



**NAM NGIEP 1
POWER COMPANY**

Nam Ngiep 1 Hydropower Project

Quarterly Environment Monitoring Report Fourth Quarter of 2019

October to December 2019

A	5 August 2020				Final
A1	14 July 2020				2 nd draft sent to ADB for review
A0	29 April 2020	Hendra WINASTU Khamstone SAYSOMPHOU	Peter G JENSEN	Khamlar PHONSAVAT	1 st draft sent to LTA for review
REV	DATE	AUTHOR	CHECKED	APPROVED	MODIFICATION DETAILS
Accessibility		Document No. NNP1-C-J0905-RP-020-A			
<input checked="" type="checkbox"/>	Public				
<input type="checkbox"/>	Internal				
<input type="checkbox"/>	Confidential				

This document is NNP1 property and shall not be used, reproduced, transmitted and/or disclosed without prior permission.

TABLE OF CONTENTS

1	EXECUTIVE SUMMARY	7
2	INTRODUCTION	9
3	WORK PROGRESS OF PRINCIPAL CONTRACTORS	9
3.1	CIVIL WORK	10
3.2	MAIN QUARRY	10
3.3	ELECTRICAL AND MECHANICAL WORKS	11
3.4	HYDRO-MECHANICAL WORKS	12
4	OPERATION AND MAINTENANCE	13
4.1	Operation	13
5	ENVIRONMENTAL MANAGEMENT AND MONITORING	17
5.1	Contractor SS-ESMMPs	17
5.2	Results of Compliance Inspections at Construction Sites	18
5.3	WASTE MANAGEMENT AT THE CONSTRUCTION SITES	20
5.3.1	<i>General Waste Management</i>	<i>20</i>
5.3.2	<i>Hazardous Waste Management.....</i>	<i>21</i>
5.3.3	<i>Sewage Sludge Disposal</i>	<i>21</i>
5.4	COMMUNITY WASTE MANAGEMENT SUPPORT	21
5.4.1	<i>Animal Fodder (Pig Feed) Collection Programme.....</i>	<i>21</i>
5.4.2	<i>Community Solid Waste Management and Recycling Programme</i>	<i>22</i>
5.4.3	<i>Houay Soup Landfill</i>	<i>23</i>
5.5	MAIN RESERVOIR OPERATIONS	23
5.6	ENVIRONMENTAL MONITORING	28
5.6.1	<i>Surface Water (River) Quality.....</i>	<i>28</i>
5.6.2	<i>Compliance Monitoring of Effluents from Camps</i>	<i>35</i>
5.6.3	<i>Compliance Monitoring of Discharges from Construction Sites.....</i>	<i>41</i>
5.6.4	<i>Groundwater Quality Monitoring.....</i>	<i>42</i>
5.6.5	<i>Gravity Fed Water Supply (GFWS) System Monitoring</i>	<i>44</i>
5.6.6	<i>Landfill Leachate Monitoring.....</i>	<i>45</i>
5.6.7	<i>Air Quality (Dust) Monitoring</i>	<i>46</i>
6	WATERSHED AND BIODIVERSITY MANAGEMENT	48
6.1	WATERSHED MANAGEMENT	48
6.1.1	<i>Implementation of Watershed Management Plan</i>	<i>48</i>
6.2	BIODIVERSITY OFFSET MANAGEMENT.....	49

6.2.1 Implementation of Biodiversity Offset Management Plan.....	49
7 BIOMASS CLEARANCE / FLOATING DEBRIS REMOVAL.....	54
8 FISHERY MONITORING.....	54
APPENDICES.....	60
APPENDIX 1: STATUS OF SS-ESMMPs REVIEW AND APPROVAL DURING Q4 2019	61
APPENDIX 2: ENVIRONMENTAL MONITORING CORRECTIVE ACTIONS Q4-2019	64
APPENDIX 3: CODES AND LOCATIONS OF THE SURFACE WATER QUALITY MONITORING STATIONS.....	74
APPENDIX 4: KEY TRENDS OF WATER QUALITY MONITORING FROM JULY 2018 TO END OF DECEMBER 2019 (ONLY PARAMETERS THAT EXCEEDED GUIDELINE STANDARDS)	75
APPENDIX 5: WATER QUALITY MONITORING DATA	80
APPENDIX 5-1:SURFACE WATER QUALITY MONITORING – Q4 2019	80
APPENDIX 5-2:EFFLUENT CAMP MONITORING RESULTS – Q4 2019	98
APPENDIX 5-3:EFFLUENT CONSTRUCTION AREA DISCHARGED MONITORING RESULTS – Q4 2019	104
APPENDIX 5-4:GROUNDWATER QUALITY MONITORING RESULTS – Q4 2019	105
APPENDIX 5-5: GRAVITY FED WATER SUPPLY MONITORING RESULTS – Q4 2019.....	108
APPENDIX 5-6:LANDFILL LEACHATE MONITORING RESULTS – Q4 2019	109

TABLE OF TABLES

Table 3-1: Summary progress of Minor Outstanding Work and Defects at 31 December 2019	10
Table 5-1: Document reviewed during Q4 2019	17
Table 5-2: Status of non-compliance report during Q4 2019	19
Table 5-3: Amounts of recyclables sold during Q4 2019	20
Table 5-4: Hazardous waste recorded during Q4 2019	21
Table 5-5: Amount of food waste collected by local villagers for use as pig feed during Q4 2019	22
Table 5-6: Amounts of recyclables sold at the Community Recycle Waste Bank.....	22
Table 5-7: River depth measurements in Nam Ngiep downstream the re-regulation dam	26
Table 5-8: DO results of the surface water in the main reservoir, re-regulation reservoir, Nam Ngiep and its main tributaries monitored from October to December 2019	31

Table 5-9: Ammonia Nitrogen results for the surface water in Nam Ngiep and its main tributaries monitored in Q4 2019.....	33
Table 5-10: BOD₅ results of the surface water in Nam Ngiep and its main tributaries monitored from October to December 2019.....	33
Table 5-11: COD results for surface water in Nam Ngiep and its main tributaries during Q4 2019	34
Table 5-12: Results of faecal coliforms in Nam Ngiep and its main tributaries in Q4 2019 (MPN/100 ml faecal coliform bacteria).....	34
Table 5-13: Results of total coliforms in Nam Ngiep and its main tributaries in Q4 2019 ...	35
Table 5-14: Results of effluent water quality monitoring of the camps in Q4 2019	37
Table 5-15: Compliance status of effluent discharge from the camps in Q4 2019.....	39
Table 5-16: Results of the construction area discharge monitoring in Q4 2019.....	42
Table 5-17: Compliance status of effluent discharge and corrective action during Q4 2019	42
Table 5-18: The GFWS monitoring result in Q4 2019	45
Table 5-19: Results of air quality (dust) monitoring at the host villages during October to December 2019	47
Table 5-20: Dust monitoring results at key Project sites during October to December 2019	48
Table 6-1: List of wildlife recorded from direct observation in Q4 2019	52
Table 8-1: Fish Species dominating the Fish Catch in Q4 2019	54
Table 8-2: Threatened and Near Threatened Species of the Fish Catch in Q4 2019	55
Table 8-3: Occurrence of Threatened and Near Threatened Species in the Fish Catch	56
Table 8-4: Total fish catch in Q4 by the Upstream (Excluding Zone 2LR), Downstream and Mekong Control Group Fishing Households.....	57
Table 8-5: Median household fish catch per fishing day in Q4 2015, Q4 2016, Q4 2017, Q4 2018 and Q4 2019.....	58
Table 8-6: Results of one-way ANOVA tests on mean household fish catch in Q4	59

TABLE OF FIGURES

Figure 3-1: Quarry Area View.....	10
Figure 3-2: Joint inspection of oil leakage inside turbine pit.....	12
Figure 3-3: Oil leakage was found on thrust bearing bracket and turbine guide bearing cover	12
Figure 3-4: Main shaft levelling check for Unit 1.....	12
Figure 3-5: Main shaft inclination check for Unit 1	12
Figure 3-6: Adjustment of platform inside turbine pit for Unit 1.....	12
Figure 3-7: Main shaft levelling for Unit 2	12

Figure 4-1: Dam Reservoir Level.....	13
Figure 4-2: Unit Generated Energy (Main Power Station)	14
Figure 4-3: Unit Operation Hours (main power station)	14
Figure 4-4: Unit Generated Energy (Re-regulation Power Station)	15
Figure 4-5: Unit Operation Hours (Re-regulation Power Station)	15
Figure 4-6: Schedule of Significant Remaining Works	16
Figure 4-7: Installation and Connection of Temporary Tower No.1.....	16
Figure 4-8: Planned Location of Permanent Replacement Tower No.1 (A or B in blue circles)17	
Figure 5-1: Status of ONCs during Q4 2019	19
Figure 5-2: Impounding progress of the main reservoir.....	24
Figure 5-3: Discharge from the Re-regulation Dam during Q4 2019	25
Figure 5-4: Location map of river depth monitoring points	27
Figure 5-5: Dissolved Oxygen Immediately Upstream and Downstream of the Main Dam.28	
Figure 5-6: Main reservoir dissolved oxygen at the end of Q4 2019.....	29
Figure 5-7: Dissolved Oxygen – depth profile in the main reservoir and re-regulation reservoir (station R05)	30
Figure 5-8: Map of effluent monitoring locations during the Q4 2019	36
Figure 5-9: Location of discharge points of key construction sites	41
Figure 5-10: Groundwater sampling locations.....	43
Figure 5-11: Overview of Gravity fed water supply	44
Figure 5-12: Landfill Leachate Monitoring Location	46
Figure 5-13: Noise and dust monitoring locations at the host villages.....	47
Figure 6-1: Map of patrolling track from October – December 2019.....	51
Figure 6-2: Overall Record of Threats in NC-NX Offset Sites in 2019	52
Figure 6-3: Red-shanked Douc Langurs in Nam Houg area – TPZ Higher Priority Area	53
Figure 6-4: Gibbon in Nam Houg area – TPZ Higher Priority Area.....	53
Figure 6-5: Brown Hornbill in Nam Houg area – TPZ Higher Priority Area.....	53
Figure 6-6: White-cheeked gibbon	53
Figure 6-7: Small wire snares at Houay Xai Gnai.....	53
Figure 6-8: Hunting camp around Nam Houg – TPZ Higher Priority Area.....	53
Figure 8-1: Total monthly fish catch during July 2015 – December 2019.....	57
Figure 8-2 : Total fish catch in Q4 by the Upstream (Excluding Zone 2LR), Downstream and Mekong Control Group Fishing Households.....	58
Figure 8-3: Median monthly household fish catch per fishing day (excluding Zone 2LR)	59

ABBREVIATIONS / ACRONYMS

AIP	Annual Implementation Plan
ADB	Asian Development Bank
BOF	Biodiversity Offset Framework
BOMC	Biodiversity Offset Management Committee
BOMP	Biodiversity Offset Management Plan
CA	Concession Agreement between the NNP1PC and GOL
COD	Commercial Operation Date
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
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
kV	kilo-Volt
LTA	Lender's Technical Advisor
MAF	Ministry of Agriculture and Forestry
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
SIR	Site Inspection Report

SMO	Social Management Office of ESD within NNP1PC
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	Waste Water 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).

During Q4 2019, the Environmental Management Office (EMO) of NNP1PC reviewed and approved four Detailed Work Program (DWP) & Site Specific ESMMPs, three Site Decommissioning Plans, one letter of the Taking over the Areas Occupied for Temporary Facility and Work, one Environmental Pre-construction Checklist and one Working Drawing. A total of sixteen Observations of Non-Compliance (ONCs) were active. Out of these, fourteen ONCs were resolved during the reported period, two ONCs will be carried over to Q1 2020.

During Q4 2019, a total of 166.7 m³ of solid waste was disposed of at the NNP1 Project Landfill, a decrease of 90.6 m³ compared to Q3 2019. A total of 2,108 kg of recyclable waste was recorded at the Community Waste Bank. A total 192 m³ of solid waste from Phouhomxay, Thahuea and Hat Gniun Villages was disposed of at the Houay Soup Landfill and local villagers collected a total of 6,610 kg of food wastefrom the Owner's Site Office and Village (OSOV) and Contractors' camps for feeding their animals.

NNP1PC is in the process of procuring a new local contractor to support the waste collection, disposal and delivery from the Project areas to NNP1 Project Landfill and from the host villages and Phouhomxay Village to Houay Soup Landfill. It is expected that the contractor will be on board by February 2020.

The monthly site visit by the Bolikhan District EMU was not carried out during the Q4 of 2019 because the Environmental and Social Management and Monitoring Plan for the Operational Phase (ESMMP-OP) document has yet been approved by the Government (Ministry of Natural Resources and Environment).

The quarterly site visit schedule by the Environmental Management Unit (EMU) of Xaysomboun Province was received and scheduled to be carried out during 13-14 January 2020.

During the Q4 2019, the concentration of dissolved oxygen (DO) at the depth of 0.2 m in R05 (Main Reservoir immediately upstream of the main dam), –was more than 6 mg/L in October and then dropped to between 2 mg/L and 5.5 mg/L from early November to middle of December 2019.

The DO concentrations in the entire water column in the re-regulation reservoir (R07) were between 0.3 mg/L – 4 mg/L. During October to mid-November 2019, the DO concentration in the downstream stations remained above 6 mg/L due to aeration from discharge through the gate and/or over the labyrinth spillway; however, during remaining part of Q4 2019, the water

was predominantly discharged through the turbine and the DO concentrations in the downstream stations decreased to less than 6 mg/L in most of the monitoring rounds.

In addition, the Nam Ngiep Upstream station (NNG01), Nam Chian (NCH01), Nam Phouan (NPH01) and Main Reservoir (R01) were above 6 mg/L. However, DO concentration in the main reservoir at R02, R03 and R04 were between 2.14 mg/L – 7.84 mg/L. The concentration of the DO in Nam Xao (except on 25 October 2019, 11 December and 20 December 2019) and Nam Houay Soup were above 6 mg/L.

The budget summary of AIP2019 related to the No Net Loss from both Provinces was submitted to ADB on 25 September 2019. ADB provided comments on 15 October 2019 and the revised version with further clarification was re-submitted to ADB on 19 October 2019. ADB provided a no objection on 06 November 2019 for the proposed AIP2019 from Xaysomboun and Bolikhamxay Provinces. The Department of Forestry (DOF), Ministry of Agriculture and Forestry (MAF) issued an official request for fund disbursement of USD 154,785 to NNP1PC on 25 November 2019.

The DOF received a total of USD 112,034 from the Watershed Management Fund (WMF) under GOL's Concession Agreement (CA) budget on 09 December 2019. DOF further transferred the fund to Bolikhamxay and Xaysomboun Provincial WRPOs on 20 December 2019. The total amount of USD 42,751 from NNP1PC additional No Net Loss (NNL) commitment comprises of: 1) USD 23,257 was transferred to DOF on 26 December 2019 and; 2) USD 19,494 for the procurement of office and field equipment which is being processed by NNP1PC as per GOL request.

Bolikhamxay Provincial BOMU submitted the request to NNP1PC on 26 September 2019 for the last quarter fund disbursement of NC-NX BOMP AIP2019 totalling USD 60,878 that covers the implementation period from October to December 2019. Bolikhamxay Provincial BOMU received the last quarter fund from DOF on 20 October 2019. Activities under the Components of Spatial Planning and Law Enforcement were carried out according to the approved AIP2019.

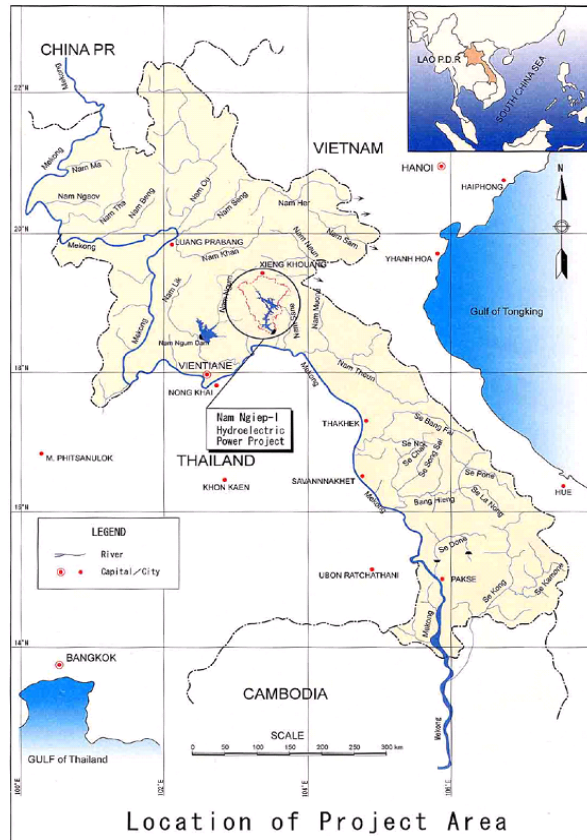
The five type of fish that dominated the fish catch by weight in Q4 2019 include two species (*Channa striata* and *Oreochromis niloticus*) and species group of Poropuntius, Hampala and Mastacembelus that are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species. The recorded catch includes one Endangered species, four Vulnerable species (VU), and six Near Threatened species (NT).

2 INTRODUCTION

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

The project consists of two dams. The main dam is located 9.0 km upstream of Hat Gniun Village in Bolikhan District, will create a 70-km-long, narrow reservoir that extends up the Ngiep Valley as far as Thathom District. At 167 m high, the main dam will be the second largest in Lao PDR. The Power Station at this dam will generate up to 1,546 GWh of electricity for export to Thailand. With a combined capacity of 290 MW, Nam Ngiep 1 will generate around 1,620 GWh of electricity annually. Two transmission lines are used to transport the electricity generated by the project. From the main power station, a 230-kV transmission line will run for 125 km to the Nabong Substation outside Vientiane Capital. A 115-kV transmission line was constructed by EDL from the Re-regulation Power Station to Pakxan substation over a distance of 40 km.

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



This Quarterly Environmental Monitoring Report provides a summary of environmental monitoring activities and mitigation actions during Q4 2019. 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 WORK PROGRESS OF PRINCIPAL CONTRACTORS

Construction Works for the Project are being carried out through four separate main construction contracts under the supervision of the Technical Division of NNP1PC. The four contracts are the Civil Works, the Electrical and Mechanical Works, the Hydraulic Metal or Hydro-mechanical Works and the 230 kV Transmission Line Works. Each Contract is in its Defects Notification Period all ending at different times in 2020 or 2021 following the issue of Taking-over Certificates in 2018 and 2019.

Table 3-1 shows the progress of the minor outstanding work and defects that comprise the Punch List of work items completed for each of these four principal Contracts for the Project. An addendum to the Punch List is maintained for each Contract for any and all defects list that are discovered during the Defects Notification Period with relevant tabular records made of the date of the discovery, the nature of the defects and by what date the defect was remedied.

Table 3-1: Summary progress of Minor Outstanding Work and Defects at 31 December 2019

Type of Contract Works		Total Items	Items Completed	Completion by No. of Items	Total Value of Items	Value Completed	Completion by Value	Taking-Over
		(No.)	(No.)	(%)	(USD)	(USD)	(%)	(Date)
Civil	RR Power Station	74	74	100	108,890	108,890	100	31-Jan-19
	Main Power Station	482	480	99	5,507,375	5,307,375	96	31-Jan-19
Electro-Mechanical	RRPS	170	170	100	6,515	6,515	100	16-Mar-19
	MPS	95	92	97	10,950	9,450	86	27-Aug-19
Hydro-Mechanical	RRPS	39	39	100	8,825	8,825	100	16-Mar-19
	MPS	174	174	100	13,775	13,775	100	31-Mar-19
230 kV Transmission Line		301	301	100	150,000	150,000	100	31-Jul-18

3.1 CIVIL WORK

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

3.2 MAIN QUARRY

After several inspections by ADB on behalf of the Lenders and GOL, the rehabilitation of the quarry site is being improved by partial levelling of the quarry floor, revegetation of the berms and fencing off steep slopes in the quarry periphery by large rock boulders or soil bunds. A gate near the steel bridge will be installed to prevent unauthorised persons from entering the site. The levelling of quarry bottom will be completed in January 2020.

Figure 3-1: Quarry Area View



3.3 ELECTRICAL AND MECHANICAL WORKS

The EMWC was executed between Hitachi-Mitsubishi Hydro Corporation and NNP1PC on 13 June 2014 and the NTP was issued on 03 October 2014.

The cumulative work progress of the Electrical and Mechanical Works by value at the end of November 2019 was 100 % (compared to planned progress of 100.0 %).

The main activities carried out during December are described below:

Main Power Station

a) Punch List Work

- Internal punch list inspection was carried out and progress continued with the 97 % or 92 items completed out of a total of 95 items listed.

Re-regulation Power Station

a) Punch List Work

Internal punch list inspection was carried out and 100% or 170 items were completed out of a total 170 items listed.

b) Observation of Oil Leakage inside Turbine Pit

- An oil leakage at the bearing bracket was observed on 04 December 2019.
- A joint inspection of oil leakage was performed by NNP1 and HM Hydro on 06 December 2019. The leakage oil were found on the thrust bearing bracket and the turbine guide bearing cover during the inspection as shown in **Figure 3-2** and **Figure 3-7**.
- The unit can continue to operate for the time being since the amount of oil leakage is very small.
- Countermeasures for the oil leakage is being developed and will be reported in the next QMR.

Figure 3-2: Joint inspection of oil leakage inside turbine pit



Figure 3-3: Oil leakage was found on thrust bearing bracket and turbine guide bearing cover



Figure 3-4: Main shaft levelling check for Unit 1



Figure 3-5: Main shaft inclination check for Unit 1



Figure 3-6: Adjustment of platform inside turbine pit for Unit 1



Figure 3-7: Main shaft levelling for Unit 2



3.4 HYDRO-MECHANICAL WORKS

NNP1PC issued the Taking Over Certification for the main powerhouse and the re-regulation powerhouse, which was dated on 31 March 2019 for the main powerhouse and 16 March 2019 for the re-regulation powerhouse, to IIS on 30 September 2019 and 16 August 2019, respectively.

4 OPERATION AND MAINTENANCE

4.1 Operation

The Main Power Station achieved Commercial Operation Date on 05 September 2019.

Figure 4-1 shows the dam water level compared with the rule curve. The dam was filled with water up to Full Supply Level at El. 320 m on 17 August 2019, but has slightly decreased because generating discharge was higher than inflow.

Figure 4-1: Dam Reservoir Level

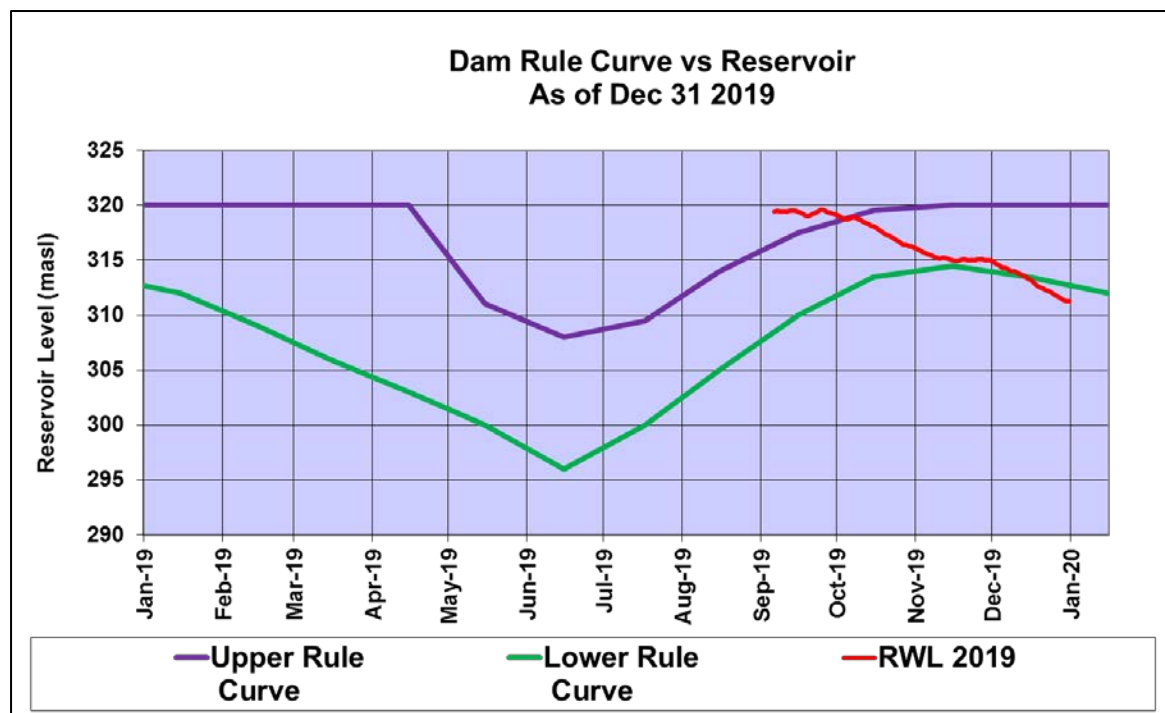


Figure 4-2 and Figure 4-3 shows the generation data at the main power station after COD until December 2019.

The generation from 5, 8, 30 and 31 were lower than others due to low dispatch by EGAT National Control Centre (NCC).

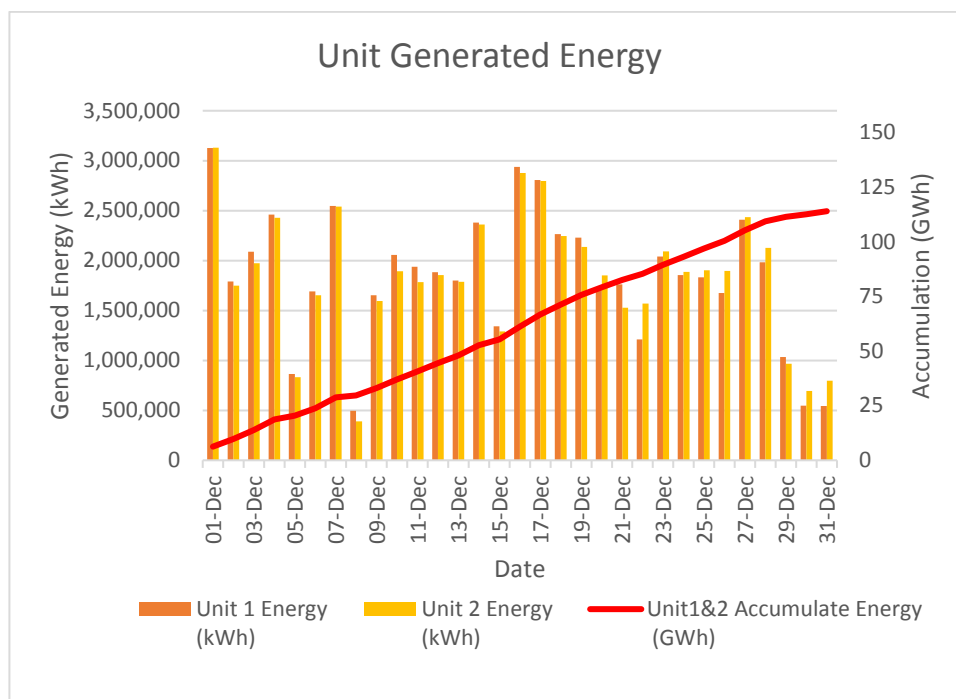
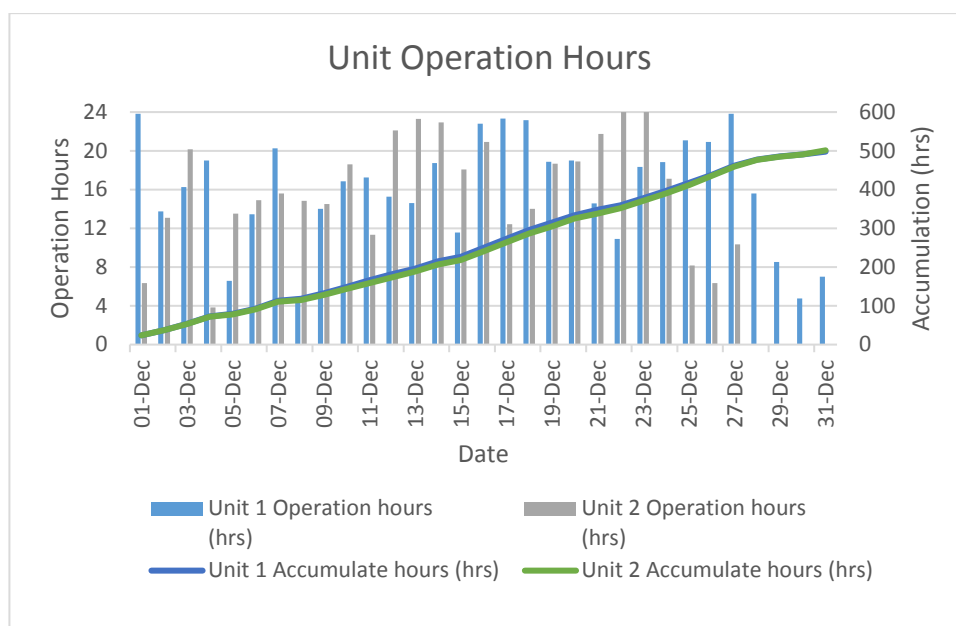
Figure 4-2: Unit Generated Energy (Main Power Station)**Figure 4-3: Unit Operation Hours (main power station)**

Figure 4-4 and Figure 4-5 shows the generation data at the re-regulation power station in December 2019. The generation and operation time are affected by the operations of the main power station according to EGAT PPA. So, the amount of inflow is determined by the operation resulting at the main power station. Notwithstanding, even if the main power station is stopped, the specified 27 m³/sec water from re-regulation power station must be discharged to downstream.

Figure 4-4: Unit Generated Energy (Re-regulation Power Station)

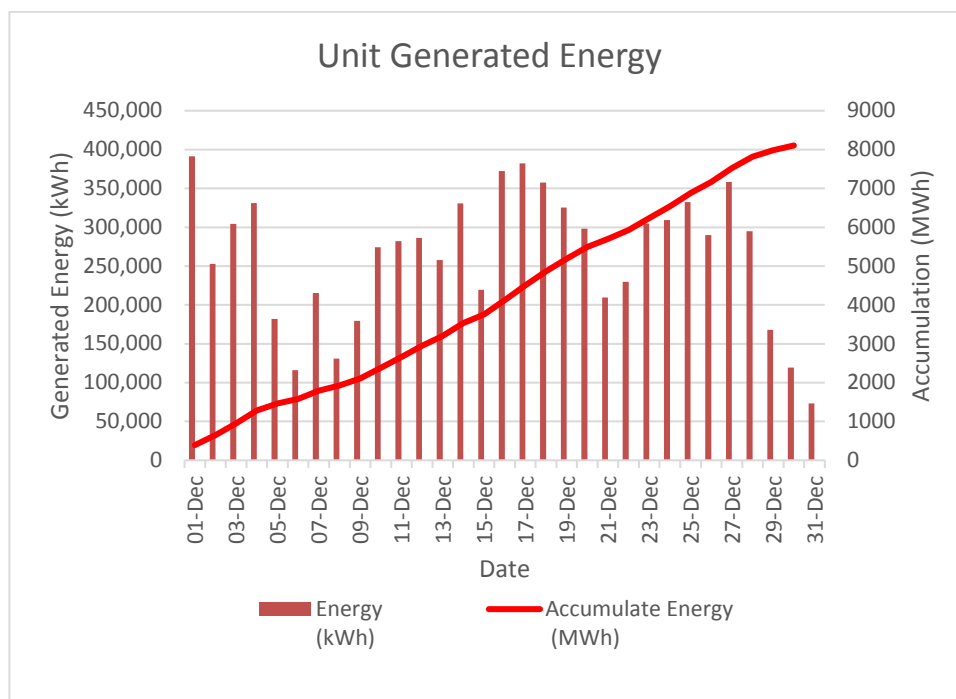
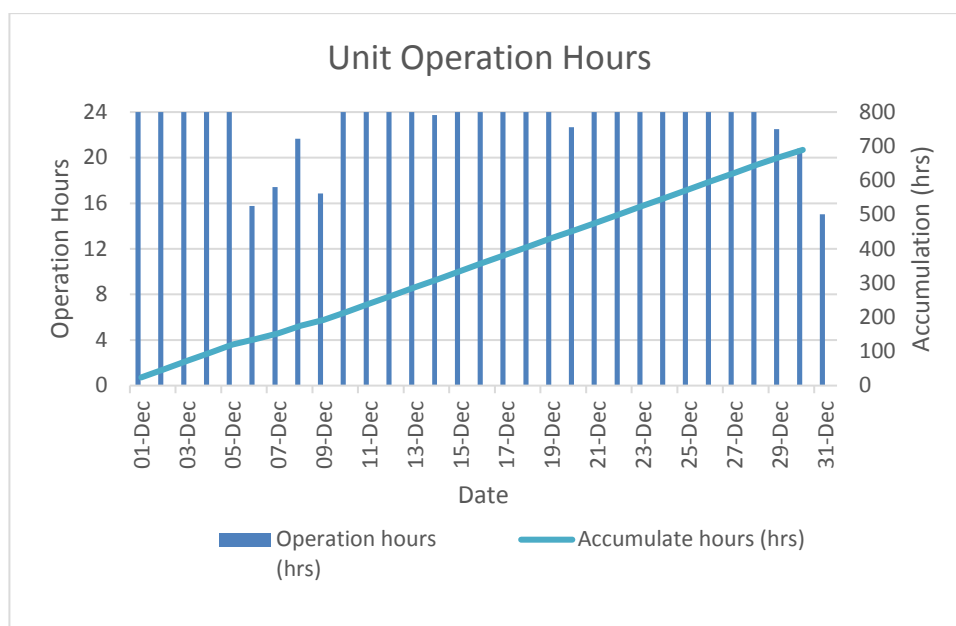


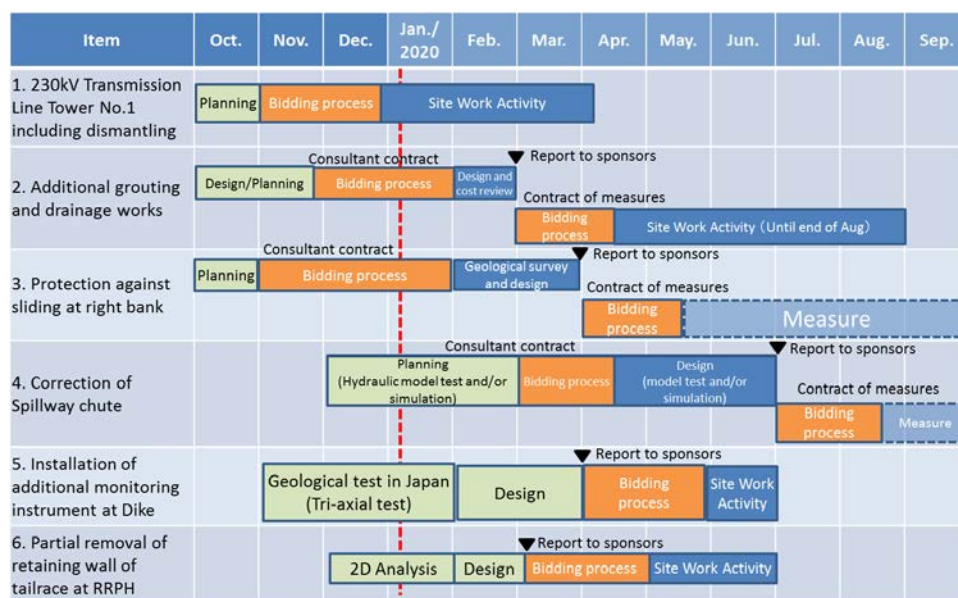
Figure 4-5: Unit Operation Hours (Re-regulation Power Station)



4.1.1 Significant Technical Occurrences

As shown in **Figure 4-6** there remain seven items of significant works. Nos. 1, 3, 4 and 5 are related to the main powerhouse and Nos. 2, 6 and 7 are related to the re-regulation powerhouse.

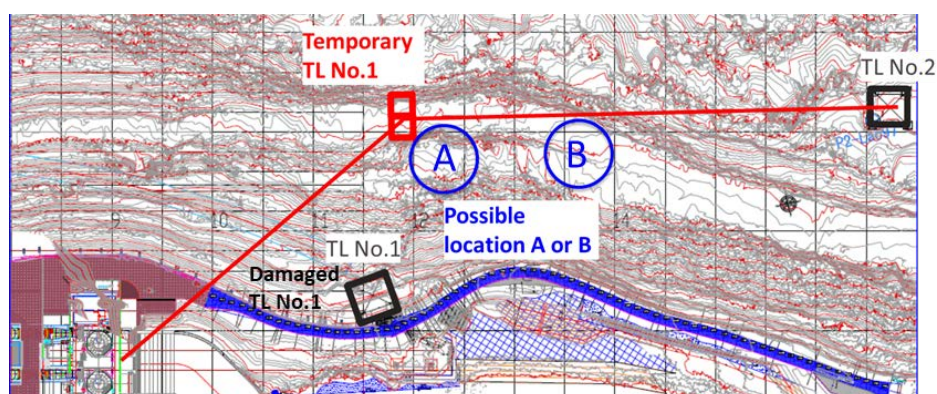
Figure 4-6: Schedule of Significant Remaining Works



A Temporary Tower No.1 was constructed and the transmission line was moved to it from the damaged tower over the period 06 to 24 September 2019. (See **Figure 4-7**) The construction of the permanent Replacement Tower No.1, disassembly of existing Tower No.1 started in late December 2019.

Figure 4-7: Installation and Connection of Temporary Tower No.1



Figure 4-8: Planned Location of Permanent Replacement Tower No.1 (A or B in blue circles)

5 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 Construction Phase during Q4 2019 until the ESMMP for the Operational Phase which was submitted to MONRE (on behalf of GOL) on 24 August 2019 is officially approved.

5.1 Contractor SS-ESMMPs

During Q4 2019, four Detailed Work Programme & Site Specific Environmental and Social Management Plans (DWP & SS-ESMMPs), three Site Decommissioning and Rehabilitation Plans, one letter of the Taking over the Areas Occupied for Temporary Facility and Work, one environmental site pre-construction checklist and one working drawing were submitted for review and approval by the Environmental Management Office (EMO). All these submitted documents were cleared under the document review timeframe as shown in **Table 5-1: Document reviewed during Q4 2019**.

More details can be found in **Appendix 1**.

Table 5-1: Document reviewed during Q4 2019

Document Name	Rev. 1	Rev. 2	Rev. 3	Approved
The Taking Over the Areas Occupied for Temporary Facility and Work (Document Ref. PC- 05181)	√			√
Site Decommissioning and Rehabilitation Plan for Civil Works Contractor (Obayashi Camp)	√	√		√
SS-ESMMP for the Improvement of IHI and HM Camps (new ESD office and camp)	√			√

Document Name	Rev. 1	Rev. 2	Rev. 3	Approved
Working Drawing of Additional Fence and Security Gates for the Main Dam Area	√			√
Environmental Checklist for the Improvement of the Entrance and Water Supply for the Market in Zone 2UR	√			√
DWP & SS-ESMMP for Main Dam Plunge Pool Excavation Work	√	√	√	√
Site Decommissioning and Rehabilitation Plan for Song Da5 Camp No.1	√			
Site Decommissioning and Rehabilitation Plan for Song Da5, Temporary CVC Batching Plant and Stockyard	√			
DWP & SS-ESMMP for the Maintenance and Repairing Works for the Nam Ngiep 1 Project	√			√
DWP & SS-ESMMP for the Installation of Double Corrosion Protection Rock Bolts at the Left Bank Slope of Main Dam	√			

5.2 Results of Compliance Inspections at Construction Sites

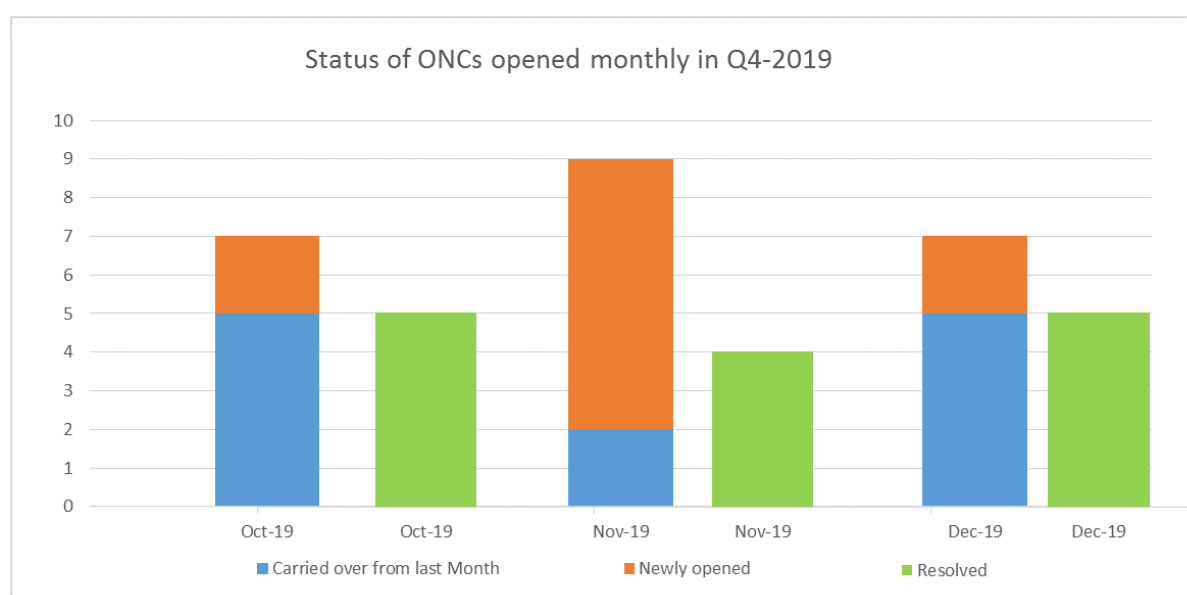
The monthly site visit by the Bolikhan District EMU was not carried out during Q4 of 2019 because the Environmental and Social Management and Monitoring Plan for the Operational Phase (ESMMP-OP) document has not yet been approved by the Government (Ministry of Natural Resources and Environment). The quarterly site visit schedule by the Environmental Management Unit (EMU) of Xaysomboun Province was received and scheduled to be carried out on during 13-14 January 2020.

During Q4 2019, the EMO conducted bi-weekly and weekly follow-up inspections at 20 construction sites and camps of the main civil works and the 230 kV Transmission Line. The total inspected sites have decreased from 30 in Q3 2019 to 20 monitoring sites because 10 construction sites and camps were closed.

The status of these non-compliance reports is summarized in **Table 5-2** and **Figure 5-1**. The progress of corrective actions is presented in **Appendix 2**.

Table 5-2: Status of non-compliance report during Q4 2019

Status	ONC	NCR- Level 1	NCR- Level 2	NCR- Level 3	Incident Report
Carried over ONC/NCR	5	0	0	0	0
Newly opened ONC/NCR	11	0	0	0	0
Total No. of ONC/NCR	16	0	0	0	0
Resolved ONC/NCR	14	0	0	0	0
Unresolved ONC/NCR carried forward to the next Quarter	2	0	0	0	0

Figure 5-1: Status of ONCs during Q4 2019**Photograph 1: Joint inspection for the preparation of a site decommissioning and rehabilitation at a sand stockpile area****Photograph 2: EMO-Contractor Inspection for the WWTS operation and maintenance at HM Hydro Camp**

Photograph 3: NNP1PC and the Contractor jointly inspect the rehabilitation of Lilama10 Camp



Photograph 4: A small nursery was set up at Song Da5 workshop area



5.3 WASTE MANAGEMENT AT THE CONSTRUCTION SITES

5.3.1 General Waste Management

During Q4 2019, a total of 166.7 m³ of solid waste was disposed of at the NNP1 Project Landfill, a decrease of 90.6 m³ compared to Q3 2019 because many subcontractors were demobilized and moved out from the Project. EMO conducted three waste spot checks in this quarter at the NNP1 Project Landfill, construction sites and camps. Mixed waste inside the waste bins was observed at the OC Camp, Song Da5 Camp No.1, Song Da5 Stock Yard (below CVC Plant), V&K Camp, CVC Plant and RCC Plant. NNP1PC issued two ONCs to the Principle Contractors for further issuance of the instruction to the related subcontractors for proper waste management practices.

A total of 5,890.5 kg of recyclable waste was collected by Khounmixay Processing Factory and transported offsite to its facilities for recycling or processing as shown in **Table 5-3**.

Table 5-3: Amounts of recyclables sold during Q4 2019

Source and Type of Recyclables		Unit	Total in Q4 of 2019 (A)	Sold (B)	Remaining Amount (A - B)
Construction activity					
1	Scrap metal	kg	5000	5000	0
Sub-Total 1		kg	5000	5000	0
Operation camp					
2	Glass bottles	kg	518	471	47
3	Plastic bottles	kg	192.5	182	10.5
4	Aluminium cans	kg	76.5	71.5	5
5	Paper/cardboard	kg	196	166	30
Sub-Total 2		kg	983	890.5	92.5
Grand Total 1+2		kg	5,983	5,890.5	92.5

5.3.2 Hazardous Waste Management

During Q4 2019, joint hazardous materials and waste inventories were carried out at the remaining construction sites and the Contractors' camps. The amounts of hazardous waste collected, stored and disposed of during Q4 2019 are shown in **Table 5-4**. The treatment and final disposal of hazardous waste including used hydraulic oil and engine oil are outsourced to Khounmixay Processing Factory. The remaining waste will be collected, treated and disposed of by Khounmixay Processing Factory.

Table 5-4: Hazardous waste recorded during Q4 2019

No.	Hazardous Waste Type	Unit	Total in Q4 2019	Disposal	Remaining
1	Used hydraulic and engine oil	litre (l)	4,652	4652	0
2	Contaminated soil, sawdust and concrete	kg	398	398	0
3	Used tyre	No.	238	238	0
4	Used oil mixed with water	Litre	200	200	0
5	Ink cartridges	No.	224	45	179
6	Used oil filters	No.	156	156	0
7	Empty used chemical drum/container	drum (200 l)	65	65	0
8	Empty used oil drum/container	drum (20 l)	26	26	0
9	Lead acid batteries	No.	22	22	0
10	Empty contaminated bitumen drum/container	drum (200 l)	20	20	0
11	Contaminated textile and material	kg	7	7	0
12	Clinical waste	kg	15	15	0
13	Empty paint and spray cans	can	7	7	0
14	Lithium-ion batteries	No.	7	7	0
15	Halogen/fluorescent bulbs	No.	15	0	15
16	Empty used chemical drum/container	Drum (20 l)	0	0	0

5.3.3 Sewage Sludge Disposal

As part of site decommissioning activity, a total of 40 m³ of sewage sludge from V&K Camp and OC Camp was transported and disposed of at the spoil disposal area No. 6 by following NNP1PC's Standard Operating Procedure (SOP) on Sewage/Black Water Disposal.

5.4 COMMUNITY WASTE MANAGEMENT SUPPORT

5.4.1 Animal Fodder (Pig Feed) Collection Programme

During Q4 2019, local villagers collected a total of 6,610 kg of food waste from the Owner's Site Office and Village (OSOV) and remaining Contractors' camps for feeding their animals as shown in **Table 5-5**. This is a decrease of 2135 kg compared to Q3 2019.

Table 5-5: Amount of food waste collected by local villagers for use as pig feed during Q4 2019

NO.	SITE NAME	UNIT	TOTAL
1	Song Da5 Camp No. 1	kg	1,169
2	Obayashi Corporation Camp	kg	1,739
3	Owner's Site Office and Village (OSOV)	kg	2,995
4	LILAMA 10 Camp	kg	707
Total		kg	6,610

5.4.2 Community Solid Waste Management and Recycling Programme

During Q4 2019, the Community Recycle Waste Bank collected a total of 3,735 kg of recyclables from villagers and 1,627 kg was sold to Khounmixay and Keo Lao Processing Factory as presented in **Table 5-6** below.

Table 5-6: Amounts of recyclables sold at the Community Recycle Waste Bank

Types of Waste	Unit	Purchased Amount During the Q4 2019 (A)	Sold (B)	Remaining Amount (A - B)
Scrap metal	kg	9.5	9.5	0
Glass	kg	2,616	1467	1,149
Paper/cardboards	kg	923.5	0	923.5
Plastic bottles	kg	184.5	149	35.5
Aluminium	kg	1.5	1.5	0
Total	kg	3,735	1,627	2,108

In addition, EMO and the local waste management Contractor carried out a community briefing on the waste management for host villages (Thaheau and Hat Gnuin Villages) and Phouhomxay Village during 08 - 09 October 2019 to improve their awareness on proper waste separation, waste transportation from their house to the central collection area. A total of 58 villagers including the Village Chiefs, Lao Women's Union representatives and elders from three villages participated.

On 21 November and 06 December 2019, the local authorities and villagers of Phouhomxay village carried out village clean-up activities. All the solid waste was transported and disposed of at Houy Soup Landfill by the local waste management Contractor.

During 23 – 24 December 2019, an annual maintenance of the Community Recycle Waste Bank at Hat Gnuin Village was carried out which included grass cutting, surface shaping and gravel placement at the entrance, repairing an entrance door, and fixing wooden windows and doors of the building, as well as installing a new sign board.

5.4.3 Houay Soup Landfill

Approximately 192 m³ of solid waste was collected from the Thaheau, Hat Gniun and Phouhomxay villages for transportation and disposal at the Houy Soup Landfill.

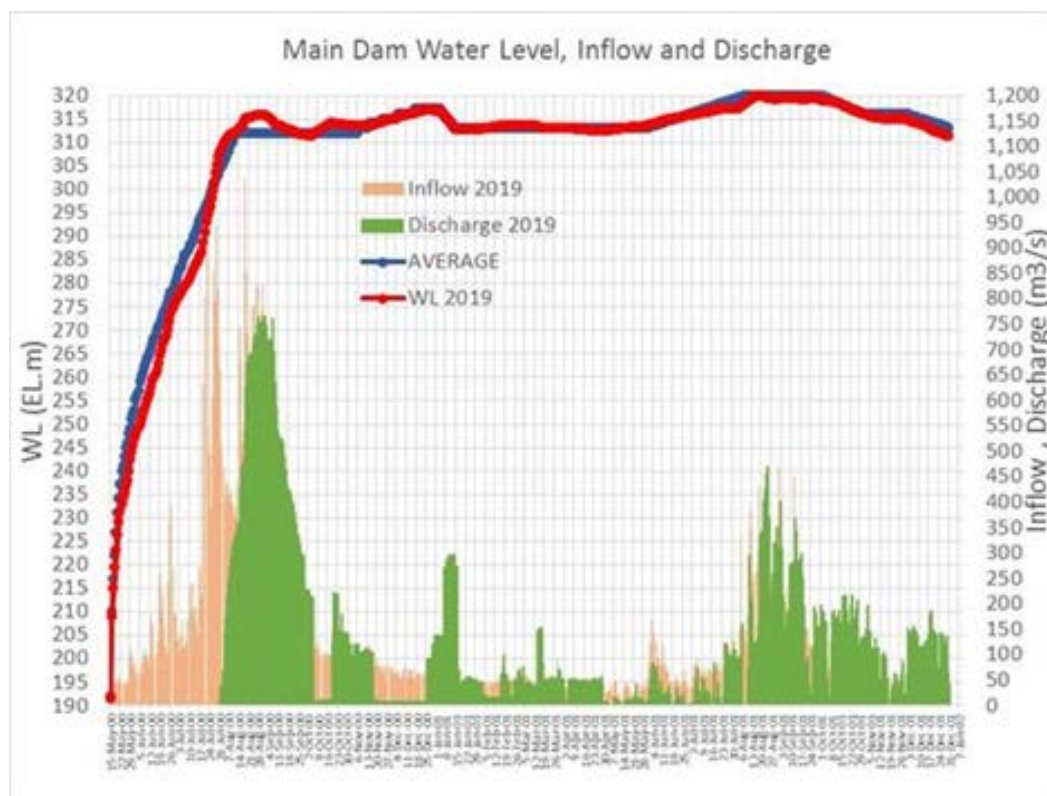
NNP1PC is in the process of procuring a new local Contractor to support the waste collection, disposal and delivery from the Project areas to NNP1 Project Landfill as well as from the host Villages and Phouhomxay Village to the Houay Soup Landfill. It is expected that the local Contractor will be on board by February 2020. During this transition period (January to the end of February 2020), NNP1PC-EMO will work with the villagers to deliver the wastes to the Houay Soup landfill on a weekly basis.

5.5 MAIN RESERVOIR OPERATIONS

The impounding of the main reservoir was completed in August 2019 when the reservoir reached full supply level. The progress of impounding from 15 May 2018 until COD on 05 September 2019 and the subsequent operation of the main reservoir until 31 December 2019 is presented on the graph in **Figure 5-2** indicating the water level in the main reservoir, the inflow to the main reservoir and the discharge from the main reservoir into the re-regulation reservoir.

During Q4 2019, the mean inflow to the main reservoir gradually decreased from about 90 m³/s in early October 2019 to about 40 m³/s towards the end of December 2019. Over the course of Q4 2019, the water level in the main reservoir gradually dropped 7.7 m from El. 319.0 m asl to El. 311.3 m asl.

The total turbine discharge from both units at the main dam varied between about 100 m³/s and 200 m³/s interrupted by usually night-time periods with no discharge.

Figure 5-2: Impounding progress of the main reservoir

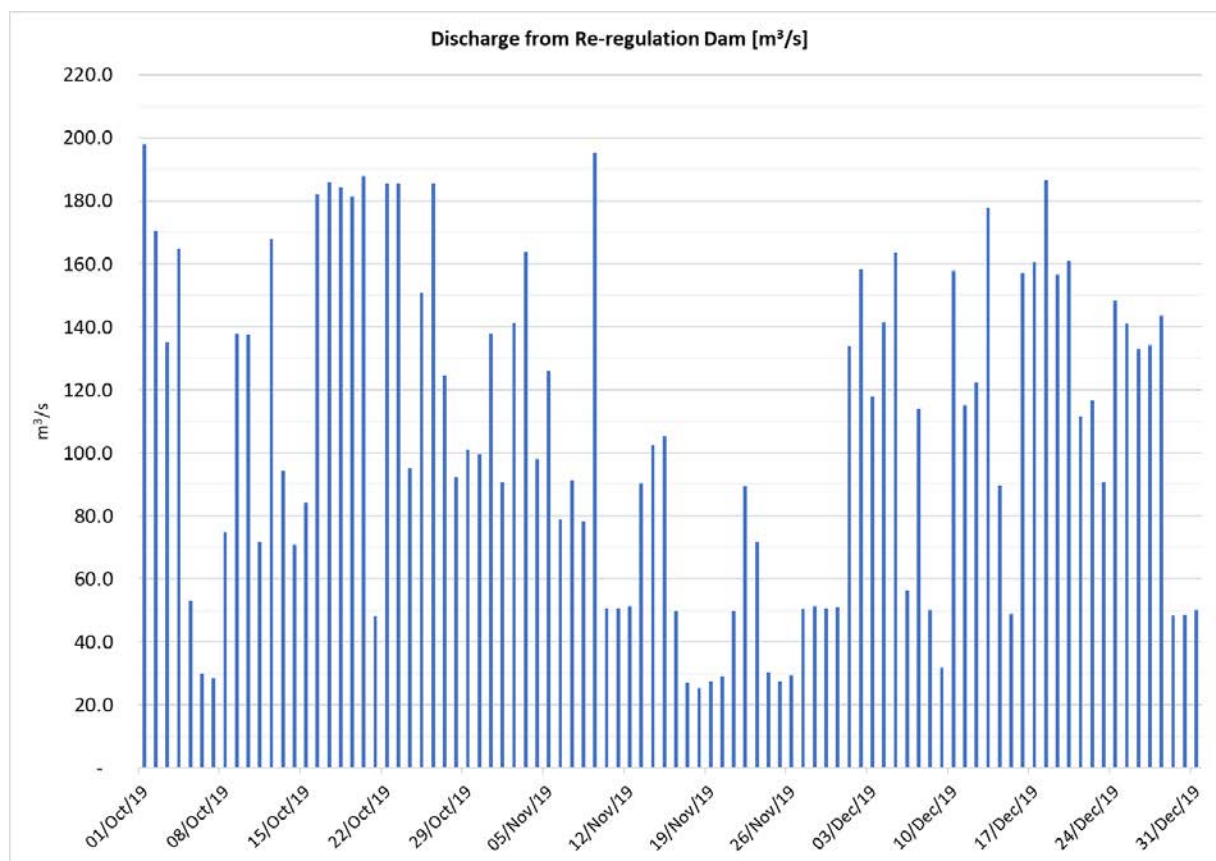
The discharge monitoring data for the re-regulation dam during Q4 2019 is presented in *Error! Reference source not found.*

The turbine at the re-regulation powerhouse has been under repair and out of operation from end of August 2019 to 09 November 2019, and during that period all discharges from the re-regulation dam has passed through the gate and/or over the labyrinth weir. During that period, the discharge from the re-regulation dam has generally varied between 120 m³/s and 185 m³/s only interrupted by short periods usually during weekends with discharges from 30 m³/s to 70 m³/s.

During the remaining part of November 2019, the turbine has been in operation about 2/3 of the time with discharges varying between 50 m³/s and 160 m³/s, and the gate has been in use 1/3 of the time with a mean discharge of about 30 m³/s - only interrupted by short periods (about 4% of the time) with discharge from both the turbine and the gate. During December 2019, the discharge from the re-regulation dam was about 140 m³/s interrupted by short periods – usually on Sundays - with gate discharge between 30 m³/s and 60 m³/s.

The discharge from the re-regulation dam has been kept above the minimum flow requirement of 27 m³/s at all times since start of commercial operations on 05 September 2019.

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

Figure 5-3: Discharge from the Re-regulation Dam during Q4 2019

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 5-4**. 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).

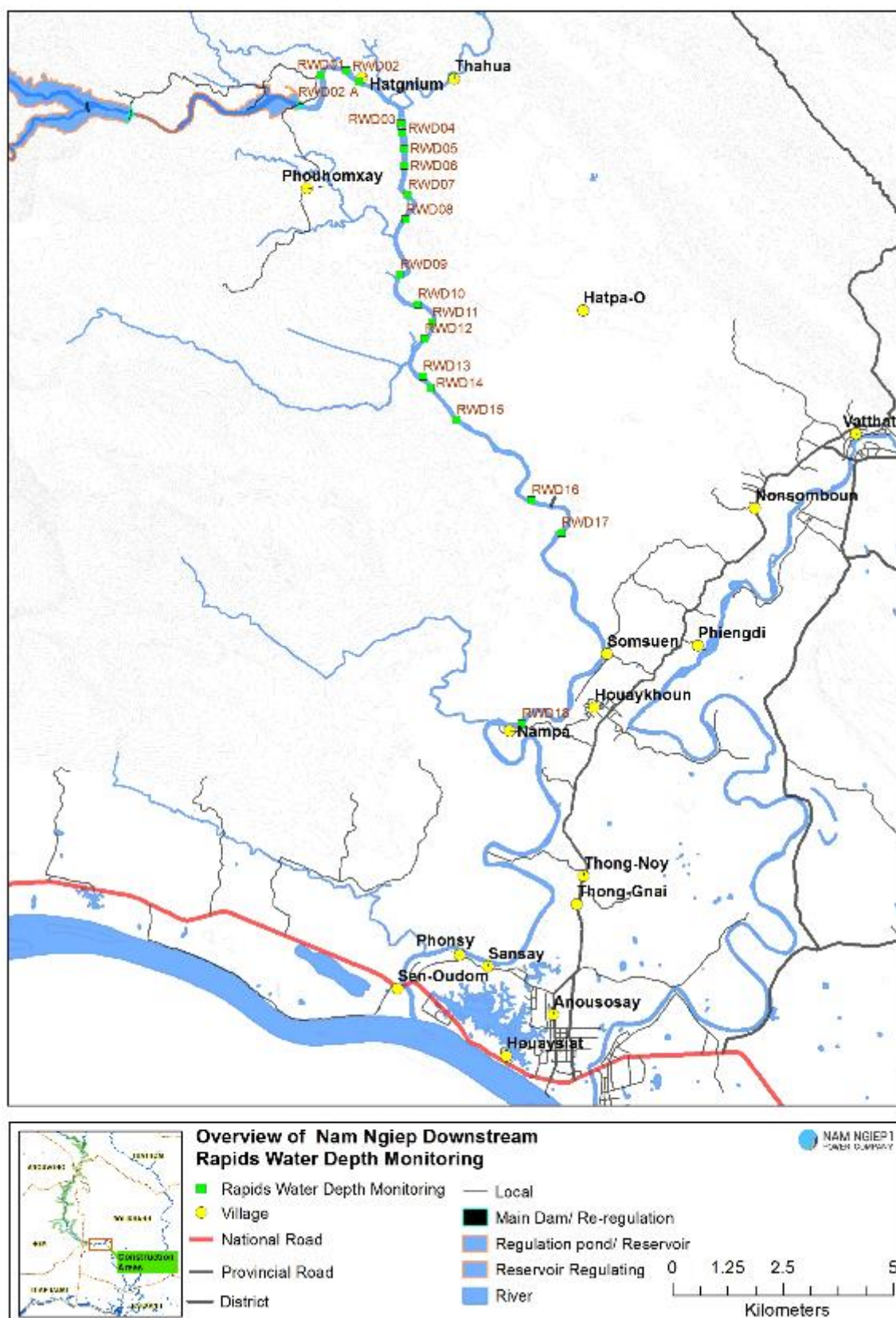
The results of the monitoring are presented in Table 5-7. Depths below 0.5 m are shown in red font.

During Q4 2019, there were no instances of difficult navigation due to reduced water depths, and only one measurement indicated a water depth of less than 0.5 m at stations close to the dam.

Table 5-7: 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)
2-Oct-19	170	1.66	1.71	1.75	1.96	2.02	1.74	1.9	1.98	2.13	2.08	2.27	2.18	2.28	2.54	3.02	3.21	3.15	3.3	2.2
9-Oct-19	138	1.21	1.5	1.54	1.71	1.78	1.49	1.65	1.73	1.88	1.73	1.98	1.85	2.0	2.24	2.7	2.91	2.85	3.0	1.9
16-Oct-19	184.7	1.37	1.66	1.7	1.87	1.94	1.65	1.76	1.89	2.05	1.93	2.18	2.05	2.2	2.44	2.9	3.11	3.05	3.2	2.1
23-Oct-19	185.6	1.68	1.73	1.78	1.98	2.04	1.76	2.01	2.0	2.15	2.1	2.29	2.2	2.3	2.56	3.04	3.23	3.17	3.33	2.23
30-Oct-19	117.2	0.93	1	1.03	1.23	1.3	1.02	1.28	1.27	1.4	1.35	1.55	1.36	1.56	1.8	2.3	2.48	2.43	2.5	1.45
6-Nov-19	77	0.68	0.75	0.78	0.98	1.05	0.77	1.01	1.0	1.13	1.08	1.27	1.08	1.28	1.5	2.0	2.18	2.13	2.2	1.15
13-Nov-19	90.6	0.83	0.9	0.93	1.13	1.2	0.92	1.16	1.15	1.28	1.23	1.42	1.24	1.44	1.66	2.16	2.34	2.29	2.36	1.31
20-Nov-19	29.2	0.33	0.4	0.43	0.63	0.7	0.42	0.66	0.65	0.78	0.73	0.92	0.74	0.84	1.0	1.2	1.38	1.3	1.4	1.31
27-Nov-19	50.3	0.63	0.7	0.73	0.83	1	0.72	0.96	0.95	1.08	1.03	1.22	1.04	1.14	1.33	1.53	1.72	1.54	1.78	1.65
4-Dec-19	202	1.13	1.2	1.23	1.33	1.6	1.32	1.56	1.55	1.68	1.63	1.82	1.92	1.84	2.03	2.53	2.72	2.54	2.78	2.45
11-Dec-19	122	1.11	1.18	1.21	1.31	1.58	1.3	1.53	1.5	1.6	1.55	1.7	1.82	1.74	1.9	2.43	2.62	2.44	2.68	2.35
18-Dec-19	186	1.1	1.17	1.2	1.3	1.57	1.29	1.52	1.49	1.59	1.57	1.73	1.85	1.8	2.0	2.5	2.7	2.51	2.75	2.43
25-Dec-19	154	1.15	1.22	1.25	1.35	1.62	1.34	1.57	1.54	1.64	1.62	1.78	1.9	1.85	2.05	2.55	2.75	2.56	2.8	2.48

Figure 5-4: Location map of river depth monitoring points



5.6 ENVIRONMENTAL MONITORING

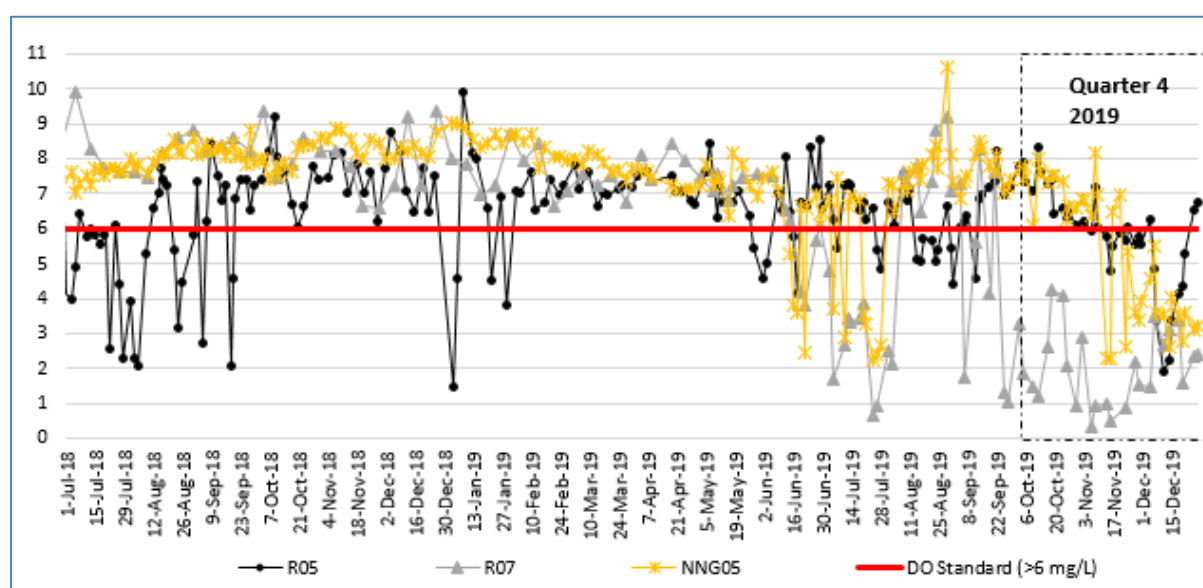
5.6.1 Surface Water (River) Quality

Descriptions of each monitoring station and surface water quality monitoring parameters can be found in **Appendix 3** and all surface water quality data for Q4 2019 are listed in **Appendix 5.1**

Dissolved Oxygen (DO)

The results of dissolved oxygen measurements for the stations immediately upstream and downstream the Project are presented in **Figure 5-5**, and the full set of surface water data are shown in **Table 5-8**.

Figure 5-5: Dissolved Oxygen Immediately Upstream and Downstream of the Main Dam



During the Q4 2019, the concentration of dissolved oxygen (DO) at the depth of 0.2 m in R05 (Main Reservoir immediately upstream of the main dam), was more than 6 mg/L in October and then dropped to between 2 mg/L and 5.5 mg/L from early November to middle of December 2019.

The DO concentrations in the entire water column in the re-regulation reservoir (R07) were between 0.3 mg/L – 4 mg/L. During the period with gate and/or spillway discharge from 01 October 2019 to 09 November 2019, the DO concentration in the downstream stations remained above 6 mg/L due to aeration generated by the gate/weir discharge. During the remaining part of Q4 2019, the DO level fell below 6 mg/L in all downstream stations during periods with turbine discharge.

The Nam Ngiep Upstream station (NNG01), Nam Chian (NCH01), Nam Phouan (NPH01) and Main Reservoir (R01) had DO levels above 6 mg/L. However, DO concentrations in the main reservoir at R02, R03 and R04 were between 2.14 mg/L – 7.84 mg/L. The concentration of DO in Nam Xao and Nam Houay Soup were above 6 mg/L except for a couple of measurement.

The DO depth profiles in the main reservoir and in the re-regulation reservoir during Q4 2019 is summarized in **Figure 5-6**.

The depth profile monitoring indicates formation of oxyclines and thermocline in all the stations in the main reservoir at depths between 3.5 – 26.0 m.

There is no any indications of a thermocline in R06 and R07 in the re-regulation reservoir.

On 22 November 2019, some dead fish were observed in the re-regulation reservoir, and specimens were collected at R06 and R07 for fish species identification.

Figure 5-6: Main reservoir dissolved oxygen at the end of Q4 2019

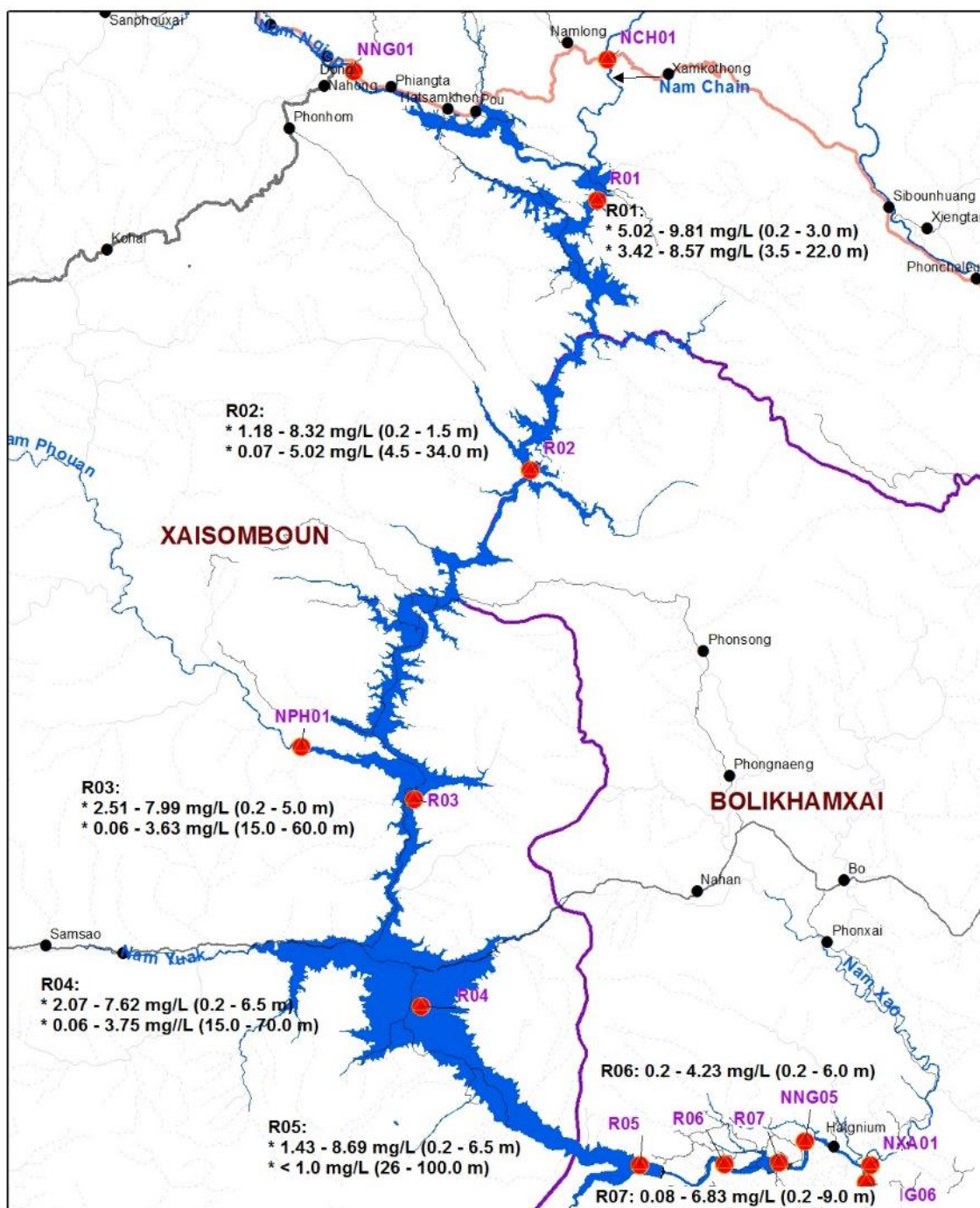


Figure 5-7: Dissolved Oxygen – depth profile in the main reservoir and re-regulation reservoir (station R05)

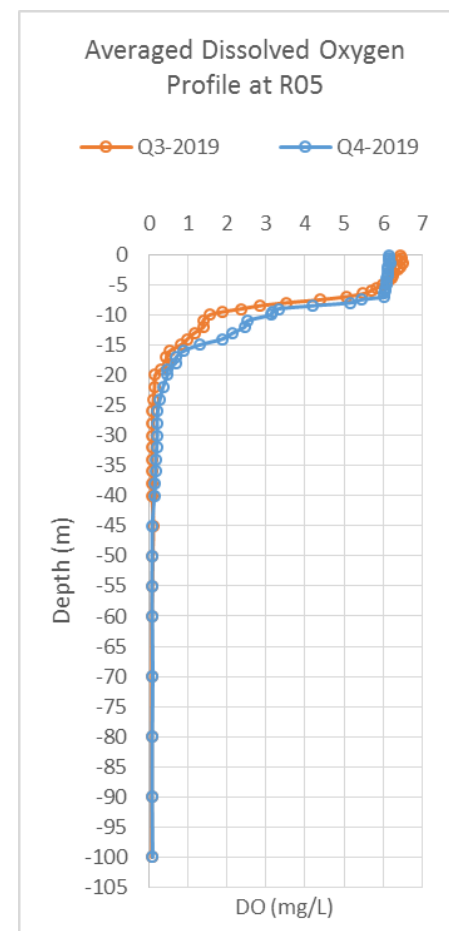
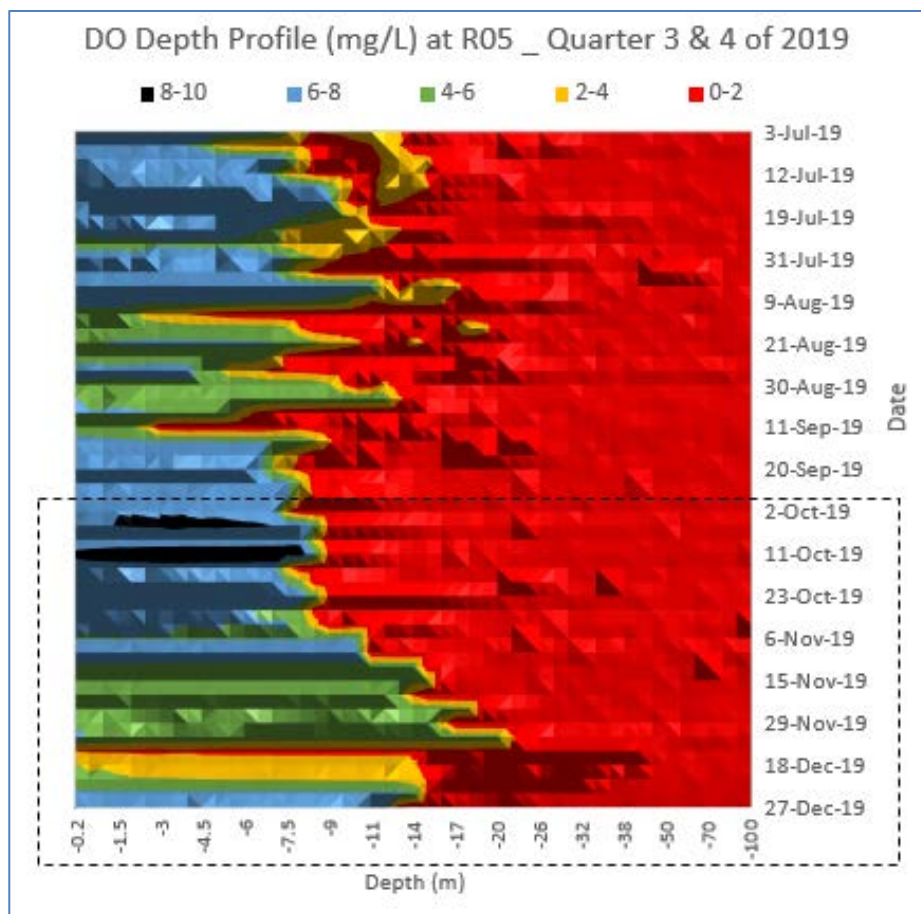


Table 5-8: DO results of the surface water in the main reservoir, re-regulation reservoir, Nam Ngiep and its main tributaries monitored from October to December 2019

Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
1-Oct-19		7.88	7.72	7.5	7											
2-Oct-19						7.79	2.88	3.29	7.75	7.66	7.1	6.61			7.03	7.1
4-Oct-19						7.9	2.94	1.84	7.43	7.43					7.4	7.1
5-Oct-19						7.35	3.5		7.81							
7-Oct-19	7.95												8.33			
8-Oct-19		7.87	7.03	7.5	7.1											
9-Oct-19						7.07	3.4	1.48	6.1	7.37	7	6.69			7.24	7.4
11-Oct-19						8.31	0.92	1.18	8.03	8.66					7.74	
12-Oct-19						7.63	3.01		7.65							
16-Oct-19						7.3	1.17	2.62	7.32	7.38	7.2	7.04			7.23	7
18-Oct-19						7.4	0.52	4.25	7.54	7.96					7.39	
19-Oct-19						6.42	3.2		7.49							
22-Oct-19	8.14	7.31	7.37	7	7.4								8.05			
23-Oct-19						6.59	2.11	4.08	7.36	7.48	7.1	6.9			7.02	6.6
25-Oct-19						6.31	0.43	2.05	6.27	6.34					5.47	
26-Oct-19						6.48	0.95		6.67							
29-Oct-19		7.67	7.84	7.2	6.9											
30-Oct-19						6.09	0.41	0.92	6.59	7.01	6.8	6.73			6.99	6.6
1-Nov-19							0.75	2.9	6.87	6.71					6.19	
2-Nov-19						6.2	2.65		6.8							
5-Nov-19					5.9											
6-Nov-19						5.94	0.63	0.31	6.35	7.2	7	7.11			7.49	7.1
7-Nov-19		7.66	6.5	7.2												
8-Nov-19						7.19	1	0.95	8.15	7.78					7.42	
9-Nov-19						6.06	1.46		6.96							
13-Nov-19						5.77	0.39	0.96	2.26	2.8	4.8	6.62			6.94	6.8
14-Nov-19		6.19	5.69	5.7	5.5									7.9		

Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
15-Nov-19						4.8	0.36	0.47	2.28	2.87	4.6	6.32			7.02	6.6
16-Nov-19						5.52	2.12		6.48	6.3					6.72	
19-Nov-19	8.16	8.4	6.29	7.3	6.2								8.17	8.5		
20-Nov-19						5.86	4.15		6.95	7.53	7	7.42			7.64	7.3
22-Nov-19						5.69	0.57	0.85	2.6	3.23					6.11	6.3
23-Nov-19						6.06	3.2		5.32							
26-Nov-19		6.91	5.25	6.1	6											
27-Nov-19						5.54	2.92	2.2	3.6	3.74	5.4	6.92			7	7.2
29-Nov-19						5.78	3.17	1.55	3.35	5.25					6.84	
30-Nov-19						5.54	2.71		3.9							
4-Dec-19						6.28	1.82	1.47	4.57	4.04	4.2	5.23			6.97	6.2
5-Dec-19		7.9	2.52	4.8	3.9									8.84		
6-Dec-19						4.82	2.86	3.5	5.51							
7-Dec-19						3.35	4.04		3.57							
9-Dec-19	9.06												8.58			
10-Dec-19		6.5	2.14	3.6	2.3									9.62		
11-Dec-19						1.9	3.02	2.65	3.53	3.82	4.6	4.73			5.67	6.1
13-Dec-19						2.23	1.71	3.11	2.61	2.75					7.22	
14-Dec-19						3.39	2.42		4.04							
17-Dec-19		9.29	2.23	6.8	3.1									10.7		
18-Dec-19						4.13	2.99	3.38	3.49	3.35	4.1	5.12			6.57	6.3
20-Dec-19						4.37	3.51	1.58	2.75	4.02					4.35	
21-Dec-19						5.27	1.02		3.6							
23-Dec-19	8.39												8.76			
24-Dec-19		8.59	3.38	7.3	4.7									8.65		
25-Dec-19						6.53	1.75	2.33	3.12							
27-Dec-19						6.78	1.36	2.37	3.19	3.45					6.65	

Ammonia Nitrogen

Since 2014, the Ammonia Nitrogen levels in the Nam Ngiep River and its tributaries have generally been below the detection limit (<0.2 mg/L). In the Q4 2019, Ammonia Nitrogen complied with the National Surface Water Quality Standard of <0.2 mg/L in all stations monitored.

Table 5-9: Ammonia Nitrogen results for the surface water in Nam Ngiep and its main tributaries monitored in Q4 2019

Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
7-Oct-19	<0.2															
8-Oct-19		<0.2	<0.2	<0.2	<0.2											
9-Oct-19						<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2			<0.2	<0.2
13-Nov-19						<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2			<0.2	<0.2
14-Nov-19		<0.2	<0.2	<0.2	<0.2									<0.2		
19-Nov-19	<0.2												<0.2			
9-Dec-19	<0.2												<0.2			
10-Dec-19		<0.2	<0.2	<0.2	<0.2									<0.2		
11-Dec-19						<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2			<0.2	<0.2

Biochemical Oxygen Demand (BOD₅)

Since 2014, the Biochemical Oxygen Demand (BOD₅) levels in the Nam Ngiep River and its tributaries have generally been below the detection limit (< 1 mg/L). The results for Q4 2019 are within the normal ranges previously measured except in R06, R07, NNG05 and NNG06 which showed some exceedances. These are believed to be the result of the decomposition of biomass in the hypolimnion of the main reservoir being discharged to the re-regulation reservoir and further downstream which is likely to gradually improve.

Table 5-10: BOD₅ results of the surface water in Nam Ngiep and its main tributaries monitored from October to December 2019

Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA 01	NHS 01
2-Oct-19						<1.0	2.94	1.49	<1.0							
7-Oct-19	<1.0												<1.0			
8-Oct-19		1.2	<1.0	1.5	<1.0											
9-Oct-19						<1.0	3.54	2.77	1.14	<1.0	<1.0	<1.0			<1.0	<1.0
16-Oct-19						<1.0	7.46	7.9	<1.0							
23-Oct-19						<1.0	6.4	8.04	<1.0							
30-Oct-19						<1.0	6.18	6.66	<1.0							
6-Nov-19						<1.0	4.24	2.3	<1.0							
13-Nov-19						<1	4.88	4.86	4.18	3.95	1.19	<1.0			<1.0	<1.0
14-Nov-19		1.49	<1.0	<1.0	<1.0									<1.0		
19-Nov-19	<1.0												<1.0			
20-Nov-19						<1.0	2.97	<1.0	<1.0							
27-Nov-19						<1.0	3.26	3.9	2.3							
4-Dec-19						<1.0	7.14	7.32	4.46							
9-Dec-19	1.53												1.48			
10-Dec-19		1.99	<1.0	<1.0	<1.0									<1.0		
11-Dec-19						<1.0	2.8	3.38	2.93	2.86	1.82	<1.0			2.04	1.21

Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA 01	NHS 01
18-Dec-19						<1.0	4.52	5.04	3.7							

Chemical Oxygen Demand (COD)

The COD measurements in Q4 2019 are presented in **Table 5-11**.

Table 5-11: COD results for surface water in Nam Ngiep and its main tributaries during Q4 2019

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	NHS 01
7-Oct-19	7.1												<5.0			
8-Oct-19		10.4	13.8	6	8											
9-Oct-19						7.2	6.4	<5.0	5	5.6	5.8	<5.0			5.6	5.4
13-Nov-19						11.5	<5.0	5.9	5.5	9.5	5.1	<5.0			5.5	5.5
14-Nov-19		8.7	9.3	6.9	8.7									<5.0		
19-Nov-19	7.9												8.4			
9-Dec-19	6.4												<5.0			
10-Dec-19		10	15.8	5.6	5.2									<5.0		
11-Dec-19						<5.0	18.4	12.8	6.4	7	7.2	9.4			<5.0	8.8

The mean COD values for the main reservoir in Q4 2019 was 8.7 mg/L which is on the same level as previous measurements (9.1 mg/L COD for Q3 2019 and 8.0 mg/L COD for the period from start of impounding to Q4 2019) in the main reservoir and also similar to pre-impounding levels. The upstream measurements in NNG01 also show COD concentrations at a similar level.

Faecal Coliforms

The results of the faecal coliform analyses in Q4 of 2019 are presented in **Table 5-12**. There were no exceedances of the National Surface Water Quality Standard of 1,000 MPN/100 ml for faecal coliform bacteria in the neither the reservoirs nor downstream the project.

Table 5-12: Results of faecal coliforms in Nam Ngiep and its main tributaries in Q4 2019 (MPN/100 ml faecal coliform bacteria)

Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA 01	NHS 01
2-Oct-19						22	13	22	33							
7-Oct-19	1,600												170			
8-Oct-19		79	13	22	17											
9-Oct-19						11	8	79	70	22	49	79			34	280
16-Oct-19						0	7	14	2							
23-Oct-19						0	0	0	0							
30-Oct-19						0	0	0	2							
6-Nov-19						21	9	7	14							
13-Nov-19						0	0	0	7	5	21	240			27	22
14-Nov-19		0	0	0	0									33		
19-Nov-19	540												11			
20-Nov-19						8	11	8	17							
27-Nov-19						0	0	2	2							
4-Dec-19						7	5	11	17							
9-Dec-19	49												9			
10-Dec-19		2	0	0	0									7.8		
11-Dec-19						0	0	0	4	11	5	17			21	79
18-Dec-19						0	0	0	2							

Total Coliforms

The results of measurements for total coliform bacteria are presented in **Table 5-13**. The results indicate a similar pattern and same tendency as for faecal coliform bacteria.

Table 5-13: Results of total coliforms in Nam Ngiep and its main tributaries in Q4 2019

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	NHS 01
2-Oct-19						110	33	240	350							
7-Oct-19	1,600												1,600			
8-Oct-19		79	49	79	170											
9-Oct-19						33	140	1,700	1,600	220	920	1,600			540	1,600
16-Oct-19						79	70	1,600	240							
23-Oct-19						12	11	33	110							
30-Oct-19						13	33	240	280							
6-Nov-19						540	40	170	350							
13-Nov-19						79	540	350	920	540	350	350			350	920
14-Nov-19		13	13	13	17									220		
19-Nov-19	920												33			
20-Nov-19						33	49	79	170							
27-Nov-19						34	130	110	170							
4-Dec-19						27	17	79	240							
9-Dec-19	240												240			
10-Dec-19		130	33	49	7									170		
11-Dec-19						49	79	49	240	170	280	1,600			1,600	280
18-Dec-19						49	23	13	13							

5.6.2 Compliance Monitoring of Effluents from Camps

A total of 07 effluent camps including OSOV were in use during Q4-2019 and the effluents were monitored in 06 camps and one Wastewater Treatment System of the Main Powerhouse (07 sampling sites) as indicated in **Figure 5-8**. The Wastewater Treatment System (WWTS) at the Obayashi Camp and V&K Camp have not been in use since November 2019 as these camps were decommissioned.

The results are described in **Table 5-14** and the full data set is in **Appendix 5.2**.

The status of compliance as of 31 December 2019 can be summarized as follows:

- Non-compliance with total coliform bacteria for four camps (EF01, EF07, EF10 and EF14);
- The camp EF13, EF14 and EF19 have the worst record of compliance with many instances of non-compliance with the parameters;
- All camps (except V&K Camp (EF10)) have experienced varied degree of non-compliance with ammonia and total nitrogen;

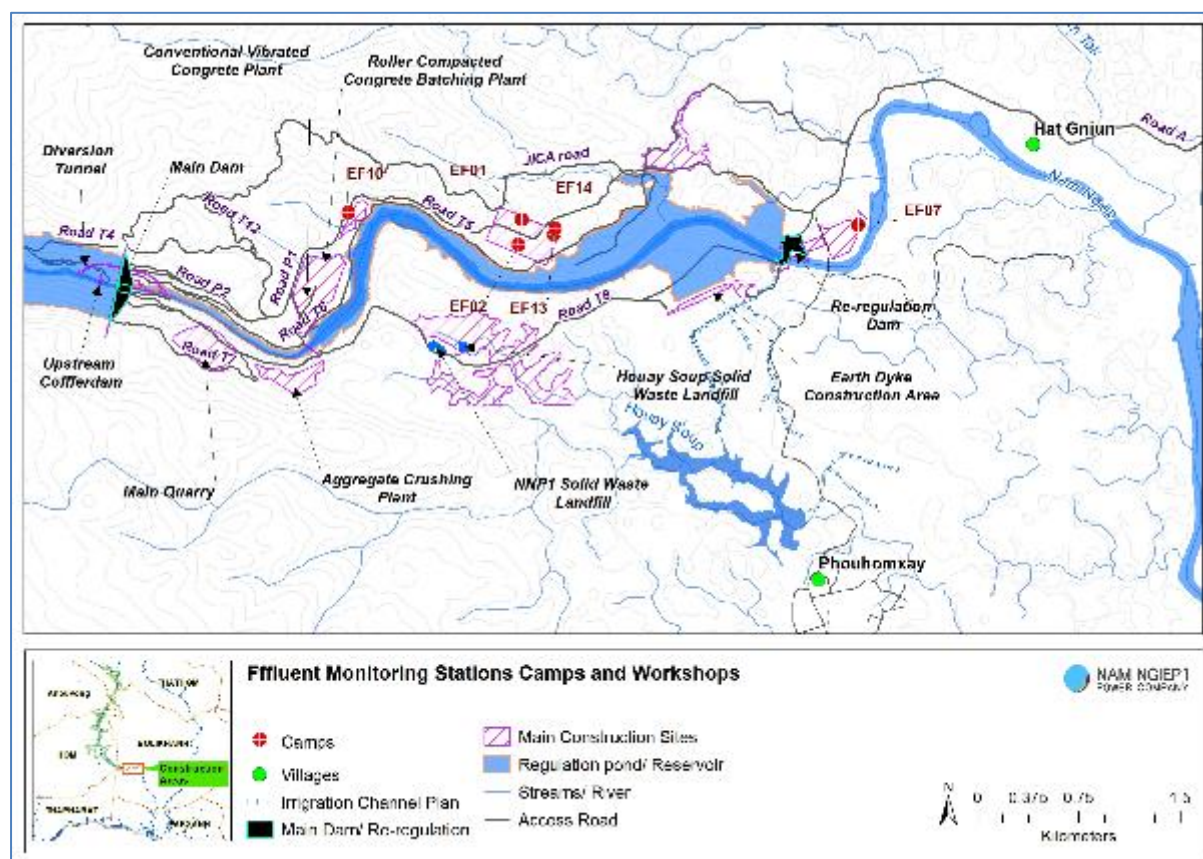
Figure 5-8: Map of effluent monitoring locations during the Q4 2019

Table 5-14: Results of effluent water quality monitoring of the camps in Q4 2019

		Site Name	Owner's Site Office and Village	Obayas hi Camp	Song Da5 Camp No.1	V & K Camp	HM Main Camp	Former IHI (ESD Camp)	Main Powerhouse
		Station Code	EF01	EF02	EF07	EF10	EF13	EF14	EF19
Date	Parameter (Unit)	Guideline in the CA							
03-Oct-19	TSS (mg/L)	<50	<5	<5	<5	5.76	25.13	18.6	
17-Oct-19	TSS (mg/L)	<50	<5	<5		9.03	33.33	56	
04-Nov-19	TSS (mg/L)	<50	<5		<5		37.94	20.26	
18-Nov-19	TSS (mg/L)	<50	<5				27.22	6.4	27.22
03-Dec-19	TSS (mg/L)	<50	<5				16.21	24.69	46.28
16-Dec-19	TSS (mg/L)	<50	<5				11.14	7.78	65
03-Oct-19	BOD ₅ (mg/L)	<30	<6	<6	<6	<6	33	19.74	
17-Oct-19	BOD ₅ (mg/L)	<30	7.47	<6		<6	<6	<6	
04-Nov-19	BOD ₅ (mg/L)	<30	6.27		<6		<6	<6	
18-Nov-19	BOD ₅ (mg/L)	<30	15.18				<6	<6	<6
03-Dec-19	BOD ₅ (mg/L)	<30	8.52				<6	<6	19.08
16-Dec-19	BOD ₅ (mg/L)	<30	17.82				34.44	<6	<6
03-Oct-19	COD (mg/L)	<125	<25	<25	29.4	<25	128	36.5	
17-Oct-19	COD (mg/L)	<125	<25	<25		30	63.2	53.6	
04-Nov-19	COD (mg/L)	<125	<25		<25		117	35.5	
18-Nov-19	COD (mg/L)	<125	<25				128	<25	128
03-Dec-19	COD (mg/L)	<125	<25				96.6	<25	125
16-Dec-19	COD (mg/L)	<125	<25				49.8	<25	135
03-Oct-19	NH ₃ -N (mg/L)	<10	9.5	6.4	6.5	<2	14.5	14.9	
17-Oct-19	NH ₃ -N (mg/L)	<10	4.9	4.2		<2	17.9	20	
04-Nov-19	NH ₃ -N (mg/L)	<10	4.9		8.1		2.9	23.2	
18-Nov-19	NH ₃ -N (mg/L)	<10	4.5				13	8.5	13
03-Dec-19	NH ₃ -N (mg/L)	<10	<1.5				23.5	15.3	59.1

		Site Name	Owner's Site Office and Village	Obayas hi Camp	Song Da5 Camp No.1	V & K Camp	HM Main Camp	Former IHI (ESD Camp)	Main Powerhouse
		Station Code	EF01	EF02	EF07	EF10	EF13	EF14	EF19
Date	Parameter (Unit)	Guideline in the CA							
16-Dec-19	NH ₃ -N (mg/L)	<10	2.3				11.5	17.3	60.5
03-Oct-19	Total Nitrogen (mg/L)	<10	19	10.4	20.4	6.02	21.3	22.5	
17-Oct-19	Total Nitrogen (mg/L)	<10	15.7	11.5		0.84	22.2	23.8	
04-Nov-19	Total Nitrogen (mg/L)	<10	13.6		9.14		4.09	24.4	
18-Nov-19	Total Nitrogen (mg/L)	<10	14.7				14.2	11.1	14.2
03-Dec-19	Total Nitrogen (mg/L)	<10	17.5				32.2	17.7	65.1
16-Dec-19	Total Nitrogen (mg/L)	<10	19.8				13.3	19.2	132
03-Oct-19	Total Phosphorus (mg/L)	<2.0	1.2	0.62	0.59	0.13	1.24	1.46	
17-Oct-19	Total Phosphorus (mg/L)	<2.0	1.06	0.52		0.24	1.62	1.93	
04-Nov-19	Total Phosphorus (mg/L)	<2.0	1.07		0.52		0.81	1.75	
18-Nov-19	Total Phosphorus (mg/L)	<2.0	0.92				1.15	0.86	1.15
03-Dec-19	Total Phosphorus (mg/L)	<2.0	1.35				2.23	0.81	6.26
16-Dec-19	Total Phosphorus (mg/L)	<2.0	1.83				0.67	0.6	7.07
03-Oct-19	Faecal Coliform (MPN/100mL)	<400	130	79	540	220	4.5	1400	
17-Oct-19	Faecal Coliform (MPN/100mL)	<400	22	0		0	0	0	
04-Nov-19	Faecal Coliform (MPN/100mL)	<400	240		540		0	0	
18-Nov-19	Faecal Coliform (MPN/100mL)	<400	7.8				0	0	0
03-Dec-19	Faecal Coliform (MPN/100mL)	<400	14				0	0	0
16-Dec-19	Faecal Coliform (MPN/100 mL)	<400	4				0	0	0
03-Oct-19	Total coliform (MPN/100 mL)	<400	350	170	1,600	1,600	33	16,000	
17-Oct-19	Total coliform (MPN/100 mL)	<400	240	0		0	0	0	
04-Nov-19	Total coliform (MPN/100 mL)	<400	920		1600		0	0	
18-Nov-19	Total coliform (MPN/100 mL)	<400	920				0	0	0
03-Dec-19	Total coliform (MPN/100 mL)	<400	46				0	0	0
16-Dec-19	Total coliform (MPN/100 mL)	<400	110				0	0	0

Table 5-15: Compliance status of effluent discharge from the camps in Q4 2019

Site	ID	WWTS	Key Non-Compliance Issues ¹ in Q4 2019	Corrective Actions
Owner's Site Office and Village (NNP1PC)	EF01	Septic tanks (kitchen and black water) and wetland (grey water), discharge: 70 m ³ /day	<ul style="list-style-type: none"> - Total nitrogen (<10 mg/L): Non-compliance in 6 out of 6. Q4 mean 16.7 mg/L. - Total coliform (<400 MPN/100 mL): Non-compliance in 2 out of 6. Q4 mean 431 MPN/100 mL. 	The improvement work of wetland pond no. 2 and cleaning up of septic tanks system is expected to be carried out in February 2020.
OC Camp – WWTS01	EF02	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	<ul style="list-style-type: none"> - Total nitrogen (<10 mg/L): Non-compliance in 2 out of 2. Q4 mean 10.9 mg/L. 	The camp was decommissioned in December 2019.
V&K Camp	EF10	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	<ul style="list-style-type: none"> - Total coliform (<400 MPN/100 mL): Non-compliance in 1 out of 2. Q4 mean 800 MPN/100 mL. 	This camp was decommissioned in November 2019.
HM Hydro Main Camp – WWTS01	EF13	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	<ul style="list-style-type: none"> - BOD₅ (<30 mg/L): Non-compliance in 2 out of 6. Q4 mean 12.9 mg/L. - COD (<125 mg/L): Non-compliance in 2 out of 6. Q4 mean 97.1 mg/L. - Ammonia (<10 mg/L): Non-compliance in 5 out of 6. Q4 mean 13.8 mg/L. - Total nitrogen (<10 mg/L): Non-compliance in 5 out of 6. Q4 mean 17.9 mg/L. 	This camp will be taken over by ESD in January 2020. A short-term consultant is being recruited to assess the current wastewater treatment system and make suggestions for long-term improvements.

¹ The values in brackets indicate the applicable standard

Site	ID	WWTS	Key Non-Compliance Issues ¹ in Q4 2019	Corrective Actions
			<ul style="list-style-type: none"> - Total phosphorus (<2.0 mg/L): Non-compliance in 1 out of 6. Q4 mean 1.3 mg/L. 	
IHI Camp	EF14	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	<ul style="list-style-type: none"> - TSS (<50 mg/L): Non-compliance in 1 out of 6. Q4 mean 22.3 mg/L. - Ammonia (<10 mg/L): Non-compliance in 5 out of 6. Q4 mean 16.5 mg/L. - Total nitrogen (<10 mg/L): Non-compliance in 6 out of 6. Q4 mean 19.8 mg/L. - Faecal coliform (<400 MPN/100 mL): Non-compliance in 1 out of 6. Q4 mean 233 MPN/100 mL. - Total coliform (<400 MPN/100 mL): Non-compliance in 1 out of 6. Q4 mean 2,667 MPN/100 mL. 	Same as the HM Hydro Main Camp – WWTS01 (above)
Song Da 5 Camp No. 1	EF07	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	<ul style="list-style-type: none"> - Total nitrogen (<10 mg/L): Non-compliance in 1 out of 2. Q4 mean 14.8 mg/L. - Faecal coliform (<400 MPN/100 mL): Non-compliance in 2 out of 2. Q4 mean 540 MPN/100 mL. - Total coliform (<400 MPN/100 mL): Non-compliance in 2 out of 2. Q4 mean 1600 MPN/100 mL. 	This camp was decommissioned and planned to be vacated by the end of December 2019.
Main Powerhouse	EF19	Septic tanks (grey and black water), biofilm tank and chlorination tank.	<ul style="list-style-type: none"> - TSS (<50 mg/L): Non-compliance in 1 out of 3. Q4 mean 46.2 mg/L. - COD (<125 mg/L): Non-compliance in 2 out of 3. Q4 mean 129.3 mg/L. - Ammonia (<10 mg/L): Non-compliance in 3 out of 3. Q4 mean 44.2 mg/L. - Total nitrogen (<10 mg/L): Non-compliance in 3 out of 3. Q4 mean 70.4 mg/L. - Total phosphorus (<2.0 mg/L): Non-compliance in 2 out of 3. Q4 mean 4.8 mg/L. 	A short-term consultant is being recruited to assess the current wastewater treatment system and make suggestions for long-term improvements.

5.6.3 Compliance Monitoring of Discharges from Construction Sites

All main construction works have been completed and monitoring of discharges from the construction sites have therefore also been reduced (see **Figure 5-9**). The results are presented in **Table 5-16**.

Figure 5-9: Location of discharge points of key construction sites

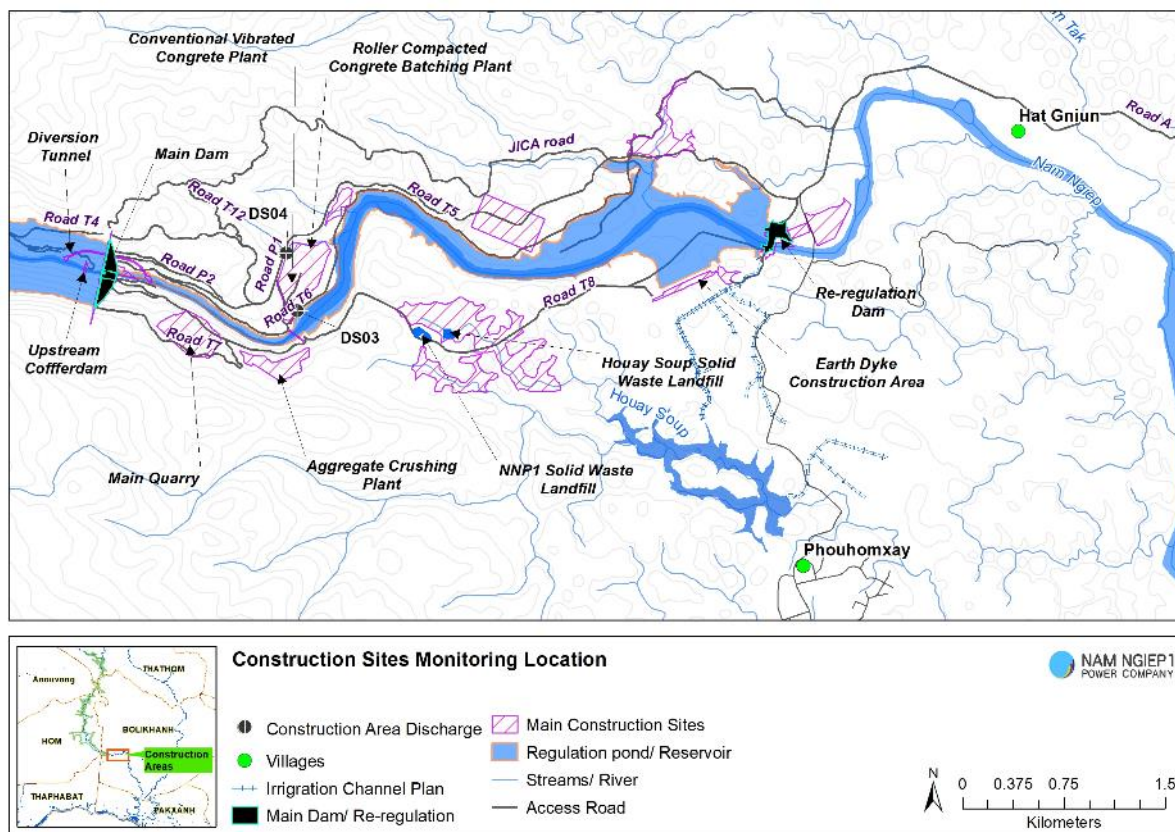


Table 5-16: Results of the construction area discharge monitoring in Q4 2019

Date	Parameter (Unit)	Site Name (Code)	Spoil Disposal Area No.2 (DS04)
		Effluent Standard	
03-Oct-19	TSS (mg/l)	<50	6.16
10-Oct-19	TSS (mg/l)	<50	3.2
17-Oct-19	TSS (mg/l)	<50	3.8
24-Oct-19	TSS (mg/l)	<50	3.4
31-Oct-19	TSS (mg/l)	<50	2.4
07-Nov-19	TSS (mg/l)	<50	2.51
15-Nov-19	TSS (mg/l)	<50	0.8
21-Nov-19	TSS (mg/l)	<50	0.53
29-Nov-19	TSS (mg/l)	<50	0.74
05-Dec-19	TSS (mg/l)	<50	1
12-Dec-19	TSS (mg/l)	<50	1.2
19-Dec-19	TSS (mg/l)	<50	2.04

Table 5-17: Compliance status of effluent discharge and corrective action during Q4 2019

Site	ID	Treatment System	Key Non-Compliance Issues ² in Q4-2019	Corrective Actions
Spoil Disposal No.2	DS04	Sediment pond	- Fully compliance.	Not applicable

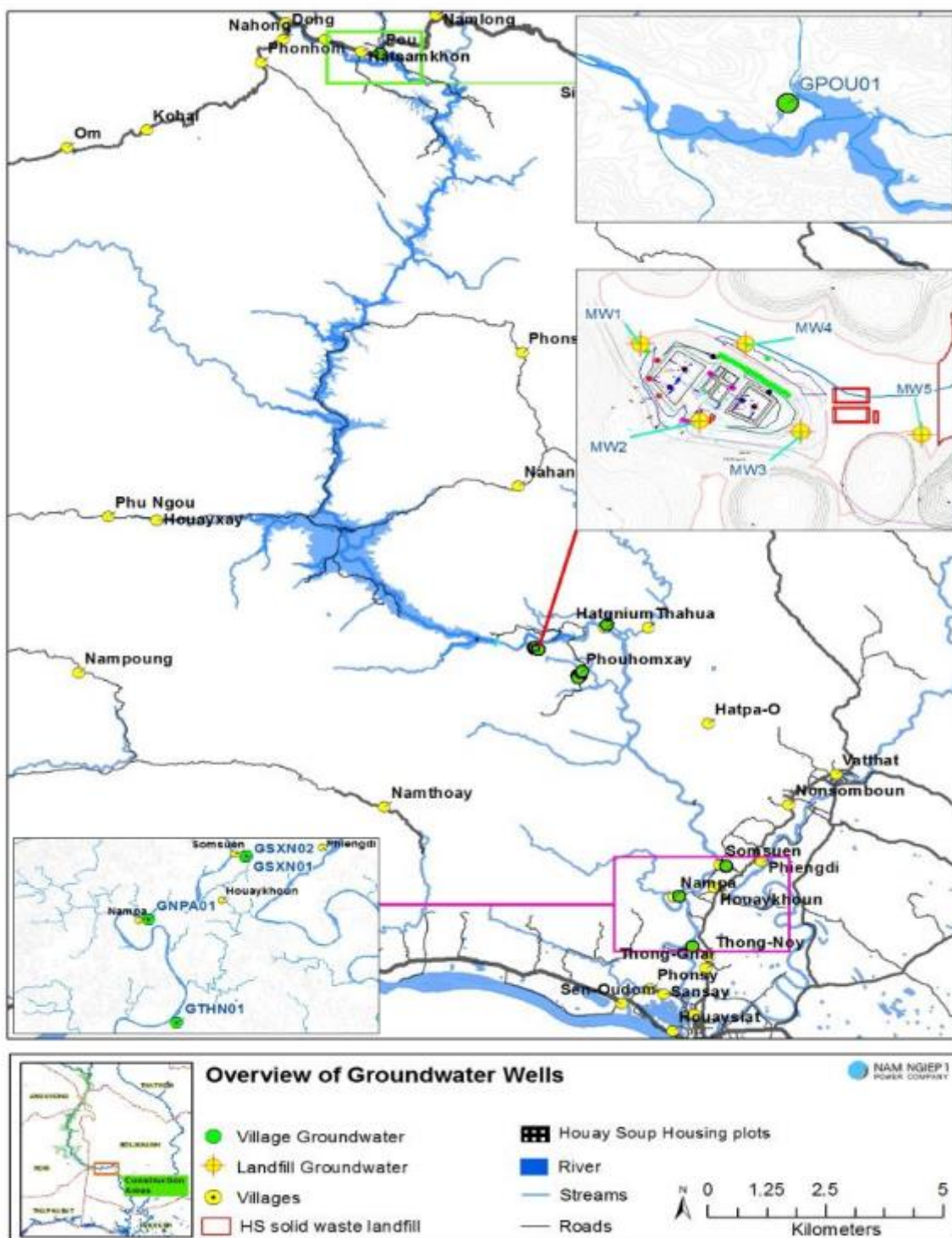
5.6.4 Groundwater Quality Monitoring

During Q4 2019, a total of four boreholes at Somseun, Nam Pa, Thong Noy and Pou Villages (one borehole in each village) have been monitored for the following parameters:

- Monthly:* pH, DO (%), DO (mg/L), Conductivity (µs/cm), TDS (mg/L), Temperature (°C), Turbidity (NTU), Faecal Coliform (MPN/100 mL) and E. coli (MPN/100 mL);
- Bi-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 5-10** and the groundwater monitoring data is presented in **Appendix 5.4**

² The values in brackets indicate the applicable standard

Figure 5-10: Groundwater sampling locations

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

Somsuen Village: All monitored parameters complied with the standard except for faecal coliform and E.Coli bacteria in October 2019 sample. In addition, low pH was recorded in December 2019. Low pH is a natural feature of the ground water in this area which has been found since the beginning of the Project. The low pH levels detected do not pose any threat to public health.

Nam Pa Village: All monitored parameters complied with the standard except for faecal coliform and E.Coli bacteria in October and November 2019 samples. In addition, low pH was recorded in December 2019.

Pou Village: All monitored parameters complied with the standard except for faecal coliform and E.Coli bacteria in November 2019 sample.

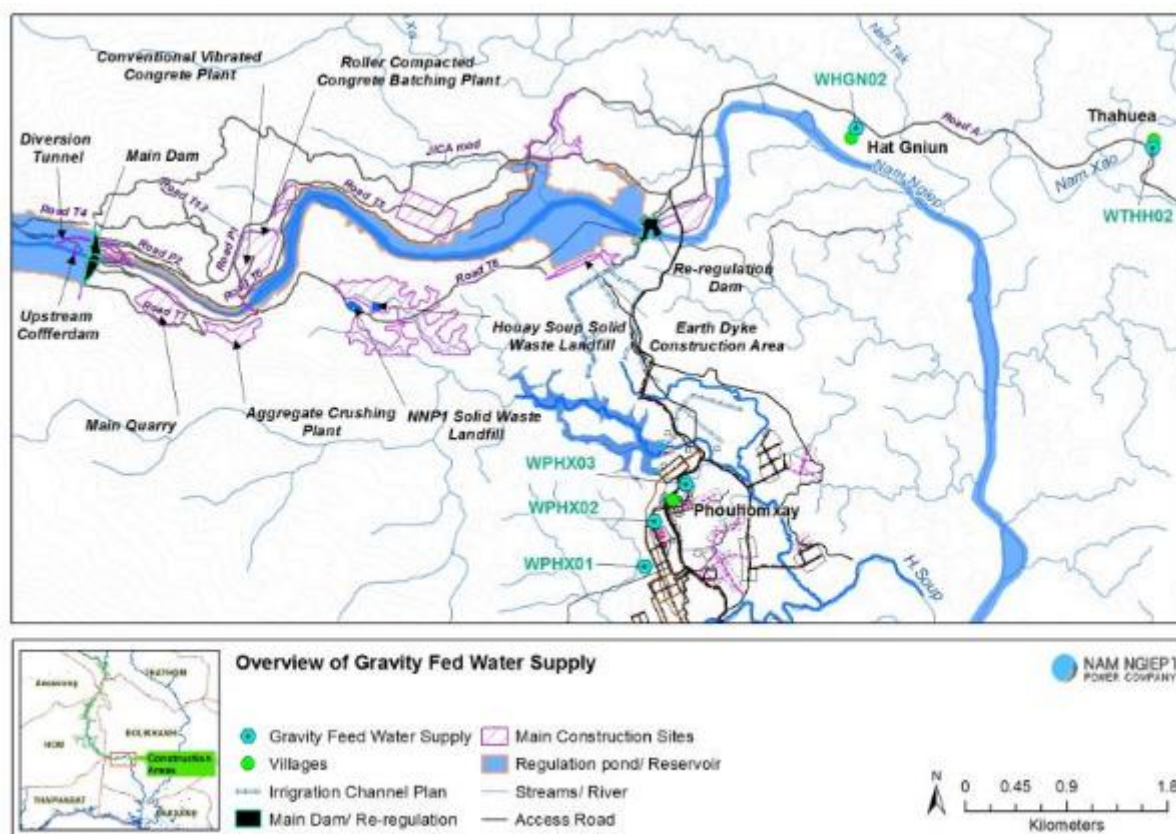
Thong Noy Village: All of monitored parameters complied with the relevant National Standard except for faecal coliform and E. Coli bacteria in Q4 2019 samples.

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.

5.6.5 Gravity Fed Water Supply (GFWS) System 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.

Figure 5-11: 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 5-18**. A full set of data is presented in **Appendix 5.5**

Table 5-18: The GFWS monitoring result in Q4 2019

Date	Parameter (Unit)	Site Name	Tha Heua Village	Hat Gnuin Village	Phouhomxay Village		
		Station	WTHH02	WHGN02	WPHX01	WPHX02	WPHX03
		Guideline					
21-Oct-19	E. Coli Bacteria (MPN/100 ml)	0	11	13	350	34	220
21-Nov-19		0	22	110	920	170	110
16-Dec-19		0	11	27	220	540	350
21-Oct-19	Faecal coliform (MPN/100 ml)	0	17	13	350	34	220
21-Nov-19		0	22	220	920	170	110
16-Dec-19		0	11	27	220	540	540

Thahuea Village (WTHH02): all parameters complied with the National Drinking Water Standards, except for faecal coliform and E.Coli bacteria during the Quarter.

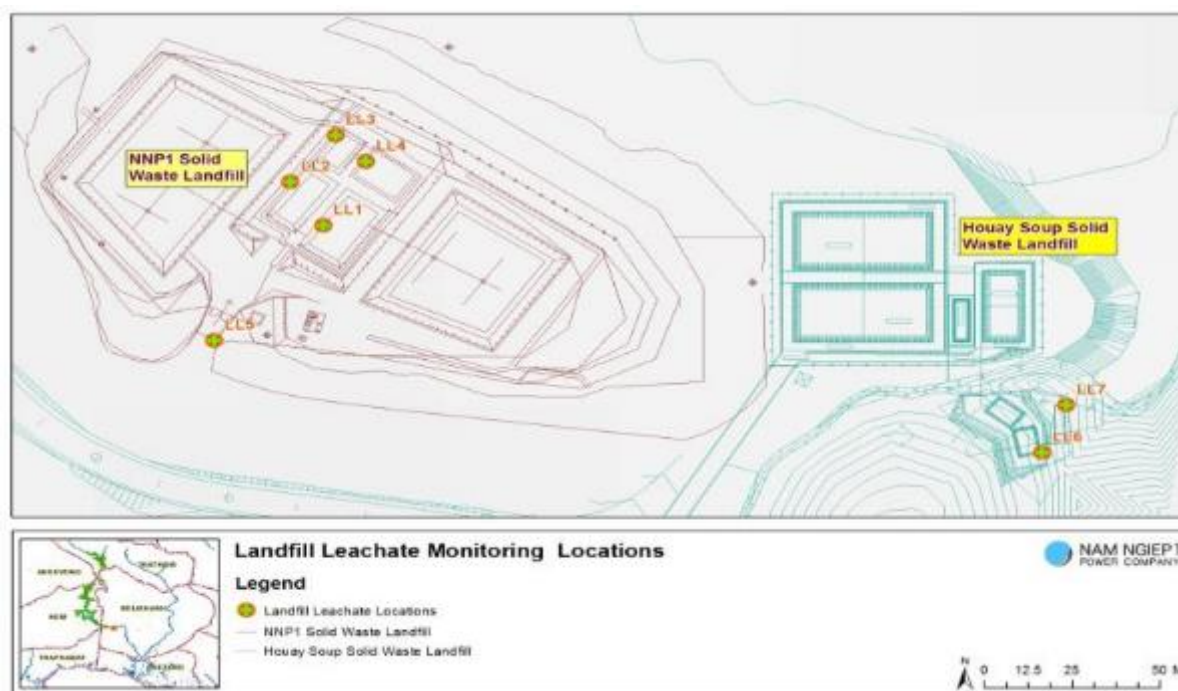
Hat Gnuin Village (WHGN02): all parameters complied with the National Drinking Water Standards, except the faecal coliform and E.Coli bacteria. Low pH was recorded in September 2019.

Phouhomxay Village (WPHX01 -raw water in the head tank before filtration, WPHX02 - tap water at primary school & WPHX03-tap water at the villager's house): all parameters complied with the National Drinking Water Standards, except the faecal coliform and E.Coli bacteria.

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. In addition, the NNP1PC is planning to improve the water quality of this GFWS system in Phouhomxay in 2020.

5.6.6 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 5-12**.

Figure 5-12: Landfill Leachate Monitoring Location

The monitoring results for Q4 2019 indicate compliance with the applicable standards for all monitored parameters except faecal coliform and total coliform at the last pond of NNP1 Landfill. In addition, the non-compliance for COD, faecal coliform and total coliform were also recorded at the last pond of Houay Soup Landfill during the Quarter. All leachate are contained and treated in the ponds with no discharge to the environment. The monitoring data can be found in **Appendix 5.6**

5.6.7 Air Quality (Dust) Monitoring

Since all construction activities were completed and the COD was reached on 05 September 2019, the dust monitoring program in the Project area has been ended as of 31 December 2019 because it is unlikely that the project would generate any significant dust impact.

5.6.7.1 Ambient Air Quality in the Host Villages

The ambient air quality monitoring for dust (measured as PM₁₀ – particulate matter with diameter of 10 micrometre or smaller) was carried out for 72 consecutive hours at Hat Gniun and Phouhomxay Villages. The main purpose of the dust monitoring at Hat Gniun and Phouhomxay Villages is to assess if the project construction works may have caused significant dust levels in the ambient air. As the construction works have been completed, the dust monitoring will be phased out and terminated from Q1 2020 onwards.

The monitoring stations are displayed in **Figure 5-13** and the results are summarized in

Table 5-19. The measured concentrations of PM₁₀ in the ambient air complied with the standard during the monitored periods.

Figure 5-13: Noise and dust monitoring locations at the host villages

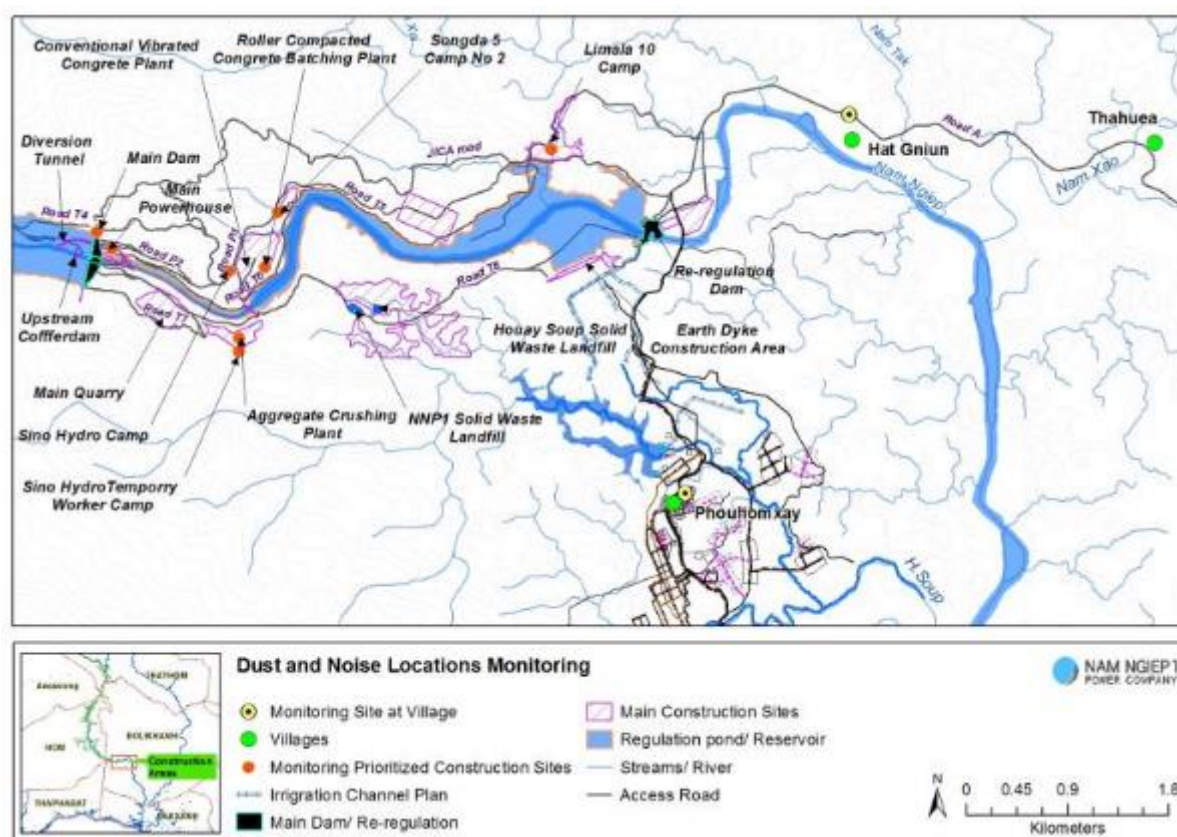


Table 5-19: Results of air quality (dust) monitoring at the host villages during October to December 2019

[illegible][illegible]

5.6.7.2 Project Sites

During Q4 2019, dust (PM₁₀) monitoring was carried out monthly for 24 consecutive hours at the main dam and main power house to assess possible impact on workers' health. The results are summarized in **Table 5-20** which indicates compliance with the standard (0.12 mg/m³ PM₁₀) for both sites.

Table 5-20: Dust monitoring results at key Project sites during October to December 2019

Site Name	Main Dam		
Period	00-24 Hours	00-24 Hours	00-24 Hours
Start Time	30/Oct/19 18:00	04/Nov/19 18:00	26/Dec/19 18:30
End Time	31/Oct/19 18:00	05/Nov/19 18:00	27/Dec/19 18:00
Average Data Record (mg/m ³) – 24 h	0.028	0.029	0.084
Guideline Average (mg/m ³) – 24 h	0.12	0.12	0.12

Site Name	Main Powerhouse		
Period	00-24 Hours	00-24 Hours	00-24 Hours
Start Time	02/Oct/19 18:30	05/Nov/19 17:30	23/Dec/19 18:00
End Time	03/Oct/19 18:00	06/Nov/19 17:00	24/Dec/19 18:00
Average Data Record (mg/m ³) – 24 h	0.017	0.032	0.059
Guideline Average (mg/m ³) – 24 h	0.12	0.12	0.12

6 WATERSHED AND BIODIVERSITY MANAGEMENT

6.1 WATERSHED MANAGEMENT

6.1.1 Implementation of Watershed Management Plan

Following the guidance provided by ADB, the budget summary of AIP2019 related to the No Net Loss from both Provinces was consolidated by NNP1PC and submitted to ADB on 25 September 2019. ADB provided comments on 15 October 2019 and the revised version with further clarification was re-submitted to ADB on 19 October 2019.

ADB provided a no objection to the proposed AIP2019 (October to December 2019) of Xaysomboun and Bolikhamxay Provinces on 06 November 2019. The Xaysomboun and Bolikhamxay Provincial Watershed and Reservoir Protection Offices (WRPO) further revised their proposals and submitted these to the Department of Forestry (DOF), Ministry of Agriculture and Forestry (MAF) on 22 November 2019. The DOF-MAF issued an official request for fund disbursement to NNP1PC on 25 November 2019.

The total requested budget of both Provinces' AIPs is USD 154,785 which will be funded from two different sources: 1) USD 112,034 from the Watershed Management Fund (WMF) under GOL's CA budget; and 2) USD 42,751 from NNP1PC additional No Net Loss (NNL) commitment.

DOF received a total amount of USD 112,034 as requested from the Watershed Management Fund (WMF) under GOL's CA budget on 09 December 2019. DOF further transferred the fund to Bolikhamxay and Xaysomboun Provincial WRPOs on 20 December 2019. A total amount of USD 42,751 from NNP1PC additional No Net Loss (NNL) commitment comprised of: 1) USD

23,257 which was transferred to DOF on 26 December 2019 and; 2) USD 19,494 for the procurement of office and field equipment which is being processed by NNP1PC on behalf of GOL as per their request.

NNP1PC-EMO together with a consultant is preparing a Fishery Co-management Plan. A meeting with DOF and Xaysomboun and Bolikhamxay Provincial WRPOs was organized in Longxan District, Xaysomboun Province on 31 October 2019. The meeting discussed the lessons learned from other hydropower Projects, the vision and objectives of the Plan, the institutional arrangement for NNP1 main reservoir fishery co-management and the scope of key activities to be implemented.

The team conducted village level consultations, field visits and assessment at NNP1 watershed villages during 19-26 November 2019. The consultant has submitted a first draft of the Plan on 20 December 2019 and it was translated to English for further review by NNP1 management until end of December 2019.

NNP1PC-EMO recruited a local consultant in Q4 2019 to conduct an assessment of options for sustainable livelihood opportunities focussing on nine villages in Xaysomboun Province comprising of Houayxay and Phu Ngou Villages in Hom District; Om, Korhai and Thamlo Villages in Anouvong District; Thaviengxay, Naxong, Nahong, and Phonehom Villages in Thathom District. The technical evaluation was concluded on 22 November 2019 and the contract was signed on 25 December 2019.

6.2 BIODIVERSITY OFFSET MANAGEMENT

6.2.1 Implementation of Biodiversity Offset Management Plan

Bolikhamxay Provincial BOMU submitted a request to NNP1PC on 26 September 2019 for the last quarter fund disbursement of NC-NX BOMP AIP2019 totalling USD 60,878 that will cover the implementation period from October to December 2019. Bolikhamxay Provincial BOMU received the fund on 20 October 2019.

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

a. Component 1 - Spatial Planning and Regulation

The second round of consultation meeting was conducted in Na Gngang Village during 9-10 October 2019 to consult and obtain the villagers' agreement on NC-NX TPZ boundary. This meeting was participated by a Vice District Governor of Viengthong District, high ranking provincial and district officials, NNP1PC-EMO staff and key persons from village authorities and communities in Na Gngang Village. The main conclusions from this meeting are summarized below:

1. The villagers agreed with the proposed TPZ boundary in Na Gngang Village.
2. The villagers can continue their agriculture practices at the existing land use area outside the agreed NC-NX TPZ boundary.
3. Patrolling teams can fully conduct the patrolling activity within the NC-NX offset site in their village according to their strategy and plan.

The vice chairman of Bolikhamxay Provincial Biodiversity Offset Management Committee (BOMC) and both District Governors of Xaychamphone and Viengthong Districts advised the Biodiversity Offset Management Unit (BOMU) in the first week of November 2019 to complete the boundary demarcation of the Totally Protection Zone (TPZ) agreed with the

villagers and conduct community awareness activity on the agreed boundary prior to obtaining an official recognition by GOL.

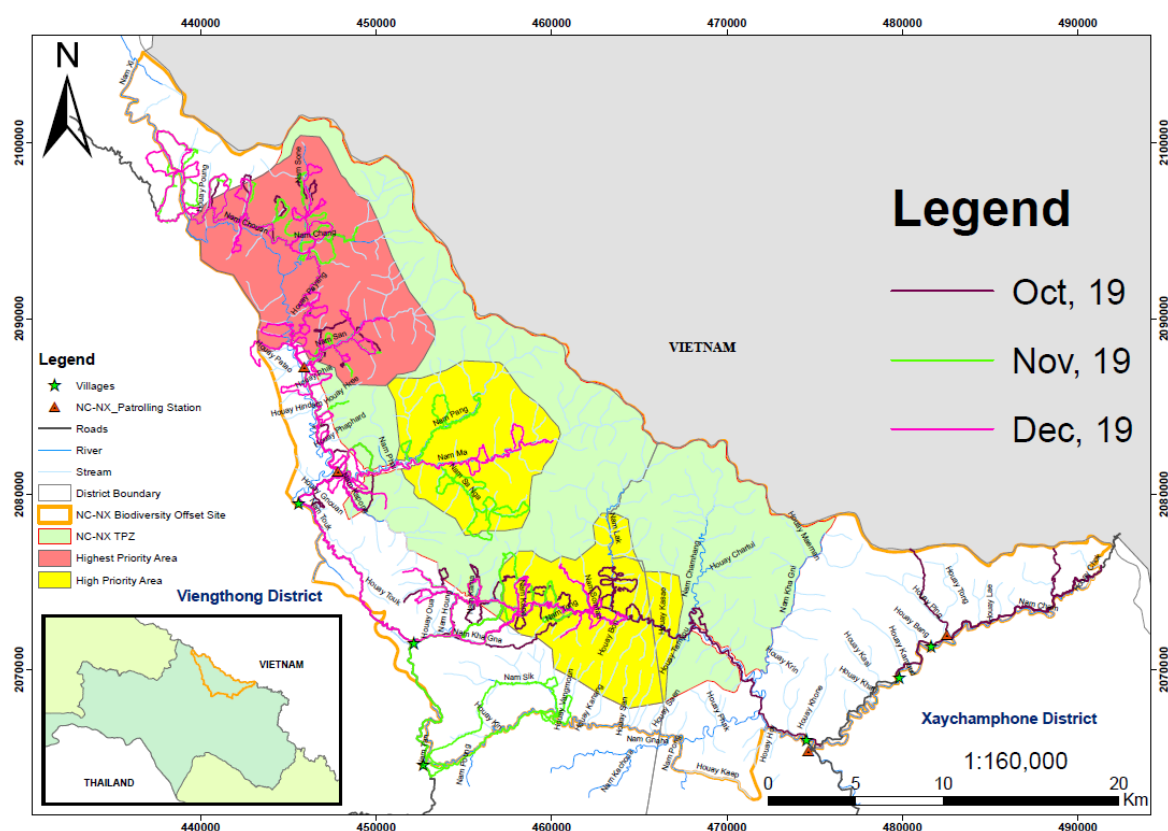
Bolikhamxay Provincial BOMU procured 60 small signage (40x40 cm), 50 concrete poles, and six big signs (2x3 m) for installation at designated locations along the TPZ boundary in the NC-NX as well as within six NC-NX villages. Installation of written signs and poles is a standard GOL method specified in the Forestry Law to inform villagers of the agreed NC-NX TPZ boundary. The installation was re-scheduled to start in January 2020.

b. Component 2 – Law Enforcement

The patrolling continued from 17 October to 05 November 2019. Three teams focussed their patrolling efforts in the TPZ Highest Priority Area covering Nam Xi, Nam Chang, Nam Pong, Nam Chang, Nam Sone, Houy Pong, Houy Xai Gnai, Houy Xai Noi, Nam Chang and Nam Sa. One team focused on Houy Tong, Houy Kamoud, Houy Ping, Nam Kha Gni and Nam Houg in the TPZ higher priority area as well as along the Lao-Vietnam border within Xaychamphone District.

The patrolling continued from 15 November to 04 December 2019. One team focussed the patrolling efforts in the TPZ Highest Priority Area covering Nam San, Nam Chang, Houy Xai Gnai, Houy Xai Noi, Houy Pong and Nam Xi. Two teams focussed their patrolling efforts in the TPZ higher priority area covering Nam Kha Gna, Nam Houg, Nam Kama and Nam Kapa, Nam Somfard and Houy Tong. One team conducted joint patrolling with Pu Mat National Team along the Lao-Vietnam border at Houay Wot-Wot, Houay Tong, Houay Or of Xaychamphone District.

The patrolling continued from 06-25 December 2019. The first team carried out the patrolling at Nam Houg and Nam Kapa (Nam Houg High Priority Area), Nam San (Highest Priority Area) and Houy Pha lai. The second team carried out the patrolling at Nam Chang, Nam Sone, Nam Xi, Houy Xai Gnai, Houy Xai Noi and Houy Pong in the TPZ Highest Priority Area. The third team carried out the patrolling at Nam Ma, Nam Pang, Nam Sa Nga and Nam Mong in Nam Ma High Priority Area.

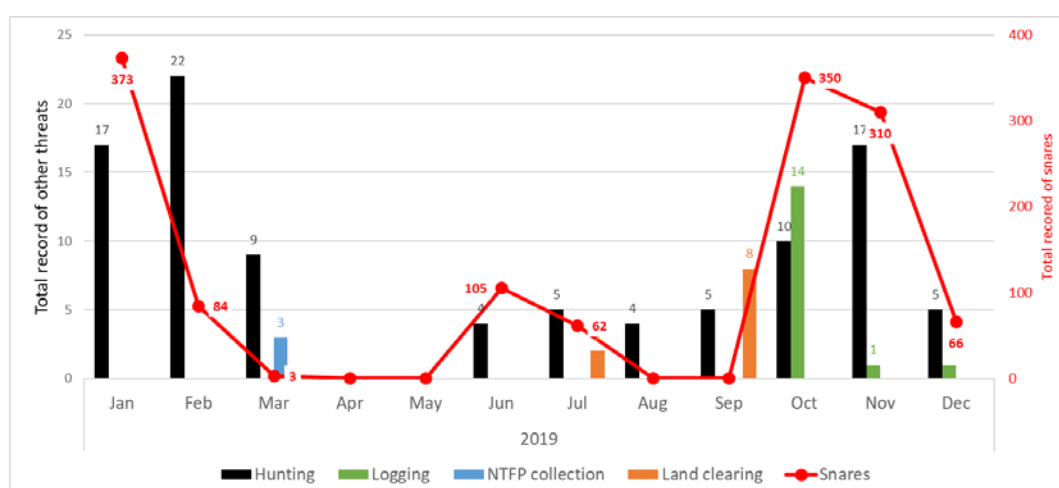
Figure 6-1: Map of patrolling track from October – December 2019

A record of threats from patrolling work in 2019 can be seen from Figure 6-2. During Q4 2019, the team confiscated a total of 350 small wire snares from the CUZ area within Xaychamphone District in October 2019; 310 and 50 small wire snares from Nam Sone area within TPZ Highest Priority Area in November and December 2019 respectively; and 16 small wire snares from Nam Ma TPZ Higher Priority Area in December 2019. The team noted that the snares in Nam Sone TPZ Highest Priority Area were newly set and very likely to be by Vietnamese poachers.

The total number of hunting camps recorded in the TPZ priority area in Q4 2019 is higher than the previous quarters. The patrolling team destroyed a total of 22 hunting camps that were found in Q4 2019. The hunting related activity in this quarter occurred within TPZ Highest and Higher Priority Area but the higher records are located around CUZ area of Na Gngang village close to Nam Hung TPZ higher priority area.

There was one record of handmade gun use in October 2019. The person was fined and the gun was confiscated by the patrolling team and handed over to the village authority.

There was also a record of logging activity which is mostly from Na Gngang Village close to Nam Hung TPZ Higher Priority Area. Bolikhamxay Provincial BOMC members visited the village again on 18 December 2019 to discuss about the logging matter and noted that Bolikhamxay Provincial Forest Inspection (POFI) and District Forest Inspection (DOFI) will continue to enforce the Law and prosecute the poachers who did the illegal tree cutting in Na Gngang Village.

Figure 6-2: Overall Record of Threats in NC-NX Offset Sites in 2019

The record of wildlife observed from patrolling work in 2019 can be seen from **Table 6-1**. There are a total of 603 wildlife recorded through direct observation in Q4 2019

Table 6-1: List of wildlife recorded from direct observation in Q4 2019

No.	Scientific Name	Common Name	Total Number
1	<i>Naja Sp.</i>	Asian Cobra	1
2	<i>Ratufa bicolor</i>	Black Giant Squirrel	85
3	<i>Anorrhinus tickelli</i>	Brown Hornbill	73
4	<i>Viverra zibetha</i>	Large-spotted Civet	6
5	<i>Aquila heliaca</i>	Eagle	1
6	<i>Hystrix brachyura</i>	East Asian Porcupine	2
7	<i>Sacalia quadriocellata</i>	Four-eyed turtle	
8	<i>Buceros bicornis</i>	Great Hornbill	5
9	<i>Polyplectron bicalcaratum</i>	Grey peacock pheasant	
10	<i>Arctonyx collaris</i>	Hog Badger	12
11	<i>Manouria impressa</i>	Impressed Tortoise	3
12	<i>Melogale personata</i>	Large-toothed Ferret Badger	6
13	<i>Macaca assamensis</i> / <i>Macaca mulatta</i> / <i>M. arctoides</i>	Macaque	930
14	<i>Muntiacus rooseveltorum</i> / <i>Muntiacus truongsonensis</i> / <i>Muntiacus muntjac</i>	Muntjac	53
15	<i>Lutrogale perspicillata</i> / <i>Aonyx cinerea</i>	Otter	11
16	<i>Callosciurus erythraeus</i>	Pallas's Squirrel	2
17	<i>Semnopithecus phayrei</i>	Phayre's Leaf Monkey	415
18	<i>Picus rabieri</i>	Pollared Woodpecker	
19	<i>Streptopelia tranquebarica</i>	Red Turtle-dove	
20	<i>Pygathrix nemaeus</i>	Red-shanked Douc Langur	121
21	<i>Cervus unicolor</i>	Sambar	1
22	<i>Nomascus leucogenys</i>	White-cheeked gibbon	61
23	<i>Sus scrofa</i>	Wild Pig	71
24	<i>Aceros undulatus</i>	Wreathed Hornbill	
25	<i>Lophura nycthemera</i>	Silver pheasant	
Grand Total			1,859

Figure 6-3: Red-shanked Douc Langurs in Nam Houng area – TPZ Higher Priority Area



Figure 6-4: Gibbon in Nam Houng area – TPZ Higher Priority Area

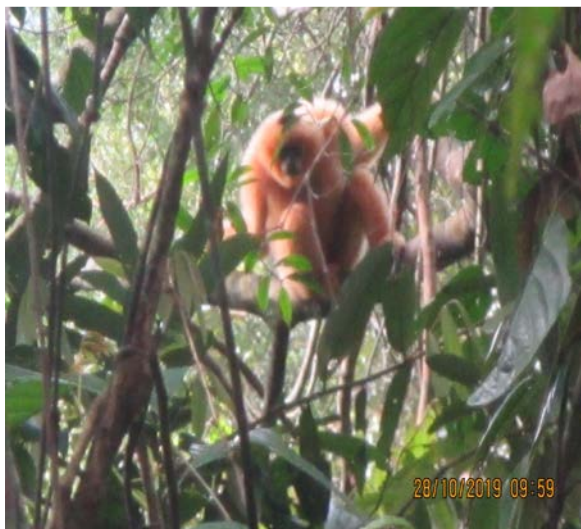


Figure 6-5: Brown Hornbill in Nam Houng area – TPZ Higher Priority Area



Figure 6-6: White-cheeked gibbon

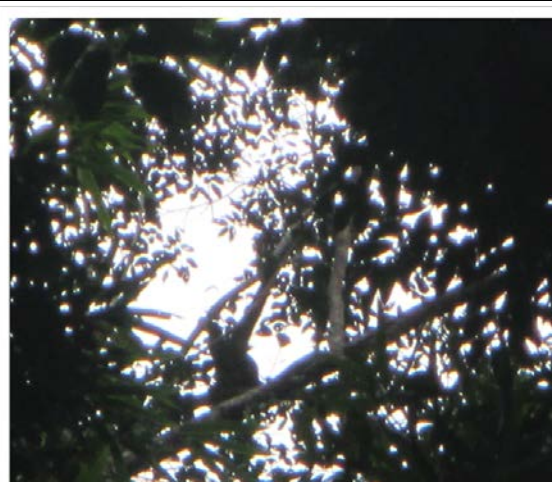


Figure 6-7: Small wire snares at Houay Xai Gnai



Figure 6-8: Hunting camp around Nam Houng – TPZ Higher Priority Area



c. Component 4 – Conservation linked livelihood

NNP1PC is in progress of recruiting a consultant to prepare a Community Development Plan (CDP) for the six NC-NX villages. An advertisement of the consultancy service started from 23 September 2019 until 07 October 2019. However, there were no qualified applicants and so the vacancy advertisement is extended for another round until the middle of November 2019. NNP1PC concluded the technical evaluation on 22 November 2019. The contract was signed on 25 December 2019 and the consultant will start working in January 2020.

7 BIOMASS CLEARANCE / FLOATING DEBRIS REMOVAL

As planned, there was no cutting and burning during this reporting period. NNP1PC-EMO conducted regular monitoring and removal of floating materials/logs from the temporary log-boom as needed.

8 FISHERY MONITORING

The five type of fish that dominated the fish catch by weight in Q4 2019 are listed in **Table 8-1**. This includes two species and three species group that are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species³.

Table 8-1: Fish Species dominating the Fish Catch in Q4 2019

Species	Lao Name	Fish Catch in Q4 2019 (kg)	IUCN Red List Classification
<i>Poropuntius normani</i> , <i>Poropuntius laoensis</i> , <i>Poropuntius carinatus</i>	ປາຈາດ	510.6	LC
<i>Channa striata</i>	ປາຄໍ່	356.8	LC
<i>Hampala dispar</i> , <i>Hampala macrolepidota</i>	ປາສູດ	322.3	LC
<i>Oreochromis niloticus</i>	ປານິນ	320.4	LC
<i>Mastacembelus armatus</i> , <i>Mastacembelus favus</i>	ປາຫຼາດ	231.5	LC

The recorded catch of Threatened and Near Threatened species (IUCN Red List classification) in the Q4 2019 fish catch is presented in **Table 8-2**. The list includes one Endangered species, four Vulnerable species (VU), and six Near Threatened species (NT).

³ The IUCN Red List of Threatened Species is the world's most comprehensive inventory and classification of threatened species. The Red List classifies species into nine groups: Extinct (EX), Extinct in the wild (EW), Critically endangered (CR), Endangered (EN), Vulnerable (VU), Near threatened (NT), Least concern (LC), Data deficient (DD), and Not evaluated (NE). The term "Threatened" includes Critically Endangered, Endangered, and Vulnerable.

Table 8-2: Threatened and Near Threatened Species of the Fish Catch in Q4 2019

Species	Lao Name	Fish Catch ⁴ in Q4 2019 (kg)	IUCN Red List Classification
<i>Cirrhinus molitorella</i>	ປານວນຈັນ/ປາແກງ	5	NT
<i>Cyprinus carpio</i>	ປາໄນ	3	VU
<i>Mekongina erythrospila</i>	ປາສະອີ	0.2	NT
<i>Neolissochilus stracheyi</i>	ປາສອງ	3.6	NT
<i>Onychostoma gerlachi</i>	ປາຄິງ	30.3	NT
<i>Probarbus jullieni</i>	ປາເອີນ	15	EN
<i>Scaphognathops bandanensis</i>	ປາວຽນໄຟ/ປາປ່ຽນ	44.4	VU
<i>Syncrossus beauforti</i>	ປາແຂ້ວໄກ້/ປາໝູ	2.3	NT
<i>Tor sinensis</i>	ປາແດງ	139.7	VU
<i>Wallago attu</i>	ປາຄ້າວ	3.2	NT
<i>Yasuhikotakia splendida</i>	ປາແຂ້ວໄກ້/ປາໝູ	3.5	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 7-3**.

⁴ The list only includes species caught in Nam Ngiep basin – not fish caught by the Mekong Control Group

Table 8-3: 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
<i>Bagarius bagarius</i> (NT)			+	+	+	+	+	+	+	+	+	+	+	+	+			
<i>Bagarius yarrelli</i> (NT)	+			+					+					+				
<i>Bangana behri</i> (VU)	+	+	+	+	+	+	+	+	+			+	+	+	+	+		
<i>Chitala blanci</i> (NT)														+				
<i>Cirrhinus cirrhosus</i> (VU)	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	
<i>Cirrhinus molitorella</i> (NT)	+	+										+	+	+	+	+	+	+
<i>Cyprinus carpio</i> (VU)	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+
<i>Epalzeorhynchus munense</i> (VU)												+						
<i>Hypophthalmichthys molitrix</i> (NT)	+				+									+		+		
<i>Laubuca caeruleostigmata</i> (EN)																	+	
<i>Luciocyprinus striolatus</i> (EN)	+	+	+	+			+	+	+	+			+	+		+		
<i>Mekongina erythrospila</i> (NT)	+	+	+	+	+	+	+	+	+			+	+	+			+	+
<i>Neolissochilus stracheyi</i> (NT)	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Ompok bimaculatus</i> (NT)	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			
<i>Onychostoma gerlachi</i> (NT)	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Pangasianodon hypophthalmus</i> (EN)	+																	
<i>Probarbus jullieni</i> (EN)	+	+	+			+		+	+	+		+		+			+	+
<i>Probarbus labeamajor</i> (EN)				+	+			+							+	+		
<i>Scaphognathops bandanensis</i> (VU)	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Syncrossus beauforti</i> (NT)		+	+	+	+	+					+			+		+	+	+
<i>Tor sinensis</i> (VU)	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Wallago attu</i> (NT)	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+	+
<i>Yasuhikotakia splendida</i> (VU)																		+

The total recorded monthly fish catch from July 2015 to December 2019 for the downstream, upstream and Mekong control group fishing households involved in the monitoring programme is presented in **Figure 8-1**. 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 8-1: Total monthly fish catch during July 2015 – December 2019

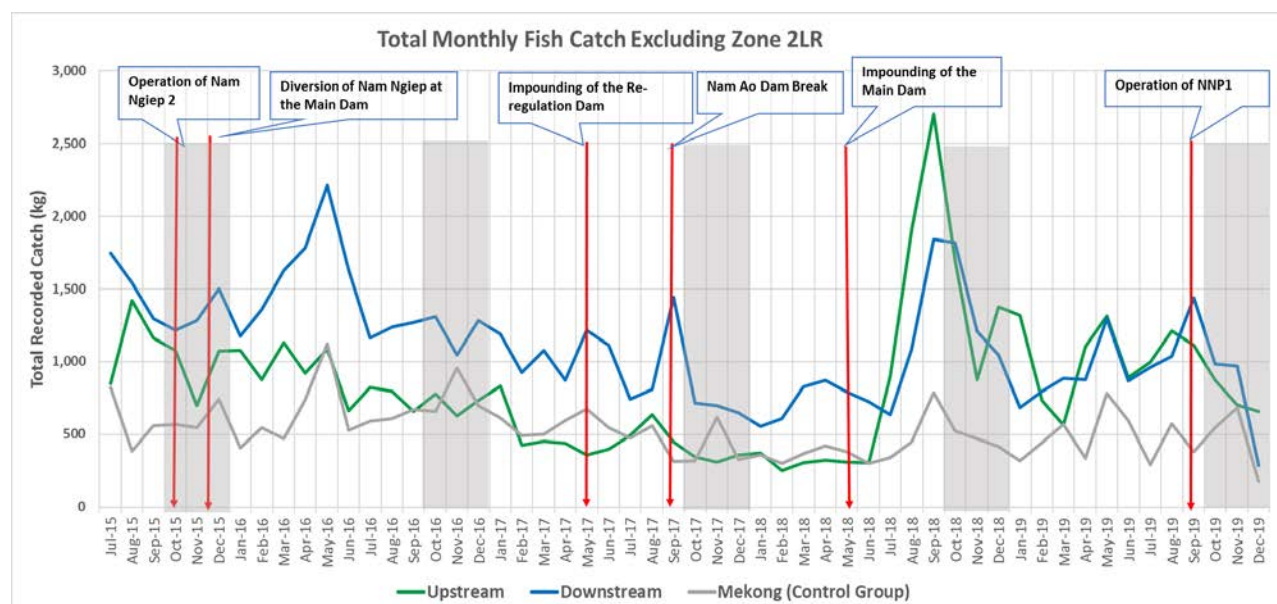


Table 8-4 and Figure 8-2 show the total recorded fish catch for Q4 2015, Q4 2016, Q4 2017, Q4 2018 and Q4 2019 by the upstream (excluding Zone 2LR), downstream and the Mekong control group fishing households. Note that the recording days was reduced from 30 days/month to only seven days/month starting 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 8-4: Total fish catch in Q4 by the Upstream (Excluding Zone 2LR), Downstream and Mekong Control Group Fishing Households

	Q4 2015 (kg)	Q4 2016 (kg)	Q4 2017 (kg)	Q4 2018 (kg)	Q4 2019 (kg)
Upstream	2,847.9	2,130.9	1,008.2	3,949.6	2,231.4
Downstream	3,999.7	3,641.3	2,062.2	4,073.7	2,237.2
Mekong Control Group	1,854.3	2,314.3	1,261.1	1,407.6	1,399.7

Figure 8-2 : Total fish catch in Q4 by the Upstream (Excluding Zone 2LR), Downstream and Mekong Control Group Fishing Households

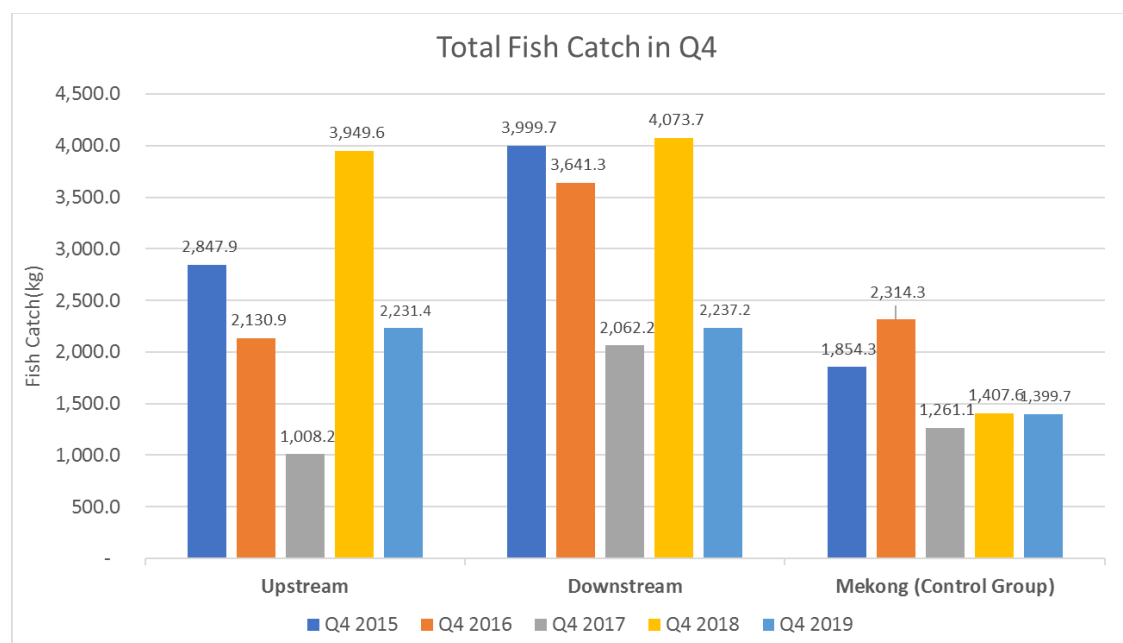
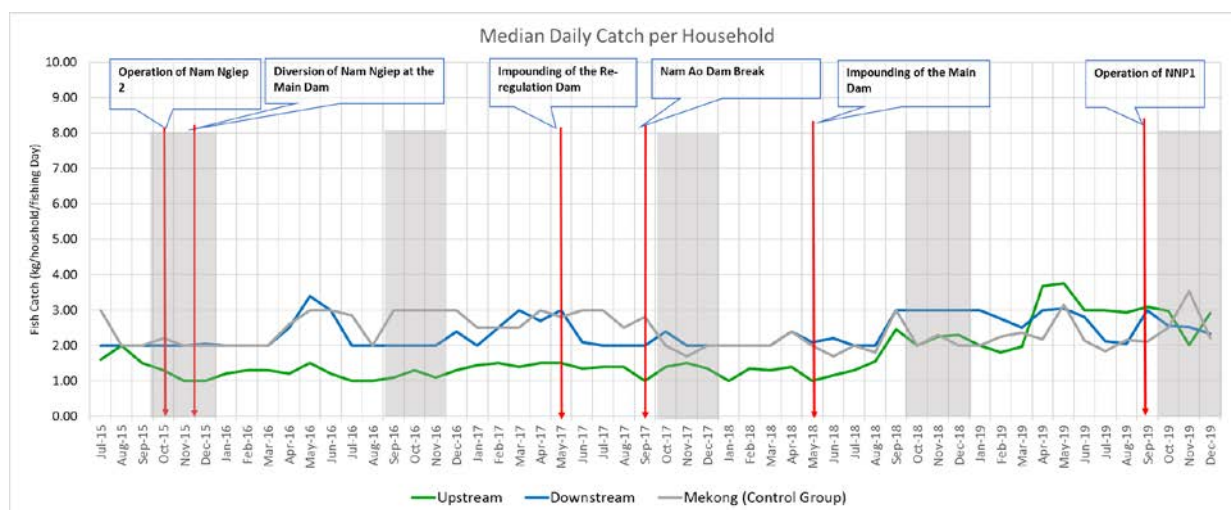


Table 8-5 presents the median household fish catch per fishing day for Q4 2015, Q4 2016, Q4 2017, Q4 2018 and Q4 2019 in the upstream (excluding Zone 2LR), downstream and the Mekong Control Group, and shows the median monthly household fish catch per fishing day from July 2015 to December 2019.

Table 8-5: Median household fish catch per fishing day in Q4 2015, Q4 2016, Q4 2017, Q4 2018 and Q4 2019

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

Figure 8-3: Median monthly household fish catch per fishing day (excluding Zone 2LR)

To test whether there are any significant differences among the quarterly mean household fish catch per fishing day for each fishing zone, one-way ANOVA (analysis of variance) statistical tests have been performed on the data from each fishing zone. The null-hypothesis is that the sample means are equal, and the alternative hypothesis is that at least one of the means is statistically different. The level of significance is set to 0.05 (5%). The results of the one-way ANOVA tests are presented in **Table 8-6**.

Table 8-6: Results of one-way ANOVA tests on mean household fish catch in Q4

Fishing Zone	F-Statistic	P-value	F-Critical	Significance
Upstream	80.67	1.96 ^{*-65}	2.37	Highly Significant
Downstream	27.47	1.40 ^{*-22}	2.37	Highly Significant
Mekong Control Group	1.40	0.23	2.38	Not Significant

The rule for interpreting the results of an ANOVA test is that if the F-statistic is lower than the F-Critical value then this supports that the null-hypothesis cannot be rejected (same if the *p*-value is greater than the significance level). The results of the ANOVA tests in **Table 8-6** indicates that upstream and downstream area are highly significant, while the Mekong area means not significantly different.

APPENDICES

APPENDIX 1: STATUS OF SS-ESMMPs REVIEW AND APPROVAL DURING Q4 2019

No	Site name	Document Name	Contractor / subcontractor	Approval Status by NNP1PC-EMO (date)	Detailed Site Information	Monthly Construction & Operation Status
01	<ul style="list-style-type: none"> - Sino Hydro camp and workshop; - Aggregate plant and associate facilities; - KENBER camp; - Borrow pit at adjacent to KENBER camp; - Song Da5 camp No.2; - Main Quarry; - GFE camp; - Borrow pit P1/P1A; - RCC Plant (upper part); - Spoil disposal No.2, 3, 6 & 8; - Former TCM crusher plant area; - Former RT camp; - CVC Plant; - V&K camp; - Former Song Da5 batching plant (current stock yard). 	The Taking Over the Areas Occupied for Temporary Facility and Work	OBAYASHI CORPORATION	No objection with comment on 06 November 2019; 1 st submission on 21 October 2019		On-going of site decommissioning and rehabilitation
02	OBAYASHI camp	Site Specific Decommissioning and Rehabilitation Plan for	OBAYASHI Corporation	Under review 2 nd submission on 24 December 2019		On-going

		Civil Works Contractor (OC) Camp.				
03	New ESD camp (former HM and IHI camp)	SS-ESMMP for the Improvement of IHI and HM Camps (new ESD Office and Camp)	Thanongxay Development Construction Co., Ltd	No objection with no comment on 05 November 2019 for the 1 st submission on 05 November 2019		Completed
04	Main Dam Area	Working Drawing of Additional Fence and Security Gates for the Main Dam Area	OBAYASHI Corporation	No objection with no comment for the 1 st submission on 19 November 2019		Completed
05	Market for the Community (PAPs) in 2UR Zone	Environmental checklist for the improvement of the entrance and water supply for the market in Zone 2UR	Thanasay Construction limited	No objection with no comment for the 1 st submission on 19 November 2019		Completed, site was closed
06	Main Dam tailrace	DWP & SS-ESMMP for Main Dam Plunge Pool Excavation Work	Song Da5	No objection with no further comment on 26 November 2019 for the 5 th submission on 22 November 2019		Completed, site was closed
07	Song Da5 Camp No.1	Site Decommissioning and Rehabilitation Plan for Song Da5 Camp No.1	Song Da5	No objection with comment on 17 December 2019 for the 1 st submission on 04 December 2019.		Ongoing
08	Former Song Da5 batching plant (current Song Da5 stock yard)	Site Decommissioning and Rehabilitation Plan for Song Da5, Temporary CVC	Song Da5	No objection with comment on 13 December 2019 for		On-going

		Batching Plant and Stockyard		the 1 st submission on 09 December 2019		
09	Main Dam and Re-regulation Dam	DWP & SS-ESMMP for the Maintenance and Repairing Works for the Nam Ngiep 1 Hydropower Project	Vorarath road-bridge Co., Ltd	No objection with no comment on 19 December 2019 for the 1 st submission on 16 December 2019		On-going
10	Main Dam Left Bank	DWP & SS-ESMMP for the Installation of Double Corrosion Protection Rock Bolts at the Left bank slope	Song Da5	Under review for the 1 st submission on 23 December 2019		On-going

APPENDIX 2: ENVIRONMENTAL MONITORING CORRECTIVE ACTIONS Q4-2019

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow-up Date	Status
ONC_OC-0321	09.09.2019	OC Camp	Consistent non-compliance on the Total and Faecal Coliform was found during July and August 2019 fortnightly monitoring (between 540 - 1600 MPN/100 ml where the guideline requires less than 400 MPN/100 ml), as a result of less chlorine dosing (detailed effluent results have been shared with OC separately).	It is noted that OC camp and office are under demolition/ decommissioning, but the camp still accommodates some staff and, therefore, adequate operation of the camp's WWTS is required. The Contractor was instructed to accomplish the following actions by the specified deadline: - Adjust the chlorine dosing rate to obtain the residual chlorine of between 0.3-0.9 mg/l. - Clean up the harvested vegetation in the wetland ponds.	15.09.2019	04.10.2019	Resolved
ONC_OC-0322	09.09.2019	V&K Camp	During the second fortnight monitoring in August 2019, Total coliform and Faecal coliform were above the limit (1600 MPN/100 ml where the guideline requires less than 400 MPN/100ml), due to inconsistent chlorine dosing	It is noted that V&K camp is under demolition/ decommissioning, but the camp still accommodates some staff and, therefore, proper operation of the camp's WWTS is required. The Contractor was instructed to accomplish the following actions by the specified	11.09.2019	04.10.2019	Resolved

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow-up Date	Status
			and the chlorine mixing pump was not working sometimes during the inspection.	deadline: - Adjust the chlorine dosing rate to obtain the residual chlorine of between 0.3-0.9 mg/l and; - Repair the mixing pump and chlorine dripping pipeline/valve.			
ONC_OC-0323	09.09.2019	Song Da5 Camp No.1	During the August monitoring, detection of Total and Faecal coliform fluctuated, (between 130-1600 MPN/100 ml for both, where the guideline requires less than 400 MPN/100 ml), as a result of less chlorine dosing and mixing before discharging. Note: Discontinuing chlorine dosing and mixing was found out during GOL-EMU missions in May and July 2019. The findings were recorded in the EMU's reports of May and July 2019.	The Contractor was instructed to complete the following actions by the specified deadline: - Adjust the chlorine dosage to obtain residual chlorine of between 0.3-0.9 mg/l; - Clean up all wetland ponds and repair the wastewater circulation system.	11.09.2019	22.10.2019	Resolved
ONC_OC-0324	24.09.2019	RCC Plant Yard	Oily equipment was directly washed on the bare ground without any control measures.	Stop washing any oily tools/equipment on the bare ground immediately; - Any oily tools/equipment shall	25.09.2019	03.10.2019	Resolved

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow-up Date	Status
			As a result, oil film was washed off site.	be maintained within designated area.			
ONC_AM-0002	24.09.2019	ESD Camp	<p>On 18 September 2019, during the environmental inspection, it was observed that chlorine in the dosing container has finished.</p> <ul style="list-style-type: none"> - NNP1 site admin personnel were instructed to provide key staff/operator to check and refill the chlorine into the system as well as; - Maintaining and modifying the chlorine dripping tap as per the manual prepared by EMO. <p>This finding and recommendation was reported during the Weekly DMD Meeting for the week 16-21 September and on 30 September 2019 respectively.</p>	<ul style="list-style-type: none"> - ADM to include the WWTS operation activity as part of ADM's routine works until there is an official assignment of the work to the O&M team. During this transitional period, it is very important that ADM include this activity as part of their routine activity and assign a manpower to manage a daily operation and maintenance of the WWTS; - Maintain and modify the chlorine dripping tap (the existing steel tap was corrosive and the dripping pipe was often clogged, which resulted in inconsistent chlorine dosing). 	30.09.2019	02.10.2019	Resolved
ONC_OC-0325	22.10.2019	Spoil dumping area (former	The site was originally used by TCM (OC's subcontractor) as mobile crusher set up for road	The Contractor was instructed to take the following actions by specified deadline:	30.11.2019	03.12.2019	Resolved

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow-up Date	Status
		TCM crusher)	<p>construction. This site was being used as temporary material dumping area (sand, gravel, spoil) by main civil work's contractors and Loxley contractor as part of maintaining work of the tower No. 1.</p> <p>- During this bi-weekly joint inspection between EMO and OC, it was observed that the material dumped by both CWC and Loxey contractors was left behind without site landscaping and reshaping for a proper site closure.</p>	<p>- Carry out site landscaping and reshaping to ensure proper surface gradient to avoid further soil erosion and sediment transport and;</p> <p>- Provide aids for re-vegetation;</p> <p>- This site shall be counted as one of the aftercare rehabilitated site during the liability period until January 2021.</p>			
ONC_OC-0326	22.10.2019	Former RT camp	<p>Incomplete site decommissioning and rehabilitation:</p> <p>- Some part of the concrete slab was remained, the area was not levelled properly which post high risk of surface runoff and soil erosion;</p> <p>- No removal of concrete water tanks;</p>	<p>The Contractor was instructed to take the following actions by specified deadline:</p> <p>- Completely break and remove the concrete slab and level the area properly;</p> <p>- Break the concrete water tanks and landscape the area properly;</p> <p>- Provide proper cut-off drain</p>	30.11.2019	17.12.2019	Unresolved and will be followed up in the next quarter

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow-up Date	Status
			- No provision of cut-off drains around the site to protect soil erosion and sediment transport to the re-regulation reservoir.	around the site to divert the run-off during the wet season.			
ONC_OC-0327	05.11.2019	Song Da5 Stock Yard below CVC Plant	<p>The site was originally used as the Batching Plant set up by Song Da 5 contractor. Later, this site was used as a temporary material stock yard (belt conveyor materials, structures, crane equipment, and etc...) by the main civil work's contractors.</p> <p>- During this bi-weekly joint inspection between EMO and OC, it was observed that the area was partially landscaped, and some metal and materials were remained. OC informed that the area will be cleaned and landscaped after all materials have been removed by Song Da5 Contractor.</p> <p>- Importantly, it is unclear for the decommissioning</p>	<p>The Contractor was instructed to submit a Site-Specific Decommissioning and Rehabilitation Plan with indicative timeline for NNP1PC review and approval at least 14 days prior to commencing the decommissioning work. This Plan needs to be in line with the requirements provided in the Construction Site Decommissioning and Rehabilitation Plan (CSDRP).</p> <p>Note: Post inspection, TD informed EMO via email on 06 November 2019 that RCC foundation is a "trial embankment and we will leave them and add in the land right area."</p>	30.11.2019	28.11.2019	Resolved

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow-up Date	Status
			responsibility of the RCC foundation that was placed on site during the trail RCC testing work. OC insisted that the remaining RCC concrete foundation is the Owner's property and discussion should be carried out with TD.				
ONC_OC-0328	05.11.2019	Song Da5 Stock Yard below CVC Plant	Mixed construction waste was remained on site near the left bank of the re-regulation reservoir.	The contractor was instructed to clean up the area, segregate the mixed waste for proper disposal in accordant to the waste management measures	15.11.2019	28.11.2019	Resolved
ONC_OC-0329	05.11.2019	Song Da5 Camp No.1	Mixed waste was remained on site without adequate waste management practice: — Mixed waste was observed on site including construction waste, scrap metal and general waste;	Construction waste shall be segregated properly. Wooden waste shall be controllly burnt at the spoil disposal area No.6; - General waste shall be disposed of at NNP1 project landfill and; - Recycle waste shall be sold to authorized local vendor.	15.11.2019	17.12.2019	Resolved
ONC_HM-0030	05.11.2019	LILAMA10 Camp	During the bi-weekly joint site inspection, it was observed that site landscaping for LILAMA10 Camp area was	In accordance to the rehabilitation measures provided in the Constrction Site Decommsioning and Rehabilitation Pant (CSDRP),	12.11.2019	20.11.2019	Resolved

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow-up Date	Status
			completed. However, there was no application of necessary aids to re-vegetate the site.	the Contractor was instructed to sow local native grass seed and necessary aids to ensure vegetation re-growth.			
ONC_VSP-0013	12.11.2019	Irrigation canal of HSRA	<p>As a long time facing on difficulty of rock blasting and delaying. During the bi-weekly joint site inspection, the contractor informed NNP1PC that the canal rock blasting and spoil/rock disposal activity work would be completed by November 2019.</p> <p>The camp operation is expected to be extended and operated for other two more months after completing rock blasting and excavation work for other concrete works.</p> <p>In accordance to the construction site decommissioning and rehabilitation requirements, the Contractor is obliged to decommission and rehabilitate</p>	<p>The Contractor is required to prepare the Site Decommissioning and Rehabilitation Plan of the camp area and spoil / rock disposal area and submit the plan for NNP1-EMO's for review and approval at least 15 business day before work completion:</p> <ul style="list-style-type: none"> - The camp facilities shall be decommissioned, treated and clean up properly; - The spoil/rock disposal area could be landscaped, cover with topsoil and re-vegetated to protect soil erosion and restore original site condition as much as possible. Please note that: EMO is only to participate the Final Inspection when the site 	25.11.2019	18.12.2019	Unresolved

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow-up Date	Status
			all of their sites which include temporary accommodation, workshop, construction supporting areas, etc. properly before leaving the project.	decommissioning and rehabilitation work is completed.			
ONC_OC-0340	19.11.2019	OC Camp	Incomplete decommissioning and removal of concrete foundation and construction waste from the site: - Some concrete foundation of the camp were remained over 30 cm above of ground level and was backfilled / covered by soil. This will be an obstruction for future land use. - In addition, construction waste such as gypsum, broken brick walls and broken concrete was filled in the open ditch. The waste was likely to be covered rather than removed.	Referring to the Construction Site Decommissioning and Rehabilitation Plan (CSDRP), any structure and / or foundation higher than 20 cm above ground level shall be decommissioned and disposed (buried) properly at the Spoil Disposal No.6. Therefore, the contractor was instructed to clean up the construction waste properly and dispose of at the approved area to return to its viable site condition as much as possible.	20.11.2019	28.11.2019	Resolved
ONC_OC-0341	19.11.2019	Song Da5 Camp No.1	During this bi-weekly joint site inspection, the sub-contractor representative informed that Song Da5 camp No.1 was	The Contractor was instructed to prepare and submit a Site Decommissioning and Rehabilitation Plan of Song Da5	25.11.2019	17.12.2019	Resolved

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow-up Date	Status
			expected to be completely decommissioned by December 2019.	Camp No.1, (either full or partial decommissioning) for NNP1PC review and approval.			
ONC_OC-0342	17.12.2019	Song Da5 Camp No.1	Inadequate handling of hazardous material (oil) during the site decommissioning of the temporary workshop. - Oil spillage on the concrete floor but no cleaning up; - Five used oil gallons were left in an undesignated area.	Clean up the oil contaminated stain on the floor and dispose this contaminated waste as per the hazardous waste elimination measures; - Specify a proper location for the remaining hazardous material/waste on site.	25.12.2019	24.12.2019	Resolved
ONC_OC-0343	17.12.2019	RCC Plant Yard	Oil contaminated soil disposed into the open ditch behind RCC plant's workshop: - On 03-Dec-19, during the last week's weekly joint safety and environment patrol, the Contractor was instructed to immediately stop of disposing the oil contaminated soil into the open ditch drainage line, as well as clean up the disposed contaminated waste for proper disposal/eliminating.	Stop disposing of hazardous stain to the environment; Clean up the disposed oil contaminated soil from the open ditch. Any oil stain shall be well collected, stored for a proper disposal / elimination.	25.12.2019	24.12.2019	Resolved

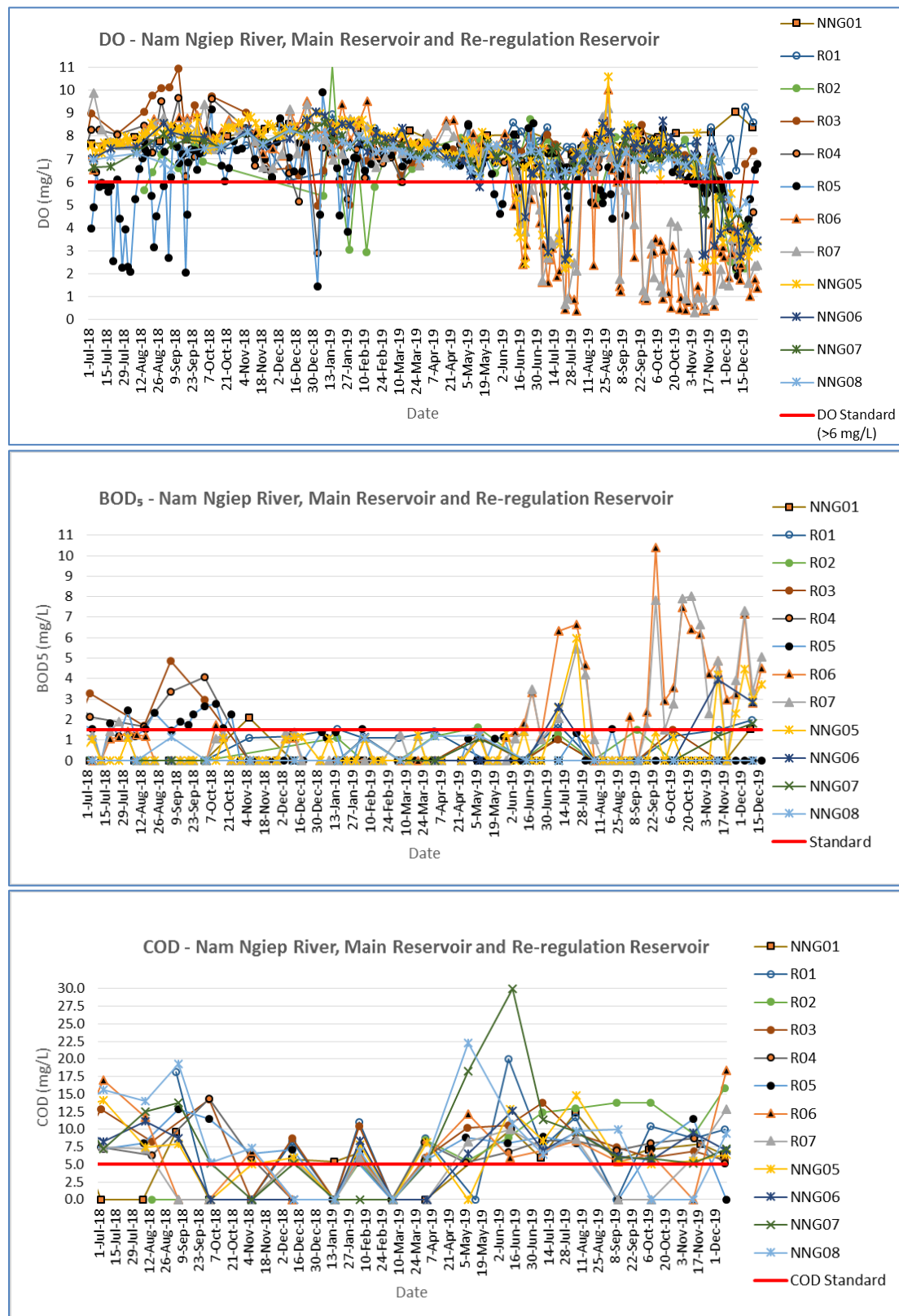
Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow-up Date	Status
			- On 17-Dec-19, during the bi-weekly joint site inspection, there was no action taken by the Contractor.				

APPENDIX 3: CODES AND LOCATIONS OF THE SURFACE WATER QUALITY MONITORING STATIONS

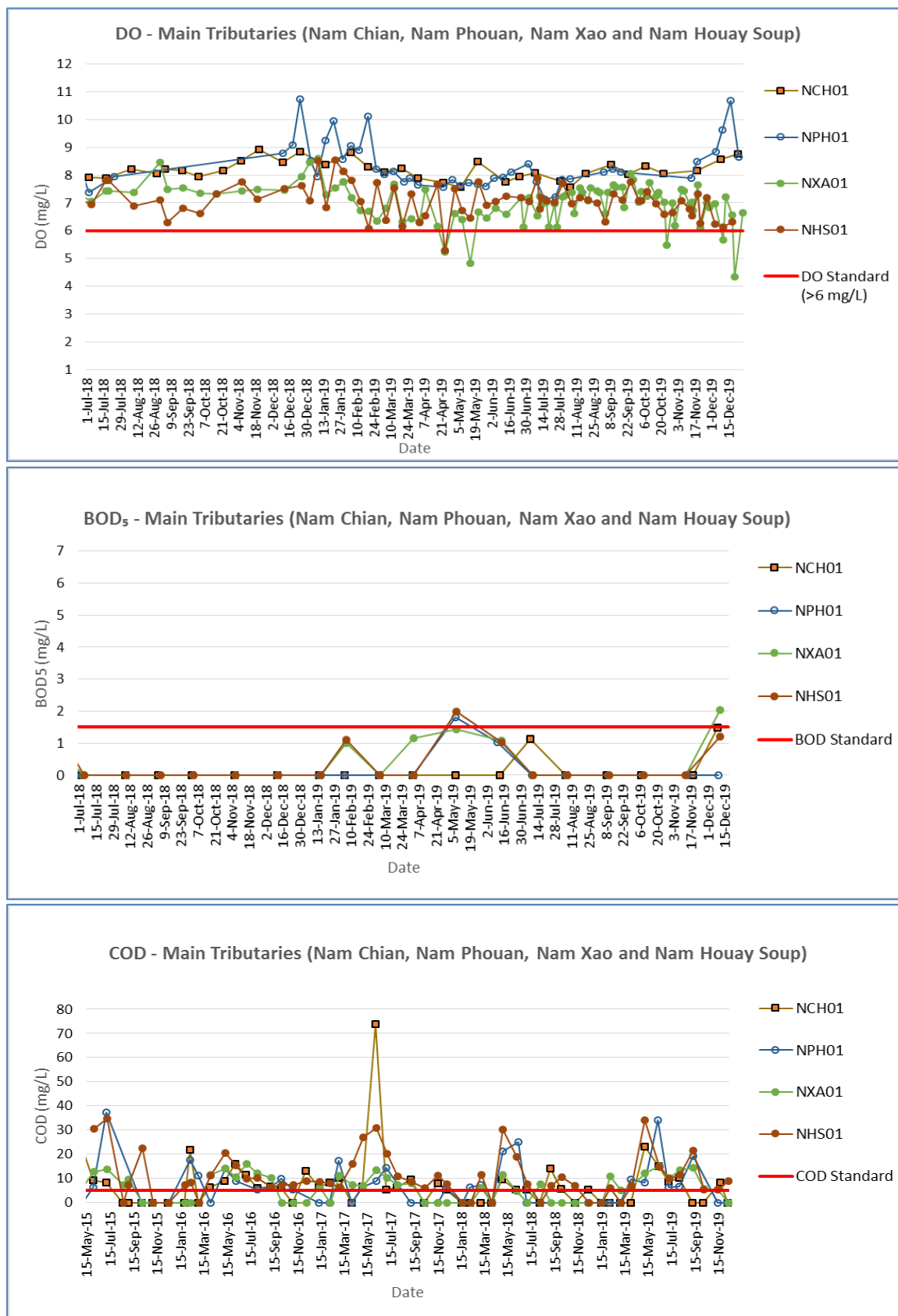
Site Code	Location station	Zone
NNG01	Nam Ngiep Upstream of Ban Phiengta	Upstream Project Construction Site
R01	Main reservoir upstream main dam approx. 50 Km.	
R02	Main reservoir upstream main dam approx. 35 Km.	
NNG02/R03	Nam Ngiep Upstream of Nam Phouan Confluence / Main reservoir upstream main dam approx. 21 Km.	
NNG03/R04	Nam Ngiep Downstream of Ban Sop-Yuak / Main reservoir upstream main dam approx. 13 Km.	
NNG09/R05	Nam Ngiep Upstream Main Dam / Main reservoir upstream main dam approx. 0.5 Km	Within Project Construction Site
NNG04 / R06	Nam Ngiep Downstream RT Camp (Middle Re-regulation Reservoir)	
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	

APPENDIX 4: KEY TRENDS OF WATER QUALITY MONITORING FROM JULY 2018 TO END OF DECEMBER 2019 (ONLY PARAMETERS THAT EXCEEDED GUIDELINE STANDARDS)

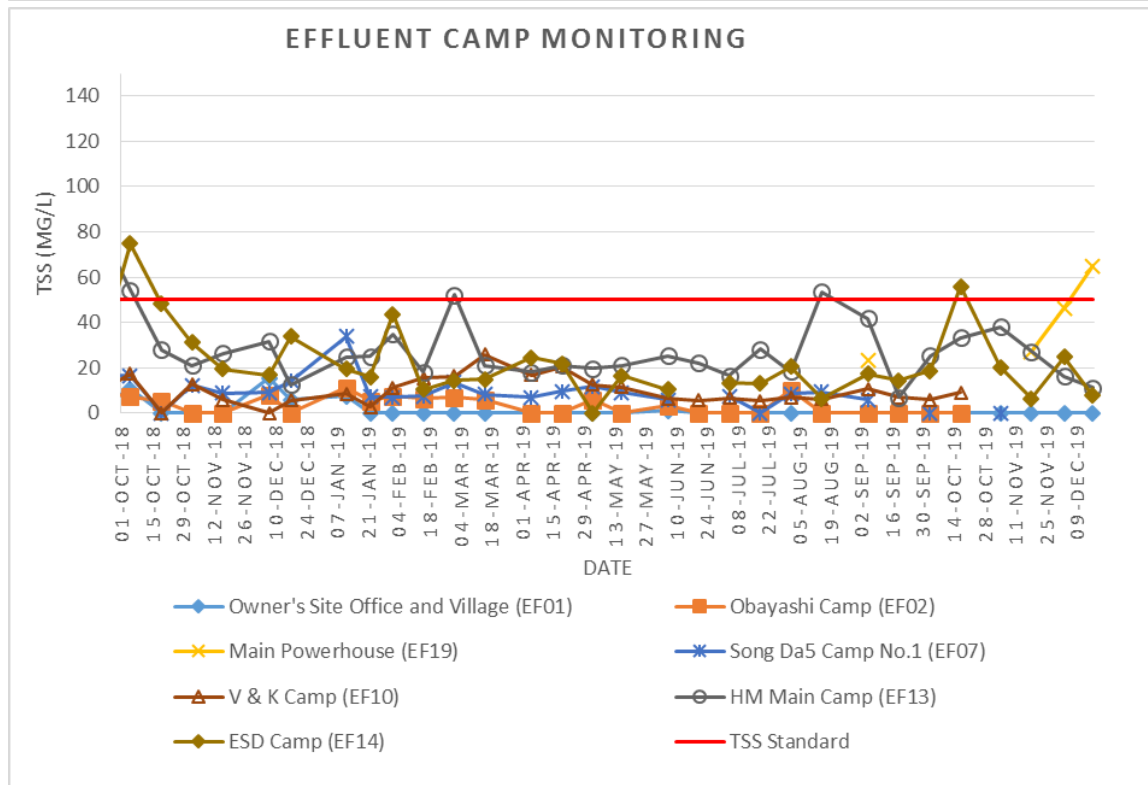
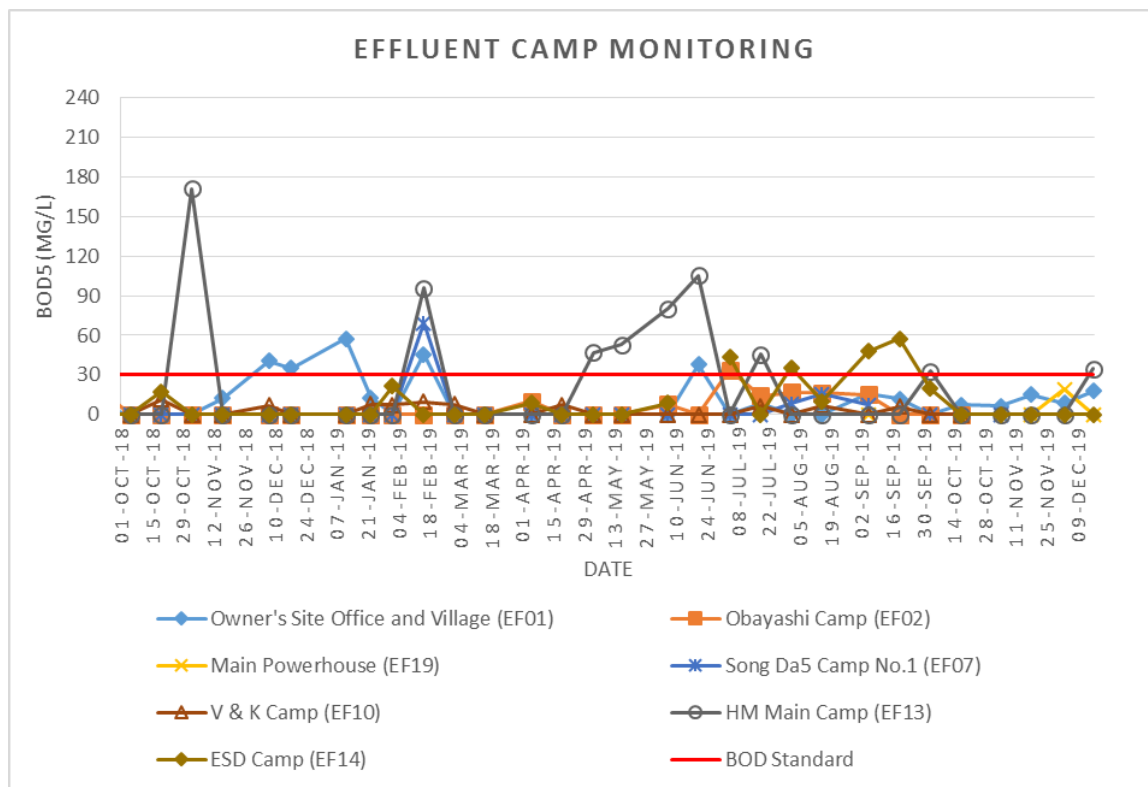
Nam Ngiep Surface Water

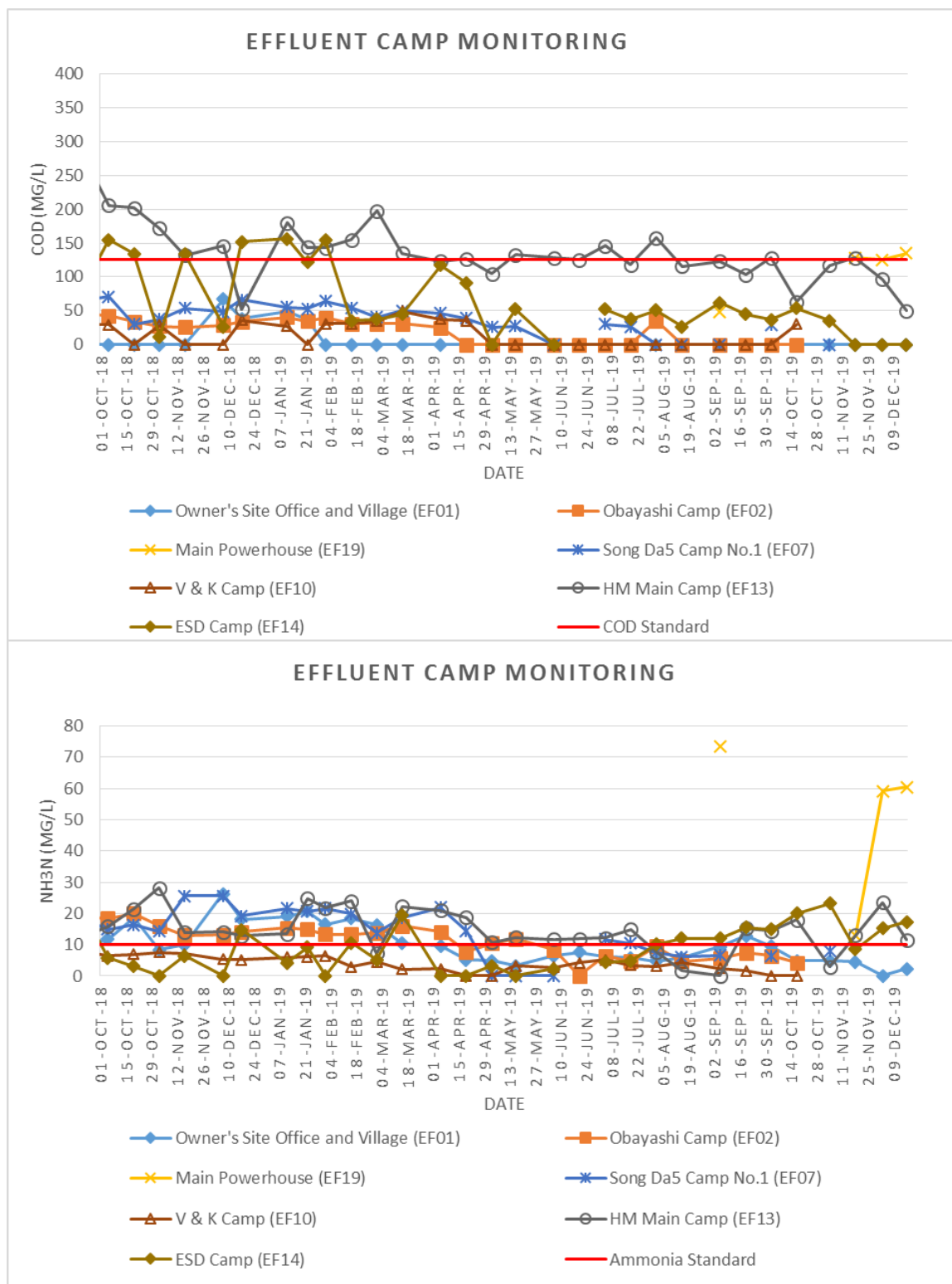


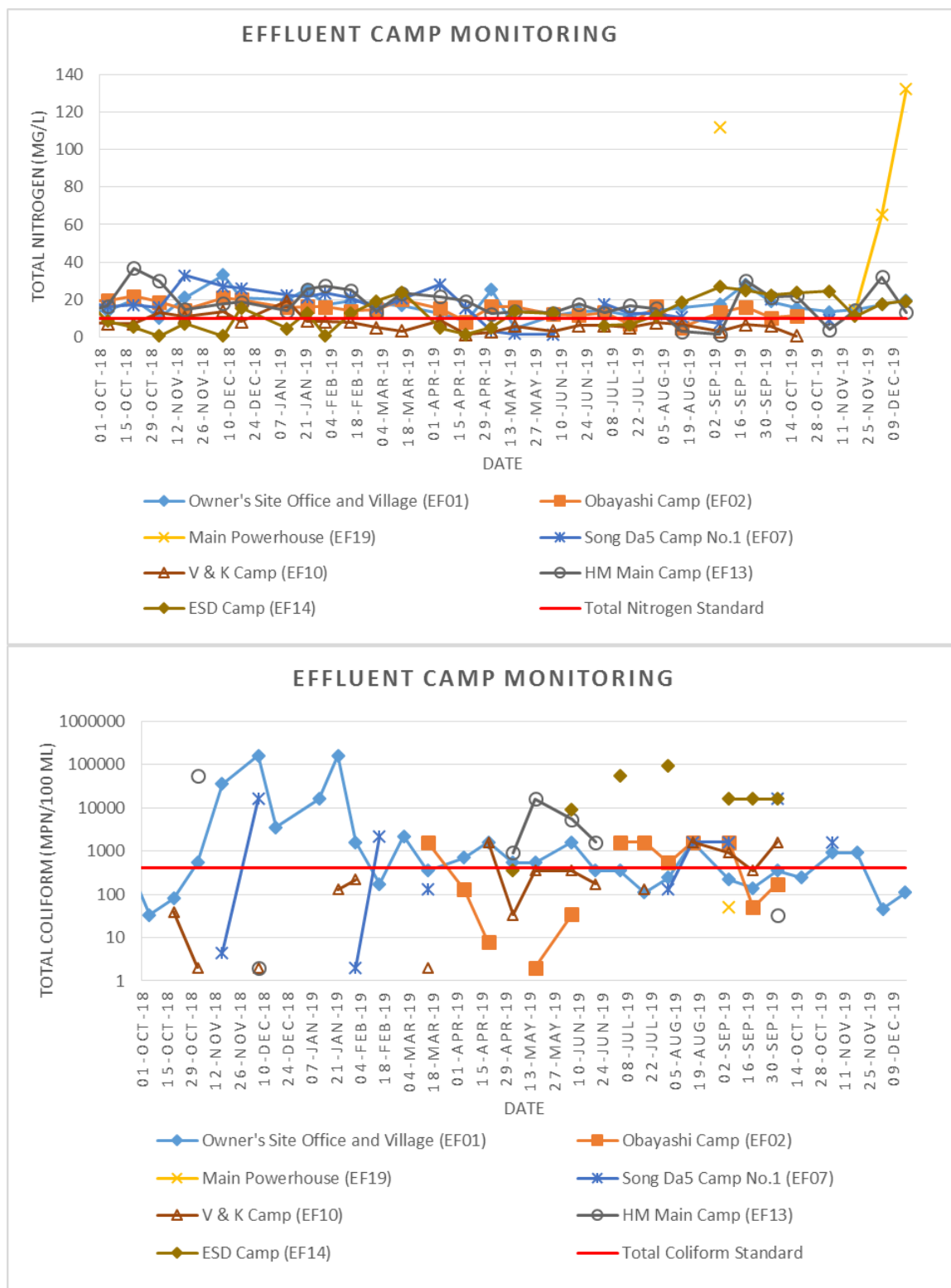
Key Water Quality Parameters for the Nam Ngiep Tributaries: Nam Chian, Nam Phouan, Nam Xao, Nam Houay Soup



Camps' Effluent Water Quality Trends (Since October 2018 – December 2019)







5 August 2020

APPENDIX 5: WATER QUALITY MONITORING DATA**APPENDIX 5-1: SURFACE WATER QUALITY MONITORING – Q4 2019**

		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
1-Oct-19	pH	5.0 - 9.0		7.54	7.24	7.21	7.67											
2-Oct-19	pH	5.0 - 9.0						7.11	6.7	6.56	6.77	7.03	6.97	7.09			7.01	6.86
4-Oct-19	pH	5.0 - 9.0						6.65	6.43	6.72	6.63	6.11					6.09	
5-Oct-19	pH	5.0 - 9.0						7.03	6.96		7.14							
7-Oct-19	pH	5.0 - 9.0	7.81												7.15			
8-Oct-19	pH	5.0 - 9.0		7.76	7.45	7.88	7.74											
9-Oct-19	pH	5.0 - 9.0						7.5	7	7.01	7.06	7.12	6.81	6.74			7.02	7.03
11-Oct-19	pH	5.0 - 9.0						7.35	6.63	6.56	6.69	7.06					6.98	
12-Oct-19	pH	5.0 - 9.0						7.04	6.36		6.41							
16-Oct-19	pH	5.0 - 9.0						7.28	6.8	6.66	6.22	6.29	7.94	7.77			6.18	6.44
18-Oct-19	pH	5.0 - 9.0						7.65	7.01	6.98	7.03	7.5					7.24	
19-Oct-19	pH	5.0 - 9.0						7.95	7.1		7.16							
22-Oct-19	pH	5.0 - 9.0	7.8	7.52	7.68	7.6	7.38								7.95			
23-Oct-19	pH	5.0 - 9.0						7.19	7.17	7.36	7.26	7.36	7.77	7.81			7.1	7.88
25-Oct-19	pH	5.0 - 9.0						7.82	7.33	6.93	7.41	7.52					7.71	
26-Oct-19	pH	5.0 - 9.0						7.58	7.4		7.46							
29-Oct-19	pH	5.0 - 9.0		7.68	7.36	7.86	7.78											
30-Oct-19	pH	5.0 - 9.0						7.96	7.45	7.34	7.33	6.17	6.18	6.3			6.24	6.26
1-Nov-19	pH	5.0 - 9.0							7.3	7.57	7.62	8.07					7.79	
2-Nov-19	pH	5.0 - 9.0						7.71	7.72		7.73							
5-Nov-19	pH	5.0 - 9.0					7.91											
6-Nov-19	pH	5.0 - 9.0						8.01	7.41	7.37	7.62	7.42	6.8	6.68			7.37	7.17
7-Nov-19	pH	5.0 - 9.0		6.36	6.34	6.39												
8-Nov-19	pH	5.0 - 9.0						6.4	6.4	6.51	6.51	7.16					6.88	
9-Nov-19	pH	5.0 - 9.0						6.65	6.57		6.52							
13-Nov-19	pH	5.0 - 9.0						6.74	6.38	6.5	6.53	6.06	7.15	7.28			6.27	7.62
14-Nov-19	pH	5.0 - 9.0		7.05	7.18	6.94	6.85									7.31		
15-Nov-19	pH	5.0 - 9.0						7.02	6.57	6.62	6.51	7.11	7.61	7.88			7.09	7.79
16-Nov-19	pH	5.0 - 9.0						6.74	6.5		6.51	6.93					7.06	

5 August 2020

		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
19-Nov-19	pH	5.0 - 9.0	7.6	7.27	7.1	6.84	6.6								8	7.21		
20-Nov-19	pH	5.0 - 9.0						6.63	6.74	7.04	7.49	6.32	6.19	6.34			6.71	6.29
22-Nov-19	pH	5.0 - 9.0						6.98	6.3	6.78	6.81	7.12					7.14	7.02
23-Nov-19	pH	5.0 - 9.0						7.16	6.33		6.92							
26-Nov-19	pH	5.0 - 9.0		6.94	6.83	6.01	6.56											
27-Nov-19	pH	5.0 - 9.0						6.66	6.66	6.41	6.42	6.16	6.72	7.15			6.24	6.14
29-Nov-19	pH	5.0 - 9.0						7.09	6.1	6.47	6.72	7.29					7.2	
30-Nov-19	pH	5.0 - 9.0						7	6.32		6.34							
4-Dec-19	pH	5.0 - 9.0						6.61	6.52	6.75	6.87	6.78	6.56	6.63			6.95	6.77
5-Dec-19	pH	5.0 - 9.0		6.96	7.26	7.14	6.98									7.57		
6-Dec-19	pH	5.0 - 9.0						6.8	6.48	7	6.75							
7-Dec-19	pH	5.0 - 9.0						6.97	6.82		6.85							
9-Dec-19	pH	5.0 - 9.0	6.11												6.33			
10-Dec-19	pH	5.0 - 9.0		7.43	7.21	7	6.81									7.61		
11-Dec-19	pH	5.0 - 9.0						7.05	7.06	7.15	6.64	6.72	7.11	7.93			6.36	6.24
13-Dec-19	pH	5.0 - 9.0						6.99	6.98	6.95	6.97	7.24					7.23	
14-Dec-19	pH	5.0 - 9.0						7.25	7.07		7.07							
17-Dec-19	pH	5.0 - 9.0		7.55	7.34	7.05	6.71									7.79		
18-Dec-19	pH	5.0 - 9.0						6.38	6.84	6.78	6.77	7.03	6.23	6.21			6.36	6.27
20-Dec-19	pH	5.0 - 9.0						6.85	6.93	7.1	6.86	7.04					7.19	
21-Dec-19	pH	5.0 - 9.0						7.22	6.92		7.34							
23-Dec-19	pH	5.0 - 9.0	7.13												7.41			
24-Dec-19	pH	5.0 - 9.0		6.94	6.59	7.31	6.81									6.68		
25-Dec-19	pH	5.0 - 9.0						6.83	6.57	6.89	6.83							
27-Dec-19	pH	5.0 - 9.0						7.05	6.84	6.84	6.94	7.22					7.34	
1-Oct-19	Sat. DO (%)			108.7	102.6	99.3	92.1											
2-Oct-19	Sat. DO (%)							101.6	27.6	26.5	93.6	91.9	87.5	81.5			91	90.7
4-Oct-19	Sat. DO (%)							102.4	34.1	22.1	94.9	94.5					96.9	
5-Oct-19	Sat. DO (%)							94	41.8		94.6							
7-Oct-19	Sat. DO (%)		102.1												103.2			
8-Oct-19	Sat. DO (%)			106.3	94.8	98.5	92.9											
9-Oct-19	Sat. DO (%)							91.4	37.3	16.2	73.8	94.8	89.6	85.8			96.2	97.1

5 August 2020

		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
11-Oct-19	Sat. DO (%)							108	10.6	13.4	97.8	103.6					99.1	
12-Oct-19	Sat. DO (%)							105.8	38.3		93.6							
16-Oct-19	Sat. DO (%)							98.3	17.1	26.4	93.8	94.7	91.4	89			94.2	89.7
18-Oct-19	Sat. DO (%)							95.8	6.1	51.2	91.1	95.9					94.2	
19-Oct-19	Sat. DO (%)							83.1	38.2		89.8							
22-Oct-19	Sat. DO (%)		104.8	99.3	98.2	92.3	96.7								100.2			
23-Oct-19	Sat. DO (%)							85.1	23	48	96.2	95.7	92.6	88.3			94.6	87.5
25-Oct-19	Sat. DO (%)							82.8	5	24.8	77.2	78.1					71.8	
26-Oct-19	Sat. DO (%)							83.6	11.1		81.8							
29-Oct-19	Sat. DO (%)			104	105.2	94.7	90											
30-Oct-19	Sat. DO (%)							78.6	4.8	11.1	90.1	89.8	85.8	85.4			89.1	83.9
1-Nov-19	Sat. DO (%)								8.9	34.3	81.9	80.1					75.1	
2-Nov-19	Sat. DO (%)							81.9	32.5		82.1							
5-Nov-19	Sat. DO (%)						76											
6-Nov-19	Sat. DO (%)					1		75.5	7.5	4	76.6	93.5	91.6	91.1			94.7	90.8
7-Nov-19	Sat. DO (%)			98.1	84.7	91.9												
8-Nov-19	Sat. DO (%)							89.5	11.6	10.5	98.6	93.7					91.2	
9-Nov-19	Sat. DO (%)							76.4	17		83.5							
13-Nov-19	Sat. DO (%)							72.1	4.7	11.6	27.2	34.7	58.7	80.8			86.2	84.4
14-Nov-19	Sat. DO (%)			77.9	72.1	71.8	69.1									90.3		
15-Nov-19	Sat. DO (%)							59.7	4.6	5.8	2.28	2.87	60.9	79.2			87.2	81.4
16-Nov-19	Sat. DO (%)							67.5	25.2		79.3	76.9					80.8	
19-Nov-19	Sat. DO (%)		105.9	109.4	80.1	91.5	77.3								102.9	96		
20-Nov-19	Sat. DO (%)							72.9	49.5	82.4	86	97.4	89.3	94			93.7	94.7
22-Nov-19	Sat. DO (%)							70.5	6.8	10.2	31.8	38.8					73.8	71.6
23-Nov-19	Sat. DO (%)							74.6	38.3		64.1							
26-Nov-19	Sat. DO (%)			88	65.8	75.1	73.9											
27-Nov-19	Sat. DO (%)							69	35.3	27.1	41.8	48.1	68.4	88.8			88.9	89.5
29-Nov-19	Sat. DO (%)							72.5	36.3	17.8	40.5	63.2					82.3	
30-Nov-19	Sat. DO (%)							67.8	31.9		46.7							
4-Dec-19	Sat. DO (%)							76.9	1.82	1.47	4.57	49.4	50.8	62.1			83.6	57.6
5-Dec-19	Sat. DO (%)			95.9	30.7	58.1	48									90.6		

5 August 2020

		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
6-Dec-19	Sat. DO (%)							57.5	34.1	41.3	65.2							
7-Dec-19	Sat. DO (%)							39.3	47.5		42.1							
9-Dec-19	Sat. DO (%)		100.8												95.8			
10-Dec-19	Sat. DO (%)			77.9	26.1	40.2	27.2									93.6		
11-Dec-19	Sat. DO (%)							22.4	36.5	30.3	42.2	46.1	58	64.2			67.5	72
13-Dec-19	Sat. DO (%)							26.1	19.2	36.5	30.9	32.6					78.8	
14-Dec-19	Sat. DO (%)							39.5	28.6		47.9							
17-Dec-19	Sat. DO (%)			112.3	27.1	81.6	36.6									112.5		
18-Dec-19	Sat. DO (%)							47.4	35.4	36.5	42.2	41.6	51.9	64.1			83.1	73.2
20-Dec-19	Sat. DO (%)							51.9	41.1	19	32.5	49.2					52.8	
21-Dec-19	Sat. DO (%)							59.9	12		43.2							
23-Dec-19	Sat. DO (%)		102.8												99.9			
24-Dec-19	Sat. DO (%)			107.5	38.8	88.8	55.6									94.3		
25-Dec-19	Sat. DO (%)							78	20.7	25.8	32.4							
27-Dec-19	Sat. DO (%)							81	15.8	27.4	38.1	41					80.7	
1-Oct-19	DO (mg/L)	>6.0		7.88	7.72	7.48	7.03											
2-Oct-19	DO (mg/L)	>6.0						7.79	2.88	3.29	7.75	7.66	7.11	6.61			7.03	7.08
4-Oct-19	DO (mg/L)	>6.0						7.9	2.94	1.84	7.43	7.43					7.4	7.08
5-Oct-19	DO (mg/L)	>6.0						7.35	3.5		7.81							
7-Oct-19	DO (mg/L)	>6.0	7.95												8.33			
8-Oct-19	DO (mg/L)	>6.0		7.87	7.03	7.45	7.09											
9-Oct-19	DO (mg/L)	>6.0						7.07	3.4	1.48	6.1	7.37	6.97	6.69			7.24	7.4
11-Oct-19	DO (mg/L)	>6.0						8.31	0.92	1.18	8.03	8.66					7.74	
12-Oct-19	DO (mg/L)	>6.0						7.63	3.01		7.65							
16-Oct-19	DO (mg/L)	>6.0						7.3	1.17	2.62	7.32	7.38	7.2	7.04			7.23	6.97
18-Oct-19	DO (mg/L)	>6.0						7.4	0.52	4.25	7.54	7.96					7.39	
19-Oct-19	DO (mg/L)	>6.0						6.42	3.2		7.49							
22-Oct-19	DO (mg/L)	>6.0	8.14	7.31	7.37	6.97	7.42								8.05			
23-Oct-19	DO (mg/L)	>6.0						6.59	2.11	4.08	7.36	7.48	7.11	6.9			7.02	6.6
25-Oct-19	DO (mg/L)	>6.0						6.31	0.43	2.05	6.27	6.34					5.47	
26-Oct-19	DO (mg/L)	>6.0						6.48	0.95		6.67							
29-Oct-19	DO (mg/L)	>6.0		7.67	7.84	7.19	6.85											

5 August 2020

		Station Code	NGG01	R01	R02	R03	R04	R05	R06	R07	NGG05	NGG06	NGG07	NGG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
30-Oct-19	DO (mg/L)	>6.0						6.09	0.41	0.92	6.59	7.01	6.76	6.73			6.99	6.64
1-Nov-19	DO (mg/L)	>6.0							0.75	2.9	6.87	6.71					6.19	
2-Nov-19	DO (mg/L)	>6.0						6.2	2.65		6.8							
5-Nov-19	DO (mg/L)	>6.0					5.93											
6-Nov-19	DO (mg/L)	>6.0						5.94	0.63	0.31	6.35	7.2	7.02	7.11			7.49	7.09
7-Nov-19	DO (mg/L)	>6.0		7.66	6.5	7.15												
8-Nov-19	DO (mg/L)	>6.0						7.19	1	0.95	8.15	7.78					7.42	
9-Nov-19	DO (mg/L)	>6.0						6.06	1.46		6.96							
13-Nov-19	DO (mg/L)	>6.0						5.77	0.39	0.96	2.26	2.8	4.79	6.62			6.94	6.78
14-Nov-19	DO (mg/L)	>6.0		6.19	5.69	5.69	5.49									7.9		
15-Nov-19	DO (mg/L)	>6.0						4.8	0.36	0.47	2.28	2.87	4.63	6.32			7.02	6.55
16-Nov-19	DO (mg/L)	>6.0						5.52	2.12		6.48	6.3					6.72	
19-Nov-19	DO (mg/L)	>6.0	8.16	8.4	6.29	7.3	6.17								8.17	8.5		
20-Nov-19	DO (mg/L)	>6.0						5.86	4.15		6.95	7.53	7.01	7.42			7.64	7.32
22-Nov-19	DO (mg/L)	>6.0						5.69	0.57	0.85	2.6	3.23					6.11	6.28
23-Nov-19	DO (mg/L)	>6.0						6.06	3.2		5.32							
26-Nov-19	DO (mg/L)	>6.0		6.91	5.25	6.1	6.02											
27-Nov-19	DO (mg/L)	>6.0						5.54	2.92	2.2	3.6	3.74	5.37	6.92			7	7.19
29-Nov-19	DO (mg/L)	>6.0						5.78	3.17	1.55	3.35	5.25					6.84	
30-Nov-19	DO (mg/L)	>6.0						5.54	2.71		3.9							
4-Dec-19	DO (mg/L)	>6.0						6.28	1.82	1.47	4.57	4.04	4.17	5.23			6.97	6.23
5-Dec-19	DO (mg/L)	>6.0		7.9	2.52	4.8	3.94									8.84		
6-Dec-19	DO (mg/L)	>6.0						4.82	2.86	3.5	5.51							
7-Dec-19	DO (mg/L)	>6.0						3.35	4.04		3.57							
9-Dec-19	DO (mg/L)	>6.0	9.06												8.58			
10-Dec-19	DO (mg/L)	>6.0		6.5	2.14	3.58	2.26									9.62		
11-Dec-19	DO (mg/L)	>6.0						1.9	3.02	2.65	3.53	3.82	4.63	4.73			5.67	6.12
13-Dec-19	DO (mg/L)	>6.0						2.23	1.71	3.11	2.61	2.75					7.22	
14-Dec-19	DO (mg/L)	>6.0						3.39	2.42		4.04							
17-Dec-19	DO (mg/L)	>6.0		9.29	2.23	6.8	3.07									10.69		
18-Dec-19	DO (mg/L)	>6.0						4.13	2.99	3.38	3.49	3.35	4.08	5.12			6.57	6.31
20-Dec-19	DO (mg/L)	>6.0						4.37	3.51	1.58	2.75	4.02					4.35	

5 August 2020

		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
21-Dec-19	DO (mg/L)	>6.0						5.27	1.02		3.6							
23-Dec-19	DO (mg/L)	>6.0	8.39												8.76			
24-Dec-19	DO (mg/L)	>6.0		8.59	3.38	7.34	4.67									8.65		
25-Dec-19	DO (mg/L)	>6.0						6.53	1.75	2.33	3.12							
27-Dec-19	DO (mg/L)	>6.0						6.78	1.36	2.37	3.19	3.45					6.65	
1-Oct-19	Conductivity (µs/cm)			82	82	74	72											
2-Oct-19	Conductivity (µs/cm)							72	94	90	94	90	87	83			108	28
4-Oct-19	Conductivity (µs/cm)							71	94	89	63.3	61.8					79.8	
5-Oct-19	Conductivity (µs/cm)							77	98		88							
7-Oct-19	Conductivity (µs/cm)		81.5												50.7			
8-Oct-19	Conductivity (µs/cm)			82	84	73	73											
9-Oct-19	Conductivity (µs/cm)							72	92	83	90	61.8	60.1	59.5			83.3	22.8
11-Oct-19	Conductivity (µs/cm)							72	93	92	93	85					112	
12-Oct-19	Conductivity (µs/cm)							86.1	62.2		63.6							
16-Oct-19	Conductivity (µs/cm)							72	90	89	64.1	60.4	70.3	69.5				
18-Oct-19	Conductivity (µs/cm)							73	92	83	86	87					117	
19-Oct-19	Conductivity (µs/cm)							72	90		88							
22-Oct-19	Conductivity (µs/cm)		80.4	85	82	75	74								38			
23-Oct-19	Conductivity (µs/cm)							72	89	88	90	69.8	56	59			88.2	23.2
25-Oct-19	Conductivity (µs/cm)							72	88	85	86	89					122	
26-Oct-19	Conductivity (µs/cm)							76	89		90							
29-Oct-19	Conductivity (µs/cm)			83	83	76	75											
30-Oct-19	Conductivity (µs/cm)							72	86	85	57.7	59	57.7	56.9			90	30
1-Nov-19	Conductivity (µs/cm)								90	83	83	83					128	
2-Nov-19	Conductivity (µs/cm)							76	84		82							
5-Nov-19	Conductivity (µs/cm)						75											
6-Nov-19	Conductivity (µs/cm)							72	85	80	80	57.5	57.3	56			89.3	34.6
7-Nov-19	Conductivity (µs/cm)			89	84	77												
8-Nov-19	Conductivity (µs/cm)							74	85	79	82	82					128	
9-Nov-19	Conductivity (µs/cm)							74	82		84							
13-Nov-19	Conductivity (µs/cm)							73	85	81	81	58	99.7	103			95.1	89.2
14-Nov-19	Conductivity (µs/cm)			91	89	78	75									78		

5 August 2020

		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
15-Nov-19	Conductivity (µs/cm)							73	84	82	70.6	66.2	92.4	84.5			95.3	35.5
16-Nov-19	Conductivity (µs/cm)							75	86		80	83					133	
19-Nov-19	Conductivity (µs/cm)		82.4	90	90	78	75								24.2	67		
20-Nov-19	Conductivity (µs/cm)							74	84	75	77	61.5	66.1	67.8			95.8	39
22-Nov-19	Conductivity (µs/cm)							73	87	85	81	84					135	54
23-Nov-19	Conductivity (µs/cm)							75	87		82							
26-Nov-19	Conductivity (µs/cm)			90	90	80	76											
27-Nov-19	Conductivity (µs/cm)							73	81	79	80	57.3	58.4	58			100	39.2
29-Nov-19	Conductivity (µs/cm)							73	87	81	79	79					140	
30-Nov-19	Conductivity (µs/cm)							72	82		80							
4-Dec-19	Conductivity (µs/cm)							72	85	86	83	61	57.4	56.9			84.7	40.9
5-Dec-19	Conductivity (µs/cm)			88	93	79	75									77		
6-Dec-19	Conductivity (µs/cm)							74	85	80	78							
7-Dec-19	Conductivity (µs/cm)							75	85	82								
9-Dec-19	Conductivity (µs/cm)		65.9												25.4			
10-Dec-19	Conductivity (µs/cm)			90	95	81	77									76		
11-Dec-19	Conductivity (µs/cm)							76	80	81	66	59.7	71.4	60.4			99.4	56.2
13-Dec-19	Conductivity (µs/cm)							77	82	81	81	80					126	
14-Dec-19	Conductivity (µs/cm)							78	83		81							
17-Dec-19	Conductivity (µs/cm)			90	94	81	78									78		
18-Dec-19	Conductivity (µs/cm)							77	87	86	86	60.1	58.2	57.2			101.7	41.3
20-Dec-19	Conductivity (µs/cm)							75	87	86	86	85					90	
21-Dec-19	Conductivity (µs/cm)							76	84		71							
23-Dec-19	Conductivity (µs/cm)		67.3												26.6			
24-Dec-19	Conductivity (µs/cm)			92	94	83	77									78		
25-Dec-19	Conductivity (µs/cm)							77	93	90	90							
27-Dec-19	Conductivity (µs/cm)							76	95	91	88	89					141	
1-Oct-19	TDS (mg/L)			41	41	37	36											
2-Oct-19	TDS (mg/L)							36	47	45	47	45	43.5	41.5			54	14
4-Oct-19	TDS (mg/L)							35.5	47	44.5	31.65	30.9					39.9	
5-Oct-19	TDS (mg/L)							38.5	49		44							
7-Oct-19	TDS (mg/L)		40.75												25.35			

5 August 2020

		Station Code	NING01	R01	R02	R03	R04	R05	R06	R07	NING05	NING06	NING07	NING08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
8-Oct-19	TDS (mg/L)			41	42	36.5	36.5											
9-Oct-19	TDS (mg/L)							36	46	41.5	45	30.5	30	29.4			41.6	11.4
11-Oct-19	TDS (mg/L)							36	46.5	46	46.5	42.5					56	
12-Oct-19	TDS (mg/L)							43.05	31.1		31.8							
16-Oct-19	TDS (mg/L)							36	45	44.5	32.05	30.2	35.15	34.75			42.1	10.8
18-Oct-19	TDS (mg/L)							36.5	46	41.5	43	43.5					58.5	
19-Oct-19	TDS (mg/L)							36	45		44							
22-Oct-19	TDS (mg/L)		40.2	42.5	41	37.5	37								19			
23-Oct-19	TDS (mg/L)							36	44.5	44	45	34.9	28	29.5			44.1	11.6
25-Oct-19	TDS (mg/L)							36	44	42.5	43							
26-Oct-19	TDS (mg/L)							38	44.5		45							
29-Oct-19	TDS (mg/L)			41.5	41.5	38	37.5											
30-Oct-19	TDS (mg/L)							36	43	42.5	28.9	29	28.5	28.4			45	15
1-Nov-19	TDS (mg/L)								45	41.5	41.5	41.5					64	
2-Nov-19	TDS (mg/L)							38	42		41							
5-Nov-19	TDS (mg/L)						37.5											
6-Nov-19	TDS (mg/L)							36	42.5	40	40	28.2	28.5	27			44.5	17.3
7-Nov-19	TDS (mg/L)			44.5	42	38.5												
8-Nov-19	TDS (mg/L)							37	42.5	39.5	41	41					64	
9-Nov-19	TDS (mg/L)							37	41		42							
13-Nov-19	TDS (mg/L)							36.5	42.5	40.5	40.5	29	49.85	51.5			47.55	44.6
14-Nov-19	TDS (mg/L)			45.5	44.5	39	37.5									39		
15-Nov-19	TDS (mg/L)							36.5	42	41	35.3	33.1	46.2	42.25			47.65	17.75
16-Nov-19	TDS (mg/L)							37.5	43		40	41.5					66.5	
19-Nov-19	TDS (mg/L)		41	45	45	39	37.5								12	33.5		
20-Nov-19	TDS (mg/L)							37	42	37.5	38.5	30.7	33	33.9			47.8	19
22-Nov-19	TDS (mg/L)							37	43.5	42.5	40.5	42					67.5	27
23-Nov-19	TDS (mg/L)							37.5	43.5		41							
26-Nov-19	TDS (mg/L)			45	45	40	38											
27-Nov-19	TDS (mg/L)							36.5	40.5	39.5	40	28.65	29.2	29			50	19.6
29-Nov-19	TDS (mg/L)							36.5	43.5	40.5	39.5	39.5					70	
30-Nov-19	TDS (mg/L)							36	41		40							

5 August 2020

		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
4-Dec-19	TDS (mg/L)							36	42.5	43	41.5	30.5	28.7	28.6			42.3	20.4
5-Dec-19	TDS (mg/L)			44	46.5	39.5	37.5									38.5		
6-Dec-19	TDS (mg/L)							37	42.5	40	39							
7-Dec-19	TDS (mg/L)							37.5	42.5		41							
9-Dec-19	TDS (mg/L)		32.95												12.7			
10-Dec-19	TDS (mg/L)			45	47.5	40.5	38.5									38		
11-Dec-19	TDS (mg/L)							38	40	40.5	33	29.85	35.7	30.2			49.7	
13-Dec-19	TDS (mg/L)							38.5	41	40.5	40.5	40					63	
14-Dec-19	TDS (mg/L)							39	41.5		40.5							
17-Dec-19	TDS (mg/L)			45	47	40.5	39									39		
18-Dec-19	TDS (mg/L)							37.5	43.5	43	43	30	29.1	28.5			50.7	20.6
20-Dec-19	TDS (mg/L)							37.5	43.5	43	43	42.5					90	
21-Dec-19	TDS (mg/L)							38	42		35.6							
23-Dec-19	TDS (mg/L)		33												13			
24-Dec-19	TDS (mg/L)			46	47	41.5	38.5									39		
25-Dec-19	TDS (mg/L)							38.5	46.5	46.5	46							
27-Dec-19	TDS (mg/L)							38	47.5	45.5	44	44.5					70.5	
1-Oct-19	Temperature (°C)			31.67	30.56	30.7	29.98											
2-Oct-19	Temperature (°C)							28.87	24.26	24.91	24.84	25.13	25.91	26.02			28.78	28.09
4-Oct-19	Temperature (°C)							28.97	24.19	24.94	26.6	26.1					27.8	
5-Oct-19	Temperature (°C)							28.09	24.9		24.91							
7-Oct-19	Temperature (°C)		26.2												23.9			
8-Oct-19	Temperature (°C)			31.09	30.9	29.88	29.48											
9-Oct-19	Temperature (°C)							28.73	24.39	26.12	24.93	26.8	26.8	26.8			28.6	28
11-Oct-19	Temperature (°C)							28.95	24.04	24.87	21.94	24.76					28.17	
12-Oct-19	Temperature (°C)							30.3	26.2		24.4							
16-Oct-19	Temperature (°C)							29.59	24.55	24.82	26.9	26.4	26.4	26.2			27.7	27
18-Oct-19	Temperature (°C)							28.71	24.31	25.29	24.76	24.68					28.26	
19-Oct-19	Temperature (°C)							28.7	24.96		24.39							
22-Oct-19	Temperature (°C)		26	31.49	30.16	29.63	29.06								23.9			
23-Oct-19	Temperature (°C)							28.55	24.51	24.99	22.26	26.3	28.1	26.5			29.2	28.3
25-Oct-19	Temperature (°C)							29.57	24.63	25.63	25.93	25.38					29.55	

5 August 2020

		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
26-Oct-19	Temperature (°C)							28.58	24.81		25.6							
29-Oct-19	Temperature (°C)			31.47	30.7	29.97	29.55											
30-Oct-19	Temperature (°C)							28.55	24.71	25.18	27.5	26.6	26.3	26.4			26.4	25.8
1-Nov-19	Temperature (°C)								24.33	24.41	24.22	24.29					25.02	
2-Nov-19	Temperature (°C)							29.92	25.67		24.94							
5-Nov-19	Temperature (°C)						28.28											
6-Nov-19	Temperature (°C)							27.72	24.83	25.24	24.98	27.3	27.4				26.4	26.8
7-Nov-19	Temperature (°C)			28.15	29.01	28.33												
8-Nov-19	Temperature (°C)							26.68	24.49	24.85	24.91	24.74					25.86	
9-Nov-19	Temperature (°C)							27.33	24.75		24.58							
13-Nov-19	Temperature (°C)							26.74	24.57	24.64	24.72	25.1	24.6	24.2			25.6	24.9
14-Nov-19	Temperature (°C)			26.98	27.41	27.12	26.87									22.4		
15-Nov-19	Temperature (°C)							26.45	24.76	25.21	25.5	25.4	28.6	28.1			25.3	25.4
16-Nov-19	Temperature (°C)							25.65	24.38		24.95	24.69					27.4	
19-Nov-19	Temperature (°C)		26.7	28.76	27.73	27.17	26.86								24.6	21.36		
20-Nov-19	Temperature (°C)							26.55	24.89	26.42	26.01	27.4	26.6	26.9			27.1	26.2
22-Nov-19	Temperature (°C)							26.24	24.59	24.84	24.89	24.75					24.37	21.79
23-Nov-19	Temperature (°C)							25.94	24.87		24.93							
26-Nov-19	Temperature (°C)			27.89	27.3	26.63	26.99											
27-Nov-19	Temperature (°C)							26.61	24.82	25.28	24.45	26.9	26.5	27			26.2	25.5
29-Nov-19	Temperature (°C)							27.01	24.47	24.44	24.98	24.82					24.56	
30-Nov-19	Temperature (°C)							25.79	24.39		24.59							
4-Dec-19	Temperature (°C)							25.38	24.66	24.47	24.07	24.58	24.6	23.7			25	24.7
5-Dec-19	Temperature (°C)			25.43	25.99	25.79	25.47									16.46		
6-Dec-19	Temperature (°C)							24.19	24.49	23.98	23.97							
7-Dec-19	Temperature (°C)							23.32	23.98		23.64							
9-Dec-19	Temperature (°C)		19.2												18.9			
10-Dec-19	Temperature (°C)			24.5	25.6	24.81	24.59									13.88		
11-Dec-19	Temperature (°C)							24.4	24.39	24.32	23.5	23.8	25.7	26.2			22.6	23
13-Dec-19	Temperature (°C)							23.58	24.14	23.82	23.8	23.66					19.54	
14-Dec-19	Temperature (°C)							23.2	23.85		23.88							
17-Dec-19	Temperature (°C)			25.05	25.49	24.82	24.57									17.6		

5 August 2020

		Station Code	NGG01	R01	R02	R03	R04	R05	R06	R07	NGG05	NGG06	NGG07	NGG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
18-Dec-19	Temperature (°C)							23.89	24.23	24.3	24.38	25.1	26.1	26.9			25.7	25.8
20-Dec-19	Temperature (°C)							24.36	24.13	24.31	24.22	24.23					24.96	
21-Dec-19	Temperature (°C)							24.5	24.5		24.64							
23-Dec-19	Temperature (°C)		23.4												19.5			
24-Dec-19	Temperature (°C)			26.6	25.78	24.97	24.51									18.19		
25-Dec-19	Temperature (°C)							24.42	23.97	23.88	23.94							
27-Dec-19	Temperature (°C)							24.56	23.99	24.11	24.27	24.1					24.91	
1-Oct-19	Turbidity (NTU)			1.48	2.57	1.5	1.69											
2-Oct-19	Turbidity (NTU)							1.29	1.55	3.64	4.04	4.51	5.62	6.65			5.13	2.92
4-Oct-19	Turbidity (NTU)							1.25	1.73	3.61	4.89	6.62					6.65	
5-Oct-19	Turbidity (NTU)							1.66	7.73		6.7							
7-Oct-19	Turbidity (NTU)		12												12.04			
8-Oct-19	Turbidity (NTU)			1.64	2.27	1.4	1.47											
9-Oct-19	Turbidity (NTU)							1.37	2.06	8.64	5.08	4.81	7.73	8.44			3.85	3.62
11-Oct-19	Turbidity (NTU)							1.29	1.37	2.15	5.85	6.46					3.96	
12-Oct-19	Turbidity (NTU)							1.5	4.7		5.54							
16-Oct-19	Turbidity (NTU)							1.4	1.38	1.96	9.19	10.22	13.62	16.88			6.35	4.56
18-Oct-19	Turbidity (NTU)							1.4	1.19	10.44	7.13	7.48					4.34	
19-Oct-19	Turbidity (NTU)							3.23	4.26		5.1							
22-Oct-19	Turbidity (NTU)		6.53	2.18	2.8	1.59	1.31								44.72			
23-Oct-19	Turbidity (NTU)							1.6	1.88	4.58	5.72	7.22	6.67	8.25			5.67	4.43
25-Oct-19	Turbidity (NTU)							1.57	1.54	4.15	4.87	7.21					6.19	
26-Oct-19	Turbidity (NTU)							1.78	2.69		5.19							
29-Oct-19	Turbidity (NTU)			2.35	2.73	1.71	1.63											
30-Oct-19	Turbidity (NTU)							1.41	1.48	4.09	7.78	7.92	8.62	8.87			4.27	5.38
1-Nov-19	Turbidity (NTU)								1.59	7.14	9.38	8.54					4.63	
2-Nov-19	Turbidity (NTU)							2.48	3.2		7.17							
5-Nov-19	Turbidity (NTU)						1.37											
6-Nov-19	Turbidity (NTU)							1.27	3.71	8.81	8.62	10.39	8.04	8.94			4.75	3.04
7-Nov-19	Turbidity (NTU)			2.06	1.88	1.63												
8-Nov-19	Turbidity (NTU)							1.53	3.5	9.35	11.62	9.95					3.35	
9-Nov-19	Turbidity (NTU)							1.74	2.37		10.2							

5 August 2020

		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
13-Nov-19	Turbidity (NTU)							1.36	1.63	4.63	5.3	5.29	5.21	5.92			4.29	5.03
14-Nov-19	Turbidity (NTU)			2.33	1.6	1.31	1.32									2.14		
15-Nov-19	Turbidity (NTU)							1.15	1.23	3.87	11.8	11.71	8.97	9.34			5.49	4.91
16-Nov-19	Turbidity (NTU)							2.09	4.25		9.01	8.47					5.65	
19-Nov-19	Turbidity (NTU)		2.59	2.55	2.13	1.82	1.89								1.96	3.08		
20-Nov-19	Turbidity (NTU)							1.61	2.3	5.66	15.02	14.5	31.58	12.84			8.08	4.16
22-Nov-19	Turbidity (NTU)							1.34	1.13	1.65	5.25	6.29					3.71	2.86
23-Nov-19	Turbidity (NTU)							1.28	3.02		5.29							
26-Nov-19	Turbidity (NTU)			3.12	2.1	2.15	1.97											
27-Nov-19	Turbidity (NTU)							2.24	4.26	9.29	8.38	6.91	7.96	9.85			6.03	4.45
29-Nov-19	Turbidity (NTU)							1.76	2.58	15.27	10.92	10.87					6.9	
30-Nov-19	Turbidity (NTU)							2.3	3.71		10.44							
4-Dec-19	Turbidity (NTU)							1.78	2.28	2.72	7.1	5.58	7.25	10.74			5.81	5.26
5-Dec-19	Turbidity (NTU)			3.6	2.26	2.08	1.99									2.74		
6-Dec-19	Turbidity (NTU)							2.8	2.68	5.3	6.14							
7-Dec-19	Turbidity (NTU)							2.64	3.7		4.85							
9-Dec-19	Turbidity (NTU)		5.24												6.2			
10-Dec-19	Turbidity (NTU)			3.05	1.73	1.43	1.85									1.89		
11-Dec-19	Turbidity (NTU)							1.39	1.62	2.22	4.5	4.97	5.01	6.89			6.23	5.31
13-Dec-19	Turbidity (NTU)							3.24	3.54	4.05	6.43	4.81					8.21	
14-Dec-19	Turbidity (NTU)							3.26	2.89		4.23							
17-Dec-19	Turbidity (NTU)			4.06	2.28	2.17	2.22									2.64		
18-Dec-19	Turbidity (NTU)							2.57	3	4.12	5.62	6.72	9.09	8.96			8.03	5.04
20-Dec-19	Turbidity (NTU)							2.16	3.02	4.3	6.11	7.49					6.36	
21-Dec-19	Turbidity (NTU)							1.58	3.01		4.61							
23-Dec-19	Turbidity (NTU)		3.15												2.95			
24-Dec-19	Turbidity (NTU)			4.92	3.27	2.81	2.48									4.26		
25-Dec-19	Turbidity (NTU)							2.65	3.07	5.19	5.93							
27-Dec-19	Turbidity (NTU)																	
7-Oct-19	TSS (mg/L)		60.19												19.01			
8-Oct-19	TSS (mg/L)			<5	5.69	<5	<5											
9-Oct-19	TSS (mg/L)							<5	<5	<5	<5	<5	6	17.92			<5	<5

		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
16-Oct-19	TSS (mg/L)							<5	<5	<5	<5							
23-Oct-19	TSS (mg/L)							<5	<5	5.1	<5							
6-Nov-19	TSS (mg/L)							<5	5	<5	<5							
13-Nov-19	TSS (mg/L)							<5	<5	<5	<5	<5	<5	7.53			<5	<5
14-Nov-19	TSS (mg/L)			<5	<5	<5	<5									5.69		
19-Nov-19	TSS (mg/L)		7.4												5.15			
20-Nov-19	TSS (mg/L)							<5	<5	8.36	26.66							
27-Nov-19	TSS (mg/L)							<5	<5	<5	<5							
3-Dec-19	TSS (mg/L)							<5	<5	<5	8.52							
4-Dec-19	TSS (mg/L)							<5	<5	<5	8.52							
9-Dec-19	TSS (mg/L)		7.11												<5			
10-Dec-19	TSS (mg/L)			6.27	<5	<5	<5									6.22		
11-Dec-19	TSS (mg/L)							<5	<5	<5	<5	<5	8.6	13.72			<5	<5
18-Dec-19	TSS (mg/L)							<5	<5	<5	<5							
2-Oct-19	BOD ₅ (mg/L)	<1.5						<1.0	2.94	1.49	<1.0							
7-Oct-19	BOD ₅ (mg/L)	<1.5	<1.0												<1.0			
8-Oct-19	BOD ₅ (mg/L)	<1.5		1.2	<1.0	1.49	<1.0											
9-Oct-19	BOD ₅ (mg/L)	<1.5						<1.0	3.54	2.77	1.14	<1.0	<1.0	<1.0			<1.0	<1.0
16-Oct-19	BOD ₅ (mg/L)	<1.5						<1.0	7.46	7.9	<1.0							
23-Oct-19	BOD ₅ (mg/L)	<1.5						<1.0	6.4	8.04	<1.0							
30-Oct-19	BOD ₅ (mg/L)	<1.5						<1.0	6.18	6.66	<1.0							
6-Nov-19	BOD ₅ (mg/L)	<1.5						<1.0	4.24	2.3	<1.0							
13-Nov-19	BOD ₅ (mg/L)	<1.5						<1	4.88	4.86	4.18	3.95	1.19	<1.0			<1.0	<1
14-Nov-19	BOD ₅ (mg/L)	<1.5		1.49	<1.0	<1.0	<1.0									<1.0		
19-Nov-19	BOD ₅ (mg/L)	<1.5	<1.0												<1.0			
20-Nov-19	BOD ₅ (mg/L)	<1.5						<1.0	2.97	<1.0	<1.0							
27-Nov-19	BOD ₅ (mg/L)	<1.5						<1.0	3.26	3.9	2.3							
4-Dec-19	BOD ₅ (mg/L)	<1.5						<1.0	7.14	7.32	4.46							
9-Dec-19	BOD ₅ (mg/L)	<1.5	1.53												1.48			
10-Dec-19	BOD ₅ (mg/L)	<1.5		1.99	<1.0	<1.0	<1.0									<1.0		
11-Dec-19	BOD ₅ (mg/L)	<1.5						<1.0	2.8	3.38	2.93	2.86	1.82	<1.0			2.04	1.21
18-Dec-19	BOD ₅ (mg/L)	<1.5						<1.0	4.52	5.04	3.7							

5 August 2020

		Station Code	NGG01	R01	R02	R03	R04	R05	R06	R07	NGG05	NGG06	NGG07	NGG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
7-Oct-19	COD (mg/L)	<5.0	7.1												<5.0			
8-Oct-19	COD (mg/L)	<5.0		10.4	13.8	6	8											
9-Oct-19	COD (mg/L)	<5.0						7.2	6.4	<5.0	5	5.6	5.8	<5.0			5.6	5.4
13-Nov-19	COD (mg/L)	<5.0						11.5	<5.0	5.9	5.5	9.5	5.1	<5.0			5.5	5.5
14-Nov-19	COD (mg/L)	<5.0		8.7	9.3	6.9	8.7									<5.0		
19-Nov-19	COD (mg/L)	<5.0	7.9												8.4			
9-Dec-19	COD (mg/L)	<5.0	6.4												<5.0			
10-Dec-19	COD (mg/L)	<5.0		10	15.8	5.6	5.2									<5.0		
11-Dec-19	COD (mg/L)	<5.0						<5.0	18.4	12.8	6.4	7	7.2	9.4			<5.0	8.8
7-Oct-19	NH ₃ -N (mg/L)	<0.2	<0.2															
8-Oct-19	NH ₃ -N (mg/L)	<0.2		<0.2	<0.2	<0.2	<0.2											
9-Oct-19	NH ₃ -N (mg/L)	<0.2						<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2			<0.2	<0.2
13-Nov-19	NH ₃ -N (mg/L)	<0.2						<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2			<0.2	<0.2
14-Nov-19	NH ₃ -N (mg/L)	<0.2		<0.2	<0.2	<0.2	<0.2									<0.2		
19-Nov-19	NH ₃ -N (mg/L)	<0.2	<0.2												<0.2			
9-Dec-19	NH ₃ -N (mg/L)	<0.2	<0.2												<0.2			
10-Dec-19	NH ₃ -N (mg/L)	<0.2		<0.2	<0.2	<0.2	<0.2									<0.2		
11-Dec-19	NH ₃ -N (mg/L)	<0.2						<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2			<0.2	<0.2
7-Oct-19	NO ₃ -N (mg/L)	<5.0	<0.02												0.04			
8-Oct-19	NO ₃ -N (mg/L)	<5.0		<0.02	<0.02	<0.02	<0.02											
9-Oct-19	NO ₃ -N (mg/L)	<5.0						<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.04			0.03	0.04
13-Nov-19	NO ₃ -N (mg/L)	<5.0						<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02			0.06	<0.02
14-Nov-19	NO ₃ -N (mg/L)	<5.0		<0.02	<0.02	<0.02	<0.02									0.09		
19-Nov-19	NO ₃ -N (mg/L)	<5.0	<0.02												<0.02			
9-Dec-19	NO ₃ -N (mg/L)	<5.0	<0.02												0.04			
10-Dec-19	NO ₃ -N (mg/L)	<5.0		<0.02	<0.02	<0.02	<0.02									<0.02		
11-Dec-19	NO ₃ -N (mg/L)	<5.0						<0.02	0.03	<0.02	<0.02	<0.02	0.04	<0.02			<0.02	<0.02
2-Oct-19	Faecal coliform (MPN/100 ml)	<1,000						22	13	22	33							
7-Oct-19	Faecal coliform (MPN/100 ml)	<1,000	1,600												170			
8-Oct-19	Faecal coliform (MPN/100 ml)	<1,000		79	13	22	17											

5 August 2020

		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
9-Oct-19	Faecal coliform (MPN/100 ml)	<1,000						11	8	79	70	22	49	79			34	280
16-Oct-19	Faecal coliform (MPN/100 ml)	<1,000						0	7	14	2							
23-Oct-19	Faecal coliform (MPN/100 ml)	<1,000						0	0	0	0							
30-Oct-19	Faecal coliform (MPN/100 ml)	<1,000						0	0	0	2							
6-Nov-19	Faecal coliform (MPN/100 ml)	<1,000						21	9	7	14							
13-Nov-19	Faecal coliform (MPN/100 ml)	<1,000						0	0	0	7	5	21	240			27	22
14-Nov-19	Faecal coliform (MPN/100 ml)	<1,000		0	0	0	0									33		
19-Nov-19	Faecal coliform (MPN/100 ml)	<1,000	540												11			
20-Nov-19	Faecal coliform (MPN/100 ml)	<1,000						8	11	8	17							
27-Nov-19	Faecal coliform (MPN/100 ml)	<1,000						0	0	2	2							
4-Dec-19	Faecal coliform (MPN/100 ml)	<1,000						7	5	11	17							
9-Dec-19	Faecal coliform (MPN/100 ml)	<1,000	49												9			
10-Dec-19	Faecal coliform (MPN/100 ml)	<1,000		2	0	0	0									7.8		
11-Dec-19	Faecal coliform (MPN/100 ml)	<1,000						0	0	0	4	11	5	17			21	79
18-Dec-19	Faecal coliform (MPN/100 ml)	<1,000						0	0	0	2							
2-Oct-19	Total Coliform (MPN/100 ml)	<5,000						110	33	240	350							
7-Oct-19	Total Coliform (MPN/100 ml)	<5,000	1,600												1,600			
8-Oct-19	Total Coliform (MPN/100 ml)	<5,000		79	49	79	170											
9-Oct-19	Total Coliform (MPN/100 ml)	<5,000						33	140	1,700	1,600	220	920	1,600			540	1,600

		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
16-Oct-19	Total Coliform (MPN/100 ml)	<5,000						79	70	1,600	240							
23-Oct-19	Total Coliform (MPN/100 ml)	<5,000						12	11	33	110							
30-Oct-19	Total Coliform (MPN/100 ml)	<5,000						13	33	240	280							
6-Nov-19	Total Coliform (MPN/100 ml)	<5,000						540	40	170	350							
13-Nov-19	Total Coliform (MPN/100 ml)	<5,000						79	540	350	920	540	350	350			350	920
14-Nov-19	Total Coliform (MPN/100 ml)	<5,000		13	13	13	17									220		
19-Nov-19	Total Coliform (MPN/100 ml)	<5,000	920												33			
20-Nov-19	Total Coliform (MPN/100 ml)	<5,000						33	49	79	170							
27-Nov-19	Total Coliform (MPN/100 ml)	<5,000						34	130	110	170							
4-Dec-19	Total Coliform (MPN/100 ml)	<5,000						27	17	79	240							
9-Dec-19	Total Coliform (MPN/100 ml)	<5,000	240												240			
10-Dec-19	Total Coliform (MPN/100 ml)	<5,000		130	33	49	7									170		
11-Dec-19	Total Coliform (MPN/100 ml)	<5,000						49	79	49	240	170	280	1,600			1,600	280
18-Dec-19	Total Coliform (MPN/100 ml)	<5,000						49	23	13	13							
9-Dec-19	Chloride (mg/L)		<2												<2			
10-Dec-19	Chloride (mg/L)			<2	<2	<2	<2									6.9		
11-Dec-19	Chloride (mg/L)							<2	<2	<2	<2	<2	<2	<2			<2	<2
9-Dec-19	Sulphate(mg/L)	<500	1.6												0.5			
10-Dec-19	Sulphate(mg/L)	<500		1.6	1.1	1.1	14									1.4		
11-Dec-19	Sulphate(mg/L)	<500						1.5	1.6	2.2	2.3	1.5	1.8	1.4			1.9	1.8
9-Dec-19	Alkalinity (mg/L)		56.7												35.8			
10-Dec-19	Alkalinity (mg/L)			63.7	66.7	60.7	52.7									55.7		
11-Dec-19	Alkalinity (mg/L)							50.7	56.7	59.7	52.7	51.7	44.8	54.7			59.7	52.7

5 August 2020

		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
9-Dec-19	Calcium (mg/L)		9.69												2.83			
10-Dec-19	Calcium (mg/L)			9.5	9.15	7.75	7.75									8.4		
11-Dec-19	Calcium (mg/L)							7.94	7.45	7.36	7.72	7.16	7.5	7.34			8.92	7.98
9-Dec-19	Manganese (mg/L)	<1.0	0.056												0.204			
10-Dec-19	Manganese (mg/L)	<1.0		0.052	0.052	0.069	0.122									0.026		
11-Dec-19	Manganese (mg/L)	<1.0						0.109	0.182	0.199	0.227	0.032	0.152	0.222			0.168	0.187
9-Dec-19	Mercury (mg/L)	<0.002	0.0002												<0.0002			
10-Dec-19	Mercury (mg/L)	<0.002		0.0002	<0.0002	<0.0002	<0.0002									<0.0002		
11-Dec-19	Mercury (mg/L)	<0.002						<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	2E-04	<0.0002			<0.0002	<0.0002
9-Dec-19	Magnesium (mg/L)		2.02															
10-Dec-19	Magnesium (mg/L)			2.32	2.02	1.58	1.62								0.7	1.22		
11-Dec-19	Magnesium (mg/L)							1.61	1.54	1.51	1.58	1.49	1.55	1.52			1.97	1.62
9-Dec-19	Lead (mg/L)	<0.05	<0.01												<0.01			
10-Dec-19	Lead (mg/L)	<0.05		<0.01	<0.01	<0.01	<0.01									<0.01		
11-Dec-19	Lead (mg/L)	<0.05						<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			<0.01	<0.01
9-Dec-19	Potassium (mg/L)		1.3												1.04			
10-Dec-19	Potassium (mg/L)			1.65	1.46	1.24	1.28									1.1		
11-Dec-19	Potassium (mg/L)							1.31	1.43	1.27	1.35	1.3	1.29	1.26			1.25	1.44
9-Dec-19	Sodium (mg/L)		2.5												1.64			
10-Dec-19	Sodium (mg/L)			2.54	2.28	1.97	1.94									2.26		
11-Dec-19	Sodium (mg/L)							1.98	1.92	1.89	1.9	1.78	1.84	1.8			2.44	1.99
9-Dec-19	Total Iron (mg/L)		0.55												0.729			
10-Dec-19	Total Iron (mg/L)			0.553	0.42	0.242	0.427									0.159		
11-Dec-19	Total Iron (mg/L)							0.446	1.34	1.44	1.64	1.05	1.29	1.65			1.22	1.12
8-Oct-19	TOC (mg/L)			2.93	4.34	2.41	2.17											
9-Oct-19	TOC (mg/L)							2.21	1.59	1.62								
13-Nov-19	TOC (mg/L)							1.86	1.25	1.2								
14-Nov-19	TOC (mg/L)			2.41	2.76	2	1.77											
10-Dec-19	TOC (mg/L)			2.8	2	1.42	1.3											
11-Dec-19	TOC (mg/L)							1.28	1.39	1.47								
8-Oct-19	Phytoplankton Biomass (g dry wt/m³)			2.4	1.6	1	1.4											

5 August 2020

		Station Code	NNG01	R01	R02	R03	R04	R05	R06	R07	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline																
9-Oct-19	Phytoplankton Biomass (g dry wt/m³)							0.8	4	4.2								
13-Nov-19	Phytoplankton Biomass (g dry wt/m³)							0.6	1.2	2.4								
14-Nov-19	Phytoplankton Biomass (g dry wt/m³)			3	1.2	2.4	0.4											
8-Oct-19	Total Phosphorus (mg/L)			<0.01	<0.01	<0.01	<0.01											
9-Oct-19	Total Phosphorus (mg/L)							<0.01	<0.01	<0.01								
13-Nov-19	Total Phosphorus (mg/L)							<0.01	<0.01	<0.01								
14-Nov-19	Total Phosphorus (mg/L)			<0.01	<0.01	<0.01	<0.01											
10-Dec-19	Total Phosphorus (mg/L)			<0.01	<0.01	<0.01	<0.01											
11-Dec-19	Total Phosphorus (mg/L)							<0.01	<0.01	<0.01								
8-Oct-19	Total Dissolved Phosphorus (mg/L)			<0.01	<0.01	<0.01	<0.01											
9-Oct-19	Total Dissolved Phosphorus (mg/L)							<0.01	<0.01	<0.01								
13-Oct-19	Total Dissolved Phosphorus (mg/L)							<0.01	<0.01	<0.01								
14-Oct-19	Total Dissolved Phosphorus (mg/L)			<0.01	<0.01	<0.01	<0.01											
10-Dec-19	Total Dissolved Phosphorus (mg/L)			<0.01	<0.01	<0.01	<0.01											
11-Dec-19	Total Dissolved Phosphorus (mg/L)							<0.01	<0.01	<0.01								

APPENDIX 5-2: EFFLUENT CAMP MONITORING RESULTS – Q4 2019

		Site Name	Owner's Site Office and Village	Obayashi Camp	Song Da5 Camp No.1	V & K Camp	HM Main Camp	ESD Camp	Main Powerhouse
		Station Code	EF01	EF02	EF07	EF10	EF13	EF14	EF19
Date	Parameter (Unit)	Guideline in the CA							
03-Oct-19	pH	6.0 - 9.0	7	7.09	7.09	6.72	6.92	6.91	
17-Oct-19	pH	6.0 - 9.0	6.89	7.03		6.19	7.08	7.32	
04-Nov-19	pH	6.0 - 9.0	6.76		6.66		6.53	6.4	
18-Nov-19	pH	6.0 - 9.0	6.62				7.05	6.4	7.05
03-Dec-19	pH	6.0 - 9.0	7.3				6.96	7.12	6.31
16-Dec-19	pH	6.0 - 9.0	7.36				6.37	6.06	6.35
03-Oct-19	Sat. DO (%)		40.6	67.2	67.2	91.8	59	26.6	
17-Oct-19	Sat. DO (%)		54.5	61.9		92.6	42.8	42.6	
04-Nov-19	Sat. DO (%)		62		72.2		74.4	129.2	
18-Nov-19	Sat. DO (%)		53.1				36.3	61.7	36.3
03-Dec-19	Sat. DO (%)		87.6				63.3	73.3	74.3
16-Dec-19	Sat. DO (%)		78				39.2	33.1	43.3
03-Oct-19	DO (mg/L)		2.97	4.9	4.9	6.95	4.39	1.93	
17-Oct-19	DO (mg/L)		4.17	5.02		7.19	3.25	3.26	
04-Nov-19	DO (mg/L)		4.82		5.54		5.58	9.66	
18-Nov-19	DO (mg/L)		4.03				2.75	4.72	2.75
03-Dec-19	DO (mg/L)		7.17				5.21	6.16	5.95
16-Dec-19	DO (mg/L)		6.15				3.22	2.66	3.46
03-Oct-19	Conductivity (µs/cm)		346	394	394	260	551	469	
17-Oct-19	Conductivity (µs/cm)		299	331		322	569	762	
04-Nov-19	Conductivity (µs/cm)		317		623		829	482	
18-Nov-19	Conductivity (µs/cm)		408				637	531	637

5 August 2020

		Site Name	Owner's Site Office and Village	Obayashi Camp	Song Da5 Camp No.1	V & K Camp	HM Main Camp	ESD Camp	Main Powerhouse
		Station Code	EF01	EF02	EF07	EF10	EF13	EF14	EF19
Date	Parameter (Unit)	Guideline in the CA							
03-Dec-19	Conductivity (µs/cm)		381				793	831	1128
16-Dec-19	Conductivity (µs/cm)		350				141.6	356	1104
03-Oct-19	TDS (mg/L)		173	197	197	130	275.5	234.5	
17-Oct-19	TDS (mg/L)		149	165.5		161	284.5	381	
04-Nov-19	TDS (mg/L)		158.5		311.5		414.5	241	
18-Nov-19	TDS (mg/L)		204				318.5	265.5	318.5
03-Dec-19	TDS (mg/L)		190.5				391.5	415.5	569
16-Dec-19	TDS (mg/L)		175				70.8	178	550
03-Oct-19	Temperature (°C)		30.2	30.3	30.3	28.3	29.2	30.7	
17-Oct-19	Temperature (°C)		28.2	28.9		26.8	28.2	27.8	
04-Nov-19	Temperature (°C)		26.6		27.7		28.7	28.9	
18-Nov-19	Temperature (°C)		27.9				28.2	27.6	28.2
03-Dec-19	Temperature (°C)		24.2				195.5	23	25.5
16-Dec-19	Temperature (°C)		25.8				26.7	24.3	25.5
03-Oct-19	Turbidity (NTU)		1.47	2.71	2.71	3.62	36.75	7.87	
17-Oct-19	Turbidity (NTU)		1.72	2.05		5.42	37.15	1.03	
04-Nov-19	Turbidity (NTU)		1.46		3.29		23.25	5.76	
18-Nov-19	Turbidity (NTU)		1.64				39.04	3.33	39.04
03-Dec-19	Turbidity (NTU)		1.36				26.79	7.08	13.03
16-Dec-19	Turbidity (NTU)		1.06				4.33	3.47	16.35
03-Oct-19	TSS (mg/L)	<50	<5	<5	<5	5.76	25.13	18.6	
17-Oct-19	TSS (mg/L)	<50	<5	<5		9.03	33.33	56	
04-Nov-19	TSS (mg/L)	<50	<5		<5		37.94	20.26	
18-Nov-19	TSS (mg/L)	<50	<5				27.22	6.4	27.22

		Site Name	Owner's Site Office and Village	Obayashi Camp	Song Da5 Camp No.1	V & K Camp	HM Main Camp	ESD Camp	Main Powerhouse
		Station Code	EF01	EF02	EF07	EF10	EF13	EF14	EF19
Date	Parameter (Unit)	Guideline in the CA							
03-Dec-19	TSS (mg/L)	<50	<5				16.21	24.69	46.28
16-Dec-19	TSS (mg/L)	<50	<5				11.14	7.78	65
03-Oct-19	BOD ₅ (mg/L)	<30	<6	<6	<6	<6	33	19.74	
17-Oct-19	BOD ₅ (mg/L)	<30	7.47	<6		<6	<6	<6	
04-Nov-19	BOD ₅ (mg/L)	<30	6.27		<6		<6	<6	
18-Nov-19	BOD ₅ (mg/L)	<30	15.18				<6	<6	<6
03-Dec-19	BOD ₅ (mg/L)	<30	8.52				<6	<6	19.08
16-Dec-19	BOD ₅ (mg/L)	<30	17.82				34.44	<6	<6
03-Oct-19	COD (mg/L)	<125	<25	<25	29.4	<25	128	36.5	
17-Oct-19	COD (mg/L)	<125	<25	<25		30	63.2	53.6	
04-Nov-19	COD (mg/L)	<125	<25		<25		117	35.5	
18-Nov-19	COD (mg/L)	<125	<25				128	<25	128
03-Dec-19	COD (mg/L)	<125	<25				96.6	<25	125
16-Dec-19	COD (mg/L)	<125	<25				49.8	<25	135
03-Oct-19	NH ₃ -N (mg/L)	<10	9.5	6.4	6.5	<2	14.5	14.9	
17-Oct-19	NH ₃ -N (mg/L)	<10	4.9	4.2		<2	17.9	20	
04-Nov-19	NH ₃ -N (mg/L)	<10	4.9		8.1		2.9	23.2	
18-Nov-19	NH ₃ -N (mg/L)	<10	4.5				13	8.5	13
03-Dec-19	NH ₃ -N (mg/L)	<10	<1.5				23.5	15.3	59.1
16-Dec-19	NH ₃ -N (mg/L)	<10	2.3				11.5	17.3	60.5
03-Oct-19	Total Nitrogen (mg/L)	<10	19	10.4	20.4	6.02	21.3	22.5	
17-Oct-19	Total Nitrogen (mg/L)	<10	15.7	11.5		0.84	22.2	23.8	
04-Nov-19	Total Nitrogen (mg/L)	<10	13.6		9.14		4.09	24.4	
18-Nov-19	Total Nitrogen (mg/L)	<10	14.7				14.2	11.1	14.2

		Site Name	Owner's Site Office and Village	Obayashi Camp	Song Da5 Camp No.1	V & K Camp	HM Main Camp	ESD Camp	Main Powerhouse
		Station Code	EF01	EF02	EF07	EF10	EF13	EF14	EF19
Date	Parameter (Unit)	Guideline in the CA							
03-Dec-19	Total Nitrogen (mg/L)	<10	17.5				32.2	17.7	65.1
16-Dec-19	Total Nitrogen (mg/L)	<10	19.8				13.3	19.2	132
03-Oct-19	Total Phosphorus (mg/L)	<2.0	1.2	0.62	0.59	0.13	1.24	1.46	
17-Oct-19	Total Phosphorus (mg/L)	<2.0	1.06	0.52		0.24	1.62	1.93	
04-Nov-19	Total Phosphorus (mg/L)	<2.0	1.07		0.52		0.81	1.75	
18-Nov-19	Total Phosphorus (mg/L)	<2.0	0.92				1.15	0.86	1.15
03-Dec-19	Total Phosphorus (mg/L)	<2.0	1.35				2.23	0.81	6.26
16-Dec-19	Total Phosphorus (mg/L)	<2.0	1.83				0.67	0.6	7.07
03-Oct-19	Faecal Coliform (MPN/100mL)	<400	130	79	540	220	4.5	1400	
17-Oct-19	Faecal Coliform (MPN/100mL)	<400	22	0		0	0	0	
04-Nov-19	Faecal Coliform (MPN/100mL)	<400	240		540		0	0	
18-Nov-19	Faecal Coliform (MPN/100mL)	<400	7.8				0	0	0
03-Dec-19	Faecal Coliform (MPN/100mL)	<400	14				0	0	0
16-Dec-19	Faecal Coliform (MPN/100mL)	<400	4				0	0	0
03-Oct-19	Total coliform (MPN/100mL)	<400	350	170	16000	1600	33	16000	
17-Oct-19	Total coliform (MPN/100mL)	<400	240	0		0	0	0	

		Site Name	Owner's Site Office and Village	Obayashi Camp	Song Da5 Camp No.1	V & K Camp	HM Main Camp	ESD Camp	Main Powerhouse
		Station Code	EF01	EF02	EF07	EF10	EF13	EF14	EF19
Date	Parameter (Unit)	Guideline in the CA							
04-Nov-19	Total coliform (MPN/100mL)	<400	920		1600		0	0	
18-Nov-19	Total coliform (MPN/100mL)	<400	920				0	0	0
03-Dec-19	Total coliform (MPN/100mL)	<400	46				0	0	0
16-Dec-19	Total coliform (MPN/100mL)	<400	110				0	0	0
03-Oct-19	Oil & Grease (mg/L)	<10	<1	<1	<1	<1	5	<1	
17-Oct-19	Oil & Grease (mg/L)	<10							
04-Nov-19	Oil & Grease (mg/L)	<10	<1		<1		4	<1	
18-Nov-19	Oil & Grease (mg/L)	<10							
03-Dec-19	Oil & Grease (mg/L)	<10	<1				<1	<1	<1
16-Dec-19	Oil & Grease (mg/L)	<10							
03-Oct-19	Residual Chlorine (mg/L)	<1.0		0.32	0.32	0.09	0.62	0.02	
17-Oct-19	Residual Chlorine (mg/L)	<1.0		0.25		2.16	1.22	1.03	
04-Nov-19	Residual Chlorine (mg/L)	<1.0			0.04		1.72	0.65	
18-Nov-19	Residual Chlorine (mg/L)	<1.0					0.92	1.23	0.92
03-Dec-19	Residual Chlorine (mg/L)	<1.0					1.8	1.53	1.83
16-Dec-19	Residual Chlorine (mg/L)	<1.0					1.58	1.86	1.9
03-Oct-19	Chlorination Dosing Rate (ml/mn)			115	115	20	6	0	
17-Oct-19	Chlorination Dosing Rate (ml/mn)			260		27		1.8	

		Site Name	Owner's Site Office and Village	Obayashi Camp	Song Da5 Camp No.1	V & K Camp	HM Main Camp	ESD Camp	Main Powerhouse
		Station Code	EF01	EF02	EF07	EF10	EF13	EF14	EF19
Date	Parameter (Unit)	Guideline in the CA							
04-Nov-19	Chlorination Dosing Rate (ml/mn)				10		10	11	
18-Nov-19	Chlorination Dosing Rate (ml/mn)						15	11	15
03-Dec-19	Chlorination Dosing Rate (mL/mn)								600
16-Dec-19	Chlorination Dosing Rate (mL/mn)						15	15	600
03-Oct-19	Effluent Discharge Volume (L/mn)			5	5	3	5	3	
17-Oct-19	Effluent Discharge Volume (L/mn)		12	12		0.5	6	3.6	
04-Nov-19	Effluent Discharge Volume (L/mn)		12		0.3		12	4	
18-Nov-19	Effluent Discharge Volume (L/mn)		6				6	4	6
03-Dec-19	Effluent Discharge Volume (L/mn)		10				12		2000
16-Dec-19	Effluent Discharge Volume (L/mn)		10				10	6	2000

APPENDIX 5-3: EFFLUENT CONSTRUCTION AREA DISCHARGED MONITORING RESULTS – Q4 2019

Date	Site Name	Parameter (Unit)	pH	Sat. DO (%)	DO (mg/L)	Conductivity (µS/cm)	TDS (mg/L)	Temperature (°C)	Turbidity (NTU)	TSS (mg/L)	Oil & Grease (mg/L)
		Standard	6.0 - 9.0							<50	<10
03-Oct-19	Spoil Disposal No.2	DS04	6.1	59.5	4.7	20.93	10.46	25.9	6.68	6.16	<1
10-Oct-19	Spoil Disposal No.2	DS04	6.83	74.9	5.87	23.5	11.75	26.3	3.88	3.2	
17-Oct-19	Spoil Disposal No.2	DS04	7.93	74.6	5.94	28.7	14.3	26	4.44	3.8	
24-Oct-19	Spoil Disposal No.2	DS04	6.54	76.7	6.23	48	24	26.02	3.39	3.4	
31-Oct-19	Spoil Disposal No.2	DS04	6.76	55.8	4.62	44	22	25.09	3.48	2.4	
07-Nov-19	Spoil Disposal No.2	DS04	6.95	81.4	6.48	32.5	16.2	25.6	3.16	2.51	
15-Nov-19	Spoil Disposal No.2	DS04	6.69	50.1	3.95	76.6	38.3	26.2	1.82	0.8	<1
21-Nov-19	Spoil Disposal No.2	DS04	6.21	54	4.68	36.5	18.7	24	2.31	0.53	
29-Nov-19	Spoil Disposal No.2	DS04	6.45	59.7	4.74	37.7	18.85	25.6	3.38	0.74	
05-Dec-19	Spoil Disposal No.2	DS04	6.17	69.7	6.17	45.1	22.5	20.6	4.18	1	
12-Dec-19	Spoil Disposal No.2	DS04	6.92	73.7	5.93	28.5	14.2	25.3	1.87	1.2	<1
19-Dec-19	Spoil Disposal No.2	DS04	6.19	73.9	6.12	38.9	19.4	23.8	3.13	2.04	

APPENDIX 5-4: GROUNDWATER QUALITY MONITORING RESULTS – Q4 2019

Month Year	Parameter (Unit)	Site Name	Somseun Village	NamPa Village	ThongNoy Village	Pou Village
		Station	GSXN01	GNPA01	GTHN01	GPOU01
		Guideline				
07-Oct-19	pH	6.5 - 9.2				7.22
21-Oct-19	pH	6.5 - 9.2	7.16	6.96	7.18	
19-Nov-19	pH	6.5 - 9.2				7.02
21-Nov-19	pH	6.5 - 9.2	7.12	6.93	6.82	
09-Dec-19	pH	6.5 - 9.2				7.57
16-Dec-19	pH	6.5 - 9.2	6.47	6.14	6.77	
07-Oct-19	Sat. DO (%)					91.8
21-Oct-19	Sat. DO (%)		85.3	89.5	89.7	
19-Nov-19	Sat. DO (%)					86.9
21-Nov-19	Sat. DO (%)		99.2	85.1	72.5	
09-Dec-19	Sat. DO (%)					77.5
16-Dec-19	Sat. DO (%)		79.4	81.2	66.8	
07-Oct-19	DO (mg/l)					6.92
21-Oct-19	DO (mg/l)		6.7	7.12	7.09	
19-Nov-19	DO (mg/l)					6.41
21-Nov-19	DO (mg/l)		7.42	6.59	5.6	
09-Dec-19	DO (mg/l)					6.78
16-Dec-19	DO (mg/l)		6.81	6.86	5.52	
07-Oct-19	Conductivity (µS/cm)					69.1
21-Oct-19	Conductivity (µS/cm)		318	333	297	
19-Nov-19	Conductivity (µS/cm)					12.58
21-Nov-19	Conductivity (µS/cm)		199.7	196.1	302	
09-Dec-19	Conductivity (µS/cm)					56.1
16-Dec-19	Conductivity (µS/cm)		324	310	329	
07-Oct-19	TDS (mg/l)					34.55
21-Oct-19	TDS (mg/l)		159	166.5	148.5	
19-Nov-19	TDS (mg/l)					6
21-Nov-19	TDS (mg/l)		99.5	98	151	
09-Dec-19	TDS (mg/l)					28.05
16-Dec-19	TDS (mg/l)		162	155	164.5	
07-Oct-19	Temperature (°C)					27.7
21-Oct-19	Temperature (°C)		26.5	26.1	26.5	
19-Nov-19	Temperature (°C)					29
21-Nov-19	Temperature (°C)		26.1	27.5	28.4	
09-Dec-19	Temperature (°C)					20.2
16-Dec-19	Temperature (°C)		22.3	22.6	25.1	
07-Oct-19	Turbidity (NTU)	<20				2.31
21-Oct-19	Turbidity (NTU)	<20	1.13	1.22	1.35	

Month Year	Parameter (Unit)	Site Name	Somseun Village	NamPa Village	ThongNoy Village	Pou Village
		Station	GSXN01	GNPA01	GTHN01	GPOU01
		Guideline				
19-Nov-19	Turbidity (NTU)	<20				1.28
21-Nov-19	Turbidity (NTU)	<20	1.86	1.42	1.65	
09-Dec-19	Turbidity (NTU)	<20				3.73
16-Dec-19	Turbidity (NTU)	<20	1.04	1.02	1.1	
07-Oct-19	Fecal coliform (MPN/100ml)	0				0
21-Oct-19	Fecal coliform (MPN/100ml)	0	2	2	130	
19-Nov-19	Fecal coliform (MPN/100ml)	0				13
21-Nov-19	Fecal coliform (MPN/100ml)	0	0	6.8	130	
09-Dec-19	Fecal coliform (MPN/100ml)	0				0
16-Dec-19	Fecal coliform (MPN/100ml)	0	0	0	26	
07-Oct-19	E.coli Bacteria (MPN/100ml)	0				0
21-Oct-19	E.coli Bacteria (MPN/100ml)	0	2	0	130	
19-Nov-19	E.coli Bacteria (MPN/100ml)	0				0
21-Nov-19	E.coli Bacteria (MPN/100ml)	0	0	6.8	130	
09-Dec-19	E.coli Bacteria (MPN/100ml)	0				0
16-Dec-19	E.coli Bacteria (MPN/100ml)	0	0	0	26	
09-Dec-19	Arsenic (mg/)	<0.05				<0.0003
16-Dec-19	Arsenic (mg/)	<0.05	0.0018	0.0013	0.0017	
16-Dec-19	Cadmium (mg/l)	<0.01				
09-Dec-19	Total Iron (mg/l)	<1				0.026
16-Dec-19	Total Iron (mg/l)	<1	<0.01	0.02	<0.01	
09-Dec-19	Magnesium (mg/l)					0.276
16-Dec-19	Magnesium (mg/l)		6.09	4.09	7.83	
09-Dec-19	Manganese (mg/l)	<0.5				0.035
16-Dec-19	Manganese (mg/l)	<0.5	<0.005	<0.005	<0.005	
09-Dec-19	Fluoride (mg/l)	<1				0.06
16-Dec-19	Fluoride (mg/l)	<1	0.1	0.09	0.12	
09-Dec-19	Total hardness (mg/l)	<500				12.4
16-Dec-19	Total hardness (mg/l)	<500	240	244	253	
16-Dec-19	Mercury (mg/l)	<0.001				

Month Year	Parameter (Unit)	Site Name	Somseun Village	NamPa Village	ThongNoy Village	Pou Village
		Station	GSXN01	GNPA01	GTHN01	GPOU01
		Guideline				
16-Dec-19	Selenium (mg/l)	<0.01				
09-Dec-19	Nitrate (mg/l)	<45				0.18
16-Dec-19	Nitrate (mg/l)	<45	0.27	0.18	0.35	
09-Dec-19	Nitrite (mg/l)	<3				<0.07
16-Dec-19	Nitrite (mg/l)	<3	<0.07	<0.07	<0.07	
09-Dec-19	Lead (mg/l)	<0.05				<0.01
16-Dec-19	Lead (mg/l)	<0.05	<0.01	<0.01	<0.01	

APPENDIX 5-5: GRAVITY FED WATER SUPPLY MONITORING RESULTS – Q4 2019

		Site Name	Thaheau Village	Hat Gnuin Village	Phouhomxay Village		
		Station	WTHH02	WHGN02	WPHX01	WPHX02	WPHX03
Date	Parameter (Unit)	Guideline					
21-Oct-19	pH	6.5 - 8.6	7.87	7.97	8.43	8.61	8.52
21-Nov-19	pH	6.5 - 8.6	6.38	6.35	6.49	7.61	7.5
16-Dec-19	pH	6.5 - 8.6	7.46	6.99	8.16	6.67	6.61
21-Oct-19	Sat. DO (%)		101.2	98	98	99.6	100.2
21-Nov-19	Sat. DO (%)		106.1	100.5	94.5	88.8	86
16-Dec-19	Sat. DO (%)		84.3	108.4	91.2	77.7	93
21-Oct-19	DO (mg/L)		7.79	7.54	7.81	7.55	7.76
21-Nov-19	DO (mg/L)		8.61	8.9	7.79	6.9	6.9
16-Dec-19	DO (mg/L)		6.9	8.88	7.24	6.82	7.25
21-Oct-19	Conductivity (µS/cm)	<1,000	38.6	56.3	5.61	5.52	7.02
21-Nov-19	Conductivity (µS/cm)	<1,000	38	69.5	8.56	8.76	8.75
16-Dec-19	Conductivity (µS/cm)	<1,000	41.5	75.8	10.07	11.3	10.38
21-Oct-19	TDS (mg/L)	<600	19.3	28.1	2.3	2.7	3
21-Nov-19	TDS (mg/L)	<600	19	34.5	4.2	4.3	4.4
16-Dec-19	TDS (mg/L)	<600	20.7	37.8	5	5.6	5.2
21-Oct-19	Temperature (°C)	<35	27.7	27.5	25.3	28.3	27.4
21-Nov-19	Temperature (°C)	<35	24.8	24.3	23.7	27.1	24.7
16-Dec-19	Temperature (°C)	<35	24.5	21.9	25.4	21.2	21.7
21-Oct-19	Turbidity (NTU)	<10	1.52	2.4	1.52	1.38	1.53
21-Nov-19	Turbidity (NTU)	<10	4.01	3.85	1.5	1.64	1.47
16-Dec-19	Turbidity (NTU)	<10	1.24	1.29	1.23	1.07	1.02
21-Oct-19	Faecal Coliform (MPN/100ml)	0	17	13	350	34	220
21-Nov-19	Faecal Coliform (MPN/100ml)	0	22	220	920	170	110
16-Dec-19	Faecal Coliform (MPN/100 mL)	0	11	27	220	540	540
21-Oct-19	E.coli Bacteria (MPN/100ml)	0	11	13	350	34	220
21-Nov-19	E.coli Bacteria (MPN/100ml)	0	22	110	920	170	110
16-Dec-19	E.coli Bacteria (MPN/100 mL)	0	11	27	220	540	350
16-Dec-19	Arsenic (mg/L)	<0.05	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
16-Dec-19	Cadmium (mg/L)	<0.003	<0.002	<0.002	<0.002	<0.002	<0.002
16-Dec-19	Iron (mg/L)		0.07	0.074	0.128	0.112	0.104
16-Dec-19	Lead (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
16-Dec-19	Magnesium (mg/L)		1.49	2.32	0.828	0.803	0.794
16-Dec-19	Manganese (mg/L)	<0.5	<0.005	0.008	0.008	<0.005	<0.005

		Site Name	Thaheau Village	Hat Gnuin Village	Phouhomxay Village		
		Station	WTHH02	WHGN02	WPHX01	WPHX02	WPHX03
Date	Parameter (Unit)	Guideline					
16-Dec-19	Fluoride (mg/L)	<1.5	0.16	0.14	0.14	0.11	0.05
16-Dec-19	Nitrate (mg/L)	<50	<0.09	<0.09	<0.09	0.22	0.27
16-Dec-19	Nitrite (mg/L)	<3	<0.02	<0.02	<0.02	<0.02	<0.02
16-Dec-19	Total hardness (mg/L)	<300	44	66.7	22.2	25.8	21.3
16-Dec-19	Selenium (mg/L)	<0.01	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
16-Dec-19	Mercury (mg/L)	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002

APPENDIX 5-6: LANDFILL LEACHATE MONITORING RESULTS – Q4 2019

		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-Oct-19	pH	6.0-9.0				8.44		7.77	
4-Nov-19	pH	6.0-9.0				7.79		7.19	
3-Dec-19	pH	6.0-9.0				7.69		7.06	
3-Oct-19	Sat. DO (%)					107		156	
4-Nov-19	Sat. DO (%)					128.6		159.6	
3-Dec-19	Sat. DO (%)					139.6		227.8	
3-Oct-19	DO (mg/L)					7.67		11.13	
4-Nov-19	DO (mg/L)					9.71		11.42	
3-Dec-19	DO (mg/L)					10.45		17.35	
3-Oct-19	Conductivity (µS/cm)					380		63.1	
4-Nov-19	Conductivity (µS/cm)					90.1		396	
3-Dec-19	Conductivity (µS/cm)					118.3		427	
3-Oct-19	TDS (mg/L)					190		31.55	
4-Nov-19	TDS (mg/L)					45.5		198	
3-Dec-19	TDS (mg/L)					59.1		213.5	
3-Oct-19	Temperature (°C)					30.5		31.3	
4-Nov-19	Temperature (°C)					28.2		31.4	
3-Dec-19	Temperature (°C)					29.1		28.1	
3-Oct-19	Turbidity (NTU)					14.48		5.41	
4-Nov-19	Turbidity (NTU)					7.82		10.83	

		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-Dec-19	Turbidity (NTU)					7.86		19.71	
3-Oct-19	BOD5 (mg/L)	<30				5.46		5.94	
4-Nov-19	BOD5 (mg/L)	<30				17.04		11.73	
3-Dec-19	BOD5 (mg/L)	<30				24.48		24.12	
3-Oct-19	COD (mg/L)	<125				34.8		93.3	
4-Nov-19	COD (mg/L)	<125				78.7		118	
3-Dec-19	COD (mg/L)	<125				108		154	
3-Oct-19	Faecal Coliform (MPN/100mL)	<400				540		79	
4-Nov-19	Faecal Coliform (MPN/100mL)	<400				220		920	
3-Dec-19	Faecal Coliform (MPN/100 mL)	<400				0		2	
3-Oct-19	Total Coliform (MPN/100mL)	<400				1,600		540	
4-Nov-19	Total Coliform (MPN/100mL)	<400				1,600		1,600	
3-Dec-19	Total Coliform (MPN/100 mL)	<400				8		23	
3-Dec-19	Mercury (mg/L)					<0.0005		<0.0005	
3-Dec-19	Total nitrogen (mg/L)	<10				1		2	
3-Dec-19	Arsenic (mg/L)					<0.0003		0.0016	
3-Dec-19	Lead (mg/L)	<0.2				<0.010		<0.010	
3-Dec-19	Iron (mg/L)					0.954		1.82	
3-Dec-19	Total Petroleum Hydrocarbons (mg/L)					<1		<1	