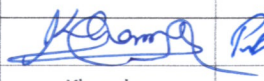
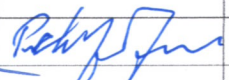
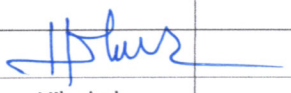
NAM NGIEP 1
POWER COMPANY

Nam Ngiep 1 Hydropower Project

Environmental Management Monthly Monitoring Report

May 2019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ABBREVIATIONS / ACRONYMS

AIP	Annual Implementation Plan
ADB	Asian Development Bank
BBS	Biodiversity Baseline Survey
BAC	Biodiversity Advisory Committee
BOF	Biodiversity Offset Framework
BOMC	Biodiversity Offset Management Committee
BOMP	Biodiversity Offset Management Plan
CA	Concession Agreement between the NNP1PC and GOL,
CAP	Corrective Action Plan
COD	Commercial Operation Date
CVC	Conventional Vibrated Concrete
CWC	Civil Works Contract
CTA	Common Terms Agreement
DEB	Department of Energy Business, MEM
DEPP	Department of Energy Policy and Planning, MEM
DEQP	Department of Environment and Quality Promotion, MONRE
DESIA	Department of Environmental and Social Impact Assessment, MONRE
DFRM	Department of Forest Resources Management, MONRE
DLA	Department of Land Administration, MONRE
DSRP	Dam Safety Review Panel
EC	Electrolytic Conductivity
ECOCD	EGAT Construction Obligation Commencement Date
EDL	Electricite du Laos
EDL PPA	Power Purchase Agreement between NNP1PC and EDL
EGAT	Electricity Generating Authority of Thailand
EGATi	EGAT International Company Limited
EIA	Environmental Impact Assessment
EMMR	Environmental Management and Monitoring Reports
EMO	Environmental Management Office of ESD within NNP1PC
EMU	Environmental Monitoring Unit
EMWC	Electrical-Mechanical Works Contract
EPF	Environmental Protection Fund

ERIC	Environmental Research Institute Chulalongkhorn University
ERM	Environmental Resource Management
ESD	Environmental and Social Division of NNP1PC
ESMMP	Environmental and Social Monitoring and Management Plan
FY	Fiscal Year
GOL	Government of Lao PDR
GIS	Geographic Information Systems
HH	Household
HMWC	Hydraulic Metal Works Contract
HR	Human Resources
IEE	Initial Environmental Examination
IMA	Independent Monitoring Agency
INRMP	Integrated Natural Resources Management Plan
ISP	Intergraded Spatial Planning
km	kilometre
kV	kilo-Volt
LEPTS	Lao Electric Power Technical Standard
LHSE	Lao Holding State Enterprise
LTA	Lender's Technical Advisor
M	million
m	metre
MAF	Ministry of Agriculture and Forestry
MEM	Ministry of Energy and Mines, Lao PDR
MOF	Ministry of Finance, Lao PDR
MOM	Minutes of Meeting
MONRE	Ministry of Natural Resource and Environment, Lao PDR
MOU	Memorandum of Understanding
NBCA	National Biodiversity Conservation Area
NCI	Non-Compliance Issue
NCR	Non-Compliance Report
NN2	Nam Ngum 2 Power Company Limited
NNP1PC	Nam Ngiep 1 Power Company Limited
NPF	National Protection Forest
NTFP	Non-Timber Forest Products
NT2	Nam Theun 2 Hydropower Project

OC	Obayashi Corporation
ONC	Observation of Non-Compliance
PAFO	Provincial Department of Agriculture and Forestry
PAP	Project Affected People
PD	Property Damage
PONRE	Provincial Department of Natural Resource and Environment, MONRE
PvPA	Provincial Protection Area
RCC	Roller Compacted Concrete
SIR	Site Inspection Report
SLBMP	Salvage Logging Biomass Management Plan
SOP	Standard Operating Procedure
SMO	Social Management Office of ESD within NNP1PC
SS-ESMMP	Site Specific Environmental and Social Monitoring and Management Plan
TD	Technical Division of NNP1PC
TOR	Terms of Reference
TSS	Total Suspended Solids
UAE	United Analysis and Engineering Consultant Company Ltd.
UXO	Unexploded Ordinance
WMF	Watershed Management Fund
WMP	Watershed Management Plan
WRPC	Watershed and Reservoir Protection Committee
WRPO	Watershed and Reservoir Protection Office
WWTS	Waste Water Treatment System

EXECUTIVE SUMMARY

In May 2019, the Environmental Management Office (EMO) of Nam Ngiep 1 Power Company (NNP1PC) received three Detailed Work Programme and Site Specific Environmental & Social Monitoring and Management Plans (DWP & SS-ESMMP) for review and approval. Out of these, four Site Decommissioning and Rehabilitation Plans, which were carried over from last month have been cleared.

During 14 – 15 May 2019, the Bolikhan District Environmental Management Unit (EMU) conducted a monthly visit at NNP1PC's Project sites. Inadequate operation of the waste water treatment system at the Song Da 5 Camp was observed.

The effluent monitoring results for the camps in May 2019 indicate that the results of COD, BOD_5, ammonia nitrogen, total nitrogen, faecal coliform and total coliform comply with the relevant effluent standards for some camps whereas the results for Zhefu Camp [EF09] and HMH Camp [EF13] did not comply with the Standards. In addition, minor non-compliance on faecal coliform and total coliform was recorded at Owner's Site Office and Village [EF01]. Corrective actions were being implemented for non-compliances and results will be reported next month. The V&K Camp [EF10] and Song Da 5 Camp No.1 [EF07] were fully compliant with the Standards.

In May 2019, the Dissolved Oxygen (DO) levels at the surface of the Main Reservoir (R1, R2, R3, R4 and R5) were between 5.47 mg/L – 8.54 mg/L, for the Re-regulation Reservoir (R6 and R7) DO was generally between 6.8 mg/L – 8.09 mg/L and the DO at the Nam Ngiep downstream of the Re-regulation Dam (NNG05) has remained above 6 mg/L.

A total of 83.4 m^3 of solid waste was disposed of at the NNP1 Project Landfill, a decrease of 15.3 m^3 compared to April 2019. EMO conducted three waste spot checks at the NNP1 Project Landfill, construction sites and the camps. A total of 2,404 kg of recyclable waste was recorded at the Community Waste Bank. A total of 76 m^3 of solid waste from Phouhomxay, Thahuea and Hat Gniun villages was disposed of at the Houay Soup Landfill.

NNP1PC-EMO is working on improving the Watershed Management Plan to further address the comments from GOL and refining the budget before submitting to the Department of Forestry (DOF), Ministry of Agriculture and Forestry (MAF).

The improved draft of AIP2019 from three Watershed and Reservoir Protection Offices (WRPOs) were discussed during a workshop on the Financial Management Manual (FMM) for Watershed and Biodiversity Management Funds on 10 May 2019. NNP1PC-EMO has not received the final draft AIP2019 from three WRPOs until 31 May 2019.

Xaysomboun Provincial Justice Department provided final comments on the improved draft on 06 May 2019. The final revision was re-submitted to Xaysomboun Provincial Justice Department on 14 May 2019 and was certified on 22 May 2019. Xaysomboun Provincial WRPO submitted a letter to Xaysomboun Provincial Assembly at the end of May 2019 for review and approval prior to submission to the Provincial Governor for signing.

The NC-NX Biodiversity Offset Management Plan (BOMP) was discussed with the Biodiversity Offset Management Unit (BOMU) and relevant government agencies during a technical workshop on 21 May 2019 in Viengthong District, Bolikhamxay Province. All parties understood and agreed with the BOMP structure, components and all activities. The meeting agreed to organize a high level consultation for BOMP approval during the week of 10-14 June 2019.

ADB provided a final confirmation accepting the BOMP AIP2019 on 10 May 2019. The fund transfer for the first quarter covering the implementation period from April-June 2019 was

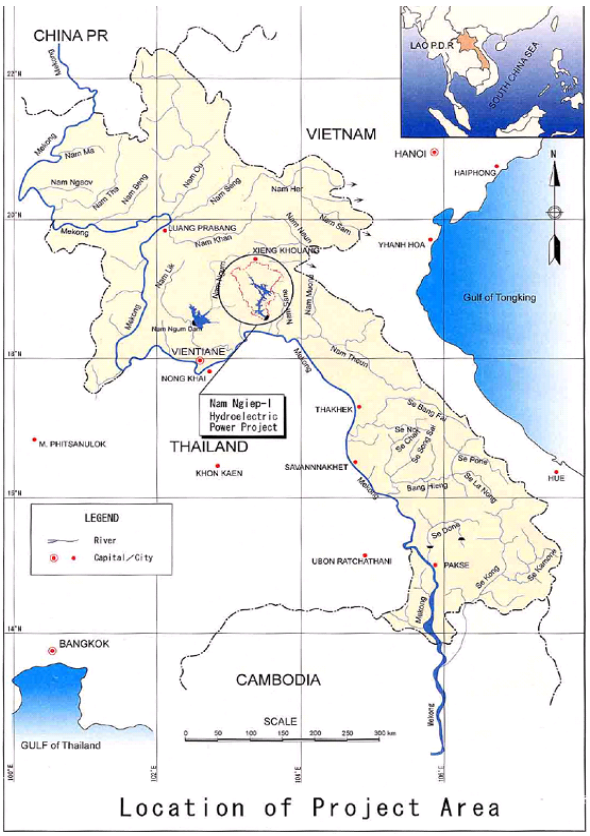
completed on 29 May 2019. Due to the delay in the Plan approval, there were no activities in the field since the pre-BOMP2B funding was over on 31 March 2019. The activities are expected to commence as soon as in the middle of June 2019 after the fund is received by BOMU and the completion of high level consultation workshop for BOMP approval.

The fish catch monitoring for April 2019 in Nam Ngiep watershed was dominated by two species groups and three species. These species are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species, except Tor sinensis which is classified as a Vulnerable (VU) species. However, the record also included one species that are classified as Endangered (EN) species, three Vulnerable (VU) species, and six Near Threatened (NT) species.

1. INTRODUCTION

The Nam Ngiep originates in the mountains of Xieng Khouang Province, flowing through Khoun District into Thathom District of Xaysomboun Province, through Hom District and into Bolikhan District of Bolikhamxay Province. The Nam Ngiep meets the Mekong River just upstream from Pakxan in Bolikhamxay Province (Fig. 1-1).

FIGURE 1-1: LOCATION MAP



The project will consist of two dams. The main dam which is located 9.0 km upstream of Hat Gnuin Village in Bolikhan District, will create a 70-km-long, narrow reservoir that extends up the Ngiep Valley as far as Thathom District. At almost 150 m high, the main dam will be the second largest in Lao PDR. The Power Station at this dam will generate up to 272 MW of electricity for export to Thailand. With a combined capacity of 290 MW, Nam Ngiep 1 will generate around 1,620 GWh of electricity annually. Two transmission lines will be required to transport the electricity generated by the project. From the main power station, a 230-kV line will run for 125 km to the Nabong outside Vientiane Capital. A 115-kV transmission line will be constructed by EDL from the Re-regulation Power Station to Pakxan substation over a distance of 40 km.

This Environmental Monthly Monitoring Report (EMMR) provides a summary of environmental monitoring activities and mitigation actions in January 2017. The EMMR was prepared by the Project's Environmental Management Office (EMO). It has been internally reviewed and cleared by EMO senior technical staff and management prior to submitting the report to the Government of Lao PDR (GoL) related agencies.

The EMMR and other related reports including related construction Site Specific Environmental and Social Monitoring and Management Plans (SS-ESMMPs) are publicly disclosed on the Project website in line with the ADB and GoL Public Disclosure Policies. Hard copies of the final reports will also be available upon requests at the Project's main office in Vientiane Capital and field office in Pakxan, Bolikhamxay Province.

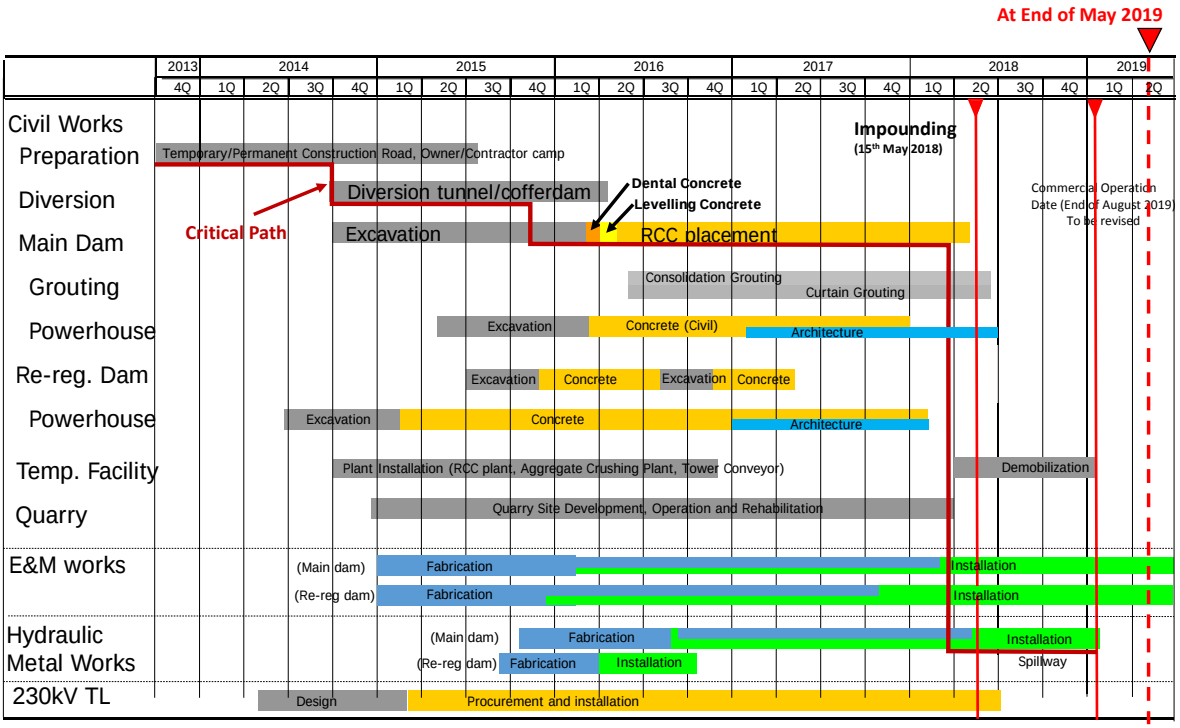
2. WORK PROGRESS OF PRINCIPAL CONTRACTORS

Construction works for the Project are being carried out through four separate main construction contracts under the supervision of the Technical Division of NNP1PC. The four contracts are the Civil Works, the Electrical and Mechanical Works, the Hydraulic Metal or Hydro-Mechanical Works and the 230 kV Transmission Line Works.

Figure 2-2 shows the overall progress of the Project in terms of value of work done and paid. It is shown that all works are substantially complete except for the Hydro-Mechanical Works. In fact the works of this Contractor are complete but not yet paid under contract payment terms. Both Civil and Transmission Line Works are complete except for minor outstanding work and

defects with the Civil Contractor carrying out almost 20 per cent more value of work in the original contract period. The Electrical and Mechanical Works Contractor is shown almost 100 per cent complete but additional work has been necessary to disassemble and reassemble the units due to the main powerhouse inclination problem. Actual overall cumulative work progress by value of work carried out and paid for until the end of May 2019 for all Contracts was 99.3 %[1] (compared to planned progress of 100 %), based on achieved Interim Milestone Payments for all Contracts excluding the value of Advance Payments, varied works and other adjustments allowed under each Contract. As TOC had not been issued to IIS, the progress of April had decreased from 99.7% to 99.3 % in March 2019. In terms of the value of actual work done the percentage is understated since work completed, but not paid, is not included. The overall construction schedule and progress curve (by achieved Milestone Payments) are shown in *Figure 2-1*

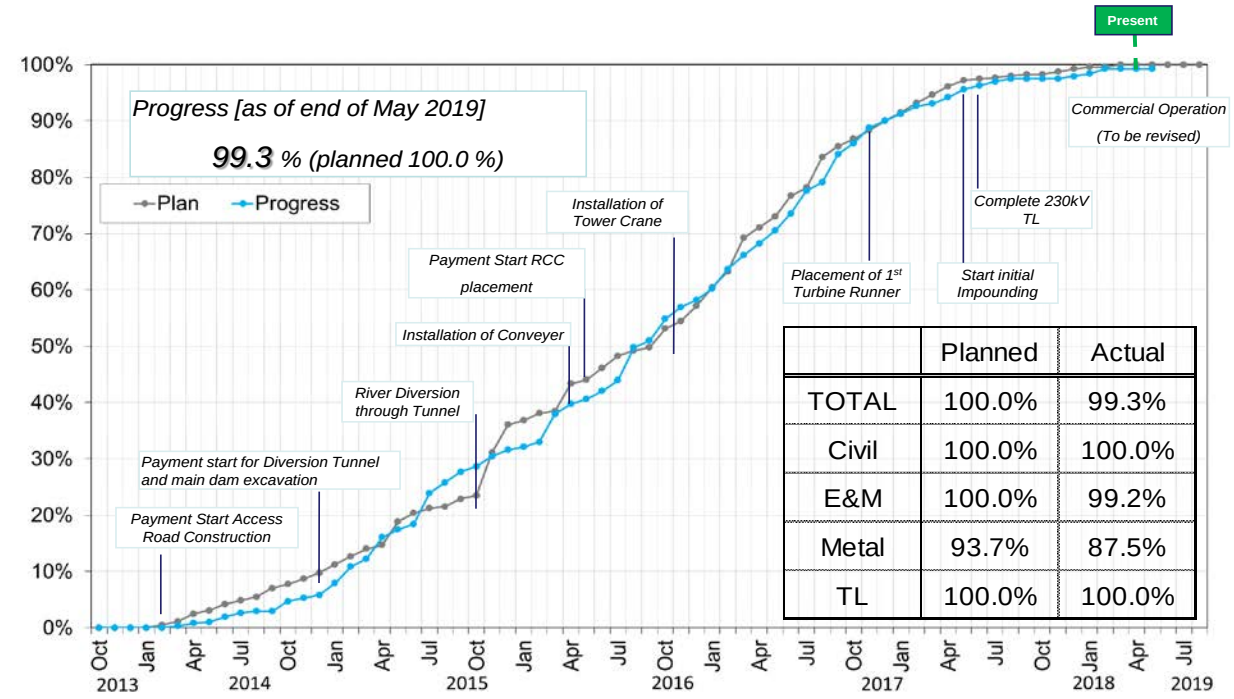
FIGURE 2-1: OVERALL CONSTRUCTION SCHEDULE



[1] The progress to-date is calculated as (Cumulative Amount of Achieved Interim Milestone Payments) / (Total Agreed Original Price of Construction Contracts) and expressed as a percentage. These totals exclude varied works and other adjustments allowed under each Contract.

[2] The progress to-date is calculated as (Cumulative Value Achieved for Completed Work by Variation Order or Other Adjustment) / (Total Budget Contingency Amount)

Figure 2-2: Overall Construction Progress Curve[1]



	Planned	Actual
TOTAL	100.0%	99.3%
Civil	100.0%	100.0%
E&M	100.0%	99.2%
Metal	93.7%	87.5%
TL	100.0%	100.0%

2.1 CIVIL WORK

The Civil Works Contract was executed between Obayashi Corporation and the Nam Ngiep 1 Power Company on 30 September 2013 and the Notice to Proceed was issued on 03 October 2014. Excavation works of the main dam, the diversion tunnel and the re-regulation dam were commenced in October 2014 and completed in February 2016, following which the concreting works were commenced.

The cumulative actual work progress of the Civil Works until the end of March 2019 was 100 % (compared to planned progress of 100 %) calculated in the same manner as described above for the value of achieved Interim Milestone Payments excluding advance payment.

2.1.1 MAIN DAM AND POWER HOUSE

After starting the main dam excavation in October 2014 on the left bank, these works were about one month advanced when diversion of the Nam Ngiep River was achieved at the end of October 2015. However, excavated volumes were 20 % greater in total than expected and part of this additional work was necessary to construct a 'shear key' structure due to the weak layers of rock encountered in the dam foundation. Following significant efforts on Site, the additional excavation work was completed at the end of February 2016.

2.1.2 RE-REGULATION DAM AND POWERHOUSE

The re-regulation powerhouse excavation and cofferdam works for the first river diversion were commenced in early October 2014. The excavation works for the powerhouse on the left bank were fully completed down to El. 146.7 m at the end of February 2015.

Structural concrete works were commenced in March 2015, in coordination with installation of the grounding system. The progress of overall re-regulating dam and powerhouse works at the left bank section and the right bank and labyrinth weir are shown in ***Figure*** below:

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

2.1.3 TEMPORARY WORK FACILITY

2.1.3.1 DIVERSION TUNNEL INLET AND OUTLET

The diversion tunnel, excavated over 600 m in length and 10 m in diameter, was commenced in October 2014 by drill and blast techniques and completed in late September 2015. The river diversion took place on 31 October 2015 after completion of inlet and outlet structures together with construction of earth-fill cofferdams upstream and downstream.

The second diversion to divert the river from the diversion tunnel through the bottom outlet or conduit in the dam was implemented on 13 January 2018. Dewatering of the diversion tunnel and construction of the concrete plug was commenced during January 2018. Concrete works and the valve installation for discharge was completed before the start of main dam impounding. On 22 May 2018, the valve discharge commenced by using 3 valves with around 5 m^3/s discharge in total. Construction of concrete plug including valve was completed on 27 January 2019.

2.1.3.2 SECONDARY UPSTREAM COFFERDAM

The concrete placement works in both conventional and roller-compacted concrete (CVC and RCC respectively) for the secondary upstream cofferdam were started in November 2015 and completed ahead of construction schedule in the middle of February 2016. The grout curtain works for this cofferdam were completed on 02 April 2016.

2.1.3.3 PLANT YARDS

These comprise the Aggregate Crushing Plant, the CVC Batching Plant and the RCC Batching Plant.

Foundation work and installation of equipment were completed at all the plant yards and the belt conveyor system from the RCC plant to the main dam was completed in early April 2016. Decommissioning and rehabilitation is underway on both plants and almost completed for the Aggregate Crushing Plant.

2.1.3.4 QUARRY

After removal of overburden the excavation of raw materials for aggregate crushing were started in July 2015. The nature and type of the rock being exploited is acceptable though unsuitable soil layers are removed to spoil disposal areas, and good quarry management continues.

2.1.3.5 DISPOSAL AREAS

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

2.2 ELECTRICAL AND MECHANICAL WORKS

The EMW Contract was executed between Hitachi-Mitsubishi Hydro Corporation and NNP1PC on 13 June 2014 and the NTP was issued in 03 October 2014. The cumulative work progress of the Electrical and Mechanical Works by value at the end of May 2019 was 98.8 % (compared to planned progress of 100.0 %).

Figure 4.2-1: Cabling work of SSG system for Unit 1

Figure 4.2-2: Assembly of guide vane servomotor's arm for Unit 1

Figure 4.2-3: Initial spinning test by manual for Unit 2

Figure 4.2-4: Bearing run under excitation verification test for Unit 2

Figure 4.2-5: Adjusting of governor and over speed test as well as brake test for Unit 2

Figure 4.2-6: Unit balance test and checking for Unit 2

Figure 4.2-7: No load saturation characteristic test for Unit 2

Figure 4.2-8: Phase rotation and residual voltages test for Unit 2

Figure 4.2-9: Three phase short circuit test and single phase short circuit test for Unit 2

Figure 4.2-10: Generator stability data test for Unit 2

Figure 4.2-11: Punch list work for turbine (Countermeasure for water leakage)

Figure 4.2-12: Punch list work for turbine (Countermeasure for oil leakage)

Figure 4.2-13: Punch list work (Remodelling piping for pressure gauge)

Figure 4.2-14: Punch list work (Changing position of oil detector)

2.3 HYDRO-MECHANICAL WORKS

The HMW Contract was executed between IHI Infrastructure Systems (IIS) and NNP1PC on 18 April 2014 and the NTP was issued to the Contractor on 03 October 2014. The actual cumulative work progress of the Hydro-Mechanical Works until the end of March 2019 was 100 % (compared to planned progress of 100 %).

2.4 230 KV TRANSMISSION LINE WORKS

The 230 kV Transmission Line Contract was executed between Loxley-Sri Consortium and NNP1PC on 11 July 2014 and the TP was issued to the 230 kV TL Works Contractor on 03 October 2014. The cumulative work progress of the Transmission Line Works until the end of June 2018 was 100 % (compared to planned progress of 100 %).

FIGURE 2-4: CUMULATIVE WORK PROGRESS OF TOWER FOUNDATION (ORIGINAL/REVISED PLANNED AND ACTUAL)

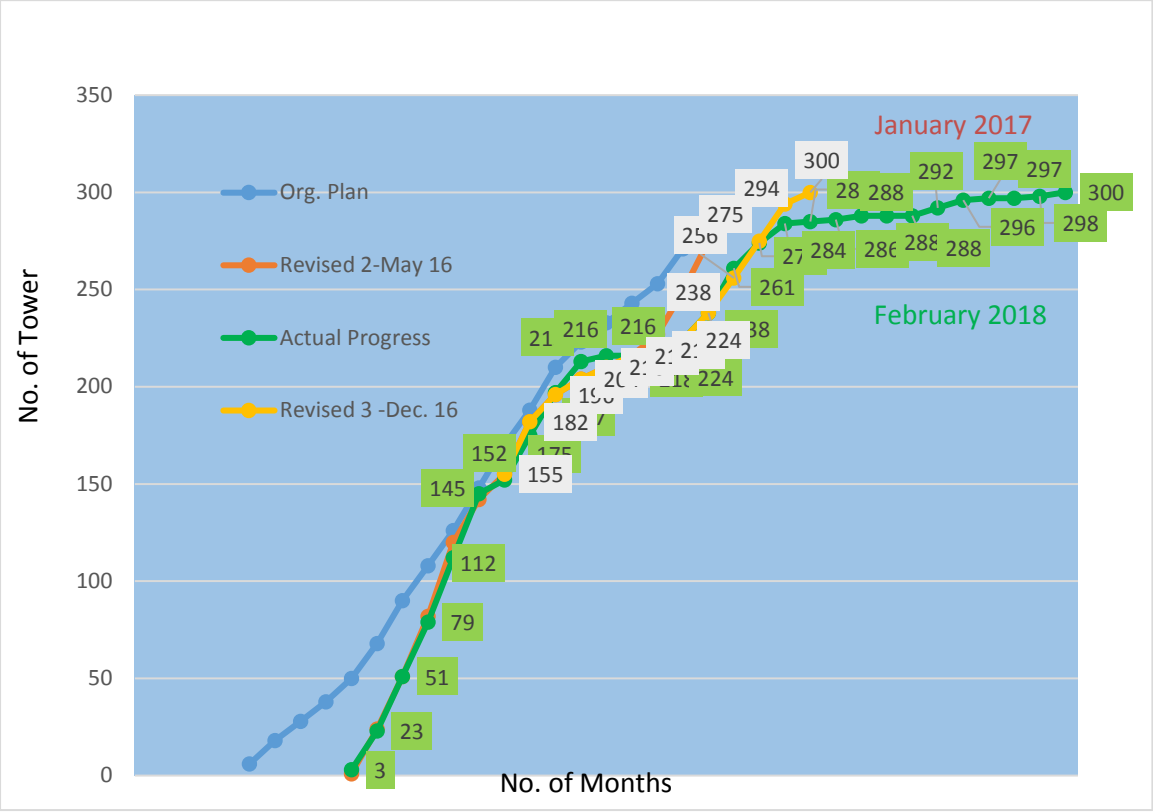


FIGURE 2-5: REVISED CUMULATIVE WORK PROGRESS OF TOWER ERECTION (PLANNED AND ACTUAL)

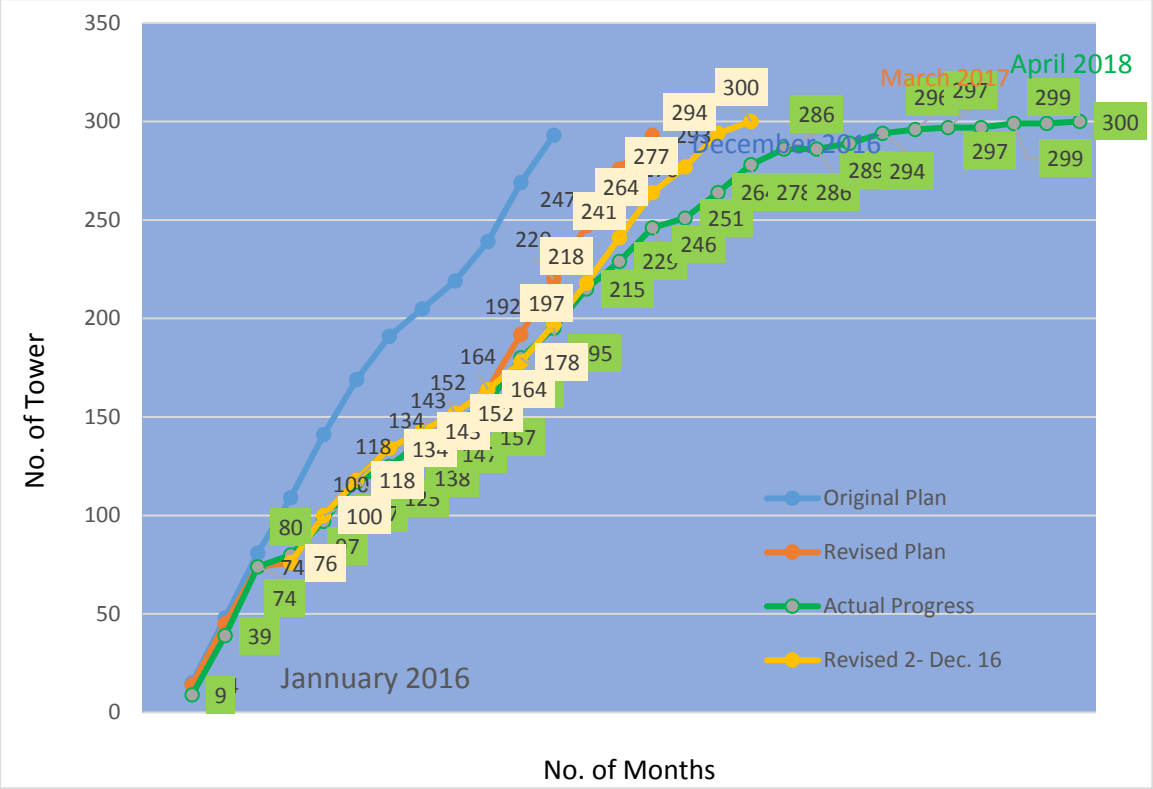
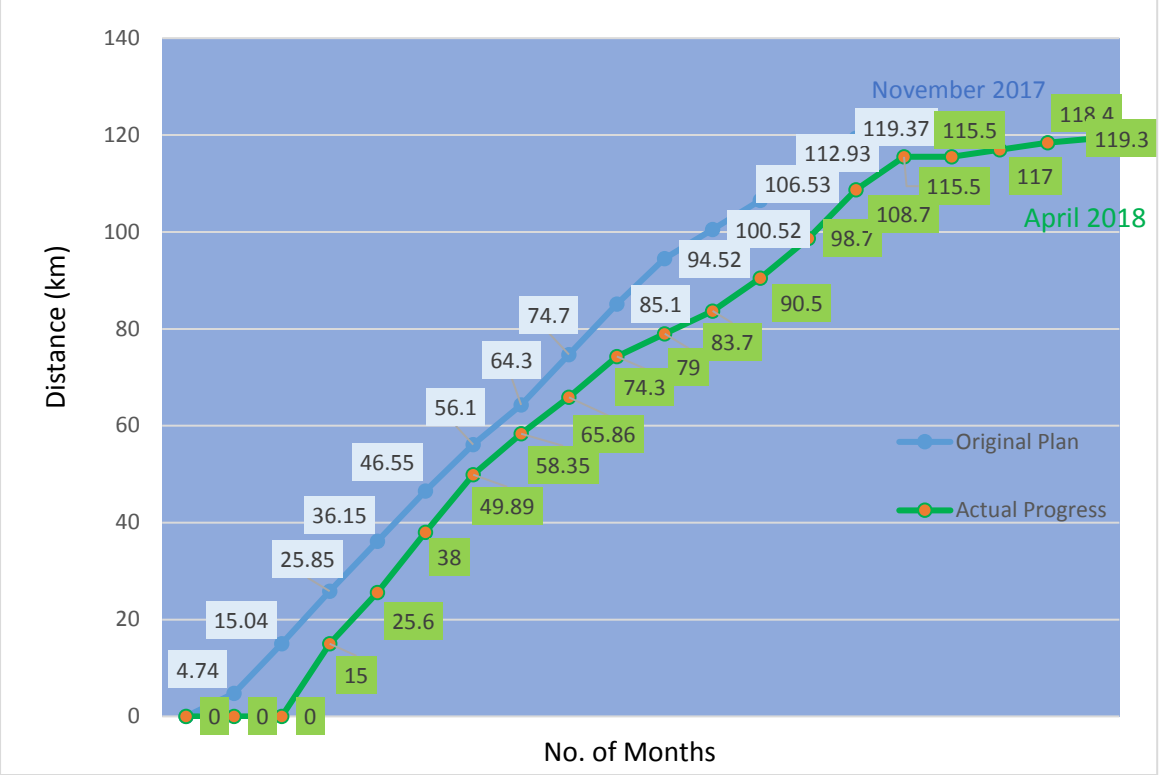


Figure 2-6: Cumulative Progress of Stringing Works (Planned & Actual)



3. ENVIRONMENTAL MANAGEMENT MONITORING

3.1 COMPLIANCE MANAGEMENT

In May 2019, the Environmental Management Office (EMO) of Nam Ngiep 1 Power Company (NNP1PC) received five Site Specific Decommissioning and Rehabilitation Plans and three Detailed Work Program and Site Specific Environmental & Social Monitoring and Management Plans (DWP & SS-ESMMP) for review and approval.

TABLE 3-1: *SS-ESMMP AND DOCUMENTS REVIEW STATUS IN MAY 2019*

Title	Date Received	Status
Site Specific Decommissioning and Rehabilitation Plan for GFE camp	09 April 2019 (1st submission)	No objection with comments on 28 May 2019
Site Specific Decommissioning and Rehabilitation Plan for IIS field shop and 276 Subcontractor camp	10 April 2019 (2nd submission)	No objection with No further comments on 28 May 2019
Site Specific Decommissioning and Rehabilitation Plan for Zhefu camp	16 April 2019 (2nd submission)	No objection with no further comments on 28 May 2019
Site Specific Decommissioning and Rehabilitation Plan Song Da5 workshop at Re-regulation Dam	25 April 2019 (1st submission)	No objection with no further comments on 28 May 2019
DWP & SS-ESMMP for the River Bed Excavation at the Re-regulation Tailrace under VO-98	09 May 2019 (4th submission)	No objection with comments on 28 May 2019
DWP & SS-ESMMP for Construction of Access Road to Cemetery Site and Internal Roads Improvement in the Phouhomxay Resettlement Village	10 May 2019 (1st submission)	No objection with comments on 15 May 2019
DWP & SS-ESMMP for the Improvement of Site Office and Resource Center in the Phouhomxay Resettlement Village	23 May 2019 (1st submission)	Under review

The status of compliance reports (Observation of Non-Compliance or ONC, Non-Compliance Report or NCR) issued by NNP1PC to the Contractors is summarized in *Table 3-2*

TABLE 3-2: SUMMARY OF ONC AND NCR

Items	ONC	NCR-1	NCR-2	NCR-3
Carried over from April 2019	2	0	0	0
Newly Opened in May 2019	7	0	0	0
Total in May 2019	**9**	**0**	**0**	**0**
Resolved in May 2019	6	0	0	0
Carried over to June 2019	3	0	0	0
Unsolved Exceeding Deadlines	**0**	**0**	**0**	**0**

3.1.1 INSPECTION BY ENVIRONMENT MANAGEMENT UNIT

During 14 to 15 May 2019, the Bolikhan District Environmental Management Unit (EMU) of Bolikhamxay Province conducted a monthly visit at NNP1PC's construction sites. During this inspection, it was found that chlorine dosage was not performed at the Waste Water Treatment System of Song Da 5 Camp No.1. Also, EMU noted that NNP1PC has a plan to hand over the Houay Soup Landfill to the district and community sometime after COD. However, they were concerned about the capacity of the local authority and community involvement in the management of the Houay Soup landfill. Therefore, a detailed discussion meeting between NNP1PC and EMU on this matter is needed. EMO will propose a meeting with the EMU on this matter in July 2019.

3.2 ENVIRONMENTAL QUALITY MONITORING

The analyses of Total Suspended Solids (TSS), Biochemical Oxygen Demand (BOD_5), faecal coliforms, E.Coli bacteria and total coliforms have been carried out by NNP1PC's environmental laboratory since August 2017.

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

3.2.1 EFFLUENT DISCHARGE FROM CAMPS AND CONSTRUCTION SITES

Detailed monitoring results are provided in ***Annex B*** of this Report. The effluent monitoring results for the camps in May 2019 indicate that the results of COD, BOD_5, ammonia nitrogen, total nitrogen, faecal coliform and total coliform comply with the relevant effluent standards for some camps whereas the results for Zhefu Camp [EF09] and HMH Camp [EF13] did not comply with the Standards. In addition, minor non-compliance on faecal coliform and total coliform was recorded at Owner's Site Office and Village [EF01]. The V&K Camp [EF10] and Song Da 5 Camp No.1 [EF07] were fully compliant with the Standard.

The status of implementation of the corrective actions addressing non-compliances at the camps and key construction sites that continue to have non-compliances is summarized in ***Table 1-3***.

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

Site	Sampling ID	Status	Corrective Actions
Owner's Site Office and Village (OSOV)	EF01	Non-compliance for faecal coliform, total coliform and total nitrogen. However, total nitrogen was back in compliance with the standard in the second fortnight sampling.	Additional maintenance of the wetland ponds will be followed up and the results will be monitored and reported in the June 2019 Report.
Obayashi Corporation Camp	EF02	Non-compliance for total nitrogen and ammonia-nitrogen.	As above
Song Da5 Camp No. 1	EF07	Full compliance.	
Song Da 5 Camp No. 2	EF08	No sampling because the wetland and treatment ponds were filled up.	The site decommissioning was about 100 % completed as of the end of May 2019. The waste water treatment system at this site will no longer be operated and the monitoring will be terminated by June 2019.
Zhefu Camp (Subcontractor of Hitachi-Mitsubishi Hydro)	EF09	Non-compliance for BOD_5, COD, ammonia nitrogen, total nitrogen, faecal coliform and total coliform. However, there was no discharge during the second fortnight sampling due to the camp is being decommissioned.	
V&K Camp	EF10	Full compliance.	
HMH Main Camp (WWTS)	EF13	Non-compliance for BOD_5, COD, ammonia nitrogen, total nitrogen, faecal coliform and total coliform.	
IHI Main Camp	EF14	Non-compliance for total nitrogen in the second fortnight sampling.	
Lilama 10 Camp	EF17	No sampling because no outflow from the wetland system.	

Site	Sampling ID	Status	Corrective Actions
IHI Field Shop 276 Camp	EF18	No sampling because the wetland and treatment ponds were landscaped.	Decommissioning of the field shop and camp was about 100% completed as of the end of May 2019. These facilities will be no longer be operated and the monitoring will be terminated by June 2019.
CVC Plant	DS03	No discharged water during the sampling dates.	
Spoil Disposal Area No.2	DS04	Non-compliance for TSS on 08 May 2019. However, the following sample was complied with the Standard.	
Upstream Spoil Disposal Area No.2	DS04-US	Non-compliance for TSS on 08 and 30 May 2019.	

3.2.2 AMBIENT SURFACE WATER QUALITY MONITORING

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

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

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

Frequency of Monitoring	Parameters (Unit)	Monitoring Sites
Saturday	pH, DO (%), DO (mg/l), Conductivity (µs/cm), TDS (mg/l), Temperature (°C) and Turbidity (NTU)	- R5, main reservoir immediately upstream the main dam; - NNG05, Nam Ngiep downstream the re-regulation dam at Hat Gniun Village
Weekly	pH, DO (%), DO (mg/l), Conductivity (µs/cm), TDS (mg/l), Temperature (°C), Turbidity (NTU), TSS (mg/l), BOD_5 (mg/l), Faecal coliform	- Main Reservoir: R1, R2, R3, R4, R5 - Re-regulation Reservoir: R6, R7 - Nam Ngiep downstream: NNG05 - Tributaries: NPH01, Nam Phouan

Frequency of Monitoring	Parameters (Unit)	Monitoring Sites
	(MPN/100 ml), Total coliform (MPN/100 ml)	
Fortnightly	pH, DO (%), DO (mg/l), Conductivity (µs/cm), TDS (mg/l), Temperature (°C), Turbidity (NTU)	All stations
Monthly	TSS (mg/l), BOD_5 (mg/l), COD (mg/l), NH_3-N (mg/l), NO_3-N (mg/l), total coliform (MPN/100 ml), faecal coliform (MPN/100 ml) and Hydrogen sulphide (mg/l)	All stations

The monitoring results for key parameters (DO, TSS and BOD_5) during May 2019 are presented in
Table 3-5, Table 3-6, and ***Table*** 3-7. The full set of data for May 2019 is attached in ***Annex A***. In addition, the results for DO are presented as line graphs in ***Figure*** 3-2.

Re-regulation Reservoir

At R7, the DO level in the water column were fluctuated from 4.00 mg/L to 7.96 mg/L. And at R6, the DO level were between 6.32 mg/L – 8.20 mg/L in the whole water column and with some water temperatures changed from the surface to the bottom of the reservoir. There were indications of a thermocline.

Main Reservoir

At R5, the DO level in the upper 4.0 m fluctuated from about 5.04 mg/L to 9.55 mg/L and the entire water column below 8.0 m had DO levels less than 0.85 mg/L.

At R4, the DO level in the upper 5.0 m fluctuated from about 5.53 mg/L to 8.79 mg/L and the entire water column below 8.0 m had DO levels below 0.51 mg/L.

The DO concentrations at R3 were recorded between 6.35 mg/L to 7.86 mg/L in the upper 4.0 m and the concentration of DO in the entire water column below 8.5 m was less than 0.67 mg/L.

The DO concentrations at R2 were between 6.08 mg/L to 8.24 mg/L in the upper 3.0 m and DO concentration in entire water column below 6.5 m was less than 0.76 mg/L.

On 14 and 21 May 2019, DO concentration at R1 were recorded between 5.04 mg/L to 7.70 mg/L in the upper 4.0 m and the concentration of DO in the entire water column below 11 m was less than 1.08 mg/L. in addition, on 28 May 2019, the DO concentrations in the entire water column at R1 were from 4.91 mg/L to 7.13 mg/L.

The measurements indicate the formation of oxy-clines in R1, R2, R3, R4 and R5.

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

The BOD_5 measurements in May 2019 were all (except R2) within the standard and some of them below the limit of detection.

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

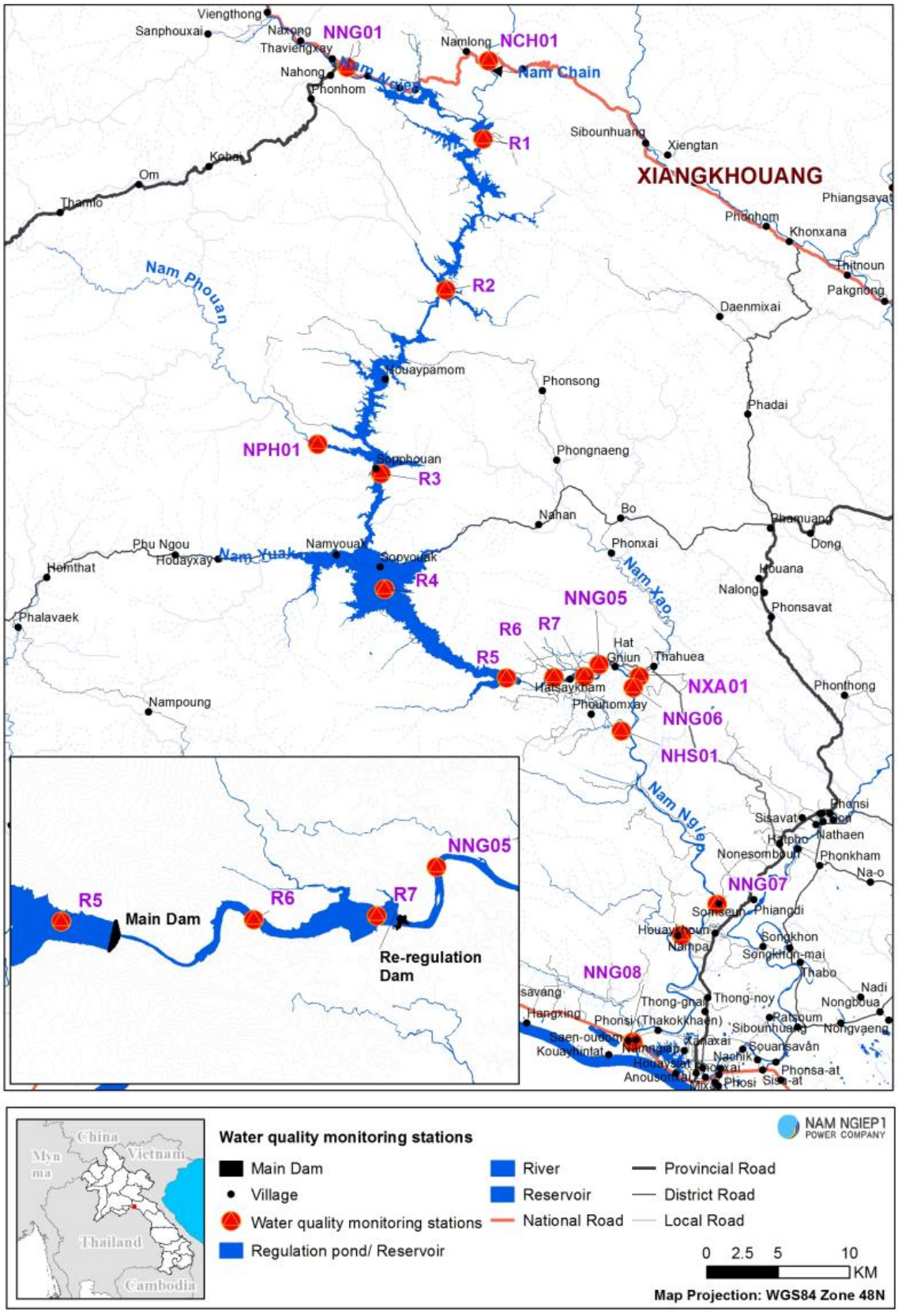


FIGURE 3-2: *CONCENTRATION OF DISSOLVED OXYGEN IN THE UPPER 0.2 M SINCE THE START OF IMPOUNDING*

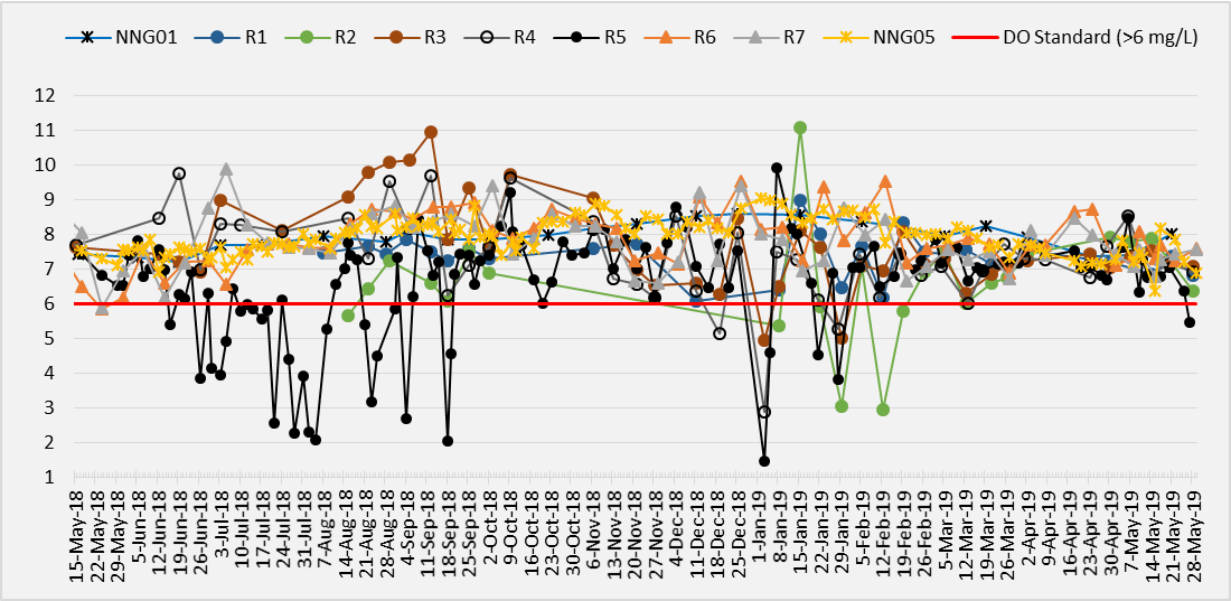


TABLE 3-5: *RESULTS OF SURFACE WATER QUALITY MONITORING FOR DISSOLVED OXYGEN (MG/L) IN THE UPPER 0.2 M, WATER QUALITY STANDARD: >6.0 MG/L*

Dissolved Oxygen (mg/L)	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
2-May-19							7.11	7.44	7.26	6.92	7.37	7.55			6.62	7.51
4-May-19						7.64			7.83							
6-May-19					8.54	8.45										
7-May-19	7.39		7.8	7.32									7.57	7.62		
8-May-19							7.35	7.07	7.22	6.27	6.89	6.49			6.41	6.72
10-May-19						6.34	8.09	7.56	7.46							
11-May-19						7.27			7.33							
13-May-19					6.79	6.78										
14-May-19		6.85	7.88	7.52										7.72		
15-May-19							7.29	6.8	6.38	5.78	6.45	6.24			4.82	6.45
17-May-19						6.78	7.69	7.26	8.19							
20-May-19					7.16	7.06										
21-May-19	8.02	7.36	7.16	7.2									8.49	7.68		
22-May-19							7.25	7.44	7.84	7.54	7.69	7.55			6.67	7.75
25-May-19						6.36			7.22							
27-May-19						5.47										
28-May-19		6.83	6.38	7.09	6.91									7.6		
29-May-19							7.6	7.56	6.9	7.04	7.13	7.61			6.46	6.92

TABLE 3-6: *RESULTS OF SURFACE WATER QUALITY MONITORING FOR TOTAL SUSPENDED SOLIDS (MG/L) - WATER QUALITY STANDARD: NO STANDARD*

Total Suspended Solids (mg/L)	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
2-May-19							<5	<5	<5							
6-May-19					<5	<5										
7-May-19	21.74		5.47	3.64									859.7	5.34		
8-May-19							7.6	5	30.99	30.95	44.37	34.64			85.62	281
13-May-19						<5										
14-May-19		<5														
15-May-19							<5	<5	5.86							
20-May-19						<5										
22-May-19							<5	5.17	5.08							
27-May-19						<5										
29-May-19							<5	<5	5.21							

TABLE 3-7: *RESULTS OF SURFACE WATER QUALITY MONITORING FOR BOD5 (MG/L) - WATER QUALITY STANDARD: < 1.5 MG/L*

BOD5 (mg/L)	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
6-May-19					<1.0	<1.0										
7-May-19	<1.0		1.63	1.19									<1.0	1.8		
8-May-19							1.16	1.39	1.12	<1.0	1.05	1.21			1.44	1.99
13-May-19						<1.0										
14-May-19		<1.0														
15-May-19							<1.0	<1.0	<1.0							
20-May-19						1.07										
22-May-19							<1.0	<1.0	<1.0							

3.2.3 GROUNDWATER QUALITY MONITORING

During May 2019, community groundwater quality analyses were carried out for four wells located in Somseun Village, Nam Pa Village, Thong Noy Village and Pou Village.

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

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

	Site Name	Somseun Village	NamPa Village	ThongNoy Village	Pou Village
	Station	GSXN01	GNPA01	GTHN01	GPOU01
Parameter (Unit)	Guideline				
pH	6.5 - 9.2	7.71	7.21	7.19	7.61
Sat. DO (%)		90.8	89.7	81.4	85.8
DO (mg/l)		7.41	6.91	6.06	6.28
Conductivity (µS/cm)		326	272	291	24.3

Parameter (Unit)	Site Name	Somseun Village	NamPa Village	ThongNoy Village	Pou Village
	Station	GSXN01	GNPA01	GTHN01	GPOU01
	Guideline				
TDS (mg/l)		163	136	145.5	12.15
Temperature (°C)		24.7	27.5	28.4	29
Turbidity (NTU)	<20	1.54	1.4	1.32	2.83
Fecal coliform (MPN/100 ml)	0	0	0	0	0
E.coli Bacteria (MPN/100 ml)	0	0	0	0	0

3.2.4 GRAVITY FED WATER SUPPLY (GFWS) QUALITY MONITORING

During May 2019, water samples from water taps at Thahuea Village, Hat Gniun Village and Phouhomxay Village were analysed. The WPHX01 represents raw water in the head tank before the filtration system.

The results of the water quality analyses are presented in ***Table 3-9***. All parameters complied with the National Drinking Water Standards except for faecal coliforms and E.Coli at WTHH02, WHGN02, WPHX01 (intake), WPHX02 (tap water at the primary school in Phouhomxay Village) and WPHX03 (tap water at a house in Phouhomxay Village). The villagers generally use the tap water for washing and cleaning. They were informed about the results and were encouraged to boil the water before drinking.

TABLE 3-9: RESULTS OF THE GRAVITY FED WATER SUPPLY QUALITY MONITORING

Date	Parameter (Unit)	Site Name	Thaheau Village	Hat Gnuin Village	Phouhomxay Village		
		Station	WTHH02	WHGN02	WPHX01	WPHX02	WPHX03
		Guideline					
24-May-19	pH	6.5 - 8.6	6.97	6.94	8.81	7.78	7.67
24-May-19	Sat. DO (%)		80.7	97.7	97.3	97.6	98.4
24-May-19	DO (mg/l)		6.17	7.52	7.57	7.47	7.5
24-May-19	Conductivity (µS/cm)	<1,000	58.5	76.4	8.81	7.84	7.52
24-May-19	TDS (mg/l)	<600	29.2	38.2	4.4	3.9	3.7
24-May-19	Temperature (°C)	<35	28.1	27.6	26.6	27.7	27.9
24-May-19	Turbidity (NTU)	<10	1.86	1.31	1.08	1.35	1.33
24-May-19	Faecal Coliform (MPN/100 ml)	0	13	26	79	27	11
24-May-19	E.coli Bacteria (MPN/100 ml)	0	13	17	49	14	11

3.2.5 LANDFILL LEACHATE MONITORING

During May 2019, the landfill leachate monitoring was conducted at NNP1 Project Landfill (Last pond - LL4) and at Houay Soup Solid Waste Landfill (Last pond - LL6).

The results indicate that pH (NNP1 Project Landfill), faecal coliform (Houay Soup Landfill), COD, and total coliform did not comply with the relevant effluent standards.

3.2.6 DUST MONITORING

The results indicate that the dust levels at all monitoring comply with the National Standard during the monitored period in May 2019. The results were shared internally with NNP1PC Technical Department as a reference for following-up inspection to ensure proper establishment of health and safety procedures.

3.2.7 NOISE MONITORING

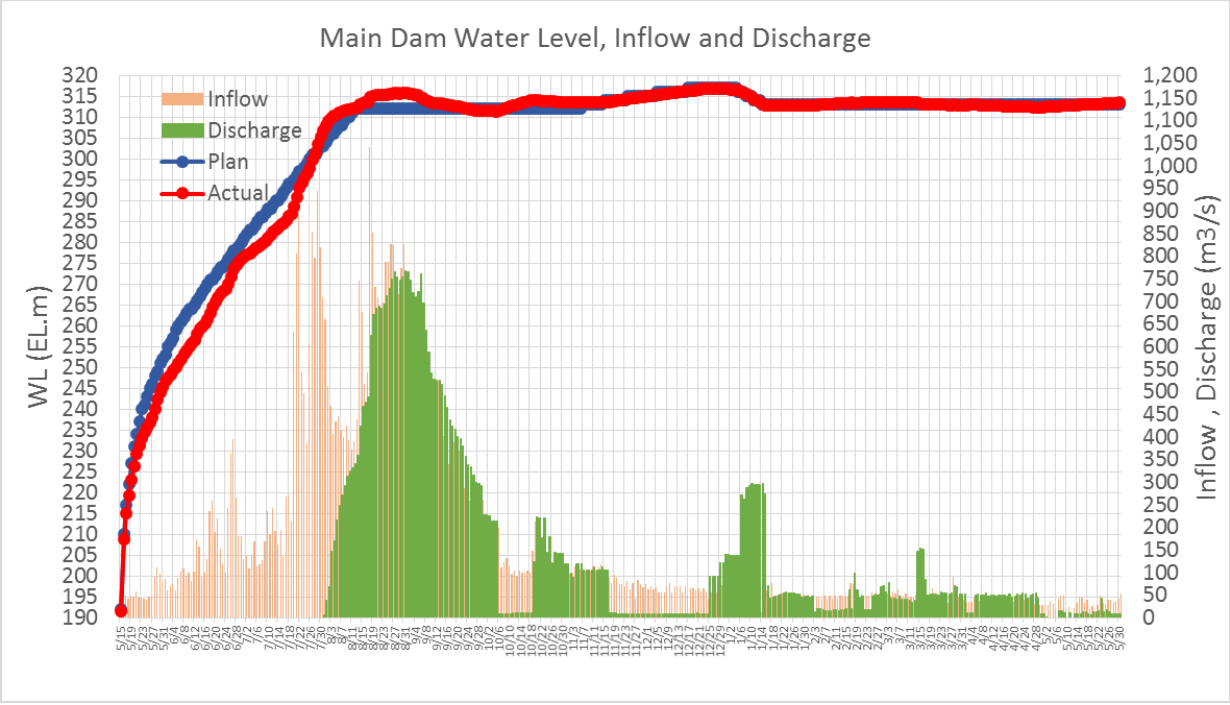
During May 2019, noise monitoring was conducted for 72 consecutive hours at Hat Gniun Village and Phouhomxay Village, and for 24 consecutive hours at the Main Dam, Song Da5 Camp No.2, Lilama 10 Camp and the Main Powerhouse.

The results indicate that the recorded maximum noise levels and averaged noise levels complied with the Standard for all stations, except Hat Gniun Village (07-08 May 2019 during 22:01-06:00). The exceedance of noise level in Hat Gniun Village was caused by heavy rain.

3.2.8 DISCHARGE MONITORING

The progress of impounding from 15 May 2018 to 31 May 2019 is presented on the graph in ***Figure 3-3*** indicating the water level in the main reservoir, the inflow to the main reservoir and the discharge from the main reservoir into the re-regulation reservoir. The inflow data shows the gradual reduction in flows from the end of the wet season into the dry season with inflows from about 100 m^3/s at the beginning of November 2018 to an average of about 48 m^3/s during March 2019, which is very close to the long-term average for the month of March (51 m^3/s).

FIGURE 3-3: PROGRESS OF IMPOUNDING THE MAIN RESERVOIR



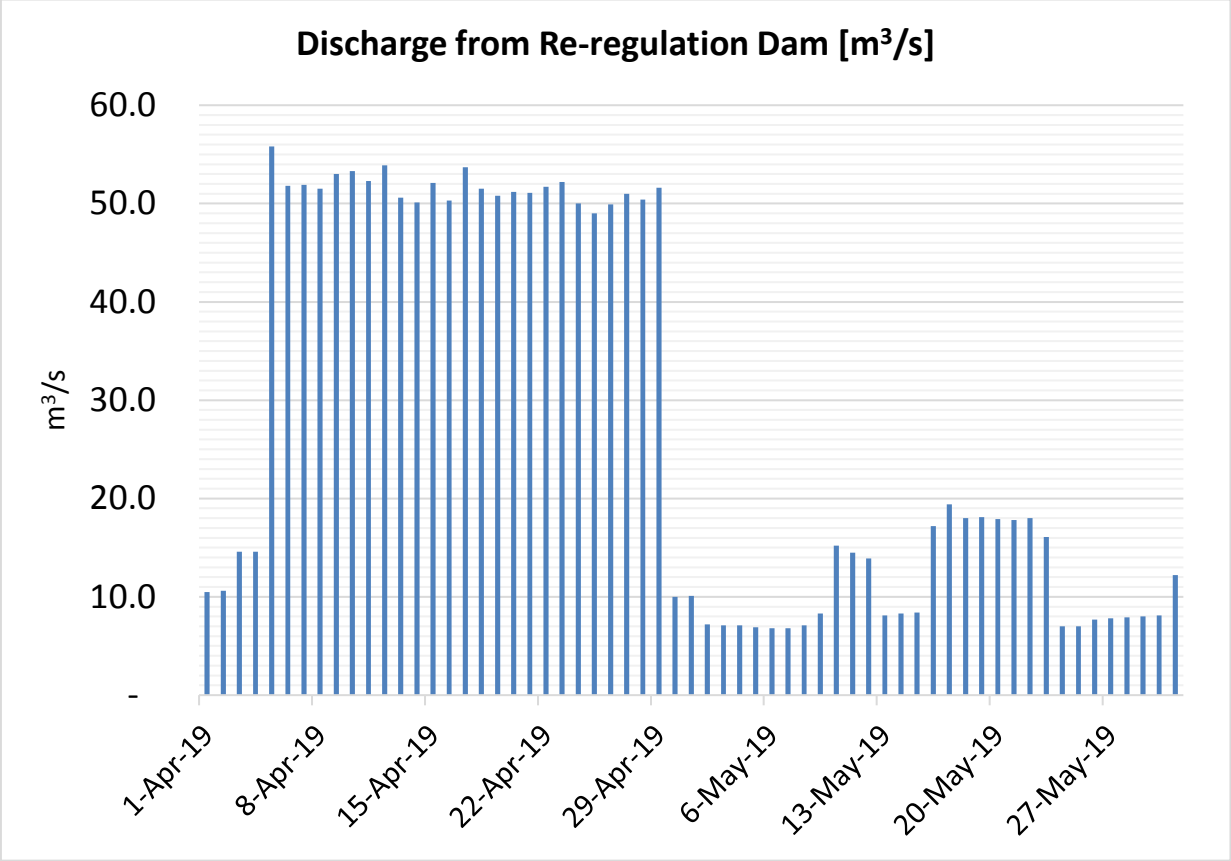
On 17 November 2018 the impounding of the main reservoir was restarted and continued until 25 December 2018. The water level in the reservoir rose with 3.2 m from 313.6 m asl on 17 November 2018 to 316.8 m asl on 25 December 2018. In the same period, the discharges from the main dam and the re-regulation dam were reduced (see ***Figure 1-3***) and maintained close to 10 m^3/s, which is well above the minimum flow requirement of 5.5 m^3/s. On 25 December 2018

the discharge from the main dam and the re-regulation dam was increased to equal the inflow to the main reservoir and this was maintained during the remaining part of December 2018. In the first two weeks of January 2019, the discharge from the re-regulation dam was increased to about 300 m^3/s or about 250 m^3/s above the inflow to the main reservoir thereby lowering the water level in the main reservoir by about 4 m to 312.8 m asl. During the remaining part of January 2019, the discharge from the re-regulation dam was generally kept about 10-20 m^3/s above the inflow to the main reservoir. From 03 February 2019 to 25 February 2019, the mean discharge from the re-regulation dam was kept at about 20 m^3/s (approximately 20 m^3/s lower than the inflow to the main reservoir), however with intermittent higher outflows in connection with testing of the turbine and the power generation in the re-regulation powerhouse. The testing of the turbine and power generation at the re-regulation powerhouse continued during March 2019 with the notable low discharge in the first week of March and the peaks in discharge of about 160 m^3/s from 14-16 March 2019.

From 01-04 April 2019, the discharge from the main dam was reduced to about 12 m^3/s to enable road construction and slope stabilization work for the access road to the main powerhouse. The discharge from the re-regulation dam was equally reduced. During the period 05 to 29 April 2019, power generation at the re-regulation powerhouse was resumed based on a constant flow rate of about 50 m^3/s. From 01 May to 30 May 2019 power generation at the re-regulation powerhouse was suspended and resumed again on 31 May 2019. As indicated in ***Figure 3-4***, the discharge from the re-regulation dam was between 8 m^3/s and 18 m^3/s in May 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 3-4: DISCHARGE MONITORING AT THE RE-REGULATION DAM IN APRIL AND MAY 2019



3.2.9 NAM NGIEP DOWNSTREAM WATER DEPTH MONITORING

In May 2019, EMO carried out five missions by boat to monitor the water depth in the Nam Ngiep downstream of the re-regulation dam. EMO has currently identified 19 sites with potential shallow water depths. Out of 19 sites monitored, there were 12 sites (02 May 2019), 6 sites (08 May 2019 and 15 May 2019), 5 sites (22 May 2019) and 7 sites (29 May 2019) that were difficult to navigate due to shallow water depths caused by decreased discharge from the re-regulation dam and low amount of rainfall as mentioned in Section 1.3 above.

3.3 PROJECT WASTE MANAGEMENT

3.3.1 SOLID WASTE MANAGEMENT

In May 2019, a total of 83.4 m^3 of solid waste was disposed of at the NNP1 Project Landfill, an increase of 15.3 m^3 compared to April 2019. During May 2019, EMO conducted three waste spot checks at the NNP1 Project Landfill, construction sites and the camps. Mixed waste inside the waste bins was found out at LILAMA 10 camp, Song Da 5 Camp No.1, V&K camp, and main dam site on right bank, NNP1PC instructed the supervisors of all concerned Contractors and subcontractors to ensure proper waste management practices.

A total of 180 kg of recyclable waste (mostly scrap metal) was sold to Khounmixay Processing Factory by the Contractors. The remaining scrap metal will be sold or transported off site by the Contractor at a later date.

TABLE 3-10: AMOUNTS OF RECYCLABLE WASTE SOLD

Source and Type of Recycled Waste		Unit	Sold	Cumulative Total by 31 May 2019
Construction Activity				
1	Scrap metal	kg	0	5,000
Sub-Total 1		**kg**	**0**	**5,000**
Camp Operations				
2	Glass bottles	kg	97	412
3	Plastic bottles	kg	46	150
4	Paper/Cardboard	kg	27	288
5	Aluminium cans	kg	10	10
Sub-Total 2		**kg**	**180**	**860**
Grand Total 1+2		**kg**	**180**	**5,860**

The villagers of Phouhomsay Village collected a total of 4,046 kg of food waste from selected camps for animal feed in May 2019, an increase of 645 kg compared to April 2019 as a result of GFE, Zhefu and 276 Camp decommissioning and a reduction in the number of construction workers at Song Da 5 Camps.

TABLE 3-11: AMOUNTS OF FOOD WASTE COLLECTED BY VILLAGERS

No.	Site Name	Unit	Total
1	Song Da 5 Camp No. 1	kg	707
2	Obayashi Corporation Camp	kg	1,171
3	Owner's Village and Site Office (OSOV)	kg	1,310
4	LILAMA 10 Camp	kg	858
Total		**kg**	**3,401**

3.3.2 HAZARDOUS MATERIALS AND WASTE MANAGEMENT

The types and amounts of hazardous waste collected and transported for off-site treatment and final disposal at Khounmixay Processing Factory in May 2019 are shown below.

TABLE 3-12: RESULTS OF HAZARDOUS MATERIAL INVENTORY

No.	Hazardous Waste Type	Unit	Total in May 2019 (A)	Disposed (B)	Remainder (A - B)
1	Used hydraulic and engine oil	litre	3,670	0	3,670
2	Contaminated soil, sawdust and concrete	bag	473	0	473
3	Used tyre	piece	238	0	238
4	Used oil filters	piece	201	0	201
5	Used oil mixed with water	litre	200	0	200
6	Ink cartridge	unit	158	0	158
7	Halogen/fluorescent bulbs	unit	154	0	154
8	Empty used chemical drum/container	drum (200 L)	116	11	105
9	Empty paint and spray cans	can	97	0	97
10	Empty used oil drum/container	drum (20 L)	36	6	30
11	Lead acid batteries	unit	22	0	22
12	Empty contaminated bitumen drum/container	drum (200 L)	25	5	20
13	Contaminated textile and material	kg	17	0	17
14	Lithium-ion batteries	unit	7	0	7
15	Empty used oil drum/container	drum (200 L)	10	6	4
16	Clinic Waste	kg	15.6	15.1	0.5

In addition, a total of 18 m^3 of sewage sludge from Zhefu and 276 Subcontractor Camp was transported and disposed of at Spoil Disposal Area No. 6 by following the NNP1PC Standard Operating Procedure (SOP) on Sewage/Black Water Disposal.

3.4 COMMUNITY WASTE MANAGEMENT

3.4.1 COMMUNITY RECYCLING PROGRAMME

In May 2019, the Community Waste Bank received 323.5 kg of recyclable waste and sold 943 kg. At the end of the month, 2,404 kg of recyclable waste remained in store, a decrease of 433 kg compared to April 2019.

TABLE 3-13: *TYPES AND AMOUNTS OF RECYCLABLE WASTE TRADED AT THE COMMUNITY WASTE BANK*

Types of Waste	Unit	Remaining in Apr 2019	Additions in May 2019	Sold	Remaining in May 2019
Scrap metal	kg	44	0	44	0
Glass bottles	kg	1,635.5	191	0	1,826.5
Paper/cardboard	kg	1,098.5	214.5	891	422
Aluminium cans	kg	10	7	8	9

Plastic bottles	kg	49	106.5	0	155.5
Total	**kg**	**2,513**	**323.5**	**943**	**2,404**

3.4.2 COMMUNITY SOLID WASTE MANAGEMENT

In May 2019, a total of 76 m^3 of solid waste was collected from Phouhomxay, Thahuea and Hat Gniun Villages. The solid waste was transported to Houay Soup Landfill where recyclable materials were segregated before being disposed of at the landfill.

On 17 and 26 May 2019, villagers of Thaheau and Hat Gnuin Villages carried out a monthly village clean-up, the solid waste was transported to and disposed of at Houay Soup landfill by the local Contractor.

3.5 WATERSHED AND BIODIVERSITY MANAGEMENT

3.5.1 WATERSHED MANAGEMENT

3.5.1.1 WATERSHED MANAGEMENT PLAN

NNP1PC-EMO is improving the Plan addressing the comments from GoL and refining the budget for submission to the Department of Forestry (DoF), Ministry of Agriculture and Forestry (MAF).

3.5.1.2 IMPLEMENTATION OF ANNUAL IMPLEMENTATION PLAN (AIP) 2019

The improved draft of AIP2019 from three Watershed and Reservoir Protection Offices (WRPOs) were discussed during a workshop on Financial Management Manual (FMM) for Watershed Management Fund on 10 May 2019. The key conclusions from the workshop are as below:

- The meeting principally agreed with the content in the draft Financial Management Manual for Watershed and Biodiversity Management Funds with minor comments for further improvement.
- The meeting agreed to apply MoF's Agreement No. 4000 as the basis for calculation and use for both Funds by GoL.
- Three WRPOs will further improve their AIP2019 incorporating the comments from the meeting participants by 31 May 2019.

Xaysomboun Provincial WRPO submitted an official design and cost estimation for the construction of Xaysomboun WRPO sub-office in Hom District. The design was reviewed internally by ESD team and noted for options to reduce the cost. NNP1PC-EMO have advised Xaysomboun Provincial WRPO to revisit the proposal.

DoF-WRPO submitted their revised AIP2019 on 16 May 2019. NNP1PC-EMO reviewed the Plan and reverted back to DOF-WRPO.

NNP1PC-EMO has not received the final draft AIP2019 from three WRPOs until 31 May 2019.

3.5.1.3 PREPARATION OF PROVINCIAL REGULATION FOR WATERSHED MANAGEMENT

Xaysomboun Provincial Justice Department provided final comments on the improved draft on 06 May 2019. The final revision was re-submitted to Xaysomboun Provincial Justice Department on 14 May 2019 and was certified on 22 May 2019.

Xaysomboun Provincial WRPO submitted a letter to Xaysomboun Provincial Assembly at the end of May 2019 for review and approval prior to submission to the Provincial Governor for signing.

3.5.2 BIODIVERSITY OFFSET MANAGEMENT

3.5.2.1 PREPARATION OF BIODIVERSITY OFFSET MANAGEMENT PLAN

The NC-NX Biodiversity Offset Management Plan (BOMP) was discussed with Biodiversity Offset Management Unit (BOMU) and relevant government agencies during a technical workshop on 21 May 2019 in Viengthong District, Bollikhamxay Province. The key conclusion from the workshop:

1. All parties understood and agreed with the BOMP structure, components and all activities;
2. NNP1PC would consider the overall budget for BOMP particularly to increase the amount for conservation linked livelihood component;
3. All parties acknowledged and understood the sources of fund (Concession Agreement, NNP1PC and ADB additional funds), its management principles and the coverage period for each source of fund;
4. Agreed on the proposed activities, budget and the fund transfer mechanism for the Annual Implementation Plan (AIP) 2019;
5. Agreed to revisit the existing land use of the six target villages prior to the adjustment or finalization of the TPZ and CUZ as well as conducting the demarcation on the ground as soon as possible and clear to the local communities;
6. The meeting agreed to organize a high level consultation for BOMP approval during 10 - 14 June 2019.

3.5.2.2 IMPLEMENTATION OF PRE-BIODIVERSITY OFFSET MANAGEMENT PLAN (BOMP)

ADB provided a final confirmation accepting the Biodiversity Offset Management Programme AIP2019 on 10 May 2019 after 47 days of review process. The fund transfer for the first quarter covering the implementation period from April-June 2019 for the amount of USD 52,914 (around 27% from the total fund of USD 197,726) was completed on 29 May 2019. The NC-NX Biodiversity Offset Management Unit (BOMU) is processing the fund withdrawal from the Central Bank under the DOF account on 31 May 2019.

Due to the delay in Plan approval then there were no activities in the field since the pre-BOMP2B funding was over on 31 March 2019. The activities are expected to commence as soon as in the middle of June 2019 after the transferred fund is received by BOMU and the completion of the high level consultation workshop for BOMP approval which is scheduled during the week of 10-14 June 2019.

3.6 FLOATING DEBRIS REMOVAL

The Contractor continued cutting and burning logs on the right bank of the reservoir in the middle section until 13 May 2018. Cutting and burning logs will be stopped due to the onset of the rainy season and the work will be resumed from the middle of October or November 2019.

FIGURE 3-5: TEMPORARY LOG-BOOM WITH BOAT PASSING GATE

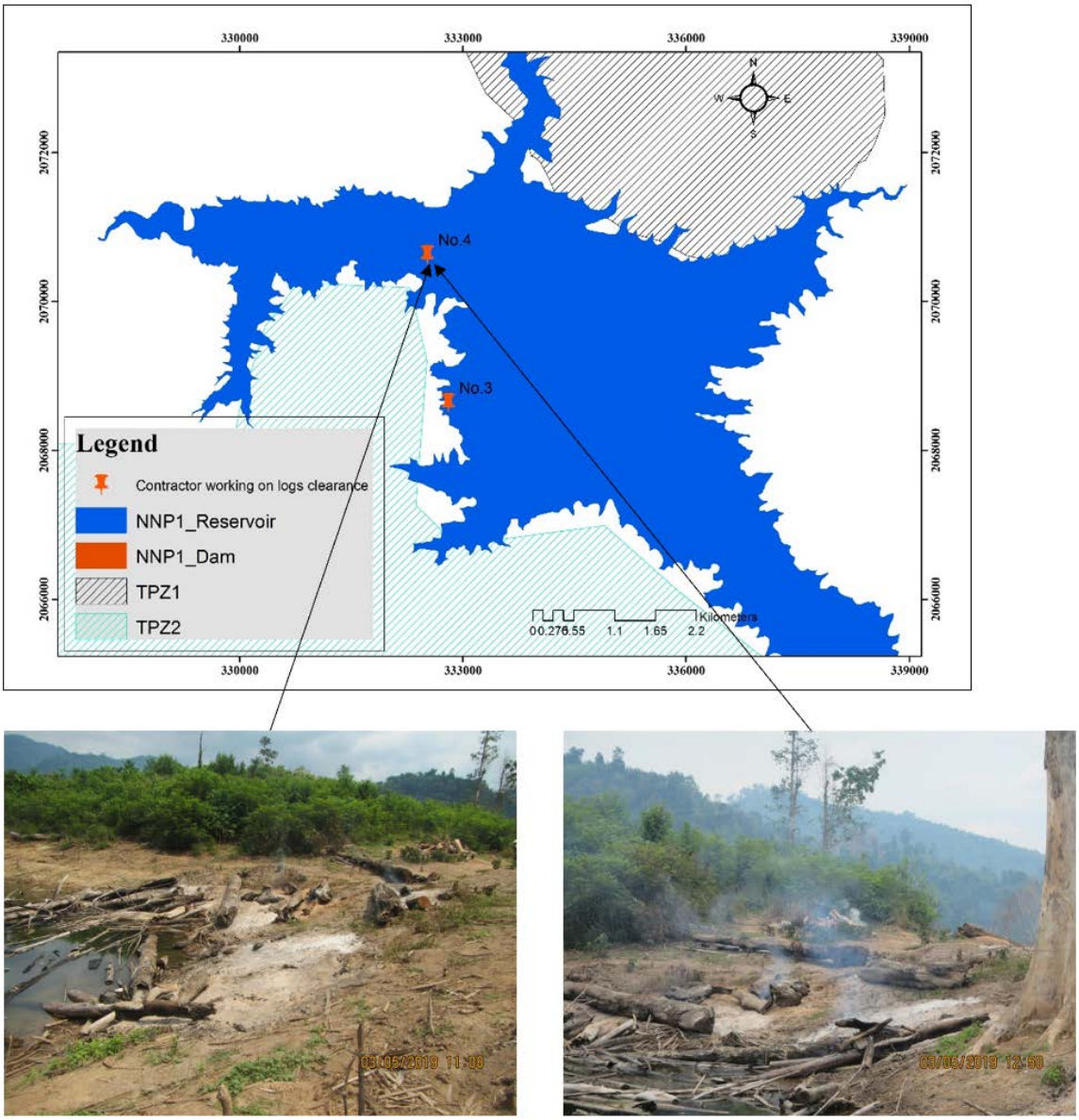


FIGURE 3-6: REPRESENTATIVE PHOTOS OF COLLECTING LOGS, CUTTING, AND BURNING IN THE MIDDLE OF MAIN RESERVOIR

4. FISHERY MONITORING

Two species groups and three species dominated the fish catch by weight in April 2019 as listed in ***Table 4-1.*** These species are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species[2], except *Tor sinensis* which is classified as Vulnerable (VU)[3].

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

[3] Status of *Tor sinensis* was updated from Data Deficient (DD) to be Vulnerable (VU)

TABLE 4-1: FISH SPECIES DOMINATING THE FISH CATCH IN APRIL 2019

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
Systomus orphoides	ปาปึก	400.1	LC
Poropuntius normani, Poropuntius laoensis,Poropuntius carinatus	ปาจาด	240.1	LC
Hemibagrus nemurus, Hemibagrus filamentus	ปากืด	215.4	LC, DD
Tor sinensis	ปาแดง	82.7	VU
Channa striata	ปาถ่ำ	77.5	LC

The recorded catch of Threatened and Near Threatened species (IUCN Red List classification) in April 2019 is presented in ***Table 4-2***. The list includes one species that is classified as an Endangered (EN) species, three Vulnerable (VU) species and six Near Threatened (NT) species.

TABLE 4-2: THREATENED SPECIES OF APRIL 2019 FISH CATCH

Species	Lao Name	Fish Catch (kg)	IUCN Red List Classification
Bangana behri	ปาอ่า	17.8	VU
Cirrhinus molitorella	ปาแกง	4.2	NT
Hypophthalmichthys molitrix		7	NT
Luciocyprinus striolatus	ปากอมขาย	0.2	EN
Neolissochilus stracheyi	ปาสอง	2.5	NT
Onychostoma gerlachi	ปาถิง	14.9	NT
Scaphognathops bandanensis	ปาอรุมไฟ/ปาป่รุม	9.2	VU
Syncrossus beauforti	ปาแข้อไก้	0.3	NT
Tor sinensis	ปาแดง	82.7	VU
Wallago attu	ปาถ้าอ	4	NT

The total recorded monthly fish catch for the downstream and upstream fishing households and the Mekong control group involved in the monitoring programme from July 2015 to April 2019 is presented in ***Figure 4-1***. Note that the upstream fish catch excludes the fish catch from the fishing households in Zone 2LR because these households were resettled during Q4-2017. In addition, 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 has been carefully discussed with a fishery expert and noted that NNP1PC needs to continue the monitoring and the long trend data analysis should carefully consider the different sampling methods that were implemented. Consequently, the total monthly fish catch was estimated by using median catch for active fishing household since February 2019.

FIGURE 4-1: TOTAL RECORDED MONTHLY FISH CATCH JULY 2015-APRIL 2019

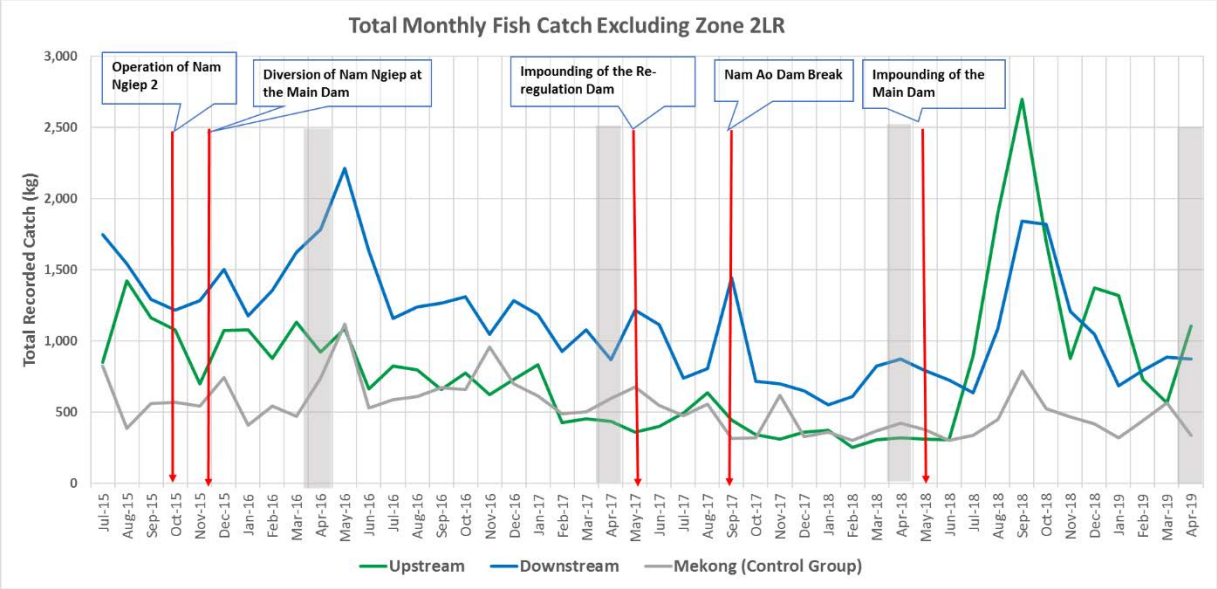
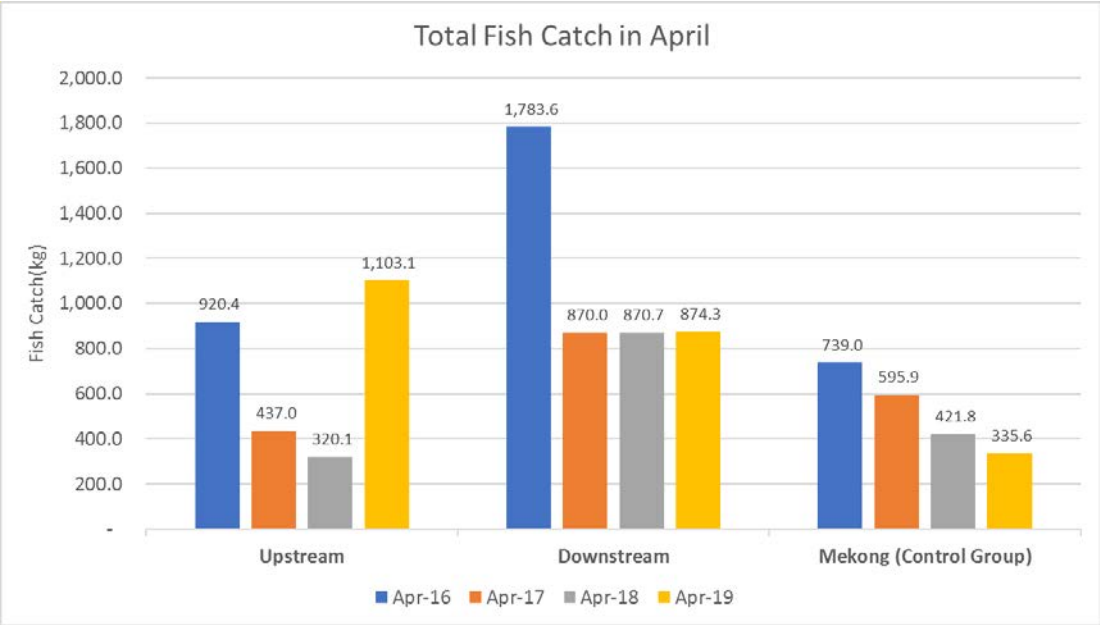


Table 4-3 and ***Figure 4-2*** show the total recorded fish catch for April 2016, April 2017, April 2018 and April 2019 in the upstream (excluding Zone 2LR) and downstream communities and the Mekong control group. The total fish catch data represents the total fish supply provided by the involved fishing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

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

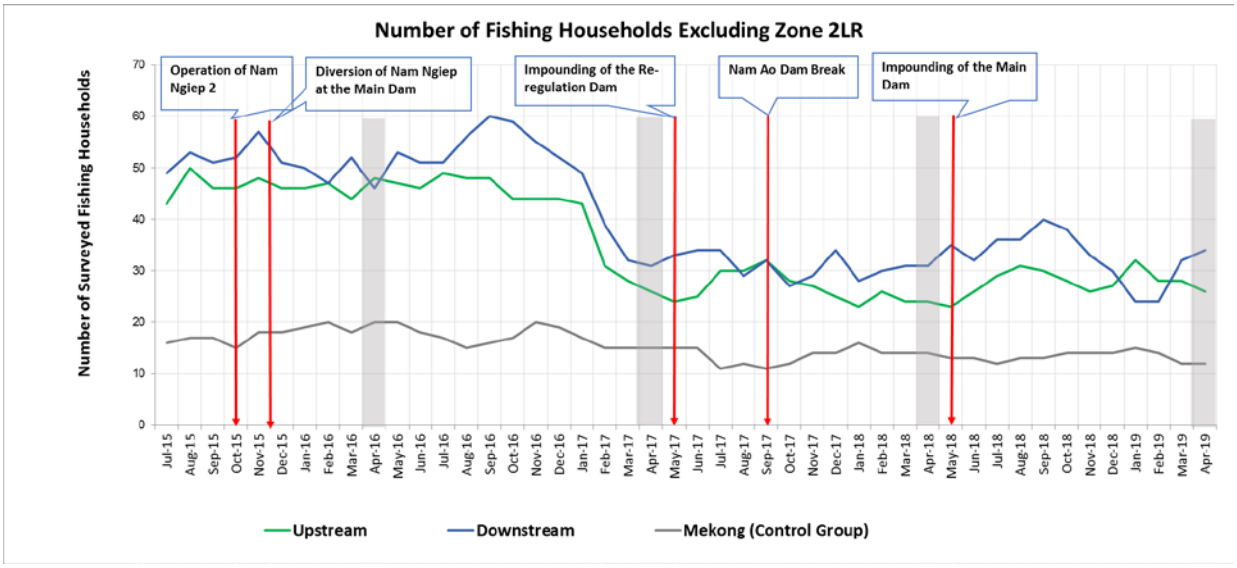
Fishing Zone	April 2016 (kg)	April 2017 (kg)	April 2018 (kg)	April 2019 (kg)
Upstream	920.4	437.0	320.1	1,103.1
Downstream	1,783.6	870.0	870.7	874.3
Mekong Control Group	739.0	595.9	421.8	335.6

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



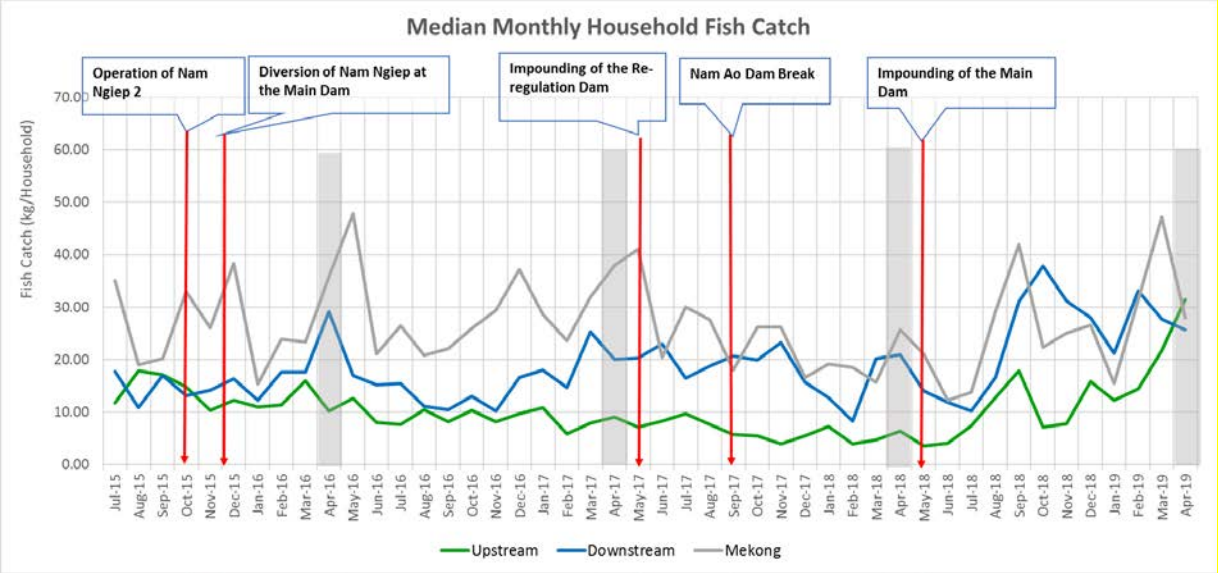
The numbers of fishing households involved in the fish catch monitoring programme are displayed in ***Figure 4-3***.

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



The median monthly household fish catch from July 2015 to April 2019 for the upstream (excluding Zone 2LR) and downstream communities, and the Mekong control group are presented in ***Figure 4-4***.

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



The median household fish catch for April 2016, April 2017, April 2018 and April 2019 in the upstream (excluding Zone 2LR) and downstream communities and the Mekong control group are displayed in ***Table 4-4.***

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

Fishing Zone	April 2016 (kg)	April 2017 (kg)	April 2018 (kg)	April 2019 (kg)
Upstream	10.3	9.0	6.4	31.5
Downstream	29.1	20.0	21.0	25.7
Mekong Control Group	35.8	38.0	25.8	28.0

The median daily fish catch per household are displayed in ***Figure 4-5***, and the median fish catch per household per fishing day in April 2016, April 2017, April 2018 and April 2019 are shown in ***Table 4-5***.

FIGURE 4-5: MEAN MONTHLY HOUSEHOLD FISH CATCH PER FISHING DAY

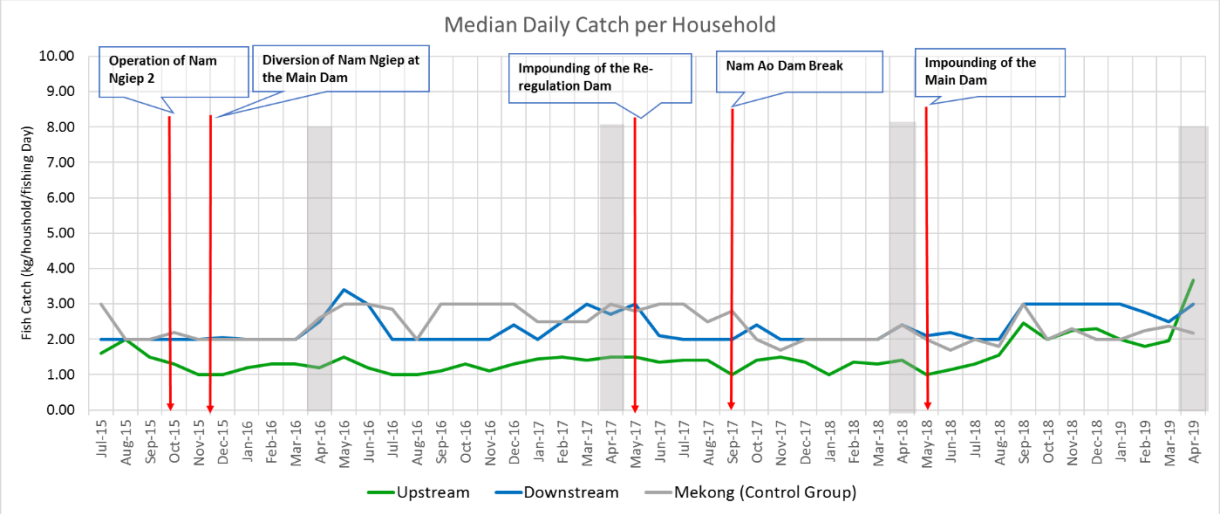


TABLE 4-5: MEAN HOUSEHOLD FISH CATCH PER FISHING DAY IN APRIL

Fishing Zone	April 2016 (kg)	April 2017 (kg)	April 2018 (kg)	April 2019 (kg)
Upstream	1.20	1.50	1.40	3.67
Downstream	2.50	2.70	2.40	3.00
Mekong (Control Group)	2.60	3.00	2.40	2.18

ANNEXES

ANNEX A: RESULTS OF WATER QUALITY MONITORING

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

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08
Date	Parameters (Unit)	Guideline												
2-May-19	pH	5.0 - 9.0							7.71	7.85	7.83	7.65	6.78	6.56
4-May-19	pH	5.0 - 9.0						7.52			7.45			
6-May-19	pH	5.0 - 9.0					8.24	8.05						
7-May-19	pH	5.0 - 9.0	8.9		8.67	8.24								
8-May-19	pH	5.0 - 9.0							7.88	7.98	8.35	7.93	6.8	6.94
10-May-19	pH	5.0 - 9.0						7.87	8.29	7.82	7.94			
11-May-19	pH	5.0 - 9.0						7.67			7.46			
13-May-19	pH	5.0 - 9.0					8.56	8.16						
14-May-19	pH	5.0 - 9.0		8.13	8.94	8.49								
15-May-19	pH	5.0 - 9.0							7.96	8	7.88	8.19	8.12	8.29
17-May-19	pH	5.0 - 9.0						8.29	8.59	8.52	8.16			
20-May-19	pH	5.0 - 9.0					8.55	8.21						
21-May-19	pH	5.0 - 9.0	7.76	8.16	8.34	8.74								
22-May-19	pH	5.0 - 9.0							8.06	8.29	7.97	7.88	7.1	7.25
25-May-19	pH	5.0 - 9.0						8.04			7.7			
27-May-19	pH	5.0 - 9.0						7.94						
28-May-19	pH	5.0 - 9.0		7.96	7.87	8.24	7.75							
29-May-19	pH	5.0 - 9.0							8.44	8.54	8.09	7.96	6.98	7.14
2-May-19	Sat. DO (%)								97.5	100.9	98	95.8	102.7	106.9
4-May-19	Sat. DO (%)							101.8			102.1			
6-May-19	Sat. DO (%)						117.8	113.8						
7-May-19	Sat. DO (%)		100.3		104.8	98.4								
8-May-19	Sat. DO (%)								97	93.4	94.2	83.2	89.4	87.5
10-May-19	Sat. DO (%)							82.2	107.8	100	97.6			
11-May-19	Sat. DO (%)							97.6			97.1			
13-May-19	Sat. DO (%)						92.2	90.7						
14-May-19	Sat. DO (%)			93.2	105.1	100.9								
15-May-19	Sat. DO (%)								95.6	89.7	82.5	74.4	83.4	81.5
17-May-19	Sat. DO (%)							88.5	102.6	97	107.5			
20-May-19	Sat. DO (%)						97	94.1						
21-May-19	Sat. DO (%)		108.1	102.4	96.1	97								

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08
Date	Parameters (Unit)	Guideline												
22-May-19	Sat. DO (%)								93.8	98.1	104.8	7.88	103.7	108.2
25-May-19	Sat. DO (%)							83.3			93.9			
27-May-19	Sat. DO (%)							71.8						
28-May-19	Sat. DO (%)			93	85.2	95.4	91.8							
29-May-19	Sat. DO (%)								99.9	99	87.9	92.7	96.8	107.5
2-May-19	DO (mg/l)	>6.0							7.11	7.44	7.26	6.92	7.37	7.55
4-May-19	DO (mg/l)	>6.0						7.64			7.83			
6-May-19	DO (mg/l)	>6.0					8.54	8.45						
7-May-19	DO (mg/l)	>6.0	7.39		7.8	7.32								
8-May-19	DO (mg/l)	>6.0							7.35	7.07	7.22	6.27	6.89	6.49
10-May-19	DO (mg/l)	>6.0						6.34	8.09	7.56	7.46			
11-May-19	DO (mg/l)	>6.0						7.27			7.33			
13-May-19	DO (mg/l)	>6.0					6.79	6.78						
14-May-19	DO (mg/l)	>6.0		6.85	7.88	7.52								
15-May-19	DO (mg/l)	>6.0							7.29	6.8	6.38	5.78	6.45	6.24
17-May-19	DO (mg/l)	>6.0						6.78	7.69	7.26	8.19			
20-May-19	DO (mg/l)	>6.0					7.16	7.06						
21-May-19	DO (mg/l)	>6.0	8.02	7.36	7.16	7.2								
22-May-19	DO (mg/l)	>6.0							7.25	7.44	7.84	7.54	7.69	7.55
25-May-19	DO (mg/l)	>6.0						6.36			7.22			
27-May-19	DO (mg/l)	>6.0						5.47						
28-May-19	DO (mg/l)	>6.0		6.83	6.38	7.09	6.91							
29-May-19	DO (mg/l)	>6.0							7.6	7.56	6.9	7.04	7.13	7.61
2-May-19	Conductivity (µs/cm)								73	73	54.3	59	56.4	53.6
4-May-19	Conductivity (µs/cm)							51.5			53.6			
6-May-19	Conductivity (µs/cm)						72	70						
7-May-19	Conductivity (µs/cm)		91.8		89	73								
8-May-19	Conductivity (µs/cm)								73	70	62.1	63.6	32.2	27.9
10-May-19	Conductivity (µs/cm)							69	73	72	79			
11-May-19	Conductivity (µs/cm)							50.3			56			
13-May-19	Conductivity (µs/cm)						71	69						

	Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08
Date	Parameters (Unit)	Guideline											
14-May-19	Conductivity (µs/cm)			125	89	74							
15-May-19	Conductivity (µs/cm)								76	76	79	89	64	45
17-May-19	Conductivity (µs/cm)							69	75	75	75			
20-May-19	Conductivity (µs/cm)						71	70						
21-May-19	Conductivity (µs/cm)		89.1	120	89	74								
22-May-19	Conductivity (µs/cm)								75	75	90.6	55.2	51.5	48
25-May-19	Conductivity (µs/cm)							70			77			
27-May-19	Conductivity (µs/cm)							69						
28-May-19	Conductivity (µs/cm)			109	92	74	72							
29-May-19	Conductivity (µs/cm)								73	73	77	58.7	51.3	44.7
2-May-19	TDS (mg/l)								36.5	36.5	27.1	29.5	28.2	26.5
4-May-19	TDS (mg/l)							25.5			26.5			
6-May-19	TDS (mg/l)						36	35						
7-May-19	TDS (mg/l)		45.9		44.5	36.5								
8-May-19	TDS (mg/l)								36.5	35	31.5	31.8	16.1	13.95
10-May-19	TDS (mg/l)							34.5	36.5	36	39.5			
11-May-19	TDS (mg/l)							25.15			28			
13-May-19	TDS (mg/l)						35.5	34.5						
14-May-19	TDS (mg/l)			62.5	44.5	37								
15-May-19	TDS (mg/l)								38	38	39.5	44.5	32	22.5
17-May-19	TDS (mg/l)							34.5	37.5	37.5	37.5			
20-May-19	TDS (mg/l)						35.5	35						
21-May-19	TDS (mg/l)		44.55	60	44.5	37								
22-May-19	TDS (mg/l)								37.5	37.5	45.3	27.6	25.75	24
25-May-19	TDS (mg/l)							35			38.5			
27-May-19	TDS (mg/l)							34.5						
28-May-19	TDS (mg/l)			54.5	46	37	36							
29-May-19	TDS (mg/l)								36.5	36.5	38.5	29.3	25.5	22.3
2-May-19	Temperature (°C)								31.67	31.32	29.6	30.6	32.2	32.3

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08
Date	Parameters (Unit)	Guideline												
4-May-19	Temperature (°C)							28.7			27.5			
6-May-19	Temperature (°C)						32.25	30.94						
7-May-19	Temperature (°C)		28.7		30.62	30.87								
8-May-19	Temperature (°C)								29.77	29.77	27.6	28.5	27.3	29.3
10-May-19	Temperature (°C)							28.86	30.62	30.24	29.43			
11-May-19	Temperature (°C)							29.1			28.4			
13-May-19	Temperature (°C)						31.46	30.39						
14-May-19	Temperature (°C)			31.6	30.32	30.72								
15-May-19	Temperature (°C)								29.56	29.85	28.8	28.51	28.7	29.3
17-May-19	Temperature (°C)							29.18	30.3	30.37	29.59			
20-May-19	Temperature (°C)						31.36	30.35						
21-May-19	Temperature (°C)		28.6	32.9	30.71	30.98								
22-May-19	Temperature (°C)								28.68	29.71	29.1	29.8	29.7	30.3
25-May-19	Temperature (°C)							29.24			28.84			
27-May-19	Temperature (°C)							29.44						
28-May-19	Temperature (°C)			31.46	30.48	30.85	30.24							
29-May-19	Temperature (°C)								29.59	29.69	27.48	28.5	29.1	31.3
2-May-19	Turbidity (NTU)								3.09	3.32	3.88	4.44	4.31	11.27
4-May-19	Turbidity (NTU)							1.91			4.6			
6-May-19	Turbidity (NTU)						1.15	1.06						
7-May-19	Turbidity (NTU)		18.73		1.79	1.48								
8-May-19	Turbidity (NTU)								5.33	3.21	26.65	23.33	34.79	20.6

	Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08
Date	Parameters (Unit)	Guideline											
10-May-19	Turbidity (NTU)						2.07	5.33	4.87	8.4			
11-May-19	Turbidity (NTU)						2.13			10.69			
13-May-19	Turbidity (NTU)					1.89	2.95						
14-May-19	Turbidity (NTU)			3.25	2.77	2.41							
15-May-19	Turbidity (NTU)							5.5	4.29	6.27	8.84	14.68	36.92
17-May-19	Turbidity (NTU)						2.01	4.17	3.32	7.14			
20-May-19	Turbidity (NTU)					1.04	1.15						
21-May-19	Turbidity (NTU)		25.64	4.2	1.8	1.57							
22-May-19	Turbidity (NTU)							1.45	2.25	2.65	3.17	4.26	6.01
25-May-19	Turbidity (NTU)						1.31			2.46			
27-May-19	Turbidity (NTU)						1.73						
28-May-19	Turbidity (NTU)			2.12	2.06	2.16	2.19						
29-May-19	Turbidity (NTU)							2.8	3.02	3.46	4.87	188.8	21.09
2-May-19	TSS (mg/l)							<5	<5	<5			
6-May-19	TSS (mg/l)					<5	<5						
7-May-19	TSS (mg/l)		21.74		5.47	3.64							
8-May-19	TSS (mg/l)							7.6	5	30.99	30.95	44.37	34.64
13-May-19	TSS (mg/l)						<5						
14-May-19	TSS (mg/l)			<5									
15-May-19	TSS (mg/l)							<5	<5	5.86			
20-May-19	TSS (mg/l)						<5						
22-May-19	TSS (mg/l)							<5	5.17	5.08			
27-May-19	TSS (mg/l)						<5						
29-May-19	TSS (mg/l)							<5	<5	5.21			
6-May-19	BOD_5 (mg/l)	<1.5				<1.0	<1.0						
7-May-19	BOD_5 (mg/l)	<1.5	<1.0		1.63	1.19							
8-May-19	BOD_5 (mg/l)	<1.5						1.16	1.39	1.12	<1.0	1.05	1.21

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08
Date	Parameters (Unit)	Guideline												
13-May-19	BOD_5 (mg/l)	<1.5						<1.0						
14-May-19	BOD_5 (mg/l)	<1.5		<1.0										
15-May-19	BOD_5 (mg/l)	<1.5							<1.0	<1.0	<1.0			
20-May-19	BOD_5 (mg/l)	<1.5						1.07						
22-May-19	BOD_5 (mg/l)	<1.5							<1.0	<1.0	<1.0			
6-May-19	COD (mg/l)	<5.0					5.3	8.8						
7-May-19	COD (mg/l)	<5.0			5.5	10.2								
8-May-19	COD (mg/l)	<5.0							12.2	8.2	<5.0	6.5	18.2	22.3
14-May-19	COD (mg/l)	<5.0		<5										
6-May-19	NH_3-N (mg/l)	<0.2					0.34	0.47						
7-May-19	NH_3-N (mg/l)	<0.2	<0.2		0.25	0.46								
8-May-19	NH_3-N (mg/l)	<0.2							0.49	0.27	<0.2	<0.2	<0.2	<0.2
14-May-19	NH_3-N (mg/l)	<0.2		<0.2										
6-May-19	NO_3-N (mg/l)	<5.0					<0.02	<0.02						
7-May-19	NO_3-N (mg/l)	<5.0	<0.02		<0.02	<0.02								
8-May-19	NO_3-N (mg/l)	<5.0							<0.02	<0.2	<0.02	<0.02	0.05	0.06
14-May-19	NO_3-N (mg/l)	<5.0		<0.02										
2-May-19	Faecal coliform (MPN/100 ml)	<1,000							8	2	79			
6-May-19	Faecal coliform (MPN/100 ml)	<1,000						8						
7-May-19	Faecal coliform (MPN/100 ml)	<1,000	920		27	7.8	7							
8-May-19	Faecal coliform (MPN/100 ml)	<1,000							8	17	350	3,500	1,100	1,100
13-May-19	Faecal coliform (MPN/100 ml)	<1,000						540						
14-May-19	Faecal coliform (MPN/100 ml)	<1,000		920										
15-May-19	Faecal coliform (MPN/100 ml)	<1,000							170	220	350			
20-May-19	Faecal coliform (MPN/100 ml)	<1,000						11						

	Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08
Date	Parameters (Unit)	Guideline											
22-May-19	Faecal coliform (MPN/100 ml)	<1,000						170	49	130			
2-May-19	Total Coliform (MPN/100 ml)	<5,000						46	49	240			
6-May-19	Total Coliform (MPN/100 ml)	<5,000					33						
7-May-19	Total Coliform (MPN/100 ml)	<5,000	1,600		110	33	79						
8-May-19	Total Coliform (MPN/100 ml)	<5,000						350	170	920	9,200	1,700	1,700
13-May-19	Total Coliform (MPN/100 ml)	<5,000					1,600						
14-May-19	Total Coliform (MPN/100 ml)	<5,000		1,600									
15-May-19	Total Coliform (MPN/100 ml)	<5,000						920	1,600	920			
20-May-19	Total Coliform (MPN/100 ml)	<5,000					220						
22-May-19	Total Coliform (MPN/100 ml)	<5,000						1,600	79	350			
6-May-19	TOC (mg/l)						7.34	6.78					
7-May-19	TOC (mg/l)				10.8	7.93							
8-May-19	TOC (mg/l)							6.78	7.99				
14-May-19	TOC (mg/l)			5.23									
6-May-19	Phytoplankton Biomass (g dry wt/m³)						2.2	1.8					
7-May-19	Phytoplankton Biomass (g dry wt/m³)				1.6	2.8							
8-May-19	Phytoplankton Biomass (g dry wt/m³)							6.8	4.2				
14-May-19	Phytoplankton Biomass (g dry wt/m³)			3.2									
6-May-19	Total Phosphorus (mg/l)						<0.01	<0.01					
7-May-19	Total Phosphorus (mg/l)				<0.01	<0.01							

	Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08
Date	Parameters (Unit)	Guideline											
8-May-19	Total Phosphorus (mg/l)							<0.01	<0.01				
14-May-19	Total Phosphorus (mg/l)			<0.01									
6-May-19	Total Dissolved Phosphorus (mg/l)						<0.01	<0.01					
7-May-19	Total Dissolved Phosphorus (mg/l)				<0.01	<0.01							
8-May-19	Total Dissolved Phosphorus (mg/l)							<0.01	<0.01				
14-May-19	Total Dissolved Phosphorus (mg/l)			<0.01									
6-May-19	Hydrogen Sulfide (mg/l)						0.09						
8-May-19	Hydrogen Sulfide (mg/l)								<0.02	<0.02			

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

		Station Code	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**				
2-May-19	pH	5.0 - 9.0			7.8	6.94
7-May-19	pH	5.0 - 9.0	8.95	7.99		
8-May-19	pH	5.0 - 9.0			8.12	7.3
14-May-19	pH	5.0 - 9.0		8.23		
15-May-19	pH	5.0 - 9.0			8.11	8.3
17-May-19	pH	5.0 - 9.0				
20-May-19	pH	5.0 - 9.0				
21-May-19	pH	5.0 - 9.0	7.81	7.93		
22-May-19	pH	5.0 - 9.0			7.85	7.56
28-May-19	pH	5.0 - 9.0		8.13		
29-May-19	pH	5.0 - 9.0			7.78	7.75
2-May-19	Sat. DO (%)				88.3	102.3
7-May-19	Sat. DO (%)		99.2	94.5		
8-May-19	Sat. DO (%)				86.1	84.3
14-May-19	Sat. DO (%)			94.2		
15-May-19	Sat. DO (%)				63.3	79.2
21-May-19	Sat. DO (%)		109.9	93.3		
22-May-19	Sat. DO (%)				90	102.6
28-May-19	Sat. DO (%)			93.9		
29-May-19	Sat. DO (%)				83.9	91.1
2-May-19	DO (mg/l)	>6.0			6.62	7.51
7-May-19	DO (mg/l)	>6.0	7.57	7.62		
8-May-19	DO (mg/l)	>6.0			6.41	6.72
14-May-19	DO (mg/l)	>6.0		7.72		
15-May-19	DO (mg/l)	>6.0			4.82	6.45
21-May-19	DO (mg/l)	>6.0	8.49	7.68		
22-May-19	DO (mg/l)	>6.0			6.67	7.75
28-May-19	DO (mg/l)	>6.0		7.6		
29-May-19	DO (mg/l)	>6.0			6.46	6.92
2-May-19	Conductivity (µs/cm)				131.1	47.6
7-May-19	Conductivity (µs/cm)		31.6	75		

		Station Code	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline				
8-May-19	Conductivity (µs/cm)				110.9	15.56
14-May-19	Conductivity (µs/cm)			74		
15-May-19	Conductivity (µs/cm)				119	30
21-May-19	Conductivity (µs/cm)		33.2	76		
22-May-19	Conductivity (µs/cm)				115.5	23.9
28-May-19	Conductivity (µs/cm)			121		
29-May-19	Conductivity (µs/cm)				111.1	13.95
2-May-19	TDS (mg/l)				65.5	23.8
7-May-19	TDS (mg/l)		15.8	37.5		
8-May-19	TDS (mg/l)				55.45	7.78
14-May-19	TDS (mg/l)			37		
15-May-19	TDS (mg/l)				59.5	15
21-May-19	TDS (mg/l)		16.6	38		
22-May-19	TDS (mg/l)				57.75	11.95
28-May-19	TDS (mg/l)			60.5		
29-May-19	TDS (mg/l)				55.5	6.9
2-May-19	Temperature (°C)				32.5	30.5
7-May-19	Temperature (°C)		26.5	26.23		
8-May-19	Temperature (°C)				29.2	25.4
14-May-19	Temperature (°C)			25.34		
15-May-19	Temperature (°C)				29.4	25.67
21-May-19	Temperature (°C)		25.9	25.23		
22-May-19	Temperature (°C)				29.6	28.6
28-May-19	Temperature (°C)			26.03		
29-May-19	Temperature (°C)				29	28.2
2-May-19	Turbidity (NTU)				3.64	8.46
7-May-19	Turbidity (NTU)		687	2		
8-May-19	Turbidity (NTU)				45.64	221
14-May-19	Turbidity (NTU)			66.93		
15-May-19	Turbidity (NTU)				6.92	11.6
21-May-19	Turbidity (NTU)		16.18	11.58		
22-May-19	Turbidity (NTU)				6.36	5.33

		Station Code	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**				
28-May-19	Turbidity (NTU)			12.08		
29-May-19	Turbidity (NTU)				6.71	5.31
7-May-19	TSS (mg/l)		859.7	5.34		
8-May-19	TSS (mg/l)				85.62	281
7-May-19	BOD_5 (mg/l)	<1.5	<1.0	1.8		
8-May-19	BOD_5 (mg/l)	<1.5			1.44	1.99
7-May-19	COD (mg/l)	<5.0	23.3	8.2		
8-May-19	COD (mg/l)	<5.0			12.2	34.3
7-May-19	NH_3-N (mg/l)	<0.2	<0.2	<02		
8-May-19	NH_3-N (mg/l)	<0.2			<0.2	<0.2
7-May-19	NO_3-N (mg/l)	<5.0	0.03	<0.02		
8-May-19	NO_3-N (mg/l)	<5.0			0.02	0.06
7-May-19	Faecal coliform (MPN/100 ml)	<1,000	920	130		
8-May-19	Faecal coliform (MPN/100 ml)	<1,000			920	16,000
7-May-19	Total Coliform (MPN/100 ml)	<5,000	1,600	540		
8-May-19	Total Coliform (MPN/100 ml)	<5,000			1,700	16,000

ANNEX B: RESULTS OF EFFLUENT ANALYSES

TABLE B-1: *RESULTS OF CAMP EFFLUENTS IN MAY 2019*

	Site Name	Owner's Site Office and Village		Obayashi Camp		SongDa5 Camp No.1	
	Station Code	EF01		EF02		EF07	
	Date	03-May-19	16-May-19	03-May-19	16-May-19	03-May-19	16-May-19
Parameters (Unit)	**Guideline**						
pH	6.0 - 9.0	7.14	7.79	7.89	8.4	7.75	7.56
Sat. DO (%)		66.5	47.3	92.5	88.5	69.4	88.9
DO (mg/l)		4.79	3.66	6.69	6.72	3.16	6.87
Conductivity (µs/cm)		313	409	402	545	1,384	1,520
TDS (mg/l)		165.5	204.5	201	272.5	692	760
Temperature (°C)		31	28.82	30.8	29.7	30	28.29
Turbidity (NTU)		2.1	2.92	4.08	3.44	8.11	10.14
TSS (mg/l)	<50	<5	<5	5.7	<5	11.8	8.9
BOD_5 (mg/l)	<30	<6	<6	<6	<6	<6	<6
COD (mg/l)	<125	<25	<25	<25	<25	25.8	27.1
NH_3-N (mg/l)	<10.0	4.8	3.3	10.5	11.9	<0.2	<0.2
Total Nitrogen (mg/l)	<10.0	25.3	4.65	16.3	16.1	3.3	1.71
Total Phosphorus (mg/l)	<2	0.64	0.44	0.81	0.58	0.7	0.53
Oil & Grease (mg/l)	<10.0	<1		<1		<1	
Total coliform (MPN/ 100 ml)	<400	540	540	0	2	0	0
Faecal Coliform (MPN/ 100 ml)	<400	130	540	0	0	0	0
Effluent Discharge Volume (L/mn)		6	6	12	7.5	3	3
Chlorination Dosing Rate (ml/mn)		n/a	n/a	109	80	120	160
Residual Chlorine (mg/l)	<1.0	n/a	n/a	0.79	0.55	1.96	2.19

	Site Name	SongDa5 Camp No.2		Zhefu Camp		V&K Camp	
	Station Code	EF08		EF09		EF10	
	Date	03-May-19	16-May-19	03-May-19	16-May-19	03-May-19	16-May-19
Parameters (Unit)	**Guideline**						
pH	6.0 - 9.0			7.28		7.84	8.21
Sat. DO (%)		This camp was completely decommissioned during the mission.		23.6	No discharged during the mission.	125.8	57
DO (mg/l)				1.68		10.35	4.45
Conductivity (µs/cm)				519		277	443
TDS (mg/l)				259		138.5	221.5
Temperature (°C)				32.6		30.5	29.18
Turbidity (NTU)				57.11		6.48	6.03
TSS (mg/l)	<50			11.8		12.4	11.4
BOD_5 (mg/l)	<30			68.75		<6	<6
COD (mg/l)	<125			174		<25	<25
NH_3-N (mg/l)	<10.0			47.3		<0.2	3.3
Total Nitrogen (mg/l)	<10.0			49.8		2.82	5.9
Total Phosphorus (mg/l)	<2			1.58		0.15	0.39
Oil & Grease (mg/l)	<10.0			8		<1	
Total coliform (MPN/100 ml)	<400			3,500		33	350
Faecal Coliform (MPN/100 ml)	<400			1,600		22	17
Effluent Discharge Volume (L/mn)				2		1.6	6
Chlorination Dosing Rate (ml/mn)						2	40
Residual Chlorine (mg/l)	<1.0			0.09		0.10	0.12

	Site Name	HM Main Camp		IHI Main Camp		Lilama10 Camp		IHI Field Shop 276 Camp	
	Station Code	EF13		EF14		EF17		EF18	
	Date	03-May-19	16-May-19	03-May-19	16-May-19	03-May-19	16-May-19	03-May-19	16-May-19
Parameters (Unit)	**Guideline**								
pH	6.0 - 9.0	7.61	8.13	7.47	7.93	No discharge during the mission		This camp was completely decommissioned during the mission	
Sat. DO (%)		77.4	55.1	74.5	88.4				
DO (mg/l)		5.64	4.27	5.41	6.79				
Conductivity (µs/cm)		313	432	147	859				
TDS (mg/l)		156.5	216	73.3	429.5				
Temperature (°C)		30.6	28.69	30.6	28.97				
Turbidity (NTU)		19.21	12.19	13.99	9.9				
TSS (mg/l)	<50	19.7	21.0	<5	16.4				
BOD_5 (mg/l)	<30	46.76	52.94	<6	<6				
COD (mg/l)	<125	105	133	<25	52.3				
NH_3-N (mg/l)	<10.0	10.8	12.4	3.2	<0.2				
Total Nitrogen (mg/l)	<10.0	12.6	13.9	5.25	13.9				
Total Phosphorus (mg/l)	<2	0.47	0.48	0.27	0.28				
Oil & Grease (mg/l)	<10.0	4		<1					
Total coliform (MPN/100 ml)	<400	920	16,000	350	0				
Faecal Coliform (MPN/100 ml)	<400	130	16,000	350	0				
Effluent Discharge Volume (L/mn)		6	6	1.2	6				
Chlorination Dosing Rate (ml/mn)		5	2		15				
Residual Chlorine (mg/l)	<1.0	0.09	0.03	0.00	2.10				

TABLE B-2: *RESULTS OF THE CONSTRUCTION AREA DISCHARGE IN MAY 2019*

	Site Name	Upstream Spoil Disposal Area No.2				
	Station Code	DS04 - US				
	Date	03-May-19	08-May-19	16-May-19	23-May-19	30-May-19
Parameter (Unit)	**Guideline**					
pH	6.0 - 9.0	7.69	7.78	7.7	7.82	7.66
Sat. DO (%)		60.6	96	81.4	85.4	92.9
DO (mg/L)		4.5	7.47	6.41	6.56	7.01
Conductivity (µs/cm)		22.1	63.2	22	13.83	18.42
TDS (mg/l)		11	31.5	11	6.91	9.21
Temperature (°C)		29.5	26.5	28.24	27.3	28.2
Turbidity (NTU)		9.64	46.47	8.49	2.48	54.64
TSS (mg/L)	<50	14.57	52.15	5.62	3.49	58.14
Oil & Grease (mg/L)	<10		<1			

	Site Name	Spoil Disposal Area No.2				
	Station Code	DS04				
	Date	03-May-19	08-May-19	16-May-19	23-May-19	30-May-19
Parameter (Unit)	**Guideline**					
pH	6.0 - 9.0	6.82	6.84	7.02	6.82	6.43
Sat. DO (%)		60.4	46.3	62.4	53.9	51.5
DO (mg/L)		4.47	3.66	5.03	4.17	3.88
Conductivity (µs/cm)		67.5	98.3	69	51.3	82.3
TDS (mg/l)		33.5	49.1	34.5	25.65	41.15
Temperature (°C)		29.3	25.8	26.89	26.9	27.9
Turbidity (NTU)		12.09	173	6.49	6.38	40.7
TSS (mg/L)	<50	11.51	179.51	4.1	9.77	42.12
Oil & Grease (mg/L)	<10		<1			

ANNEX C: AMBIENT DUST QUALITY

TABLE C-1: *24-HOUR AVERAGE DUST CONCENTRATIONS MEASURED IN HAT GNIUN VILLAGE*

Hat Gnuin Village - 24 Hours Average Particulate Matter (PM10) Concentration			
Period	00 to 24 Hours	24 to 48 Hours	48 to 72 Hours
Start Time	07-May-19 18:30	08-May-19 18:30	09-May-19 18:30
End Time	08-May-19 18:30	09-May-19 18:30	10-May-19 18:00
Average Data Record in 24h (mg/m^3)	0.046	0.056	0.078
Guideline Average in 24h (mg/m^3)	***0.12***	***0.12***	***0.12***

TABLE C-2: *24-HOUR AVERAGE DUST CONCENTRATIONS MEASURED IN PHOUHOMXAY VILLAGE*

Phouhomxay Village - 24 Hours Average Particulate Matter (PM10) Concentration			
Period	00 to 24 Hours	24 to 48 Hours	48 to 72 Hours
Start Time	13-May-19 18:00	14-May-19 18:00	15-May-19 18:00
End Time	14-May-19 18:00	15-May-19 18:00	16-May-19 18:00
Average Data Record in 24h (mg/m^3)	0.069	0.051	0.067
Guideline Average in 24h (mg/m^3)	***0.12***	***0.12***	***0.12***

TABLE C-3: AVERAGE RESULTS OF NOISE MONITORING AT SONG DA5 CAMP NO. 2 AND LILAMA10 CAMP IN MAY 2019

Song Da5 Camp No.2 - Dust Emission Average in 24 hours	
Period	24 Hours
Start Time	21-May-19 18:30
End Time	22-May-19 18:00
Average Data Record - 24 h	0.081
Guideline Average - 24 h	***0.12***

Lilama10 Camp - Dust Emission Average in 24 hours	
Period	24 Hours
Start Time	20-May-19 18:00
End Time	21-May-19 18:00
Average Data Record - 24 h	0.096
Guideline Average - 24 h	***0.12***

TABLE C-4 AND TABLE C-5: AVERAGE RESULTS OF NOISE MONITORING AT MAIN DAM, AND MAIN POWERHOUSE IN MAY 2019

Main Dam - Dust Emission Average in 24 hours	
Period	**24 Hours**
Start Time	**06-May-19 18:00**
End Time	**07-May-19 18:00**
Average Data Record (mg/m^3) -24h	**0.061**
Guideline Average (mg/m^3) - 24h	***0.12***

Main Powerhouse - Dust Emission Average in 24 hours	
Period	24 Hours
Start Time	28-May-19 18:00
End Time	29-May-19 18:00
Average Data Record -24h	0.023
Guideline Average - 24h	***0.12***

ANNEX D: AMBIENT NOISE DATA

Table D-1: *Average Results of Noise Monitoring at Hat Gniun Village in May 2019*

Noise Level (dB)	07-08/May/19			08-09/May/19			09-10/May/19		
	18:30-22:00	22:01 – 06:00	06:01 – 18:00	18:00-22:00	22:01 – 06:00	06:01 – 18:00	18:00-22:00	22:01 – 06:00	06:01 – 18:00
Maximum Value Recorded	64.50	82.00	76.40	65.70	66.90	79.40	71.00	64.60	74.30
Guideline Max	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	45.92	52.54	46.98	47.13	43.49	43.81	45.25	42.18	43.60
Guideline Averaged	***55***	***45***	***55***	***55***	***45***	***55***	***55***	***45***	***55***

Table D-2: *Average Results of Noise Monitoring at Phouhomxay Village in May 2019*

Noise Level (dB)	13-14/May/19			14-15/May/19			15-16/May/19		
	18:00-22:00	22:01 – 06:00	06:01 – 18:00	18:00-22:00	22:01 – 06:00	06:01 – 18:00	18:00-22:00	22:01 – 06:00	06:01 – 18:00
Maximum Value Recorded	58.90	51.70	71.80	57.30	56.50	74.30	56.70	6.00	76.10
Guideline Max	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	43.89	40.94	45.42	42.17	40.00	41.36	39.54	38.36	40.44
Guideline Averaged	***55***	***45***	***55***	***55***	***45***	***55***	***55***	***45***	***55***

Table *D- 3 and Table D- 4: Average Results of Noise Monitoring at Song Da5 Camp No. 2 and Lilama10 Camp in May 2019*

Song Da5 Camp No.2

Noise Level (dB)	21-22/May/19		22/May/19
	18:30 – 22:00	22:01 – 06:00	06:01-18:00
Maximum Value Recorded	42.9	49.9	62
Guideline Max	***115***	***115***	***115***
Average Data Recorded	35.91	35.03	38.92
Guideline Averaged	***70***	***50***	***70***

Lilama10 Camp

Noise Level (dB)	20-21/May/2019		21/May/2019
	18:00 – 22:00	22:01 – 06:00	06:00-18:00
Maximum Value Recorded	63.4	58.4	63.5
Guideline Max	***115***	***115***	***115***
Average Data Recorded	41.26	40.10	40.47
Guideline Averaged	***70***	***50***	***70***

Table D- 5 and Table D- 6: Average Results of Noise Monitoring at Main Dam and Main Powerhouse in May 2019

Main Dam

Noise Level (dB)	06-07/May/19		07/May/19
	18:00 – 22:00	22:01 – 06:00	06:01-18:00
Data Record Max	53.6	78.6	83.5
Guideline Max	***115***	***115***	***115***
Data Record Average	47.15	49.12	59.83
Guideline Averaged	***70***	***70***	***70***

Main Powerhouse

Noise Level (dB)	28-29/May/19		29/May/19
	18:00 – 22:00	22:01 – 06:00	06:01-18:00
Data Record Max	65.9	66.8	77.5
Guideline Max	***115***	***115***	***115***
Data Record Average	57.72	57.80	61.23
Guideline Averaged	***70***	***70***	***70***