NAM NGIEP 1
POWER COMPANY

Nam Ngiep 1 Hydropower Project

Quarterly Environment Monitoring Report
Fourth Quarter of 2020

October to December 2020

Rev	Date	Author	Checked	Approved	Modification Details
A					
A1	20 April 2021				Final
A0	15 March 2021	Hendra WINASTU	Wanidaporn RODE	Khamlar PHONSAVAT	1st draft sent to LTA and ADB for Review

Accessibility	
☑	Public
☐	Internal
☐	Confidential

Document No.

NNP1-C-J0905-RP-024-A

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ABBREVIATIONS / ACRONYMS

AIP	Annual Implementation Plan
ADB	Asian Development Bank
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
EC	Electrolytic Conductivity
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
ESD	Environmental and Social Division of NNP1PC
ESMMP	Environmental and Social Monitoring and Management Plan
GOL	Government of Lao PDR
GIS	Geographic Information Systems
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
kV	kilo-Volt
LTA	Lender's Technical Advisor
MAF	Ministry of Agriculture and Forestry
MEM	Ministry of Energy and Mines, Lao PDR

MOM	Minutes of Meeting
MONRE	Ministry of Natural Resource and Environment, Lao PDR
MOU	Memorandum of Understanding
NCR	Non-Compliance Report
NNP1PC	Nam Ngiep 1 Power Company Limited
OC	Obayashi Corporation
ONC	Observation of Non-Compliance
OSOV	Owners' Site Office and Village
PAFO	Provincial Department of Agriculture and Forestry
PONRE	Provincial Department of Natural Resource and Environment, MONRE
RCC	Roller Compacted Concrete
SIR	Site Inspection Report
SMO	Social Management Office of ESD within NNP1PC
SMART	Spatial Monitoring and Reporting Tool
SOP	Standard Operating Procedure
SS-ESMMP	Site Specific Environmental and Social Monitoring and Management Plan
TOR	Terms of Reference
TSS	Total Suspended Solids
UAE	United Analysis and Engineering Consultant Company Ltd.
WMF	Watershed Management Fund
WMP	Watershed Management Plan
WRPC	Watershed and Reservoir Protection Committee
WRPO	Watershed and Reservoir Protection Office
WWTS	Wastewater Treatment System

1 EXECUTIVE SUMMARY

The quarterly environment monitoring reports of Nam Ngiep 1 Hydropower Project provides information and analysis of compliance with the environmental and social obligations of the Project stipulated in the Concession Agreement between the Nam Ngiep 1 Power Company (NNP1PC) and the Government of Lao PDR (GOL), and as required by environmental legislation of the Lao PDR, the ADB Safeguard Policy Statement and IFC Performance Standards. The Company ensures compliance with these requirements through implementation of project specific sub-plans, programmes and activities prepared as part of the Environmental and Social Management and Monitoring Plan for the Operation Phase (ESMMP-OP).

A joint ADB and IAP virtual mission was conducted during 07 to 11 December 2020 and the work progress of NNP1PC Environmental Management Office (EMO) was shared during the mission. The queries raised by ADB were addressed and EMO prepared additional data and explanations in response to some of the issues.

During Q4 2020, the Company's Environmental and Social Policies were announced by the Managing Director of NNP1PC to all staff on 17 November 2020 followed by the official establishment of NNP1PC ISO Committee on 18 November 2020. The ISO Committee is comprised of 12 staffs representing all work sections. The Environmental Management Office (EMO) of NNP1PC completed the technical evaluation of the bids for the EMS Training and ISO14001 Certification Audit in October 2020 and signed a 3-year service contract with SGS (Lao) Sole Co., Ltd. in November 2020. Three ISO training modules have subsequently been completed including (i) Requirements and Interpretation of ISO14001:2015; (ii) Organization Context and Risk Assessment; and (iii) Documented Information. An ISO14001:2015 Internal Audit is scheduled to be held in February 2021.

EMO received two Detailed Work Program (DWP) & Site Specific Environmental and Social Management and Monitoring Plan (SS-ESMMP) for review and approval. A total of four Observations of Non-Compliance (ONCs) and two Non-Compliance (NCR) were active. Out of these, one ONC was resolved during the reported period. Three ONCs and two NCRs will be carried over to Q1 2021.

EMO continued working with the wastewater treatment expert in upgrading the operation of the wastewater treatment system (WWTS) at OSVO1, OSOV2 and the Main Dam Powerhouse. The proposal for WWTS improvement and modification was approved by NNP1PC management in early November 2020. The bidding process for WWTS improvement and modification was started by public advertising for interested bidders on 17 December 2020. The pre-bidding meeting including site visit attended by three interested bidders was organized on 24 December 2020 at NNP1PC Site Office and Village (OSOV1). The deadline for submission of proposals is on 15 January 2021 and the selection process is expected to be completed by the end of January 2021.

In parallel, the consultancy contract of the wastewater treatment expert which expired on 31 December 2020 was extended for 7 months until 19 August 2021 to provide technical support during the construction and commissioning of the Sequencing Batch Reactor system (SBR) in OSOV2 during Q1 - Q2 2021.

A total of 32 sites (09 sites that were rehabilitated earlier during the construction phase in 2018 and another 23 sites that were rehabilitated during the operation phase from the end of 2019 to 2020) continued to be monitored in Q4 2020. The percentage of vegetation cover has been

maintained but the green cover has decreased compared with the Q3 2020 due to the dry season. EMO coordinated with the GOL-EMU and requested that they undertake a site visit within January 2021 before the end of the contractor's liability period on 31 January 2021 to inspect the status of rehabilitation and consider the hand-over of the sites to GOL.

During Q4 2020, a total of 55.4 m^3 solid waste from NNP1 project sites and camps was disposed of at the NNP1 Project Landfill, a decrease of 2.5 m^3 compared to Q3 2020. A total of 42.9 m^3 solid waste from Phouhomxay, Thahuea and Hat Gniun villages was disposed of at the Houay Soup Landfill. A total of 2,689.5 kg recyclable waste was recorded at the Community Waste Bank and villagers collected a total of 1,783.5 kg of food waste from the Owner's Site Office and Village (OSOV) for feeding their animals.

The monthly site visits by the Environmental Management Unit (EMU) of Bolikhan District and a quarterly site visit by the EMU of Xaysomboun Province were not carried out during Q4 2020.

During Q4 2020, the concentration of dissolved oxygen (DO) at the surface level in the Main Reservoir (except at R05 on 09 and 25 December 2020, DO were 4.8 mg/L and 5.0 mg/L respectively), Nam Ngiep Upstream station (NNG01), Nam Chian (NCH01) and Nam Phouan (NPH01) had DO levels above 6 mg/L. In addition, the DO concentrations in Nam Xao and Nam Houay Soup were above 6 mg/L.

The DO concentrations at the surface level in the re-regulation reservoir (R07) were between 1.6 – 4.3 mg/L.

The DO levels in Nam Ngiep downstream the re-regulation dam was about 3 mg/L - 4 mg/L for the first few kilometres gradually increasing to about 5 mg/L or just above 6 mg/L over the following 25 km.

The depth profile monitoring during the period indicates formation of oxyclines in the main reservoir at all stations at varying depths, except at R01 which due to its location at the narrow upper end of the reservoir behaves like a river.

On 25 September 2020, NNP1 (EMO and INFRA) conducted a field investigation of the groundwater system of Somseun, Nam Pa and Thong Noy villages to identify the potential causes of bacterial contamination. The Investigation Report incorporating the possible sources of contamination and recommendations for the water supply system operation and maintenance was finalized and shared with the NNP1 SMO in October 2020 for further actions.

The management activities as per the approved Watershed Management AIP2019 and AIP2020 under the component of forest cover maintenance and reservoir management progressed during this reported period.

On 24 September 2020, NNP1PC transferred the funds for the watershed management activities of Bolikhamxay Provincial WRPO planned to be implemented during October to December 2020. The forest and reservoir patrolling started on 12 November 2020 but the reservoir patrolling could not be completed as planned due to an issue with the boat engine. The process of changing the bank account of GOL from USD to LAK was completed on 07 December 2020 and the fund under the approved AIP2020 of Xaysomboun provincial WRPO was transferred to DOF-MAF on 18 December 2020. NNP1PC organized a three-day water safety training in collaboration with Lao Red Cross on 03-05 November 2020 and handed over the SMART system equipment to Xaysomboun Provincial WRPO on 10 December 2020. The

handover of the SMART system equipment to Bolikhamxay Provincial WRPO was scheduled to be carried out in January 2021.

The management activities as per the approved NC-NX Biodiversity Offset Management AIP2020 under the component of spatial planning, law enforcement, and conservation linked livelihood progressed during this reported period.

The five species that dominated the fish catch by weight in Q4 2020 include two species (*Channa striata* and *Tor sinensis*) and three species group of Hampala, Poropuntius and Barbonymus and Hypsibarbus that are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species, except *Tor sinensis* that is classified as a Vulnerable species (VU). The recorded catch of threatened species includes one Endangered species (EN), and three Vulnerable species (VU).

2 INTRODUCTION

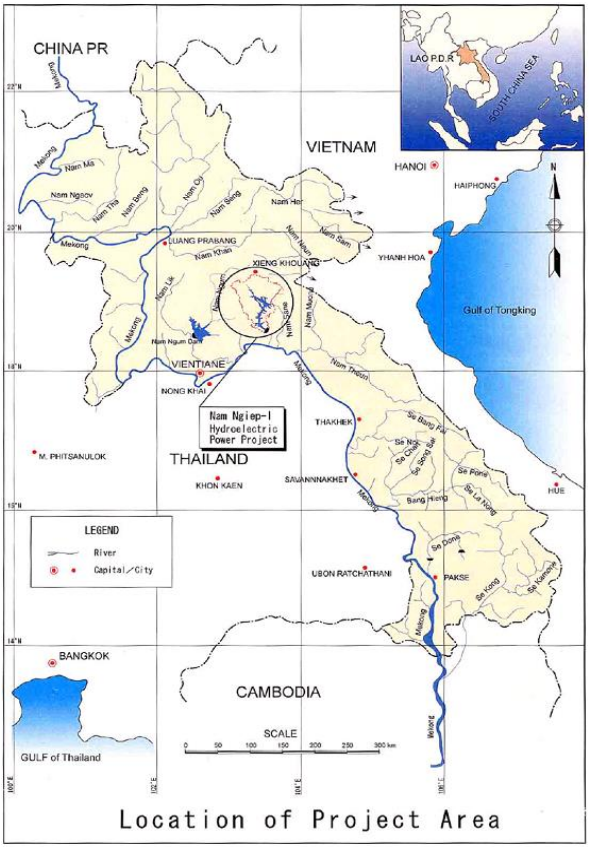
The Nam Ngiep originates in the mountains of Xieng Khouang Province, flowing through Khoun District into Thathom District of Xaysomboun Province, through Hom District and into Bolikhan District of Bolikhamxay Province. The Nam Ngiep meets the Mekong River just upstream from Paksan in Bolikhamxay Province.

Two dams and power stations were constructed along the Ngiep River in Bolikhamxay. At the main dam site, a primary power station generated around 1,546 GWh of electricity for export to Thailand and release water to a regulating pond where a second dam and power station generate around 105 GWh of electricity for local use.

The Project Commercial Operation Date was achieved on 05 September 2019.

This Quarterly Environment Report provides a summary of environmental monitoring activities and mitigation actions during **Q4 2020**. The report is published on the Company website (https://namngiep1.com/).

Related construction Site Specific Environmental and Social Monitoring and Management Plans (SS-ESMMPs) are also publicly disclosed on the Company website as required under the Concession Agreement.



3 ENVIRONMENTAL MANAGEMENT AND MONITORING

The environmental management and monitoring activities reported in this section document implementation of the relevant sub-plans and programmes of the Environmental and Social Management and Monitoring Plan for the Operation Phase during Q4 2020.

3.1 ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)

During Q4 2020, the Company's Environmental and Social Policies were announced by the Managing Director of NNP1PC to all staff on 17 November 2020 followed by the official establishment of NNP1PC ISO Committee on 18 November 2020 comprised of 12 staffs representing all work sections. The Environmental Management Office (EMO) of NNP1PC completed the technical evaluation of the bids for the EMS Training and ISO14001 Certification Audit in October 2020 and signed a 3-year service contract with SGS (Lao) Sole Co., Ltd. in November 2020. Three ISO training modules have subsequently been completed. The first module covered training on Requirements and Interpretation of ISO14001:2015 and was attended by 21 NNP1PC staff over 2 days on 30 November and 01 December 2020. The second module dealt with training on Organization Context and Risk Assessment (1 day), and the third module was on Documented Information (2 days) for 24 NNP1PC staffs and one EGAT staff

conducted on 21-23 December 2020. An ISO14001:2015 Internal Audit was scheduled to be conducted in February 2021.

The progress on establishing the EMS according to ISO14001:2015 is on tract and follows the tentative work plan as shown in **Table 3-1.**

TABLE 3-1: ***ENVIRONMENTAL MANAGEMENT SYSTEM WORK PLAN***

Item	ISO14001:2015 Work Plan	Year 2020		Year 2021			
		Q3	Q4	Q1	Q2	Q3	Q4
1	Continue to prepare EMS documents (8 Standard Operating Procedures are completed)						
2	**NNP1PC Environmental Policy announcement**						
3	NNP1PC ISO Committee establishment						
4	Training relevant staff on: - Requirement and Interpretation of ISO14001:2015 - Organization Context and Risk Management for ISO14001 - ISO14001:2015 Document Information - ISO14001:2015 Internal Audit						
5	Implement the EMS procedures and processes						
6	ISO14001:2015 Internal Audit						
7	Implement the corrective actions and preventive actions according to the Internal Audit						
8	Management Review by NNP1PC Management						
9	ISO 14001:2015 Assessment and Certification Audit – **1st Stage** (***remote audit*** on the documentation review)						
10	Implement the corrective actions and preventive actions according to the 1st Stage Audit						
11	ISO 14001:2015 Assessment and Certification Audit – **2nd Stage** (***on-site audit***)						
12	Implement the corrective actions and preventive actions according to the 2nd Stage Audit						
13	**Certify of ISO14001:2015 upon successful completion of the audit**						

3.2 CONTRACTOR SS-ESMMPS

During Q4 2020, the Environmental Management Office (EMO) of NNP1PC received two Detailed Work Program (DWP) & Site Specific Environmental and Social Management and Monitoring Plan (SS-ESMMP), for review and approval.

All these submitted documents were cleared within the document review timeframe as shown in **Table 3-2** - more details can be found in **Appendix 1**.

TABLE 3-2*: DOCUMENTS REVIEWED DURING Q4 2020*

Document Name	Rev. 1	Rev. 2	Rev. 3	Approved
DWP and SS-ESMMP for Geotechnical Investigation at the Main Dam Downstream Right Bank Slope Area	√			√
DWP and SS-ESMMP for Construction of Suspension Bridge in 2UR	√			√

3.3 RESULTS OF COMPLIANCE INSPECTIONS AT CONSTRUCTION SITES

During Q4 2020, the EMO conducted bi-weekly and monthly site inspections at a total of 42 sites including a 32 previous construction sites undergoing rehabilitation, four main operation sites, and six construction sites and temporary contractor camps. An increase of 15 monitoring sites compared with Q3 2020.

A total of four Observations of Non-Compliance (ONCs) and two Non-Compliance Reports (NCR) were active (three ONCs and two NCRs carried over from the Q3 of 2020, and one new ONC). Out of these, one ONC was resolved during the reported period. Three ONCs and two NCRs will be carried over to Q1 20201.

The status of Non-Compliance Reports (NCRs) and ONCs are summarized in **Table 3-3**, **Figure 3-1** and **Figure 3-2**. The progress of corrective actions is presented in **Appendix 2**.

TABLE 3-3: *STATUS OF NON-COMPLIANCE REPORT DURING Q4 2020*

Status	ONC	NCR-Level 1	NCR-Level 2	NCR-Level 3	Incident Report
Carried over ONC/NCR from the previous quarter	3	2	0	0	0
Newly opened ONC/NCR	1	0	0	0	0
Total No. of ONC/NCR	4	2	0	0	0
Resolved ONC/NCR	1	0	0	0	0
Unresolved ONC/NCR carried forward to the next quarter	3	2	0	0	0

FIGURE 3-1: *STATUS OF ONCS DURING Q4 2020*

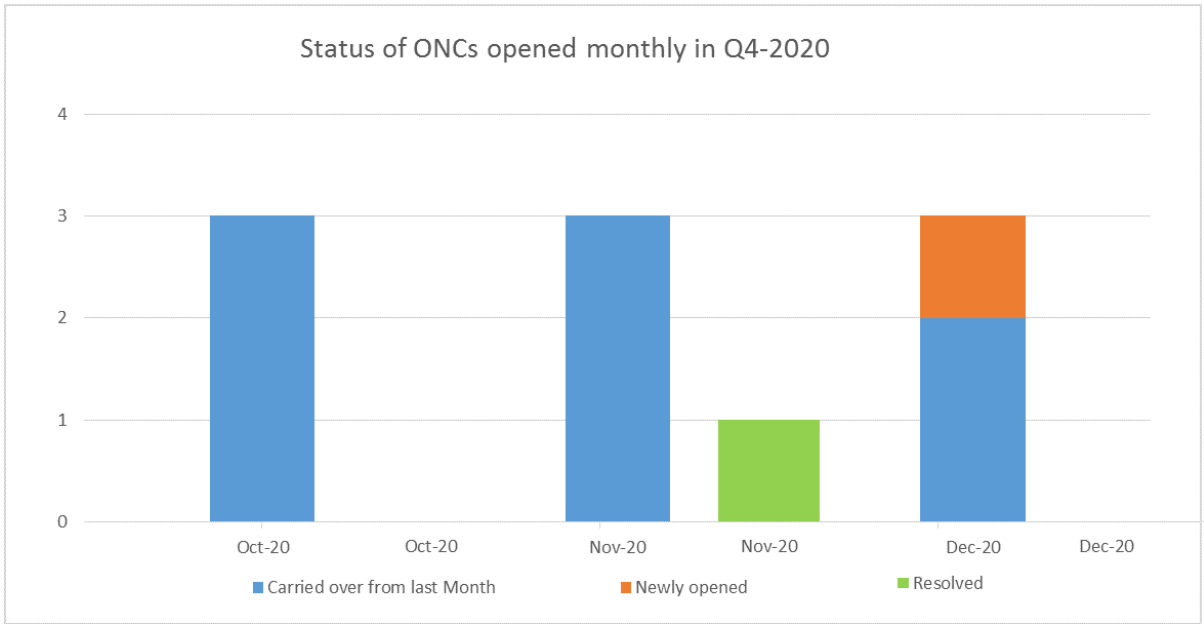
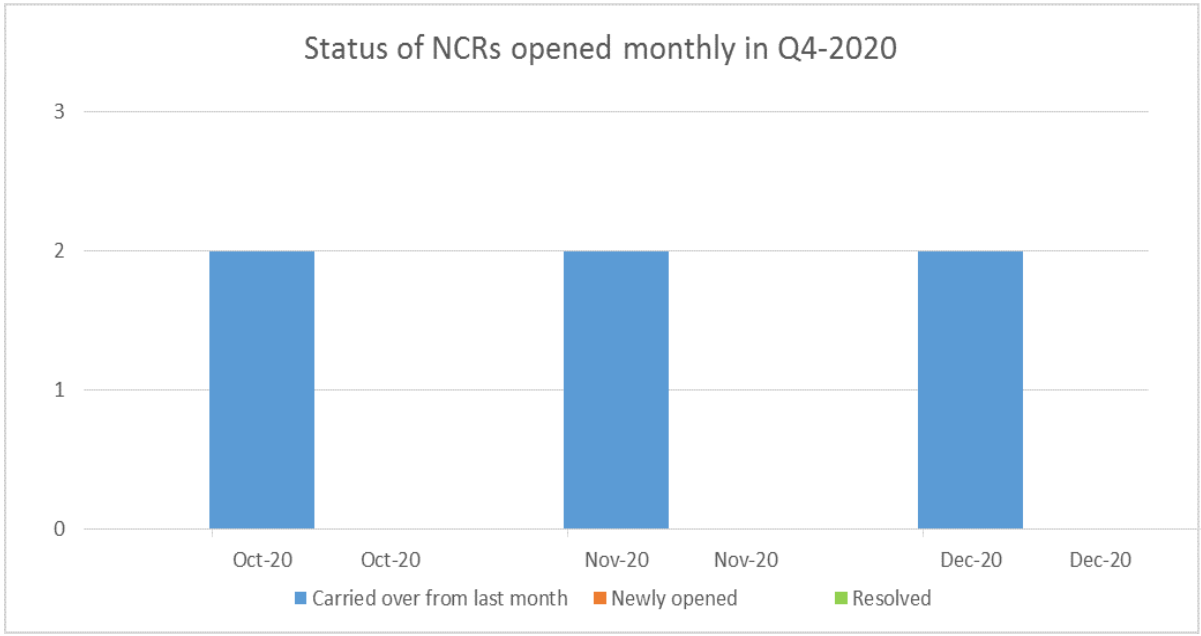


FIGURE 3-2: *STATUS OF NCRS DURING Q4 2020*



PHOTOGRAPH 1: SITE REHABILITATION DEFECT REMEDYING AT SLOPE OF FORMER RCC PLANT

PHOTOGRAPH 2: ADM-EMO AND SUPPLIER JOINT SITE INSPECTION AND ASSESSMENT OF THE BIOFILM SEPTIC TANK EFFICIENCY AT OSOV1

PHOTOGRAPH 3: ISO14001:2015 ONLINE TRAINING

PHOTOGRAPH 4:TD-EMO-ADM AND THE BIDDERS JOINT SITE VISIT AT THE WWTS OF OSOV1 AFTER PRE-BIDDING MEETING

3.4 RESULTS OF SITE DECOMMISSIONING AND REHABILITATION

During Q4 2020, EMO continued to monitor the 32 sites and associated facilities that have been fully rehabilitated. The Contractors will continue with the aftercare and maintenance activities until the end of the Contractors' liability period on 31 January 2021. Due to the onset of the dry season, the percentage of re-vegetation coverage and germination was unchanged but the green cover was reduced compared with the previous quarter. However, for two sites (LILAMA10 camp and Phouhomxay Village's Irrigation canal spoil and rock disposal area) the percentage of vegetation cover had slightly increased compared with Q3 2020. It is expected that all 32 sites (9 sites that were rehabilitated in 2018 and 23 sites that were rehabilitated during the operation phase in 2019 and 2020) will be handed over to the GOL in Q2 2021.

During Q4 2020, there was no jointly site inspection between NNP1PC (EMO and TD) and the Civil Works Contractor (Obayashi) to evaluate the vegetation cover percentage and site stability due to EMO treated that the percentage of vegetation covering were maintained or equivalent

to the values evaluated in Q3 2020, except two sites of LILAMA10 camp and Phouhomxay Village's Irrigation canal spoil and rock disposal area, that latterly re-vegetated in August 2020.

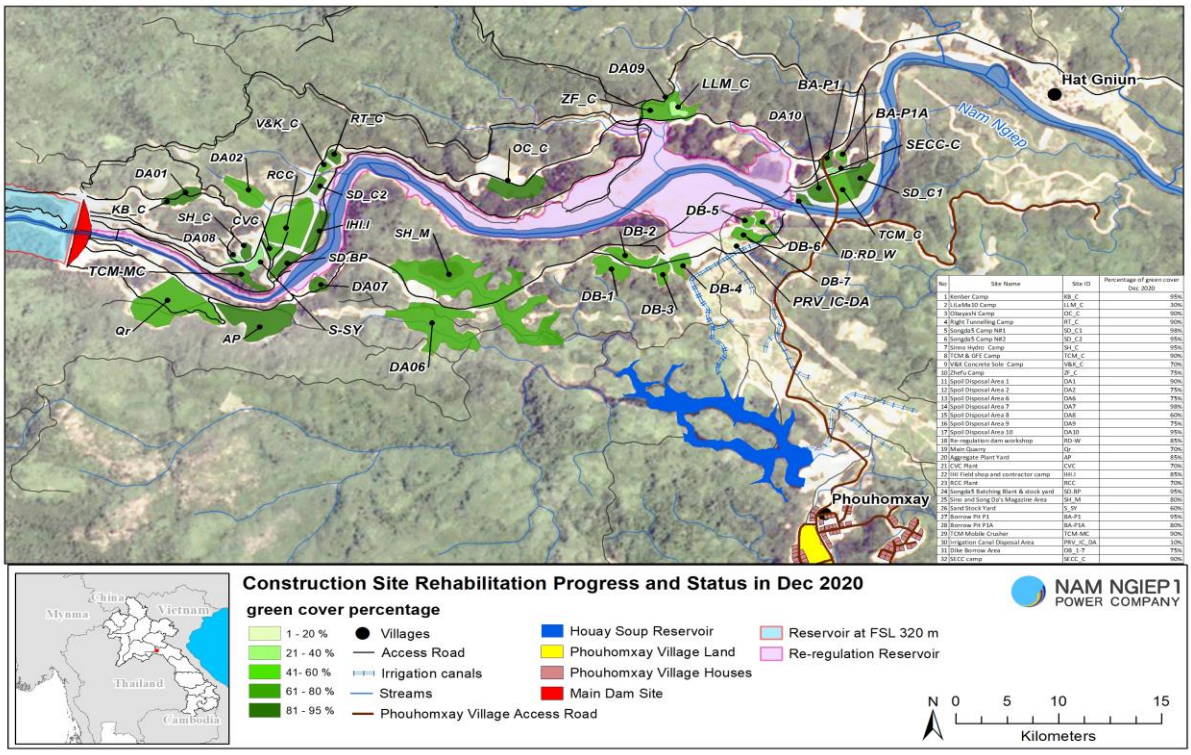
The status of site rehabilitation and revegetation is summarized in **Table 3-4** and the revegetated sites are shown in **Figure 3-3** with the relevant photographs.

TABLE 3-4: *SUMMARY STATUS OF CONSTRUCTION SITES REHABILITATION*

No	Site Name	Status of Decommissioning & Re-vegetation	Percentage of Vegetation Cover Evaluation		
			Jun-2020	Sep-2020	Dec-2020
01	TCM & GFE Camp	Completed	70%	90%	90%
02	Spoil Disposal Area 7	Completed	-	98%	98%
03	Spoil Disposal Area 9	Completed	-	75%	75%
04	Spoil Disposal Area 10	Completed	80%	95%	95%
05	Borrow Pit P1	No need for decommissioning	-	95%	95%
06	Borrow Pit P1A	No need for decommissioning	-	80%	80%
07	TCM Mobile Crusher	Completed	-	90%	90%
08	Dike Borrow Areas	No need for decommissioning	-	75%	75%
09	SECC camp	Completed	-	90%	90%
10	KENBER Camp	Completed	80%	95%	95%
11	LILAMA10 Camp	Completed	5%	20%	40%
12	Obayashi Camp	Completed	80%	90%	90%
13	Right Tunnelling Camp	Completed	70%	90%	90%
14	Songda5 Camp N#1	Completed	90%	98%	98%
15	Songda5 Camp N#2	Completed	80%	95%	95%
16	Sino Hydro Camp	Completed	80%	95%	95%
17	V&K Concrete Sole Camp	Completed	50%	70%	70%
18	Zhefu Camp	Completed	60%	75%	75%
19	Spoil Disposal Area 1	Completed	80%	90%	90%
20	Spoil Disposal Area 2 & main dam workshop	Completed	60%	75%	75%
21	Spoil Disposal Area 6	Completed	70%	75%	75%
22	Spoil Disposal Area 8	No need for decommissioning	40%	60%	60%
23	Re-regulation dam workshop	Completed	80%	85%	85%
24	Main Quarry	Completed	50%	70%	70%
25	Aggregate Plant Yard	Completed	80%	85%	85%
26	CVC Plant	Completed	60%	70%	70%
27	IHI Field shop and contractor camp	Completed	70%	85%	85%
28	RCC Plant	Completed	50%	70%	70%

No	Site Name	Status of Decommissioning & Re-vegetation	Percentage of Vegetation Cover Evaluation		
			Jun-2020	Sep-2020	Dec-2020
29	Songda5 Batching Plant & Stock yard	Completed	80%	95%	95%
30	Sino and Song Da's Magazine Area	Completed	70%	80%	80%
31	Sand Stock Yard	No need for decommissioning	-	60%	60%
32	Irrigation Canal Spoil Disposal Area *Phouhomxay Village*	No need for decommissioning	-	5%	10%

FIGURE 3-3*: REVEGETATION SITES MAP DURING Q4 2020*



Some aerial photos be shown the different of green colour and vegetation covering comparing in Q3 and Q4 2020

AERIAL PHOTO OF THE MAIN DAM'S SUPPORTING FACILITY AREAS

PHOTOGRAPH 1: Q3 2020

PHOTOGRAPH 2: Q4 2020

AERIAL PHOTO OF THE RE-REGULATION DAM'S SUPPORTING FACILITY AREAS

PHOTOGRAPH 3: Q3 2020

PHOTOGRAPH 4: Q4 2020

AERIAL PHOTO OF THE SPOIL DISPOSAL NO.6

PHOTOGRAPH 5: Q3 2020

PHOTOGRAPH 6: Q4 2020

AERIAL PHOTO OF THE MAIN QUARRY

PHOTOGRAPH 7: Q3 2020

PHOTOGRAPH 8: Q4 2020

AERIAL PHOTO OF THE EARTH DIKE AND BORROW PITS (NO.1-7)

PHOTOGRAPH 9: Q3 2020

PHOTOGRAPH 10: Q4 2020

AERIAL PHOTO OF THE HEAD CONTRACTOR CAMP (OBAYASHI CORPORATION)

PHOTOGRAPH 11: Q3 2020

PHOTOGRAPH 12: Q4 2020

THE SITE STATUS OF FORMER LILAMA10 CAMP

PHOTOGRAPH 13: Q3 2020

PHOTOGRAPH 14: Q4 2020

THE SITE STATUS OF PHOUHOMXAY VILLAGE'S IRRIGATION CANAL ROCK /SPOIL DISPOSAL AREA

PHOTOGRAPH 15: Q3 2020

PHOTOGRAPH 16: Q4 2020

3.5 WASTE MANAGEMENT AT THE CONSTRUCTION SITES

3.5.1 General Waste Management

During Q4 2020, a total of 55.4 m^3 of solid waste from NNP1 project sites and camps was disposed at the NNP1 Project Landfill, a decrease of 2.5 m^3 compared with Q3 2020.

No recyclable waste was sold during the reporting period. The amount of accumulated recyclable wastes is shown in **Table 3-5.**

TABLE 3-5: *AMOUNTS OF RECYCLABLE WASTE DURING Q3 2020*

Source and Type of Recyclables		Unit	Total in Q4 2020 (A)	Sold (B)	Remaining Amount (A - B)
Construction activity					
1	Scrap metal	kg	0	0	0
Sub-Total 1		**kg**	**0**	**0**	**0**
Operation camp					
2	Plastic bottle	kg	96	0	96
3	Aluminium	kg	114	0	114
4	Paper/Cardboard	kg	63	0	63
5	Glass	kg	77	0	77
Sub-Total 2		**kg**	**350**	**0**	**350**
Grand Total 1+2		**kg**	**350**	**0**	**350**

3.5.2 Hazardous Waste Management

During Q4 2020, joint hazardous materials and waste inventory monitoring were carried out at the OSOV1 warehouse, the Main Dam Powerhouse and the Re-regulation Dam Powerhouse. The amounts of hazardous waste and hazardous materials that were collected, stored and disposed of during Q4 2020 are shown in **Table 3-6.** No disposal of hazardous waste during the reporting period, except a total of 100 Fluorescent bulbs were crushed and stored in the Crushing Container**.** The remaining waste will be collected, treated and also disposed of by Khounmixay Processing Factory.

TABLE 3-6: *HAZARDOUS MATERIAL AND HAZARDOUS WASTE RECORDED DURING Q4 2020*

No.	Type of Hazardous Material	Unit	Total in Q4 2020	Used/ Disposed	Remaining
01	Diesel	Litre	18,750.0	16,350.0	**2,400.0**
02	Gasoline	Litre	1,098.0	670.0	**428.0**
03	Lubricant (Turbine oil)	Litre	7,210.0	0	**7,210.0**
04	Colour paint	Litre	266.0	0	**266.0**
05	Tinner	Litre	12.0	0	**12.0**
06	Grease oil	Litre	725.0	0	**725.0**
07	Gear Oil	Litre	220.0	0	**220.0**
08	Chlorine Liquid	Litre	195.0	95.0	**100.0**
09	Chlorine Powder	Kg	65.0	0	**65.0**
10	Fire Extinguisher (18Kg)	Unit	0	0	**0**
11	Sika	Litre	7.0	0	**7.0**
	Type of Hazardous Waste				
12	Used Oil (Hydraulic + Engine)	Litre	272.3	0	**272.3**
13	Used oil mixed with water	Litre	0	0	**0.0**
14	Empty used oil drum/container (drum 200L)	Unit	3.0	0	**3.0**
15	Used oil filters	Uni	0	0	**0**
16	Contaminated soil, sawdust and textile material	M3	0.5	0	**0.5**

No.	Type of Hazardous Material	Unit	Total in Q4 2020	Used/ Disposed	Remaining
17	Used tyre	Piece	17.0	0	**17.0**
18	Empty used chemical drum/container (drum 20L)	Unit	6.0	0	**6.0**
19	Lithium-ion batteries	Unit	0	0	**0.0**
20	Lead acid batteries	Unit	7.0	0	**7.0**
21	Empty paint and spray cans	Can	138.0	0	**138.0**
22	Halogen/fluorescent bulbs	Unit	328.0	100.0	**228.0**
23	Empty cartridge (Ink)	Piece	169.0	0	**169.0**
24	Clinic Waste	Kg	6.9	0	**6.9**

3.5.3 Animal Fodder (Pig Feed) Collection Programme

During Q4 2020, local villagers collected 1,783.4 kg of food waste from the Owner's Site Office and Village (OSOV) for feeding their animals, a decrease of 244.5 kg compared with Q3 2020 because the villagers did not regularly come and collect food waste during December 2020 due to the Hmong New Year festival.

3.5.4 Community Solid Waste Management and Recycling Programme

The trading of recyclable materials at the Community Recycle Waste Bank during Q4 2020 is summarized in **Table 3-7.** The waste bank collected a total of 55 kg of glass bottles segregated at the NNP1's landfill and Houay Soup landfill.

TABLE 3-7: *AMOUNTS OF RECYCLABLES SOLD AT THE COMMUNITY RECYCLE WASTE BANK*

Type of Waste	Unit	Remaining in Q3 2020	Purchased/ Collected in Q4 2020	Sold	Disposed	Remaining in Q4 2020
Plastic bottle	kg	35.5	28	0	28.5	**35.0**
Aluminum	kg	0	0	0	0	**0**
Paper/Cardboard	kg	852.5	0	0	556	**296.5**
Glass	kg	2,304	54	0	0	**2,358.0**
Scrap metal	kg	0	0	0	0	**0**
Total	**kg**	**3,192**	**82**	**0**	**584.5**	**2,689.5**

During the Q4 2020, the local waste collection contractor continued to carry out landfill operation and maintenance which included daily and weekly waste cover, repairing the damaged perimeter at the landfills, grass mowing, storage cleaning and clean up sediment in the open ditches around the leachate ponds.

3.5.5 Houay Soup Landfill

During Q4 2020, approximately 42.9 m^3 of solid waste was collected from Thaheua, Hat Gniun and Phouhomxay villages and transported to Houay Soup Landfill for disposal. The basic landfill maintenance was carried out which included fixing the fence, cleaning up the open ditches and mowing grass.

As of December 2020, the remaining capacity of the Houay Soup Landfill is approximately 5,444 m^3. The landfill is expected to serve for 25 years considering the average monthly waste disposal of 17.6 m^3 based on waste disposal during the 1st year of operation. The estimate includes a 30% reduction in volume due to compaction and settlement, and a 30% increase from regular soil covers.

3.6 RESERVOIR OPERATIONS

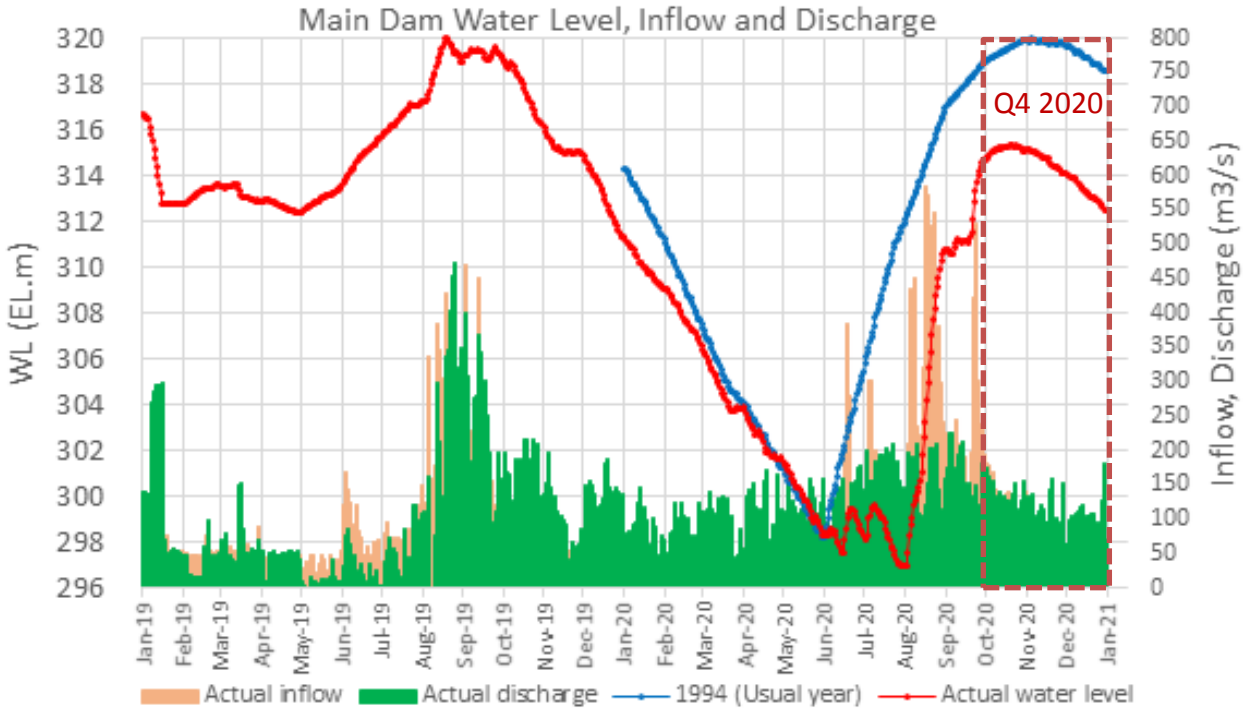
3.6.1 Main Reservoir

The water level in the main reservoir, inflow to the reservoir and discharge from the reservoir since 01 January 2019 are displayed in the graph in **Figure 3-4.**

During Q4 2020, the mean daily inflow to the main reservoir was 93 m^3/s. The minimum daily inflow was 43 m^3/s, maximum daily inflow was recorded at 180 m^3/s, and 25th percentile of 63 m^3/s and 75th percentile of 115 m^3/s.

During Q4 2020, the water level in the main reservoir decreased with 2.22 m from El. 314.75 m asl. to El. 312.53 m asl. The maximum water level was observed at 315.33 m asl. on 19 October 2020, and the lowest water level was observed at El. 312.53 m asl. on 30 and 31 December 2020.

FIGURE 3-4: ***IMPOUNDING PROGRESS OF THE MAIN RESERVOIR***



3.6.2 Environmental Flow Requirements (EFRs) for the Operation Phase

NNP1PC has monitored compliance with the Environmental Flow Requirements (EFRs) stipulated in the CA, Annex C, Clause 53 (g) and as further modified in the Environmental Flow Assessment Report of July 2014 approved by MONRE. The EFRs have been monitored in accordance with the monitoring programme outlined in the ESMMP-OP 2019 (Vol. II, Part 2 on Subplan 1 on Reservoir and River Health Management).

The results of the EFR compliance monitoring during Q4 2020 are summarized in **Table 3-8.**

TABLE 3-8: ***SUMMARY OF EFRS COMPLIANCE MONITORING IN Q3 2020***

No	EFRs in the Downstream of the Re-regulation dam	EFRs compliance
1	Min flow 27 m^3/s at all times, except a data of 24 m^3/s recorded on 14 November 2020 at 12:00	One case of observations non-comply
2	Thalweg water depth at least 0.5 m in the entire reach from immediately downstream of the Re-regulation dam until 4.3 km downstream the dam (measured at cross-sections where visual observations or boat navigation indicate shallow waters)	100% of measurements comply
3	Maximum rate of change (both rise and fall, separately) in stage of 0.6 m per hour	100% of hourly fluctuations comply
4	Maximum fluctuation in stage of 1.7 m over 24-hour (this requirement is about range and determines the maximum difference in stage height over 24-hour periods)	100% of 24-hour fluctuations comply
5	Maximum fluctuation in stage of 1.7 m over 7-days (this requirement is about range and determines the maximum difference in stage height over 7-day periods)	All 7-day fluctuations comply

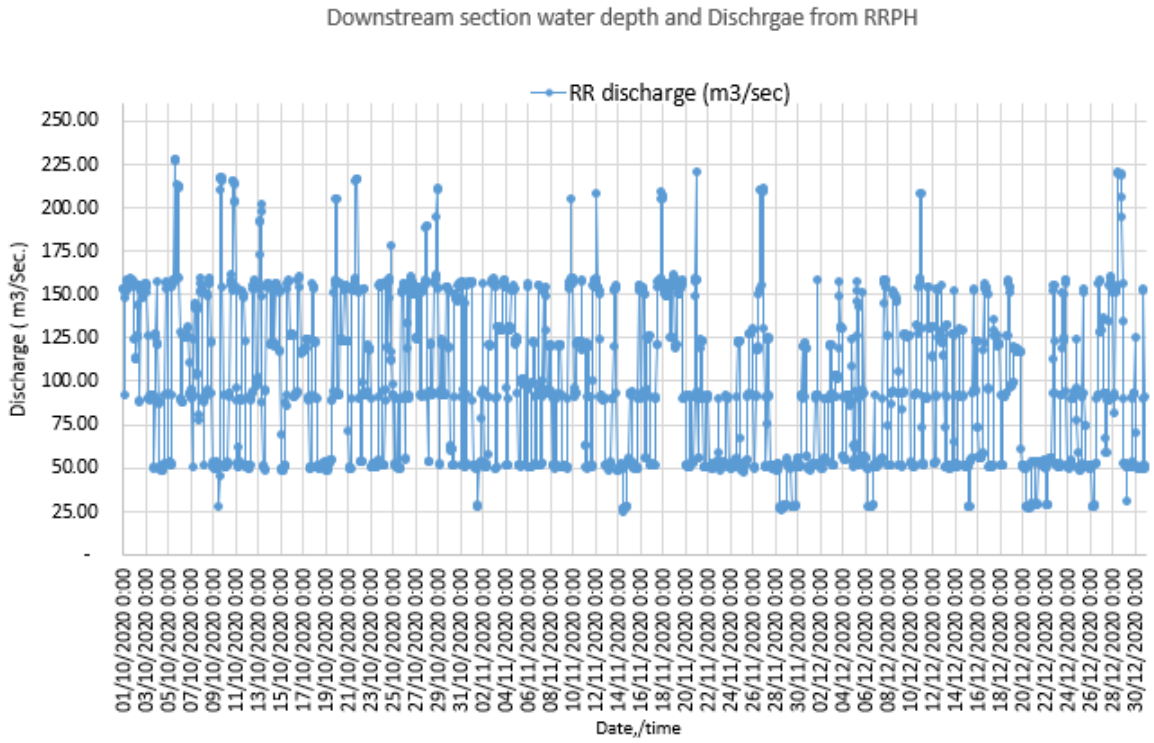
3.6.2.1 Minimum Flow Requirements

The discharge monitoring data for the re-regulation dam during Q4 2020 indicates that the minimum flow requirement of 27 m^3/s has been met at all times, except a data of 24 m^3/s recorded on 14 November 2020 at 12:00. It was the instant discharge data at 12:00 sharp just during the opening operation of the Re-regulation Gate and immediately increased to 27 m^3/s just after 12:00 by finishing the opening of the Re-regulation Gate- as presented in **Figure 3-5.**

During Q4 2020, the mean discharge from the re-regulation dam was about 113 m^3/s in October 2020 and about 92 m^3/s and 85 m^3/s in November and December 2020 respectively.

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. There was no complaint related to the flow discharges or fluctuation levels downstream the Re-regulation dam during the reporting period.

FIGURE 3-5: *DISCHARGE FROM THE RE-REGULATION DAM DURING Q4 2020*



3.6.2.2 Minimum Water Depth

Since 18 July 2018, NNP1PC has carried out weekly monitoring of river depths at 19 locations downstream the re-regulation dam as shown on ***Figure 3-6.*** These locations represent cross-sections with possible shallow water depths at low discharge rates.

The monitoring is undertaken to confirm compliance with the water depth requirements in the Concession Agreement, Annex C, and the approved Environmental Flow Assessment (at least 0.5 m measured immediately downstream the re-regulation dam).

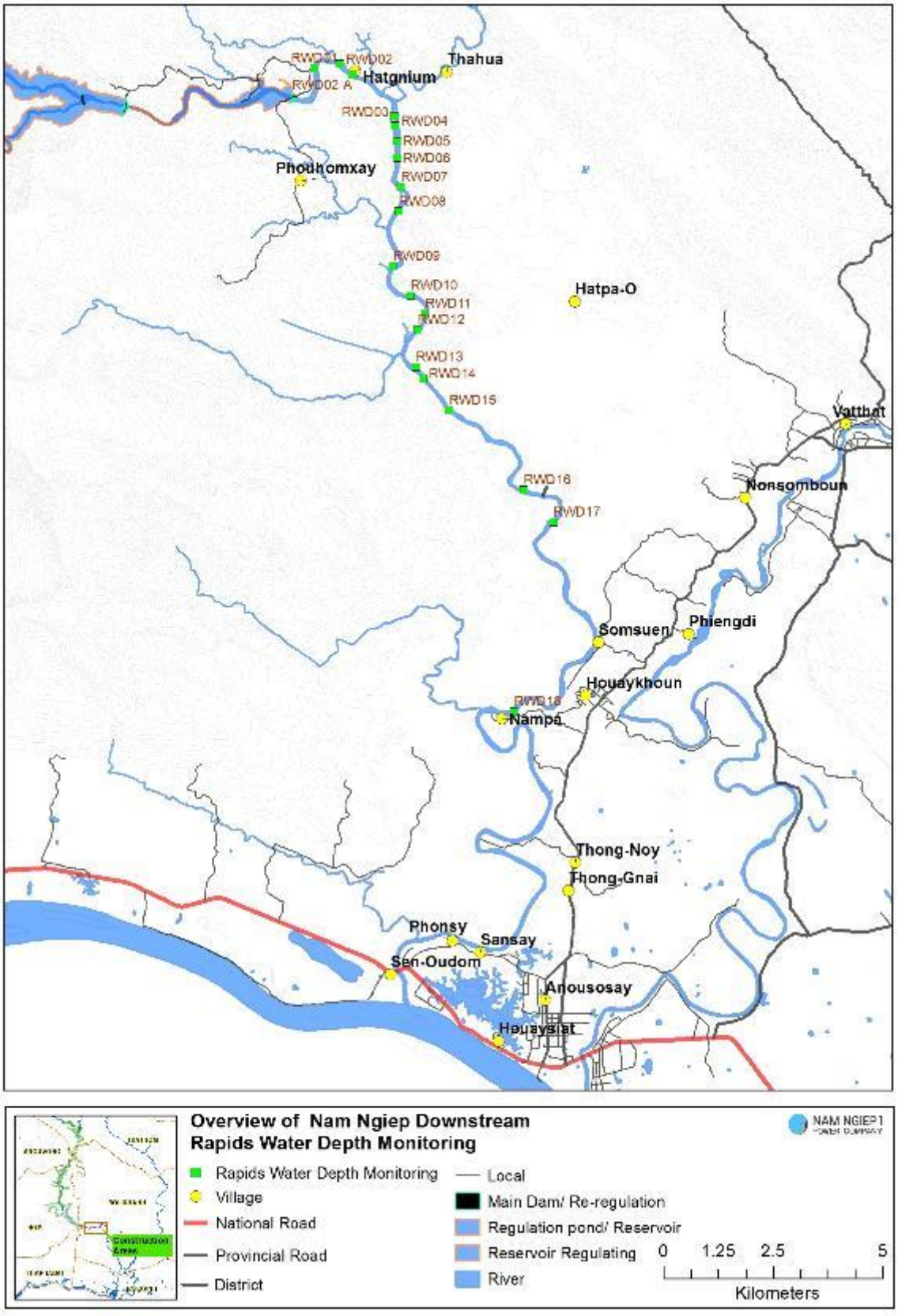
The results of the monitoring are presented in ***Table 3-9***. During Q4 2020, two measurements at RWD05 located 5.7 km from the re-regulation dam had a depth of less than 0.5 m.

Starting in December 2020, the water depths were measured across the river channel where visual observations or boat navigation indicate shallow waters to ensure that the measurements represent the river thalweg.

TABLE 3-9: *RIVER DEPTH MEASUREMENTS IN NAM NGIEP DOWNSTREAM THE RE-REGULATION DAM*

Station ID		RWD 01	RWD 02	RWD 02.a	RWD 03	RWD 04	RWD 05	RWD 06	RWD 07	RWD 08	RWD 09	RWD 10	RWD 11	RWD 12	RWD 13	RWD 14	RWD 15	RWD 16	RWD 17	RWD 18
Distance from Re-regulation Dam (km)		1.55	2.43	2.97	4.9	5.2	5.66	6.16	7.13	8.01	9.97	11.31	12.08	12.62	14.1	14.49	15.77	19.76	21.58	30.09
Date	Discharge (m3/s)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)
8-Oct-20	93.7	1.15	1.18	1.19	1.4	1.06	1.55	1.7	1.66	1.65	1.45	1.9	2.13	2.2	2.31	2.4	2.5	2.55	2.6	2.3
13-Oct-20	149.3	1.05	1.08	1.12	1.42	1.08	1.57	1.72	1.68	1.77	1.57	2.48	2.53	2.76	2.88	2.98	3.12	3.15	3.23	3.1
21-Oct-20	152	1.36	1.39	1.4	1.62	1.28	1.77	1.93	1.89	1.88	1.68	2.25	2.38	2.45	2.56	2.65	2.65	2.8	2.85	2.5
28-Oct-20	121.9	1.16	1.19	1.2	1.4	1.05	1.55	1.7	1.65	1.64	1.45	2	2.1	2.15	2.25	2.3	2.31	2.4	2.43	2.2
5-Nov-20	100.4	0.96	0.99	1	1.14	0.9	1.35	1.5	1.45	1.44	1.25	1.78	1.85	1.9	1.95	2.02	2.05	2.08	2.1	1.9
12-Nov-20	152.6	1.35	1.4	1.42	1.62	1.3	1.79	1.95	1.92	1.9	1.71	2.28	2.42	2.48	2.59	2.68	2.72	2.85	2.9	2.55
18-Nov-20	156.3	1.32	1.37	1.39	1.59	1.27	1.76	1.92	1.89	1.87	1.68	2.25	2.39	2.45	2.56	2.65	2.69	2.82	2.87	2.52
25-Nov-20	55	0.9	0.78	0.88	0.93	0.98	0.5	0.93	0.98	1.08	0.88	0.88	1.08	0.93	1.18	1.28	1.48	1.38	1.58	1.08
3-Dec-20	103.6	1.3	1.18	1.28	1.43	1.38	1	1.43	1.4	1.5	1.3	1.3	1.45	1.4	1.55	1.65	1.85	1.85	1.95	1.45
6-Dec-20	27	0.62	0.5	0.6	0.65	0.7	0.32	0.65	0.7	0.8	0.6	0.6	0.8	0.65	0.9	1	1.2	1.1	1.3	0.8
10-Dec-20	51.1	0.85	0.73	0.83	0.88	0.93	0.45	0.88	0.93	1.03	0.82	0.83	1.03	0.88	1.13	1.22	1.43	1.32	1.53	1.02
16-Dec-20	57.03	0.91	0.79	0.9	0.95	1	0.52	0.95	1	1.1	0.9	0.9	1.1	0.95	1.2	1.3	1.5	1.4	1.6	1.1
25-Dec-20	153	1.6	1.45	1.55	1.5	1.5	1.02	1.4	1.35	1.3	1.4	1.4	1.4	1.45	1.3	1.5	1.6	1.5	1.7	1.2

FIGURE 3-6: LOCATION MAP OF RIVER DEPTH MONITORING POINTS



3.6.2.3 Stage Height Fluctuations

The requirements on stage height fluctuations constitute a rise or a fall in water elevation and include two aspects:

1. A requirement on the rate of change which is set at 0.6 m per hour.
2. Requirements on the range in fluctuations over 24-hour periods and 7-day periods respectively, which is set at a maximum of 1.7 m for both periods. In other words, the range requirements determine the maximum difference in stage height over 24-hour periods and 7-day periods respectively.

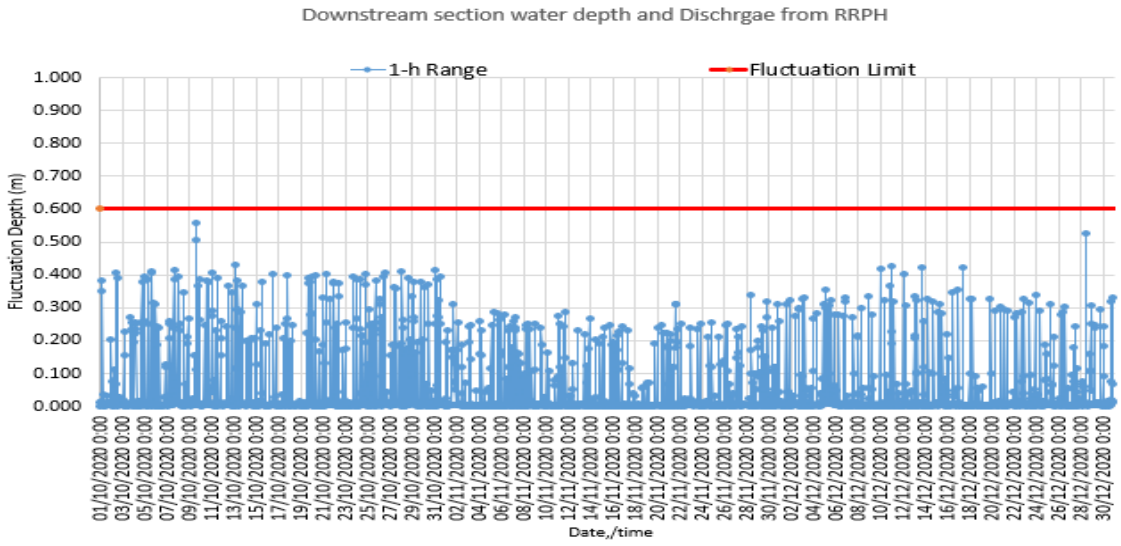
For the 0.6 m in 1-hour maximum fluctuation EFR, the cumulative rises and falls are calculated from the hourly water level recordings.

Compliance with the 24-hour maximum fluctuation EFR is determined by calculating the difference between the maximum and the minimum stage height over each 24-hour period. In the same way, the 7-day maximum fluctuation EFR, is determined by calculating the difference between the maximum and the minimum stage height over each 7-day period. There is no compulsion for the Company to meet the stage height fluctuation EFRs after a high flow event passes over the Re-regulation dam spillway.

In practice, meeting stage height fluctuation EFRs are managed through controlling the rate of change in discharge from the re-regulation dam/powerhouse. This is done using established rating relationships between stage height and discharge, as set out in the Re-regulation dam operation manual. These relationships are regularly checked and revised as necessary, as they would change whenever the channel morphology changes due to significant erosion or deposition.

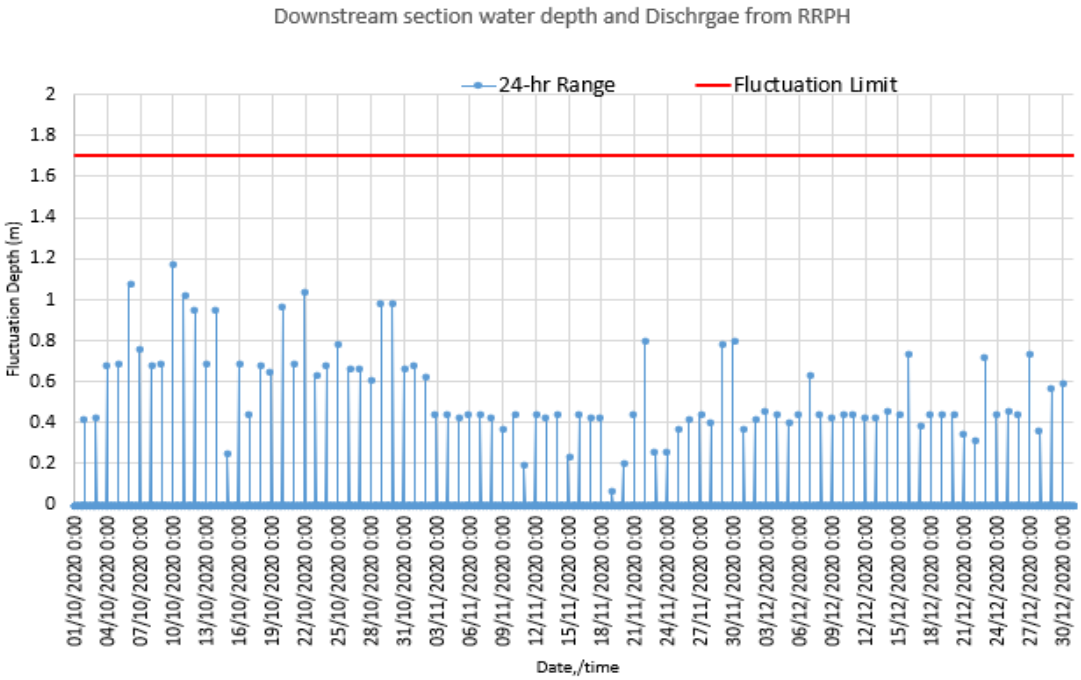
During Q4 2020, the maximum rate of change of 0.6 m over 1-hour was complied with for 100% of the hourly fluctuations. The results are presented in **FIGURE 3-7**.

FIGURE 3-7: HOURLY STAGE HEIGHT FLUCTUATIONS DURING Q4 2020



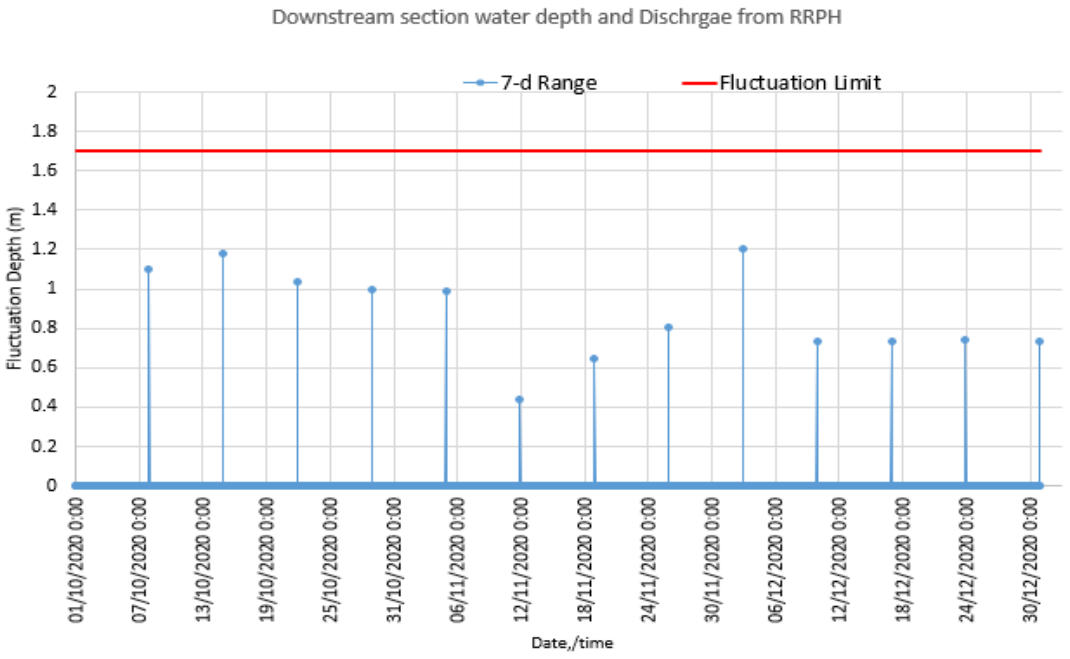
During Q4 2020, the maximum range in stage of 1.7 m over 24-hour was complied with for all 24-hour periods (00:00 – 23:00). The results of the monitoring are presented in **FIGURE 3-8.**

FIGURE 3-8: 24- HOUR STAGE HEIGHT DIFFERENCE (M) DURING Q4 2020



During Q4 2020, the maximum range in stage of 1.7 m over 7-days was complied with for all 7-day periods. The results are presented in **FIGURE 3-9**.

FIGURE 3-9: 7- DAY STAGE HEIGHT DIFFERENCE (M) DURING Q4 2020



3.7 ENVIRONMENTAL MONITORING

Since the second week of August 2020, shipment of water samples to UAE Laboratory in Thailand was resumed (following easement of COVID-19 restrictions). Therefore, all water quality monitoring parameters were monitored and sampled according to the Water Quality Monitoring Program during Q4 2020.

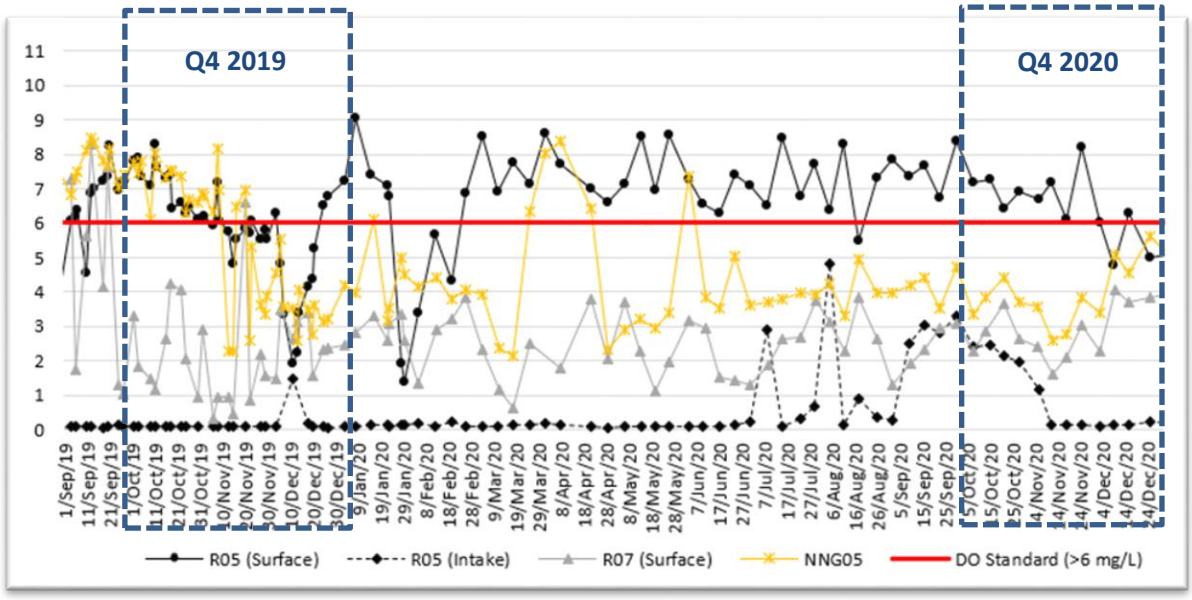
3.7.1 Surface Water (River) and Depth Profile Water Quality

Descriptions of each monitoring station, surface water quality monitoring parameters and the location of sampling map can be found in ***Appendix 3*** and all surface water quality data for Q4 2020 are listed in ***Appendix 5.1***

Dissolved Oxygen (DO)

The results of DO measurements for the stations immediately upstream and downstream of the main dam are presented in **Figure 3-10** and the full set of surface water quality data are shown in **Table 3-10.**

FIGURE 3-10: ***DISSOLVED OXYGEN IMMEDIATELY UPSTREAM AND DOWNSTREAM OF THE MAIN DA***



During Q4 2020, the DO concentrations at the depth 0.2 m in R05 (Main Reservoir immediately upstream of the main dam), was more than 6 mg/L in October and November 2020. The DO decreased to about 5.5 mg/L in December 2020 due to the upper water column was partially mixed with low-oxygen water at deeper levels by the effect of the ambient temperature decreasing during the cold-dry season. This phenomenon may have caused the reduction in DO concentrations in the upper water column as presented in **Figure 3-12** and **Figure 3-13.**

The DO concentrations in the reservoir at the level where the water intake is located (R05-Intake) from October 2020 to early of November 2020 decreased from about 2.5 mg/L to less than 0.5 mg/L. Thereafter, the DO concentrations were maintained less than 0.5 mg/L until the end of December 2020.

Figure 3-13 also indicates that compared with Q4 2019, the water quality at or near the intake level at R05 has improved. Water renewal over the wet season may have contributed to this.

The DO concentrations at R06 in the Re-regulation Reservoir varied between 2.1 mg/L and 4.3 mg/L over the depth of the water column with an average concentration of about 3 mg/L. A similar pattern was found at R07, although with slightly lower DO concentrations (average about 2.6 mg/L). The water quality in the Re-regulation Reservoir represented by R06 and R07 generally match well with the water quality in R05 at or near the intake level, although the DO concentrations in R06 and R07 occasionally were slightly higher than the corresponding DO concentrations at or near the intake level in R05. However, it should be noted that the actual flow patterns and movements of water from R05 to the intake is not known and is likely rather complex with circulation patterns or other complex water movements near the intake, which adds uncertainties to direct correlation of water quality data at or near the intake depth at R05 in the main reservoir with water quality data in the Re-regulation Reservoir.

The DO concentration in the surface level increased during December 2020 could be contributed by decreasing of the ambient temperature (the solubility of oxygen increases as water temperature decreases).

During Q4 2020, the discharge from the re-regulation dam mainly went through the turbine and was occasionally combined with discharge through the gate or for short periods only through the gate. The DO levels in Nam Ngiep downstream the re-regulation dam was generally between 3 mg/L and 5 mg/L at the stations within 5.2 km from the dam (NNG05 and NNG06) gradually increasing to between 5 mg/L and just above 6 mg/L over the next 25 km (NNG07). No dead fish was observed in Nam Ngiep downstream during Q4 2020.

NNP1PC is in the process of compilating all monitoring information for the design of additional aeration system to improve the DO level at downstream.

The Nam Ngiep Upstream station (NNG01), Nam Chian (NCH01), Nam Phouan (NPH01) and Main Reservoir (R01, R02, R03 and R04) had DO levels above 6 mg/L.

The water temperature and DO depth profiles in the main reservoir at R05 during Q4 2020, Q3 2020 and Q4 2019 are presented in ***Figure 3-11*** to ***Figure 3-13.***

The depth profiles monitoring during the period indicates formation of oxyclines in the main reservoir at all stations at varying depths, except at R01, which due to its location at the narrow upper end of the reservoir behaves like a river.

There is no indication of a thermocline at R06 and R07 in the re-regulation reservoir, because the re-regulation reservoir behaves more like a river than a lake.

During Q4 2020, the oxycline in R05 deepened from depths about 6-10 m in October 2020 to about 34 m at the end of December 2020. The data also indicates an increased mixing in the water column as the oxycline moved downwards resulting in DO concentrations between 4 mg/L and 5 mg/L in the epilimnion. Anoxic conditions were found at depths between 28 m and 45 m.

Figure 3-13 presents the monthly average depth profiles in the Main Reservoir from September 2018 to December 2020, the graphs clearly show seasonal variations in water temperatures and a deepening of the thermocline during periods with cooler water leading to a corresponding deepening of the oxycline.

When comparing Q4 2020 with Q4 2019, the second half of Q4 2020 shows a significant deepening of the thermocline and a corresponding deepening of the oxycline compared to

the same period in Q4 2019. The mean DO concentration in the upper 6 m was about 6 mg/L similar to Q4 2019 and lower than in Q3 2020. Q4 2020, globally shows that DO in the entire water column insignificantly improved over the year.

FIGURE 3-11: ***MAIN RESERVOIR DISSOLVED OXYGEN AT THE END OF Q4 2020***

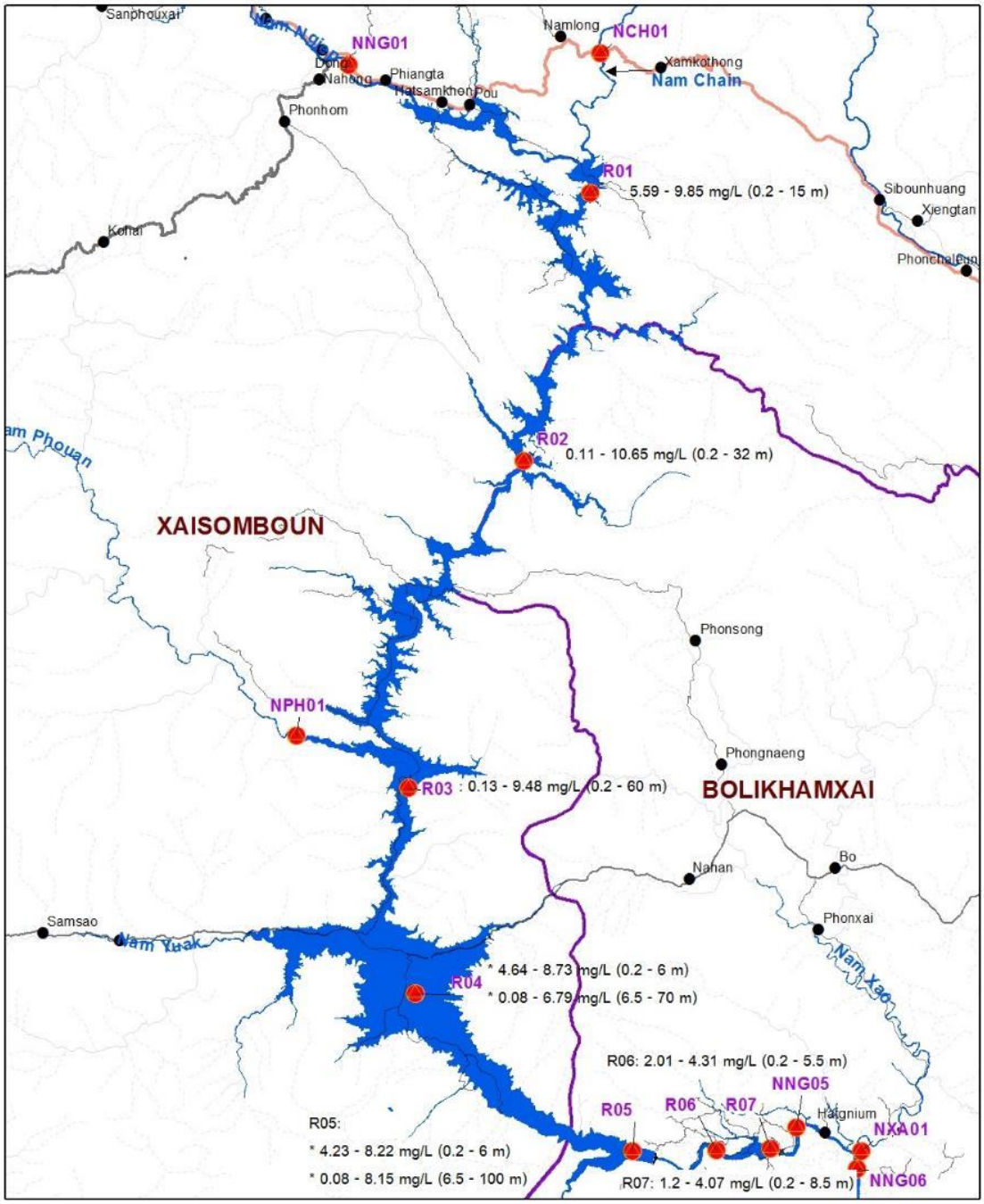
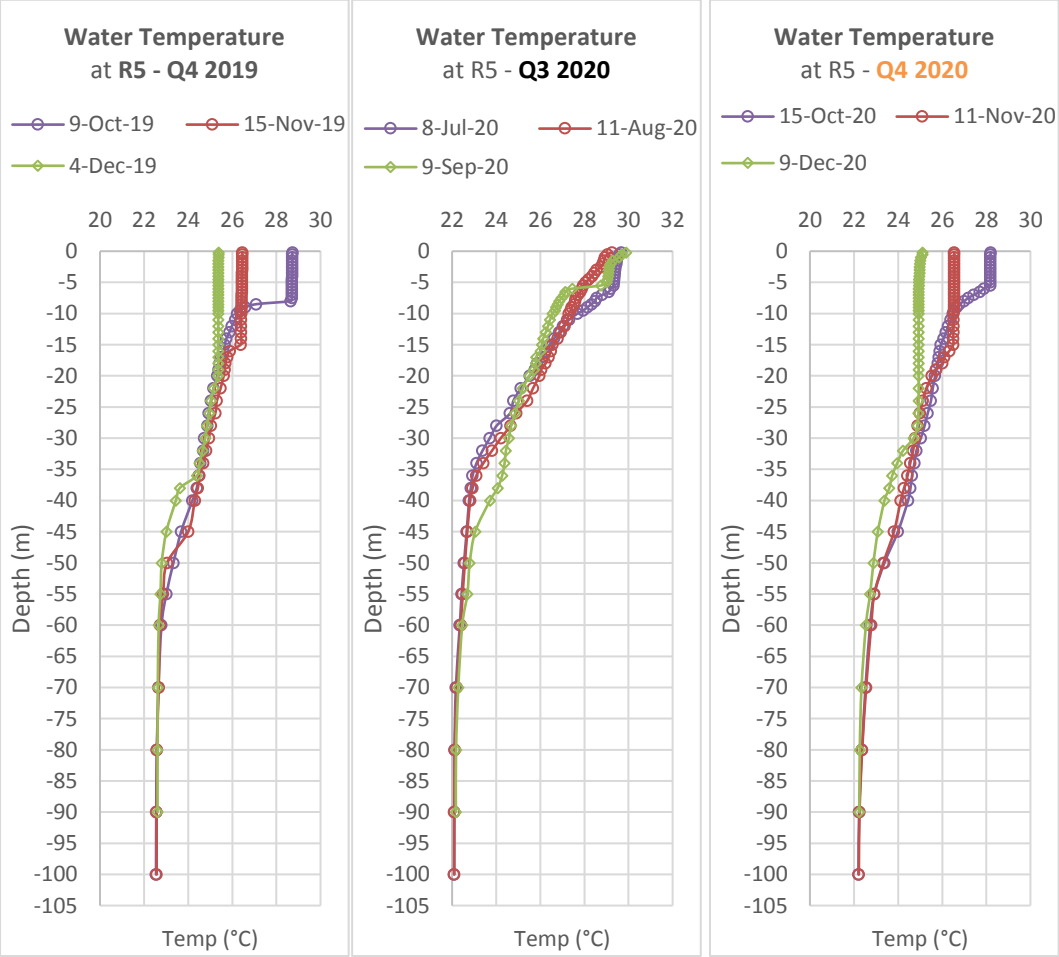
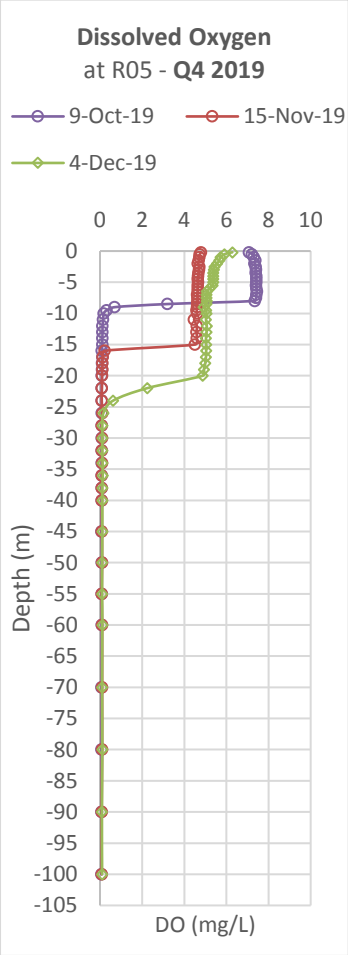
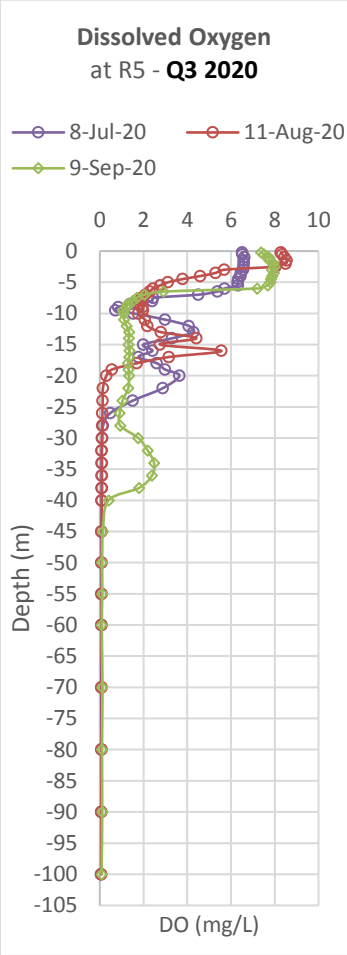


FIGURE 3-12: ***WATER TEMPERATURE AND DISSOLVED OXYGEN – DEPTH PROFILES IN THE MAIN RESERVOIR IMMEDIATELY UPSTREAM OF THE MAIN DAM (R05)***




Dissolved Oxygen
at R05 - Q4 2019
9-Oct-19
15-Nov-19
4-Dec-19
0 2 4 6 8 10
0 -5 -10 -15 -20 -25 -30 -35 -40 -45 -50 -55 -60 -65 -70 -75 -80 -85 -90 -95 -100 -105
Depth (m)
DO (mg/L)


Dissolved Oxygen
at R5 - Q3 2020
8-Jul-20
11-Aug-20
9-Sep-20
0 2 4 6 8 10
0 -5 -10 -15 -20 -25 -30 -35 -40 -45 -50 -55 -60 -65 -70 -75 -80 -85 -90 -95 -100 -105
Depth (m)
DO (mg/L)

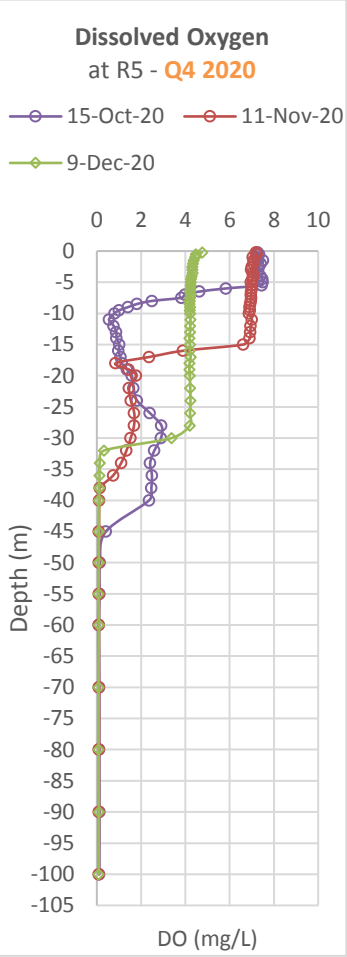

Dissolved Oxygen
at R5 - Q4 2020
15-Oct-20
11-Nov-20
9-Dec-20
0 2 4 6 8 10
0 -5 -10 -15 -20 -25 -30 -35 -40 -45 -50 -55 -60 -65 -70 -75 -80 -85 -90 -95 -100 -105
Depth (m)
DO (mg/L)

FIGURE 3-13: ***MONTHLY AVERAGE OF WATER TEMPERATURE AND DO DEPTH PROFILES IN THE MAIN RESERVOIR (R01 - R05), WITH POSITION OF INTAKE AT THE ACTUAL WATER LEVEL DURING SEPTEMBER 2018 - DECEMBER 2020***

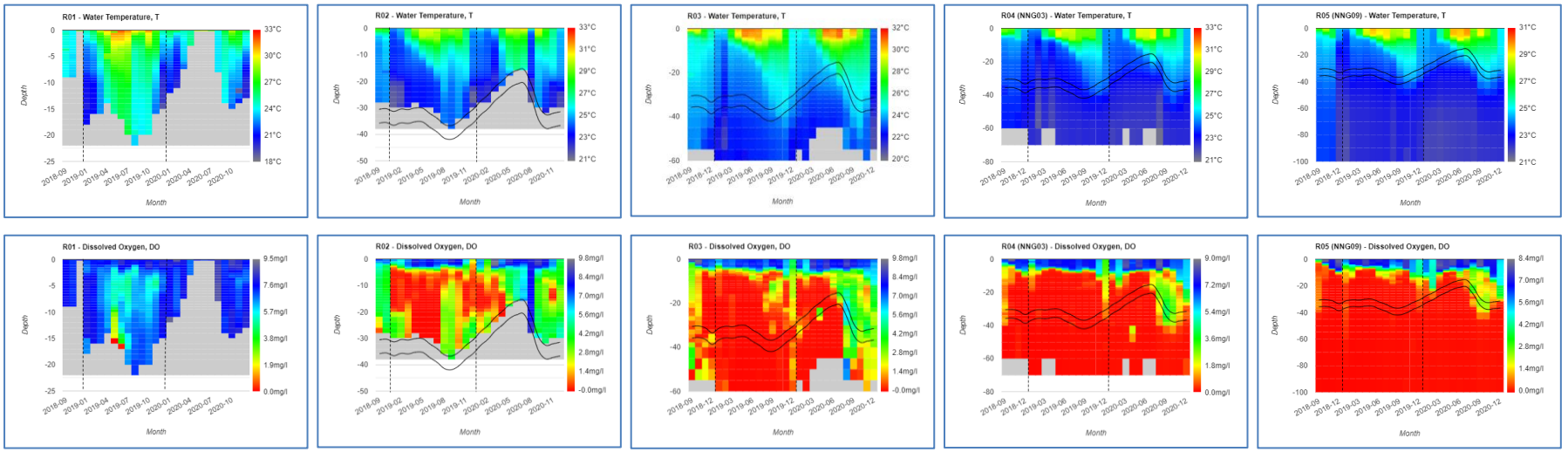


TABLE 3-10: ***DO (MG/L) RESULTS OF SURFACE WATER IN MAIN RESERVOIR, RE-REGULATION RESERVOIR, NAM NGIEP AND ITS MAIN TRIBUTARIES MONITORED IN Q4 2020***

(NATIONAL SURFACE WATER QUALITY STANDARD FOR DISSOLVED OXYGEN: ≥6 MG/L)

Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
7-Oct-20		9.54	10.06	9.45	8.66									10.12		
8-Oct-20						7.18	3.42	2.27	3.34	4.97	5.6	5.78			6.63	6.53
12-Oct-20	9.07												7.93			
13-Oct-20							2.16	2.85	3.83	4.43	5.52	6.34			6.65	6.63
15-Oct-20						7.26										
16-Oct-20		8.02	7.83	7.08	6.56									8.34		
20-Oct-20		9.35	7.95	6.91	5.73											
21-Oct-20						6.44	3.22	3.66	4.41	4.6	5.37	6.29			7.01	7.31
27-Oct-20		7.71	5.92	6.5	5.56											
28-Oct-20						6.93	3.61	2.62	3.69	4.16	6.66	6.59			7.51	7.54
29-Oct-20	7.77												8.38			
5-Nov-20							2.78	2.42	3.58	3.84	5.71	5.7			6.48	6.54
6-Nov-20		8.7	7.37	8.01	7.12	6.71										
10-Nov-20		8.49	6.26	7.23										9.3		
11-Nov-20	8.3				5.9	7.19							7.96			
12-Nov-20							3.07	1.62	2.61	2.94	4.96	5.6			7.23	6.8
17-Nov-20		7.26	6.02	6.26	6.14											
18-Nov-20						6.1	2.37	2.1	2.75	3.17	4.51	5.69			6.54	6.59
23-Nov-20	8.97												8.29			
24-Nov-20		8.22	7.83	7.97	7.52											
25-Nov-20						8.22	2.91	3.04	3.82	4.85	6.34	6.89			7.46	7.76
2-Dec-20		6.87	5.11	7.15	6.9											

Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
3-Dec-20						6.02	2.42	2.29	3.38	4.01	6.11	6.57			7.25	7.33
7-Dec-20	8.96												8.52			
8-Dec-20		7.11	4.64	5.06										9.34		
9-Dec-20					4.78	4.76										
10-Dec-20							3.91	4.07	5.08	5.19	6.52	6.73			8.3	7.98
15-Dec-20		9.01	4.96	7.25	6.28											
16-Dec-20						6.27	4.31	3.7	4.55	4.91	6.41	7.48			8.19	8.71
24-Dec-20	9.29	6.54	4.17	9.1	5.18								9.26			
25-Dec-20						4.98	3.93	3.82	5.63	5.77	6.47	6.8			6.26	6.7

Ammonia Nitrogen

Since 2014, the Ammonia Nitrogen concentration in the Upper Nam Ngiep River and its tributaries have been below the detection limit (<0.2 mg/L). In Q4 2020, Ammonia Nitrogen complied with the National Surface Water Quality Standard (<0.2 mg/L) in all monitored stations.

TABLE 3-11: ***AMMONIA NITROGEN (MG/L) RESULTS FOR THE SURFACE WATER IN NAM NGIEP AND ITS MAIN TRIBUTARIES MONITORED IN Q4 2020***

(NATIONAL SURFACE WATER QUALITY STANDARD FOR AMMONIA NITROGEN: <0.2 MG/L)

Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA 01	NH S01
12-Oct-20	<0.2												<0.2			
15-Oct-20						<0.2								<0.2		
15-Oct-20 Hypolimnion						0.53										
16-Oct-20		<0.2		<0.2	<0.2									<0.2		
16-Oct-20 Hypolimnion				<0.2	0.99											
10-Nov-20		<0.2		<0.2										<0.2		
10-Nov-20 Hypolimnion				<0.2												
11-Nov-20	<0.2				<0.2	<0.2							<0.2			
11-Nov-20 Hypolimnion					0.83	0.58										
7-Dec-20	<0.2												<0.2			
8-Dec-20		<0.2		<0.2										<0.2		
8-Dec-20 Hypolimnion				<0.2												
9-Dec-20					<0.2	<0.2										
9-Dec-20 Hypolimnion					<0.2	<0.2										

Biochemical Oxygen Demand (BOD_5)

Since 2014, the Biochemical Oxygen Demand (BOD_5) values in the Nam Ngiep River and its tributaries have generally been below the detection limit (< 1 mg/L) with some measurements exceed the National Surface Water Quality Standard (< 1.5 mg/L). The results for Q4 2020 indicate some exceedances and noteworthy are the elevated BOD levels in the hypolimnion in the main reservoir representing water that is transferred downstream. NNP1PC is in the process of compilating all monitoring information for the design of additional aeration system to improve the BOD level at downstream.

TABLE 3-12: *BOD_5 (MG/L) RESULTS FOR THE SURFACE WATER IN NAM NGIEP AND ITS MAIN TRIBUTARIES MONITORED IN Q4 2020*

(NATIONAL SURFACE WATER QUALITY STANDARD FOR BOD_5: <1.5 MG/L)

Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG0 5	NNG 06	NNG 07	NNG0 8	NCH 01	NPH 01	NXA 01	NHS 01
12-Oct-20	<1												<1			
13-Oct-20							<1	<1	<1	<1	<1	<1			<1	<1
15-Oct-20						<1										
15-Oct-20 Hypolimnion						12.4										
16-Oct-20		1.04		<1	1.12									<1		
16-Oct-20 Hypolimnion				11.68	11.6 2											
10-Nov-20		1.71		2.8										1.16		
10-Nov-20 Hypolimnion				3.6												
11-Nov-20	<1				1.8	2.1							<1			
11-Nov-20 Hypolimnion					13.9	13.72										
12-Nov-20							2.06	2.08	2.14	1.4	<1	<1			<1	<1
7-Dec-20	1.14												1.12			
8-Dec-20		<1		<1										<1		
8-Dec-20 Hypolimnion				<1												
9-Dec-20					<1	<1										
9-Dec-20 Hypolimnion					7.41	6.09										
10-Dec-20							1.74	1.18	<1	<1	<1	<1			<1	<1

Chemical Oxygen Demand (COD)

The COD measurements in Q4 2020 are presented in **Table 3-13.**

TABLE 3-13: *COD (MG/L) RESULTS FOR THE SURFACE WATER IN NAM NGIEP AND ITS MAIN TRIBUTARIES IN Q4 2020*

(NATIONAL SURFACE WATER QUALITY STANDARD FOR COD: < 5 MG/L)

Station Code	NNG01	R01	R02	R0 3	R0 4	R0 5	R06	R07	NNG0 5	NNG0 6	NNG0 7	NNG0 8	NCH 01	NPH0 1	NXA 01	NHS0 1
12-Oct-20	<5												6.6			
13-Oct-20							<5.0	<5.0	5.2	6	5.6	6.2			11.2	8.2
15-Oct-20														5.6		
10-Nov-20														10.8		
11-Nov-20	6.6												12.9			
12-Nov-20							8.2	12.9	8	8.2	8.8	6.8			6.8	8.4
7-Dec-20	7.7												8.4			
8-Dec-20														9.2		
10-Dec-20							8	<5	8.6	6.8	7.6	11			8.4	7.8

Faecal Coliform Bacteria (FCB)

The results of the faecal coliform analyses in Q4 2020 are presented in **Table 3-14.**

Faecal coliform complied with the standard in all monitored stations during the Quarter 4 2020.

TABLE 3-14: ***FAECAL COLIFORMS (MPN/100 ML) RESULTS IN NAM NGIEP AND ITS MAIN TRIBUTARIES IN Q4 2020 (NATIONAL SURFACE WATER QUALITY STANDARD FOR TOTAL COLIFORMS: <1,000 MPN/100 ML)***

Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
12-Oct-20	220												34			
13-Oct-20							0	0	5	11	33	17			220	220
15-Oct-20						0										
15-Oct-20 Hypolimnion						0										
16-Oct-20		5		920	220									220		
16-Oct-20 Hypolimnion				350	47											
10-Nov-20		13		4.5										540		
10-Nov-20 Hypolimnion				0												
11-Nov-20	140				26	0							94			
11-Nov-20 Hypolimnion					0	0										
12-Nov-20							4	33	46	110	220	920			920	540
7-Dec-20	33												17			
8-Dec-20		23		0										7.8		
9-Dec-20					0	0										
10-Dec-20							0	0	2	34	33	79			49	170

Total Coliform Bacteria (TCB)

The results of measurements for total coliform bacteria are presented in **Table 3-15.** The results indicate a similar pattern and same tendency as for faecal coliform bacteria. There were no exceedances of the National Surface Water Quality Standard (<5,000 MPN/100 ml) for total coliform bacteria.

TABLE 3-15: ***TOTAL COLIFORMS (MPN/100 ML) RESULTS IN NAM NGIEP AND ITS MAIN TRIBUTARIES IN Q4 2020***

(NATIONAL SURFACE WATER QUALITY STANDARD FOR TOTAL COLIFORMS: <5,000 MPN/100 ML)

Station Code	NNG 01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NN G07	NNG 08	NC H01	NPH 01	NX A01	NHS 01
12-Oct-20	920												350			
13-Oct-20							2	5	17	26	79	26			280	220
15-Oct-20						2										
15-Oct-20 Hypolimnion						0										
16-Oct-20		220		920	220									350		
16-Oct-20 Hypolimnion				1600	540											
10-Nov-20	11	13		5										240		
10-Nov-20 Hypolimnion				0												
11-Nov-20					0	0							33			
11-Nov-20 Hypolimnion					0	0										
12-Nov-20							0	2	5	26	22	21			33	33
7-Dec-20	1,600												110			
8-Dec-20		110		0										79		
9-Dec-20					0	49										
10-Dec-20							110	33	33	170	170	540			540	540

3.7.2 Compliance Monitoring of Effluents from Camps

A total of 03 sites discharged effluents in Q4 2020, including 02 camps (OSOV1 and OSOV2) and at the Wastewater Treatment System of the Main Powerhouse**.** The effluent monitoring location sites can be found in **Figure 3-14.** The effluent camp EF14 was connected with EF13 and treated as EF13.The results are described in ***Table 3-16*** and the full data set is in ***Appendix 5.2***.

The status of compliance as of 31 December 2020 can be summarized as follows:

- Non-compliance with TSS, ammonia-nitrogen, total nitrogen and total phosphorus for Wastewater Treatment Systems in Main Powerhouse (EF19) and OSOV2 Camp (EF13);
- The OSOV1 (EF01) and OSOV2 (EF13) have experienced minor of non-compliance with faecal coliform and total coliform.

FIGURE 3-14: LOCATION OF EFFLUENT MONITORING POINTS

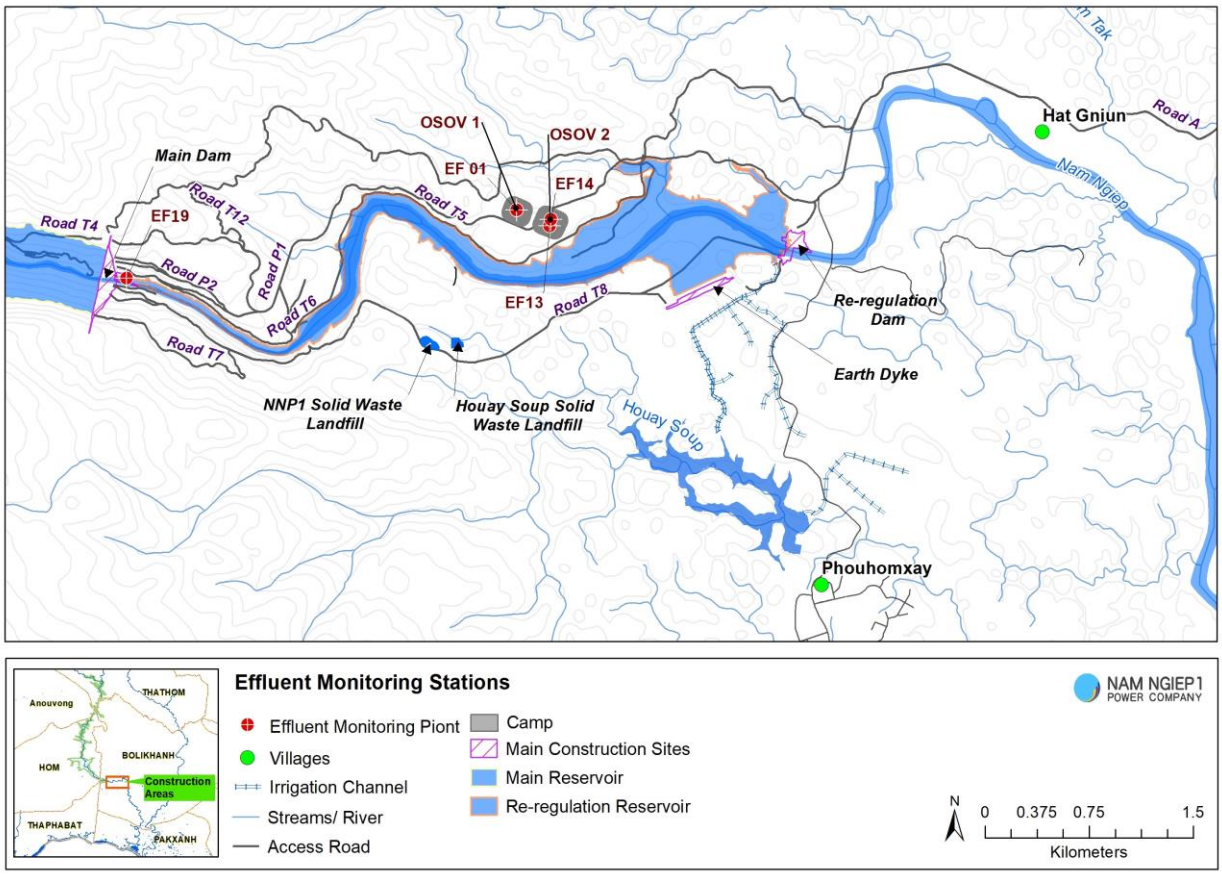


TABLE 3-16: *RESULTS OF THE EFFLUENT WATER QUALITY MONITORING OF THE CAMPS IN Q4 2020 (NON-COMPLIANCE PARAMETERS ONLY)*

		Site Name	OSOV1	OSOV 2	Main Powerhouse
		Station Code	EF01	EF13	EF19
Date	Parameter (Unit)	Guideline in the CA			
06-Oct-20	TSS (mg/L)	<50	<5	7.11	43.18
19-Oct-20	TSS (mg/L)	<50	<5	10.45	53.62
03-Nov-20	TSS (mg/L)	<50	<5	67.13	18.97
16-Nov-20	TSS (mg/L)	<50	<5	45.81	61.17
02-Dec-20	TSS (mg/L)	<50	<5	9.34	23.96
14-Dec-20	TSS (mg/L)	<50	<5	9.09	87.09
06-Oct-20	NH_3-N (mg/L)	<10.0	4.5	5.1	24.1
19-Oct-20	NH_3-N (mg/L)	<10.0	2.3	11.3	21.5
03-Nov-20	NH_3-N (mg/L)	<10.0	2.2	16.3	18.9
16-Nov-20	NH_3-N (mg/L)	<10.0	<2	9.8	21.5
02-Dec-20	NH_3-N (mg/L)	<10.0	<2	2.3	27.9
14-Dec-20	NH_3-N (mg/L)	<10.0	2.8	18	30.7
06-Oct-20	Total Nitrogen (mg/L)	<10.0	7.39	6.2	53.6
19-Oct-20	Total Nitrogen (mg/L)	<10.0	5.41	12.8	22
03-Nov-20	Total Nitrogen (mg/L)	<10.0	6.2	24	29.5
16-Nov-20	Total Nitrogen (mg/L)	<10.0	1.02	10.5	27.1
02-Dec-20	Total Nitrogen (mg/L)	<10.0	2.39	5.41	29.3
14-Dec-20	Total Nitrogen (mg/L)	<10.0	7.33	23	34.7
06-Oct-20	Total Phosphorus (mg/L)	<2	0.91	0.54	5.64
19-Oct-20	Total Phosphorus (mg/L)	<2	1.01	1.21	6.59
03-Nov-20	Total Phosphorus (mg/L)	<2	<1	1.24	3.31
16-Nov-20	Total Phosphorus (mg/L)	<2	1.15	1.24	2.8
02-Dec-20	Total Phosphorus (mg/L)	<2	1.29	1.33	7.94
14-Dec-20	Total Phosphorus (mg/L)	<2	1.36	1.47	6.72
06-Oct-20	Faecal Coliform (MPN/100 mL)	<400	27	0	0
19-Oct-20	Faecal Coliform (MPN/100 mL)	<400	14	0	0
03-Nov-20	Faecal Coliform (MPN/100 mL)	<400	0	920	0
16-Nov-20	Faecal Coliform (MPN/100 mL)	<400	6.8	0	0
02-Dec-20	Faecal Coliform (MPN/100 mL)	<400	22	0	0
14-Dec-20	Faecal Coliform (MPN/100 mL)	<400	17	0	0
06-Oct-20	Total coliform (MPN/100 mL)	<400	540	0	0
19-Oct-20	Total coliform (MPN/100 mL)	<400	240	0	0
03-Nov-20	Total coliform (MPN/100 mL)	<400	240	920	0
16-Nov-20	Total coliform (MPN/100 mL)	<400	47	0	0
02-Dec-20	Total coliform (MPN/100 mL)	<400	220	0	0
14-Dec-20	Total coliform (MPN/100 mL)	<400	49	0	0

TABLE 3-17: *COMPLIANCE STATUS OF EFFLUENT DISCHARGE FROM THE CAMPS IN Q4-2020*

Site	ID	WWTS	Key Non-Compliance Issues in Q4-2020	Corrective Actions
OSOV 1 (Owner's Site Office and Village)	EF01	Septic tanks (kitchen and black water) and wetland (grey water), discharge: 70 m^3/day	- Total coliform (<400 MPN/100 mL): Non-compliance in 1 out of 6 samplings. Q4 mean 223 MPN/100 mL.	WWTSs Improvement was under bidding process.
OSOV 2 (ESD Camp)	EF13	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	- TSS (<50 mg/L): Non-compliance in 1 out of 6 samplings. Q4 mean 24.8 mg/L. - Ammonia-nitrogen (<10 mg/L): Non-compliance in 3 out of 6 samplings. Q4 mean 10.5 mg/L. - Total nitrogen (<10 mg/L): Non-compliance in 4 out of 6 samplings. Q4 mean 13.6 mg/L. - Total coliform (<400 MPN/100 mL): Non-compliance in 1 out of 6 samplings. Q4 mean 153 MPN/100 mL. - Faecal coliform (<400 MPN/100 mL): Non-compliance in 1 out of 6 samplings. Q4 mean 153 MPN/100 mL.	As above.
Main Powerhouse	EF19	Septic tanks (grey and black water), biofilm tank and chlorination tank.	- TSS (<50 mg/L): Non-compliance in 3 out of 6 samplings. Q4 mean 48 mg/L. - Ammonia-nitrogen (<10 mg/L): Non-compliance all 6 samplings. Q4 mean 24.1 mg/L. - Total Nitrogen (<10 mg/L): Non-compliance in all 6 samplings. Q4 mean 32.7 mg/L. - Total Phosphorus (<2 mg/L): Non-compliance in all 6 samplings. Q4 mean 5.5 mg/L.	As above

3.7.3 Groundwater Quality Monitoring

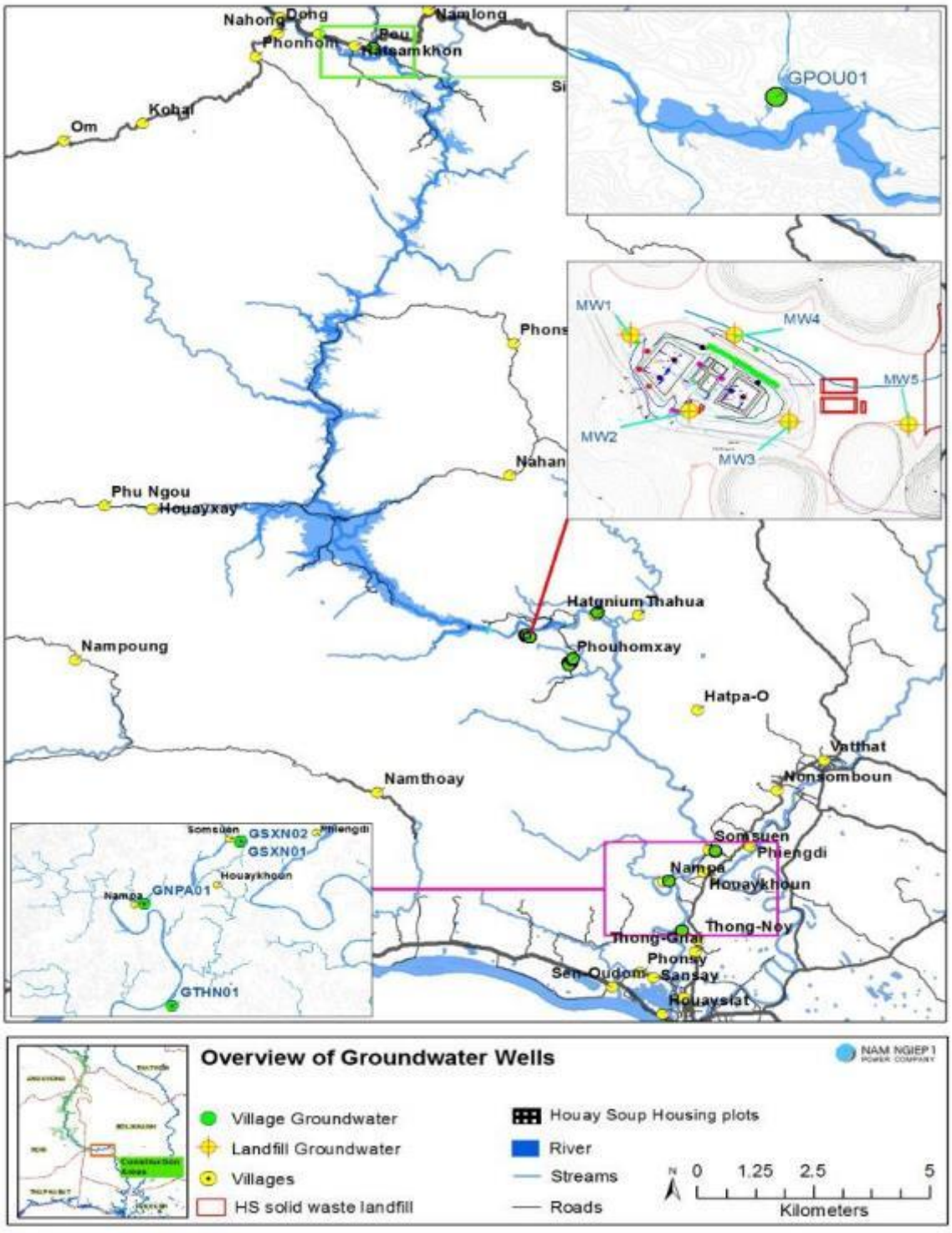
During Q4 2020, a total of six boreholes at Somseun, Nam Pa, Thong Noy, Pou Villages (one borehole in each village) and Phouhomxay Village (two new boreholes – commencing in June 2020) have been monitored for the following parameters:

a. *Monthly:* pH, DO (%), DO (mg/L), Conductivity (µs/cm), Temperature (°C), Turbidity (NTU), Faecal Coliform (MPN/100 mL) and E. coli (MPN/100 mL);

b. *Annually*: Arsenic (mg/L), Total Iron (mg/L), Magnesium (mg/L), Fluoride (mg/L), Total Hardness (mg/L), Nitrate (mg/L), Nitrite (mg/L) and Lead (mg/L).

The groundwater sampling locations are displayed in ***Figure 3-15*** and the groundwater monitoring data is presented in ***Appendix 5.3.***

FIGURE 3-15*: GROUNDWATER SAMPLING LOCATIONS*



Key findings from the groundwater quality monitoring are summarized as the follows:

Thong Noy Village: all monitored parameters complied with the standard, except faecal coliform and E.coli bacteria in all Q4 2020 samples.

Somsuen and Nam Pa Villages: all monitored parameters complied with the standard, except faecal coliform and E.coli bacteria in October and November 2020 samples.

Pou Village: all monitored parameters complied with the standard in all Q4 2020 samples.

Phouhomxay Village: all monitored parameters complied with the standard in all Q4 2020 samples.

The villagers were advised to boil water before drinking. This advice is in accordance with the Law on Hygiene, Disease Prevention and Health Promotion No 01/NA of 10 April 2001, which states that domestic water supply for daily use is not required to be readily drinkable but would normally have to be boiled or otherwise treated before it would be suitable for drinking.

On 25 September 2020, NNP1PC EMO and INFRA teams jointly inspected the water supply systems in Som Seun, Nam Pa and Thong Noy villages to investigate the root cause of Faecal coliform and *E. coli* bacteria contamination in the ground water supply systems. The inspection team also consulted with the Village Water Use Committee (VWUC) and interviewed some water consumers in those three villages for information and feedback. On 28 September 2020, NNP1PC EMO team took water samples at the existing water tap, the nearest opened wells and the furthest water tap to investigate the issue of bacterial contamination. The conclusion and recommendations of this investigation were shared with the NNP1PC SMO team in October 2020 for further actions and communicate to the VWUC:

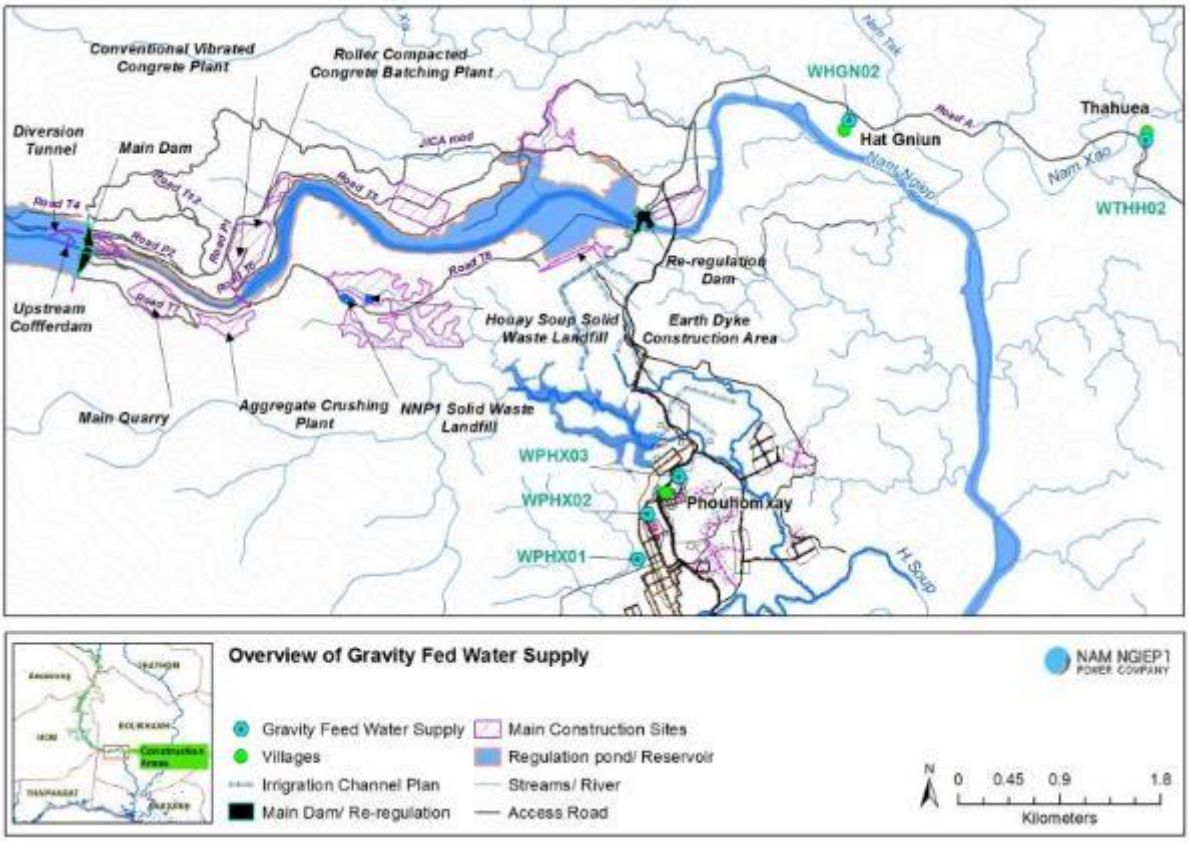
- **Potential contamination sources** - during the inspection, newly constructed house with seepage toilet was observed about 5 m away from the water well in Thong Noy and another house and seepage toilet were about 20m from the well in Nam Pa Village. The VWUC was requested to inspect and discuss with the house-owners to ensure that their sanitary facilities are well managed and will not cause bacterial contamination to the groundwater. In addition, the grazing and gathering of livestock close to the water wells in Nam Pa and Thong Noy villages should be considered as the factor that associates to the presence of bacteria in the supplied water. Excluding of livestock from the water supply areas is a good practice for the village water supply management.
- **Water quality results -** in Som Seun and Nam Pa villages, the results showed no bacterial contamination in the supplied water just after the storage tanks were cleaned/washed but the contamination was observed in the following months after cleaning. Therefore, increasing the water tanks clean up frequency from a quarter to a monthly routine is believed a better practice to get rid of bacterial contamination and ensure overall cleanliness of the supplied water. The portable filters used by some households in Nam Pa do not completely remove bacteria and, therefore, it is important to instruct those who use filtrated water to boil water before drinking.
- **Operational care**
    - Minimize bacterial contamination by human physical activities during the cleaning of the water wells, submersible pumps, water storage tanks.
    - If the broken pipeline occurs, fix the properly and as soon as possible to avoid any bacterial pick-up along the water distribution network.
    - Flushing the water wells when it is considerably required (i.e., every year) for a complete recharging of new ground water into the wells.
    - Fencing the water taking zones from the tap to prevent the bacterial contamination by the cattle's' faeces.

3.7.4 Gravity Fed Water Supply (GFWS) Monitoring

The monitoring of the GFWS aims to assess the quality of water that is being used for bathing and washing by villagers at Hat Gniun, Thahuea and Phouhomxay villages. The gravity fed water supply system at Phouhomxay Village has been in use since December 2017. Commencing in October 2020,

two new boreholes in Phouhomxay Village were put in use as a source of water supply instead of the previous gravity fed water supply system.

FIGURE 3-16: *OVERVIEW OF GRAVITY FED WATER SUPPLY*



Water samples were taken from the taps for analysis during the reported period and selected results are shown in ***Table 3-18***. The full set of data is presented in ***Appendix 5.4.***

TABLE 3-18*: THE GFWS MONITORING RESULT IN Q4 2020*

Date	Parameter (Unit)	Site Name	Thaheua Village	Hat Gnuin Village	Phouhomxay Village		
		Station	WTHH02	WHGN02	WPHX01	WPHX02	WPHX03
		Guideline					
26-Oct-20	E. Coli Bacteria (MPN/100 mL)	0	8	13	-	0	0
19-Nov-20		0	27	17	-	0	0
18-Dec-20		0	8	280	-	49	27
26-Oct-20	Faecal coliform (MPN/100 mL)	0	8	13	-	0	0
19-Nov-20		0	79	27	-	0	0
18-Dec-20		0	8	280	-	49	27

Thahuea Village (WTHH02): all parameters complied with the standard, except faecal coliform and E.coli.

Hat Gniun Village (WHGN02): all parameters complied with the standard, except faecal coliform and E.coli.

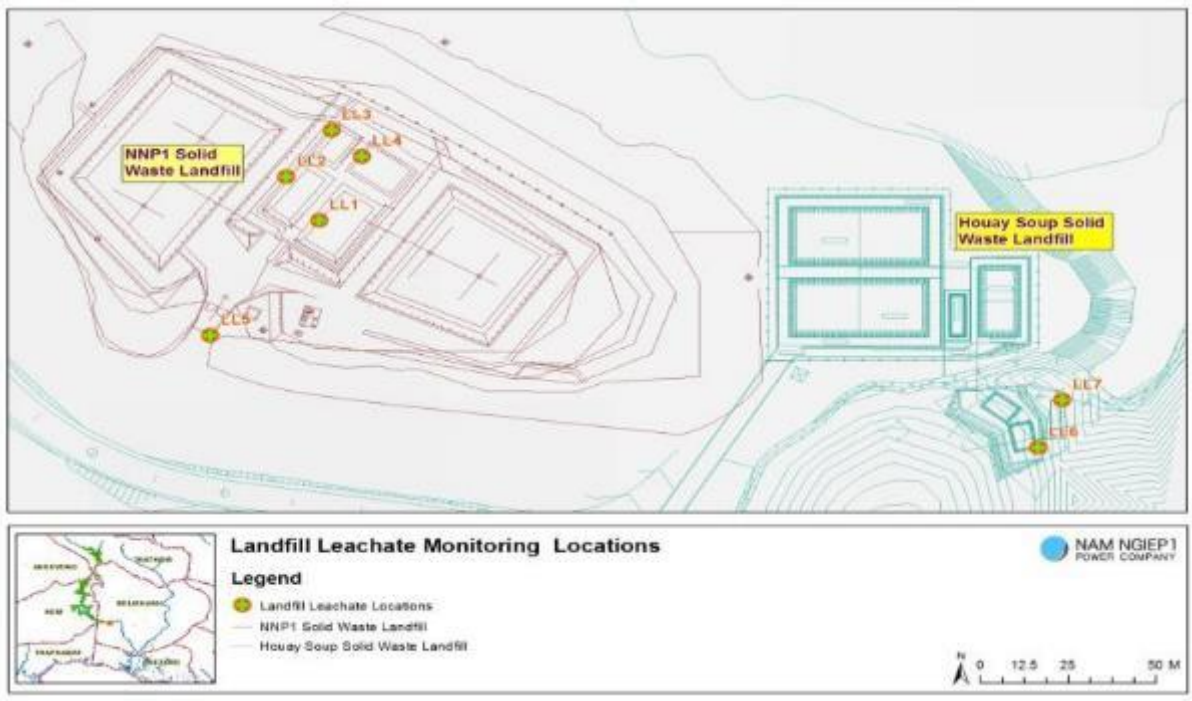
Phouhomxay Village (WPHX01-raw water in the head tank before filtration; **WPHX02**-tap water at primary school; and **WPHX03**-tap water at the villager's house**):** all parameters complied with the standard, except faecal coliform and E.coli in November 2020. The bacteria contamination in Phouhomxay may cause of Nam Houay Sop Gnai (original gravity fed water supply source) was still applied occasionally to ensure sufficient supply of water.

As observed in the field during water sample collection, livestock is roaming around in the water intake areas which may have contributed to the presence of Faecal Coliform Bacteria and E.coli in GFWS samples. The villagers generally use tap water for washing and cleaning. They were informed about the monitoring results and were advised to boil water before drinking. This advice is in accordance with the Law on Hygiene, Disease Prevention and Health Promotion No 01/NA of 10 April 2001, which states that domestic water supply for daily use is not required to be readily drinkable but would normally have to be boiled or otherwise treated before it would be suitable for drinking.

3.7.5 Landfill Leachate Monitoring

The landfill leachate treatment systems at NNP1 Project landfill and Houay Soup landfill are monitored to control the functioning of the treatment process and ensure compliance with effluent standards. The monitoring locations are presented in the **Figure 3-17.**

FIGURE 3-17*: LANDFILL LEACHATE MONITORING LOCATION*



The monitoring results in Q4 2020 indicate compliance with the applicable standards for all monitored parameters, except total coliform in the NNP1 Project Landfill (at the last pond in November 2020) but there was zero discharge from the leachate ponds. The monitoring data can be found in ***Appendix 5.5.***

4 WATERSHED AND BIODIVERSITY MANAGEMENT

4.1 WATERSHED MANAGEMENT

4.1.1 Implementation of Watershed Management Plan

The final draft of Fishery Co-Management Plan (FCMP) in English was submitted to ADB on 28 September 2020. ADB and BSP provided their comments on 20 October 2020 and NNP1PC-EMO provided the clarification to them on 28 October 2020. The final draft in Lao language was submitted to Xaysomboun PAFO on 27 October 2020 for their approval. Xaysomboun Provincial WRPO and PAFO Fishery Section confirmed in the first week of December 2020 that they have no further comments on the final draft of Fishery Co-Management Plan (FCMP) in Lao language and will elaborate the activities under the XSB WMP AIP2021.

The final report in Lao language of the Assessment on Sustainable Livelihood Opportunities for NNP1 watershed communities was further reviewed and discussed internally among NNP1PC-EMO at the end of October 2020. The report was further improved in November 2020 and finalized in December 2020. The report will be shared to Xaysomboun Provincial WRPO for their reference to implement the activities under component 5 of NNP1 WMP – Livelihood Improvement.

On 24 September 2020, NNP1PC transferred the funds for the watershed management activities between October and December 2020 to Bolikhamxay Provincial WRPO. The WRPO updated the implementation schedule to start in the last week of October 2020 because of their internal meetings between the first and the third week of October 2020 as well as to accommodate recommendations from NNP1PC for them to have the Water Safety Training prior to continuing their reservoir patrol activity. Bolikhamxay Provincial WRPO commenced reservoir and forest patrolling between 12 and 19 November 2020. The reservoir patrolling team had to return back on 15 November 2020 because of an issue with the boat engine. Bolikhamxay WRPO is preparing a report of their patrolling until the end of November 2020. Bolikhamxay Provincial WRPO commenced forest patrolling between 21 and 30 December 2020 while the reservoir patrolling will resume after the boat engine is fixed by the supplier and delivered back to patrolling Team. The report will be shared to NNP1PC-EMO and BSP team afterward.

On 21 October 2020, DOF-MAF submitted an official request to NNP1PC for fund disbursement to Xaysomboun Provincial WRPO for the implementation of activities between October and December 2020. NNP1PC-EMO informed ADB and IAP on 25 October 2020 on the concern that some of the activities were excluded and postponed to 2021. These include: survey of villagers' land use and data collection in Hom district, installation of signboards of the village land-use and forest land area, and the land patrolling for forest and TPZ area. There was no clear justification for the exclusion of land use survey and signboard installation while the exclusion of patrol activities is related to a request for additional accommodation allowance for field work which does not follow the GOL financial policy. This issue has been discussed many times between NNP1PC and Xaysomboun PAFO and is still pending. NNP1PC management planned to organize a meeting with all relevant parties, including DOF, in January 2021 to discuss the issues related to GOL financial policy affecting the field activities under the watershed and biodiversity programmes.

A meeting on the design of Xaysomboun Provincial WRPO sub-office at Huayxay Village was organized on 25 December 2020 at Xaysomboun PAFO. The main conclusions are:

- NNP1PC-EMO will assist GOL in improving the design of office and other facilities. The design of office and other facilities should be ready and presented to WRPC for review and approval before 15 January 2021.

- The BOQ should be based on the agreement at the Meeting 16 July 2020 at XSB PAFO.

Three days Water Safety Training was organized by NNP1PC-EMO in collaboration with Lao Red Cross on 03-05 November 2020 at Bolikhamxay PAFO and NNP1PPC OSOV. The training was attended by 11 representatives from NNP1PC, two representatives from Hom DAFO, two representatives from Thathom DAFO, two representatives from Bolikhan DAFO and one representative from BLX WRPO. During the training the participants learned first aid, safe working in water, victim management and rescue, swimming technique, and boat operation. NNP1PC-EMO also handed over the SMART system equipment to Xaysomboun Provincial WRPO on 10 December 2020 while the equipment handover to Bolikhamxay Provincial WRPO will be carried out in January 2021.

FIGURE 4-1*:* PHOTOS DURING THE WATER SAFETY TRAINING 03-05 NOVEMBER 2020 (FIRST AID, VICTIM MANAGEMENT AND RESCUE, SWIMMING TECHNIQUE)

FIGURE 4-2: PHOTOS DURING THE WATER SAFETY TRAINING 03-05 NOVEMBER 2020 (BOAT OPERATION AND SAFETY WORKING IN THE WATER)

4.2 BIODIVERSITY OFFSET MANAGEMENT

4.2.1 Engagement of Biodiversity Service Provider (BSP)

NNP1PC finalized the fourth draft Memorandum of Understanding (MOU) to be signed between ADB, WCS and NNP1PC on 18 May 2020. The ADB and WCS (as Biodiversity Service Provider) agreed with the revised draft on 19 May 2020 and 17 June 2020 respectively. ADB shared the final draft of MOU with NNP1PC for confirmation on 17 June 2020. NNP1PC has further improved the final draft per discussion with NNP1PC lawyer, management, and the shareholders. The improved draft was communicated to BSP and ADB on 27 July 2020. ADB provided advice on 28 July 2020 indicating that ADB did not have further comments, and WCS provided comments in late August 2020 after further internal discussions regarding the confidentiality clause. The MOU was further improved between September to November 2020. The MOU was finalized and agreed by all parties in December 2020 and the signed MOU by NNP1PC was sent to WCS and ADB for further signatures.

NNP1PC-EMO and the BSP continued to make progress on the preparation of a Law Enforcement Strategy (LES) document for NC-NX offset site, the overall biological monitoring program for NNP1 watershed and NC-NX offset site, community outreach program and conservation linked livelihood for NC-NX offset site.

4.2.2 Implementation of Biodiversity Offset Management Plan

Progresses on the implementation of activities by Component are described below:

a. Component 1 - Spatial Planning and Regulation

The dissemination and outreach activity on the TPZ boundary in Viengthong and Xaychamphone District could not be commenced because of impassable access after the rainy season. The activity was postponed to January 2021.

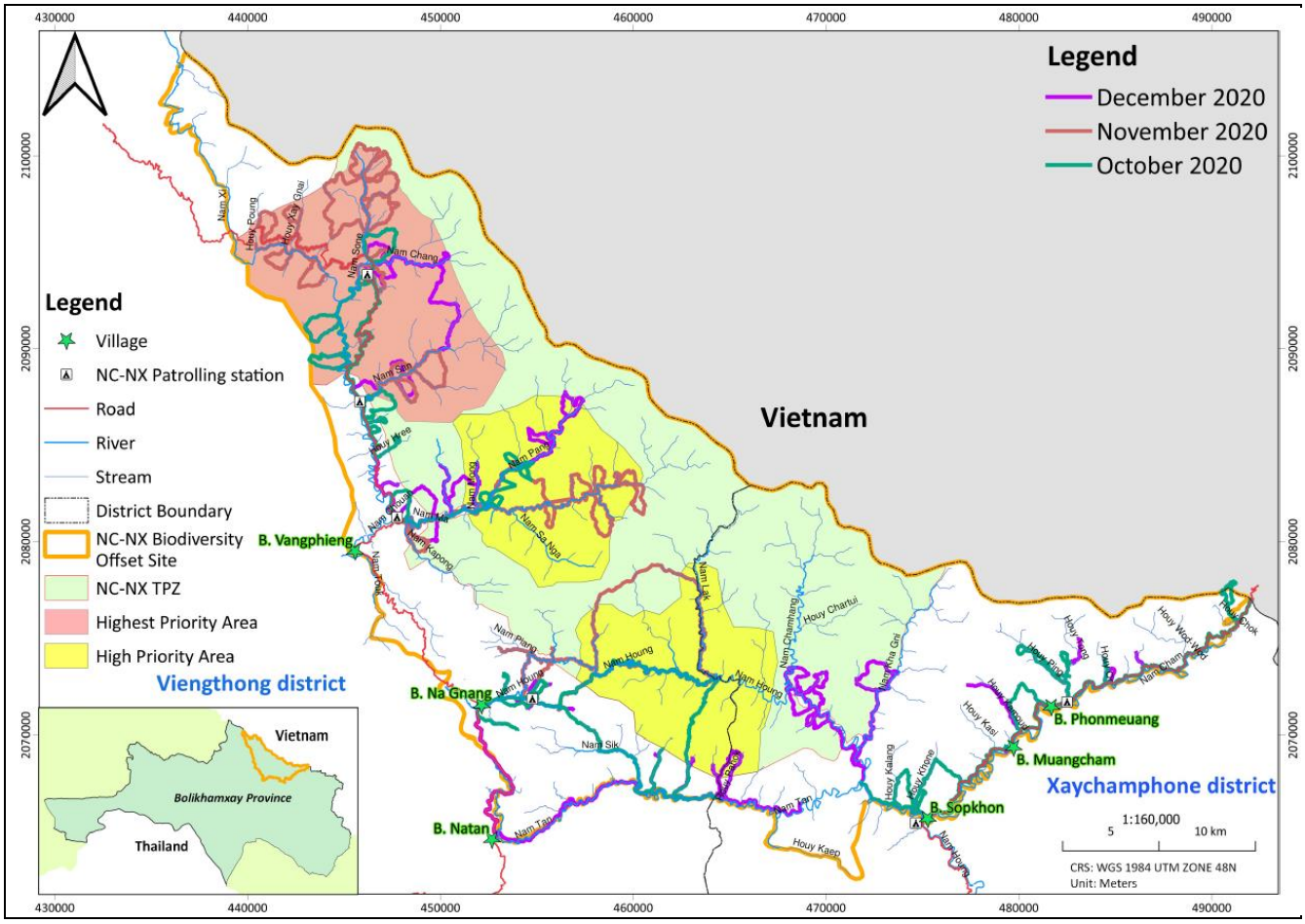
b. Component 2 – Enforcement

During 7-27 October 2020, four patrolling teams continued with patrolling activities. The first team carried out patrolling at Nam Houng TPZ high priority area including Nam Houng, Nam Kha Gna, Nam Sik, Houay Kanang, Houay Vangmoun. The second team carried out patrolling at TPZ highest priority including Houay Hree, Houay Phai, Nam San, Nam Chouan and Nam Sone. The third team carried out patrolling at Nam Ma TPZ high priority area including Nam Ma and Nam Pang. The fourth team carried out patrolling at Xaychamphone District including Houay Chok, Houay Or, Houay Ping, Houay Tong, Houay Bon, Houay Kamoud, Houay Khone and Houay Kalang.

During 7-27 November 2020, four patrolling teams continued with patrolling activities. The first team carried out patrolling at Nam Houng TPZ high priority area including Nam Houng, Nam Kha Gna, Nam Plang, Nam Kama, Nam Kapa, Nam Lak and upstream of Nam Somfard. The second team carried out patrolling at TPZ highest priority including Nam san, Houay Payang, Houay Poung, Nam Chang and Nam Sone. The third team carried out patrolling at Nam Ma TPZ high priority area including Nam Ma and Nam Pang. The fourth team carried out patrolling at TPZ highest priority area including Nam San, Nam Chang, Nam Sone, Houay Xay Gnai, Houay Xay Noi, Houay Poung and Nam Chouan.

During 7-27 December 2020, four patrolling teams continued with patrolling activities. The first team carried out patrolling at Nam Houng TPZ high priority area including Nam Houng, Nam Kha Gna, Nam Tan, Houay Vangmoun, Houay Kanang, Houay San and Houay Pahok. The second team carried out patrolling at TPZ highest priority including Nam San, Nam Chang and Nam Sone. The third team carried out patrolling at Nam Ma TPZ high priority area including Nam Ma, Nam Pang, Nam Mong, Nam Phai and Houay Phaphard. The fourth team carried out patrolling at Xaychamphone District including Nam Cham Hang, Nam Kha Gni, Houay Lampang, Houay Kamoud, Houay Ping, Houay Tong, Houay Or and Houay Mouang.

FIGURE 4-3: ***MAP OF PATROLLING TRACK FROM OCTOBER – DECEMBER 2020***

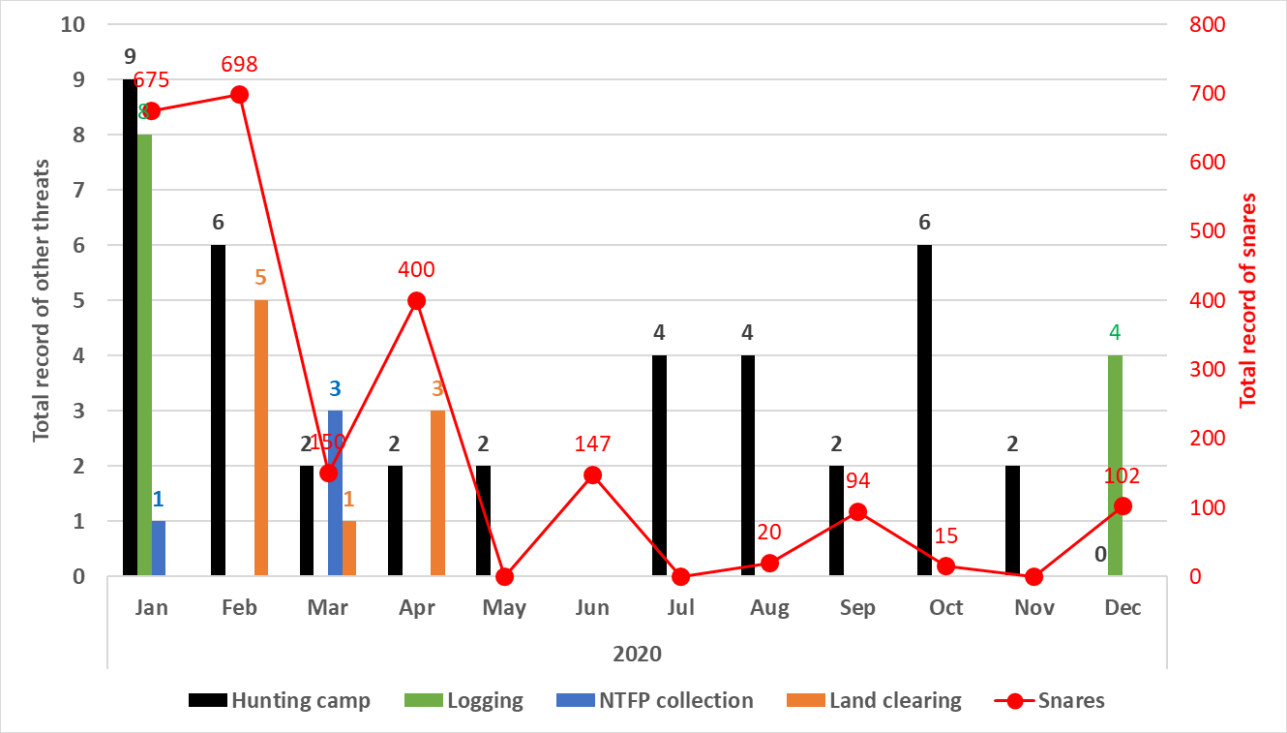


The record of threats from patrolling work in 2020 is presented in **Figure 4-4**. The team collected and destroyed a total of 15 large wire snares close to Nam Ma sub-station in October 2020; 01 large wire snare at Houay San, 10 large wire snares at Houay Pahok, 40 large wire snares at Houay Vangmoun, 03 large wire snares at Houay Mouang, and 48 large wire snares close to Nam Houng in December 2020.

The patrolling team observed and destroyed a total of eight hunting camps in Q4 2020. Hunting related activities in this quarter were mostly observed around Nam Sik, Nam Houng, Nam Chouan, Houay Khone, Nam Pang in the TPZ highest and higher priority area.

The patrolling team also observed the illegal timber cutting outside TPZ priority area around Houay Kamoud and Houay Mouang at Xaychamphone District. The DAFO planned to further investigate the case in January 2021.

FIGURE 4-4: ***OVERALL RECORD OF THREATS IN NC-NX OFFSET SITES IN 2020***



The record of wildlife observed from patrolling work in Q4 2020 is presented in Error! Not a valid bookmark self-reference.. A total of 355 wildlife was recorded through direct observation between October and December 2020.

Table 4-1: ***List of Wildlife recorded from Direct Observation between October-December 2020.***

Species (English name)	Species (Scientific Name)	Total
Black Giant Squirrel	*Ratufa bicolor*	3
Brown Hornbill	*Anorrhinus tickelli*	13
Eagle	*Aquila heliaca*	13
East Asian Porcupine	*Hystrix brachyura*	2
Great Hornbill	*Buceros bicornis*	9
Indochinese Serow	*Capriconis sumatraensis*	5
Macaque*	*Macaca sp.*	153
Muntjac	*Muntiacus muntjak*	28
Otter	*Lutra*	8
Phayre's Leaf Monkey	*Trachypithecus phayrei*	45
Red Junglefowl	*Gallus gallus*	1
Red-shanked Douc Langur	*Pygathrix nemaeus*	6
Sun Bear	*Ursus malayanus*	1
White-cheeked gibbon	*Nomascus leucogenys*	18
Wild Pig	*Sus scrofa*	49
Grand Total		354

Note: * The species could not be identified clearly by the patrol team, so Macaque here refers to all types of Macaque observed and recorded in the area.

FIGURE 4-5: ***HUNTING CAMP FOUND AND DESTROYED BY TEAM 1 IN OCTOBER 2020***

FIGURE 4-6: ***FISHING CAMP FOUND AND DESTROYED BY TEAM 2 IN OCTOBER 2020***

FIGURE 4-7: ***LARGE WIRE SNARES COLLECTED AND DESTROYED BY TEAM 3 IN OCTOBER 2020***

FIGURE 4-8: ***HUNTING CAMP FOUND AND DESTROYED BY TEAM 1 AT NAM HOUNG IN NOVEMBER 2020***

FIGURE 4-9: ***FISHING CAMP FOUND AND DESTROYED BY TEAM 1 AT NAM HOUNG IN NOVEMBER 2020***

FIGURE 4-10: ***HUNTING CAMP FOUND BY TEAM 2 AT EASTERN OF NAM SONE IN NOVEMBER 2020***

c. Component 3 – Conservation Outreach

The pre-assessment of the target communities and schools was scheduled at the end of October 2020 but due to impassable road access after weeks of heavy rains, the activity was postponed to 11-21 November 2020. The results will be discussed during the BOMU monthly meeting in January 2021.

d. Component 4 – Conservation linked livelihood

The Consultant submitted a draft in English and Lao language to NNP1PC-EMO on 15 and 19 October 2020 respectively. The English version was reviewed by NNP1PC-EMO and BSP and then submitted to ADB and IAP on 19 October 2020. EMO received their comments on 27 October 2020. The comments will be addressed and elaborated together with the results of the final workshop with GOL that was organized on 10 November 2020 attended by 42 participants. The Consultant, NNP1PC-EMO, and BSP further improved the draft plan (English version) addressing the comments from ADB, IAP, and from the workshop with relevant GOL agencies. The revised version was submitted to ADB on 27 November 2020. ADB provided the compiled comments from ADB and IAP team on 18 December 2020. The improved final plan was re-submitted to ADB and IAP on 30 December 2020. The final lao version was expected to be finalized and submitted to Bolikhamxay Provincial BOMU after ADB and IAP review in January 2021. The activities were elaborated into the BOM AIP2021.

The Community Snare Removal Plan was further discussed during the technical meeting between NC-NX BOMU, NNP1PC-EMO, and BSP on 13 October 2020. The plan was further improved and discussed during monthly meeting on 05 November 2020. The plan was finalized and submitted to BOMU on 20 November 2020. The team establishment, the training and the first snare removal were re-scheduled to be held in January 2021.

5 BIOMASS CLEARANCE / FLOATING DEBRIS REMOVAL

NNP1PC-EMO team removed some logs from the temporary log-booms in the second week of November 2020. Starting from January 2021, NNP1PC EMO team will no longer conduct biomass removal from the main reservoir and the temporary log boom will be removed/demolished. NNP1PC will employ a private contractor for doing the overall maintenance of main log boom and he biomass removal in the main and re-regulation reservoir.

6 FISHERY MONITORING

A consultant, Mr. Theodorus Adrianus Maria Visser, has been hired by NNP1PC during the period from 01 October to 31 December 2020 with the role and responsibilities to prepare a Biennial Fisheries Report 2020 by focusing on: (i) data analysis and report for fishery monitoring data including the impacts on livelihood and fish species diversity and abundance; and (ii) provide recommendation and advice on fishery monitoring (fish catch monitoring and gillnet survey). The consultant conducted the data analysis and reporting in close communication with NNP1 EMO Fishery Monitoring Team particularly on the hydrology, water quality, fisheries, and socio-livelihood within the NNP1 Project area. The Biennial Fisheries Report is expected to complete in February 2021.

The 5 species that dominated the fish catch by weight in Q4 2020 are listed in ***Table 6-1.*** This includes two species and three species group that are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species, except *Tor sinensis* is classified as Vulnerable species (VU).

TABLE 6-1: *FISH SPECIES DOMINATING THE FISH CATCH IN Q4 2020*

Species	Lao Name	Fish Catch in Q4 2020 (kg)	IUCN Red List Classification
Hampala dispar, Hampala macrolepidota	ปาสูด	516.4	LC
Poropuntius normani, Poropuntius laoensis, Poropuntius carinatus	ปาจาด	358.6	LC
Channa striata	ปาถ่ำ	259.2	LC
Barbonymus gonionotus, Hypsibarbus malcomi, Hypsibarbus vernayi, Hypsibarbus wetmorei	ปาปาก	211.3	LC
Tor sinensis	ปาแดง	173.7	VU

The recorded catch of threatened species (IUCN Red List classification) in the Q4 2020 fish catch is presented in ***Table 6-2***. The threatened species includes one Endanger species (EN) and three Vulnerable species (VU).

TABLE 6-2: *THREATENED AND NEAR THREATENED SPECIES OF THE Q4 2020 FISH CATCH*

Species	Lao Name	Fish Catch in Q4 2020 (kg)	IUCN Red List Classification
Cirrhinus molitorella	ปาแกง	38.1	NT
Cyprinus carpio	ปาไน	24.4	VU
Neolissochilus stracheyi	ปาสอง	25.9	NT
Onychostoma gerlachi	ปาถิง	12.6	NT
Probarbus jullieni	ปาเอิน	6	EN
Scaphognathops bandanensis	ปาอวนไฟ/ปาป่วน	46	VU
Tor sinensis	ปาแดง	173.7	VU

The occurrence of Threatened and Near Threatened species in the fish catch by Quarter since the start of species identification in Q3 2015 is displayed in **Table 6-3.**

TABLE 6-3: *OCCURRENCE OF THREATENED AND NEAR THREATENED SPECIES IN THE FISH CATCH*

Species	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018	Q2 2018	Q3 2018	Q4 2018	Q1 2019	Q2 2019	Q3 2019	Q4 2019	Q1 2020	Q2 2020	Q3 2020	Q4 2020
Bagarius bagarius (NT)			+	+	+	+	+	+	+	+	+	+	+	+	+							
Bagarius yarrelli (NT)	+			+					+					+								
Bangana behri (VU)	+	+	+	+	+	+	+	+	+			+	+	+	+	+						
Chitala blanci (NT)														+								
Cirrhinus cirrhosus (VU)	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+		+	+	+	
Cirrhinus molitorella (NT)	+	+										+	+	+	+	+	+	+	+	+	+	+
Cyprinus carpio (VU)	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+
Epalzeorhynchos munense (VU)												+										
Hypophthalmichthys molitrix (NT)	+				+									+		+						
Laubuca caeruleostigmata (EN)																	+					
Luciocyprinus striolatus (EN)	+	+	+	+			+	+	+	+			+	+		+						
Mekongina erythrospila (NT)	+	+	+	+	+	+	+	+	+			+	+	+			+					
Neolissochilus stracheyi (NT)	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Ompok bimaculatus (NT)	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+							
Onychostoma gerlachi (NT)	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Pangasianodon hypophthalmus (EN)	+																					
Probarbus jullieni (EN)	+	+	+			+		+	+	+		+		+			+	+			+	+
Probarbus labeamajor (EN)				+	+			+							+	+						
Scaphognathops bandanensis (VU)	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Syncrossus beauforti (NT)		+	+	+	+	+					+			+		+	+	+				
Tor sinensis (VU)	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Wallago attu (NT)	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+	+		+	+	

The total recorded monthly fish catch from July 2015 to December 2020 for the downstream, upstream and Mekong control group fishing households involved in the monitoring programme is presented in ***Figure 6-1***. Note that the upstream fish catch excludes the fish catch from the fishing households in Zone 2LR because these households were resettled during Q4-2017.

***FIGURE 6-1*: TOTAL MONTHLY FISH CATCH JULY 2015 – DECEMBER 2020**

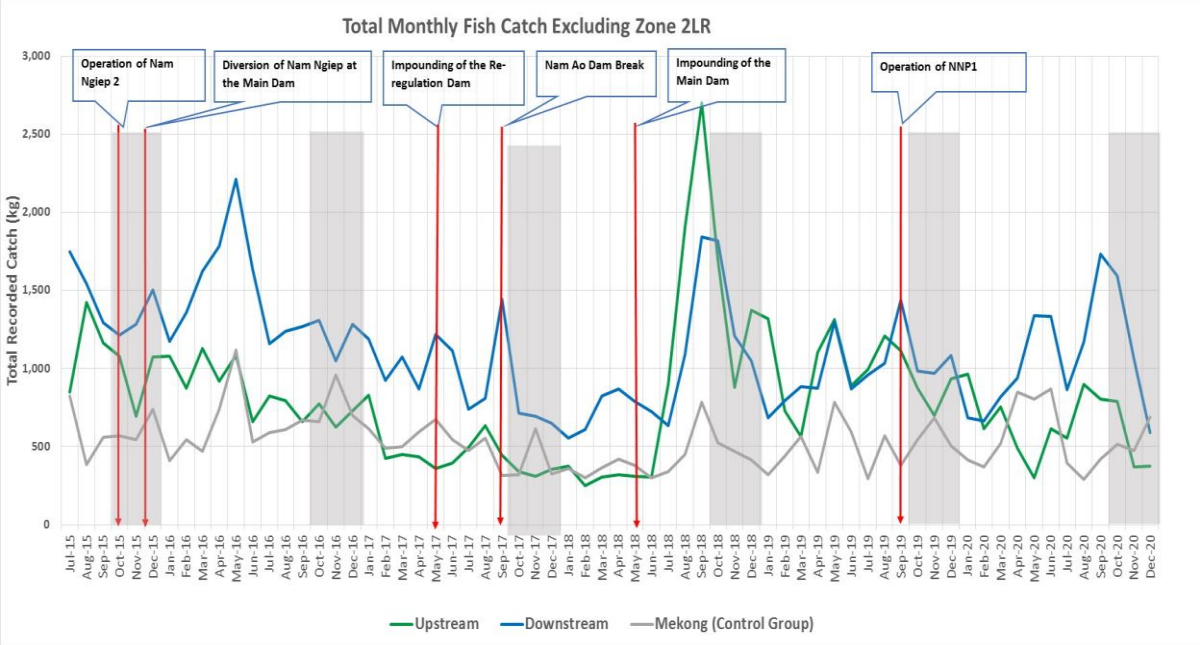


Table 6-4 and **Figure 6-2** show the total recorded fish catch for Q4 in 2015 to 2020 by the upstream (excluding Zone 2LR), downstream and the Mekong control group fishing households. Note that the recording days was reduced from 30 days/month to only seven days/month starting from February 2019 due to Company financial constraint. However, redesigning the sampling program have been carefully discussed with fishery expert and noted that NNP1PC needs to continue the monitoring and the long trend data analysis should carefully consider the different sampling programs that were implemented.

TABLE 6-4: *TOTAL FISH CATCH IN Q4 BY UPSTREAM (EXCLUDING ZONE 2LR), DOWNSTREAM AND BY THE MEKONG CONTROL GROUP FISHING HOUSEHOLDS*

Fishing Zone	Q4 2015 (kg)	Q4 2016 (kg)	Q4 2017 (kg)	Q4 2018 (kg)	Q4 2019 (kg)	Q4 2020 (kg)
Upstream	2,847.9	2,130.9	1,008.2	3,949.6	2,506.6	1,538.2
Downstream	3,999.7	3,641.3	2,062.2	4,073.7	3,036.6	3,242.2
Mekong Control Group	1,854.3	2,314.3	1,261.1	1,407.6	1,732.6	1,679.8

FIGURE 6-2: ***TOTAL FISH CATCH IN Q4 BY UPSTREAM (EXCLUDING ZONE 2LR), DOWNSTREAM AND MEKONG CONTROL GROUP FISHING HOUSEHOLDS***

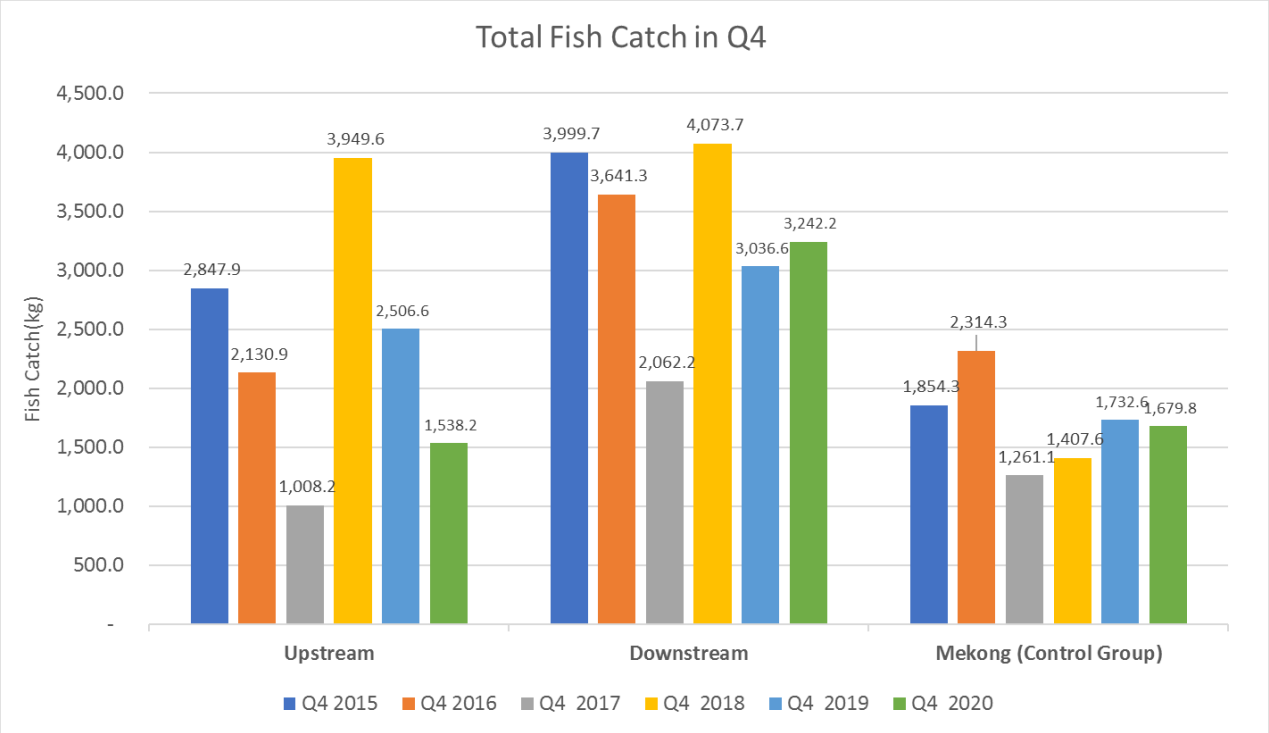
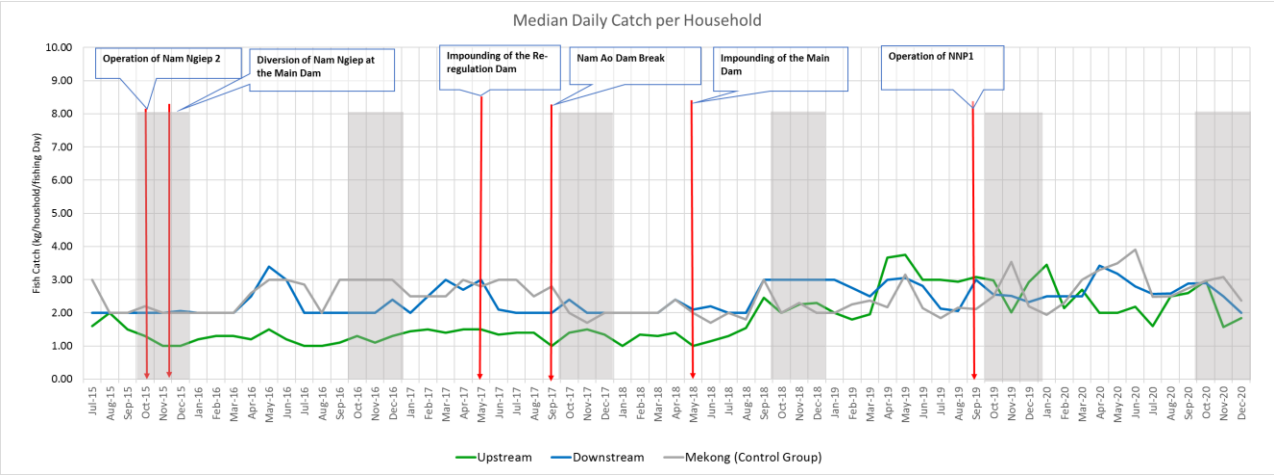


Table 6-5 presents the median household fish catch per fishing day for Q4 in 2015 to 2020 in the upstream (excluding Zone 2LR), downstream and the Mekong Control Group, and ***Figure 6-3*** shows the median monthly household fish catch per fishing day from July 2015 to December 2020.

TABLE 6-5: ***MEDIAN HOUSEHOLD FISH CATCH PER FISHING DAY FOR Q4 IN 2015 TO 2020***

Fishing Zone	Q4 2015 (kg)	Q4 2016 (kg)	Q4 2017 (kg)	Q4 2018 (kg)	Q4 2019 (kg)	Q4 2020 (kg)
Upstream (Excluding Zone 2LR)	1.10	1.23	1.42	2.18	2.64	2.13
Downstream	2.02	2.13	2.13	3.00	2.47	2.47
Mekong (Control Group)	2.07	3.00	1.90	2.10	2.75	2.81

FIGURE 6-3: *MEDIAN MONTHLY HOUSEHOLD FISH CATCH PER FISHING DAY (EXCLUDING ZONE 2LR)*



7 Health and Safety

A summary of the safety incidents reported during the Construction Phase (up to the end of August 2019) are provided in ***Table 7-1*** and ***Figure 7-1*** below.

TABLE 7-1: SAFETY INCIDENTS REPORTED DURING THE CONSTRUCTION PHASE (UP TO AUGUST 2019)

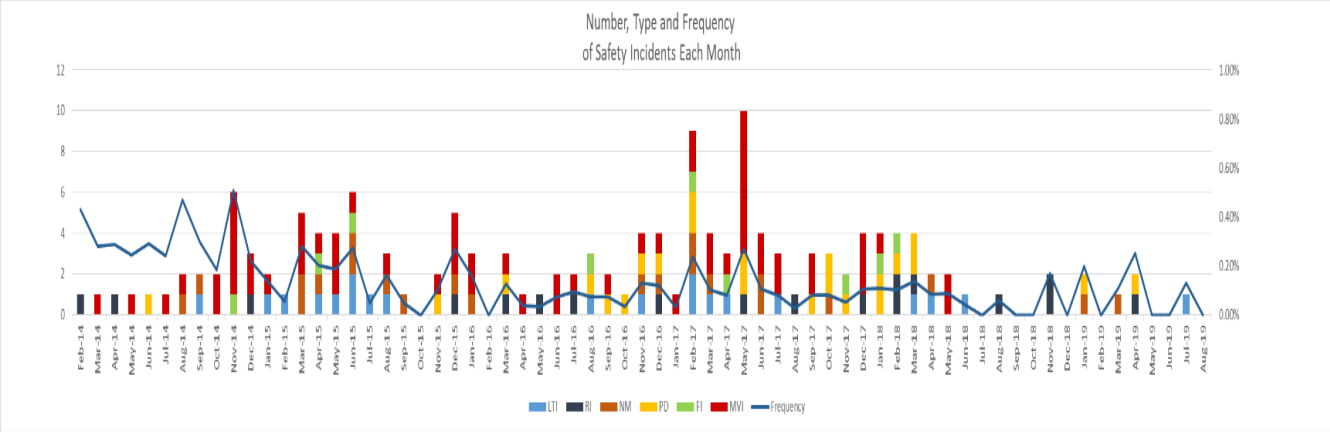
Type of Incidents	LTI	RI	NM	PD	FI	MVI	Total
No. of Incidents in Q4 2020	0	0	0	0	0	0	0
Cumulative Total Incidents to 31 August 2019	20	18	22	23	9	62	**154**

LEGEND:
- LTI - Lost Time Incident
- RI - Recordable Injury
- NM - Near Miss
- PD - Property Damage
- FI - Fire Incident
- MVI - Motor Vehicle Incident

The histogram below in ***Figure 7-1*** shows the number of reported incidents occurring in each month since the start of the Civil Works Contract with the colour indicating the type of incident including near misses. Up to the end of December 2015, all incidents related to the Civil Contractor and from 01 January 2016, those of the other three principal Contractors have been included. The graph superimposed on the histogram shows the frequency of incidents, including reported near misses, with the number of incidents occurring each month expressed as a percentage of the total number of Project workers employed in each month being the total man-months.

All reported incidents that have involved the Owner and its Contractors and Subcontractors are included in the histogram and shown graphically below.

FIGURE 7-1: NUMBER, TYPE AND FREQUENCY OF SAFETY INCIDENTS DURING THE CONSTRUCTION PHASE UP TO 31 AUGUST 2019



A summary of the safety incidents reported during the Operation Phase (September 2019 to August 2019) are provided in **Table 7-2.**

TABLE 7-2: SAFETY INCIDENTS REPORTED DURING THE OPERATION PHASE (SEPTEMBER 2019 TO DECEMBER 2020)

Type of Incidents	LTI	RI	NM	PD	FI	MVI	Total
No. of Incidents in March 2021	0	0	0	0	0	0	0
Cumulative Total Incidents to 31 December 2020	0	0	0	0	0	0	**0**

LEGEND:
- LTI - Lost Time Incident
- RI - Recordable Injury
- NM - Near Miss
- PD - Property Damage
- FI - Fire Incident
- MVI - Motor Vehicle Incident

There were no incidents or accidents reported during Q4 2020.During Q4 2020, no activities relating to Emergency Preparedness and Response Plan (EPRP) and Health and Safety (H&S) Plan including the trainings and drills. It was planned that the Firefighting Training and the

Emergency Fire Hydrant Drill for NNP1PC staff who works on site will be organized in Q1 2021.

8 External missions and visits

A joint ADB and IAP virtual mission were conducted during 07 to 11 December 2020 and the work progress of NNP1PC Environmental Management Office (EMO) was shared during the mission with BSP-WCS and NNP1PC TD supports.

The discussion topics on work progress during the virtual mission were:

- Environmental monitoring results
- Implementation of the environmental sub-plans
- Environmental flows
- Operation Manual
- Emergency Action Plan (EAP) and Emergency Preparedness and Response Plan (EPRP)
- Health and Safety
- Watershed and Biodiversity Offset Management Programs
- NC-NX Community Development Plan (CDP)
- EMO work progress with BSP support
    - Impact analysis on TPZ re-delineation in NC-NX offset site and NNP1 watershed
    - NC-NX Patrolling and SMART analysis
    - Biological monitoring matrix

The queries raised by ADB and IAP were addressed during discussion and some pending issues were responded/explained later through the email exchanges.

The virtual mission was successfully completed and actions priorities recommended by ADB and IAP are listed for further follow up as follows:

No	Requested/Recommended Actions	Status as of 31 Dec 2020
1	Conclusion of the Environment and Social LTA Contract extension.	Pending
2	Hiring of a new EMO staff and provide the job descriptions of EMO key positions.	Pending
3	Provide a timeline of next steps to resolve the issue of low oxygen levels/feasibility study.	Pending
4	Submit the draft GOL AIP2021 of WRPOs and BOMU for ADB review and approval as soon as possible.	The plans were yet finalized by GOL.
5	Analysis of Fish Monitoring Data up to 2020 by a Fishery Expert.	The report was still under finalizing by the Fish Expert, it is expected to be shared to ADB in Q1 2021.
6	Provide the Transmission Lines (TLs) monitoring report which was planned to conduct by EGAT in Q4 2020.	The report will be provided in Q1 2021.
7	Provide the latest dam safety report.	Completed in Dec 2020
8	Provide the landslide monitoring report.	Pending

No	Requested/Recommended Actions	Status as of 31 Dec 2020
9	Provide the rehabilitation plans agreed with the Government.	Completed in Dec 2020 and well prepared for the GOL inspection in Jan 2021.
	H&S and Emergency Plans	
10	Provide the Organization Chart for H&S Team and identifying first aiders.	Completed in Dec 2020
11	Provide the updated H&S plans that include relevant measures on navigation safety and incident response.	The H&S plan is still under review and updating. It is expected to be ready in June 2021.
12	Revise the Emergency Preparedness and Response Plan (EPRP) for the project operations, including an update on associated training and emergency drills performed.	The plan is still under review. It is expected to be ready in June 2021.
13	Revise/update the Emergency Action Plan (EAP), engagement with the emergency authorities, and perform desktop and field test.	The plan is still under review. It is expected to be ready in April 2021, the desktop and field-testing s are scheduled in July 2021.
14	Revise/update the Emergency Evacuation Plan (EEP) including an update on associated training and drills performed.	The plan is still under review. It is expected to be ready in June 2021.
	Watershed Management and Biodiversity Offset Management Program	
15	Analyse patrol information notably snare encounter rates in the highest priority area of NCNX. Based on results, either quickly evolve patrolling effort in NCNX to be highly concentrated in the highest priority area or produce clear case-specific justification to depart from the BOMP.	Discussed with BSP for further actions
16	Implement law enforcement activities in Sub-catchment to full capacity as soon as possible.	Discussed with BSP for further actions
17	Determine effects of proposed boundary changes to Sub-catchment Totally Protected Zones and take appropriate follow-on actions.	Discussed with BSP for further actions
18	Finalize and implement NC-NX Community Development Plan.	Under revising per ADB and IAP comments for further review by GOL

The status of the requested/recommended actions will be followed up and updated in the next quarterly report.

APPENDICES

APPENDIX 1: STATUS OF DOCUMENTS REVIEW AND APPROVAL DURING Q4 2020

No	Site name	Document Name	Contractor / Subcontractor	Approval Status by EMO/NNP1 (date)	Detailed Site Information	Monthly Construction & Operation Status as of 30 Sept 2020
1	Main Dam Downstream Right Bank	DWP and SS-ESMMP for Geotechnical Investigation at the Main Dam Downstream Right Bank Slope Area	**Entura Hydro Tasmania India Pvt Ltd**	2nd submission on 30 October 2020. No objection with No comment on 04 November 2020		Completed. **(Site closed)**
2	Suspension Bridge, 2UR	DWP and SS-ESMMP for Construction of Suspension Bridge in 2UR	**Khounmeuangxay Development Co., Ltd**	2nd submission on 25 November 2020 No objection with comments on 26 November 2020		On-going

APPENDIX 2: ENVIRONMENTAL MONITORING CORRECTIVE ACTIONS Q4-2020

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
ONC_AM-0003	28.02.2020	OSOV	Issued to ADM to improve the second wetland pond similarly to the first wetland pond. (Based on the LTA's recommendation made during the mission in August 2019 to improve the OSOV's WWTS)	ADM shall carry out a basic improvement of the second wetland pond similarly to the first wetland pond.	12.03.2020	24.12.2020	**Unresolved** NNP1PC and the WWTS Consultant have completed the conceptual report and proposal for WWTS improvement for management review and approval. The bidding process for wastewater treatment systems (WWTSs) improvement and modification was started by public advertising seeking interested bidders on 17 December 2020 and a pre-bidding meeting including site visit attended by three interested bidders was organized on 24

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
							December 2020 at NNP1PC OSOV1. The deadline for submission of proposal is scheduled on 15 January 2021 and the selection process is expected to be completed by the end of January 2021.
NCR_HM-0007	06.04.2020	LILAMA 10 Camp	Non-Compliance with the site revegetation requirements at HM Hydro's Labour Camp No.2 (LILAMA10 Camp).	In accordance with the rehabilitation measures provided in the Construction Site Decommissioning and Rehabilitation Plan (CSDRP), the SIR Ref. NNP1-ESD-EMO-SIR-HM-0020 dated 11 November 2019 and a mutual agreement made during the Joint Site Inspection between NNP1PC (EMO, O&M and ADM) and HM Hydro Contractor on 06 December 2019, the	15.07.2020	29.12.2020	**Unresolved** The corrective action was completed on 08 September 2020 by HM Hydro Contractor. This revegetated site was monitored by NNP1-EMO until the end of the rainy season 2020. The first joint site inspection and evaluation of the revegetation will be conducted three months after completion of the re-vegetation.

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
				HM Contractor is instructed to assess the LILAMA10 camp area for further revegetation during the wet season of this year (which is considerably starting since April 2020) to ensure successful site revegetation under one-year liability period.			***The NCR1 will be closed when the revegetation has been successfully completed***.
ONC_OC-0349	24.03.2020	OC camp	Instructed the OC Contractor to use only the approved tree species for revegetation and dead plant replacement.	The Contractor was instructed to take appropriate corrective action as the following: - Commercial trees need to be added if any future replacement of the dead and weak trees; and - No further flowers, fruit trees are allowed to be additional planted/replaced.	Action needed throughout the Liability Period	25/12/2020	**<u>Unresolved</u>** The contractor is continuing routine inspection combined with revegetation and maintenance of perimeter fence as necessary. ***The ONC will be closed by the end of the contractor's liability period (January 2021).***

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
NCR_VSP-0001	10.07.2020	HSRA's Irrigation Spoil and Rock Disposal Area	Non-Compliance with site rehabilitation at the Spoil Disposal Area for the construction of the irrigation canal.	Add more suitable local vegetation or local grass in some part of the areas that slow growth.	24.07.2020	28.12.2020	**Unresolved** The site was partially covered with a thin green of sown RUZI grass seed germination. The NCR1 will be closed when the revegetation has been successfully completed.
ONC_OC-0352	23.09.2020	17 Rehabilitation sites under CWC	A quarterly joint site inspection between NNP1PC (EMO and TD) and OC is ongoing for the rehabilitated sites to evaluate the vegetation cover percentage and site stability over the contractor's liability period as per the CA. Annex C, Clause 39, 40, 44 and 46 on the Site Decommissioning and Rehabilitation Requirements. - On 30-Jun-20 (mid-wet season of 2020), a total of 19 rehabilitated sites were evaluated and the Site Inspection Report (SIR-0103 dated 03-Jul-20) was issued to OC via TD. - This quarterly joint inspection on	1) These partial areas need additional countermeasures by planting more local vegetation / tall grass to close the bare ground and avoid additional comment from the upcoming LTA and GOL-EMU visits. 2) The contractor was instructed to prepare the Corrective Action Plan (CAP) and submit to NNP1PC for review and approval before	05.10.2020	30.11.20	Resolved

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
			23-Sept-20 (late-wet season of 2020), a total of 17 rehabilitated sites were evaluated as the following results:	further corrective action is carried out as the following: - Resolve/fix the eroded area; - Provide the counter measures to avoid future soil erosion (i.e., slope trimming, rock compaction and grassing, etc.) 3) A silt fence installation across the gully line as illustrated in the photos to trap the sand / silt, but allow free water runoff through the silt fence; Improve the cut-off drain to divert runoff. 4) The contractor was instructed to: - Replace the dead plants as soon as possible during this wet season to ensure that			

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
				the planted trees/grass will survive until the contactor's liability period; Note: Please refer to previous SIR-0101, dated 25 March 2020, EMO's instruction: - Replacement of dead or weak trees will be commercial trees only; - No further flowers, fruit trees are allowed to be additional planted / replaced. - Provide adequate countermeasures to prevent cattle entering in to the revegetated site.			
ONC_SC .JV.K-0001	16.12.2020	Suspension Bridge, 2UR	During a joint bi-weekly inspection, EMO found out that: - No perimeter fence for camp and construction sites to restrict public, cattle and pets;	The Contractor was instructed to perform the following corrective actions by the specified deadline:	30.12.2020	24.12.2020	**Unresolved** The corrective action is in progress with additional comments regarding the waste

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
			- No waste management on site which resulted in disposing of solid waste and food waste on the ground. This posted potential hygienic and sanitary risks to workers. - No wastewater collection ponds for grey water generated from cooking and washing areas.	- Install secure fence for camp and construction areas to restrict public cattle and pet's entry; - Designate location for temporary collection of waste generated from camp and construction site operation; - Provide a waste pit (size: 1.5m x 1.5m x 1m) for disposal of food waste; - Construct series of two wastewater ponds (size: 2m x 2m x1 m each) to collect wastewater generated from camp operation.			segregation and washing areas improvement.

APPENDIX 3: SITE CODES, LOCATIONS, MONITORING PARAMETERS AND ITS MAP OF THE SURFACE WATER QUALITY MONITORING

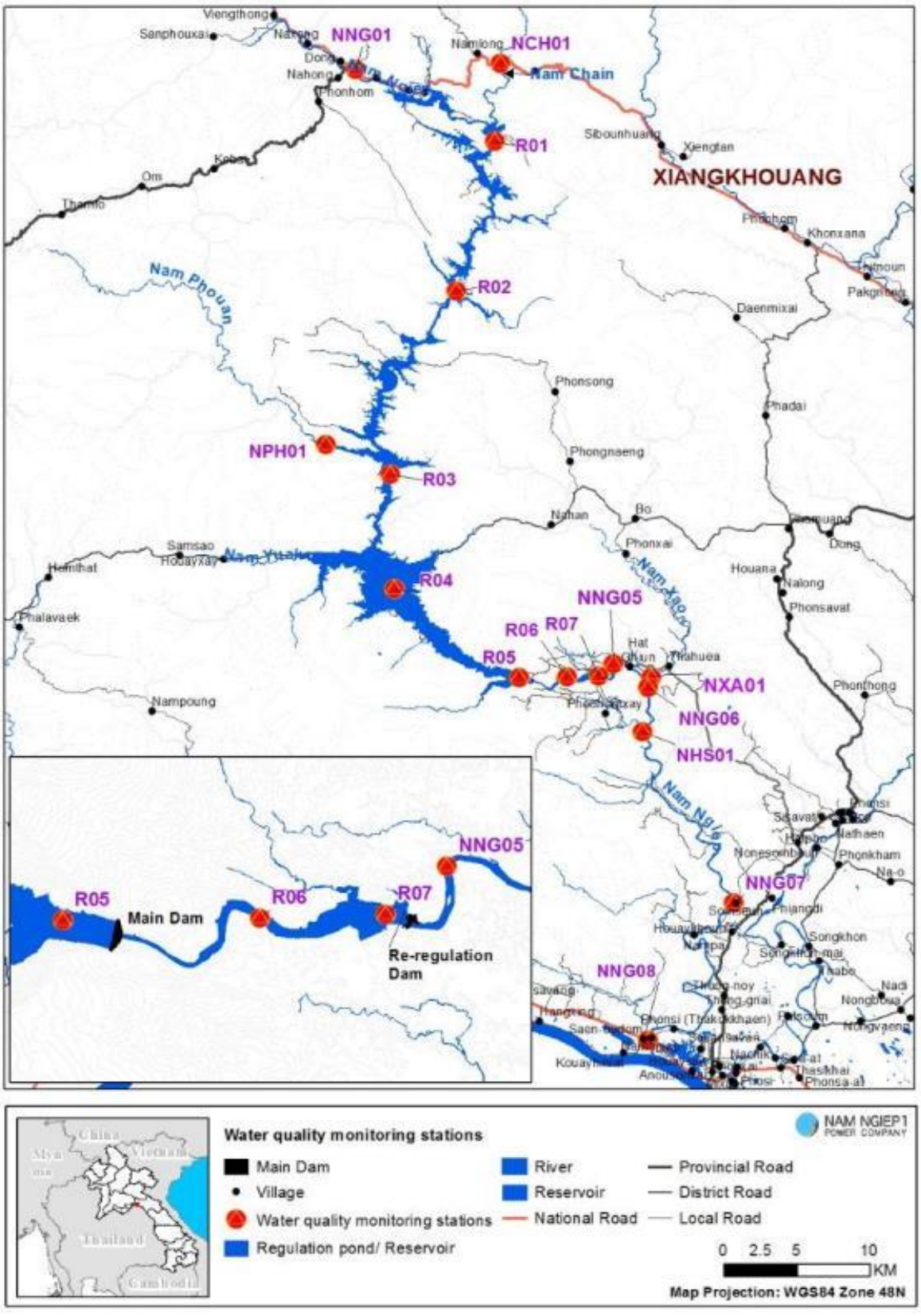
SITE CODES AND LOCATION STATION FOR SURFACE WATER QUALITY MONITORING

Site Code	Location station	Zone
NNG01	Nam Ngiep Upstream of Ban Phiengta	Upstream Project Construction Site
R01	Main reservoir upstream main dam approx. 50 Km.	
R02	Main reservoir upstream main dam approx. 35 Km.	
NNG02/R03	Nam Ngiep Upstream of Nam Phouan Confluence / Main reservoir upstream main dam approx. 21 Km.	
NNG03/R04	Nam Ngiep Downstream of Ban Sop-Youak / Main reservoir upstream main dam approx. 13 Km.	
NNG09/R05	Nam Ngiep Upstream Main Dam / Main reservoir upstream main dam approx. 0.5 Km	
NNG04 / R06	Nam Ngiep Downstream RT Camp (Middle Re-regulation Reservoir)	Within Project Construction Site
R07	Reservoir Upstream Re-Regulation Dam	
NNG05	Nam Ngiep Upstream of Ban Hat Gniun	Downstream Project Construction Site
NNG06	Nam Ngiep Downstream of Nam Xao Confluence	
NNG07	Nam Ngiep at Ban Somsuen	
NNG08	Nam Ngiep at the Bridge of Road 13	
NCH01	Nam Chiane at the Bridge of Road 1D	Tributaries Upstream of Project Construction Site
NPH01	Nam Phouan Upstream of Nam Ngiep Confluence	
NXA01	Nam Xao Upstream of Nam Ngiep Confluence	Tributaries Downstream of Project Construction Site
NSH01	Nam Houay Soup Upstream Nam Ngiep Confluence	

MONITORING FREQUENCY FOR SURFACE WATER QUALITY PARAMETERS

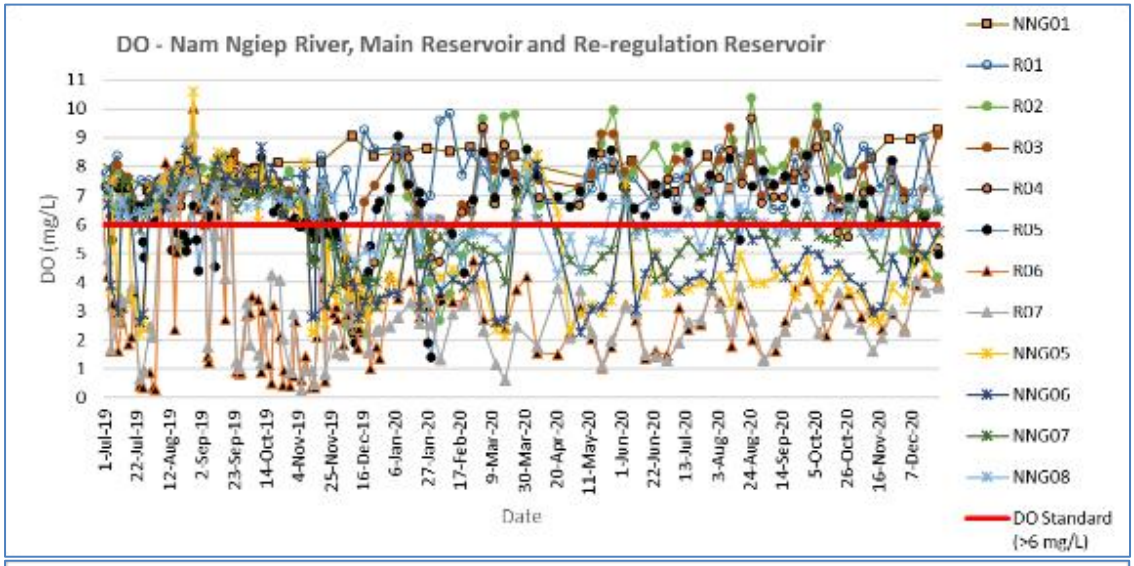
Frequency of Monitoring	Parameters (Unit)	Monitoring Sites
Weekly	pH, DO (%), DO (mg/L), Conductivity (µs/cm), TDS (mg/L), Temperature (°C), Turbidity (NTU).	- Main Reservoir: R01, R02, R03, R04, R05; - Nam Ngiep downstream: NNG05, NNG06, NNG07 and NNG08; - Tributaries: Nam Phouan [NPH01], Nam Xao [NXA01] 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.

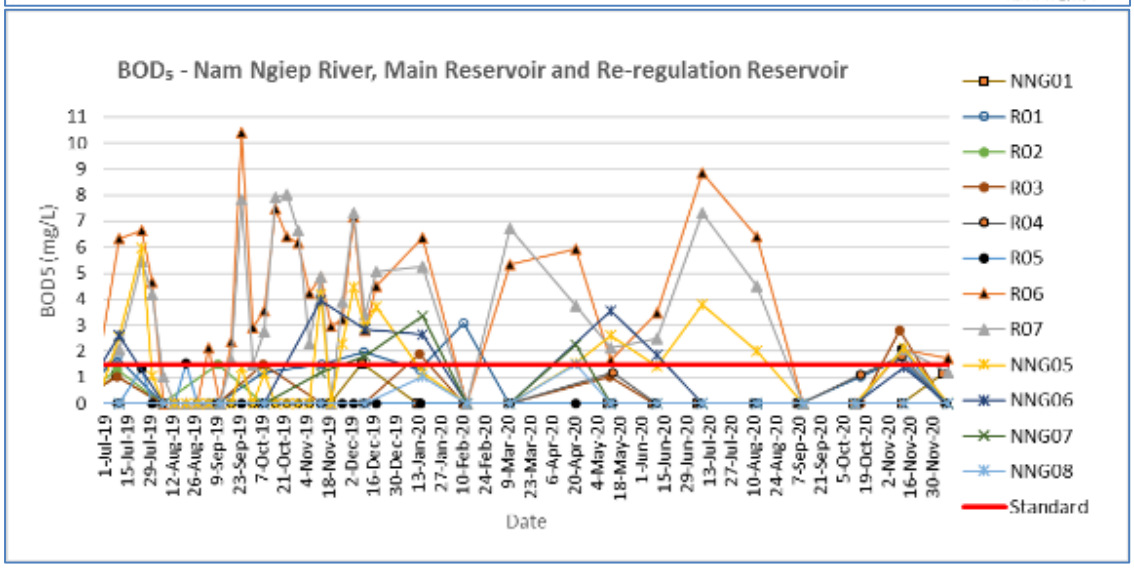
SURFACE WATER QUALITY MONITORING LOCATIONS

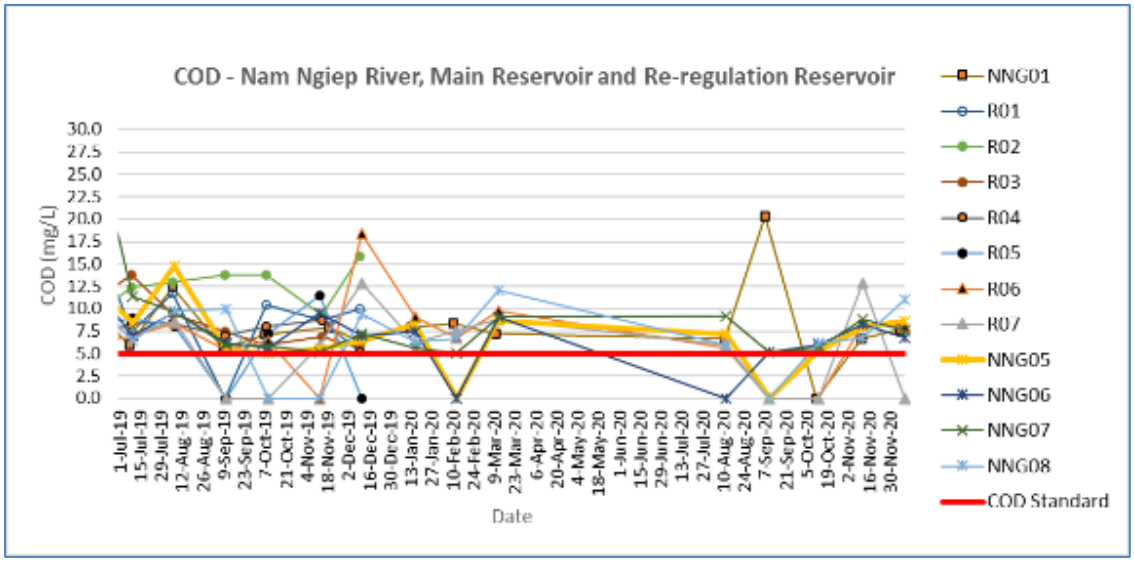


APPENDIX 4: KEY TRENDS OF WATER QUALITY MONITORING FROM JULY 2019 TO END OF DECEMBER 2020 (ONLY PARAMETERS THAT EXCEEDED THE STANDARDS)

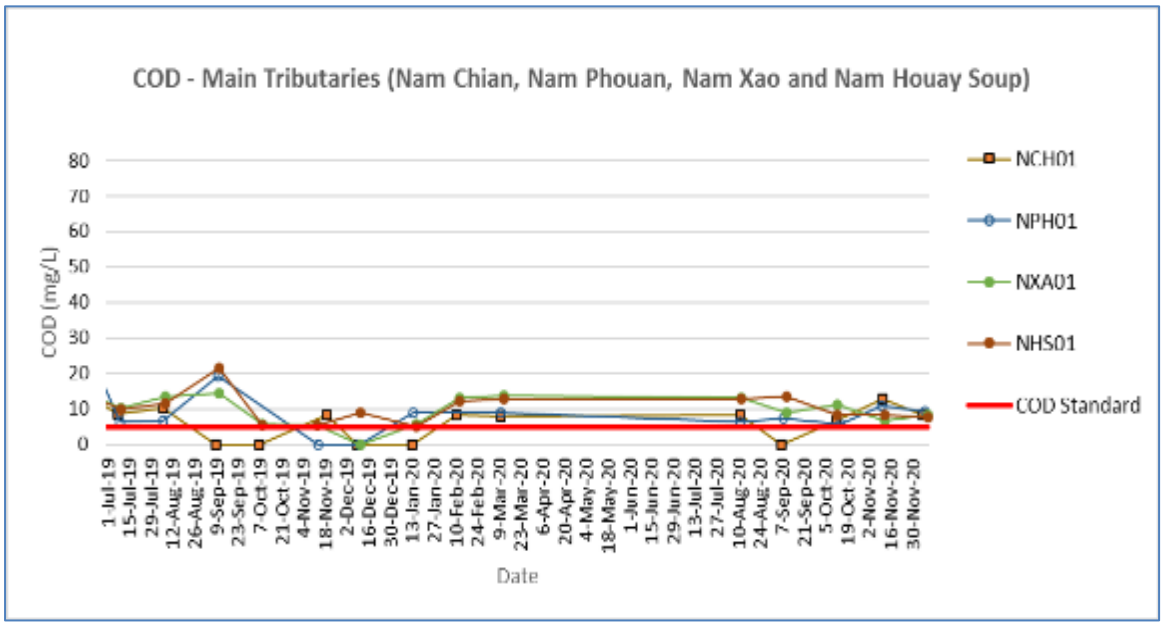
NAM NGIEP SURFACE WATER



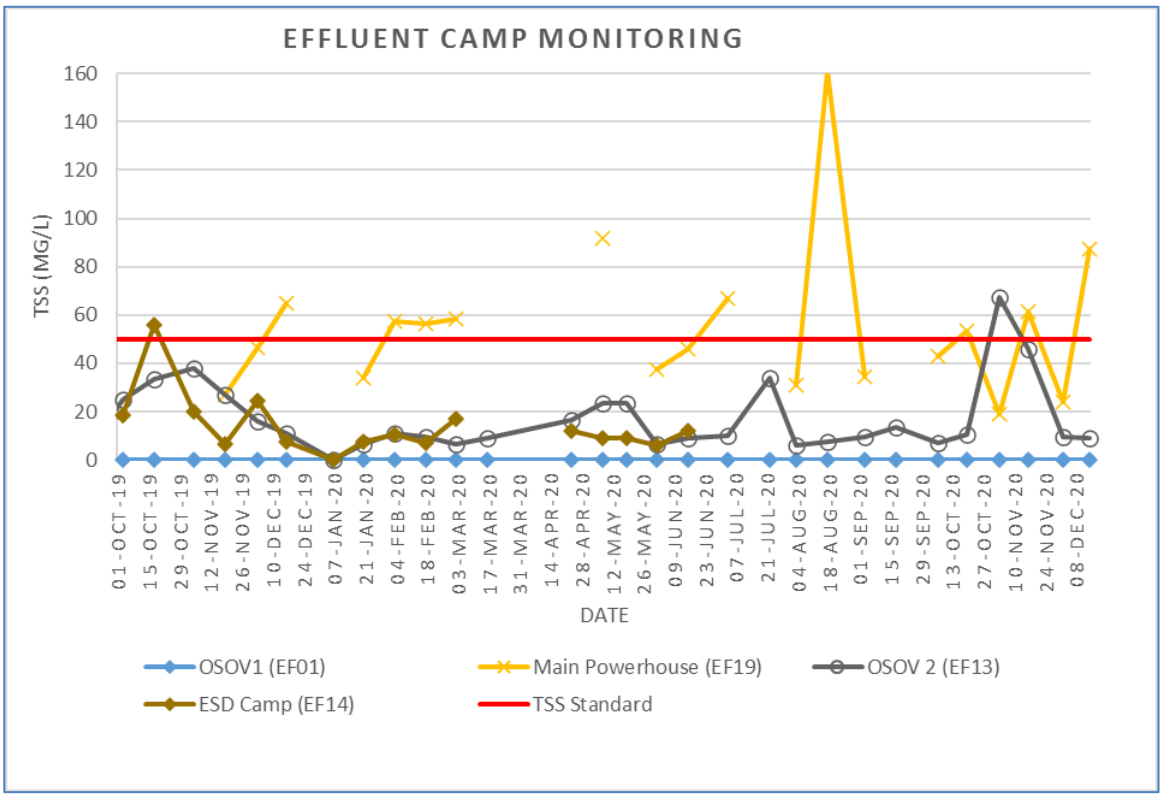


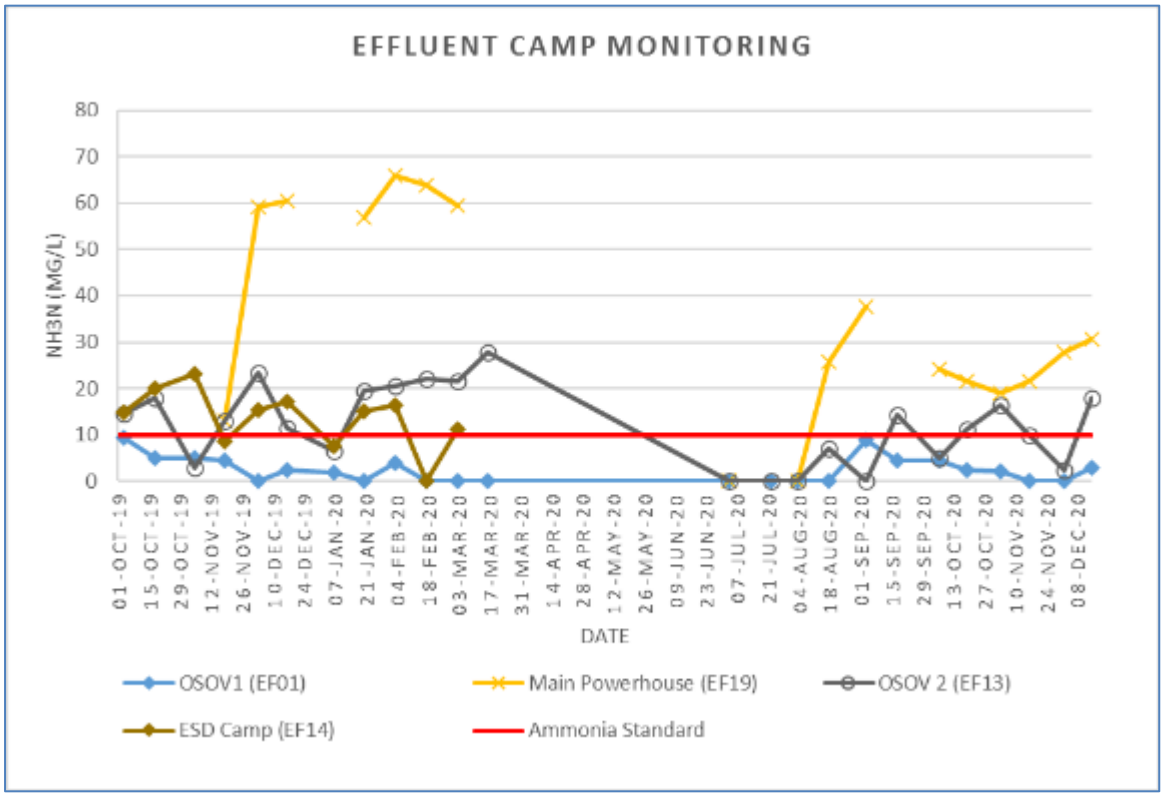


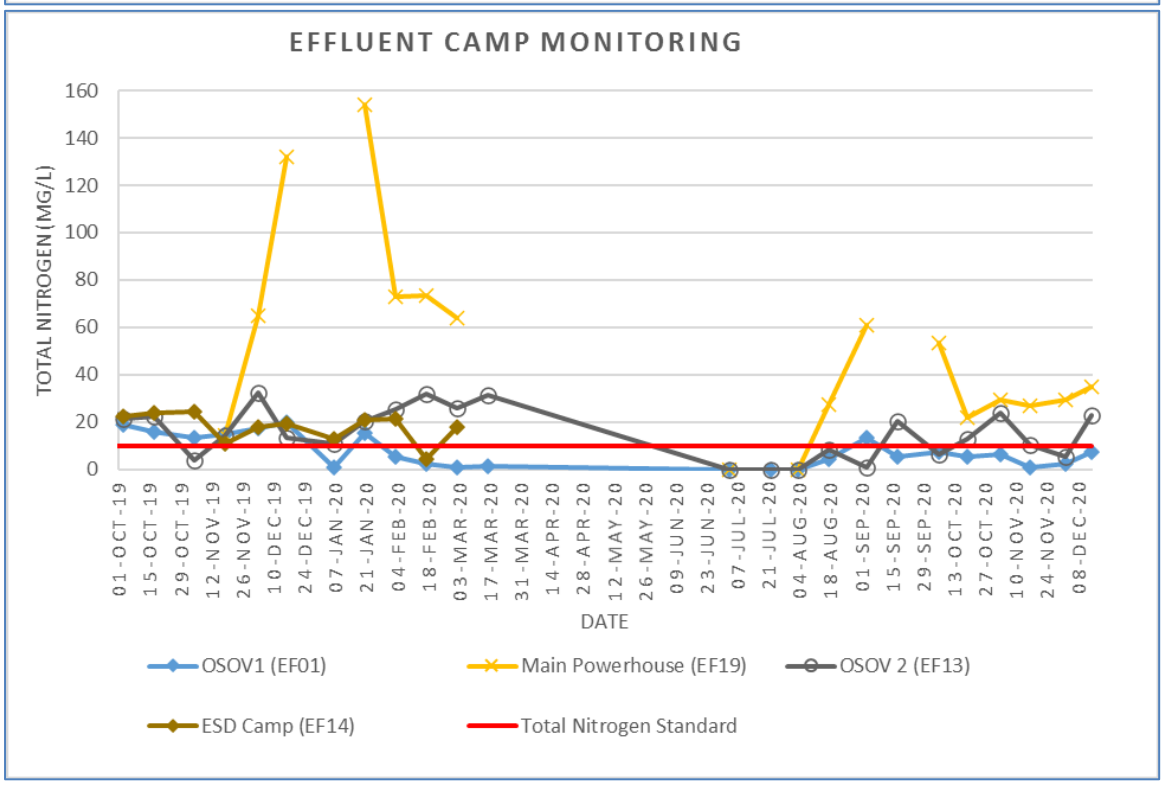
Key Water Quality Parameters for the Nam Ngiep Tributaries: Nam Chian, Nam Phouan, Nam Xao, Nam Houay Soup

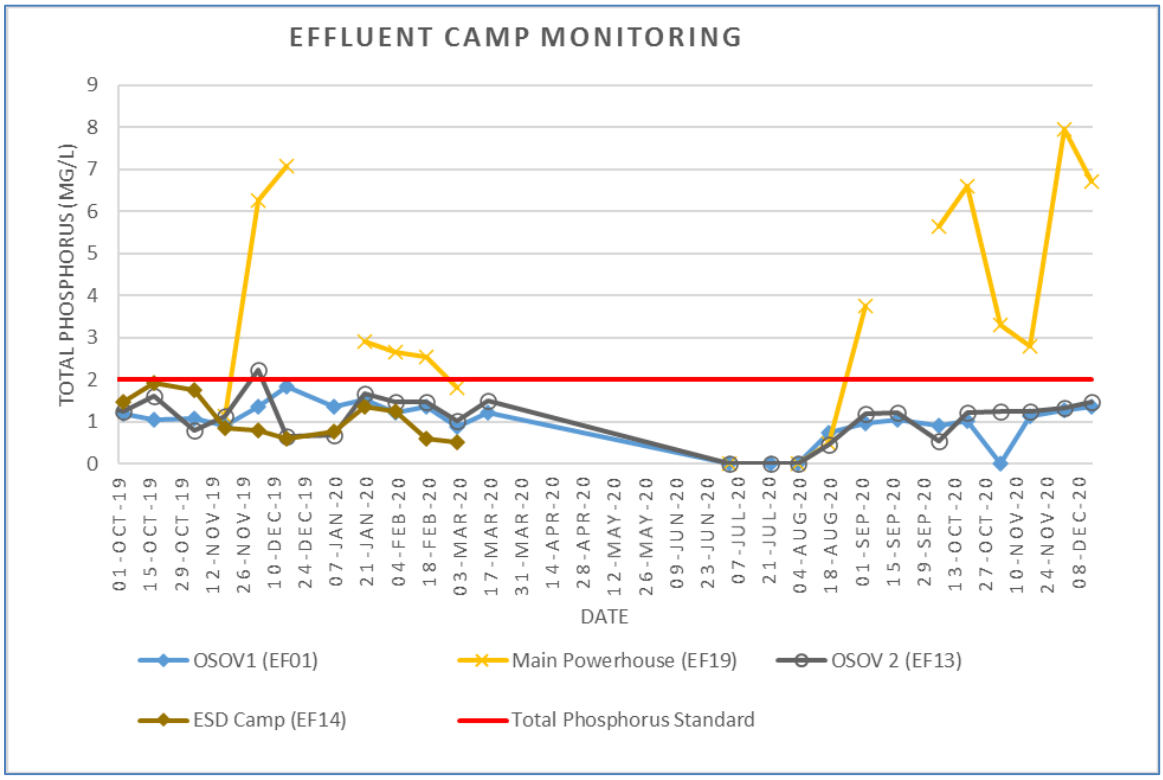


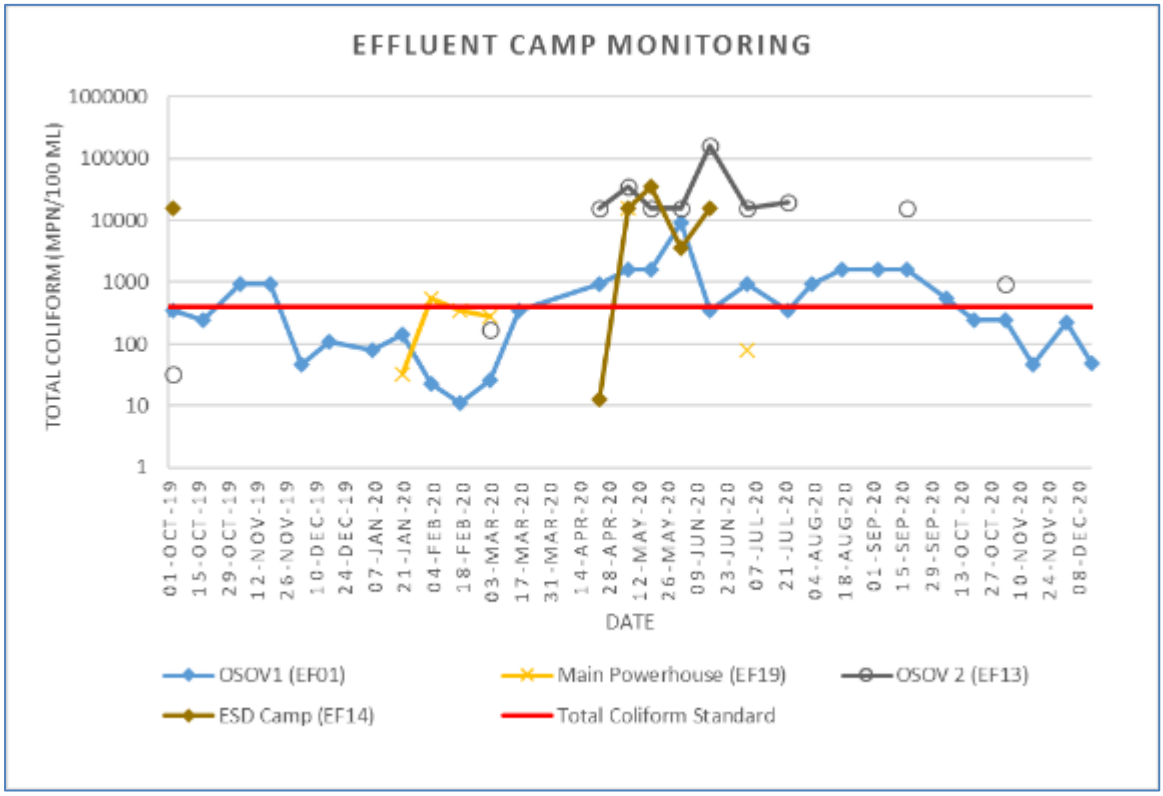
Camps' Effluent Water Quality Trends (Since October 2019 – December 2020)




EFFLUENT CAMP MONITORING
NH3N (MG/L)
80
70
60
50
40
30
20
10
0
01-OCT-19
15-OCT-19
29-OCT-19
12-NOV-19
26-NOV-19
10-DEC-19
24-DEC-19
07-JAN-20
21-JAN-20
04-FEB-20
18-FEB-20
03-MAR-20
17-MAR-20
31-MAR-20
14-APR-20
28-APR-20
12-MAY-20
26-MAY-20
09-JUN-20
23-JUN-20
07-JUL-20
21-JUL-20
04-AUG-20
18-AUG-20
01-SEP-20
15-SEP-20
29-SEP-20
13-OCT-20
27-OCT-20
10-NOV-20
24-NOV-20
08-DEC-20
DATE
OSOV1 (EF01)
Main Powerhouse (EF19)
OSOV 2 (EF13)
ESD Camp (EF14)
Ammonia Standard


EFFLUENT CAMP MONITORING
TOTAL NITROGEN (MG/L)
160
140
120
100
80
60
40
20
0
01-OCT-19
15-OCT-19
29-OCT-19
12-NOV-19
26-NOV-19
10-DEC-19
24-DEC-19
07-JAN-20
21-JAN-20
04-FEB-20
18-FEB-20
03-MAR-20
17-MAR-20
31-MAR-20
14-APR-20
28-APR-20
12-MAY-20
26-MAY-20
09-JUN-20
23-JUN-20
07-JUL-20
21-JUL-20
04-AUG-20
18-AUG-20
01-SEP-20
15-SEP-20
29-SEP-20
13-OCT-20
27-OCT-20
10-NOV-20
24-NOV-20
08-DEC-20
DATE
OSOV1 (EF01)
Main Powerhouse (EF19)
OSOV 2 (EF13)
ESD Camp (EF14)
Total Nitrogen Standard


EFFLUENT CAMP MONITORING
TOTAL PHOSPHORUS (MG/L)
0
1
2
3
4
5
6
7
8
9
01-OCT-19
15-OCT-19
29-OCT-19
12-NOV-19
26-NOV-19
10-DEC-19
24-DEC-19
07-JAN-20
21-JAN-20
04-FEB-20
18-FEB-20
03-MAR-20
17-MAR-20
31-MAR-20
14-APR-20
28-APR-20
12-MAY-20
26-MAY-20
09-JUN-20
23-JUN-20
07-JUL-20
21-JUL-20
04-AUG-20
18-AUG-20
01-SEP-20
15-SEP-20
29-SEP-20
13-OCT-20
27-OCT-20
10-NOV-20
24-NOV-20
08-DEC-20
DATE
OSOV1 (EF01)
Main Powerhouse (EF19)
OSOV 2 (EF13)
ESD Camp (EF14)
Total Phosphorus Standard


EFFLUENT CAMP MONITORING
TOTAL COLIFORM (MPN/100 ML)
1
10
100
1000
10000
100000
1000000
01-OCT-19
15-OCT-19
29-OCT-19
12-NOV-19
26-NOV-19
10-DEC-19
24-DEC-19
07-JAN-20
21-JAN-20
04-FEB-20
18-FEB-20
03-MAR-20
17-MAR-20
31-MAR-20
14-APR-20
28-APR-20
12-MAY-20
26-MAY-20
09-JUN-20
23-JUN-20
07-JUL-20
21-JUL-20
04-AUG-20
18-AUG-20
01-SEP-20
15-SEP-20
29-SEP-20
13-OCT-20
27-OCT-20
10-NOV-20
24-NOV-20
08-DEC-20
DATE
OSOV1 (EF01)
Main Powerhouse (EF19)
OSOV 2 (EF13)
ESD Camp (EF14)
Total Coliform Standard

APPENDIX 5: WATER QUALITY MONITORING DATA
APPENDIX 5-1: SURFACE WATER QUALITY MONITORING – Q4 2020

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
7-Oct-20	pH	5.0 - 9.0		7.83	7.65	7.81	7.25									7.94		
8-Oct-20	pH	5.0 - 9.0						7.57	6.54	6.46	7.11	6.89	6.84	7.22			7.59	7.84
12-Oct-20	pH	5.0 - 9.0	7.44												7.12			
13-Oct-20	pH	5.0 - 9.0							6.98	6.86	6.74	7.19	7.11	7.08			7.25	7.58
15-Oct-20	pH	5.0 - 9.0						6.25										
16-Oct-20	pH	5.0 - 9.0		7.42	7.11	7.07	6.5									8.39		
20-Oct-20	pH	5.0 - 9.0		7.78	7.68	7.56	6.95											
21-Oct-20	pH	5.0 - 9.0						6.71	6.87	6.94	7.22	7.16	7.39	7.76			7.78	7.8
27-Oct-20	pH	5.0 - 9.0		6.72	6.97	6.79	7.2											
28-Oct-20	pH	5.0 - 9.0						6.44	6.68	6.73	6.97	7.1	6.67	6.78			7.87	6.84
29-Oct-20	pH	5.0 - 9.0	6.97												7.22			
5-Nov-20	pH	5.0 - 9.0							6.63	7.68	6.67	6.61	7.13	7.22			6.72	6.85
6-Nov-20	pH	5.0 - 9.0		7.29	7.38	7.22	7.1	6.58										
10-Nov-20	pH	5.0 - 9.0		6.84	7.38	7.31										7.91		
11-Nov-20	pH	5.0 - 9.0	7.77				7.22	7.64							7.67			
12-Nov-20	pH	5.0 - 9.0							7.44	7.3	7.1	7.24	7.09	7.2			7.48	7.71
17-Nov-20	pH	5.0 - 9.0		7.25	6.42	6.91	6.99											
18-Nov-20	pH	5.0 - 9.0						6.88	6.94	7.02	6.98	6.95	7.03	7.03			7.89	6.76
23-Nov-20	pH	5.0 - 9.0	7.93												7.88			
24-Nov-20	pH	5.0 - 9.0		6.2	6.56	6.18	6.51											
25-Nov-20	pH	5.0 - 9.0						7.08	6.88	6.83	6.77	6.91	6.78	6.74			7.22	7.33
2-Dec-20	pH	5.0 - 9.0		7.22	7.16	6.92	6.88											
3-Dec-20	pH	5.0 - 9.0						6.78	6.72	6.84								

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
7-Dec-20	pH	5.0 - 9.0	7.62												8.07			
8-Dec-20	pH	5.0 - 9.0		6.89	6.72	6.65										6.99		
9-Dec-20	pH	5.0 - 9.0					6.41	6.57										
10-Dec-20	pH	5.0 - 9.0							6.94	6.98	6.85	7.15	7.19	7.29			7.52	7.66
15-Dec-20	pH	5.0 - 9.0		6.96	6.44	6.55	6.85											
16-Dec-20	pH	5.0 - 9.0						6.43	6.51	6.6	6.34	6.84	7.26	7.15			7.12	7.25
24-Dec-20	pH	5.0 - 9.0	7.37	6.81	6.88	6.79	6.69								8.31			
25-Dec-20	pH	5.0 - 9.0						6.55	6.92	6.95	7.16	6.63	7.77	7.68			7.41	6.48
7-Oct-20	Sat. DO (%)			128.5	136.4	126.1	114.7									118.2		
8-Oct-20	Sat. DO (%)							93.9	41.4	27.4	42.1	60.8	68.6	71			83.4	81
12-Oct-20	Sat. DO (%)		113.4												100.2			
13-Oct-20	Sat. DO (%)								26	35.3	46.8	53.9	68.6	78.4			81.3	81.1
15-Oct-20	Sat. DO (%)							93.1										
16-Oct-20	Sat. DO (%)			102.7	102	91.4	84.4									96.7		
20-Oct-20	Sat. DO (%)			118.6	100.9	87.6	72.2											
21-Oct-20	Sat. DO (%)							81.4	39.1	44.7	53.8	56.4	66.6	79.2			85.9	90.2
27-Oct-20	Sat. DO (%)			100	75.6	82.6	69.9											
28-Oct-20	Sat. DO (%)							85.7	43.7	31.6	44.7	50.4	82.1	81.1			90.6	91.6
29-Oct-20	Sat. DO (%)		89.5												93.5			
5-Nov-20	Sat. DO (%)								33.4	29.2	43.4	46.6	69.9	69.7			79	78.8
6-Nov-20	Sat. DO (%)			110.4	92.9	100.7	89	83.3										
10-Nov-20	Sat. DO (%)			106.2	78.2	90.5										102.2		
11-Nov-20	Sat. DO (%)		104.1				73.1	89.6							95.5			
12-Nov-20	Sat. DO (%)								36.5	19.2	30.9	35.4	60.1	68.3			86.5	79.4
17-Nov-20	Sat. DO (%)			91.8	76	78	75.8											
18-Nov-20	Sat. DO (%)							75.1	28.5	25.3	33.1	38.3	54.8	69.6			79.8	80.7

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
23-Nov-20	Sat. DO (%)		112												102.6			
24-Nov-20	Sat. DO (%)			106.1	100	100.1	94.6											
25-Nov-20	Sat. DO (%)							1024	34.8	36.3	46.1	59.9	78.7	85.7			91.9	94.6
2-Dec-20	Sat. DO (%)			86.1	63.5	88.5	85.1											
3-Dec-20	Sat. DO (%)							73.6	28.8	27.4	40.5	47.8	73.1	79.2			84.2	82.9
7-Dec-20	Sat. DO (%)		106.5												100.1			
8-Dec-20	Sat. DO (%)			87	56.8	61.9										100.6		
9-Dec-20	Sat. DO (%)						58.1	57.7										
10-Dec-20	Sat. DO (%)								46.4	48.1	60.6	61.3	78	80.8			91.2	87.8
15-Dec-20	Sat. DO (%)			110.3	60.6	88.4	75.9											
16-Dec-20	Sat. DO (%)							75.6	51.2	44.1	54.7	58.2	76.5	90.5			95.4	99.6
24-Dec-20	Sat. DO (%)		113	78.1	50.4	93.6	62.2								108.8			
25-Dec-20	Sat. DO (%)							59.5	46.3	45.2	68.8	70.8	81.1	86.7			76.9	81.4
7-Oct-20	DO (mg/L)	>6.0		9.54	10.06	9.45	8.66									10.12		
8-Oct-20	DO (mg/L)	>6.0						7.18	3.42	2.27	3.34	4.97	5.6	5.78			6.63	6.53
12-Oct-20	DO (mg/L)	>6.0	9.07												7.93			
13-Oct-20	DO (mg/L)	>6.0							2.16	2.85	3.83	4.43	5.52	6.34			6.65	6.63
15-Oct-20	DO (mg/L)	>6.0						7.26										
16-Oct-20	DO (mg/L)	>6.0		8.02	7.83	7.08	6.56									8.34		
20-Oct-20	DO (mg/L)	>6.0		9.35	7.95	6.91	5.73											
21-Oct-20	DO (mg/L)	>6.0						6.44	3.22	3.66	4.41	4.6	5.37	6.29			7.01	7.31
27-Oct-20	DO (mg/L)	>6.0		7.71	5.92	6.5	5.56											
28-Oct-20	DO (mg/L)	>6.0						6.93	3.61	2.62	3.69	4.16	6.66	6.59			7.51	7.54
29-Oct-20	DO (mg/L)	>6.0	7.77												8.38			
5-Nov-20	DO (mg/L)	>6.0							2.78	2.42	3.58	3.84	5.71	5.7			6.48	6.54
6-Nov-20	DO (mg/L)	>6.0		8.7	7.37	8.01	7.12	6.71										

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
10-Nov-20	DO (mg/L)	>6.0		8.49	6.26	7.23										9.3		
11-Nov-20	DO (mg/L)	>6.0	8.3				5.9	7.19							7.96			
12-Nov-20	DO (mg/L)	>6.0							3.07	1.62	2.61	2.94	4.96	5.6			7.23	6.8
17-Nov-20	DO (mg/L)	>6.0		7.26	6.02	6.26	6.14											
18-Nov-20	DO (mg/L)	>6.0						6.1	2.37	2.1	2.75	3.17	4.51	5.69			6.54	6.59
23-Nov-20	DO (mg/L)	>6.0	8.97												8.29			
24-Nov-20	DO (mg/L)	>6.0		8.22	7.83	7.97	7.52											
25-Nov-20	DO (mg/L)	>6.0						8.22	2.91	3.04	3.82	4.85	6.34	6.89			7.46	7.76
2-Dec-20	DO (mg/L)	>6.0		6.87	5.11	7.15	6.9											
3-Dec-20	DO (mg/L)	>6.0						6.02	2.42	2.29	3.38	4.01	6.11	6.57			7.25	7.33
7-Dec-20	DO (mg/L)	>6.0	8.96												8.52			
8-Dec-20	DO (mg/L)	>6.0		7.11	4.64	5.06										9.34		
9-Dec-20	DO (mg/L)	>6.0					4.78	4.76										
10-Dec-20	DO (mg/L)	>6.0							3.91	4.07	5.08	5.19	6.52	6.73			8.3	7.98
15-Dec-20	DO (mg/L)	>6.0		9.01	4.96	7.25	6.28											
16-Dec-20	DO (mg/L)	>6.0						6.27	4.31	3.7	4.55	4.91	6.41	7.48			8.19	8.71
24-Dec-20	DO (mg/L)	>6.0	9.29	6.54	4.17	9.1	5.18								9.26			
25-Dec-20	DO (mg/L)	>6.0						4.98	3.93	3.82	5.63	5.77	6.47	6.8			6.26	6.7
7-Oct-20	Conductivity (µs/cm)			72	66	61	60									66		
8-Oct-20	Conductivity (µs/cm)							59	64	64	63	65	68	68			83	21
12-Oct-20	Conductivity (µs/cm)		65												39.2			
13-Oct-20	Conductivity (µs/cm)								64	63	65	66	65	65			87	22

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
15-Oct-20	Conductivity (µs/cm)							58										
16-Oct-20	Conductivity (µs/cm)			76	68	62	60									62		
20-Oct-20	Conductivity (µs/cm)			76	72	63	61											
21-Oct-20	Conductivity (µs/cm)							57	64	63	65	66	65	64			94	24
27-Oct-20	Conductivity (µs/cm)			72	73	62	61											
28-Oct-20	Conductivity (µs/cm)							57	66	66	66	67	68	65			97	28
29-Oct-20	Conductivity (µs/cm)		92												30			
5-Nov-20	Conductivity (µs/cm)								67	66	66	68	67	68			103	32
6-Nov-20	Conductivity (µs/cm)			73	72	62	61	57										
10-Nov-20	Conductivity (µs/cm)			73	73	63										64		
11-Nov-20	Conductivity (µs/cm)		61.2				61	58							19.82			
12-Nov-20	Conductivity (µs/cm)								70	71	71	72	70	68			104	35
17-Nov-20	Conductivity (µs/cm)			73	74	64	61											

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
18-Nov-20	Conductivity (µs/cm)							58	71	71	71	72	71	70			105	38
23-Nov-20	Conductivity (µs/cm)		80												29.8			
24-Nov-20	Conductivity (µs/cm)			73	71	63	61											
25-Nov-20	Conductivity (µs/cm)							60	73	71	70	71	70	67			112	43
2-Dec-20	Conductivity (µs/cm)			74	72	63	61											
3-Dec-20	Conductivity (µs/cm)							59	74	71	71	72	81	72			112	42
7-Dec-20	Conductivity (µs/cm)		65.3												32.8			
8-Dec-20	Conductivity (µs/cm)			75	74	64										74		
9-Dec-20	Conductivity (µs/cm)						61	61										
10-Dec-20	Conductivity (µs/cm)								70	68	68	70	69	68			114	38
15-Dec-20	Conductivity (µs/cm)			74	74	65	62											
16-Dec-20	Conductivity (µs/cm)							62	72	70	69	71	71	70			114	44
24-Dec-20	Conductivity (µs/cm)		61.2	76	75	78	62								24.4			

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
25-Dec-20	Conductivity (µs/cm)							63	74	70	69	66	64	62			112	40
7-Oct-20	Temperature (°C)			31.02	31.44	30.46	29.87									23.27		
8-Oct-20	Temperature (°C)							29.28	24.94	24.94	25.14	25.46	25.64	25.72			27.04	26.3
12-Oct-20	Temperature (°C)		24.2												24.5			
13-Oct-20	Temperature (°C)								24.88	24.97	25.52	25.29	25.86	26.13			25.52	25.52
15-Oct-20	Temperature (°C)							28.2										
16-Oct-20	Temperature (°C)			28.38	28.96	28.72	28.3									22.67		
20-Oct-20	Temperature (°C)			27.64	27.81	27.56	27.26											
21-Oct-20	Temperature (°C)							27.37	25.18	25.39	25.29	25.66	26.31	26.52			25.62	26.1
27-Oct-20	Temperature (°C)			28.89	28.01	27.69	27.09											
28-Oct-20	Temperature (°C)							26.53	24.86	24.88	24.95	25.04	25.95	25.88			24.92	25.1
29-Oct-20	Temperature (°C)		22.31												20.8			
5-Nov-20	Temperature (°C)								24.74	24.97	25.05	25.17	25.77	25.97			25.42	24.86

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
6-Nov-20	Temperature (°C)			27.78	27.47	27.31	26.91	26.37										
10-Nov-20	Temperature (°C)			26.82	26.83	26.84										20.13		
11-Nov-20	Temperature (°C)		24.8				26.37	26.55							22.1			
12-Nov-20	Temperature (°C)								24.56	24.47	24.66	24.62	25.05	25.5			24.33	23.05
17-Nov-20	Temperature (°C)			27.35	27.26	26.66	26.2											
18-Nov-20	Temperature (°C)							26.01	24.6	24.73	24.68	24.85	25.27	25.57			25.35	24.32
23-Nov-20	Temperature (°C)		24.5												23.8			
24-Nov-20	Temperature (°C)			28.41	27.76	27.24	27.2											
25-Nov-20	Temperature (°C)							26.64	24.39	24.6	25.14	25.97	26.35	26.55			25.77	25.33
2-Dec-20	Temperature (°C)			27.02	26.46	26.32	25.99											
3-Dec-20	Temperature (°C)							25.67	24.28	24.3	24.41	24.19	24.48	24.7				
7-Dec-20	Temperature (°C)		22												21.1			
8-Dec-20	Temperature (°C)			25.86	25.94	25.42										18.97		

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
9-Dec-20	Temperature (°C)						25.1	25.12										
10-Dec-20	Temperature (°C)								24.1	24.08	24.23	23.86	24.34	24.56			19.99	19.28
15-Dec-20	Temperature (°C)			26.19	25.62	25.4	24.99											
16-Dec-20	Temperature (°C)							24.78	24.17	24.13	24.35	24.14	24.23	24.9			23	21.92
24-Dec-20	Temperature (°C)		22.8	24.45	24.96		24.48								21			
25-Dec-20	Temperature (°C)							24.27	23.63	23.75	24.5	24.6	24.8	25.2			24.7	24.1
7-Oct-20	Turbidity (NTU)			2.1	2.4	2.38	2.31									5.35		
8-Oct-20	Turbidity (NTU)							2.12	2.81	2.34	2.98	3.45	3.42	4.42			7.1	3
12-Oct-20	Turbidity (NTU)		5.29												5.71			
13-Oct-20	Turbidity (NTU)								2.96	3.12	2.97	6.82	3.32	4.89			7.41	3.83
15-Oct-20	Turbidity (NTU)							2.8										
15-Oct-20	Turbidity (NTU)-Hypolimnion							2.44										
16-Oct-20	Turbidity (NTU)			2.47	3.56	3.54	3.01									4.51		
16-Oct-20	Turbidity (NTU)-Hypolimnion					3.5	2.07											
20-Oct-20	Turbidity (NTU)			2.29	2.52	2.55	2.28											
21-Oct-20	Turbidity (NTU)							2.32	2.6	2.61	2.71	2.97	3.16	4.09			5.44	3.05
27-Oct-20	Turbidity (NTU)			2.19	2.03	2.16	1.88											

		River Name	Nam Ngiep											Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites											Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
28-Oct-20	Turbidity (NTU)							2.2	2.75	2.65	2.81	3.35	2.32	4.82			4.52	3.29
29-Oct-20	Turbidity (NTU)		4.7												4.78			
5-Nov-20	Turbidity (NTU)								2.64	3.07	25.05	9.8	8.04	5.81			4.55	11.12
6-Nov-20	Turbidity (NTU)			2.96	2.25	2.11	2.24	2.05										
10-Nov-20	Turbidity (NTU)			3.45	3.08	2.39										3.87		
10-Nov-20	Turbidity (NTU)-Hypolimnion					6.94												
11-Nov-20	Turbidity (NTU)		4.02				2.54	2.2							6.68			
11-Nov-20	Turbidity (NTU)-Hypolimnion						10.08	9.05										
12-Nov-20	Turbidity (NTU)								2.37	2.77	3.45	4.68	3.63	5.79			4.24	3.38
17-Nov-20	Turbidity (NTU)			2.33	1.26	1.9	1.79											
18-Nov-20	Turbidity (NTU)							2.01	2.69	3.13	3.87	4.24	3.17	4.93			4.68	3.82
23-Nov-20	Turbidity (NTU)		4.65												2.56			
24-Nov-20	Turbidity (NTU)			2.14	1.66	1.5	1.48											
25-Nov-20	Turbidity (NTU)							1.37	2.02	2.26	1.82	2.23	2.71	3.52			4.03	2.69
2-Dec-20	Turbidity (NTU)			2.29	2.05	2.15	1.97											
3-Dec-20	Turbidity (NTU)							1.69	2.15	2.54	2.32	2.46	2.49	3.84			3.69	3.09
7-Dec-20	Turbidity (NTU)		3.42												3.64			
8-Dec-20	Turbidity (NTU)			1.82	1.43	2.3										3.64		
8-Dec-20	Turbidity (NTU)-Hypolimnion					13.3												
9-Dec-20	Turbidity (NTU)						2.01	1.77										

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
12-Oct-20	TSS (mg/L)		6.45												6.2			
13-Oct-20	TSS (mg/L)								<5	<5	<5	<5	6.3	11			7.2	6.79
15-Oct-20	TSS (mg/L)							<5										
15-Oct-20	TSS (mg/L)-Hypolimnion							9.36										
16-Oct-20	TSS (mg/L)			<5		<5	<5									11		
16-Oct-20	TSS (mg/L)-Hypolimnion					31.89	28.11											
10-Nov-20	TSS (mg/L)		6.47	<5		<5										<5		
10-Nov-20	TSS (mg/L)-Hypolimnion					7.35												
11-Nov-20	TSS (mg/L)						<5	<5							<5			
11-Nov-20	TSS (mg/L)-Hypolimnion						<5	<5										
12-Nov-20	TSS (mg/L)								<5	<5	<5	<5	5.2	14.2			<5	<5
12-Oct-20	BOD_5 (mg/L)	<1.5	<1												<1			
13-Oct-20	BOD_5 (mg/L)	<1.5							<1	<1	<1	<1	<1	<1			<1	<1
15-Oct-20	BOD_5 (mg/L)	<1.5						<1										
15-Oct-20	BOD_5 (mg/L)-Hypolimnion							12.4										
16-Oct-20	BOD_5 (mg/L)	<1.5		1.04		<1	1.12									<1		
16-Oct-20	BOD_5 (mg/L)-Hypolimnion					11.68	11.62											
10-Nov-20	BOD_5 (mg/L)	<1.5		1.71		2.8										1.16		
10-Nov-20	BOD_5 (mg/L)-Hypolimnion					3.6												
11-Nov-20	BOD_5 (mg/L)	<1.5	<1				1.8	2.1							<1			

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
11-Nov-20	BOD_5 (mg/L)-Hypolimnion						13.9	13.72										
12-Nov-20	BOD_5 (mg/L)	<1.5							2.06	2.08	2.14	1.4	<1	<1			<1	<1
12-Oct-20	COD (mg/L)	<5.0	<5												6.6			
13-Oct-20	COD (mg/L)	<5.0							<5.0	<5.0	5.2	6	5.6	6.2			11.2	8.2
15-Oct-20	COD (mg/L)	<5.0														5.6		
10-Nov-20	COD (mg/L)	<5.0														10.8		
11-Nov-20	COD (mg/L)	<5.0	6.6												12.9			
12-Nov-20	COD (mg/L)	<5.0							8.2	12.9	8	8.2	8.8	6.8			6.8	8.4
7-Dec-20	COD (mg/L)	<5.0	7.7												8.4			
8-Dec-20	COD (mg/L)	<5.0														9.2		
10-Dec-20	COD (mg/L)	<5.0							8	<5	8.6	6.8	7.6	11			8.4	7.8
12-Oct-20	NH_3-N (mg/L)	<0.2	<0.2												<0.2			
15-Oct-20	NH_3-N (mg/L)	<0.2						<0.2								<0.2		
15-Oct-20	NH_3-N (mg/L)-Hypolimnion							0.53										
16-Oct-20	NH_3-N (mg/L)	<0.2		<0.2		<0.2	<0.2									<0.2		
16-Oct-20	NH_3-N (mg/L)-Hypolimnion					<0.2	0.99											
10-Nov-20	NH_3-N (mg/L)	<0.2		<0.2		<0.2										<0.2		
10-Nov-20	NH_3-N (mg/L)-Hypolimnion					<0.2												
11-Nov-20	NH_3-N (mg/L)	<0.2	<0.2				<0.2	<0.2							<0.2			
11-Nov-20	NH_3-N (mg/L)-Hypolimnion						0.83	0.58										
7-Dec-20	NH_3-N (mg/L)	<0.2	<0.2												<0.2			

		River Name	Nam Ngiep											Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites											Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
12-Oct-20	NO_3-N (mg/L)	<5.0	<0.02												<0.02			
15-Oct-20	NO_3-N (mg/L)	<5.0						<0.02										
15-Oct-20	NO_3-N (mg/L)-Hypolimnion							<0.02										
16-Oct-20	NO_3-N (mg/L)	<5.0		<0.02		<0.02	<0.02									<0.02		
16-Oct-20	NO_3-N (mg/L)-Hypolimnion					<0.02	<0.02											
10-Nov-20	NO_3-N (mg/L)	<5.0		<0.02		<0.02										0.04		
10-Nov-20	NO_3-N (mg/L)-Hypolimnion					0.08												
12-Oct-20	Faecal coliform (MPN/100 mL)	<1,000	220												34			
13-Oct-20	Faecal coliform (MPN/100 mL)	<1,000							0	0	5	11	33	17			220	220
15-Oct-20	Faecal coliform (MPN/100 mL)	<1,000						0										
15-Oct-20	Faecal coliform (MPN/100 mL)-Hypolimnion							0										
16-Oct-20	Faecal coliform (MPN/100 mL)	<1,000		5		920	220									220		
16-Oct-20	Faecal coliform (MPN/100 mL)-Hypolimnion					350	47											
10-Nov-20	Faecal coliform (MPN/100 mL)	<1,000		13		4.5										540		

		River Name	Nam Ngiep											Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites											Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
10-Nov-20	Faecal coliform (MPN/100 mL)-Hypolimnion					0												
11-Nov-20	Faecal coliform (MPN/100 mL)	<1,000	140				26	0							94			
11-Nov-20	Faecal coliform (MPN/100 mL)-Hypolimnion						0	0										
12-Nov-20	Faecal coliform (MPN/100 mL)	<1,000							4	33	46	110	220	920			920	540
12-Oct-20	Total Coliform (MPN/100 mL)	<5,000	920												350			
13-Oct-20	Total Coliform (MPN/100 mL)	<5,000							2	5	17	26	79	26			280	220
15-Oct-20	Total Coliform (MPN/100 mL)	<5,000						2										
15-Oct-20	Total Coliform (MPN/100 mL)-Hypolimnion							0										
16-Oct-20	Total Coliform (MPN/100 mL)	<5,000		220		920	220									350		
16-Oct-20	Total Coliform (MPN/100 mL)-Hypolimnion					1600	540											
10-Nov-20	Total Coliform (MPN/100 mL)	<5,000	11	13		5										240		

		River Name	Nam Ngiep											Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites											Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
10-Nov-20	Total Coliform (MPN/100 mL)-Hypolimnion					0												
11-Nov-20	Total Coliform (MPN/100 mL)	<5,000					0	0							33			
11-Nov-20	Total Coliform (MPN/100 mL)-Hypolimnion						0	0										
12-Nov-20	Total Coliform (MPN/100 mL)	<5,000							0	2	5	26	22	21			33	33
12-Oct-20	TKN		<1.5												<1.5			
15-Oct-20	TKN							<1.5										
15-Oct-20	TKN-Hypolimnion							<1.5										
16-Oct-20	TKN			<1.5		<1.5	<1.5									<1.5		
16-Oct-20	TKN-Hypolimnion					<1.5	<1.5											
10-Nov-20	TKN			<1.5		<1.5										<1.5		
10-Nov-20	TKN-Hypolimnion					<1.5												
11-Nov-20	TKN		<1.5				<1.5	<1.5							<1.5			
12-Oct-20	TOC (mg/L)		0.78												1.22			
13-Oct-20	TOC (mg/L)								1.19	1.18	1.12	1.08	1.07	1.19			1.18	2.12
15-Oct-20	TOC (mg/L)															1.28		
10-Nov-20	TOC (mg/L)															0.79		
11-Nov-20	TOC (mg/L)		0.9												1.06			
7-Dec-20	TOC (mg/L)		5.98												6.1			

		River Name	Nam Ngiep											Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites											Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
8-Dec-20	TOC (mg/L)															9.81		
12-Nov-20	TOC (mg/L)								0.97	1.22	1.21	1.14	1.09	1.23			1.09	1.5
10-Dec-20	TOC (mg/L)								1.22	1.3	1.15	1.07	1.18	1.26			0.93	1.48
15-Oct-20	Phytoplankton Biomass (g dry wt/m³)							2.6										
15-Oct-20	Phytoplankton Biomass (g dry wt/m³)-Hypolimnion							3.2										
16-Oct-20	Phytoplankton Biomass (g dry wt/m³)			3.6		2.8	2.2											
16-Oct-20	Phytoplankton Biomass (g dry wt/m³)-Hypolimnion					1	1.2											
10-Nov-20	Phytoplankton Biomass (g dry wt/m³)			1.6		1.4												
10-Nov-20	Phytoplankton Biomass (g dry wt/m³)-Hypolimnion					6.4												
12-Oct-20	Total Phosphorus (mg/L)		0.02												0.01			

		River Name	Nam Ngiep											Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites											Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
15-Oct-20	Total Phosphorus (mg/L)							0.08										
15-Oct-20	Total Phosphorus (mg/L)-Hypolimnion																	
16-Oct-20	Total Phosphorus (mg/L)					<0.01	<0.01									<0.01		
16-Oct-20	Total Phosphorus (mg/L)-Hypolimnion																	
10-Nov-20	Total Phosphorus (mg/L)			<0.01		<0.01										0.02		
10-Nov-20	Total Phosphorus (mg/L)-Hypolimnion					<0.01												
11-Nov-20	Total Phosphorus (mg/L)		<0.01				<0.01	<0.01							<0.01			
12-Oct-20	Total Dissolved Phosphorus (mg/L)		0.02												<0.01			

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
15-Oct-20	Total Dissolved Phosphorus (mg/L)							<0.01										
15-Oct-20	Total Dissolved Phosphorus (mg/L)-Hypolimnion							<0.01										
16-Oct-20	Total Dissolved Phosphorus (mg/L)			0.02		<0.01	<0.01									0.02		
16-Oct-20	Total Dissolved Phosphorus (mg/L)-Hypolimnion					<0.01	<0.01											
10-Nov-20	Total Dissolved Phosphorus (mg/L)			<0.01		<0.01										<0.1		
10-Nov-20	Total Dissolved Phosphorus (mg/L)-Hypolimnion					<0.01												
11-Nov-20	Total Dissolved Phosphorus (mg/L)		<0.01				<0.01	<0.01							<0.01			
16-Oct-20	Hydrogen Sulfide (mg/L)			<0.02		<0.02	<0.02											

		River Name	Nam Ngiep											Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites											Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
10-Nov-20	Hydrogen Sulfide (mg/L)			<0.02		<0.02												
10-Nov-20	Hydrogen Sulfide (mg/L)-Hypolimnion					<0.02												
11-Nov-20	Hydrogen Sulfide (mg/L)						<0.02	<0.02										
11-Nov-20	Hydrogen Sulfide (mg/L)-Hypolimnion						0.03	0.08										
9-Dec-20	Turbidity (NTU)-Hypolimnion						3.8	2.44										
10-Dec-20	Turbidity (NTU)								2.27	2.38	1.9	1.66	2.81	3.43			3.29	2.79
10-Dec-20	Turbidity (NTU)-Hypolimnion								<5	<5	<5	<5	<5	6.2			<5	<5
15-Dec-20	Turbidity (NTU)			1.85	2.27	1.85	1.77											
16-Dec-20	Turbidity (NTU)							1.85	2.83	3.08	3.01	3.59	3.03	3.23			5.21	3.41
24-Dec-20	Turbidity (NTU)		2.95	3.12	2.46	2.2	1.97								5.14			
25-Dec-20	Turbidity (NTU)							1.37	1.66	2.02	2.31	2.57	2.78	3.89			2.72	4.17
7-Dec-20	TSS (mg/L)		<5												<5			
8-Dec-20	TSS (mg/L)			<5		<5										<5		
8-Dec-20	TSS (mg/L)-Hypolimnion					28.57												
9-Dec-20	TSS (mg/L)						<5	<5										

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
9-Dec-20	TSS (mg/L)-Hypolimnion						23.65	11.01										
10-Dec-20	TSS (mg/L)								<5	<5	<5	<5	<5	6.2			<5	<5
7-Dec-20	BOD_5 (mg/L)	<1.5	1.14												1.12			
8-Dec-20	BOD_5 (mg/L)	<1.5		<1		<1										<		
8-Dec-20	BOD_5 (mg/L)-Hypolimnion					<1												
9-Dec-20	BOD_5 (mg/L)	<1.5					<1	<1										
9-Dec-20	BOD_5 (mg/L)-Hypolimnion						7.41	6.09										
10-Dec-20	BOD_5 (mg/L)	<1.5							1.74	1.18	<1	<1	<1	<1			<1	<1
7-Dec-20	Total Coliform (MPN/100 mL)	<5,000	1,600												110			
8-Dec-20	Total Coliform (MPN/100 mL)	<5,000		110		0										79		
9-Dec-20	Total Coliform (MPN/100 mL)	<5,000					0	49										
10-Dec-20	Total Coliform (MPN/100 mL)	<5,000							110	33	33	170	170	540			540	540
7-Dec-20	Faecal coliform (MPN/100 mL)	<1,000	33												17			
8-Dec-20	Faecal coliform (MPN/100 mL)	<1,000		23		0										7.8		
9-Dec-20	Faecal coliform (MPN/100 mL)	<1,000					0	0										
10-Dec-20	Faecal coliform (MPN/100 mL)	<1,000							0	0	2	34	33	79			49	170

		River Name	Nam Ngiep											Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites											Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-regulation Reservoir		Downstream			Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
8-Dec-20	NH_3-N (mg/L)	<0.2	<0.2															
8-Dec-20	NH_3-N (mg/L)	<0.2		<0.2		<0.2										<0.2		
8-Dec-20	NH_3-N (mg/L)-Hypolimnion					<0.2												
9-Dec-20	NH_3-N (mg/L)	<0.2																
9-Dec-20	NH_3-N (mg/L)	<0.2					<0.2	<0.2										
9-Dec-20	NH_3-N (mg/L)-Hypolimnion						<0.2	<0.2										
11-Nov-20	NO_3-N (mg/L)	<5.0	<0.02				<0.02	<0.02							0.03			
11-Nov-20	NO_3-N (mg/L)-Hypolimnion						<0.02	<0.02										
7-Dec-20	NO_3-N (mg/L)	<5.0	0.06												0.08			
8-Dec-20	NO_3-N (mg/L)	<5.0		<0.02		0.03										0.03		
8-Dec-20	NO_3-N (mg/L)-Hypolimnion					<0.02												
9-Dec-20	NO_3-N (mg/L)-Hypolimnion						0.04	<0.02										
11-Nov-20	TKN-Hypolimnion						<1.5	<1.5										
7-Dec-20	TKN		<1.5												<1.5			
8-Dec-20	TKN			<1.5		<1.5										<1.5		
8-Dec-20	TKN-Hypolimnion					<1.5												
9-Dec-20	TKN						<1.5	<1.5										
9-Dec-20	TKN-Hypolimnion						<1.5	<1.5										

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
11-Nov-20	Total Dissolved Phosphorus (mg/L)-Hypolimnion						<0.01	0.04										
7-Dec-20	Total Dissolved Phosphorus (mg/L)		<0.01												<0.01			
8-Dec-20	Total Dissolved Phosphorus (mg/L)			<0.01		<0.01										<0.01		
8-Dec-20	Total Dissolved Phosphorus (mg/L)-Hypolimnion					<0.01												
9-Dec-20	Total Dissolved Phosphorus (mg/L)						<0.01	<0.01										
9-Dec-20	Total Dissolved Phosphorus (mg/L)-Hypolimnion						<0.01	<0.01										
11-Nov-20	Total Phosphorus (mg/L)-Hypolimnion						<0.01	0.05										

		River Name	Nam Ngiep											Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites											Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-regulation Reservoir		Downstream			Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
7-Dec-20	Total Phosphorus (mg/L)		<0.01												<0.01			
8-Dec-20	Total Phosphorus (mg/L)			<0.01		<0.01										<0.01		
8-Dec-20	Total Phosphorus (mg/L)- Hypolimnion					<0.01												
9-Dec-20	Total Phosphorus (mg/L)						<0.01	<0.01										
9-Dec-20	Total Phosphorus (mg/L)- Hypolimnion						<0.01	<0.01										
8-Dec-20	Hydrogen Sulfide (mg/L)			<0.02		<0.02												
8-Dec-20	Hydrogen Sulfide (mg/L)- Hypolimnion					0.02												
9-Dec-20	Hydrogen Sulfide (mg/L)						<0.02	<0.02										
9-Dec-20	Hydrogen Sulfide (mg/L)- Hypolimnion						<0.02	0.02										

		River Name	Nam Ngiep												Nam Chain	Nam Phouan	Nam Xao	Nam Houay Soup
		Zone	Location Refer to Construction Sites												Location Refer to Construction Sites			
			Upstream/Main Reservoir						Re-regulation Reservoir		Downstream				Tributaries Upstream		Tributaries Downstream	
		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
11-Nov-20	Phytoplankton Biomass (g dry wt/m³)						1.4	19.2										
11-Nov-20	Phytoplankton Biomass (g dry wt/m³)-Hypolimnion						0.2	9.2										
8-Dec-20	Phytoplankton Biomass (g dry wt/m³)			0.8		0.6												
8-Dec-20	Phytoplankton Biomass (g dry wt/m³)-Hypolimnion					1												
9-Dec-20	Phytoplankton Biomass (g dry wt/m³)						0.2	0.4										
9-Dec-20	Phytoplankton Biomass (g dry wt/m³)-Hypolimnion						1.4	1.6										

APPENDIX 5-2: EFFLUENT CAMP MONITORING RESULTS – Q4 2020

		Site Name	OSOV1	OSOV 2	Main Powerhouse
		Station Code	EF01	EF13	EF19
Date	Parameter (Unit)	Guideline in the CA			
06-Oct-20	pH	6.0 - 9.0	6.93	7.84	7.54
19-Oct-20	pH	6.0 - 9.0	6.48	7.43	7.33
03-Nov-20	pH	6.0 - 9.0	7.39	6.93	7.54
16-Nov-20	pH	6.0 - 9.0	6.61	6.62	7.2
02-Dec-20	pH	6.0 - 9.0	6.7	7.6	7.42
14-Dec-20	pH	6.0 - 9.0	6.56	7.51	7.31
06-Oct-20	Sat. DO (%)		50	52.4	66.4
19-Oct-20	Sat. DO (%)		46	26.8	63.8
03-Nov-20	Sat. DO (%)		50.8	30.3	39.9
16-Nov-20	Sat. DO (%)		43.1	16.5	22.8
02-Dec-20	Sat. DO (%)		80.2	13.1	24
14-Dec-20	Sat. DO (%)		75.9	44.2	40.7
06-Oct-20	DO (mg/L)		3.62	3.84	4.91
19-Oct-20	DO (mg/L)		3.6	3.75	5.04
03-Nov-20	DO (mg/L)		3.89	2.02	2.95
16-Nov-20	DO (mg/L)		3.43	1.29	1.76
02-Dec-20	DO (mg/L)		6.51	1.06	1.83
14-Dec-20	DO (mg/L)		6.29	3.52	3.1
06-Oct-20	Conductivity (µs/cm)		306	250	808
19-Oct-20	Conductivity (µs/cm)		316	419	743
03-Nov-20	Conductivity (µs/cm)		404	351	805
16-Nov-20	Conductivity (µs/cm)		285	540	734
02-Dec-20	Conductivity (µs/cm)		342	359	769
14-Dec-20	Conductivity (µs/cm)		340	537	776
06-Oct-20	Temperature (°C)		30.5	29.7	29.4
19-Oct-20	Temperature (°C)		26.3	25.7	25.9
03-Nov-20	Temperature (°C)		27.9	27.9	29.8
16-Nov-20	Temperature (°C)		25.6	26.4	27.4
02-Dec-20	Temperature (°C)		24.7	25	28.3
14-Dec-20	Temperature (°C)		25.2	25.5	28
06-Oct-20	Turbidity (NTU)		2.7	5.39	16.58
19-Oct-20	Turbidity (NTU)		2.92	7.16	14.24
03-Nov-20	Turbidity (NTU)		2.57	16.25	6.66
16-Nov-20	Turbidity (NTU)		2.54	16.76	6.56
02-Dec-20	Turbidity (NTU)		1.39	20	7.37
14-Dec-20	Turbidity (NTU)		2.38	17.34	17.91

		Site Name	OSOV1	OSOV 2	Main Powerhouse
		Station Code	EF01	EF13	EF19
Date	Parameter (Unit)	Guideline in the CA			
06-Oct-20	TSS (mg/L)	<50	<5	7.11	43.18
19-Oct-20	TSS (mg/L)	<50	<5	10.45	53.62
03-Nov-20	TSS (mg/L)	<50	<5	67.13	18.97
16-Nov-20	TSS (mg/L)	<50	<5	45.81	61.17
02-Dec-20	TSS (mg/L)	<50	<5	9.34	23.96
14-Dec-20	TSS (mg/L)	<50	<5	9.09	87.09
06-Oct-20	BOD_5 (mg/L)	<30	6.39	<6	<6
19-Oct-20	BOD_5 (mg/L)	<30	10.62	<6	<6
03-Nov-20	BOD_5 (mg/L)	<30	<6	21.24	<6
16-Nov-20	BOD_5 (mg/L)	<30	7.26	<6	<6
02-Dec-20	BOD_5 (mg/L)	<30	<6	<6	<6
14-Dec-20	BOD_5 (mg/L)	<30	<6	24.48	<6
06-Oct-20	COD (mg/L)	<125	<25	<25	117
19-Oct-20	COD (mg/L)	<125	<25	59.8	102
03-Nov-20	COD (mg/L)	<125	<25	43.8	36.8
16-Nov-20	COD (mg/L)	<125	<25	52.4	54.9
02-Dec-20	COD (mg/L)	<125	<25	47.2	51.6
14-Dec-20	COD (mg/L)	<125	<25	93.3	116
06-Oct-20	NH_3-N (mg/L)	<10.0	4.5	5.1	24.1
19-Oct-20	NH_3-N (mg/L)	<10.0	2.3	11.3	21.5
03-Nov-20	NH_3-N (mg/L)	<10.0	2.2	16.3	18.9
16-Nov-20	NH_3-N (mg/L)	<10.0	<2	9.8	21.5
02-Dec-20	NH_3-N (mg/L)	<10.0	<2	2.3	27.9
14-Dec-20	NH_3-N (mg/L)	<10.0	2.8	18	30.7
06-Oct-20	Total Nitrogen (mg/L)	<10.0	7.39	6.2	53.6
19-Oct-20	Total Nitrogen (mg/L)	<10.0	5.41	12.8	22
03-Nov-20	Total Nitrogen (mg/L)	<10.0	6.2	24	29.5
16-Nov-20	Total Nitrogen (mg/L)	<10.0	1.02	10.5	27.1
02-Dec-20	Total Nitrogen (mg/L)	<10.0	2.39	5.41	29.3
14-Dec-20	Total Nitrogen (mg/L)	<10.0	7.33	23	34.7
06-Oct-20	Total Phosphorus (mg/L)	<2	0.91	0.54	5.64
19-Oct-20	Total Phosphorus (mg/L)	<2	1.01	1.21	6.59
03-Nov-20	Total Phosphorus (mg/L)	<2	<1	1.24	3.31
16-Nov-20	Total Phosphorus (mg/L)	<2	1.15	1.24	2.8
02-Dec-20	Total Phosphorus (mg/L)	<2	1.29	1.33	7.94
14-Dec-20	Total Phosphorus (mg/L)	<2	1.36	1.47	6.72
06-Oct-20	Faecal Coliform (MPN/100 mL)	<400	27	0	0

		Site Name	OSOV1	OSOV 2	Main Powerhouse
		Station Code	EF01	EF13	EF19
Date	Parameter (Unit)	Guideline in the CA			
19-Oct-20	Faecal Coliform (MPN/100 mL)	<400	14	0	0
03-Nov-20	Faecal Coliform (MPN/100 mL)	<400	0	920	0
16-Nov-20	Faecal Coliform (MPN/100 mL)	<400	6.8	0	0
02-Dec-20	Faecal Coliform (MPN/100 mL)	<400	22	0	0
14-Dec-20	Faecal Coliform (MPN/100 mL)	<400	17	0	0
06-Oct-20	Total coliform (MPN/100 mL)	<400	540	0	0
19-Oct-20	Total coliform (MPN/100 mL)	<400	240	0	0
03-Nov-20	Total coliform (MPN/100 mL)	<400	240	920	0
16-Nov-20	Total coliform (MPN/100 mL)	<400	47	0	0
02-Dec-20	Total coliform (MPN/100 mL)	<400	220	0	0
14-Dec-20	Total coliform (MPN/100 mL)	<400	49	0	0
06-Oct-20	Oil & Grease (mg/L)	<10.0	<1	<1	<1
19-Oct-20	Oil & Grease (mg/L)	<10.0			
03-Nov-20	Oil & Grease (mg/L)	<10.0	1.02	5	<1
16-Nov-20	Oil & Grease (mg/L)	<10.0			
02-Dec-20	Oil & Grease (mg/L)	<10.0	<1	<1	<1
14-Dec-20	Oil & Grease (mg/L)	<10.0			
06-Oct-20	Residual Chlorine (mg/L)	<1.0		0.42	1.1
19-Oct-20	Residual Chlorine (mg/L)	<1.0		0.88	1.28
03-Nov-20	Residual Chlorine (mg/L)	<1.0		0.08	2.2
16-Nov-20	Residual Chlorine (mg/L)	<1.0		1.05	1.1
02-Dec-20	Residual Chlorine (mg/L)	<1.0		0.87	1.61
14-Dec-20	Residual Chlorine (mg/L)	<1.0		0.82	1.01
06-Oct-20	Chlorination Dosing Rate (mL/mn)		n/a	32	225
19-Oct-20	Chlorination Dosing Rate (mL/mn)		n/a	28	475
03-Nov-20	Chlorination Dosing Rate (mL/mn)		n/a	10	250
16-Nov-20	Chlorination Dosing Rate (mL/mn)		n/a	18	250
02-Dec-20	Chlorination Dosing Rate (mL/mn)		n/a	30	350
14-Dec-20	Chlorination Dosing Rate (mL/mn)		n/a	0.33	350
06-Oct-20	Effluent Discharge Volume (L/mn)		6	3	1000
19-Oct-20	Effluent Discharge Volume (L/mn)		6	4	1900

		Site Name	OSOV1	OSOV 2	Main Powerhouse
		Station Code	EF01	EF13	EF19
Date	Parameter (Unit)	Guideline in the CA			
03-Nov-20	Effluent Discharge Volume (L/mn)		6	8	1000
16-Nov-20	Effluent Discharge Volume (L/mn)		6	2	1000
02-Dec-20	Effluent Discharge Volume (L/mn)		7.5	4	1400
14-Dec-20	Effluent Discharge Volume (L/mn)		4	1.5	1400

APPENDIX 5-3: GROUNDWATER QUALITY MONITORING RESULTS – Q4 2020

		Site Name	Phouhomxay Village		Somseun Village	Nampa Village	ThongNoy Village	Pou Village
Month Year	Parameter (Unit)	Station	GPHX01	GPHX02	GSXN01	GNPA01	GTHN01	GPOU01
		Guideline						
12-Oct-20	pH	6.5 - 9.2						7.73
26-Oct-20	pH	6.5 - 9.2	8.43	8.5	7.64	7.83	7.08	
19-Nov-20	pH	6.5 - 9.2			7.09	6.98	6.55	7.73
20-Nov-20	pH	6.5 - 9.2	6.83	6.92				
07-Dec-20	pH	6.5 - 9.2						7.96
18-Dec-20	pH	6.5 - 9.2	7.33	7.4	7.5	7.64	7.55	
12-Oct-20	Sat. DO (%)							91.6
26-Oct-20	Sat. DO (%)		41.1	38.8	69.6	77.2	31.6	
19-Nov-20	Sat. DO (%)				77.9	84.2	59.3	95.7
20-Nov-20	Sat. DO (%)		33	34.9				
07-Dec-20	Sat. DO (%)							85.5
18-Dec-20	Sat. DO (%)		48.7	29.6	58.9	95.8	43.5	
12-Oct-20	DO (mg/l)							7.01
26-Oct-20	DO (mg/l)		3.84	3.66	5.63	6.34	2.54	
19-Nov-20	DO (mg/l)				6.3	6.81	4.75	7.97
20-Nov-20	DO (mg/l)		2.68	2.87				
07-Dec-20	DO (mg/l)							6.96
18-Dec-20	DO (mg/l)		4.08	2.53	4.69	7.56	3.44	
12-Oct-20	Conductivity (µS/cm)							26.3
26-Oct-20	Conductivity (µS/cm)		430	470	328	415	383	
19-Nov-20	Conductivity (µS/cm)				295	430	397	28
20-Nov-20	Conductivity (µS/cm)		400	396				
07-Dec-20	Conductivity (µS/cm)							17.84
18-Dec-20	Conductivity (µS/cm)		199	407	229	296	274	
12-Oct-20	Temperature (°C)							26.5
26-Oct-20	Temperature (°C)		18.82	18.39	26.14	25.43	26.88	
19-Nov-20	Temperature (°C)				26.06	26.23	26.71	24.45
20-Nov-20	Temperature (°C)		25.81	25.33				
07-Dec-20	Temperature (°C)							23.9

Month Year	Parameter (Unit)	Site Name	Phouhomxay Village		Somseun Village	Nampa Village	ThongNoy Village	Pou Village
		Station	GPHX01	GPHX02	GSXN01	GNPA01	GTHN01	GPOU01
		Guideline						
18-Dec-20	Temperature (°C)		24.73	23.6	25.8	26.3	26.2	
12-Oct-20	Turbidity (NTU)	<20						10.46
26-Oct-20	Turbidity (NTU)	<20	1.9	1.87	1.91	2.49	1.77	
19-Nov-20	Turbidity (NTU)	<20			2.09	1.65	1.78	2.68
20-Nov-20	Turbidity (NTU)	<20	2.93	3.12				
07-Dec-20	Turbidity (NTU)	<20						2.84
18-Dec-20	Turbidity (NTU)	<20	3.2	1.59	1.42	1.65	1.34	
12-Oct-20	Fecal coliform (MPN/100ml)	0						0
26-Oct-20	Fecal coliform (MPN/100ml)	0	0	0	7.8	17	49	
19-Nov-20	Fecal coliform (MPN/100ml)	0			4.5	2	140	0
20-Nov-20	Fecal coliform (MPN/100ml)	0	0	0				
07-Dec-20	Fecal coliform (MPN/100ml)	0						0
18-Dec-20	Fecal coliform (MPN/100ml)	0	0	0	0	0	540	
12-Oct-20	E.coli Bacteria (MPN/100ml)	0						0
26-Oct-20	E.coli Bacteria (MPN/100ml)	0	0	0	7.8	9.3	22	
19-Nov-20	E.coli Bacteria (MPN/100ml)	0			2	0	79	0
20-Nov-20	E.coli Bacteria (MPN/100ml)	0	0	0				
07-Dec-20	E.coli Bacteria (MPN/100ml)	0						0
18-Dec-20	E.coli Bacteria (MPN/100ml)	0	0	0	0	0	540	

APPENDIX 5-4: GRAVITY FED WATER SUPPLY MONITORING RESULTS – Q4 2020

		Site Name	Thaheua Village	Hat Gnuin Village	Phouhomxay Village	
		Station	WTHH02	WHGN02	WPHX02	WPHX03
Date	Parameter (Unit)	Guideline				
26-Oct-20	pH	6.5 - 8.5	8.46	8.82	7.38	7.85
19-Nov-20	pH	6.5 - 8.5	7.91	7.77		
20-Nov-20	pH	6.5 - 8.5			7.27	7.16
18-Dec-20	pH	6.5 - 8.5	8.02	7.78	7.85	7.69
26-Oct-20	Sat. DO (%)		72.7	93.3	66.9	53.7
19-Nov-20	Sat. DO (%)		105.1	96.4		
20-Nov-20	Sat. DO (%)				71.8	70.9
18-Dec-20	Sat. DO (%)		91.1	89.4	79.2	77.4
26-Oct-20	DO (mg/L)		5.94	7.76	5.48	4.47
19-Nov-20	DO (mg/L)		8.14	7.89		
20-Nov-20	DO (mg/L)				5.79	5.84
18-Dec-20	DO (mg/L)		7.82	7.79	6.74	6.56
26-Oct-20	Conductivity (µS/cm)	<1,000	47	62	385	380
19-Nov-20	Conductivity (µS/cm)	<1,000	59	76		
20-Nov-20	Conductivity (µS/cm)	<1,000			392	387
18-Dec-20	Conductivity (µS/cm)	<1,000	55	97	117	99
26-Oct-20	Temperature (°C)	<35	25.77	24.71	25.51	24.47
19-Nov-20	Temperature (°C)	<35	28.64	25.37		
20-Nov-20	Temperature (°C)	<35			26.2	25.18
18-Dec-20	Temperature (°C)	<35	23	22.18	23.5	23.66
26-Oct-20	Turbidity (NTU)	<10	2.15	2.62	2.63	1.85
19-Nov-20	Turbidity (NTU)	<10	3.38	2.09		
20-Nov-20	Turbidity (NTU)	<10			2.41	2.89
18-Dec-20	Turbidity (NTU)	<10	1.75	2.26	1.42	1.56
26-Oct-20	Faecal Coliform (MPN/100 mL)	0	8	13	0	0
19-Nov-20	Faecal Coliform (MPN/100 mL)	0	79	27		
20-Nov-20	Faecal Coliform (MPN/100 mL)	0			0	0

		Site Name	Thaheua Village	Hat Gnuin Village	Phouhomxay Village	
		Station	WTHH02	WHGN02	WPHX02	WPHX03
Date	Parameter (Unit)	Guideline				
18-Dec-20	Faecal Coliform (MPN/100 mL)	0	8	280	49	27
26-Oct-20	E.coli Bacteria (MPN/100 mL)	0	8	13	0	0
19-Nov-20	E.coli Bacteria (MPN/100 mL)	0	27	17		
20-Nov-20	E.coli Bacteria (MPN/100 mL)	0			0	0
18-Dec-20	E.coli Bacteria (MPN/100 mL)	0	8	280	49	27

APPENDIX 5-5: LANDFILL LEACHATE MONITORING RESULTS – Q4 2020

		Site Name	NNP1 Landfill Leachate					Houay Soup Landfill	
		Location	Pond No.01	Pond No.02	Pond No.03	Pond No.04	Discharge Point	Last pond	Discharged Point
		Station	LL1	LL2	LL3	LL4	LL5	LL6	LL7
Date	Parameter (Unit)	Guideline							
6-Oct-20	pH	6.0-9.0				8.94		8.86	
3-Nov-20	pH	6.0-9.0				8.38		8.96	
2-Dec-20	pH	6.0-9.0				8.76		8.74	
6-Oct-20	Sat. DO (%)					124.8		139.5	
3-Nov-20	Sat. DO (%)					110.3		227.4	
2-Dec-20	Sat. DO (%)					106.9		109.2	
6-Oct-20	DO (mg/L)					8.74		9.81	
3-Nov-20	DO (mg/L)					8.26		16.86	
2-Dec-20	DO (mg/L)					8.42		8.59	
6-Oct-20	Conductivity (µS/cm)					32.5		133	
3-Nov-20	Conductivity (µS/cm)					46		123.9	
2-Dec-20	Conductivity (µS/cm)					46.6		126.2	
6-Oct-20	Temperature (°C)					31.4		31.1	
3-Nov-20	Temperature (°C)					29		29.6	
2-Dec-20	Temperature (°C)					26.3		26.3	
6-Oct-20	Turbidity (NTU)					7.43		9.27	
3-Nov-20	Turbidity (NTU)					10.59		19.17	
2-Dec-20	Turbidity (NTU)					4.02		21.24	
6-Oct-20	BOD5 (mg/L)	<30				6.36		<6	
3-Nov-20	BOD5 (mg/L)	<30				8.7		11.7	
2-Dec-20	BOD5 (mg/L)	<30				<6		18	
6-Oct-20	COD (mg/L)	<125				29.4		33.4	
3-Nov-20	COD (mg/L)	<125				41.4		60.6	
2-Dec-20	COD (mg/L)	<125				36.1		67.8	
6-Oct-20	Faecal Coliform (MPN/100mL)	<400				0		2	
3-Nov-20	Faecal Coliform (MPN/100mL)	<400				0		0	
2-Dec-20	Faecal Coliform (MPN/100mL)	<400				0		4	
6-Oct-20	Total Coliform (MPN/100mL)	<400				33		79	

		Site Name	NNP1 Landfill Leachate					Houay Soup Landfill	
		Location	Pond No.01	Pond No.02	Pond No.03	Pond No.04	Discharge Point	Last pond	Discharged Point
		Station	LL1	LL2	LL3	LL4	LL5	LL6	LL7
Date	Parameter (Unit)	Guideline							
3-Nov-20	Total Coliform (MPN/100mL)	<400				920		5	
2-Dec-20	Total Coliform (MPN/100mL)	<400				23		17	
6-Oct-20	Total nitrogen (mg/L)	<10				0.90		2.64	
3-Nov-20	Total nitrogen (mg/L)	<10				0.61		0.88	
2-Dec-20	Total nitrogen (mg/L)	<10				0.81		1.06	
6-Oct-20	Lead (mg/L)	<0.2				<0.01		<0.01	
3-Nov-20	Lead (mg/L)	<0.2				<0.01		<0.01	
2-Dec-20	Lead (mg/L)	<0.2				<0.01		<0.01	
6-Oct-20	Copper (mg/L)					<0.006		<0.006	
3-Nov-20	Copper (mg/L)					<0.006		<0.006	
2-Dec-20	Copper (mg/L)					<0.006		<0.006	
6-Oct-20	Iron (mg/L)					0.202		0.169	
3-Nov-20	Iron (mg/L)					0.545		0.418	
2-Dec-20	Iron (mg/L)					0.118		1.16	
6-Oct-20	Ammonia nitrogen (mg/L)	<10				<2		1.80	
3-Nov-20	Ammonia nitrogen (mg/L)	<10				<2		<2	
2-Dec-20	Ammonia nitrogen (mg/L)	<10				<2		<2	
6-Oct-20	Oil & Grease (mg/L)	<10				<1		<1	
3-Nov-20	Oil & Grease (mg/L)	<10							
2-Dec-20	Oil & Grease (mg/L)	<10				<1		<1	