NAM NGIEP 1
POWER COMPANY

Nam Ngiep 1 Hydropower Project

Environment Monitoring Report
First Quarter of 2018

January to March 2018

REV	DATE	PREPARED	REVIEWED	APPROVED	MODIFICATION DETAILS
A	13 September 2018				Final
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☐	Confidential

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Table of Contents

Tables

Figures

BBREVIATIONS / ACRONYMS

AIP	Annual Implementation Plan
ADB	Asian Development Bank
BAC	Biodiversity Advisory Committee
BOF	Biodiversity Offset Framework
BOMC	Biodiversity Offset Management Committee
BOMP	Biodiversity Offset Management Plan
CA	Concession Agreement between the NNP1PC and GOL,
CAP	Corrective Action Plan
COD	Commercial Operation Date
CVC	Conventional Vibrated Concrete
CWC	Civil Works Contract
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
EDL	Electricite du Laos
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
ESD	Environmental and Social Division of NNP1PC
ESMMP	Environmental and Social Monitoring and Management Plan
GOL	Government of Lao PDR
GIS	Geographic Information Systems
HMWC	Hydraulic Metal Works Contract

HR	Human Resources
IEE	Initial Environmental Examination
IMA	Independent Monitoring Agency
INRMP	Integrated Natural Resources Management Plan
ISP	Intergraded Spatial Planning
kV	kilo-Volt
LEPTS	Lao Electric Power Technical Standard
LHSE	Lao Holding State Enterprise
LTA	Lender's Technical Advisor
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
NCI	Non-Compliance Issue
NCR	Non-Compliance Report
NN2	Nam Ngum 2 Power Company Limited
NNP1PC	Nam Ngiep 1 Power Company Limited
NTFP	Non-Timber Forest Products
NT2	Nam Theun 2 Hydropower Project
OC	Obayashi Corporation
ONC	Observation of Non-Compliance
OSOV	Owners' Site Office and Village
PAFO	Provincial Department of Agriculture and Forestry
PAP	Project Affected People
PONRE	Provincial Department of Natural Resource and Environment, MONRE
PvPA	Provincial Protection Area
RCC	Roller Compacted Concrete
SIR	Site Inspection Report
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

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 Construction Phase (ESMMP-CP).

During Q1 2018, the Environmental Management Office (EMO) of NNP1PC received 08 Site Specific ESMMPs and one camp decommissioning plan for review and approval. One of the Site Specific ESMMPs is pending additional information and will be carried over to Q2 2018.

During Q1 2018, the EMO conducted bi-weekly and weekly follow-up inspections at 33 construction sites and camps of the main civil works, the 230 kV Transmission Line, the 115-kV transmission line and construction sites in Phouhomxay Village, Zone 2UR and Zone 4 (Dam downstream community water supply), as well as the biomass clearance activities in the main reservoir area.

During Q1 2018, a total of 545.3 m^3 of solid waste was disposed at the NNP1 Project Landfill, an increasing of 74.1 m^3 compared to Q4 2017. Spot checks of waste bags were conducted on a daily basis before disposal of the waste. A total of 1,624.5 kg of recyclable waste was collected by Khounmixay Processing Factory and transported offsite to its facilities for recycling/processing or final disposal.

The clean-up of waste in the resettlement villages of Zone 2LR prior to impounding started on 01 December 2017 and was completed on 11 April 2018. NNP1PC and Xaysomboun PONRE conducted a joint final inspection on 12 April 2018.

The Nam Ngiep 1 Watershed Management Plan is close to completion. The final review and approval of the plan will take place once the Watershed and Reservoir Protection Committee (WRPC) and its secretariat (the Watershed and Reservoir Protection Office) have been reconstituted. The revised provincial watershed management regulations have been reviewed by relevant GOL offices in March 2018 and the final presentation by the technical committee is expected in April 2018 prior to submission to the Provincial Justice Department for further review prior to final approval by the Provincial Assembly.

The preparation of NNP1 Biodiversity Offset Management Plan (BOMP) has continued with several studies/surveys being undertaken since January 2018. The Total Protection Zone (TPZ) survey, aquatic biodiversity survey, and Forest Classification and Habitat Mapping in NCNX offset site were completed in March 2018. A herpetology survey in NNP1 Watershed will be started in April 2018.

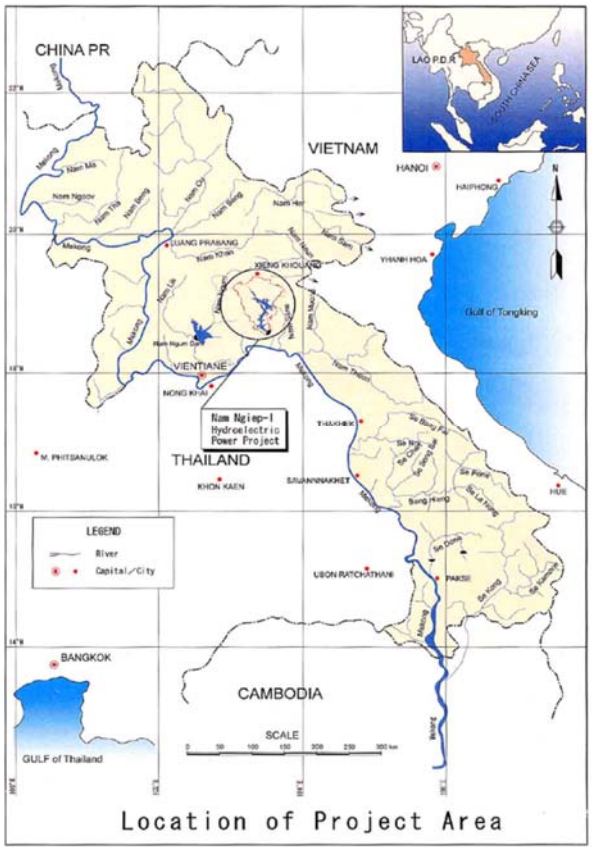
The biomass clearance continues to progress, as of 31 March 2018, a total of 1,547.31 ha out of 1,640 ha have been fully cleared and the remaining 93.44 ha will be completed in April 2018.

The fishery monitoring programme has continued according to the plan. The data from the daily fish catch logbook monitoring indicates that the mean daily fish catch in Nam Ngiep River was 1.6 kg/household/day in February 2018. The estimated total fish catch in Nam Ngiep basin for February 2018 is 24,600 kg. Around 42 % of the catch was sold, 52% was consumed fresh, 4% processed and approximately 2% was used for other purposes.

2 INTRODUCTION

The Nam Ngiep originates in the mountains of Xieng Khuang 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.

The project consists of two dams. The main dam which 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 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 Substation 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.



Location of Project Area

This Quarterly Environment Report provides a summary of environmental monitoring activities and mitigation actions during Q1 2018. 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.

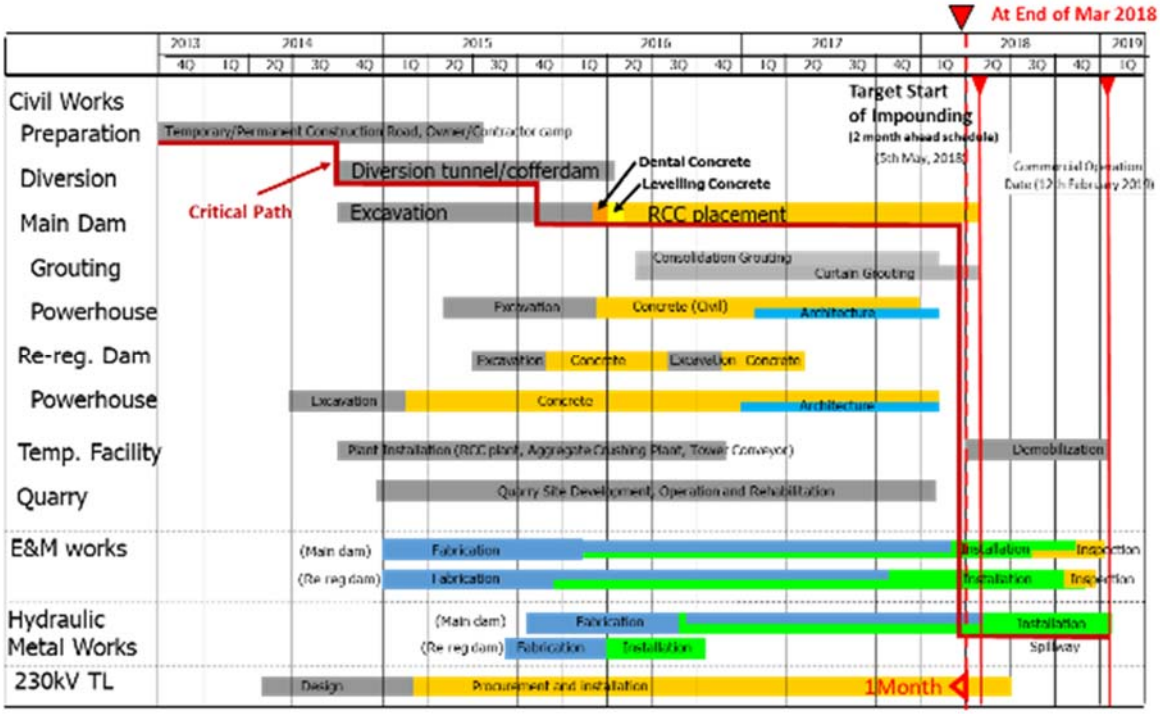
3 CONSTRUCTION PROGRESS

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. Actual overall cumulative

work progress until the end of March 2018 was 93.5 %[1] (compared to planned progress of 94.7 %), based on achieved Interim Milestone Payments for all Contracts excluding the value of Advance Payments, varied works and other adjustments allowed under each Contract. 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 *Error! Reference source not found.*.

TABLE 3-1: *OVERALL CONSTRUCTION SCHEDULE*



3.1 CIVIL WORK

The cumulative actual work progress of the Civil Works until the end of March 2018 was 94.5 % (compared to planned progress of 96.3 %) calculated in the same manner as described above for the value of achieved Interim Milestone Payments excluding advance payment.

[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)

3.2 MAIN DAM AND POWER HOUSE

On 16 March 2018 the total concrete volume placed at the Main Dam was about 2.31 million m^3 out of the expected 2.34 million m^3 (99% complete) and the dam height had reached 145.6 m, or 87.2 % of its final height, at the left bank. .

FIGURE 3-1*: MAIN DAM AND POWERHOUSE FROM OVERHEAD LOOKING UPSTREAM*

The consolidation drilling and grouting for the main dam, which started in May 2016 is ongoing. The progress is 99 % by achievement of total anticipated drilled length as of the end of March 2018 as a proportion of the total expected drilling.

The main powerhouse concrete placement is 99% complete. .

3.2.1 Re-regulation dam and powerhouse

The re-regulation dam *Error! Reference source not found.*was completed in May 2017 where after the re-regulation reservoir was impounded.

FIGURE 3-2*: RE-REGULATION DAM AND POWERHOUSE, 31 MARCH 2018*

3.3 ELECTRICAL AND MECHANICAL WORKS

The Assembly of water turbines and installation of inlet valves for the two units at the main power house is ongoing. The cumulative work progress of the Electrical and Mechanical Works by value at the end of March 2018 was 96.5 % (compared to planned progress of 96.5 %).

FIGURE 3-3: *PREPARATION FOR INSTALLATION OF STAY RING INSTALLING OF UNIT 1 AT THE MAIN POWERHOUSE*

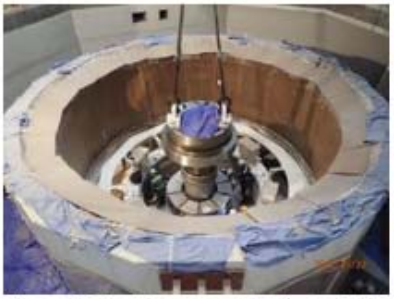


Figure 4.2-1: Placement of main shaft for Unit 1

Figure 4.2-2: High potential test for Unit1

Figure 4.2-3: Current progress of rotor for Unit 1

Figure 4.2-4: Placement of stator for Unit 2

3.4 HYDRO-MECHANICAL WORKS

All fabrication and installation of the penstock at the main dam sections is complete and removal of spider support is 46 % complete, with 85 % of concrete encasement completed. The horizontal penstock installation has reached the intake on both lines.

3.5 230 KV TRANSMISSION LINE WORKS

The tower foundations are 100 % complete (300 foundations), erection of tower is 99 % complete (299 towers) and stringing is 98 % complete (117 km).

3.6 115-KV TRANSMISSION LINE WORKS

The 115-kV Transmission Line from the re-regulation powerhouse to Pakxan substation is an associated facility to NNP1, owned and being constructed by Electricite' Du Laos (EDL).

The 115-kV transmission line will pass through Phouhomxay Village and EDL and NNP1PC has drafted an agreement whereby NNP1PC will lease the right of way to EDL under certain conditions. The agreement is expected to be executed in April 2018. where after EDL will be able to proceed with construction works in Phouhomxay Village. The Transmission Line consists of two components, (1) a small substation at the re-regulation dam (within the project area) and (2) a 32.8 km transmission line with a 25 m wide right-of-way and 86 towers of which 9 km with 24 towers are in Phouhomxay Village.

The agreement requires that the construction of the line in Phouhomxay Village shall comply with applicable environmental and social measures of NNP1PC's ESMMP-CP, and in accordance with these requirements, EDL has prepared and submitted a Site Specific ESMMP to NNP1PC for review and approval. NNP1PC has subsequently approved the Site Specific ESMMP.

4 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, 2017.

4.1 Contractor SS-ESMMPs

During Q1 2018, the Environmental Management Office (EMO) of NNP1PC received 08 Site Specific ESMMPs and one camp decommissioning plan for review and approval. One of the Site Specific ESMMPs is pending additional information and will be carried over to Q2 2018.

The status of the Site Specific ESMMPs received in Q1 2018 is shown in *Error! Reference source not found.* with details in ***Appendix 1***.

TABLE 4-1*: SS-ESMMP AND WORKING DRAWINGS REVIEWED DURING Q1 2018*

Name of SS-ESMMP Document/ Working Drawings	Rev. 1	Rev. 2	Rev. 3	Approved
SS-ESMMP for 2nd River Diversion & Diversion Tunnel Closure (2nd submission)	√	√		√
Reply to owner's comment for SS-ESMMP for closing of the dyke at borrow pit No.7 (1st submission)	√	Pending detailed discussion on the scope of re-vegetation and rehabilitation of spoil disposal		
Reply to owner's comment for SS-ESMMP–RRPS for closing of borrow pit at the corner of road P1 &P1A (1st submission)	√	Pending detailed discussion on the scope of re-vegetation and rehabilitation of spoil disposal		
SS-ESMMP for dam monitoring equipment installation at main Dam (1st submission)	√			√
SS-ESMMP for dam monitoring system (3rd submission)	√	√	√	√
SS-ESMMP for construction of main Dam (3rd submission)	√	√	√	√
SS-ESMMP for Re-regulation dam Powerhouse Building (4th submission)	√	√	√	√
SS-ESMMP for IHI's labor camp (3rd submission)	√	√	√	√
SS-ESMMP for Construction of Quarry Site **(version A6)**	Pending detailed discussion on the scope of quarry site closure			

Name of SS-ESMMP Document/ Working Drawings	Rev. 1	Rev. 2	Rev. 3	Approved
SS-ESMMP for Construction of Installation Work of 115 kV substation equipment for Re-regulation Power Station (2nd submission)	√	√		√
TCM contractor's camp decommissioning plan (1st submission)	√			√
Propose design for temporary / mobile toilets at top main dam right bank and left bank (1st submission)	√			√

4.2 Results of Compliance Inspections at Construction Sites

During Q1 2018, the EMO conducted bi-weekly and weekly follow-up inspections at 33 construction sites and camps of the main civil works, the 230 kV Transmission Line, the 115-kV transmission line and construction sites in Phouhomxay Village, Zone 2UR and Zone 4 (Dam downstream community water supply), as well as the biomass clearance activities in the main reservoir area. See maps in ***Figure 4-1***.

FIGURE 4-1*: SITE INSPECTION LOCATION*

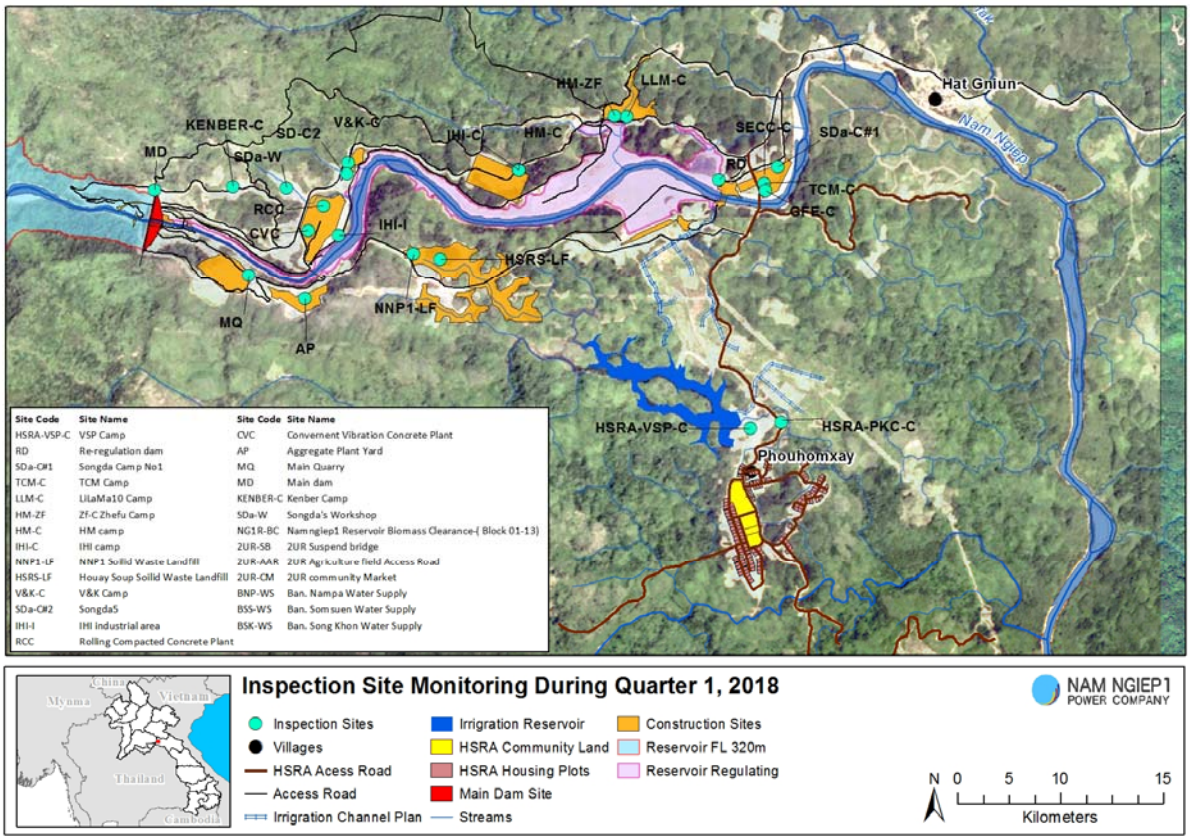
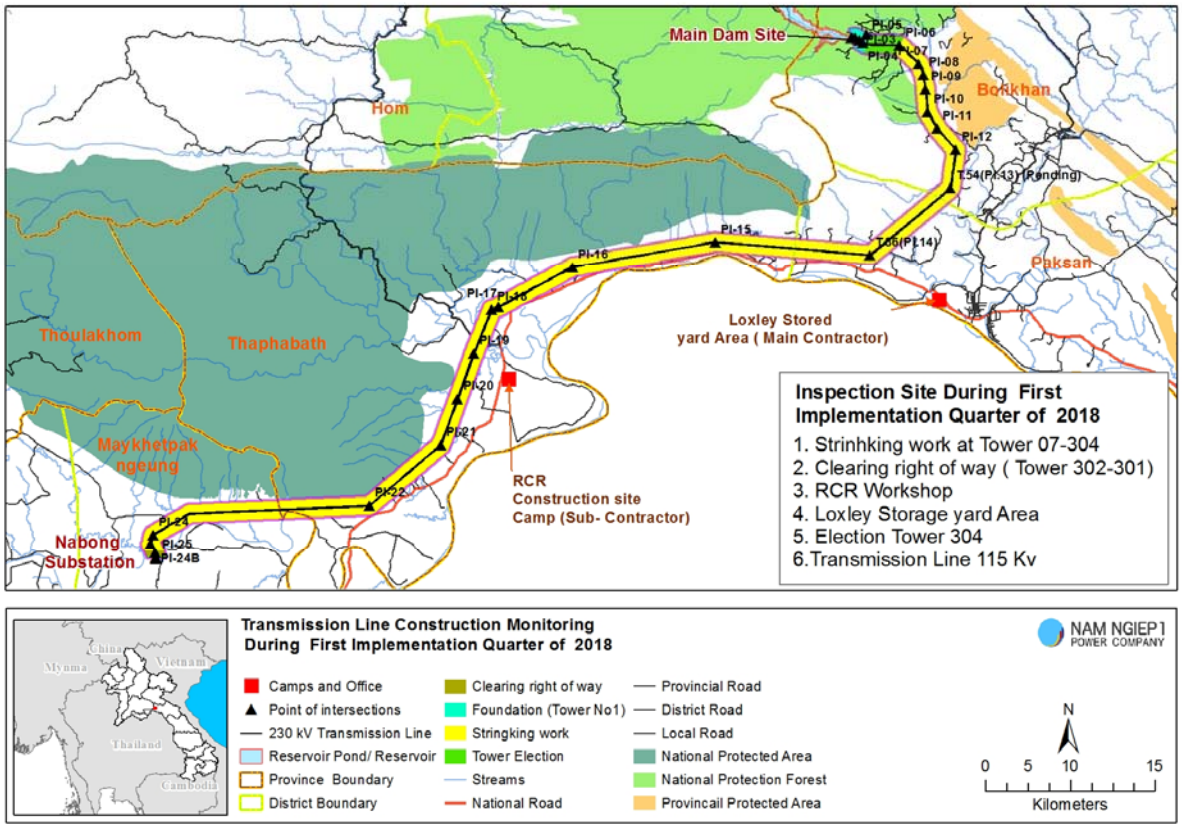


FIGURE 4-2: *230 KV TRANSMISSION LINE CONSTRUCTION MONITORING*



A total of 19 Observations of Non-Compliance (ONCs)[2], two Non-Compliance Level-1 (NCR1)[3] were active during the reported period. Out of these, eight ONCs, were carried over from the previous Quarter; and 11 ONCs and the two NCR1 were newly issued. A total of eight ONCs and one NCR1 could not be resolved in this Quarter and will be carried forward into Q2 2018. The status is summarized in the *Error! Reference source not found.*, ***Figure 4-3*** and ***Figure 4-4****Error! Reference source not found.*. The progress of corrective actions is presented in ***Appendix 2***.

TABLE 4-2: *NON-COMPLIANCE STATUS DURING Q1 2018*

Environmental Non-Compliance Status	ONC	NCR-Level 1	NCR-Level 2	NCR-Level 3	Incident Report
Carried over ONC/NCR	08	0	0	0	0
Newly opened ONC/NCR	11	2	0	0	0

[2] ONCs are issued for minor environmental issues that can easily be corrected, but which still need to be recorded and followed-up.

[3] There are three levels of NCRs. NCR Level 1 is issued in case of a clear non-compliance with environmental requirements, but which do not pose an immediate risk to human health or the environment. A failure to correct a level 1 will lead to issuance of a NCR Level 2. NCR Level 2 is issued for a non-compliance with environmental requirements that poses significant risks to human health or the environment. NCR Level 3 is issued in case of a critical environmental non-compliance that requires immediate intervention and correction

Total ONC/NCR	19	2	0	0	0
Resolved ONC/NCR	11	1	0	0	0
Unresolved ONC/NCR carried forward to the next Quarter	08	1	0	0	0

FIGURE 4-3*: STATUS OF ONCS DURING Q1 2018*

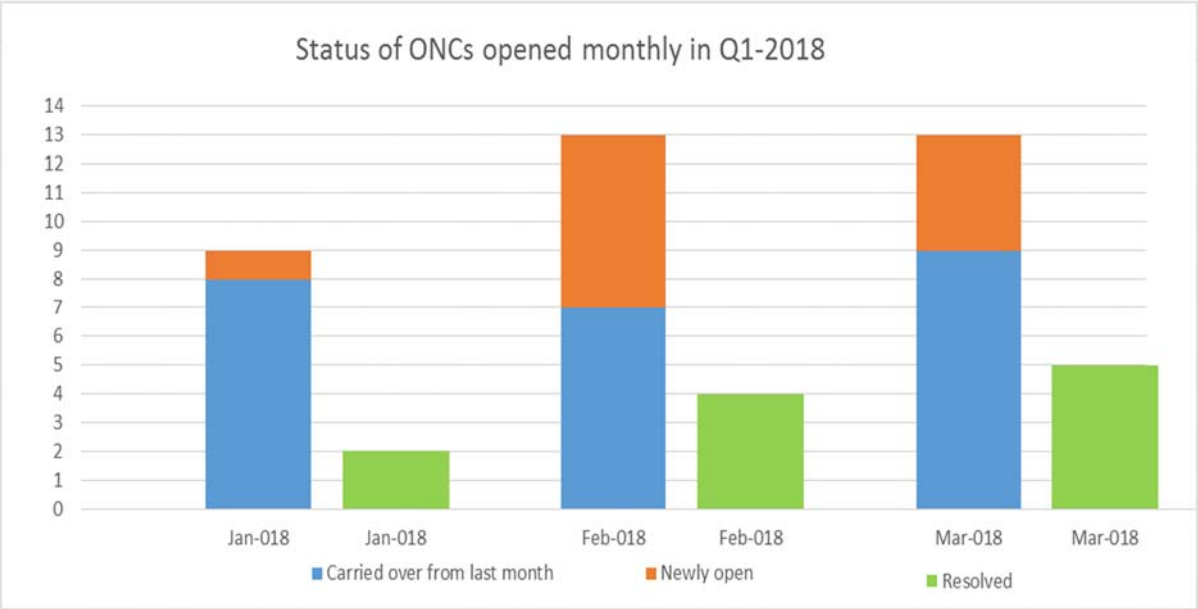
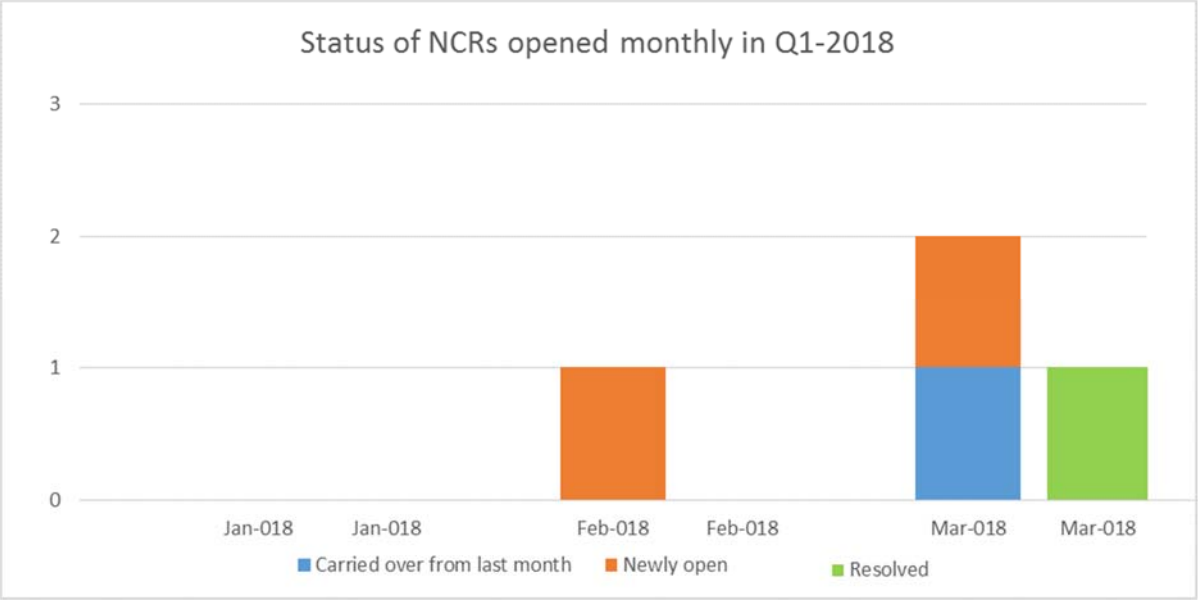


FIGURE 4-4 STATUS OF NCR REPORTS DURING Q1 2018



PHOTOGRAPH 1: BI-WEEKLY JOINT MONITORING AND INSPECTION BETWEEN NNP1PC AND CONTRACTORS

PHOTOGRAPH 2: JOINT BOLIKHAMXAY PROVINCIAL EMU ON 22 FEBRUARY 2018

PHOTOGRAPH 3: JOINT LTA MISSION ON 1 MARCH 2018

PHOTOGRAPH 4: JOINT IMA MISSION ON 6 MARCH 2018

4.3 WASTE MANAGEMENT AT THE CONSTRUCTION SITES

4.3.1 General Waste Management

During Q1 2018, a total of 545.3 m^3 of solid waste was disposed at the NNP1 Project Landfill, an increasing of 74.1 m3 compared to Q4 of 2017. Spot checks of waste bags were conducted on a daily basis before disposal of the waste.

A total of 1,624.5 kg of recyclable waste was collected by Khounmixay Processing Factory and transported offsite to its facilities for recycling or processing and final disposal as shown in ***Table 4-3***.

TABLE 4-3: *AMOUNTS OF RECYCLABLE WASTE SOLD DURING THE FIRST QUARTER OF 2018*

Source and Type of Recycled Waste		Unit	Total in First Quarter of 2018 (A)	Sold (B)	Remaining Amount (A - B)
Construction activity					
1	Scrap metal	kg	64,644	426	64,218

Source and Type of Recycled Waste		Unit	Total in First Quarter of 2018 (A)	Sold (B)	Remaining Amount (A - B)
Sub-Total 1		**kg**	**64,644**	**426**	**64,218**
Operation camp					
2	Glass bottles	kg	4,784	693	4,091
3	Plastic bottles	kg	381	182	199
4	Aluminium cans	kg	159.5	101.5	58
5	Paper/Cardboard	kg	373	222	151
Sub-Total 2		**kg**	**5,697.5**	**1,198.5**	**4,499**
Grand Total 1+2		**kg**	**70,341.5**	**1,624.5**	**68,717**

4.3.2 Hazardous Waste Management

In Q1 2018, joint hazardous materials and waste inventories was carried out monthly at the main construction sites and the contractors' camps. The amounts of hazardous waste collected, stored and disposed during Q1 2018 are shown in **Table 4-4**. The treatment and final disposal of hazardous waste is outsourced to Khounmixay Processing Factory**.**

TABLE 4-4: HAZARDOUS WASTE RECORDED DURING THE FIRST QUARTER OF 2018

No.	Hazardous Waste Type	Unit	Total in First Quarter 2018	Disposal	Remaining
1	Used Oil (Hydraulic and Engine)	litre	17,470	9,494	7,976
2	Contaminated soil, sawdust and concrete	kg	1,262	582	680
3	Used tyre	piece	442	117	325
4	Used oil filters	piece	527	246	281
5	Empty used chemical drum/container	drum (20 L)	2,683	2,513	170
6	Empty paint and spray cans	can	284	130	154
7	Halogen/fluorescent bulbs	unit	120	0	120
8	Empty used oil drum/container	drum (20 L)	192	89	103
9	Ink cartridge	unit	203	102	101
10	Empty used oil drum/container	drum (200 L)	169	69	100
11	Empty used chemical drum/container	drum (200 L)	70	1	69
12	Contaminated textile and material	kg	85	54	31
13	Empty contaminated bitumen drum/container	drum (200 L)	27	0	27
14	Lead acid batteries	unit	22	0	22
15	Clinical Waste	kg	57	37	20
16	Lithium-ion batteries	unit	7	0	7

No.	Hazardous Waste Type	Unit	Total in First Quarter 2018	Disposal	Remaining
17	Acid and caustic cleaners	bottle	84	84	0
18	Cement bag	bag	0	0	0
19	Used oil mixed with water	litre	0	0	0

A total of 250 kg compost was produced from grass, cow dung, rice husk, molasses, bio-effect and leftover vegetables and fruits from the canteens and used by villagers.

4.3.3 Sewage Sludge Disposal

There was no disposal of sewage sludge during Q1 2018.

4.4 COMMUNITY WASTE MANAGEMENT SUPPORT

4.4.1 Animal Fodder (Pig Feed) Collection Programme

During Q1 2018, local villagers collected a total of 22,005 kg of food waste from the Owner's Site Office and Village (OSOV) and the contractor camps for feeding their animals. This is an increasing of 3,670 kg compared to Q4 2017, details are shown in ***Table 4-5*** below.

TABLE 4-5: AMOUNT OF FOOD WASTE COLLECTED BY LOCAL VILLAGERS FOR USE AS PIG FEED DURING THE FIRST QUARTER OF 2018

NO.	SITE NAME	UNIT	TOTAL
1	SongDa5 Camp No. 2	kg	8,390
2	SongDa5 Camp No. 1	kg	6,984
3	Obayashi Corporation Camp	kg	3,603
4	Owner's Village and Site Office (OSOV)	kg	1,925
5	LILAMA 10 Camp	kg	624
6	Kenber Camp	kg	479
Total		**kg**	**22,005**

4.5.2 Community Consultation on Waste Management

On 02 March 2018, villagers of Thaheau Village, Hat Gniun Village and Phouhomxay Village carried out a monthly waste clean-up of their village areas. The EMO has continued to raise the awareness of the villagers in terms of waste management including the importance of waste collection, segregation for recycling, and disposal of non-recyclable waste at Houay Soup Landfill (***Photograph 5*** and ***Photograph 6***)

PHOTOGRAPH 5 & PHOTOGRAPH 6 : BIG CLEANING DAY (THAHEAU VILLAGE AND HAT GNIUN VILLAGE) AND PHOUHOMXAY VILLAGE

4.4.2 Community Recycling Programme

The Community Recycle Waste Bank collected a total of 3,674.5 kg of recyclables from villagers and 1,383 kg was sold to Khounmixay Processing Factory as presented in ***Table 4-6*** below.

TABLE 4-6: AMOUNTS OF RECYCLABLES SOLD AT THE COMMUNITY RECYCLE WASTE BANK

Types of Waste	Unit	Purchased Amount During the First Quarter of 2018 (A)	Sold (B)	Remaining Amount (A - B)
Scrap metal	kg	611	611	0
Glass	kg	1,900.5	0	1,900.5
Paper/cardboards	kg	404	173	231
Plastic bottles	kg	566	452	114
Aluminium	kg	193	147	46
Total	**kg**	**3,674.5**	**1,383**	**2,291.5**

4.4.3 Houay Soup Landfill

The PKC Company started operating Houay Soup Landfill under a one-year contract in December 2017. The works include solid waste collection and transportation from Phouhomxay, Thahuea, Hat Gniun villages to Houay Soup Landfill three days/week (Mondays, Wednesdays and Fridays), waste segregation, waste compaction and daily waste covering at the landfill.

During Q1 2018, approximately 173 m^3 of solid waste from the Thaheau Village, Hat Gniun Village, Phouhomxay Village and local contractors was disposed of at Houay Soup Landfill.

4.4.4 Waste Clean-up in Four Villages of Zone 2LR

The waste clean-up in the four villages of Zone 2LR (Houaypamom, Sopphoune, Sopyouak and Namyouak villages) started on 01 December 2017 and was completed by the end of March 2018. The purpose of the waste clean-up is to remove and safely dispose waste that remains after relocation of the households before the impounding of main reservoir.

4.5 ENVIRONMENTAL MONITORING

The environmental monitoring activities followed the programmes presented in the ESMMP-CP Volume III. The programmes consist of the following components:

a) Effluent discharge from camps and construction sites
b) Ambient surface water quality monitoring
c) Groundwater quality monitoring
d) Reservoir water quality monitoring
e) Landfill leachate quality monitoring
f) Ambient air quality monitoring (particulate matter of less than 10 microns)
g) Ambient noise and noise emission monitoring.

The monitoring results are assessed against the relevant National Environmental Standards and Effluent Standards specified in the Concession Agreement Annex C[4] as applicable. This Section focuses on the key results that did not meet the Standards. All monitoring results can be found in ***Appendix 5***.

The NNP1PC Environmental Laboratory carries out water quality analyses for TSS, BOD_5, total coliform, faecal coliform and E. Coli bacteria. All other laboratory water quality analyses are performed by United Analysis and Engineering Consultant Company Ltd.

4.5.1 Surface Water (River) Quality

The regular surface water quality monitoring programme includes 14 stations in the Nam Ngiep 1 watershed area:

i. six stations located upstream of NNP1 Main Dam, including four stations in the Nam Ngiep main stream, one at the lower Nam Phouan, and one at the lower Nam Chian;

ii. eight stations located downstream of NNP1 Main Dam, including four stations in the Nam Ngiep main stream, two in the re-regulation reservoir, one at the lower Nam Xao and one at the lower Nam Houay Soup.

The frequency of monitoring is presented in the ***Table 4-7*** and the locations of monitoring stations are shown in ***Table 4-7*****.**

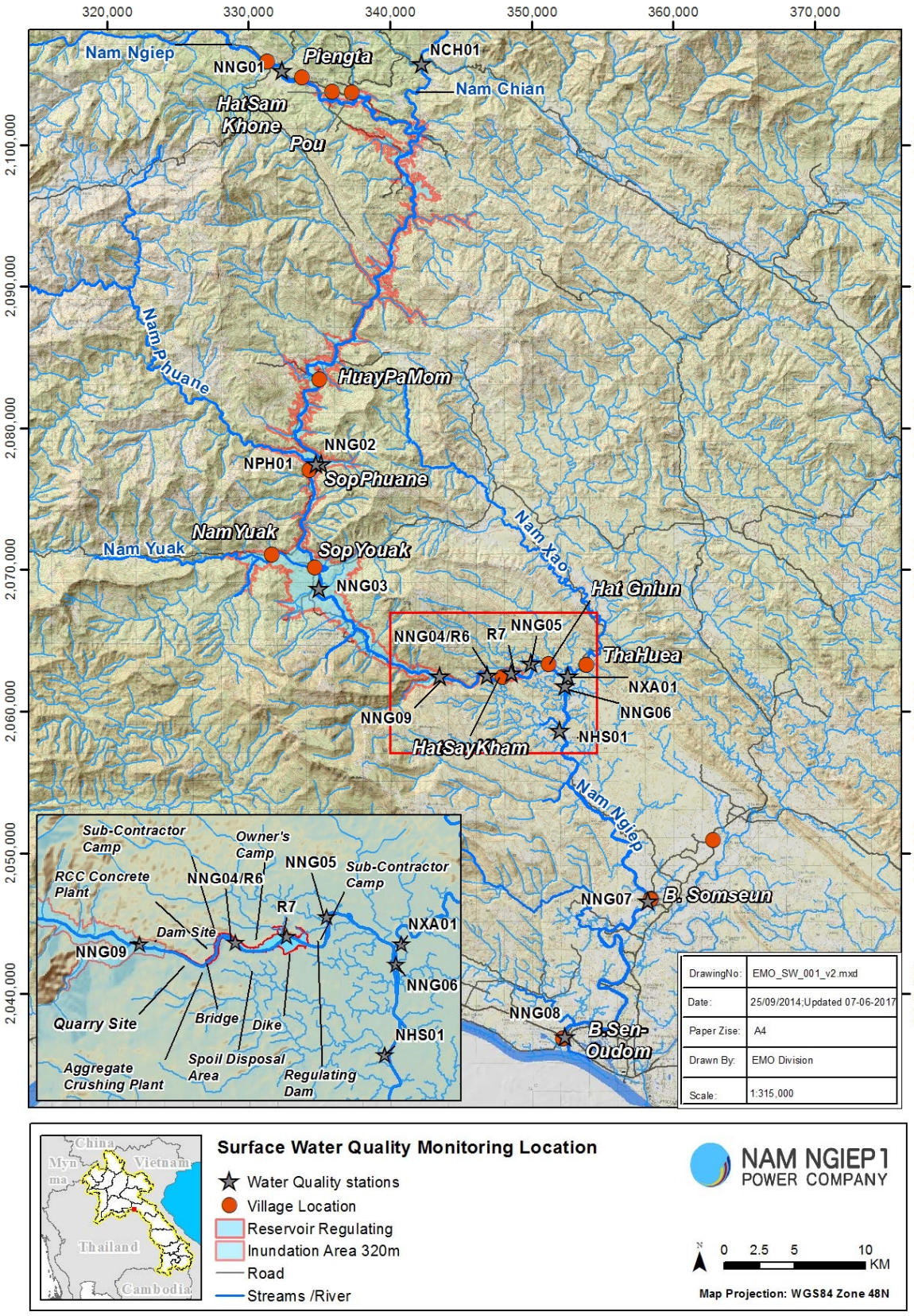
TABLE 4-7: MONITORING FREQUENCY FOR SURFACE WATER QUALITY PARAMETERS

Frequency of Monitoring	Parameters (Unit)	Monitoring Sites
Weekly	pH, DO (%), DO (mg/l), Conductivity (µs/cm), TDS (mg/l), Temperature (°C), Turbidity (NTU), TSS, BOD_5, faecal coliform and total coliform.	For 4 stations: Nam Ngiep Upstream of the Main Dam (NNG09), Re-regulation Reservoir Downstream of RT Camp (NNG04 / R6), Re-

[4] The Effluent Standards in Annex C are **the stricter of** the indicative guideline values applicable to sanitary wastewater in IFC Environmental Health and Safety Guideline, General Guidelines: Wastewater and Ambient Water Quality – and the applicable values in the Lao National Environmental Standards. Note also that the indicative guideline values in the IFC EHS Guideline are meant to apply in the absence of national values

Frequency of Monitoring	Parameters (Unit)	Monitoring Sites
		Regulation Reservoir (Upstream Re-Regulation Dam (R7)) and Nam Ngiep at Hat Gniun Village (NNG05).
Fortnightly	pH, DO (%), DO (mg/l), Conductivity (µs/cm), TDS (mg/l), Temperature (°C), Turbidity (NTU)	All 14 stations.
Monthly	TSS (mg/l), BOD_5 (mg/l), COD (mg/l), NH_3-N (mg/l), NO_3-N (mg/l), Total Iron (mg/l), Manganese (mg/l), total coliform (MPN/100 ml), faecal coliform (MPN/100 ml)	All 14 stations
Quarterly	Total Kjeldahl Nitrogen (mg/l), Chloride (mg/l), Sulphate (mg/l), Alkalinity (mg/l), Lead (mg/l), Arsenic (mg/l), Mercury (mg/l), Calcium (mg/l), Magnesium (mg/l), Potassium (mg/l), Sodium (mg/l)	All 14 stations

FIGURE 4-5: *SURFACE WATER QUALITY MONITORING LOCATIONS*



Descriptions of each monitoring station and surface water quality monitoring parameters can be found in ***Appendix 3*** and all surface water quality data for Q1 2018 are listed in ***Appendix 5.1***

4.5.1.1 Biochemical Oxygen Demand (BOD_5)

Since 2014, the Biochemical Oxygen Demand (BOD_5) levels in the Nam Ngiep River and its tributaries have generally been below the detection limit (< 1 mg/L) with only minor exceedances of the National Surface Water Quality Standard of < 1.5 mg/L on 08 March 2018 both upstream, downstream and in some of the tributaries. These measurements are neither critical nor attributable to discharges from the Project, and overall the results for this quarter are within the normal ranges previously measured.

TABLE 4-8: *BOD5 RESULTS OF SURFACE WATER IN NAM NGIEP AND ITS MAIN TRIBUTARIES MONITORED FROM JANUARY TO MARCH 2018 (NATIONAL SURFACE WATER QUALITY STANDARD FOR BOD5: <1.5 MG/L)*

Station Code	NNG 01	NNG 02	NNG 03	NNG 09	R6	R7	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA 01	NHS 01
5-Jan-18				<1.0	<1.0	<1.0	<1.0							
11-Jan-18				<1.0	<1.0	<1.0	<1.0							
18-Jan-18	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
25-Jan-18				<1.0	<1.0	<1.0	<1.0							
2-Feb-18				<1.0	<1.0	<1.0	<1.0							
8-Feb-18	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
15-Feb-18				<1.0	<1.0	<1.0	<1.0							
22-Feb-18				<1.0	<1.0	<1.0	<1.0							
1-Mar-18				<1.0	1.21	1.51	1.21							
8-Mar-18	1.37	1.4	1.06	1.47	1.75	1.97	1.85	1.8	1.46	1.34	1.35	1.88	2.12	1.89
15-Mar-18				<1.0	1.07	1.1	<1.0							
22-Mar-18				<1.0	<1.0	<1.0	<1.0							
29-Mar-18				<1.0	<1.0	<1.0	<1.0							

4.5.1.2 Chemical Oxygen Demand (COD)

The COD measurements in Q1 2018 are presented in ***Table 4-9***.

TABLE 4-9: COD RESULTS FOR SURFACE WATER IN NAM NGIEP AND ITS MAIN TRIBUTARIES DURING Q1 2018 (NATIONAL SURFACE WATER QUALITY STANDARD FOR COD: < 5 MG/L)

	NNG 01	NNG 02	NNG 03	NNG 09	R6	R7	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA 01	NHS 01
Date														
18-Jan-18	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
8-Feb-18	9.9	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	6.5	<5.0	<5.0
8-Mar-18	<5.0	<5.0	<5.0	<5.0	11.2	<5.0	<5.0	6.3	<5.0	15.3	<5.0	7.5	5.9	11.6

The mean COD values for the high flow and low flow seasons are presented in ***Table 4-10.*** The data indicates seasonal variation with higher values in the high flow season.

TABLE 4-10 MEAN VALUES OF COD MEASUREMENTS

Mean[5] COD Values	Upstream High Flow Season Mean (Jun-Nov) (mg/L)	Upstream Low Flow Season Mean (Dec-May) (mg/L)	Downstream High Flow Season Mean (Jun-Nov) (mg/L)	Downstream Low Flow Season Mean (Dec-May) (mg/L)
Hydrological Year[6] 2015	15.3	6.7	22.0	5.9
Hydrological Year 2016	10.8	5.6	10.6	5.4
Hydrological Year 2017	13.9	7.0	12.4	4.7
Hydrological Year 2018	14.8	5.0	7.1	5.7
Q1 2018		4.1		4.7

Furthermore, a statistical hypothesis test using Excel's TTEST function (unpaired, two-tailed, different variances, level of significance: 0.05) comparing the upstream sample for Q1-2018 with the downstream sample for Q1-2018 gives a p-value[7] of 0.55, which supports that the observed data are compatible with a hypothesis that the true COD means of the two samples are identical (the null hypothesis[8]).

4.5.1.3 Faecal Coliforms

The results of the faecal coliform analyses in Q1-2018 are presented in ***Table 4-11***. All measurements comply with the National Water Quality Standard of < 1,000 MPN/100 ml.

The basic statistics of the faecal coliform measurements from September 2014 until March 2018 are displayed in the box and whisker diagrams in ***Figure 4-6***. Note that to visually be able to compare the boxes only measurements below 10,000 MPN/100 ml are displayed. The boxes have rather similar interquartile ranges with right skewed data and similar medians. This points towards there being no significant difference in measurements upstream the project, within the Construction Area and downstream the Project.

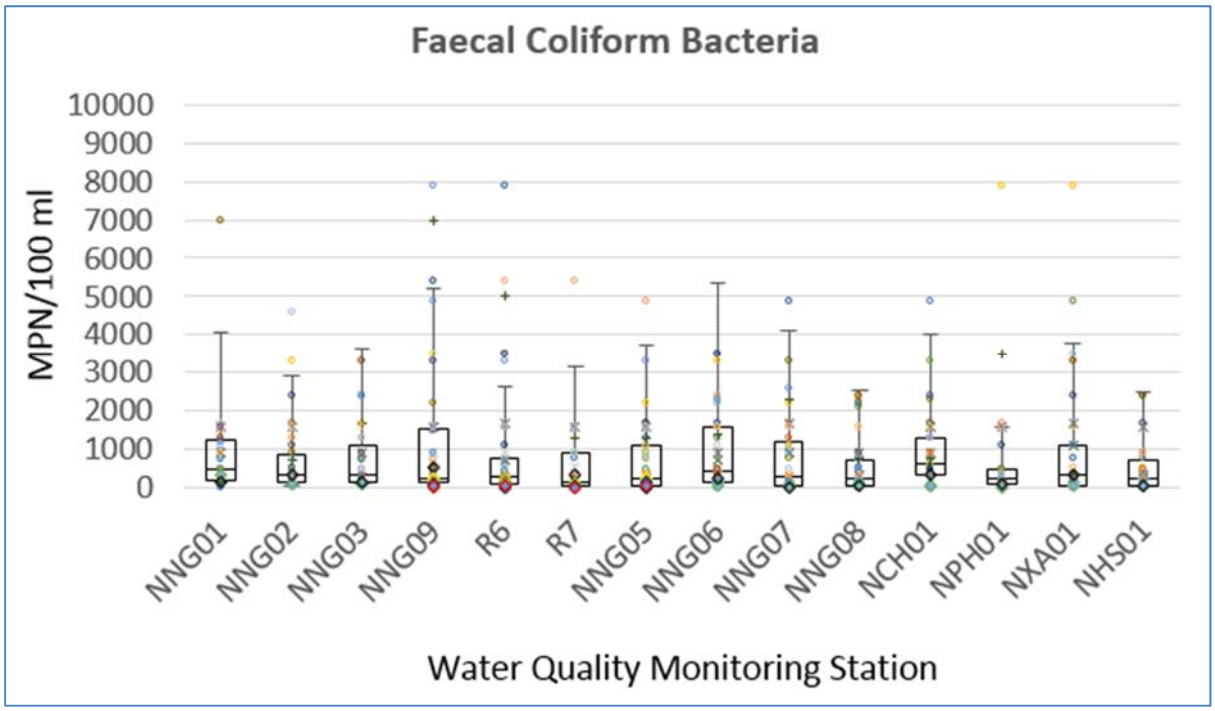
[5] If the measurement is below the Limit of Detection, then the value is determined as the Limit of Detection divided by the square root of 2

[6] The hydrological year is from start of the wet season in June to the end of the dry season in May the following year. The year denotes the year of the end of the hydrological year. For the hydrological year 2015 the high flow season data only includes September-November 2014, and for the hydrological year 2018 the low flow season data only until March 2018

[7] The p-value is defined as the probability of obtaining a t equal to or "more extreme" than what was actually observed, when the null hypothesis is true.

[8] In statistics the null-hypothesis is a hypothesis of no difference

FIGURE 4-6: BOX AND WHISKER DIAGRAMS OF FAECAL COLIFORM MEASUREMENTS 09/2014- 03/2018



A statistical hypothesis test using Excel's TTEST function (unpaired, two-tailed, different variances, level of significance: 0.05) comparing the upstream sample (NNG09) for Q1-2018 with the downstream sample (NNG05) for Q1-2018 gives a p-value of 0.06, which indicates that the observed data are compatible with the null hypothesis that the true faecal coliform means of the two samples are identical.

TABLE 4-11: RESULTS OF FAECAL COLIFORMS IN NAM NGIEP AND ITS MAIN TRIBUTARIES FROM JANUARY TO MARCH 2018 (NATIONAL SURFACE WATER QUALITY STANDARD FOR TOTAL COLIFORMS: < 1,000 MPN/100 ML)

Station Code	NNG01	NNG02	NNG03	NNG09	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
5-Jan-18				22	130	49	49							
11-Jan-18				170	79	79	34							
18-Jan-18	130	110	79	79	11	49	110	170	79	170	47	79	140	240
25-Jan-18				170	34	13	70							
2-Feb-18				130	4.5	2	22							
8-Feb-18	350	79	79	170	47	79	79	49	33	79	40	27	49	34
15-Feb-18				34	23	34	40							
22-Feb-18				140	94	0	70							
1-Mar-18				240	130	9	130							
8-Mar-18	170	350	130	540	240	350	23	240	23	33	350	79	350	33
15-Mar-18				240	240	79	240							
22-Mar-18				79	33	49	130							

Station Code	NNG01	NNG02	NNG03	NNG09	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
29-Mar-18				70	33	33	8							

Table 4-12 presents seasonal (high flow season and low flow season) means of faecal coliform bacteria upstream the main dam and downstream the re-regulation dam. The data indicates that there is a tendency towards higher values in the high flow season.

TABLE 4-12: SEASONAL MEANS FOR FAECAL COLIFORMS UPSTREAM THE MAIN DAM AND DOWNSTREAM THE RE-REGULATION DAM

	Upstream High Flow Season Mean (Jun-Nov) (MPN/100 ml)	Upstream Low Flow Season Mean (Dec-May) (MPN/100 ml)	Downstream High Flow Season Mean (Jun-Nov) (MPN/100 ml)	Downstream Low Flow Season Mean (Dec-May) (MPN/100 ml)
Hydrological Year[9] 2015		659		399[10]
Hydrological Year 2016	2,971	529	2,092	570
Hydrological Year 2017	1,286	452	939	171
Hydrological Year 2018	2,055	211	1,157	91

4.5.1.4 Total Coliforms

The results of measurements for total coliform bacteria are presented in ***Table 4-13***. The results indicate a similar pattern and same tendency as for faecal coliform bacteria.

TABLE 4-13: RESULTS OF TOTAL COLIFORMS IN NAM NGIEP AND ITS MAIN TRIBUTARIES FROM JANUARY TO MARCH 2018 (NATIONAL SURFACE WATER QUALITY STANDARD FOR TOTAL COLIFORMS: < 5,000 MPN/100 ML)

Station Code	NNG 01	NNG 02	NNG 03	NNG 09	R6	R7	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA 01	NHS 01
5-Jan-18				27	240	130	170							
11-Jan-18				170	110	350	170							
18-Jan-18	350	280	220	79	240	540	220	540	350	540	920	350	140	240
25-Jan-18				280	130	22	110							
2-Feb-18				240	7.8	4.5	130							

[9] The hydrological year is from start of the high flow season in June to the end of the low flow season in May the following year. The year denotes the year of the end of the hydrological year.

[10] This mean excludes an anomaly of 92,000 MPN/100 ml reported for NNG07 in January 2015

Station Code	NNG 01	NNG 02	NNG 03	NNG 09	R6	R7	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA 01	NHS 01
8-Feb-18	350	220	110	540	540	79	130	79	79	170	350	130	130	140
15-Feb-18				130	49	47	110							
22-Feb-18				920	920	9	170							
1-Mar-18				350	240	17	240							
8-Mar-18	540	350	130	540	540	350	350	240	350	350	2,400	79	350	240
15-Mar-18				350	540	170	350							
22-Mar-18				170	540	110	280							
29-Mar-18				350	350	33	79							

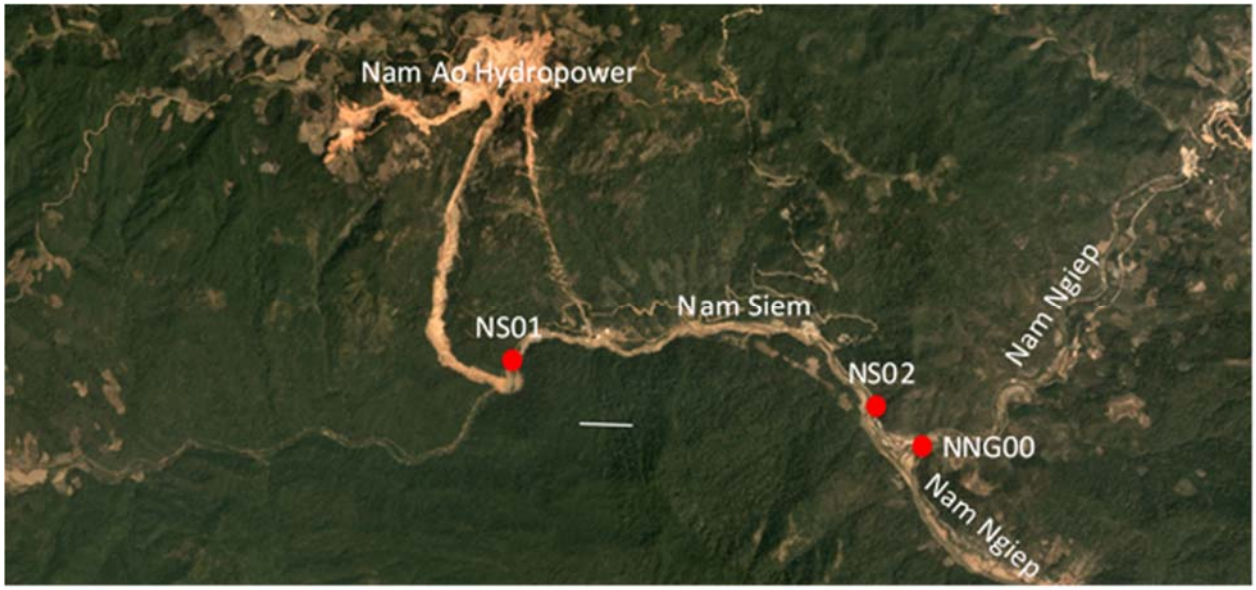
4.5.2 Emergency Surface Water Quality Monitoring

On 29 March 2018, the Environmental Monitoring Team of NNP1PC visually noticed unusual high turbidity in Nam Ngiep at Thaviengxay Village near monitoring station NNG01 upstream the reservoir.

The team immediately initiated an investigation with the objective of determining the turbidity levels and to identify the source of the turbidity. The team visually tracked the turbidity to the confluence of Nam Ao with Nam Siem and collected water samples at NS01 located in Nam Siem 300 m downstream the confluence with Nam Ao, at NS02 in Nam Siem close to its confluence with Nam Ngiep, and at NNG00 in Nam Ngiep upstream the Nam Siem confluence. The location of these monitoring points is shown in ***Figure 4-7.*** The sampling of these stations took place on 30 March 2018.

In addition, to identify and measure the downstream transport of the turbidity plume, the team monitored NCH01 in Nam Chian - a major tributary to the reservoir, NNG09 immediately upstream the main dam of Nam Ngiep 1 Hydropower Project, and NNG05 located in Nam Ngiep downstream re-regulation dam – see location of the stations on the overview map in ***Figure 4-7***. The latter two stations were monitored over three days from 30 March 2018 to 02 April 2018 as the plume would be expected have a lag time of about 2 days.

FIGURE 4-7: WATER QUALITY MONITORING STATIONS UPPER NAM NGIEP AND TRIBUTARIES



The results of the water quality measurements are presented in ***Table 4-14***. The measurements of pH, temperature, conductivity, total dissolved solids and dissolved oxygen are all within normal ranges. The measurements of total suspended solids (TSS) and turbidity carried out on 30 March 2018 show extremely high levels at NS01 immediately downstream the confluence of Nam Ao with Nam Siem. The levels taper off as the plume moves downstream, however with elevated TSS and turbidity levels measured at NNG09 near the main dam on 31 March 2018 – approximately 2 days after the first observations of high turbidity were made at NNG01.

TABLE 4-14: RESULTS OF MONITORING THE WATER QUALITY INCIDENT

	NS01	NS02	NNG00	NNG01	NCH01	NNG09	NNG09	NNG09	NNG05	NNG05	NNG05
Parameter (Unit)	30-Mar-18	30-Mar-18	30-Mar-18	30-Mar-18	30-Mar-18	30-Mar-18	31-Mar-18	02-Apr-18	30-Mar-18	31-Mar-18	02-Apr-18
pH	7.93	7.78	7.82	7.96	8.16	7.90	7.86	7.81	7.80	7.85	7.91
Sat.DO (%)	99.5	96.5	99.9	95.4	99.7	97.9	107.5	102.2	103.2	103.3	104.7
DO (mg/L)	7.93	7.91	8.07	8.07	8.33	7.88	8.12	8.11	8.23	7.91	8.16
Conductivity (µS/cm)	19.10	58.6	43	67.2	35.2	80.0	83.6	77.1	70.0	73.3	71.4
TDS (mg/L)	10	29	21	38	17	40	41.53	38.5	35	36.5	35.5
Temperature (°C)	24.5	23.1	23.9	21.8	22.1	25.2	28.7	26.0	25.7	28.2	26.9
Turbidity (NTU)	23,580	3,574	5.29	1,467	3.87	5.54	22	25.2	4.08	3.97	25.0
TSS (mg/L)	13,365	2,266	7.71	824.37	8.33	9.35	158.22	88.69	4.89	6.50	51.26

The visual observations of the turbid water are documented in a series of pictures displayed in ***Figure 4-8*** to ***Figure 4-9***.

FIGURE 4-8: NAM SIEM DOWNSTREAM NAM AO HYDROPOWER PROJECT ON 30 MARCH 2018 (NEAR NS01)

The picture in ***Figure 4-9*** clearly shows sediment-laden water in Nam Siem downstream the confluence of Nam Ao.

FIGURE 4-9: NAM SIEM UPSTREAM NAM NGIEP CONFLUECE ON 30 MARCH 2018 (NEAR NS02)

The difference in water clarity between Nam Siem near the confluence with Nam Ngiep and in Nam Ngiep upstream the confluence with Nam Siem can be seen from the pictures in ***Figure 4-10*** and ***Figure 4-11*** respectively.

FIGURE 4-10: NAM NGIEP UPSTREAM THE CONFLUENCE OF NAM SIEM ON 30 MARCH 2018 (NEAR NNG00)

FIGURE 4-11: NAM NGIEP AT PHIENGTA VILLAGE ON 30 MARCH 2018

For comparison, the basic statistics of TSS measured at NNG01, NNG09 and NNG05 during the low flow season since December 2014 are displayed in ***Table 4-15***

TABLE 4-15: BASIC STATISTICS FOR TOTAL SUSPENDED SOLIDS DURING THE LOW FLOW SEASONS

Statistics for the Low Flow Seasons since December 2014	**NNG01** TSS (mg/L)	**NNG09** TSS (mg/L)	**NNG05** TSS (mg/L)
Number of Measurements	22	35	33
Mean	53.3	25.2	24.9
Standard Deviation	86.1	37.2	40.8
Maximum	374.0	183.0	195.0
75th Percentile	45.9	24.5	20.6
Median	25.4	12.0	10.1
25th Percentile	12.3	7.9	6.2
Minimum	6.3	5.1	3.4
Range	367.7	177.9	191.6

When comparing the basic water quality statistics in ***Table 4-15*** with the measurements during the investigation of the turbid water incident in ***Table 4-14*** it can be concluded that:

- The TSS level in NS01 immediately downstream the confluence of Nam Ao measured on 30 March 2018 is extremely high;
- The TSS level in NNG01 measured on 30 March 2018 is about twice as high as ever recorded during the low flow season in NNG01, and about 15 times higher than the low flow season mean;
- The TSS level in NNG09 measured on 31 March 2018 is at the same level as the low flow season maximum for NNG09 and about 6 times higher than the low flow season mean and about 12 times higher than the low flow season median;
- The TSS measurement in NNG05 on 02 April 2018 lies in the 4th quartile of the low flow season measurements;

The results of the investigations of the turbid water incident carried out by NNP1PC from 30 March 2018 to 02 April 2018 document that Nam Ngiep was polluted by unusually high levels of suspended solids. Extremely high concentrations of total suspended solids and very high turbidity levels were measured in Nam Siem at NS01 immediately downstream the confluence of Nam Ao on 30 March 2018, and the levels tapered off downstream from that site indicating that the source of the turbid water is in the Nam Ao catchment.

4.5.3 Compliance Monitoring of Effluents from Camps

A total of 12 camps including OSOV were in use during Q1-2018 and the effluents were monitored in 10 camps (10 sampling sites) as indicated on the map in ***Figure 4-12.*** The results are described in ***Table 4-16*** and the full data set is in ***Appendix 5.2***.

The two camps that were not monitored are the TCM camp and Lilama10 camp. The Wastewater Treatment Plant (WWTP) at the TCM camp has no discharge due to small number of workers and was therefore not sampled. The wetland pond of the Lilama10 treatment plant

was put in operation in December 2017 and is being filled with wastewater – no discharge yet.

The status of compliance as of 31 March 2018 can be summarized as follows:

- Non-compliance with total coliform bacteria for three camps (EF09, EF13 and EF14);
- The camps EF09, EF13 and EF14 have the worst record of compliance with instances of non-compliance with all parameters;
- All camps except EF10 have experienced varied degree of non-compliance with ammonia and total nitrogen;

EMO will review the contractors' Standard Operation Procedure (SOP) on chlorination, increase the inspection frequency and provide recommendation for bacteria treatment.

FIGURE 4-12: *MAP OF EFFLUENT MONITORING LOCATIONS DURING THE FOURTH QUARTER OF 2018*

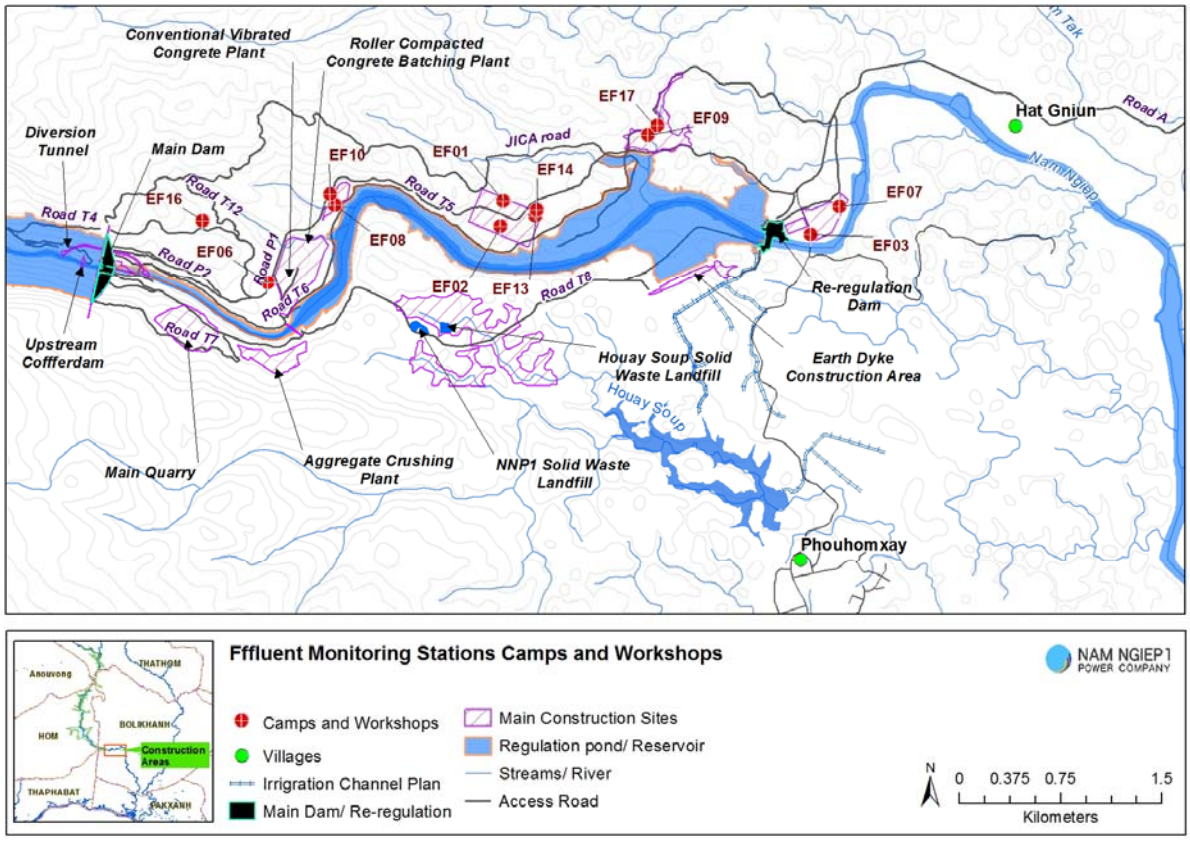


TABLE 4-16: *RESULTS OF THE EFFLUENT WATER QUALITY MONITORING OF THE CAMPS FROM JANUARY TO MARCH 2018*

		Site Name	Owner's Site Office and Village	Obayashi Camp	Sino Hydro Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Kenber Camp	TCM Camp	Lilama10 Camp
		Station Code	EF01	EF02	EF06	EF07	EF08	EF09	EF10	EF13	EF14	EF16	EF03	EF17
Date	Parameter (Unit)	Guideline in the CA												
08-Jan-18	TSS (mg/l)	<50	<5	8.37	6.38	40.12	40.3		<5	34.34	74.66	13.85		
22-Jan-18	TSS (mg/l)	<50	<5	10.76	<5	44.38	25.88		<5	19.39	36.6	30.26		
05-Feb-18	TSS (mg/l)	<50	<5	6.5	<5	25.42	34.8		8.83	34.49	37.98	7.77		
19-Feb-18	TSS (mg/l)	<50	<5	10.68	5.53	29.91	33.33	117.69	<5	31.95	20.06	10.54		
05-Mar-18	TSS (mg/l)	<50	<5	9.3	<5	23.47	19.49		<5	35.2	23.98	15.46		
19-Mar-18	TSS (mg/l)	<50	<5	7.43	<5	27.81	21.1		<5	25.32	38.14	16.26		
08-Jan-18	BOD_5 (mg/l)	<30	<6	<6	<6	<6	<6		<6	<6	<6	<6		
22-Jan-18	BOD_5 (mg/l)	<30	<6	<6	<6	<6	<6		<6	<6	64.9	<6		
05-Feb-18	BOD_5 (mg/l)	<30	6.33	<6	<6	<6	<6		<6	<6	47.28	<6		
19-Feb-18	BOD_5 (mg/l)	<30	9.9	<6	29.1	18.42	<6	41.82	<6	<6	<6	<6		
05-Mar-18	BOD5 (mg/l)	<30	<6	<6	<6	<6	<6		16.86	<6	<6	<6		
19-Mar-18	BOD5 (mg/l)	<30	<6	<6	<6	<6	<6		<6	27.12	104	<6		
08-Jan-18	COD (mg/l)	<125	<25	57.6	58.1	120	172		<25	229	262	<25.0		
22-Jan-18	COD (mg/l)	<125	<25	65.5	48	122	155		<25	198	186	50.5		
05-Feb-18	COD (mg/l)	<125	<25	76.3	36.8	82.1	177		<25	264	298	<25		
19-Feb-18	COD (mg/l)	<125	<25	41.6	47.2	110	132	235	30.1	147	160	45.4		
05-Mar-18	COD (mg/l)	<125	<25	55.4	37.2	122	79.1		<25	187	240	<25		
19-Mar-18	COD (mg/l)	<125	<25	38.4	37	110	128		<25	214	275	47.2		
08-Jan-18	NH_3-N (mg/l)	<10	3.2	70.5	71.5	52.3	58.9		<0.2	22.7	15.5	<0.2		
22-Jan-18	NH_3-N (mg/l)	<10	3.7	31.6	38.5	28.6	30.6		<0.2	27.2	20.7	8.9		
05-Feb-18	NH_3-N (mg/l)	<10	3.2	24.3	<0.2	22.4	44.9		<0.2	24.2	16.2	2.5		
19-Feb-18	NH_3-N (mg/l)	<10	8.8	8	37.3	32.6	43.9	39.3	4.7	14.6	29	13.7		

		Site Name	Owner's Site Office and Village	Obayashi Camp	Sino Hydro Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Kenber Camp	TCM Camp	Lilama10 Camp
		Station Code	EF01	EF02	EF06	EF07	EF08	EF09	EF10	EF13	EF14	EF16	EF03	EF17
Date	Parameter (Unit)	Guideline in the CA												
05-Mar-18	NH3-N (mg/l)	<10	5.6	24.6	21.1	19.4	31.8		4.1	18.2	9.9	4.3		
19-Mar-18	NH3-N (mg/l)	<10	12.3	40.8	34.2	20.2	24.4		2.1	33.2	5.3	8.2		
08-Jan-18	Total Nitrogen (mg/l)	<10	11.8	72.2	73	53.2	60		2.68	25.9	20.6	1.15		
22-Jan-18	Total Nitrogen (mg/l)	<10	13.8	32.2	39.5	29	31.2		1.33	28.8	22	9.42		
05-Feb-18	Total Nitrogen (mg/l)	<10	14.2	25.2	26.7	25.4	45.3		1.37	25.4	17.5	6.03		
19-Feb-18	Total Nitrogen (mg/l)	<10	9.7	9.39	38.4	33	44.2	39.7	5.36	15.2	29.6	14.4		
05-Mar-18	Total Nitrogen (mg/l)	<10	5.89	25.3	24.4	20.1	32.2		4.32	19	10.6	4.52		
19-Mar-18	Total Nitrogen (mg/l)	<10	16	41.4	34.6	21	25.1		3.06	33.5	13.2	8.36		
08-Jan-18	Total Phosphorus (mg/l)	<2.0	0.43	0.73	1.31	0.96	2.04		0.12	0.76	1.61	0.33		
22-Jan-18	Total Phosphorus (mg/l)	<2.0	0.62	1.33	0.96	0.37	1.9		0.17	0.5	0.55	0.95		
05-Feb-18	Total Phosphorus (mg/l)	<2.0	0.86	1.49	1.83	1.19	1.71		1.37	1.56	1.5	0.62		
19-Feb-18	Total Phosphorus (mg/l)	<2.0	1.37	0.51	1.79	1.28	1.7	1.84	0.39	1.45	1.52	1.06		
05-Mar-18	Total Phosphorus (mg/l)	<2.0	1.15	1.36	1.51	1.26	1.42		0.48	1.48	1.29	0.62		
19-Mar-18	Total Phosphorus (mg/l)	<2.0	1.4	1.15	1.45	1.19	1.55		0.33	1.29	0.95	1.18		
08-Jan-18	Faecal Coliform (MPN/100 ml)		13	350	0	0	7.8		0	1,600	0	0		
22-Jan-18	Faecal Coliform (MPN/100 ml)		0	23	0	0	17		0	0	9,200	0		
05-Feb-18	Faecal Coliform (MPN/100 ml)		2	0	0	0	0		0	0	0	0		
19-Feb-18	Faecal Coliform (MPN/100 ml)		2	0	33	0	0	16,000	7.8	0	0	0		

		Site Name	Owner's Site Office and Village	Obayashi Camp	Sino Hydro Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Kenber Camp	TCM Camp	Lilama10 Camp
		Station Code	EF01	EF02	EF06	EF07	EF08	EF09	EF10	EF13	EF14	EF16	EF03	EF17
Date	Parameter (Unit)	Guideline in the CA												
05-Mar-18	Faecal Coliform (MPN/100 ml)		4.5	0	0	0	0		240	0	0	0		
19-Mar-18	Faecal Coliform (MPN/100 ml)		2	0	0	0	0		0	0	2.4	0		
08-Jan-18	Total Coliform (MPN/100 ml)	<400	17	350	0	0	13		0	1,600	0	0		
22-Jan-18	Total Coliform (MPN/100 ml)	<400	0	23	2	0	17		0	0	9,200	0		
05-Feb-18	Total Coliform (MPN/100 ml)	<400	2	0	0	0	0		0	0	0	0		
19-Feb-18	Total Coliform (MPN/100 ml)	<400	2	0	33	0	0	35,000	7.8	0	0	0		
05-Mar-18	Total Coliform (MPN/100 ml)	<400	32	0	0	0	0		240	0	0	0		
19-Mar-18	Total Coliform (MPN/100 ml)	<400	350	0	2	0	0		0	0	3500	0		
08-Jan-18	Oil & Grease (mg/l)	<10	<1	<1	<1	<1	3		<1	13	11	<1		
05-Feb-18	Oil & Grease (mg/l)	<10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		
05-Mar-18	Oil & Grease (mg/l)	<10	<1	<1	<1	<1	<1		<1	11	19	<1		

TABLE 4-17: *COMPLIANCE STATUS OF EFFLUENT DISCHARGE FROM THE CAMPS IN Q1 2018*

Site	ID	WWTS	Key Non-Compliance Issues[11] in Q1-2018	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	- Total nitrogen (<10 mg/L): Non-compliance in 4 out of 6. Q1 mean 11.9 mg/L. - Ammonia (<10 mg/L): Non-compliance in 1 out of 6. Q1 mean 6.1 mg/L	- EMO continues to monitor and corrective action will be suggested (if required).
OC Camp – WWTS01	EF02	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	- Ammonia (<10 mg/L): Q1 mean 33.30 mg/L. - Total nitrogen (<10 mg/L): Q1 mean 34.28 mg/L.	- EMO continues to monitor, share effluent monitoring results to the contractor. - The non--compliance issue was raised during monthly progress meeting with the contractor. - Contractor was requested to pay attention on the operation and maintenance of the wetland component such as replacement of unhealthy wetland reeds and flushing pipe system to maintain proper sub-surface flow mechanism.

[11] The values in brackets indicate the applicable standard

Site	ID	WWTS	Key Non-Compliance Issues[11] in Q1-2018	Corrective Actions
TCM Camp	EF03	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	-	- There was no discharge of wastewater for sampling during Q1 2018
Sino Hydro Camp	EF06	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	- Ammonia (<10 mg/L): Q1 mean 40.52 mg/L. - Total nitrogen (<10 mg/L): Q1 mean 39.43 mg/L.	- EMO continues to monitor, share effluent monitoring results to the contractor. - The non-compliance issue was raised during monthly progress meeting with the contractor. - Contractor was requested to pay attention on the operation and maintenance of the wetland component such as replacement of unhealthy wetland reeds and flushing pipe system to maintain proper sub-surface flow mechanism.
Zhefu Camp (HMH Worker Camp No.1)	EF09	Septic tank (kitchen and black water), sediment ponds (grey water)	- BOD_5 (<30 mg/L): Non-compliance in 1 out of 1 41.82 mg/L. - COD (<125 mg/L): Non-compliance in 1 out of 1 235 mg/L. - Ammonia-nitrogen (<10 mg/L): Non-compliance in 1 out of 1 39.30 mg/L. - Total nitrogen (<10 mg/L): Non-compliance in 1 out of 1 39.70 mg/L	- As above.

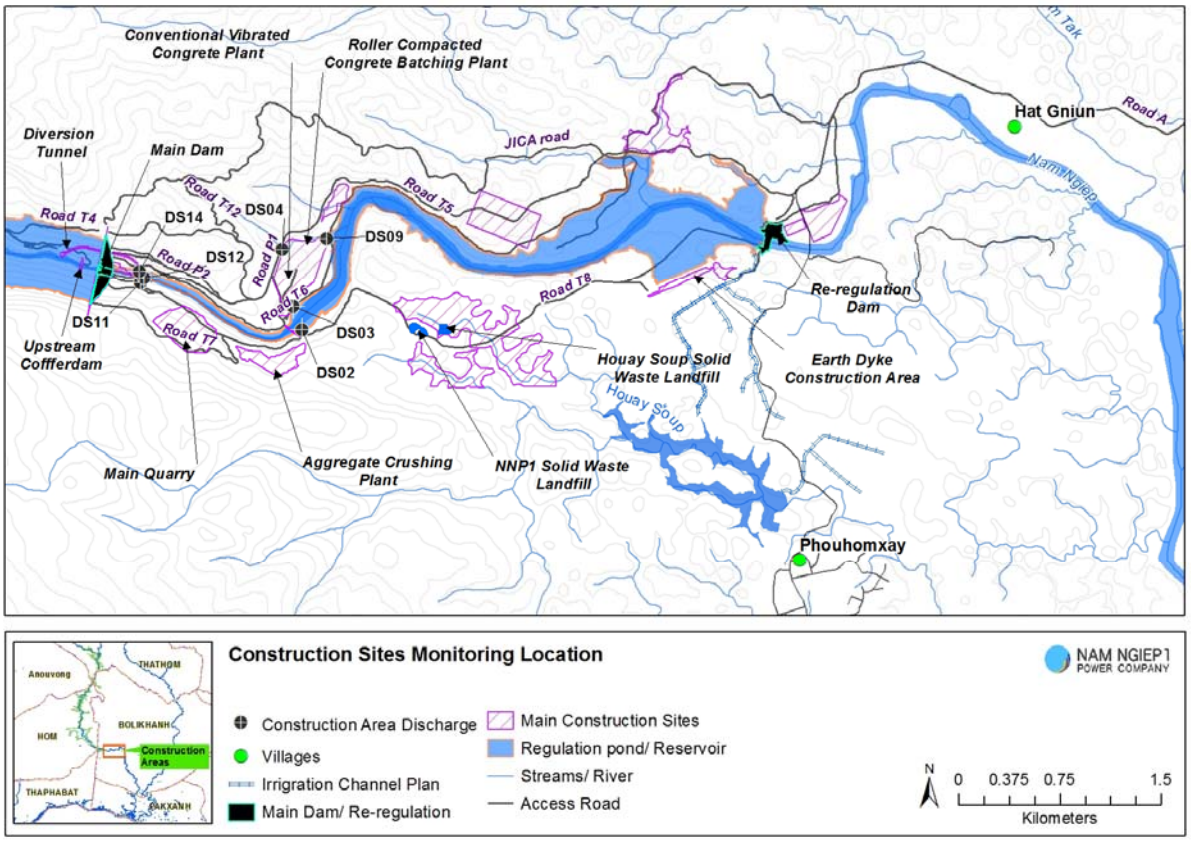
Site	ID	WWTS	Key Non-Compliance Issues[11] in Q1-2018	Corrective Actions
V&K Camp	EF10	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	- Full compliance in Q1 2018	
HMH Main Camp – WWTS01	EF13	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	- COD (<125 mg/L): Non-compliance in 6 out of 6. Q1 mean 206.5 mg/L. - Ammonia (<10 mg/L): Non-compliance in 6 out of 6. Q1 mean 23.35 mg/L. - Total nitrogen (<10 mg/L): Non-compliance in 6 out of 6. Q1 mean 24.63 mg/L.	- As above.
IHI Camp	EF14	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	- BOD_5 (<30 mg/L): Non-compliance in 3 out of 6 measurements. Q1 mean 72.06 mg/L. - Ammonia (<10 mg/L): Non-compliance in 4 out of 6 measurements. Q1 mean 16.10 mg/L. - COD (<125 mg/L): Non-compliance in 6 out of 6. Q1 mean 236.83 mg/L. - Total nitrogen (<10 mg/L): Non-compliance in 6 out of 6. Q1 mean 18.92 mg/L.	- As above.
Song Da 5 Camp No. 1	EF07	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	- Ammonia (<10 mg/L): Non-compliance in 6 out of 6. Q1 mean 29.25 mg/L. - Total nitrogen (<10 mg/L): Non-compliance in 6 out of 6. Q1 mean 30.28 mg/L.	- As above.
Song Da 5 Camp No. 2	EF08	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	- Ammonia (<10 mg/L): Non-compliance in 6 out of 6. Q1 mean 39.08 mg/L. - Total nitrogen (<10 mg/L): Non-compliance in 6 out of 6. Q1 mean 39.67 mg/L. - COD (<125 mg/L): Non-compliance in 5 out of 6. Q1 mean 140.52 mg/L.	- As above.

Site	ID	WWTS	Key Non-Compliance Issues[11] in Q1-2018	Corrective Actions
Kenber Camp	EF16	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	- Ammonia (<10 mg/L): Non-compliance in 1 out of 6 13.7 mg/L. - Total nitrogen (<10 mg/L): Non-compliance in 1 out of 6 14.4 mg/L.	- As above.
Lilama10 Camp	EF17	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	-	- There was no discharge of wastewater for sampling during Q1 2018

4.5.4 Compliance Monitoring of Discharges from Construction Sites

Discharges from the key construction sites (see ***Figure 4-13***) were monitored during the reported period. The results are presented in ***Table 4-18.*** Results that are above the prescribed standards are highlighted in yellow. The full set of data is in ***Appendix 5.3***.

FIGURE 4-13 LOCATION OF DISCHARGE POINTS OF KEY CONSTRUCTION SITES



During Q1 2018, NNP1PC worked closely with the contractor to ensure the discharges from the sediment retention ponds at the aggregate crushing plant and the RCC batching Plant are in compliance with the relevant standard, and during the Q1 2018 the following actions continued to be implemented:

Aggregate crushing plant:

- Application of aluminium sulphate [Al2(SO4)3] for flocculation of suspended particles at the open ditch prior to the sediment pond, and application of lime at the last pond for controlling the pH;
- Regular clean out of sediments;

RCC batching plant:

- Daily clean out of sediments from the ponds;
- Application of aluminium sulphate [Al2(SO4)3] for flocculation of suspended particles at the open ditch prior to the sediment pond;

As illustrated in ***Figure 4-13*** and ***Figure 4-14***, these measures continue to ensure that the discharges from the aggregate crushing plant and the RCC batching plant are in compliance with the standard for Total Suspended Solids (50 mg/L).

The compliance status for each of the key construction sites is summarized in ***Table 4-17***

FIGURE 4-14: TOTAL SUSPENDED SOLIDS IN THE DISCHARGE FROM THE AGGREGATE CRUSHING PLANT

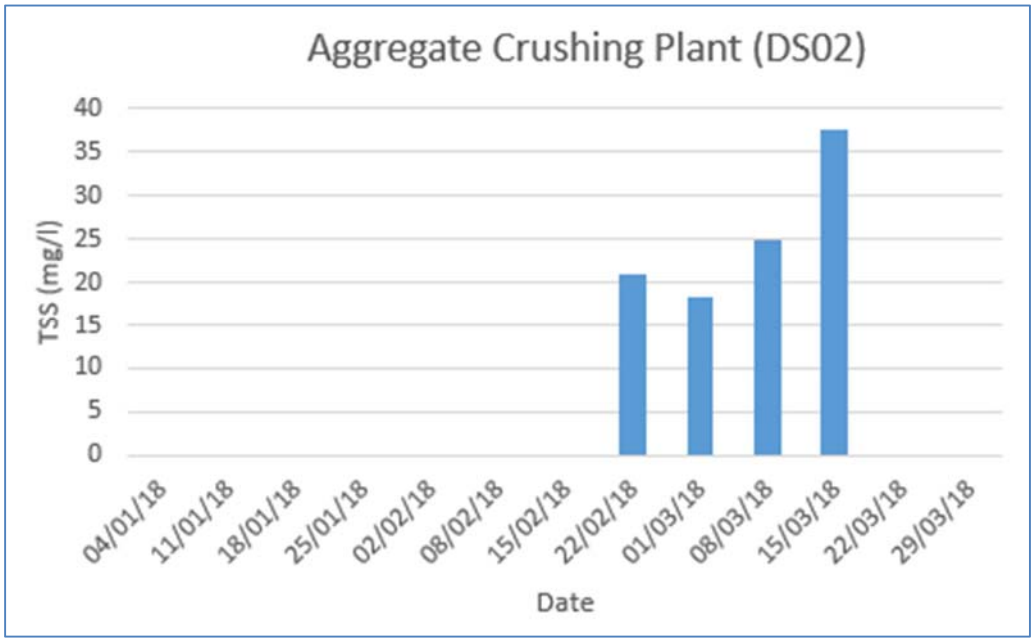


FIGURE 4-15: TOTAL SUSPENDED SOLIDS IN THE DISCHARGE FROM THE RCC BATCHING PLANT

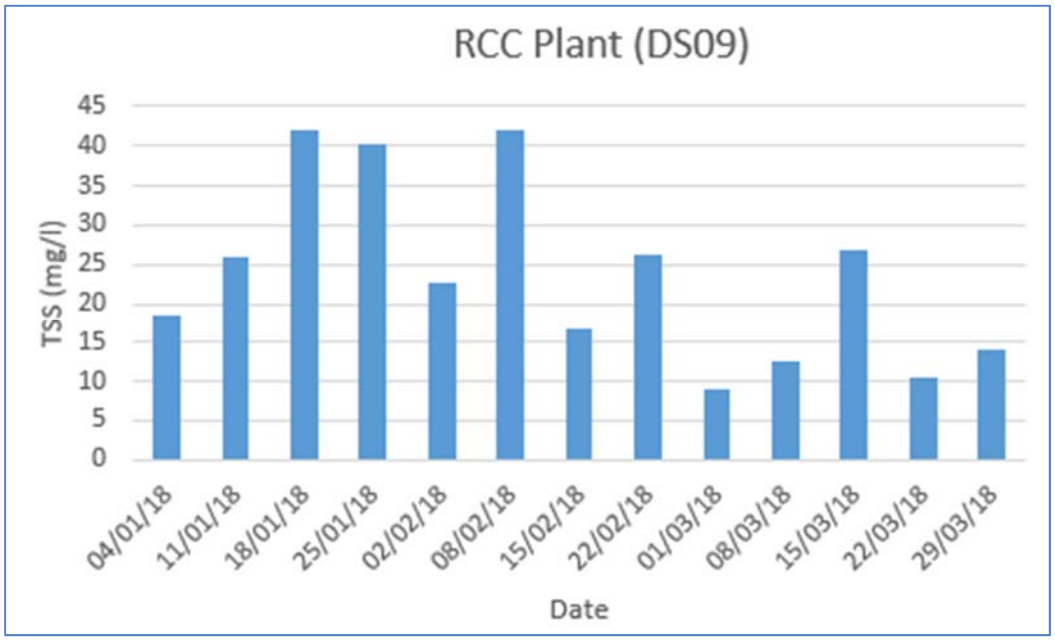


TABLE 4-18 RESULTS OF THE CONSTRUCTION AREA DISCHARGE MONITORING IN Q1 2018

Date	Parameter (Unit)	Site Name (Code)	Aggregate Crushing Plant (DS02)	Spoil Disposal No.2	RCC Plant (DS09)	Main Dam Treatment Plant No.1 (DS11)	Main Dam Treatment Plant No.2 (DS12)	Main Dam Treatment Plant No.3 (DS14)
		Effluent Standard						
04-Jan-18	pH	6.0-9.0		5.68	6.65	6.12		
11-Jan-18	pH	6.0-9.0		7.56	8.45	8.22		
18-Jan-18	pH	6.0-9.0		7.09	8.39	7.84		
25-Jan-18	pH	6.0-9.0		7.51	8.63	8.22		
02-Feb-18	pH	6.0-9.0		7.84	8.32	8.53		
08-Feb-18	pH	6.0-9.0		6.06	6.9			9.99
15-Feb-18	pH	6.0-9.0		5.9	7	6.64		10.84
22-Feb-18	pH	6.0-9.0	7.09	5.67	7.05	6.93		4.72
01-Mar-18	pH	6.0-9.0	6.7		6.79		4.85	
08-Mar-18	pH	6.0-9.0	7.31	6.15	7.08		7.0	11.2
15-Mar-18	pH	6.0-9.0	6.88		6.91		4.87	2.36
22-Mar-18	pH	6.0-9.0		5.93	7.12		6.65	8.59
29-Mar-18	pH	6.0-9.0		6.16	7.44		7.83	7.25
04-Jan-18	TSS (mg/l)	<50		4.5	18.4	8.53		
11-Jan-18	TSS (mg/l)	<50		3.9	26.02	5.33		
18-Jan-18	TSS (mg/l)	<50		2.79	41.96	13.47		
25-Jan-18	TSS (mg/l)	<50		3.47	40.17	10.78		
02-Feb-18	TSS (mg/l)	<50		6.08	22.72	9.18		
08-Feb-18	TSS (mg/l)	<50		2.63	42.16			8,272
15-Feb-18	TSS (mg/l)	<50		5.45	16.71	6.36		43.9
22-Feb-18	TSS (mg/l)	<50	20.96	5.69	26.33	8.7		110.48
01-Mar-18	TSS (mg/l)	<50	18.37		8.94		18.37	
08-Mar-18	TSS (mg/l)	<50	24.81	7.69	12.66		45.43	125.57

Date	Parameter (Unit)	Site Name (Code) / Effluent Standard	Aggregate Crushing Plant (DS02)	Spoil Disposal No.2	RCC Plant (DS09)	Main Dam Treatment Plant No.1 (DS11)	Main Dam Treatment Plant No.2 (DS12)	Main Dam Treatment Plant No.3 (DS14)
15-Mar-18	TSS (mg/l)	<50	37.57		26.79		62.68	97.38
22-Mar-18	TSS (mg/l)	<50		8.61	10.61		13.73	79.34
29-Mar-18	TSS (mg/l)	<50		11.33	14.11		77.89	11.52

TABLE 4-19: COMPLIANCE STATUS OF EFFLUENT DISCHARGE AND CORRECTIVE ACTION DURING THE FIRST QUARTER OF 2018

Site	ID	Treatment System	Key Non-Compliance Issues[12] in Q1-2018	Corrective Actions
Aggregate Crushing Plant	DS02	Sediment ponds	- Full compliance.	- No corrective action is required. However, EMO will continue to monitor this site and share the results to contractor for their improvement.
CVC Plant	DS03	Sediment ponds	- No discharge during Q1 2018	
Spoil Disposal No.2	DS04	Sediment pond	- pH (>6.0 and <9.0): Non-compliance in 5 out of 11 measurements.	- As above.
RCC Plant (at Lower Ponds)	DS09	Sediment ponds	- Full compliance.	- As above.
Main Dam Construction Area (Treatment Plant No.1)	DS11	pH adjustment and chemical flocculation 6,000 m^3/day	- Full compliance.	- As above.
Main Dam Construction Area (Treatment Plant No.2)	DS12	pH adjustment and chemical flocculation	- TSS (<50 mg/L): Q1 mean 23 mg/L. Non-compliance in 2 out of 12 measurements. - pH (>6 and <9): Non-compliance in 2 out of 12 measurements. Back in compliance since mid-March 2018.	- As above.
Main Dam Construction Area (Treatment Plant No.3)	DS14	pH adjustment and chemical flocculation	- TSS (<50 mg/L): Q1 mean 1,249 mg/L. Non-compliance in 5 out of 7 measurements. - pH (>6 and <9): Non-compliance in 5 out of 7	- As above.

[12] The values in brackets indicate the applicable standard

Site	ID	Treatment System	Key Non-Compliance Issues[12] in Q1-2018	Corrective Actions
			measurements. Back in compliance since mid-March 2018.	

4.5.5 Groundwater Quality Monitoring

During the Q1 2018, three out of six boreholes at Phouhomxay Village[13], two boreholes at Somseun, one borehole at Nam Pa and one borehole at Thong Noy villages have been monitored for the following parameters:

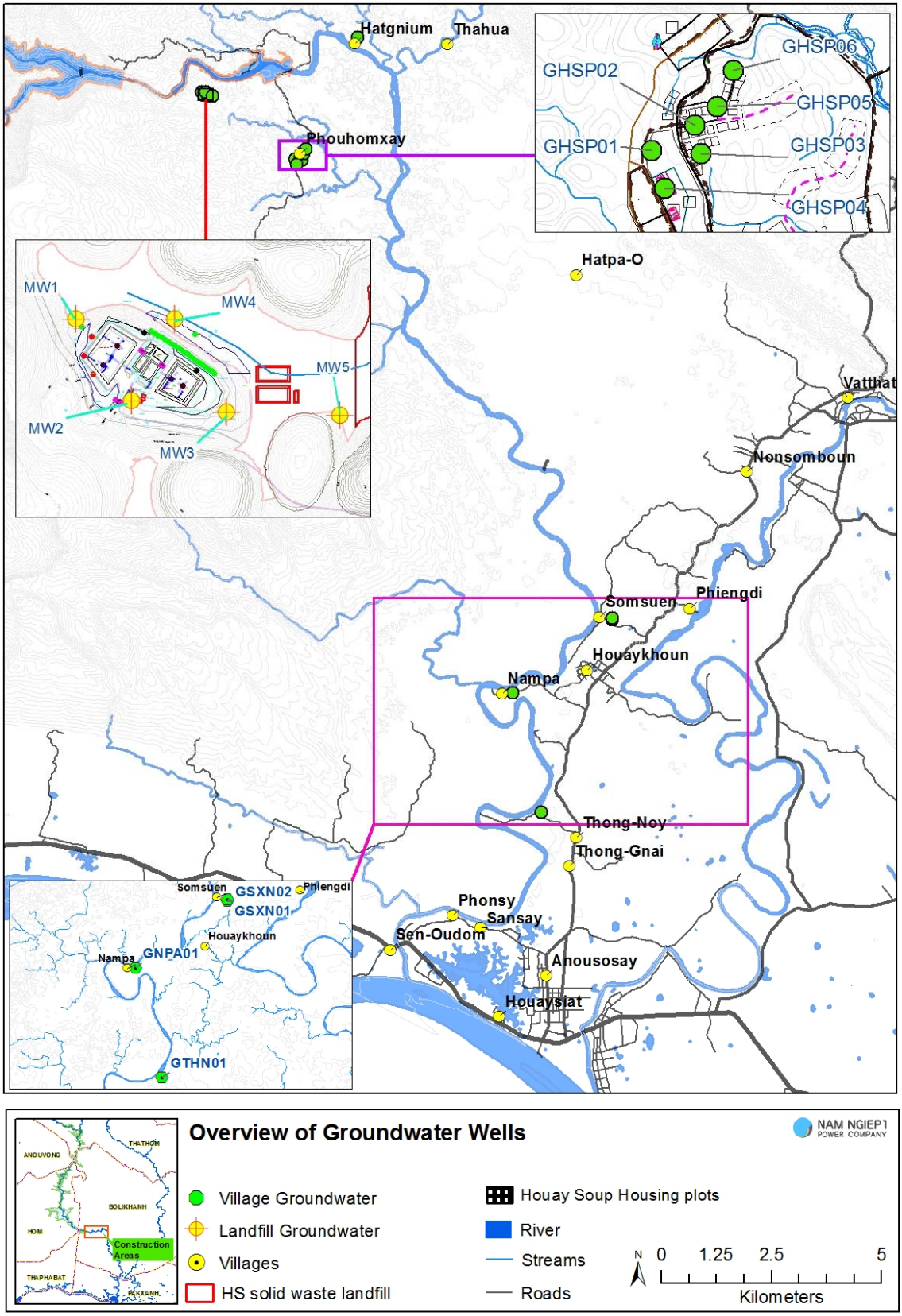
a. *Monthly:* pH, DO (%), DO (mg/l), Conductivity (µs/cm), TDS (mg/l), Temperature (^{o}C), Turbidity (NTU), Faecal Coliform (MPN/100 ml) and E. coli (MPN/100 ml);

b. *Quarterly:* Arsenic (mg/l), Cadmium (mg/l), Iron (mg/l), Magnesium (mg/l), Manganese (mg/l), Fluoride (mg/l), Nitrate (mg/l), Nitrite (mg/l), Total Hardness (mg/l) Lead (mg/l).

In addition, the landfill groundwater sampling was taken immediately upstream and downstream of the NNP1 Project landfill (in total of four boreholes) and Houay Soup landfill (one borehole). The groundwater monitoring data is presented in ***Appendix 5.4 and 5.7***

[13] Three boreholes have been taken permanently out of use and are therefore no longer monitored. The water supply from these boreholes was replaced with water from a gravity fed water supply system in December 2017

FIGURE 4-16: *GROUNDWATER SAMPLING LOCATIONS*



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

Phouhomxay, Somsuen and Nam Pa villages: all of monitored parameters complied with the relevant National Standard during the reported period.

Thong Noy Village: all monitored parameters, except faecal coliform and Ecoli bacteria were not complied with the standard for March 2018. This bacteria contamination may be caused from the dirty environment surrounded the borehole.

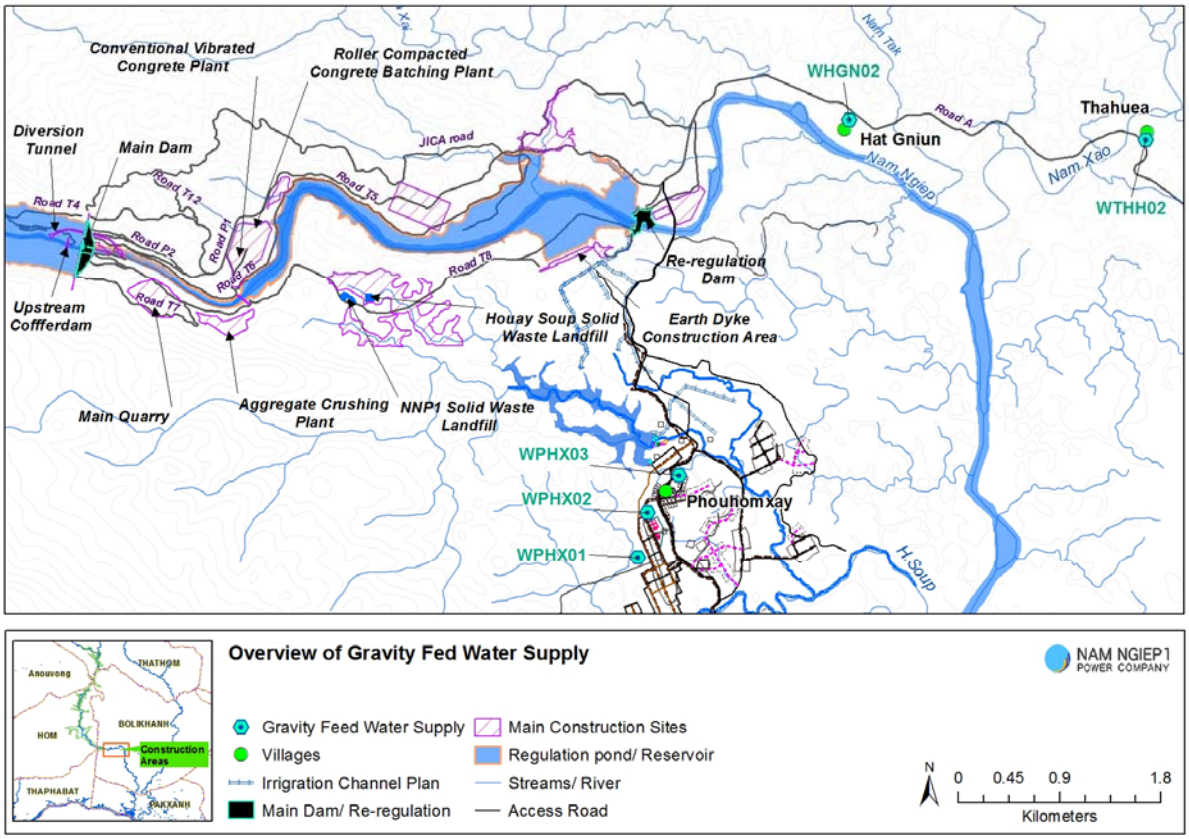
The villagers were advised to boil water before drinking. This advice is in accordance with the Law on Hygiene, Disease Prevention and Health Promotion No 01/NA of 10 April 2001, which states that domestic water supply for daily use is not required to be readily drinkable but would normally have to be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

NNP1 Landfill and Houay Soup Landfill: all parameters monitored (except lead) complied with the standard. The monitoring results can be found in Appendix 5.

4.5.6 Gravity Fed Water Supply (GFWS) Monitoring

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

FIGURE 4-17: 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 4-20***. The full set of data is presented in ***Appendix 5.5***

TABLE 4-20*: THE GFWS MONITORING RESULT FROM JANUARY TO MARCH 2018*

Date	Parameter (Unit)	Site Name	Tha Heua Village	Hat Gnuin Village	Phouhomxay Village		
		Station	WTHH02	WHGN02	WPHX01	WPHX02	WPHX03
		Guideline					
09-Jan-18	E. Coli Bacteria (MPN/100 ml)	0	79	79	13	49	
13-Feb-18		0	34	11	34	41	
20-Mar-18		0	9.3	79	33	79	33
09-Jan-18	Faecal coliform (MPN/100 ml)	0	79	79	13	49	
13-Feb-18		0	34	11	34	41	
20-Mar-18		0	9.3	79	33	49	33

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

Hat Gniun Village (WHGN02): all parameters complied with the National Drinking Water Standards, except the faecal coliform and E.Coli bacteria.

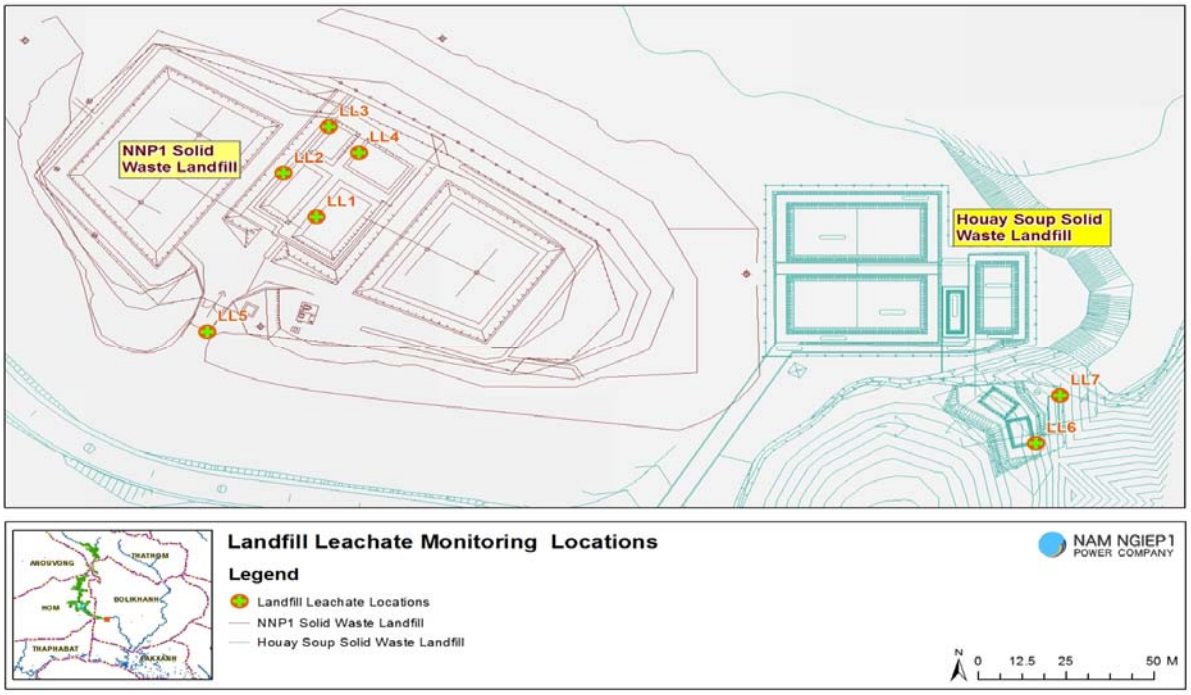
Phouhomxay Village (WPHX01, WPHX02 & WPHX03): all parameters complied with the National Drinking Water Standards, except the faecal coliform and E.Coli bacteria.

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.

4.5.7 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 4-18***.

FIGURE 4-18: *LANDFILL LEACHATE MONITORING LOCATION*



The monitoring results for Q1 2018 indicated compliance with the applicable standards for all monitored parameters. The monitoring data can be found in ***Appendix 5.6***

4.5.8 Air Quality (Dust) Monitoring

Ambient Air Quality in the Host Villages

The ambient air quality monitoring for dust (measured as PM_{10} – 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.

The monitoring stations are displayed in ***Figure 4-19*** and the results are summarized in Error! Reference source not found.**.** The measured concentrations of PM_{10} in the ambient air generally complied with the standard during the monitored period; however, there were some minor exceedances which are unusual and believed to have been caused by slash-and burned activities in the area near the villages**.**

FIGURE 4-19: *NOISE AND DUST MONITORING LOCATIONS AT THE CONSTRUCTION SITES AND NEARBY VILLAGES*

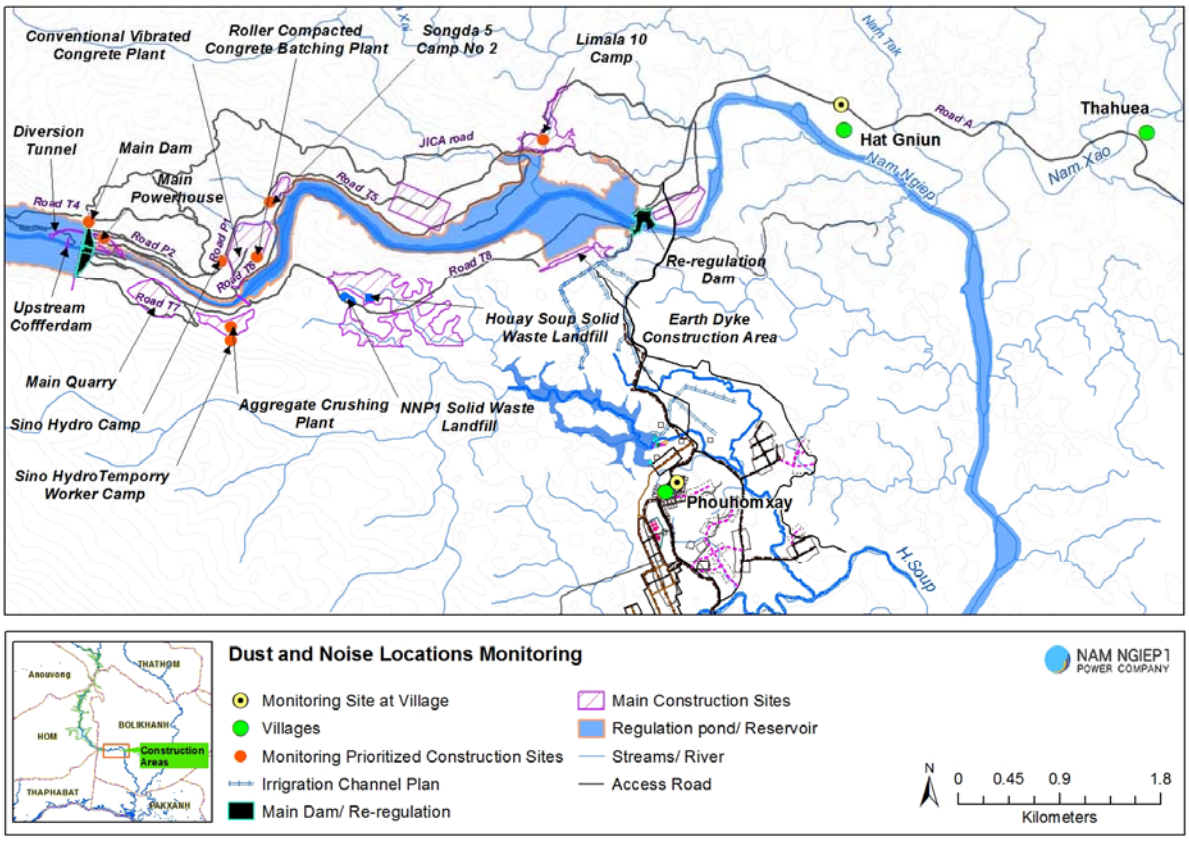


TABLE 4-21: *RESULTS OF AIR QUALITY (DUST) MONITORING AT THE VILLAGES NEAR THE PROJECT CONSTRUCTION SITES DURING JANUARY TO MARCH 2018*

Site Name	Hat Gniun Village								
Start Time	15/Jan/18 18:00	16/Jan/18 18:01	17/Jan/18 18:01	05/Feb/18 18:00	06/Feb/18 18:01	07/Feb/18 18:01	05/Mar/18 18:00	06/Mar/18 18:01	07/Mar/18 18:01
End Time	16/Jan/18 18:00	17/Jan/18 18:00	18/Jan/18 18:00	06/Feb/18 18:00	07/Feb/18 18:00	08/Feb/18 18:00	06/Mar/18 18:00	07/Mar/18 18:00	08/Mar/18 18:00
Average Data Record - 24 hours	0.04	0.05	0.06	0.03	0.03	0.03	0.18	0.14	0.12
Guideline	***0.12***	***0.12***	***0.12***	***0.12***	***0.12***	***0.12***	***0.12***	***0.12***	***0.12***

Site Name	Phouhomxay Village								
Start Time	23/Jan/18 18:00	24/Jan/18 18:00	25/Jan/18 18:00	19/Feb/18 18:00	20/Feb/18 18:00	21/Feb/18 18:00	20/Mar/18 18:00	21/Mar/18 18:00	22/Mar/18 18:00
End Time	24/Jan/18 18:00	25/Jan/18 18:00	26/Jan/18 18:00	20/Feb/18 18:00	21/Feb/18 18:00	22/Feb/18 18:00	21/Mar/18 18:00	22/Mar/18 18:00	23/Mar/18 18:00
Average Data Record - 24 hours	0.066	0.065	0.067	0.171	0.155	0.061	0.10	0.09	0.13
Guideline	***0.12***	***0.12***	***0.12***	***0.12***	***0.12***	***0.12***	***0.12***	***0.12***	***0.12***

Project Construction Sites

During Q1 2018, dust (PM_{10}) monitoring was carried out for 24 hours consecutively monthly at eight priority construction sites and camps to assess possible impact on workers' health. The results summarized in ***Table 4-22*** indicate compliance with the standard (0.12 mg/m^3

PM_{10}) for most of construction sites, except at the Aggregate Crushing Plant, Sino Hydro Worker Camp and Song Da 5 Camp No.2 (for March 2018). All staff were advised to wear dust masks while working in these areas.

TABLE 4-22: DUST MONITORING RESULTS AT THE CONSTRUCTION SITES DURING JANUARY TO MARCH 2018

Site Name	**Aggregate Crushing Plant**		
Averaging Period	24 Hours	24 Hours	24 Hours
Start Time	19/Jan/18 18:00	23/Feb/18 18:00	19/Mar/18 18:00
End Time	20/Jan/18 18:00	24/Feb/18 18:00	20/Mar/18 18:00
Average Data Record -24h	0.048	0.023	0.199
Guideline	***0.12***	***0.12***	***0.12***

Site Name	**RCC Plant**		
Averaging Period	24 Hours	24 Hours	24 Hours
Start Time	10/Jan/18 18:00	14/Feb/18 18:00	16/Mar/18 18:00
End Time	11/Jan/18 18:00	15/Feb/18 18:00	17/Mar/18 18:00
Average Data Record -24h	0.026	0.104	0.091
Guideline	***0.12***	***0.12***	***0.12***

Site Name	**Main Dam**		
Averaging Period	24 Hours	24 Hours	24 Hours
Start Time	02/Jan/18 18:00	27/Feb/18 18:00	01/Mar/18 18:00
End Time	03/Jan/18 18:00	28/Feb/18 18:00	02/Mar/18 17:30
Average Data Record -24h	0.021	0.039	0.089
Guideline	***0.12***	***0.12***	***0.12***

Site Name	**Sino Hydro Temporary Worker Camp**		
Averaging Period	24 Hours	24 Hours	24 Hours
Start Time	22/Jan/18 18:00	26/Feb/18 18:00	27/Mar/18 18:00
End Time	23/Jan/18 18:00	27/Feb/18 17:30	28/Mar/18 17:30
Average Data Record -24h	0.047	0.034	0.136
Guideline	***0.12***	***0.12***	***0.12***

Site Name	**Song Da5 Camp No.2**		
Averaging Period	24 Hours	24 Hours	24 Hours
Start Time	08/Jan/18 18:00	13/Feb/18 18:30	12/Mar/18 18:00
End Time	09/Jan/18 18:00	14/Feb/18 17:30	13/Mar/18 18:00
Average Data Record -24h	0.037	0.076	0.187
Guideline	***0.12***	***0.12***	**0.12**

Site Name	**Lilama 10 Camp**		
Averaging Period	24 Hours	24 Hours	24 Hours
Start Time	04/Jan/18 18:00	12/Feb/18 18:00	02/Mar/18 18:00
End Time	05/Jan/18 18:00	13/Feb/18 18:00	03/Mar/18 18:00
Average Data Record -24h	0.022	0.059	0.118
Guideline	***0.12***	***0.12***	**0.12**

Site Name	**Main Powerhouse**		
Averaging Period	24 Hours	24 Hours	24 Hours
Start Time	02/Jan/18 18:00	27/Feb/18 18:00	01/Mar/18 18:00
End Time	03/Jan/18 18:00	28/Feb/18 18:00	02/Mar/18 17:30
Average Data Record -24h	0.021	0.039	0.089
Guideline	***0.12***	***0.12***	**0.12**

Site Name	**Sino Hydro Camp**		
Averaging Period	24 Hours	24 Hours	24 Hours
Start Time		01/Feb/18 18:00	15/Mar/18 18:00
End Time		02/Feb/18 18:00	16/Mar/18 17:30
Average Data Record -24h		0.059	0.085
Guideline		***0.12***	**0.12**

4.5.9 Noise Monitoring

Nearby Communities

Noise monitoring was carried out in Hat Gniun Village and Phouhomxay Village for 72 consecutive hours. The recorded values were measured against the standards, including maximum average noise levels for daytime during 06:00-18:00, evening time during 18:00-22:00 and night time during 22:00-06:00.

The results (see ***Table 4-23***) show that the noise levels at the villages were within the allowable maximum peak value at 115 dB(A) as well as below the average noise standards.

TABLE 4-23: **NOISE MONITORING RESULTS FROM OCTOBER TO DECEMBER 2017 AT THE HOST VILLAGES**

Hat Gnuin Village -Noise Monitoring 72 consecutive hours - January 2018									
Noise Level (dB)	**15-16/January/18**			**16-17/January/18**			**17-18/January/18**		
	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	64.00	62.40	67.60	66.90	65.10	70.20	68.70	63.40	65.90
Guideline Max	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	40.43	38.65	44.50	42.96	42.84	45.31	41.63	39.33	42.19
Guideline Averaged	***55***	***45***	***55***	***55***	***45***	***55***	***55***	***45***	***55***
Hat Gnuin Village -Noise Monitoring 72 consecutive hours - Februay 2018									
Noise Level (dB)	**05-06/February/18**			**06-07/February/18**			**07-08/February/18**		
	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	70.20	62.40	67.10	60.10	54.50	66.30	65.70	63.20	70.20
Guideline Max	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	41.46	35.32	45.18	41.62	37.65	43.92	40.55	41.06	43.34
Guideline Averaged	***55***	***45***	***55***	***55***	***45***	***55***	***55***	***45***	***55***
Hat Gnuin Village -Noise Monitoring 72 consecutive hours - March 2018									
Noise Level (dB)	**05-06/March/18**			**06-07/March/18**			**07-08/March/18**		
	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	54.40	54.20	66.60	56.20	64.80	64.80	65.20	58.90	62.60
Guideline Max	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	40.04	39.27	42.81	42.37	38.44	41.92	43.80	37.40	46.92
Guideline Averaged	***55***	***45***	***55***	***55***	***45***	***55***	***55***	***45***	***55***

Phouhomxay Village -Noise Monitoring 72 consecutive hours - January 2018									
Noise Level (dB)	**23-24/January/18**			**24-25/January/18**			**25-26/January/18**		
	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	57.30	62.00	88.20	60.70	65.50	78.40	62.30	62.30	68.30
Guideline Max	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	41.16	38.23	42.03	45.55	42.52	45.12	41.16	40.11	41.05
Guideline Averaged	***55***	***45***	***55***	***55***	***45***	***55***	***55***	***45***	***55***
Phouhomxay Village -Noise Monitoring 72 consecutive hours - February 2018									
Noise Level (dB)	**19-20/February/18**			**20-21/February/18**			**21-22/February/18**		
	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	52.70	52.70	63.60	66.90	67.30	71.20	56.60	56.80	62.20
Guideline Max	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	40.35	37.80	40.58	45.33	40.30	43.02	41.68	40.87	41.86
Guideline Averaged	***55***	***45***	***55***	***55***	***45***	***55***	***55***	***45***	***55***
Phouhomxay Village -Noise Monitoring 72 consecutive hours - March 2018									
Noise Level (dB)	**20-21/March/18**			**21-22/March/18**			**22-23/March/18**		
	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	52.70	52.70	63.60	66.90	67.30	71.20	56.60	56.80	62.20
Guideline Max	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	40.35	37.80	40.58	45.33	40.30	43.02	41.68	40.87	41.86
Guideline Averaged	***55***	***45***	***55***	***55***	***45***	***55***	***55***	***45***	***55***

Project Camps and Construction Sites

During Q1 2018, noise monitoring was conducted at the Aggregate Crushing Plant, RCC Plant, Sino Hydro camp and Song Da 5 camp No.2, Main Dam, Sino Hydro temporary worker camp, Lilama10 camp and Main Powerhouse to assess possible impacts on workers' health as well as to estimate any potential impact on the ambient noise levels in nearby communities.

The result shown that all maximum peak noise levels were within the National Standard. However, the average noise level during 22:01-06:00 at Sino Hydro temporary worker camp (January 2018), and the average noise level during 18:01-22:00, 22:01-06:00 and 06:01-18:00 at Main Powerhouse (during January and February 2018) were higher than the National standard. All staff were advised to wear ear mugs while working in these areas.

TABLE 4-24: NOISE MONITORING RESULTS FOR PROJECT CONSTRUCTION SITES FROM JANUARY TO MARCH 2018

Site Name	Aggregate Crushing Plant - Noise Monitoring (dB (A))								
Noise Level (dB)	19-20/Jan/18		20/Jan/18	23-24/Feb/18		24/Feb/18	19-20/Mar/18		20/Mar/18
	18:01 - 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	79.2	59.6	80.8	55.3	48.2	69.5	51.1	61.8	77.3
Guideline Max	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	46.51	45.60	46.33	41.24	39.79	50.86	39.08	42.51	59.43
Guideline Averaged	***70***	***70***	***70***	***70***	***70***	***70***	***70***	***70***	***70***

Site Name	RCC Plant								
Noise Level (dB)	10-11/Jan/18		11/Jan/18	14-15/Feb/18		15/Feb/18	16-17/Mar/18		17/Mar/18
	18:00 - 22:00	22:01 - 06:00	06:01 - 18:00	18:00 - 22:00	22:01 - 06:00	06:01 - 17:59	18:00 - 22:00	22:01 - 06:00	06:01 - 18:00
Maximum Value Recorded	49.40	53.60	65.70	66.50	56.40	74.50	55.4	58.2	65.9
Guideline Max	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	39.72	37.98	48.45	48.72	43.50	40.78	49.89	46.77	55.66
Guideline Averaged	***70***	***70***	***70***	***70***	***70***	***70***	***70***	***70***	***70***

Site Name	Main Dam								
Noise Level (dB)	02-03/Jan/18		03/Jan/18	27-28/Feb/18		28/Feb/18	01-02/Mar/18		02/Mar/18
	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 - 22:01	22:01 - 06:01	06:01 - 18:01
Maximum Value Recorded	57.3	60.1	63	68.1	67.7	63.9	66.5	61.6	65.4
Guideline Max	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	50.59	49.43	50.55	55.52	55.21	54.27	52.59	53.06	51.51
Guideline Averaged	***70***	***70***	***70***	***70***	***70***	***70***	***70***	***70***	***70***

Site Name	Sino Hydro Temporary Worker Camp								
Noise Level (dB)	30-31/Jan/18		31/Jan/18	26-27/Feb/18		27/Feb/18	27-28/Mar/18		28/Mar/18
	18:00 - 22:01	22:01 - 06:01	06:01 - 18:01	18:00 - 22:02	22:01 - 06:02	06:01- 18:01	18:00 - 22:03	22:01 - 06:00	06:01 - 18:01
Maximum Value Recorded	65	63.6	64.4	59.7	51.1	68.3	71.2	46.6	62.3
Guideline Max	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	56.07	55.98	55.49	46.21	41.85	52.61	42.99	38.57	49.65
Guideline Averaged	***70***	***50***	***70***	***70***	***50***	***70***	***70***	***50***	***70***

Site Name	Song Da5 Camp No.2								
Noise Level (dB)	08-09/Jan/18		09/Jan/18	13-14/Feb/18		14/Feb/18	12-13/Mar/18		13/Mar/18
	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 - 22:01	22:01 - 06:01	06:01 - 18:01
Maximum Value Recorded	68.10	78.80	86.60	54	59	67.1	65.5	60	76.5
Guideline Max	115	115	115	115	115	115	***115***	***115***	***115***
Average Data Recorded	46.02	48.96	52.80	50.97	45.70	44.08	53.53	47.69	45.95

Site Name	Song Da5 Camp No.2								
Noise Level (dB)	08-09/Jan/18		09/Jan/18	13-14/Feb/18		14/Feb/18	12-13/Mar/18		13/Mar/18
	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 - 22:01	22:01 - 06:01	06:01 - 18:01
Guideline Averaged	***70***	***50***	***70***	***70***	***50***	***70***	***70***	***50***	***70***

Site Name	Lilama 10 Camp								
Noise Level (dB)	04-05/Jan/18		05/Jan/18	12-13/Feb/18		13/Feb/18	02-03/Mar/18		03/Mar/18
	18:00 - 22:01	22:01 - 06:01	06:01 - 17:31	18:00 - 22:02	22:01 - 06:02	06:01 - 18:00	18:00 - 22:03	22:01 - 06:03	06:01 - 18:01
Maximum Value Recorded	63.6	52.8	65	64.4	62.2	69.4	71.3	52.9	71.4
Guideline Max	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	41.18	41.33	43.78	47.19	37.54	46.41	46.28	37.26	44.66
Guideline Averaged	***70***	***50***	***70***	***70***	***50***	***70***	***70***	***50***	***70***

Site Name	Main Powerhouse								
Noise Level (dB)	27-28/Jan/18		28/Jan/18	09-10/Feb/18		10/Feb/18	28-29/Mar/18		29/Mar/18
	18:00 - 22:01	22:01 - 06:01	06:01 - 17:59	18:00 - 22:02	22:01 - 06:02	06:01 - 18:00	18:00 - 22:03	22:01 - 06:03	06:01 - 18:01
Maximum Value Recorded	89	89	85.5	77.2	83.5	84.7	82.7	62.8	86.6
Guideline Max	*115*	*115*	*115*	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	69.49	69.29	72.45	67.91	73.20	73.84	55.21	46.83	64.48
Guideline Averaged	***70***	***70***	***70***	***70***	***70***	***70***	***70***	***70***	***70***

Site Name	Sino Hydro Camp								
Noise Level (dB)				01-02/Feb/18		02/Feb/18	15-16/Mar/18		16/Mar/18
	18:00 - 22:01	22:01 - 06:01	06:01 - 17:31	18:00 - 22:02	22:01 - 06:02	06:01 - 18:00	18:00 - 22:03	22:01 - 06:03	06:01 - 18:01
Maximum Value Recorded				58.9	60.2	61.4	57.9	75.7	64.3
Guideline Max				***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded				42.24	42.60	45.11	47.12	49.32	50.83
Guideline Averaged				***70***	***50***	***70***	***70***	***50***	***70***

4.5.10 Vibration

Structural damage from road construction activity (e.g. vibratory rollers) and ancillary activity (e.g. blasting at the quarries) are unlikely to impact the human health and surrounded environment given the long distance between public infrastructure and construction areas.

5 WATERSHED AND BIODIVERSITY MANAGEMENT

5.1 WATERSHED MANAGEMENT

5.1.1 Preparation of Watershed Management Plan

The Nam Ngiep 1 Watershed Management Plan is close to completion. The final review and approval of the plan will take place once the Watershed and Reservoir Protection Committee (WRPC) and its secretariat (the Watershed and Reservoir Protection Office) have been reconstituted. The plan has been revised to include biodiversity mitigation measures to achieve no net loss of biodiversity due to likely impacts of the Project.

5.1.2 Preparation of Provincial Regulation for the Watershed Management

The revised provincial watershed management regulations have been reviewed by relevant GOL offices in February and March 2018 and the final presentation by the technical committee is expected in April 2018 prior to submission to the Provincial Justice Department for further review prior to final approval by the Provincial Assembly.

5.2 BIODIVERSITY OFFSET MANAGEMENT

5.2.1 Preparation of Biodiversity Offset Management Plan

The preparation of NNP1 Biodiversity Offset Management Plan (BOMP) continues with several studies/surveys started since January 2018. At the end of February 2018, the land use and natural resources survey and the threat assessment survey in Nam Chouane – Nam Xang (NCNX) offset site were completed. The Totally Protected Zone (TPZ) survey, aquatic biodiversity survey, and Forest Classification and Habitat Mapping in NCNX offset site were completed in March 2018. The last survey on herpetology in NNP1 Watershed will be started in April 2018.

Following disbursement of funds from NNP1PC to the implementation of Pre-BOMP activities in March 2018, the patrolling activities in the offset site continued. Two patrolling teams with a total of 18 people conducted forest patrolling in both Xaychamphone and Viengthong District.

The patrolling team recorded evidences of threats in the area include hunting camps, fence wire snares, logging track, and fishing and land clearance outside the allocated area under land use plan. The patrolling team destroyed the hunting camps, collected and destroyed the fence wire snare, provided the written warning for the hunter, and educated the people who are doing practices outside the allocated land use. All detailed information were recorded into the SMART database.

6 BIOMASS CLEARANCE

As of 31 March 2018, a total of 1,547.31 ha out of 1,640 ha was fully cleared. The remaining area of 93.44 ha is expected to be fully completed in April 2018. The certification of complete clearance work by the Ministry of Natural Resource and Environment (MONRE) is expected by the end of April 2018 prior to reservoir impounding. ***Table 6-1*** summarizes cumulative progress.

TABLE 6-1: *BIOMASS CLEARANCE PROGRESS IN EACH PRIORITY AREA AS OF 31 MARCH 2018*

Target Area		Progress as of 31 March 2018	
Block	**Total area to be cleared (Ha)**	**Total area in progress (Ha)**	**100% completed within the total area in progress (Ha)**
B1	109.24	109.24	105.00
B2	158.63	158.63	152.19
B3	80.35	80.35	80.35
B4	163.74	163.74	163.74
B5	340.14	340.14	333.22
B6	31.92	31.92	31.92
B7	39.65	39.65	39.65
B8	37.61	37.61	37.61

Target Area		Progress as of 31 March 2018	
Block	**Total area to be cleared (Ha)**	**Total area in progress (Ha)**	**100% completed within the total area in progress (Ha)**
B9	52.75	52.75	48.58
B10	269.10	269.10	197.43
B11	89.98	89.98	89.98
B12	64.11	64.11	64.11
B13	101.24	101.24	101.24
B14	43.33	43.33	43.33
B15	43.73	43.73	43.73
B16	3.32	3.32	3.32
B17	7.96	7.96	7.96
B18	3.95	3.95	3.95
Total	**1,640.75**	**1,640.75**	**1,547.31**

7 FISHERY MONITORING

The 5 species that dominated the fish catch by weight in Q1 2018 are listed in ***Table 7-1.*** This includes one species that is classified as Vulnerable (VU) according to the IUCN Red List of Threatened Species[14], and three species that are classified as Least Concern (LC) and one species that is classified as Not Evaluated.

TABLE 7-1 FISH SPECIES DOMINATING THE FISH CATCH IN Q1 2018

Species	Fish Catch Q1 2018 (kg)	IUCN Red List Classification
Scaphiodonichthys acanthopterus	229.4	LC
Channa striata	176.4	LC
Clarias batrachus	129.9	LC
Cyprinus carpio	94.0	VU
Oreochromis niloticus	82.7	NE

The recorded catch of threatened species (IUCN Red List classification) in the Q1 2018 fish catch is presented in ***Table 7-2***. The list includes three Vulnerable species and two Near Threatened species.

[14] 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 7-2 THREATENED SPECIES OF THE Q1 2018 FISH CATCH

Species	Fish Catch Q1 2018 (kg)	IUCN Red List Classification
Cyprinus carpio	94.0	VU
Onychostoma gerlachi	56.1	NT
Scaphognathops bandanensis	9.0	VU
Cirrhinus cirrhosus	2.1	VU
Ompok bimaculatus	1.2	NT
Syncrossus beauforti	0.6	NT
Hypophthalmichthys molitrix	0.4	NT

The total recorded monthly fish catch from July 2015 to March 2018 for the downstream, upstream and Mekong control group fishing households involved in the monitoring programme is presented in ***Figure 7-1***. 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 7-1 TOTAL RECORDED FISH CATCH 2015-2018

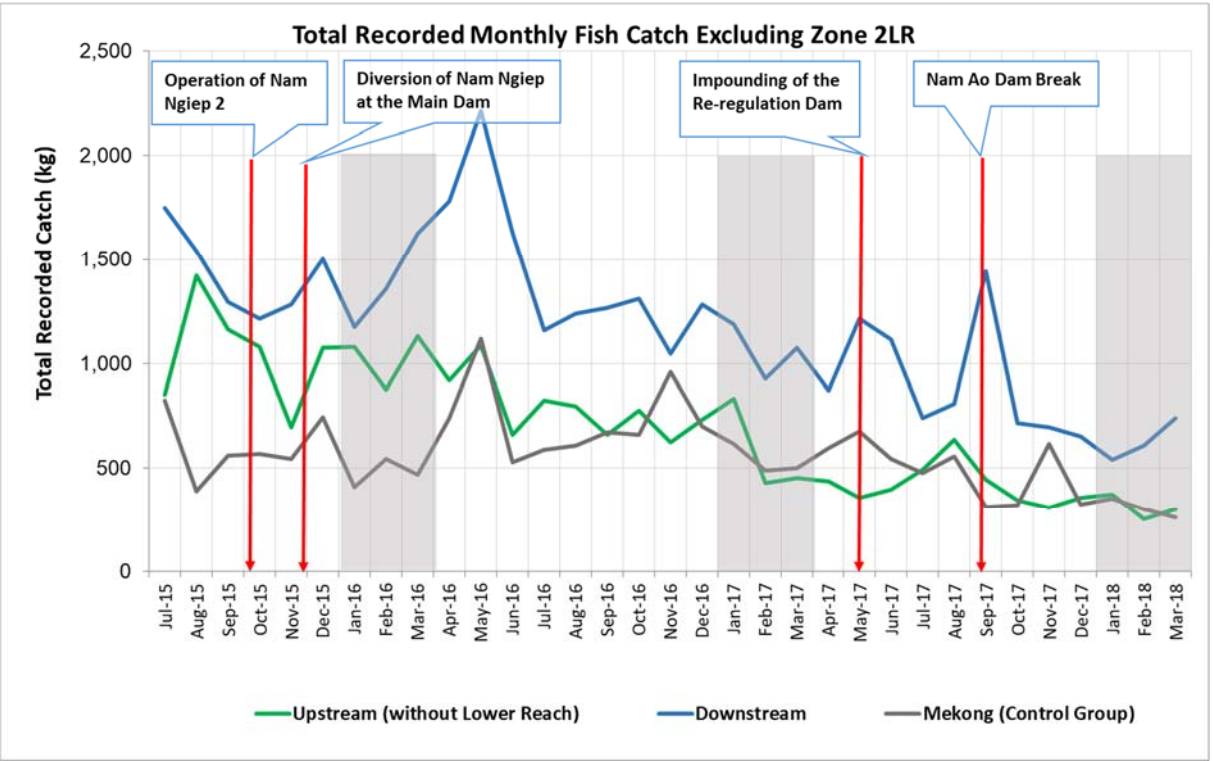
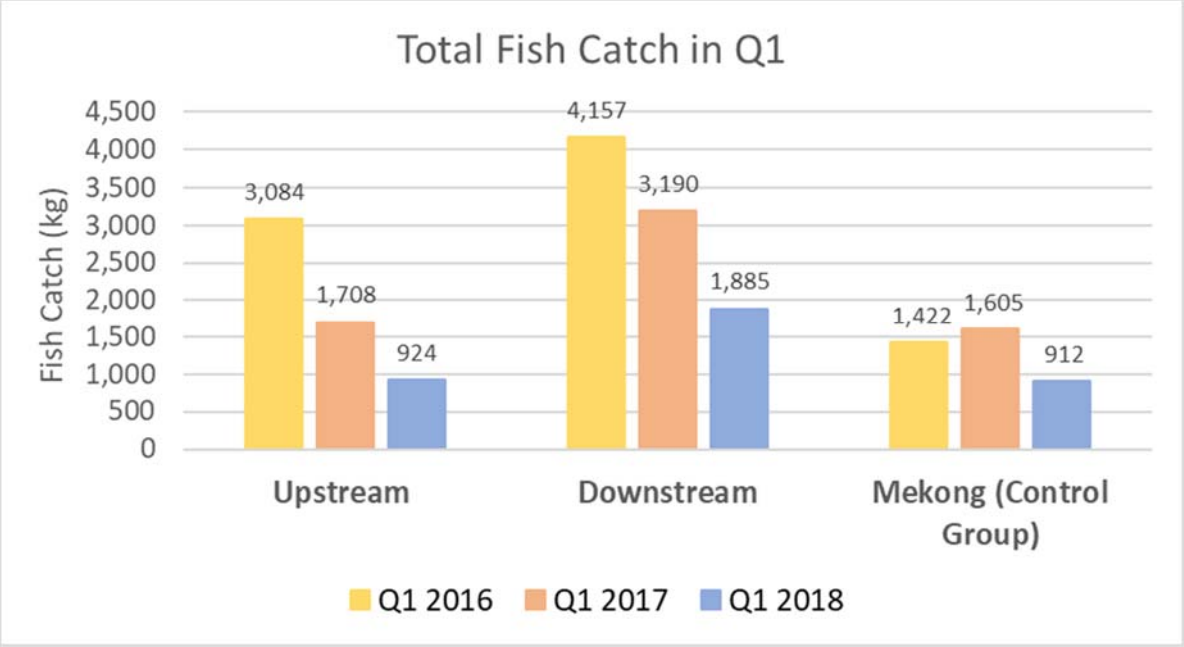


Table 7-3 and ***Figure 7-2*** show the total recorded fish catch for Q1 2016, Q1 2017 and Q1 2018 by the upstream (excluding Zone 2LR), downstream and the Mekong control group fishing households. Both the monthly data in ***Figure 7-1*** and the quarterly data in ***Table 7-3*** indicate a declining trend in the total amount of fish caught both upstream and downstream the project. The total recorded fish catch for Q4 2015, Q4 2016 and Q4 2017 reported in the Q4 2017 Environment Monitoring Report shows a similar declining trend.

TABLE 7-3 TOTAL RECORDED FISH CATCH IN Q1 BY UPSTREAM (EXCLUDING ZONE 2LR), DOWNSTREAM AND BY THE MEKONG CONTROL GROUP FISHING HOUSEHOLDS

	Q1 2016 (kg)	Q1 2017 (kg)	Q1 2018 (kg)
Upstream	3,084	1,708	924
Downstream	4,157	3,190	1,885
Mekong Control Group	1,422	1,605	912

FIGURE 7-2 TOTAL RECORDED FISH CATCH IN Q1 BY UPSTREAM (EXCLUDING ZONE 2LR), DOWNSTREAM AND MEKONG CONTROL GROUP FISHING HOUSEHOLDS

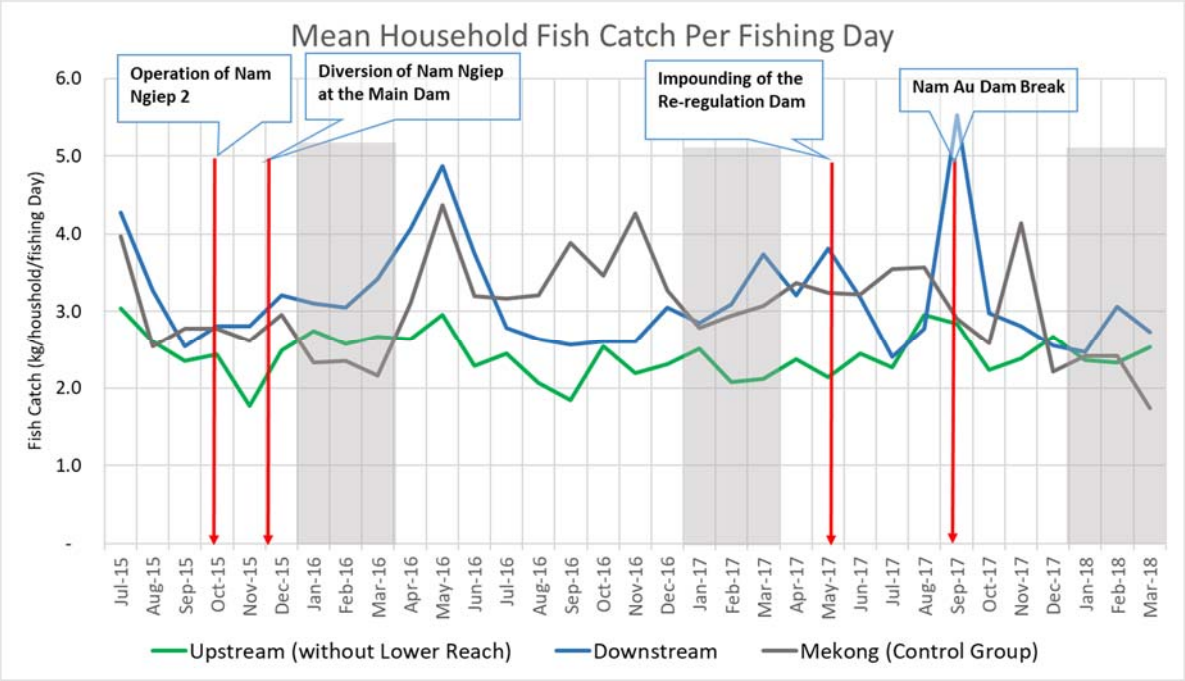


However, when also considering the number of fishing households involved in the monitoring programme and the number of fishing days, the picture is somewhat different. This is presented in *Error! Reference source not found.* where the mean household fish catch per fishing day for Q1 2016, Q1 2017 and Q1 2018 in the upstream (excluding Zone 2LR), downstream and the Mekong Control Group are displayed, and in ***Figure 7-3***, which shows the mean monthly household fish catch per fishing day from July 2015 to March 2018.

TABLE 7-4 MEAN HOUSEHOLD FISH CATCH PER FISHING DAY IN Q1 2016, Q1 2017 AND Q1 2018

Fishing Zone	Q1 2016	Q1 2017	Q1 2018
Upstream (Excluding Zone 2LR)	2.67	2.28	2.41
Downstream	3.20	3.18	2.74
Mekong (Control Group)	2.28	2.92	2.18

FIGURE 7-3 MEAN MONTHLY HOUSEHOLD FISH CATCH PER FISHING DAY (EXCLUDING ZONE 2LR)



Both the number of fishing households involved in the programme and the number of fishing days have decreased over the period; and therefore, based on a rough initial interpretation the fish-catch-per-fishing-day data appears rather constant.

Further statistical analyses will be carried out when longer time series become available and the data and information from the monitoring programme will be studied to identify the possible reasons for the decrease in fishing households and fishing days.

8 EXTERNAL MONITORING

8.1 LENDERS' TECHNICAL ADVISER

The Lenders' Technical Adviser (LTA) carried out a mission to the Project from 27 February to 02 March 2018. With respect to environmental matters, the main comments and recommendations of the LTA focused on biomass removal and decommissioning and rehabilitation.

In terms of biomass removal, the LTA agreed with the steps taken by NNP1PC to reach the biomass removal target in time before start of impounding. The LTA further recommended to make sure that workers are timely paid and to focus the activities in the two more significant blocks. The LTA also recommended that the Company should prepare a plan to deal with the risk that the biomass removal targets could not be fully reached by the end of April 2018. Such plan should include proper ways to collect floating debris and logs once the reservoir is full.

With respect to decommissioning and rehabilitation, the LTA noted that the ESMMP-CP 2017 has been updated to include decommissioning and rehabilitation, and that NNP1PC has prepared a guideline for camp decommissioning/demolition. NNP1PC is in process of completing a separate Decommissioning and Rehabilitation Plan that will define, in concept, the necessary decommissioning and rehabilitation measures and identified the sites where rehabilitation plans shall be developed. The LTA further recommended that the plan should

map all the non-permanent structures/facilities, demarcate the areas that will need rehabilitation, and determine the relevant decommissioning and rehabilitation dates.

8.2 INDEPENDENT MONITORING AGENCY

The Independent Monitoring Agency (IMA) undertook their quarterly monitoring mission to the Project from 05-07 March 2018. The IMA checked 43 environmental obligations and did not find any non-compliances. However, the IMA identified 11 partial compliances mainly related to delays in biomass removal, effluents from camps, and spoil disposal. The full monitoring report is available on NNP1PC's website.

APPENDICES

APPENDIX 1: STATUS OF SS-ESMMPS AND WORKING DRAWINGS OF THE CAMPS' WASTE WATER TREATMENT SYSTEMS REVIEW AND APPROVAL DURING OCTOBER TO DECEMBER, 2017

No	Site name	List of ESMMP and SS-ESMMP	Subcontractor	Approval Status by EMO/NNP1 (date)	Detailed Site Information	Monthly Construction & Operation Status
Electrical and Mechanical Works (Hitachi-Mitsubishi Hydro)						
1	Main Dam	SS-ESMMP for Construction of Installation Work of 230 kV substation equipment for Main Power Station	LILAMA10 and HPC Contractors	No further comments on 17 October 2017	Installation Work of 230 kV substation equipment	On-going
2	Re-regulating Dam	SS-ESMMP for Construction of Installation Work of 115 kV substation equipment for Re-regulation Power Station	LILAMA10 and HPC Contractors	No further comments on 17 October 2017	Installation Work of 115 kV substation equipment	On-going
3	Main Dam	SS-ESMMP for Construction of Main Transformer for Main Power Station	LILAMA10 and HPC Contractors	No further comments on 17 October 2017	Warehouse construction	On-going
4	Main Dam	SS-ESMMP for Installation of Turbine for Main Power	HPC and LILAMA10 Contractors	No further comments on 17 October 2017	Installation of Turbine	On-going

5	Re-regulating Dam	SS-ESMMP for Electrical Work for Re-regulation Power Station	HPC and LILAMA10 Contractors	No further comments on 27 November 2017	Electrical Work for Re-regulation Power Station	On-going
6	Main Dam	SS-ESMMP for Electrical Work for Main Power Station	HPC and LILAMA10 Contractors	No further comments on 27 November 2017	Electrical Work for Re-regulation Power Station	On-going
7	Re-regulating Dam	SS-ESMMP for Assembly of Stator in Re-regulation Power Station.	HPC and LILAMA10 Contractors	No further comments on 11 December 2017	Assembly of Stator	On-going
8	Re-regulating Dam	SS-ESMMP for Assembly and Installation of Distributor for in Re-regulation Power Station.	HPC and LILAMA10 Contractors	No further comments on 11 December 2017	Assembly and Installation of Distributor	On-going
9	Main dam to Re-regulating dam	SS-ESMMP for Supply and Installation of 22kV Transmission Line to Conduct Electricity from the Re-regulation Power Station to the Main Power Station and Construction of the Foundation for the Diesel Generator	SES Electrical Installation CO., Ltd	No further comments on 26 December 2017	Supply and Installation of 22kV Transmission Line to Conduct Electricity	On-going
Civil Works Contractor (Obayashi Corporation)						

10	Main Dam	SS-ESMMP for Building Construction at Main Powerhouse	Civil Works Contractor (Obayashi Corporation)	No further comments on 04 October 2017	Building Construction at Main Powerhouse	On-going
11	RCC Plant	SS-ESMMP for Operation and Maintenance Works of RCC Plant	Song Da 5 Subcontractor	No further comments on 18 October 2017	Operation and Maintenance Works RCC plant sand and aggregate washing sedimentation control and management	On-going
12	Aggregate Plant	DWP & Appendix for Aggregate Crushing Plant	Sino Hydro Contractor	No objection with comments on 16 November 2017	Sediment control system improvement	Completed
13	Main Dam	DWP & SS-ESMMP for 2nd River Diversion & Diversion Tunnel Closure	No information	On hold Only a cover letter was received and the Contractor is to send a soft copy document to TD/ESD	WWTS improvement	Completed
Phouhomxay (NNP1PC-ESD Contractors)						
14	2UR Zone, Thathom District, Xaysomboun Province	SS-ESMMP for Construction of Tractor Road No: 04 & 05 Zone 2UR	Souksana Development Co., Ltd	No further comments on 17 October 2017	Tractor road construction	On-going

15	Houay Soup Landfill	SS-ESMMP for Houay Soup Landfill Operation	Soksaykham Construction Co., Ltd	No objection with comments on 14 November 2017	Houay Soup landfill operation	On-going
16	Phouhomxay	SS-ESMMP for Construction of Internal Road 3.1 km in HSRA	DS Road &Bridge Construction Co., Ltd	No further comments on 15 November 2017	Internal road construction	Completed
17	2UR Zone, Thathom District, Xaysomboun Province	SS-ESMMP for Construction of Access Road No.1 & No. 2 to Agricultural Land at Zone 2UR	LDC &PT-XCC	No objection with no further comments on 16 November 2017	Internal road construction	On-going
18	Phouhomxay	SS-ESMMP for Construction of Internal Road 1.73 km in HSRA	KCP Construction Co., Ltd	No further comments on 27 November 2017	Internal road construction	Completed
19	Phouhomxay	SS-ESMMP for Construction of Tractor Road 2.7km at HSRA.	VRC Co., Ltd	No further comments on 31 November 2017	Tractor road construction	Completed
	Project Zone 4	SS-ESMMP for Water Supply Installation for three villages (zone4) downstream of NNP1 Project	KPC Co., Ltd	No further comments on 31 November 2017	Water Supply Installation	On-going
20	2UR Zone, Thathom District,	SS-ESMMP for Construction of Access Road No.3 &	Soukxana Development Co., Ltd	No further comments on 15 December 2017	Construction of Bus Stop Stations and Market Building	On-going

	Xaysomboun Province	No.6 to Agricultural Land at Zone 2UR				

APPENDIX 2: ENVIRONMENTAL MONITORING CORRECTIVE ACTIONS Q1-2018

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
ONC_OC-0232	30.08.2016	Re-regulation Dam Borrow Pit (Borrow Pit Area at Corner of P1 & P1A Road)	The borrow pit was operated without adequate environmental management actions: - The slope of the cut had no berm and cut-off drains; - Lack of closure plan for the borrow pit.	A Response to Owner's comment was submitted on 03 March 2018. However, actual work did not properly reflect on the Owner's comments.	27.09.2016	15.02.2018	Pending
ON_INFRA-0001	07.09.2017	Temporary Accommodation for 44 HH from 2LR at HSRA	The decommissioning of a temporary accommodation for resettlement households from 2LR was in complete. The bamboo building structure, toilet septic tanks and waste water ponds were not removed and sanitised.	Decommissioning and clean-up work is ongoing and expected to be completed by early April 2018.	19.09.2017	20.03.2018	Pending
ONC_VSP-0009	09.01.2018	VSP camp	Electricity generator was placed on the bare ground without oil spill protection tray. As a result, oil spillage has occurred during refuelling which caused soil contamination.	- Clean-up contaminated soil from the refuelling area immediately and store in the hazardous material storage area	23.01.2018	23.01.2018	Resolved

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
				at VSP camp for proper disposal/ elimination; - Provide oil spill protection tray and the tray must be always used during the operation of electricity generator.			
ONC_SXN-0001	10.11.2017	SXN Camp	- Unsecure camp and facilities. Plastic sheet was used as the camp roofing and wall material. This was far lower standard than what has been proposed in the DWP and SSESMMP; - No drainage line and sediment pond to remain waste water from cooking and washing activities (grey water from cooking area was discharged directly to Nam Ngiep river). - Inadequate housekeeping and	- Collect, segregate the disposed waste properly by following the waste management sub-plan as proposed in the contractor SS-ESMMP; - Improve the camp and facilities as per proposed Appendix 4 of the contractor DWP & SSESMMP; - Remove cooking and wasing are at least 30m from the Nam Gniep River Bank, all waste water from cooking and	24.11.2017	28.02.2018	Resolved

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
			improper waste management. No waste collection which resulted in disposing of solid waste around camp areas	washing need to be drained to the waste water pond (must be provided).			
ONC_VSP-0006	28.11.2017	VSP Camp	Poor housekeeping was observed. Solid waste was disposed around camp	- Clean up the camp premises on a daily basis; and - Dispose of general waste at Houay Soup Landfill on a regular basis to avoid waste accumulation and vector attraction.	15.02.2017	20..02.2018	Resolved
ONC_VSP-0007	28.11.2017	VSP Camp	Poor housekeeping. Old camp structure was not decommissioned and cleaned up properly, construction and general waste was disposed around the camp site.	- Daily clean-up of the camp premises; and - Dispose of general waste at Houay Soup Landfill on a regular basis. - Prepare site decommissioning plan.	12.12.2017	20.02.2018	Resolved
ONC_PRMC-0001	28.11.2017	PRMC Camp	Pyramid's sub-contractors set up a seeping hut at the construction site within	- Three waste bins for proper waste separation at the camp;	15.12.2017	23.01.2018	Resolved

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
			Phouhomxay village without a management plan, no waste bins, toilet and other appropriate camp facilities provided at the camp.	- Install temporary mobile toilet; - Install sediment pond for grey water from washing and cooking activities; - The Pyramid contractor was instructed to submit the camp operation & management and decommissioning plan for EMO's review and approval by the specified deadline.			
ONC_VNV-0002	28.11.2017	VNV Camp	Vannavong's sub-contractors set up two seeping huts at the construction site within Phouhomxay village without a management plan, no waste bins, toilet and other appropriate camp facilities provided at the camp.	- Provide secure wall material for sleeping huts; - Three waste bins for proper waste separation at the camp; - Install temporary mobile toilet;	15.12.2017	23.01.2018	Resolved

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
				- Install sediment pond for grey water from washing and cooking activities..			
ONC_VSP-0008	09.01.2018	VSP Camp	Inappropriate management of hazardous material. Oil drums were placed on the bare ground without any protection device to prevent oil spillage. Contaminated oil was left without containing or clean-up.	- Remove oil drums to the hazardous storage and collect contaminated soil for proper elimination; - It is recommended that refuelling and maintaining of heavy equipment and machinery need to be conducted within appropriate protection facility with suitable spill response kits.	23.01.2018	23.01.2018	Resolved
ONC_OC-0271	13.02.2018	Main Powerhouse	Non-compliance with pH and TSS effluent limit values. The WWTS is operated manually which likely cause fluctuation of pH and TSS. The WWTS is not equipped with a sediment retention pond.	Corrective actions: - Automatic pH adjustment; - Temporarily improve sediment retention by creating small ponds	27.02.2018	27.02.2018	Resolved

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
				along the drainage before discharge.			
ONC_OC-0272	13.02.2018	Sino Hydro labour camp	Poor waste management hygiene and sanitation.	Improve toilet and washing areas by providing sufficient water supply, regular clean up and fix the sanitary structures.	27.02.2018	27.02.2018	Resolved
ONC_OC-0272	13.02.2018	Main quarry site	Waste rock had been pushed down the slope towards Nam Ngiep. The operation has damaged riparian vegetation.	- Clean up and remove discarded rocks to designated spoil disposal No. 6; - Carry out mitigation measures for erosion and sediment control at the main quarry site area to restore and prevent further damage to riparian vegetation.	27.02.2018	27.03.2018	Pending
ONC_KCP-0004	20.02.2018	KCP camp	No waste bins were provided at the camp site for daily waste collection resulting in scattering of garbage, burning of plastic waste was also observed.	- Provide sufficient waste bins on site for daily waste collection; - Regularly remove / transport general waste to Houay Soup	06.03.2018	19.03.2018	Pending

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
				Landfill, and construction waste to spoil disposal No: 6 - Stop burning of plastic and non-segregate waste.			
ONC_KCP-0005	20.02.2018	KCP camp	Lack of proper storing of hazardous material, oily equipment and fuel drums were left on the bare ground. This resulted in oil spillage causing oil contaminated soil.	- Contain and clean up oil contaminated soil for proper incineration by Khounmysay steel factory (an approved vendor) and; - Install a secure hazardous material storage on site with a proper spill response kits including steel tray and dry sand)	06.03.2018	06.03.2018	Resolved
NCR_PRMC-0001	01.02.2018	Pyramid's Sub-contractor	- Lack of a camp management and no decommissioning plan. - Lack of waste bins, toilet and other necessary camp facilities.	Provide appropriate camp facility, submit the camp management and decommissioning plan for EMO review.	14.02.2018	14.02.2018	Resolved
NCR_OC-0022	06.03.2018	Main dam and powerhouse	Improper operation and maintenance of electricity generators and air compressors	- Repair / fix the sources of oil spillage;	20.03.2018	27.03.2018	Pending

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
			at the main dam left and right banks causing oil spillage and soil contamination (NCR_OC-0022)	- Refuelling of the electricity generator and air compressor shall be undertaken with appropriate protection measures to prevent oil spillage; - Provide spill clean-up materials such as absorbent pads and dry sand on site if spills or leaks occur, undertake immediate the clean-up; - Clean-up of any disposed oil contaminated soil for proper elimination by authorized vendor (Khounmixay factory).			
ONC_OC-0274	06.03.2018	Top main dam right bank and left bank	No mobile toilet provided for an approximate of 50 workers of Songda5 and Kenber contractors.	- The Kenber contractor agreed to arrange the mobile toilet for its workers within one week by 20 March 2017;	20.03.2018	27.03.2018	Pending

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
				- Obayashi Cooperation was required to instruct Song Da 5 contractor to provide the mobile toilet for their workers by 10 April 2018.			
ONC_OC-0275	06.03.2018	Sino Hydro workers' camp	Poor hygienic cooking / washing areas; a total of 50 workers are staying in the camp, but only two toilet rooms are usable, other seven toilet rooms were clogged without maintenance.	- Provide daily cleaning at cooking and washing areas to keep the location tidy in orderly; - Repair the clogged toilet rooms, wall and door for proper use. In addition, water sink, bowl and water tap need to be provided in each toilet room.	20.03.2018	27.03.2018	Pending
ONC_HM-0014	27.03.2018	HM Hyro's labor camp N#1 (ZHEFU camp)	Wastewater was discharged into outside environment without proper treatment, a chlorination container was not properly maintained and currently is out of services.	The following action was raised to the contractor to take corrective action by 05 April 2018: - It is noted that the Wastewater Treatment Plant is operated as a	05.04.2018	Not available	Pending

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
				"Sequencing Batch Reactor process (SBR) which the effluent does not continuously flow, this would not be suitable for a manual chlorine injection. Therefore, the contractor is required to prepare and submit a chlorination manual for Owner's review and approval; - Chlorine container has to be installed in a secure stand with proper roof to prevent sun light, heat and evaporation.			
ONC_IHI-0009	27.03.2018	IHI's labor camp (276 camp)	The WWTS design proposed in the DWP & SS-ESMMP ref no.: 0-0065 submitted on 23 January 2018 has not been put into construction. Instead, the chlorine contact tank and monitoring tank were set up	The following action was raised to the contractor to take corrective action by 05 April 2018: - The contractor is required to clarify the reason why the actual	05.04.2018	Not available	Pending

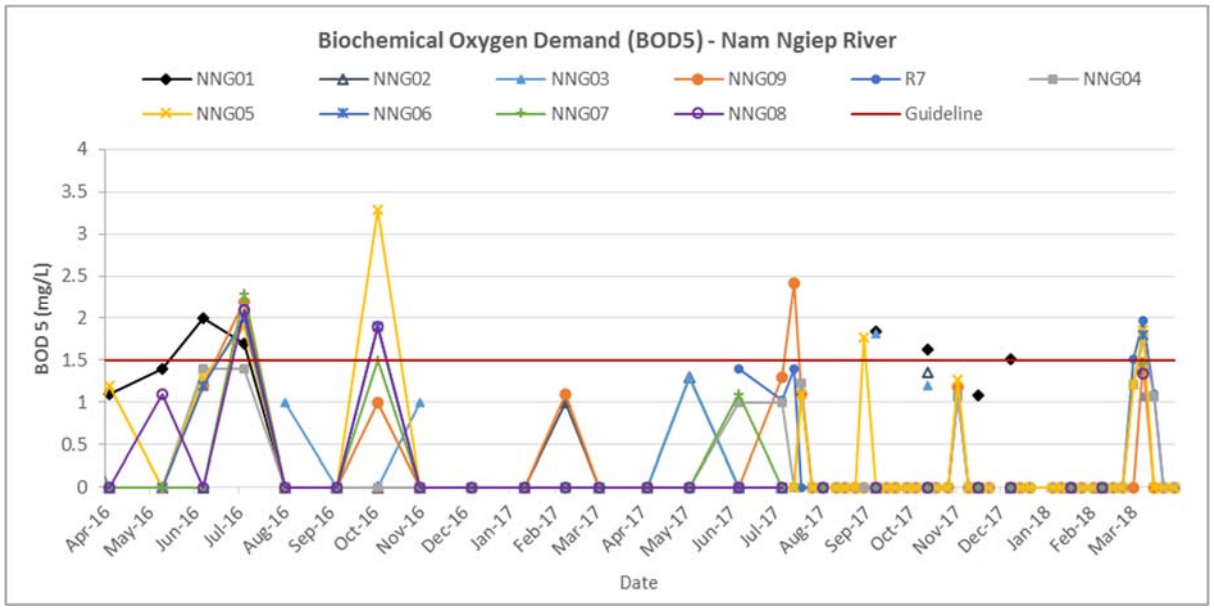
Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
			and no chlorination was performed.	construction of the Waste Water Treatment System is not consistent with the proposed design which was approved by NNP1PC; - EMO will conduct the effluent monitoring at this site around the beginning of April 2018. Renovation/improvement work will be required in case of noncompliance with effluent standards.			

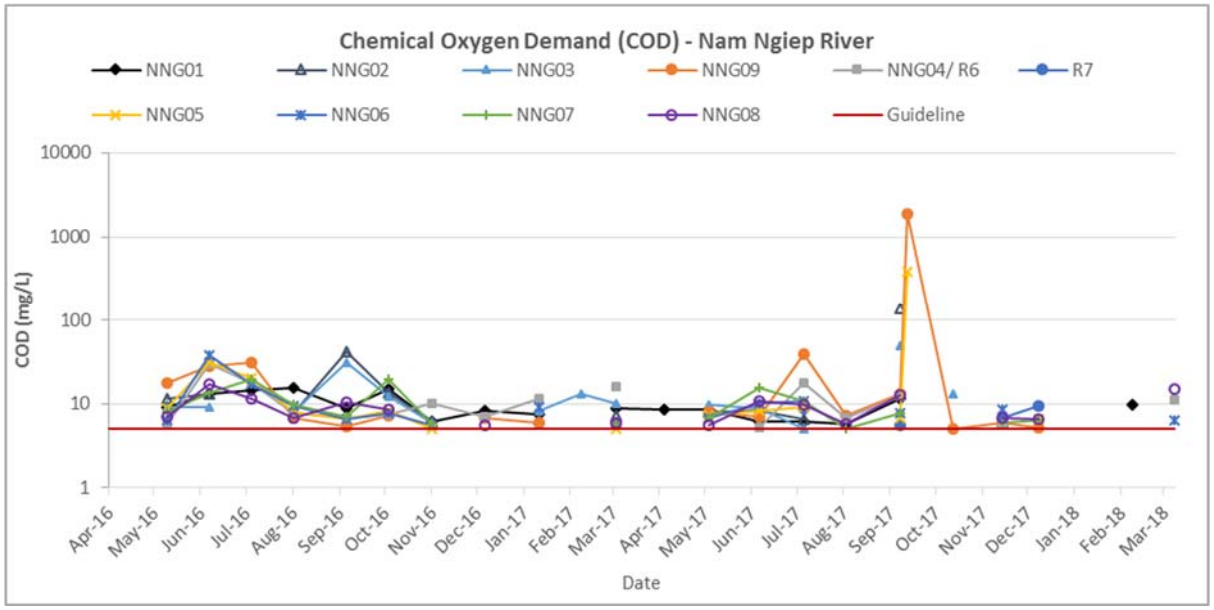
APPENDIX 3: CODES AND LOCATIONS OF THE SURFACE WATER QUALITY MONITORING STATIONS

Site Code	Location station	Zone
NNG01	Nam Ngiep Upstream of Ban Phiengta	Upstream Project Construction Site
NNG02	Nam Ngiep Upstream of Nam Phouan Confluence	
NNG03	Nam Ngiep Downstream of Ban Sop-Yuak	
NNG09	Nam Ngiep Upstream Main Dam	
NNG04 / R6	Nam Ngiep Downstream RT Camp (Middle Re-regulation Reservoir)	Within Project Construction Site
R7	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	

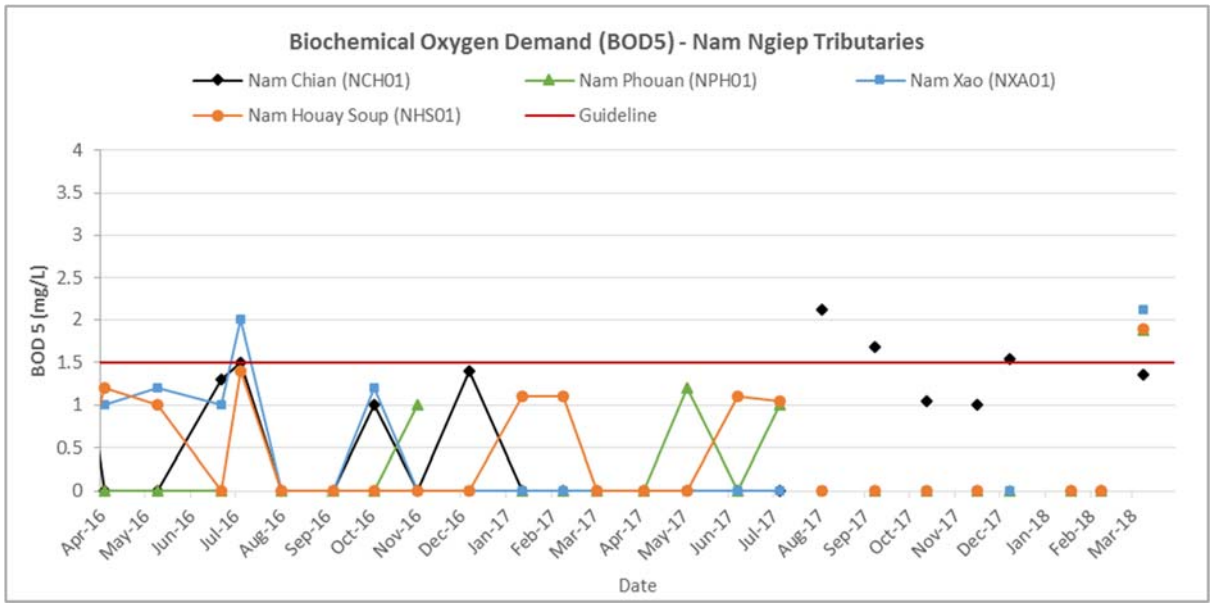
APPENDIX 4: KEY TRENDS OF WATER QUALITY MONITORING FROM APRIL 2016 TO END OF MARCH 2018 (ONLY PARAMETERS THAT EXCEEDED GUIDELINE STANDARDS)

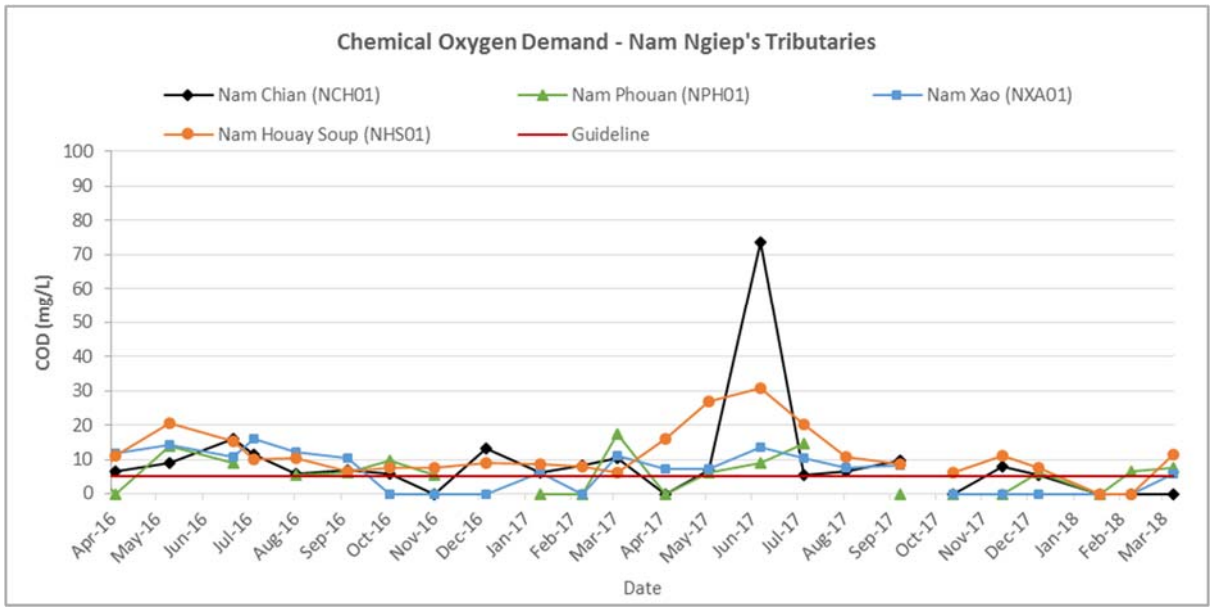
Nam Ngiep Surface Water



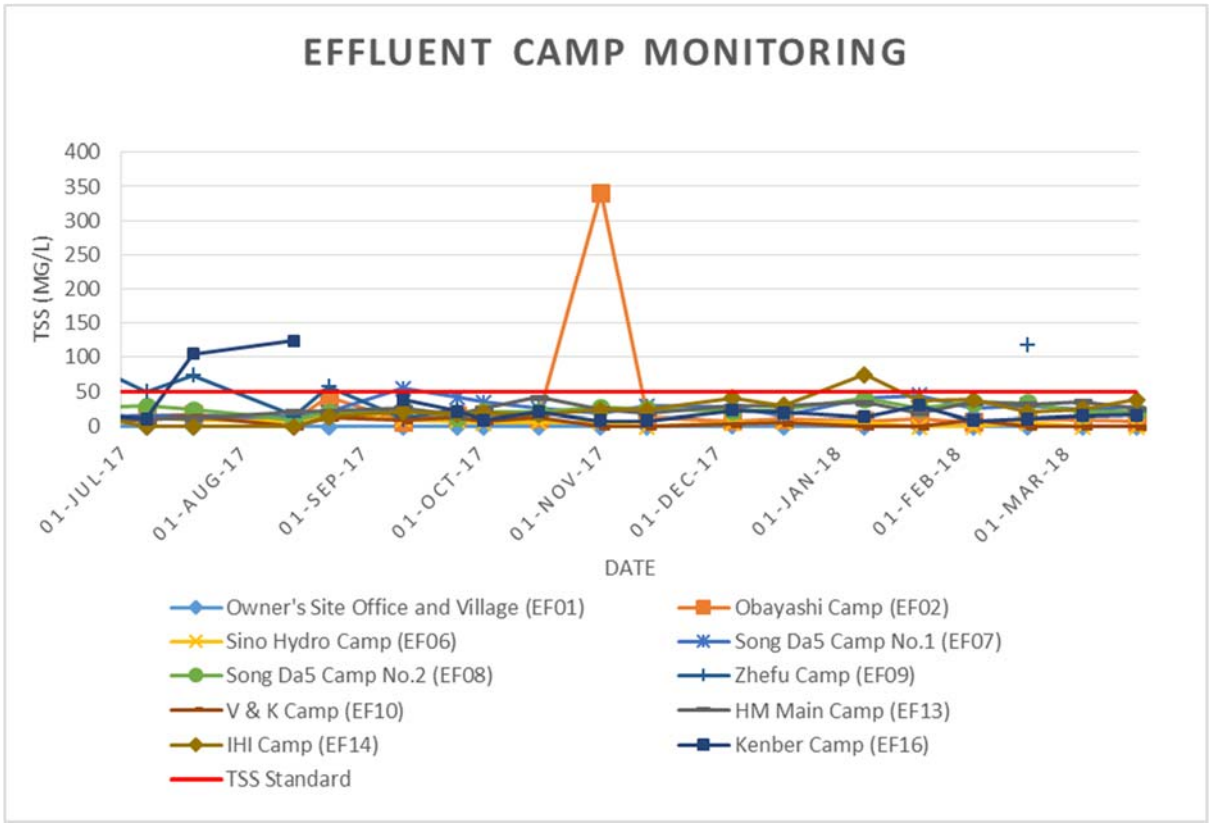


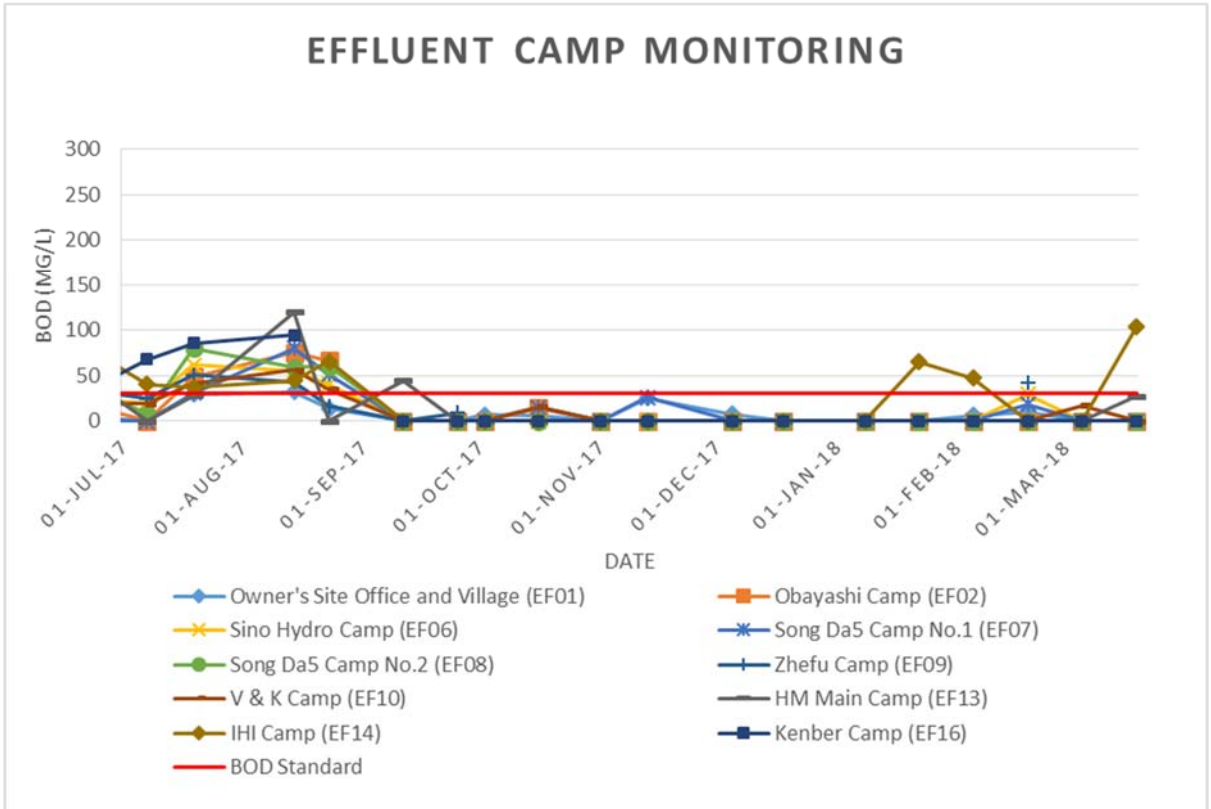
Key Water Quality Parameters for the Nam Ngiep Tributaries: Nam Chian, Nam Phouan, Nam Xao, Nam Houay Soup

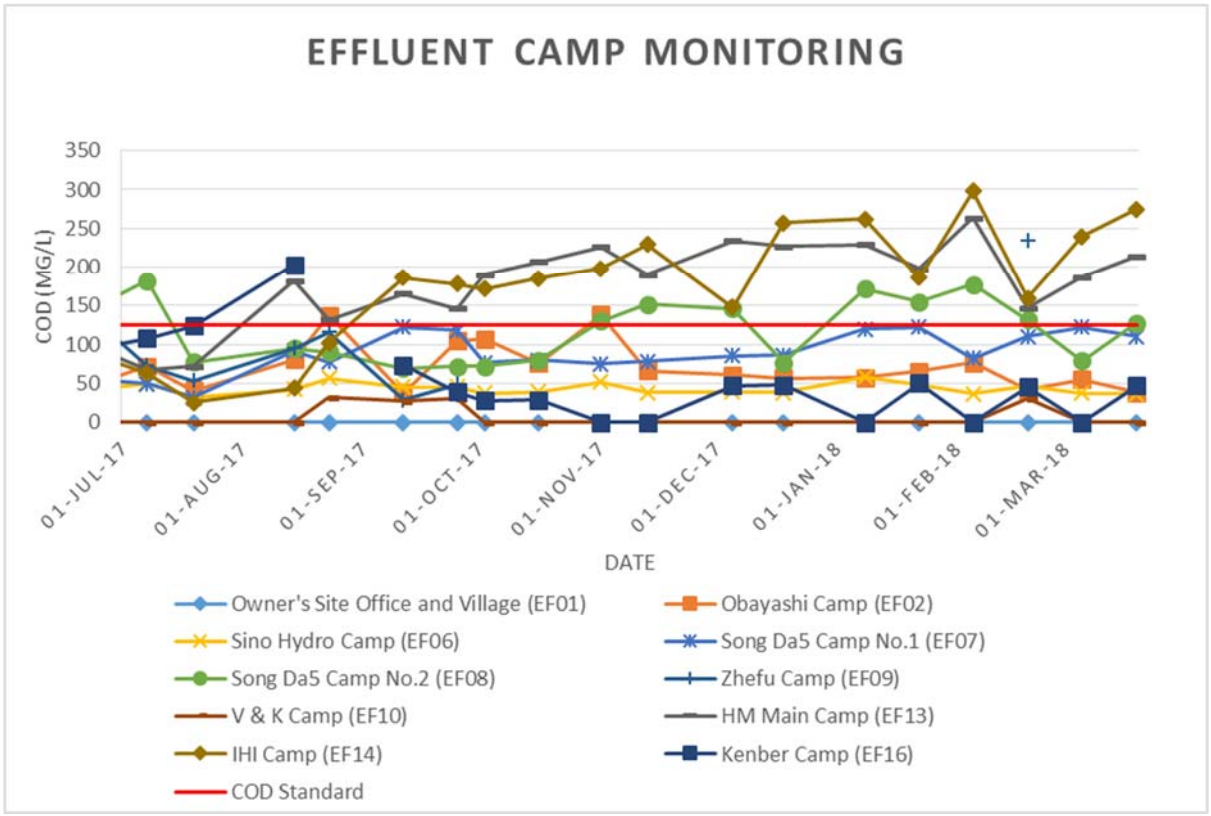


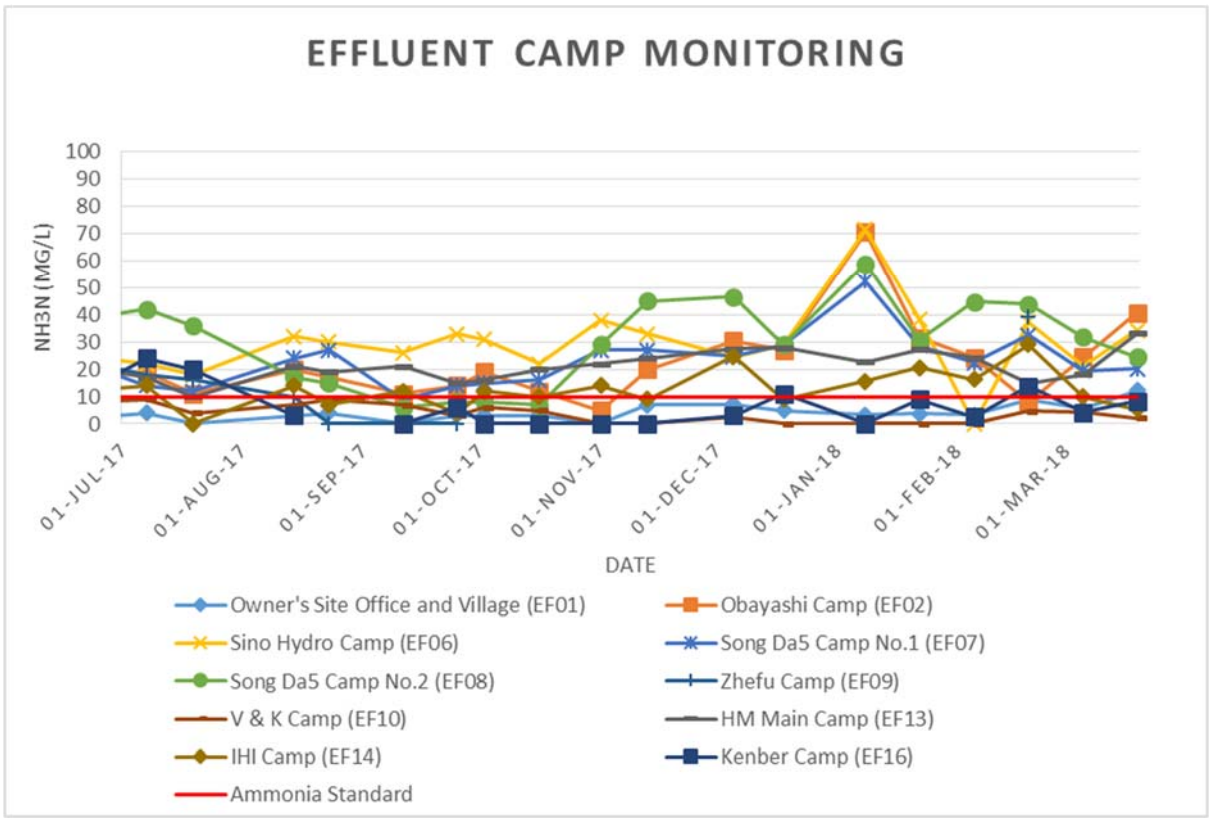


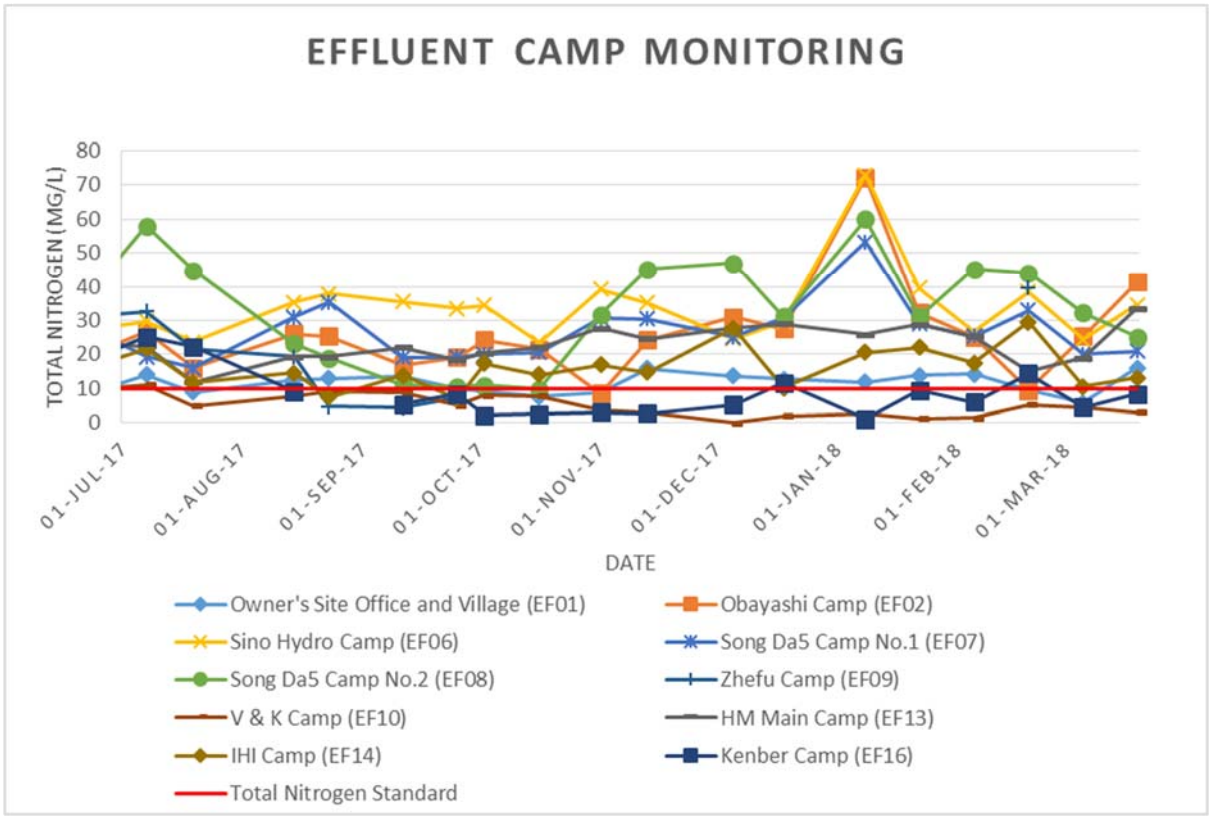
Camps' Effluent Water Quality Trends (Since July 2017– March 2018)

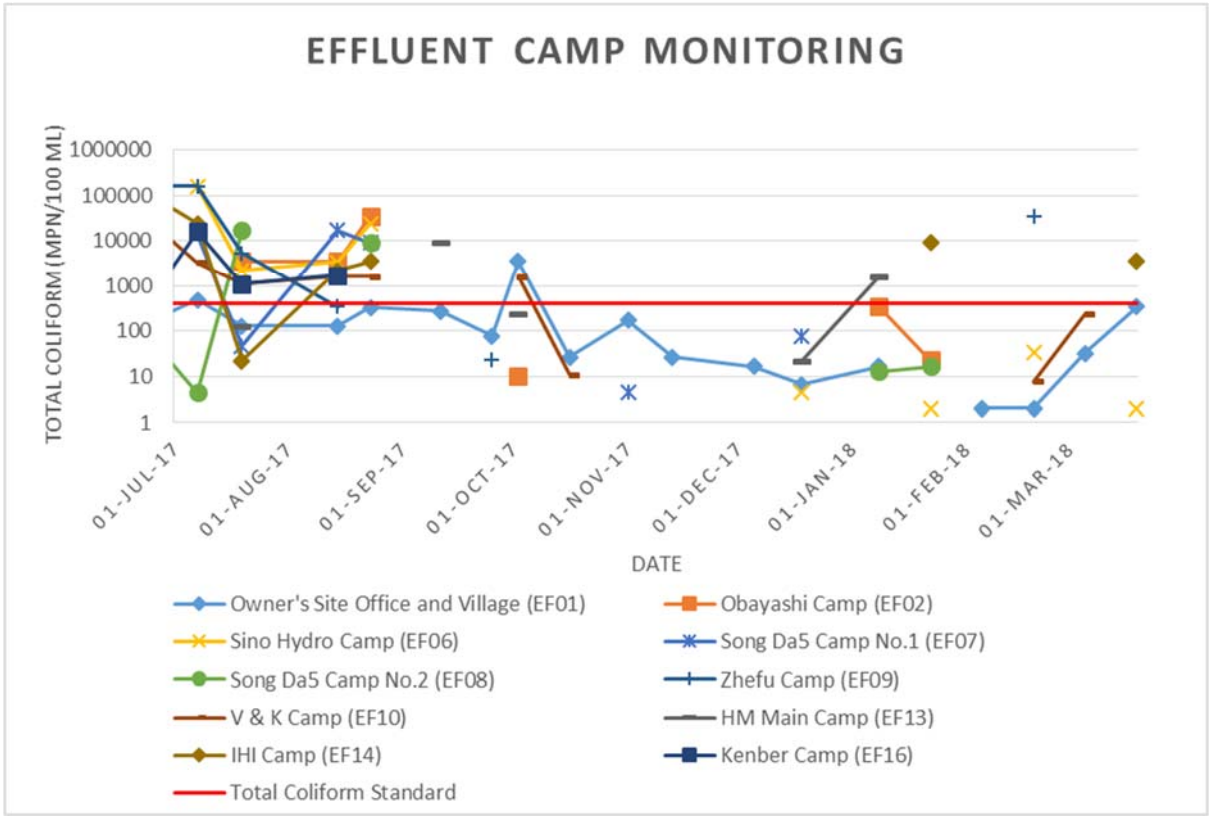




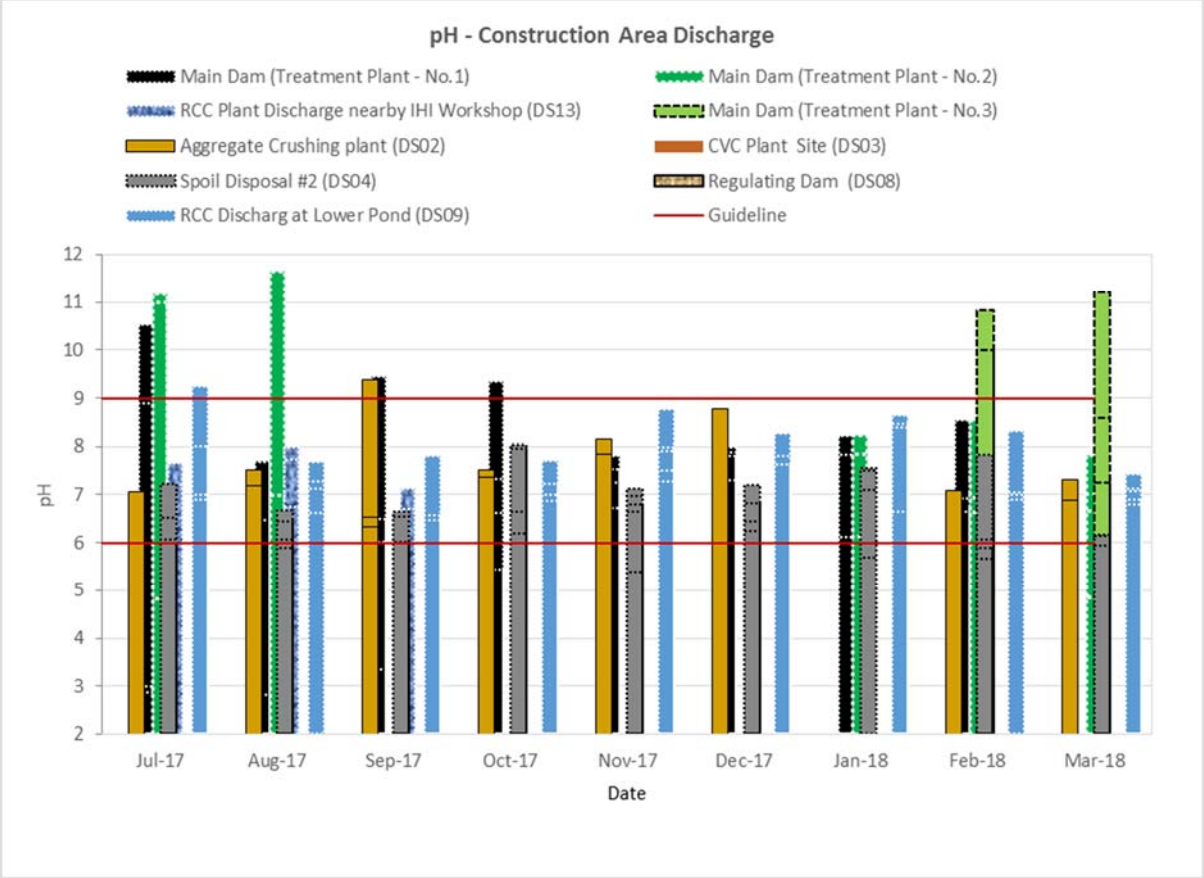

EFFLUENT CAMP MONITORING
COD (MG/L)
350
300
250
200
150
100
50
0
01-JUL-17
01-AUG-17
01-SEP-17
01-OCT-17
01-NOV-17
01-DEC-17
01-JAN-18
01-FEB-18
01-MAR-18
DATE
Owner's Site Office and Village (EF01)
Obayashi Camp (EF02)
Sino Hydro Camp (EF06)
Song Da5 Camp No.1 (EF07)
Song Da5 Camp No.2 (EF08)
Zhefu Camp (EF09)
V & K Camp (EF10)
HM Main Camp (EF13)
IHI Camp (EF14)
Kenber Camp (EF16)
COD Standard

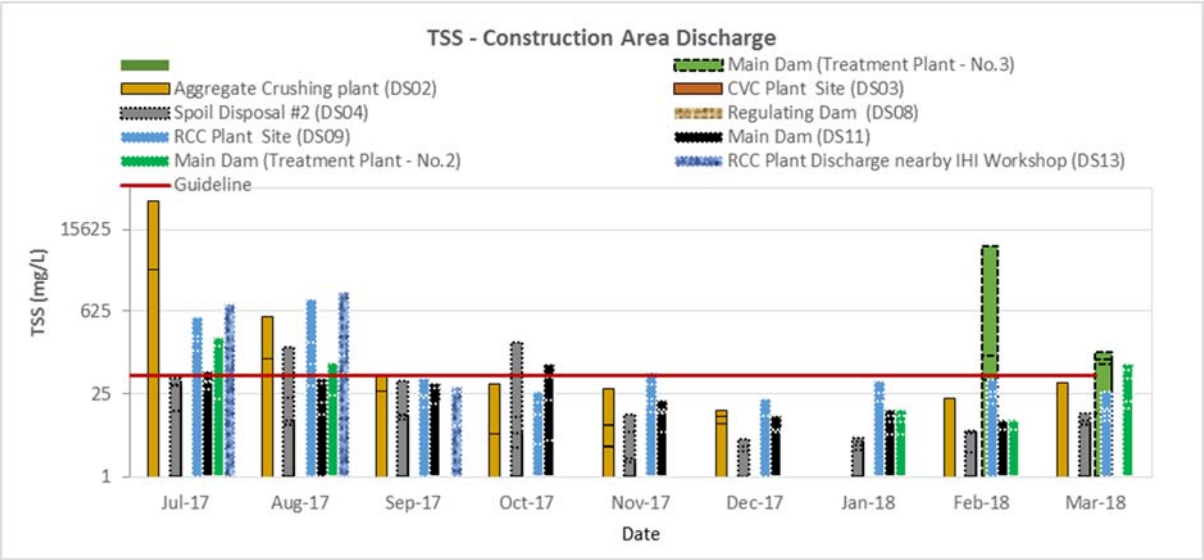

EFFLUENT CAMP MONITORING
NH3N (MG/L)
100
90
80
70
60
50
40
30
20
10
0
01-JUL-17
01-AUG-17
01-SEP-17
01-OCT-17
01-NOV-17
01-DEC-17
01-JAN-18
01-FEB-18
01-MAR-18
DATE
Owner's Site Office and Village (EF01)
Obayashi Camp (EF02)
Sino Hydro Camp (EF06)
Song Da5 Camp No.1 (EF07)
Song Da5 Camp No.2 (EF08)
Zhefu Camp (EF09)
V & K Camp (EF10)
HM Main Camp (EF13)
IHI Camp (EF14)
Kenber Camp (EF16)
Ammonia Standard


EFFLUENT CAMP MONITORING
TOTAL NITROGEN (MG/L)
80
70
60
50
40
30
20
10
0
01-JUL-17
01-AUG-17
01-SEP-17
01-OCT-17
01-NOV-17
01-DEC-17
01-JAN-18
01-FEB-18
01-MAR-18
DATE
Owner's Site Office and Village (EF01)
Obayashi Camp (EF02)
Sino Hydro Camp (EF06)
Song Da5 Camp No.1 (EF07)
Song Da5 Camp No.2 (EF08)
Zhefu Camp (EF09)
V & K Camp (EF10)
HM Main Camp (EF13)
IHI Camp (EF14)
Kenber Camp (EF16)
Total Nitrogen Standard


EFFLUENT CAMP MONITORING
TOTAL COLIFORM (MPN/100 ML)
1000000
100000
10000
1000
100
10
1
01-JUL-17
01-AUG-17
01-SEP-17
01-OCT-17
01-NOV-17
01-DEC-17
01-JAN-18
01-FEB-18
01-MAR-18
DATE
Owner's Site Office and Village (EF01)
Obayashi Camp (EF02)
Sino Hydro Camp (EF06)
Song Da5 Camp No.1 (EF07)
Song Da5 Camp No.2 (EF08)
Zhefu Camp (EF09)
V & K Camp (EF10)
HM Main Camp (EF13)
IHI Camp (EF14)
Kenber Camp (EF16)
Total Coliform Standard

Construction Area Discharge Water Quality (Since July 2017 to March 2018)





APPENDIX 5: WATER QUALITY MONITORING DATA

APPENDIX 5-1: SURFACE WATER QUALITY MONITORING – Q1 2018

		Station Code	NNG01	NNG02	NNG03	NNG09	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline														
5-Jan-18	pH	5.0 - 9.0	7.51	8.03	8.28	8.09	7.03	7.08	8.05	7.89	8.13	8.04	8.12	8.09	7.12	7.6
11-Jan-18	pH	5.0 - 9.0				7.97	7.93	8.79	8.64							
12-Jan-18	pH	5.0 - 9.0				7.18			7.22							
13-Jan-18	pH	5.0 - 9.0				7.81			7.28							
15-Jan-18	pH	5.0 - 9.0				7.58			7.33							
18-Jan-18	pH	5.0 - 9.0	8.96	8.57	8.8	7.97	7.93	8.79	8.64	8.51	7.15	7.12	8.99	8.07	8.59	8.58
25-Jan-18	pH	5.0 - 9.0				8.01	8.04	8.19	8.16							
2-Feb-18	pH	5.0 - 9.0				8.24	8.82	8.88	8.75							
8-Feb-18	pH	5.0 - 9.0	7.01	7.14	7.18	7.01	7.03	7.06	7.07	7.1	7.01	6.84	7.06	7.21	7.03	7
15-Feb-18	pH	5.0 - 9.0				7.28	7.12	7.08	7.58							
22-Feb-18	pH	5.0 - 9.0	7.48	6.83	7.3	7.37	7.89	7.76	7.35	7.58	7.41	7.19	7.49	7.05	7.4	6.9
1-Mar-18	pH	5.0 - 9.0				6.9	6.98	7.13	7.09							
8-Mar-18	pH	5.0 - 9.0	7.42	7.11	7.27	7.19	7.33	7.51	7.42	7.33	7.37	7.4	7.27	7.17	7.29	7.25
15-Mar-18	pH	5.0 - 9.0				7.38	7.45	7.6	7.45							
22-Mar-18	pH	5.0 - 9.0	7.38			7	7.85	7.06	7.42	7.57	7.43	7.26	7.55		7.3	7.26
29-Mar-18	pH	5.0 - 9.0				7.52	7.87	7.83	7.97							
30-Mar-18	pH	5.0 - 9.0	7.96			7.9			7.8				8.16			
31-Mar-18	pH	5.0 - 9.0				7.86			7.85							
2-Apr-18	pH	5.0 - 9.0				7.81			7.91							
5-Jan-18	Sat. DO (%)		96.8	100.5	104.1	101.1	93	96.5	104.2	104.9	103.5	101.6	100.9	106.1	92.1	84

		Station Code	NNG01	NNG02	NNG03	NNG09	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline														
11-Jan-18	Sat. DO (%)					99.5	100.3	95.5	101.1							
12-Jan-18	Sat. DO (%)					102.3			102.2							
13-Jan-18	Sat. DO (%)					104.8			103.4							
15-Jan-18	Sat. DO (%)					101.7			103.4							
18-Jan-18	Sat. DO (%)		95.8	99	103.5	100	99.6	99.7	102.3	102.7	105.4	103.1	100.8	103	97.6	85.7
25-Jan-18	Sat. DO (%)					100.3	101.1	99.7	106.1							
2-Feb-18	Sat. DO (%)					104.2	106.6	108.8	103.4							
8-Feb-18	Sat. DO (%)		96.9	100.3	103.1	102.5	99.2	100.5	104.4	105.5	98.9	98.8	101.8	103.8	104.1	90.3
15-Feb-18	Sat. DO (%)					103.9	108.4	127.8	109.9							
22-Feb-18	Sat. DO (%)		100	103.6	105.5	104.6	97.3	98.5	107.1	105.9	99.1	99.6	104.3	104.8	98.5	88.1
1-Mar-18	Sat. DO (%)					103.3	104	126.1	104.8							
8-Mar-18	Sat. DO (%)		96.9	100.8	101.8	101.1	94.6	96.1	102.9	102.3	103.2	102.6	100.4	7.17	87.4	97.1
15-Mar-18	Sat. DO (%)					100.8	102.3	100.3	106.4							
22-Mar-18	Sat. DO (%)		96.6			100.7	96	98.8	105.3	101.5	104.2	100.3	101.1		88	94.5
29-Mar-18	Sat. DO (%)					99.7	99.2	98.3	102.2							
30-Mar-18	Sat. DO (%)		95.4			97.9			103.2				99.7			
31-Mar-18	Sat. DO (%)					107.5			103.3							
2-Apr-18	Sat. DO (%)					102.2			104.7							
5-Jan-18	DO (mg/l)	>6.0	8.61	8.42	8.7	8.39	7.89	8.45	8.61	8.86	8.37	8.2	9.2	9.11	7.52	7.1
11-Jan-18	DO (mg/l)	>6.0				9.29	9.06	8.29	9							
12-Jan-18	DO (mg/l)	>6.0				9.41			9.15							
13-Jan-18	DO (mg/l)	>6.0				9.23			9.1							

		Station Code	NNG01	NNG02	NNG03	NNG09	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline														
15-Jan-18	DO (mg/l)	>6.0				8.88			8.97							
18-Jan-18	DO (mg/l)	>6.0	8.62	8.67	8.97	8.89	8.92	8.99	8.91	8.92	8.79	8.67	9.29	9.38	8.31	7.53
25-Jan-18	DO (mg/l)	>6.0				8.77	8.57	8.27	8.84							
2-Feb-18	DO (mg/l)	>6.0				9.3	9.43	9.31	8.84							
8-Feb-18	DO (mg/l)	>6.0	9.21	9.25	9.3	8.79	9.11	9.14	9.45	9.45	9.21	9.02	9.79	9.69	9.15	8.39
15-Feb-18	DO (mg/l)	>6.0				8.85	9.59	10.8	9.2							
22-Feb-18	DO (mg/l)	>6.0	8.67	8.58	8.68	8.74	7.84	7.79	8.85	8.64	8.22	8.25	8.67	8.69	7.85	7.24
1-Mar-18	DO (mg/l)	>6.0				8.3	8.03	9.75	8.17							
8-Mar-18	DO (mg/l)	>6.0	8.53	8.3	8.29	8.08	7.49	7.49	8.26	8.08	7.98	7.83	8.9	8.48	6.83	7.81
15-Mar-18	DO (mg/l)	>6.0				8.65	8.62	8.24	8.61							
22-Mar-18	DO (mg/l)	>6.0	8.23			8.37	7.77	7.92	8.59	8.34	8.2	7.8	8.68		7.05	8.04
29-Mar-18	DO (mg/l)	>6.0				8.33	8.2	7.92	8.16							
30-Mar-18	DO (mg/l)	>6.0	8.07			7.88			8.23				8.33			
31-Mar-18	DO (mg/l)	>6.0				8.12			7.91							
2-Apr-18	DO (mg/l)	>6.0				8.11			8.16							
5-Jan-18	Conductivity (µs/cm)		79.1	72.8	70.8	69.9	102	103	71.3	72.9	75.2	71.6	30.3	56.4	113.4	50.2
11-Jan-18	Conductivity (µs/cm)					89	73	73.7	74.1							
12-Jan-18	Conductivity (µs/cm)					75.3			74.9							
13-Jan-18	Conductivity (µs/cm)					69.7			72							

		Station Code	NNG01	NNG02	NNG03	NNG09	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline														
15-Jan-18	Conductivity (µs/cm)					69.6			73.5							
18-Jan-18	Conductivity (µs/cm)		78.9	75	68	71.4	111	112	77.5	75.7	75.8	74.6	29.3	56.1	114.2	51.5
25-Jan-18	Conductivity (µs/cm)					75.1	73.8	73.8	72.4							
2-Feb-18	Conductivity (µs/cm)					73.5	105	114	75.8							
8-Feb-18	Conductivity (µs/cm)		79.5	71.9	68.7	66.6	107	112	70.4	71.2	72.4	72.7	36	55	121.7	55.1
15-Feb-18	Conductivity (µs/cm)					75.6	115	111	73.8							
22-Feb-18	Conductivity (µs/cm)		81.6	80.9	77.3	77	76.9	76.4	77.7	77.3	79.9	77.8	41.3	58.7	134.3	52.3
1-Mar-18	Conductivity (µs/cm)					74.3	111	118	72.8							
8-Mar-18	Conductivity (µs/cm)		78.2	82.5	77.2	79.3	92	101	77.8	78.6	82.6	79.3	48.4	59	144	44.9
15-Mar-18	Conductivity (µs/cm)					70.9	73.1	75.2	68.1							
22-Mar-18	Conductivity (µs/cm)		78.3			75.2	100	98	81.3	77.9	77.6	79.2	38.7		137.6	28.45
29-Mar-18	Conductivity (µs/cm)					75.8	74	75.4	76.1							
30-Mar-18	Conductivity (µs/cm)		67.2			80			70				35.2			

		Station Code	NNG01	NNG02	NNG03	NNG09	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline														
31-Mar-18	Conductivity (µs/cm)					83.6			73.3							
2-Apr-18	Conductivity (µs/cm)					77.1			71.4							
5-Jan-18	TDS (mg/l)		39	36.4	35.4	35	53	53	35.5	36.4	37.5	35.8	15	28.2	56.2	25.1
11-Jan-18	TDS (mg/l)					44	36	37	37							
12-Jan-18	TDS (mg/l)					37.5			37.4							
13-Jan-18	TDS (mg/l)					34.8			36							
15-Jan-18	TDS (mg/l)					34.5			36.4							
18-Jan-18	TDS (mg/l)		39	37.5	34	35.5	56	56	38.75	37.85	38	37.3	15	28	57.1	25.55
25-Jan-18	TDS (mg/l)					37.5	36.5	36.5	36.2							
2-Feb-18	TDS (mg/l)					36.5	56	57	37							
8-Feb-18	TDS (mg/l)		39	36	34.5	33.3	53	56	35.2	35.6	36	36	18	27.5	60.85	27.5
15-Feb-18	TDS (mg/l)					37.5	57	56	36.5							
22-Feb-18	TDS (mg/l)		40	40	38	38	38.45	38.2	38.85	38.65	39.95	38.9	41.3	29	67.15	26.15
1-Mar-18	TDS (mg/l)					37	55	59	36.4							
8-Mar-18	TDS (mg/l)		39	41	38	39	46	50	38.9	39.3	41	40	24.2	29	72	22.45
15-Mar-18	TDS (mg/l)					35.45	36.55	37.6	34.05							
22-Mar-18	TDS (mg/l)		39			37	50	49	40.65	38.95	38.8	39.6	19		68.8	22.5
29-Mar-18	TDS (mg/l)					38	37	37	38							
30-Mar-18	TDS (mg/l)		38			40			35				17			
31-Mar-18	TDS (mg/l)					41.53			36.5							

		Station Code	NNG01	NNG02	NNG03	NNG09	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline														
2-Apr-18	TDS (mg/l)					38.5			35.5							
5-Jan-18	Temperature (°C)		19.2	22.5	22.9	23.3	22.42	23.57	23.8	22.6	24.8	24.9	17.6	21.3	24.4	22.6
11-Jan-18	Temperature (°C)					18.1	19.78	21.7	20.5							
12-Jan-18	Temperature (°C)					18.2			20							
13-Jan-18	Temperature (°C)					20.3			20.6							
15-Jan-18	Temperature (°C)					20.9			21.4							
18-Jan-18	Temperature (°C)		18.6	20.5	20.9	20.6	21.08	21.56	21.2	21.3	22	22.3	17.3	18.6	22.3	20.8
25-Jan-18	Temperature (°C)					20.6	22.4	22.25	23.5							
2-Feb-18	Temperature (°C)					19.9	21.37	22.08	21.8							
8-Feb-18	Temperature (°C)		16.2	18.2	20	23.2	18.56	20.06	19.5	20.4	18.5	19.1	15.5	17.5	21.3	18.1
15-Feb-18	Temperature (°C)					22.3	22.57	23.11	23.4							
22-Feb-18	Temperature (°C)		20.5	23.2	23.7	23.3	25.2	25.4	24	24.6	23.6	23.9	18.8	23.1	25.9	24.3
1-Mar-18	Temperature (°C)					25	27.01	26.98	26.2							
8-Mar-18	Temperature (°C)		19.6	23.6	24.3	25.5	25.4	26.9	25.5	26.3	27.3	28.1	19.2	22.6	27.2	25.5

		Station Code	NNG01	NNG02	NNG03	NNG09	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline														
15-Mar-18	Temperature (°C)					21.8	22.9	24.2	25							
22-Mar-18	Temperature (°C)		21.5			23.5	24.9	25.4	24.7	24.3	26.4	27.1	20.9		25.7	22.5
29-Mar-18	Temperature (°C)					23.2	23.8	25.3	25.6							
30-Mar-18	Temperature (°C)		21.8			25.2			25.7				22.1			
31-Mar-18	Temperature (°C)					28.7			28.2							
2-Apr-18	Temperature (°C)					26			26.9							
5-Jan-18	Turbidity (NTU)		7.53	9.3	7.2	8.03	5.87	4.73	6.08	6.19	6.41	8.6	3.9	1.58	2.7	4.39
11-Jan-18	Turbidity (NTU)					6.43	8.79	5.84	6.29							
12-Jan-18	Turbidity (NTU)					6.5			5.39							
13-Jan-18	Turbidity (NTU)					6.65			7.33							
15-Jan-18	Turbidity (NTU)					5.46			9.8							
18-Jan-18	Turbidity (NTU)		4.64	6.12	5.37	5.74	6.47	5.95	7.37	7.33	7.01	8.58	5.85	2.29	3.04	3.65
25-Jan-18	Turbidity (NTU)					5.08	5.4	4.08	4.31							
2-Feb-18	Turbidity (NTU)					4.95	3.28	3.16	5.3							
8-Feb-18	Turbidity (NTU)		4.42	6.35	5.7	5.02	4.43	3.05	4.46	4.05	4.49	10.2	3.89	1.72	1.76	7.23
15-Feb-18	Turbidity (NTU)					4.6	4.13	2.66	3.77							
22-Feb-18	Turbidity (NTU)		3.34	3.79	3.53	6.62	8.7	2.25	5.25	5.45	4.74	9.27	2.13	1.95	2.38	5.81
1-Mar-18	Turbidity (NTU)					16.8	11.6	7.7	15.6							

		Station Code	NNG01	NNG02	NNG03	NNG09	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline														
8-Mar-18	Turbidity (NTU)		8.03	8.2	6.46	5.79	4.16	3.86	5.07	5.31	5.15	8.26	3.04	2.24	2.74	4.82
15-Mar-18	Turbidity (NTU)					8.03	6.56	4.84	6.71							
22-Mar-18	Turbidity (NTU)		11.43			5.26	4.92	3.07	4.25	5.08	4.88	9.15	2.09		2.55	5.5
29-Mar-18	Turbidity (NTU)					4.42	3.22	2.43	3.21							
30-Mar-18	Turbidity (NTU)		1,467			5.54			4.08				3.87			
31-Mar-18	Turbidity (NTU)					22			3.97							
2-Apr-18	Turbidity (NTU)					25.2			25							
5-Jan-18	TSS (mg/l)					10.9	6.96	6.39	<5							
11-Jan-18	TSS (mg/l)					11.47	9.9	5.43	6.86							
18-Jan-18	TSS (mg/l)		7.31	6.36	7.42	6	8.52	8.46	10.19	19.44	10.35	20.35	11.08	<5	<5	<5
25-Jan-18	TSS (mg/l)					5.56	6.92	3.05	3.5							
2-Feb-18	TSS (mg/l)					7.47	6.04	3.76	3.36							
8-Feb-18	TSS (mg/l)		6.26	12.06	10.88	9.31	5.69	<5	<5	<5	6.26	28.19	10.56	<5	<1	<5
15-Feb-18	TSS (mg/l)					7.87	4.76	2.7	5.26							
22-Feb-18	TSS (mg/l)					13.5	13.85	2.62	8.47							
1-Mar-18	TSS (mg/l)					29.96	13.4	9.39	18.11							
8-Mar-18	TSS (mg/l)		12.11	9.91	8.87	8.59	4.85	3.13	5.33	4.74	5.37	13.22	1.34	3.26	4.06	6.25
15-Mar-18	TSS (mg/l)					16.42	8.59	5.31	9.18							
22-Mar-18	TSS (mg/l)					8.68	5.34	2	4.45							
29-Mar-18	TSS (mg/l)					7.37	3.86	2.54	3.96							
30-Mar-18	TSS (mg/l)		824.37			9.35			4.89				8.33			

		Station Code	NNG01	NNG02	NNG03	NNG09	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline														
31-Mar-18	TSS (mg/l)					158.22			6.5							
2-Apr-18	TSS (mg/l)					88.69			51.26							
5-Jan-18	BOD5 (mg/l)	<1.5				<1.0	<1.0	<1.0	<1.0							
11-Jan-18	BOD5 (mg/l)	<1.5				<1.0	<1.0	<1.0	<1.0							
18-Jan-18	BOD5 (mg/l)	<1.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
25-Jan-18	BOD5 (mg/l)	<1.5				<1.0	<1.0	<1.0	<1.0							
2-Feb-18	BOD5 (mg/l)	<1.5				<1.0	<1.0	<1.0	<1.0							
8-Feb-18	BOD5 (mg/l)	<1.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
15-Feb-18	BOD5 (mg/l)	<1.5				<1.0	<1.0	<1.0	<1.0							
22-Feb-18	BOD5 (mg/l)	<1.5				<1.0	<1.0	<1.0	<1.0							
1-Mar-18	BOD5 (mg/l)	<1.5				<1.0	1.21	1.51	1.21							
8-Mar-18	BOD5 (mg/l)	<1.5	1.37	1.4	1.06	1.47	1.75	1.97	1.85	1.8	1.46	1.34	1.35	1.88	2.12	1.89
15-Mar-18	BOD5 (mg/l)	<1.5				<1.0	1.07	1.1	<1.0							
22-Mar-18	BOD5 (mg/l)	<1.5				<1.0	<1.0	<1.0	<1.0							
29-Mar-18	BOD5 (mg/l)	<1.5				<1.0	<1.0	<1.0	<1.0							
18-Jan-18	COD (mg/l)	<5	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
8-Feb-18	COD (mg/l)	<5	9.9	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	6.5	<5.0	<5.0
8-Mar-18	COD (mg/l)	<5	<5.0	<5.0	<5.0	<5.0	11.2	<5.0	<5.0	6.3	<5.0	15.3	<5.0	7.5	5.9	11.6
18-Jan-18	NH3-N (mg/l)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
8-Feb-18	NH3-N (mg/l)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.69	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
8-Mar-18	NH3-N (mg/l)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2

		Station Code	NNG01	NNG02	NNG03	NNG09	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline														
18-Jan-18	NO3-N (mg/l)	<5	0.07	0.05	0.05	0.05	0.05	0.04	0.05	0.04	0.04	0.03	0.08	0.07	0.02	0.08
8-Feb-18	NO3-N (mg/l)	<5	0.07	0.07	0.06	0.06	0.06	0.02	0.04	0.04	0.05	0.04	0.13	0.03	<0.02	0.06
8-Mar-18	NO3-N (mg/l)	<5	0.04	0.03	0.03	0.03	0.03	0.05	0.03	0.02	<0.02	0.03	0.05	<0.02	0.06	0.08
5-Jan-18	Faecal coliform (MPN/100ml)	<1,000				22	130	49	49							
11-Jan-18	Faecal coliform (MPN/100ml)	<1,000				170	79	79	34							
18-Jan-18	Faecal coliform (MPN/100ml)	<1,000	130	110	79	79	11	49	110	170	79	170	47	79	140	240
25-Jan-18	Faecal coliform (MPN/100ml)	<1,000				170	34	13	70							
2-Feb-18	Faecal coliform (MPN/100ml)	<1,000				130	4.5	2	22							
8-Feb-18	Faecal coliform (MPN/100ml)	<1,000	350	79	79	170	47	79	79	49	33	79	40	27	49	34
15-Feb-18	Faecal coliform (MPN/100ml)	<1,000				34	23	34	40							
22-Feb-18	Faecal coliform (MPN/100ml)	<1,000				140	94	0	70							
1-Mar-18	Faecal coliform (MPN/100ml)	<1,000				240	130	9	130							
8-Mar-18	Faecal coliform (MPN/100ml)	<1,000	170	350	130	540	240	350	23	240	23	33	350	79	350	33
15-Mar-18	Faecal coliform (MPN/100ml)	<1,000				240	240	79	240							

		Station Code	NNG01	NNG02	NNG03	NNG09	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline														
22-Mar-18	Faecal coliform (MPN/100ml)	<1,000				79	33	49	130							
29-Mar-18	Faecal coliform (MPN/100ml)	<1,000				70	33	7.8	33							
5-Jan-18	Total Coliform (MPN/100ml)	<5,000				27	240	130	170							
11-Jan-18	Total Coliform (MPN/100ml)	<5,000				170	110	350	170							
18-Jan-18	Total Coliform (MPN/100ml)	<5,000	350	280	220	79	240	540	220	540	350	540	920	350	140	240
25-Jan-18	Total Coliform (MPN/100ml)	<5,000				280	130	22	110							
2-Feb-18	Total Coliform (MPN/100ml)	<5,000				240	7.8	4.5	130							
8-Feb-18	Total Coliform (MPN/100ml)	<5,000	350	220	110	540	540	79	130	79	79	170	350	130	130	140
15-Feb-18	Total Coliform (MPN/100ml)	<5,000				130	49	47	110							
22-Feb-18	Total Coliform (MPN/100ml)	<5,000				920	920	9	170							
1-Mar-18	Total Coliform (MPN/100ml)	<5,000				350	240	17	240							
8-Mar-18	Total Coliform (MPN/100ml)	<5,000	540	350	130	540	540	350	350	240	350	350	2,400	79	350	240
15-Mar-18	Total Coliform (MPN/100ml)	<5,000				350	540	170	350							

		Station Code	NNG01	NNG02	NNG03	NNG09	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	Parameters (Unit)	Guideline														
22-Mar-18	Total Coliform (MPN/100ml)	<5,000				170	540	110	280							
29-Mar-18	Total Coliform (MPN/100ml)	<5,000				350	350	33	79							
8-Mar-18	Manganese (mg/l)	<1.0	0.036	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.019	<0.005	0.06	<0.005
8-Mar-18	Potassium (mg/l)		0.02	0.02	0.04	0.03	0.03	0.02	0.02	0.02	0.03	0.02	0.01	0.03	0.03	0.02
8-Mar-18	Total Iron (mg/l)		0.822	0.65	0.603	0.41	0.218	0.17	0.219	0.28	0.331	0.536	0.211	0.151	0.251	0.536
8-Mar-18	TOC (mg/l)		0.72	0.79	0.62	0.66	0.76	2.03	0.66	0.69	0.71	0.68	0.61	0.62	1.68	1.59

APPENDIX 5-2: EFFLUENT CAMP MONITORING RESULTS – Q1 2018

		Site Name	Owner's Site Office and Village	Obayashi Camp	Sino Hydro Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Kenber Camp
		Station Code	EF01	EF02	EF06	EF07	EF08	EF09	EF10	EF13	EF14	EF16
Date	Parameter (Unit)	Guideline in the CA										
08-Jan-18	pH	6.0-9.0	7.38	7.79	7.44	7.54	7.62		7.01	7.33	7.21	8.61
22-Jan-18	pH	6.0-9.0	7.93	8.24	8.11	7.9	8.14		8.15	8.00	7.9	8.92
05-Feb-18	pH	6.0-9.0	6.71	7.4	7.49	7.47	7.63		6.66	7.54	7.11	7.65
19-Feb-18	pH	6.0-9.0	6.97	6.99	7.38	7.59	7.52	7.54	7.25	7.07	7.79	8.3
05-Mar-18	pH	6.0-9.0	6.95	7.53	7.15	7.21	7.32		7.14	7.02	6.98	7.63
19-Mar-18	pH	6.0-9.0	6.9	7.61	7.33	6.71	7.63		6.98	7.24	6.76	8.12
08-Jan-18	Sat. DO (%)		55.4	74.8	50.5	65.8	65.6		76.5	68.7	44.8	97
22-Jan-18	Sat. DO (%)		63.4	73.7	64.4	71.2	59.2		89.7	80.01	10.2	96.9
05-Feb-18	Sat. DO (%)		42.5	73.2	71.8	79.4	72.8		88.6	67.7	47	99.6
19-Feb-18	Sat. DO (%)		54.9	85.7	71.7	84.7	72.6	27	50.7	76.7	27	82.1
05-Mar-18	Sat. DO (%)		56.1	83.9	55.9	66.6	77.6		45.5	52.7	49.8	100.8

		Site Name	Owner's Site Office and Village	Obayashi Camp	Sino Hydro Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Kenber Camp
		Station Code	EF01	EF02	EF06	EF07	EF08	EF09	EF10	EF13	EF14	EF16
Date	Parameter (Unit)	Guideline in the CA										
19-Mar-18	Sat. DO (%)		44.3	39.1	90.6	61.4	77		64.7	82.9	49	93.6
08-Jan-18	DO (mg/l)		4.16	5.63	3.87	4.71	5.05		5.73	5.22	3.39	7.38
22-Jan-18	DO (mg/l)		4.9	5.74	5.15	5.22	4.68		6.99	6.2	0.78	7.73
05-Feb-18	DO (mg/l)		3.56	6.04	6.17	6.84	6.38		7.49	5.72	3.96	8.57
19-Feb-18	DO (mg/l)		4.39	6.49	5.77	6.42	5.89	2.04	4.06	5.89	5.1	6.66
05-Mar-18	DO (mg/l)		4.22	6.38	4.49	4.98	5.76		3.59	4.03	3.72	7.72
19-Mar-18	DO (mg/l)		3.37	3.6	6.85	4.31	5.76		4.91	6.13	3.59	7.17
08-Jan-18	Conductivity (µS/cm)		341	802	585	1,538	833		349	658	1,042	185.1
22-Jan-18	Conductivity (µS/cm)		374	787	529	1,752	692		198.6	869	636	357
05-Feb-18	Conductivity (µS/cm)		414	687	632	1,656	797		188	872	732	226
19-Feb-18	Conductivity (µS/cm)		395	478	679	1,676	793	561	296	709	1,050	506
05-Mar-18	Conductivity (µS/cm)		395	708	586	1,610	644		299	882	974	287

		Site Name	Owner's Site Office and Village	Obayashi Camp	Sino Hydro Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Kenber Camp
		Station Code	EF01	EF02	EF06	EF07	EF08	EF09	EF10	EF13	EF14	EF16
Date	Parameter (Unit)	Guideline in the CA										
19-Mar-18	Conductivity (µS/cm)		370	650	644	1,912	771		284	996	477	439
08-Jan-18	TDS (mg/l)		170	401	292	769	416		174	329	521	92
22-Jan-18	TDS (mg/l)		187	393	264	871	346		94.3	434	118	185
05-Feb-18	TDS (mg/l)		207	343	316	828	398		94	436	366	113
19-Feb-18	TDS (mg/l)		197	239	339	838	396	280	148	354	525	253
05-Mar-18	TDS (mg/l)		197.5	354	293	805	322		149	441	487	143.5
19-Mar-18	TDS (mg/l)		185	325	322	956	385		142	498	238	219
08-Jan-18	Temperature (°C)		28.6	28.6	27.5	31.5	28.3		28.9	27.8	28.1	27.5
22-Jan-18	Temperature (°C)		26.8	26.6	25.4	30	25.9		26.8	26.8	27.6	24.9
05-Feb-18	Temperature (°C)		23.1	24.4	22.1	22.4	21.3		24.2	22.8	22.9	20.8
19-Feb-18	Temperature (°C)		25.2	28.3	25	30.3	30.7	28.5	25.4	29	24	24.1
05-Mar-18	Temperature (°C)		28.7	27.9	25	27.4	25.9		26	27.4	28.9	27.2

		Site Name	Owner's Site Office and Village	Obayashi Camp	Sino Hydro Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Kenber Camp
		Station Code	EF01	EF02	EF06	EF07	EF08	EF09	EF10	EF13	EF14	EF16
Date	Parameter (Unit)	Guideline in the CA										
19-Mar-18	Temperature (°C)		27.6	29.5	28.3	32.6	29		28.2	29.3	29.7	27.1
08-Jan-18	Turbidity (NTU)		1.07	11.9	11.68	19.9	53.3		7.65	18.8	19	10.17
22-Jan-18	Turbidity (NTU)		1.2	32.3	10.25	16.8	54.3		4.37	28.1	24	11.35
05-Feb-18	Turbidity (NTU)		0.93	17.6	9.66	14.1	31.4		5.89	15.8	25.7	5.88
19-Feb-18	Turbidity (NTU)		0.82	5.79	11.3	13.5	30.7	24.4	2.54	17.5	24	4.85
05-Mar-18	Turbidity (NTU)		1.19	13.7	4.45	32.6	29.1		3.07	18.3	23.98	12.5
19-Mar-18	Turbidity (NTU)		1	8.36	12.5	16.7	29..2		3.38	18.5	20	5.84
08-Jan-18	TSS (mg/l)	<50	<5	8.37	6.38	40.12	40.3		<5	34.34	74.66	13.85
22-Jan-18	TSS (mg/l)	<50	<5	10.76	<5	44.38	25.88		<5	19.39	36.6	30.26
05-Feb-18	TSS (mg/l)	<50	<5	6.5	<5	25.42	34.8		8.83	34.49	37.98	7.77
19-Feb-18	TSS (mg/l)	<50	<5	10.68	5.53	29.91	33.33	117.69	<5	31.95	20.06	10.54
05-Mar-18	TSS (mg/l)	<50	<5	9.3	<5	23.47	19.49		<5	35.2	23.98	15.46

		Site Name	Owner's Site Office and Village	Obayashi Camp	Sino Hydro Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Kenber Camp
		Station Code	EF01	EF02	EF06	EF07	EF08	EF09	EF10	EF13	EF14	EF16
Date	Parameter (Unit)	Guideline in the CA										
19-Mar-18	TSS (mg/l)	<50	<5	7.43	<5	27.81	21.1		<5	25.32	38.14	16.26
08-Jan-18	BOD5 (mg/l)	<30	<6	<6	<6	<6	<6		<6	<6	<6	<6
22-Jan-18	BOD5 (mg/l)	<30	<6	<6	<6	<6	<6		<6	<6	64.9	<6
05-Feb-18	BOD5 (mg/l)	<30	6.33	<6	<6	<6	<6		<6	<6	47.28	<6
19-Feb-18	BOD5 (mg/l)	<30	9.9	<6	29.1	18.42	<6	41.82	<6	<6	<6	<6
05-Mar-18	BOD5 (mg/l)	<30	<6	<6	<6	<6	<6		16.86	<6	<6	<6
19-Mar-18	BOD5 (mg/l)	<30	<6	<6	<6	<6	<6		<6	27.12	104	<6
08-Jan-18	COD (mg/l)	<125	<25	57.6	58.1	120	172		<25	229	262	<25.0
22-Jan-18	COD (mg/l)	<125	<25	65.5	48	122	155		<25	198	186	50.5
05-Feb-18	COD (mg/l)	<125	<25	76.3	36.8	82.1	177		<25	264	298	<25
19-Feb-18	COD (mg/l)	<125	<25	41.6	47.2	110	132	235	30.1	147	160	45.4
05-Mar-18	COD (mg/l)	<125	<25	55.4	37.2	122	79.1		<25	187	240	<25

		Site Name	Owner's Site Office and Village	Obayashi Camp	Sino Hydro Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Kenber Camp
		Station Code	EF01	EF02	EF06	EF07	EF08	EF09	EF10	EF13	EF14	EF16
Date	Parameter (Unit)	Guideline in the CA										
19-Mar-18	COD (mg/l)	<125	<25	38.4	37	110	128		<25	214	275	47.2
08-Jan-18	NH3-N (mg/l)	<10	3.2	70.5	71.5	52.3	58.9		<0.2	22.7	15.5	<0.2
22-Jan-18	NH3-N (mg/l)	<10	3.7	31.6	38.5	28.6	30.6		<0.2	27.2	20.7	8.9
05-Feb-18	NH3-N (mg/l)	<10	3.2	24.3	<0.2	22.4	44.9		<0.2	24.2	16.2	2.5
19-Feb-18	NH3-N (mg/l)	<10	8.8	8	37.3	32.6	43.9	39.3	4.7	14.6	29	13.7
05-Mar-18	NH3-N (mg/l)	<10	5.6	24.6	21.1	19.4	31.8		4.1	18.2	9.9	4.3
19-Mar-18	NH3-N (mg/l)	<10	12.3	40.8	34.2	20.2	24.4		2.1	33.2	5.3	8.2
08-Jan-18	Total Nitrogen (mg/l)	<10	11.8	72.2	73	53.2	60		2.68	25.9	20.6	1.15
22-Jan-18	Total Nitrogen (mg/l)	<10	13.8	32.2	39.5	29	31.2		1.33	28.8	22	9.42
05-Feb-18	Total Nitrogen (mg/l)	<10	14.2	25.2	26.7	25.4	45.3		1.37	25.4	17.5	6.03
19-Feb-18	Total Nitrogen (mg/l)	<10	9.7	9.39	38.4	33	44.2	39.7	5.36	15.2	29.6	14.4
05-Mar-18	Total Nitrogen (mg/l)	<10	5.89	25.3	24.4	20.1	32.2		4.32	19	10.6	4.52

		Site Name	Owner's Site Office and Village	Obayashi Camp	Sino Hydro Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Kenber Camp
		Station Code	EF01	EF02	EF06	EF07	EF08	EF09	EF10	EF13	EF14	EF16
Date	Parameter (Unit)	Guideline in the CA										
19-Mar-18	Total Nitrogen (mg/l)	<10	16	41.4	34.6	21	25.1		3.06	33.5	13.2	8.36
08-Jan-18	Total Phosphorus (mg/l)	<2.0	0.43	0.73	1.31	0.96	2.04		0.12	0.76	1.61	0.33
22-Jan-18	Total Phosphorus (mg/l)	<2.0	0.62	1.33	0.96	0.37	1.9		0.17	0.5	0.55	0.95
05-Feb-18	Total Phosphorus (mg/l)	<2.0	0.86	1.49	1.83	1.19	1.71		1.37	1.56	1.5	0.62
19-Feb-18	Total Phosphorus (mg/l)	<2.0	1.37	0.51	1.79	1.28	1.7	1.84	0.39	1.45	1.52	1.06
05-Mar-18	Total Phosphorus (mg/l)	<2.0	1.15	1.36	1.51	1.26	1.42		0.48	1.48	1.29	0.62
19-Mar-18	Total Phosphorus (mg/l)	<2.0	1.4	1.15	1.45	1.19	1.55		0.33	1.29	0.95	1.18
08-Jan-18	Faecal Coliform (MPN/100 ml)		13	350	0	0	7.8		0	1,600	0	0
22-Jan-18	Faecal Coliform (MPN/100 ml)		0	23	0	0	17		0	0	9,200	0
05-Feb-18	Faecal Coliform (MPN/100 ml)		2	0	0	0	0		0	0	0	0

		Site Name	Owner's Site Office and Village	Obayashi Camp	Sino Hydro Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Kenber Camp
		Station Code	EF01	EF02	EF06	EF07	EF08	EF09	EF10	EF13	EF14	EF16
Date	Parameter (Unit)	Guideline in the CA										
19-Feb-18	Faecal Coliform (MPN/100 ml)		2	0	33	0	0	16,000	7.8	0	0	0
05-Mar-18	Faecal Coliform (MPN/100 ml)		4.5	0	0	0	0		240	0	0	0
19-Mar-18	Faecal Coliform (MPN/100 ml)		2	0	0	0	0		0	0	2.4	0
08-Jan-18	Total Coliform (MPN/100 ml)	<400	17	350	0	0	13		0	1,600	0	0
22-Jan-18	Total Coliform (MPN/100 ml)	<400	0	23	2	0	17		0	0	9,200	0
05-Feb-18	Total Coliform (MPN/100 ml)	<400	2	0	0	0	0		0	0	0	0
19-Feb-18	Total Coliform (MPN/100 ml)	<400	2	0	33	0	0	35,000	7.8	0	0	0
05-Mar-18	Total Coliform (MPN/100 ml)	<400	32	0	0	0	0		240	0	0	0
19-Mar-18	Total Coliform (MPN/100 ml)	<400	350	0	2	0	0		0	0	3500	0

		Site Name	Owner's Site Office and Village	Obayashi Camp	Sino Hydro Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Kenber Camp
		Station Code	EF01	EF02	EF06	EF07	EF08	EF09	EF10	EF13	EF14	EF16
Date	Parameter (Unit)	Guideline in the CA										
08-Jan-18	Oil & Grease (mg/l)	<10	<1	<1	<1	<1	3		<1	13	11	<1
05-Feb-18	Oil & Grease (mg/l)	<10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
05-Mar-18	Oil & Grease (mg/l)	<10	<1	<1	<1	<1	<1		<1	11	19	<1
08-Jan-18	Residual Chlorine (mg/l)	<1.0		0.09	0.47	1.27	1		1.8	0	1.86	2.2
22-Jan-18	Residual Chlorine (mg/l)	<1.0		0.13	0.07	0.58	0.2		6.9	0.92	0	0.74
05-Feb-18	Residual Chlorine (mg/l)	<1.0		0.34	0.13	0.28	1.15		4.9	0.43	0.16	0.45
19-Feb-18	Residual Chlorine (mg/l)	<1.0		0.84	0.04	0.36	1.6		0.08	0.65	2.25	0.9
05-Mar-18	Residual Chlorine (mg/l)	<1.0		0.61	0.57	0.41	0.8		0.02	0.82	0.23	0.79
05-Mar-18	Residual Chlorine (mg/l)	<1.0		0.61	0.57	0.41	0.8		0.02	0.82	0.23	0.79
19-Mar-18	Residual Chlorine (mg/l)	<1.0		1.29	0.45	0.99	1.84		1.21	0.55	0	2.04
08-Jan-18	Chlorination Dosing Rate (ml/mn)			135	430	120	260		52	3.1	6	162

		Site Name	Owner's Site Office and Village	Obayashi Camp	Sino Hydro Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Kenber Camp
		Station Code	EF01	EF02	EF06	EF07	EF08	EF09	EF10	EF13	EF14	EF16
Date	Parameter (Unit)	Guideline in the CA										
22-Jan-18	Chlorination Dosing Rate (ml/mn)			430	160		285		30	3.1	6	45
05-Feb-18	Chlorination Dosing Rate (ml/mn)			350	85	113	180		50	3.1	0	140
19-Feb-18	Chlorination Dosing Rate (ml/mn)			430	160		285		30	3.1	6	45
05-Mar-18	Chlorination Dosing Rate (ml/mn)			430	160		285		30	3.1	6	45
19-Mar-18	Chlorination Dosing Rate (ml/mn)			350	85	113	180		50	3.1	0	140
08-Jan-18	Effluent Discharge Volume (L/mn)		20	20	6	60	30		6	4.2	6	3
22-Jan-18	Effluent Discharge Volume (L/mn)											
05-Feb-18	Effluent Discharge Volume (L/mn)											
19-Feb-18	Effluent Discharge Volume (L/mn)											

		Site Name	Owner's Site Office and Village	Obayashi Camp	Sino Hydro Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Kenber Camp
		Station Code	EF01	EF02	EF06	EF07	EF08	EF09	EF10	EF13	EF14	EF16
Date	Parameter (Unit)	Guideline in the CA										
05-Mar-18	Effluent Discharge Volume (L/mn)		15	20	12	15	20		12	4.2	10	0
19-Mar-18	Effluent Discharge Volume (L/mn)		4	6	2.7	30	12		6	4.2	2.4	3

APPENDIX 5-3: EFFLUENT CONSTRUCTION AREA DISCHARGED MONITORING RESULTS – Q1 2018

			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)
Date	Site Name	Station Code	Guideline	6.0 - 9.0							<50	<10
22-Feb-18	Aggregate Crushing Plant	DS02		7.09	113.5	8.93	166.8	83	26.3	12.3	20.96	
1-Mar-18	Aggregate Crushing Plant	DS02		6.7	111.6	7.98	205.1	102.5	31.7	2.56	18.37	
8-Mar-18	Aggregate Crushing Plant	DS02		7.31	97.7	7.52	324	162	27.5	8.19	24.81	<1
15-Mar-18	Aggregate Crushing Plant	DS02		6.88	105	7.67	331	165.5	30.4	13	37.57	

			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)
Date	Site Name	Station Code	Guideline	6.0 - 9.0							<50	<10
22-Mar-18	Aggregate Crushing Plant	DS02										
29-Mar-18	Aggregate Crushing Plant	DS02										
4-Jan-18	Spoil Disposal No.2	DS04		5.68	24.6	2.51	37	18.5	26.5	4.74	4.5	
11-Jan-18	Spoil Disposal No.2	DS04		7.56	40	3.34	33.6	17	22.8	4.34	3.9	
18-Jan-18	Spoil Disposal No.2	DS04		7.09	43.1	3.45	36.4	18	25	3.77	2.79	
25-Jan-18	Spoil Disposal No.2	DS04		7.51	45.4	3.58	40.4	20.2	25.6	3.7	3.47	
2-Feb-18	Spoil Disposal No.2	DS04		7.84	76.5	6.29	45.9	23	24	4.16	6.08	
8-Feb-18	Spoil Disposal No.2	DS04		6.06	77	6.22	41.5	20.5	24.8	4.83	2.63	
15-Feb-18	Spoil Disposal No.2	DS04		5.9	68	5.27	53.4	26.8	26.9	5.11	5.45	
22-Feb-18	Spoil Disposal No.2	DS04		5.67	52.5	4.18	54.4	27	25.5	8.06	5.69	
1-Mar-18	Spoil Disposal No.2	DS04										
8-Mar-18	Spoil Disposal No.2	DS04		6.15	57.2	4.59	58	29	25.2	7.18	7.69	<1
15-Mar-18	Spoil Disposal No.2	DS04										
22-Mar-18	Spoil Disposal No.2	DS04		5.93	49.3	3.86	56.2	28	26.3	8.56	8.61	
29-Mar-18	Spoil Disposal No.2	DS04		6.16	60.1	4.61	68.7	34	27.3	9.06	11.33	
4-Jan-18	RCC Plant Discharged at lower ponds	DS09		6.65	79.2	6.22	435	217.5	26.3	11.2	18.4	

			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)
Date	Site Name	Station Code	Guideline	6.0 - 9.0							<50	<10
11-Jan-18	RCC Plant Discharged at lower ponds	DS09		8.45	80.5	7.09	318	159	20.8	11.7	26.02	
18-Jan-18	RCC Plant Discharged at lower ponds	DS09		8.39	113.4	8.68	251	125	27.7	26.8	41.93	
25-Jan-18	RCC Plant Discharged at lower ponds	DS09		8.63	95.7	7.44	293	146.5	26.6	15.5	40.17	
2-Feb-18	RCC Plant Discharged at lower ponds	DS09		8.32	89.9	7.46	295	147	23.6	11.4	22.72	
8-Feb-18	RCC Plant Discharged at lower ponds	DS09		6.9	87.6	7.4	307	153	23	18.7	42.16	<1
15-Feb-18	RCC Plant Discharged at lower ponds	DS09		7.00	98.2	7.53	287	143.5	27.7	9.5	16.71	
22-Feb-18	RCC Plant Discharged at lower ponds	DS09		7.05	95.8	7.71	303	151.5	25	12.2	26.33	
1-Mar-18	RCC Plant Discharged at lower ponds	DS09		6.79	85.7	6.29	289	144.5	29.9	7.5	8.94	
8-Mar-18	RCC Plant Discharged at lower ponds	DS09		7.08	93.7	7.17	301	150	27.9	7.7	12.66	<1
15-Mar-18	RCC Plant Discharged at lower ponds	DS09		6.91	81.1	6.3	295	147	26.9	11.3	26.79	

			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)
Date	Site Name	Station Code	Guideline	6.0 - 9.0							<50	<10
22-Mar-18	RCC Plant Discharged at lower ponds	DS09		7.12	87.6	6.69	299	149	27.9	9.2	10.61	
29-Mar-18	RCC Plant Discharged at lower ponds	DS09		7.44	80.8	6.15	312	156	28	8.2	14.11	
4-Jan-18	Main Dam's Treatment Plant No.1	DS11		6.12	101.3	7.68	875	437.5	27.4	6.16	8.53	
11-Jan-18	Main Dam's Treatment Plant No.1	DS11		8.22	95.4	8.36	999	499	20.9	2.97	5.33	
18-Jan-18	Main Dam's Treatment Plant No.1	DS11		7.84	102.2	8.17	1,273	636	25.2	5.5	13.47	
25-Jan-18	Main Dam's Treatment Plant No.1	DS11		8.22	102.9	8.1	934	467	26.5	3.98	10.78	
2-Feb-18	Main Dam's Treatment Plant No.1	DS11		8.53	106.6	9.02	2.22	1	22.5	3.81	9.18	
8-Feb-18	Main Dam's Treatment Plant No.1	DS11										
15-Feb-18	Main Dam's Treatment Plant No.1	DS11		6.64	105.9	8.2	930	465	27.2	1.65	6.36	
22-Feb-18	Main Dam's Treatment Plant No.1	DS11		6.93	104.2	8.21	543	271	26.1	1.63	8.7	

			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)
Date	Site Name	Station Code	Guideline	6.0 - 9.0							<50	<10
4-Jan-18	Main Dam's Treatment Plant No.2	DS12		6.12	101.3	7.68	875	437.5	27.4	6.16	8.53	
11-Jan-18	Main Dam's Treatment Plant No.2	DS12		8.22	95.4	8.36	999	499	20.9	2.97	5.33	
18-Jan-18	Main Dam's Treatment Plant No.2	DS12		7.84	102.2	8.17	1,273	636	25.2	5.5	13.47	
25-Jan-18	Main Dam's Treatment Plant No.2	DS12		8.22	102.9	8.1	934	467	26.5	3.98	10.78	
2-Feb-18	Main Dam's Treatment Plant No.2	DS12		8.53	106.6	9.02	2.22	1	22.5	3.81	9.18	
8-Feb-18	Main Dam's Treatment Plant No.2	DS12										
15-Feb-18	Main Dam's Treatment Plant No.2	DS12		6.64	105.9	8.2	930	465	27.2	1.65	6.36	
22-Feb-18	Main Dam's Treatment Plant No.2	DS12		6.93	104.2	8.21	543	271	26.1	1.63	8.7	
1-Mar-18	Main Dam's Treatment Plant No.2	DS12		4.85	98.5	7.27	1,125	562.5	29.4	7.7	18.37	
8-Mar-18	Main Dam's Treatment Plant No.3	DS12		7	97.3	7.64	2	1	26.3	5.83	45.43	<1

			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)
Date	Site Name	Station Code	Guideline	6.0 - 9.0							<50	<10
15-Mar-18	Main Dam's Treatment Plant No.4	DS12		4.87	100.5	7.41	1270	635	29.7	8.98	62.68	
22-Mar-18	Main Dam's Treatment Plant No.5	DS12		6.65	100	7.63	1,337	668	27.9	4.64	13.73	
29-Mar-18	Main Dam's Treatment Plant No.2	DS12		7.83	99.1	7.44	1,008	504	28.7	8.31	77.89	
8-Feb-18	Main Dam's Treatment Plant No.3	DS14		9.99	101.4	8.52	4290	2145	23.1	6,720	8,272	
15-Feb-18	Main Dam's Treatment Plant No.3	DS14		10.84	104	7.91	746	373	28.1	9.13	43.9	
22-Feb-18	Main Dam's Treatment Plant No.3	DS14		4.72	104.3	8.16	3.11	1	26.4	23.3	110.48	
1-Mar-18	Main Dam's Treatment Plant No.3	DS14										
8-Mar-18	Main Dam's Treatment Plant No.3	DS14		11.2	100.6	7.96	523	261	26	29.6	125.57	<1
15-Mar-18	Main Dam's Treatment Plant No.3	DS14		2.36	102	7.51	3090	1500	29.8	22.4	97.38	
22-Mar-18	Main Dam's Treatment Plant No.3	DS14		8.59	100.1	7.71	1,984	994	27.3	13.4	79.34	

			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)
Date	Site Name	Station Code	Guideline	6.0 - 9.0							<50	<10
29-Mar-18	Main Dam's Treatment Plant No.3	DS14		7.25	97.7	7.43	1,242	621	27.9	5.17	11.52	

APPENDIX 5-4: GROUNDWATER QUALITY MONITORING RESULTS – QUARTER -Q1 2018

		Site Name	Phouhomxay Village						Soumseun Village		NamPa Village	ThongNoy Village
Month Year	Parameter (Unit)	Station	GHSP01	GHSP02	GHSP03	GHSP04	GHSP05	GHSP06	GSXN01	GSXN02	GNPA01	GTHN01
		Guideline										
09-Jan-18	pH	6.5 - 9.2			7.83		7.23	7.63				
24-Jan-18	pH	6.5 - 9.2							7.07	7.94	7.61	7.84
13-Feb-18	pH	6.5 - 9.2			6.65			7.16	6.7	6.8	6.69	6.57
13-Mar-18	pH	6.5 - 9.2							6.59	6.86	6.87	6.82
20-Mar-18	pH	6.5 - 9.2			7.06							
09-Jan-18	Sat. DO (%)				89.8		83.8	70.9				
24-Jan-18	Sat. DO (%)								45.8	43.1	33.1	40.9

		Site Name	Phouhomxay Village						Soumseun Village		NamPa Village	ThongNoy Village
Month Year	Parameter (Unit)	Station	GHSP01	GHSP02	GHSP03	GHSP04	GHSP05	GHSP06	GSXN01	GSXN02	GNPA01	GTHN01
		Guideline										
13-Feb-18	Sat. DO (%)				73.7			85.6	53.6	43.6	32.7	28.2
13-Feb-18	Sat. DO (%)								34.6	27.7	19.6	29.9
20-Mar-18	Sat. DO (%)				79.3							
09-Jan-18	DO (mg/l)				7.23		6.72	5.7				
24-Jan-18	DO (mg/l)								3.59	3.38	2.59	3.13
13-Feb-18	DO (mg/l)				6.11			6.97	4.22	3.38	2.52	1.4
13-Mar-18	DO (mg/l)								2.61	2.06	1.47	2.27
20-Mar-18	DO (mg/l)				6.65							
09-Jan-18	Conductivity (µS/cm)				380		291	356				
24-Jan-18	Conductivity (µS/cm)								156.8	268	353	366
13-Feb-18	Conductivity (µS/cm)				379			357	153.6	260	317	336
13-Mar-18	Conductivity (µS/cm)								153.4	263	334	322
20-Mar-18	Conductivity (µS/cm)				385							
09-Jan-18	TDS (mg/l)	1200			190		145	178				
24-Jan-18	TDS (mg/l)	1200							78.4	134	176.5	183
13-Feb-18	TDS (mg/l)	1200			189			178	76.5	130	158	168
13-Mar-18	TDS (mg/l)	1200							76.7	131.5	167	161

		Site Name	Phouhomxay Village						Soumseun Village		NamPa Village	ThongNoy Village
Month Year	Parameter (Unit)	Station	GHSP01	GHSP02	GHSP03	GHSP04	GHSP05	GHSP06	GSXN01	GSXN02	GNPA01	GTHN01
		Guideline										
20-Mar-18	TDS (mg/l)	1200			192							
09-Jan-18	Temperature (°C)				25.1		25.3	25.1				
24-Jan-18	Temperature (°C)								26.7	26.6	26.7	27.7
13-Feb-18	Temperature (°C)				24.2			25	21	21.6	21.7	25.1
13-Mar-18	Temperature (°C)								28.9	29.6	29	28.7
20-Mar-18	Temperature (°C)				24.4							
09-Jan-18	Turbidity (NTU)	<20			1.6		1.01	1.01				
24-Jan-18	Turbidity (NTU)	<20							7.19	0.79	1.05	1.52
13-Feb-18	Turbidity (NTU)	<20			0.71			0.76	7.62	1.88	1.29	1.65
13-Mar-18	Turbidity (NTU)	<20							1.6	3.1	2.13	8.39
20-Mar-18	Turbidity (NTU)	<20			0.78							
09-Jan-18	Fecal coliform (MPN/100ml)	0			0		0	0				
24-Jan-18	Fecal coliform (MPN/100ml)	0							0	0	0	0
13-Feb-18	Fecal coliform (MPN/100ml)	0			0				0	0	0	0
13-Mar-18	Fecal coliform (MPN/100ml)	0							0	0	0	0

Month Year	Parameter (Unit)	Site Name	Phouhomxay Village						Soumseun Village		NamPa Village	ThongNoy Village
		Station	GHSP01	GHSP02	GHSP03	GHSP04	GHSP05	GHSP06	GSXN01	GSXN02	GNPA01	GTHN01
		Guideline										
20-Mar-18	Fecal coliform (MPN/100ml)	0			0							
09-Jan-18	E.coli Bacteria (MPN/100ml)	0			0		0	0				
24-Jan-18	E.coli Bacteria (MPN/100ml)	0							0	0	0	0
13-Feb-18	E.coli Bacteria (MPN/100ml)	0			0				0	0	0	0
13-Mar-18	E.coli Bacteria (MPN/100ml)	0							0	0	0	0
20-Mar-18	E.coli Bacteria (MPN/100ml)	0			0							
24-Jan-18	Arsenic (mg/)	<0.05							<0.0003	0.0005	0.0005	0.0008
20-Mar-18	Arsenic (mg/)	<0.05			0.0004							
24-Jan-18	Total Iron (mg/l)								0.978	<0.01	0.08	0.278
24-Jan-18	Maganesium (mg/l)								1.75	3.14	2.51	3.89
24-Jan-18	Manganese (mg/l)	<0.5							<0.005	<0.005	<0.005	0.036
24-Jan-18	Fluoride (mg/l)	<1							0.12	0.23	0.24	0.05
20-Mar-18	Fluoride (mg/l)	<1			0.47							

		Site Name	Phouhomxay Village						Soumseun Village		NamPa Village	ThongNoy Village
Month Year	Parameter (Unit)	Station	GHSP01	GHSP02	GHSP03	GHSP04	GHSP05	GHSP06	GSXN01	GSXN02	GNPA01	GTHN01
		Guideline										
24-Jan-18	Total hardness (mg/l)	<500							86.9	161	191	210
20-Mar-18	Total hardness (mg/l)	<500			226							
24-Jan-18	Nitrate (mg/l)	<45							0.2	0.42	0.06	0.29
20-Mar-18	Nitrate (mg/l)	<45			1.28							
24-Jan-18	Nitrite (mg/l)	<3							<0.02	<0.02	<0.02	<0.02
20-Mar-18	Nitrite (mg/l)	<3			<0.02							
24-Jan-18	Lead (mg/l)	<0.05							0.0009	<0.008	<0.008	<0.008
20-Mar-18	Lead (mg/l)	<0.05			<0.008							

APPENDIX 5-5: GRAVITY FED WATER SUPPLY MONITORING RESULTS – Q1 2018

		Site Name	Thaheau Village	Hat Gnuin Village	Phouhomxay Village		
		Station	WTHH02	WHGN02	WPHX01	WPHX02	WPHX03
Date	Parameter (Unit)	Guideline					
09-Jan-18	pH	6.5 - 8.6	8.19	7.94	8.25	8.12	
13-Feb-18	pH	6.5 - 8.6	7.27	7.63	7.53	6.23	
20-Mar-18	pH	6.5 - 8.6	6.94	6.75	7.32	7.63	7.77
09-Jan-18	Sat. DO (%)		98.1	87.8	99.8	103.2	
13-Feb-18	Sat. DO (%)		101.8	119.4	95.1	108.3	
20-Mar-18	Sat. DO (%)		90.3	62.2	93	94.1	93.7
09-Jan-18	DO (mg/l)		8.01	6.72	8.22	8.47	
13-Feb-18	DO (mg/l)		8.71	10.27	8.17	8.28	
20-Mar-18	DO (mg/l)		7.15	4.99	7.65	7.74	7.66
09-Jan-18	Conductivity (µS/cm)	<1,000	53.1	67.4	11.17	10.94	
13-Feb-18	Conductivity (µS/cm)	<1,000	53.5	79.3	21.5	18.45	
20-Mar-18	Conductivity (µS/cm)	<1,000	59	86.9	25.8	21.73	22.7
09-Jan-18	TDS (mg/l)	<600	26	33	5	5	
13-Feb-18	TDS (mg/l)	<600	26.5	39.5	10.5	9.2	
20-Mar-18	TDS (mg/l)	<600	30	43	13	11	11
09-Jan-18	Temperature (°C)	<35	24.5	25.3	23.9	24.1	
13-Feb-18	Temperature (°C)	<35	22.6	22.5	22.2	22.4	
20-Mar-18	Temperature (°C)	<35	26.2	25.4	23.9	24	24.3
09-Jan-18	Turbidity (NTU)	<10	1.07	3.21	1.03	0.9	
13-Feb-18	Turbidity (NTU)	<10	0.95	2.48	2.87	2.23	
20-Mar-18	Turbidity (NTU)	<10	1	1.14	1.28	1.29	1.26
09-Jan-18	Faecal Coliform (MPN/100ml)	0	79	79	13	49	
13-Feb-18	Faecal Coliform (MPN/100ml)	0	34	11	34	41	
20-Mar-18	Faecal Coliform (MPN/100ml)	0	9.3	79	33	79	33
09-Jan-18	E.coli Bacteria (MPN/100ml)	0	79	79	13	49	
13-Feb-18	E.coli Bacteria (MPN/100ml)	0	34	11	34	41	
20-Mar-18	E.coli Bacteria (MPN/100ml)	0	9.3	79	33	49	33

		Site Name	Thaheau Village	Hat Gnuin Village	Phouhomxay Village		
		Station	WTHH02	WHGN02	WPHX01	WPHX02	WPHX03
Date	Parameter (Unit)	Guideline					
20-Mar-18	Arsenic (mg/l)	<0.05	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
20-Mar-18	Lead (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
20-Mar-18	Fluoride (mg/l)	<1.5	0.32	0.49	0.39	0.42	0.59
20-Mar-18	Nitrate (mg/l)	<50	0.22	<0.09	1.37	1.28	1.33
20-Mar-18	Nitrite (mg/l)	<3	<0.02	<0.02	<0.02	<0.02	<0.02
20-Mar-18	Total hardness (mg/l)	<300	55.2	69	21.9	29.6	19.5

APPENDIX 5-6: LANDFILL LEACHATE MONITORING RESULTS – Q1 2018

		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							
8-Jan-18	pH	6.0-9.0				8.62		8.95	
8-Jan-18	*Sat.* DO (%)					132.8		106.6	
8-Jan-18	DO (mg/l)					9.48		7.81	
8-Jan-18	Conductivity (µS/cm)					360		17.12	
8-Jan-18	TDS (mg/l)					180		8	
8-Jan-18	Temperature (°C)					31.4		30	
8-Jan-18	Turbidity (NTU)					9.99		1.6	
8-Jan-18	BOD (mg/l)	<30				<6		<6	
8-Jan-18	COD (mg/l)	<125				116		<25	
8-Jan-18	Faecal Coliform (MPN/100ml)					0		4.5	
8-Jan-18	Total Coliform (MPN/100ml)	<400				2		4.5	

APPENDIX 5-7: LANDFILL GROUNDWATER QUALITY MONITORING RESULTS – Q1 2018

	Site Name	NNP1PC Landfill				Houay Soup Landfill
	Station	MW1	MW2	MW3	MW4	MW5
	Date	28-Mar-18	28-Mar-18	28-Mar-18	28-Mar-18	28-Mar-18
Parameter (Unit)	Guideline					
pH		6.31	5.55	6.35	5.62	6.37
Sat. DO (%)		34	45.1	30	22.7	49.6

Parameter (Unit)	Site Name	NNP1PC Landfill				Houay Soup Landfill
	Station	MW1	MW2	MW3	MW4	MW5
	Date	28-Mar-18	28-Mar-18	28-Mar-18	28-Mar-18	28-Mar-18
	Guideline					
DO (mg/l)		2.61	3.48	2.29	1.76	389
Conductivity (µS/cm)		144.4	32.3	149.7	47.8	119.6
TDS (mg/l)		72.2	16.15	74.85	23.9	59.8
Temperature (°C)		27.5	27.3	27.8	27.1	26.6
Turbidity (NTU)		0.82	0.81	1.37	0.48	15.75
Total Nitrogen (mg/l)		6.75	4.10	4.82	1.77	1.59
Lead (mg/l)	<0.01	0.132	0.011	0.091	0.030	0.253
Total Phosphorus (mg/l)		0.05	0.02	0.06	0.01	0.05
Faecal Coliform (MPN/100ml)		0	0	0	0	0
Total Coliform (MPN/100ml)		0	0	0	0	0
NH_3-N (mg/l)		<1.5	<1.5	<1.5	<1.5	<1.5
Copper (mg/l)		<0.003	<0.003	<0.003	<0.003	<0.003
Total Petroleum (mg/l)		<3	<3	<3	<3	<3
Water level (m)		29.50	35.55	25.95	24.70	14.80