-Mar-20	BOD_5 (mg/L)	<1.5					<1	<1	5.32	6.72	<1	<1	<1	<1
11-Mar-20	BOD_5 (mg/L)-bottom						5.0	4.3						
10-Mar-20	COD (mg/L)	<5.0	7.2											
12-Mar-20	COD (mg/L)	<5.0							9.8	8.8	8.6	9.0	9.0	12.0
10-Mar-20	NH_3-N (mg/L)	<0.2	<0.2	<0.2		<0.2								
10-Mar-20	NH_3-N (mg/L)-bottom					<0.2								
11-Mar-20	NH_3-N (mg/L)	<0.2						<0.2						
11-Mar-20	NH_3-N (mg/L)-bottom						<0.2	<0.2						
10-Mar-20	NO_3-N (mg/L)	<5.0	<0.02	<0.02		<0.02								
10-Mar-20	NO_3-N (mg/L)-bottom					<0.02								
11-Mar-20	NO_3-N (mg/L)	<5.0						<0.02						
11-Mar-20	NO_3-N (mg/L)-bottom						<0.02	<0.02						

		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												
10-Mar-20	Faecal coliform (MPN/100 mL)	<1,000	170	920		0								
10-Mar-20	Faecal coliform (MPN/100 mL)-bottom					0								
11-Mar-20	Faecal coliform (MPN/100 mL)	<1,000					0	0						
11-Mar-20	Faecal coliform (MPN/100 mL)-bottom						0	0						
12-Mar-20	Faecal coliform (MPN/100 mL)	<1,000							0	0	7	8	11	27
10-Mar-20	Total Coliform (MPN/100 mL)	<5,000	1,600	1,600		22								
10-Mar-20	Total Coliform (MPN/100 mL)-bottom					21								
11-Mar-20	Total Coliform (MPN/100 mL)	<5,000					33	350						
11-Mar-20	Total Coliform (MPN/100 mL)-bottom						13	40						
12-Mar-20	Total Coliform (MPN/100 mL)	<5,000							79	350	220	130	920	920
10-Mar-20	TKN (mg/L)		<1.5	<1.5		<1.5								
10-Mar-20	TKN (mg/L)-bottom					<1.5								
11-Mar-20	TKN (mg/L)							<1.5						
11-Mar-20	TKN (mg/L)-bottom						<1.5	<1.5						
10-Mar-20	TOC (mg/L)		1.33											
12-Mar-20	TOC (mg/L)								1.73	1.74	1.7	1.62	1.82	1.61
10-Mar-20	Phytoplankton Biomass (g dry wt/m³)			50.6		2								
10-Mar-20	Phytoplankton Biomass (g dry wt/m³)-bottom					8.6								
11-Mar-20	Phytoplankton Biomass (g dry wt/m³)							1.2						
11-Mar-20	Phytoplankton Biomass (g dry wt/m³)-bottom						5.6	2.6						
10-Mar-20	Total Phosphorus (mg/L)		<0.01	<0.01		<0.01								

		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												
10-Mar-20	Total Phosphorus (mg/L)-bottom					<0.01								
11-Mar-20	Total Phosphorus (mg/L)							<0.01						
11-Mar-20	Total Phosphorus (mg/L)-bottom						<0.01	<0.01						
10-Mar-20	Total Dissolved Phosphorus (mg/L)		<0.01	<0.01		<0.01								
10-Mar-20	Total Dissolved Phosphorus (mg/L)-bottom					<0.01								
11-Mar-20	Total Dissolved Phosphorus (mg/L)							<0.01						
11-Mar-20	Total Dissolved Phosphorus (mg/L)-bottom						<0.01	<0.01						
10-Mar-20	Hydrogen Sulfide (mg/L)			0.02		<0.02								
10-Mar-20	Hydrogen Sulfide (mg/L)-bottom					<0.02								
11-Mar-20	Hydrogen Sulfide (mg/L)							<0.02						
11-Mar-20	Hydrogen Sulfide (mg/L)-bottom						0.05	0.08						

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				
3-Mar-20	pH	5.0 - 9.0		7.35		
4-Mar-20	pH	5.0 - 9.0			6.96	6.94
10-Mar-20	pH	5.0 - 9.0	8.8	7.35		
12-Mar-20	pH	5.0 - 9.0			6.75	6.82
17-Mar-20	pH	5.0 - 9.0		6.92		
18-Mar-20	pH	5.0 - 9.0			6.68	6.86
23-Mar-20	pH	5.0 - 9.0	8.46			
24-Mar-20	pH	5.0 - 9.0		7.32		
25-Mar-20	pH	5.0 - 9.0			6.61	6.52
3-Mar-20	Sat. DO (%)			102.7		
4-Mar-20	Sat. DO (%)				75.4	75.7
10-Mar-20	Sat. DO (%)		101.3	98.1		
12-Mar-20	Sat. DO (%)				59.1	84.1
17-Mar-20	Sat. DO (%)			94.8		
18-Mar-20	Sat. DO (%)				61.3	68.2
23-Mar-20	Sat. DO (%)		106.2			
24-Mar-20	Sat. DO (%)			95.4		
25-Mar-20	Sat. DO (%)				81.4	73.4
3-Mar-20	DO (mg/L)	>6.0		8.64		
4-Mar-20	DO (mg/L)	>6.0			6.28	6.4
10-Mar-20	DO (mg/L)	>6.0	8.22	9.07		
11-Mar-20	DO (mg/L)	>6.0				
12-Mar-20	DO (mg/L)	>6.0			4.75	6.98
17-Mar-20	DO (mg/L)	>6.0		7.85		
18-Mar-20	DO (mg/L)	>6.0			4.85	5.5
23-Mar-20	DO (mg/L)	>6.0	8.52			
24-Mar-20	DO (mg/L)	>6.0		8.37		
25-Mar-20	DO (mg/L)	>6.0			6.86	6.17
3-Mar-20	Conductivity (µs/cm)			88		
4-Mar-20	Conductivity (µs/cm)				174	71
10-Mar-20	Conductivity (µs/cm)		26.1	93		
12-Mar-20	Conductivity (µs/cm)				172	62
17-Mar-20	Conductivity (µs/cm)			74		
18-Mar-20	Conductivity (µs/cm)				168	68
23-Mar-20	Conductivity (µs/cm)		25			
24-Mar-20	Conductivity (µs/cm)			91		
25-Mar-20	Conductivity (µs/cm)				172	60
3-Mar-20	Temperature (°C)			22.08		
4-Mar-20	Temperature (°C)				24.65	23.45
10-Mar-20	Temperature (°C)		23.4	18.4		
12-Mar-20	Temperature (°C)				26.65	24.78

		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				
17-Mar-20	Temperature (°C)			23.12		
18-Mar-20	Temperature (°C)				27.86	26.55
23-Mar-20	Temperature (°C)		23.9			
24-Mar-20	Temperature (°C)			22.01		
25-Mar-20	Temperature (°C)				26.48	24.13
3-Mar-20	Turbidity (NTU)			6.02		
4-Mar-20	Turbidity (NTU)				148	9.02
10-Mar-20	Turbidity (NTU)		2	8.94		
12-Mar-20	Turbidity (NTU)				4.04	4.32
17-Mar-20	Turbidity (NTU)			4.08		
18-Mar-20	Turbidity (NTU)				4.78	3.89
23-Mar-20	Turbidity (NTU)		5.28			
24-Mar-20	Turbidity (NTU)			10.18		
25-Mar-20	Turbidity (NTU)				5.06	23.25
10-Mar-20	TSS (mg/L)		<5	49.49		
12-Mar-20	TSS (mg/L)				<5	<5
10-Mar-20	BOD_5 (mg/L)	<1.5	<1	<1		
11-Mar-20	BOD_5 (mg/L)	<1.5			<1	<1
10-Mar-20	COD (mg/L)	<5.0	8.0	8.8		
12-Mar-20	COD (mg/L)	<5.0			13.8	12.8
10-Mar-20	NH_3-N (mg/L)	<0.2	<0.2	<0.2		
10-Mar-20	NO_3-N (mg/L)	<5.0	0.07	<0.02		
10-Mar-20	Faecal coliform (MPN/100 mL)	<1,000	79	33		
12-Mar-20	Faecal coliform (MPN/100 mL)	<1,000			17	27
10-Mar-20	Total Coliform (MPN/100 mL)	<5,000	240	920		
12-Mar-20	Total Coliform (MPN/100 mL)	<5,000			540	1,600
10-Mar-20	TKN (mg/L)		<1.5	<1.5		
10-Mar-20	TOC (mg/L)		1.04	1.85		
12-Mar-20	TOC (mg/L)				3.16	2.9
10-Mar-20	Total Phosphorus (mg/L)		<0.01	<0.01		
10-Mar-20	Total Dissolved Phosphorus (mg/L)		<0.01	<0.01		

ANNEX B: RESULTS OF EFFLUENT ANALYSES

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

	Site Name	Owner's Site Office and Village		ESD Camp No.2 (HM Main Camp)		ESD Camp		Main Powerhouse	
	Station Code	EF01		EF13		EF14		EF19	
	Date	02-Mar-20	16-Mar-20	02-Mar-20	16-Mar-20	02-Mar-20	16-Mar-20	02-Mar-20	16-Mar-20
Parameters (Unit)	**Guideline**								
pH	6.0 - 9.0	6.92	6.46	7.1	7.27	7.2		7.31	
Sat. DO (%)		40.7	58.3	45.8	50.1	21.6		58.9	
DO (mg/L)		3.1	4.39	3.45	3.65	1.6		3.92	
Conductivity (µs/cm)		309	338	430	817	406		1006	
TDS (mg/L)		154.5	164	215	408.5	203		503	
Temperature (°C)		27.7	28.6	28.3	29.4	29.3		30.3	
Turbidity (NTU)		1.65	0.69	26.59	11.18	9.1		16.37	
TSS (mg/L)	<50	<5	<5	6.8	9.3	17.14		58.2	
BOD_5 (mg/L)	<30	<6	7.38	28.8	<6	<6	No discharged and no inflow	12.18	No discharged and no inflow
COD (mg/L)	<125	<25	<25	96.6	55.6	47.2		118	
NH_3-N (mg/L)	<10.0	<2	<2	21.6	27.8	11.1		59.5	
Total Nitrogen (mg/L)	<10.0	1.07	1.34	25.8	31.6	17.8		63.8	
Total Phosphorus (mg/L)	<2	0.87	1.23	1.02	1.49	0.51		1.82	
Oil & Grease (mg/L)	<10.0	<1		<1		<1		<1	
Total coliform (MPN/100 mL)	<400	26	350	170	0	0		280	
Faecal Coliform (MPN/100 mL)	<400	14	8	70	0	0		79	
Effluent Discharge Volume (L/mn)		6	3	3	3	2		1650	
Chlorination Dosing Rate (mL/mn)		n/a	n/a	18	38	15		415	
Residual Chlorine (mg/L)	<1.0	n/a	n/a	0.2	1.6	0.94		0.87	

TABLE B-2: *RESULTS OF THE CONSTRUCTION AREA DISCHARGE IN MARCH 2020*

	Site Name	Upstream Spoil Disposal Area No.2			
	Station Code	DS04 - US			
	Date	04-Mar-20	12-Mar-20	18-Mar-20	25-Mar-20
Parameter (Unit)	Guideline				
pH	6.0 - 9.0	6.55	5.99	5.87	5.65
Sat. DO (%)		88.7	74.2	40.5	62.4
DO (mg/L)		7.53	6.15	3.54	5.24
Conductivity (µs/cm)		52	27	32	20
TDS (mg/L)		26	13.5	16	10
Temperature (°C)		23.4	25.19	22.3	24.21
Turbidity (NTU)		41.43	6.21	24.62	6.1
TSS (mg/L)	<50	52.1			

	Site Name	Spoil Disposal Area No.2			
	Station Code	DS04			
	Date	04-Mar-20	12-Mar-20	18-Mar-20	25-Mar-20
Parameter (Unit)	Guideline				
pH	6.0 - 9.0	6.3	5.65	5.71	5.5
Sat. DO (%)		76.5	52.2	54.1	40.5
DO (mg/L)		6.37	4.22	4.71	3.32
Conductivity (µs/cm)		188	102	120	95
TDS (mg/L)		94	51	60	47.5
Temperature (°C)		24.62	26.48	22.4	25.52
Turbidity (NTU)		613	3.73	6.87	6.51
TSS (mg/L)	<50	217.5			