Environmental Monitoring Report

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23 March 2017

Nam Ngiep 1 Hydropower Project
(Lao People's Democratic Republic)

Quarterly Monitoring Report 2016 – Q4 Environmental

Prepared by Nam Ngiep 1 Power Company Limited for the Asian Development Bank

NAM NGIEP 1
POWER COMPANY

Nam Ngiep 1 Hydropower Project

Environment Monitoring Report

Fourth Quarter of 2016

October to December 2016

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A1	07 February 2017				Sent to ADB for review
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☐	Confidential

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ABBREVIATIONS / ACRONYMS

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

HMWC	Hydraulic Metal Works Contract
HR	Human Resources
IEE	Initial Environmental Examination
IMA	Independent Monitoring Agency
INRMP	Integrated Natural Resources Management Plan
ISP	Intergraded Spatial Planning
km	kilometre
kV	kilo-Volt
LTA	Lender's Technical Advisor
M	million
m	metre
MEM	Ministry of Energy and Mines, Lao PDR
MOF	Ministry of Finance, Lao PDR
MOM	Minutes of Meeting
MONRE	Ministry of Natural Resource and Environment, Lao PDR
MOU	Memorandum of Understanding
NBCA	National Biodiversity Conservation Area
NCR	Non-Compliance Report
NN2	Nam Ngum 2 Power Company Limited
NNP1PC	Nam Ngiep 1 Power Company Limited
NPF	National Protection Forest
OC	Obayashi Corporation
ONC	Observation of Non-Compliance
PONRE	Provincial Department of Natural Resource and Environment, MONRE
PvPA	Provincial Protection Area
RCC	Roller Compacted Concrete
ROW	Right of Way
SIR	Site Inspection Report
SLBMP	Salvage Logging Biomass Management Plan
SMO	Social Management Office of ESD within NNP1PC
SS-ESMMP	Site Specific Environmental and Social Monitoring and Management Plan
TD	Technical Division of NNP1PC
TOR	Terms of Reference
TSS	Total Suspended Solids
UXO	Unexploded Ordinance
WMF	Watershed Management Fund

WMP	Watershed Management Plan
WRPC	Watershed and Reservoir Protection Committee
WRPO	Watershed and Reservoir Protection Office
WWTS	Waste Water Treatment System

1. EXECUTIVE SUMMARY

In September 2016, NNP1PC completed the draft updated Environmental and Social Management and Monitoring Plan for the Construction Phase (ESMMP-CP) and submitted it to the Department of Environmental and Social Impact Assessment (DESIA), Ministry of Natural Resources and Environment (MONRE), the Independent Monitoring Agency (IMA), the Lender's Technical Adviser and ADB for their review. A consultation workshop on the draft updated ESMMP-CP was organized in Vientiane on 14 September 2016 with concerned agencies of the Government of Lao PDR (GOL). The workshop was attended by representatives of DESIA, Department of Energy Business (DEB, Ministry of Energy and Mines), IMA and Provincial Department of Natural Resources and Environment (PONRE) from Xaysomboun and Bolikhamxay Provinces. MONRE submitted their official comments to NNP1PC in October 2016. NNP1PC is finalizing this document for submission to MONRE in early 2017.

During the Fourth Quarter of 2016, NNP1PC-EMO reviewed 26 SS-ESMMPs and one Contractor's ESMMP. Out of these, 22 SS-ESMMPs and one ESMMP were approved and four SS-ESMMPs are under review and carried over to first quarter of 2017.

A total of 36 Observations of Non-Compliances (ONCs), two Non-Compliance Level-1 and one Non-Compliance level-2 were recorded and considered as active during the Fourth Quarter of 2016. Out of these, 13 ONCs and one NCR were carried over from the previous Quarter; 23 ONCs and one NCR were newly issued. The issued NCR level-1 was related to hazardous material management and the NCR-level-2 was related to the sediment control at the Aggregate Crushing Plant. A total of 14 ONCs, one NCR level-1 and one NCR level-2 were not resolved in this Quarter and will be carried forward into the First Quarter of 2017.

During October to December 2016, an amount of approximately 530 m^3 of solid waste was disposed at the NNP1 Project landfill. In addition, a total of 11,261 kg of food waste from Owner's Site Office and Village and Contractors' camps were collected by the villagers from Hatsaykham for use as animal feed.

In October 2016, the construction of NNP1PC's laboratory was commenced at the Owner's Site Office and Village Compound. Once it is completed, the laboratory will be able to provide basic water quality analyses (Total Coliforms, E. Coli, Biochemical Oxygen Demand (BOD_5), and Total Suspended Solid (TSS). By the end of December 2016, the construction progress was 35% and the construction is expected to be completed by the end of February 2017. Meanwhile, in the second week of December 2016, laboratory equipment was purchased and delivered to Owner's Site Office and Village. A training for water samples analysis and laboratory management was held during 13 – 19 December 2016 by Environmental Training and Utilities Company Limited (ETU), Bangkok, Thailand. A total of four NNP1PC–EMO staff and four representatives from EMUs of Xaysomboun and Bolikhamxay Provinces participated in this training.

The compliance monitoring conducted during this Quarter confirmed that all construction camps, excluding the Owner's Site Office and Village, continued to have higher concentrations of total coliforms than the allowable effluent standard. However, improvements of the Wastewater Treatment Systems (WWTS) are progressing. By the end of December 2016, WWTS at the new Kenber Camp, IHI Camp, Song Da 5 Camp No. 1 and No. 2 were completed in accordance with the conceptual design prepared by the external consultant, and the NNP1PC Instruction Letter (reference No. NNP1/0750-016/OBA/EPC-CE dated 12 October 2016) and the design drawings that were cleared by NNP1PC in November 2016. The principle Contractors have agreed to try to complete the improvement of WWTS for the remaining camps by the end of February 2017.

The overall progress of the Nam Ngiep 1 Watershed Management Plan (WMP) development was acknowledged as positive by the multiple mission of ADB, IAP, LTA, and BAC in December 2016. The preparation continued with a focus on finalizing Section 7 (Baseline and Trend Analysis) and improving

Section 8 (Watershed Management Issues and Actions) including further analysis on the information collected concerning the socio-economic and land-use practices from 14 villages within the NNP1 watershed. The December 2016 mission further recommended that consultation with GoL agencies is a high priority and should take place soon.

In the first week of December 2016, the biodiversity consultant hired by ADB submitted a preliminary report on the findings of a biodiversity survey of the Nam Chouan—Nam Xang watershed area. The report recommends that in order to meet the biodiversity related obligations of the Concession Agreement it is important to involve an experienced biodiversity conservation organisation from the very early stages of project planning and implementation. The report further recommends to include additional areas of higher long-term biodiversity significance, and to consider investment in additional offset sites and/or other offset options.

In the second week of December 2016, ADB provided comments to the Terms of Reference for the preparation of the Biodiversity Offset Management Plan (BOMP) and the procurement process will be started in January 2017.

As of 31 December 2016, biomass clearance was completed for around 372 ha representing 61% of the target for 2016. The IAP/LTA mission in December 2016 strongly recommended NNP1PC and its biomass contractor to put more effort into settling the issues with local GOL and communities such as how to deal with the remaining trees with diameter greater than 20 cm and the compensation that has delayed the progress of biomass clearance.

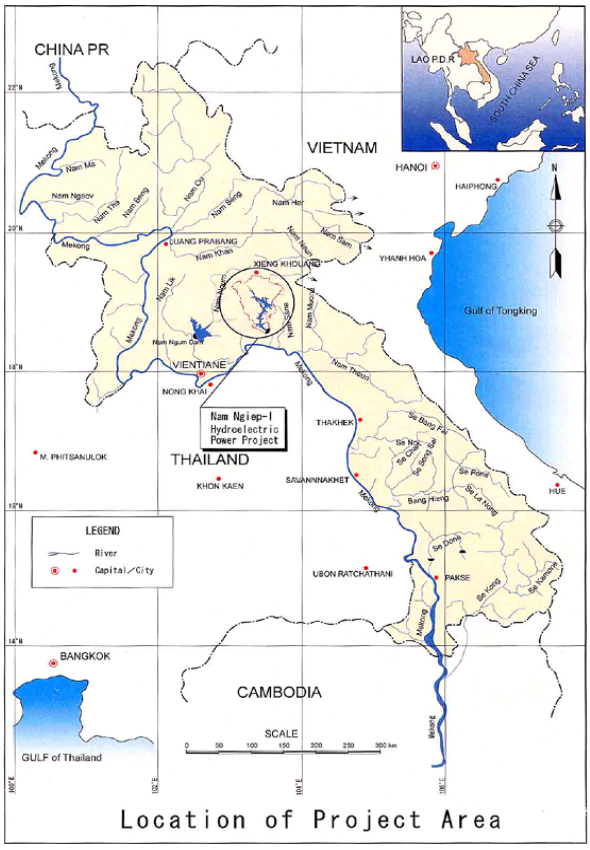
The fishery monitoring programme is progressing, and a database has been developed to support the future fish management programme as part of the in Nam Ngiep 1 Watershed Management Plan. Two types of surveys were conducted during December 2016 including daily fish catch logbook monitoring and community interviews. The gathered information is being put into the database. The data from the daily fish catch logbook monitoring indicates that the mean daily fish catch in the Nam Ngiep River was 2 kg/household/day in November 2016. The estimated total fish catch in the Nam Ngiep basin for November 2016 is 25,000 kg. Around 63% of the catch was sold, 26% was consumed fresh, 7% processed and approximately 4% was used for other purposes.

2. INTRODUCTION

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

The project is constructing two dams. The main dam, which is located 9 km upstream of Hat Gnuin Village in Bolikhan District, will create a 70-km-long, narrow reservoir that extends up the Ngiep Valley as far as Thathom District. At almost 150 m high, the main dam will be the second largest in Lao PDR. The power station at this dam will generate up to 272 MW of electricity for export to Thailand. With a combined capacity of 290 MW, Nam Ngiep 1 will generate around 1,620 GWh of electricity annually. Two transmission lines will be required to transport the electricity generated by the Project. From the main power station, a 230 kV Transmission Line will run for 125 km to the Nabong substation outside Vientiane Capital. An 115 kV Transmission Line will be constructed by EDL from the Re-Regulating Power Station to Pakxan substation over a distance of 40 km.

Figure 2-1: Project Location



This Quarterly Monitoring Report provides a summary of environmental management and monitoring activities from 01 October to 31 December 2016. The report was prepared by the Project's Environmental Management Office (EMO). It has been internally reviewed and cleared by EMO senior technical staff and management prior to submitting the report to the Lenders' Technical Adviser (LTA) and ADB.

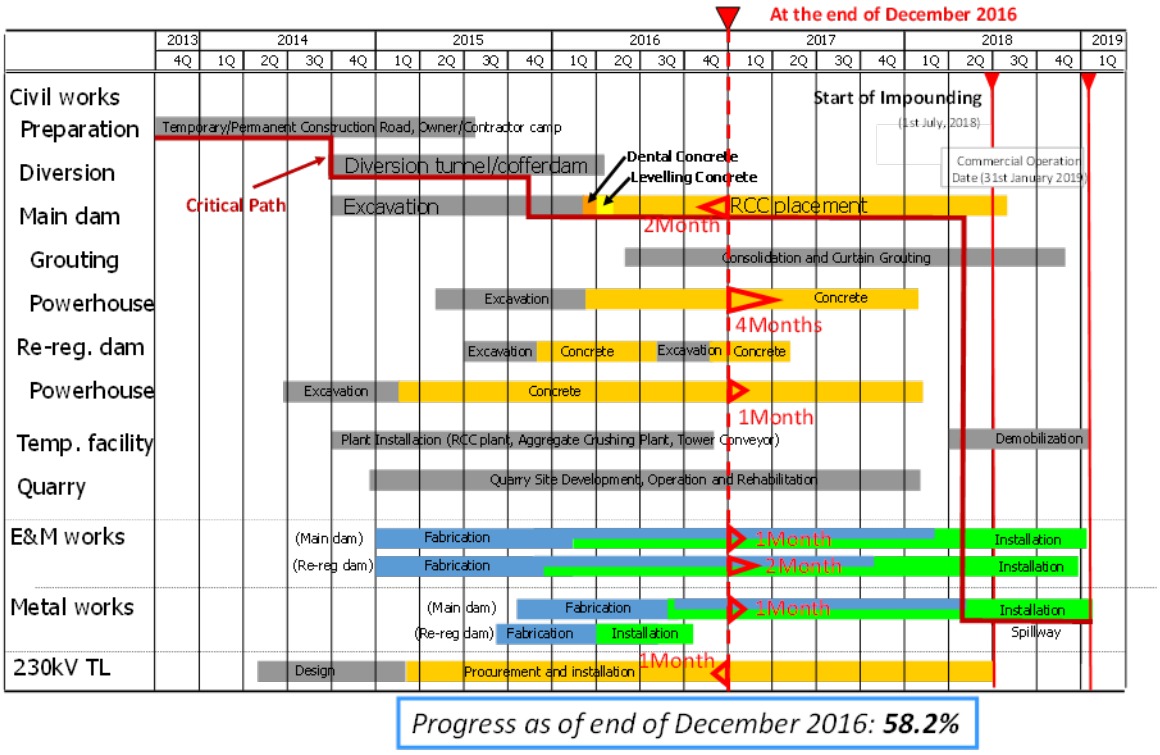
The Quarterly Monitoring Report and other related reports, including the Site-Specific Environmental and Social Monitoring and Management Plans (SS-ESMMPs), are publicly disclosed on NNP1PC's website http://namngiep1.com/. Hard copies of these reports are also available upon written request to the Project's main office in Vientiane Capital and at the field office in Pakxan, Bolikhamxay Province.

3. CONSTRUCTION PROGRESS

Construction Works for the Project are being carried out through four separate main construction contracts. These are the Civil Works, the Electrical and Mechanical Works, the Hydro-Mechanical Works and the 230 kV Transmission Line Works. Actual overall cumulative work progress until the end

of December 2016 was 58.2%[1] (compared to planned progress of 57.2%). The main construction activities and respective progress made from the Fourth Quarter 2013 to December 2016 are shown in **Figure 3-1**.

Figure 3-1: Overall Construction Progress up to the end of December 2016



Excavation works of the main dam, the diversion tunnel, and the re-regulation dam were commenced in October 2014 and completed in February 2016. Accordingly, the concreting work has commenced.

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

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

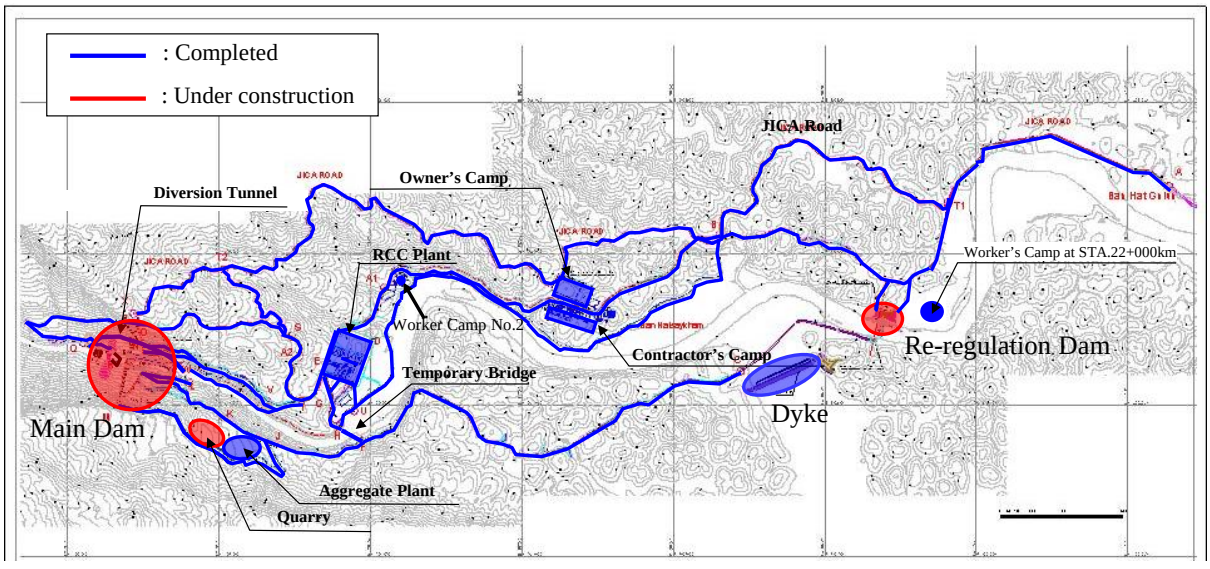
The cumulative actual work progress of the Civil Works until the end of December 2016 was 59.7% (compared to planned progress of 58.1 %).

The Civil Works overall can be considered to be on or ahead of schedule despite increased quantities of dam excavation and slope stabilisation and additional RCC placed in the shear key. The complex bedding of hard over soft layers of rock and the folding nature of these layers in the foundation rock of the main dam below the old river bed had created difficulty to finalise the foundation design to the satisfaction of the Dam Safety Review Panel in all respects. Accordingly, further review of the dam foundation design was carried out to create sufficient safety factor for stability against sliding of the dam on the weak zones. This resulted in further excavation and concreting of a shear key structure in the old river bed, taking the dam height to 167 m, measured from the deepest excavation level to the crest level, some 19 m higher than anticipated. The original schedule is maintained as a result of the combined efforts of the Owner, the Owner's Engineer and all the principal Contractors and Subcontractors. The additional excavation works were completed at the end of February 2016 and RCC consolidation grouting and RCC placement for the main dam were commenced on 10 and 21 May 2016 respectively. In the last wet season progress of RCC placement has been frequently interrupted by rain, sometimes heavy. In addition, the fly ash supply issue made progress slower with concrete reaching an elevation of El. 209.2 m only by the end of December 2016

3.1 Access Roads

All main access road construction works were completed following an early December 2013 start, and maintenance of these continues during the 2016 wet season. Temporary access roads are constructed to reach the various construction activities and others will be developed or modified as is necessary as activities change to reach current or new areas of dam concreting and consolidation grouting, the upstream and downstream cofferdams and the main powerhouse and belt conveyor support tower foundations. The layout of the access road system is as shown in **Figure 3-2** below:

Figure 3-2: Access Road Progress



3.2 Main Quarry

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

The quarry as originally conceived will not yield enough rock material of the required specification to complete all RCC and CVC concrete works for the Project. The quarry has therefore been extended as

indicated on the map in **Figure 3-3** and an additional quarry license has been obtained from Bolikhamxay Province. The extension area is within the designated area of the Concession Agreement.

The impact assessment in the approved EIA covers the extended area so further environmental assessments and approvals are not required. The surface clearing, topsoil and overburden removal works at the extension area was completed in December 2016 and preparation of blasting works is on-going.

Figure 3-3: Works at Quarry Extension Area

3.3 Main Dam and Power House

The dental concreting works were commenced in March 2016, and conventional RCC leveling concrete placement for the main dam in the 'shear key' structure up to El. 170.5 m was completed at the beginning of May. Consolidation grouting at the main dam area was commenced on 10 May 2016 and RCC concrete placement for the main dam body was commenced on 21 May 2016. Consolidation grouting covers the whole footprint of the main dam and RCC concrete placement and consolidation grouting is implemented in parallel, section by section.

The consolidation drilling and grouting for the main dam started in May 2016 and is ongoing. The progress is 66 % by achievement of total anticipated drilled length at the end of December 2016 as a proportion of the total expected drilling shown in **Table 3-1** below.

Table 3-1: Progress of Consolidation drilling and grouting at *as of 23 December 2016*

Item	Total Anticipated Drilling (m)	Completed (m)	Progress (%)
Consolidation Grouting	16,510	10,894	66.0
Curtain Grouting	27,945	240	< 1

Powerhouse excavation works were completed in January 2016 and leveling concreting works was started in coordination with the installation of the grounding system. The progress of the concreting works is proceeding well and is shown in **Table 3-2** below.

Table 3-2: Progress of the Main Powerhouse Structural Concrete Works to *23 December* 2016

Location	Total Anticipated Volume (m^3)	Completed (m^3)	Progress (%)
Main Powerhouse	32,600	20,000	61
Penstock Embedment	6,977	5,266	75

3.4 Secondary Upstream Cofferdam and RCC Trial Embankment

The concrete placement works in both conventional and roller compacted concrete (CVC and RCC respectively) for the secondary upstream cofferdam were started in November 2015 and completed

ahead of construction schedule in the middle of February 2016. The grout curtain works for this cofferdam were completed on 02 April 2016.

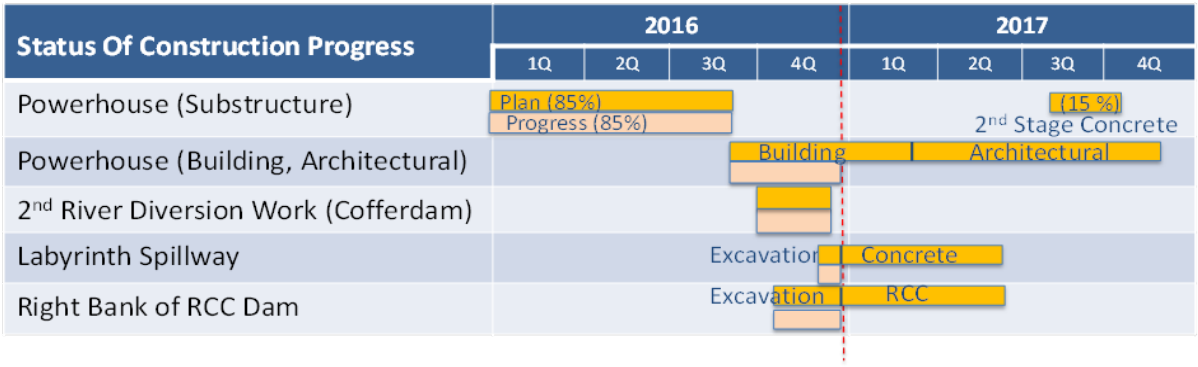
The RCC trial embankment was anticipated to be carried out during and as part of the dike construction, originally intended to be an RCC structure. However, this was not possible as it was found to be more economical to construct the dike as an earth fill embankment. The trial embankment was then necessarily constructed in isolation laboratory and close to the RCC plant in October and November 2015. Once finished the construction of the left bank structure of the re-regulating dam started soon after in November 2015 and was substantially complete in March 2016. In November 2015, the secondary upstream cofferdam was also constructed in RCC and it was completed, in February 2016. Both structures allowed valuable practical construction experience to be had in this means of concrete placement, ahead of the main dam concreting.

3.5 Re-Regulation Dam

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

Structural concrete works were commenced in March 2015, in coordination with the installation of the grounding system. The progress of structural concrete works is shown below.

Figure 3-4: Progress of Re-regulation Dam Structural Concrete Works to 30 December 2016



Structure	Civil Structure	Spillway			Building			Excavation			Left Bank Backfill
	Intake + PH + Tailrace	Right bank side concrete	Concrete Apron	Downstream Riprap Stone	Column	Beam	Block Wall over El.177	Right Bank RCC Area		River bed	Powerhouse and Switch Yard
	(m3)	(m3)	(m3)	(m3)	(m3)	(m3)	(m2)	Soil (m3)	Rock (m3)	(m3)	(m3)
Design	26,549	17,515	471	1,890	136	40	2,010	9,378	1,083	3,375	45,000
Completed	24,748	90	0	1,890	136	40	70	9,378	1,083	3,375	42,000
Progress %	**93**	**1**	**0**	**100**	**100**	**100**	**3**	**100**	**100**	**100**	**93**

The powerhouse concreting has advanced well and secondary concrete embedment for the draft tube liner was completed at the end of April 2016. The left bank structure was re-designed as roller compacted concrete (RCC) and was completed on 18 March 2016. Installation of the re-regulation waterway gate and stop log and re-regulation intake gate and structural concrete works for the retaining wall to support the substation yard were completed in October 2016. Building superstructure work continued for the powerhouse with the commencement of construction of concrete columns.

The excavation works at the left bank for the labyrinth weir portion of the dam and the left bank embankment structure in RCC were started and finished in October 2015 and March 2016 respectively. The shaping of the excavation at the re-regulating dam for the right bank embankment structure in RCC was carried out starting in September 2016 and completed in the beginning of December 2016,

the overburden excavation being complete in December 2016 accordingly. The right bank structure was also re-designed as roller compacted concrete (RCC) and will be commenced soon.

The dyke, constructed as an earth fill saddle dam embankment on the right bank near the Houay Soup Resettlement Area, was also started in November 2015 and completed on 30 April 2016.

Biomass clearing works at the area to be submerged by the re-regulation reservoir impounding will be commenced in January 2017.

3.6 Disposal Areas and Solid Waste Landfill Areas

Disposal Area No.6 on the right bank has been available for operation since January 2015, as was the adjacent waste Disposal Area No.9. Disposal Area No.9 along Road P1 near the entrance of Road T5 started operation in April 2015. Unsuitable material from the quarry continues to be hauled to Disposal Area No.6 and Disposal Area No.9 is being developed by the E&M Contractor as stated above.

The solid waste landfill adjacent to Disposal Area No.6 was extended after bulk excavation was carried out by the Civil Works Contractor in December 2015. Following redesign, construction documents were issued for bidding to interested contractors for permanent pit and leachate pond construction in early Q1 of 2016. The Lao local contractor was appointed and their work to complete the waste landfill was commenced in April 2016 and substantially completed in July 2016. This Contractor is following on with a second solid waste landfill construction contract for the Houay Soup Resettlement Area and Phase 1 of that is completed in October 2016.

3.7 230 kV Transmission Line

The Transmission Line Contract was executed between Loxley-Sri Consortium and NNP1PC on 11 July 2014 and on 03 October 2014, the NTP was issued to the contractor. The cumulative work progress of the Transmission Line Works until the end of November 2016 was 67.9% (compared to planned progress of 69.8%). The Transmission Line works is about 1 month ahead of planned by value as the procurement of material forms a large part of the payment to-date and this is ahead of schedule. Due to the fact that the actual tower foundation work and erection are behind schedule, work is being undertaken to ensure that stringing will commence in October 2016 and will be completed 3 months before COD.

Figure 3-5: Cumulative Work Progress of Tower Foundation (Original Planned and Actual)

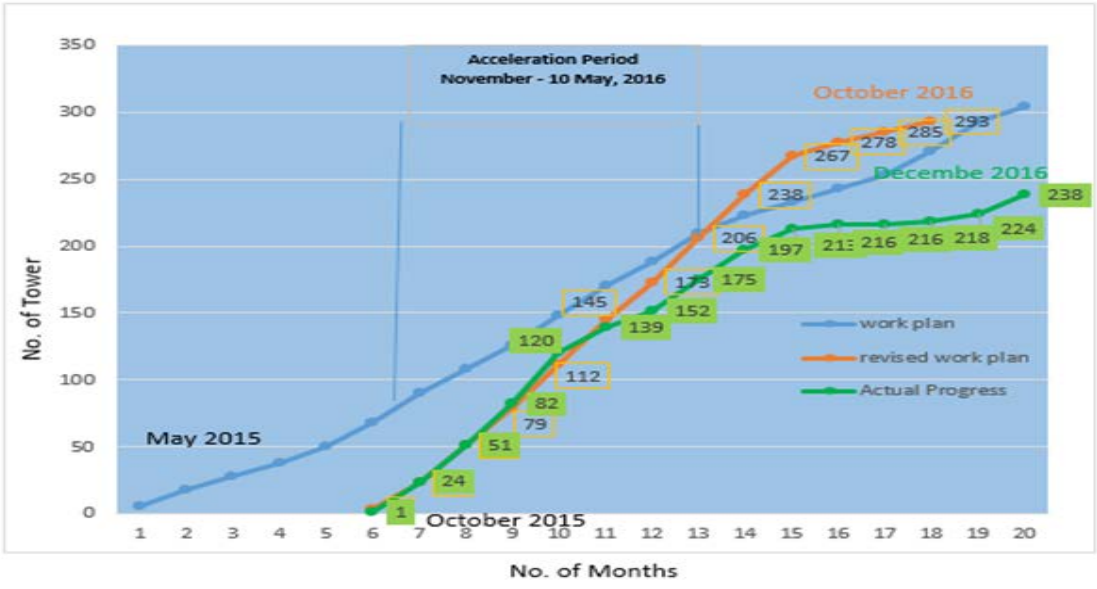


Figure 3-6: Cumulative Works Progress of tower foundation (Revised Planned & Actual)

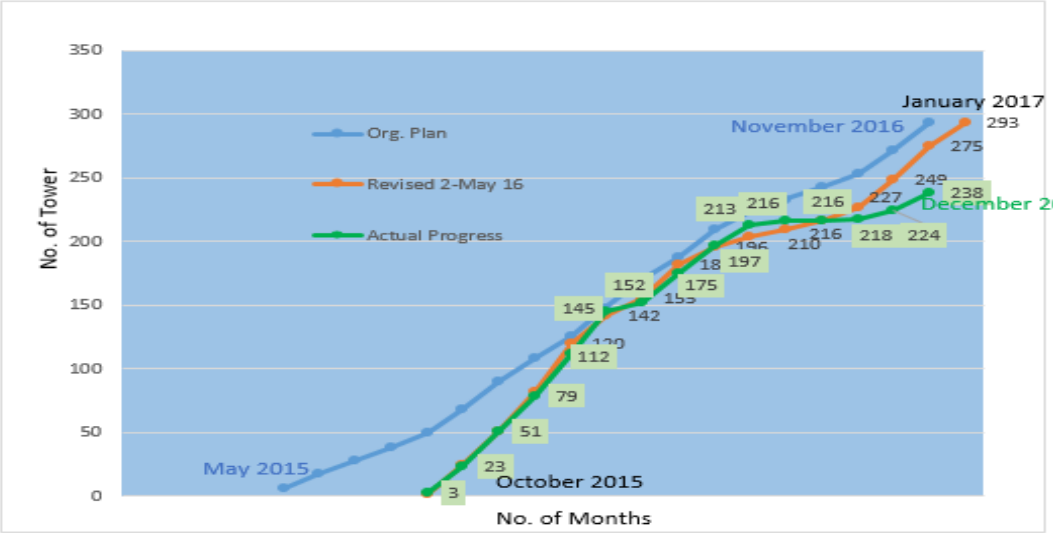
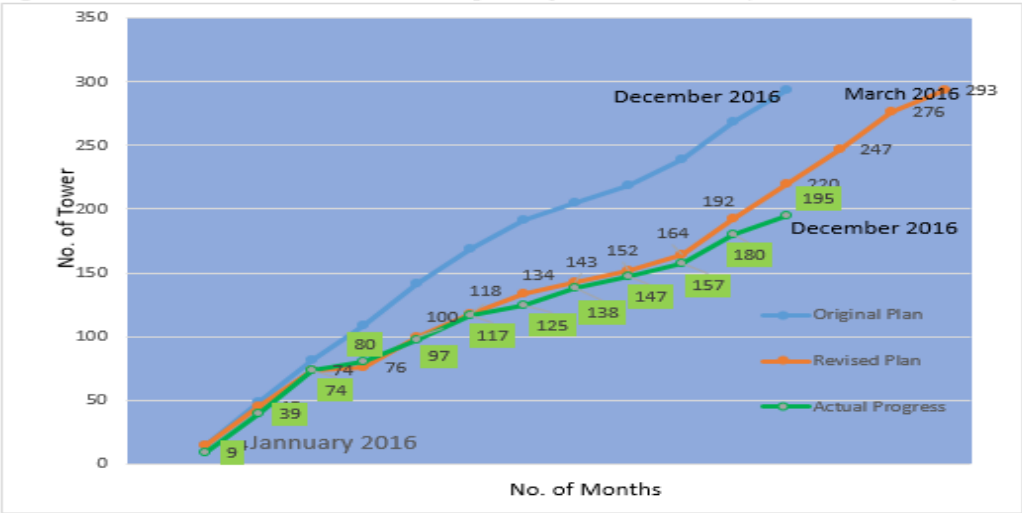


Figure 3-7: Revised Cumulative Works Progress of Tower Erection (Planned & Actual)



3.8 Electrical and Mechanical Work

The Electrical and Mechanical Work contract were 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 until the end of December 2016 was 59.5% (the same when compared to planned progress of 59.5%).

The installation work of embedded piping for the main powerhouse commenced on 17 February 2016 and it is under way in coordination with concrete casting work.

The grounding works for the main powerhouse and re-regulation powerhouse are under way in coordination with concrete casting work.

Figure 3-8: Installation of Draft Tube for 1 at the Main Powerhouse

Figure 3-9: Installation of Draft Tube for Unit 2 at the Main Powerhouse

3.9 Hydro-Mechanical Work

The cumulative work progress of the Hydraulic Metal Works until the end of December 2016 was 30.1% (compared to planned progress of 30.1%). The main activities carried out during this month are described below:

a) Main Dam and Powerhouse Penstock Pipe Fabrication Work

- Site witnessed inspection of ultrasonic field test joint of Penstock Pipe Nos. P32 Continue to P33 for Line 1 for Line 2 was approved by the Owner's Engineer on 03 December 2016. (RFI No. F-0129).
- Site witnessed inspection after field welding at the joint between Penstock Pipe Nos. P32 and P33 for Line 1 was approved by the Owner's Engineer on 05 December 2016. (RFI No. F-0122).
- Site witnessed inspection of ultrasonic field test joint of Penstock Pipe Nos. P32 and P33 for Line 1 was approved by the Owner's Engineer on 03 December 2016. (RFI No. F-0129).
- Site witnessed inspection of ultrasonic field test joint of Penstock Pipe Nos. P32 and P33 for Line 2 was approved by the Owner's Engineer on 07 December 2016. (RFI No. F-0130).
- Site witnessed inspection after field welding at the joint between Penstock Pipe Nos. P32 and P33 for Line 2 was approved by the Owner's Engineer on 07 December 2016. (RFI No. F-0136).
- Site witnessed inspection ultrasonic field test joint of Penstock Pipe Nos. P31 and P32 for Line 1 was approved by the Owner's Engineer on 13 December 2016. (RFI No. F-0133).
- Site witnessed inspection after field welding at the joint between Penstock Pipe Nos. P31 and P32 for Line 1 was approved by the Owner's Engineer on 14 December 2016. (RFI No. F-0134).
- Site witnessed inspection for ultrasonic field test joint of Penstock Pipe Nos. P31 and P32 for Line 2 was approved by the Owner's Engineer on 17 December 2016. (RFI No. F-0139).
- Site witnessed inspection after field welding at the joint between Penstock Pipe Nos. P31 and P32 for Line 2 was approved by the Owner's Engineer on 17 December 2016. (RFI No. F-0141).

- Site witnessed inspection after field welding at the joint between Penstock Pipe Nos. P30 and P31 for Line 1 was approved by the Owner's Engineer on 22 December 2016. (RFI No. F-0143).
- Site witnessed inspection after field welding at the joint between Penstock Pipe Nos. P30 and P31 for Line 2 was approved by the Owner's Engineer on 23 December 2016. (RFI No. F-0144).
- Site witnessed inspection of ultrasonic field test joint of Penstock Pipe Nos. P30 and P31 for Line 1 was approved by the Owner's Engineer on 23 December 2016. (RFI No. F-0151).
- Site witnessed inspection for ultrasonic field test joint of Penstock Pipe Nos. P30 Continue to P31 for Line 2 was approved by the Owner's Engineer on 24 December 2016. (RFI No. F-0152).
- Latest progress of penstock pipes fabrication at IHI field shop as of the end of June 2016 is shown in **Table 3-3:** Progress of the penstock pipe fabrication at the IHI field shop as at the end of December 2016 below:

Table 3-3: Progress of the penstock pipe fabrication at the IHI field shop as at the end of December 2016

Item No.	Work Description	Work Progress (%)	Remarks
1.1	Assembly & Welding	53.4 %	Straight pipes
1.1	Painting	45.5 %	"
1.1	Delivery to Main Dam Laydown Area	17.8 %	"
1.1	Site Erection at Main Dam	17.8 %	Inclined part

b) Re-regulation dam Gates Installation Work:

- **Re-regulation Waterway Gate**: Site installation work was started on 15 March 2016 and the gate was completed on 16 October 2016, including the wire rope type hoist. Witness inspection for 'functional test before initial filling of reservoir' was conducted by Owner's Engineer and NNP1PC staff on 16 October 2016. The result of inspection was concluded to be 'approved', and further confirmed that this work item was completed in compliance with the Owner's Requirements. Site inspection was conducted on 19 October 2016 between staff of NNP1PC, the Civil Works Contractor, the Hydro-Mechanical Works Contractor for the temporary handing over of the area, for the placement of cement mortar under the base frame of hoist and driving block. The result of the handover inspection is 'approved'. The remaining and final inspection to be done is the 'functional test after initial filling of reservoir'.
- **Re-regulation Waterway Stop-log**: Site installation work was started on 15 March 2016 and the stop-log was completed on 09 July 2016 together with the lifting beam and wire rope. Witnessed inspection for 'functional test before initial filling of reservoir' was conducted by the Owner's Engineer and NNP1PC staff on 09 July 2016. The result of inspection was concluded to be 'approved'. The remaining inspection to be done is the 'functional test after initial filling of reservoir'.
- **Re-regulation Intake Gate**: Site installation work was started on 15 March 2016 and the gate was completed on 16 October 2016, including the wire rope type hoist. Witness inspection for 'functional test before initial filling of reservoir' was conducted by Owner's

Engineer and NNP1PC staff on 16 October 2016. The result of inspection was concluded to be 'approved' and further confirmed that this work item was completed in compliance to Owner's Requirements. Site inspection was conducted on 19 October 2016 between staff of NNP1PC, the Civil Works Contractor and the Hydro-Mechanical Works Contractor for the temporary handing over of the area, for placement of cement mortar under the base frame of hoist and driving block. The result of the handover inspection is 'approved'. The remaining and final inspection to be done is the 'functional test after initial filling of reservoir'.

- **Re-regulation Intake Trash Rack**: Site installation work was started on 15 June 2016 and the trash rack panels and beams at the left and right bank was completed on 11 July 2016. Witness inspection for 'dimensional and visual' was conducted by the Owner's Engineer and NNP1PC staff on 11 July 2016. The result of inspection was concluded to be 'approved'. On 19 September 2016, the Civil Works Contractor requested inspection by the Owner's Engineer for checking trash rack panels and support beams to confirm condition after cleaning and touch-up painting work following the CWC completion of second stage concreting. The one remaining trash rack panel located at the right bank, which was previously open for access to intake gate upstream side, was already installed by the HMW Contractor on 18 October 2016. Quality and workmanship of installation was concluded by Owner's Engineer as 'acceptable' in conformance to the Owner's Requirements.
- **Re-regulation Draft Gate**: Site installation work was started on 01 May 2016 and the gate was completed on October 2016 together with the lifting beam. Witnessed inspection for 'functional test before initial filling of reservoir' was conducted by the Owner's Engineer and NNP1PC staff on 01 October 2016. The result of inspection was concluded to be 'approved' and further confirmed that this work item was completed in compliance to the Owner's Requirements. Site inspection was conducted on 04 October 2016 between staff of NNP1PC, the Civil Works Contractor, the HMW Contractor and the EMW Contractor for the temporary handing over of the area. The result of the handover inspection is 'approved'. The remaining and final inspection to be done is the 'functional test after initial filling of reservoir'.
- Latest progress of steel gate installation for each work item at the end of December 2016 is shown **Table 3-4*:***

Table 3-4*:* Progress of steel gate installation for each work item at the end of December 2016

Item No.	Description	Installation Progress	Remaining Inspection
2.1	Re-regulation Waterway Gate	100 %	Wet Test
2.2	Re-regulation Waterway Stop log	100 %	Wet Test
2.3.1	Intake Gate	100 %	Wet Test
2.3.2	Intake Trash Rack	100 %	N.A.
2.4	Draft Gate	100 %	Wet Test

4. ENVIRONMENTAL MANAGEMENT AND MONITORING

4.1 ESMMP-CP

In September 2016, NNP1PC completed the draft updated Environmental and Social Management and Monitoring Plan for the Construction Phase (ESMMP-CP) and submitted it to the Department of Environmental and Social Impact Assessment (DESIA), Ministry of Natural Resources and Environment (MONRE), to the Independent Monitoring Agency (IMA), the Lender's Technical Adviser and ADB for their review. A consultation workshop on the draft updated ESMMP-CP was organized in Vientiane on 14 September 2016 with related agencies of the Government of Lao PDR (GOL). The workshop was attended by representatives of DESIA, Department of Energy Business (DEB, Ministry of Energy and Mines), IMA and Provincial Department of Natural Resources and Environment (PONRE) from Xaysomboun and Bolikhamxay Provinces. MONRE submitted official comments to NNP1PC in October 2016. NNP1PC is finalizing this document for submission to MONRE in early 2017.

4.2 Contractor SS-ESMMPs

During the Fourth Quarter of 2016, NNP1PC-EMO reviewed 26 SS-ESMMPs and one Contractor's ESMMP. Out of these, 22 SS-ESMMPs and one ESMMP were approved and 04 SS-ESMMPs are under review as listed in **Table 4-1** and are carried over to first quarter of 2017.

All SS-ESMMPs for camps and other temporary facilities received since June 2016 have been required to include decommissioning plans.

Table 4-1: SS-ESMMP and ESMMP reviewed during the fourth Quarter of 2016

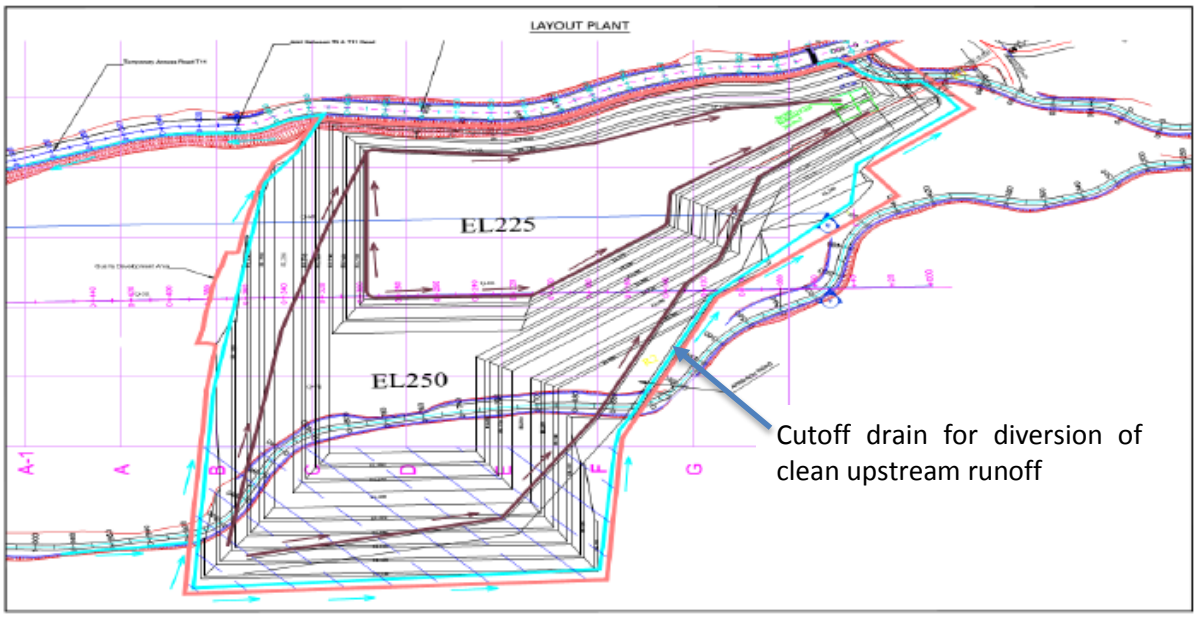
Name of SS-ESMMP/EMP Document	Rev. 1	Rev. 2	Rev. 3	Approved
SS-ESMMP for Second River Diversion and Excavation of Right Bank	√	√		√
SS-ESMMP for Construction of Houay Soup Landfill	√	√		√
SS-ESMMP for supplemental information for Curtain Grouting Works at the Main Dam (5th submission)	√	√	√	√
SS-ESMMP for Construction of Zhefu Warehouse	√			√
SS-ESMMP for Labour Camp (Zhefu Camp)	√	√	√	√
SS-ESMMP for HM Hydro Worker Camp No. 2 (LILAMA10) (4th submission)	√	√	√	√
SS-ESMMP for Fabrication Work of Concrete Weight for Overhead Traveling Crane Load Test	√			√
SS-ESMMP for Construction of Quarry Extension	√	√		√
SS-ESMMP for Installation work of embedded piping for main power station	√	√		√
ESMMP update (R3) from HM Hydro Contractor	√	√	√	√
SS-ESMMP for Construction of Tractor road at HSRA	√	√		√
SS-ESMMP for Construction of Intake Mount at Houay Soup Resettlement Site	√			√
SS-ESMMP for Closing of Borrow Pit Area at Corner of P1 & P1A Road beside the Re-regulation Dam	√			√

Name of SS-ESMMP/EMP Document	Rev. 1	Rev. 2	Rev. 3	Approved
SS-ESMMP for Biomass Clearance at Reg-regulation Pond	√	√		√
SS-ESMMP for Building Construction at Main Powerhouse	√	Under review		
SS-ESMMP for Paddy Field Development Of 48 ha for 2LR People in the Resettlement Site	√	√		√
SS-ESMMP for Installation Work of 80 Ton Electrical Overhead Traveling Crane for Re-regulation Power Station	√			√
SS-ESMMP for Land Levelling (Cutting and Filling) for 90 House Plots at 2LR-Lower Reservoir Village and Health Centre at Resettlement Site	√			√
SS-ESMMP for the Supply and Installation Material for Natural Grass Soccer Field	√			√
SS-ESMMP for Construction of Core Box House at Owner Site Office	√			√
SS-ESMMP for installation of 360 Ton Electrical Overhead Traveling Crane for Main Power Station	√			√
SS-ESMMP for Construction of Health Centre at HSRA	√			√
SS-ESMMP for Construction of Village Office and Hall at HSRA	√			√
SS-ESMMP for UXO Clearance at HSRA	√			√
SS-ESMMP for Operation and Maintenance Works of RCC Plant	√	√	Under review	
SS-ESMMP for Construction of Re-regulation Power Station Building (Super Structure) Re-regulation Powerhouse Station (B1)	Under review			
SS-ESMMP for Adit Closure at Right Bank of Main Dam	Under review			

4.2.1 Main Quarry Extension

In order to ensure sufficient supply of rock material with the required quality, the originally conceived quarry will be extended from an area of approx. 7 ha to 8.6 ha. The total amount of materials to be excavated is estimated to 3.5 million m^3 of which about 2.2 million m^3 are rock. The quarry layout plan is displayed in **Figure 4-1**.

Figure 4-1: Quarry layout drawing



The extended quarry lies within the area that is designated as quarry site in the Concession Agreement and this is also the site that was presented and assessed in the approved Environmental Impact Assessment (2014).

The Contractor is required to submit a rehabilitation plan not later than 15 February 2017 for review. The rehabilitation plan will include erosion and sediment control measures (slope revegetation where feasible, diversion drain for clean upstream runoff, pit drainage), slope stability measures and monitoring and aftercare.

The environmental management and control measures for the quarry extension is being incorporated into the final ESMMP-CP.

4.3 Results of Non-Compliance Inspections

During October to December 2016, EMO conducted bi-weekly and weekly follow-up inspections of 31 construction sites and camps including temporary camps at Houay Soup Resettlement Areas (HSRA), the 230 kV Transmission Line and biomass removal areas as indicated in **Figure 4-1** and **Figure 4-2** below.

Figure 4-2: Site Inspection Location

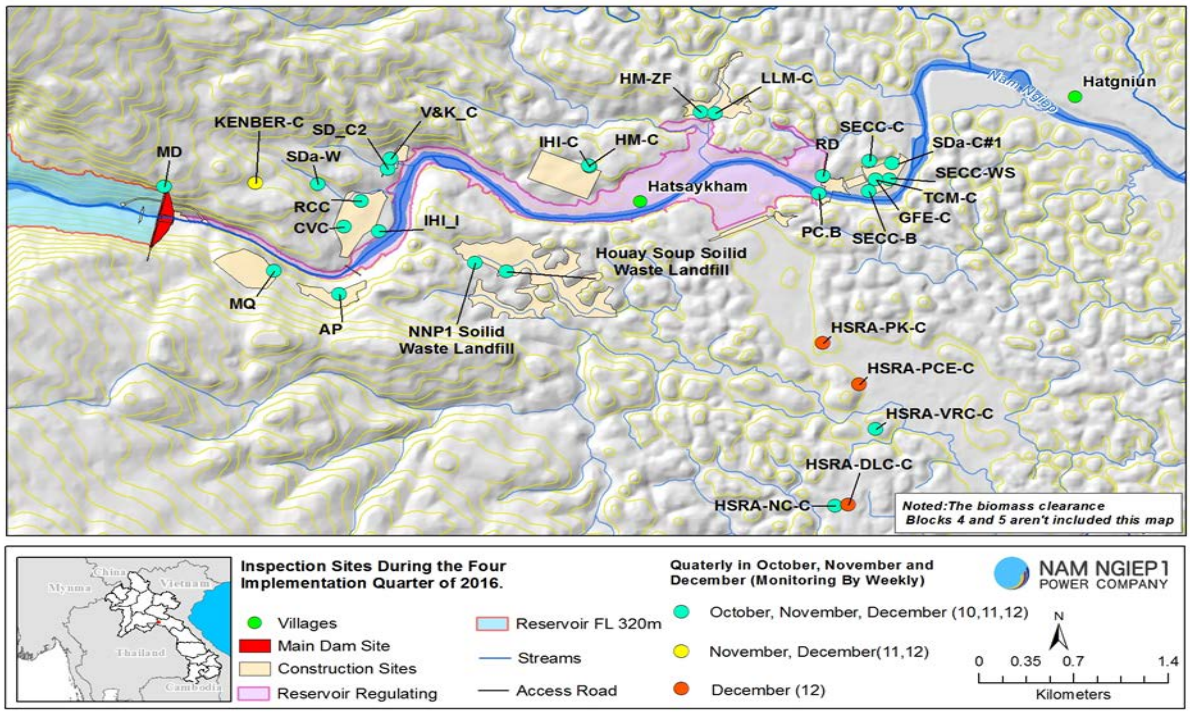
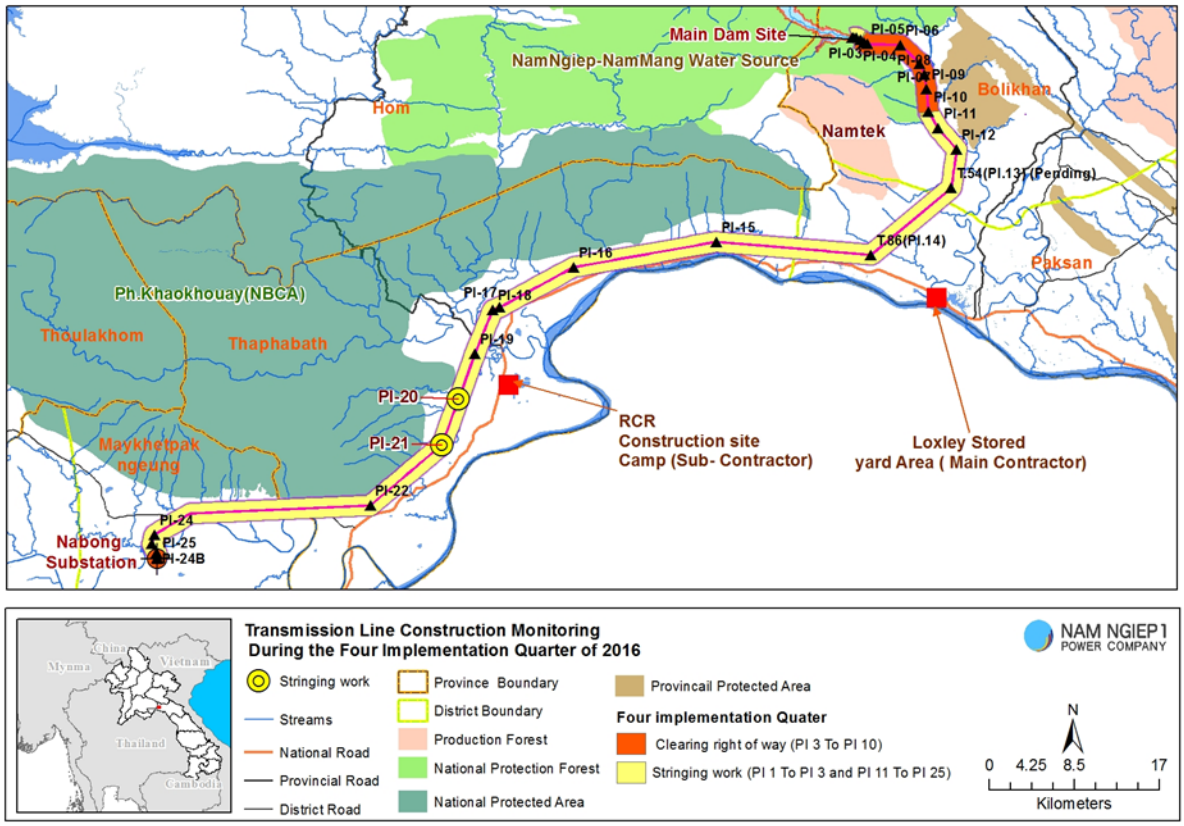


Figure 4-3: 230 kV Transmission Line construction monitoring



A total of 36 Observations of Non-Compliances (ONC), two Non-Compliance Level-1 and one Non-Compliance level-2 were recorded and considered as active during the reported period. Out of these,

13 ONCs and one NCR were carried over from the previous Quarter; 23 ONCs and one NCR were newly issued. The issued NCR level-1 was related to hazardous material management and the NCR-level-2 was related to the sedimentation control at the Aggregate Crushing Plant. A total of 14 ONC, one NCR level-1 and one NCR level-2 could not be resolved in this quarter and will be carried forward into the First Quarter of 2017. More details on the issued ONC and NCR as well as the corrective actions can be found in the **Table 4-2** and **Figure 4-3** and in the **Appendix 2: Environmental Monitoring Corrective Actions from October to December 2016**.

Table 4-2: Non-Compliance Status during the Fourth Quarter of 2016

Environmental Non-Compliance Status	ONC	NCR-Level 1	NCR-Level 2
Carried over ONC/NCR	13	1	0
Newly opened ONC/NCR	23	1	1
Total ONC/NCR	36	2	1
Resolved ONC/NCR	22	1	0
Unresolved ONC/NCR carried forward to the next Quarter	14	1	1

Figure 4-4: ONCs and NCRs during the Fourth Quarter of 2016

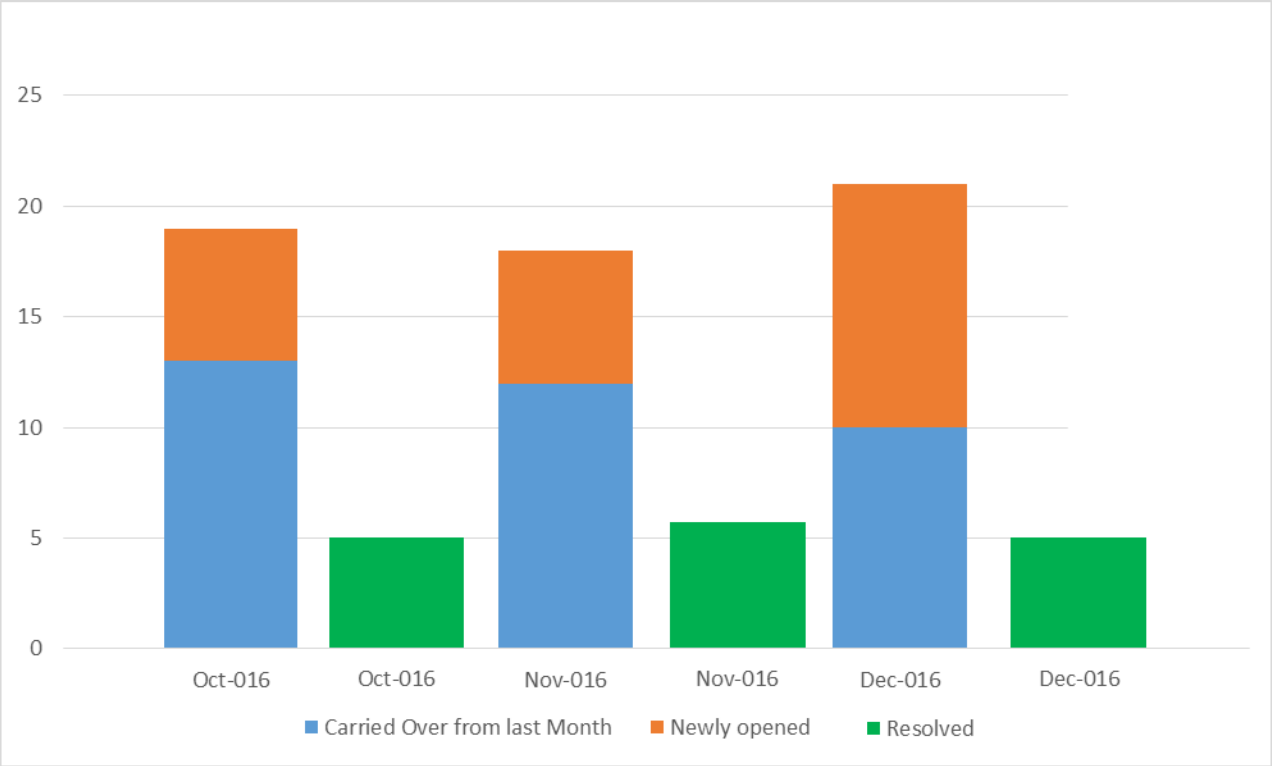


Table 4-3: Types of ONCs and NCRs during the Fourth Quarter of 2016

Non-Compliance Issue	ONCs			NCR-1			NCR-2		
	Opened	Closed	Carried Over	Opened	Closed	Carried Over	Opened	Closed	Carried Over
Construction of Worker Camp	2	2	0	0	0	0	0	0	0
Erosion & Sedimentation Control	12	3	9	0	0	0	0	0	0
Hazardous Material Management	7	7	0	1	1	0	0	0	0
Landscaping & Re-vegetation	1	0	1	0	0	0	0	0	0
Waste Management	7	7	0	0	0	0	0	0	0
Water Availability & Pollution Control	7	3	4	1	0	1	1	0	1
Total	**36**	**22**	**14**	**2**	**1**	**1**	**1**	**0**	**1**

Photo 1: Chlorine Contact Tank at Song Da5 Camp No. 2 in November 2016

Photo 2**:** Progress of the WWTS Improvement at Song Da5 Camp No. 1 in November 2016

Photo 3: WWTS at Song Da5 Camp No. 1 in December 2016

Photo 4: An IAP/LTA/ADB mission No.9 (12 to 16 December 2016)

4.4 Waste Management at the Construction Sites

4.4.1 General Waste Management

During October to December 2016, NNP1PC closely followed-up on the landfill operation. This included waste disposal record, waste compaction and conducting spot checks of the Contractors' waste bags. It was evident that during October and November 2016, the waste segregation by some sub-contractors was inadequate - recyclables, general and construction wastes were mixed with the solid waste to be disposed at the landfill. The main Contractors and sub-contractors were instructed to properly segregate the mixed waste prior to disposal at the landfill. An amount of approximately 529.5 m^3 of solid waste was disposed at the NNP1 Project landfill (See **Photographs 5 and 6**) during the reporting period.

Several types of waste generated from construction activities were sold to Khounmixay Processing Factory for further processing as shown in **Table 4-5** below.

Photo 5: Waste Compaction and Soil Cover at the NNP1 Project Landfill

Photo 6: Waste Disposal Spot Checking by NNP1PC staff at NNP1 Project landfill

4.4.2 Hazardous Materials and Waste Management

During October to December 2016, NNP1PC-EMO together with contractors and sub-contractors conducted a number of joint inventories for hazardous materials and hazardous waste at the main construction sites, workshops and sub-contractors' camps including Loxley office, Stockyard and Loxley RCR (sub-contractor Camp along the 230 kV Transmission Line); TCM; Song Da 5 Camp No. 1 and Camp No. 2; Regulation dam; Song Da 5 workshop; V&K Camp; CVC Plant; RCC plant; Sino-Hydro Camp; Sino Hydro's worker Camp; HM Hydro contractor camp; HM Hydro's ZHEFU Camp; LILAMA 10 Camp; IHI contractor Camp; IHI's 276 Camp and Sino Hydro's explosive storage areas. The hazardous waste recorded during the joint inventories are presented in **Table 4-4** below.

Table 4-4: Hazardous materials recorded during the Fourth Quarter of 2016

No.	Hazardous Waste Type	Unit	Total in fourth Quarter 2016 (A)	Disposal by Selling (B)	Remaining (A - B)
1	Used Oil (Hydraulic and Engine)	Litre	8,120	2,400	5,720
2	Cement bag	Bag	2,800	0	2,800
3	Empty used chemical drum/container	Drum (20 litre)	2,100	600	1,500
4	Used oil filters	Piece	561	0	561
5	Used oil mixed with water	Litre	200	200	0
6	Ink cartridge	Unit	208	0	208
7	Used tyre	Piece	317	3	314
8	Empty contaminated bitumen drum/container	Drum (200 litre)	82	0	82
9	Empty paint and spray cans	Can	102	29	73
10	Empty used oil drum/container	Drum (20 litre)	97	18	79
11	Empty used chemical drum/container	Drum (200 l)	51	12	39
12	Empty used oil drum/container	Drum (200 l)	31	0	31
13	Contaminated soil, sawdust and concrete	Bag	24	0	24
14	Battery	Unit	10	0	10
15	Halogen/fluorescent bulbs	Unit	23	0	23
16	Contaminated textile and material	Bag	16	0	16
17	Acid and caustic cleaners	Bottle	0	0	0
18	Clinical Waste	kg	26	0	26

During November to December 2016, empty chemical drums (Sulfuric Acid, size: 20 liter) from CVC plant was sold to Khounmixay factory as well as recyclable waste including scrap metal, plastic bottle,

glass bottle, aluminum can and cardboard of Sinohydro Camp and Song Da 5 workshop was also sold to new vendors (Saysana and Xieng Khuang Steel Processing Factories).

Photo 7: Hazardous waste from CVC plant sold to Khounmixay Factory	Photo 8: Recyclable waste (scrap metal) from Song Da 5 workshop and Sinohydro Camp sold to new vendor (Saysana and Xieng Khuang Factories)
	

In addition, in November 2016, EMO conducted workplace hazardous waste management induction for principle contractors and sub-contractors. The induction was attended by 18 supervisors. The induction focused on prevention of hazardous material spills and response in case a spill does happen based on the "Control-Contain-Clean-up Principles". NNP1PC-EMO demonstrated the use of hydrocarbon and chemical absorbent sheets in this training.

Photo 9: Hazardous waste management induction for Song Da5 subcontractor	Photo 10: Hazardous waste management induction for Sino Hydro subcontractor
	

The amount of recyclable waste was recorded at all NNP1 Project construction sites and offices, including, the ESD office, Loxley Office and Stockyard at Paksan District, Sub-contractor's site office (RCR) and workshop at Thaphabath District, Song Da 5 Camp No. 1 and Camp No. 2; TCM Camp; Regulation dam; V&K Camp; Song Da 5 Workshop at the Spoil Disposal Area No. 2, RCC Plant, Sino Hydro Camp, Sino Hydro's worker, SECC Camp and each Contractor's camp at Houay Soup Resettlement Area (HSRA). The amount of sold recyclable waste is summarized in **Table 4-5**.

Table 4-5: Amounts of recyclable waste sold during the Fourth Quarter of 2016

N0.	Recycled Waste Type	Unit	Total in Fourth Quarter of 2016 (A)	Sold (B)	Remaining Amount (A - B)
1	Scrap metal	kg	26,154	13,029	13,125
2	Glass	kg	856.2	178	678.2
3	Plastic bottles	kg	470.2	227.7	242.5
4	Aluminum	kg	267	193.5	73.5
5	Paper/Cardboard	kg	399.8	158.3	241.5
	Total	**kg**	**28,147.2**	**13,786.5**	**14,360.7**

NNP1PC-EMO conducted waste management awareness training for 123 staff of the ESD and OSOV. The objective of the training was to raise awareness and understanding of the waste management programme (both non-hazardous, and hazardous waste) at the NNP1 Project sites ***(see photos below)***.

Photo 11: Waste management awareness training for ESD staff

Photo 12: Waste management awareness training for OSO staff

4.4.3 Medical Waste Management

During the Fourth Quarter of 2016, a total of 26 kg of medical waste was generated from clinics at the Owners' Site Office and Village, Song Da 5 Camp No. 1 and Camp No. 2 and OC Camp.

4.5 Community Waste Management Support

4.5.1 Animal Fodder (Pig Feed) Collection Programme

During the Fourth Quarter of 2016, the villagers from Hatsaykham collected a total of 11,261 kg of food waste from the Owner's Site Office and Village and Contractors' camps to feed their animals. This is an increase of 1,270 kg compared to the Third Quarter as shown in **Table 4-6**.

Table 4-6: Amount of food waste collected by local villagers for use as pig feed during the fourth Quarter of 2016

No.	Site Name	Unit	Amount
1	Song Da 5 Camp No. 2	kg	5,409
2	Song Da 5 Camp No. 1	kg	4,190
3	OC Camp	kg	1,298
4	Owner's Site Office and Village	kg	364
Total		**kg**	**11,261**

4.5.2 Community Recycling Programme

During October to December 2016, the Community Recycle Bank at Hat Gniun village bought a total of 2,173 kg of recyclable waste as shown in Table 4-7 (See also photo 13 and 14). By the end of December 2016, a total of 185 people (131 adults and 54 students) or 121 households held accounts at the Community Recycle Bank. The percentages of participation in the programme for each village have not changed since the Third Quarter of 2016 and remains as follows:

- Ban Hat Gniun 87%
- Ban Hatsaykham 64%
- Ban Thahuea 64%.

The types and amounts of waste recycled during the Fourth Quarter 2016 are presented below.

Table 4-7: Amounts of recyclables sold at the Community Recycle Waste Bank

Types of Waste	Unit	Purchased Amount During the Fourth Quarter of 2016 (A)	Sold (B)	Remaining Amount (A - B)
Scrap metal	kg	983	0	983
Glass	kg	1,020	810	210
Paper/cardboards	kg	397	0	397
Plastic bottles	kg	596	337	259
Aluminum	kg	324	0	324
Total	**kg**	**3,320**	**1,147**	**2,173**

Photo 23: Recyclable waste from the Recycle Waste Bank sold to Keo Lao Factory in Vientiane	Photo 34: Keo Lao Factory at Km 21 of Road 13th South, Vientiane Capital
	

4.5.3 Waste Management Training

On 09 November 2016, NNP1PC-ESD staff, Hat Gniun Village Chief and District authorities continued to carry out waste management induction for the camp followers/shops at Hat Gniun Village. The main purpose was to increase the participants' knowledge about waste management including about waste segregation, reduction of waste generation (reduce, reuse and recycle principle), solid waste disposal and the types of waste that the Community Recycle Waste Bank can receive. A total of 19 shop owners participated in these inductions. Amongst the shop owners, four were local villagers and the rest were Vietnamese.

Table 4-8: Number of participants who attended the waste management training

No.	Camp Follower/Shop Owner	Total No. of Camp Follower/Shop Owners	No. of Women
1	Laos camp followers/shops	12	08
2	Vietnamese camp followers/shops	07	03
Total		**19**	**11**

Photo 45: Waste management inductions conducted for camp followers (shop owners) at Hat Gnuin Village	Photo 56: Waste management induction carried out for camp followers at Hat Gnuin Village
	

A training on waste management was conducted by EMO team to the resettlers at Houay Soup Resettlement Area (HSRA). The training topics included waste segregation, waste generation reduction and waste disposal. In addition, a recycling waste program was initiated with the resettlers.

Photo 67: Waste management induction for resettlers at HSRA	Photo 78: Recycling waste program initiated with resettlers at HSRA
	

4.5.4 Houay Soup Waste Management

The construction of Houay Soup landfill was completed, and the final inspection of the 1st stage was done jointly between the NNP1PC and the contractor in October 2016. The landfill has been in operation since then and has received waste from the host village, resettles and contractors in the Houay Soup Resettlement Area. The landfill is open for business every Tuesday and Thursday from 09:30 to 10:30 am through individual arrangement with NNP1PC-EMO staff. During October to December 2016, a total of 10.81 m^3 of solid waste from HSRA's Contractors was disposed at the landfill. (See photo 19 and 20 below).

Photo 89: A final inspection of the 1st stage Houay Soup Landfill construction	Photo 20: HSRA's Contractors disposed waste at the Houay Soup Landfill
	

4.6 Environmental Monitoring

The environmental quality monitoring undertaken from October to December 2016 followed the environmental quality monitoring programme presented in the ESMMP-CP Volume III. The monitoring programme consists of the following components:

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

All the monitoring results have been assessed against the 2009 National Environmental Standards and the Effluent Standards specified in the Concession Agreement Annex C[2], as applicable. For the purposes of simplifying the report, this Section focuses on the key results that did not meet the mentioned Standards.

The construction of NNP1PC's small laboratory commenced in October 2016 at the Owner's Site Office and Village. The laboratory is designed to carry out basic water quality analyses (Total Coliforms, E.Coli, Biochemical Oxygen Demand (BOD_5), and Total Suspended Solid (TSS). By the end of December 2016, the construction progress was 35% and is expected to be completed by the end of February 2017. Laboratory equipment has been purchased and delivered to Owner's Site Office and Village in the second week of December 2016. A training event on water samples analysis and laboratory

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

management was held during 13 – 19 December 2016 by Environmental Training and Utilities Company Limited (ETU), Bangkok, Thailand. A total of 4 key staff from NNP1PC–EMO and four representatives of EMUs from Xaysomboun and Bolikhamxay Provinces participated in this training.

Due to the time required for the laboratory training, it was only possible to carry out one water sampling mission in December 2016.

4.6.1 Surface Water (River) Quality

Water quality monitoring was conducted at 13 stations in the Nam Ngiep 1 watershed area as the following:

i. six stations located in the upstream of the NNP1 Main Dam, included four stations along the upper Nam Ngiep River, a station at lower Nam Phouan and a station at lower Nam Chian;

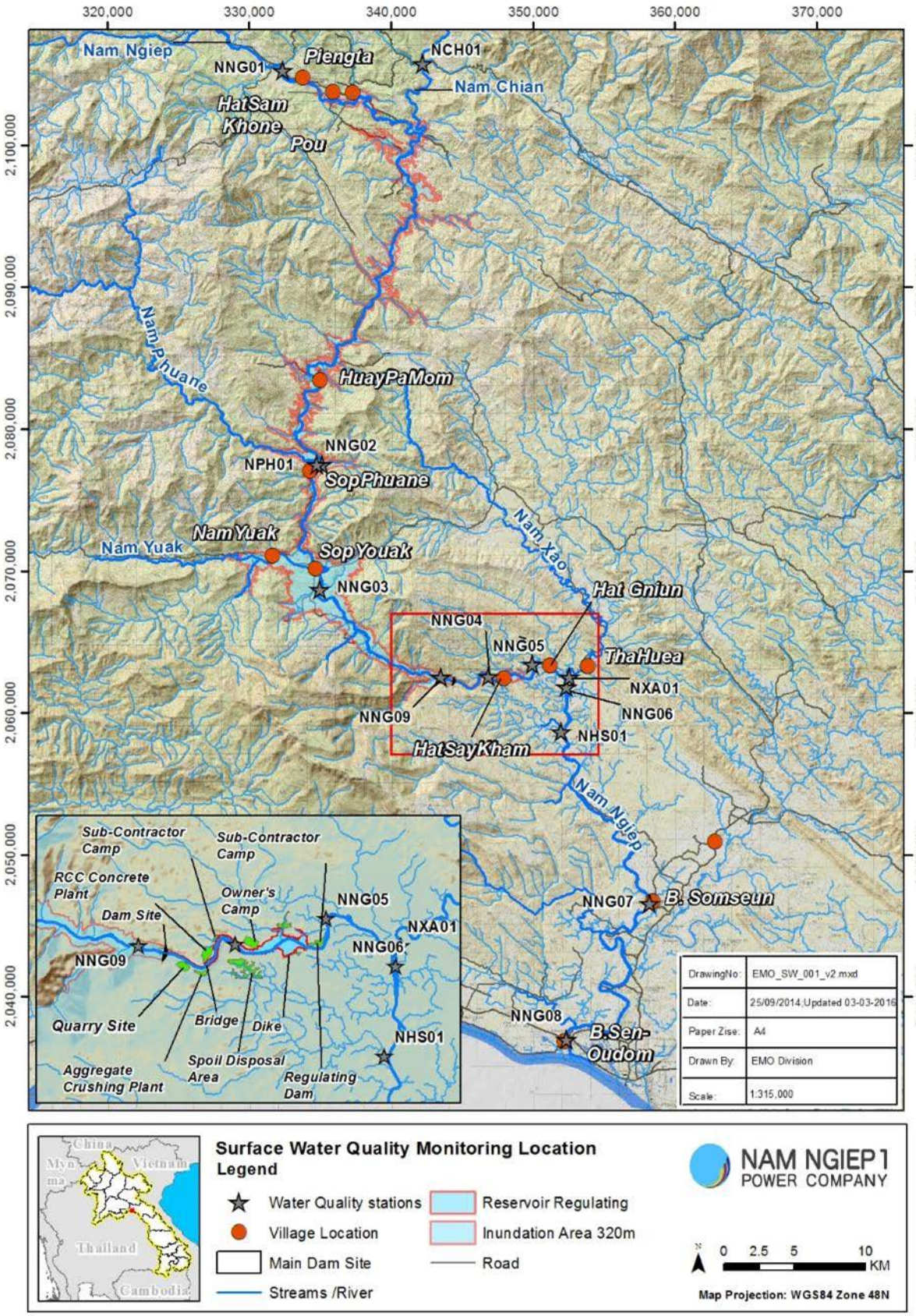
ii. seven stations located downstream of the NNP1 Main Dam including five stations along Nam Ngiep, a station at lower Nam Xao and a station at lower Nam Houay Soup.

The weekly surface water quality monitoring was carried out commencing in July 2016. The frequency of monitoring divided by group of parameters is presented in **Table 4-9** and the locations of the monitoring stations are shown in **Figure 4-4**.

Table 4-9: Monitoring Frequency for Surface Water Quality Parameters

Frequency of Monitoring	**Parameters (Unit)**	**Monitoring Sites**
Weekly	Physical parameters: pH, DO (%), DO (mg/l), Conductivity (µs/cm), TDS (mg/l), Temperature (°C), Turbidity (NTU)	3 stations: Nam Ngiep Upstream Main Dam (NNG09), Nam Ngiep Downstream RT Camp (NNG04) and Nam Ngiep Upstream Ban Hat Gniun (NNG05).
Fortnightly	Physical parameters: pH, DO (%), DO (mg/l), Conductivity (µs/cm), TDS (mg/l), Temperature (°C), Turbidity (NTU)	All 13 stations.
Monthly	Biological parameters: TSS (mg/l), BOD5 (mg/l), COD (mg/l), NH3-N (mg/l), NO3-N (mg/l), Total Iron (mg/l), Manganese (mg/l), total coliform (MPN/100 ml), faecal coliform (MPN/100 ml)	All 13 stations.
Quarterly	Chemical parameters: Total Kjeldahl Nitrogen (mg/l), Chloride (mg/l), Sulphate (mg/l), Alkalinity (mg/l), Lead (mg/l), Arsenic (mg/l), Mercury (mg/l), Calcium (mg/l), Magnesium (mg/l), Potassium (mg/l), Sodium (mg/l)	All 13 stations.

Figure 4-5: Surface water quality monitoring locations



Descriptions of each monitoring station and surface water quality monitoring parameters can be found in Appendix 3 Codes and Locations of the Surface Water Quality Monitoring Stations.

During the Fourth Quarter of 2016, the results of the monitoring programme indicated values exceeding the Lao National Environmental Standard (Surface Water Quality Guideline) with respect to Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD_5), faecal coliforms and total coliform as described in details below.

4.6.1.1 Chemical Oxygen Demand (COD)

The results of the COD analyses are presented in **Table 4-10**.

The COD levels measured in Nam Ngiep River since the start of the monitoring programme in 2014 indicate substantial spatial and temporal variations from 'not detected' to double-digit mg/L. A statistical analysis of the COD values will be included in the 2016 Annual Report.

It is unlikely that the current construction works of NNP1 would cause any significant increase of COD levels in the Nam Ngiep River. The purpose of the monitoring is therefore mainly to establish a baseline prior to the formation of the reservoir after which it will be important to monitor and assess changes in the downstream water quality of the Nam Ngiep River.

Table 4-10: COD results of surface water in Nam Ngiep and its main tributaries monitored from October to December 2016 (National Surface Water Quality Standard for COD: < 5 mg/L)

	Nam Ngiep Upstream the Construction Area				Nam Ngiep Within the Construction Area	Nam Ngiep Downstream the Construction Area			
Date	**NNG01**	**NNG02**	**NNG03**	**NNG09**	**NNG04**	**NNG05**	**NNG06**	**NNG07**	**NNG08**
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
03/10/2016	15.2	13.6	12.4	7.3	7.5	8.4	7.8	19.6	8.6
01/11/2016	6.1	6.1	5.9	< 5.0	10	5.1	5.5	5.7	< 5.0
06/12/2016	8.3	NA	NA	6.9	7.1	< 5.0	< 5.0	< 5.0	5.5

	Tributaries Upstream of Project Construction Area		Tributaries Downstream of Project Construction Area	
	Nam Chiane	**Nam Phouan**	**Nam Xao**	**Nam Houay Soup**
	NCH01	**NPH01**	**NXA01**	**NHS01**
Date	mg/L	mg/L	mg/L	mg/L
03/10 2016	5.9	9.8	< 5.0	7.5
01/11 2016	< 5.0	5.5	< 5.0	7.5
06/12 2016	13.3	NA	< 5.0	8.8

Note: *NA means data Not Available due to water samples damaged during transportation*

4.6.1.2 Biochemical Oxygen Demand (BOD_5)

The results of the Biochemical Oxygen Demand (BOD_5) analyses are presented in **Table 4-11**.

Similar to the COD analyses, the purpose of the BOD_5 measurements is mainly to establish a baseline prior to reservoir impoundment.

The results show that the samples taken in October 2016 from three stations downstream the Construction Area had BOD_5 levels slightly higher than the Standard set at less than 1.5 mg/L.

Table 4-11: BOD_5 results of surface water in Nam Ngiep and its main tributaries from October to December 2016 (National Surface Water Quality Standard for BOD_5: < 1.5 mg/L)

	Nam Ngiep Upstream the Construction Area				Nam Ngiep Within the Construction Area	Nam Ngiep Downstream the Construction Area			
	NNG01	**NNG02**	**NNG03**	**NNG09**	**NNG04**	**NNG05**	**NNG06**	**NNG07**	**NNG08**
Date	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
03/10 2016	< 1.0	< 1.0	< 1.0	1	< 1.0	3.3	1.9	1.5	1.9
01/11 2016	< 1.0	< 1.0	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
06/12 2016	< 1.0	NA	NA	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

	Tributaries Upstream of Project Construction Area		Tributaries Downstream of Project Construction Area	
	Nam Chiane	**Nam Phouan**	**Nam Xao**	**Nam Houay Soup**
	NCH01	**NPH01**	**NXA01**	**NHS01**
Date	mg/L	mg/L	mg/L	mg/L
03/10 2016	1	< 1.0	1.2	< 1.0
01/11 2016	< 1.0	1	< 1.0	< 1.0
06/12 2016	1.4	NA	< 1.0	< 1.0

Note: *NA means data Not Available due to water samples damaged during transportation*

4.6.1.3 Total Coliforms

During the Fourth Quarter of 2016, the total coliform amount were significantly lower in the Nam Ngiep River and its tributaries than in the Third Quarter of 2016. As indicated in **Table 4-12**, two samples taken upstream the Construction Area exceeded the standard.

A more detailed statistical analysis will be included in the Annual Report for 2016.

Table 4-12: Results of total coliforms in Nam Ngiep and its main tributaries from October to December 2016 (*National Surface Water Quality Standard for total coliforms: < 5,000 MPN/100 ml*)

	Nam Ngiep Upstream the Construction Area				Nam Ngiep Within the Construction Area	Nam Ngiep Downstream the Construction Area			
	NNG01	**NNG02**	**NNG03**	**NNG09**	**NNG04**	**NNG05**	**NNG06**	**NNG07**	**NNG08**
Date	MPN/100 ml								
03/10/2016	790	350	700	5,400	280	2,400	4,900	3,100	220
01/11/2016	1,700	7,900	490	240	2,200	700	3,500	790	490
06/12/2016	330	NA	NA	230	330	1,700	1,100	490	2,300

	Tributaries Upstream of Project Construction Area		Tributaries Downstream of Project Construction Area	
	Nam Chiane	**Nam Phouan**	**Nam Xao**	**Nam Houay Soup**
	NCH01	**NPH01**	**NXA01**	**NHS01**
Date	MPN/100 ml			
03/10 2016	1,300	540	460	350
01/11 2016	1,300	1,700	700	940
06/12 2016	790	NA	330	330

Note: *NA means data Not Available due to water samples damaged during transportation*

4.6.1.4 Faecal Coliforms

During the Fourth Quarter of 2016, the levels of faecal coliform in the Nam Ngiep River and its tributaries were significantly lower than previously measured. As indicated in Table 4-13, three samples (one upstream and one downstream the Construction Area, and one in a upstream tributary) exceeded the standard for faecal coliform.

A more detailed statistical analysis will be included in the Annual Report for 2016.

Table 4-13: Results of faecal coliforms in Nam Ngiep and its main tributaries from October to December 2016 (*National Surface Water Quality Standard for faecal coliforms: <1,000 MPN/100 ml*)

	Nam Ngiep Upstream the Construction Area				Nam Ngiep Within the Construction Area	Nam Ngiep Downstream the Construction Area			
	NNG01	**NNG02**	**NNG03**	**NNG09**	**NNG04**	**NNG05**	**NNG06**	**NNG07**	**NNG08**
Date	MPN/100 ml								
03/10 2016	170	350	460	700	31	920	490	330	220
01/11 2016	1,700	220	170	240	210	210	1,100	330	330
06/12 2016	170	NA	NA	230	170	700	310	330	70

	Tributaries Upstream of Project Construction Area		Tributaries Downstream of Project Construction Area	
	Nam Chiane	**Nam Phouan**	**Nam Xao**	**Nam Houay Soup**
	NCH01	**NPH01**	**NXA01**	**NHS01**
Date	MPN/100 ml			
03/10 2016	1,300	140	110	350
01/11 2016	790	84	49	70
06/12 2016	330	NA	2	11

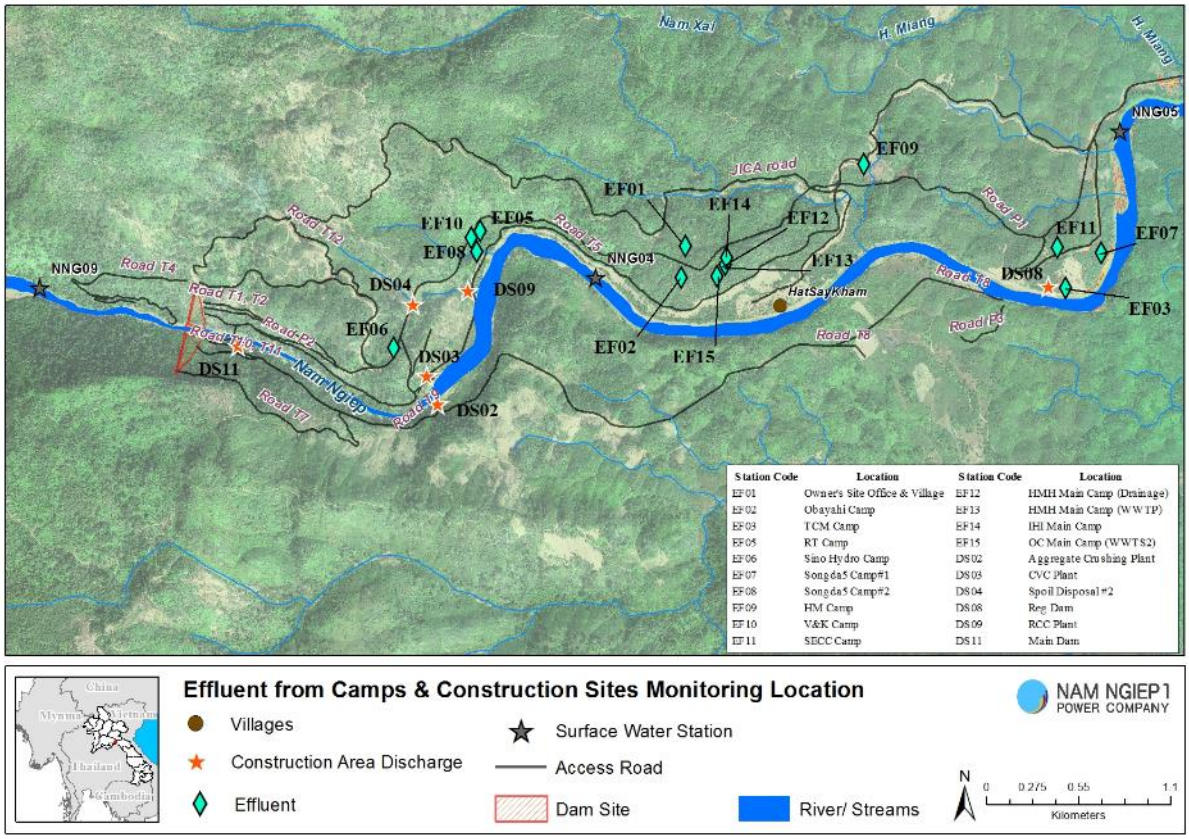
Note: *NA means data Not Available due to water samples damaged during transportation*

4.6.2 Effluent Discharge Quality Monitoring

All the camps' effluent water was sampled and analysed irrespective of whether or not effluents were discharged at the time of sampling. In case of no discharge, the samples were collected from the downstream end of the final treatment pond.

During the Fourth Quarter of 2016, effluents were monitored in 12 camps (12 sampling sites). The location of the sites are displayed in **Figure 4-5**, and the results are presented in **Table 4-14**.

Figure 4-6: Map of effluent monitoring locations during the Fourth Quarter of 2016



The results show that none of the camps excluding the Owner's Site Office and Village complied with all of the applicable effluent standards. However, improvements of the Wastewater Treatment Systems (WWTS) are progressing. By the end of December 2016, the WWTS at a the new Kenber Camp, IHI Camp, Song Da 5 Camp No. 2 and No. 1 have been completed in accordance to the

conceptual design prepared by an external consultant, the NNP1PC Instruction Letter (reference no. NNP1/0750-016/OBA/EPC-CE dated 12 October 2016) and design drawings cleared by NNP1PC in early November 2016. Discussions between NNP1PC and contractors were carried out and the Contractors have agreed to complete the improvement of WWTS for the remaining camps by the end of February 2017. Corrective actions are summarized in Figure **4-16**.

Table 4-7: Results of the effluent water quality monitoring of the camps from October to December 2016

Date	Parameters (Unit)	Site Name	Owner's Site Office and Village	Obayashi Camp WWTS1	TCM Camp	Sino Hydro Camp	Songda5 Camp No.1
		Station Code	EF01	EF02	EF03	EF06	EF07
		Guideline in the CA					
06-10-16	TSS (mg/l)	<50	ND[16]	41.6		25.1	11.6
20-10-16	TSS (mg/l)	<50	ND[16]	22		19.2	21
08-11-16	TSS (mg/l)	<50	ND[16]	28.4	7.2	17.7	58
21-11-16	TSS (mg/l)	<50	ND[16]	19.9	27	38.3	56
01-12-16	TSS (mg/l)	<50	ND[16]	24.6		22.3	49.3
06-10-16	COD (mg/l)	<125	10.7	171		69.6	75.5
20-10-16	COD (mg/l)	<125	12.8	140		54.6	99.9
08-11-16	COD (mg/l)	<125	12.3	183	16.7	98.2	160
21-11-16	COD (mg/l)	<125	9.4	148	186	96.8	161
01-12-16	COD (mg/l)	<125	10	134		63.4	102
06-10-16	BOD (mg/l)	<30	ND[13]	45.4		22.1	9.4
20-10-16	BOD (mg/l)	<30	1.1	61.8		23.4	30.6
08-11-16	BOD (mg/l)	<30	2.1	36.4	2.7	45.9	28.2
21-11-16	BOD (mg/l)	<30	7.4	67.8	75.6	32.8	27.6
01-12-16	BOD (mg/l)	<30	6.4	57.8	N/A	29.2	17.2
06-10-16	NH3-N (mg/l)	<10	3	31	N/A	12	13
20-10-16	NH3-N (mg/l)	<10	5	25	N/A	15	8
08-11-16	NH3-N (mg/l)	<10	4	27	ND[12]	31	5
21-11-16	NH3-N (mg/l)	<10	4	23	ND[12]	31	5
01-12-16	NH3-N (mg/l)	<10	6	36	N/A	21	3
06-10-16	Faecal Coliform (MPN/100ml)		330	160,000	N/A	160,000	160,000
20-10-16	Faecal Coliform (MPN/100ml)		79	160,000	N/A	160,000	160,000
08-11-16	Faecal Coliform (MPN/100ml)		4,900	160,000	3,300	160,000	92,000
21-11-16	Faecal Coliform (MPN/100ml)		13	160,000	92,000	160,000	160,000
01-12-16	Faecal Coliform (MPN/100ml)		17	160,000	N/A	92,000	35,000
06-10-16	Total Coliform (MPN/100ml)	<400	330	160,000	N/A	160,000	160,000
20-10-16	Total Coliform (MPN/100ml)	<400	220	160,000	N/A	160,000	160,000
08-11-16	Total Coliform (MPN/100ml)	<400	5,400	160,000	160,000	160,000	160,000
21-11-16	Total Coliform (MPN/100ml)	<400	170	160,000	160,000	160,000	160,000
01-12-16	Total Coliform (MPN/100ml)	<400	17	160,000	N/A	160,000	160,000

Note: *N/A no data available due to no water for sampling*.

ND[1] (<0.0005 mg/L) ND[2] (<0.0003 mg/L) ND[3] (<0.0002 mg/L) ND[4] (<0.005 mg/L) ND[5] (<0.003 mg/L)
ND[6] (<0.09 mg/L) ND[7] (<0.07 mg/L) ND[8] (<0.04 mg/L) ND[9] (<0.02 mg/L) ND[10] (<0.01 mg/L)
ND[11] (<0.3 mg/L) ND[12] (<0.2 mg/L) ND[13] (<1.0 mg/L) ND[14] (<1.5 mg/L) ND[15] (<4.0 mg/L)
ND[16] (<5.0 mg/L) ND[17] (<2.7 mg/L)

During the Fourth Quarter of 2016, effluent was monitored from six construction sites as in Table 4-15. Parameters that are above the prescribed Standards are highlighted in yellow. The locations of the sites are indicated on the map in Figure 4-7.

The compliance status and summary of corrective actions are presented in **Table 4-15**.

Figure 4-8: The effluent monitoring locations at construction areas

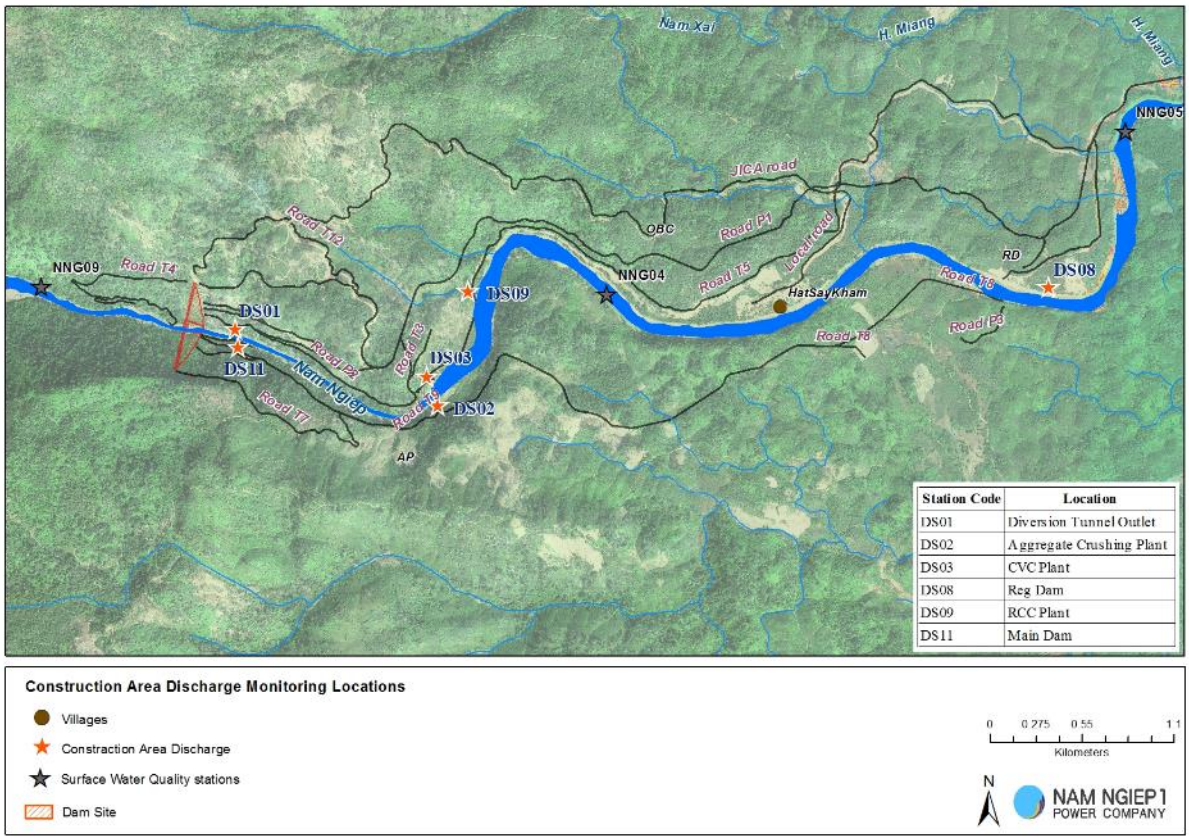


Table 4-14: Results of the construction area discharge monitoring from October to December 2016

			Site Name	Aggregate Crushing Plant	CVC Plant	Spoil Disposal No.2	Regulating Dam	RCC Plant	Main Dam
			Station	DS02	DS03	DS04	DS08	DS09	DS11
Month Year	Parameter (Unit)	Unit	Guideline						
05-10-2016	pH		6.0 - 9.0	8.66	N/A	6.89	7.46	7.37	8.88
11-10-2016	pH		6.0 - 9.0	8.98	N/A	5.87	N/A	7.13	7.82
20-10-2016	pH		6.0 - 9.0	7.37	N/A	6.61	N/A	8.34	7.89
24-10-2016	pH		6.0 - 9.0	N/A	N/A	7.02	8.68	8.88	7.96
03-11-2016	pH		6.0 - 9.0	8.4	N/A	6.88	N/A	10.57	11.42
09-11-2016	pH		6.0 - 9.0	8.89	N/A	6.97	N/A	7.23	8.87
17-11-2016	pH		6.0 - 9.0	8.32	N/A	6.34	N/A	7.1	8.45
22-11-2016	pH		6.0 - 9.0	6.76	N/A	5.96	N/A	6.82	10.88
08-12-2016	pH		6.0 - 9.0	6.2	N/A	5.49	N/A	6.15	4.31
05-10-2016	TSS (mg/l)	mg/L	<50	2,000	N/A	9	23.5	28,170	10.7
11-10-2016	TSS (mg/l)	mg/L	<50	10,027	N/A	6	N/A	48,420	31.9
20-10-2016	TSS (mg/l)	mg/L	<50	3,322	N/A	ND[16]	N/A	47,693	16.8
24-10-2016	TSS (mg/l)	mg/L	<50	N/A	N/A	12	74.5	212	27.4
03-11-2016	TSS (mg/l)	mg/L	<50	1,778	N/A	ND[16]	N/A	14,175	24.6
09-11-2016	TSS (mg/l)	mg/L	<50	14,107	N/A	ND[16]	N/A	163	ND[16]
17-11-2016	TSS (mg/l)	mg/L	<50	1,699	N/A	9	N/A	N/A	35.3
22-11-2016	TSS (mg/l)	mg/L	<50	2,227	N/A	6	N/A	29,443	41.8
08-12-2016	TSS (mg/l)	mg/L	<50	23,000	N/A	ND[16]	N/A	60,000	ND[16]

Note: N/A means data 'not available' due to no discharge into the environment*

ND[1] (<0.0005 mg/L)	ND[2] (<0.0003 mg/L)	ND[3] (<0.0002 mg/L)	ND[4] (<0.005 mg/L)	ND[5] (<0.003 mg/L)
ND[6] (<0.09 mg/L)	ND[7] (<0.07 mg/L)	ND[8] (<0.04 mg/L)	ND[9] (<0.02 mg/L)	ND[10] (<0.01 mg/L)
ND[11] (<0.3 mg/L)	ND[12] (<0.2 mg/L)	ND[13] (<1.0 mg/L)	ND[14] (<1.5 mg/L)	ND[15] (<4.0 mg/L)
ND[16] (<5.0 mg/L)	ND[17] (<2.7 mg/L)			

Table 4-15: Compliance status of effluent discharge and corrective action during the Fourth Quarter of 2016

Site	ID	WWTS	Compliance Status	Corrective Actions
Owner's Site Office and Village (NNP1PC)	EF01	Septic tanks (kitchen and black water) and wetland (grey water), discharged 70 m^3/day	Total coliforms: Non-compliance in November 2016. Complied in December 2016	None
OC Camp – WWTS01	EF02	Septic tanks (kitchen and black water) and wetland (grey water)	Non-compliance: BOD_5, COD, Ammonia Nitrogen and total coliforms	Deadline for improvements and compliance: 28 February 2017
OC Camp – WWTS02	EF15	Septic tanks (kitchen and black water) and wetland (grey water)	Non-compliance: Total coliforms	Deadline for improvements and compliance: 28 February 2017
TCM Camp	EF03	Septic tank (kitchen and black water), sediment ponds (grey water)	Non-compliance: BOD and COD	Deadline for improvements and compliance: 28 February 2017
Sino Hydro Camp	EF06	Septic tank (kitchen and black water), sediment ponds (grey water)	Non-compliance: Ammonia nitrogen, BOD and total coliforms	Deadline for improvements and compliance: 28 February 2017
HMH Worker Camp No.1	EF09	Septic tank (kitchen and black water), sediment ponds (grey water)	Non-compliance: Total coliforms	A meeting was held between NNP1PC and HM Hydro to discuss the WWTS improvement plan for their own and sub-contractors' camps as per the NNP1PC Instruction Letter. No conclusion was made by December 2016. Further discussion will be carried out in January 2017 to meet the completion deadline by 28 February 2017.
V&K Camp	EF10	Septic tank (kitchen and black water), sediment ponds (grey water)	Non-compliance: TSS and total coliforms	Deadline for improvements and compliance: 28 February 2017
SECC Camp	EF11	Septic tank (kitchen and black water),	Non-compliance: Total coliforms	The camp is being decommissioned in early December 2016. Small number of workers remain in the camp for another year for the guarantee period of completed road and the Nam Ngiep

Site	ID	WWTS	Compliance Status	Corrective Actions
		sediment ponds (grey water)		Bridge. NNP1PC will continue to monitor the waste water quality at this camp.
HMH Main Camp – WWTS01	EF13	Septic tank (kitchen and black water), sediment ponds (grey water)	Non-compliance: Ammonia nitrogen, TSS, BOD, COD, and total coliforms	Deadline for improvements and compliance: 28 February 2017
IHI Camp	EF14	Septic tank (kitchen and black water), sediment ponds (grey water)	Non-compliance: The BOD, COD, NH_3-N and total coliforms	A chlorine contact tank and a monitoring tank were built by middle of December 2016. Deadline for improvements and compliance: 28 February 2017
Song Da 5 Camp No. 1	EF07	Septic tank (kitchen and black water), sediment ponds (grey water)	Non-compliance: TSS, COD, BOD, NH3-N and total coliforms	The improvement of the wetland ponds to be sub-surface flow systems and installation of a chlorine contact tank and monitoring tank started in November 2016 and completed by mid-December 2016. Deadline for improvements and compliance: 28 February 2017
Song Da 5 Camp No. 2	EF08	Septic tank (kitchen and black water), sediment ponds (grey water)	Non-compliance: TSS, BOD, NH_3-N and total coliforms	The improvement of the wetland ponds to be a sub-surface flow system and installation of a chlorine contact tank and monitoring tank were completed in early December 2016 and chlorination was started by mid-December 2016. Deadline for improvements and compliance: 28 February 2017
Aggregate Crushing Plant	DS02	Sediment pond	Non-compliance: TSS	Improvements of the sediment pond was underway, but not according to the design. There was no installation of baffles, no reinforcement of sediment pond's embankment and no submission of a proposed construction design for NNP1PC review before the improvement works. The NCR level 2 was issued. Deadline for improvements and compliance: 28 February 2017
CVC Plant	DS03	Sediment ponds	No water discharge during the Quarter	
Spoil Disposal No.2	DS04	Sediment pond	Non-compliance: pH	Low pH values in the past four months confirmed the natural water quality condition of the creek which passes this sampling site. Similar cases happened in the last dry season (2015).

Site	ID	WWTS	Compliance Status	Corrective Actions
Re-regulating Dam	DS08	pH adjustment and chemical flocculation	Non-compliance: TSS	No action was required.
RCC Plant	DS09	Sediment ponds	Non-compliance: pH, TSS	The SS-ESMMP has developed and submitted to NNP1PC for review. The contractor was instructed to develop an improvement plan for the first 3 ponds by early January 2017. Deadline for improvements and compliance: 28 February 2017
Main Dam Construction Area	DS11	pH adjustment and chemical flocculation 6000 m^3/day	Non-compliance: pH	The Contractor was notified to ensure that the wastewater from the main dam is properly treated. NNP1PC will continue to monitor this in January 2017.

4.6.3 Groundwater Quality Monitoring

The groundwater quality monitoring program includes groundwater for community water supply and since July 2016 also groundwater at the landfill sites.

The community groundwater quality was monitored in two boreholes of Hatsaykham Village installed by NNP1PC, a private well in Hat Gniun Village and six boreholes of Houay Soup Resettlement Area (HSRA). The boreholes of Hatsaykham Village are used for drinking, washing, cooking and bathing purposes for 42 households, whereas the private well in Hat Gniun Village is used by six households for washing and bathing purpose only. In addition, during the Fourth Quarter 2016, groundwater samples were collected from six boreholes installed at the Houay Soup Resettlement Area (HSRA) as a baseline data. All the community groundwater samples were tested for 21 parameters including:

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

b. *Quarterly:* Arsenic (mg/l), Cadmium (mg/l), Calcium (mg/l), Iron (mg/l), Magnesium (mg/l), Manganese (mg/l), Potassium (mg/l), Sodium (mg/l), Fluoride (mg/l), Nitrate (mg/l), Nitrite (mg/l) and Total Hardness (mg/l)].

The landfill groundwater monitoring was conducted for four monitoring wells (MW1, MW2, MW3 and MW4) at the NNP1 Project Landfill and one monitoring well (MW5) Houay Soup Landfill for assessing the potential risk of leachate seepage and contamination to the groundwater below the landfills.

The full set of monitoring data is attached in Appendix 5 and key results are presented in Table 4-16.

Figure 4-9: Groundwater sampling locations

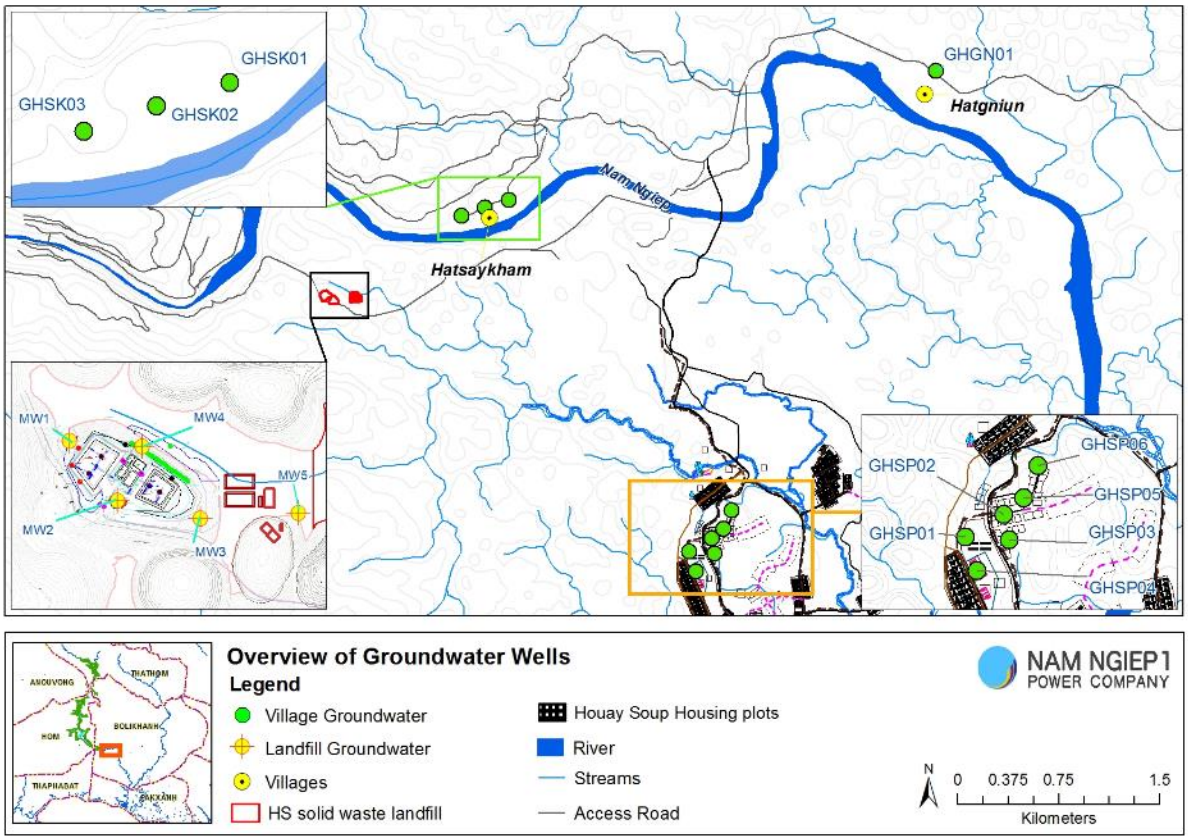


Table 4-16: Key results of the groundwater quality monitoring from October to December 2016

Date	Parameter (Unit)	Site Name	Ban Hatsaykham			Ban Hat Gnuin	Houay Soup Resettlement Village					
		Station	GHSK01	GHSK02	GHSK03	GHGN01	GHSPO1	GHSPO2	GHSPO3	GHSPO4	GHSPO5	GHSPO6
		Guideline										
Oct-16	pH	6.5 - 9.2	5.68	N/A	5.78	7.4	7.24	7.62	7.87	7.78	6.9	6.76
Nov-16	pH	6.5 - 9.2	6.05	N/A	6.19	6.36	8.47	7.36	7.44	7.08	7.87	7.78
Dec-16	pH	6.5 - 9.2	5.36	N/A	5.3	5.49	6.92	6.55	6.67	5.51	6.26	6.27
Oct-16	Turbidity (NTU)	<20	0.86	N/A	0.58	8.7	0.8	0.62	1.06	0.47	0.66	0.69
Nov-16	Turbidity (NTU)	<20	24.3	N/A	26	26.2	0.82	0.97	0.83	1.92	1.18	0.91
Dec-16	Turbidity (NTU)	<20	0.77	N/A	0.79	3.16	1.42	1.23	1.06	1.74	0.91	0.67
Oct-16	Faecal coliform (MPN/100 ml)	0	0	N/A	0	170	0	0	0	0	0	0
Nov-16	Faecal coliform (MPN/100 ml)	0	0	N/A	0	2,400	0	0	2	0	0	0
Dec-16	Faecal coliform (MPN/100 ml)	0	0	N/A	0	23	0	0	0	0	0	0
Oct-16	E.Coli bacteria (MPN/100 ml)	0	0	N/A	0	170	0	0	0	0	0	0
Nov-16	E.Coli bacteria (MPN/100 ml)	0	0	N/A	0	2,400	0	0	2	0	0	0
Dec-16	E.Coli bacteria (MPN/100 ml)	0	0	N/A	0	23	0	0	0	0	0	0

Note: *N/A no data available.*

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

Ban Hatsaykham: All two boreholes (GHSK01 & GHSK03) monitored contained pH level lower than the standard during the reported Quarter and slightly high turbidity recorded of 24.3 and 26.0 NTU respectively in November 2016. The low pH level does not pose any risk to human health.

Ban Hat Gniun: During November to December 2016, the pH level was lower than the National Standard pH interval (6.50 - 9.20). The low level of pH does not pose any risk to human health. Faecal coliform and E.coli bacteria levels exceeded the National Standard. The measured content of E.coli and faecal coliform bacteria indicates probable presence of pathogens. This means that the water is not safe to drink. NNP1PC regularly provide the water quality results to the local authorities, and the concerned unit at NNP1PC to educate and inform the villagers accordingly.

Houay Soup Resettlement Area: The pH level measure in December 2016 at the boreholes GHSP04, GHSP05 and GHSP06 were slightly lower than the Standard level. In addition, the borehole GHSP03 for November 2016 contained faecal coliform and ecoli bacteria slightly exceeding the standard. The low pH does not pose any risk to human health.

NNP1PC and Houay Soup Landfills Groundwater: The pH levels were slightly acidic in the monitoring wells at NNP1PC and Houay Soup Landfills. Faecal coliform contamination were found from time to time in the monitored wells MW3, MW4 and MW5. In addition, the lead at the monitored wells (MW1, MW2 and MW4) exceeded the guideline.

Table 4-17: Results of groundwater monitoring at the NNP1 Project and Houay Soup landfills

	Site Name	NNP1PC Landfill												Houay Soup Landfill		
	Station	MW1			MW2			MW3			MW4			MW5		
	Date	25-10-16	10-11-16	9-12-16	25-10-16	10-11-16	9-12-16	25-10-16	10-11-16	9-12-16	25-10-16	10-11-16	9-12-16	25-10-16	10-11-16	9-12-16
Parameter (Unit)	Guideline															
pH		6.96	6.22	5.75	5.79	5.99	5.05	7.43	6.35	5.85	6.25	5.96	4.76	7.68	6.3	5.7
Lead (mg/l)	<0.01	0.126	0.111	0.017	0.038	0.01	ND[10]	0.404	0.065	0.017	0.12	0.014	0.01	0.022	0.022	0.113
Faecal Coliform (MPN/100 ml)		0	0	0	0	0	0	2400	0	0	0	0	32	3300	1600	0

4.6.4 Gravity Fed Water Supply (GFWS) Monitoring

The results of the regular monthly water quality monitoring of the tap water from the Gravity Fed Water Supply System in Ban Hat Gniun and Ban Thahuea are shown in **Table 4-18**. The system supplies water, which the villagers use for bathing and washing.

Table 4-18: The GFWS monitoring result from *October to December* 2016

Date	Parameter (Unit)	Site Name	Ban Thahuea	Ban Hat Gnuin
		Station	WTHH02	WHGN02
		Guideline		
Oct-16	Faecal coliform (MPN/100 ml)	0	12	17
Nov-16	Faecal coliform (MPN/100 ml)	0	33	140
Dec-16	Faecal coliform (MPN/100 ml)	0	23	130
Oct-16	E.Coli bacteria (MPN/100 ml)	0	12	17
Nov-16	E.Coli bacteria (MPN/100 ml)	0	33	140
Dec-16	E.Coli bacteria (MPN/100 ml)	0	23	130

Ban Thahuea (WTHH02): All samples had content of faecal coliform and E.Coli bacteria above the National Drinking Water Quality Standard and the water is therefore not safe to drink. All other parameters complied with the relevant National Standards. NNP1PC-SMO has advised the villagers to boil the water before drinking.

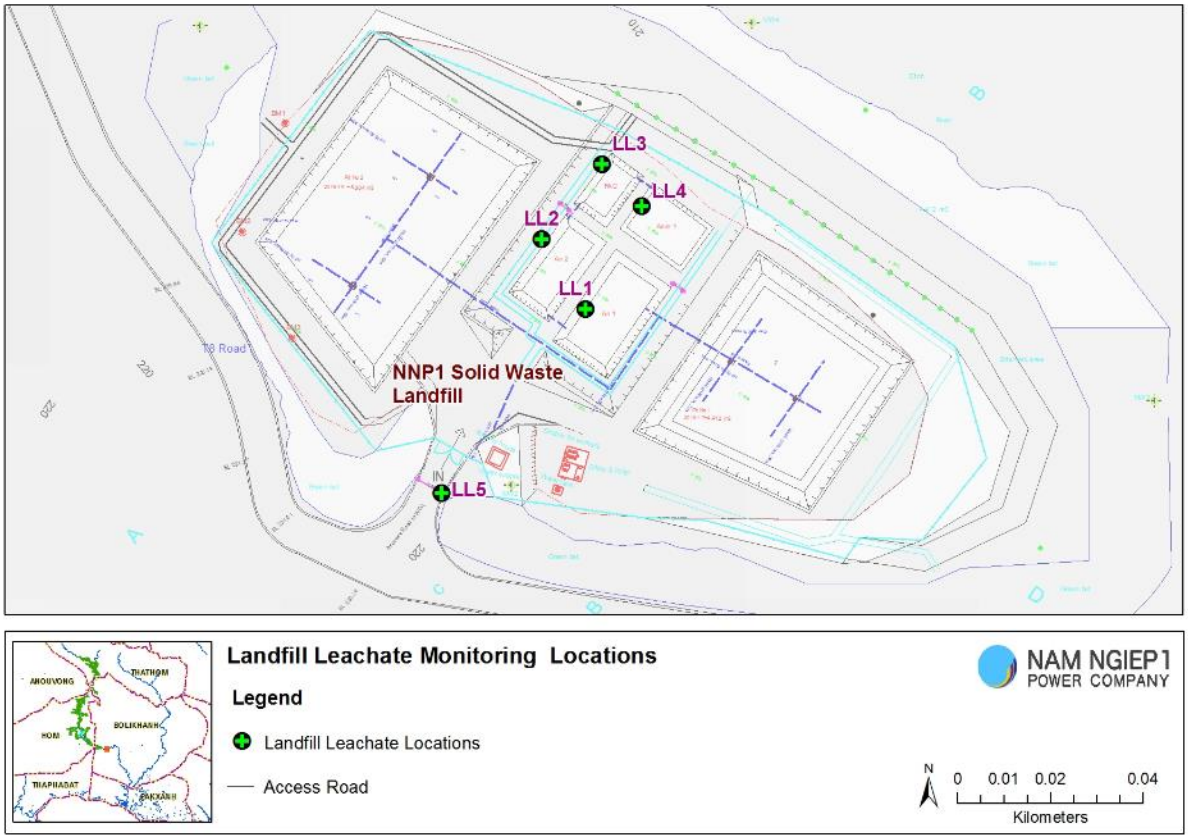
Ban Hat Gniun (WHGN02): All samples had content of faecal coliform and E.Coli bacteria above the National Drinking Water Quality Standard and the water is therefore not safe to drink. All other parameters complied with the relevant National Standards. NNP1PC-SMO has advised the villagers to boil the water before drinking.

4.6.5 Landfill Leachate Monitoring

There was no discharge of leachate during the Fourth Quarter of 2016. The landfill leachate monitoring was conducted to evaluate the effectiveness of the treatment ponds.

The parameters monitoring for landfill leachate were carried out according to the ESMMP-CP Volume III updated 2016. The monitoring location points are present in the **Figure 4-10**.

Figure 4-10: Landfill Leachate Monitoring Location



Key results of the landfill leachate monitoring are described below. Parameters that are above the prescribed Standards are highlighted in yellow and presented below.

Table 4-19: The results of landfill leachate monitoring from October to December 2016

Date	Parameter (Unit)	Site Name	NNP1 Landfill Leachate			
		Station Code	LL1	LL2	LL3	LL4
		Guideline				
10-10-16	Total nitrogen (mg/l)	<10	8.59	8.75	5.81	4
9-11-16	Total nitrogen (mg/l)	<10	6.28	5.03	3.79	20
9-12-16	Total nitrogen (mg/l)	<10	4.7	1.56	1.2	2
10-10-16	Faecal Coliform (MPN/100ml)		7	8	0	0
9-11-16	Faecal Coliform (MPN/100ml)		35000	1100	140	31
9-12-16	Faecal Coliform (MPN/100ml)		23	0	0	0
10-10-16	Total Coliform (MPN/100ml)	<400	11	13	79	330
9-11-16	Total Coliform (MPN/100ml)	<400	35000	4600	700	330
9-12-16	Total Coliform (MPN/100ml)	<400	79	0	4.5	13

During the reported Quarter, the monitoring results show that the leachate quality improved for total nitrogen, total coliform and faecal coliform through the treatment from the first pond (LL1) to last pond (LL4). The leachate quality in the final treatment pond (LL4) complied with the measured effluent standards – except with respect to total nitrogen in the November sample.

4.6.6 Air Quality (Dust) Monitoring

4.7.6.1 Ambient Air Quality in the Host Villages

The ambient air quality monitoring for dust was carried out for 72 consecutive hours in the village closest (Ban Hat Gniun) to the project construction sites (see location in **Figure 4-11**. The monitoring included 20 hours on a weekend to obtain a record of background conditions. The main purpose of the dust monitoring in Ban Hat Gniun is to assess if the project construction works and the project related traffic passing through the village cause elevated levels of dust in the ambient air. The ambient air quality monitoring for Ban Hatsaykham was ended, because by November 2016 most of the households had moved out and resettled in Houay Soup Resettlement Area.

The 24-hour mean values for dust (Particulate Matter <= 0.010 mm) measured during the Fourth Quarter of 2016 are shown in **Table 4-20**. The records show compliance with the Lao National Environmental Standard for Air Quality of 0.12 mg/m^3.

Figure 4-11: Noise and dust monitoring locations at the construction sites and nearby villages

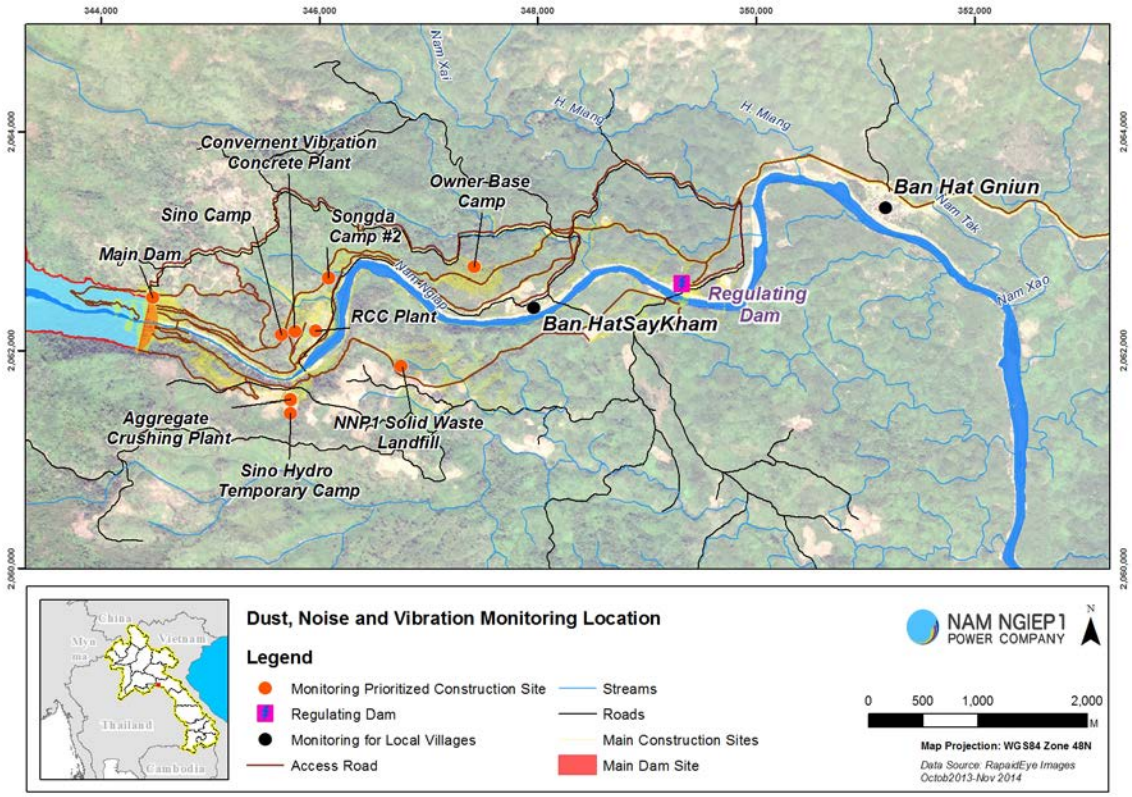


Table 4-20: Results of air quality (dust) monitoring at the Hat Gnuin village near the Project Construction sites during November to December 2016

Site Name	Ban Hat Gnuin - Dust Monitoring - Quarter 4, 2016					
Start Time	20-11-16 09:57	21-11-16 09:57	22-11-16 09:57	04-12-16 10:28	05-12-16 10:28	06-12-16 10:28
End Time	21-11-16 09:57	22-11-16 09:57	23-11-16 09:57	05-12-16 10:28	06-12-16 10:28	07-12-16 10:28
Average Data Record -24h	0.10	0.04	0.04	0.03	0.05	0.08
Guideline	***0.12***	***0.12***	***0.12***	***0.12***	***0.12***	***0.12***

4.7.6.2 Project Construction Sites

During November and December 2016, dust monitoring was carried out at priority project construction sites for 24 hours consecutively at six construction sites including the Aggregate Crushing Plant, RCC Plant, Main Dam, Sino Hydro Camp, Sino Hydro Temporary Work Camp, Song Da 5 Camp No. 2 (to assess possible impact on worker's health) and at the Owner's Site Office and Village (to

monitor the ambient dust levels). The results of dust monitoring in these construction sites are summarized in Table 4 21. All results indicate compliance with the Lao National Environmental Standard for Air Quality of 0.12 mg/m^3 (24 hour average).

Table 4-21: Dust Monitoring Results at the Construction Sites during November - December 2016

Site Name	Aggregate Crushing Plant - Dust Monitoring - Quarter 4, 2016	
Period	**00-24 Hours**	**00-24 Hours**
Start Time	18-11-16 14:38	26-12-16 10:41
End Time	19-11-16 14:16	27-12-16 10:41
Average Data Record -24h	0.110	0.030
Guideline	***0.12***	***0.12***

Site Name	Sino Hydro Temporary Worker Camp - Dust Monitoring - Quarter 4, 2016	
Period	00-24 Hours	00-24 Hours
Start Time	23-11-16 13:49	27-12-16 11:36
End Time	24-11-16 13:48	28-12-16 11:36
Average Data Record -24h	0.04	0.04
Guideline	***0.12***	***0.12***

Site Name	Sino Hydro Camp - Dust Monitoring - Quarter 4, 2016	
Period	00-24 Hours	00-24 Hours
Start Time	11-11-16 10:46	20-12-16 14:05
End Time	12-11-16 10:53	21-12-16 13:54
Average Data Record -24h	0.014	0.014
Guideline	***0.12***	***0.12***

Site Name	RCC Plant - Dust Monitoring - Quarter 4, 2016	
Period	00-24 Hours	00-24 Hours
Start Time	17-11-16 14:15	21-12-16 14:15
End Time	18-11-16 14:03	22-12-16 14:15
Average Data Record -24h	0.038	0.029
Guideline	***0.12***	***0.12***

Site Name	SongDa Camp No.2 - Dust Monitoring - Quarter 4, 2016	
Period	00-24 Hours	00-24 Hours
Start Time	28-11-16 10:53	12-12-16 10:54
End Time	29-11-16 10:53	13-12-16 10:54
Average Data Record -24h	0.036	0.025
Guideline	***0.12***	***0.12***

Site Name	Main Dam - Dust Monitoring - Quarter 4, 2016
Period	00-24 Hours
Start Time	22-12-16 14:55
End Time	23-12-16 14:55
Average Data Record -24h	0.023
Guideline	***0.12***

Owner's Site Office and Village - Dust Emission Average in 24 hours	
Period	24 Hours
Start Time	09-12-16 13:17
End Time	10-12-16 13:17
Average Data Record -24h	0.052
Guideline	***0.12***

4.7.7 Noise Monitoring

4.7.7.1 Host Villages

Noise monitoring was carried out in Hat Gniun Villages from 10:50 in the morning for 72 consecutive hours. The monitoring was started on a non-working day (Sunday), to obtain a record of at least 20 hours of background conditions. The recorded values were measured against the Standards (maximum average noise levels for daytime 06:00-18:00, evening 18:00-22:00 and night time 22:00-06:00; and the maximum peak noise level).

The noise monitoring results are presented in **Table 4-22**. The results indicate that the peak noise levels were within the allowable maximum peak value of 115 dB(A). The mean night time noise level standard was exceeded for the monitoring carried out in November 2016.

Table 4-22: Noise monitoring results from October to December 2016 at the host villages

Ban Hat Gnuin - Noise Monitoring 72 consecutive hours - October 2016										
Noise Level (dB)	02-03/10/2016			03-04/10/2016			04-05/10/2016			05-10-16
	09:46-18:00	18:01 – 22:00	22:01 – 06:00	06:01 – 18:00	18:01 – 22:00	22:01 – 06:00	06:01 – 18:00	18:01 – 22:00	22:01 – 06:00	06:01 - 09:46
Maximum Value Recorded	70.40	73.40	61.20	70.80	62.20	70.10	75.70	68.10	72.10	74.90
Guideline Max	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	49.43	51.45	50.15	48.11	50.80	49.35	46.78	50.75	50.76	50.01
Guideline Averaged	***55***	***55***	***45***	***55***	***55***	***45***	***55***	***55***	***45***	***55***
Ban Hat Gnuin - Noise Monitoring 72 consecutive hours - November 2016										
Noise Level (dB)	20-21/11/2016			21-22/11/2016			22-23/11/16			23-11-16
	10:37-18:00	18:01 – 22:00	22:01 – 06:00	06:01 – 18:00	18:01 – 22:00	22:01 – 06:00	06:01 – 18:00	18:01 – 22:00	22:01 – 06:00	06:01 - 10:37
Maximum Value Recorded	74.90	70.20	68.10	76.20	67.30	68.10	73.30	66.20	63.90	67.10
Guideline Max	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	48.29	47.41	43.30	49.96	43.02	41.18	51.20	45.38	40.90	46.34
Guideline Averaged	***55***	***55***	***45***	***55***	***55***	***45***	***55***	***55***	***45***	***55***
Ban Hat Gnuin - Noise Monitoring 72 consecutive hours - December 2016										
Noise Level (dB)	04-05/12/2016			05-06/12/2016			06-07/12/2016			07-12-16
	10:58-18:00	18:01 – 22:00	22:01 – 06:00	06:01 – 18:00	18:01 – 22:00	22:01 – 06:00	06:01 – 18:00	18:01 – 22:00	22:01 – 06:00	06:01 - 10:58
Maximum Value Recorded	76.20	63.00	61.90	73.00	64.40	60.60	77.20	60.00	60.10	75.50
Guideline Max	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	51.60	46.37	41.79	49.21	42.90	37.87	47.95	42.07	40.17	50.44
Guideline Averaged	***55***	***55***	***45***	***55***	***55***	***45***	***55***	***55***	***45***	***55***

4.7.7.2 Project Camps and Construction Sites

During the Fourth Quarter of 2016, noise monitoring was conducted at the Aggregate Crushing Plant, RCC Plant, Sino Hydro Camp and Song Da 5 Camp No.2, Main Dam, Sino Hydro Temporary Worker Camp (new site) and Owner's Site Office and Village mainly in order to assess possible impacts on workers' health as well as to estimate any potential impact on the ambient noise levels in the surrounding areas.

The results indicate that all maximum peak noise levels were within the National Standard. The monitoring results indicate that the noise level during 22:00-06:00 at the Aggregate Crushing Plant, Sino Hydro Camp, Sino Hydro Temporary Camp, RCC Plant, Song Da 5 Camp No. 2 and Owner's Site Office and Village were higher than the National standard (<50 dB(A)). In addition, the average noise level at the Aggregate Crushing Plant during 15:09-22:00 on 18 October 2016 exceeded the standard (70 dB(A)).

The ESMMP-CP states that all workers must wear appropriate ear protection equipment if they are exposed to the noise levels that is greater than 80 dB(A).

Table 4-23: Noise monitoring results for Project construction sites from October to December 2016

Noise Level (dB)	Aggregate Crushing Plant - Noise monitoring results for the Fourth Quarter 2016								
	26-27/10/2016		27/10/16	18-19/11/2016		19/11/16	26-27/12/2016		27/12/16
	10:04 – 22:00	22:01 – 06:00	06:01-10:04	15:09 – 22:00	22:01 – 06:00	06:01-14:51	11:09 – 22:00	22:01 – 06:00	06:01-11:09
Maximum Value Recorded	82.90	83.70	75.30	83.90	83.70	83.50	71.70	67.80	73.60
Guideline Max	115	115	115	115	115	115	115	115	115
Average Data Recorded	68.84	74.66	60.56	74.06	74.18	65.24	44.14	43.34	47.13
Guideline Averaged	70	50	70	70	50	70	70	50	70

Noise Level (dB)	Sino Hydro Temporary Worker Camp - Noise monitoring results for the Fourth Quarter 2016								
	27-28/10/2016		28/10/16	23-24/11/2016		24/11/16	27-28/12/2016		28/12/16
	11:32 – 22:00	22:01 – 06:00	06:01-11:32	14:21 – 22:00	22:01 – 06:00	06:01-14:20	12:16 – 22:00	22:01 – 06:00	06:01-12:16
Maximum Value Recorded	70.2	66.7	64.4	85.9	67.1	84.7	82.5	66.9	73
Guideline Max	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	56.06	56.56	54.55	58.10	57.31	58.46	50.61	59.66	55.75
Guideline Averaged	***70***	***50***	***70***	***70***	***50***	***70***	***70***	***50***	***70***

Noise Level (dB)	Sino Hydro Camp - Noise monitoring results for the Fourth Quarter 2016								
	21-22/10/2016		22/10/16	11-12/11/2016		12/11/16	20-21/12/2016		21/12/16
	11:12 – 22:00	22:01 – 06:00	06:01-11:12	11:09 – 22:00	22:01 – 06:00	06:01-11:09	14:41 – 22:00	22:01 – 06:00	06:01-14:33
Maximum Value Recorded	73.3	62.8	64.7	74.5	60.5	75.5	74.5	60.5	75.5
Guideline Max	115	115	115	115	115	115	115	115	115
Average Data Recorded	53.09	54.22	51.10	55.17	53.17	51.45	55.17	53.17	51.45
Guideline Averaged	70	50	70	70	50	70	70	50	70

Noise Level (dB)	Main Dam - Noise monitoring results for the Fourth Quarter 2016								
	28-29/10/2016		29/10/16	01-02/11/2016		02/11/16	22-23/12/2016		23/12/16
	10:52 – 22:00	22:01 – 06:00	06:01-10:52	11:38 – 22:00	22:01 – 06:00	06:01-11:38	15:38 – 22:00	22:01 – 06:00	06:01-15:38
Maximum Value Recorded	63	59.3	61.5	65.1	62.9	67.8	64.8	68.4	66
Guideline Max	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	51.02	52.41	54.58	53.82	52.98	56.82	56.60	55.06	59.95
Guideline Averaged	***70***	***50***	***70***	***70***	***50***	***70***	***70***	***50***	***70***

Noise Level (dB)	RCC Plant - Noise monitoring results for the Fourth Quarter 2016								
	24-25/10/2016		25/10/16	17-18/11/2016		18/11/16	21-22/12/2016		22/12/16
	10:22 – 22:00	22:01 – 06:00	06:01-10:22	10:40 – 22:00	22:01 – 06:00	06:01-10:38	14:59 – 22:00	22:01 – 06:00	06:01-14:59
Maximum Value Recorded	84.3	73.4	61.2	81.2	70.6	74.9	70.9	71.5	73.9
Guideline Max	115	115	115	115	115	115	115	115	115
Average Data Recorded	55.71	55.54	51.76	61.95	67.71	64.05	61.40	60.41	56.83
Guideline Averaged	***70***	***50***	***70***	***70***	***50***	***70***	***70***	***50***	***70***

Noise Level (dB)	SongDa5 Camp No.2 - Noise monitoring results for the Fourth Quarter 2016								
	12-13/10/2016		13/10/16	28-29/11/2016		29/11/16	12-13/12/2016		13/12/16
	13:37 – 22:00	22:01 – 06:00	06:01-13:37	11:31 – 22:00	22:01 – 06:00	06:01-11:31	11:28 – 22:00	22:01 – 06:00	06:01-11:28
Maximum Value Recorded	75.5	63.7	76.5	64.3	57.2	67.7	78.8	61	67.8
Guideline Max	115	115	115	115	115	115	***115***	***115***	***115***
Average Data Recorded	52.51	54.16	51.71	46.19	48.05	46.63	50.86	53.20	51.15
Guideline Averaged	***70***	***50***	***70***	***70***	***50***	***70***	***70***	***50***	***70***

Noise Level (dB)	Owner's Site Office and Village - Noise monitoring results for the Fourth Quarter 2016								
	10-11/10/2016		11/10/16	04-05/11/2016		05/11/16	09-10/12/2016		10/12/16
	11:58 – 22:00	22:01 – 06:00	06:01-11:17	11:00 – 22:00	22:01 – 06:00	06:01-11:00	13:50 – 22:00	22:01 – 06:00	06:01-13:50
Maximum Value Recorded	63.1	58.3	56.9	53.8	54.6	54.2	55.6	43.9	56.6
Guideline Max	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***	***115***
Average Data Recorded	42.93	50.11	37.89	37.64	39.81	36.06	36.10	37.37	35.16
Guideline Averaged	***70***	***50***	***70***	***70***	***50***	***70***	***70***	***50***	***70***

4.7.8 Vibration

Lao PDR does not have guidelines for vibration. Structural damage from road construction activity (e.g. vibratory rollers) and ancillary activity (e.g. blasting at the quarries) are unlikely to impact on human and surrounded environment given that the distance from public infrastructure to the construction areas are far from each other.

5. WATERSHED AND BIODIVERSITY MANAGEMENT

5.1 Watershed Management

Obligations	Status by end of the Fourth Quarter of 2016
Prepare: **1) Interim Nam Ngiep 1 Watershed Management Plan by 01 September 2016; and** **2) Full draft Nam Ngiep 1Watershed Management Plan by 15 November 2016**	The interim Nam Ngiep 1 Watershed Management Plan was completed and accepted by ADB on 02 November 2016. In December 2016, it was agreed with ADB that the condition precedent for disbursement of the loan amount related to the delivery of the full draft Nam Ngiep 1 Watershed Management Plan has been met, although some parts of the plan still need more work
Prepare draft Watershed Management Regulations by 15 November 2016	First draft Watershed Management Regulation prepared
Final Watershed Management Plan by 23 December 2016	As agreed between ADB and NNP1PC, this target date will be moved to the First Quarter of 2017
1) A draft provincial regulation submitted to Provincial Justice Department by 23 December 2016. **2) Start of public hearing process by 10 January 2017**	As agreed between ADB and NNP1PC, this target date will be moved to the First Quarter of 2017

Activities in the Fourth Quarter of 2016	Results
Data and Information Collection and Analysis for WMP Development	• Village consultation meetings were conducted at seven villages within Xaysomboun Province from 19-21 October 2016. These villages included Tamlo, Om, and Korhai at Anouvong District and Thaviengxay, Naxong, Nahong, and Phonehom at Tathom District. • The consultations aimed at providing additional information for data and problem analysis such as: family setting, land use, forest use, food supply and rice sufficiency, income generating activities, and the villagers' preferences with respect to family size. • The interim plan was discussed during ADB mission on 27 October 2016 and subsequently approved. The planning work continued throughout November and December 2016 focusing on the baseline and trend analysis and improving the section on watershed management issues and action plans. • In December 2016, the draft Nam Ngiep 1 Watershed Management Plan was presented to the ADB, IAP, LTA, and BAC mission; and the mission expressed satisfaction

Activities in the Fourth Quarter of 2016	Results
	with the current progress and recommended that consultation with GOL agencies should have a high priority and should take place soon.
Prepare draft Watershed Management Regulations by 15 November 2016	• The Watershed Management Committee has prepared a first draft Watershed Management Regulation and NNP1PC has reviewed the draft and added comments
WRPO Activities	• NNP1PC completed fund transfer of USD 47,226.88 to DFRM WRPO, Xaysomboun WRPO, and Bolikhamxay WRPO for the implementation of 2nd pre-WMP proposal for the period up to April 2017. • Xaysomboun WRPO is preparing tools and equipment for village land-use planning exercise at three villages including Ban Thamlo, Om and Kohai in Anouvong District, Xaysomboun Province. The village land-use planning is expected to conduct in early January 2017
Xaysomboun ISP	• In October 2016, DEQP/MONRE provided feedback on the ISP reports prepared by the Province and relevant districts. • DEQP/MONRE held a technical workshop on 4 November 2016 which concluded as follows: o There is need to further improve the draft ISP particularly on the section of baseline analysis and management plan o DEQP agreed to provide further technical assistance to help Xaysomboun ISP team and Xaysomboun Districts in finalizing the report o To have internal technical workshop between DEQP and Xaysomboun ISP team

5.2 Biodiversity Management

Obligations[3]	Status by end of the Fourth Quarter of 2016
Final Biodiversity Offset Survey Report by 30 June 2016	• The final report was approved 02 September 2016

[3] The biodiversity offset obligations were revised and agreed with ADB in August 2016. The Table only shows the current near term obligations up to end of January 2017

Start of the Boundary Confirmation Baseline Survey by 20 September 2016	• The survey officially started on 20 September 2016 and was completed on 23 October 2016
Consultant acceptable to ADB is engaged as technical consultant for preparation of biodiversity offset management plan by 30 November 2016	• ADB provided the comment to the TOR in the second week of December and it was discussed during the mission that this deadline will be waived.
Issuance of the Boundary Confirmation Baseline Survey draft final report by 31 January 2017	• Not relevant at this quarter
Submission of a draft legal agreement to the government by 31 January 2017	• On 28 November 2016, NNP1PC submitted a draft Memorandum of Understanding to ADB for comments

Activities in the Fourth Quarter of 2016	**Results**
Boundary Confirmation Baseline Survey led by ADB Consultant	• The field work was completed on 23 October 2016. ADB Consultant presented the initial outcomes of the survey to NNP1 and Biodiversity Offset Management Committee (BOMC) on 26 October 2016. • The preliminary report was submitted by ADB Consultant in the first week of December with some notes: o The offset site is noteworthy in a Lao context for its populations of gibbons, Phayre's Leaf Monkeys and large hornbills. In the context of other Annamite areas the conservation significance of the ground living large mammal community is well above average. o There is still some biodiversity conservation significance in the river system and its associated species within the offset site o The great majority of the forest in the offset site has little to no significant affinity with Wet Evergreen Forest o In order to fulfil the obligation of the Project Concession Agreement (CA) and its wider implications for both company and ADB then it requires such involvement of an experienced biodiversity conservation organisation from the very earliest stages of project planning and implementation, revision of boundaries to include additional areas of higher long-term biodiversity significance, and/or investment in additional offset sites and or other offset options. • The report was discussed during the mission and GOL wish to see the full survey report before deciding further per conclusion and recommendation of the report.
Consultant acceptable to ADB is engaged as technical consultant for preparation of biodiversity offset	• ADB consultant provided the first comment to the Term of Reference (TOR) on 14 October 2016 recommending that the scope of service to also incorporate lesson-learned from Nam Theun 2 watershed and biodiversity management.

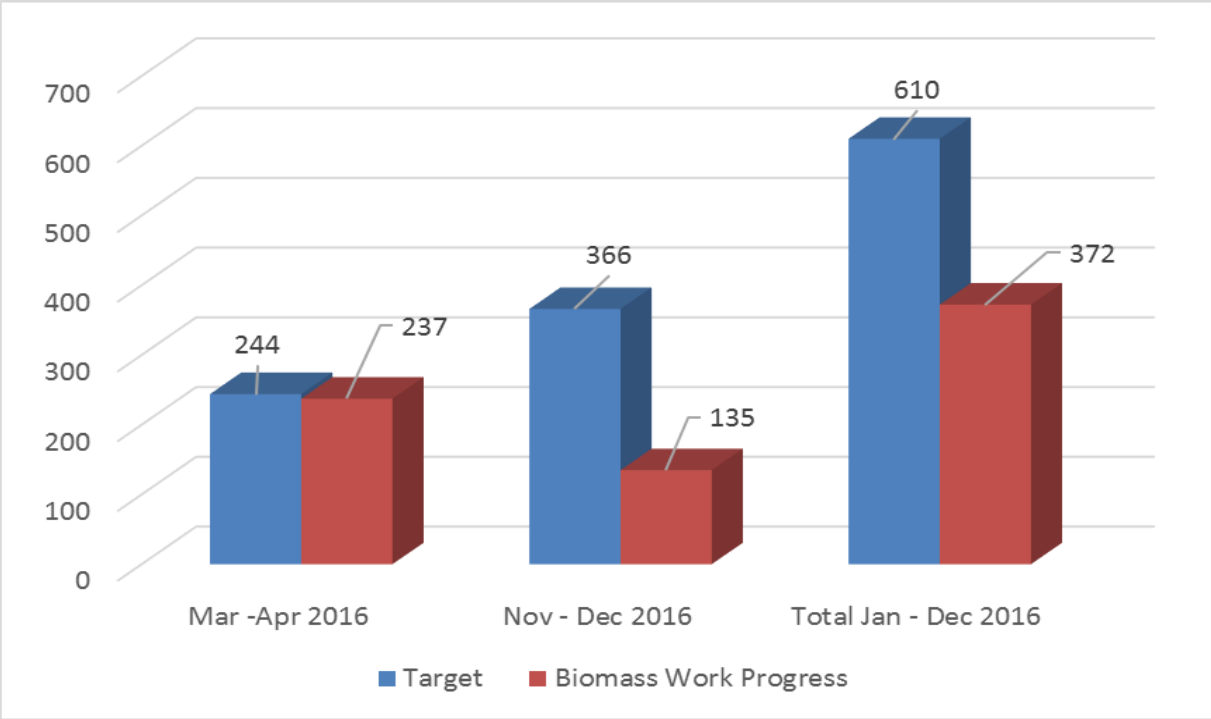
Activities in the Fourth Quarter of 2016	Results
management plan by 30 November 2016	• In addition, ADB Mission in October also reiterated that engagement of international conservation organization is a condition for the proper preparation and implementation of the Biodiversity Offset Management Plan (BOMP) as well as with respect to offset management activities prior to the completion of the BOMP. • The TOR was further revised in the first week of November 2016 and was submitted to BAC for further review. BAC provided their comments in the last week of November 2016. • NNP1 agreed with BAC recommendation that additional surveys should be designed by the BOMP consultant to seek information to shape the management content of the BOMP. • The TOR was updated based on the comment from ADB and was acknowledged by ADB during the mission for further process. The procurement will be initiated in January 2017.
Preparation of legal agreement between GOL and NNP1PC on biodiversity management in Nam Chouane – Nam Xang Offset Site	• NNP1PC prepared a draft Memorandum of Understanding detailing the roles and responsibilities of GOL and NNP1PC in terms of biodiversity offset management of the Nam Chouane – Nam Xang Offset Site. The draft MOU was submitted to ADB for comments
Activities pre-BOMP period of 1 October 2016 – 31 September 2017	• The proposal of pre-BOMP activities with BAC comments was submitted to ADB on 6 October 2016. The proposal was initially discussed during the ADB mission on 26 October and ADB final review was provided in the first week of November. • The proposal was further updated based on ADB review and submitted to BAC for their final comments which was received in the third week of November 2016. • NNP1 prepared the response matrix to BAC review and forwarded to ADB for final approval in last week of November 2016. • The proposal was discussed and agreed during the mission in the second week of December. • The fund flow mechanism has been arranged by BOMC through Ministry of Finance in the last week of December.

5.3 Biomass Clearance

The progress of Biomass Clearance is presented in **Figure 5-1**.

Figure 5-1: Biomass Clearance Progress as of 31 December 2016

Biomass Clearance Target 2016 (in ha)	610 ha
Completion	372 ha
Percentage of completion	61%



Activities in the Fourth Quarter of 2016	Results
Labour recruitment	• In October 2016, 10 labourers from Ban Som Phouan were employed to support UXO work in Block 8 and Block 9. • In November 2016, 15 workers from Ban Nong were employed for biomass clearing in Block 1 and daily contract was awarded for 30 workers from Ban Houaypamom for vegetation clearing in Block 10. • In December 2016: o 85 households (around 187 workers) were contracted with lump-sum payment for biomass clearance work in Block 14. o 35 workers from Longsan District were employed for biomass clearing in Block 1. o Contracts were signed with 30 worksers from Ban Houaypamom for vegetation clearing in Block 10. o The recruitment of additional workers from Ban Pou and Ban Phiengta for biomass clearing in Block 16 to 18 is ongoing.

Activities in the Fourth Quarter of 2016	Results
Perform biomass clearance	• The Contractor provided an updated work plan for November 2016 – December 2017, which was discussed during the meeting with Xaysomboun Provincial Authority on 19 October 2016. • The meeting with Xaysomboun Provincial Authority was a follow-up on the coordination meeting on 28 September 2016 in Hom District. The meeting was chaired by the Provincial Governor and attended by 10 high-ranking officers from relevant offices including Provincial Agriculture and Forestry Office (PAFO), Provincial Natural Resource Environment (PONRE), Provincial Department of Energy and Mines (PDEM), Department of Industry and Commerce (DIC), Xaysomboun Provincial Military Headquarters, and the Provincial Governor's Office. • The key highlights from the meeting were: o NNP1PC to review the Concession Agreement (CA) and the contract with the biomass contractor to address the issue on cutting and stockpiling the trees with diameter more than 20 cm o The progress should be continuously monitored and reported on a weekly and monthly basis to the WRPO and concerned authorities o The biomass clearance shall continue according to the Concession Agreement because it is not against the PM Instruction Letter, No. 15/PM, dated 13 May 2016. • A meeting with Xaysomboun provincial authorities on the remaining valuable timber in the biomass clearance area was held on 9 November 2016 at Xaysomboun Provincial Governor Office. The key results of the meeting were as follows: o Biomass clearance shall continue as planned. o The contractor has to cut and stockpile the remaining value timber with diameter >20 cm in the priority biomass clearance area. o NNP1PC, the contractor and Xaysomboun provincial authorities will conduct weekly inspection and general inventory of felling and stockpiling of remaining timber with diameter >20 cm in the priority biomass clearance area o Xaysomboun provincial authorities will consult with MONRE and MAF on utilization of remaining value timber. o If the relevant authorities do not wish to use the remaining value timber, then this shall be cut, stockpiled and burned on site. • Village Consultation Meeting on Commencement of Biomass Clearance on B13-B18 in Zone 2UR in Thathom District was held on 11 November 2016 with the following highlights: o There are no land or asset compensation issues related to biomass clearance in blocks B13-B18 in 2UR. o Biomass clearance in blocks B13 and B16-B18 in 2UR can be accessed by boat and walking. Biomass clearing will involve only hand cutting.

Activities in the Fourth Quarter of 2016	Results
	o Biomass clearance in blocks B14 and B15 in 2UR can be accessed by truck during dry season. Biomass clearing will involve a combination of manual and machinery clearing. o Decision on stockpiling of remaining value timber with diameter >20 cm will be made during survey for block demarcation and tree inventory. o Local labourers for biomass clearance in 2UR are available only from December 2016 after rice harvesting period. • Biomass clearance resumed in the third week of November 2016 in Blocks 1, 3 and 5 using manual clearing in Block 1 and machinery clearing in Block 3 and 5. By the end of November 2016, the biomass cutting was completed for 9 ha in Block 3 and 10 ha in Block 5. • In December 2016, the biomass clearance was completed for around 5 ha in Block 2, 18 ha in Block 3, 16 ha in Block 5, 23 ha in Block 11, 42 ha in Block 14, and 13 ha in Block 15. • Until the end of Q4 2016, the biomass clearance (cutting and burning) was completed in around 372 ha. The progress of the biomass clearance work to date is showed in **Figure 5-1** and **Table 5-1.** • The IAP/LTA/ADB mission in December 2016 strongly recommended NNP1PC and the biomass contractor to put more efforts into settling the issues with local authorities and communities such as to deal with trees with diameter >20 cm, and the compensation that delayed the progress of biomass clearance. The mission was concerned that any further delays might impact the completion of biomass clearance prior to the scheduled start of impounding the main reservoir.
Utilization of NTFP, waste biomass and lesser value tree	• Hom District contracted a company for extraction of trees in the reservoir within Hom District as well as collecting cut trees with diameter >20 cm in the biomass clearance area. The GOL's contractor was on progress locating machinery and clearing area between Block 3 and Block 4 for stockpiling logs at the end of Q4 2016.
Opportunity in the cleared biomass area	• Villagers completed the harvesting of crops planted in the cleared biomass area, Block 4-5. • The harvested crops included rice, cucumber, melon, pumpkin and maize. The preliminarily collected data showed that the rice production is 2.8 tons per household. There are 144 households

Table 5-1: Biomass and UXO clearance progress in each priority area as of 31 December 2016

Priority area	Zone	Total area (ha)	Island & Buffer zone (315-320 masl)	Priority Biomass Clearance Area			Completed UXO Clearance as of 31 December 2016	Status of Biomass clearance as of 31 December 2016 (ha)	
				Forests	Fallow-shifting cultivation-garden-plantation lands	Total			
Block 01	1	115.38	6.15	29.35	79.88	109.24	38.97	30.00	- Completed cutting and burning vegetation (bush and small trees) 30 ha in April and then paused in May 2016 due to rainy season. - Cutting re-growth vegetation by 35 outside workers
Block 02	1	165.92	7.30	38.72	119.89	158.62	43.68	15.00	- Completed cutting and burning vegetation (bush and small trees) 10 ha. Remaining wood to be piled and burned in Jan 2017 - Further biomass clearing in Dec 2016 completed around 5 ha
Block 03	1	88.86	8.51	14.43	65.92	80.35	21.97	27.00	Under clearing with progress 27 ha
Block 04	1	167.68	3.94	122.97	40.77	163.74	110.36	132.28	- Completed cutting and burning vegetation clearance completed 132.28 ha as Apr 2016. Remaining wood to be piled and burned in Jan 2017 - Further biomass clearing will be resumed in Jan 2017
Block 05	1	350.72	10.61	66.53	273.58	340.11	110.75	76.00	- Completed cutting and burning vegetation clearance completed 50 ha as Apr 2016. Remaining wood to be piled and burned in Jan 2017

Priority area	Zone	Total area (ha)	Island & Buffer zone (315-320 masl)	Priority Biomass Clearance Area			Completed UXO Clearance as of 31 December 2016	Status of Biomass clearance as of 31 December 2016 (ha)	
				Forests	Fallow-shifting cultivation-garden-plantation lands	Total			
									- Further biomass clearing resumed in Dec 2016 and completed around 26 ha
Block 06	1	46.71	14.87	20.31	11.54	31.84	8.96	10.00	- Completed cutting and burning vegetation (bush and small trees) 10 ha. Remaining wood to be piled and burned - Further biomass clearing to be commence in Jan 2017
Block 07	2	43.03	3.39	18.48	21.17	39.65	33.23		Not yet start
Block 08	2	41.00	3.40	14.64	22.97	37.61	17.68	4.00	- Completed cutting and burning vegetation (bush and small trees) 4 ha. Remaining wood to be piled and burned - Further biomass clearing to be commence in Jan 2017
Block 09	2	54.13	1.38	11.67	41.08	52.75	25.05		Not yet start
Block 10	2	317.39	48.28	128.97	140.14	269.10	139.20		Not yet start
Block 11	2	98.05	8.07	24.06	65.92	89.98	89.98	23.00	Under clearing (manual clearing) by village workers from Ban Houay Pamom
Block 12	3	84.23	20.13	64.11		64.11	64.11		Not yet start
Block 13	3	131.35	30.10	76.44	24.81	101.24	101.25		Under recruitment of local labourers
Block 14	3	53.00	9.66	7.79	35.54	43.33	43.34	42.00	Under vegetation clearing (manual clearing) by 88 hhs (187 village workers) from Ban Hat Samkhone
Block 15	3	93.27	49.54	13.52	30.21	43.73	43.73	13.00	Under clearing using bulldozer

Priority area	Zone	Total area (ha)	Island & Buffer zone (315-320 masl)	Priority Biomass Clearance Area			Completed UXO Clearance as of 31 December 2016	Status of Biomass clearance as of 31 December 2016 (ha)	
				Forests	Fallow-shifting cultivation-garden-plantation lands	Total			
Block 16	3	9.86	6.53	1.30	2.02	3.32	3.32		Under recruitment of local laborers
Block 17	3	44.25	36.29	1.33	6.63	7.96	7.96		
Block 18	3	7.18	3.23	3.95		3.95	3.95		
Total		1,912.01	**271.38**	**658.55**	**982.08**	**1,640.63**	**907.48**	**372.28**	

6. FISHERY MONITORING PROGRAM

The fishery monitoring program is progressing, and a database has been developed to support the future fish management program as part of the in Nam Ngiep 1 Watershed Management Plan. Two types of the survey were conducted including daily fish catch logbook monitoring and community interview. The gathered information is being inputted into the database. Daily fish catch logbook monitoring is to analyze the amount fish catch each day and species using available data from previous month

The overall progress of fish monitoring programme is illustrated in **Figure 6-1** below

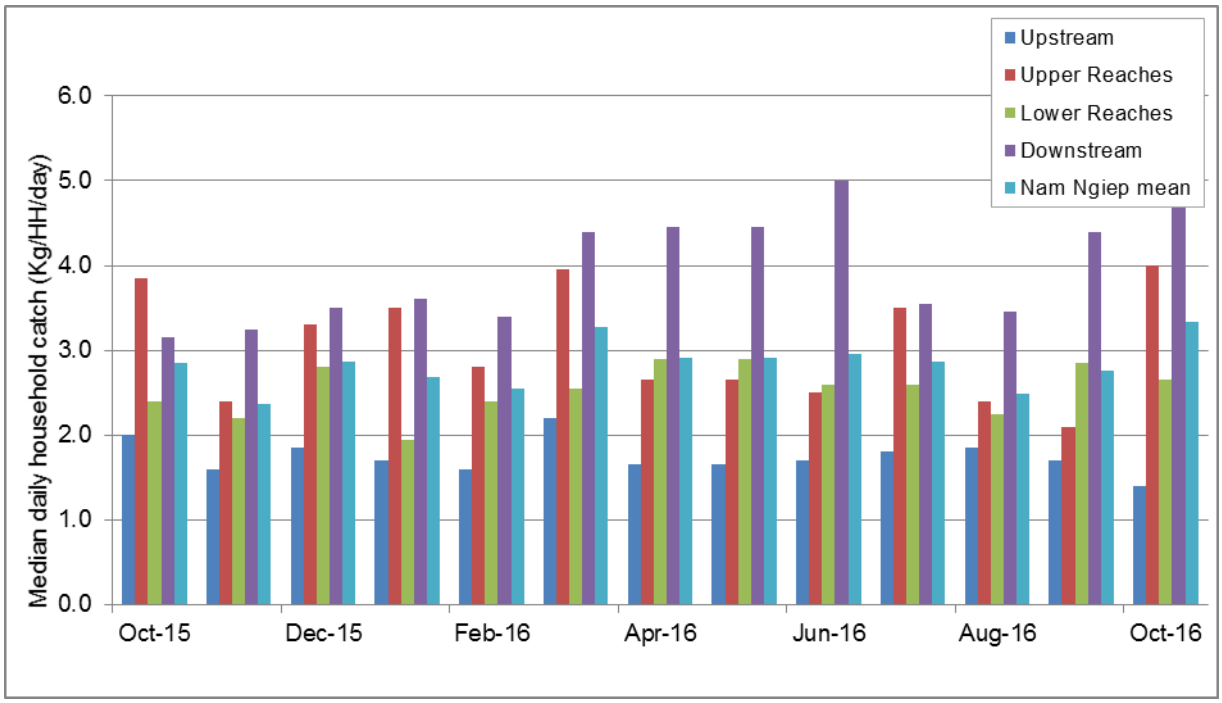
Figure 6-1: Gantt Chart of Fish Monitoring Programme as of 31 December 2016

	Task List / Steps of work		Weight (%)	YEAR 2016												% S-Curve	Assigned to
				Q1			Q2			Q3			Q4				
				01	02	03	04	05	06	07	08	09	10	11	12		
1	**Daily catch logbook and Verification Survey**		100.0														
			-														
1.1	Daily catch logbook data collection on 162 HHs in 25 villages	Planed	24.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	100	FM Team
		Actual	24.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	-	3.0	3.0	97	
1.2	Survey design, interview form design, test and development for verification survey	Planed	4.0		4.0											93	Consultant and FM team
		Actual	4.0		4.0											90	
1.3	Daily catch logbook verification survey for Q 2-4 on 144 HHs	Planed	10.0			2.0		2.0		2.0		2.0		2.0		87	FM Team
		Actual	10.0			2.0		2.0		2.0		1.5	0.5	1.5	0.5	83	
2	**Household Catch Assessment Survey**		-													80	
			-													77	
2.1	Data collection and validation on 121 HHs	Planed	10.0		2.0		2.0		2.0		2.0		2.0			73	FM team
		Actual	10.0		2.0		2.0		2.0		2.0		2.0			70	
3	**Fish Spawning Survey**		-													67	
			-													63	
3.1	Survey design, interview form design, test and development	Planed	2.0						2.0							60	Consultant and FM team
		Actual	2.0						2.0							57	
3.2	Data collection and validation on 16 villages	Planed	2.0						2.0							53	FM team
		Actual	2.0						2.0							50	
4	**Village Community Interview**		-													47	
			-													43	
4.1	Survey design, interview form design, test and development	Planed	7.0								4.0	3.0				40	Consultant and FM team
		Actual	7.0								4.0	3.0				37	
4.2	Data collection and validation on 34 villages	Planed	9.0										3.0	3.0	3.0		FM team
		Actual	9.0									1.0	3.0	3.5	1.5		
5	**Data management and report**															33	
																30	
5.1	Data input to database system	Planed	21.0	1.0	3.0	1.0	2.0	3.0	2.0	3.0	2.0	2.0	2.0	2.0	2.0	27	FM team/ Database team
		Actual	20.0	1.0	0.5	1.0	2.0	2.0	2.0	2.0	2.0	1.0	2.0	2.0	2.0	23	
5.2	Annual Data analysis and draft annual report for 2015-2016	Planed	5.0							5.0						20	Consultant
		Actual	5.0							5.0						17	
5.3	Disemination/presentation the report for 2015-2016	Planed	3.0								3.0					13	Consultant
		Actual	3.0							3.0						10	
5.4	Final Annual Report for 2015-2016	Planed	3.0									3.0				7	Consultant
		Actual	3.0								3.0					3	
	Total	Planed	100.0														
		Actual	99.0														
		Planned Progress monthly		3.0	9.0	5.0	6.0	6.0	10.0	11.0	13.0	12.0	6.0	6.0	4.0		
		Planned Progress Cumulative		3.0	12.0	17.0	23.0	29.0	39.0	50.0	63.0	75.0	81.0	87.0	91.0		
		Actual Progress monthly		-	8.5	5.5	6.0	6.0	10.0	14.0	13.0	7.5	4.5	6.5	5.5		
		Actual Progress Cumulative		-	8.5	14.0	20.0	26.0	36.0	50.0	63.0	70.5	75.0	81.5	87.0		
	Budget Code EL4.03	Approved USD		3,000	2,450	1,850	3,000	1,850	1,850	3,000	1,850	1,850	5,600	1,850	1,850		30,000
		Actual Paid USD															-

Activities in the Fourth Quarter of 2016	Results
Daily Catch Logbook and Verification Survey	• In October 2016: o Completed the daily catch logbook survey in 152 households out of the total target of 162 households. There were around 4,845 forms used for the survey o Database was developed on the collected information • In November 2016: o Completed the daily catch logbook survey in 152 households out of the total target of 162 households. There were around 4,919 forms used for the survey. o Conducted daily catch logbook survey for round# 5 on 116 of 144 households. o Database was developed on the collected information o The daily household catch on average for Nam Ngiep in October 2016 was 3.3 kilos/HH/day. The median catch for all fishing zone is presented as Figure 6-2. o The estimated total catch for Nam Ngiep in October 2016 is 87,000 kilograms approximately that show as Figure 6-3 • In December 2016: o Completed the daily catch logbook survey in 152 households out of the total target of 162 households. 6,156 forms were used in the survey. o Conducted daily catch logbook survey for round 5 on 144 households o Database was developed on the collected information o The daily household catch on average for Nam Ngiep in November 2016 is 2.2 kg/household/day. The median catch for all fishing zone is presented as Figure 6-4. o The estimated total catch for Nam Ngiep in November 2016 is approximately 25,000 kg as shown in Figure 6-5
Household Catch Assessment Survey	• The household catch assessment including the exit survey was completed in monthly basis of 121 households. • The data base was developed on the collected information obtained in monthly basis. • The analysis was ongoing by fisheries consultant in December 2016.
Village Community Interview	• In October 2016: o Completed village community interview at 18 villages out of the total target of 34 villages. o Database was developed on the collected information. • In November 2016: o Completed village community interview at 29 villages out of the total target of 35 villages. o Database is being developed on the collected information. • In December 2016 o Completed village community interview in total 35 target villages.

Activities in the Fourth Quarter of 2016	Results
	o Completed data entry and submit to fishery consultant for analysis and report
Gillnet Sampling Survey	• The Consultant (FishBio) submitted the draft annual gillnet survey report to NNP1 and currently being reviewed by NNP1 EMO. • The Consultant presented the draft annual gillnet survey report to NNP1 on 18 November 2016 and the notes from discussion to be elaborated into the final version. • The final annual gillnet survey report to NNP1 on 28 December 2016

Figure 6-2: Median daily household catch by fishing zone and Nam Ngiep mean value for all fishing zones combined (Kg/HH/day) per analysis in November 2016



The estimated total catch for Nam Ngiep in October 2016 is 87,000 kilograms approximately that show as **Figure 6-3.**

Figure 6-3: Total estimated fish catch for Nam Ngiep by month (Kg)

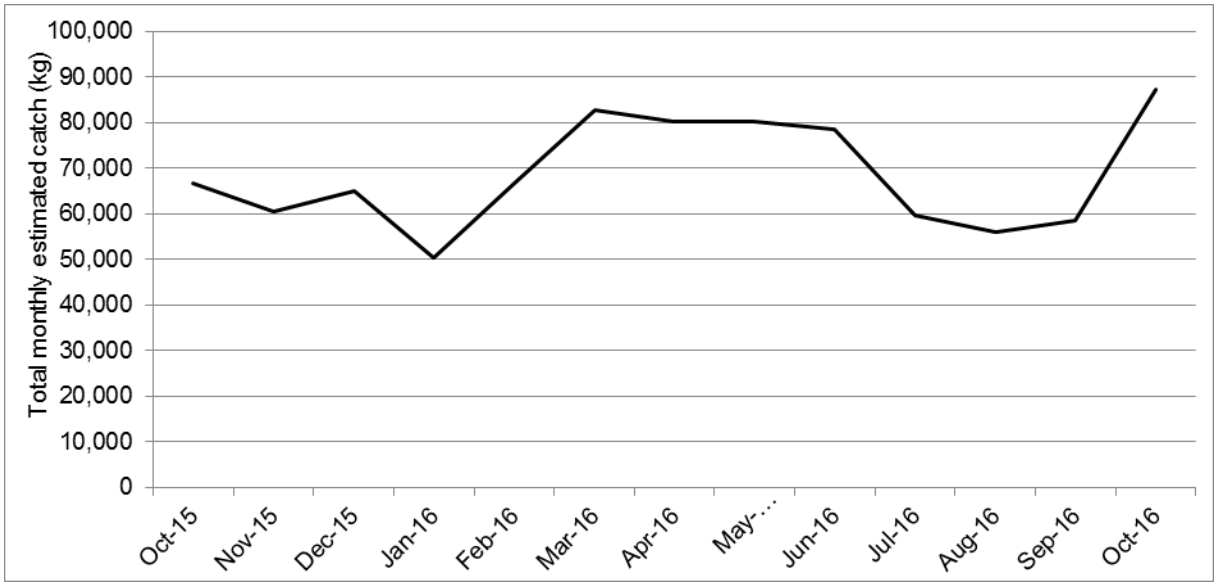
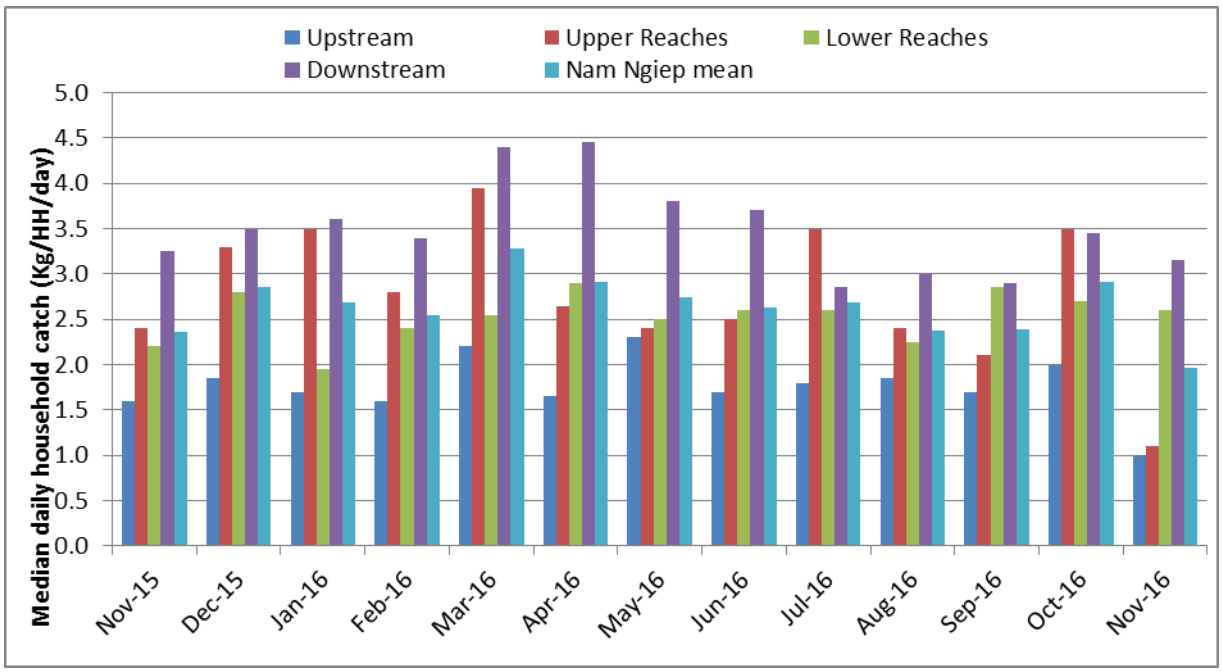
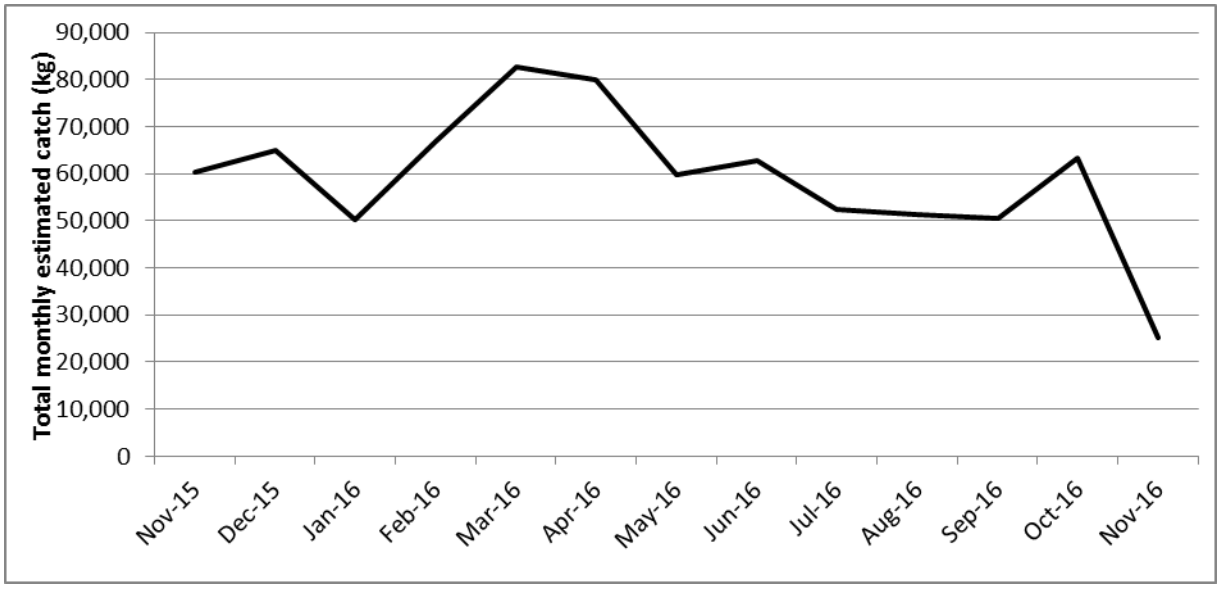


Figure 6-4: Median daily household catch by fishing zone and Nam Ngiep mean value for all fishing zones combined (Kg/HH/day) per analysis in December 2016



The estimated total catch for Nam Ngiep in November 2016 is 25,000 kilograms approximately that show as **Figure 6-5**.

Figure 6-5: Total estimated fish catch for Nam Ngiep by month (Kg)



7. OTHER SUPPORT PROGRAMMES

7.1 Nabong Substation Upgrade - Due Diligence Assessment (DDA)

A Due Diligence Assessment (DDA) Report was finalized and submitted to the ADB at the end of May 2016 and comments were received from ADB regarding the provision of supporting documents such as a Notice to Proceed issued by the GOL. After a follow-up with EDL and Nam Ngiep 2 Power Company on the permission letters for the upgrade works in the Nabong Substation, NNP1PC discussed and agreed with ADB on the way forward to conclude the DDA process. Further development on this issue will be reported in January 2017.

7.2 115 kV Transmission Line IEE Due Diligence Assessment

NNP1PC (TD, EMO and SMO) initiated a discussion with EDL and its contractor (Dong Fang Company), a meeting was held on 23 December 2016 to discuss the survey of new alignment at the Houay Soup Resettlement Area and revision of the IEE. The survey of new alignment was completed, further development on IEE revision will be followed up and reported in January 2017.

7.3 External Monitoring

Three EMU missions by Bolikhamxay Province and Bolikhan District were conducted at NNP1 Project sites during this Quarter - on 04 October 2016, 16-18 November and 21-23 December 2016. All missions identified similar key environmental issues of concern including wastewater discharge from camps, high turbid effluent discharge at the RCC plant, hazardous waste management at the workshop areas and, dust suppression at the quarry and internal access roads. NNP1PC is addressing EMU's concerns and will closely monitor the Contractors' environmental corrective actions. Progress on implementation of the corrective actions was prepared and submitted to the EMUs.

In addition, a joint IAP, LTA, ADB, mission was conducted from 11 to 18 December 2016. Mission findings and recommendations is expected to provide separately in January 2017.

7.4 Independent Monitoring Agency (IMA) Mission

Training for EMUs and RMUs were carried out by IMA during 5-6 September 2016.

7.5 Environmental Protection Fund (EPF)

A grant agreement was signed between EPF and the Bolikhamxay Province in October 2016. There was an on-going discussion on the establishment of Committee and Project team. The fund will be transferred to the Province upon submission of an official letter of establishment of Committee and Project team. In November 2016, PAFO Bolikhamxay as the new implementing agency for the Bolikhamxay EPF was re-establishing the Project organization structure and refining the proposal. There was no further update from Bolikhamxay Province until the end of December 2016.

There was no further update on the EPF proposal from Xaysomboun province in the fourth quarter 2016.

The Xieng Khuang Proposal was under finalization in October 2016. A working session to finalize the proposal between EPF and Xieng Khuang Province team was held in November 2016. Xieng Khuang EPF project proposal was translated by EPF and shared with NNP1-EMO in December 2016.

7.6 Biodiversity Advisory Committee

The recruitment of Dr. William Duckworth as BAC chair was completed in October 2016. The new BAC Chairman together with other BAC members conducted offset site visitation at Ban Vangphieng in Viengthong District from 19 to 21 December 2016.

BAC chairman conducted debriefing meeting with GOL and NNP1 Team on 22 December 2016 with key notes that additional area should be considered and the on-site management plan particularly for the endemic species found in NNP1 watershed including small endemic fish (Laubuca caeruleostigmata), Luciocyprinus striolatus, Lao Warty Newt (Laotriton laoensis), and Owston's Civet (Chrotogale owston).

BAC will have further internal discussion and agreement to provided single concrete comment to GOL BOMC and NNP1.

8 OCCUPATIONAL HEALTH AND SAFETY

8.1 Safety Organisation

In December 2016, the Electrical & Mechanical works Contractor has recently appointed and new Health, Safety and Environment supervisor to assist in developing and maintaining health, safety and environment standards applicable to their works.

NNP1PC has presently increased HSE coverage across the project as well as has employed an experienced HS officer to assist HS department to implement general duties that Contractors/subcontractors fail to comply with.

As stated in the last report, since September, the project has brought in senior managers from its three principle Contractors to join the Combined Contractors Health & Safety patrol. This inspection has been able to bring in resources at speed to deal with critical issues and has delivered enhanced capability on the site, resulting in an improvement in the site's health and safety performance.

To date, 2 fully equipped ambulances of NNP1PC and the civil subcontractor with drivers are available 24 hours/day for immediate transfer to permanent medical facilities.

Since 31 December 2016, excluding Subcontractors, the total dedicated safety personnel for the quarter are 15 persons from Owner and the four principal Contractors for Civil, Electrical and Mechanical, Hydro-Mechanical and 230 kV Transmission Line Works.

So far, the project presently has 31 safety personnel employed to increase HSE coverage across the project including subcontracted safety personnel, as contractors and owner.

During the month of December 2016, we were running a road safety campaign for three villages nearby through the combined efforts of HS team and SMO. In its implementation in the safety training support of villagers, NNP1PC has utilized existing system within the relevant public authorities and collaborated with the same program to conduct the road safety awareness trainings for three villages with a total of 132 participants. The aim of the training was to provide villagers with knowledge of road safety and major emphasis on increasing recent traffic accidents associated with motorcyclists.

In relation to specific safety management for the current works of reservoir biomass clearance, the HS team is continually supporting and very cooperative towards clearance contractors and EMO by providing periodical joint inspections on regular basis to assist contractors in improving site safety management. We are striving for improvement and will continue to help contractors to work safer..

8.2 Safety Training

The Civil Contractor has continually assisted their subcontractors through training practical and theory. The majority of the training during the reporting period has developed and implemented for managers, supervisors, safety members and employees. Monthly tracking of training subjects is in place and carried out depending on the urgency of issues arising in the implementation of the current activities.

Similar to that more held with other Contractors shall be complied. NNP1PC is continually pressing these Contractors to improve performance.

The HSE training function continues to make progress since, as can be seen from the Table 7-1 below, specific HSE training compliance is maintained. A total of 11,699 employees (including refresher training courses after accidents occurred) were trained in Q4 2016 compared 9,245 employees in the previous quarter. The HS function continues to make progress as can be seen from the increase or maintaining in training compliance.

Table 8-1 Safety training for the reporting period from October to December 2016

Month & Year	Total Number of Training Courses Held in Each Month	Total Number of Workers Receiving Training in Each Month According to Their Needs	Subject Matter of Training Courses Variously Attended According to the Needs of Workers
October 2016	43	1,275	Induction, first aid, updated site regulation & code of conduct, heavy equipment, rock fall, road safety, grounding, housekeeping, safe access and workplace conditions.
November 2016	56	4,864	Induction, housekeeping, construction health care, site regulations and instructions, awareness on accidents, lesson learned and prevention measures, motorbike safety (rules reminding), emergency information & communication system, accident reoccurrence prevention, crane safety and lifting work.
December 2016	42	1,803	Induction, road safety, accident report procedure, traffic rules, caution map with speed limit, driving rules, excavator and lifting standards.

Table 8-2 Environmental training carried out by the Contractors for the Reporting Period from October to December 2016

Month & Year	Total Number of Training Courses Held in Each Month	Total Number of Workers Receiving Training in Each Month According to Their Needs	Subject Matter of Training Courses Variously Attended According to the Needs of Workers
October 2016	14	1,088	Sediment pond maintenance, wildlife preservation, hazardous material management, waste management, solid waste landfill operation manual.
November 2016	16	1,233	Water quality management
December 2016	15	1,436	Waste management

8.3 Safety Classification and Statistics

Incidents are classified into six categories in accordance with international convention. The number of incidents by category are presented in Table 7-3.

Table 8-3 Safety Incidents by Category

ID	Incident Category	No. of Incidents from 01-Feb-14 to 31-Dec-16	No. of Incidents from 01-Oct-16 to 31 Dec-16
LTI	Lost Time Incident	11	1
RI	Recoverable Injury	8	1
NM	Near Miss (Reported)	14	2
PD	Property Damage	8	3
FI	Fire Incident	4	0
MVI	Motor Vehicle Incident	36	2
	Total	81	9

The Table indicates both the total number of incidents since records began in February 2014, and the number of incidents in the Fourth Quarter of 2016.

The Project continues to focus on identifying risk by regular inspection, training and warning to avoid risk and in this has had good cooperation between the Owner and all Contractors and Subcontractors.

8.4 Reporting to the Lenders, LTA and Others on Safety Incidents and Accidents

The total of 81 incidents recorded to 31 December 2016 are as tabulated above. There was one Lost time injury occurred in the Q4 2016 period. NNP1PC includes data, statistics and related information on safety incidents in their Monthly Progress Report to its Shareholders, Lenders and their Technical Advisor.

APPENDICES

APPENDIX 1: STATUS OF SS-ESMMPS APPROVAL DURING OCTOBER TO DECEMBER, 2016

No	Site name	List of ESMMP and SS-ESMMP	Subcontractor	Approval Status by EMO/NNP1 (date)	Detailed Site Information	Monthly Construction & Operation Status
Electrical and Mechanical works (Hitachi-Mitsubishi Hydro)						
1	Main dam and re-regulating dam	SS-ESMMP for HM's Sub-Contractor Labor Camp #2	Lilama 10 joint stock Company (LILAMA)	No objection with comments on 12 January 2017 (3rd Revision)	Installing the camp for workers	On-going installation of the camp platform
2	Re-regulating dam	SS-ESMMP for Construction of Zhefu Warehouse	Zhefu subcontractor	No objection with comments on 14 November 2016 (1st Revision)	Installing the warehouse for workers	Completed
3	Re-regulating dam	SS-ESMMP for Labor Camp (Zhefu Camp)	Zhefu subcontractor	No objection with comments on 27 December 2016 (1st Revision)	Installing the camp for workers	Completed
4	Re-regulating dam Power Station	SS-ESMMP for Fabrication Work of Concrete Weight for Overhead Traveling Crane Load Test	Lilama 10 joint stock Company (LILAMA)	No objection with comments on 23 November 2016 (1st Revision)	Concrete work for the travelling crane at Re-regulation powerhouse station	On-going
5	Re-regulating dam Power Station	SS-ESMMP for Installation work of embedded piping for main power station	Lilama 10 joint stock Company (LILAMA)	No objection with comments on 27 December 2016 (2nd Revision)	Piping work for main powerhouse	On-going
6	HM Hydro Contractor's sites	ESMMP update (R3) from HM Hydro Contractor	HM Hydro Contractor	No objection on 27 December 2016 (3rd Revision)	ESMMP update	Completed
7	Re-regulating dam Power Station	SS-ESMMP for Installation Work of 80 Ton Electrical Overhead Traveling	Lilama 10 joint stock Company (LILAMA)	No objection with comments on 29 November 2016 (1st Revision)	Installation Work of Electrical Overhead Traveling Crane	On-going

		Crane for Re-regulation Power Station				
8	Main Dam Power Station	SS-ESMMP for installation of 360 Ton Electrical Overhead Traveling Crane for Main Power Station	Lilama 10 joint stock Company (LILAMA)	No objection with comments on 29 November 2016 (1st Revision)	Installation Work of Electrical Overhead Traveling Crane	On-going
Civil Works Contractor (Obayashi Corporation)						
9	Re-regulating dam	SS-ESMMP for Second River Diversion and Excavation of Right Bank	Civil Works Contractor (Obayashi Corporation)	No objection with comments on 13 October 2016 (1st Revision) No objection with comments on 06 December 2016 (2nd Revision)	Excavation and construction work of re-regulation at the right bank of re-regulation power station	On-going
10	Re-regulating Pond	SS-ESMMP for Re-regulation Pond Biomass Clearance	Civil Works Contractor (Obayashi Corporation)	No objection with comments on 08 November 2016 (1st Revision) No objection with comments on 05 January 2016 (2nd Revision)	Biomass Clearance at the re-regulation pond	On-going
11	Main Dam	SS-ESMMP for supplemental information for Curtain Grouting Works at the Main Dam	Kenber Subcontractor	No objection with comments on 07 October 2016 (4th Revision) No objection with comments on 06 December 2016 (5th Revision)	Grouting Works at the Main Dam	On-going
12	Quarry site	SS-ESMMP for Construction of Quarry Site	Sino Hydro Subcontractor	No objection with comments on 12 December 2016 (1stRevision)	Expansion of the quarry area	On-going

13	Re-regulating Dam	SS-ESMMP for Closing of Borrow Pit Area at Corner of P1 & P1A Road beside the Re-regulation Dam	Civil Works Contractor (Obayashi Corporation)	No objection with comments on 11 January 2017 (1st Revision)	Spoil disposal from left bank coffer dam removal	On-going
14	Main Dam	SS-ESMMP for Building Construction at Main Powerhouse	Civil Works Contractor (Obayashi Corporation)	No objection with comments on 11 November 2016 (1st Revision)	Building Construction at Main Powerhouse	On-going
15	RCC Plant	SS-ESMMP for Operation and Maintenance Works of RCC Plant	Songda 5 Subcontractor	Under review during the reporting period		
16	Re-regulating Dam	SS-ESMMP for Construction of Re-regulation Power Station Building (Super Structure) Re-regulation Powerhouse Station (B1)	Civil Works Contractor (Obayashi Corporation)	Under review during the reporting period		
17	Main Dam	SS-ESMMP for Adit Closure at Right Bank of Main Dam	Civil Works Contractor (Obayashi Corporation)	Under review during the reporting period		
Houay Soup Resettlement Area (NNP1PC-ESD Contractors)						
18	Houay Soup Resettlement Area	SS-ESMMP for the Construction of Houay Soup Waste Landfill	PhouKham Chanvong Construction Co. Ltd (PKC)	Under review during the reporting period	Construction of landfill phase 2 stated in January 2017	
19	Houay Soup Resettlement Area	SS-ESMMP for Construction of Tractor road at HSRA	VRC Construction Co., Ltd	No objection with comments on 05 January 2017 (1st Revision)	Construction of Tractor road connecting between the main road and the paddy field at HSRA	Completed

20	Houay Soup Resettlement Area	SS-ESMMP for Construction of Intake Mount at Houay Soup Resettlement Site	KCP Construction Co., Ltd	No objection with comments on 09 December 2016 (1st Revision)	Construction of Intake Mount at Houay Soup Resettlement Site	On-going
21	Houay Soup Resettlement Area	SS-EMMP for Paddy Field Development Of 48 ha for 2LR People in the Resettlement Site	P.K Road Bridge Construction and Irrigation Sole Co., Ltd	No objection with comments on 01 December 2016 (1st Revision)	Paddy Field Development Of 48 ha for 2LR People in the Resettlement Site	On-going
22	Houay Soup Resettlement Area	SS-EMMP for Land Levelling (Cutting and Filling) for 90 House Plots at 2LR-Lower Reservoir Village and Health Center at Resettlement Site	DLC Road and Bridge Construction Company Limited	No objection with comments on 30 November 2016 (1st Revision)	Land Levelling (Cutting and Filling) for 90 House Plots at 2LR-Lower Reservoir Village and Health Center at Resettlement Site	On-going
23	Houay Soup Resettlement Area	SS-ESMMP for Construction of Health Centre at HSRA	Nalux Construction Co., Ltd	No objection with comments on 27 December 2016 (1st Revision)	Construction of Health Centre at HSRA	On-going
24	Houay Soup Resettlement Area	SS-ESMMP for Construction of Village Office and Hall at HSRA	Nalux Construction Co., Ltd	No objection with comments on 27 December 2016 (1st Revision)	Construction of Village Office and Hall at HSRA	On-going
25	Houay Soup Resettlement Area	SS-ESMMP for UXO Clearance at HSRA	Lao UNEOD Cooper Co., Ltd (LAUNC)	No objection with comments on 05 January 2017 (1st Revision)	UXO Clearance at HSRA	On-going
NNP1PC-TD Contractor						
26	Owner Site Office (OSO)	SS-ESMMP for the Supply and Installation Material for Natural Grass Soccer Field	PK Construction	No objection with comments on 29 November 2016 (1st Revision)	Supply and Installation Material for Natural Grass Soccer Field at OSO	On-going

27		SS-ESMMP for Construction of Core Box House at Owner Site Office	VIENGOUDOMXAP Construction Co., Ltd (VCC)	No objection with comments on 15 December 2016 (1st Revision)	Construction of Core Box House at Owner Site Office	On-going

APPENDIX 2: ENVIRONMENTAL MONITORING CORRECTIVE ACTIONS Q4-2016

List of Environmental Issues Recorded and Corrective Action Progressed

Issue ID	Inspection Date	Site Name	Issue/ Description	Action Required / Recommendation	Deadline	Latest Follow up dated	Final Status
ONC_OC-0085	02.06.2015	Song Da 5 Camp No. 2	The waste water treatment system does not follow the proposed design.	i. Contractors needs to follow the proposed plan, submitted on 31 Mar 2015; ii. Contractor should fix the drainage system with the sediment pond. It needs to separate the drain of surface water run-off and wastewater from bathroom and kitchen.	16/06/2015	30.12.2016	Pending
ONC_OC-0087	02.06.2015	V&K Camp	Refer the previous site inspection report ref; NNP1-ESD-EMO-SIR-OC-0005 on SI-0036 dated 03 Mar 2015, the issue has been repeated. No improvement on the design of wastewater treatment system. The camp has insufficient facilities for the long-term operation. There is an evidence of grey water has been released from the septic tank to the open ditch. This is observed to be non-compliance to the project's environmental guideline.	i. Contractor needs to improve the submitted plan on 31 Mar 2015 which EMO has been commended and advised. ii. Contractor shall install the wastewater treatment system following the improved system under the EMO's recommendation.	16/06/2015	30.12.2016	Pending

List of Environmental Issues Recorded and Corrective Action Progressed							
Issue ID	**Inspection Date**	**Site Name**	**Issue/ Description**	**Action Required / Recommendation**	**Deadline**	**Latest Follow up dated**	**Final Status**
ONC_HM-0004	25.05.2016	LILAMA10 Camp	EMO previously commented in writing on 18 February 2016 to the submitted SS-ESMMP for the Construction of HM Labour Camp #2 (1st version dated 29 January 2016) that the clean surface water, black and grey water shall be separated and detailed designs of the waste water treatment systems were needed. Owner (EMO) followed up with the Contractor during the Weekly Coordination Meeting held in April 2016 where the Contractor agreed to submit a revised SS-ESMMP and detailed drawings of the waste water treatment system by mid-May 2016. During the site inspection, it was found that the Contractor has commenced the construction of the waste water treatment system (WWTS) without submitting revised detailed designs and update the SS-ESMMP responding to the Owner's comments. For example, the retention ponds were not built in accordance to the proposed designs in the SS-ESMMP (i.e. using readily made concrete blocks with less than 100 mm thick compared to the proposed bricks to make 220 mm tank walls, see photos). The	The Owner recommends that the Contractor temporarily hold the construction of the waste water treatment system until a discussion with the Owner is made to agree on the final designs. If significant adjustments are to be made, revised designs with detailed information on the adjustments shall be submitted to the NNP1PC for prior review and approval.	08.06.2016	10.11.2016	Resolved

List of Environmental Issues Recorded and Corrective Action Progressed							
Issue ID	**Inspection Date**	**Site Name**	**Issue/ Description**	**Action Required / Recommendation**	**Deadline**	**Latest Follow up dated**	**Final Status**
			Contractor's representatives informed the Owner that they were not sure if the construction would follow the specifications highlighted in the first approved SS-ESMMP. A revised diagram was later submitted showing the separation of the black water from the grey water but still was not adequate in responding to the Owner's comments. Also, these concrete blocks cannot handle the long-term operation of the system and are likely to collapse.				
ONC_VSP-0001	31.05.2016	Borrow Pit for HSRA Irrigation Canal	Based on the Owner (EMO)'s follow up inspection in May 2016 and this joint bi-weekly inspection, it was observed that the a borrow pit was operated about 10 m close approximately to Houay Soup Noi stream. The borrow pit was used for irrigation construction without environmental protection measures as per approved SS-ESMMP with comments dated 11 May 2016. This has a potential risk of erosion and sediment transport to the Houay Soup Noi stream in the event of heavy rain.	Provide erosion and sediment control system for the borrow pit including adequate cut-off drain and sediment pond to prevent direct sediment runoff. The Owner requests the Contractor to revise and re-submit a revised version of the SS-ESMMP as per the EMO's comments for the proposed SSE-SMMP for construction of irrigation canal dated 11 May 2016.	14.06.2016	31.10.2016	Resolved

List of Environmental Issues Recorded and Corrective Action Progressed							
Issue ID	**Inspection Date**	**Site Name**	**Issue/ Description**	**Action Required / Recommendation**	**Deadline**	**Latest Follow up dated**	**Final Status**
ONC_OC-0217	28.06.2016	RCC Plant Yard	1). Referring to previous site inspection reports on turbid water at the RCC plant which have been issued: - SIR-0018, 18 /07/2015 - SIR- 0023, 06/10/2015 - SIR-0028, 15/12/2015 - SIR-0032, 09/02/2016 and - SIR-0040, 25/05/2016 2). Referring to the approved SS-ESMMP for the RCC Plant Foundation and Installation (note that this document does not cover the operation stage of the RCC Plant) The Contractor has implemented simple corrective actions to improve the turbid water quality generated from the RCC material washing area including cleaning-up of the sediment from the first and second sediment ponds which they are full. However, it was found that no proper sedimentation control facilities were installed to improve the turbid water discharge and inadequate cleaning-up and removal of sediment. Specifically, no cleaning-up of these sediment ponds was carried out whilst the RCC plant was temporary shut-down and no removal of sediment from the drying yards.	The Contractor is required to: - Follow the agreed actions specified in earlier issued SIRs above. These include the frequency adjustment of the sediment clean-up from the sedimentation ponds when observed that they are 60% full; - Regularly remove dried sediment from the drying yards to keep space for incoming sediment cleaning-up from the ponds; - Prepare/update the Site Specific Environmental and Social Management Plan (SS-ESMMP) for the operation stage of the RCC plant and submit to NNP1 for review and approval. Note: the mentioned SS-ESMP needs to fully address the areas of Sedimentation Control and Water Availability & Pollution control. - If these issues are still not fixed by this agreed timeline, a NCR level 1 will be issued.	20.07.2016	31.12.2016	Pending

List of Environmental Issues Recorded and Corrective Action Progressed							
Issue ID	**Inspection Date**	**Site Name**	**Issue/ Description**	**Action Required / Recommendation**	**Deadline**	**Latest Follow up dated**	**Final Status**
			EMO conducted water discharge sampling and testing at the last sediment pond prior to discharging into the drainage canals and found the results as follows: - Monthly testing dated 08/06/2016 detected 64,000 NTU of turbidity and 27,850 mg/L of TSS. - Field testing dated 25/06/ 2016, detected 2186 NTU of turbidity. By comparing/ converting the Turbidity of the latest field tested (2186 NTU on 25/06/2016) to/from the monthly sampling and laboratory testing (64,000 NTU on 08/06/2016), the TSS value of 951 mg/l was obtained. 64,000 NTU 27,850 mg/L 2,186 NTU X Þ X=(27,850 * 2,186)/64,000 = 951 mg/l This shows that the concentration of the TSS in the turbid water being discharged continues to exceed the effluent standard specified in the Concession Agreement Annex C.				

List of Environmental Issues Recorded and Corrective Action Progressed							
Issue ID	**Inspection Date**	**Site Name**	**Issue/ Description**	**Action Required / Recommendation**	**Deadline**	**Latest Follow up dated**	**Final Status**
ONC_VRC-0004	12.07.2016	Borrow Pit for HSRA Main Road	The Contractor operated a borrow pit at the adjacent area to Houay Soup Noi river without appropriate environmental management plan and/or mitigation measures. Topsoil and spoil were also stockpiled at less than 10 meters away from the river. This has a potential risk of soil erosion and being washed into Houay Soup Noi river.	The Contractor is required to : - Provide erosion and sediment control systems for the borrow pit including a silt fence and/ or similar device, adequate cut-off drains and sediment ponds at the lower downslope to prevent direct sediment run-off into the river; - Revise and re-submit the SS-ESMMP for the main road construction as per the EMO's Document Approval Sheet (DAS) dated 24 June 2016. The revised SS-ESMMP needs to incorporate the updated environmental mitigation measures for, but not limited to, this borrow pit area.	21.07.2016	31.10.2016	Resolved
ONC_VRC-0005	12.07.2016	VRC Camp	Mixed disposal of recyclable waste and non-recyclable waste was observed during the joint site inspection. The Contractor was instructed to improve the waste management but there was no action implemented.	It is strongly advised that the Contractor recovers recyclable wastes from the pit and sell to the local villagers at the Recycle Bank located at Hat Gniun village that operates every Wednesdays from 9:30 a.m to 5:00 p.m. Note: During this site inspection, the Contractor informed that their work would be finished soon and camp demobilization would start accordingly. NNP1PC, therefore, requires that the Contractor's camp facilities are decommissioned properly and	22.07.2016	04.10.2016	Resolved

List of Environmental Issues Recorded and Corrective Action Progressed							
Issue ID	**Inspection Date**	**Site Name**	**Issue/ Description**	**Action Required / Recommendation**	**Deadline**	**Latest Follow up dated**	**Final Status**
				completely.			
ONC_HM-0010	03.08.2016	LILAMA10 Camp	Referring to the Contractor's SS-ESMMP for LILAMA10 camp and the actual completed work, the constructed oil/grease traps for kitchen and bathing areas were not built in accordance with the design and function. There was no partition and no proper "L" pipe installed. The Contractor informed that about 8 workers will move to the camp by weekend. Therefore, without improvement to the proper design, the oil/grease traps for the waste water from kitchen and washing/bathing areas will be released to the wetland ponds and reduce their treatment effectiveness.	The contractor is required to: Provide additional concrete partition in the existing oil trap; Connect the "L" bend pipe (50 mm in diameter) between partitions to separate oil/grease from grey water. Note: The contractor confirmed that the oil traps would be rectified prior the operation of the kitchen and camp (this weekend).	05.08.2016	01.11.2016	Resolved

List of Environmental Issues Recorded and Corrective Action Progressed							
Issue ID	**Inspection Date**	**Site Name**	**Issue/ Description**	**Action Required / Recommendation**	**Deadline**	**Latest Follow up dated**	**Final Status**
NCR_SECC-0001	09.08.2016	SECC Workshop & Industrial Area	During the bi-weekly joint site inspection conducted on 09/08/2016, it was observed that the hazardous storage area was cleaned up but there was no evidence of storing the contaminated sand from the clean-up activity. EMO finally found out that about 15-20 kg of the mentioned oil contaminated sand was disposed on the SECC platform's side slope which is close to Nam Ngiep River (see Photos below). This action can pollute the aquatic lives in the Nam Ngiep River from the rain water run-off that carries the hydrocarbon absorbed by the sand into the River and is a breach of environmental management requirements stated in the SP05.35 of the NNP1PC's ESMMP-CP 2014 and approved Contractor's SS-ESMMP. Referring to EMO's Site Inspection Report Reference No.: 0001, 0002, 0005, 0006, 0007, 0008, 0010, 0011, 0012, EMO consistently provided recommendations and explained to the Contractor on how to manage hazardous materials especially contaminated soil/sand in accordance with the requirements. However, the same issue continued to occur without implementing proper	The Contractor is required to: Immediately collect the disposed oil contaminated sand and store in the hazardous storage facility for proper disposal by an authorized vendor; Provide a detailed training program to their staff related to hazardous material and waste management as per requirements stated in SP02.16, SP 02.17, SP05.12, SP05.20 and SP05.35. The draft training material shall be shared with EMO for prior review; Conduct this training regularly as per proposed training program. EMO shall be invited to observe the training.	22.08.2016	12.10.2016	Resolved

List of Environmental Issues Recorded and Corrective Action Progressed							
Issue ID	**Inspection Date**	**Site Name**	**Issue/ Description**	**Action Required / Recommendation**	**Deadline**	**Latest Follow up dated**	**Final Status**
			corrective actions. This indicated poor accountability, poor supervision and following-up on this outstanding hazardous waste management by the site supervisor.				
ONC_PKC-0001	25.08.2016	HSRA Landfill	Poor hazardous waste management was observed at the temporary worker's camp. The designated storage area for petrol/engine oil did not have proper impermeable surface and earth bund. As a result, used oil was spilled on ground inside the storage area. Some used engine oil was found to be poured on the ground outside the storage area and there was some diesel spill located less than 5 m from the natural drainage.	The contractor is required to: Clean up the spills and poured engine oil for disposal properly; Provide steel trays/thick plastic sheets to cover the surface of the designated storage for petrol/ engine oil. Place and display "hazardous material/waste poster" in local language for awareness by the workers as well as stockpile some spill response kits.	04.08.2016	04.10.2016	Resolved

List of Environmental Issues Recorded and Corrective Action Progressed							
Issue ID	**Inspection Date**	**Site Name**	**Issue/ Description**	**Action Required / Recommendation**	**Deadline**	**Latest Follow up dated**	**Final Status**
ONC_OC-0232	30.08.2016	Re-regulation Dam Borrow Pit	During the past couple of weeks, EMO conducted routine and follow up site inspections and observed that the Contractor started operating a borrow pit with inadequate environmental management practices as the following: Topsoil was stockpiled at sensitive erosion area; The cut slope area had no berm and cut-off drains; Spoil was disposed and stockpiled on the access road to the SECC waste disposal pit. No information and management measures on the excavation of this borrow pit was included in the two (02) approved SS-ESMMPs for the Re-Regulation Dam (i.e. the Re-	1. The Contractor is required to submit a revised SS-ESMMP to include this borrow pit and provide the following information: - Estimated quantity of materials to be used; - Biomass clearing and topsoil management; Spoil management and disposal (stockpiling, excavation, etc.); Detail design of slope stabilization including cut-off drains and berm; Site environmental rehabilitation and site closure plan, 2. Clean up spoil that was pushed and blocked the access to of the SECC's waste pit.	27.09.2016	30.12.2016	Pending

List of Environmental Issues Recorded and Corrective Action Progressed							
Issue ID	**Inspection Date**	**Site Name**	**Issue/ Description**	**Action Required / Recommendation**	**Deadline**	**Latest Follow up dated**	**Final Status**
			Regulation Dam Left Bank Excavation and Re-Regulation Dam Power Station). EMO received a verbal complaint from a ESD's Contractor (SECC company) that the Contractor has pushed the spoil and blocked the access road to their temporary spoil disposal area. The Company has maintained this assess road twice, but it was damaged again so far.	The contractor is required to take immediate actions without waiting for the above-mentioned documents to be completed by OC as the following: Separate and designate an area that is easily accessible as a topsoil stockpile to minimise the soil erosion and preserve for borrow pit rehabilitation in the later stage; Install borrow pit berms, cut-off drains and sediment ponds where feasible to prevent landslide and retain the sediment from being washed downstream; Submit the revised SS-ESMMP for the Re-regulation Dam together with the Borrow Pit Management and Closure Plan within 2 weeks after this inspection date, i.e. 11 October 2016 for review and approval by NNP1PC. The first two requests need to be started immediately. NNP1PC-EMO will follow up on the progress of the actions on 03/09/2016. The NCR level 1 will be issued if no actions are implemented.			
ONC_SECC-0039	06.09.2016	SECC Camp	During this site inspection and wrap up meeting, it was noted that the SECC Contractor would finish its construction activities by the end of September 2016. To ensure that SECC's site demolition is done	The Contractor was required to prepare and submit the site decommissioning plan covering all SECC's sites (SECC Camp, Temporary Waste Pit, SECC's Workshop and SECC Batching Plant) to EMO for review and approval,	19.09.2016	31/12/2016	Pending

List of Environmental Issues Recorded and Corrective Action Progressed							
Issue ID	**Inspection Date**	**Site Name**	**Issue/ Description**	**Action Required / Recommendation**	**Deadline**	**Latest Follow up dated**	**Final Status**
			properly, the Contractor was instructed to prepare and submit a Site Decommissioning Plan to EMO for review and approval at least 7 days prior to the commencement of decommissioning work.	Note: The Infra team would forward the EMO's presentation on site decommissioning requirements (presented by EMO during the July Monthly Meeting) to the SECC as a reference.			
ONC-HM-0011	14.09.2016	LILAMA10 Camp	It was found during this joint site inspection that the LILAMA10 Camp has been accommodated with 11 workers, but the construction of the Waste Water Treatment System (WWTS) remained incomplete. As result, the grey water collection tanks and wetland ponds were inundated. Without immediate corrective actions and improvements, it has a potential risk of sewage mixing with the rain water mixture and overflowing off site.	The Contractor was required to: - Drain the rain water and empty the three (03) waste water collection tanks; Check inside of wastewater collection tanks and ensure that the inner walls are sealed to prevent the rain and groundwater seepage into the waste water collection tanks. Complete the construction of wetland ponds as per the EMO's recommendations in the SIR Reference No.: NNP1-ESD-EMO-SIR-HM-0003 and 0007 and the 3rd revision SS-ESMMP for HM Hydro Workers' Camp No.2 (LALIMA10 Camp). **Note:** There were 2 pending SIRs that need immediate corrective actions as below: 1. SIR-HM-0003, inspected 25/05/2016 on the grey water wetland ponds improvement and; 2. SIR-HM-0007, inspected 03/08/ 2016 on the oil traps improvement. During this inspection, EMO Senior Compliance staff introduced a	21.09.2016	12/10/2016	Resolved

List of Environmental Issues Recorded and Corrective Action Progressed							
Issue ID	**Inspection Date**	**Site Name**	**Issue/ Description**	**Action Required / Recommendation**	**Deadline**	**Latest Follow up dated**	**Final Status**
				Procedure on the Non-Compliance Report as highlighted in the NNP1 Project's ESMMP-CP that environmental issues with no progress on the implementation of corrective actions by the first deadline or delayed or incomplete corrective actions by the first extension will be proceeded to three (03) levels of Non-Compliance Report (NCR) even though it is a minor environmental issue.			
ONC_LS-0015	15.09.2016	TL 230 KV	There was no secure storage for hazardous waste generated from workshop operation. Used oil drums were stored on the ground and exposed to the rain, oil filters, machinery spare parts and tools were left on the concrete floor with no proper protective bund. Oil spills and contaminated soil were found around the workshop area.	Improve the workshop housekeeping including cleaning up the contaminated soil around the workshop, storing oil contaminated sand in the storage area with concrete floor, bund and rain protection roof; Provide oil spill trays for truck maintenance related activities and dry sand/soil at the workshop for use as spill response kits.	29.09.2016	20.10.2016	Resolved
ONC_OC-0235	03.10.2016	Aggregate Plant Yard	On 22/09/2106, the NNP1PC-EMO conducted a joint inspection and discussion with OC and Sino Hydro subcontractor about the improvement of the sedimentation control from the aggregate washing plant. The Contractor and subcontractor were required to take actions as below: 1. Immediate actions:	The Contractor is required to immediately fix the sediment pond's embankment to stop turbid water leakage and provide a rough drawing for sediment pond lining with impermeable material (concrete/HDPE sheet/clay) with the installation of at least 4 baffles in the sediment pond for prior review by NNP1PC-EMO.	11.10.2016	31.12.2016	Resolved

List of Environmental Issues Recorded and Corrective Action Progressed							
Issue ID	**Inspection Date**	**Site Name**	**Issue/ Description**	**Action Required / Recommendation**	**Deadline**	**Latest Follow up dated**	**Final Status**
			- Stop direct discharge of sediment water to Nam Ngiep river by blocking the culvert connected between the aggregate washing plant's drainage and Nam Ngiep river since the turbidity level has not complied with the effluent discharge standard for the last few months (photo 1); - Remove the sediment deposit in the last sediment pond located at spoil disposal no. 7 and record the amount of sediment being removed prior to disposing at spoil disposal no.6 (photo2) - Repair the sediment pond embankment by filling and compacted with soil (not rocks) to stop turbid water leakage from the sediment pond; 2. Medium to long term improvements: - Line the sediment pond with concrete, HDPE or good permeable clay to prevent seepage of turbid water to Nam Ngiep river; - Install at least 4 baffles to allow proper sediment settlement time. During this bi-weekly inspection, it was observed that some short-term actions were implemented including: stopping direct discharge of sediment				

List of Environmental Issues Recorded and Corrective Action Progressed							
Issue ID	**Inspection Date**	**Site Name**	**Issue/ Description**	**Action Required / Recommendation**	**Deadline**	**Latest Follow up dated**	**Final Status**
			water to Nam Ngiep (Photo 3); Cleaning up sediment deposit in the last sediment pond (Photo 4). However, the repair of the sediment pond embankment to stop turbid water leakage from the sediment pond was not carried out and no actions on the long terms improvement actions such as lining the sediment pond and install at least 4 baffles.				
ONC_OC-0236	11.10.2016	Re-regulation dam	During this inspection, it was observed that there was a land leveling activity for permanent spoil disposal from the excavation of left bank coffer dam behind the SECC camp. The Contractor will check if this spoil disposal plan was previously included in the existing SS-ESMMP for the Re-regulation Dam Construction. If not, please refer to the Corrective Actions as below:	The Contractor is required to include this spoil disposal management plan in the revised SS-ESMMP for the Re-regulation Dam which will be submitted by 11/10/2016 to the EMO for review and approval. The spoil disposal management needs to follow ESMMP-CP 2014 and Draft Updated ESMMP-CP 2016 Vol. III and IV, SP10 Spoil Disposal.	11.10.2016	31.12.2016	Pending
ONC_OC-0237	11.10.2016	Aggregate Plant Yard	It was observed during this inspection that the Contractor did a good job in storing removed sediment from drainage lines into piles for easy removal and disposal at the spoil disposal area No. 6. However, these sediment stockpiles along open ditches shall be cleaned up regularly. If not being removed soon, it is very	The Contractor is required to clean up sediment from the open ditches and remove sediment stockpiles more frequently. Otherwise, sufficient sandbags along the roadside shall be provided to prevent the overflowing of turbid water.	24.10.2016	30.12.2016	Pending

List of Environmental Issues Recorded and Corrective Action Progressed							
Issue ID	**Inspection Date**	**Site Name**	**Issue/ Description**	**Action Required / Recommendation**	**Deadline**	**Latest Follow up dated**	**Final Status**
			likely that these sediment stockpiles will collapse into the open ditches again causing overflowing of turbid water to the road T11 and subsequently Nam Ngiep River.				
ONC_IHI-0004	12.10.2016	IHI Worker Camp & Industrial Area	There was an evidence of black water leaked from the underground septic tank of the toilet and released to the open ditch from the RCC plant yard. This may be resulted from either septic tanks broken or full. It was concerned that the leaked wastewater has a high potential risk of contained high bacteria and released to the environment.	The contractor please check and identify the source of leakage for further repairing and stop of leakage accordingly to the actual cause and condition: 1. Fix / repair the source of leaked immediately (if no need to empty the sewage). 2. Inform and consult with EMO for an advising (provide a guidance and procedure) and approval; (if the leakage was from the septic tanks are full and necessary to be emptied). Note: No empty and disposal of sewage without approval by the owner (NNP1-EMO).	20.10.2016	26.10.2016	Resolved
ONC_SECC-0040	19.10.2016	PC Bridge	It was observed that some garbage has been disposed on the ground within the SECC's construction area for a couple of months. EMO has raised a number of environmental concerns about the improper waste disposal by the Contractor. So far, no	The Contractor is required to collect the garbage and arrange a disposal at the Houay Soup landfill properly. Note: In reference to EMO's last Site Inspection Report dated 06/09/2016 (Ref. No.: NNP1-ESD-EMO-SIR-SECC-0015; issue ID: ONC_SECC-0039), the	20.10.2016	01.11.2016	Resolved

List of Environmental Issues Recorded and Corrective Action Progressed							
Issue ID	**Inspection Date**	**Site Name**	**Issue/ Description**	**Action Required / Recommendation**	**Deadline**	**Latest Follow up dated**	**Final Status**
			corrective action was undertaken by the Contractor.	Contractor was required to prepare their Site Decommissioning Plan and submit to EMO by September 2016 for review and approval. The Contractor is reminded to prepare and submit this Site Decommissioning Plan and submitted to EMO by this extended agreed deadline.			
ONC_OC-0238	26.10.2016	Access Road P1	During follow up environmental issues in the construction site, there were solid waste scattered around at cement truck parking area/assembly point at along P1 road side. However, the OC was ever cleaned up solid waste at those area on 13 October 2016, but this issue was found again.	The Contractor shall be regularly cleaned up solid waste at the area and transported and dumped it to NNP1 landfill also instructed cement truck drivers to more understand on waste management in NNP1PC.	08.11.2016	22.11.2016	Resolved
NCR_VSP-0001	07.11.2016	HSRA Irrigation Canal	Descriptions of non-compliance: 1. Incidence: On 31/10/2016, EMO conducted environmental follow up inspection at the irrigation canal construction areas within the HSRA. It was observed that an old water pump supplied by the Irrigation Office at the irrigation canal was operated without any steel tray, earth bund and spill response kit causing continuous engine oil dripping into the ground and washed into the adjacent Houay Soup Noi (a	The Contractor is required to complete the following actions Immediately: - Fix the two water pumps to stop engine oil and hydrocarbon seepage to the ground. If these cannot be fixed, alternate water pumps shall be replaced - Contain and clean up contaminated soil on the ground and oil film in the water; - Provide oil spill protective trays/steel trays or similar material to ensure that any oil spills are well contained and easily cleaned up during the operation period,	10.11.2016	29.11.2016	Resolved

List of Environmental Issues Recorded and Corrective Action Progressed							
Issue ID	**Inspection Date**	**Site Name**	**Issue/ Description**	**Action Required / Recommendation**	**Deadline**	**Latest Follow up dated**	**Final Status**
			stream). Some oil film was evidenced on the stream surface. On 01/11/2016, EMO conducted a joint site inspection with the SMO (Infrastructure Team) where the engine oil dripping issue was discussed and mitigated. Key findings from this joint site inspection are as the following: - Two old water pumps were operated less than five (05) meters from Houay Soup Noi stream without close supervision and oil spill protection facilities such as steel trays, bunds and spill response kits; - A total of three (03) petro drums with 20 litres/each were stored on bare ground; - Poor maintenance of the old water pumps which caused engine oil seepage into the ground. 2. Environmental Impact: As a result, the surrounding ground was contaminated with engine oil, some oil film has already entered to Houay Soup Noi stream. EMO team temporary responded to this incidence by installing the hydrocarbon absorbent booms and pads to prevent further	It is noted that these water pumps will be operated until the end of November 2016 (one more month). Therefore, the Contractor is required to take these corrective actions immediately before the specified deadline.			

List of Environmental Issues Recorded and Corrective Action Progressed							
Issue ID	**Inspection Date**	**Site Name**	**Issue/ Description**	**Action Required / Recommendation**	**Deadline**	**Latest Follow up dated**	**Final Status**
			contamination to the ground and stream. The engine was also turned off and temporarily on standby.				
NCR_OC-0013	08.11.2016	Aggregate Plant Yard	Description of Non-compliance: Inadequate maintenance and implementation of agreed corrective actions on controlling the sediment pond at the Aggregate Plant below the spoil disposal area no.7. Improper monitor and maintenance of the said sediment pond resulted in continuously discharging the turbid water from the sediment pond into the adjacent of Nam Ngiep River, and this is seriously none-compliance with CA annex C and ESMMP-CP 2014. More details on the non-compliance are provided below: 1) On 13 January 2016 , the NCR level 1 was issued to the Contractor and agreed to be closed on 22 February 2016 with the following condition: "The Contractor was required to carry out basic self-monitoring and record the water quality (pH and turbidity) from construction sites that will be	The contractor is strongly required to take following actions by specified deadlines, failure to fully implement the recommended corrective actions by the given deadlines, a Non-Compliance Report level 3 (NCR Level 3) will be elevated: 1. Repair sedimentation pond's embankment to stop turbid water discharge into to Nam Ngiep River completely by 25 November 2016; 2. Clean up sediment in the sediment pond before it reaches 60% of sediment pond capacity and dispose at designated spoil disposal area no.6 on a daily basis; 3. Provide the sediment clean up record to NNP1 including (1) daily clean up frequency and (2) amount of collected sediment on a Weekly basis; 4. A design for installing at least four (04) baffles in the sediment pond to aid proper sediment settlement shall be proposed by 22 November 2016. If the	25.11.2016	31.12.2016	Pending

List of Environmental Issues Recorded and Corrective Action Progressed							
Issue ID	**Inspection Date**	**Site Name**	**Issue/ Description**	**Action Required / Recommendation**	**Deadline**	**Latest Follow up dated**	**Final Status**
			discharged into the river and resolve waste water leakage from the sediment pond to Nam Ngiep River;…" (see enclosed NCR Ref. no: NNP1-ESD_EMO-NCR-0012). 2) On 27 September 2016, during a joint site inspection carried out with OC (Environmental staff and engineers) and Sinohydro, the Contractor was instructed by NNP1PC-EMO to: - Immediately fix the sediment pond's embankment to stop turbid water leakage into Nam Ngiep River; - Clean up sediment deposit, when it is 60% full, and disposed at designated spoil disposal no.6; - Provide at least 4 baffles in the sediment pond to aid sediment settlement (see enclosed SIR Ref. No.: NNP1-ESD-EMO-SIR-OC-0050). 3) On 05 November 2016, the NNP1PC-EMO conducted environmental follow up of this sediment pond, there was no implementation of any agreed corrective actions as per the NNP1PC-EMO's requirements. As a result, the wastewater from the sediment pond	effluent quality results still show no significant improvement (turbidity remains to be high), the baffles need to be installed.			

List of Environmental Issues Recorded and Corrective Action Progressed							
Issue ID	**Inspection Date**	**Site Name**	**Issue/ Description**	**Action Required / Recommendation**	**Deadline**	**Latest Follow up dated**	**Final Status**
			leaked to the Nam Ngiep River and was detected at 10,520 NTU for Turbidity (see enclosed record of water discharge quality monitoring 2016). 4) On 08 November 2016, the latest joint bi-weekly inspection observed that the pond was so full as the sediment was not cleaned–up for months, the embankment was not fixed and no installation of baffles. This allowed a direct discharge of turbid water into Nam Ngiep River (see Photos below).				
ONC_HM -0012	10.11.2016	LILAMA10 Camp	HM Hydro informed EMO during a joint site inspection that 32 workers were accommodated in this camp. However, waste management was observed to be inadequate. For examples, food waste bags were placed on the ground instead of proper containers and were not disposed in weeks. As a result, these waste bags created unpleasant smell and attracting flies.	The Contractor is required to: - Separate recyclables (glass, plastic , aluminum bottle/cans, etc. …) from general waste (food waste, etc.…) properly; - Remove and dispose general waste at NNP1 Landfill through coordination with the NNP1PC staff and; - Build the waste storage facility with proper signage within one month.	23.11.2016	23.11.2016	Resolved
ONC_HM -0013	10.11.2016	ZHEFU Camp	Construction waste such as scrap metal, wood off-cut and rubber were stored in the undesignated place beside the Zhefu Camp. It is projected that the waste will continue to be accumulated in this area when a	The Contractor is required to: - Segregate the waste based on the NNP1 Project's waste management hierarchy (4Rs: Reduce, Re-use, Recycle and Right Disposal). - Provide a designated area with clear	23.11.2016	23.11.2016	Resolved

List of Environmental Issues Recorded and Corrective Action Progressed							
Issue ID	**Inspection Date**	**Site Name**	**Issue/ Description**	**Action Required / Recommendation**	**Deadline**	**Latest Follow up dated**	**Final Status**
			warehouse is built and fully operated from May 2017.	signage and facility for storing the construction waste. Waste wood off-cut can be burnt in secure area with full supervision away from the residential area (preferably at Spoil Disposal Area No.6); scrap metal should be sold to an authorized local vendor in coordination with NNP1PC-EMO.			
ONC_HM -0005	10.11.2016	IHI Worker Camp & Industrial Area	There was no provision of a concrete floor next to the oil storage facility where daily oil refueling is operated. Instead, a large pile of sand was used to absorb oil spills during the refueling process. This practice will increase a volume of oil contaminated sand which consequently causes difficulty for the Contractor to clean-up and dispose of correctly. Storing contaminated sand outside the bund area exposing to the weather is also risky in case of rain events because all hydrocarbon absorbed by sand will be washed away into the drains and ended up in rivers poisoning aquatic lives. In addition, an open container with some used oil (hydrocarbon) was observed to be placed on the bare ground outside the bunding area.	The Contractor is required to: 1. Collect the open used oil container, clean-up oil contaminated sand and store inside the storage area for proper disposal by an authorized vendor; 2. Pave the oil refueling area next to the oil storage facility with concrete. Note that dry sand should be used only when oil spills occur.	23.11.2016	23.11.2016	Resolved

List of Environmental Issues Recorded and Corrective Action Progressed							
Issue ID	**Inspection Date**	**Site Name**	**Issue/ Description**	**Action Required / Recommendation**	**Deadline**	**Latest Follow up dated**	**Final Status**
ONC_LS-0016	17.11.2016	TL 230 KV	There was no protective tray for a winch machine which is being used for tower election activity. This caused some oil spill on the dirt floor and soil contamination where the machine was operated.	The Contractor is required to: - Clean-up the oil contaminated soil, store in a secure facility for proper elimination; - Provide oil protective tray for the winch machine and absorb oil spill immediately using absorbent pads or fine soil that can easily be found in the remote site.	01.12.2016	22.12.2016	Resolved
ONC_OC-0239	22.11.2016	Songda5 Camp #1	The following evidences were observed during this bi-weekly site inspection: - A grey water pipe from the extended camp to the wetland ponds was disconnected (photo A); - Some grey water overflowed from the bathing/washing areas to open drainage lines around the camp area due to poor maintenance of filters installed in bathrooms. These allowed the nutrient-rich wastewater discharge from the camp perimeter into Nam Ngiep river without prior treatment in the wetland ponds.	The Contractor is required to complete the following actions Immediately: - Reconnect and secure the PVC pipe to stop the grey water release into the environment; - Remove garbage in the filter installed in bathrooms to prevent grey water overflow into the open drainage; - Repair and close the holes that allowed grey water discharge from the washing areas.	29.11.2016	20.12.2016	Resolved

List of Environmental Issues Recorded and Corrective Action Progressed							
Issue ID	**Inspection Date**	**Site Name**	**Issue/ Description**	**Action Required / Recommendation**	**Deadline**	**Latest Follow up dated**	**Final Status**
ONC_OC-0240	22.11.2016	CVC Plant Yard	The slurry from the RCC Plant was cleaned up and disposed at the areas above the CVC plant (the junction of Road P1 and P2). Some slurry has already been flushed into the road side drainage lines which are connected directly to the Nam Ngiep river. This practice breached the agreement and the latest submitted SS-ESMMP for the RCC Plant Operation on 10 November 2016 that all cleaned up slurry from the RCC plants and construction sites must be disposed of at a designated spoil disposal area no.6. Note: this area is not suitable for either sludge drying bed or permanent stockpile of sediment because of the topographic condition (steep slope on the drainage lines).	The Contractor is required to clean up slurry at this area and removed it to the spoil disposal no.6. Please be cautious that in the future, there should be no slurry disposal in any areas other than the designated spoil disposal area no. 6. If a similar evidence is observed, a NCR level 2 will be issued.	05.12.2016	31.12.2016	Pending
ONC_OC-0241	06.12.2016	Aggregate Plant Yard	During the improvement of the aggregate crushing plant's sediment pond below spoil disposal area no.7, sand bags were installed in the drainage ditch to create additional small sediment retention ponds (photo 1). However, all the sediment retention ponds were 100% full of sediment and the wastewater which overflew from these ponds, was diverted to Nam Ngiep River directly	Whilst an official response to the Contractor's letter on the NCR2 (PCL-2775) dated 08 December 2016, the Contractor is required to: - Clean up the sediment from all ponds along the drainage line on a daily basis to create space for sediment deposit while working on the larger pond; - Record the frequency and volume of sediment being disposed at spoil disposal area No. 6.	14.12.2016	31.12.2016	Pending

List of Environmental Issues Recorded and Corrective Action Progressed							
Issue ID	**Inspection Date**	**Site Name**	**Issue/ Description**	**Action Required / Recommendation**	**Deadline**	**Latest Follow up dated**	**Final Status**
			by a 100 mm dimeter pipe (photo 2). This allowed direct discharge of turbid water from the aggregate crushing plant's sediment ponds into Nam Ngiep River without sufficient settlement time. Note that a NCR level 2 response submitted by the Contractor (PCL-2775) on 08 December 2016 is being evaluated by the Owner. A formal response will be provided by 23 December 2016.				
ONC_OC-0242	06.12.2016	Aggregate Plant Yard	The improvement of the aggregate crushing plant's sediment pond below spoil disposal area No.7 was not consistent with NNP1PC's recommendations stating in the NCR level 2 (Document No. NNP1-ESD-EMO-NCR-OC-0013, dated 08 November 2016) as the following: 1. The improvement of the above mentioned sediment pond was carried out without submitting a design drawing to NNP1 for prior review and concurrence; 2. The construction activities did not address the requirement for (i) repairing the sediment pond's embankment to stop turbid water	The Contractor is required to take corrective action based on: 1. NNP1 recommendations stating in the NCR level 2 (Document No. NNP1-ESD-EMO-NCR-OC-0013, dated 08 November 2016) and; 2. LTA's recommendations during LTA mission dated 13 December 2016. The given deadline for complete action is 15th January 2017	14.12.2016	31.12.2016	Pending

List of Environmental Issues Recorded and Corrective Action Progressed							
Issue ID	**Inspection Date**	**Site Name**	**Issue/ Description**	**Action Required / Recommendation**	**Deadline**	**Latest Follow up dated**	**Final Status**
			leakage into Nam Ngiep River, (ii) installing at least four (04) baffles in the sediment pond to aid proper sediment settlement. If the effluent quality results still show no significant improvement (turbidity remains to be too high than the applicable effluent standard), the Contractor needs to discuss with NNP1PC on the final improvement plan and submit a drawing.				
ONC_OC-0243	06.12.2016	Aggregate Plant Yard	There was no dust suppression during the operation of the aggregate crushing plant. As a result, dust emission was observed covering the Sino Hydro Camp located 30 m West from the crushing plant and surrounding vegetation. This presented high health and safety risk to workers. Approximately 50 people are known to work at this site and live in the above mentioned camp.	The Contractor is required to take the following actions: - Spray the water at the aggregate crushing plant to suppress dust; - Monitor and ensure that all workers living in the Sino Hydro Camp and working at aggregate crashing plant are provided with proper PPEs including masks and safety glasses in accordance to Contractor's SS-ESMMP on dust management.	20.12.2016	31.12.2016	Pending
ONC_OC-0244	06.12.2016	RCC Plant Yard	During this joint site inspection, it was observed that sediment deposit was not cleaned up from the first three sediment ponds on a daily basis as stated in the 2nd version of the RCC Plant's SS-ESMMP for the operation phase. In addition, the embankment between pond# 2 and pond#3 did not aid the surface flow of turbid water.	The Contractor is required to clean up sediment deposit from all sediment ponds on a daily basis and more cleaning up of sediment is required if the water discharge water testing results reveal significant high turbidity.	20.12.2016	31.12.2016	Pending

List of Environmental Issues Recorded and Corrective Action Progressed							
Issue ID	**Inspection Date**	**Site Name**	**Issue/ Description**	**Action Required / Recommendation**	**Deadline**	**Latest Follow up dated**	**Final Status**
			As a result, all sediment ponds were 100% filled up with slurry which ended up discharging to Nam Ngiep River.				
ONC_OC-0245	06.12.2016	Spoil Disposal #8	The spoil disposal area No. 8 is no longer active due to the situation of Sino Hydro Workers Camp and completion of landscaping work (levelling and permanent drainage control system). However, it was observed that the slurry from the RCC Plant was cleaned up and disposed of at this areas. This practice breached the agreement and the latest submitted SS-ESMMP for the RCC Plant Operation on 10 November 2016 that all cleaned up slurry from the RCC plants and construction sites must be disposed of at a designated spoil disposal area no.6.	The Contractor is required to clean up the slurry at this area and removed it to the spoil disposal no.6. Please be cautious that in the future, there should be no slurry disposal in any areas other than the designated spoil disposal area no. 6. The Contractor shall identify appropriate drying areas that are not at risk from being washed off site into the drains. If a similar evidence is observed, a NCR level 1 will be issued.	20.12.2016	31.12.2016	Pending
ONC_HM-0013	07.12.2016	LILAMA10 Camp	There is an evidence of burning recyclables and general waste on site. This indicated a continuous breach of the previous agreement with NNP1PC that no burning of solid waste would be allowed on site and it shall be disposed of at NNP1 Project landfill.	The Contractor is required to: 1. Stop burning of solid waste on the camp site as this causes air pollution and a breach to NNP1PC Environmental Policy, Contractor's ESMMP as well as the sub-contractor's SS-ESMMP. General waste need to be disposed at NNP1 Project landfill which is located at	21.12.2016	21.12.2016	Resolved

List of Environmental Issues Recorded and Corrective Action Progressed							
Issue ID	**Inspection Date**	**Site Name**	**Issue/ Description**	**Action Required / Recommendation**	**Deadline**	**Latest Follow up dated**	**Final Status**
			Please note that proper waste management advices have been provided for LILAMA10 sub-contractor in every joint site inspection. The latest instruction for this sub-contractor was to build a waste storage at the camp site before being disposed at the landfill to handle waste generation from a total of 35 workers. According to the LILAMA10 Camp's submitted DWP and SS-ESMMP, there will be around 270 workers in 2017. Thus, a proper waste management system is urgently needed.	spoil disposal No.6 in coordination with NNP1PC Admin staff; 2. Build a waste storage with at least 03 partitions for general waste, recycle waste and hazardous waste. The construction of waste storage facility needs to be completed by the end of December 2016; 3. Please be cautious that similar findings of improper waste management in the next bi-weekly inspection will be automatically trigger NCR level 1.			
ONC_HM-0006	07.12.2016	IHI Worker Camp & Industrial Area	Improper storage of an electricity generator at a welding area. There were no concrete floor, bund, oil trap, and proper roof. As a result, there was an evidence of oil spills from an electricity generator that caused a continuous contamination of soil where the generator is refueled.	The Contractor is required to: 1. Clean up the contaminated soil from the electricity generator storage area and store in a designated hazardous waste storage area for final disposal by an authorized vendor; 2. Install the missing storage component namely concrete floor, bund, oil trap, and proper roof.	21.12.2016	21.12.2016	Resolved
ONC_VRC-0006	13.12.2016	VRC Camp	An electricity generator was stored outside the VRC work camp boundary. There was no provision of steel tray and adequate roofing. As a result, oil spillage was observed and hazardous contaminated waste was	The Contractor is required to : - Move this power generator to designated area inside VRC work camp boundary; - Clean up oil contaminated soil and store in the secure hazardous waste storage for proper elimination;	27.12.2016	27.12.2016	Resolved

List of Environmental Issues Recorded and Corrective Action Progressed							
Issue ID	**Inspection Date**	**Site Name**	**Issue/ Description**	**Action Required / Recommendation**	**Deadline**	**Latest Follow up dated**	**Final Status**
			created continually at the refueling point of this power generator.	- Provide steel tray and proper roofing material.			
ONC_PK-0001	13.12.2016	PK Camp	The workers camp was not built as proposed in the DWP & SSESMMP for Paddy Field Development Of 48 ha for 2LR People in the Resettlement Site. There were cooking, bathing and toilet facility	With reference to the EMO comment on the DWP & SSESMMP for Paddy Field Development Of 48 ha for 2LR People in the Resettlement Site. The Contractor is required to: - Construct toilet facility as per design proposed in the DWP & SSESMMP, - Provide a layout of drainage control system (diversion canal) surrounding the camp, oil/grease trap and pipe line from the kitchen to the sediment pond.	27.12.2016	27.12.2016	Pending
ONC_PK-0002	13.12.2016	PK Camp	There was insufficient number of waste bins provided in camp; resulting in garbage mix disposed into plastic bag in kitchen room.	Provide sufficient number of waste bins (at least 2-3 bins / locations for on-site waste segregation and temporary collection for proper disposal	27.12.2016	27.12.2016	Resolved
ONC_PK-0003	13.12.2016	PK Camp	Improper hazardous material storage, hydrocarbon drums were stored on the expose ground without spillage protection facilities.	The contractor is required to construct related facilities namely: A 120% capacity secure oil storage, impermeable workshop and hazardous waste storage.	27.12.2016	27.12.2016	Resolved

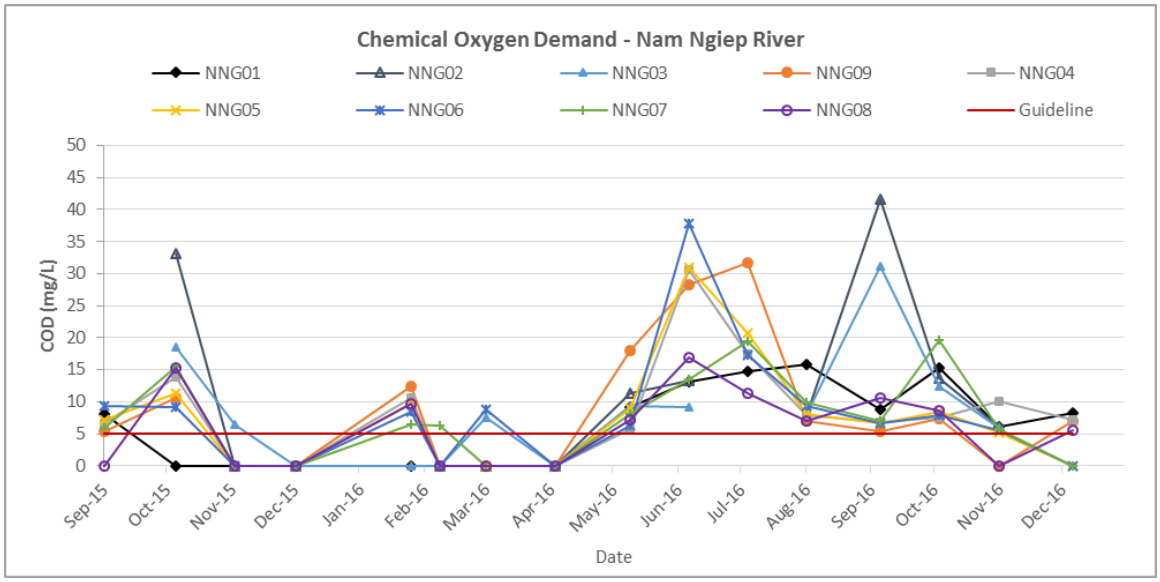
APPENDIX 3 CODES AND LOCATIONS OF THE SURFACE WATER QUALITY MONITORING STATIONS

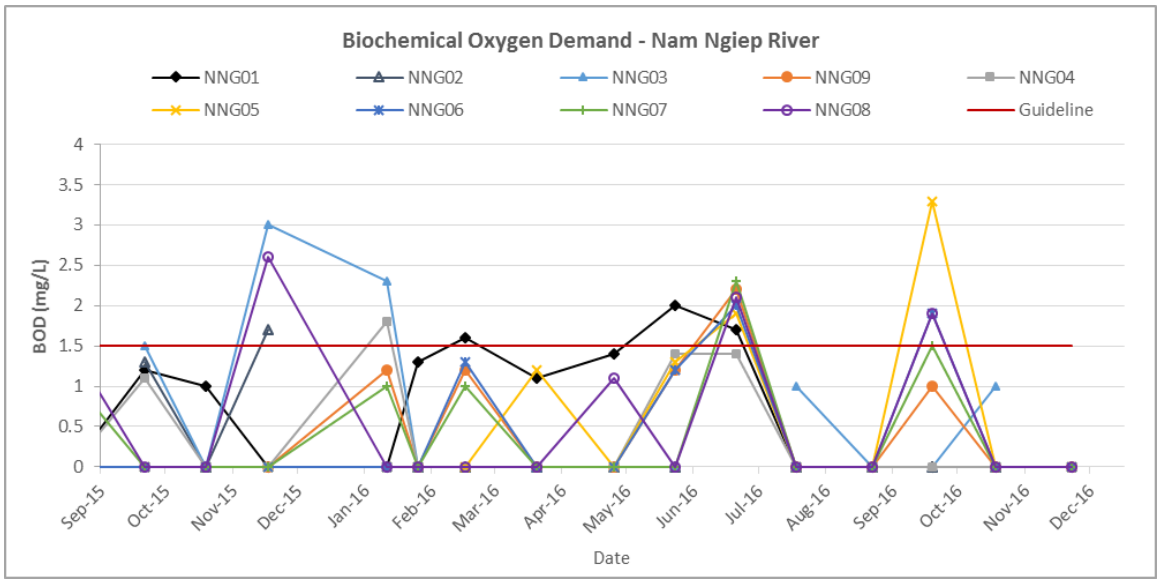
Site Code	Location station	Zone
NNG01	Nam Ngiep Upstream of Ban Phiengta	Upstream Project Construction Site
NNG02	Nam Ngiep Upstream of Nam Phouan Confluence	
NNG03	Nam Ngiep Downstream of Ban Sop-Yuak	
NNG09	Nam Ngiep Upstream Main Dam	
NNG04	Nam Ngiep Downstream RT Camp	Within Project Construction Site
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	

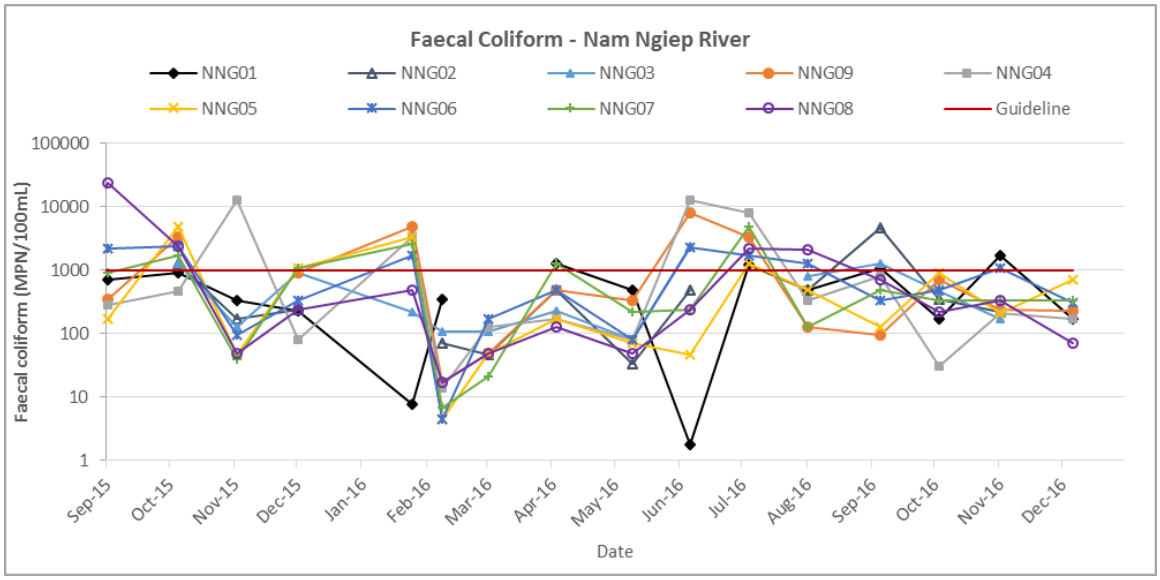
APPENDIX 4: KEY TRENDS OF WATER QUALITY Q4-2016

ONLY PARAMETERS THAT EXCEEDED THE RELEVANT STANDARDS

Nam Ngiep Surface Water main channel






Faecal Coliform - Nam Ngiep River
NNG01
NNG02
NNG03
NNG09
NNG04
NNG05
NNG06
NNG07
NNG08
Guideline
Faecal coliform (MPN/100mL)
100000
10000
1000
100
10
1
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
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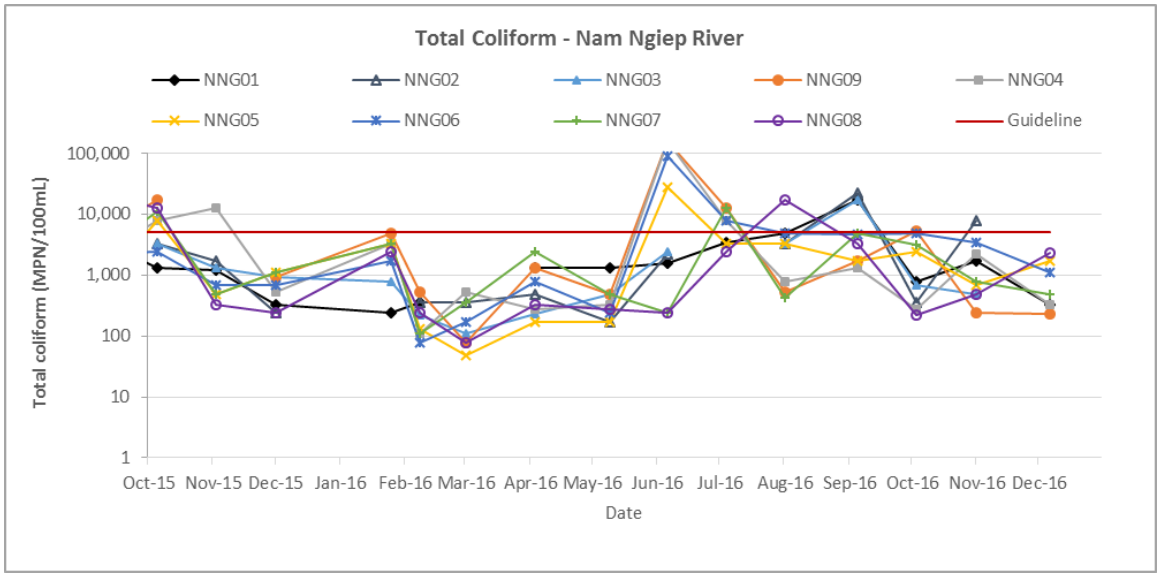
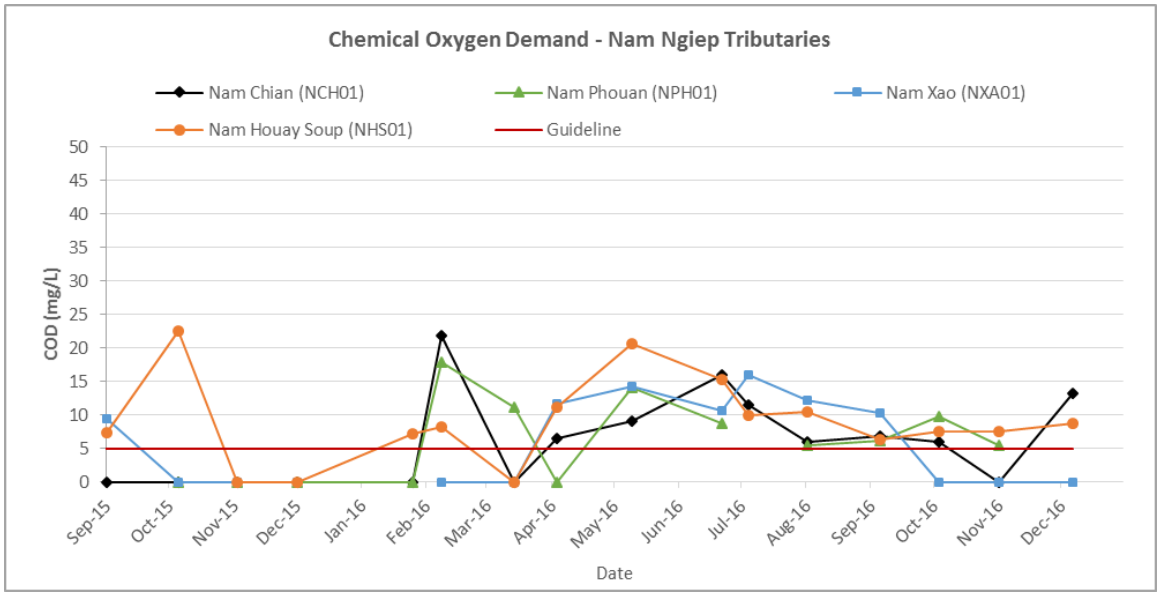
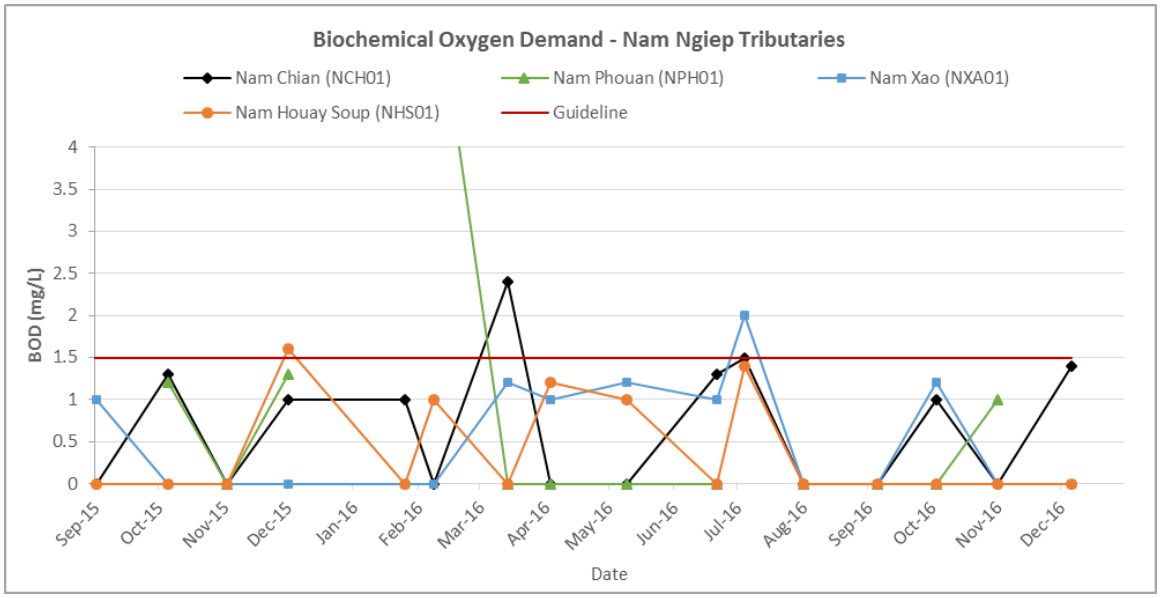
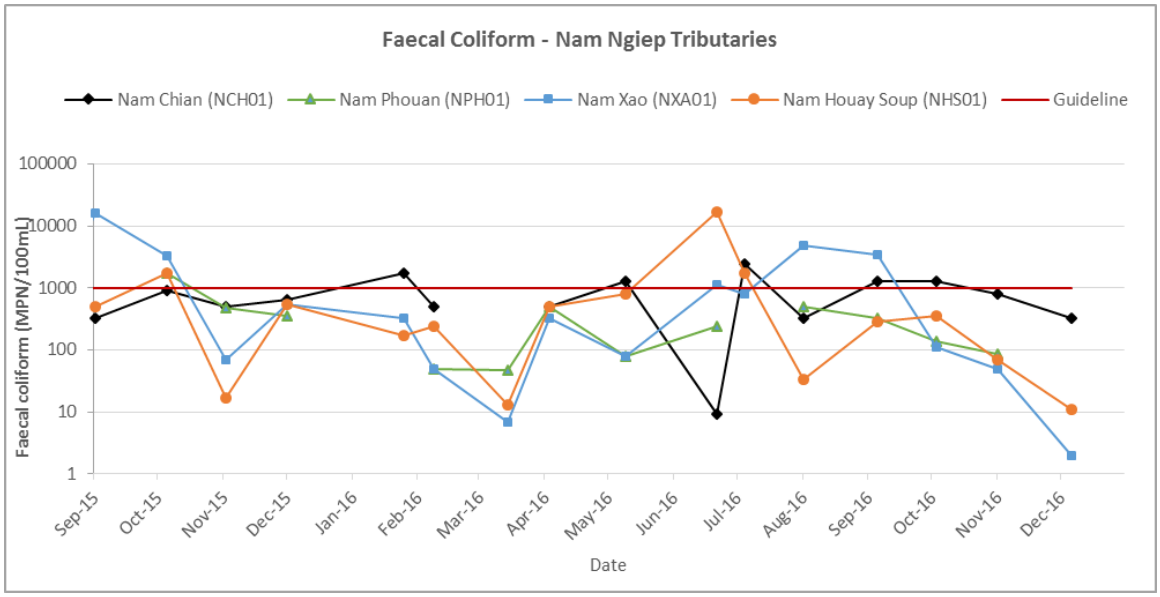
Date


Total Coliform - Nam Ngiep River
NNG01
NNG02
NNG03
NNG09
NNG04
NNG05
NNG06
NNG07
NNG08
Guideline
Total coliform (MPN/100mL)
100,000
10,000
1,000
100
10
1
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
Date

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






Faecal Coliform - Nam Ngiep Tributaries
Nam Chian (NCH01)
Nam Phouan (NPH01)
Nam Xao (NXA01)
Nam Houay Soup (NHS01)
Guideline
Faecal coliform (MPN/100mL)
100000
10000
1000
100
10
1
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
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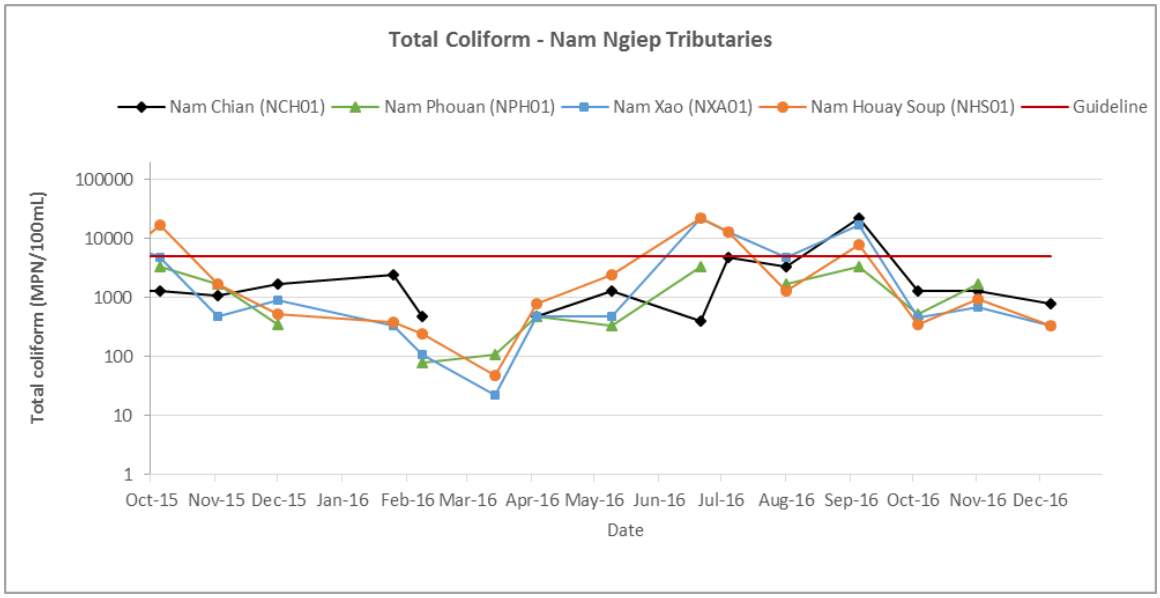
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
Date


Total Coliform - Nam Ngiep Tributaries
Nam Chian (NCH01)
Nam Phouan (NPH01)
Nam Xao (NXA01)
Nam Houay Soup (NHS01)
Guideline
Total coliform (MPN/100mL)
100000
10000
1000
100
10
1
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
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Jul-16
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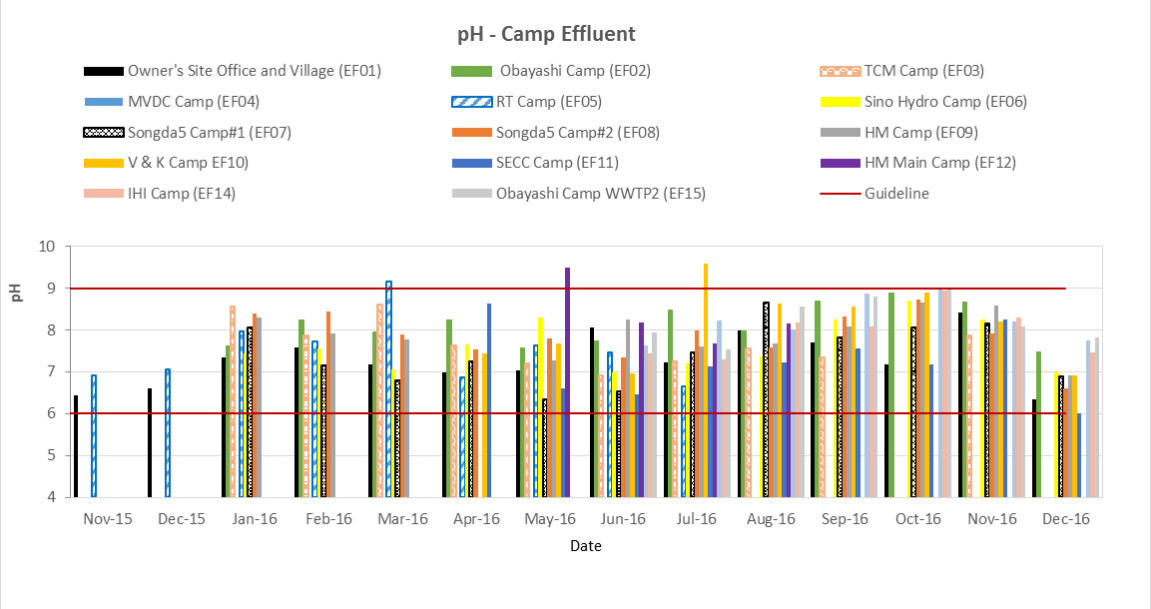
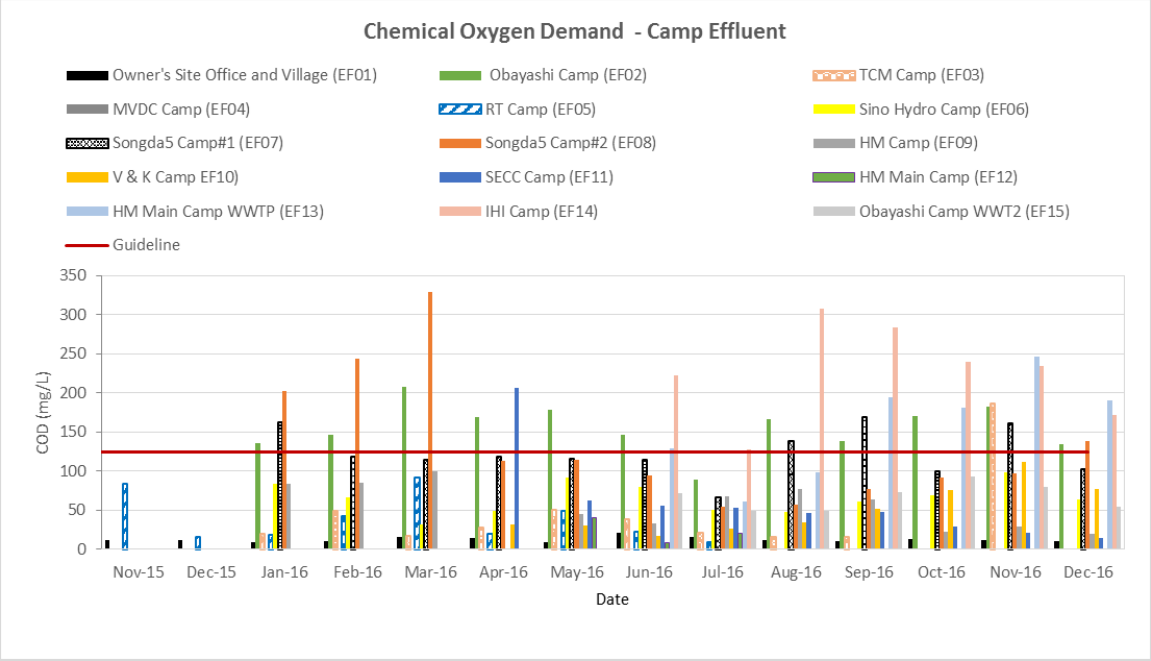
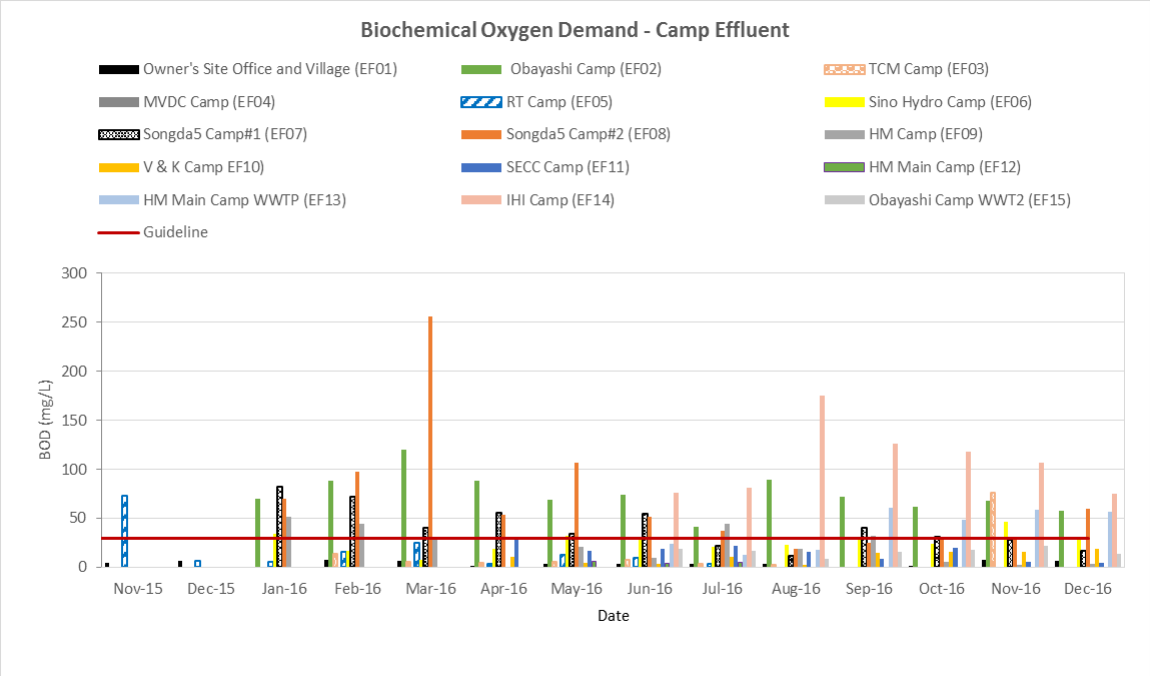
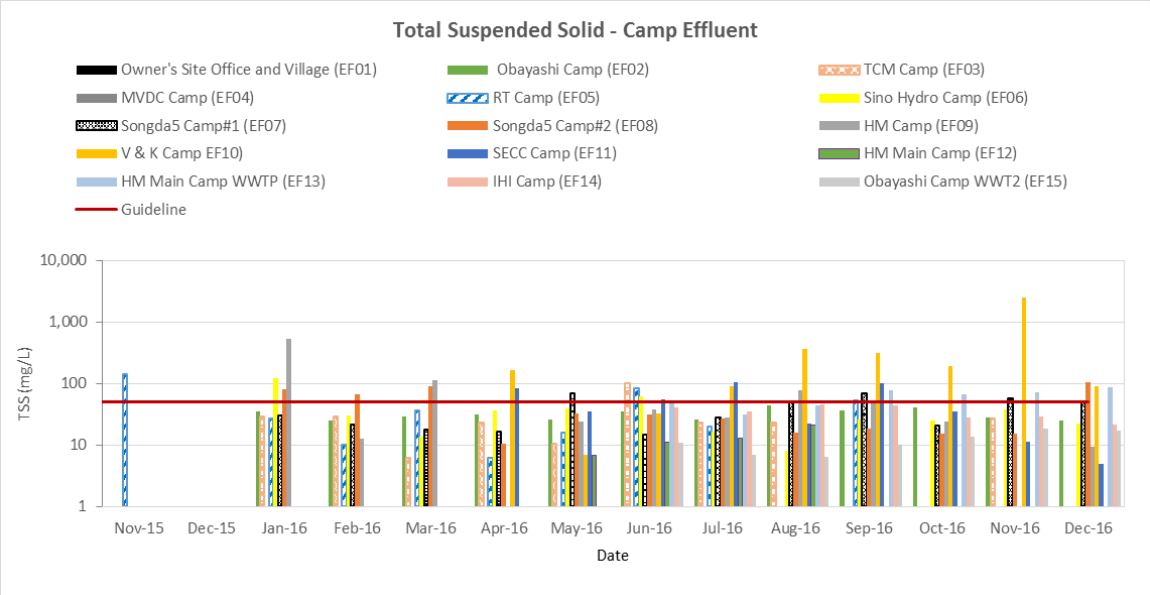
Oct-16
Nov-16
Dec-16
Date

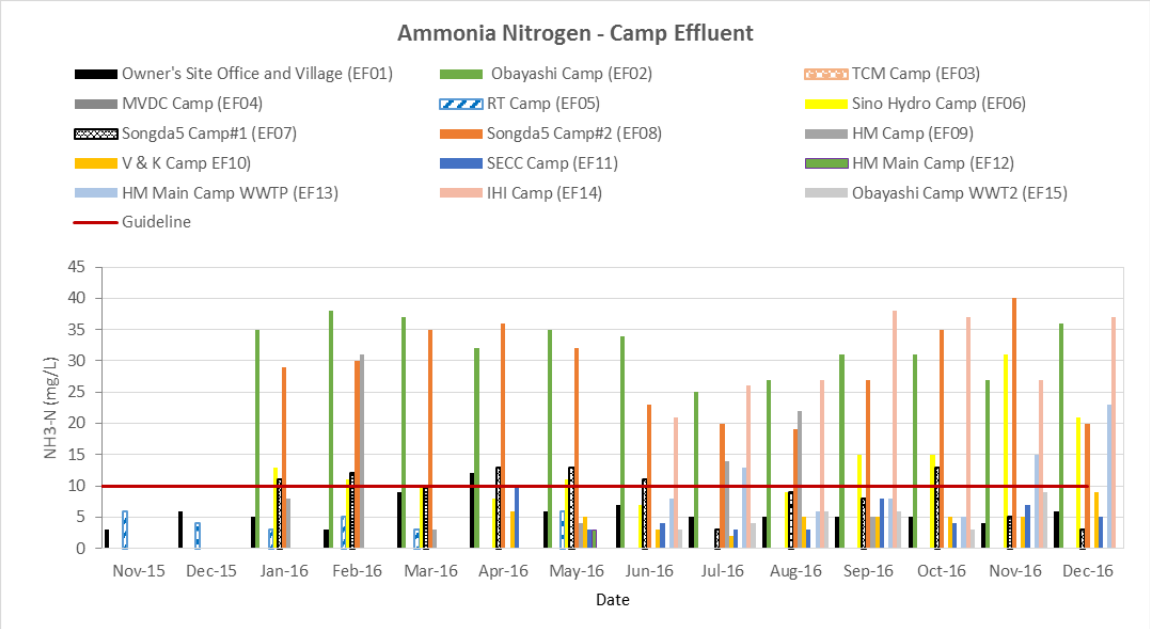
Camps' Effluent Water Quality Trends

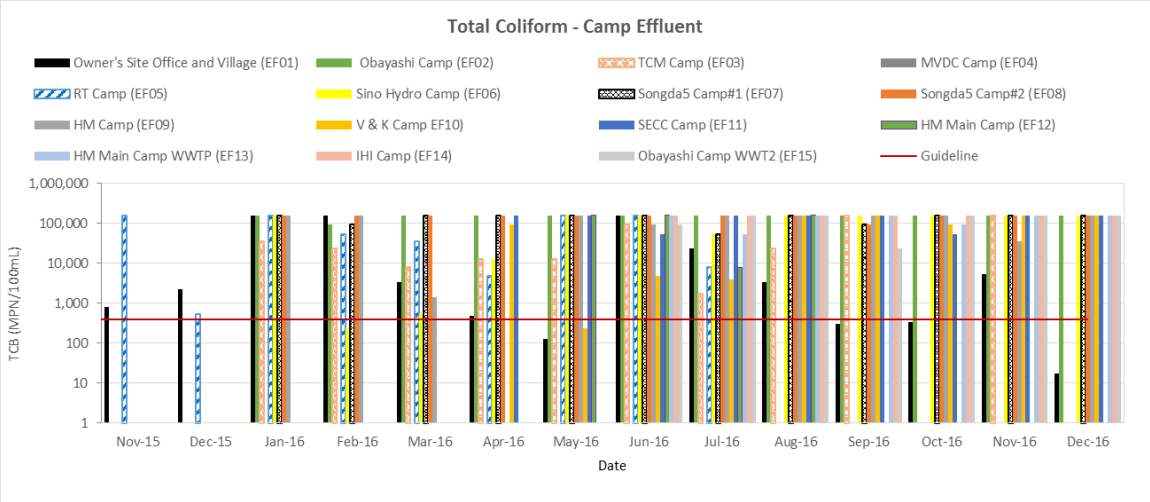




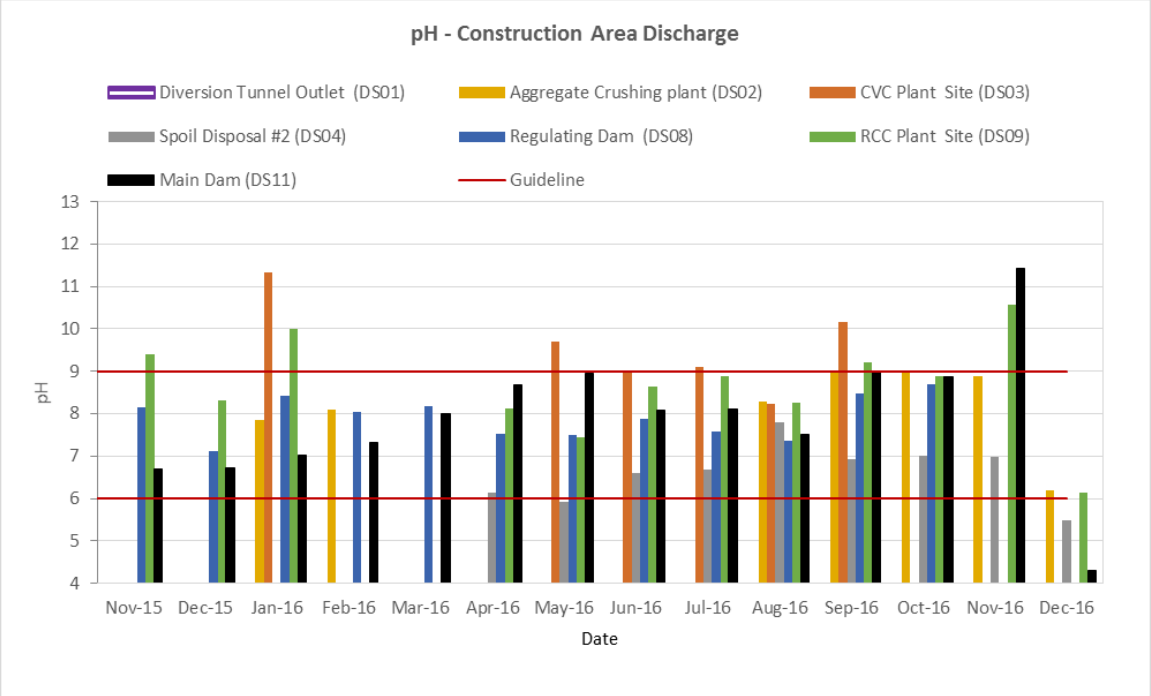

Biochemical Oxygen Demand - Camp Effluent
Owner's Site Office and Village (EF01)
Obayashi Camp (EF02)
TCM Camp (EF03)
MVDC Camp (EF04)
RT Camp (EF05)
Sino Hydro Camp (EF06)
Songda5 Camp#1 (EF07)
Songda5 Camp#2 (EF08)
HM Camp (EF09)
V & K Camp EF10)
SECC Camp (EF11)
HM Main Camp (EF12)
HM Main Camp WWTP (EF13)
IHI Camp (EF14)
Obayashi Camp WWT2 (EF15)
Guideline
BOD (mg/L)
300
250
200
150
100
50
0
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
Date

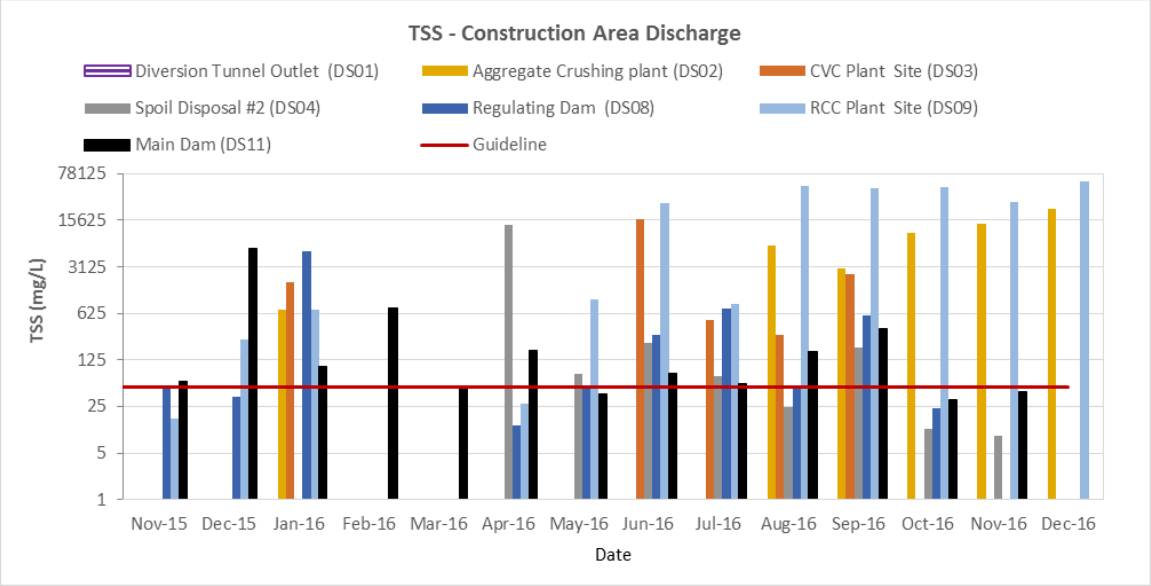

Total Suspended Solid - Camp Effluent
Owner's Site Office and Village (EF01)
Obayashi Camp (EF02)
TCM Camp (EF03)
MVDC Camp (EF04)
RT Camp (EF05)
Sino Hydro Camp (EF06)
Songda5 Camp#1 (EF07)
Songda5 Camp#2 (EF08)
HM Camp (EF09)
V & K Camp EF10)
SECC Camp (EF11)
HM Main Camp (EF12)
HM Main Camp WWTP (EF13)
IHI Camp (EF14)
Obayashi Camp WWT2 (EF15)
Guideline
TSS (mg/L)
10,000
1,000
100
10
1
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
Date


Ammonia Nitrogen - Camp Effluent
Owner's Site Office and Village (EF01)
Obayashi Camp (EF02)
TCM Camp (EF03)
MVDC Camp (EF04)
RT Camp (EF05)
Sino Hydro Camp (EF06)
Songda5 Camp#1 (EF07)
Songda5 Camp#2 (EF08)
HM Camp (EF09)
V & K Camp EF10)
SECC Camp (EF11)
HM Main Camp (EF12)
HM Main Camp WWTP (EF13)
IHI Camp (EF14)
Obayashi Camp WWT2 (EF15)
Guideline
NH3-N (mg/L)
0
5
10
15
20
25
30
35
40
45
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
Date


Total Coliform - Camp Effluent
Owner's Site Office and Village (EF01)
Obayashi Camp (EF02)
TCM Camp (EF03)
MVDC Camp (EF04)
RT Camp (EF05)
Sino Hydro Camp (EF06)
Songda5 Camp#1 (EF07)
Songda5 Camp#2 (EF08)
HM Camp (EF09)
V & K Camp EF10)
SECC Camp (EF11)
HM Main Camp (EF12)
HM Main Camp WWTP (EF13)
IHI Camp (EF14)
Obayashi Camp WWT2 (EF15)
Guideline
TCB (MPN/100mL)
1
10
100
1,000
10,000
100,000
1,000,000
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
Date

Construction Area Discharge Water Quality





APPENDIX 5: ALL MONITORING DATA OF Q4-2016

SURFACE WATER QUALITY MONITORING – Q4, 2016.

		River Name	Nam Ngiep									Nam Chiane	Nam Phouan	Nam Xao	Nam Houay Soup
		Station	NNG01	NNG02	NNG03	NNG09	NNG04	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
		Zone	Upstream of Project Construction Area				Within Construction Area	Downstream of Project Construction Area				Tributaries Upstream of Project Construction Area		Tributaries Downstream of Project Construction Area	
Date	Parameter (Unit)	Guideline													
03-10-16	pH	5.0 - 9.0	7.67	7.18	7.85	7.61	7.74	7.88	7.98	8.34	8.44	7.83	7.52	8.01	7.37
11-10-16	pH	5.0 - 9.0	N/A	N/A	N/A	7.7	6.99	7.33	N/A	N/A	N/A	N/A	N/A	N/A	N/A
18-10-16	pH	5.0 - 9.0	7.07	7.58	7.45	7.68	7.42	7.74	7.59	7.12	7.6	7.68	7.6	7.05	6.64
24-10-16	pH	5.0 - 9.0	N/A	N/A	N/A	6.81	7.11	7.37	N/A	N/A	N/A	N/A	N/A	N/A	N/A
01-11-16	pH	5.0 - 9.0	6.7	7.05	7.47	7.16	8.11	7.15	7.25	8.01	7.88	6.93	7.01	7.51	7.57
09-11-16	pH	5.0 - 9.0	N/A	N/A	N/A	7.45	7.68	7.63	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15-11-16	pH	5.0 - 9.0	7.4	7.64	7.56	7.85	7.37	7.19	7.54	7.54	7.59	7.78	7.34	7.47	7.03
22-11-16	pH	5.0 - 9.0	N/A	N/A	N/A	7.18	7.15	7.36	N/A	N/A	N/A	N/A	N/A	N/A	N/A
06-12-16	pH	5.0 - 9.0	6.97	7.18	7.32	7.3	6.85	7.15	7.37	7.3	7.25	6.98	7.75	7.33	7.49
03-10-16	Sat. DO (%)		92.8	99.7	97.3	99.4	100.8	85.7	102.8	97.6	93	97.9	98.9	92.7	83.1
11-10-16	Sat. DO (%)		N/A	N/A	N/A	100.7	99.2	99.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A
18-10-16	Sat. DO (%)		95	97.8	97.7	99.7	99.9	90.9	82.7	94.4	92.8	97	103.2	80.1	72.7
24-10-16	Sat. DO (%)		N/A	N/A	N/A	101.2	101.6	101.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A
01-11-16	Sat. DO (%)		92.2	95.1	97.8	100.8	103.8	99.7	88.7	98.5	98.1	100.4	99.7	6.44	6.22

		River Name	Nam Ngiep									Nam Chiane	Nam Phouan	Nam Xao	Nam Houay Soup
		Station	NNG01	NNG02	NNG03	NNG09	NNG04	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
		Zone	Upstream of Project Construction Area				Within Construction Area	Downstream of Project Construction Area				Tributaries Upstream of Project Construction Area		Tributaries Downstream of Project Construction Area	
Date	Parameter (Unit)	Guideline													
09-11-16	Sat. DO (%)		N/A	N/A	N/A	101.4	102.1	101.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15-11-16	Sat. DO (%)		104.4	96.6	102	102.1	93.6	97	90.8	101.1	99.3	104.2	98.2	90.1	84.5
22-11-16	Sat. DO (%)		N/A	N/A	N/A	100.7	103.9	107	N/A	N/A	N/A	N/A	N/A	N/A	N/A
06-12-16	Sat. DO (%)		73.8	89.9	88.7	70.9	68.8	84.3	85.5	75.2	86.3	74.6	96.8	73.6	73.7
03-10-16	DO (mg/l)	>6	7.59	7.65	7.58	7.92	7.66	6.8	8.18	7.35	6.98	8.04	8.01	7.09	6.62
11-10-16	DO (mg/l)	>6	N/A	N/A	N/A	7.83	7.51	7.62	N/A	N/A	N/A	N/A	N/A	N/A	N/A
18-10-16	DO (mg/l)	>6	7.21	7.56	7.54	7.89	7.71	7.99	6.58	7.01	6.95	7.68	8.06	6.06	6.04
24-10-16	DO (mg/l)	>6	N/A	N/A	N/A	7.88	7.84	7.57	N/A	N/A	N/A	N/A	N/A	N/A	N/A
01-11-16	DO (mg/l)	>6	7.72	7.89	8.07	8.43	8.26	8.07	7.67	7.86	7.77	8.45	8.39	8.14	8.02
09-11-16	DO (mg/l)	>6	N/A	N/A	N/A	8.3	8.14	8.17	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15-11-16	DO (mg/l)	>6	8.26	8.22	8.41	8.28	7.48	7.85	7.3	7.96	7.89	8.53	8.46	7.11	6.86
22-11-16	DO (mg/l)	>6	N/A	N/A	N/A	7.89	8.17	8.28	N/A	N/A	N/A	N/A	N/A	N/A	N/A
06-12-16	DO (mg/l)	>6	6.47	7.28	6.96	6.23	6.12	6.35	6.46	7.28	6.16	6.16	8.61	6.09	6.36
03-10-16	Conductivity (µS/cm)		102.3	70.5	71.6	69.8	74	275	119	67.9	89.6	36.5	48.6	137	60
11-10-16	Conductivity (µS/cm)		N/A	N/A	N/A	95.4	75.7	86.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A
18-10-16	Conductivity (µS/cm)		185.1	73.6	82.3	73.5	70.7	131	136	110	116	40.9	63.5	156	60
24-10-16	Conductivity (µS/cm)		N/A	N/A	N/A	70.5	69.8	75	N/A	N/A	N/A	N/A	N/A	N/A	N/A
01-11-16	Conductivity (µS/cm)		115.2	89.3	78	75.7	75.9	120	133	78.6	196	33.6	66.7	147	54
09-11-16	Conductivity (µS/cm)		N/A	N/A	N/A	73.2	72.3	71.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15-11-16	Conductivity (µS/cm)		105.6	138.3	89.8	98.9	114.7	83.5	84.4	93	86.3	35.7	73.6	112.9	34.6

		River Name	Nam Ngiep									Nam Chiane	Nam Phouan	Nam Xao	Nam Houay Soup
		Station	NNG01	NNG02	NNG03	NNG09	NNG04	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
		Zone	Upstream of Project Construction Area				Within Construction Area	Downstream of Project Construction Area				Tributaries Upstream of Project Construction Area		Tributaries Downstream of Project Construction Area	
Date	Parameter (Unit)	Guideline													
22-11-16	Conductivity (µS/cm)		N/A	N/A	N/A	83	83.7	81.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
06-12-16	Conductivity (µS/cm)		126	141	150	114	112	156	114	120	114	53	93	148	65
03-10-16	TDS (mg/l)		51.15	35	36	35	37	138	59	34	44.25	18.45	24.3	69	30
11-10-16	TDS (mg/l)		N/A	N/A	N/A	47.7	37.85	43.35	N/A	N/A	N/A	N/A	N/A	N/A	N/A
18-10-16	TDS (mg/l)		92	37	41	36	35	66	68	55	58	20	31	78	30
24-10-16	TDS (mg/l)		N/A	N/A	N/A	35.25	35	37.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A
01-11-16	TDS (mg/l)		57	45	39	38	38	60	66	39	98	16	33	74	27
09-11-16	TDS (mg/l)		N/A	N/A	N/A	36	36	36	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15-11-16	TDS (mg/l)		52	69	45	49	57.35	41.75	42.2	46	43	17	36	56.85	17.3
22-11-16	TDS (mg/l)		N/A	N/A	N/A	41	42	40	N/A	N/A	N/A	N/A	N/A	N/A	N/A
06-12-16	TDS (mg/l)		63	71	75	57	56	77	57	60	57	27	46	74	32
03-10-16	Temperature (°C)		23	26.5	26.3	25.4	26.1	26.27	26.42	28.7	27.7	22.8	24.2	27.9	26.4
11-10-16	Temperature (°C)		N/A	N/A	N/A	26.7	28.2	27.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A
18-10-16	Temperature (°C)		26.9	26.3	26.4	25	26.7	25.2	25.64	26.59	28.6	24.4	25.7	27.32	25.78
24-10-16	Temperature (°C)		N/A	N/A	N/A	26.7	27.2	28.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A
01-11-16	Temperature (°C)		22.4	23.3	24.2	23.4	25.9	23.6	24.12	25.8	26.4	21.9	22.6	25.33	23.99
09-11-16	Temperature (°C)		N/A	N/A	N/A	24	25.6	25	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15-11-16	Temperature (°C)		25.2	21.9	23.6	24.8	25.67	25.05	25.14	26.3	25.9	23.3	21.3	25.9	25.54
22-11-16	Temperature (°C)		N/A	N/A	N/A	26.5	26.2	27.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A
06-12-16	Temperature (°C)		20.61	22.3	21.5	20.77	22.5	22.03	22.8	23.3	23.4	19.3	19.66	20.69	20.35

		River Name	Nam Ngiep									Nam Chiane	Nam Phouan	Nam Xao	Nam Houay Soup
		Station	NNG01	NNG02	NNG03	NNG09	NNG04	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
		Zone	Upstream of Project Construction Area				Within Construction Area	Downstream of Project Construction Area				Tributaries Upstream of Project Construction Area		Tributaries Downstream of Project Construction Area	
Date	Parameter (Unit)	Guideline													
03-10-16	Turbidity (NTU)		80	86	84.9	45.2	41.5	61.8	54.1	73.3	71.4	12	7.18	9.1	16.2
11-10-16	Turbidity (NTU)		N/A	N/A	N/A	39.5	50.7	41.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A
18-10-16	Turbidity (NTU)		764	603	102	55.8	56.6	70.7	84.1	99.4	77.3	12	4.26	5.13	5.1
24-10-16	Turbidity (NTU)		N/A	N/A	N/A	36.8	36.8	38.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A
01-11-16	Turbidity (NTU)		24.4	34.6	25.3	16.2	17.3	32.7	28.8	32.8	26.6	7	4.51	4.59	4.46
09-11-16	Turbidity (NTU)		N/A	N/A	N/A	33	60.7	71.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15-11-16	Turbidity (NTU)		14.5	13.2	11.5	11.9	14.7	17.8	19.5	20	11.1	14	2.76	3.68	4.19
22-11-16	Turbidity (NTU)		N/A	N/A	N/A	13.2	18.4	21.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A
06-12-16	Turbidity (NTU)		46.3	32.9	250	29.8	40.4	23	24.1	30.8	24	845	3.18	6.24	14.44
03-10-16	TSS (mg/l)		304	405	634	120	97.3	99.6	89	112	153	23.4	15.1	12.7	5.2
01-11-16	TSS (mg/l)		75.3	104	72	42	33.6	57.2	56.1	73.2	42.8	20.3	10.1	ND5	ND5
06-12-16	TSS (mg/l)		88.6	N/A	N/A	55.4	96.9	44.3	43.5	44.9	46.6	515	N/A	ND	9.8
03-10-16	BOD (mg/l)	<1.5	ND[13]	ND[13]	ND[13]	1	ND[13]	3.3	1.9	1.5	1.9	1	ND[13]	1.2	ND[13]
01-11-16	BOD (mg/l)	<1.5	ND[13]	ND[13]	1	ND[13]	ND[13]	ND[13]	ND[13]	ND[13]	ND[13]	ND[13]	1	ND[13]	ND[13]
06-12-16	BOD (mg/l)	<1.5	ND[13]	N/A*	N/A*	ND[13]	ND[13]	ND[13]	ND[13]	ND[13]	ND[13]	1.4	N/A*	ND[13]	ND[13]
03-10-16	COD (mg/l)	<5	15.2	13.6	12.4	7.3	7.5	8.4	7.8	19.6	8.6	5.9	9.8	ND[16]	7.5
01-11-16	COD (mg/l)	<5	6.1	6.1	5.9	ND[16]	10	5.1	5.5	5.7	ND[16]	ND[16]	5.5	ND[16]	7.5
06-12-16	COD (mg/l)	<5	8.3	N/A*	N/A*	6.9	7.1	ND[16]	ND[16]	ND[16]	5.5	13.3	N/A*	ND[16]	8.8
03-10-16	NH3-N (mg/l)	<0.2	ND[12]	ND[12]	ND[12]	ND[12]	ND[12]	ND[12]	ND[12]	0.2	ND[12]	ND[12]	ND[12]	ND[12]	ND[12]

		River Name	Nam Ngiep									Nam Chiane	Nam Phouan	Nam Xao	Nam Houay Soup
		Station	NNG01	NNG02	NNG03	NNG09	NNG04	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
		Zone	Upstream of Project Construction Area				Within Construction Area	Downstream of Project Construction Area				Tributaries Upstream of Project Construction Area		Tributaries Downstream of Project Construction Area	
Date	Parameter (Unit)	Guideline													
01-11-16	NH3-N (mg/l)	<0.2	ND[12]	ND[12]	ND[12]	ND[12]	ND[12]	ND[12]	ND[12]	ND[12]	ND[12]	ND[12]	ND[12]	ND[12]	ND[12]
06-12-16	NH3-N (mg/l)	<0.2	ND[12]	N/A	N/A	ND[12]	ND[12]	ND[12]	ND[12]	ND[12]	ND[12]	ND[12]	ND[12]	ND[12]	ND[12]
03-10-16	NO3-N (mg/l)	<5	0.77	2.85	0.17	0.16	0.15	0.13	0.16	0.5	0.1	0.13	0.16	0.12	0.16
01-11-16	NO3-N (mg/l)	<5	2.92	0.11	0.12	0.25	3.12	0.13	0.13	0.14	0.14	0.13	0.13	0.11	0.17
06-12-16	NO3-N (mg/l)	<5	0.13	N/A	N/A	0.1	0.1	0.09	0.09	0.09	0.16	0.12	N/A	0.05	0.11
06-12-16	TKN (mg/l)		ND[14]	N/A	N/A	ND[14]	ND[14]	ND[14]	ND[14]	ND[14]	ND[14]	ND[14]	N/A	ND[14]	ND[14]
06-12-16	Chloride (mg/l)		ND[13]	N/A	N/A	ND[13]	ND[13]	ND[13]	ND[13]	ND[13]	ND[13]	ND[13]	N/A	3.4	2.9
06-12-16	Sulphate (mg/l)	<500	5.2	N/A	N/A	4	4.5	4.2	4.1	4.3	4	5.4	N/A	3.9	3.8
06-12-16	Alkalinity (mg/l)		57.1	N/A	N/A	47.8	51.7	49.8	49.8	48.8	48.8	22.4	N/A	61.7	22.9
06-12-16	Arsenic (mg/l)	<0.01	ND[2]	N/A	N/A	ND[2]	ND[2]	ND[2]	ND[2]	ND[2]	ND[2]	0.0259	N/A	ND[2]	ND[2]
06-12-16	Calcium (mg/l)		12.2	N/A	N/A	10.5	10.5	11.1	11	11.5	10.9	4.25	N/A	12	5.7
03-10-16	Manganese (mg/l)	<1.0	0.183	0.229	0.134	0.089	0.083	0.09	0.087	0.092	0.103	0.042	0.046	0.071	0.057
01-11-16	Manganese (mg/l)	<1.0	0.098	0.083	0.058	ND[4]	0.038	0.05	0.051	0.064	0.045	0.035	0.033	0.065	0.036
06-12-16	Manganese (mg/l)	<1.0	0.065	N/A	N/A	ND[4]	0.058	ND[4]	ND[4]	ND[4]	ND[4]	0.4	N/A	ND[4]	ND[4]
06-12-16	Mercury (mg/l)	<0.002	ND3	N/A	N/A	ND[3]	ND[3]	ND[3]	ND[3]	ND[3]	0.0005	0.0009	N/A	ND[3]	ND[3]
06-12-16	Magnesium (mg/l)		2.58	N/A	N/A	2.28	2.5	2.36	2.41	2.42	2.37	2.26	N/A	3.34	1.09
06-12-16	Lead (mg/l)	<0.05	ND[10]	N/A	N/A	ND[10]	ND[10]	ND[10]	ND[10]	ND[10]	ND[10]	ND[10]	N/A	ND[10]	ND[10]
06-12-16	Potassium (mg/l)		0.911	N/A	N/A	0.952	1.16	0.946	0.946	0.981	0.949	3.52	N/A	0.602	0.355
06-12-16	Sodium (mg/l)		2.11	N/A	N/A	2.32	2.27	2.41	2.37	2.64	2.48	1.8	N/A	3.98	1.58

		River Name	Nam Ngiep									Nam Chiane	Nam Phouan	Nam Xao	Nam Houay Soup
		Station	NNG01	NNG02	NNG03	NNG09	NNG04	NNG05	NNG06	NNG07	NNG08	NCH01	NPH01	NXA01	NHS01
		Zone	Upstream of Project Construction Area				Within Construction Area	Downstream of Project Construction Area				Tributaries Upstream of Project Construction Area		Tributaries Downstream of Project Construction Area	
Date	Parameter (Unit)	Guideline													
03-10-16	Total Iron (mg/l)		13.4	40.6	21.2	7.34	7.19	6.91	6.41	7.68	12.5	1.16	0.484	0.949	0.886
01-11-16	Total Iron (mg/l)		4.38	4.59	3.98	2.18	1.84	2.96	2.62	3.6	2.47	1.34	0.34	0.625	1.02
06-12-16	Total Iron (mg/l)		4.51	N/A	N/A	3.26	4.33	2.32	2.04	2.42	1.85	19.9	N/A	0.425	1.22
03-10-16	Faecal Coliform (MPN/100ml)	<1,000	170	350	460	700	31	920	490	330	220	1,300	140	110	350
01-11-16	Faecal Coliform (MPN/100ml)	<1,000	1,700	220	170	240	210	210	1,100	330	330	790	84	49	70
06-12-16	Faecal Coliform (MPN/100ml)	<1,000	170	N/A	N/A	230	170	700	310	330	70	330	N/A	2	11
03-10-16	Total Coliform (MPN/100ml)	<5,000	790	350	700	5,400	280	2,400	4,900	3,100	220	1,300	540	460	350
01-11-16	Total Coliform (MPN/100ml)	<5,000	1,700	7,900	490	240	2,200	700	3,500	790	490	1,300	1,700	700	940
06-12-16	Total Coliform (MPN/100ml)	<5,000	330	N/A	N/A	230	330	1,700	1,100	490	2300	790	N/A	330	330

EFFLUENT CAMP MONITORING RESULTS – Q4, 2016

Date	Parameter (Unit)	Site Name	Owner's Site Office and Village	Obayashi Camp WWTS1	TCM Camp	RT Camp	Sino Hydro Camp	Songda5 Camp No.1	Songda5 Camp No.2	HMH Worker Camp No.1	V & K Camp	SECC Camp	HMH Main Camp Drainage	HMH Main Camp WWTP	IHI Camp	Obayashi Camp WWT2
		Station Code	EF01	EF02	EF03	EF05	EF06	EF07	EF08	EF09	EF10	EF11	EF12	EF13	EF14	EF15
		Guideline in the CA														
06-10-16	pH	6.0 - 9.0	6.72	8.88	N/A	N/A	8.42	7.01	8.69	7.64	8.89	6.53	N/A	8.78	6.97	8.77
20-10-16	pH	6.0 - 9.0	7.17	8.75	N/A	N/A	8.71	8.06	8.72	8.66	8.78	7.17	N/A	8.98	8.94	8.97
08-11-16	pH	6.0 - 9.0	8.42	8.11	7.88	N/A	8.26	8.11	7.77	7.98	7.99	7.96	N/A	8.21	8.31	8.09
21-11-16	pH	6.0 - 9.0	7.28	8.66	7.65	N/A	8.06	8.16	7.92	8.59	8.21	8.26	N/A	7.23	7.83	7.38
01-12-16	pH	6.0 - 9.0	6.35	7.47	N/A	N/A	6.98	6.90	6.60	6.91	6.91	6.01	N/A	7.74	7.46	7.82
06-10-16	Sat. DO (%)		35.6	1.1	N/A	N/A	10.1	263.3	1.7	96.9	96.8	64.2	N/A	163.9	1.5	87.9
20-10-16	Sat. DO (%)		17.4	1.5	N/A	N/A	9.4	20.8	29.6	97.5	207.1	31.6	N/A	116.9	1.7	81.7
08-11-16	Sat. DO (%)		37.9	20.6	72.2	N/A	8.4	96.9	26	94.2	79.5	18.1	N/A	21.2	0.7	83.1
21-11-16	Sat. DO (%)		56.5	7.6	64.7	N/A	4.9	106.2	15.4	95.7	116.3	79.4	N/A	106.3	8.5	88.2
01-12-16	Sat. DO (%)		61.3	32.1	N/A	N/A	1.6	86	21.9	73.1	14.5	12.4	N/A	76.9	37.4	54.7
06-10-16	DO (mg/l)		2.6	0.08	N/A	N/A	0.72	19.01	0.12	6.75	6.79	4.69	N/A	11.83	0.11	6.58
20-10-16	DO (mg/l)		1.3	0.11	N/A	N/A	0.72	1.56	2.15	6.72	14.75	2.47	N/A	11.93	0.12	6.13
08-11-16	DO (mg/l)		2.94	1.62	5.72	N/A	0.66	7.59	2.1	6.73	6.39	1.44	N/A	1.65	0.05	6.47
21-11-16	DO (mg/l)		4.24	0.57	4.98	N/A	0.37	11.21	1.17	7.02	10.6	6.24	N/A	10.3	0.67	6.86
01-12-16	DO (mg/l)		5.13	2.62	N/A	N/A	0.13	7	1.85	5.29	1.21	1.05	N/A	6.16	3.01	4.89
06-10-16	Conductivity (µS/cm)		415	647	N/A	N/A	458	537	542	205.4	275	175.4	N/A	354	589	573
20-10-16	Conductivity (µS/cm)		786	655	N/A	N/A	484	545	668	294	265	208.8	N/A	435	789	611

Date	Parameter (Unit)	Site Name	Owner's Site Office and Village	Obayashi Camp WWTS1	TCM Camp	RT Camp	Sino Hydro Camp	Songda5 Camp No.1	Songda5 Camp No.2	HMH Worker Camp No.1	V & K Camp	SECC Camp	HMH Main Camp Drainage	HMH Main Camp WWTP	IHI Camp	Obayashi Camp WWT2
		Station Code	EF01	EF02	EF03	EF05	EF06	EF07	EF08	EF09	EF10	EF11	EF12	EF13	EF14	EF15
		Guideline in the CA														
08-11-16	Conductivity (µS/cm)		446	696	119.1	N/A	737	535	710	278	139	189.2	N/A	444	753	600
21-11-16	Conductivity (µS/cm)		488	759	523	N/A	666	597	762	221	340	313	N/A	610	779	735
01-12-16	Conductivity (µS/cm)		638	1052	N/A	N/A	710	1096	612	372	533	551	N/A	833	972	830
06-10-16	TDS (mg/l)		207	324	N/A	N/A	229	269	272	102.77	142.75	84.44	N/A	177	245	287
20-10-16	TDS (mg/l)		396	327	N/A	N/A	242	272.5	334	197	132	104.4	N/A	267.5	393	305.5
08-11-16	TDS (mg/l)		223	348	59.9	N/A	368.5	267	355	169	69.5	90	N/A	222	376	300
21-11-16	TDS (mg/l)		244	379	261	N/A	333	298	381	110	170	156	N/A	305	375	367
01-12-16	TDS (mg/l)		319	528	N/A	N/A	355	531	306	184	266	275	N/A	417	486	414
06-10-16	Temperature (°C)		29.8	30.4	N/A	N/A	30	31.1	30.9	31.2	32.6	30.3	N/A	30.9	30.1	28.7
20-10-16	Temperature (°C)		28.65	31.1	N/A	N/A	29.8	28.9	30.2	33.7	31.5	26.4	N/A	31.3	29.8	28.4
08-11-16	Temperature (°C)		27.3	26.6	26.2	N/A	26.7	26.8	25.1	31.9	25.4	25.8	N/A	26.8	26.4	27
21-11-16	Temperature (°C)		28.6	28.5	27.4	N/A	28	27.7	29.8	30.2	28.9	26.3	N/A	27.2	27.8	26.9
09-12-16	Temperature (°C)		26.08	24.4	N/A	N/A	23.9	24.8	22.9	30.9	21.9	22.7	N/A	22.73	25.8	23.2
06-10-16	Turbidity (NTU)		2.79	13.5	N/A	N/A	10.07	8.11	12.1	17.3	60	5.69	N/A	11.3	19	6.96
20-10-16	Turbidity (NTU)		1.4	15.9	N/A	N/A	19.9	12.6	51.8	7.07	9.6	5.56	N/A	21.2	24.6	11.2
08-11-16	Turbidity (NTU)		1.94	31.3	10.37	N/A	7.38	12.67	11.6	5.65	3328	3.41	N/A	12.1	50.6	15.4
21-11-16	Turbidity (NTU)		2.09	15.1	8.62	N/A	9.83	12.94	15.8	4.35	8.61	13	N/A	12.6	50.9	6.91
01-12-16	Turbidity (NTU)		2.75	15.4	N/A	N/A	14.53	11.8	42.9	6.15	34	3.44	N/A	27.7	40.3	19.1
06-10-16	TSS (mg/l)	<50	ND[16]	41.6	N/A	N/A	25.1	11.6	9.8	24.5	194	35.2	N/A	42.1	27.8	8.5

Date	Parameter (Unit)	Site Name	Owner's Site Office and Village	Obayashi Camp WWTS1	TCM Camp	RT Camp	Sino Hydro Camp	Songda5 Camp No.1	Songda5 Camp No.2	HMH Worker Camp No.1	V & K Camp	SECC Camp	HMH Main Camp Drainage	HMH Main Camp WWTP	IHI Camp	Obayashi Camp WWT2
		Station Code	EF01	EF02	EF03	EF05	EF06	EF07	EF08	EF09	EF10	EF11	EF12	EF13	EF14	EF15
		Guideline in the CA														
20-10-16	TSS (mg/l)	<50	ND[16]	22	N/A	N/A	19.2	21	15.3	6.3	19.6	5.5	N/A	67.8	24.4	13.5
08-11-16	TSS (mg/l)	<50	ND[16]	28.4	7.2	N/A	17.7	58	13.6	ND5	2540	7.9	N/A	69.8	24.1	18.7
21-11-16	TSS (mg/l)	<50	ND[16]	19.9	27	N/A	38.3	56	15.5	ND5	11.9	11.2	N/A	72.2	29.2	7.2
01-12-16	TSS (mg/l)	<50	ND[16]	24.6	N/A	N/A	22.3	49.3	106	9.5	88.9	5	N/A	85.8	21.5	17
06-10-16	BOD (mg/l)	<30	ND[13]	45.4	N/A	N/A	22.1	9.4	26.4	5.1	15.5	20.2	N/A	17	51.8	13.9
20-10-16	BOD (mg/l)	<30	1.1	61.8	N/A	N/A	23.4	30.6	31.4	ND[13]	8.8	ND[13]	N/A	48.6	118	17.5
08-11-16	BOD (mg/l)	<30	2.1	36.4	2.7	N/A	45.9	28.2	22.5	2.4	16.2	ND[13]	N/A	54.4	102	21.6
21-11-16	BOD (mg/l)	<30	7.4	67.8	75.6	N/A	32.8	27.6	29.5	ND[13]	5.6	5.3	N/A	58.8	107	8.2
01-12-16	BOD (mg/l)	<30	6.4	57.8	N/A	N/A	29.2	17.2	59.8	3.9	18.6	4.2	N/A	57	74.9	14
06-10-16	COD (mg/l)	<125	10.7	171	N/A	N/A	69.6	75.5	85.5	22	75.5	29.2	N/A	137	211	77.5
20-10-16	COD (mg/l)	<125	12.8	140	N/A	N/A	54.6	99.9	91.9	14.3	48.6	14.7	N/A	181	240	93.5
08-11-16	COD (mg/l)	<125	12.3	183	16.7	N/A	98.2	160	94.2	29.2	112	13.3	N/A	190	212	80.2
21-11-16	COD (mg/l)	<125	9.4	148	186	N/A	96.8	161	96.8	8	36.2	21.4	N/A	246	234	61
01-12-16	COD (mg/l)	<125	10	134	N/A	N/A	63.4	102	139	20.4	77.6	14.9	N/A	190	172	54.4
06-10-16	Ammonia-Nitrogen (mg/l)	<10	3	31	N/A	N/A	12	13	28	ND[12]	4	4	N/A	5	27	ND[12]
20-10-16	Ammonia-Nitrogen (mg/l)	<10	5	25	N/A	N/A	15	8	35	ND[12]	5	ND[12]	N/A	5	37	3
08-11-16	Ammonia-Nitrogen (mg/l)	<10	4	27	ND[12]	N/A	31	5	38	ND[12]	ND[12]	ND[12]	N/A	4	11	9
21-11-16	Ammonia-Nitrogen (mg/l)	<10	4	23	ND[12]	N/A	31	5	40	ND[12]	5	7	N/A	15	27	ND[12]

Date	Parameter (Unit)	Site Name	Owner's Site Office and Village	Obayashi Camp WWTS1	TCM Camp	RT Camp	Sino Hydro Camp	Songda5 Camp No.1	Songda5 Camp No.2	HMH Worker Camp No.1	V & K Camp	SECC Camp	HMH Main Camp Drainage	HMH Main Camp WWTP	IHI Camp	Obayashi Camp WWT2
		Station Code	EF01	EF02	EF03	EF05	EF06	EF07	EF08	EF09	EF10	EF11	EF12	EF13	EF14	EF15
		Guideline in the CA														
01-12-16	Ammonia-Nitrogen (mg/l)	<10	6	36	N/A	N/A	21	3	20	ND[12]	9	5	N/A	23	37	ND[12]
06-10-16	Faecal Coliform (MPN/100 ml)		330	160,000	N/A	N/A	160,000	160,000	160,000	54,000	35,000	2,300	N/A	680	160,000	92,000
20-10-16	Faecal Coliform (MPN/100 ml)		79	160,000	N/A	N/A	160,000	160,000	92,000	1,700	49	130	N/A	7000	28,000	7,000
08-11-16	Faecal Coliform (MPN/100 ml)		4,900	160,000	3,300	N/A	160,000	92,000	24,000	35,000	160,000	1,300	N/A	160000	160,000	160,000
21-11-16	Faecal Coliform (MPN/100 ml)		13	160,000	92,000	N/A	160,000	160,000	160,000	4,900	240	35,000	N/A	35000	160,000	54,000
01-12-16	Faecal Coliform (MPN/100 ml)		17	160,000	N/A	N/A	92,000	35,000	54,000	160,000	54,000	1,100	N/A	160,000	160,000	160,000
06-10-16	Total Coliform (MPN/100 ml)	<400	330	160,000	N/A	N/A	160,000	160,000	160,000	160,000	92000	54,000	N/A	4,600	160,000	160,000
20-10-16	Total Coliform (MPN/100 ml)	<400	220	160,000	N/A	N/A	160,000	160,000	160,000	1,700	1100	1,100	N/A	92,000	160,000	35,000
08-11-16	Total Coliform (MPN/100 ml)	<400	5,400	160,000	160,000	N/A	160,000	160,000	160,000	35,000	160000	35,000	N/A	160,000	160,000	160,000
21-11-16	Total Coliform (MPN/100 ml)	<400	170	160,000	160,000	N/A	160,000	160,000	160,000	14,000	1300	160,000	N/A	160,000	160,000	160,000
01-12-16	Total Coliform (MPN/100 ml)	<400	17	160,000	N/A	N/A	160,000	160,000	160,000	160,000	160000	160,000	N/A	160,000	160,000	160,000
06-10-16	Oil & Grease (mg/l)	<10	ND[13]	8	N/A	N/A	1	ND[13]	ND[13]	ND[13]	ND[13]	ND[13]	N/A	1	3	ND[13]
20-10-16	Oil & Grease (mg/l)	<10	ND[13]	5	N/A	N/A	2	ND[13]	2	ND[13]	1	ND[13]	N/A	1	3	ND[13]
08-11-16	Oil & Grease (mg/l)	<10	ND[13]	3	ND[13]	N/A	2	ND[13]	1	ND[13]	1	ND[13]	N/A	4	5	ND[13]
21-11-16	Oil & Grease (mg/l)	<10	ND[13]	4	1	N/A	3	1	2	ND[13]	ND[13]	ND[13]	N/A	2	9	ND[13]
01-12-16	Oil & Grease (mg/l)	<10	ND13	5	N/A	N/A	2	ND13	3	ND13	1	ND[13]	N/A	3	5	ND[13]
01-12-16	Manganese (mg/l)		0.095	ND[4]	N/A	N/A	0.09	0.073	0.083	ND[4]	0.273	ND[4]	N/A	ND[4]	0.065	ND[4]
01-12-16	Total iron (mg/l)	< 2.0	ND[10]	ND[10]	N/A	N/A	0.379	0.912	1.56	0.204	3.5	0.497	N/A	0.152	ND[10]	0.127

Date	Parameter (Unit)	Site Name	Owner's Site Office and Village	Obayashi Camp WWTS1	TCM Camp	RT Camp	Sino Hydro Camp	Songda5 Camp No.1	Songda5 Camp No.2	HMH Worker Camp No.1	V & K Camp	SECC Camp	HMH Main Camp Drainage	HMH Main Camp WWTP	IHI Camp	Obayashi Camp WWT2
		Station Code	EF01	EF02	EF03	EF05	EF06	EF07	EF08	EF09	EF10	EF11	EF12	EF13	EF14	EF15
		Guideline in the CA														
08-11-16	Total Phosphorus (mg/l)	<2	0.96	1.63	0.09	N/A	1.69	1.58	1.63	1.39	0.19	0.12	N/A	0.85	1.63	0.9
21-11-16	Total Phosphorus (mg/l)	<2	1.04	1.39	0.15	N/A	1.5	1.44	1.59	1.32	0.2	0.21	N/A	1.6	1.63	0.29
01-12-16	Total Phosphorus (mg/l)	<2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
08-11-16	Total Nitrogen (mg/l)	<10	12.2	30.9	0.84	N/A	34.2	9.02	34	14.2	3.96	1.79	N/A	8.67	17.8	11
21-11-16	Total Nitrogen (mg/l)	<10	15.4	27.6	2.35	N/A	33	9.91	39.3	11.1	7.28	9.58	N/A	12.9	27.9	2.97
01-12-16	Total Nitrogen (mg/l)	<10	16.8	37.2	N/A	N/A	25.2	13.8	22.5	10.6	12.9	9.56	N/A	25.9	27.6	3.72

EFFLUENT CONSTRUCTION AREA DISCHARGED MONITORING RESULTS – Q4, 2016.

Date	Parameter (Unit)	Site Name	Aggregate Crushing Plant	CVC Plant	Spoil Disposal No.2	Regulating Dam	RCC Plant	Main Dam
		Station Code	DS02	DS03	DS04	DS08	DS09	DS11
		Guideline						
05-10-16	pH	6.0 - 9.0	8.66	N/A	6.89	7.46	7.38	8.88
11-10-16	pH	6.0 - 9.0	8.98	N/A	5.87	8.68	7.13	7.82
20-10-16	pH	6.0 - 9.0	7.37	N/A	6.61	N/A	8.34	7.89
24-10-16	pH	6.0 - 9.0	N/A	N/A	7.02	N/A	8.88	7.96
03-11-16	pH	6.0 - 9.0	8.40	N/A	6.88	N/A	10.57	11.42
09-11-16	pH	6.0 - 9.0	8.89	N/A	6.97	N/A	7.23	8.87
17-11-16	pH	6.0 - 9.0	8.32	N/A	6.34	N/A	7.10	8.45
22-11-16	pH	6.0 - 9.0	6.76	N/A	5.96	N/A	6.82	10.88
08-12-16	pH	6.0 - 9.0	6.20	N/A	5.49	N/A	6.15	4.31
05-10-16	*Sat. DO (%)*		98.4	N/A	40.1	101.7	98.3	100.4
11-10-16	*Sat. DO (%)*		95.8	N/A	89.9	99	97.8	97.4
20-10-16	*Sat. DO (%)*		95.9	N/A	70.1	N/A	98.1	97
24-10-16	*Sat. DO (%)*		N/A	N/A	52.1	N/A	99.1	100
03-11-16	*Sat. DO (%)*		97.2	N/A	84.9	N/A	99.3	98
09-11-16	*Sat. DO (%)*		99.5	N/A	92.5	N/A	100.4	100.4
17-11-16	*Sat. DO (%)*		102.7	N/A	88.2	N/A	100	101.1
22-11-16	*Sat. DO (%)*		100.4	N/A	86.7	N/A	101.1	101.4
08-12-16	*Sat. DO (%)*		72.4	N/A	56.4	N/A	63.5	60.6
05-10-16	DO (mg/l)		7.05	N/A	3.14	7.67	7.5	7.38
11-10-16	DO (mg/l)		6.97	N/A	6.73	6.92	7.37	7.39
20-10-16	DO (mg/l)		7.14	N/A	6.02	N/A	7.03	7.33
24-10-16	DO (mg/l)		N/A	N/A	3.96	N/A	7.25	7.68
03-11-16	DO (mg/l)		7.86	N/A	6.57	N/A	7.39	8.04
09-11-16	DO (mg/l)		8.09	N/A	7.13	N/A	8.03	7.79
17-11-16	DO (mg/l)		8.19	N/A	6.93	N/A	8.01	7.94
22-11-16	DO (mg/l)		7.75	N/A	6.69	N/A	7.61	7.78

Date	Parameter (Unit)	Site Name	Aggregate Crushing Plant	CVC Plant	Spoil Disposal No.2	Regulating Dam	RCC Plant	Main Dam
		Station Code	DS02	DS03	DS04	DS08	DS09	DS11
		Guideline						
08-12-16	DO (mg/l)		6.28	N/A	4.44	N/A	5.12	5.11
05-10-16	Conductivity (µS/cm)		81.2	N/A	481	180.8	102.9	466
11-10-16	Conductivity (µS/cm)		82	N/A	17.26	136.1	96.8	1313
20-10-16	Conductivity (µS/cm)		53.1	N/A	37	N/A	70.7	705
24-10-16	Conductivity (µS/cm)		N/A	N/A	23.9	N/A	226	337
03-11-16	Conductivity (µS/cm)		58.8	N/A	19.94	N/A	261	1896
09-11-16	Conductivity (µS/cm)		69.1	N/A	46.6	N/A	193.5	342
17-11-16	Conductivity (µS/cm)		27.6	N/A	39.1	N/A	160	423
22-11-16	Conductivity (µS/cm)		65.9	N/A	43.3	N/A	120.3	1295
08-12-16	Conductivity (µS/cm)		102	N/A	109	N/A	92	584
05-10-16	TDS (mg/l)		40.5	N/A	241	90.4	51.89	233
11-10-16	TDS (mg/l)		41	N/A	8.63	68	48.4	656.5
20-10-16	TDS (mg/l)		26	N/A	19	N/A	35	352
24-10-16	TDS (mg/l)		N/A	N/A	12	N/A	113	168.5
03-11-16	TDS (mg/l)		29	N/A	10	N/A	130	948
09-11-16	TDS (mg/l)		37	N/A	23	N/A	96	171
17-11-16	TDS (mg/l)		13	N/A	20	N/A	80	211
22-11-16	TDS (mg/l)		33	N/A	21	N/A	60	647
08-12-16	TDS (mg/l)		51	N/A	55	N/A	46	290
05-10-16	Temperature (°C)		31.1	N/A	25.88	28.5	28	29.8
11-10-16	Temperature (°C)		30.5	N/A	28.9	33.7	28.5	28.2
20-10-16	Temperature (°C)		28.9	N/A	27.9	N/A	30	28.2
24-10-16	Temperature (°C)		N/A	N/A	27.8	N/A	30.2	27.5
03-11-16	Temperature (°C)		25.1	N/A	26.7	N/A	29.6	24.3
09-11-16	Temperature (°C)		24.7	N/A	26.3	N/A	25.6	26
17-11-16	Temperature (°C)		26.5	N/A	26.6	N/A	26	26.4
22-11-16	Temperature (°C)		27.2	N/A	27.2	N/A	28.7	27.6
08-12-16	Temperature (°C)		21.42	N/A	25.3	N/A	23.78	23.12

Date	Parameter (Unit)	Site Name	Aggregate Crushing Plant	CVC Plant	Spoil Disposal No.2	Regulating Dam	RCC Plant	Main Dam
		Station Code	DS02	DS03	DS04	DS08	DS09	DS11
		Guideline						
05-10-16	Turbidity (NTU)		2,067	N/A	12	50	12,800	6
11-10-16	Turbidity (NTU)		17,970	N/A	8	63	44,000	7
20-10-16	Turbidity (NTU)		1,170	N/A	7	N/A	84,000	5
24-10-16	Turbidity (NTU)		N/A	N/A	12	N/A	84	7
03-11-16	Turbidity (NTU)		3,470	N/A	5	N/A	32,000	8
09-11-16	Turbidity (NTU)		7,840	N/A	7	N/A	94	4
17-11-16	Turbidity (NTU)		64	N/A	7	N/A	216,000	9
22-11-16	Turbidity (NTU)		2,485	N/A	7	N/A	29,470	13
08-12-16	Turbidity (NTU)		24,680	N/A	11	N/A	66,000	10
05-10-16	TSS (mg/l)	<50	2,000	N/A	8.6	23.50	28,170	10.7
11-10-16	TSS (mg/l)	<50	10,027	N/A	5.6	N/A	48,420	31.9
20-10-16	TSS (mg/l)	<50	3,322	N/A	ND[16]	N/A	47,693	16.8
24-10-16	TSS (mg/l)	<50	N/A	N/A	11.7	74.50	212	27.4
03-11-16	TSS (mg/l)	<50	1,778	N/A	ND[16]	N/A	14,175	24.6
09-11-16	TSS (mg/l)	<50	14,107	N/A	ND[16]	N/A	163	ND[16]
17-11-16	TSS (mg/l)	<50	1,699	N/A	9.2	N/A	N/A	35.3
22-11-16	TSS (mg/l)	<50	2,227	N/A	6.2	N/A	29,443	41.8
08-12-16	TSS (mg/l)	<50	23,000	N/A	ND[16]	N/A	60,000	ND[16]
20-10-16	Oil & Grease (mg/l)	<10	ND[13]	N/A	ND[13]	ND[13]	ND[13]	ND[13]
24-10-16	Oil & Grease (mg/l)	<10	ND[13]	N/A	ND[13]	ND[13]	ND[13]	ND[13]
03-11-16	Oil & Grease (mg/l)	<10	ND[13]	N/A	ND[13]	ND[13]	ND[13]	ND[13]
09-11-16	Oil & Grease (mg/l)	<10	ND[13]	N/A	ND[13]	ND[13]	ND[13]	ND[13]
08-12-16	Oil & Grease (mg/l)	<11	ND[13]	N/A	ND[13]	ND[13]	ND[13]	ND[13]

GROUNDWATER QUALITY MONITORING RESULTS – Q4, 2016.

Date	Parameter (Unit)	Site Name	Ban Hatsaykham			Ban Hat Gnuin	Houay Soup Resettlement Village					
		Station	GHSK01	GHSK02	GHSK03	GHGN01	GHSP01	GHSP02	GHSP03	GHSP04	GHSP05	GHSP06
		Guideline										
20-10-16	pH	6.5 - 9.2	5.68	N/A	5.78	7.4	7.24	7.62	7.87	7.78	6.9	6.76
25-11-16	pH	6.5 - 9.2	6.05	N/A	6.19	6.36	8.47	7.36	7.44	7.08	7.87	7.78
05-12-16	pH	6.5 - 9.2	5.36	N/A	5.3	5.49	6.92	6.55	6.67	5.51	6.26	6.27
20-10-16	Sat. DO (%)		55.7	N/A	40.8	45.3	87.1	93.8	96.9	49.1	30.8	96.6
25-11-16	Sat. DO (%)		49.8	N/A	49.3	47.4	80.9	30.5	40.4	21.4	87.4	86.1
05-12-16	Sat. DO (%)		77.3	N/A	55.2	64.6	66.9	68.2	70.4	51.8	79	75.1
20-10-16	DO (mg/l)		4.33	N/A	3.15	3.49	6.57	6.92	7.2	3.91	7.02	7.06
25-11-16	DO (mg/l)		4.01	N/A	3.9	3.77	6.34	2.11	2.99	1.67	6.81	6.56
05-12-16	DO (mg/l)		6.19	N/A	4.35	5.12	5.7	5.53	5.68	5.01	6.3	6
20-10-16	Conductivity (µS/cm)		63.9	N/A	21.14	25	345	174	52	82.1	116.9	58.8
25-11-16	Conductivity (µS/cm)		70.6	N/A	60.6	24.4	407	200.1	432	153.5	122.4	204
05-12-16	Conductivity (µS/cm)		166	N/A	102	254	553	251	576	220	210	210
20-10-16	TDS (mg/l)	<1200	32	N/A	10.52	12.5	172.5	87	26	41.05	58.45	29.4
25-11-16	TDS (mg/l)	<1200	35.2	N/A	30.3	12.2	203	100	216	76.75	61.2	102
05-12-16	TDS (mg/l)	<1200	83	N/A	51	127	277	125	287	110	105	104
20-10-16	Temperature (°C)		26.9	N/A	27.3	27.5	28.5	29.7	29.5	26.8	28.8	30.3
25-11-16	Temperature (°C)		24.3	N/A	26	26.2	26.5	26.3	26.6	26.8	26.7	28
05-12-16	Temperature (°C)		26.34	N/A	26.5	25.9	25.05	25.2	25.68	25.53	25.5	25.87
07-10-16	Turbidity (NTU)	<20	0.86	N/A	0.58	8.7	0.8	0.62	1.06	0.47	0.66	0.69
10-11-16	Turbidity (NTU)	<20	24.3	N/A	26	26.2	0.82	0.97	0.83	1.92	1.18	0.91
05-12-16	Turbidity (NTU)	<20	0.77	N/A	0.79	3.16	1.42	1.23	1.06	1.74	0.91	0.67

Date	Parameter (Unit)	Site Name	Ban Hatsaykham			Ban Hat Gnuin	Houay Soup Resettlement Village					
		Station	GHSK01	GHSK02	GHSK03	GHGN01	GHSP01	GHSP02	GHSP03	GHSP04	GHSP05	GHSP06
		Guideline										
07-10-16	Faecal coliform (MPN/100ml)	0	0	N/A	0	170	0	0	0	0	0	0
10-11-16	Faecal coliform (MPN/100ml)	0	0	N/A	0	2,400	0	0	2	0	0	0
05-12-16	Faecal coliform (MPN/100ml)	0	0	N/A	0	23	0	0	0	0	0	0
07-10-16	E.Coli Bacteria (MPN/100ml)	0	0	N/A	0	170	0	0	0	0	0	0
10-11-16	E.Coli Bacteria (MPN/100ml)	0	0	N/A	0	2400	0	0	2	0	0	0
05-12-16	E.Coli Bacteria (MPN/100ml)	0	0	N/A	0	23	0	0	0	0	0	0
05-12-16	Arsenic (mg/l)	<0.05	ND[2]	N/A	ND[2]	ND[2]	ND[2]	ND[2]	ND[2]	ND[2]	ND[2]	ND[2]
05-12-16	Cadmium (mg/l)	<0.01	ND[5]	N/A	ND[5]	ND[5]	ND[5]	ND[5]	ND[5]	ND[5]	ND[5]	ND[5]
05-12-16	Iron (mg/l)		ND[10]	N/A	ND[10]	0.123	ND[10]	ND[10]	ND[10]	0.098	ND[10]	ND[10]
05-12-16	Magnesium (mg/l)	<0.5	1.11	N/A	1	0.404	4.02	1.93	4.08	1.41	2.16	2.39
05-12-16	Manganese (mg/l)	<0.5	ND[4]	N/A	ND[4]	0.094	ND[4]	ND[4]	ND[4]	ND[4]	ND[4]	ND[4]
05-12-16	Fluoride (mg/l)	<1	ND[9]	N/A	ND[9]	ND[9]	0.13	ND[9]	0.13	0.02	0.07	ND[9]
05-12-16	Total hardness (mg/l)	<500	46.8	N/A	32.4	ND	223	109	256	67.5	79.2	98.1
05-12-16	Calcium (mg/l)		12.1	N/A	11.3	0.956	69	30.1	76.4	13.4	18.9	26.8
05-12-16	Potassium (mg/l)		0.359	N/A	0.546	1.42	0.671	0.842	0.706	0.274	0.637	0.524
05-12-16	Sodium (mg/l)		0.842	N/A	0.933	2.36	5.57	3.31	5.86	1.08	2.37	3.13
05-12-16	Nitrate (mg/l)	<45	0.26	N/A	0.25	0.63	0.27	0.29	0.25	0.24	0.25	0.16
05-12-16	Nitrite (mg/l)	<3	ND[7]	N/A	ND[7]	ND[7]	ND[7]	ND[7]	ND[7]	ND[7]	ND[7]	ND[7]

Gravity fed water supply monitoring results – Q4, 2016.

Date	Parameter (Unit)	Site Name	Ban Thaheua	Ban HatGnuin
		Station	WTHH02	WHGN02
		Guideline		
20-10-16	pH	6.5 - 8.5	6.97	7.38
25-11-16	pH	6.5 - 8.5	8.23	5.85
05-12-16	pH	6.5 - 8.5	7.04	6.99
20-10-16	*Sat.* DO (%)		96.4	95.2
25-11-16	*Sat.* DO (%)		98.8	97.2
05-12-16	*Sat.* DO (%)		65.8	74.4
20-10-16	DO (mg/l)		7.31	7.14
25-11-16	DO (mg/l)		7.85	7.57
05-12-16	DO (mg/l)		5.33	5.72
20-10-16	Conductivity (µS/cm)	<1,000	36.3	69.5
25-11-16	Conductivity (µS/cm)	<1,000	46.4	64.5
05-12-16	Conductivity (µS/cm)	<1,000	74	170
20-10-16	TDS (mg/l)	<600	18.1	35
25-11-16	TDS (mg/l)	<600	23	32.2
05-12-16	TDS (mg/l)	<600	37	85
20-10-16	Temperature (°C)	<35	28.3	29
25-11-16	Temperature (°C)	<35	26.1	27.3
05-12-16	Temperature (°C)	<35	25.26	27.8
20-10-16	Turbidity (NTU)	<10	1.77	1.27
25-11-16	Turbidity (NTU)	<10	2.3	1.45
05-12-16	Turbidity (NTU)	<10	1.52	1.05
20-10-16	Faecal Coliform (MPN/100ml)	0	12	17
25-11-16	Faecal Coliform (MPN/100ml)	0	33	140
05-12-16	Faecal Coliform (MPN/100ml)	0	23	130
20-10-16	E.coli bacteria (MPN/100ml)	0	12	17
25-11-16	E.coli bacteria (MPN/100ml)	0	33	140
05-12-16	E.coli bacteria (MPN/100ml)	0	23	130
05-12-16	Aesenic (mg/l)	<0.05	ND[2]	ND[2]
05-12-16	Cadmium (mg/l)	<0.003	ND[5]	ND[5]
05-12-16	Iron (mg/l)		ND[10]	ND[10]
05-12-16	Maganesium (mg/l)		1.36	1.82
05-12-16	Manganese (mg/l)	<0.5	N/A	N/A
05-12-16	Fluoride (mg/l)	<1.5	0.13	ND[9]
05-12-16	Nitrate (mg/l)	<50	0.1	0.09
05-12-16	Nitrite (mg/l)	<3	ND[7]	ND[7]
05-12-16	Total hardness (mg/l)	<300	36.9	56.7
05-12-16	Mercury (mg/l)	<0.001	ND[3]	ND[3]

LANDFILL LEACHATE MONITORING RESULTS – Q4, 2016.

Date	Parameter (Unit)	Site Name	NNP1 Landfill Leachate				
		Station Code	Pond No.1	Pond No.2	Pond No.3	Pond No.4	Leachate Discharged
		Guideline	LL1	LL2	LL3	LL4	LL5
10-10-16	pH	6.0-9.0	7.24	6.96	7.67	7.17	N/A
09-11-16	pH	6.0-9.0	7.97	8.47	8.15	7.89	N/A
09-12-16	pH	6.0-9.0	8.1	8.38	8.45	8.01	N/A
10-10-16	*Sat.* DO (%)		133.8	79.9	124.2	132.5	N/A
09-11-16	*Sat.* DO (%)		30.9	97.6	106.1	104.2	N/A
09-12-16	*Sat.* DO (%)		82.6	82.9	69.9	75	N/A
10-10-16	DO (mg/l)		9.23	5.56	8.69	9.39	N/A
09-11-16	DO (mg/l)		2.45	7.73	8.47	8.36	N/A
09-12-16	DO (mg/l)		7.02	7	5.97	6.37	N/A
10-10-16	Conductivity (µS/cm)		246	213.5	221	163.1	N/A
09-11-16	Conductivity (µS/cm)		326	213	185	174.4	N/A
09-12-16	Conductivity (µS/cm)		518	266	242	259	N/A
10-10-16	TDS (mg/l)		123	106.75	110.5	81.55	N/A
09-11-16	TDS (mg/l)		163	106	92	87	N/A
09-12-16	TDS (mg/l)		259	133	171	129	N/A
10-10-16	Temperature (°C)		33.3	32.9	32.5	31.9	N/A
09-11-16	Temperature (°C)		25.9	26	25.5	25.2	N/A
09-12-16	Temperature (°C)		22.2	22.28	21.7	22.4	N/A
10-10-16	Turbidity (NTU)		15	13.4	18.4	9.81	N/A
09-11-16	Turbidity (NTU)		10.61	5.37	21.1	7.31	N/A
09-12-16	Turbidity (NTU)		15.9	12	9.51	4.55	N/A
10-10-16	Ammonia Nitrogen (mg/l)	<10	5	4	3	ND[12]	N/A
09-11-16	Ammonia Nitrogen (mg/l)	<10	4	ND[12]	ND[12]	ND[12]	N/A
09-12-16	Ammonia Nitrogen (mg/l)	<10	ND[12]	ND[12]	ND[12]	ND[12]	N/A
10-10-16	BOD (mg/L)	<30	5.1	3.9	3.2	4.9	N/A
09-11-16	BOD (mg/L)	<30	10.8	3.8	5.5	4.9	N/A
09-12-16	BOD (mg/L)	<30	5.6	6	3.1	14.1	N/A
10-10-16	COD (mg/L)	<125	39.6	34.3	35.7	43.5	N/A
09-11-16	COD (mg/L)	<125	56.5	37.3	45.9	38.1	N/A
09-12-16	COD (mg/L)	<125	52	49.8	44.7	104	N/A
10-10-16	Total nitrogen (mg/l)	<10	8.59	8.75	5.81	4	N/A
09-11-16	Total nitrogen (mg/l)	<10	6.28	5.03	3.79	20	N/A
09-12-16	Total nitrogen (mg/l)	<10	4.7	1.56	1.2	2	N/A
10-10-16	Total phoshorus (mg/l)	<0.2	ND[10]	0.01	0.02	0.05	N/A
09-11-16	Total phoshorus (mg/l)	<0.2	0.04	0.03	0.02	0.02	N/A
09-12-16	Total phoshorus (mg/l)	<0.2	0.06	0.04	0.05	0.08	N/A
10-10-16	Lead (mg/l)	<0.2	ND[10]	ND[10]	ND[10]	ND[10]	N/A
09-11-16	Lead (mg/l)	<0.2	ND[10]	ND[10]	ND[10]	ND[10]	N/A
09-12-16	Lead (mg/l)	<0.2	ND[10]	ND[10]	ND[10]	ND[10]	N/A
10-10-16	Copper (mg/l)	<0.3	ND[18]	ND[18]	ND[18]	ND[18]	N/A
09-11-16	Copper (mg/l)	<0.3	ND[18]	ND[18]	ND[18]	ND[18]	N/A
09-12-16	Copper (mg/l)	<0.3	ND[18]	ND[18]	ND[18]	ND[18]	N/A
10-10-16	Faecal Coliform (MPN/100ml)	<400	7	8	0	0	N/A

Date	Parameter (Unit)	Site Name	NNP1 Landfill Leachate				
		Station Code	Pond No.1	Pond No.2	Pond No.3	Pond No.4	Leachate Discharged
		Guideline	LL1	LL2	LL3	LL4	LL5
09-11-16	Faecal Coliform (MPN/100ml)	<400	35000	1100	140	31	N/A
09-12-16	Faecal Coliform (MPN/100ml)	<400	23	0	0	0	N/A
10-10-16	Total Coliform (MPN/100ml)	<400	11	13	79	330	N/A
09-11-16	Total Coliform (MPN/100ml)	<400	35000	4600	700	330	N/A
09-12-16	Total Coliform (MPN/100ml)	<400	79	0	4.5	13	N/A
09-12-16	Oil & Grease (mg/l)	<10	2	1	1	2	N/A

LANDFILL GROUNDWATER OBSERVATION MONITORING RESULTS – Q4, 2016.

Date	Parameter	Site Name	NNP1 Landfill				Houay Soup Landfill
		Station	MW1	MW2	MW3	MW4	MW5
		Guideline					
25-10-16	pH		6.96	5.79	7.43	6.25	7.68
10-11-16	pH		6.22	5.99	6.35	5.96	6.3
09-12-16	pH		5.75	5.05	5.85	4.76	5.7
25-10-16	*Sat.* DO (%)		30.1	24.4	51.7	27.2	44.1
10-11-16	*Sat.* DO (%)		39.2	39.9	27.9	31.8	42.1
09-12-16	*Sat.* DO (%)		56.76	30.5	38.9	50.7	60
25-10-16	DO (mg/l)		2.24	1.8	3.81	2.07	3.35
10-11-16	DO (mg/l)		3.12	3.17	2.23	2.53	3.33
09-12-16	DO (mg/l)		4.46	2.47	3.06	4	4.67
25-10-16	Conductivity (mg/l)		187.3	40.8	243	28.6	88.5
10-11-16	Conductivity (mg/l)		187.9	30.4	209.4	59.9	103
09-12-16	Conductivity (mg/l)		292	45	550	123	272
25-10-16	TDS (mg/l)		93.65	20.4	121	14.3	44.25
10-11-16	TDS (mg/l)		93.95	15.2	104.8	30	51.6
09-12-16	TDS (mg/l)		146	22	275	61	136
25-10-16	Temperature (°C)		29.1	29.5	29.7	28.9	28
10-11-16	Temperature (°C)		25.8	25.9	25.7	25.9	26.2
09-12-16	Temperature (°C)		26	24.78	26	26.01	25.76
25-10-16	Turbidity (NTU)		4.19	12.8	3.6	29.2	26.1
10-11-16	Turbidity (NTU)		1.62	4.35	4.79	2.89	9.88
09-12-16	Turbidity (NTU)		8.97	2.85	4.51	16.9	7.41
25-10-16	BOD (mg/l)		ND[13]	ND[13]	ND[13]	ND[13]	ND[13]
10-11-16	BOD (mg/l)		ND[13]	ND[13]	ND[13]	ND[13]	ND[13]
09-12-16	BOD (mg/l)		ND[13]	ND[13]	ND[13]	ND[13]	ND[13]
25-10-16	COD (mg/l)		ND[16]	ND[16]	ND[16]	ND[16]	ND[16]
25-10-16	NH3-N (mg/l)		ND[12]	ND[12]	ND[12]	ND[12]	ND[12]
10-11-16	NH3-N (mg/l)		ND[12]	ND[12]	ND[12]	ND[12]	ND[12]
09-12-16	NH3-N (mg/l)		ND[12]	ND[12]	ND[12]	ND[12]	ND[12]
25-10-16	Total Nitrogen (mg/l)		0.77	0.6	0.9	3.24	0.89
10-11-16	Total Nitrogen (mg/l)		0.34	1.17	0.44	1	0.57
09-12-16	Total Nitrogen (mg/l)		0.5	0.45	0.47	1	0.52
25-10-16	Copper (mg/l)		ND[18]	ND[18]	ND[18]	ND[18]	ND[18]
10-11-16	Copper (mg/l)		ND[18]	ND[18]	ND[18]	ND[18]	ND[18]
09-12-16	Copper (mg/l)		ND[18]	ND[18]	ND[18]	ND[18]	ND[18]
25-10-16	Lead (mg/l)	<0.01	0.126	0.038	0.404	0.12	0.022
10-11-16	Lead (mg/l)	<0.01	0.111	0.01	0.065	0.014	0.022
09-12-16	Lead (mg/l)	<0.01	0.017	ND[10]	0.017	0.01	0.113
25-10-16	Total Phosphorus (mg/l)		0.06	0.14	0.16	0.24	0.08
10-11-16	Total Phosphorus (mg/l)		0.04	0.03	0.1	0.04	0.07
09-12-16	Total Phosphorus (mg/l)		0.05	0.04	0.08	0.05	0.08
10-10-16	Faecal Coliform (MPN/100ml)		0	0	2400	0	3300
10-11-16	Faecal Coliform (MPN/100ml)		0	0	0	0	1600
09-12-16	Faecal Coliform (MPN/100ml)		0	0	0	32	0
09-12-16	E.coli Bacteria (MPN/100ml)		0	0	0	22	0
10-11-16	Total Petroleum hydrocarbons (mg/l)		ND[13]	ND[13]	ND[13]	ND[13]	ND[13]

Date	Parameter	Site Name	NNP1 Landfill				Houay Soup Landfill
		Station	MW1	MW2	MW3	MW4	MW5
		Guideline					
09-12-16	Total Petroleum Hydrocarbons (mg/l)		ND[13]	ND[13]	ND[13]	ND[13]	ND[13]