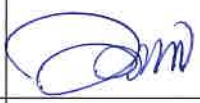
NAM NGIEP 1
POWER COMPANY

Nam Ngiep 1 Hydropower Project

Quarterly Environment Monitoring Report
Second Quarter of 2019

April to June 2019

Rev	Date	Author	Checked	Approved	Modification Details
A	18 December 2020				Final
A1	08 September 2020				2nd draft sent to ADB for Review
A0	31 January 2020	Hendra WINASTU	Wanidaporn RODE	Khamlar PHONSAVAT	1st draft sent to LTA for Review

Accessibility	
☑	Public
☐	Internal
☐	Confidential

Document No.

NNP1-C-J0905-RP-018-A

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ABBREVIATIONS / ACRONYMS

AIP	Annual Implementation Plan
ADB	Asian Development Bank
BAC	Biodiversity Advisory Committee
BOF	Biodiversity Offset Framework
BOMC	Biodiversity Offset Management Committee
BOMP	Biodiversity Offset Management Plan
CA	Concession Agreement between the NNP1PC and GOL
CAP	Corrective Action Plan
COD	Commercial Operation Date
CVC	Conventional Vibrated Concrete
CWC	Civil Works Contract
EC	Electrolytic Conductivity
EIA	Environmental Impact Assessment
EMMR	Environmental Management and Monitoring Reports
EMO	Environmental Management Office of ESD within NNP1PC
EMU	Environmental Monitoring Unit
EMWC	Electrical-Mechanical Works Contract
EPF	Environmental Protection Fund
ESD	Environmental and Social Division of NNP1PC
ESMMP	Environmental and Social Monitoring and Management Plan
GOL	Government of Lao PDR
GIS	Geographic Information Systems
HMWC	Hydraulic Metal Works Contract
HR	Human Resources
IEE	Initial Environmental Examination
IMA	Independent Monitoring Agency
INRMP	Integrated Natural Resources Management Plan
ISP	Intergraded Spatial Planning
kV	kilo-Volt
LTA	Lender's Technical Advisor
MAF	Ministry of Agriculture and Forestry
MEM	Ministry of Energy and Mines, Lao PDR

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

1 EXECUTIVE SUMMARY

The quarterly environment monitoring reports of Nam Ngiep 1 Hydropower Project provide 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 Q2 2019, the Environmental Management Office (EMO) of NNP1PC reviewed and approved five Detailed Work Program (DWP) & Site Specific ESMMPs and six Site Decommissioning Plans. A total of seventeen Observations of Non-Compliance (ONCs) were active (no NCRs were issued during this reporting period). Out of these, sixteen ONCs were resolved during the reported period, one ONC shall be carried over to the third quarter of 2019.

During Q2 2019, a total of 235.5 m^3 of solid waste was disposed of at the NNP1 Project Landfill, a decrease of 46.1 m^3 compared to Q1 2019. A total of 16,540 kg of recyclable waste (mostly scrap metal) was collected by Khounmixay Processing Factory and transported offsite to its facilities for recycling or processing and final disposal.

The Environmental Management Unit (EMU) of Bolikhamxay Province conducted a site inspection during 14 – 15 May 2019. The EMU informed EMO that they would submit an inspection report for NNP1PC review and comment by the end of May 2019.

The quarterly site inspection by the Environmental Management Unit (EMU) of Xaysomboun Province was carried out on 11 – 14 June 2019. The EMU report is under preparation by EMU and will be submitted for NNP1PC review by early July 2019.

During the Q2 2019, the concentration of dissolved oxygen in R5 (Main Reservoir) fluctuated between 4.16 - 8.56 mg/L. In June 2019, DO concentration was commencing to decrease with less than 6 mg/L at the stations of Re-regulation Reservoir and Nam Ngiep Downstream.

In addition, the depth profile monitoring indicates a formation of oxyclines in all the stations in the main reservoir at depths between 2.5 – 10.0 m. During the Main Powerhouse wet-test in June 2019, some dead fish were observed; fish specimens were collected at R6 and R7 for further identification. The details of the fish kill incident can be found in the water quality incident report which was prepared by NNP1PC and submitted to ADB and MONRE.

NNP1PC-EMO completed the improvement of the Lao version of the NNP1 Watershed Management Plan (WMP) addressing comments received from the final consultation workshop with the Government on 13 March 2019. NNP1PC-EMO continues to improve the Plan from April to June 2019 addressing the comments from GoL, revising the budget, and refining the Lao translation for consistency prior to submitting to the Department of Forestry (DoF), Ministry of Agriculture and Forestry (MAF) for review and approval by the Vice-Minister of MAF. It is expected the Plan will be approved by Vice-Minister of MAF in July 2019.

The improved draft AIP2019 from three WRPOs were discussed during a workshop on the draft Financial Management Manual for Watershed Management Fund on 10 May 2019. After series of review and improvement, DOF-WRPO and Bolikhamxay Provincial WRPO submitted their final AIP2019 on 21 June 2019 and 31 June 2019 respectively. Their AIPs are being translated by NNP1PC-EMO for submission to ADB in July 2019.

After a series of follow up by NNP1PC-EMO, a discussion between Xaysomboun Provincial WRPO and NNP1PC-EMO was organized on 24 June 2019. It was noted that their AIP needed further internal discussion and approval. Thus, the submission of their AIP2019 to ADB is expected to be later than DOF-WRPO and Bolikhamxay Provincial WRPO.

The final consultation workshop with the Drafting Committee on the draft Regulation of NNP1 Watershed Management took place on 01 April 2019 at Xaysomboun Provincial Agriculture and Forestry Office (PAFO). This draft was discussed at the extraordinary session of the Provincial Assembly on 02 April 2019. It was principally agreed with some recommendations for amendments.

Xaysomboun Provincial WRPO submitted the draft Regulation to Xaysomboun Provincial Justice Department on 25 April 2019 for further review and clearance. The final revision was re-submitted to Xaysomboun Provincial Justice Department on 14 May 2019 and was certified on 22 May 2019. Xaysomboun Provincial Governor issued an Agreement on NNP1 Watershed Management on 07 June 2019. The dissemination activity will be part of AIP2019 of Xaysomboun Provincial WRPO.

NNP1PC-EMO completed the improvement of the Lao version of the NNP1 Biodiversity Offset Management Plan (BOMP) on 30 April 2019. The Plan was discussed with Biodiversity Offset Management Unit (BOMU) and relevant government agencies during a technical workshop on 21 May 2019 in Viengthong District, Bollikhamxay Province. All parties understood and agreed with the BOMP structure, components and all activities.

A High-Level Consultation Workshop for the approval of NNP1 BOMP was organized on 13 June 2019 chaired by Bolikhamxay Provincial Vice-Governor and co-chaired by NNP1PC Managing Director. The meeting agreed with the components, contents, activities and overall budget of the final draft NC-NX BOMP. NNP1PC-EMO Team completed further revision of the Plan on 17 June 2019 by addressing the comments received during the High-Level Workshop on 13 June 2019. The Plan is being reviewed by NNP1PC-EMO management prior to further submission to the Director General of DOF-MAF for approval, which is expected to be in early July 2019.

The Pre-BOMP2B funding was completed by the end of March 2019 and there was no activity being carried out until the AIP2019 is approved by the ADB. ADB provided a final confirmation accepting the AIP2019 on 10 May 2019 after a total of 47 days of review.

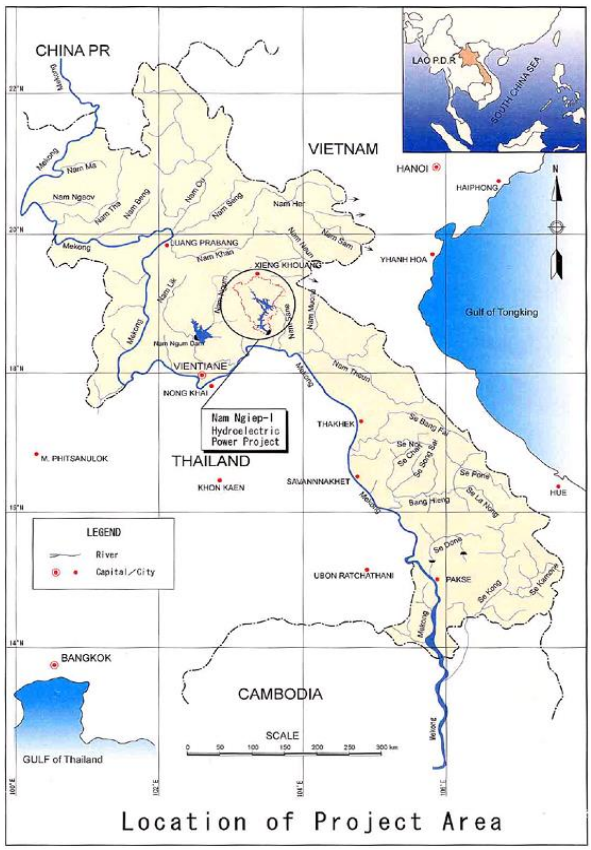
The first quarter fund transfer covering the implementation period from April-June 2019 for the amount of USD 52,914 (around 27% from the total fund of USD 197,726) was completed on 29 May 2019. Bolikhamxay Provincial BOMU confirmed that the fund transfer from DOF-MAF was completed on 20 June 2019. The patrolling activity was started from 22 June 2019 and expected to be completed in the middle of July 2019.

The five types of fish that dominated the fish catch by weight in Q2 2019, this includes three species and two species group that are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species, except *Systomus orphoides* and *Hemibagrus filamentus* which are classified as Not Evaluated (NE) and Data Deficient (DD) species respectively.

2 INTRODUCTION

The Nam Ngiep originates in the mountains of Xing 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, has created 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.



This second Quarterly Environment Report provides a summary of environmental monitoring activities and mitigation actions during Q2 2019. The report is published on the Company website (https://namngiep1.com/).

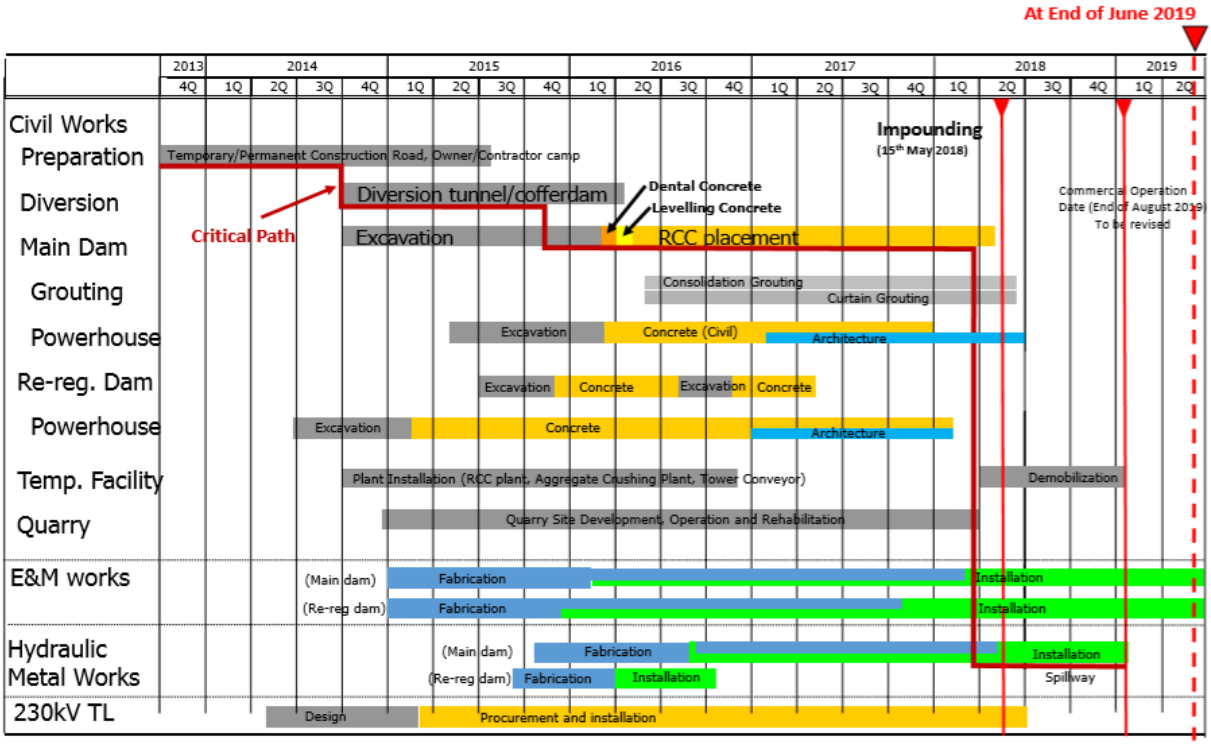
Related construction Site Specific Environmental and Social Monitoring and Management Plans (SS-ESMMPs) are also publicly disclosed on the Company website as required under the Concession Agreement.

3 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 June 2019 for all contracts was 99.3% (compared to planned progress of 100%).

The overall construction schedule and progress curve (by achieved Milestone Payments) are shown in ***Figure 3-1.***

FIGURE 3-1: *OVERALL CONSTRUCTION SCHEDULE*



3.1 CIVIL WORK

The actual overall cumulative work progress until the end of March 2019 was 100% (compared to planned progress of 100%). The Civil Works overall was always on or ahead of schedule despite increased quantities of dam excavation and slope stabilisation and additional RCC placed in the shear key.

At the end of June 2019, the progress of additional contingency works by value of variation orders and other adjustments was 88.5% in total: 85.2% in Civil Works, 0.8% in Electrical and Mechanical Works, 2.5% in Metal Works and 0.0% in the 230 kV Transmission Line Works.

3.2 MAIN DAM AND POWERHOUSE

Since the impounding of the Main Dam started 15 May 2018, monitoring has been done to confirm the dam stability, especially to the right abutment where some anomalous results had been noted. Many of the original concerns have been explained or are better understood. However, the monitoring revealed unforeseen consequences, which began unfolding with events in August and September 2018 when loading of the dam toe appeared to have caused a rotation and settlement of the main powerhouse to upstream and towards the old river bed such that the setting and fixing vertically of both turbine generating units within the required tolerances was not possible. This movement of the powerhouse also affected associated structures such as the penstocks and the intake valve. Monitoring of the instruments initially installed continues, more instruments have been installed or are planned to be installed, further drainage drilling has been carried out and more will be undertaken. As related above, all current information and opinion is contained in the separate September Monthly Report

on Main Dam Instrumentation and Monitoring. This Report has been sent to the Dam Safety Review Panel and the RCC Dam Expert for review and comment.

3.2.1 Diversion Tunnel Inlet and Outlet

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

The second diversion to divert the river from the diversion tunnel through the bottom outlet or conduit in the dam was implemented on 13 January 2018. Dewatering of the diversion tunnel and construction of the concrete plug was commenced during January 2018. Concrete works and the valve installation for discharge was completed before the start of main dam impounding. On 22 May 2018, the valve discharge commenced by using 3 valves with around 5 m3/s discharge in total. Construction of concrete plug including valve was completed on 27 January 2019.

3.3 QUARRY

The quarry operations were completed in March 2018 and the final blasting was carried out on 27 March 2018.

The surface clearing, topsoil and overburden removal works at the extension area were completed in December 2016 and its development works was commenced in January 2017. The final blasting was carried out 27 March 2018.

FIGURE 3-2: *WORKS AT QUARRY AREA VIEWED FROM DOWNSTREAM*

3.4 ELECTRICAL AND MECHANICAL WORKS

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

The cumulative work progress of the Electrical and Mechanical Works by value at the end of June 2019 was 98.8% (compared to planned progress of 100.0%). This delay is due to the delay of issuing Taking-Over Certificate for Re-regulation power station and the powerhouse inclination issue for Main power station. As verticality of the generating Unit 1 was being set within tolerance it was found there was inclination of the shaft. Further checking confirmed that the verticality could not be achieved since the powerhouse structure itself was inclined in the upstream direction.

The initial cumulative inclinations of the shaft were 0.50 mm/m for No.1 shaft and 0.28 mm/m for No.2 shaft compared to the allowable inclination in the shaft level 0.02 mm/m. Also, the fixed parts of turbine generator, such as the stator base, have inclined in the upstream direction in the same manner as the generator shaft. The EMW Contractor suspended its installation works of Unit 2 and wet test work for Unit 1 because of these events, but resumed in December 2018. The cause is considered to be fully understood and all movement of the powerhouse is believed to be plastic deformation and to have taken place. It is concluded that no remedial works or countermeasures for the main powerhouse are necessary.

3.5 HYDRO-MECHANICAL WORKS

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

3.6 230 KV TRANSMISSION LINE WORKS

The TLW Contract was executed between Loxley-Sri Consortium and NNP1PC on 11 July 2014 and the NTP was issued to the 230 kV TL Contractor on 03 October 2014. The cumulative work progress of the Transmission Line Works until the end of September 2018 was 100 % and on schedule with energization test completed successfully in September 2018.

Gabion installation work for foundation base of tower no.1 is ongoing in June 2019.

3.7 115-KV TRANSMISSION LINE

The 115 kV Transmission Line is outside the scope of the Project and EDL are undertaking these works themselves through Dong Fang Electric Company as Contractor. The 115 kV TL will transmit the electricity generated from the re-regulation powerhouse to Pakxan Substation. It is understood that Dong Fang signed a construction contract with EDL in January 2016 and the parties agreed the cost of construction and a schedule in April 2017 which required commencement on Site of the 115 kV TL on 01 October 2017 and completion by 06 May 2018. PPA connection date was established as 05 June 2018 and energisation date 05 August 2018.

EDL carried out the preliminary route survey to determine the ROUTE OF THE 115 KV LINE, THE survey works for the tower pegging were carried out in May 2017, and bush clearing and access road construction carried out from November 2017. The construction of tower foundations was started in December 2017 and has been completed being a total of 86 towers.

All 86 No. towers have been erected and stringing works completed for 33.0km out of total 33km. Bush clearing and access are completely finished. The cumulative work progress of 115kV Transmission Line Works until the end of December 2018 was almost 100 % completed in February 2019.

The remaining Dong Fang work to complete the connection to Paksan Substation was completed by the end of November 2018, thereby delaying the ability of NNP1PC to generate electricity for sale to EDL by several months.

The energization Test which was planned for 10 February 2019 was shifted to 13 February 2019 for EDL 's own reasons.

4 ENVIRONMENTAL MANAGEMENT AND MONITORING

The environmental management and monitoring activities reported in this section document the implementation of relevant sub-plans and programmes of the Environmental and Social Management and Monitoring Plan for the Construction Phase during Q2 2019.

4.1 Contractor SS-ESMMPs

During Q2 2019, five Detailed Work Programme & Site Specific Environmental and Social Management Plans (DWP & SS-ESMMPs) and six Site Decommissioning and Rehabilitation Plans were submitted for review and approval by the Environmental Management Office (EMO). These five DWP & SS-SEMMPs and the six Site Decommissioning Plans were cleared accordingly to timeframes and more details are provided in Table 4-1 and ***Appendix 1***.

TABLE 4-1*: SS-ESMMPS AND SITE SPECIFIC ENVIRONMENTAL MANAGEMENT AND MONITORING REVIEWED DURING Q2 2019*

Document Name	Rev. 1	Rev. 2	Rev. 3	Approved
Site Decommissioning and Rehabilitation Plan for Song Da5 Camp No.2	√	√		√
Site Specific Decommissioning and Rehabilitation Plan for GFE Camp	√			√
Site Decommissioning and Rehabilitation Plan for IIS's Field shop and 276 Camp	√	√		√
Site Decommissioning and Rehabilitation Plan for main dam workshop and spoil disposal No.2	√	√		√
Site Decommissioning and Rehabilitation Plan for HM's Labor Camp No.1 (ZHEFU Camp)	√	√		√
Site Decommissioning and Rehabilitation Plan for Song Da5 Workshop at the Re-regulation Dam	√			√

Document Name	Rev. 1	Rev. 2	Rev. 3	Approved
DWP & SS-ESMMP for Replacement Work of Sealing Strip of the Main Shaft seal seat and other works of Re-regulation Power Station	√			√
DWP & SS-ESMMP of Drainage Adit of Main Dam right bank under VO-94	√	√		√
DWP & SS-ESMMP for the Riverbed Excavation at the Re-regulation Tailrace under VO-98	√			√
DWP & SS-ESMMP for Construction of Access Road to Cemetery Site of Phouhomxay Resettlement Village	√			√
DWP & SS-ESMMP for the Improvement of Site Office and Resource Centre in the Phouhomxay Resettlement Village	√			√

4.2 Results of Compliance Inspections at the Construction Sites

During Q2 2019, the EMO conducted bi-weekly and weekly follow-up site inspections at 31 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. The total number of inspected sites has increased in this Quarter from 28 to 31 sites because of the construction of one temporary camp and an access road to the cemetery site and, the improvement of the ESD's Site Office and Resource Centre at Houy Soup Resettlement Area (Phouhomxay Village).

A total of eighteen Observations of Non-Compliance (ONCs) were active, one ONC was carried over from the previous quarter and seventeen ONCs were newly opened. Out of these, seventeen ONCs were resolved during the reported period, one ONC will be carried over to the Q3 2019. During the Q2 2019, no NCR was issued. The status of these non-compliance reports is summarized in ***Table 4-2*** and ***Figure 4-1.*** The progress of corrective actions is presented in the ***Appendix 2***.

TABLE 4-2: *STATUS OF NON-COMPLIANCE REPORT DURING Q2 2019*

Status	ONC	NCR-Level 1	NCR-Level 2	NCR-Level 3	Incident Report
Carried over ONC/NCR from the last Quarter	1	0	0	0	0
Newly opened ONC/NCR	17	0	0	0	0
Total No. of ONC/NCR	18	0	0	0	0
Resolved ONC/NCR	17	0	0	0	0
Unresolved ONC/NCR, carried forward to the next Quarter	1	**0**	**0**	0	0

FIGURE 4-1: *STATUS OF ONCS DURING Q2 2019*

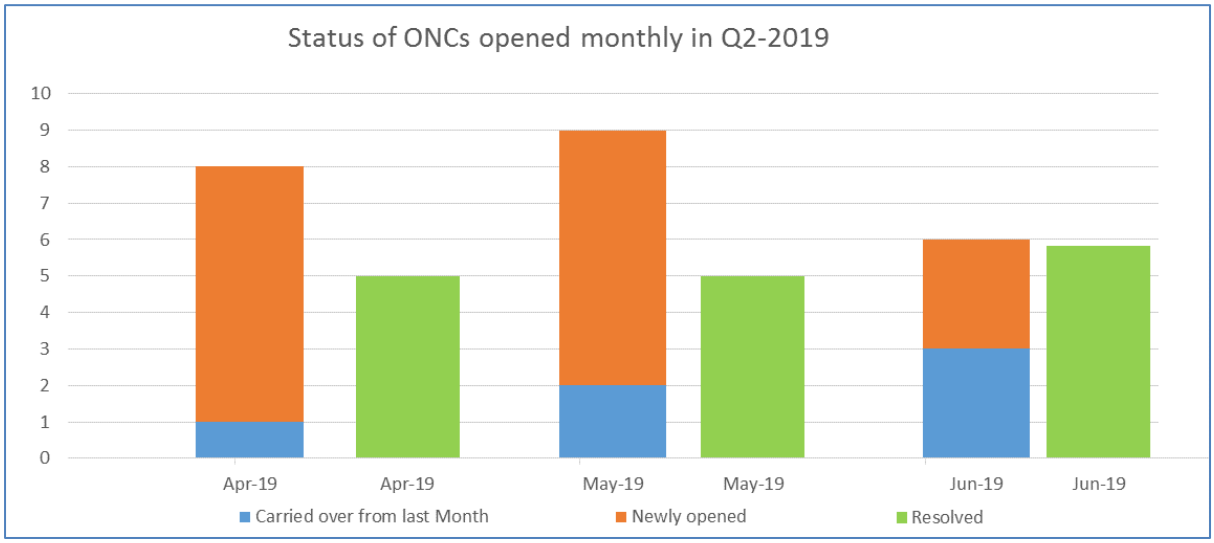


FIGURE 4-2: *STATUS OF NCR DURING Q2 2019*

No NCR was issued during the monitoring period of Q2 2019.

PHOTOGRAPH 1: INSPECTION ON SITE DECOMMISSIONING AT THE 276 CAMP

PHOTOGRAPH 2: JOINT INSPECTION ON SITE DECOMMISSIONING AT THE ZHEFU CAMP

PHOTOGRAPH 3: *XAYSOMBOUN PROVINCIAL EMU VISITED 2LR & 2UR ZONES DURING 11-14 JUNE 2019*

PHOTOGRAPH 3: *BOLIKHAMXAY PROVINCIAL EMU CONDUCTED A SITE INSPECTION DURING 14 - 15 MAY 2019*

4.3 WASTE MANAGEMENT AT THE CONSTRUCTION SITES

4.3.1 General Waste Management

During Q2 2019, a total of 235.5 m^3 of solid waste was disposed of at the NNP1 Project Landfill, a decrease of 46.1 m^3 compared to Q1 2019. EMO conducted three waste spot checks at the NNP1 Project Landfill, construction sites and the remaining camps. Mixed waste was still found out at LILAMA 10 camp, Song Da 5 Camp No.1, V&K camp, and Main Dam Drainage Adit-right bank, NNP1PC instructed the supervisors of all concerned Contractors and subcontractors to ensure proper waste management practices.

A total of 600 kg of compost was produced from grass, cow dung, rice husks, molasses, bio-extract (a liquid derived from the fermentation of vegetables and fruits with sugar and used as a natural liquid fertiliser) and vegetable and fruit waste from the canteens.

A total of 16,540 kg of recyclable waste was collected by Khounmixay Processing Factory and transported offsite to its facilities for recycling or processing as shown in ***Table 4-3***.

TABLE 4-3: *AMOUNTS OF RECYCLABLE WASTE SOLD DURING Q2 2019*

Source and Type of Recyclables		Unit	Total in Q2 of 2019 (A)	Sold (B)	Remaining Amount (A - B)
Construction activity					
1	Scrap metal	kg	20,739	15,739	5,000
	Sub-Total 1	**kg**	**20,739**	**15,739**	**5,000**
Operation camp					
2	Glass bottles	kg	867	436	431
3	Plastic bottles	kg	334	237	97
4	Aluminium cans	kg	80.5	48.5	32

Source and Type of Recyclables		Unit	Total in Q2 of 2019 (A)	Sold (B)	Remaining Amount (A - B)
5	Paper/Cardboard	kg	380	79	301
Sub-Total 2		**kg**	**1,661.5**	**800.5**	**861**
Grand Total 1+2		**kg**	**22,400.5**	**16,539.5**	**5,861**

4.3.2 Hazardous Waste Management

During Q2 2019, joint hazardous materials and waste inventories were carried out at the main construction sites and the Contractors' camps. The amounts of hazardous waste collected, stored and disposed during Q2 2019 are shown in **Table 4-4**. The treatment and final disposal of hazardous waste including used hydraulic oil and engine oil have been outsourced to Khounmixay Processing Factory**.** The remaining waste will be collected, treated and disposed by Khounmixay Processing Factory over the next months.

TABLE 4-4*: HAZARDOUS WASTE RECORDED DURING Q2 2019*

No.	Hazardous Waste Type	Unit	Total in Q2 2019	Disposal	Remaining
1	Used hydraulic and engine oil	litre (l)	3,920	250	3,670
2	Contaminated soil, sawdust and concrete	kg	525	42	483
3	Used tyre	No.	240	2	238
4	Used oil filters	No.	205	4	201
5	Used oil mixed with water	Litre	200	0	200
6	Ink cartridge	No.	163	0	163
7	Halogen/fluorescent bulbs	No.	156	0	156
8	Empty used chemical drum/container	drum (200 l)	126	11	115
9	Empty paint and spray cans	can	128	31	97
10	Empty used oil drum/container	drum (20 l)	57	27	30
11	Lead acid batteries	No.	22	0	22
12	Empty contaminated bitumen drum/container	drum (200 l)	103	83	20
13	Contaminated textile and material	kg	27	10	17
14	Lithium-ion batteries	No.	7	0	7
15	Empty used oil drum/container	drum (200 l)	10	6	4
16	Clinical waste	kg	17.6	15.1	2.5

4.3.3 Sewage Sludge Disposal

As part of site decommissioning activitiy, a total of 214 m^3 of sewage sludge from Song Da5 camp no.2, Zhefu and 276 Camps was transported and disposed of at the Spoil Disposal Area

No. 6 by following NNP1PC's Standard Operating Procedure (SOP) on Sewage/Black Water Disposal.

4.4 COMMUNITY WASTE MANAGEMENT SUPPORT

4.4.1 Animal Fodder (Pig Feed) Collection Programme

During Q2 2019, local villagers collected a total of 10,431 kg of food waste from the Owner's Site Office and Village (OSOV) and Contractors' camps for feeding their animals. This is an increase of 783 kg compared to Q1 2019. Details are shown in ***Table 4-5*** below.

TABLE 4-5: AMOUNT OF FOOD WASTE COLLECTED BY LOCAL VILLAGERS FOR USE AS ANIMAL FEED DURING Q2 2019

NO.	SITE NAME	UNIT	TOTAL
1	Song Da5 Camp No. 2	kg	12
2	Song Da5 Camp No. 1	kg	1,864
3	OC Camp	kg	3,063
4	Owner's Site Office and Village (OSOV)	kg	3,365
5	LILAMA 10 Camp	kg	2,127
6	Kenber Camp	kg	0
Total		**kg**	10,431

4.4.2 Community Recycling Programme

During Q2 2019, the Community Recycle Waste Bank collected a total of 5,235.9 kg of recyclables from villagers and 952 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	Collected Amount During the Second quarterly of 2019 (A)	Sold (B)	Remaining Amount (A - B)
Scrap metal	kg	36.5	36.5	0
Glass	kg	2,665	0	2,665
Paper/cardboards	kg	2,286.5	891	1,395.5
Plastic bottles	kg	222	0	222
Aluminium	kg	25.9	24.5	1.4
Total	**kg**	**5,235.9**	**952**	**4,283.9**

In addition, EMO conducted a community consultation on waste management for host villages (Thaheau & Hat Gnuin villages) and Phouhomxay village during 21 - 23 May 2019 to improve their awareness on proper waste separation and disposal.

4.4.3 Houay Soup Landfill

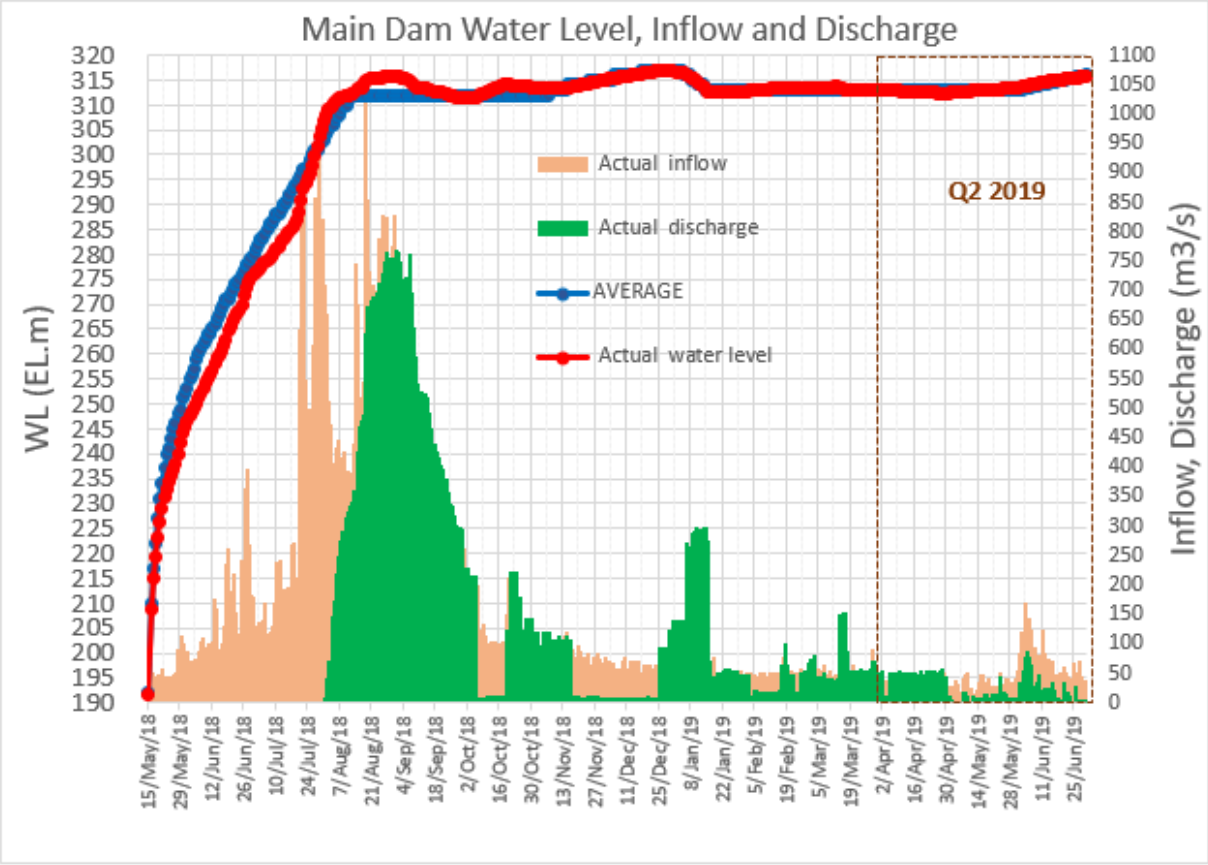
A local Contractor started the operation of the Houay Soup landfill in December 2017. The work includes solid waste collection and transportation from Phouhomxay, Thahuea and Hat Gniun villages to Houay Soup landfill three days per week (Monday, Wednesday and Friday), waste segregation, waste compaction and daily waste cover with plastic sheet at the landfill.

During Q2 2019, approximately 174 m^3 of solid waste was collected from the Thaheau, Hat Gniun and Phouhomxay Villages.

4.5 Main Reservoir Impounding

The progress of impounding from 15 May 2018 to 30 June 2019 is presented on the graph in ***Figure 4-3*** indicating the water level in the main reservoir, the inflow to the main reservoir and the discharge from the main reservoir into the re-regulation reservoir. The inflow data shows the gradual reduction in flows from the end of the wet season into the dry season with inflows from about 100 m^3/s at the beginning of November 2018 to an average of about 48 m^3/s during March 2019, which is very close to the long-term average for the month of March (51 m^3/s).

Figure 4-3: *Progress of Impounding the Main Reservoir*



The average inflow in April and May 2019 was about 35 m^3/s, which is significantly lower than the long-term average of about 75 m^3/s. In June 2019 the inflow increased to an average of 75 m^3/s, which was still much lower than the long-term average for June (189 m^3/s).

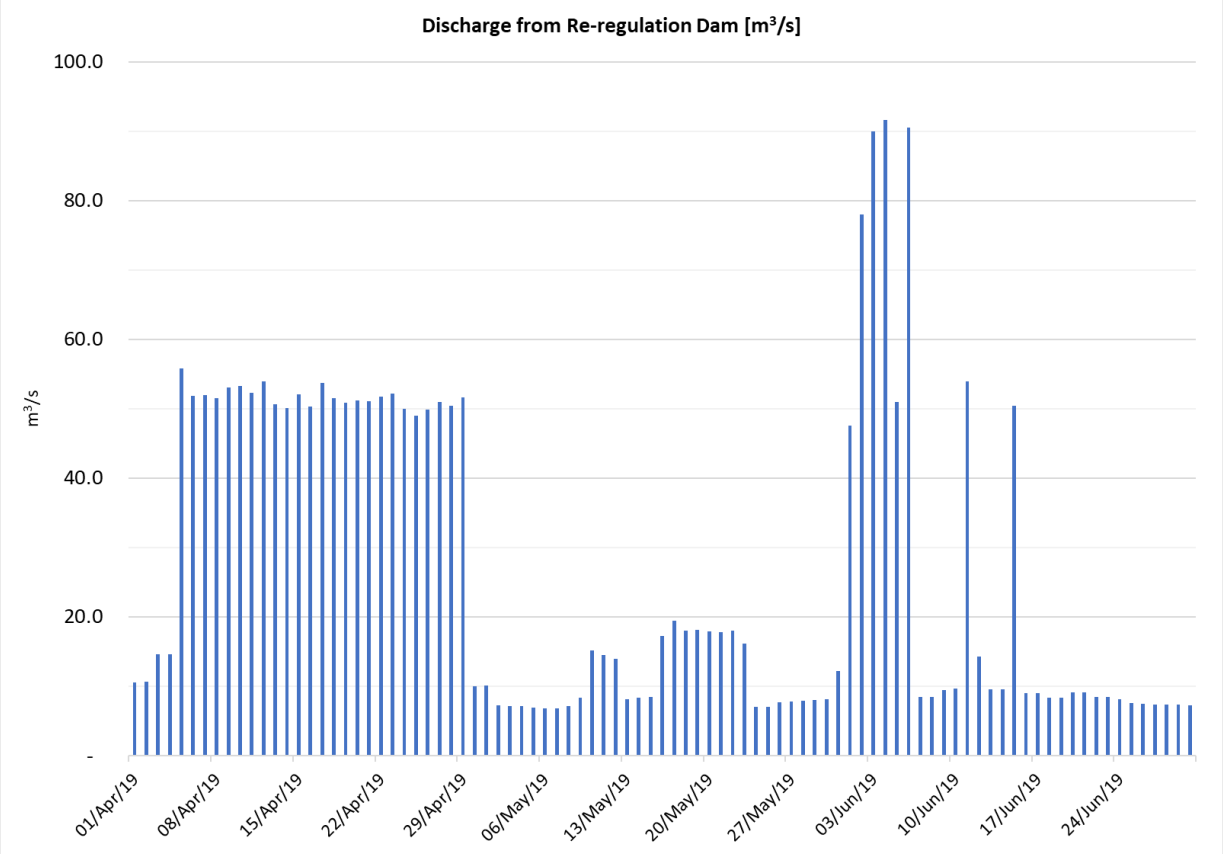
During Q1 2019, the reservoir water level decreased 3.9 m from 316.8 m asl. to 312.9 m asl, and over the course of Q2 2019, the water level rose with 2.8 m to 315.7 m asl at the end of June 2019.

The discharge from the re-regulation dam is monitored to ensure compliance with the minimum flow requirement of 5.5 m^3/s. The results of the monitoring are displayed in ***Figure 4-4.***

From 01-04 April 2019, the discharge from the main dam was reduced to about 12 m^3/s to enable road construction and slope stabilization work for the access road to the main powerhouse. The discharge from the re-regulation dam was equally reduced. During the period 05 to 29 April 2019, power generation at the re-regulation powerhouse was resumed based on a constant flow rate of about 50 m^3/s. From 01 May to 30 May 2019 power generation at the re-regulation powerhouse was suspended and resumed again on 31 May 2019. Turbine discharge continued uninterrupted until 07 June 2019 with about 80 m^3/s. From then on and until 22 June 2019 the discharge alternated between turbine discharge of 50 m^3/s – 60 m^3/s 5-10 hours per day and discharge through the re-regulation gate of 7-9 m^3/s. From 22 June 2019 until the end of June all discharge from the re-regulation dam went through the re-regulation gate.

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

FIGURE 4-4: *DISCHARGE MONITORING AT THE RE-REGULATION DAM IN Q2 2019*



Since 18 July 2018, NNP1PC has carried out weekly monitoring of river depths at 19 locations downstream the re-regulation dam as shown on ***Figure 4-5***. These locations represent cross-sections with possible shallow water depths at low discharge rates.

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

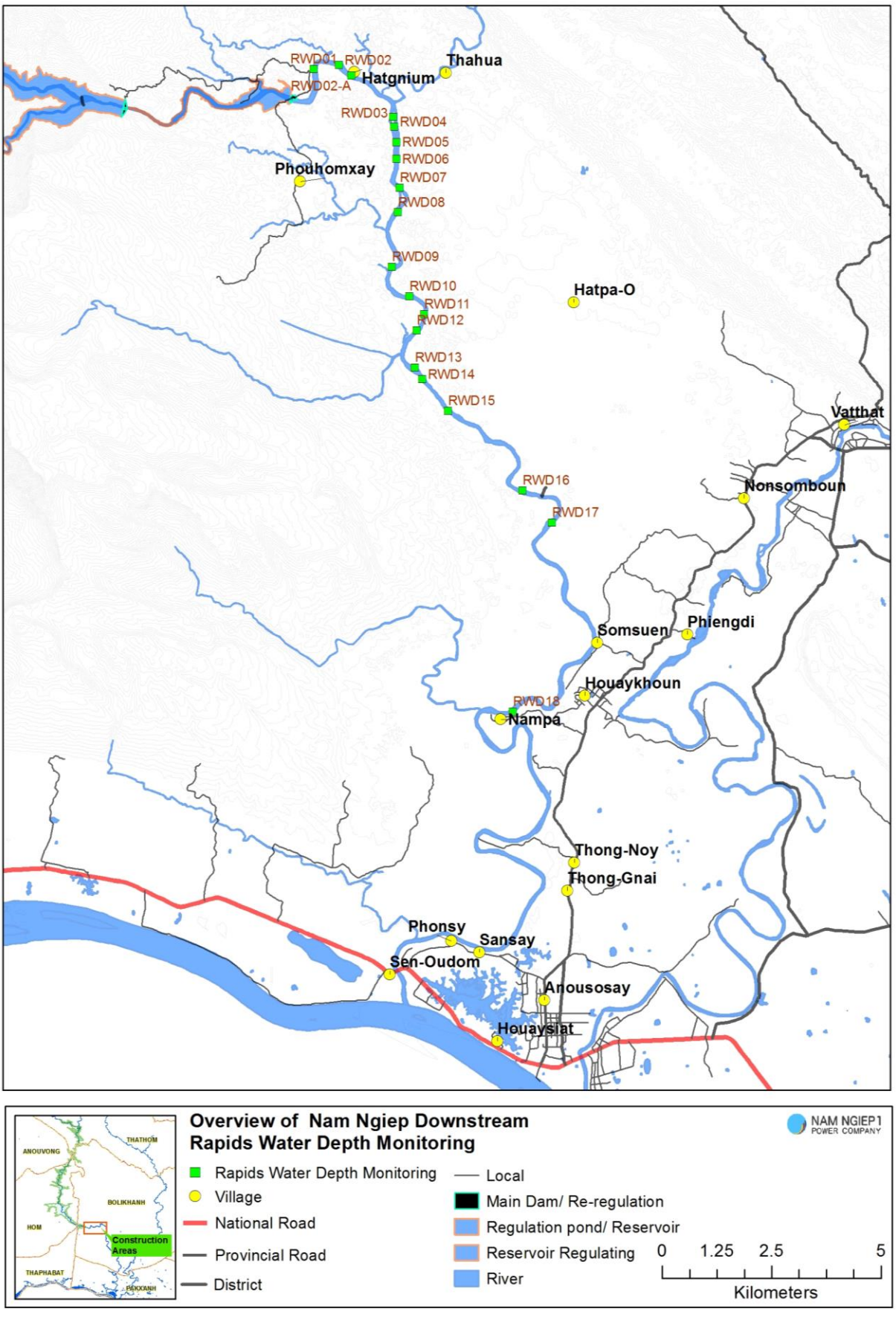
The results of the monitoring are presented in Table 4-7. The depth with yellow highlight caused difficulties for boat passage and the depths in red font were below 0.5 m. For completeness sake all depths below 0.5 m are shown in red font.

The measurements indicate that at low discharge rates from 7-18 m^3/s, the water depths are likely to fall below 0.5 m and boat passage may be difficult at all cross-sections in the 14 km reach downstream from the re-regulation dam.

TABLE 4-7: *RIVER DEPTH MEASUREMENTS IN NAM NGIEP DOWNSTREAM OF THE RE-REGULATION DAM*

Station ID		RWD 01	RWD 02	RWD 02.a	RWD 03	RWD 04	RWD 05	RWD 06	RWD 07	RWD 08	RWD 09	RWD 10	RWD 11	RWD 12	RWD 13	RWD 14	RWD 15	RWD 16	RWD 17	RWD 18
Distance from Re-regulation Dam (Km)		1.55	2.43	2.97	4.9	5.2	5.66	6.16	7.13	8.01	9.97	11.31	12.08	12.62	14.1	14.49	15.77	19.76	21.58	30.09
Date	Discharge (m3/s)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)	Depth (m)
3-Apr-19	*14.6*	0.18	0.26	0.29	0.3	0.31	0.23	0.36	0.42	0.48	0.52	0.73	0.75	0.67	0.77	0.72	1.12	1.22	1.27	0.44
8-Apr-19	*51.5*	0.69	0.8	0.83	0.85	0.87	0.69	0.9	0.95	0.94	0.97	1.12	1.25	1.05	1.14	1.05	1.36	1.56	1.62	0.72
18-Apr-19	*51.5*	0.66	0.76	0.79	0.81	0.82	0.64	0.86	0.92	0.91	0.94	1.08	1.2	1.03	1.12	1.03	1.36	1.56	1.62	0.7
24-Apr-19	*50.0*	0.64	0.74	0.77	0.79	0.8	0.62	0.83	0.89	0.88	0.91	1.05	0.98	1.00	1.09	1.00	1.32	1.52	1.58	0.66
2-May-19	*7.2*	0.25	0.3	0.28	0.36	0.38	0.13	0.27	0.38	0.4	0.35	0.45	0.36	0.34	0.44	0.6	1.12	0.64	0.65	0.26
8-May-19	*7.1*	0.3	0.33	0.3	0.42	0.41	0.17	0.35	0.48	0.47	0.4	0.51	0.42	0.4	0.5	0.72	1.2	1.02	0.95	0.3
15-May-19	*8.4*	0.3	0.33	0.3	0.42	0.41	0.17	0.35	0.48	0.47	0.4	0.51	0.42	0.4	0.5	0.7	0.95	0.9	0.8	0.3
22-May-19	*18.0*	0.41	0.43	0.45	0.55	0.52	0.3	0.48	0.6	0.68	0.63	0.74	0.65	0.6	0.71	0.9	1.1	1.05	1	0.42
29-May-19	*8.0*	0.3	0.32	0.35	0.4	0.45	0.19	0.36	0.49	0.48	0.46	0.57	0.45	0.44	0.55	0.75	0.98	0.94	0.88	0.31
5-Jun-19	*154*	1.7	1.75	1.8	1.9	1.95	1.65	1.76	1.89	2	1.97	2.2	1.95	2.1	2.25	3.1	3.5	3.45	3.6	2.9
14-Jun-19	*9.6*	0.33	0.37	0.35	0.52	0.55	0.25	0.37	0.5	0.8	0.76	0.9	0.7	0.84	0.97	1.2	1.4	1.35	1.5	0.65
19-Jun-19	*8.5*	0.33	0.37	0.35	0.52	0.55	0.25	0.37	0.5	0.8	0.76	0.9	0.7	0.84	0.91	1.22	1.45	1.37	1.6	0.75
26-Jun-19	*7.5*	0.24	0.35	0.3	0.38	0.4	0.2	0.34	0.38	0.45	0.5	0.6	0.45	0.4	0.8	1	1.6	1.2	1.25	0.6

FIGURE 4-5: ***LOCATION OF RIVER DEPTH MONITORING POINTS***



4.6 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 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 (UAE).

4.6.1 Surface Water (River) Quality

The regular surface water quality monitoring programme was adjusted in May 2018 due to the impounding of the main reservoir, which started on 15 May 2018. The programme comprises 5 monitoring stations in the main reservoir (R1-R5), 2 stations in the re-regulation reservoir (R6 and R7), 5 stations in the main stream Nam Ngiep (NNG01, and NNG05-NNG08) and 4 stations in the main tributaries to Nam Ngiep (Nam Chiane, Nam Phouan, Nam Xao and Nam Houay Soup).

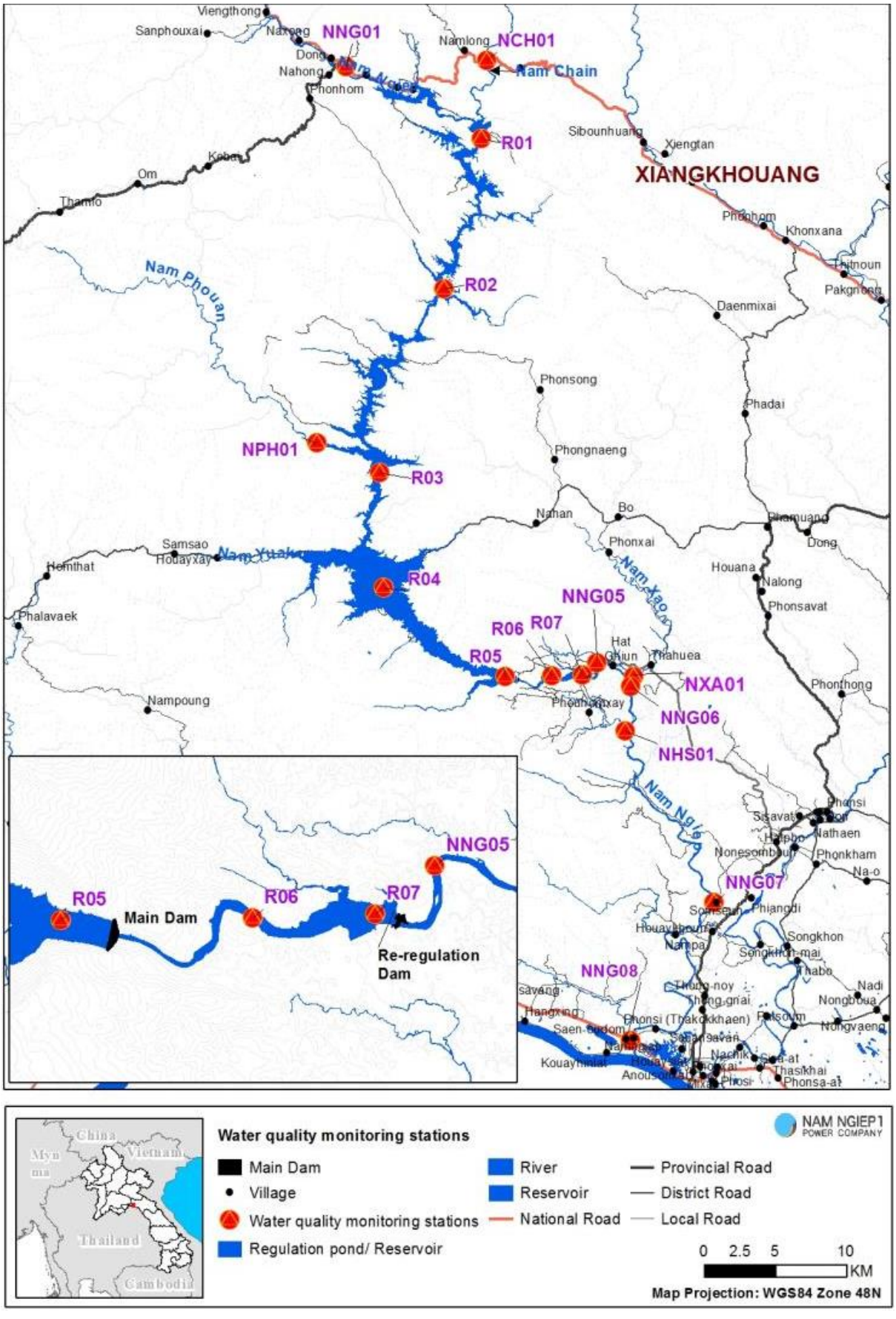
The depth profile reservoir water quality measurement (only physical parameters) was carried out for main reservoir and re-regulation reservoir commencing in mid-September 2018.

The frequency of monitoring is presented in the ***Table 4-8*** and the locations of monitoring stations are shown in ***Figure 4-6*****.**

TABLE 4-8: *MONITORING FREQUENCY FOR SURFACE WATER QUALITY PARAMETERS*

Frequency of Monitoring	Parameters (Unit)	Monitoring Sites
Tuesdays and Saturdays	pH, DO (%), DO (mg/l), Conductivity (µs/cm), TDS (mg/l), Temperature (°C) and Turbidity (NTU)	- R5 - NNG05
Weekly	pH, DO (%), DO (mg/l), Conductivity (µs/cm), TDS (mg/l), Temperature (°C), Turbidity (NTU), TSS (mg/l),	- NPH01 - R3 - R4 - R5 - R6 - R7 - NNG05
Weekly	BOD_5 (mg/l), Faecal coliform (MPN/100 ml) and Total coliform (MPN/100 ml)	- R5 - R6 - R7 - NNG05
Fortnightly	pH, DO (%), DO (mg/l), Conductivity (µs/cm), TDS (mg/l), Temperature (°C), Turbidity (NTU)	All 16 stations
Monthly	TSS (mg/l), BOD_5 (mg/l), COD (mg/l), NH_3-N (mg/l), NO_3-N (mg/l), total coliform (MPN/100 ml), faecal coliform (MPN/100 ml)	All 16 stations
Quarterly	Total iron (mg/l), Manganese (mg/l), total phosphorus (mg/l), total dissolved phosphorus (mg/l), phytoplankton biomass (g dry weight/m^3), TOC (mg/l)	All 16 stations

FIGURE 4-6: ***SURFACE WATER QUALITY MONITORING LOCATIONS***

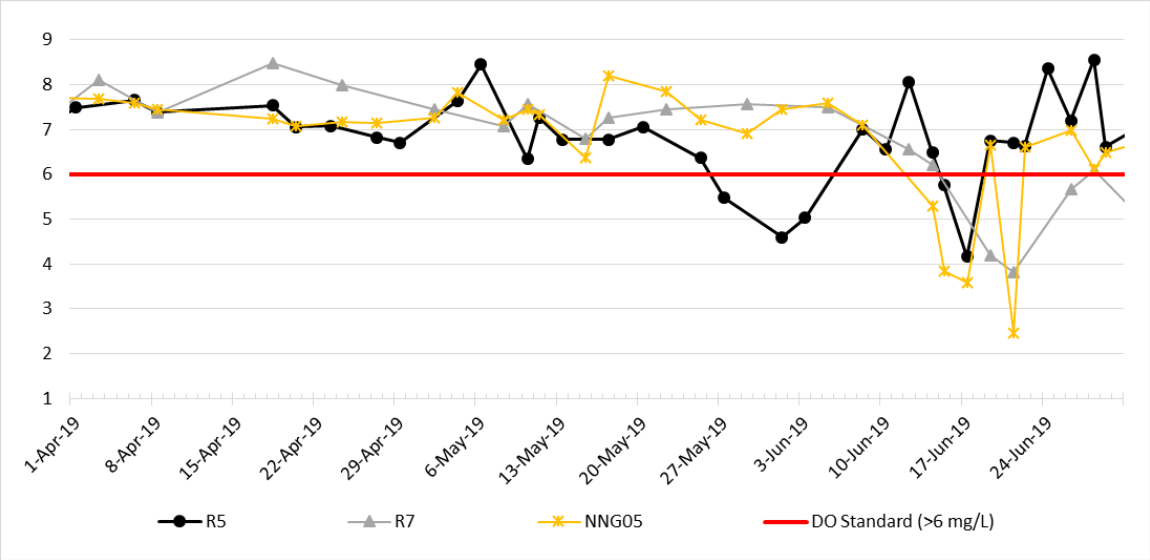


Descriptions of each monitoring station and surface water quality monitoring parameters can be found in ***Appendix 3*** and all surface water quality data for Q2 2019 are listed in ***Appendix 5.1***

Dissolved Oxygen (DO)

The results of dissolved oxygen measurements for the stations immediately upstream and downstream the Project are presented in the line graph in ***Figure 4-7,*** and the full set of surface water data are shown in ***Table 4-9.***

FIGURE 4-7: *DISSOLVED OXYGEN VALUES OF SURFACE WATER (0.2 M) IMMEDIATELY UPSTREAM AND DOWNSTREAM OF THE PROJECT*



During the Q2 2019, the concentration of dissolved oxygen in R5 (Main Reservoir) which is located immediately upstream of the main dam, fluctuated with between 4.16 - 8.56 mg/L. Some of the results recorded at R5 were below 6 mg/L (the surface water quality standard).

During April and May 2019, the dissolved oxygen concentrations in the re-regulation reservoir and in the downstream stations have remained well above 6 mg/L. In June 2019, DO concentration started to decrease to less than 6 mg/L at the stations of Re-regulation Reservoir and Nam Ngiep Downstream.

In addition, the Nam Ngiep Upstream station (NNG01), Nam Chian (NCH01), Nam Phouan (NPH01) and Main Reservoir (R1-R4) were above 6 mg/L. However, DO concentration in Nam Xao and Nam Houay Soup were less than 6 mg/L on 24 April and 15 May 2019.

The dissolved oxygen depth profile in the main reservoir and in the re-regulation reservoir since April to the end of June 2019 is summarized in ***Figure 4-8***.

The depth profile monitoring indicates formation of oxyclines in all the stations in the main reservoir at depths between 2.5 – 10.0 m.

Similarly, all the main reservoir stations except R1 have a thermocline at between 1-9 m deep. There are also indications of a thermocline occurring in R6 and R7 in the re-regulation reservoir at the depth of between 1.0 - 3.0 m.

In June 2019, some fish kill was observed at R6 and R7 (in the reg-regulation pond) and some of the dead fish specimens were collected for identification by EMO team. The details on fish kill incident can be found in the water quality incident report which was prepared by NNP1PC and submitted to ADB and MONRE separtely.

FIGURE 4-8: ***MAIN RESERVOIR DISSOLVED OXYGEN AT THE END OF Q2 2019***

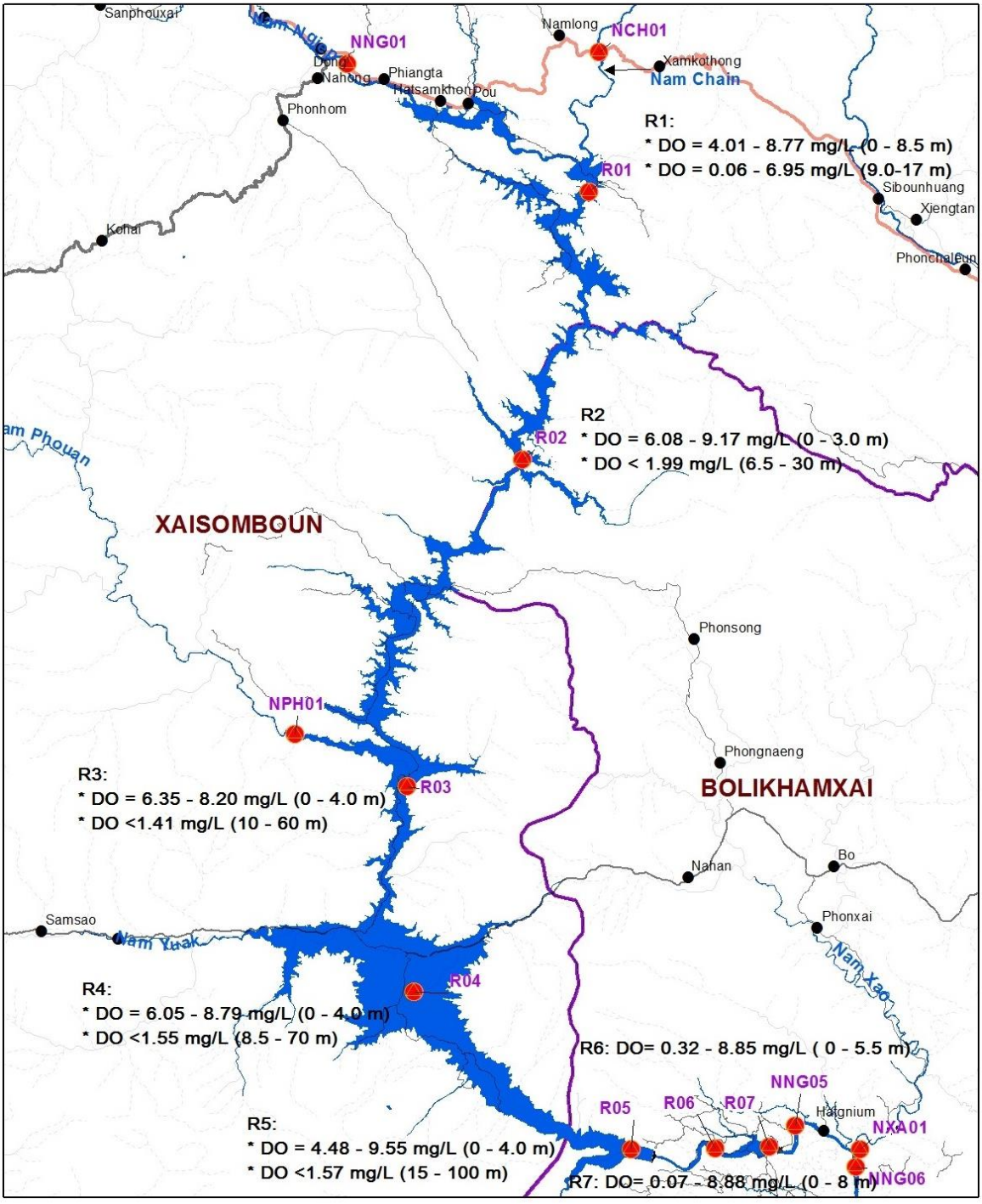
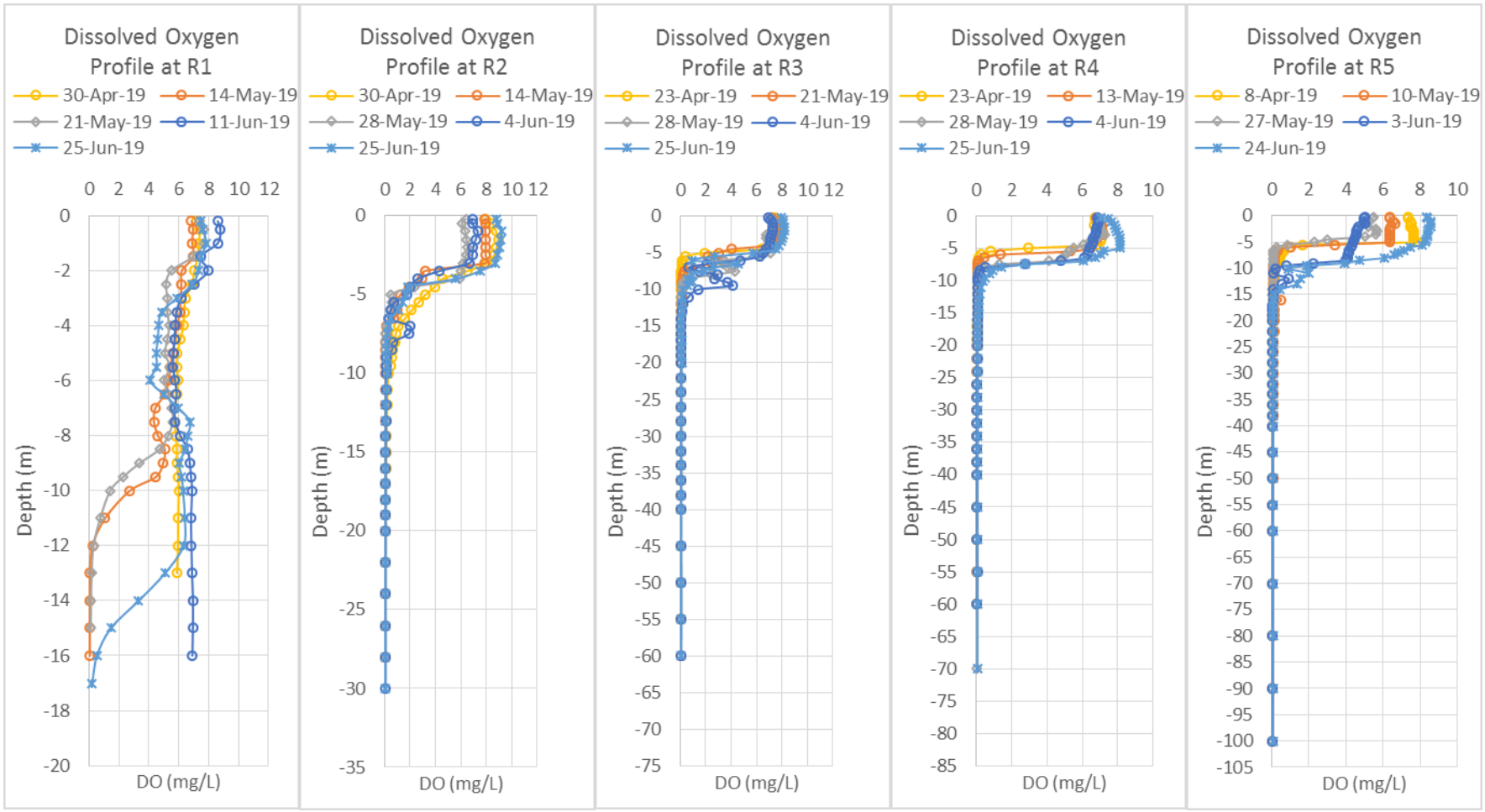
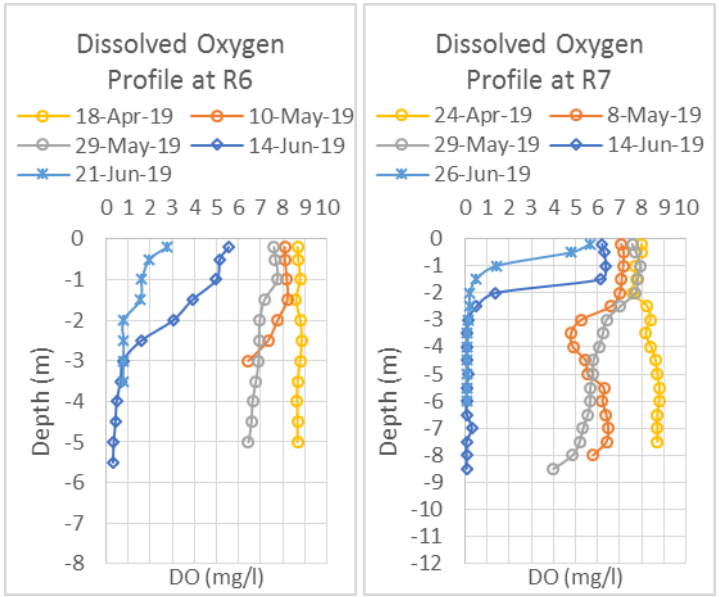


FIGURE 4-9: ***DISSOLVED OXYGEN – DEPTH PROFILES IN THE MAIN RESERVOIR AND RE-REGULATION RESERVOIR***




Dissolved Oxygen Profile at R6
18-Apr-19
10-May-19
29-May-19
14-Jun-19
21-Jun-19
0 1 2 3 4 5 6 7 8 9 10
0
-1
-2
-3
-4
-5
-6
-7
-8
Depth (m)
DO (mg/l)

Dissolved Oxygen Profile at R7
24-Apr-19
8-May-19
29-May-19
14-Jun-19
26-Jun-19
0 1 2 3 4 5 6 7 8 9 10
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
Depth (m)
DO (mg/l)

TABLE 4-9: ***DO RESULTS OF SURFACE WATER IN THE MAIN RESERVOIR, RE-REGULATION RESERVOIR, NAM NGIEP AND ITS MAIN TRIBUTARIES MONITORED FROM APRIL TO JUNE 2019 (NATIONAL SURFACE WATER QUALITY STANDARD FOR DO: >6.0 MG/L)***

Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
1-Apr-19					7.3	7.5										
2-Apr-19	7.92	7.52	7.43	7.2									7.9	7.64		
3-Apr-19							7.7	8.11	7.68	7.12	7.13	7.4			6.31	6.3
6-Apr-19						7.7			7.6							
8-Apr-19					7.3	7.4	7.7	7.39	7.45	7.56	7.18	7.12			7.48	6.55
18-Apr-19						7.5	8.67	8.47	7.25	7.05	6.82	6.83			6.15	7.69
20-Apr-19						7.1			7.07							
23-Apr-19	7.37			7.4	6.8	7.1							7.74	7.58		
24-Apr-19							8.72	7.98	7.16	7.01	6.89	6.7			5.23	5.3
27-Apr-19						6.8			7.15							
29-Apr-19					7.7	6.7										
30-Apr-19		7.2	7.91	7.1										7.85		
2-May-19							7.11	7.44	7.26	6.92	7.37	7.55			6.62	7.51
4-May-19						7.6			7.83							
6-May-19					8.5	8.5										
7-May-19	7.39		7.8	7.3									7.57	7.62		
8-May-19							7.35	7.07	7.22	6.27	6.89	6.49			6.41	6.72
10-May-19						6.3	8.09	7.56	7.46							
11-May-19						7.3			7.33							
13-May-19					6.8	6.8										
14-May-19		6.85	7.88	7.5										7.72		
15-May-19							7.29	6.8	6.38	5.78	6.45	6.24			4.82	6.45
17-May-19						6.8	7.69	7.26	8.19							
20-May-19					7.2	7.1										

Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
21-May-19	8.02	7.36	7.16	7.2									8.49	7.68		
22-May-19							7.25	7.44	7.84	7.54	7.69	7.55			6.67	7.75
25-May-19						6.4			7.22							
27-May-19						5.5										
28-May-19		6.83	6.38	7.1	6.9									7.6		
29-May-19							7.6	7.56	6.9	7.04	7.13	7.61			6.46	6.92
1-Jun-19						4.6			7.44							
3-Jun-19						5										
4-Jun-19			6.89	6.9	6.9									7.9		
5-Jun-19							8.11	7.5	7.6	7.7	7.37				6.82	7.05
8-Jun-19						7			7.1							
10-Jun-19						6.6										
11-Jun-19		8.59	7.77	7.6	7.1									7.91		
12-Jun-19						8.1	4.97	6.55								
13-Jun-19	8.08												7.75			
14-Jun-19						6.5	5.55	6.2	5.29	7.65	6.86	7.06			6.58	7.24
15-Jun-19						5.8			3.83							
17-Jun-19						4.2			3.59							
18-Jun-19		8.22	7.34	7.3	6.9									8.11		
19-Jun-19						6.8	2.42	4.18	6.66							
21-Jun-19						6.7	2.77	3.82	2.45	4.47						
22-Jun-19						6.6	3.25		6.6							
24-Jun-19						8.4										
25-Jun-19	8.19	7.5	8.74	7.9	7								7.96			
26-Jun-19						7.2	5.25	5.66	6.97	6.4	7.28	7.34			7.18	7.18
28-Jun-19						8.6	6.52	6.1	6.11	6.37					6.14	

Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
29-Jun-19						6.6			6.48							

Ammonia Nitrogen

Since 2014, the Ammonia Nitrogen levels in the Nam Ngiep River and its tributaries have generally been below the detection limit (<0.2 mg/L). In the second Quarter of 2019, Ammonia Nitrogen exceeded the National Surface Water Quality Standard of <0.2 mg/L in some stations with levels as high as between 0.2 – 0.79 mg/L. The elevated levels of ammonia nitrogen observed in June 2019 in the main reservoir and immediately downstream could be explained by the continued decomposition of biomass after the impounding of the main reservoir, but this cannot explain the elevated levels in the tributaries nor in the further downstream stations NNG05, NNG06 and NNG08.

TABLE 4-10: ***AMMONIA NITROGEN RESULTS OF SURFACE WATER IN NAM NGIEP AND ITS MAIN TRIBUTARIES MONITORED FROM APRIL TO JUNE 2019 (NATIONAL SURFACE WATER QUALITY STANDARD FOR AMMONIA NITROGEN: <0.2 MG/L)***

Station Code	NN G01	R1	R2	R3	R4	R5	R6	R7	NN G05	NN G06	NN G07	NN G08	NC H01	NP H01	NX A01	NH S01
1-Apr-19					<0.2	<0.2										
2-Apr-19	0.33	<0.2	<0.2	<0.2									<0.2	<0.2		
3-Apr-19							0.2	<0.2	<0.2	<0.2	<0.2	<0.2			<0.2	<0.2
6-May-19					0.34	0.47										
7-May-19	<0.2		0.25	0.46									<0.2	<02		
8-May-19							0.49	0.27	<0.2	<0.2	<0.2	<0.2			<0.2	<0.2
14-May-19		<0.2														
10-Jun-19						0.2										
11-Jun-19		0.28	0.28	0.31	0.32									0.38		
12-Jun-19							0.14	0.3	0.51							
13-Jun-19	0.63												<0.2			
14-Jun-19										0.79	<0.2	0.62			<0.2	0.62

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 occasional minor exceedances of the National Surface Water Quality Standard of < 1.5 mg/L. The results for Q2 2019 are within the normal ranges previously measured except in R2, R6, R7, NPH01 and NHS01 which showed some exceedances.

TABLE 4-11: *BOD5 RESULTS OF SURFACE WATER IN NAM NGIEP AND ITS MAIN TRIBUTARIES MONITORED FROM APRIL TO JUNE 2019 (NATIONAL SURFACE WATER QUALITY STANDARD FOR BOD5: <1.5 MG/L)*

Station Code	NNG 01	R1	R2	R3	R4	R5	R6	R7	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA 01	NHS 01
1-Apr-19					<1.0	<1.0										
2-Apr-19	<1.0	1.44	1.2	<1.0									<1.0	<1.0		
3-Apr-19							<1.0	<1.0	<1.0	<1.0	<1.0	1.2			1.15	<1.0
8-Apr-19						<1.0	<1.0	<1.0	<1.0							
23-Apr-19						<1.0										
24-Apr-19							<1.0	<1.0	<1.0							
29-Apr-19						1.1										
6-May-19					<1.0	<1.0										
7-May-19	<1.0		1.63	1.2									<1.0	1.8		
8-May-19							1.16	1.39	1.12	<1.0	1.05	1.21			1.44	1.99
13-May-19						<1.0										
14-May-19		<1.0														
15-May-19							<1.0	<1.0	<1.0							
20-May-19						1.1										
22-May-19							<1.0	<1.0	<1.0							
27-May-19						1.2										
29-May-19							1.13	<1.0	1.36							
3-Jun-19						<1.0										
5-Jun-19							1.39	1.05	<1.0							
10-Jun-19						<1.0										
11-Jun-19		<1.0	<1.0	<1.0	<1.0									1.03		
12-Jun-19							1.81	1.42	1.43							
13-Jun-19	<1.0												<1.0			
14-Jun-19										<1.0	<1.0	<1.0			1.08	1.04
19-Jun-19						<1.0	3.33	3.49	<1.0							
26-Jun-19						<1.0	1.14	1.04	<1.0							

Chemical Oxygen Demand (COD)

The COD measurements in Q2 2019 are presented in ***Table 4-12***.

TABLE 4-12: *COD RESULTS FOR SURFACE WATER IN NAM NGIEP AND ITS MAIN TRIBUTARIES DURING Q2 2019 (NATIONAL SURFACE WATER QUALITY STANDARD FOR COD: < 5 MG/L)*

Station Code	NNG 01	R1	R2	R3	R4	R5	R6	R7	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA 01	NHS 01
1-Apr-19					8.1	5.5										
2-Apr-19	<5.0	8.7	8.5	5.9									<5.0	9.5		
3-Apr-19							6.1	<5.0	8.1	<5.0	5.3	5.7			6.3	7.1
6-May-19					5.3	8.8										
7-May-19			5.5	10.2									23.3	8.2		
8-May-19							12.2	8.2	<5.0	6.5	18.2	22.3			12.2	34.3

Station Code	NNG 01	R1	R2	R3	R4	R5	R6	R7	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA 01	NHS 01
14-May-19		<5														
10-Jun-19						8										
11-Jun-19		20	8.8	10.6	6.8									34		
12-Jun-19							6	10	12.9							
13-Jun-19	10												15.2			
14-Jun-19										12.6	30	10.8			15	14.8

The mean COD values for the high flow and low flow seasons are presented in ***Table 4-13.*** The data indicates seasonal variation with higher values during the high flow season. However, when testing a null hypothesis that there is no significant difference in COD means before and after impounding (comparing the mean for the period after impounding with the mean for the same period in 2017 – upstream, re-regulation reservoir and downstream respectively), the tests indicate that the null hypothesis cannot be rejected.

TABLE 4-13: ***MEAN VALUES OF COD MEASUREMENTS***

Mean 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 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
Hydrological Year 2019	7.6	4.1	8.4	3.8

Faecal Coliforms

The results of the faecal coliform analyses in Q2 of 2019 are presented in

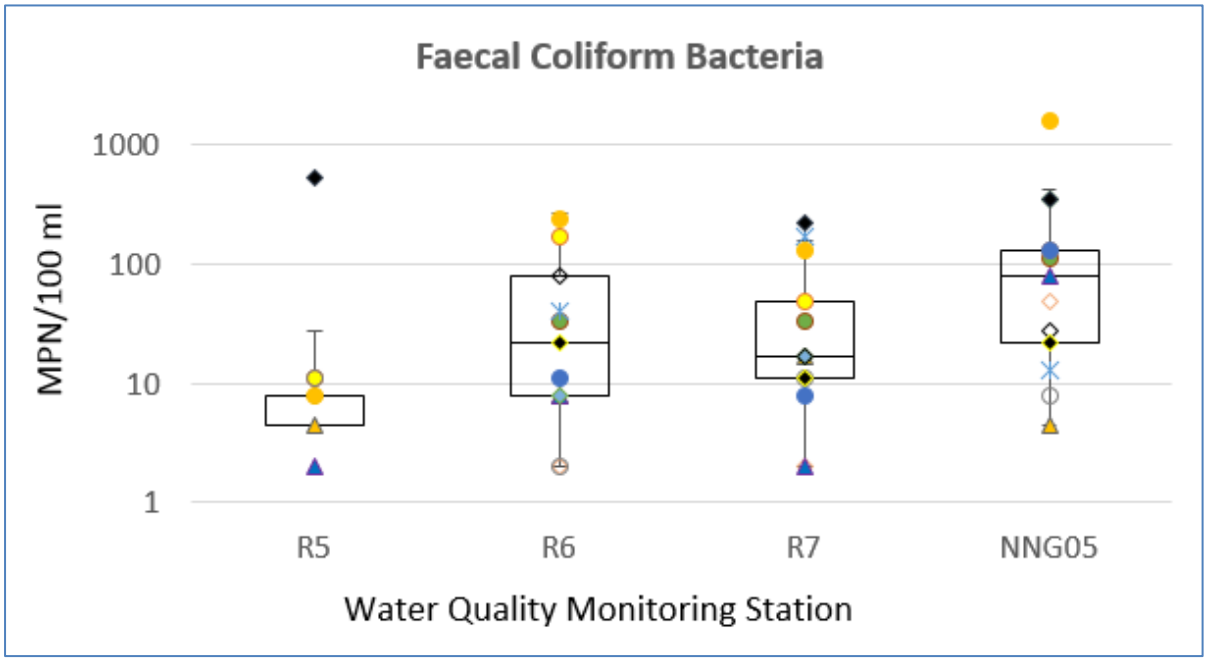


Table 4-14.

The basic statistics of the faecal coliform measurements in Q2 2019 are displayed in the box and whisker diagrams in ***Figure 4-10.*** The R5 (main reservoir immediately upstream main dam) has the same median and mean as R6 and R7 in the re-regulation reservoir and lower median and mean than NNG05 (downstream at Hat Gniun village) and the data shows outliers in R5 and NNG05.

A statistical hypothesis test using Excel's TTEST function (unpaired, two-tailed, different variances, level of significance: 0.05) comparing the upstream sample (R5) for Q2-2019 with the downstream sample (NNG05) for Q2-2019 gives a p-value of 1.39, which indicates that the observed data are compatible with the null hypothesis that the true faecal coliform means of the two samples are identical.

FIGURE 4-10: ***BOX AND WHISKER DIAGRAMS OF FAECAL COLIFORM MEASUREMENTS DURING Q2 2019 IN SELECTED STATIONS***

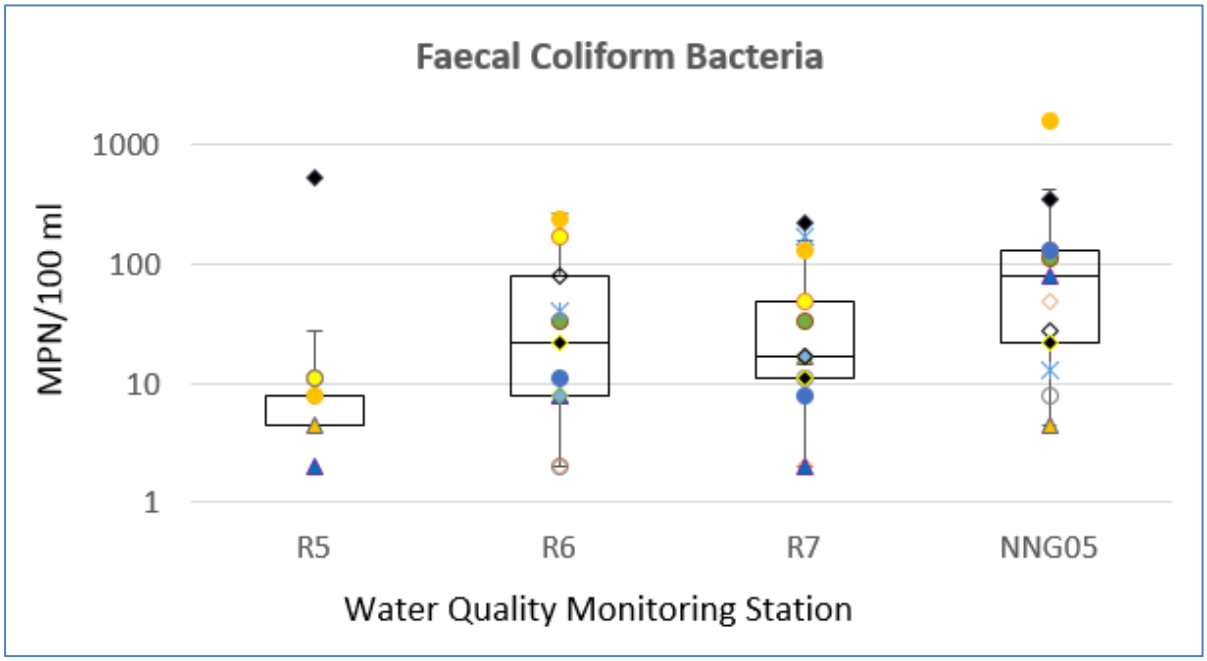


TABLE 4-14: ***RESULTS OF FAECAL COLIFORMS IN NAM NGIEP AND ITS MAIN TRIBUTARIES FROM APRIL TO JUNE 2019 (NATIONAL SURFACE WATER QUALITY STANDARD FOR TOTAL COLIFORMS: <1,000 MPN/100 ML)***

Station Code	NNG 01	R1	R2	R3	R4	R 5	R6	R7	NNG0 5	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA 01	NH S01
1-Apr-19					0	0										
2-Apr-19	920	0	2	0									79	1,600		
3-Apr-19							33	33	110	79	49	79			130	110
8-Apr-19						5	8	17	5							
18-Apr-19						0	40	170	13							
23-Apr-19						0										
24-Apr-19							2	2	49							
29-Apr-19						2										
2-May-19							8	2	79							
6-May-19						8										
7-May-19	920		27	7.8	7								920	130		
8-May-19							8	17	350	3,500	1,100	1,100			920	6,000
13-May-19						540										
14-May-19		920														
15-May-19							170	220	350							
20-May-19						11										
22-May-19							170	49	130							
27-May-19						11										
29-May-19							2	11	8							
3-Jun-19						8										

Station Code	NNG 01	R1	R2	R3	R4	R 5	R6	R7	NNG0 5	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NXA 01	NH S01
5-Jun-19							79	17	27							
10-Jun-19						0										
11-Jun-19		0	0	0	0									3,500		
12-Jun-19							22	11	22							
13-Jun-19	70												170			
14-Jun-19										170	350	130			240	330
19-Jun-19						8	240	130	1,600							
26-Jun-19						0	11	8	130							

Table 4-15 presents seasonal (high flow season and low flow season) means of faecal coliform bacteria upstream of the main dam and downstream of the re-regulation dam. The data indicates that up until the start of the high-flow season in 2018 which corresponds to the start of impounding of the main reservoir, there was a tendency towards higher values in the high flow season. However, after start of impounding that tendency has not continued. The bacteria count in the reservoir stations (R4, R5, R6 and R7) and the downstream stations NNG05 and NNG06 indicate significantly lower values after start of impounding.

TABLE 4-15: *SEASONAL MEANS FOR FAECAL COLIFORMS UPSTREAM OF THE MAIN DAM AND DOWNSTREAM OF THE RE-REGULATION DAM*

	Upstream		Re-regulation Reservoir		Downstream	
	High Flow Season Mean (MPN/100 ml)	Low Flow Season Mean (MPN/100 ml)	High Flow Season Mean (MPN/100 ml)	Low Flow Season Mean (MPN/100 ml)	High Flow Season Mean (MPN/100 ml)	Low Flow Season Mean (MPN/100 ml)
Hydrological Year 2015		659		372		399
Hydrological Year 2016	2,971	529	2,630	629	2,092	570
Hydrological Year 2017	1,286	452	3,710	197	939	171
Hydrological Year 2018	2,055	318	1,249	109	1,157	247
Hydrological Year 2019	518	150	130	17	371	36

Total Coliforms

The results of measurements for total coliform bacteria are presented in ***Table 4-16***. The results indicate a similar pattern and same tendency as for faecal coliform bacteria.

TABLE 4-16: *RESULTS OF THE TOTAL COLIFORMS IN NAM NGIEP AND ITS MAIN TRIBUTARIES DURING APRIL TO JUNE 2019 (NATIONAL SURFACE WATER QUALITY STANDARD FOR TOTAL COLIFORMS: <5,000 MPN/100 ML)*

Station Code	NNG 01	R1	R2	R3	R4	R5	R6	R7	NNG 05	NNG 06	NNG 07	NNG 08	NCH 01	NPH 01	NX A01	NHS 01
1-Apr-19					13	23										
2-Apr-19	1,600	17	2	8									540	1,600		
3-Apr-19							49	33	350	240	79	130			240	350
8-Apr-19						5	22	46	7							
18-Apr-19						22	920	1,600	920							
23-Apr-19						5										
24-Apr-19							79	540	240							
25-Apr-19						33										
2-May-19							46	49	240							
6-May-19						33										
7-May-19	1,600		110	33	79								1,600	540		
8-May-19							350	170	920	9,200	1,700	1,700			1,700	16,000
13-May-19						1,600										
14-May-19		1,600														
15-May-19							920	1,600	920							
20-May-19						220										
22-May-19							1,600	79	350							
27-May-19						22										
29-May-19							33	49	140							
3-Jun-19						130										
5-Jun-19							350	350	1,100							
10-Jun-19						49										
11-Jun-19		7	49	11	22									16,000		
12-Jun-19							350	170	540							
13-Jun-19	1,600												1,600			
14-Jun-19										540	540	350			3,500	5,400
19-Jun-19						23	540	170	1,600							
26-Jun-19						17	130	170	280							

4.6.2 Compliance Monitoring of Effluents from Camps

A total of 10 camps including OSOV were in use during Q2-2019 and the effluents were monitored in 10 camps (10 sampling sites) as indicated in ***Figure 4-11.*** The Wastewater Treatment Plant (WWTP) at the Lilama10 Camp has no discharge due to small number of workers and was therefore was not sampled.

The results are described in ***Table 4-17*** and the full data set is in ***Appendix 5.2***.

The status of compliance as of 28 June 2019 can be summarized as follows:

- Non-compliance with total coliform bacteria for five camps (EF01, EF09, EF10, EF13 and EF14);
- The HM Main Camp (EF13) has the worst record of compliance with instances of non-compliance for all parameters;
- All camps have experienced varied degree of non-compliance with ammonia and total nitrogen;

FIGURE 4-11: *MAP OF EFFLUENT MONITORING LOCATIONS DURING THE SECOND QUARTER OF 2019*

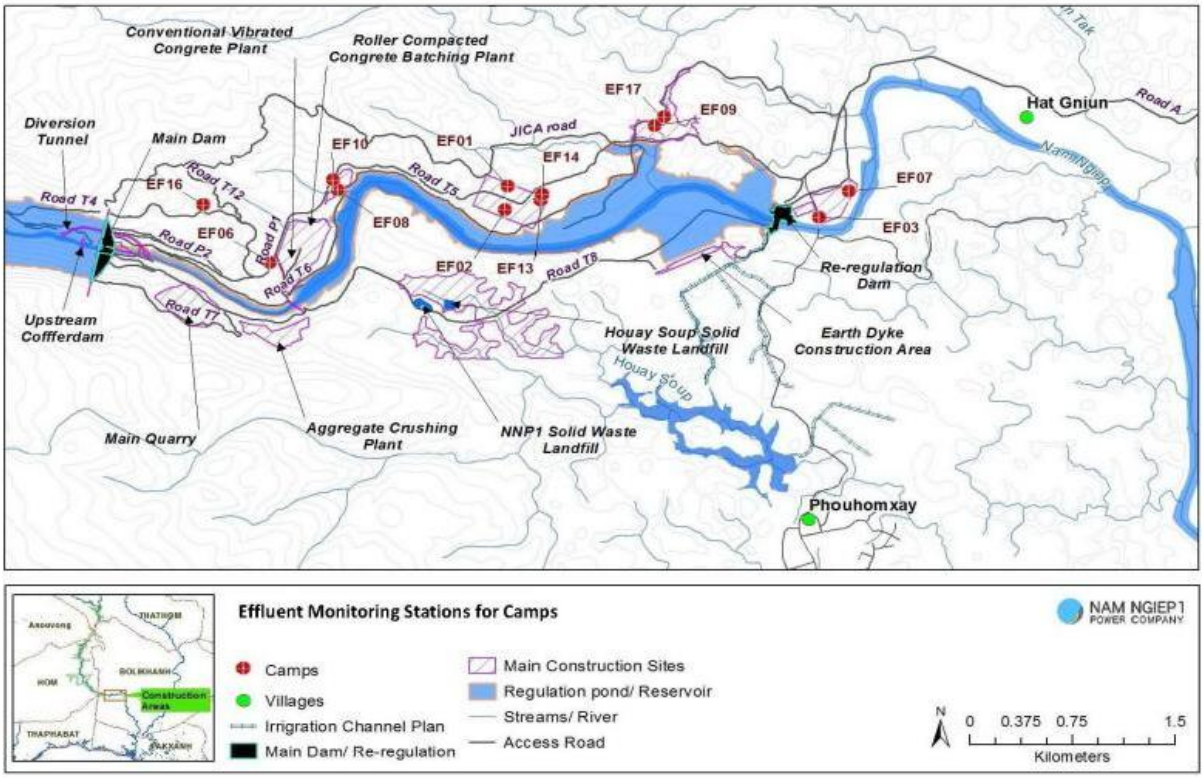


TABLE 4-17: ***RESULTS OF THE EFFLUENT WATER QUALITY MONITORING OF THE CAMPS FROM APRIL TO JUNE 2019***

		Site Name	Owner's Site Office and Village	Obayashi Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Lilama10 Camp	IHI FieldShop 276 Camp
		Station Code	EF01	EF02	EF07	EF08	EF09	EF10	EF13	EF14	EF17	EF18
Date	Parameter (Unit)	Guideline in the CA										
05-Apr-19	TSS (mg/l)	<50	<5	<5	6.76		57.81	16.8	18.13	24.5		27.27
19-Apr-19	TSS (mg/l)	<50	<5	<5	9.52		36.81	20.34	21	21.66		34.23
03-May-19	TSS (mg/l)	<50	<5	5.73	11.75		11.75	12.36	19.72	<5		
16-May-19	TSS (mg/l)	<50	<5	<5	8.86			11.39	21	16.38		
06-Jun-19	TSS (mg/l)	<50	1	3.26	5.74			6.44	25.2	10.26		
20-Jun-19	TSS (mg/l)	<50	<5	<5				5.54	22.01			
05-Apr-19	BOD_5 (mg/l)	<30	<6	9.9	<6		<6	<6	<6	8.82		<6
19-Apr-19	BOD_5 (mg/l)	<30	<6	<6	<6		<6	7.17	<6	<6		21.78
03-May-19	BOD_5 (mg/l)	<30	<6	<6	<6		68.75	<6	46.76	<6		
16-May-19	BOD_5 (mg/l)	<30	<6	<6	<6			<6	52.94	<6		
06-Jun-19	BOD_5 (mg/l)	<30	<6	7.89	<6			<6	80.1	8.46		
20-Jun-19	BOD_5 (mg/l)	<30	37.95	<6				<6	105.5			
05-Apr-19	COD (mg/l)	<125	<25	25	46.8		165	37.8	123	117		133
19-Apr-19	COD (mg/l)	<125	<25	<25	39.4		130	35.4	127	91.6		112
03-May-19	COD (mg/l)	<125	<25	<25	25.8		174	<25	105	<25		
16-May-19	COD (mg/l)	<125	<25	<25	27.1			<25	133	52.3		
06-Jun-19	COD (mg/l)	<125	<25	<25	<25			<25	128	<25		
20-Jun-19	COD (mg/l)	<125	<25	<25				<25	125			
05-Apr-19	NH3-N (mg/l)	<10	9.7	14.1	21.9		36.5	2.3	21	<0.2		10.2
19-Apr-19	NH3-N (mg/l)	<10	5.1	7.7	14.5		39.4	<0.2	18.8	<0.2		8.4
03-May-19	NH3-N (mg/l)	<10	4.8	10.5	<0.2		47.3	<0.2	10.8	3.2		
16-May-19	NH3-N (mg/l)	<10	3.3	11.9	<0.2			3.3	12.4	<0.2		
06-Jun-19	NH3-N (mg/l)	<10	6.5	8.3	<0.2			2.8	11.8	2.3		
20-Jun-19	NH3-N (mg/l)	<10	7.5	<1.5				4.3	11.9			

Date	Parameter (Unit)	Site Name	Owner's Site Office and Village	Obayashi Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Lilama10 Camp	IHI FieldShop 276 Camp
		Station Code	EF01	EF02	EF07	EF08	EF09	EF10	EF13	EF14	EF17	EF18
		Guideline in the CA										
05-Apr-19	Total Nitrogen (mg/l)	<10	12.7	15.3	28.1		38.1	8.83	21.7	4.81		11
19-Apr-19	Total Nitrogen (mg/l)	<10	8.69	8.25	15.7		41.6	1.45	19.4	1.47		10.2
03-May-19	Total Nitrogen (mg/l)	<10	25.3	16.3	3.3		49.8	2.82	12.6	5.25		
16-May-19	Total Nitrogen (mg/l)	<10	4.65	16.1	1.71			5.9	13.9	13.9		
06-Jun-19	Total Nitrogen (mg/l)	<10	11.8	12.3	1.45			3.42	13	12.8		
20-Jun-19	Total Nitrogen (mg/l)	<10	13.7	11.8				6.34	17.6			
05-Apr-19	Faecal Coliform (MPN/100 ml)	<400	49	79	0		0	0	0	0		0
19-Apr-19	Faecal Coliform (MPN/100 ml)	<400	1600	0	0		0	1600	0	0		0
03-May-19	Faecal Coliform (MPN/100 ml)	<400	130	0	0		1600	22	130	350		
16-May-19	Faecal Coliform (MPN/100 ml)	<400	540	0	0			17	16000	0		
06-Jun-19	Faecal Coliform (MPN/100 ml)	<400	40	4.5	0			22	5400	240		
20-Jun-19	Faecal Coliform (MPN/100 ml)	<400	350	0				170	1,600			
05-Apr-19	Total Coliform (MPN/100 ml)	<400	700	130	0		0	0	0	0		0
19-Apr-19	Total Coliform (MPN/100 ml)	<400	1600	7.8	0		0	1600	0	0		0
03-May-19	Total Coliform (MPN/100 ml)	<400	540	0	0		3500	33	920	350		
16-May-19	Total Coliform (MPN/100 ml)	<400	540	2	0			350	16000	0		

		Site Name	Owner's Site Office and Village	Obayashi Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Lilama10 Camp	IHI FieldShop 276 Camp
		Station Code	EF01	EF02	EF07	EF08	EF09	EF10	EF13	EF14	EF17	EF18
Date	Parameter (Unit)	Guideline in the CA										
06-Jun-19	Total Coliform (MPN/100 ml)	<400	1600	34	0			350	5400	9200		
20-Jun-19	Total Coliform (MPN/100 ml)	<400	350	0				170	1600			

TABLE 4-18: ***COMPLIANCE STATUS OF EFFLUENT DISCHARGE FROM THE CAMPS IN Q2-2019***

Site	ID	WWTS	Key Non-Compliance Issues in Q2-2019	Corrective Actions
Owner's Site Office and Village (NNP1PC)	EF01	Septic tanks (kitchen and black water) and wetland (grey water), discharge: 70 m^3/day	- Total nitrogen (<10 mg/L): Non-compliance in 4 out of 6. Q2 mean 12.8 mg/L. - BOD_5 (<30 mg/L): Non-compliance in 1 out of 6. Q2 mean 8.37 mg/L. - Faecal coliform (<400 MPN/100 mL): Non-compliance in 2 out of 6. Q2 mean 452 MPN/100 mL. - Total coliform (<400 MPN/100 mL): Non-compliance in 5 out of 6. Q2 mean 888 MPN/100 mL.	- Cleaning up of the wastewater treatment system, adjusting the wastewater piping system of the second wetland pond was completed on 25-Jun-19. The results will be monitored and reported in the next Quarterly Report. - An observation of non-compliance will be issued if no improvement.
OC Camp – WWTS01	EF02	Septic tanks (kitchen and black water) and wetland	- Ammonia (<10 mg/L): Non-compliance in 3 out of 6. Q2 mean 10.5 mg/L.	- EMO will continue to monitor and issue an observation of non-compliance if no improvement.

Site	ID	WWTS	Key Non-Compliance Issues in Q2-2019	Corrective Actions
		with chlorination system (grey water)	- Total nitrogen (<10 mg/L): Non-compliance in 5 out of 6. Q2 mean 13.3 mg/L.	
Zhefu Camp (HMH Worker Camp No.1)	EF09	Septic tank (kitchen and black water), sediment ponds (grey water)	- TSS (<50 mg/L): Non-compliance in 1 out of 3. Q2 means 35.46 mg/L. - BOD_5 (<30 mg/L): Non-compliance in 1 out of 3. Q2 mean 24.55 mg//L. - COD (<125 mg/L): Non-compliance in 3 out of 3. Q2 mean 156.33 mg/L. - Ammonia-nitrogen (<10 mg/L): Non-compliance in 3 out of 3. Q2 mean 41.1 mg/L. - Total nitrogen (<10 mg/L): Q2 mean 43.2 mg/L. - Faecal coliform (<400 MPN/100 mL): Non-compliance in 1 out of 3. Q2 mean 533 MPN/100 mL. - Total coliform (<400 MPN/100 mL): Non-compliance in 1 out of 3. Q2 mean 1,166 MPN/100 mL.	- Inconsistent dosing of chlorine was found out during a joint bi-weekly inspection and the Contractor was instructed to assign key staff for the operation and maintenance of the WWTS; - The finding and effluent results were also discussed in each Monthly Progress Meeting between NNP1PC and HM Hydro.
V&K Camp	EF10	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	- Faecal coliform (<400 MPN/100 mL): Non-compliance in 1 out of 6. Q2 mean 305 MPN/100 mL. - Total coliform (<400 MPN/100 mL): Non-compliance in 1 out of 6. Q2 mean 417 MPN/100 mL.	- Effluent results were shared with the Contractor and additional instructions on chlorination and WWTS maintenance was provided during the inspections and each monthly progress meeting between NNP1PC and the Contractor.
HM Hydro Main Camp – WWTS01	EF13	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	- BOD_5 (<30 mg/L): Non-compliance in 4 out of 6. Q2 mean 48.37 mg/L. - COD (<125 mg/L): Non-compliance in 3 out of 6. Q2 mean 123.5 mg/L. - Ammonia (<10 mgL): Non-compliance in 6 out of 6. Q2 mean 14.45 mg/L.	- NCR 2 was previously issued on 20 December 2018 on wastewater discharge; - Inconsistent chlorine dosing was found out during a joint bi-weekly inspection and the Site

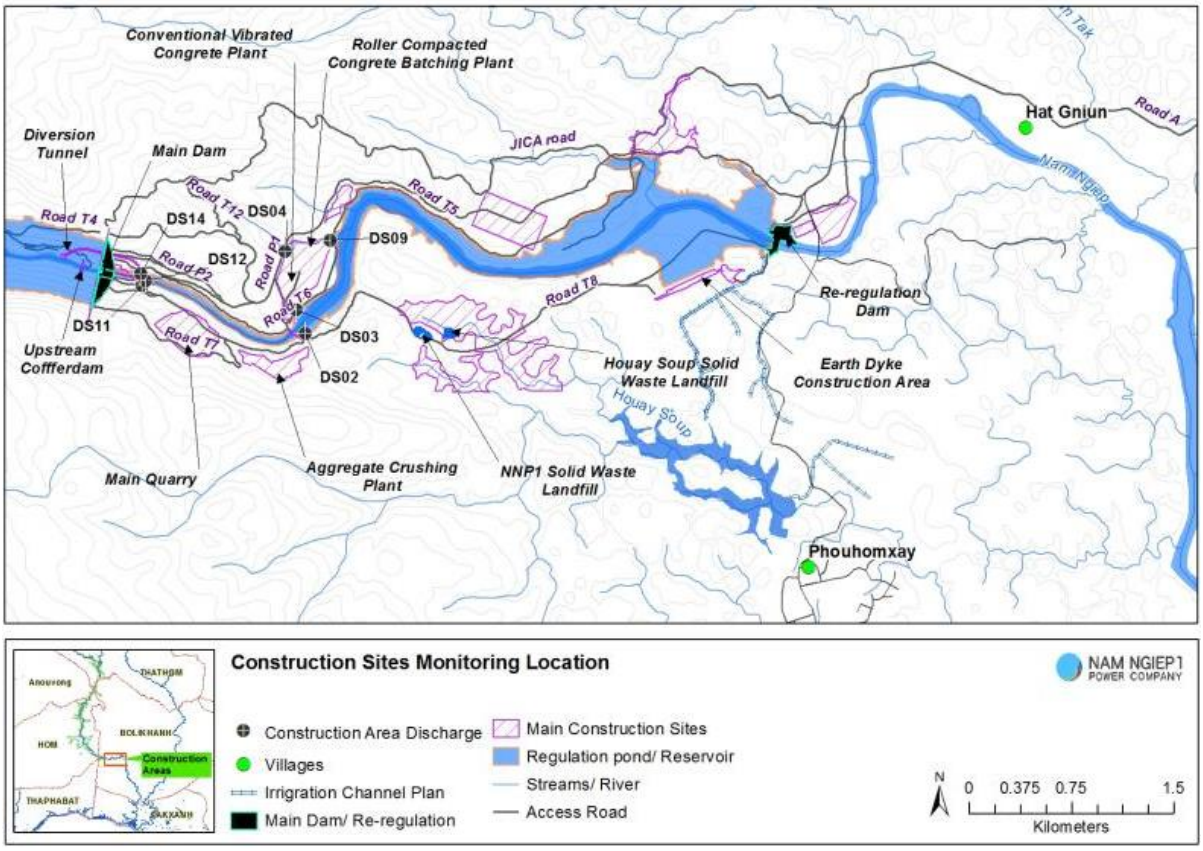
Site	ID	WWTS	Key Non-Compliance Issues in Q2-2019	Corrective Actions
			- Total nitrogen (<10 mg/L): Non-compliance in 6 out of 6. Q2 mean 16.37 mg/L. - Faecal coliform (<400 MPN/100 mL): Non-compliance in 3 out of 6. Q2 mean 3,855 MPN/100 mL. - Total coliform (<400 MPN/100 mL): Non-compliance in 4 out of 6. Q2 mean 3,986 MPN/100 mL.	Inspection Report (ONC-HM-0030) was issued on 21 May 2019. The contractor was also instructed to assign key staff for the operation and maintenance of the WWTS; - The finding and effluent results were also discussed in each Monthly Progress Meeting between NNP1PC and HM Hydro.
IHI Camp	EF14	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	- Total nitrogen (<10 mg/L): Non-compliance in 2 out of 5. Q2 mean 7.6 mg/L. - Total coliform (<400 MPN/100 mL): Non-compliance in 1 out of 5. Q2 mean 1,910 MPN/100 mL.	- Effluent results and improvement of the WWTS operation were discussed in each Monthly Progress Meeting between NNP1PC and the Contractor (IHI).
Song Da5 Camp No. 1	EF07	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	- Ammonia (<10 mg/L): Non-compliance in 2 out of 5. Q2 mean 7.3 mg/L. - Total nitrogen (<10 mg/L): Non-compliance in 2 out of 5. Q2 mean 10.1 mg/L.	- Inadequate maintenance of the WWTS was found out during the Bolikhaxay EMU site visit. The instruction for WWTS improvement was provided to the Contractor accordingly.
Song Da5 Camp No. 2	EF08	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	- No effluent was discharged from the camp therefore no sampling was conducted due to the dried wetland and treatment ponds.	

Site	ID	WWTS	Key Non-Compliance Issues in Q2-2019	Corrective Actions
Lilama10 Camp	EF17	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	- No effluent sampling due to no outflow from the wetland pond to chlorination tank.	
IHI Fieldshop 276 Camp	EF18	Septic tanks (kitchen and black water) and wetland with chlorination system (grey water)	- COD (<125 mg/L): Non-compliance in 1 out of 2. Q2 mean 122.5 mg/L. - Ammonia (<10 mgL): Non-compliance in 1 out of 2. Q2 mean 9.3 mg/L. - Total nitrogen (<10 mg/L): Non-compliance in 2 out of 2. Q2 mean 10.6 mg/L.	- Effluent results and improvement of the WWTS operation were discussed in each monthly progress meeting between NNP1PC and the Contractor.

4.6.3 Compliance Monitoring of Discharges from Construction Sites

Discharges from the key construction sites (see ***Figure 4-12***) were monitored during the reported period. The results are presented in ***Table 4-19.*** Results that are above the prescribed standards are highlighted in yellow. The full set of data is in ***Appendix 5.3***.

FIGURE 4-12: *LOCATION OF DISCHARGE POINTS OF KEY CONSTRUCTION SITES*



Construction site discharge measurement continues to ensure that the discharges from the construction sites 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 4-20**.Table 4-20: *Compliance Status of Effluent Discharge and Corrective Action During the Second Quarter of 2019*

TABLE 4-19: *RESULTS OF THE CONSTRUCTION AREA DISCHARGE MONITORING IN Q2 2019*

Date	Parameter (Unit)	Site Name (Code)	Spoil Disposal Area No.2 (DS04)	CVC Plant (DS03)
		Effluent Standard		
01-Apr-19	TSS (mg/l)	<50	16.9	No discharged during the monitoring period.
09-Apr-19	TSS (mg/l)	<50	12.88	
25-Apr-19	TSS (mg/l)	<50	20.75	
03-May-19	TSS (mg/l)	<50	11.51	
08-May-19	TSS (mg/l)	<50	179.51*	
16-May-19	TSS (mg/l)	<50	4.1	
23-May-19	TSS (mg/l)	<50	9.77	
30-May-19	TSS (mg/l)	<50	42.12	
07-Jun-19	TSS (mg/l)	<50	14.54	
13-Jun-19	TSS (mg/l)	<50	24.69	
20-Jun-19	TSS (mg/l)	<50	9.94	
27-Jun-19	TSS (mg/l)	<50	22.04	

Note: *The water sampling was carried out just after the rain event.

TABLE 4-20: *COMPLIANCE STATUS OF EFFLUENT DISCHARGE AND CORRECTIVE ACTION DURING THE SECOND QUARTER OF 2019*

Site	ID	Treatment System	Key Non-Compliance Issues in Q2-2018	Corrective Actions
CVC Plant	DS03	Sediment ponds	- No discharge during Q2 2019	
Spoil Disposal No.2	DS04	Sediment pond	- TSS (<50 mg/L): Q2 mean 30.7 mg/L. Non-compliance in 1 out of 12 measurements.	

4.6.4 Groundwater Quality Monitoring

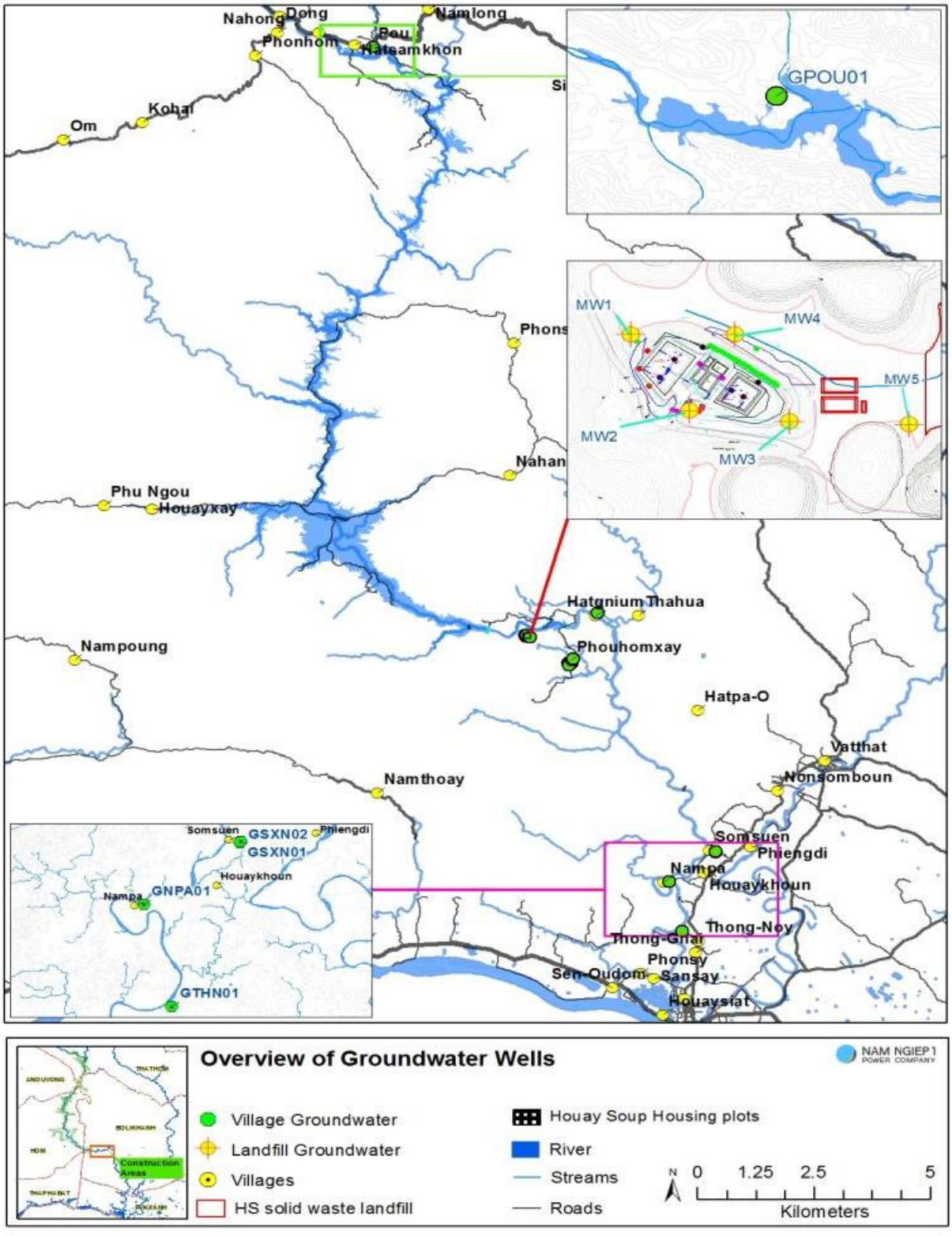
During the Q2 2019, two boreholes at Somseun, one borehole at Nam Pa, one borehole at Thong Noy and one borehole at Pou villages have been monitored for the following parameters:

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

The groundwater quality in the four monitoring wells located at the NNP1 Project Landfill and the monitoring well at Houay Soup Landfill was monitored.

The groundwater sampling locations are displayed in ***Figure 4-13*** and the groundwater monitoring data is presented in ***Appendix 5.4 and 5.7***

FIGURE 4-13: ***GROUNDWATER SAMPLING LOCATIONS***



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

Somsuen Village and Thong Noy Village: All monitored parameters complied with the standard except for faecal coliform and E.coli bacteria in the April and June 2019 samples.

Pou Village: All monitored parameters complied with the standard during the reported period.

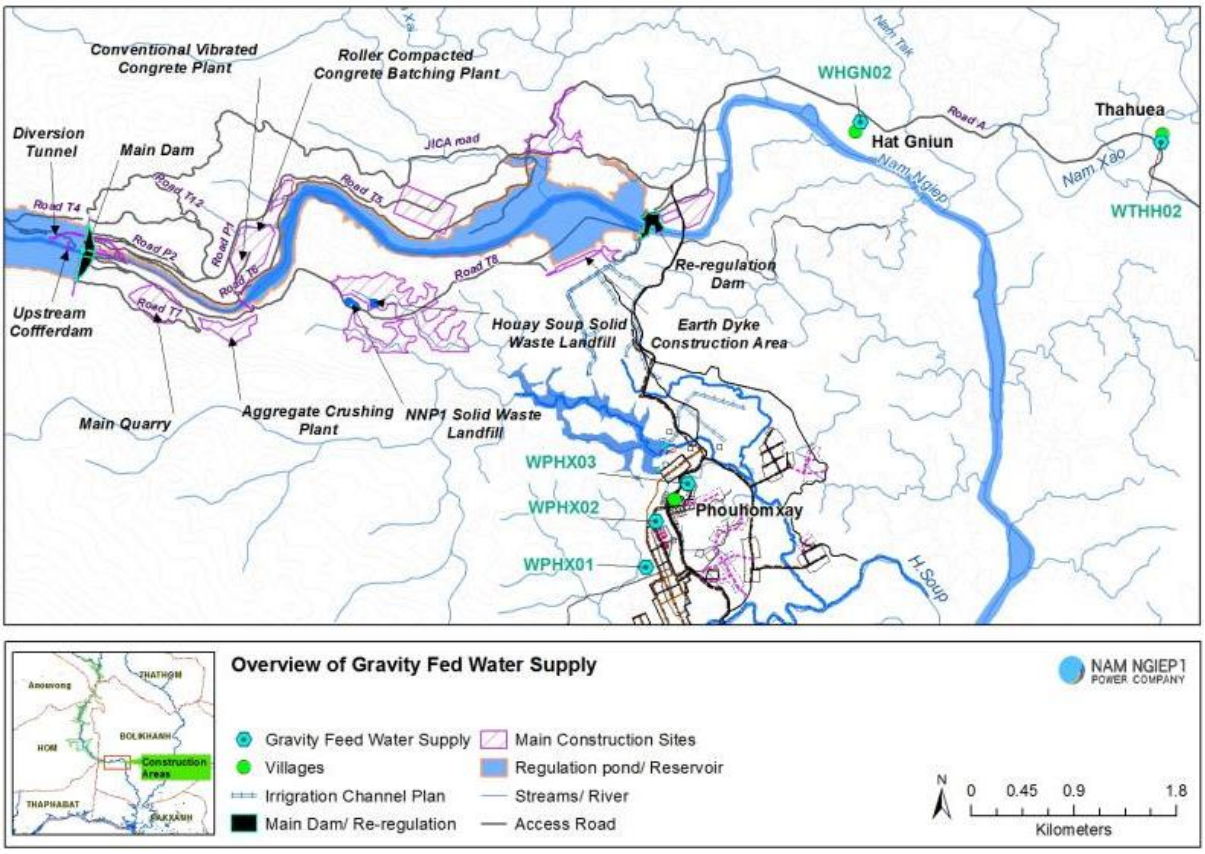
Nam Pa Village: All of monitored parameters complied with the relevant National Standard except for faecal coliform and Ecoli bacteria in the June 2019 sample.

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.

4.6.5 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 4-14: *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 4-21. The full set of data is presented in ***Appendix 5.5***

TABLE 4-21: *THE GFWS MONITORING RESULT IN Q2 2019*

Date	Parameter (Unit)	Site Name	Tha Heua Village	Hat Gnuin Village	Phouhomxay Village		
		Station	WTHH02	WHGN02	WPHX01	WPHX02	WPHX03
		Guideline					
09-Apr-19	E. Coli Bacteria (MPN/100 ml)	0	79	130	540	79	79
24-May-19		0	13	26	79	27	11
18-Jun-19		0	1,600	1,600	140	33	110
09-Apr-19	Faecal coliform (MPN/100 ml)	0	47	22	240	33	33
24-May-19		0	13	17	49	14	11
18-Jun-19		0	1,600	350	140	33	110

Thahuea Village (WTHH02): all parameters complied with the National Drinking Water Standards, except for faecal coliform and E.Coli bacteria during the Quarter. In addition, non-compliance for turbidity in the June 2019 sample. High turbidity was caused from runoff (heavy rain) into the source of gravity fed water supply.

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

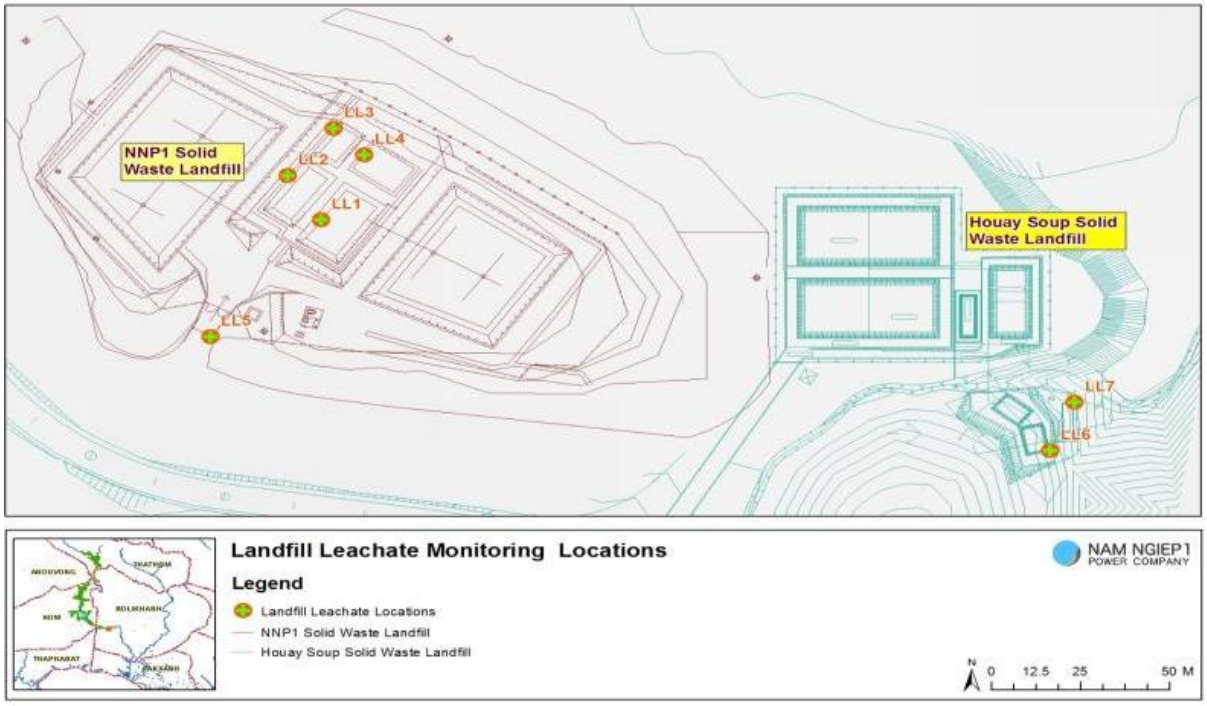
Phouhomxay Village (WPHX01 -raw water in the head tank before filtration, WPHX02 - tap water at primary school & WPHX03-tap water at the villager's house)**:** all parameters complied with the National Drinking Water Standards, except the faecal coliform and E.Coli bacteria.

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

4.6.6 Landfill Leachate Monitoring

The landfill leachate treatment systems at NNP1 Project landfill and Houay Soup landfill are monitored to control the functioning of the treatment process and ensure compliance with effluent standards. The monitoring locations are presented in the ***Figure 4-15***.

FIGURE 4-15: ***LANDFILL LEACHATE MONITORING LOCATION***



The monitoring results for Q2 2019 indicate compliance with the applicable standards for all monitored parameters except total coliform (May and June 2019), pH and COD (May 2019) at the last pond of NNP1 Landfill. In addition, the non-compliance for COD, faecal coliform and total coliform were also recorded at the last pond of Houay Soup Landfill in May and June 2019. The monitoring data can be found in ***Appendix 5.6***

4.6.7 Air Quality (Dust) Monitoring

4.6.7.1 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 4-16*** and the results are summarized in

Table 4-22***.*** The measured concentrations of PM_{10} in the ambient air complied with the standard during the monitored periods, except in April 2019***.*** Non-compliance of PM_{10} in Hat Gniun and Phouhomxay villages were caused from local slush and burn activities nearby.

FIGURE 4-16: ***NOISE AND DUST MONITORING LOCATIONS AT THE CONSTRUCTION SITES AND NEARBY VILLAGES***

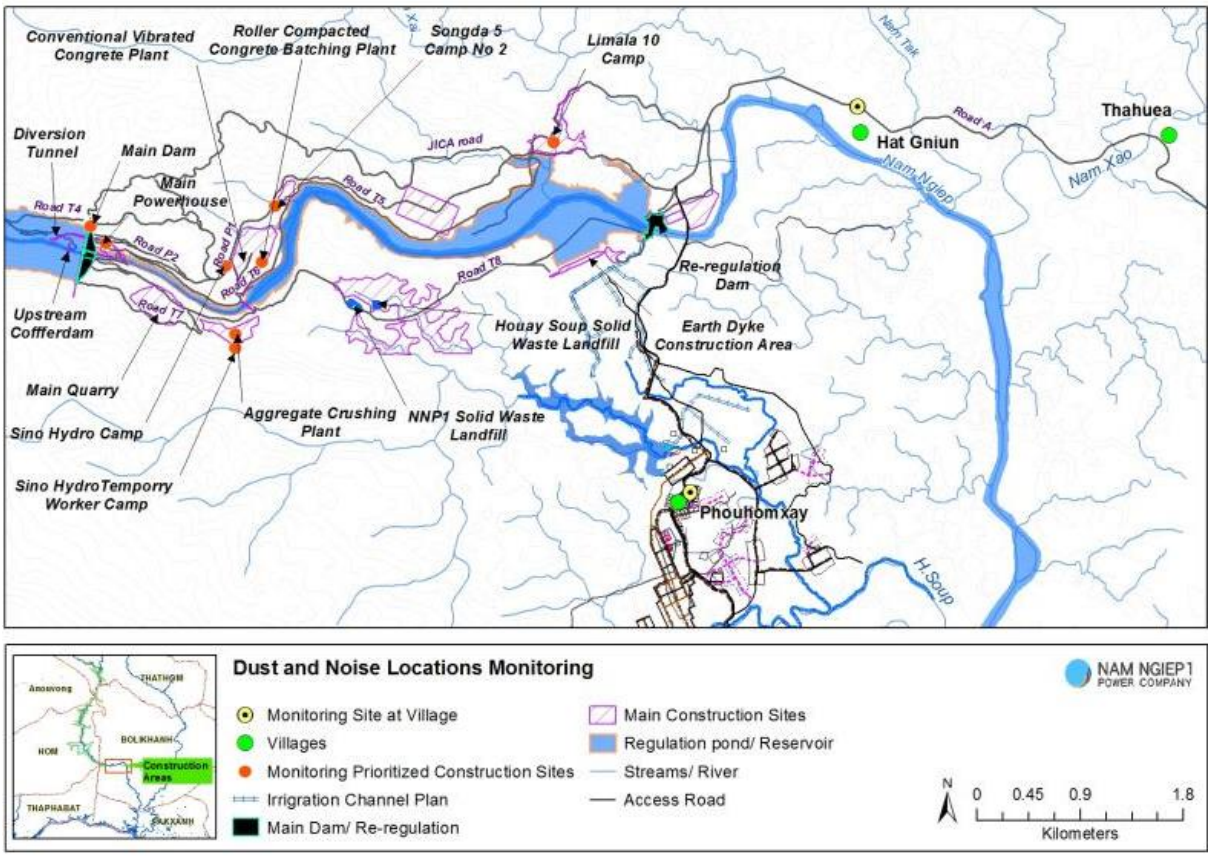


TABLE 4-22: ***RESULTS OF AIR QUALITY (DUST) MONITORING AT THE VILLAGES NEAR THE PROJECT CONSTRUCTION SITES DURING APRIL TO JUNE 2019***

Site Name	Hat Gniun Village								
Start Time	01/Apr/19 18:00	02/Apr/19 18:00	03/Apr/19 18:00	07/May/19 18:30	08/May/19 18:30	09/May/19 18:30	03/Jun/19 18:00	04/Jun/19 18:00	05/Jun/19 18:00
End Time	02/Apr/19 18:00	03/Apr/19 18:00	04/Apr/19 18:00	08/May/19 18:30	09/May/19 18:30	10/May/19 18:00	04/Jun/19 18:00	05/Jun/19 18:00	06/Jun/19 18:00
Average Data Record - 24 hours	0.12	0.13	0.14	0.05	0.06	0.08	0.009	0.014	0.022
Guideline	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12

Site Name	Phouhomxay								
Start Time	08/Apr/19 18:00	09/Apr/19 18:00	10/Apr/19 18:00	13/May/19 18:00	14/May/19 18:00	15/May/19 18:00	24/Jun/19 18:00	25/Jun/19 18:00	26/Jun/19 18:00
End Time	09/Apr/19 18:00	10/Apr/19 18:00	11/Apr/19 18:00	14/May/19 18:00	15/May/19 18:00	16/May/19 18:00	25/Jun/19 18:00	26/Jun/19 18:00	27/Jun/19 18:00
Average Data Record - 24 hours	0.300	0.485	0.326	0.07	0.05	0.07	0.03	0.03	0.03
Guideline	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12

4.6.7.2 Project Construction Sites

During Q2 2019, dust (PM_{10}) monitoring was carried out monthly for periods of 24 consecutive hours at four priority construction sites and camps to assess possible impact on workers' health. The results summarized in ***Table 4-23*** indicate compliance with the standard (0.12 mg/m^3 PM_{10}) for most of construction sites, except at the Main Dam and Lilama10 Camp (for April 2019). All staff were advised to wear dust masks while working in these areas.

TABLE 4-23: *DUST MONITORING RESULTS AT THE CONSTRUCTION SITES DURING APRIL TO JUNE 2019*

Site Name	**Main Dam**		
Period	00-24 Hours	00-24 Hours	00-24 Hours
Start Time	24/Apr/19 18:30	06/May/19 18:00	20/Jun/19 18:00
End Time	25/Apr/19 18:00	07/May/19 18:00	21/Jun/19 18:00
Average Data Record -24h	0.130	0.061	0.025
Guideline	0.12	0.12	0.12

Site Name	**Song Da 5 Camp No.2**		
Period	00-24 Hours	00-24 Hours	00-24 Hours
Start Time	23/Apr/19 18:30	21/May/19 18:30	17/Jun/19 18:00
End Time	24/Apr/19 18:00	22/May/19 18:00	18/Jun/19 17:30
Average Data Record -24h	0.115	0.081	0.039
Guideline	0.12	0.12	0.12

Site Name	**Lilama 10 Camp**		
Period	00-24 Hours	00-24 Hours	00-24 Hours
Start Time	22/Apr/19 18:00	20/May/19 18:00	13/Jun/19 18:00
End Time	23/Apr/19 18:00	21/May/19 18:00	14/Jun/19 18:00
Average Data Record -24h	0.160	0.096	0.018
Guideline	0.12	0.12	0.12

Site Name	**Main Powerhouse**		
Period	00-24 Hours	00-24 Hours	00-24 Hours
Start Time	25/Apr/19 18:30	28/May/19 18:00	18/Jun/19 18:30
End Time	26/Apr/19 18:00	29/May/19 18:00	19/Jun/19 18:00
Average Data Record -24h	0.078	0.023	0.021
Guideline	0.12	0.12	0.12

4.6.8 Noise Monitoring

4.6.8.1 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 nighttime during 22:00-06:00.

The results (see ***Table 4-24***) show that the noise levels at the villages were within the allowable maximum peak value at 115 dB(A), and some of the night-time average noise levels were slightly higher than the standard in Hat Gniun and Phouhomxay villages.

TABLE 4-24: *NOISE MONITORING RESULTS AT THE HOST VILLAGES DURING Q2 2019*

Hat Gnuin Village - Noise Monitoring 72 consecutive hours - April 2019									
Noise Level (dB)	**01-02/April/19**			**02-03/April/19**			**03-04/April/19**		
	18:00-22:00	22:01 – 06:00	06:01 – 18:00	18:00-22:00	22:01 – 06:00	06:01 – 18:00	18:00-22:00	22:01 – 06:00	06:01 – 18:00
Maximum Value Recorded	65.10	60.10	71.60	69.30	65.00	69.80	69.80	66.70	75.30
Guideline Max	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	52.27	48.26	48.34	50.54	48.28	47.75	49.89	47.63	50.45
Guideline Averaged	***55***	***45***	***55***	***55***	***45***	***55***	***55***	***45***	***55***
Hat Gnuin Village - Noise Monitoring 72 consecutive hours - May 2019									
Noise Level (dB)	**07-08/May/19**			**08-09/May/19**			**09-10/May/19**		
	18:30-22:00	22:01 – 06:00	06:01 – 18:00	18:00-22:00	22:01 – 06:00	06:01 – 18:00	18:00-22:00	22:01 – 06:00	06:01 – 18:00
Maximum Value Recorded	64.50	82.00	76.40	65.70	66.90	79.40	71.00	64.60	74.30
Guideline Max	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	45.92	52.54	46.98	47.13	43.49	43.81	45.25	42.18	43.60
Guideline Averaged	***55***	***45***	***55***	***55***	***45***	***55***	***55***	***45***	***55***
Hat Gnuin Village - Noise Monitoring 72 consecutive hours - June 2019									
Noise Level (dB)	**03-04/June/19**			**04-05/June/19**			**05-06/June/19**		
	18:30-22:00	22:01 – 06:00	06:01 – 18:00	18:00-22:00	22:01 – 06:00	06:01 – 18:00	18:00-22:00	22:01 – 06:00	06:01 – 18:00
Maximum Value Recorded	57.30	64.80	62.80	59.90	71.60	73.00	63.60	73.30	67.80
Guideline Max	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	42.05	50.38	41.51	46.28	49.48	45.20	42.97	44.69	41.44
Guideline Averaged	***55***	***45***	***55***	***55***	***45***	***55***	***55***	***45***	***55***

Phouhomxay Village - Noise Monitoring 72 consecutive hours - April 2019									
Noise Level (dB)	**08-09/April/19**			**09-10/April/19**			**10-11/April/19**		
	18:00-22:00	22:01 – 06:00	06:01 – 18:00	18:00-22:00	22:01 – 06:00	06:01 – 18:00	18:00-22:00	22:01 – 06:00	06:01 – 18:00
Maximum Value Recorded	62.40	71.10	80.60	68.10	69.60	82.60	65.20	6.00	78.00
Guideline Max	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	49.16	45.87	45.31	50.58	44.99	44.29	48.48	47.49	45.50
Guideline Averaged	***55***	***45***	***55***	***55***	***45***	***55***	***55***	***45***	***55***
Phouhomxay Village - Noise Monitoring 72 consecutive hours - May 2019									
Noise Level (dB)	**13-14/May/19**			**14-15/May/19**			**15-16/May/19**		
	18:00-22:00	22:01 – 06:00	06:01 – 18:00	18:00-22:00	22:01 – 06:00	06:01 – 18:00	18:00-22:00	22:01 – 06:00	06:01 – 18:00
Maximum Value Recorded	58.90	51.70	71.80	57.30	56.50	74.30	56.70	6.00	76.10
Guideline Max	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	43.89	40.94	45.42	42.17	40.00	41.36	39.54	38.36	40.44
Guideline Averaged	***55***	***45***	***55***	***55***	***45***	***55***	***55***	***45***	***55***
Phouhomxay Village - Noise Monitoring 72 consecutive hours - June 2019									
Noise Level (dB)	**24-25/Jun/19**			**25-26/Jun/19**			**26-27/Jun/19**		
Maximum Value Recorded									
Guideline Max									
Average Data Recorded	No noise monitoring data due to can not retrieve data from equipment to computer								
Guideline Averaged									

4.6.8.2 Project Camps and Construction Sites

During Q2 2019, noise monitoring was conducted at the Song Da5 camp No.2, Main Dam, Lilama10 camp and Main Powerhouse to assess possible impacts on workers' health as well as estimating any potential impacts on the ambient noise levels in nearby communities.

The results showed that all maximum peak noise levels were within the National Standard. However, the average noise level during 22:01-06:00 at Song Da5 Camp No.2 (June 2019) and Lilama10 Camp (April and June 2019) were slightly higher than the Standard. It was very likely that this was caused by the rainfall occurred overnight.

TABLE 4-25: *NOISE MONITORING RESULTS FOR PROJECT CONSTRUCTION SITES DURING Q2 2019*

Site Name	SongDa5 Camp No.2								
Noise Level (dB)	23-24/April/19		24/April/19	21-22/May/19		22/May/19	17-18/June/19		18/June/19
	18:30 – 22:00	22:01 – 06:00	06:01-18:00	18:30 – 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	53.30	72.20	67.30	42.9	49.9	62	76.00	70.60	75.70
Guideline Max	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	44.18	44.77	40.65	35.91	35.03	38.92	59.59	54.36	57.79
Guideline Averaged	***70***	***50***	***70***	***70***	***50***	***70***	***70***	***50***	***70***

Site Name	Lilama10 Camp								
Noise Level (dB)	22-23/April/2019		23/April/2019	20-21/May/2019		21/May/2019	13-14/June/2019		14/June/2019
	18:00 – 22:00	22:01 – 06:00	06:00-18:00	18:00 – 22:00	22:01 – 06:00	06:00-18:00	18:00 – 22:00	22:01 – 06:00	06:00-18:00
Maximum Value Recorded	68.7	69.6	71.2	63.4	58.4	63.5	56.9	61	67.3
Guideline Max	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	55.31	59.48	42.42	41.26	40.10	40.47	46.73	50.99	42.77
Guideline Averaged	***70***	***50***	***70***	***70***	***50***	***70***	***70***	***50***	***70***

Site Name	Main Dam								
Noise Level (dB)	24-25/April/19		25/April/19	06-07/May/19		07/May/19	20-21/June/19		21/June/19
	18:30 – 22:00	22:01 – 06:00	06:01-18:00	18:00 – 22:00	22:01 – 06:00	06:01-18:00	18:00 – 22:00	22:01 – 06:00	06:01-18:00
Maximum Value Recorded	81.7	71.4	87.4	53.6	78.6	83.5	54.2	54.6	64.2
Guideline Max	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	67.69	69.90	67.87	47.15	49.12	59.83	46.12	47.59	43.50
Guideline Averaged	***70***	***70***	***70***	***70***	***70***	***70***	***70***	***70***	***70***

Site Name	Main Powerhouse								
Noise Level (dB)	25-26/April/19		26/April/19	28-29/May/19		29/May/19	18-19/June/19		19/June/19
	18:30 – 22:00	22:01 – 06:00	06:01-18:00	18:00 – 22:00	22:01 – 06:00	06:01-18:00	18:30 – 22:00	22:01 – 06:00	06:01-18:00
Maximum Value Recorded	81	68	67.7	65.9	66.8	77.5	74.3	63.4	77.8
Guideline Max	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	65.89	62.58	53.88	57.72	57.80	61.23	51.82	46.74	46.01
Guideline Averaged	***70***	***70***	***70***	***70***	***70***	***70***	***70***	***70***	***70***

4.6.9 Vibration

The vibration was not conducted as the construction work during Q2 2019 was completed and unlikely to generate vibrations that would impact the human health and surrounded environment.

5 WATERSHED AND BIODIVERSITY MANAGEMENT

5.1 WATERSHED MANAGEMENT

5.1.1 Preparation of Watershed Management Plan

NNP1PC-EMO completed the improvement of the Lao version of the NNP1 Watershed Management Plan (WMP) addressing comments received from the final consultation workshop with the GoL on 13 March 2019. NNP1PC-EMO continues to improve the Plan from April to June 2019 addressing the comments from GoL, revising the budget and refining the Lao translation for consistency before submitting to the Department of Forestry (DoF), Ministry of Agriculture and Forestry (MAF). It is expected that the Plan will be approved by Minister of MAF in Q3 2019.

The Xaysomboun and Bolikhamxay Provincial Watershed and Reservoir Protection Offices (WRPOs) requested to have an agreement with NNP1PC on the administration rates to be applied for payments under the Watershed Management Fund prior to finalizing the draft AIP2019. NNP1PC-EMO Management has consulted the matter with DoF, MAF on 23 April 2019. DOF agreed to convene a workshop in May 2019 to discuss the draft Financial Management Manual (FMM) with both WRPOs.

The improved draft AIP2019 from three WRPOs were discussed during the workshop on FMM for Watershed Management Fund which was held on 10 May 2019. The key conclusions from this workshop are as below:

- The meeting principally agreed with the content in the draft Financial Management Manual (FMM) for Watershed and Biodiversity Management Funds with minor comments for further improvement.
- The meeting agreed to apply MoF's Agreement No. 4000 dated December 2018 as the basis for calculation and use of both Funds by GoL namely the Financial Regulation for Watershed Management Fund (2016) signed by the Xaysomboun Provincial Vice Governor and the Financial Regulation for Biodiversity Offset Management Program signed by the Vice-Governor of Bolikhamxay (also the Chair of BOMC) no. 008 dated January 2017.
- Three WRPOs will further improve their AIP2019 incorporating the comments from the meeting participants by 31 May 2019.

DoF-WRPO submitted their revised AIP2019 on 16 May 2019. NNP1PC-EMO reviewed the Plan and reverted back to DOF-WRPO. DOF-WRPO submitted their full AIP2019 to NNP1PC-EMO on 21 June 2019 and comments were provided on 28 June 2019. The final Plan is being translated prior to submission to ADB in July 2019.

NNP1PC-EMO further discussed with Bolikhamxay Provincial WRPO on 07 June 2019 about their AIP2019 which includes the schedule and resources of patrolling activity, the fishery co-management Plan preparation including the establishment and management of the fish landing sites and the overall improvement of proposed activities as well as the budget. The improved AIP2019 of Bolikhamxay Provincial WRPO was submitted to NNP1PC-EMO on 10

June 2019 and the final revision and comments were returned to them on 25 June 2019. Bolikhamxay Provincial WRPO had another discussion with NNP1PC-EMO on 28 June 2019 to finalize their AIP. The full AIP2019 was submitted to NNP1PC-EMO on 31 June 2019 for further review and translation prior to submission to ADB in July 2019.

Xaysomboun Provincial WRPO submitted an official design and cost estimation for the construction of Xaysomboun WRPO sub-office in Hom District in May 2019. The design was reviewed internally by ESD team and noted for options to reduce the cost. NNP1PC-EMO advised Xaysomboun Provincial WRPO to revisit their proposal. NNP1PC-EMO together with ADB and IAP mission team had discussion with Xaysomboun Provincial WRPO on 06 June 2019 about the overall progress of the WMP, the preparation of AIP2019 and the status of Xaysomboun Provincial Regulation on Watershed Management. NNP1PC-EMO had further discussion with Xaysomboun Provincial WRPO on 24 June 2019 on the overall improvement of proposed activities and its budget and noted that their AIP needed further internal discussion and approval. The submission of XSB AIP to ADB is expected to be later than DOF-WRPO and Bolikhamxay Provincial WRPO.

The operation of checkpoints in Xaysomboun Province continued in April 2019. The checkpoints made 651 records of people accessing the main reservoir through the checkpoint at Houayxay Village (Hom District, Xaysomboun Province). The main reasons why people accessing the reservoir include fishing and hunting (101 records), agriculture (214 records), livestock raising (125 records) and other purposes (211 records). The checkpoint in Pou Village recorded 1,929 boats entering the reservoir and 1,856 boats leaving the reservoir.

The funding of the pre-WMP for checkpoint operation and mobile patrolling in Xaysomboun Province is over by the end of April 2019. The military staff at Houaxay and Pou Village were dismissed from the checkpoints and the equipment were kept at Xaysomboun Provincial WRPO. The patrolling activity in NNP1 Project watershed and its reservoir will be resumed as soon as the AIP2019 of both Provinces is completed and approved by ADB.

Xaysomboun Provincial WRPO also carried out a mobile patrolling around Houayxay area with NNP1PC-EMO Biodiversity Team from 02 to 10 April 2019. The key observations and notes from the patrolling activity are as below:

1. Livestock raising were observed and reported to cover large areas within the boundary of both TPZs. However, the team could not locate the exact grazing land because the team was not able to meet all the livestock owners. Most of the livestock observed and reported are kept at the compensated areas. The owners of these livestock are mostly the self-resettlers from other villages such as Nam Khien, Homthad, Phalavek, Phouhomxay, Pak Gnong, etc.
2. Newly cleared areas for upland cultivation were observed at Sopphouan, Houy Om and Houy Pamom. The village authorities reported that most of the owners are from Houayxay Village who have already received the compensation and relocated from the former Sopphouan and Houypamom Villages.
3. All the observed fishery groups are outsiders from Vangvieng, Keoudom, Longxan and Thathom Districts without any official approvals. Some of the groups have set up their camps and fished in the reservoir since December 2018. Local villagers reported that

illegal fishing gears (electric shockers) are being used by those fishing groups. Moreover, the size of many fishing nets is reported to be less than 5 cm which is a concern for sustainable fishery in the reservoir.

4. NTFP (Haem in the local language) was heavily collected within the TPZ1 without any official approval. The traders are reported to be from Longxan and Thathom Districts.
5. Illegal gun collection was conducted by the police from the village cluster in January 2019. However, homemade guns were still observed to be carried by the locals along the access roads and in the Project sites. The patrolling team confiscated four homemade guns and one chainsaw.
6. Logs belonging to Phengkhammee Company were still observed to be kept at the log yard No. 2 at the edge of the reservoir to Nahan Village.
7. Owners of the rubber tree plantation or their relatives were observed and reported still collecting rubber from the compensated rubber tree plantations within both TPZs and some parts of the watershed area.
8. Previously approved fish trading by Hom District authority needs to be reconsidered based on the approved Watershed Management Plan and the associated regulations.

5.1.2 Preparation of Provincial Regulation for the Watershed Management

A final workshop with the Drafting Committee on the review of the draft Regulation took place on 01 April 2019 at Xaysomboun Provincial Agriculture and Forestry Office (PAFO). The workshop was chaired by Lt. Col. Vixaythor Phialouangchongser, Vice Chairman of Provincial Assembly of Xaysomboun Province and attended by 15 representatives from Provincial Assembly; Provincial Department of Justice; Provincial Office of Natural Resource and Environment (PONRE); PAFO; Provincial Department of Public Work and Transport; Provincial Department of Finance; Provincial Department of Information, Culture and Tourism; Xaysomboun Provincial WRPO and NNP1PC.

Th workshop revised some relevant sections of the draft Regulation which was agreed to be discussed at an Extraordinary Session of the Xaysomboun Provincial Assembly on 02 April 2019. This meeting principally agreed with some recommendations for amendments by the Provincial Assembly members. NNP1PC-EMO further assisted in the revision of this draft Regulation and re-submitted to the Xaysomboun Provincial WRPO on 10 April 2019 for further review. Xaysomboun Provincial WRPO submitted the draft Regulation to Xaysomboun Provincial Justice Department on 25 April 2019 for further review and clearance.

Xaysomboun Provincial Justice Department provided final comments on the improved draft on 06 May 2019. The final revision was re-submitted to Xaysomboun Provincial Justice Department on 14 May 2019 and was certified on 22 May 2019 before being signed off by the Provincial Assembly and Provincial Governor.

Xaysomboun Provincial WRPO submitted a letter to Xaysomboun Provincial Assembly at the end of May 2019. The Xaysomboun Provincial Governor endorsed the Agreement on NNP1 Watershed Management on 07 June 2019. The dissemination of this approved Agreement will be part of AIP2019 of Xaysomboun Provincial WRPO.

5.2 BIODIVERSITY OFFSET MANAGEMENT

5.2.1 Preparation of Biodiversity Offset Management Plan

NNP1PC-EMO completed the improvement of the Lao version of the NNP1 Biodiversity Offset Management Plan (BOMP) on 30 April 2019.

The Plan was discussed with the Biodiversity Offset Management Unit (BOMU) and relevant government agencies during a technical workshop held on 21 May 2019 in Viengthong District, Bollikhamxay Province. Key conclusions from the workshop are as below:

1. All parties understood and agreed with the BOMP structure, components and activities;
2. NNP1PC would consider the overall budget for BOMP particularly to increase the amount for conservation linked livelihood component as it was seen as important by GOL to achieve the biodiversity conservation;
3. All parties acknowledged and understood the sources of fund (i.e. the Concession Agreement, NNP1PC No Net Loss additional commitment and ADB additional fund through a Technical Assistance), its general management principles and the coverage period for each source of fund;
4. Agreed on the proposed activities, budget and the fund transfer mechanism for the Annual Implementation Plan (AIP) 2019;
5. Agreed to revisit the existing land use of the six target villages prior to the adjustment or finalization of the TPZ and CUZ boundaries as well as conducting the demarcation on the ground as soon as possible to make it clear for the local communities;
6. The meeting agreed to organize a high-level consultation for BOMP approval during 10 - 14 June 2019.

Following this technical meeting, a High-Level Consultation Workshop for the approval of NNP1 BOMP was organized on 13 June 2019 chaired by Bolikhamxay Provincial Vice-Governor and co-chaired by NNP1PC Managing Director.

Key points discussed during the Workshop are summarised below:

1. The meeting agreed with the components, contents, activities and overall budget of the final draft NC-NX BOMP;
2. Detailed data collection shall be conducted and a detailed action plan for conservation linked livelihood support shall be developed based on the result of the data collection to make the most use of fund available;
3. A letter requesting for the approval of BOMP will be submitted to the Director General of DOF-MAF for endorsing the Plan by end of July 2019;
4. The meeting acknowledged that the BOMP is a living document which shall be reviewed and adapted from time to time.

NNP1PC-EMO Team completed further revision of the Plan on 17 June 2019 by addressing the comments received during the high-level workshop on 13 June 2019. The Plan is being reviewed by NNP1PC-EMO management prior to further submission to the Director General of DOF-MAF for approval, which is expected to be in early July 2019.

5.2.2 Implementation of the Pre-Biodiversity Offset Management Plan

The Pre-BOMP2B funding was completed by the end of March 2019 and there was no activity being carried out until AIP2019 is approved by ADB.

ADB provided comments to the draft AIP2019 on 8 April 2019. NNP1PC-EMO revised the Plan and re-submitted to ADB on 10 April 2019 for approval. However, ADB still returned with comments on 25 April 2019. Thus, NNP1PC-EMO further improved the Plan and re-submitted to ADB on 29 April 2019. ADB provided a final confirmation accepting the Biodiversity Offset Management Programme's AIP2019 on 10 May 2019 after 47 days of review process in total.

The fund transfer for the first quarter covering the implementation period from April-June 2019 for the amount of USD 52,914 (around 27% from the total allocated fund of USD 197,726) was completed on 29 May 2019. The NC-NX BOMU was processing the first fund withdrawal from the the DOF Project's account at the Bank of Lao PDR on 31 May 2019. Bolikhamxay Provincial BOMU confirmed that the fund transfer from DOF-MAF was completed on 20 June 2019.

The patrolling activity was started from 22 June 2019 and expected to be completed in the middle of July 2019. NNP1PC-EMO had further discussion with Bolikhamxay Provincial BOMU on 26 June 2019 on the overall preparation for implementing the activities including detailed human resource management and its schedule. The key discussion can be summarised as below:

1. A log-sheet of man power will be finalized and shared with NNP1PC-EMO for reference and monitoring;
2. The location of patrolling sub-stations was discussed especially on strategic locations accessible in support of the patrolling and law enforcement in the proposed highest and high priority areas of TPZ;
3. Internal communication protocol among BOMU and NNP1PC-EMO were discussed to ensure smooth coordination and implemention of the activities.

6 BIOMASS CLEARANCE / FLOATING DEBRIS REMOVAL

The Contractor completed the installation of a temporary log-boom with a 16 m wide boat passage gate on 08 April 2019. NNP1PC-EMO installed signal lights at the boat passage gate on 23 April 2019 and further planned to install signage and navigation marks near the temporary log-boom.

The Contractor continued cutting and burning logs on the right bank of the reservoir in the middle section until 13 May 2019. NNP1PC-EMO has supervised and monitord their work in the reservoir at least twice a week.

Cutting and burning logs was stopped in June 2019 due to the onset of the rainy season and the work will be resumed from the middle of October or November 2019 during the dry season. NNP1PC-EMO conducting regular monitoring and removal of floating materials/logs from the temporary log-boom as needed

FIGURE 6-1: *TEMPORARY LOG-BOOM WITH BOAT PASSING GATE*

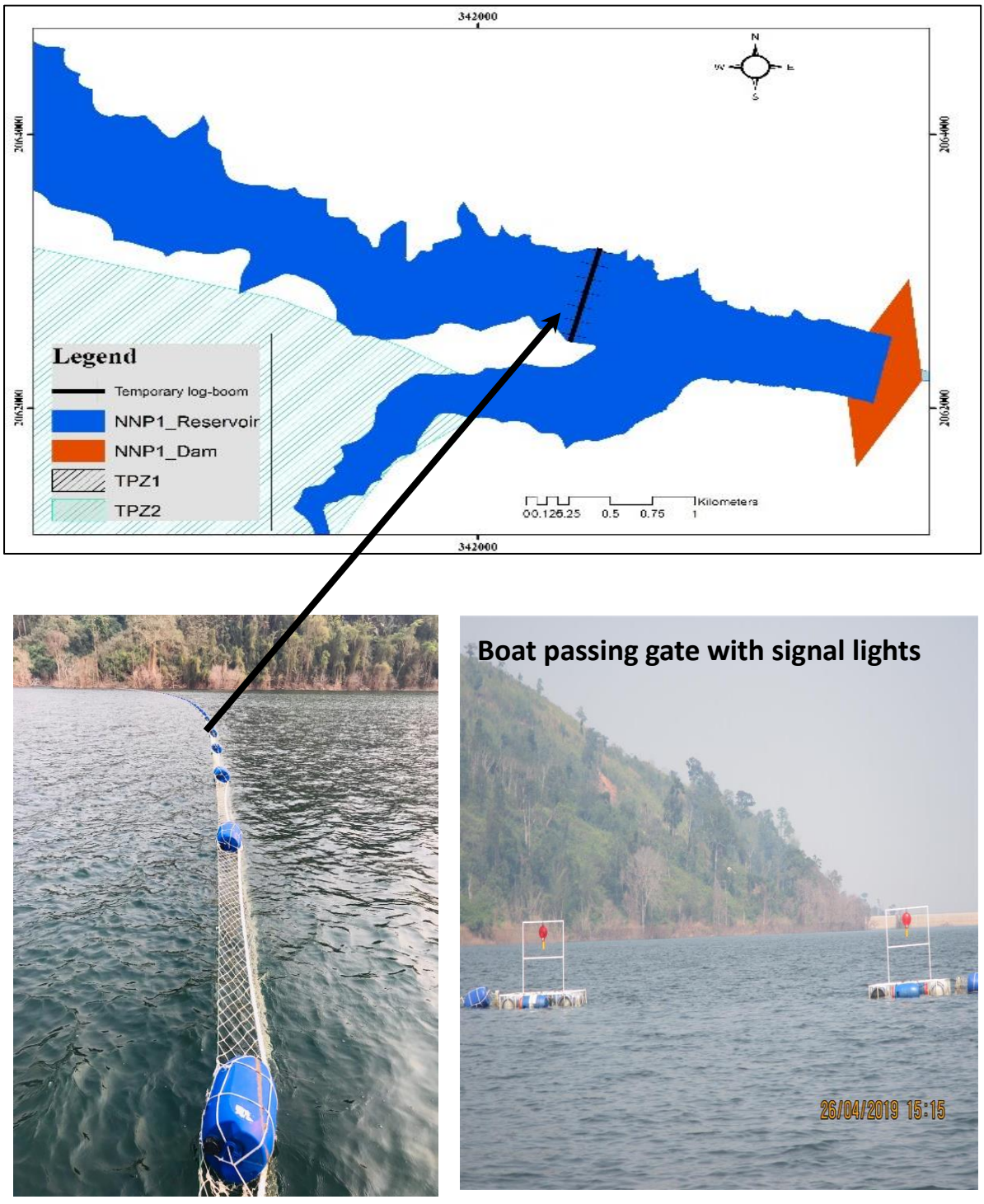


FIGURE 6-2: *REPRESENTATIVE PHOTOS OF COLLECTING LOGS, CUTTING, AND BURNING IN THE MIDDLE OF MAIN RESERVOIR*

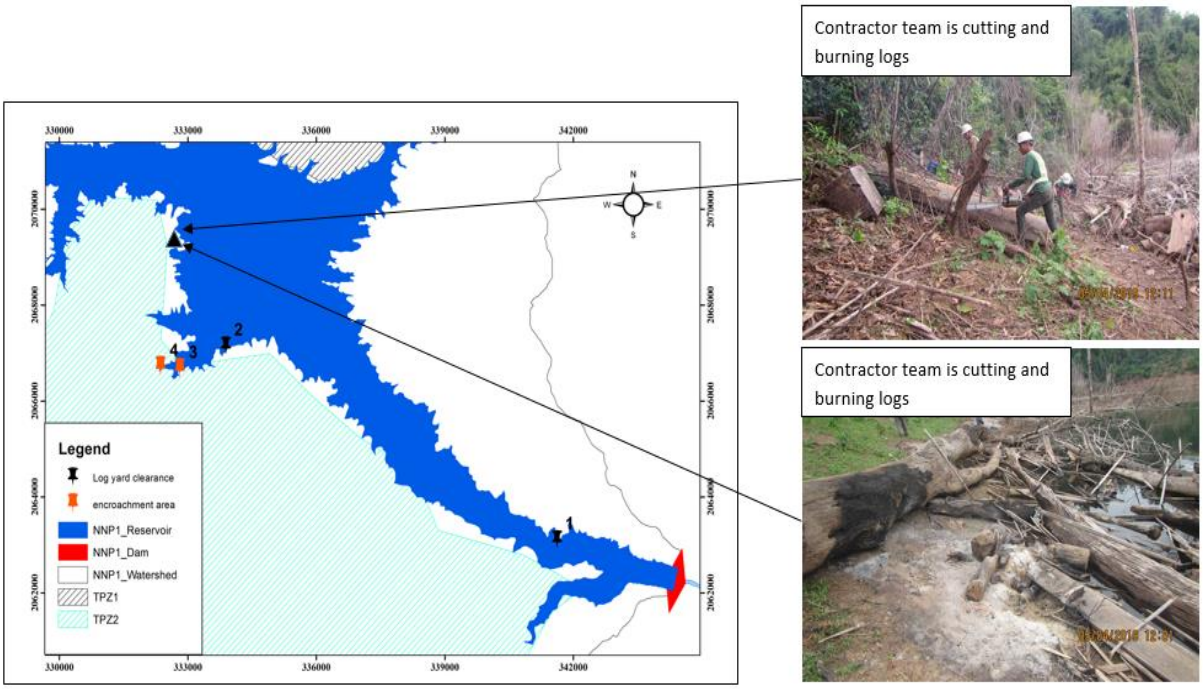


FIGURE 6-3: *REPRESENTATIVE PHOTOS OF COLLECTED LOGS, CUTTING AND BURNING IN THE MIDDLE OF THE MAIN RESERVOIR*

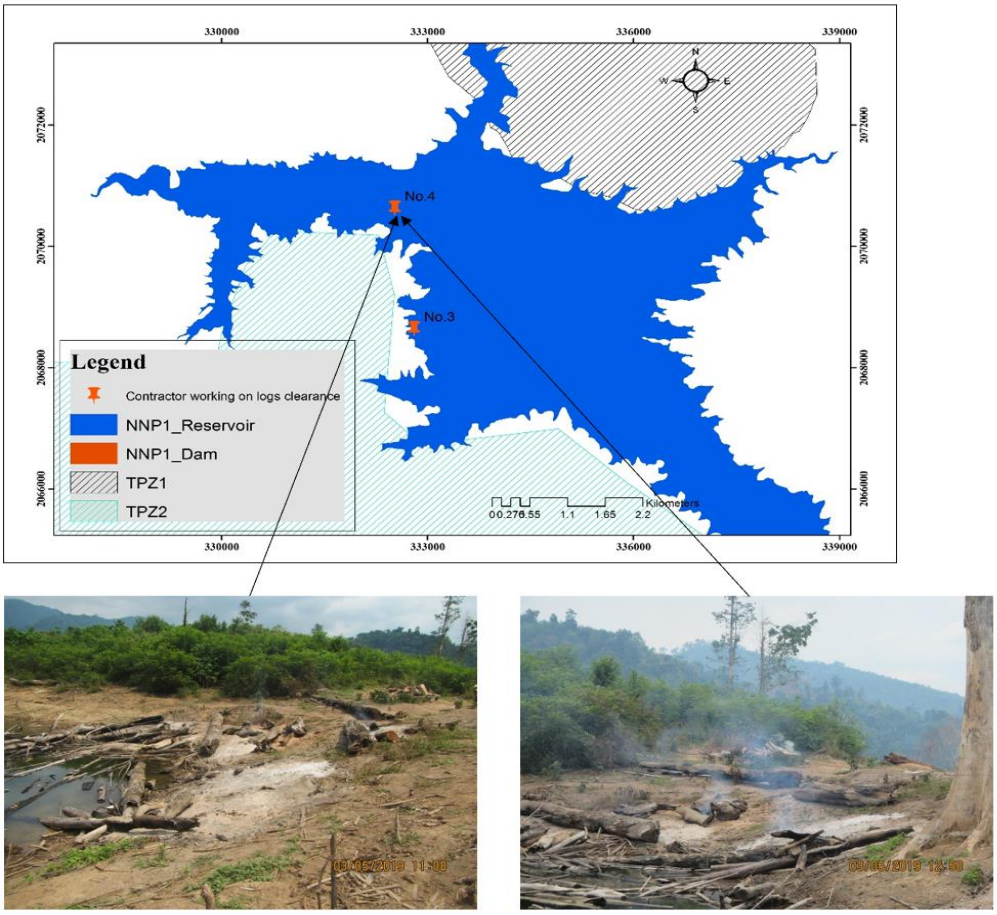


FIGURE 6-4: *REPRESENTATIVE PHOTOS OF INSTALLED SIGNS FOR THE LOG BOOM*

7 FISHERY MONITORING

The 5 types that dominated the fish catch by weight in Q2 2019 are listed in **Table 7-1.** This includes three species and two species group that are classified as Least Concern (LC) according to the IUCN Red List of Threatened Species, except *Systomus orphoides* and *Hemibagrus filamentus* which are classified as Not Evaluated (NE) and Data Deficient (DD) species respectively.

Table 7-1: *Fish Species dominating the Fish Catch in Q2 2019*

Species	Lao Name	Fish Catch in Q2 2019 (kg)	IUCN Red List Classification
Systomus orphoides	ปาป๊า	857.6	NE
Poropuntius normani, Poropuntius laoensis, Poropuntius carinatus	ปาจาด	553.4	LC
Hemibagrus nemurus, Hemibagrus filamentus	ปาฮิด	323.9	LC, DD
Channa striata	ปาถ่อ	190.3	LC

Species	Lao Name	Fish Catch in Q2 2019 (kg)	IUCN Red List Classification
Scaphiodonichthys acanthopterus	ปาม้อม	172	LC

The recorded catch of threatened species (IUCN Red List classification) in the Q2 2019 fish catch is presented in ***Table 7-2***. The list includes one Endangered species, four Vulnerable species (VU), and six Near Threatened species (NT).

TABLE 7-2: ***THREATENED AND NEAR THREATENED SPECIES OF THE Q2 2019 FISH CATCH***

Species	Lao Name	Fish Catch in Q2 2019 (kg)	IUCN Red List Classification
Bangana behri	ปาอ่า	46.5	VU
Cirrhinus cirrhosus	ปามอมจ้ัม/ปาแกง	1.6	VU
Cirrhinus molitorella	ปาแกง	10.2	NT
Hypophthalmichthys molitrix	ปาเก๊ดแลบ	7	NT
Luciocyprinus striolatus	ปากอมซาย	0.2	EN
Neolissochilus stracheyi	ปาสอง	9	NT
Onychostoma gerlachi	ปาถิง	43.5	NT
Scaphognathops bandanensis	ปาอวมไฟ/ปาป่วม	40.2	VU
Syncrossus beauforti	ปาแข้อไก้	0.5	NT
Tor sinensis	ปาแดง	109.4	VU
Wallago attu	ปาถ้าอ	5.9	NT

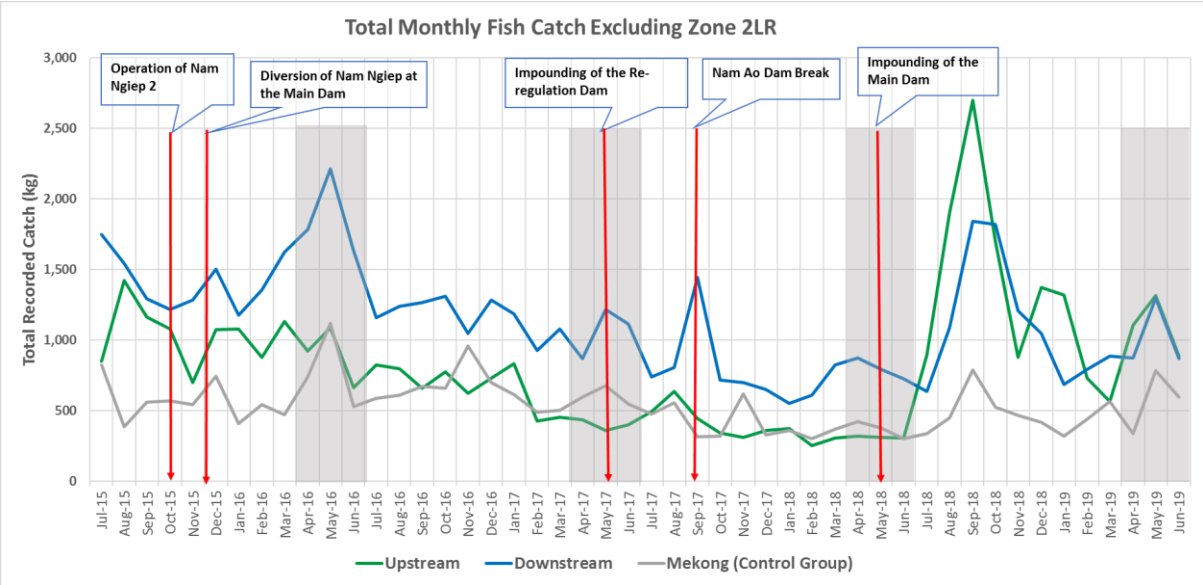
The occurrence of Threatened and Near Threatened species in the fish catch by Quarter since the start of species identification in Q3 2015 is displayed in Table 7-3.

TABLE 7-3: *OCCURRENCE OF THREATENED AND NEAR THREATENED SPECIES IN THE FISH CATCH*

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

The total recorded monthly fish catch from July 2015 to June 2019 for the downstream, upstream (upper reservoir until upstream of the reservoir) 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 MONTHLY FISH CATCH DURING JULY 2015 – JUNE 2019***



*Error! Reference source not found.****Table 7-4*** and ***Figure 7-2*** show the total recorded fish catch for Q2 2016, Q2 2017, Q2 2018 and Q2 2019 by the upstream (excluding Zone 2LR), downstream and the Mekong control group fishing households. Note that the recording days was reduced from 30 days/month to only seven days/month starting from February 2019 due to Company financial constraint. However, redesigning the sampling program have been carefully discussed with fishery expert and noted that NNP1PC needs to continue the monitoring and the long trend data analysis should carefully consider the different sampling programs that were implemented.

TABLE 7-4: ***TOTAL FISH CATCH IN Q2 BY UPSTREAM (EXCLUDING ZONE 2LR), DOWNSTREAM AND BY THE MEKONG CONTROL GROUP FISHING HOUSEHOLDS***

	Q2 2016 (kg)	Q2 2017 (kg)	Q2 2018 (kg)	Q2 2019 (kg)
Upstream	2,668.0	1,191.7	934.7	3,305.1
Downstream	5,627.0	3,200.2	2,386.8	3,038.8
Mekong Control Group	2,387.7	1,816.0	1,100.7	1,715.0

FIGURE 7-2: ***TOTAL FISH CATCH IN Q2 BY UPSTREAM (EXCLUDING ZONE 2LR), DOWNSTREAM AND MEKONG CONTROL GROUP FISHING HOUSEHOLDS***

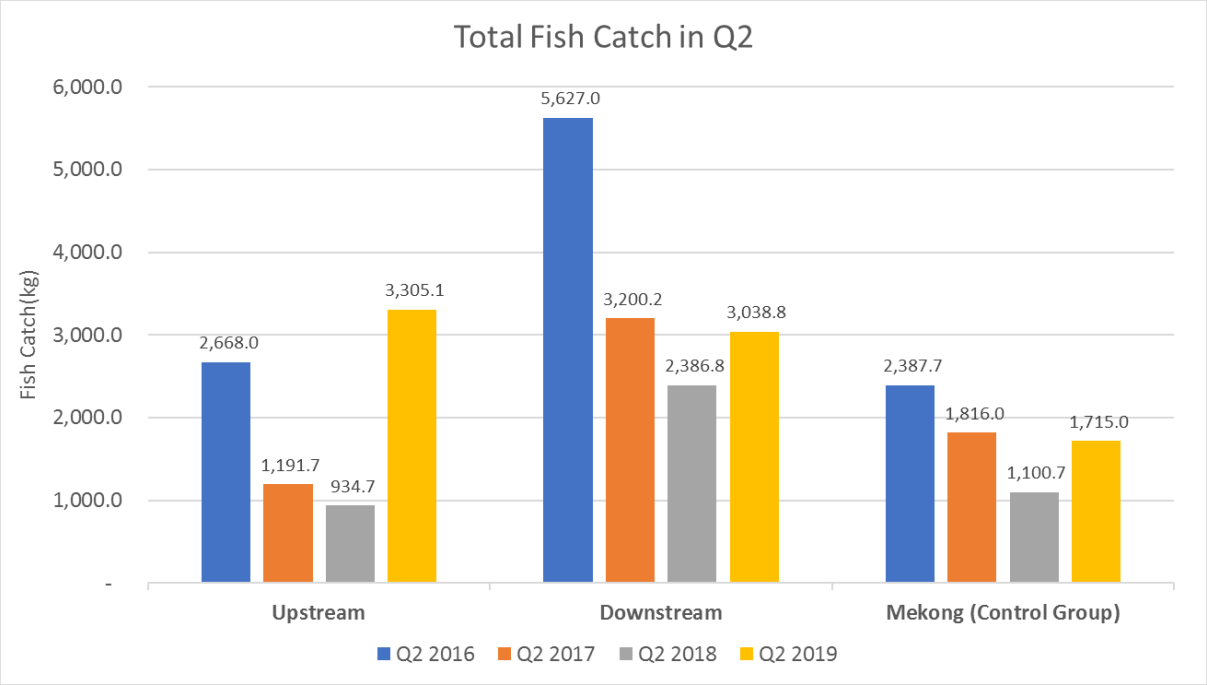
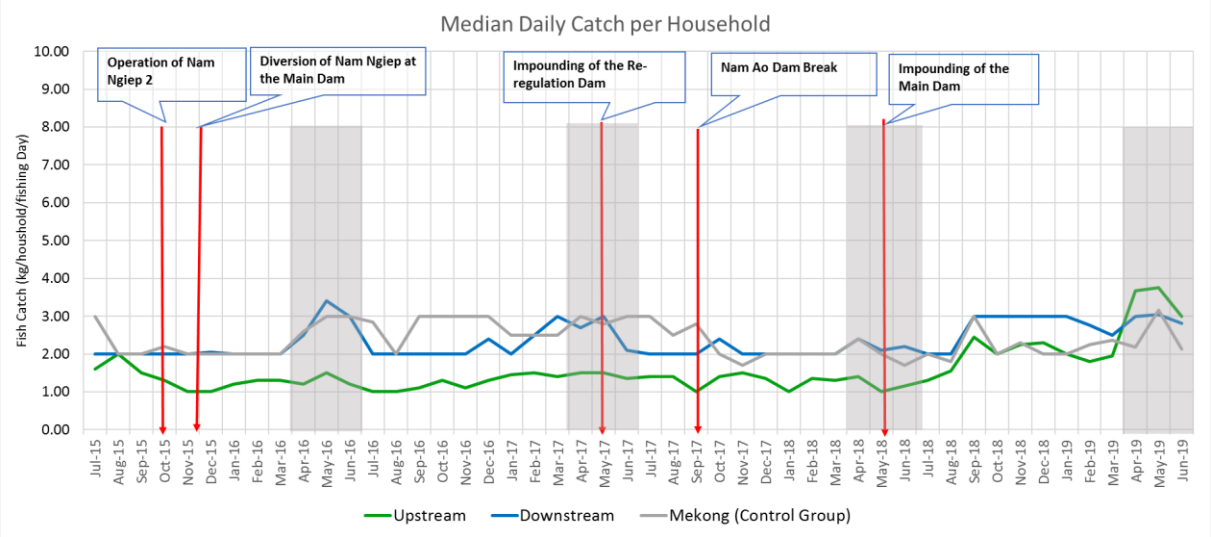


Table 7-5 presents the mean household fish catch per fishing day for Q2 2016, Q2 2017, Q2 2018 and Q2 2019 in the upstream (excluding Zone 2LR), downstream and the Mekong Control Group, and ***Figure 7-3*** shows the mean monthly household fish catch per fishing day from July 2015 to June 2019.

TABLE 7-5: ***MEDIAN HOUSEHOLD FISH CATCH PER FISHING DAY IN Q2 2016, Q2 2017, Q2 2018 AND Q2 2019***

Fishing Zone	Q2 2016 (kg)	Q2 2017 (kg)	Q2 2018 (kg)	Q2 2019 (kg)
Upstream (Excluding Zone 2LR)	1.39	1.52	1.46	2.95
Downstream	2.97	2.60	2.23	2.49
Mekong (Control Group)	2.87	2.93	2.03	2.62

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



To test whether there are any significant differences among the quarterly mean household fish catch per fishing day for each fishing zone, one-way ANOVA (analysis of variance) statistical tests have been performed on the data from each fishing zone. The null-hypothesis is that the sample means are equal, and the alternative hypothesis is that at least one of the means is statistically different. The level of significance is set to 0.05 (5%). The results of the one-way ANOVA tests are presented in **Table 7-66.**

TABLE 7-6: ***RESULTS OF ONE-WAY ANOVA TESTS ON MEAN HOUSEHOLD FISH CATCH IN Q2***

Fishing Zone	F-Statistic	*P*-value	F-Critical	Significance
Upstream	53.59	$2.27*10^{-33}$	2.609	Highly Significant
Downstream	25.02	$5.28*10^{-16}$	2.608	Highly Significant
Mekong Control Group	16.36	$1.72*10^{-10}$	2.610	Highly Significant

The rule for interpreting the results of an ANOVA test is that if the F-statistic is lower than the F-Critical value then this supports that the null-hypothesis cannot be rejected (same if the *p*-value is greater than the significance level). The results of the ANOVA tests in ***Table 7-66*** indicates that all areas such upstream, downstream and the Mekong area means are highly significantly different.

APPENDICES

APPENDIX 1: *STATUS OF SS-ESMMPS REVIEW AND APPROVAL DURING Q2 2019*

No	Site name	Document Name	Subcontractor	Approval Status by EMO/NNP1 (date)	Detailed Site Information	Monthly Construction & Operation Status
1	Song Da5 camp No.2	Site Decommissioning and Rehabilitation Plan for Song Da5 Camp No.2	Song Da5	No objection with no further comment on 22 April 2019		Site closed
2	Main Dam workshop at spoil disposal No.2	Site Decommissioning and Rehabilitation Plan for Main Dam workshop and spoil disposal No.2	Song Da5	No Objection with no further Comment on 29 April 2019		Fuel tank is remained and will be decommissioned by September 2019
3	IIS Field Shop and sub-contractor 276 Camp	Site Decommissioning and Rehabilitation Plan IIS's field shop and 276 contractor camp	IHI (IIS)	No Objection with no further Comment on 28 May 2019		Site was closed
4	HM's Hydro Labor Camp No.1	Site Decommissioning and Rehabilitation Plan for HM's Labor Camp No.1 (ZHEFU Camp)	HM Hydro	No Objection with Comment on 28 May 2019		Site was closed
5	Song Da5's Re-regulation Dam Workshop	Site Decommissioning and Rehabilitation Plan for Song Da5 Workshop at the Re-regulation Dam	Song Da5	No Objection with no further comment on 28 May 2019		Site was closed
6	GFE Camp	Site Decommissioning and Rehabilitation Plan for GFE Camp	GFE	No Objection with Comment on 28 May 2018		Site was closed
7	Re-regulation Power Station	DWP & SS-ESMMP for Replacement Work of Sealing Strip of Main Shaft	HM Hydro	No Objection with No Further comment		Site was closed

No	Site name	Document Name	Subcontractor	Approval Status by EMO/NNP1 (date)	Detailed Site Information	Monthly Construction & Operation Status
		Seal Seat and Other Works of the Re-regulation Power Station				
8	Main Dam (right bank)	DWP & SS-ESMMP of Drainage Adit of Main Dam Right Bank under VO-94	Song Da5	Under review of second submission		On-going
19	Re-regulation Dam - Tailrace	DWP & SS-ESMMP for the Riverbed Excavation at the Re-regulation Tailrace under VO-98	Song Da5	No Objection with Comment on 28 May 2019		On-going
10	Phouhomxay Resettlement Village	DWP & SS-ESMMP for Construction of Access Road to Cemetery Site of Phouhomxay Resettlement Village	Vorarath Road & Bridge Co., Ltd	No Objection with Comment on 15 May 2019		On-going
11	ESD's Resource Centre in Phouhomxay Resettlment Village	DWP & SS-ESMMP for the Improvement of Site Office and Resource Centre in the Phouhomxay Resettlement Village	SCC sole Co., Ltd	No Objection with Comment on 12 June 2019		On-going

APPENDIX 2: *ENVIRONMENTAL MONITORING CORRECTIVE ACTIONS DURING Q2-2019*

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
ONC_OC-0302	19.03.2019	RCC Plant Yard	Mixed general waste, recycle waste and some hazardous waste (use paint cans) and others waste continue to accumulate at the temporary recycle waste storage area.	- Segregate and dispose the waste by following the project's waste management procedures for general, recycle and hazardous waste disposal; - The Contractor needs to instruct its workers and staff to manage their waste properly (separation, segregation and right disposal).	29.03.2019	31.03.2019	Un-resolved
ONC_OC-0303	02.04.2019	GFE Camp	Garbage was observed disposing and scattering outside the GFE camp perimeter, this included hazardous waste (about 5 lamps).	The Contractor was instructed to take the following actions: - Collect the disposed and scattered garbage then separate and dispose properly; - Conduct an inventory of hazardous waste (the five lamps). EMO will verify this during the	05.04.2019	11.04.2019	Resolved

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
				monthly Hazardous Material/Waste Audit. **Note:** This is the second repeated observation.			
ONC_OC-0304	02.04.2019	GFE Camp	Grey water pipeline from the kitchen was broken without maintenance. This resulted in the grey water leakage into the open ditch.	The Contractor was instructed to take immediate action to repair the broken wastewater pipeline.	05.04.2019	23.04.2019	Resolved
ONC_OC-0305	02.04.2019	Song Da5 Workshop at Re-regulation Dam	Song Da5's workshop dismantling at the re-regulation dam was completed for about three weeks. However, Site Specific Decommissioning and Rehabilitation Plan has not been submitted for NNP1PC' review and approval.	The Site-Specific Decommissioning and Rehabilitation Plan needs to be prepared and submitted to NNP1PC for review and approval by the specified deadline.	15.04.2019	26.04.2019	Resolved
ONC_OC-0306	02.04.2019	Song Da5 Workshop at Re-regulation Dam	Two oil dripping trays with some oily rags were stored in the opened space without rain protection. This posts high potential risk of oil contaminated waste being flushed by the rain to the	The Contractor was instructed to take immediate action to move the oil dripping trays to hazardous waste storage area. Otherwise, the trays need to be covered with	05.04.2019	26.04.2019	Resolved

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
			Nam Ngiep River which is about 20 meters away.	plastic sheet to prevent them from rain water.			
ONC_HM-0024	02.04.2019	ZHEFU Camp	- There was an evidence of wastewater leakage from the chlorination tank to outside before chlorine treatment by batch. - Note: During the last joint bi-weekly inspection and follow up, EMO raised this finding verbally to the Contractor. So far, no appropriate action has been undertaken.	The Contractor was instructed to take the following action by the specified deadline: - Treat the wastewater in the tanks and completely discharge; - Find and fix the leakage properly. **Note:** Instead of waiting for the problem to be identified by NNP1PC, the Contractor needs to take an initiative to regularly check and maintain their Wastewater Treatment System to ensure that it is functioning well.	05.04.2019	11.04.2019	Resolved
ONC_HM-0025	23.04.2019	LILAMA10 camp	No waste bin provided at the assembly points and surrounding workplaces resulting in scattering of waste on the ground.	- Collect the scattered plastic bottles, glass bottles, aluminium cans and garbage for proper disposal at the recycle centre follows the	30.04.2019	02.05.2019	Resolved

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
				project's waste management hierarchy; - Provide at least two waste bins at each location of (i) assembly point/parking area (ii) temporary workshop and (iii) stock yard; - Provide waste management training and instructional least once per week to the workers.			
ONC_HM-0026	23.04.2019	LILAMA10 camp	- A numbers of empty paint containers were disposed to the open ditch outside of the camp perimeter; - Two plastic bottles and one drum of used oil were stored on the ground, some spills were observed.	- Collect the empty paint drums and store in hazardous material storage for a proper disposal; - Contain the oil-water mixture to a proper container / drum and store in hazardous material storage for proper disposal/elimination; - Provide training and instruction on hazardous	26.04.2019	02.05.2019	Resolved

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
				waste management to relating workers.			
ONC_OC-0307	07.05.2019	Song Da5 Camp No.1	An open ditch from the camp yard is straight toward the workshop. As a result, oily dirt was observed as being washed off site by rain.	- Divert the open ditch of camp yard away from the workshop and stock yard area; - Construct appropriate earth dike surround the temporary workshop to prevent rainwater entering; - Any oily equipment and tools inside the temporary workshop shall be stored in a proper container to avoid oil spillage; - Provide a response kits such as steel tray and absorbent sheet at the temporary workshop.	11.05.2019	21.05.2019	Resolved
ONC_OC-0308	07.05.2019	Song Da5 Workshop at Re-regulation Dam	Three drums of hazardous material and waste were remained on site, (about 300 litters of diesel and 200 litters of used oil).	The Contractor was instructed to move the hazardous material and hazardous waste to	11.05.2019	21.05.2019	Resolved

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
				designated hazardous material.			
ONC_HM-0027	07.05.2019	LILAMA10 camp	Big amount of mixed waste with about 90% of general waste was contained in the wooden boxes waiting to be transferred to spoil disposal area No.6.	- Segregate the mixed waste in accordance with the waste management requirement; - **Note:** Only inert waste such as concrete waste can be disposed/buried at the spoil disposal area No.6	24.05.2019	21.05.2019	Resolved
ONC_HM-0028	07.05.2019	LILAMA10 camp	- The concrete lining of the wetland bund was damaged for a couple months without maintenance, - Water stagnant in the treatment pond and monitoring tanks resulted unpleasant odour and this has potential risk for mosquito breeding.	- Repair the broken concrete lining and bund of wetland pond; - Clean up the chlorine and and monitoring tanks and empty stagnant water as well as provide cover to prevent rainwater stagnant. - Ensure chlorine is available on site.	24.05.2019	21.05.2019	Resolved

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
ONC_OC-0309	21.05.2019	Song Da5 Camp No.1	- The wastewater pipeline was clogged and broken without maintenance, resulting in grey water over-flowing to the open ditch (Repeated issued); - The open ditch was blocked with sludge and weeds, but no maintenance work is performed. As a result of wastewater stagnant which posts potential risk for mosquito's breeding.	- Fix the clogged and broken wastewater pipelines; - Maintain the wastewater piping system to avoid wastewater overflowing to the open ditch; - Clean-up sludge and weeds from the open ditches to allow free drains.	06.06.2019	04.06.2019	Resolved
ONC_HM-0029	21.05.2019	LILAMA10 camp	The wetland pond was covered by weeds. The wetland plants were almost died without maintenance.	- Harvest / clean up/uproot the weeds; - Plant the right wetland reeds as per the previous instruction by NNP1PC. - Cut and clean up the grass from the wetland pond.	03.06.2019	04.06.2019	Resolved
ONC-HM_0030	21.05.2019	HM Main Camp & Office	Inadequate management and maintenance of wastewater treatment system:	- Harvest / clean up/uproot the weeds; Repaired the clogged pipeline;	03.06.2019	03.06.2019	Resolved

Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
			- Too many weeds in the wetland ponds without harvesting/cleaning up. This resulted in clogged piping system; - Please note that the chlorine dosage was not performed during the joint bi-weekly inspection.	- Ensure that the chlorine dosing is always performed whilst the wastewater is pumped out.			
ONC_OC-0310	04.06.2019	Main Dam Adit Tunnel	- Concrete waste from the shotcrete shooting area was disposed into sloping area; - No proper facility provided for the shotcrete preparation works, resulting in concrete waste being flushed by rainwater to the Nam Ngiep River (downstream of main dam); - So far, no mobile toilet was provided on site. This issue has been pending for two weeks since EMO findings and during the	- Stop disposing of concrete waste to the slope, the concrete waste needs to be contained and disposed of properly at the Spoil Disposal Area no.6; - Provide a perimeter check dike/bund for the shotcrete preparation work area; - Provide an appropriate bump and/or open ditch at the upper part to divert run-off from the access road and avoid run-off flushing the shotcrete shooter area.	10.06.2019	28.06.2019	Un-resolved

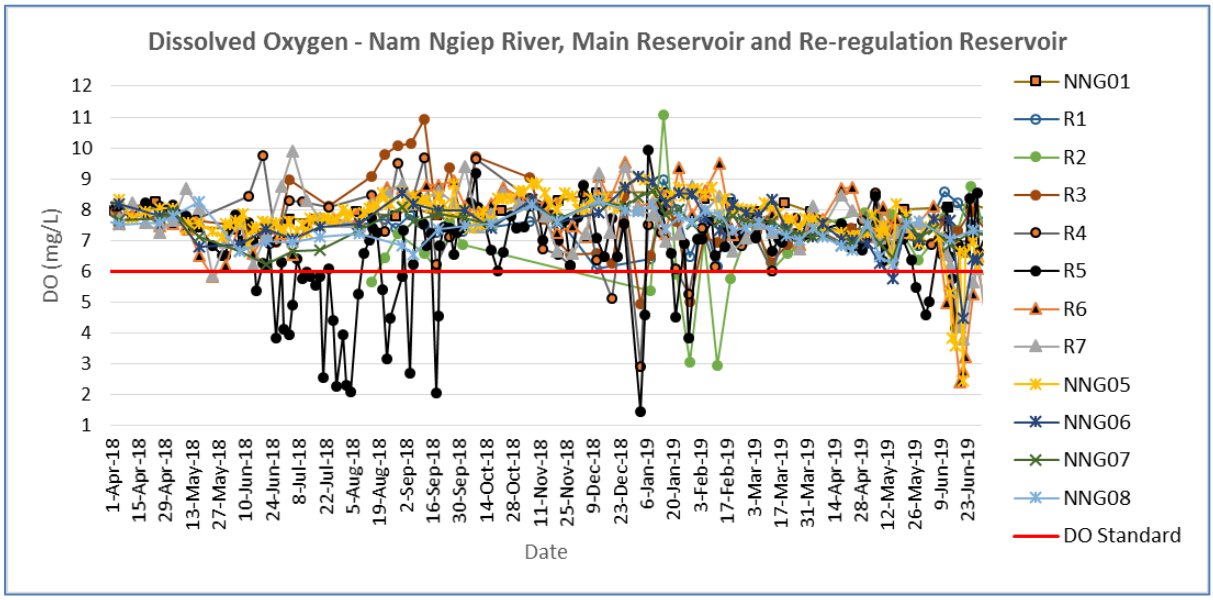
Issue ID	Inspection Date	Site Name	Issue/Description	Action Required/Recommendation	Deadline	Latest Follow- up Date	Status
			Environmental and Safety Patrol.	- Provide proper mobile toilet on site. The NCR1 will be issued if no action is taken by the specified deadline.			
ONC_OC-0311	18.06.2019	CVC Plant	General waste and recycle waste were disposed on the sloping areas behind of security gate.	- Collect the scattered waste and dispose properly in accordant to waste management measures. - Provide two waste bins at the security hut for temporary waste disposal.	25.06.2019	26.06.2019	Resolved
ONC_OC-0312	18.06.2019	RCC Plant Yard	Construction waste, scrap metal, dirt soil from the workshop, welding rod, grinding disc, PVC pipes, thinner cans and other waste types were left untidy on site.	- Properly manage and improve the housekeeping, segregate and eliminate the scattered construction waste for proper disposal.	25.06.2019	26.06.2019	Resolved

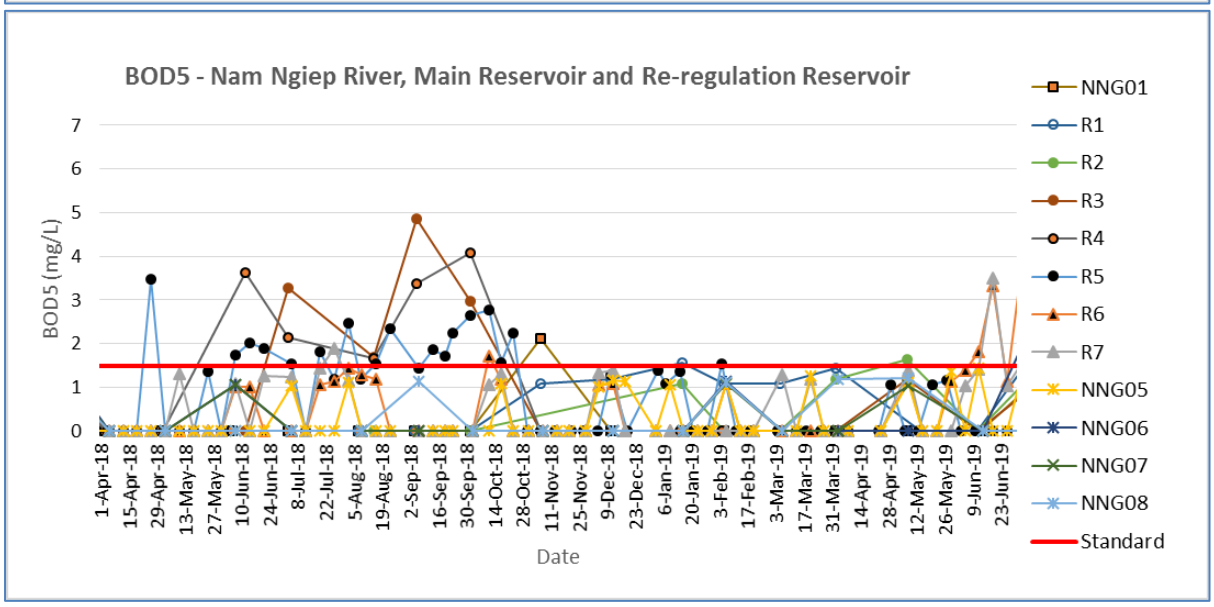
APPENDIX 3: *CODES AND LOCATIONS OF THE SURFACE WATER QUALITY MONITORING STATIONS*

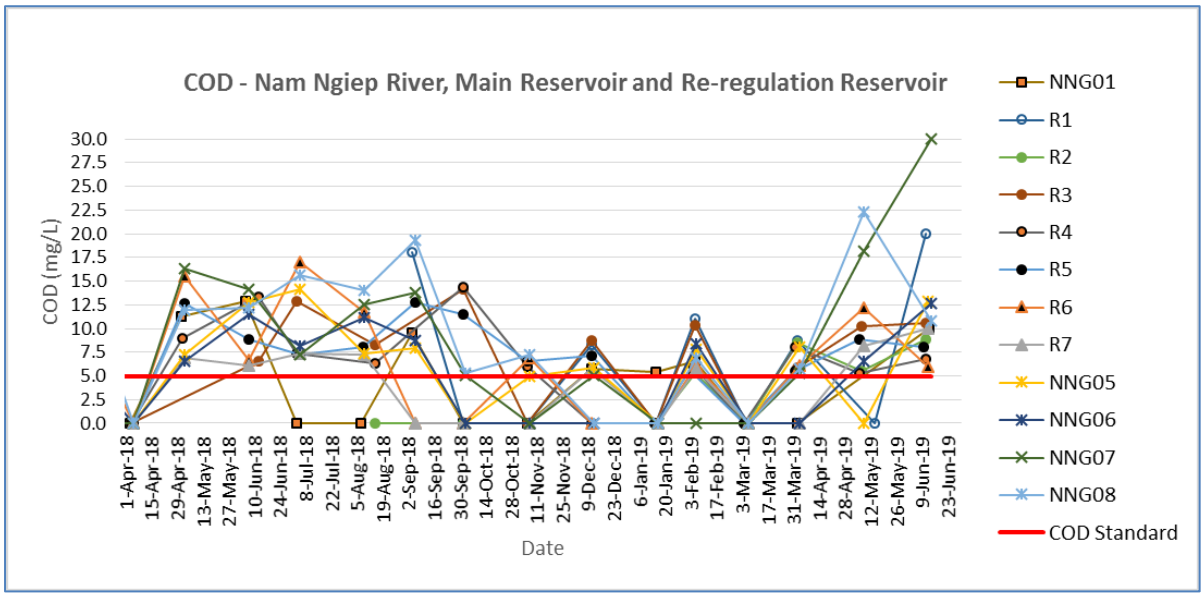
Site Code	Location station	Zone
NNG01	Nam Ngiep Upstream of Ban Phiengta	Upstream Project Construction Site
R1	Main reservoir upstream main dam approx. 50 Km.	
R2	Main reservoir upstream main dam approx. 35 Km.	
NNG02/R3	Nam Ngiep Upstream of Nam Phouan Confluence / Main reservoir upstream main dam approx. 21 Km.	
NNG03/R4	Nam Ngiep Downstream of Ban Sop-Yuak /Main reservoir upstream main dam approx. 13 Km.	
NNG09/R5	Nam Ngiep Upstream Main Dam / Main reservoir upstream main dam approx. 0.5 Km	
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	

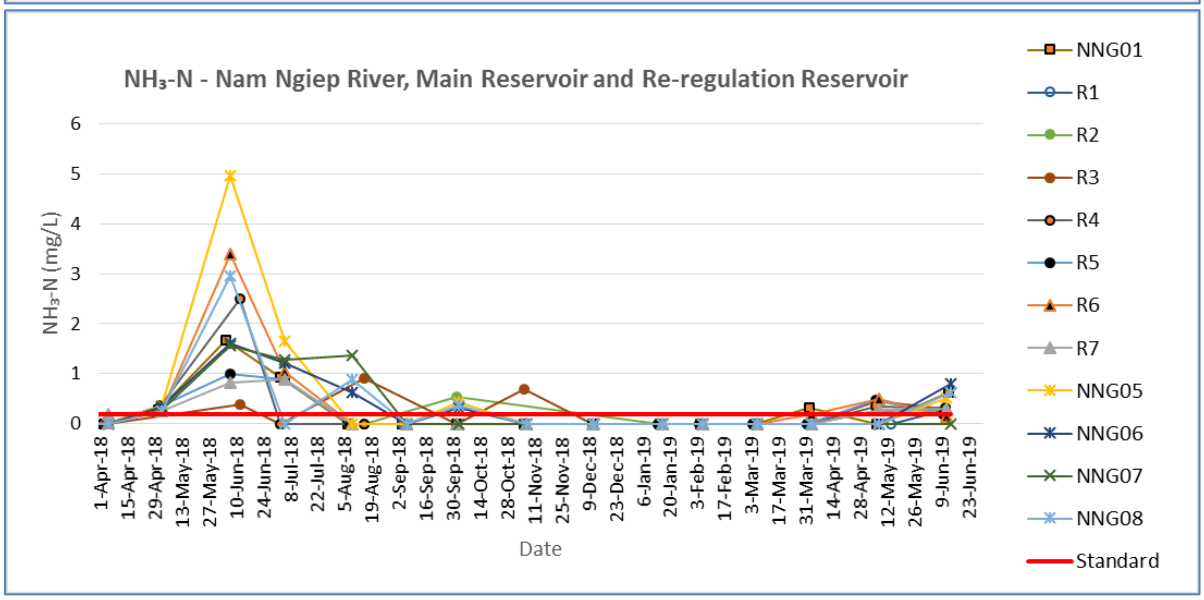
APPENDIX 4: *KEY TRENDS OF WATER QUALITY MONITORING FROM APRIL 2018 TO END OF JUNE 2019 (ONLY PARAMETERS THAT EXCEEDED GUIDELINE STANDARDS)*

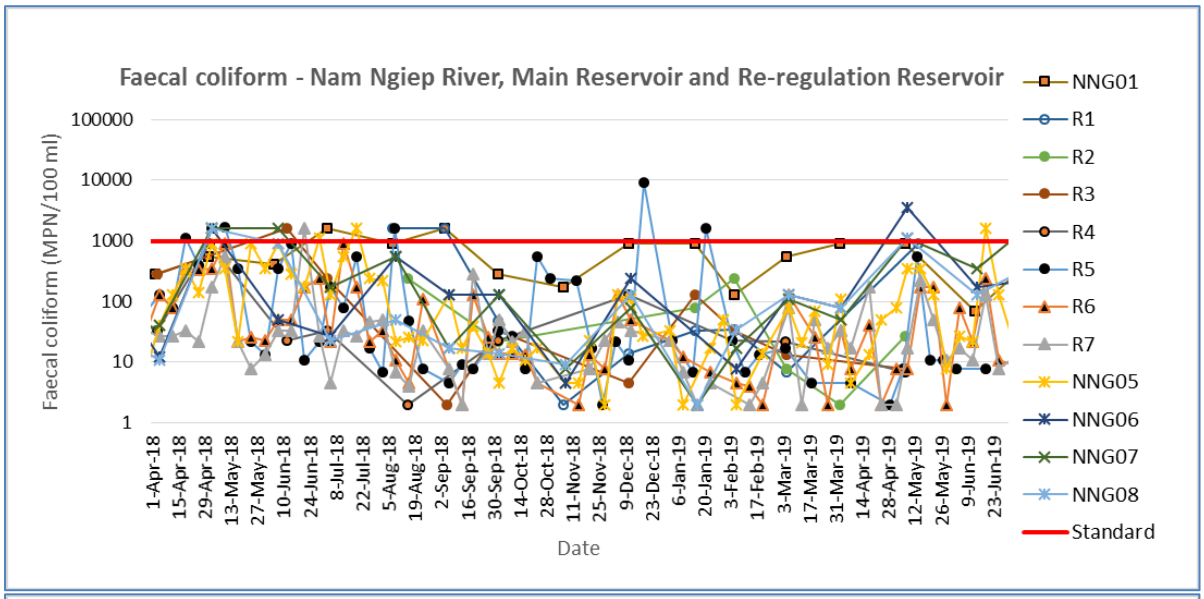
Nam Ngiep Surface Water

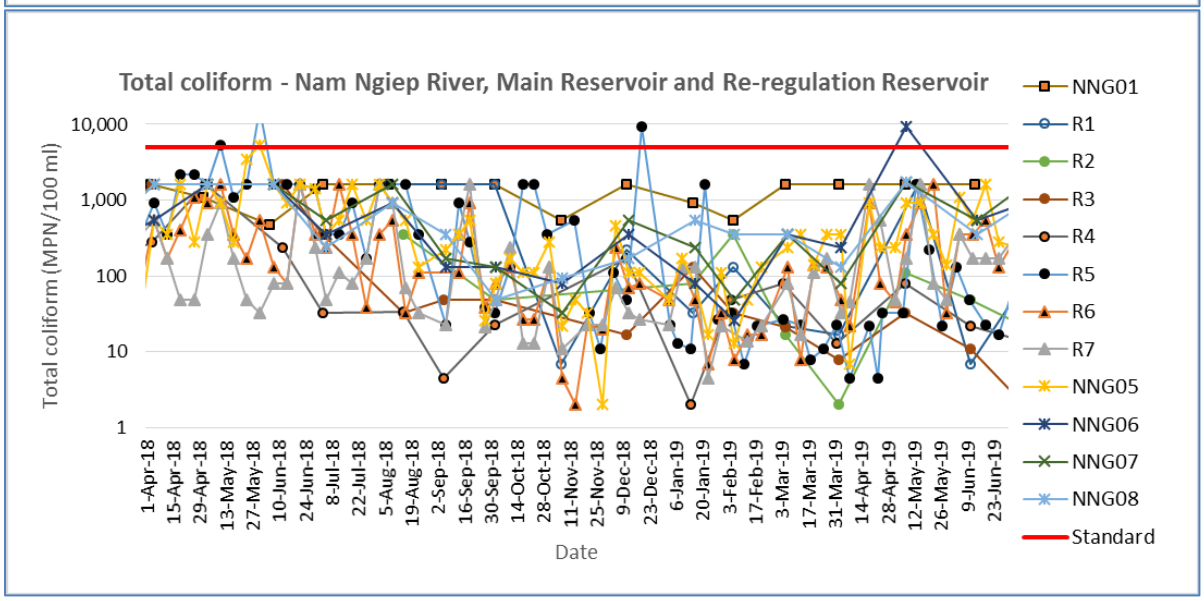




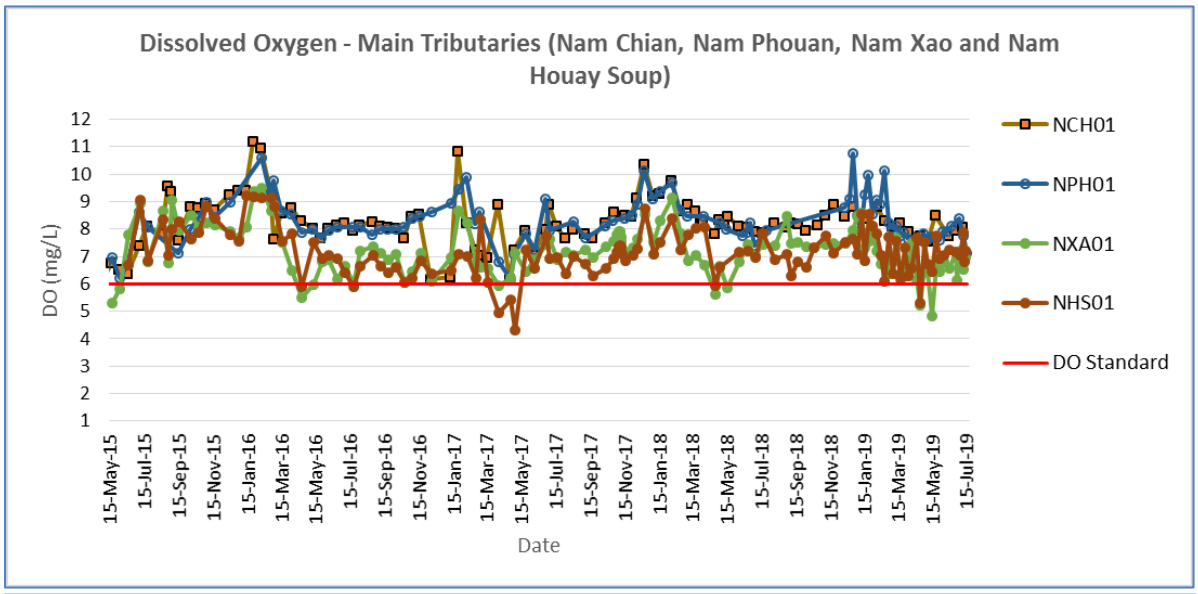

COD - Nam Ngiep River, Main Reservoir and Re-regulation Reservoir
COD (mg/L)
30.0
27.5
25.0
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
1-Apr-18
15-Apr-18
29-Apr-18
13-May-18
27-May-18
10-Jun-18
24-Jun-18
8-Jul-18
22-Jul-18
5-Aug-18
19-Aug-18
2-Sep-18
16-Sep-18
30-Sep-18
14-Oct-18
28-Oct-18
11-Nov-18
25-Nov-18
9-Dec-18
23-Dec-18
6-Jan-19
20-Jan-19
3-Feb-19
17-Feb-19
3-Mar-19
17-Mar-19
31-Mar-19
14-Apr-19
28-Apr-19
12-May-19
26-May-19
9-Jun-19
23-Jun-19
Date
NNG01
R1
R2
R3
R4
R5
R6
R7
NNG05
NNG06
NNG07
NNG08
COD Standard

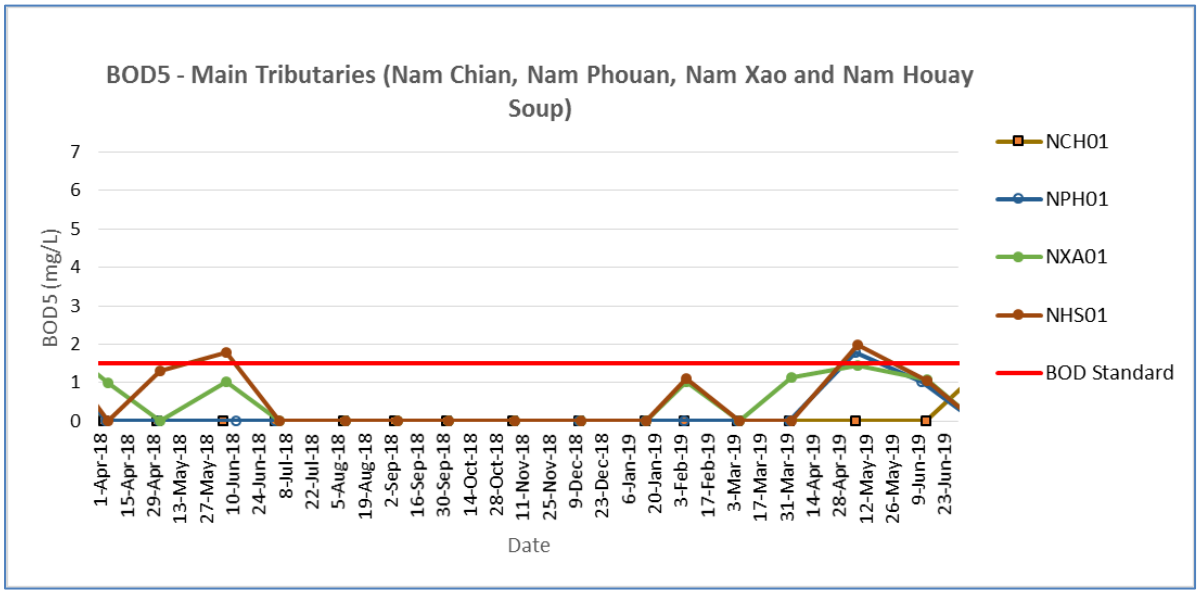

NH3-N - Nam Ngiep River, Main Reservoir and Re-regulation Reservoir
NH3-N (mg/L)
6
5
4
3
2
1
0
1-Apr-18
15-Apr-18
29-Apr-18
13-May-18
27-May-18
10-Jun-18
24-Jun-18
8-Jul-18
22-Jul-18
5-Aug-18
19-Aug-18
2-Sep-18
16-Sep-18
30-Sep-18
14-Oct-18
28-Oct-18
11-Nov-18
25-Nov-18
9-Dec-18
23-Dec-18
6-Jan-19
20-Jan-19
3-Feb-19
17-Feb-19
3-Mar-19
17-Mar-19
31-Mar-19
14-Apr-19
28-Apr-19
12-May-19
26-May-19
9-Jun-19
23-Jun-19
Date
NNG01
R1
R2
R3
R4
R5
R6
R7
NNG05
NNG06
NNG07
NNG08
Standard

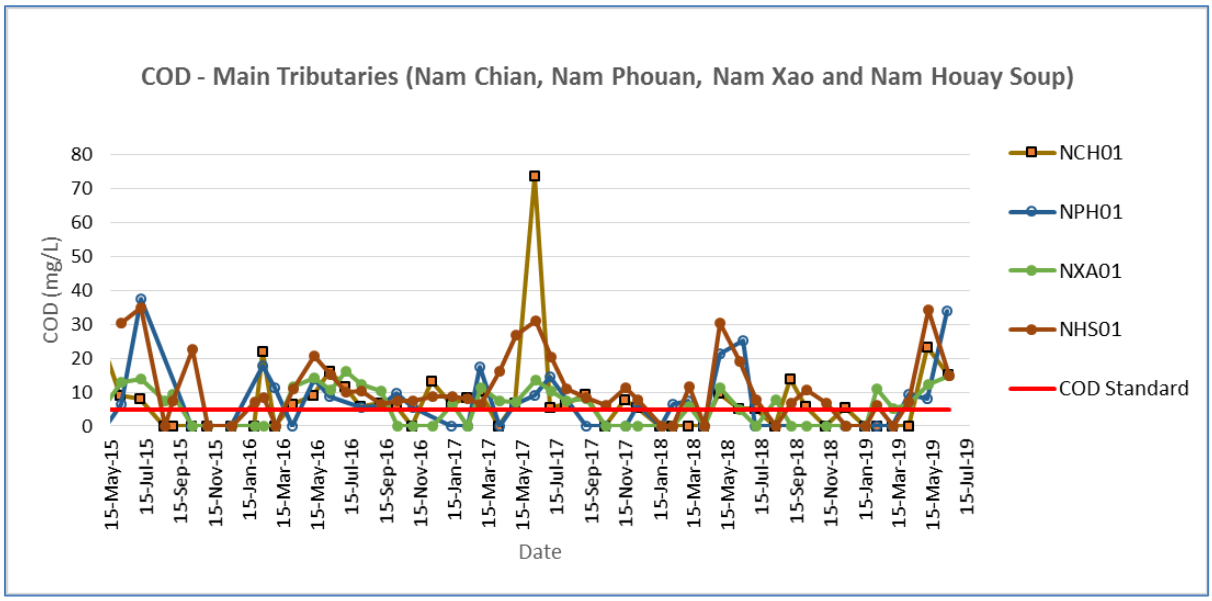

Faecal coliform - Nam Ngiep River, Main Reservoir and Re-regulation Reservoir
Faecal coliform (MPN/100 ml)
100000
10000
1000
100
10
1
1-Apr-18
15-Apr-18
29-Apr-18
13-May-18
27-May-18
10-Jun-18
24-Jun-18
8-Jul-18
22-Jul-18
5-Aug-18
19-Aug-18
2-Sep-18
16-Sep-18
30-Sep-18
14-Oct-18
28-Oct-18
11-Nov-18
25-Nov-18
9-Dec-18
23-Dec-18
6-Jan-19
20-Jan-19
3-Feb-19
17-Feb-19
3-Mar-19
17-Mar-19
31-Mar-19
14-Apr-19
28-Apr-19
12-May-19
26-May-19
9-Jun-19
23-Jun-19
Date
NNG01
R1
R2
R3
R4
R5
R6
R7
NNG05
NNG06
NNG07
NNG08
Standard

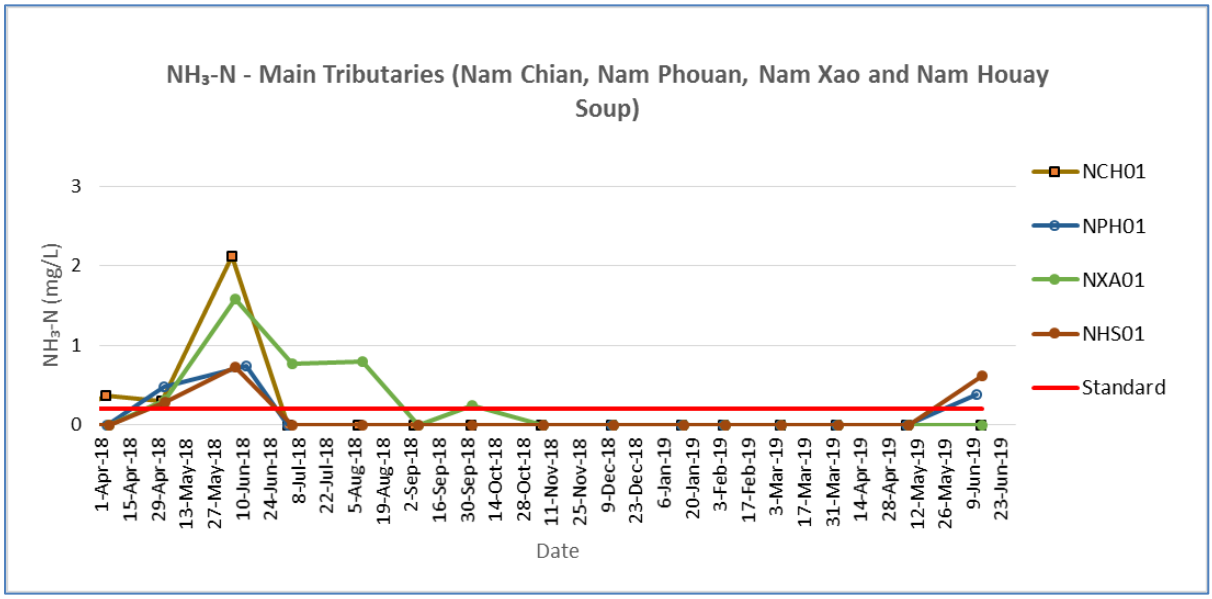

Total coliform - Nam Ngiep River, Main Reservoir and Re-regulation Reservoir
Total coliform (MPN/100 ml)
10,000
1,000
100
10
1
1-Apr-18
15-Apr-18
29-Apr-18
13-May-18
27-May-18
10-Jun-18
24-Jun-18
8-Jul-18
22-Jul-18
5-Aug-18
19-Aug-18
2-Sep-18
16-Sep-18
30-Sep-18
14-Oct-18
28-Oct-18
11-Nov-18
25-Nov-18
9-Dec-18
23-Dec-18
6-Jan-19
20-Jan-19
3-Feb-19
17-Feb-19
3-Mar-19
17-Mar-19
31-Mar-19
14-Apr-19
28-Apr-19
12-May-19
26-May-19
9-Jun-19
23-Jun-19
Date
NNG01
R1
R2
R3
R4
R5
R6
R7
NNG05
NNG06
NNG07
NNG08
Standard

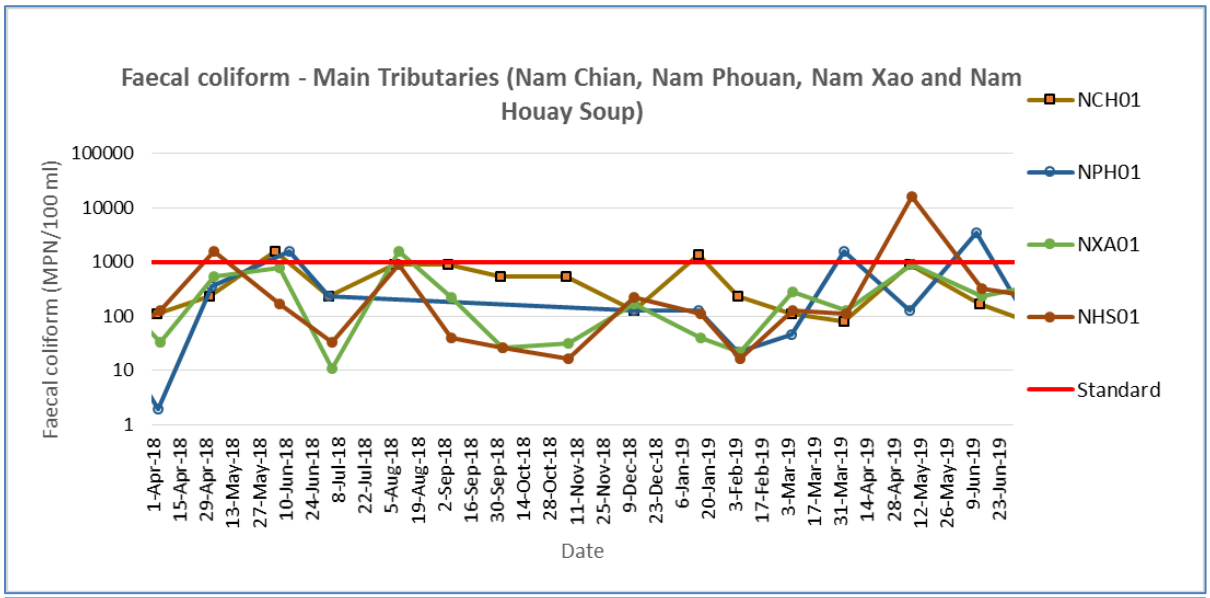
Key Water Quality Parameters for the Nam Ngiep Tributaries: Nam Chian, Nam Phouan, Nam Xao, Nam Houay Soup

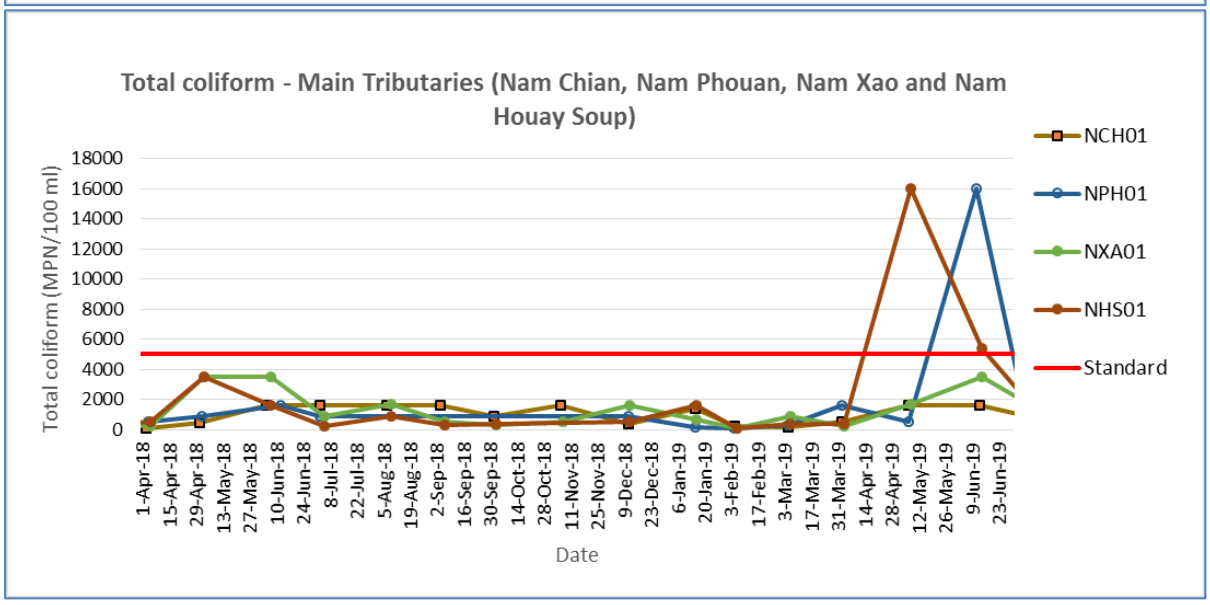




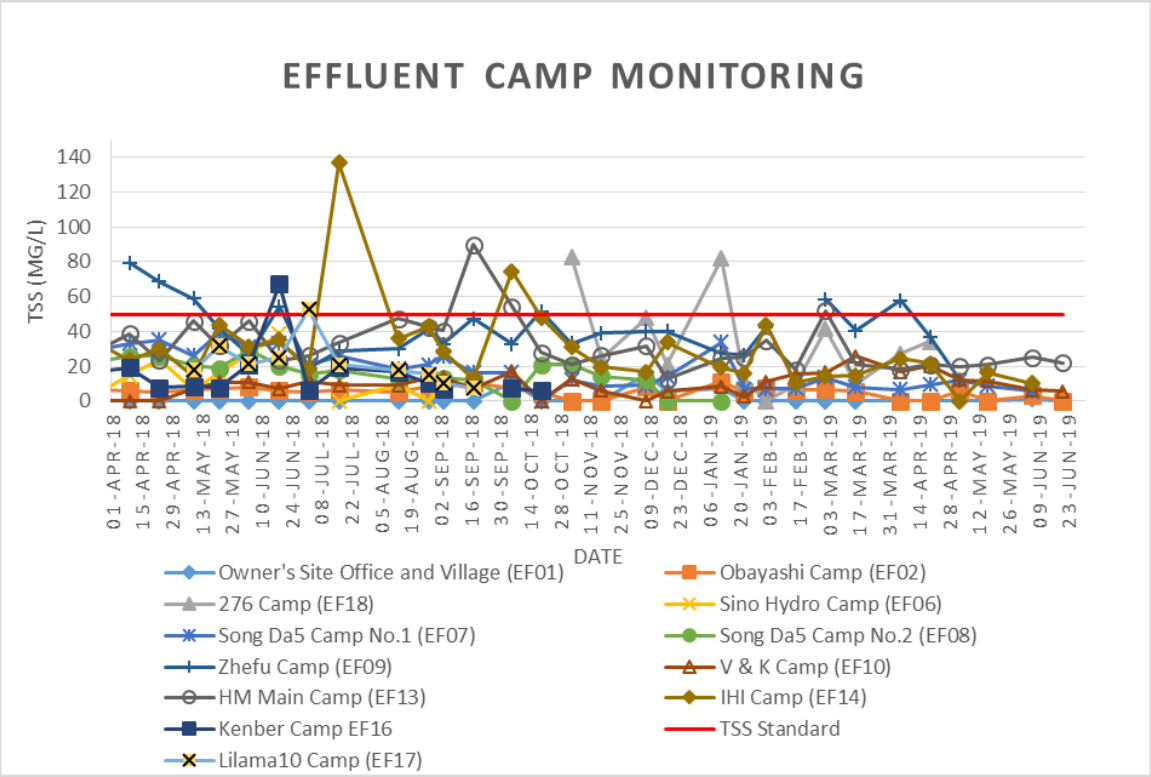

COD - Main Tributaries (Nam Chian, Nam Phouan, Nam Xao and Nam Houay Soup)
COD (mg/L)
80
70
60
50
40
30
20
10
0
15-May-15
15-Jul-15
15-Sep-15
15-Nov-15
15-Jan-16
15-Mar-16
15-May-16
15-Jul-16
15-Sep-16
15-Nov-16
15-Jan-17
15-Mar-17
15-May-17
15-Jul-17
15-Sep-17
15-Nov-17
15-Jan-18
15-Mar-18
15-May-18
15-Jul-18
15-Sep-18
15-Nov-18
15-Jan-19
15-Mar-19
15-May-19
15-Jul-19
Date
NCH01
NPH01
NXA01
NHS01
COD Standard

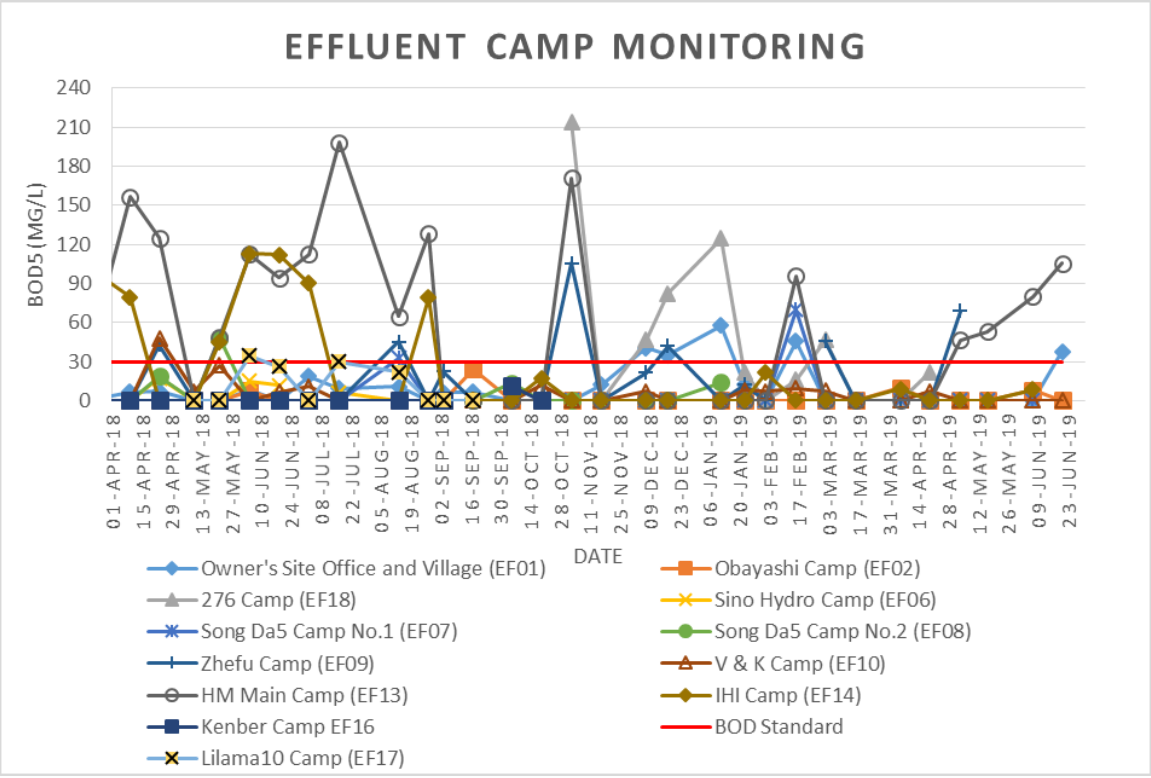

NH₃-N - Main Tributaries (Nam Chian, Nam Phouan, Nam Xao and Nam Houay Soup)
NH₃-N (mg/L)
3
2
1
0
1-Apr-18
15-Apr-18
29-Apr-18
13-May-18
27-May-18
10-Jun-18
24-Jun-18
8-Jul-18
22-Jul-18
5-Aug-18
19-Aug-18
2-Sep-18
16-Sep-18
30-Sep-18
14-Oct-18
28-Oct-18
11-Nov-18
25-Nov-18
9-Dec-18
23-Dec-18
6-Jan-19
20-Jan-19
3-Feb-19
17-Feb-19
3-Mar-19
17-Mar-19
31-Mar-19
14-Apr-19
28-Apr-19
12-May-19
26-May-19
9-Jun-19
23-Jun-19
Date
NCH01
NPH01
NXA01
NHS01
Standard

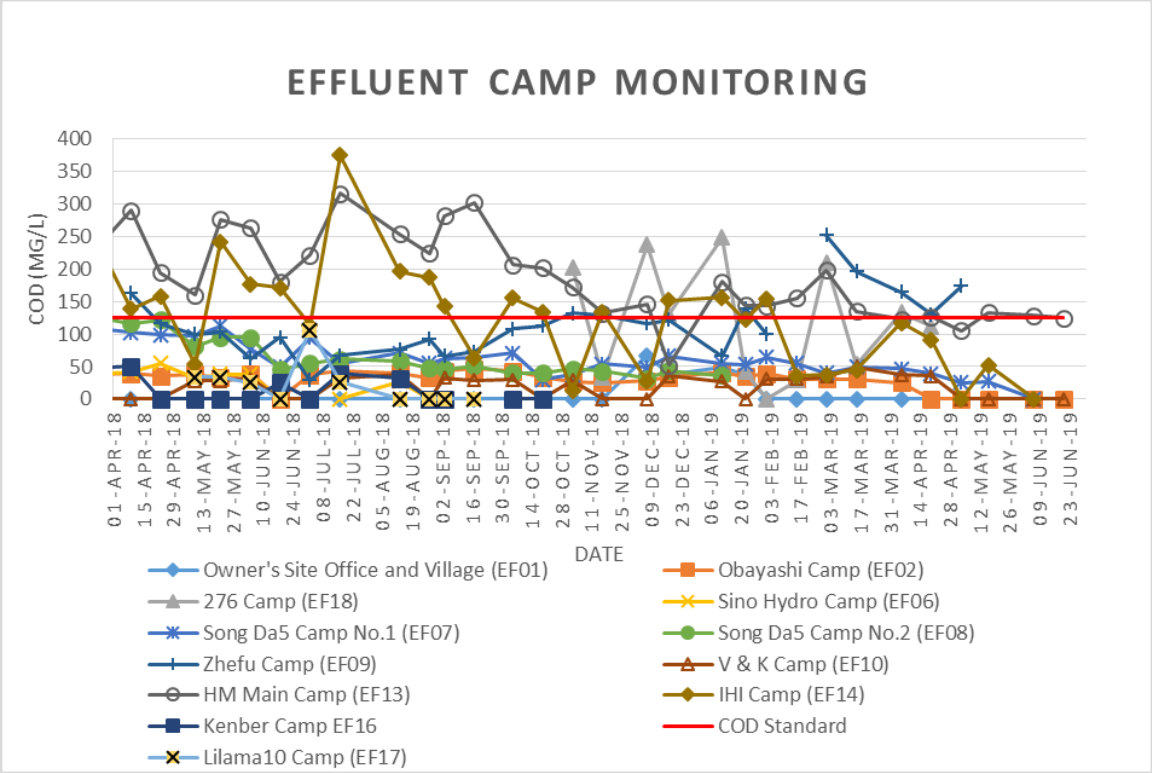

Faecal coliform - Main Tributaries (Nam Chian, Nam Phouan, Nam Xao and Nam Houay Soup)
Faecal coliform (MPN/100 ml)
100000
10000
1000
100
10
1
1-Apr-18
15-Apr-18
29-Apr-18
13-May-18
27-May-18
10-Jun-18
24-Jun-18
8-Jul-18
22-Jul-18
5-Aug-18
19-Aug-18
2-Sep-18
16-Sep-18
30-Sep-18
14-Oct-18
28-Oct-18
11-Nov-18
25-Nov-18
9-Dec-18
23-Dec-18
6-Jan-19
20-Jan-19
3-Feb-19
17-Feb-19
3-Mar-19
17-Mar-19
31-Mar-19
14-Apr-19
28-Apr-19
12-May-19
26-May-19
9-Jun-19
23-Jun-19
Date
NCH01
NPH01
NXA01
NHS01
Standard

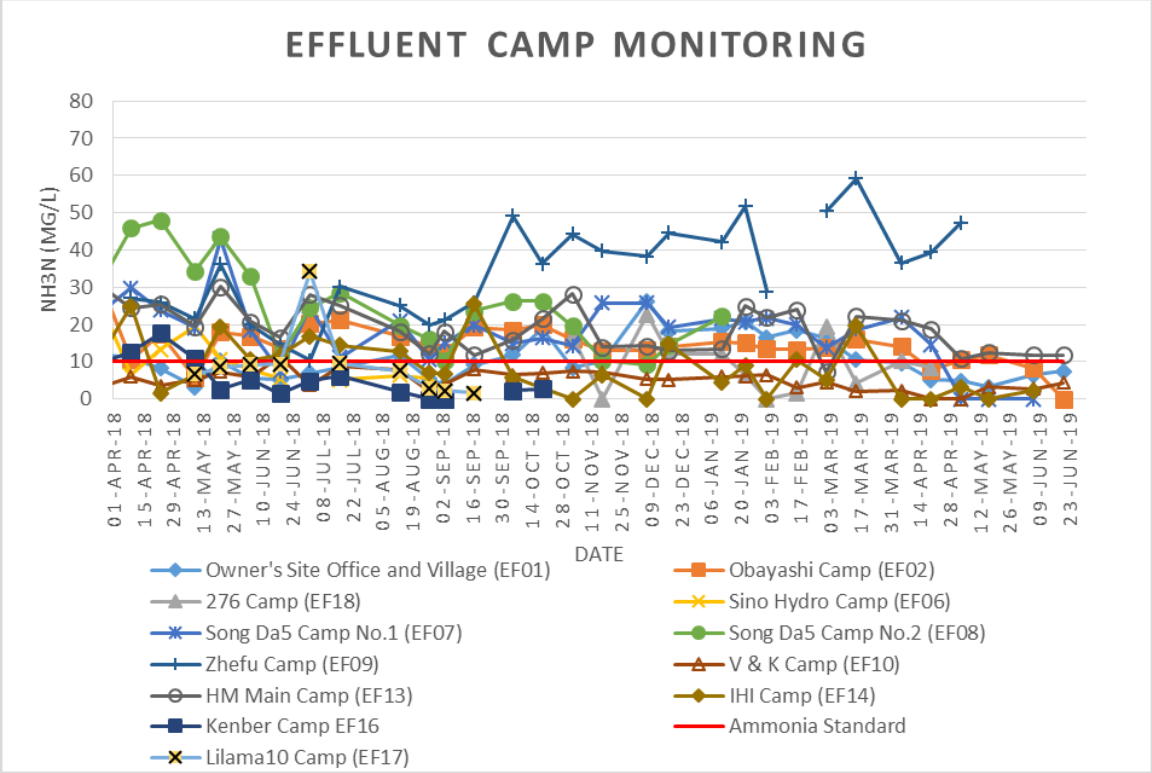

Total coliform - Main Tributaries (Nam Chian, Nam Phouan, Nam Xao and Nam Houay Soup)
Total coliform (MPN/100 ml)
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
1-Apr-18
15-Apr-18
29-Apr-18
13-May-18
27-May-18
10-Jun-18
24-Jun-18
8-Jul-18
22-Jul-18
5-Aug-18
19-Aug-18
2-Sep-18
16-Sep-18
30-Sep-18
14-Oct-18
28-Oct-18
11-Nov-18
25-Nov-18
9-Dec-18
23-Dec-18
6-Jan-19
20-Jan-19
3-Feb-19
17-Feb-19
3-Mar-19
17-Mar-19
31-Mar-19
14-Apr-19
28-Apr-19
12-May-19
26-May-19
9-Jun-19
23-Jun-19
Date
NCH01
NPH01
NXA01
NHS01
Standard

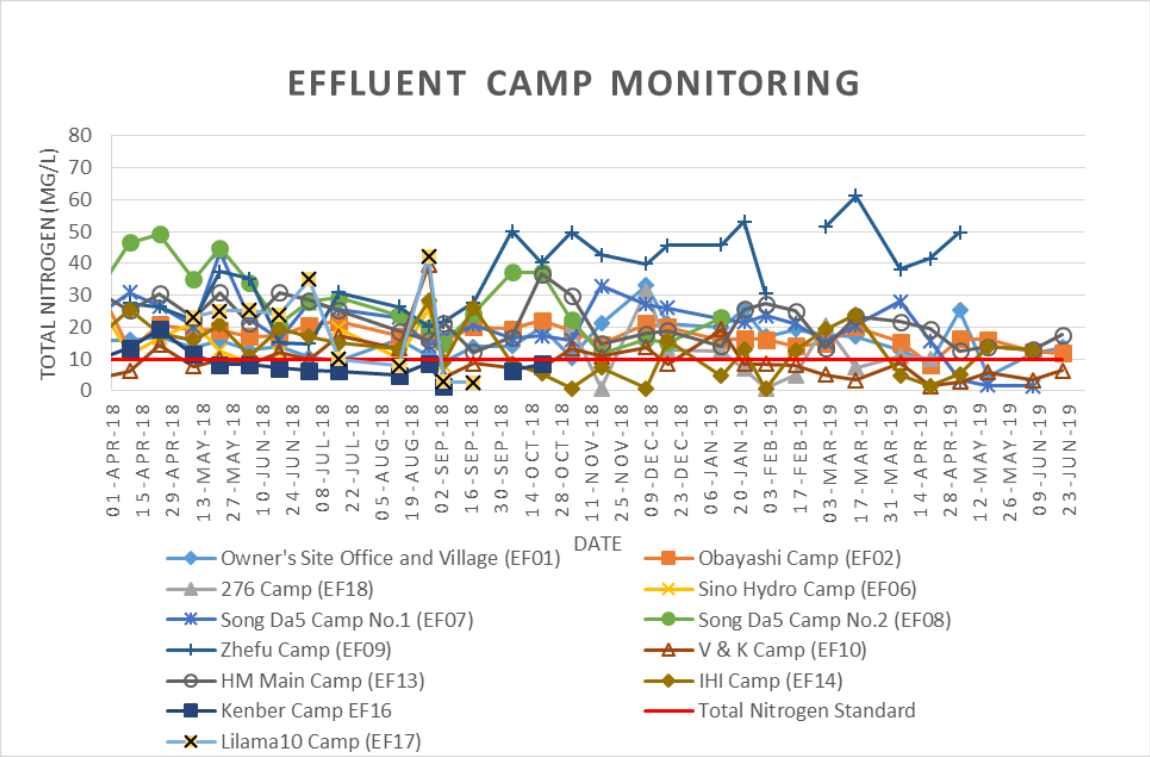
Camps' Effluent Water Quality Trends (Since April 2018 – June 2019)

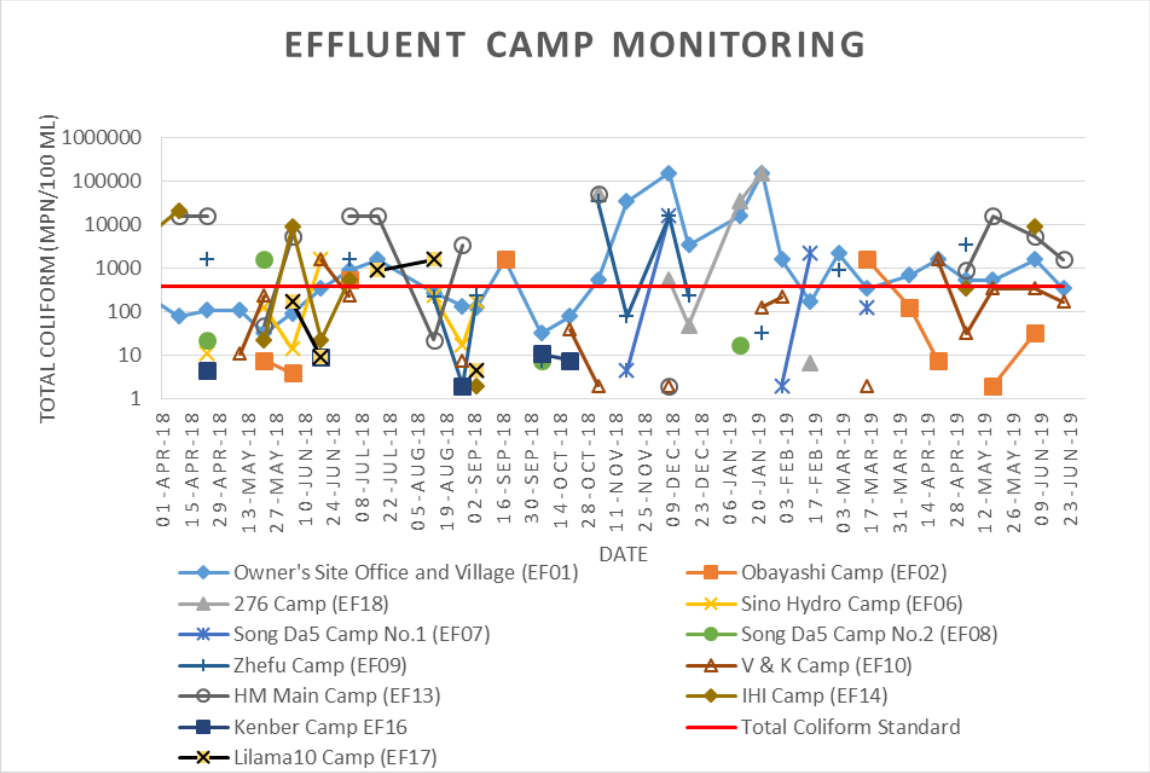





EFFLUENT CAMP MONITORING
COD (MG/L)
400
350
300
250
200
150
100
50
0
01-APR-18
15-APR-18
29-APR-18
13-MAY-18
27-MAY-18
10-JUN-18
24-JUN-18
08-JUL-18
22-JUL-18
05-AUG-18
19-AUG-18
02-SEP-18
16-SEP-18
30-SEP-18
14-OCT-18
28-OCT-18
11-NOV-18
25-NOV-18
09-DEC-18
23-DEC-18
06-JAN-19
20-JAN-19
03-FEB-19
17-FEB-19
03-MAR-19
17-MAR-19
31-MAR-19
14-APR-19
28-APR-19
12-MAY-19
26-MAY-19
09-JUN-19
23-JUN-19
DATE
Owner's Site Office and Village (EF01)
Obayashi Camp (EF02)
276 Camp (EF18)
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
Lilama10 Camp (EF17)


EFFLUENT CAMP MONITORING
NH3N (MG/L)
80
70
60
50
40
30
20
10
0
01-APR-18
15-APR-18
29-APR-18
13-MAY-18
27-MAY-18
10-JUN-18
24-JUN-18
08-JUL-18
22-JUL-18
05-AUG-18
19-AUG-18
02-SEP-18
16-SEP-18
30-SEP-18
14-OCT-18
28-OCT-18
11-NOV-18
25-NOV-18
09-DEC-18
23-DEC-18
06-JAN-19
20-JAN-19
03-FEB-19
17-FEB-19
03-MAR-19
17-MAR-19
31-MAR-19
14-APR-19
28-APR-19
12-MAY-19
26-MAY-19
09-JUN-19
23-JUN-19
DATE
Owner's Site Office and Village (EF01)
Obayashi Camp (EF02)
276 Camp (EF18)
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
Lilama10 Camp (EF17)


EFFLUENT CAMP MONITORING
TOTAL NITROGEN (MG/L)
80
70
60
50
40
30
20
10
0
01-APR-18
15-APR-18
29-APR-18
13-MAY-18
27-MAY-18
10-JUN-18
24-JUN-18
08-JUL-18
22-JUL-18
05-AUG-18
19-AUG-18
02-SEP-18
16-SEP-18
30-SEP-18
14-OCT-18
28-OCT-18
11-NOV-18
25-NOV-18
09-DEC-18
23-DEC-18
06-JAN-19
20-JAN-19
03-FEB-19
17-FEB-19
03-MAR-19
17-MAR-19
31-MAR-19
14-APR-19
28-APR-19
12-MAY-19
26-MAY-19
09-JUN-19
23-JUN-19
DATE
Owner's Site Office and Village (EF01)
Obayashi Camp (EF02)
276 Camp (EF18)
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
Lilama10 Camp (EF17)


EFFLUENT CAMP MONITORING
TOTAL COLIFORM (MPN/100 ML)
1000000
100000
10000
1000
100
10
1
01-APR-18
15-APR-18
29-APR-18
13-MAY-18
27-MAY-18
10-JUN-18
24-JUN-18
08-JUL-18
22-JUL-18
05-AUG-18
19-AUG-18
02-SEP-18
16-SEP-18
30-SEP-18
14-OCT-18
28-OCT-18
11-NOV-18
25-NOV-18
09-DEC-18
23-DEC-18
06-JAN-19
20-JAN-19
03-FEB-19
17-FEB-19
03-MAR-19
17-MAR-19
31-MAR-19
14-APR-19
28-APR-19
12-MAY-19
26-MAY-19
09-JUN-19
23-JUN-19
DATE
Owner's Site Office and Village (EF01)
Obayashi Camp (EF02)
276 Camp (EF18)
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
Lilama10 Camp (EF17)

APPENDIX 5: *WATER QUALITY MONITORING DATA*

APPENDIX 5-1: *SURFACE WATER QUALITY MONITORING – Q2 2019*

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
1-Apr-19	pH	5.0 - 9.0					8.53	7.75										
2-Apr-19	pH	5.0 - 9.0	8.49	9	8.9	8.96									8.74	7.69		
3-Apr-19	pH	5.0 - 9.0							8.05	8.03	8.06	7.24	6.86	7.12			7.2	6.74
6-Apr-19	pH	5.0 - 9.0						7.92			7.98							
8-Apr-19	pH	5.0 - 9.0					8.65	8.81	8.02	8.26	8.32	7.59	8.39	8.16			7.9	7.01
18-Apr-19	pH	5.0 - 9.0						7.83	7.62	7.68	7.96	7.27	8.35	7.97			7.33	7.49
20-Apr-19	pH	5.0 - 9.0						8.53			8.24							
23-Apr-19	pH	5.0 - 9.0	8.4			8.56	7.91	8.31							8.66	7.92		
24-Apr-19	pH	5.0 - 9.0							7.67	7.76	8.22	7.09	7.1	6.95			6.97	6.69
27-Apr-19	pH	5.0 - 9.0						7.14			8.15							
29-Apr-19	pH	5.0 - 9.0					8.19	7.85										
30-Apr-19	pH	5.0 - 9.0		7.91	8.25	8.28										8.33		
2-May-19	pH	5.0 - 9.0							7.71	7.85	7.83	7.65	6.78	6.56			7.8	6.94
4-May-19	pH	5.0 - 9.0						7.52			7.45							
6-May-19	pH	5.0 - 9.0					8.24	8.05										
7-May-19	pH	5.0 - 9.0	8.9		8.67	8.24									8.95	7.99		
8-May-19	pH	5.0 - 9.0							7.88	7.98	8.35	7.93	6.8	6.94			8.12	7.3
10-May-19	pH	5.0 - 9.0						7.87	8.29	7.82	7.94							
11-May-19	pH	5.0 - 9.0						7.67			7.46							
13-May-19	pH	5.0 - 9.0					8.56	8.16										
14-May-19	pH	5.0 - 9.0		8.13	8.94	8.49										8.23		
15-May-19	pH	5.0 - 9.0							7.96	8	7.88	8.19	8.12	8.29			8.11	8.3
17-May-19	pH	5.0 - 9.0						8.29	8.59	8.52	8.16							
20-May-19	pH	5.0 - 9.0					8.55	8.21										
21-May-19	pH	5.0 - 9.0	7.76	8.16	8.34	8.74									7.81	7.93		
22-May-19	pH	5.0 - 9.0							8.06	8.29	7.97	7.88	7.1	7.25			7.85	7.56

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
25-May-19	pH	5.0 - 9.0						8.04			7.7							
27-May-19	pH	5.0 - 9.0						7.94										
28-May-19	pH	5.0 - 9.0		7.96	7.87	8.24	7.75									8.13		
29-May-19	pH	5.0 - 9.0							8.44	8.54	8.09	7.96	6.98	7.14			7.78	7.75
1-Jun-19	pH	5.0 - 9.0						8.05			8.21							
3-Jun-19	pH	5.0 - 9.0						7.78										
4-Jun-19	pH	5.0 - 9.0			8.26	8.17	7.97									8.37		
5-Jun-19	pH	5.0 - 9.0							8.12	7.96	8.11	7.97	6.49				7.94	7.63
8-Jun-19	pH	5.0 - 9.0						7.82			7.92							
10-Jun-19	pH	5.0 - 9.0						8.16										
11-Jun-19	pH	5.0 - 9.0		8.86	8.2	8.86	8.1									8.12		
12-Jun-19	pH	5.0 - 9.0						7.69	7.84	7.97								
13-Jun-19	pH	5.0 - 9.0	8.26												8.5			
14-Jun-19	pH	5.0 - 9.0						7.98	7.91	7.9	7.89	7.44	6.23	6.34			7.55	6.92
15-Jun-19	pH	5.0 - 9.0						7.85			7.85							
17-Jun-19	pH	5.0 - 9.0						7.99			7.87							
18-Jun-19	pH	5.0 - 9.0		7.98	8.25	8.23	8.14									8.12		
19-Jun-19	pH	5.0 - 9.0						7.83	7.79	7.79	7.98							
21-Jun-19	pH	5.0 - 9.0						8.34	7.81	7.95	7.91	7.98						
22-Jun-19	pH	5.0 - 9.0						7.94	7.7		7.9							
24-Jun-19	pH	5.0 - 9.0						7.9										
25-Jun-19	pH	5.0 - 9.0	8.84	8.16	8.66	7.97	8.04								8.86			
26-Jun-19	pH	5.0 - 9.0						7.96	8.17	8.12	7.99	7.19	6.08	6.17			7.59	6.84
28-Jun-19	pH	5.0 - 9.0						8.39	8.31	8.38	8.13	8.38					8.32	
29-Jun-19	pH	5.0 - 9.0						8.46			8.23							
1-Apr-19	Sat. DO (%)						95.8	97.2										
2-Apr-19	Sat. DO (%)		103.3	101.5	97.5	93.3									102.2	90.5		
3-Apr-19	Sat. DO (%)								97.6	104.5	99.8	90.9	96.9	105.5			80.9	81.3
6-Apr-19	Sat. DO (%)							101.3			98.3							
8-Apr-19	Sat. DO (%)						95.6	95.5	100.2	99.3	99.1	99.8	97.9	97.1			102.1	87.8

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
18-Apr-19	Sat. DO (%)							98.9	116.2	114.5	96.9	94.8	94.8	94.6			82.9	108.4
20-Apr-19	Sat. DO (%)							99.3			95.5							
23-Apr-19	Sat. DO (%)		99.6			100.9	92.5	94.4							102.1	94.2		
24-Apr-19	Sat. DO (%)								108.5	104.1	95.6	93.5	93.5	95.4			72.7	71.2
27-Apr-19	Sat. DO (%)							92.7			93.9							
29-Apr-19	Sat. DO (%)						98.1	88.6										
30-Apr-19	Sat. DO (%)			99.5	108.3	95.1										95.7		
2-May-19	Sat. DO (%)								97.5	100.9	98	95.8	102.7	106.9			88.3	102.3
4-May-19	Sat. DO (%)							101.8			102.1							
6-May-19	Sat. DO (%)						117.8	113.8										
7-May-19	Sat. DO (%)		100.3		104.8	98.4									99.2	94.5		
8-May-19	Sat. DO (%)								97	93.4	94.2	83.2	89.4	87.5			86.1	84.3
10-May-19	Sat. DO (%)							82.2	107.8	100	97.6							
11-May-19	Sat. DO (%)							97.6			97.1							
13-May-19	Sat. DO (%)						92.2	90.7										
14-May-19	Sat. DO (%)			93.2	105.1	100.9										94.2		
15-May-19	Sat. DO (%)								95.6	89.7	82.5	74.4	83.4	81.5			63.3	79.2
17-May-19	Sat. DO (%)							88.5	102.6	97	107.5							
20-May-19	Sat. DO (%)						97	94.1										
21-May-19	Sat. DO (%)		108.1	102.4	96.1	97									109.9	93.3		
22-May-19	Sat. DO (%)								93.8	98.1	104.8	7.88	103.7	108.2			90	102.6
25-May-19	Sat. DO (%)							83.3			93.9							
27-May-19	Sat. DO (%)							71.8										
28-May-19	Sat. DO (%)			93	85.2	95.4	91.8									93.9		
29-May-19	Sat. DO (%)								99.9	99	87.9	92.7	96.8	107.5			83.9	91.1
1-Jun-19	Sat. DO (%)							59.2			95.1							
3-Jun-19	Sat. DO (%)							66.2										
4-Jun-19	Sat. DO (%)				92.9	92.6	90.3									95.9		
5-Jun-19	Sat. DO (%)								100.4	95	95.4	99.9	94.3				88.5	91.7
8-Jun-19	Sat. DO (%)							92.1			93.5							

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
10-Jun-19	Sat. DO (%)							86.4										
11-Jun-19	Sat. DO (%)			118.5	105.9	103.8	95.1									96		
12-Jun-19	Sat. DO (%)							106.2	64.2	87.7								
13-Jun-19	Sat. DO (%)		110.4												103.3			
14-Jun-19	Sat. DO (%)							83.8	71.4	80.2	64.5	100.9	87.3	94.9			86.4	91.8
15-Jun-19	Sat. DO (%)							74.3			46.4							
17-Jun-19	Sat. DO (%)							53.4			42.5							
18-Jun-19	Sat. DO (%)			110	97.3	97.5	91.4									97.7		
19-Jun-19	Sat. DO (%)							86.4	28.3	51.1	81.6							
21-Jun-19	Sat. DO (%)							88.3	32.3	52.6	29.5	51.8						
22-Jun-19	Sat. DO (%)							87.9	39.6		82							
24-Jun-19	Sat. DO (%)							111.6										
25-Jun-19	Sat. DO (%)		113	104.5	118.4	107.9	95								105.9			
26-Jun-19	Sat. DO (%)							96.4	70.3	77.4	94.6	84	94.8	94.4			95.7	93.4
28-Jun-19	Sat. DO (%)							111.9	90.2	85.2	76.9	81.6					92.6	
29-Jun-19	Sat. DO (%)							86.9			80.6							
1-Apr-19	DO (mg/L)	>6.0					7.31	7.49										
2-Apr-19	DO (mg/L)	>6.0	7.92	7.52	7.43	7.24									7.9	7.64		
3-Apr-19	DO (mg/L)	>6.0							7.7	8.11	7.68	7.12	7.13	7.4			6.31	6.3
6-Apr-19	DO (mg/L)	>6.0						7.65			7.6							
8-Apr-19	DO (mg/L)	>6.0					7.27	7.38	7.7	7.39	7.45	7.56	7.18	7.12			7.48	6.55
18-Apr-19	DO (mg/L)	>6.0						7.54	8.67	8.47	7.25	7.05	6.82	6.83			6.15	7.69
20-Apr-19	DO (mg/L)	>6.0						7.06			7.07							
23-Apr-19	DO (mg/L)	>6.0	7.37			7.42	6.75	7.08							7.74	7.58		
24-Apr-19	DO (mg/L)	>6.0							8.72	7.98	7.16	7.01	6.89	6.7			5.23	5.3
27-Apr-19	DO (mg/L)	>6.0						6.82			7.15							
29-Apr-19	DO (mg/L)	>6.0					7.65	6.7										
30-Apr-19	DO (mg/L)	>6.0		7.2	7.91	7.06										7.85		

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
2-May-19	DO (mg/L)	>6.0							7.11	7.44	7.26	6.92	7.37	7.55			6.62	7.51
4-May-19	DO (mg/L)	>6.0						7.64			7.83							
6-May-19	DO (mg/L)	>6.0					8.54	8.45										
7-May-19	DO (mg/L)	>6.0	7.39		7.8	7.32									7.57	7.62		
8-May-19	DO (mg/L)	>6.0							7.35	7.07	7.22	6.27	6.89	6.49			6.41	6.72
10-May-19	DO (mg/L)	>6.0						6.34	8.09	7.56	7.46							
11-May-19	DO (mg/L)	>6.0						7.27			7.33							
13-May-19	DO (mg/L)	>6.0					6.79	6.78										
14-May-19	DO (mg/L)	>6.0		6.85	7.88	7.52										7.72		
15-May-19	DO (mg/L)	>6.0							7.29	6.8	6.38	5.78	6.45	6.24			4.82	6.45
17-May-19	DO (mg/L)	>6.0						6.78	7.69	7.26	8.19							
20-May-19	DO (mg/L)	>6.0					7.16	7.06										
21-May-19	DO (mg/L)	>6.0	8.02	7.36	7.16	7.2									8.49	7.68		
22-May-19	DO (mg/L)	>6.0							7.25	7.44	7.84	7.54	7.69	7.55			6.67	7.75
25-May-19	DO (mg/L)	>6.0						6.36			7.22							
27-May-19	DO (mg/L)	>6.0						5.47										
28-May-19	DO (mg/L)	>6.0		6.83	6.38	7.09	6.91									7.6		
29-May-19	DO (mg/L)	>6.0							7.6	7.56	6.9	7.04	7.13	7.61			6.46	6.92
1-Jun-19	DO (mg/L)	>6.0						4.6			7.44							
3-Jun-19	DO (mg/L)	>6.0						5.03										
4-Jun-19	DO (mg/L)	>6.0			6.89	6.89	6.86									7.9		
5-Jun-19	DO (mg/L)	>6.0							8.11	7.5	7.6	7.7	7.37				6.82	7.05
8-Jun-19	DO (mg/L)	>6.0						7.01			7.1							
10-Jun-19	DO (mg/L)	>6.0						6.55										
11-Jun-19	DO (mg/L)	>6.0		8.59	7.77	7.64	7.11									7.91		
12-Jun-19	DO (mg/L)	>6.0						8.07	4.97	6.55								
13-Jun-19	DO (mg/L)	>6.0	8.08												7.75			
14-Jun-19	DO (mg/L)	>6.0						6.48	5.55	6.2	5.29	7.65	6.86	7.06			6.58	7.24
15-Jun-19	DO (mg/L)	>6.0						5.75			3.83							
17-Jun-19	DO (mg/L)	>6.0						4.16			3.59							

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
18-Jun-19	DO (mg/L)	>6.0		8.22	7.34	7.31	6.92									8.11		
19-Jun-19	DO (mg/L)	>6.0						6.75	2.42	4.18	6.66							
21-Jun-19	DO (mg/L)	>6.0						6.7	2.77	3.82	2.45	4.47						
22-Jun-19	DO (mg/L)	>6.0						6.63	3.25		6.6							
24-Jun-19	DO (mg/L)	>6.0						8.36										
25-Jun-19	DO (mg/L)	>6.0	8.19	7.5	8.74	7.93	7.03								7.96			
26-Jun-19	DO (mg/L)	>6.0						7.2	5.25	5.66	6.97	6.4	7.28	7.34			7.18	7.18
28-Jun-19	DO (mg/L)	>6.0						8.56	6.52	6.1	6.11	6.37					6.14	
29-Jun-19	DO (mg/L)	>6.0						6.61			6.48							
1-Apr-19	Conductivity (µs/cm)						70	70										
2-Apr-19	Conductivity (µs/cm)		73.2	89	85	73									29.3	72		
3-Apr-19	Conductivity (µs/cm)								72	72	54.3	55.1	60.6	59.9			118.5	43.6
6-Apr-19	Conductivity (µs/cm)							56.4			54.5							
8-Apr-19	Conductivity (µs/cm)						70	69	73	72	53.7	52.9	53.4	53.5			122.5	66.8
18-Apr-19	Conductivity (µs/cm)							70	73	73	55.4	53.2	53.7	53.9			102.8	75.9
20-Apr-19	Conductivity (µs/cm)							52			54.8							
23-Apr-19	Conductivity (µs/cm)		68.9			76	72	70							29.6	77		
24-Apr-19	Conductivity (µs/cm)								73	72	53.8	52.5	52.3	53.6			112.3	65.6
27-Apr-19	Conductivity (µs/cm)							51.3			59.9							
29-Apr-19	Conductivity (µs/cm)						74	70										
30-Apr-19	Conductivity (µs/cm)			94	90	76										77		
2-May-19	Conductivity (µs/cm)								73	73	54.3	59	56.4	53.6			131.1	47.6

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
4-May-19	Conductivity (µs/cm)							51.5			53.6							
6-May-19	Conductivity (µs/cm)						72	70										
7-May-19	Conductivity (µs/cm)		91.8		89	73									31.6	75		
8-May-19	Conductivity (µs/cm)								73	70	62.1	63.6	32.2	27.9			110.9	15.56
10-May-19	Conductivity (µs/cm)							69	73	72	79							
11-May-19	Conductivity (µs/cm)							50.3			56							
13-May-19	Conductivity (µs/cm)						71	69										
14-May-19	Conductivity (µs/cm)			125	89	74										74		
15-May-19	Conductivity (µs/cm)								76	76	79	89	64	45			119	30
17-May-19	Conductivity (µs/cm)							69	75	75	75							
20-May-19	Conductivity (µs/cm)						71	70										
21-May-19	Conductivity (µs/cm)		89.1	120	89	74									33.2	76		
22-May-19	Conductivity (µs/cm)								75	75	90.6	55.2	51.5	48			115.5	23.9
25-May-19	Conductivity (µs/cm)							70			77							
27-May-19	Conductivity (µs/cm)							69										
28-May-19	Conductivity (µs/cm)			109	92	74	72									121		
29-May-19	Conductivity (µs/cm)								73	73	77	58.7	51.3	44.7			111.1	13.95
1-Jun-19	Conductivity (µs/cm)							71			73							

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
3-Jun-19	Conductivity (µs/cm)							72										
4-Jun-19	Conductivity (µs/cm)				94	73	71									95		
5-Jun-19	Conductivity (µs/cm)								71	69	70	50.8	20.17				44.9	11.07
8-Jun-19	Conductivity (µs/cm)							72			89							
10-Jun-19	Conductivity (µs/cm)							71										
11-Jun-19	Conductivity (µs/cm)			100	92	75	71									60		
12-Jun-19	Conductivity (µs/cm)							71	77	75								
13-Jun-19	Conductivity (µs/cm)		86.5												25.3			
14-Jun-19	Conductivity (µs/cm)							70	76	74	85	62.7	36.1	37.7			88.8	11.73
15-Jun-19	Conductivity (µs/cm)							70			80							
17-Jun-19	Conductivity (µs/cm)							68			86							
18-Jun-19	Conductivity (µs/cm)			106	90	73	72									75		
19-Jun-19	Conductivity (µs/cm)							69	100	85	69							
21-Jun-19	Conductivity (µs/cm)							71	96	80	84	86						
22-Jun-19	Conductivity (µs/cm)							71	82		87							
24-Jun-19	Conductivity (µs/cm)							71										
25-Jun-19	Conductivity (µs/cm)		84	115	92	74	72								26			
26-Jun-19	Conductivity (µs/cm)							71	74	71	68.5	70.2	23.6	16.74			85.1	10.86

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
28-Jun-19	Conductivity (µs/cm)							70	73	71	87	95					107	
29-Jun-19	Conductivity (µs/cm)							70			90							
1-Apr-19	TDS (mg/L)						35	35										
2-Apr-19	TDS (mg/L)		36.6	44.5	42.5	36.5									14.65	36		
3-Apr-19	TDS (mg/L)								36	36	27.5	27.5	30.3	29.5			59.2	21.5
6-Apr-19	TDS (mg/L)							28.2			27.2							
8-Apr-19	TDS (mg/L)						35	34.5	36.5	36	26.85	26.45	26.7	26.75			61.25	33.4
18-Apr-19	TDS (mg/L)							35	36.5	36.5	27.7	26.6	26.85	26.95			51.4	37.95
20-Apr-19	TDS (mg/L)							26			27.4							
23-Apr-19	TDS (mg/L)		34.45			38	36	35							14.8	37.5		
24-Apr-19	TDS (mg/L)								36.5	36	26.9	26.25	26.15	26.8			56.15	32.8
27-Apr-19	TDS (mg/L)							25.5			30							
29-Apr-19	TDS (mg/L)						37	35										
30-Apr-19	TDS (mg/L)			47	45	38										38.5		
2-May-19	TDS (mg/L)								36.5	36.5	27.1	29.5	28.2	26.5			65.5	23.8
4-May-19	TDS (mg/L)							25.5			26.5							
6-May-19	TDS (mg/L)						36	35										
7-May-19	TDS (mg/L)		45.9		44.5	36.5									15.8	37.5		
8-May-19	TDS (mg/L)								36.5	35	31.5	31.8	16.1	13.95			55.45	7.78
10-May-19	TDS (mg/L)							34.5	36.5	36	39.5							
11-May-19	TDS (mg/L)							25.15			28							
13-May-19	TDS (mg/L)						35.5	34.5										
14-May-19	TDS (mg/L)			62.5	44.5	37										37		
15-May-19	TDS (mg/L)								38	38	39.5	44.5	32	22.5			59.5	15
17-May-19	TDS (mg/L)							34.5	37.5	37.5	37.5							
20-May-19	TDS (mg/L)						35.5	35										
21-May-19	TDS (mg/L)		44.55	60	44.5	37									16.6	38		
22-May-19	TDS (mg/L)								37.5	37.5	45.3	27.6	25.75	24			57.75	11.95
25-May-19	TDS (mg/L)							35			38.5							

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
27-May-19	TDS (mg/L)							34.5										
28-May-19	TDS (mg/L)			54.5	46	37	36									60.5		
29-May-19	TDS (mg/L)								36.5	36.5	38.5	29.3	25.5	22.3			55.5	6.9
1-Jun-19	TDS (mg/L)							35.5			36.5							
3-Jun-19	TDS (mg/L)							36										
4-Jun-19	TDS (mg/L)				47	36.5	35.5									47.5		
5-Jun-19	TDS (mg/L)								35.5	34.5	35	25.4	10.85				22.45	5.53
8-Jun-19	TDS (mg/L)							36				42.5						
10-Jun-19	TDS (mg/L)							35.5										
11-Jun-19	TDS (mg/L)			50	46	37.5	35.5									30		
12-Jun-19	TDS (mg/L)							35.5	38.5	37.5								
13-Jun-19	TDS (mg/L)		43.25												12			
14-Jun-19	TDS (mg/L)							35	38	37	42.5	31.35	18.05	18.85			44.4	5.86
15-Jun-19	TDS (mg/L)							35			40							
17-Jun-19	TDS (mg/L)							34			43							
18-Jun-19	TDS (mg/L)			53	45	36.5	36									37.5		
19-Jun-19	TDS (mg/L)							34.5	50	42.5	34							
21-Jun-19	TDS (mg/L)							35.5	48	40	42	43.5						
22-Jun-19	TDS (mg/L)							35.5	41		43.5							
24-Jun-19	TDS (mg/L)							35.5										
25-Jun-19	TDS (mg/L)		42	57.5	46	37	36								13			
26-Jun-19	TDS (mg/L)							35.5	37	35.5	34.2	35.1	11.8	8.3			42.5	5.4
28-Jun-19	TDS (mg/L)							35	36.5	35.5	43.5	47.5					53.5	
29-Jun-19	TDS (mg/L)							35			45							
1-Apr-19	Temperature (°C)						29.4	28.79										
2-Apr-19	Temperature (°C)		27.1	31.23	29.51	28.44									26.2	23.84		
3-Apr-19	Temperature (°C)								27.56	28.42	27.8	27.1	30	30.8			29	27.8
6-Apr-19	Temperature (°C)							27.6			27.2							
8-Apr-19	Temperature (°C)						30.02	28.92	29.23	30.79	28.6	28.2	30.1	31			30.1	29.1
18-Apr-19	Temperature (°C)							29.41	30.74	30.51	29.4	29.1	31.1	30.9			30.7	31.8

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
20-Apr-19	Temperature (°C)							30.9			29.4							
23-Apr-19	Temperature (°C)		28.6			31.59	32.03	30.4							27.1	26.35		
24-Apr-19	Temperature (°C)								26.65	29.22	28.6	29	29.9	32.6			30.6	29.2
27-Apr-19	Temperature (°C)							29.1			29.1							
29-Apr-19	Temperature (°C)						28.18	29.89										
30-Apr-19	Temperature (°C)			31.62	31.3	31.03										25.3		
2-May-19	Temperature (°C)								31.67	31.32	29.6	30.6	32.2	32.3			32.5	30.5
4-May-19	Temperature (°C)							28.7			27.5							
6-May-19	Temperature (°C)						32.25	30.94										
7-May-19	Temperature (°C)		28.7		30.62	30.87									26.5	26.23		
8-May-19	Temperature (°C)								29.77	29.77	27.6	28.5	27.3	29.3			29.2	25.4
10-May-19	Temperature (°C)							28.86	30.62	30.24	29.43							
11-May-19	Temperature (°C)							29.1			28.4							
13-May-19	Temperature (°C)						31.46	30.39										
14-May-19	Temperature (°C)			31.6	30.32	30.72										25.34		
15-May-19	Temperature (°C)								29.56	29.85	28.8	28.51	28.7	29.3			29.4	25.67
17-May-19	Temperature (°C)							29.18	30.3	30.37	29.59							
20-May-19	Temperature (°C)						31.36	30.35										
21-May-19	Temperature (°C)		28.6	32.9	30.71	30.98									25.9	25.23		
22-May-19	Temperature (°C)								28.68	29.71	29.1	29.8	29.7	30.3			29.6	28.6
25-May-19	Temperature (°C)							29.24			28.84							
27-May-19	Temperature (°C)							29.44										
28-May-19	Temperature (°C)			31.46	30.48	30.85	30.24									26.03		
29-May-19	Temperature (°C)								29.59	29.69	27.48	28.5	29.1	31.3			29	28.2
1-Jun-19	Temperature (°C)							28.43			27.95							
3-Jun-19	Temperature (°C)							29.97										
4-Jun-19	Temperature (°C)				31.57	30.65	29.74									25.02		
5-Jun-19	Temperature (°C)								26.29	27.37	27.79	27	26.5				27.3	27.5
8-Jun-19	Temperature (°C)							29.53			26.73							
10-Jun-19	Temperature (°C)							29.82										

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
11-Jun-19	Temperature (°C)			32.34	31.61	31.55	30.66									25.02		
12-Jun-19	Temperature (°C)							30.04	28.89	30.5								
13-Jun-19	Temperature (°C)		29												27.3			
14-Jun-19	Temperature (°C)							28.66	28.65	28.68	25.44	28.2	26.3	29.2			28	26.1
15-Jun-19	Temperature (°C)							28.58			25.65							
17-Jun-19	Temperature (°C)							28.36			25.06							
18-Jun-19	Temperature (°C)			30.64	30.12	30.47	29.91									24.66		
19-Jun-19	Temperature (°C)							28.27	23.52	25.97	25.8							
21-Jun-19	Temperature (°C)							29.1	25.43	32	25.68	26.48						
22-Jun-19	Temperature (°C)							29.91	27.14		26.44							
24-Jun-19	Temperature (°C)							30.45										
25-Jun-19	Temperature (°C)		29.5	33.08	31.26	31.56	31.06								27.4			
26-Jun-19	Temperature (°C)							29.66	30.91	32.16	27.9	27.7	26.8	26.7			28.6	26.8
28-Jun-19	Temperature (°C)							29.26	32.96	33.11	27.28	27.9					29.52	
29-Jun-19	Temperature (°C)							29.5			26.61							
1-Apr-19	Turbidity (NTU)						0.92	0.96										
2-Apr-19	Turbidity (NTU)		13.29	2.07	1.37	1									140	4.93		
3-Apr-19	Turbidity (NTU)								2.37	2.97	3.01	4.47	3.36	3.48			3.77	5.48
6-Apr-19	Turbidity (NTU)							2.45			6.82							
8-Apr-19	Turbidity (NTU)						0.6	0.8	3.92	5.93	7.58	7.06	5.82	6.86			4.76	5.45
18-Apr-19	Turbidity (NTU)							0.9	3.29	3.26	4.67	5.88	4.25	5.65			4.48	6.4
20-Apr-19	Turbidity (NTU)							1.65			5.01							
23-Apr-19	Turbidity (NTU)		11.1			1.92	1.72	1.27							57.19	4.02		
24-Apr-19	Turbidity (NTU)								6.97	3.59	4.8	4.29	3.79	7.08			2.62	24.11
27-Apr-19	Turbidity (NTU)							1.53			3.96							
29-Apr-19	Turbidity (NTU)						1.46	0.97										
30-Apr-19	Turbidity (NTU)			2.56	2.01	1.66										3.74		
2-May-19	Turbidity (NTU)								3.09	3.32	3.88	4.44	4.31	11.27			3.64	8.46
4-May-19	Turbidity (NTU)							1.91			4.6							
6-May-19	Turbidity (NTU)						1.15	1.06										

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
7-May-19	Turbidity (NTU)		18.73		1.79	1.48									687	2		
8-May-19	Turbidity (NTU)								5.33	3.21	26.65	23.33	34.79	20.6			45.64	221
10-May-19	Turbidity (NTU)							2.07	5.33	4.87	8.4							
11-May-19	Turbidity (NTU)							2.13			10.69							
13-May-19	Turbidity (NTU)						1.89	2.95										
14-May-19	Turbidity (NTU)			3.25	2.77	2.41										66.93		
15-May-19	Turbidity (NTU)								5.5	4.29	6.27	8.84	14.68	36.92			6.92	11.6
17-May-19	Turbidity (NTU)							2.01	4.17	3.32	7.14							
20-May-19	Turbidity (NTU)						1.04	1.15										
21-May-19	Turbidity (NTU)		25.64	4.2	1.8	1.57									16.18	11.58		
22-May-19	Turbidity (NTU)								1.45	2.25	2.65	3.17	4.26	6.01			6.36	5.33
25-May-19	Turbidity (NTU)							1.31			2.46							
27-May-19	Turbidity (NTU)							1.73										
28-May-19	Turbidity (NTU)			2.12	2.06	2.16	2.19									12.08		
29-May-19	Turbidity (NTU)								2.8	3.02	3.46	4.87	188.8	21.09			6.71	5.31
1-Jun-19	Turbidity (NTU)							1.48			5.08							
3-Jun-19	Turbidity (NTU)							2.09										
4-Jun-19	Turbidity (NTU)				1.63	1.98	2.39									20.21		
5-Jun-19	Turbidity (NTU)								4.63	4.44	14.59	5.53	64.07				69.8	19.78
8-Jun-19	Turbidity (NTU)							2.83			5.17							
10-Jun-19	Turbidity (NTU)							1.16										
11-Jun-19	Turbidity (NTU)			1.56	1.77	1.52	1.14									22		
12-Jun-19	Turbidity (NTU)							1.28	5.52	5.57								
13-Jun-19	Turbidity (NTU)		9.84												58.39			
14-Jun-19	Turbidity (NTU)							1.13	3.74	3.29	7.64	10.36	49.43	12.16			20.09	49.62
15-Jun-19	Turbidity (NTU)							1.23			7.76							
17-Jun-19	Turbidity (NTU)							1.98			9.81							
18-Jun-19	Turbidity (NTU)			1.4	1.3	1.23	1.39									4.74		
19-Jun-19	Turbidity (NTU)							1.69	16.37	9.94	19.99							
21-Jun-19	Turbidity (NTU)							1.97	5.93	9.21	14.03	14.13						

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
22-Jun-19	Turbidity (NTU)							1.85	13.47		11.35							
24-Jun-19	Turbidity (NTU)							1.21										
25-Jun-19	Turbidity (NTU)		6.55	2.03	1.35	1.24	1.15								12.16			
26-Jun-19	Turbidity (NTU)							1.82	3.73	5.06	13.1	20.26	43.03	65.44			25.07	12.08
28-Jun-19	Turbidity (NTU)							2	4.26	5.29	13.25	17.55					23.66	
29-Jun-19	Turbidity (NTU)							2.58			11.66							
1-Apr-19	TSS (mg/L)						<5	<5										
2-Apr-19	TSS (mg/L)		21.87	<5	<5	<5									238.6	20.8		
3-Apr-19	TSS (mg/L)								<5	<5	<5	<5	<5	5.15			5.15	4.16
8-Apr-19	TSS (mg/L)							<5	<5	6.94	<5							
18-Apr-19	TSS (mg/L)							<5	<5	<5	<5							
23-Apr-19	TSS (mg/L)							<5										
24-Apr-19	TSS (mg/L)								<5	<5	<5							
29-Apr-19	TSS (mg/L)							<5										
2-May-19	TSS (mg/L)								<5	<5	<5							
6-May-19	TSS (mg/L)						<5	<5										
7-May-19	TSS (mg/L)		21.74		5.47	3.64									859.7	5.34		
8-May-19	TSS (mg/L)								7.6	5	30.99	30.95	44.37	34.64			85.62	281
13-May-19	TSS (mg/L)							<5										
14-May-19	TSS (mg/L)			<5														
15-May-19	TSS (mg/L)								<5	<5	5.86							
20-May-19	TSS (mg/L)							<5										
22-May-19	TSS (mg/L)								<5	5.17	5.08							
27-May-19	TSS (mg/L)							<5										
29-May-19	TSS (mg/L)								<5	<5	5.21							
3-Jun-19	TSS (mg/L)							<5										
5-Jun-19	TSS (mg/L)								<5	<5	38.72							
10-Jun-19	TSS (mg/L)							<5										
11-Jun-19	TSS (mg/L)			<5	<5	<5	<5									244.4		
12-Jun-19	TSS (mg/L)								8.48	8.48	8							

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
13-Jun-19	TSS (mg/L)		9.81												76.9			
14-Jun-19	TSS (mg/L)											7.78	78.81	10.42			20.45	59.79
19-Jun-19	TSS (mg/L)							<5	55.33	15.82	48.34							
26-Jun-19	TSS (mg/L)							<5	<5	<5	<5							
1-Apr-19	BOD_5 (mg/L)	<1.5					<1.0	<1.0										
2-Apr-19	BOD_5 (mg/L)	<1.5	<1.0	1.44	1.2	<1.0									<1.0	<1.0		
3-Apr-19	BOD_5 (mg/L)	<1.5							<1.0	<1.0	<1.0	<1.0	<1.0	1.2			1.15	<1.0
8-Apr-19	BOD_5 (mg/L)	<1.5						<1.0	<1.0	<1.0	<1.0							
23-Apr-19	BOD_5 (mg/L)	<1.5						<1.0										
24-Apr-19	BOD_5 (mg/L)	<1.5							<1	<1	<1							
29-Apr-19	BOD_5 (mg/L)	<1.5						1.07										
6-May-19	BOD_5 (mg/L)	<1.5					<1.0	<1.0										
7-May-19	BOD_5 (mg/L)	<1.5	<1.0		1.63	1.19									<1.0	1.8		
8-May-19	BOD_5 (mg/L)	<1.5							1.16	1.39	1.12	<1.0	1.05	1.21			1.44	1.99
13-May-19	BOD_5 (mg/L)	<1.5						<1.0										
14-May-19	BOD_5 (mg/L)	<1.5		<1.0														
15-May-19	BOD_5 (mg/L)	<1.5							<1.0	<1.0	<1.0							
20-May-19	BOD_5 (mg/L)	<1.5						1.07										
22-May-19	BOD_5 (mg/L)	<1.5							<1.0	<1.0	<1.0							
27-May-19	BOD_5 (mg/L)	<1.5						1.16										
29-May-19	BOD_5 (mg/L)	<1.5							1.13	<1.0	1.36							
3-Jun-19	BOD_5 (mg/L)	<1.5						<1.0										
5-Jun-19	BOD_5 (mg/L)	<1.5							1.39	1.05	<1.0							
10-Jun-19	BOD_5 (mg/L)	<1.5						<1.0										
11-Jun-19	BOD_5 (mg/L)	<1.5		<1.0	<1.0	<1.0	<1.0									1.03		
12-Jun-19	BOD_5 (mg/L)	<1.5							1.81	1.42	1.43							
13-Jun-19	BOD_5 (mg/L)	<1.5	<1.0												<1.0			
14-Jun-19	BOD_5 (mg/L)	<1.5										<1.0	<1.0	<1.0			1.08	1.04
19-Jun-19	BOD_5 (mg/L)	<1.5						<1.0	3.33	3.49	<1.0							
26-Jun-19	BOD_5 (mg/L)	<1.5						<1.0	1.14	1.04	<1.0							

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
1-Apr-19	COD (mg/L)	<5.0					8.1	5.5										
2-Apr-19	COD (mg/L)	<5.0	<5.0	8.7	8.5	5.9									<5.0	9.5		
3-Apr-19	COD (mg/L)	<5.0							6.1	<5.0	8.1	<5.0	5.3	5.7			6.3	7.1
6-May-19	COD (mg/L)	<5.0					5.3	8.8										
7-May-19	COD (mg/L)	<5.0			5.5	10.2									23.3	8.2		
8-May-19	COD (mg/L)	<5.0							12.2	8.2	<5.0	6.5	18.2	22.3			12.2	34.3
14-May-19	COD (mg/L)	<5.0		<5														
10-Jun-19	COD (mg/L)	<5.0						8										
11-Jun-19	COD (mg/L)	<5.0		20	8.8	10.6	6.8									34		
12-Jun-19	COD (mg/L)	<5.0							6	10	12.9							
13-Jun-19	COD (mg/L)	<5.0	10												15.2			
14-Jun-19	COD (mg/L)	<5.0										12.6	30	10.8			15	14.8
1-Apr-19	NH_3-N (mg/L)	<0.2					<0.2	<0.2										
2-Apr-19	NH_3-N (mg/L)	<0.2	0.33	<0.2	<0.2	<0.2									<0.2	<0.2		
3-Apr-19	NH_3-N (mg/L)	<0.2							0.2	<0.2	<0.2	<0.2	<0.2	<0.2			<0.2	<0.2
6-May-19	NH_3-N (mg/L)	<0.2					0.34	0.47										
7-May-19	NH_3-N (mg/L)	<0.2	<0.2		0.25	0.46									<0.2	<02		
8-May-19	NH_3-N (mg/L)	<0.2							0.49	0.27	<0.2	<0.2	<0.2	<0.2			<0.2	<0.2
14-May-19	NH_3-N (mg/L)	<0.2		<0.2														
10-Jun-19	NH_3-N (mg/L)	<0.2						0.2										
11-Jun-19	NH_3-N (mg/L)	<0.2		0.28	0.28	0.31	0.32									0.38		
12-Jun-19	NH_3-N (mg/L)	<0.2							0.14	0.3	0.51							
13-Jun-19	NH_3-N (mg/L)	<0.2	0.63												<0.2			
14-Jun-19	NH_3-N (mg/L)	<0.2										0.79	<0.2	0.62			<0.2	0.62
1-Apr-19	NO_3-N (mg/L)	<5.0					<0.02	<0.02										
2-Apr-19	NO_3-N (mg/L)	<5.0	0.02	<0.02	<0.02	<0.02									0.04	0.05		
3-Apr-19	NO_3-N (mg/L)	<5.0							<0.02	<0.02	0.03	0.02	0.03	<0.02			<0.02	0.04
6-May-19	NO_3-N (mg/L)	<5.0					<0.02	<0.02										
7-May-19	NO_3-N (mg/L)	<5.0	<0.02		<0.02	<0.02									0.03	<0.02		
8-May-19	NO_3-N (mg/L)	<5.0							<0.02	<0.2	<0.02	<0.02	0.05	0.06			0.02	0.06

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
14-May-19	NO_3-N (mg/L)	<5.0		<0.02														
10-Jun-19	NO_3-N (mg/L)	<5.0						<0.02										
11-Jun-19	NO_3-N (mg/L)	<5.0		<0.02	<0.02	<0.02	<0.02									<0.02		
12-Jun-19	NO_3-N (mg/L)	<5.0							<0.02	<0.02	<0.02							
13-Jun-19	NO_3-N (mg/L)	<5.0	0.03												0.03			
14-Jun-19	NO_3-N (mg/L)	<5.0										0.02	1.03	<0.03			0.02	<0.02
1-Apr-19	Faecal coliform (MPN/100 ml)	<1,000					0	0										
2-Apr-19	Faecal coliform (MPN/100 ml)	<1,000	920	0	2	0									79	1,600		
3-Apr-19	Faecal coliform (MPN/100 ml)	<1,000							33	33	110	79	49	79			130	110
8-Apr-19	Faecal coliform (MPN/100 ml)	<1,000						5	8	17	5							
18-Apr-19	Faecal coliform (MPN/100 ml)	<1,000						0	40	170	13							
23-Apr-19	Faecal coliform (MPN/100 ml)	<1,000						0										
24-Apr-19	Faecal coliform (MPN/100 ml)	<1,000							2	2	49							
29-Apr-19	Faecal coliform (MPN/100 ml)	<1,000						2										
2-May-19	Faecal coliform (MPN/100 ml)	<1,000							8	2	79							
6-May-19	Faecal coliform (MPN/100 ml)	<1,000						8										
7-May-19	Faecal coliform (MPN/100 ml)	<1,000	920		27	7.8	7								920	130		
8-May-19	Faecal coliform (MPN/100 ml)	<1,000							8	17	350	3,500	1,100	1,100			920	#####
13-May-19	Faecal coliform (MPN/100 ml)	<1,000						540										
14-May-19	Faecal coliform (MPN/100 ml)	<1,000		920														
15-May-19	Faecal coliform (MPN/100 ml)	<1,000							170	220	350							

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
20-May-19	Faecal coliform (MPN/100 ml)	<1,000						11										
22-May-19	Faecal coliform (MPN/100 ml)	<1,000							170	49	130							
27-May-19	Faecal coliform (MPN/100 ml)	<1,000						11										
29-May-19	Faecal coliform (MPN/100 ml)	<1,000							2	11	8							
3-Jun-19	Faecal coliform (MPN/100 ml)	<1,000						8										
5-Jun-19	Faecal coliform (MPN/100 ml)	<1,000							79	17	27							
10-Jun-19	Faecal coliform (MPN/100 ml)	<1,000						0										
11-Jun-19	Faecal coliform (MPN/100 ml)	<1,000		0	0	0	0									3,500		
12-Jun-19	Faecal coliform (MPN/100 ml)	<1,000							22	11	22							
13-Jun-19	Faecal coliform (MPN/100 ml)	<1,000	70												170			
14-Jun-19	Faecal coliform (MPN/100 ml)	<1,000										170	350	130			240	330
19-Jun-19	Faecal coliform (MPN/100 ml)	<1,000						8	240	130	1,600							
26-Jun-19	Faecal coliform (MPN/100 ml)	<1,000						0	11	8	130							
1-Apr-19	Total Coliform (MPN/100 ml)	<5,000					13	23										
2-Apr-19	Total Coliform (MPN/100 ml)	<5,000	1,600	17	2	8									540	1,600		
3-Apr-19	Total Coliform (MPN/100 ml)	<5,000							49	33	350	240	79	130			240	350
8-Apr-19	Total Coliform (MPN/100 ml)	<5,000						5	22	46	7							
18-Apr-19	Total Coliform (MPN/100 ml)	<5,000						22	920	1,600	920							

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
23-Apr-19	Total Coliform (MPN/100 ml)	<5,000						5										
24-Apr-19	Total Coliform (MPN/100 ml)	<5,000							79	540	240							
25-Apr-19	Total Coliform (MPN/100 ml)	<5,000						33										
2-May-19	Total Coliform (MPN/100 ml)	<5,000							46	49	240							
6-May-19	Total Coliform (MPN/100 ml)	<5,000						33										
7-May-19	Total Coliform (MPN/100 ml)	<5,000	1,600		110	33	79								1,600	540		
8-May-19	Total Coliform (MPN/100 ml)	<5,000							350	170	920	9,200	1,700	1,700			1,700	#####
13-May-19	Total Coliform (MPN/100 ml)	<5,000						1,600										
14-May-19	Total Coliform (MPN/100 ml)	<5,000		1,600														
15-May-19	Total Coliform (MPN/100 ml)	<5,000							920	1,600	920							
20-May-19	Total Coliform (MPN/100 ml)	<5,000						220										
22-May-19	Total Coliform (MPN/100 ml)	<5,000							1,600	79	350							
27-May-19	Total Coliform (MPN/100 ml)	<5,000						22										
29-May-19	Total Coliform (MPN/100 ml)	<5,000							33	49	140							
3-Jun-19	Total Coliform (MPN/100 ml)	<5,000						130										
5-Jun-19	Total Coliform (MPN/100 ml)	<5,000							350	350	1,100							
10-Jun-19	Total Coliform (MPN/100 ml)	<5,000						49										
11-Jun-19	Total Coliform (MPN/100 ml)	<5,000		7	49	11	22									#####		

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
12-Jun-19	Total Coliform (MPN/100 ml)	<5,000							350	170	540							
13-Jun-19	Total Coliform (MPN/100 ml)	<5,000	1,600												1,600			
14-Jun-19	Total Coliform (MPN/100 ml)	<5,000										540	540	350			3,500	5,400
19-Jun-19	Total Coliform (MPN/100 ml)	<5,000						23	540	170	1,600							
26-Jun-19	Total Coliform (MPN/100 ml)	<5,000						17	130	170	280							
10-Jun-19	TKN							<1.5										
11-Jun-19	TKN			<1.5	<1.5	<1.5	<1.5											
12-Jun-19	TKN								<1.5	<1.5	<1.5					<1.5		
13-Jun-19	TKN		<1.5												<1.5			
14-Jun-19	TKN											<1.5	<1.5	<1.5			<1.5	<1.5
10-Jun-19	Chloride (mg/L)							<2										
11-Jun-19	Chloride (mg/L)			<2	<2	<2	<2									<2		
12-Jun-19	Chloride (mg/L)							<2	<2	<2	<2							
13-Jun-19	Chloride (mg/L)		<2												<2			
14-Jun-19	Chloride (mg/L)											<2	<2	2.9			3.9	<2
10-Jun-19	Sulphate(mg/L)	<500						0.4										
11-Jun-19	Sulphate(mg/L)	<500		1.4	1.2	<0.3	<0.3											
12-Jun-19	Sulphate(mg/L)	<500						0.4	1.6	<0.3	2.7					<2		
13-Jun-19	Sulphate(mg/L)	<500	2.4												2			
14-Jun-19	Sulphate(mg/L)	<500										1.3	3.1	2			4.6	5.1
10-Jun-19	Alkalinity (mg/L)							55.5										
11-Jun-19	Alkalinity (mg/L)			67.3	62.5	51.9	44.8									51.9		
12-Jun-19	Alkalinity (mg/L)								53.1	66.1	57.8							
13-Jun-19	Alkalinity (mg/L)		80.2												30.7			
14-Jun-19	Alkalinity (mg/L)											56.6	31.9	31.9			74.3	16.5
11-Jun-19	Calcium (mg/L)															8.74		
12-Jun-19	Calcium (mg/L)										8.51							

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
13-Jun-19	Calcium (mg/L)		18.6												3.35			
14-Jun-19	Calcium (mg/L)											10.4	6.35	6.46			13.3	2.65
10-Jun-19	Manganese (mg/L)	<1.0						0.024										
11-Jun-19	Manganese (mg/L)	<1.0		0.01	0.007	0.007	0.012									0.223		
12-Jun-19	Manganese (mg/L)	<1.0							0.168	0.1	0.248							
13-Jun-19	Manganese (mg/L)	<1.0	0.04												0.104			
14-Jun-19	Manganese (mg/L)	<1.0										0.282	0.112	0.03			0.115	0.061
10-Jun-19	Mercury (mg/L)	<0.002						<0.0002										
11-Jun-19	Mercury (mg/L)	<0.002		2E-04	<0.0002	<0.0002	3E-04											
12-Jun-19	Mercury (mg/L)	<0.002							3E-04	4E-04	<0.0002					3E-04		
13-Jun-19	Mercury (mg/L)	<0.002	<0.0002												<0.0002			
14-Jun-19	Mercury (mg/L)	<0.002										<0.0002	<0.0002	<0.0002			<0.0002	<0.0002
10-Jun-19	Lead (mg/L)	<0.05						<0.010										
11-Jun-19	Lead (mg/L)	<0.05		<0.010	<0.010	<0.010	<0.010									<0.010		
12-Jun-19	Lead (mg/L)	<0.05							<0.010	<0.010	<0.010							
13-Jun-19	Lead (mg/L)	<0.05	<0.010												<0.010			
14-Jun-19	Lead (mg/L)	<0.05										<0.010	<0.010	<0.010			<0.010	<0.010
10-Jun-19	Total Iron (mg/L)							0.058										
11-Jun-19	Total Iron (mg/L)			0.162	0.08	0.052	0.058									8.35		
12-Jun-19	Total Iron (mg/L)								1.38	1.08	1.58							
13-Jun-19	Total Iron (mg/L)		0.672												3.12			
14-Jun-19	Total Iron (mg/L)											1.9	3.96	1.4			1.58	2.72

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
1-Apr-19	TOC (mg/L)						4.84	3.52										
2-Apr-19	TOC (mg/L)			4.67	4.63	3.02												
3-Apr-19	TOC (mg/L)								3.02	3.31								
6-May-19	TOC (mg/L)						7.34	6.78										
7-May-19	TOC (mg/L)				10.8	7.93												
8-May-19	TOC (mg/L)								6.78	7.99								
14-May-19	TOC (mg/L)			5.23														
10-Jun-19	TOC (mg/L)							1.55										
11-Jun-19	TOC (mg/L)			1.74	1.94	2.1	1.82											
12-Jun-19	TOC (mg/L)								1.59	1.68								
1-Apr-19	Phytoplankton Biomass (g dry wt/m³)						1.2	1										
2-Apr-19	Phytoplankton Biomass (g dry wt/m³)			2.8	1.2	3.02												
3-Apr-19	Phytoplankton Biomass (g dry wt/m³)								2	2.4								
6-May-19	Phytoplankton Biomass (g dry wt/m³)						2.2	1.8										
7-May-19	Phytoplankton Biomass (g dry wt/m³)				1.6	2.8												
8-May-19	Phytoplankton Biomass (g dry wt/m³)								6.8	4.2								
14-May-19	Phytoplankton Biomass (g dry wt/m³)			3.2														

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
10-Jun-19	Phytoplankton Biomass (g dry wt/m³)							1.2										
11-Jun-19	Phytoplankton Biomass (g dry wt/m³)			2.2	1.2	2.2	2.2											
12-Jun-19	Phytoplankton Biomass (g dry wt/m³)								7.6	6.6								
1-Apr-19	Total Phosphorus (mg/L)						<0.01	<0.01										
2-Apr-19	Total Phosphorus (mg/L)			<0.01	<0.01	<0.01												
3-Apr-19	Total Phosphorus (mg/L)								<0.01	<0.01								
6-May-19	Total Phosphorus (mg/L)						<0.01	<0.01										
7-May-19	Total Phosphorus (mg/L)				<0.01	<0.01												
8-May-19	Total Phosphorus (mg/L)								<0.01	<0.01								
14-May-19	Total Phosphorus (mg/L)			<0.01														
10-Jun-19	Total Phosphorus (mg/L)							<0.01										
11-Jun-19	Total Phosphorus (mg/L)			<0.01	<0.01	<0.01	<0.01											
12-Jun-19	Total Phosphorus (mg/L)								<0.01	<0.01								
1-Apr-19	Total Dissolved Phosphorus (mg/L)						<0.01	<0.01										

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
2-Apr-19	Total Dissolved Phosphorus (mg/L)			<0.01	<0.01	<0.01												
3-Apr-19	Total Dissolved Phosphorus (mg/L)								<0.01	<0.01								
6-May-19	Total Dissolved Phosphorus (mg/L)						<0.01	<0.01										
7-May-19	Total Dissolved Phosphorus (mg/L)				<0.01	<0.01												
8-May-19	Total Dissolved Phosphorus (mg/L)								<0.01	<0.01								
14-May-19	Total Dissolved Phosphorus (mg/L)			<0.01														
10-Jun-19	Total Dissolved Phosphorus (mg/L)							<0.01										
11-Jun-19	Total Dissolved Phosphorus (mg/L)			<0.01	<0.01	<0.01	<0.01											
12-Jun-19	Total Dissolved Phosphorus (mg/L)								<0.01	<0.01								
1-Apr-19	Hydrogen Sulfide (mg/L)							0.02										
3-Apr-19	Hydrogen Sulfide (mg/L)									<0.02	<0.02							
6-May-19	Hydrogen Sulfide (mg/L)							0.09										
8-May-19	Hydrogen Sulfide (mg/L)									<0.02	<0.02							
10-Jun-19	Hydrogen Sulfide (mg/L)							<0.02										
11-Jun-19	Hydrogen Sulfide (mg/L)									<0.02	<0.02							
10-Jun-19	Selenium (mg/L)							<0.0005										

		Station Code	NNG01	R1	R2	R3	R4	R5	R6	R7	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
Date	**Parameters (Unit)**	**Guideline**																
11-Jun-19	Selenium (mg/L)			<0.0005	<0.0005	<0.0005	<0.0005									<0.0005		
12-Jun-19	Selenium (mg/L)								<0.0005	<0.0005	<0.0005							
13-Jun-19	Selenium (mg/L)		<0.0005												<0.0005			
14-Jun-19	Selenium (mg/L)											<0.0005	<0.0005	<0.0005			<0.0005	<0.0005
10-Jun-19	Alkalinity (mg/L)							55.5										
11-Jun-19	Alkalinity (mg/L)			67.3	62.5	51.9	44.8											
12-Jun-19	Alkalinity (mg/L)								53.1	66.1	57.8					51.9		
13-Jun-19	Alkalinity (mg/L)		80.2												30.7			
14-Jun-19	Alkalinity (mg/L)											56.6	31.9	31.9			74.3	16.5
10-Jun-19	Nitrite nitrogent (mg/L)														<0.02			
13-Jun-19	Nitrite nitrogent (mg/L)		<0.02															
14-Jun-19	Nitrite nitrogent (mg/L)											<0.02	<0.02	<0.02			<0.02	<0.02

APPENDIX 5-2: *EFFLUENT CAMP MONITORING RESULTS – Q2 2019*

		Site Name	Owner's Site Office and Village	Obayashi Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Lilama10 Camp	276 Camp
		Station Code	EF01	EF02	EF07	EF08	EF09	EF10	EF13	EF14	EF17	EF18
Date	Parameter (Unit)	Guideline in the CA										
05-Apr-19	pH	6.0-9.0	7.41	7.56	7.61		7.21	7.79	7.83	7.2		7.19
19-Apr-19	pH	6.0-9.0	7.31	7.5	7.44		7.2	7.99	7.48	6.84		6.94
03-May-19	pH	6.0-9.0	7.14	7.89	7.75		7.28	7.84	7.61	7.47		
16-May-19	pH	6.0-9.0	7.79	8.4	7.56			8.21	8.13	7.93		
06-Jun-19	pH	6.0-9.0	6.9	7.92	7.08			7.84	6.97	7.23		
20-Jun-19	pH	6.0-9.0	7.09	8.02				7.78	7.77			
05-Apr-19	Sat. DO (%)		29.1	69.6	47.6		36.1	106.8	94.9	65.2		75.9
19-Apr-19	Sat. DO (%)		65.4	88.3	82.4		30.8	141.6	96.5	70.9		55.9
03-May-19	Sat. DO (%)		66.5	92.5	69.4		23.6	125.8	77.4	74.5		
16-May-19	Sat. DO (%)		47.3	88.5	88.9			57	55.1	88.4		
06-Jun-19	Sat. DO (%)		51.6	65.8	63.4			62.5	72.3	31.8		
20-Jun-19	Sat. DO (%)		54	97.7				33.2	80.4			
05-Apr-19	DO (mg/l)		2.81	5.27	3.7		2.71	8.16	6.96	4.96		5.85
19-Apr-19	DO (mg/l)		4.52	6.43	6		2.24	10.43	7.06	5.06		4.23
03-May-19	DO (mg/l)		4.79	6.69	3.16		1.68	10.35	5.64	5.41		
16-May-19	DO (mg/l)		3.66	6.72	6.87			4.45	4.27	6.79		
06-Jun-19	DO (mg/l)		3.76	4.78	4.73			4.72	5.39	2.35		
20-Jun-19	DO (mg/l)		4	7.1				2.49	5.83			
05-Apr-19	Conductivity (µS/cm)		331	397	1,164		864	332	623	726		629
19-Apr-19	Conductivity (µS/cm)		339	322	1,252		679	291	551	543		404
03-May-19	Conductivity (µS/cm)		313	402	1,384		519	277	313	147		
16-May-19	Conductivity (µS/cm)		409	545	1,520			443	432	859		
06-Jun-19	Conductivity (µS/cm)		251	313	636			224	282	176		

Date	Parameter (Unit)	Site Name	Owner's Site Office and Village	Obayashi Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Lilama10 Camp	276 Camp
		Station Code	EF01	EF02	EF07	EF08	EF09	EF10	EF13	EF14	EF17	EF18
		Guideline in the CA										
20-Jun-19	Conductivity (µS/cm)		279	297				235	315			
05-Apr-19	TDS (mg/l)		165.5	198.5	582		432	166	311.5	363		629
19-Apr-19	TDS (mg/l)		169.5	161	626		339.5	145.5	275.5	271.5		404
03-May-19	TDS (mg/l)		165.5	201	692		259	138.5	156.5	73.3		314.5
16-May-19	TDS (mg/l)		204.5	272.5	760			221.5	216	429.5		202
06-Jun-19	TDS (mg/l)		125.5	156	318			112	141	88.2		
20-Jun-19	TDS (mg/l)		139.5	148.5				117.5	157.5			
05-Apr-19	Temperature (°C)		29.2	28.4	27.2		29	28.1	30.3	28.1		27.6
19-Apr-19	Temperature (°C)		33.1	30.3	30.5		30.7	29.8	30	31.3		28.3
03-May-19	Temperature (°C)		31	30.8	30		32.6	30.5	30.6	30.6		
16-May-19	Temperature (°C)		28.82	29.7	28.29			29.18	28.69	28.97		
06-Jun-19	Temperature (°C)		30.2	30.5	29.1			28.4	28.9	29.3		
20-Jun-19	Temperature (°C)		29	30.4				28.6	30.5			
05-Apr-19	Turbidity (NTU)		1.38	4.62	14.7		52.48	5.75	25.9	15.85		45.09
19-Apr-19	Turbidity (NTU)		1.23	3.84	11.28		30.95	7.08	34.58	12.38		58.43
03-May-19	Turbidity (NTU)		2.1	4.08	8.11		57.11	6.48	19.21	13.99		
16-May-19	Turbidity (NTU)		2.92	3.44	10.14			6.03	12.19	9.9		
06-Jun-19	Turbidity (NTU)		2.17	2.44	5.55			7.64	13.6	4.41		
20-Jun-19	Turbidity (NTU)		2.11	2.74				5.61	20.47			
05-Apr-19	TSS (mg/l)	<50	<5	<5	6.76		57.81	16.8	18.13	24.5		27.27
19-Apr-19	TSS (mg/l)	<50	<5	<5	9.52		36.81	20.34	21	21.66		34.23
03-May-19	TSS (mg/l)	<50	<5	5.73	11.75		11.75	12.36	19.72	<5		
16-May-19	TSS (mg/l)	<50	<5	<5	8.86			11.39	21	16.38		
06-Jun-19	TSS (mg/l)	<50	1	3.26	5.74			6.44	25.2	10.26		
20-Jun-19	TSS (mg/l)	<50	<5	<5				5.54	22.01			

		Site Name	Owner's Site Office and Village	Obayashi Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Lilama10 Camp	276 Camp
		Station Code	EF01	EF02	EF07	EF08	EF09	EF10	EF13	EF14	EF17	EF18
Date	Parameter (Unit)	Guideline in the CA										
05-Apr-19	BOD_5 (mg/l)	<30	<6	9.9	<6		<6	<6	<6	8.82		<6
19-Apr-19	BOD_5 (mg/l)	<30	<6	<6	<6		<6	7.17	<6	<6		21.78
03-May-19	BOD_5 (mg/l)	<30	<6	<6	<6		68.75	<6	46.76	<6		
16-May-19	BOD_5 (mg/l)	<30	<6	<6	<6			<6	52.94	<6		
06-Jun-19	BOD_5 (mg/l)	<30	<6	7.89	<6			<6	80.1	8.46		
20-Jun-19	BOD_5 (mg/l)	<30	37.95	<6				<6	105.5			
05-Apr-19	COD (mg/l)	<125	<25	25	46.8		165	37.8	123	117		133
19-Apr-19	COD (mg/l)	<125	<25	<25	39.4		130	35.4	127	91.6		112
03-May-19	COD (mg/l)	<125	<25	<25	25.8		174	<25	105	<25		
16-May-19	COD (mg/l)	<125	<25	<25	27.1			<25	133	52.3		
06-Jun-19	COD (mg/l)	<125	<25	<25	<25			<25	128	<25		
20-Jun-19	COD (mg/l)	<125	<25	<25				<25	125			
05-Apr-19	NH3-N (mg/l)	<10	9.7	14.1	21.9		36.5	2.3	21	<0.2		10.2
19-Apr-19	NH3-N (mg/l)	<10	5.1	7.7	14.5		39.4	<0.2	18.8	<0.2		8.4
03-May-19	NH3-N (mg/l)	<10	4.8	10.5	<0.2		47.3	<0.2	10.8	3.2		
16-May-19	NH3-N (mg/l)	<10	3.3	11.9	<0.2			3.3	12.4	<0.2		
06-Jun-19	NH3-N (mg/l)	<10	6.5	8.3	<0.2			2.8	11.8	2.3		
20-Jun-19	NH3-N (mg/l)	<10	7.5	<1.5				4.3	11.9			
05-Apr-19	Total Nitrogen (mg/l)	<10	12.7	15.3	28.1		38.1	8.83	21.7	4.81		11
19-Apr-19	Total Nitrogen (mg/l)	<10	8.69	8.25	15.7		41.6	1.45	19.4	1.47		10.2
03-May-19	Total Nitrogen (mg/l)	<10	25.3	16.3	3.3		49.8	2.82	12.6	5.25		
16-May-19	Total Nitrogen (mg/l)	<10	4.65	16.1	1.71			5.9	13.9	13.9		
06-Jun-19	Total Nitrogen (mg/l)	<10	11.8	12.3	1.45			3.42	13	12.8		
20-Jun-19	Total Nitrogen (mg/l)	<10	13.7	11.8				6.34	17.6			

		Site Name	Owner's Site Office and Village	Obayashi Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Lilama10 Camp	276 Camp
		Station Code	EF01	EF02	EF07	EF08	EF09	EF10	EF13	EF14	EF17	EF18
Date	Parameter (Unit)	Guideline in the CA										
05-Apr-19	Total Phosphorus (mg/l)	<2.0	0.92	0.99	1.02		1.5	0.18	1.06	0.68		0.8
19-Apr-19	Total Phosphorus (mg/l)	<2.0	0.78	0.96	1.38		1.8	0.11	1.53	0.48		0.7
03-May-19	Total Phosphorus (mg/l)	<2.0	0.64	0.81	0.7		1.58	0.15	0.47	0.27		
16-May-19	Total Phosphorus (mg/l)	<2.0	0.44	0.58	0.53			0.39	0.48	0.28		
06-Jun-19	Total Phosphorus (mg/l)	<2.0	0.41	0.57	0.32			0.22	0.17	0.1		
20-Jun-19	Total Phosphorus (mg/l)	<2.0	0.53	0.62				0.4	0.63			
05-Apr-19	Faecal Coliform (MPN/100 ml)	<400	49	79	0		0	0	0	0		0
19-Apr-19	Faecal Coliform (MPN/100 ml)	<400	1600	0	0		0	1600	0	0		0
03-May-19	Faecal Coliform (MPN/100 ml)	<400	130	0	0		1600	22	130	350		
16-May-19	Faecal Coliform (MPN/100 ml)	<400	540	0	0			17	16000	0		
06-Jun-19	Faecal Coliform (MPN/100 ml)	<400	40	4.5	0			22	5400	240		
20-Jun-19	Faecal Coliform (MPN/100 ml)	<400	350	0				170	1,600			
05-Apr-19	Total Coliform (MPN/100 ml)	<400	700	130	0		0	0	0	0		0

		Site Name	Owner's Site Office and Village	Obayashi Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Lilama10 Camp	276 Camp
		Station Code	EF01	EF02	EF07	EF08	EF09	EF10	EF13	EF14	EF17	EF18
Date	Parameter (Unit)	Guideline in the CA										
19-Apr-19	Total Coliform (MPN/100 ml)	<400	1600	7.8	0		0	1600	0	0		0
03-May-19	Total Coliform (MPN/100 ml)	<400	540	0	0		3500	33	920	350		
16-May-19	Total Coliform (MPN/100 ml)	<400	540	2	0			350	16000	0		
06-Jun-19	Total Coliform (MPN/100 ml)	<400	1600	34	0			350	5400	9200		
20-Jun-19	Total Coliform (MPN/100 ml)	<400	350	0				170	1600			
05-Apr-19	Oil & Grease (mg/l)	<10	<1.0	<1.0	<1.0		<1.0	<1.0	<1.0	<1.0		4
19-Apr-19	Oil & Grease (mg/l)	<10										
03-May-19	Oil & Grease (mg/l)	<10	<1.0	<1.0	<1.0		8	<1.0	4	<1.0		
16-May-19	Oil & Grease (mg/l)	<10										
06-Jun-19	Oil & Grease (mg/l)	<10	<1.0	<1.0	<1.0		<1.0	<1.0	<1.0	<1.0		
20-Jun-19	Oil & Grease (mg/l)	<10										
05-Apr-19	Residual Chlorine (mg/l)	<1.0		0.12	0.12		1.69	0.35	0.86	0.78		1.42
19-Apr-19	Residual Chlorine (mg/l)	<1.0		0.27	2.01		1.09	0.06	2.02	1.13		0.58
03-May-19	Residual Chlorine (mg/l)	<1.0		0.79	1.96		0.09	0.1	0.09	0		
16-May-19	Residual Chlorine (mg/l)	<1.0		0.55	2.19			0.12	0.03	2.1		
06-Jun-19	Residual Chlorine (mg/l)	<1.0		0.11	2.15			0.1	0.05	0		

		Site Name	Owner's Site Office and Village	Obayashi Camp	Song Da5 Camp No.1	Song Da5 Camp No.2	Zhefu Camp	V & K Camp	HM Main Camp	IHI Camp	Lilama10 Camp	276 Camp
		Station Code	EF01	EF02	EF07	EF08	EF09	EF10	EF13	EF14	EF17	EF18
Date	Parameter (Unit)	Guideline in the CA										
20-Jun-19	Residual Chlorine (mg/l)	<1.0		0.24				0.04	0.11			
05-Apr-19	Chlorination Dosing Rate (ml/mn)			85	45		3.1	18	40	35		20
19-Apr-19	Chlorination Dosing Rate (ml/mn)			76	13		1.5	20	30	20		20
03-May-19	Chlorination Dosing Rate (ml/mn)			109	120			2	5			
16-May-19	Chlorination Dosing Rate (ml/mn)			80	160			40	2	15		
06-Jun-19	Chlorination Dosing Rate (ml/mn)			30	250			25	4	0		
20-Jun-19	Chlorination Dosing Rate (ml/mn)			125				30	0.6			
05-Apr-19	Effluent Discharge Volume (L/mn)		12	30	30		4.2	6	30	4		4
19-Apr-19	Effluent Discharge Volume (L/mn)		6	20	2		0	5	6	6		4
03-May-19	Effluent Discharge Volume (L/mn)		6	12	3		2	1.6	6	1.2		
16-May-19	Effluent Discharge Volume (L/mn)		6	7.5	3			6	6	6		
06-Jun-19	Effluent Discharge Volume (L/mn)		12	4	6			6	30	4		
20-Jun-19	Effluent Discharge Volume (L/mn)		12	12				3	20			

APPENDIX 5-3: EFFLUENT CONSTRUCTION AREA DISCHARGED MONITORING RESULTS – Q2 2019

Date	Site Name	Parameter (Unit)	pH	Sat. DO (%)	DO (mg/L)	Conductivity (µS/cm)	TDS (mg/L)	Temperature (°C)	Turbidity (NTU)	TSS (mg/L)	Oil & Grease (mg/L)
		Standard	6.0 - 9.0							<50	<10
01-Apr-19	CVC Plant	DS03									
09-Apr-19	CVC Plant	DS03									
25-Apr-19	CVC Plant	DS03									
03-May-19	CVC Plant	DS03									
08-May-19	CVC Plant	DS03									
16-May-19	CVC Plant	DS03									
23-May-19	CVC Plant	DS03									
30-May-19	CVC Plant	DS03									
07-Jun-19	CVC Plant	DS03									
13-Jun-19	CVC Plant	DS03									
20-Jun-19	CVC Plant	DS03									
27-Jun-19	CVC Plant	DS03									
01-Apr-19	Spoil Disposal No.2	DS04	6.62	55.4	4.4	63.2	31.5	29.6	21.05	16.9	
09-Apr-19	Spoil Disposal No.2	DS04	6.19	61.1	4.69	74.4	37.2	27.9	28.77	12.88	<1
25-Apr-19	Spoil Disposal No.2	DS04	6.32	54.9	4.28	57.2	28.6	26.7	13.64	20.75	
03-May-19	Spoil Disposal No.2	DS04	6.82	60.4	4.47	67.5	33.5	29.3	12.09	11.51	
08-May-19	Spoil Disposal No.2	DS04	6.84	46.3	3.66	98.3	49.1	25.8	173	179.51	<1
16-May-19	Spoil Disposal No.2	DS04	7.02	62.4	5.03	69	34.5	26.89	6.49	4.1	
23-May-19	Spoil Disposal No.2	DS04	6.82	53.9	4.17	51.3	25.65	26.9	6.38	9.77	
30-May-19	Spoil Disposal No.2	DS04	6.43	51.5	3.88	82.3	41.15	27.9	40.7	42.12	
07-Jun-19	Spoil Disposal No.2	DS04	6.78	59.4	4.65	32.6	16.3	26.3	16.01	14.54	
13-Jun-19	Spoil Disposal No.2	DS04	7.24	65.8	5.39	39	19.5	25.75	17.8	24.69	<1

Date	Site Name	Parameter (Unit)	pH	Sat. DO (%)	DO (mg/L)	Conductivity (µS/cm)	TDS (mg/L)	Temperature (°C)	Turbidity (NTU)	TSS (mg/L)	Oil & Grease (mg/L)
		Standard	6.0 - 9.0							<50	<10
20-Jun-19	Spoil Disposal No.2	DS04	6.79	73.4	5.52	23	11.5	28.3	14.81	9.94	
27-Jun-19	Spoil Disposal No.2	DS04	6.71	82.8	6.49	23	11.5	26.2	21.03	22.04	

APPENDIX 5-4: ***GROUNDWATER QUALITY MONITORING RESULTS – Q2 2019***

		Site Name	Somseun Village	NamPa Village	ThongNoy Village	Pou Village
Month Year	Parameter (Unit)	Station	GSXN01	GNPA01	GTHN01	GPOU01
		Guideline				
02-Apr-19	pH	6.5 - 9.2				7.62
09-Apr-19	pH	6.5 - 9.2	7.92	7.05	6.78	
07-May-19	pH	6.5 - 9.2				7.61
24-May-19	pH	6.5 - 9.2	7.71	7.21	7.19	
13-Jun-19	pH	6.5 - 9.2				7.17
18-Jun-19	pH	6.5 - 9.2	7.94	7.54	7.47	
02-Apr-19	Sat. DO (%)					87
09-Apr-19	Sat. DO (%)		86.7	84.8	75.5	
07-May-19	Sat. DO (%)					85.8
24-May-19	Sat. DO (%)		90.8	89.7	81.4	
13-Jun-19	Sat. DO (%)					94.5
18-Jun-19	Sat. DO (%)		81.1	97	81.7	
02-Apr-19	DO (mg/l)					6.49
09-Apr-19	DO (mg/l)		6.6	6.35	5.36	
07-May-19	DO (mg/l)					6.28
24-May-19	DO (mg/l)		7.41	6.91	6.06	
13-Jun-19	DO (mg/l)					6.8
18-Jun-19	DO (mg/l)		6.27	7.53	6.19	
02-Apr-19	Conductivity (µS/cm)					25.9
09-Apr-19	Conductivity (µS/cm)		272	332	355	
07-May-19	Conductivity (µS/cm)					24.3
24-May-19	Conductivity (µS/cm)		326	272	291	
13-Jun-19	Conductivity (µS/cm)					12.28
18-Jun-19	Conductivity (µS/cm)		308	244	270	
02-Apr-19	TDS (mg/l)					12.95
09-Apr-19	TDS (mg/l)		136	166	177.5	
07-May-19	TDS (mg/l)					12.15
24-May-19	TDS (mg/l)		163	136	145.5	
13-Jun-19	TDS (mg/l)					6.14
18-Jun-19	TDS (mg/l)		154	122	135	
02-Apr-19	Temperature (°C)					28.3
09-Apr-19	Temperature (°C)		28.1	28.7	31.2	
07-May-19	Temperature (°C)					29

Month Year	Parameter (Unit)	Site Name / Station / Guideline	Somseun Village GSXN01	NamPa Village GNPA01	ThongNoy Village GTHN01	Pou Village GPOU01
24-May-19	Temperature (°C)		24.7	27.5	28.4	
13-Jun-19	Temperature (°C)					29.9
18-Jun-19	Temperature (°C)		27.1	26.9	28.2	
02-Apr-19	Turbidity (NTU)	<20				2.34
09-Apr-19	Turbidity (NTU)	<20	1.57	0.93	1.8	
07-May-19	Turbidity (NTU)	<20				2.83
24-May-19	Turbidity (NTU)	<20	1.54	1.4	1.32	
13-Jun-19	Turbidity (NTU)	<20				1.76
18-Jun-19	Turbidity (NTU)	<20	1.71	1.65	4.02	
02-Apr-19	Fecal coliform (MPN/100ml)	0				0
09-Apr-19	Fecal coliform (MPN/100ml)	0	7.8	0	13	
07-May-19	Fecal coliform (MPN/100ml)	0				0
24-May-19	Fecal coliform (MPN/100ml)	0	0	0	0	
13-May-19	Fecal coliform (MPN/100ml)	0				0
18-Jun-19	Fecal coliform (MPN/100ml)	0	2	2	240	
02-Apr-19	E.coli Bacteria (MPN/100ml)	0				0
09-Apr-19	E.coli Bacteria (MPN/100ml)	0	4.5	0	4.5	
07-May-19	E.coli Bacteria (MPN/100ml)	0				0
24-May-19	E.coli Bacteria (MPN/100ml)	0	0	0	0	
13-Jun-19	E.coli Bacteria (MPN/100ml)	0				0
18-Jun-19	E.coli Bacteria (MPN/100ml)	0	2	2	240	

APPENDIX 5-5: *GRAVITY FED WATER SUPPLY MONITORING RESULTS – Q2 2019*

		Site Name	Thaheau Village	Hat Gnuin Village	Phouhomxay Village		
		Station	WTHH02	WHGN02	WPHX01	WPHX02	WPHX03
Date	Parameter (Unit)	Guideline					
09-Apr-19	pH	6.5 - 8.6	6.58	6.74	7.92	7.56	7.28
24-May-19	pH	6.5 - 8.6	6.97	6.94	8.81	7.78	7.67
18-Jun-19	pH	6.5 - 8.6	8.51	8.56	8.65	8.82	8.57
09-Apr-19	Sat. DO (%)		102.9	100.1	90.7	92.8	90.8
24-May-19	Sat. DO (%)		80.7	97.7	97.3	97.6	98.4
18-Jun-19	Sat. DO (%)		97	102.7	101.7	100.5	101.2
09-Apr-19	DO (mg/l)		7.4	7.36	7.08	7.02	6.85
24-May-19	DO (mg/l)		6.17	7.52	7.57	7.47	7.5
18-Jun-19	DO (mg/l)		7.4	7.94	8.12	7.77	6.08
09-Apr-19	Conductivity (µS/cm)	<1,000	54.8	71.5	19.03	19.9	19.48
24-May-19	Conductivity (µS/cm)	<1,000	58.5	76.4	8.81	7.84	7.52
18-Jun-19	Conductivity (µS/cm)	<1,000	35.2	55.3	9.04	6.87	6.08
09-Apr-19	TDS (mg/l)	<600	27.4	35.8	9.5	9.9	9.7
24-May-19	TDS (mg/l)	<600	29.2	38.2	4.4	3.9	3.7
18-Jun-19	TDS (mg/l)	<600	17.6	27.65	4.52	3.43	3.04
09-Apr-19	Temperature (°C)	<35	29.8	29.3	26.5	28.5	28.6
24-May-19	Temperature (°C)	<35	28.1	27.6	26.6	27.7	27.9
09-Apr-19	Turbidity (NTU)	<10	2.18	2.44	1.26	1	0.96
24-May-19	Turbidity (NTU)	<10	1.86	1.31	1.08	1.35	1.33
18-Jun-19	Turbidity (NTU)	<10	17.81	9.77	4.79	1.72	2.48
09-Apr-19	Faecal Coliform (MPN/100ml)	0	79	130	540	79	79
24-May-19	Faecal Coliform (MPN/100ml)	0	13	26	79	27	11
18-Jun-19	Faecal Coliform (MPN/100ml)	0	1,600	1,600	140	33	110
09-Apr-19	E.coli Bacteria (MPN/100ml)	0	47	22	240	33	33
24-May-19	E.coli Bacteria (MPN/100ml)	0	13	17	49	14	11
18-Jun-19	E.coli Bacteria (MPN/100ml)	0	1,600	350	140	33	110
18-Jun-19	Arsenic (mg/l)	<0.05	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
18-Jun-19	Fluoride (mg/l)	<1.5	0.18	0.18	0.2	0.19	0.18
18-Jun-19	Nitrate (mg/l)	<50	<0.09	<0.09	0.13	<0.09	<0.09
18-Jun-19	Nitrite (mg/l)	<3	<0.02	<0.02	<0.02	<0.02	<0.02
18-Jun-19	Total hardness (mg/l)	<300	41.8	47.5	12.9	18.5	16.1
18-Jun-19	Selenium (mg/l)	<0.01	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

18-Jun-19	Mercury (mg/l)	<0.001	<0.0002	<0.0002	0.0002	0.0002	<0.0002

APPENDIX 5-6: *LANDFILL LEACHATE MONITORING RESULTS – Q2 2019*

		Site Name	NNP1 Landfill Leachate					Houay Soup Landfill	
		Location	Pond No.01	Pond No.02	Pond No.03	Pond No.04	Discharge Point	Last pond	Discharged Point
		Station	LL1	LL2	LL3	LL4	LL5	LL6	LL7
Date	Parameter (Unit)	Guideline							
16-May-19	pH	6.0-9.0				9.66		8.6	
6-Jun-19	pH	6.0-9.0				8.93		8.98	
16-May-19	Sat. DO (%)					126.2		101.6	
6-Jun-19	Sat. DO (%)					131.5		160.9	
16-May-19	DO (mg/l)					9.6		7.59	
6-Jun-19	DO (mg/l)					8.8		10.84	
16-May-19	Conductivity (µS/cm)					191		284	
6-Jun-19	Conductivity (µS/cm)					105.4		212.3	
16-May-19	TDS (mg/l)					95.5		142	
6-Jun-19	TDS (mg/l)					52.7		106.15	
16-May-19	Temperature (°C)					29.43		29.36	
6-Jun-19	Temperature (°C)					33.5		32.7	
16-May-19	Turbidity (NTU)					23.13		11.53	
6-Jun-19	Turbidity (NTU)					21.88		11.85	
16-May-19	BOD (mg/l)	<30				17.82		11.88	
6-Jun-19	BOD (mg/l)	<30				12.45		21.36	
16-May-19	COD (mg/l)	<125				158		168	
6-Jun-19	COD (mg/l)	<125				68		130	
16-May-19	Faecal Coliform (MPN/100ml)					220		540	
6-Jun-19	Faecal Coliform (MPN/100ml)	<400				350		1,600	
16-May-19	Total Coliform (MPN/100ml)	<400				1,600		1,600	
6-Jun-19	Total Coliform (MPN/100ml)	<400				9,200		5,400	
6-Jun-19	Mercury (mg/l)					<0.0005		<0.0005	
6-Jun-19	Total nitrogen (mg/l)	<10				0.890		1.080	
6-Jun-19	Arsenic (mg/l)					0.001		0.0013	
6-Jun-19	Lead (mg/l)	<0.2				<0.010		<0.010	
6-Jun-19	Iron (mg/l)					0.76		1.34	
6-Jun-19	Total Petroleum Hydrocarbons (mg/l)					<1		<1	