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PROGRAM MANAGEMENT, DESIGN AND SUPERVISION CONSULTANT

Mahaweli Water Security Investment Program

Semi Annual Environmental Monitoring Report (SAEMR) No. 08 (July to December 2020) for Upper Elahera Canal Project (UECP)

Ministry of Irrigation
Sri Lanka

ADB

January 2021

Final Report

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SAEMR No. 08 for UECP

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Project Director	Dr. Beau Freeman
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Project Title: **Mahaweli Water Security Investment Program**

Client: Ministry of Irrigation

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LIST OF ABBREVIATIONS

ADB	Asian Development Bank
AIS	Alien Invasive Species
CEA	Central Environmental Authority
CEMP	Contractor's Environmental Management Plan
D&B	Drill and Blast
D/S	Down Stream
DS	Divisional Secretary
DWC	Department of Wildlife Conservation
EARF	Environmental Assessment Review Framework
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMS	Environmental Method Statements
	Environmental Monitoring Specialist
EO	Environmental Officer
EPL	Environmental Protection License
FAM	Facility Administration Manual
FD	Forest Department
GoSL	Government of Sri Lanka
GRC	Grievance Redress Committee
GSMB	Geological Survey and Mines Burau
ICB	International contractor bidding
IML	Industrial Mining License
KMTC	Kaluganga Moragahakanda Transfer canal
MIT	Mahakithula Inlet Tunnel
MLBCRP	Minipe Left Bank Canal Rehabilitation Project
MMDE	Ministry of Mahaweli Development and Environment
MRB	Mahaweli River Basin
MWSIP	Mahaweli Water Security Investment Program
NATM	New Austrian Tunnelling Method
NCB	National Contractor bidding
NWPCP	North Western Canal Project
PD	Program Director/Project Director
PIU	Project Implementation Unit
PMDSC	Project Management Design Supervision Consultant
PMU	Program Management Unit
RE	Resident Engineer
SAEMR	Semi Annual Environmental Monitoring Report
SPS	Safeguard Policy Statement
SEO	Senior Environmental Officer
STC	State Timber Cooperation
TBM	Tunnel Boring Machine
UECP	Upper Elahera Canal Project
MRB	Mahaweli River Basin
MWSIP	Mahaweli Water Security Investment Program
NATM	New Austrian Tunnelling Method
NCB	National Contractor bidding
NWPCP	North Western Canal Project
PD	Program Director/Project Director
PIU	Project Implementation Unit
PMDSC	Project Management Design Supervision Consultant
PMU	Program Management Unit
RE	Resident Engineer

SAEMR	Semi Annual Environmental Monitoring Report
SPS	Safeguard Policy Statement
SEO	Senior Environmental Officer
STC	State Timber Cooperation
TBM	Tunnel Boring Machine
UECP	Upper Elahera Canal Project

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1 INTRODUCTION

1.1 Scope of the Report

1. This Semi-Annual Environmental Monitoring Report (SAEMR) No. 8 is prepared to update the progress of Upper Elahera Canal Project (UECP)[1] with respect to environmental safeguard aspects for the period of July to December 2020, which fulfils the Asian Development Bank (ADB) requirement to submit SAEMR to ADB and Central Environmental Authority (CEA) for the "Category A" projects as documented in FAM[2] and EARF[3].

2. The purpose of this report is to ensure that the Program is implemented with due concern for environmental and social safeguards according to the laws of Sri Lanka and ADB's Safeguard Policy Statement (SPS) 2009, and specifically to ensure that these issues are adequately addressed in compliance with the requirements of ADB.

3. Further, this report assesses the progress with implementation of the Program in complying with the approved Environmental Impact Assessment (EIA)[4], including the Addendum to the EIA: UECP Tranche 1 packages (August 2017) and Environmental Management Plan (EMP) as per the stipulation No. 14.3 of the EIA approval No. 08/EIA/WATER/07/2012 issued by CEA on 23 February 2016, renewed approval by CEA on 23 May 19 by letter Ref.08/EIA/Water/07/2012/Vol IV until 31 March 2022, and approval for the addendum (Ref.08/EIA/Water/07/2012/Vol III dated 23 April 2018).

4. This SAEMR is prepared addressing the following aspects, based on the available information for the monitoring period from July to December 2020:

(i) Background/context of the monitoring report (adequate information on the Program, including physical progress of project activities, scope of monitoring report, reporting period, and the monitoring requirements including frequency of submission as agreed upon with ADB);

(ii) Qualitative and quantitative monitoring data.

(iii) Monitoring results compared with previously established benchmarks and compliance status (e.g., obtaining necessary approvals for establishment of certain facilities, timeliness and adequacy of environmental mitigation measures; and training, capacity building, etc.);

(iv) Corrective action plan in any case of non-compliance or any major gaps identified.

(v) Proposed items of focus for the next reporting period and due date.

5. This SAEMR for UECP is prepared by the Environmental Specialist of PMDSC based on the monthly monitoring and progress reports received from the Environmental Monitoring Specialists (EMS), and the updates that were received from the respective contractors and Resident Engineers (RE).

1.2 Overall Progress of UECP as of December 2020

6. The two active contract packages are UECP-ICB-1 and UECP-ICB-2B financed under MWSIP Tranche 1 and 2. The new contract package for the longest tunnel of 27 km named as UECP-ICB-2A was

[1] Terminology for Upper Elahera Canal Project (UECP) is replaced with North Central Province Canal (NCPCP)
[2] Paragraph 60 of Facility Administration Manual (FAM), June 2015 prepared by MMDE.
[3] Paragraph 111 of Environmental Assessment Review Framework (EARF) November 2014 (updated in June2017) by MMDE.
[4] Environmental Impact Assessment Report (EIAR) dated June 2015 and approved by CEA on 31.03.2016

awarded by signing the Contract Agreement on 15 December 2020 and having kick-off meeting on 11 December 2020.

7. . The key details related to the active construction packages are summarized in **Table 1-1**.

Table 1-1: Summary of ongoing construction packages in the UECP

Item	UECP-ICB-1	UECP-ICB-2A	UECP-ICB-2B
Contract No.	MMDE/MWSIP/ADB/UEC/ICB-1/3267-3268-SRI/ICB/2016/002	MMDE/MWSIP/ADB/UECP/ICB-2A/P47381-005-SRI/ICB/2017/006 CONTRACT PACKAGE UECP-ICB-2A	MMDE/MWSIP/ADB/UECP/ICB-2B/P47381-005-SRI/ICB/2016/026
Contractor	M/s. CML-MTD Construction Ltd.	China State Construction Engineering Corporation Ltd (Sri Lanka)	M/s. Sinohydro Corporation Ltd.
Commencement Date	11 January 2017	Notice to commence to be issued after completing the document requirements	14 September 2018
Value of Contract	LKR 3,742,442,875.47 (incl. VAT)	LKR 43,278,994,452.29 (incl. VAT)	LKR 8,218,957,075.94 (incl. VAT)
Original Completion Date	08 January 2020	2191 days from Date of Commencement	10 September 2021
Updated Completion Date	26 May 2021 (as per amendment agreement 2)	N/A	12 December 2021

8. Details related to the Tranche 3 packages under additional finance and their progress of bidding process in summarized under the **Table 1-2**.

Table 1-2: Progress of Upcoming packages under UECP as of December 2020

Package (previous name)	Revised Abbreviated Name of Contract package	Scope	Status
UECP-ICB-3 (submitted the complete document on 30 April 2019)	NCPCP-3	NCP Canal from Kongetiya to Madeththawewa (including balance works of UECP-ICB-1)	Under preparation
UECP-ICB-4 submitted the complete document on 21 May 2019	NCPCP-5	NCP Canal from Namalpura to Yakalla with outlets Huruluwewa and Maminiya Oya	Environment Screening completed, and updated EMP prepared. Revised bidding documents submitted to PMU on 04 January 2021
UECP-ICB-5 (submitted the complete document on 18 September 2020)	NCPCP-6	Transfer Canal from Yakalla to Maminiya Oya, Diversion Canal from Maminiya Oya to Eruwewa and to Kanadara Oya	Bidding documents submitted to PMU on 12 February 2021

1.2.1 UECP-ICB-1

9. Construction of Upper Elahera Canal from 0+100 km to 3+980 km comes under the UECP-ICB-1 contract package, located within the ecologically sensitive, Elahera-Girithale sanctuary area. The corridor of the canal to be constructed as a cut and cover conduit, is temporary released by the Department of Wildlife Conservation (DWC) to the Ministry of Mahaweli Development (Mahaweli Authority of Sri Lanka – MASL). **Figure 1-1** shows the map on the sub-project area.

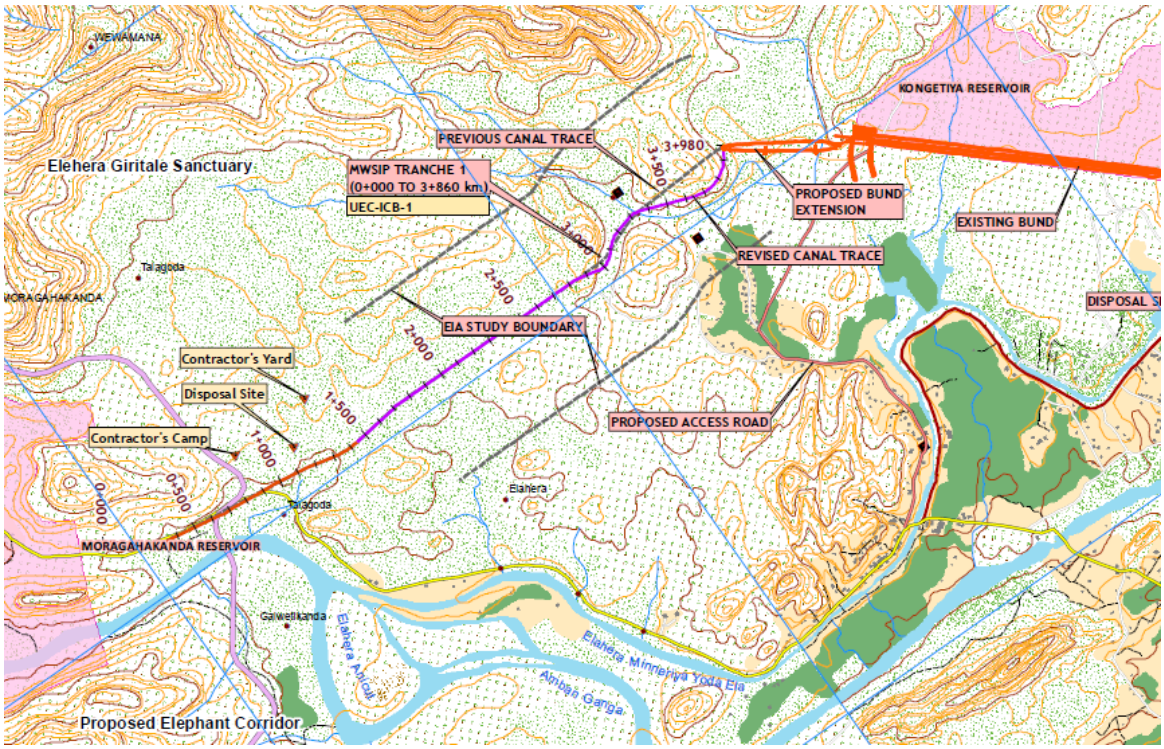


Figure 1-1: Map of the UECP-ICB-1 area

10. Financial difficulties of the Contractor have continued, resulting in further progress delays. The actual construction progress of the UECP-ICB-1 is reported as 63% against the planned progress of 100% by end of December 2020. **Figure 1-2** shows the graphical representation of the overall progress and **Table 1-3** shows the progress of the key construction work of the UECP-ICB-1 package by end December 2020.

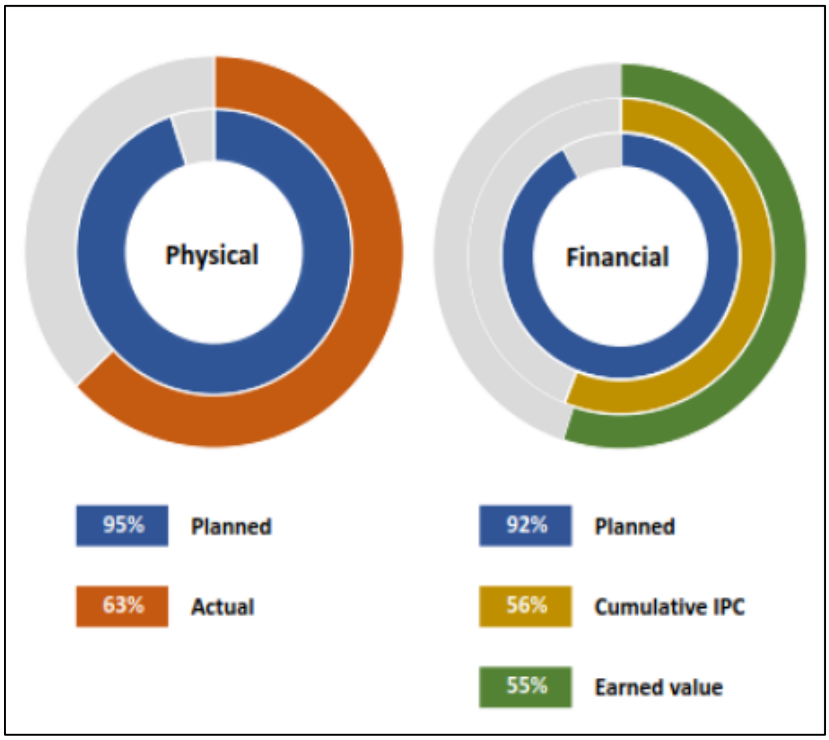


Figure 1-2: Overall package progress of UECP-ICB-1 as of end December 2020

Table 1-3: Progress of key project interventions in UECP-ICB-1 by end December 2020

<table>
<tr><td>Deliverables:</td><td>Slow progress and poor quality of the deliverables related to environmental safeguards</td></tr>
<tr><td>Construction programme:</td><td>Received and accepted but not followed</td></tr>
<tr><td>Topographic surveys:</td><td>Ongoing; progress LS 85% & CS 85%</td></tr>
<tr><td>Preparation of construction drawings by Contractor:</td><td>Ongoing; completed construction drawings for rectangular and circular conduits - progress 65%.
Late in submission of reviewed drawings and Head Regulator hydromechanical set is still pending.</td></tr>
<tr><td rowspan="4">Ongoing Construction work:</td><td>Site clearing, tree felling - progress 100%.</td></tr>
<tr><td>Excavation – progress 68.4%;</td></tr>
<tr><td>Reinforcement and concrete
▪ Rectangular Conduit Base - progress 82.7%
▪ Rectangular Conduit Wall - progress 79.1%
▪ Rectangular Conduit Slab - progress 70%</td></tr>
<tr><td>Backfilling works – 34.3%</td></tr>
<tr><td>Habitat enrichment along the canal reservation, back-filled areas</td><td>Reforestation was carried out in section 01 area and the details related to the growth and plant survival is given Annex A.
<table>
<tr><td>Plot 01</td><td>From 0+986 km to 1+070 km</td><td>1,680m^2</td></tr>
<tr><td>Plot 02</td><td>From 0+986 km to 1+150 km</td><td>2,400m^2</td></tr>
<tr><td colspan="2">Total extent enriched</td><td>4,080m^2</td></tr>
<tr><td colspan="2">Total number planted</td><td>381</td></tr>
<tr><td colspan="2">Number of planted survived by end December 2020</td><td>226</td></tr>
<tr><td colspan="2">Survival Rate</td><td>59.2%</td></tr>
<tr><td colspan="2">Number of gaps filled plants</td><td>66</td></tr>
</table></td></tr>
</table>

1.2.2 UECP-ICB-2B

11. Construction of Kaluganga – Moragahakanda link tunnel including short open canal and 2 aqueducts is the scope of work under UECP-ICB-2B contract package. The two tunnels traverse through Forest Department (FD) lands: Tunnel 1 of 1,910 m long (chainage 0+557.77 to 2+467.77 km) and with overburden varying between 5 and 80 m; Tunnel 2 of 6,040 m long (chainage 2+732.77 to 8+772.77 km) and with overburden varying between 6 and 378 m. **Figure 1-3** gives the sub-project area map on UECP-ICB-2B.

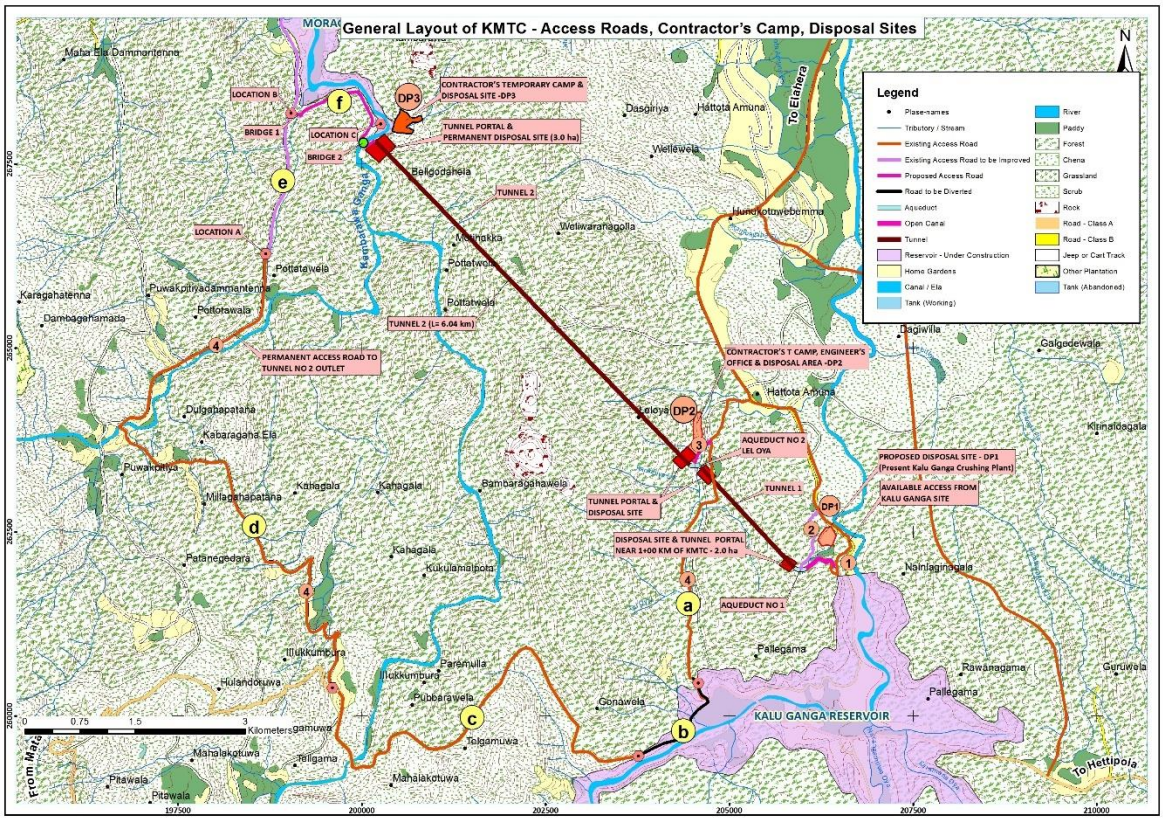


Figure 1-3: Map of UECP-ICB-2B sub-project area

12. The actual construction progress as of end December 2020 is recorded as 52%, which is below the planned progress of 89%, and hence the Engineer's estimated completion date is predicted as June 2022.

13. **Table 1-4** shows the physical progress of ongoing construction activities and **Figure 1-4** shows the graphical representation of the overall progress of the UECP-ICB-2B package by end December 2020.

Table 1-4: Physical progress of key project interventions in UECP-ICB-2B by end December 2020

Topographic surveys:	Completed 100%
Preparation of Construction drawings by Contractor:	Tunnel excavation support works 100%, Bridge 100%, Tunnel permanent support 100%, Open canal 80%, Access road 60%
Construction work:	Completed 51.52%

Concrete batching plant:	Leloya - 100%, Kambarawa - 100%
Construction activities	▪ Tunnel 1: Excavation has completed. ▪ Tunnel 2: 4375 m / 6040 m Excavation ▪ Tunnel Portals of T2 Inlet, T2 Outlet and T1 Inlet & Outlet excavations are completed. ▪ Other structures: Open canal excavation in progress 0+000 – 0+380 km (progress 80%) Aqueduct 2 excavation 50% completed ▪ Construction of Bridge no 2 - 60% completed ▪ Access roads section “D” 6+680 – 6+910 km retaining wall completed. ▪ Access roads section “D” site clearance – 50% completed

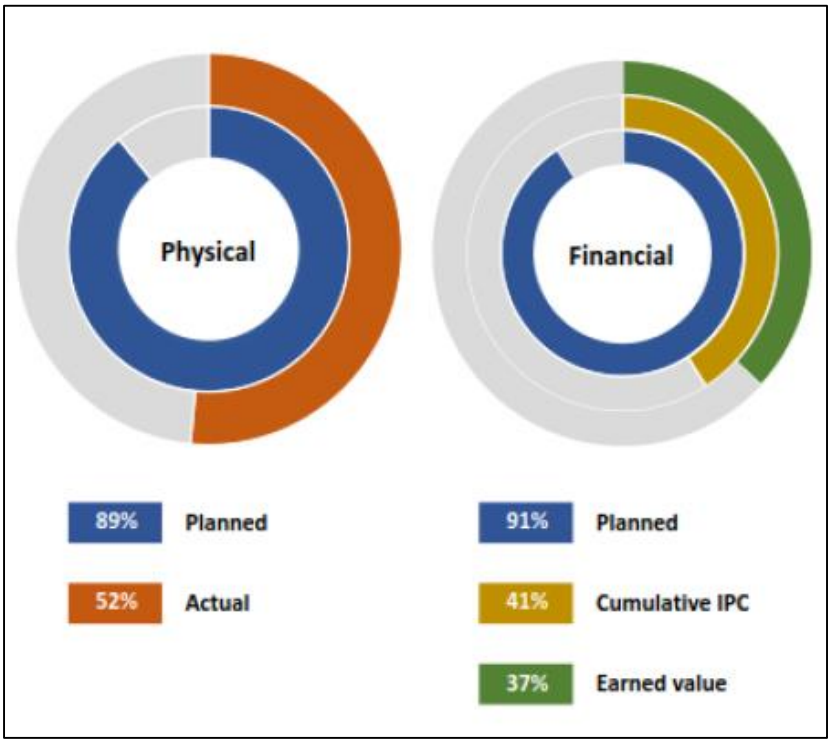


Figure 1-4: Overall package progress of UECP-ICB-2B as of end December 2020

2 ENVIRONMENTAL MONITORING FINDINGS

14. This section summarizes the key environmental issues recorded during the monitoring period from July to December 2020, and the corrective actions taken by the Contractors.

2.1 Qualitative records

2.1.1 UECP-ICB-1

15. As described in the earlier sections, UECP-ICB-1 site had a significant number of environmental issues due to lack of continuous progress of the construction work and, the Contractor having limited manpower, resources to implement CEMP. A new Environmental Officer was recruited in September 2020.

16. **Table 2-1** summarizes the specific issues noted and the status of the Contractor's response attending required corrective actions. As indicated in **Table 2-1**, progress of attending to the required preventive actions is delayed, despite the time targets given by the Engineer, and hence the Engineer has already proposed to the Employer that the Contract be terminated.

Table 2-1: Summary of the monitoring findings related to UECP-ICB-1 with specific issues

Location [5]	Issue recorded	Corrective measure proposed by PMDSC	Progress by the CML
Section -1	Stream flow at 1+203 km is disturbed due to the canal construction	▪ Arrange drainage over crossing with adequate erosion control measures ▪ Stream bypass as per appropriate engineering design	Pending for past 1 & half years
	No maintenance work in the area where habitat enrichment attended after backfilling	▪ Watering, weeding as per a schedule considering wet and dry period ▪ Submission of monthly progress reports updating plant growth, survival rate etc.	▪ 66 plants were planted under gap filling on 05th and 06th Dec. 2020
Section -2	Poor housekeeping and untidy work site	▪ Regular site maintenance to avoid water stagnation, dust, erosion and siltation issues	▪ Attended to from time to time, but no plan to carry out regular maintenance due to lack of required resources
	Slow progress of backfilling which disturb the animal movements	▪ Backfilling and removing elephant fence keeping passage for movements	▪ Backfilling started
	Abandoned safety net erected for protection of small animals	▪ CML to repair the safety net	Re-erected the safety nets supported with iron bars in Dec 2020
Section 3	Edge of the canal collapsed due to heavy rain	▪ CML to provide slope protection, erosion control measures	Not attended to during the monitoring period
	Abandoned safety net erected for protection of small animals	▪ CML to repair the safety net	

[5] Section 01 - From 0+916 to 1+420; Section 02 - From 1+420 to 2+320; Section 03 - From 2+320 to 3+980; Section 04 - From 0+100 to 0+916

Location [5]	Issue recorded	Corrective measure proposed by PMDSC	Progress by the CML
	Pit at 3+980 km resulted due to construction work create risk for animals	▪ CML to provide with required animal protection to prevent animal falling into the pit	
	No necessary accessories such as springs, tighter for electrical fence	▪ CML to provide required material and equipment for continuous operations of the electric fence	
Section 4	Stream at 0+794 km is disturbed due to the canal construction	▪ Arrange drainage over crossing with adequate erosion control measures ▪ Stream bypass as per appropriate engineering design	Not attended to during the monitoring period
	Pit at 0+810 km resulted due to construction work create risk for animals	▪ CML to provide with required animal protection to prevent animal falling into the pit	
	Collapsed riverbank of Ambanganga at 0+150 km	▪ CML to provide slope protection, erosion control measures	
Campsite/Batching and Crusher plants/Contractor's yard/ disposal sites	There are several issues in the area used for contractor facilities as follows: ▪ Isolation of explosive magazine ▪ Isolation of contractor facilities, machineries, camp sites etc. results construction waste, oil spilling of machineries, storage areas ▪ Site isolation will trigger theft, vandalism etc. ▪ Batching plant area with materials storage will result dust due to wind, and the desilting ponds, curing tanks will result water stagnation creating mosquito breeding sites. ▪ Isolated buildings like labor camps, canteen areas will attract bats, birds for nesting	▪ CML to attend to regular maintenance and Contractor facilities to be maintained as agreed in CEMP, relevant MS, and as per Engineer's instructions issued in the updated EMP	Not attended to during the monitoring period

17. No Environment Noncompliance Records (NCR) or Environment Incident Records (EIR) were issued during the reporting period but repeated instructions to attend to the pending issues as noted in the 3-1 were issued**.**

18. In addition to site-specific corrective actions, issues highlighted above, following good practices and general mitigation measures were adopted by the Contractor's EHS team under the guidance and support from Employer and the Engineer.

(i) Submission of renewed Industrial Mining License (IML) for Rock blasting	Ref. UEC/CML/PMDSC/L-946 dated 13 June 2020
(ii) Submission of letter for approval for removing a tree	Letter was submitted for approval for removing tree located in the trace of retaining wall extension with wing wall (Ref. UEC/CML/PMDSC/L-963 dated 30 July 2020)

(iii) Submission of Balance explosive site	Report on the balance quantities of the explosive at the site was submitted to the Engineer's information (Ref. UEC/CML/PMDSC/L-1005 dated 29 Sep. 2020)

19. The photographic evidence for the environmental issues and incidents recorded by PMDSC in the UECP-ICB-1 area during environmental monitoring period is shown in **Figure 2-1**.

Fence damaged by the elephants on 20.10.2020

Repaired the fence on the same day

Fallen safety net (06.11.2020)

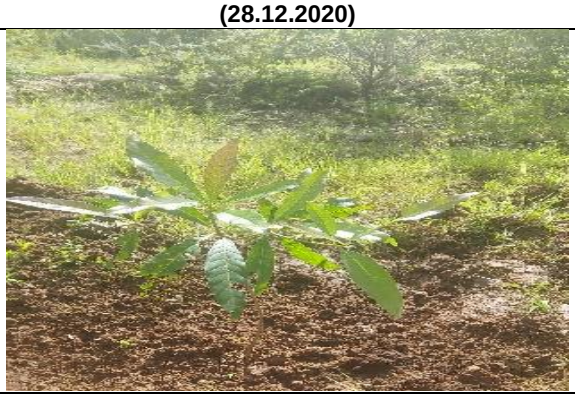
Re-erected safety net on 23.11.2020

Untidy construction site on 12.09.2020

Cleaned the site on 26.10.2020

Watering for dust controlling at road diversion on 15.09.2020

Abandoned stream crossing point at 1+203 km (28.12.2020)



Gap filling of the reforested area in Section 1 (05.12.2020)

Figure 2-1: Photographic records of Environmental Monitoring in UECP-ICB-1

2.1.2 UECP-ICB-2B

20. The environmental performance by the Synohydro was moderately satisfactory for the reporting period, as number of pending issues noted, and the attention to implementing required corrective actions was slow in progress due to financial constraints and inadequate proactive input by the Environment Officer of the Contractor. Necessary follow up is being done by the environment professionals of the Engineer through the Resident Engineer to improve the site conditions.

21. **Table 2-2** summarizes the specific issues noted and status of the Contractor's response attending to the required corrective actions.

Table 2-2: Summary of the monitoring findings related to UECP-ICB-2B with specific issues

Location	Environmental Issue	Date of record	Corrective Measure	Date Acted
Tunnel 1 inlet	Earth expose slope areas are not covered to avoid soil erosion	Sept 2020	Exposed area covered with mucking materials	28 Dec. 2020
	Stream crossing points are blocked while preparing access to the inlet portal	Sept 2020	Hume pipes were put for stream crossing points	28 Dec. 2020
	Sedimentation tanks prepared for wastewater treatment of tunnel is not	Sept 2020	Action has not been taken to connect the system	Pending

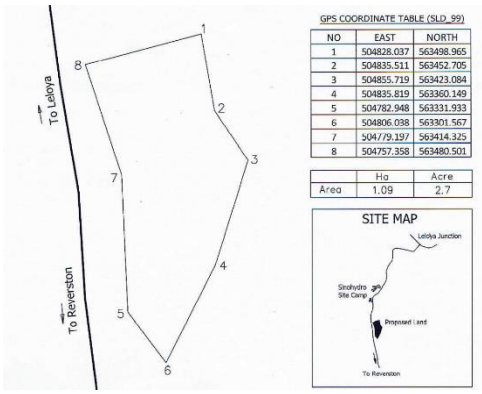
Location	Environmental Issue	Date of record	Corrective Measure	Date Acted
	connected and hence no treatment occurring			
Tunnel 2 inlet at Lel oya	There was no system for solid waste management result poor house keeping	14 Jan 2020	Cleaned the site removing the solid wastes	12 Dec. 2020
	Oil leaking generators observed at the site	26 June 2020	Removed leaked oil and cleaned the site, but no permanent solution adopted	12 Dec. 2020
	Spilled dirty water from sedimentation tank and drained to an adjacent stream	11 Sep. 2020	Stopped wastewater discharging to stream and cleaned the stream bed Temporary pit was constructed as a settling pond until the proper sedimentation tanks are completed	13 Sep. 2020
Tunnel -2 outlet-Kabarawa	Risk of slope failure and gully erosion near the bridge no. 02 at end of section-f ace road	27 Feb 2020	This area needs a permanent slope protection measure Contractor was informed through NCR before 1 and half years, but not yet attended Removed loose soil layers and developed the drainage system to erosion controlling on 06 Nov 2020 before starting rains	Pending
	Water stagnated locations recorded	26th June 2020	Cleaned the site attending dewatering	16 Dec. 2020
Batching plant at Lel Oya	Sand and quarry dust stockpiles exposed and scouring No dust covers, no erosion protection adopted	26th June 2020	Action was not taken till end December 2020	Pending
	Visual observations indicated that the treatment process is incomplete in the sedimentation tank No proper sludge disposal arrangement in place	Since March 2020	Since the sedimentation tanks are all filled, need to rehabilitate the tanks, and ensure proper function of the tanks which is not yet happened	Pending
Entire project	Not resumed environmental quality monitoring task	Since March 2020	Environment quality monitoring report is submitted on 31 Dec 2020	31 Dec 2020

22. Further to above monitoring observations, the Contractor was notified by the Environment team of PMDSC on several key matters to be rectified as summarized in the **Table 2-3**.

Table 2-3: Summary of key notifications issued to Contractor to rectify key environmental issues

Reference	Environment Issue/concern	Photographic evidence
PMDSC-KMTC-RE/ICB-2B/ShCL/L1007 on 14 December 2020	(i) Absence of effective wastewater treatment facility to Lel Oya Batching plant area, and operating batching plant against EPL conditions (ii) Poor housekeeping at Lel oya batching plant premises (iii) The wastewater treatment unit has not been connected to the wastewater conveying pipe and wastewater is still	 Lel Oya batching plant with sludge

Reference	Environment Issue/concern	Photographic evidence
	collected in the temporary sedimentation tank constructed for storm water at tunnel 1 inlet area (iv) No proper stream diversion, and drainage arrangements across the access roads is established, resulting erosion, water pollution due to siltation in the associated sensitive stream network at tunnel 1 inlet area (v) exposed slope areas in the tunnel 1 inlet area without adopting required slope protection, erosion control measures (vi) Overloaded mucking transporting trucks at the disposal site at Lel oya	 Lack of stream diversion / drainage arrangements at T1 inlet
		 Incomplete wastewater treatment unit at T1 inlet
PMDSC-KMTC-RE/ICB-2B/ShCL/L909 on 15 September 2020	(i) Dumping of the mucking materials beyond the given boundaries at Kabarawa T2 outlet area. This was immediately stopped, and action was taken to use the DS no.01 with the approval of the CEA. On the request made by RE to PMU/PIU to identify alternative lands for this disposal, PIU informed (through letter UECP/ PD/ KMTC/ 01-ii on 26/11/2020) that FD verbally said that there is no possibility of expanding the land with no addendum / supplementary EIA is done to assess possible impacts, and hence to optimize the disposal land without disturbing existing wetland/ streams of the area. (ii) Operating Lel oya batching plant area violating EPL conditions (iii) Wastewater discharged to Lel oya from tunnel 2 inlet by overflowing the sedimentation tanks. Immediate attention was taken to stop flowing sediment by putting sandbags across the stream, and cleaned the section by dewatering/ flushing	 Capacity exceeded Disposal site
		 Unmanaged sludge disposal
		 Overflowed sedimentation tanks

Reference	Environment Issue/concern	Photographic evidence
	(iv) A flatform and access have been made for drilling purposes of the proposed aqueduct (which traverses over the Lel Oya) by blocking Lel Oya natural stream. Removed all the materials and facilitate stream flow immediately (v) Oil leaks from generator at Lel Oya T2 inlet / T1 outlet	 Flatform prepaired blocking stream  Oil leak from generator
PMDSC-KMTC-RE/ICB-2B/ShCL/L246 on 25 November 2020	(i) PMU /PIU was informed through the referenced letter on 25 Nov 2020, submitting additional lands for disposal of 56,000 m^3 tunnel muck resulted from Tunnel 2 inlet at Lel oya. The additional land is located at Lel oya with an extent of 1.09 ha which is an abandoned paddy land (ii) PIU informed through Letter Ref. UECP/PD/KMTC/01-ii on 26/11/2020 that PIU will inform relevant authorities and see the possibilities to get the land, but the time taken for this process will be lengthy as it is required to carry out required environmental studies prior to approve (iii) PIU has informed FD seeking approval on 08 Dec 2020 though letter Ref. UEC/DPD/Env-16	
PMDSC-KMTC-RE/ICB-2B/ShCL/L194 on 27 July 2020	Based on the joint site inspection made by ES-PMU, ES-PMDSC and relevant contractor's and engineer's staff, some environmental issues were observed, and a corrective action plan was submitted by PMDSC to the Contractor to rectify those issues which include: (i) Absence of "visible boundary demarcating post" for approved construction sites	Marking boundaries using flag posts in certain areas, submitting environment quality monitoring report, baseline property condition report for section-d has been achieved by end of December 2020

Reference	Environment Issue/concern	Photographic evidence
	(ii) Unavailability of required documents at main office and site offices (iii) Absence of Site maps and environmental sign boards (iv) Environmental quality monitoring to be completed (v) Baseline property condition survey to be carried out for road section -d (vi) Environmental approvals required for construction of road section -d to be obtained for borrow sites, stockpiles etc	

23. The summary of the NCR and EIR recorded during the reporting period is given in the **Table 2-4**.

Table 2-4: Summary of NCR and EIR issued during the monitoring period for UECP-ICB-2B

NCR / Env Incident records (Ref. No. & Date)	Subject	Response from the contractor (Ref/Date)		Corrective actions attended	
		Ref No.	Date	Action	Date completed
PMDSC-KMTC-RE/ICB-2B/ShCL/L114 on 02 January 2019	NCR-002 Damaging Critical habitat within Beligoda FR to access Tunnel 2 outlet portal	N/A	N/A	Contractor progress with the Corrective Action Plan agreed with FD and ADB Except fine for FD, most of the other actions are completed or in progress	Pending
PMDSC-KMTC-RE/ICB-2B/ShCL/L498 on 12th September 2019	NCR No. 004 for Disposing excavated earth materials on the slope of access road section -f	L-KMTC-2019422	2 Oct 2019	As a temporary action area notified as unstable and was covered with tarpaulin sheet (16 Oct 2020) Contractor was directed to remove all loose material, and restore the area with adequate erosion protection measures through Letter Ref. PMDSC-KMTC-RE/ICB-2B/ShCL/L608 Removed loose soil layers and developed the drainage system to erosion controlling on 06 Nov 2020 before starting rains	Pending for permanent solution on the upper part of the cut slope with shot-creating as per the MS submitted by Synohydro. Basement of the slope is attended on 06 Nov 2020, and waiting until rainy season is over to check the stability of the corrective actions enabling natural vegetation to grow

24. In addition to above site-specific corrective actions, issues, PMDSC recorded following good practices and general mitigation measures adopted by the Contractor's EHS team under the guidance and support from Employer and the Engineer:

(i) Submission of updated CEMP	Final revised updated CEMP including all the new activities was submitted for the Engineer's approval (Ref. L-KMTC-2020194 dated 04 Sept. 2020)
(ii) New mining licenses	New IML for excavation of open canal section was submitted (Ref. L-KMTC2020147 dated 16 July 2020).
(iii) List of infrastructure items to be removed/shifted in section -d	Items to be removed or shifted along the road section -d was submitted for the Engineer information (Ref. L-KMTC-2020163 dated 28 July 2020).
(iv) Removal of dead trees	The letter requesting permission for a dead tree at tunnel 2 inlet at Lel oya submitted for engineer's approval (Ref. L-KMTC-2020223 dated 22 Sep. 2020).
(v) Report of environmental quality monitoring	Report of environmental quality monitoring was submitted for the Engineer (Ref. L-KMTC-2020357 dated 30 Dec. 2020)

25. Some photographic records on the key environmental issues, corrective actions attended during the environmental monitoring by PMDSC under UECP-ICB-2B are shown in **Figure 2-2**.

	
Dust issue and no watering (19 Feb. 2020)	**Watering arranged (21 Feb 2020)**
	
Erosion / scouring in Lel oya batching plant area due to no base protection (19 August 2020)	**Base protection to manage the issue (action completed on 25 August 2020)**
	
Removal of loose soil and slope protection compaction related to NCR No. 4 at section -f (3 Sep. 2020)	**After completing corrective action on 15 Sep. 2020**

	
Stagnant water in the empty admixes tanks (6 Oct 2020)	**Action taken to turn down the tanks to avoid mosquito breeding (20 Oct 2020)**
	
Stream blocking at access to T1 inlet portal Lel oya (22 Dec. 2020)	**Reinstated providing Hume pipes to manage stream flow (28 Dec. 2020)**
	
Incompleted sedimentation tanks tunnel 1 inlet (16 Dec. 2020)	**Overloaded dump trucks running in the work site absence of Tailgates (11 Dec. 2020)**

	
Non functioning sedimentation tanks in batching plant at Lel oya (31 Dec. 2020)	**Dumping the cement sludge in improper manner (sludge is left out of the pit) 22 Dec. 2020**

Figure 2-2: Photographic records of Environmental Monitoring in UECP-ICB-2B

2.2 Quantitative Monitoring Records

26. Environmental Quality Monitoring was arranged through the Contractor under the instructions of the Engineer, by issuing a Provisional Sum Order (PSO) under BOQ item No. 6.2.2, which was issued through the PMDSC's letter No. PMDSC-KMTC-RE ICB-2B/ShCL/L415 on 12 July 2019. The Engineer notified consent for the selected sub-contractor (CECB) to carry out the environmental quality monitoring, but Synohydro was unable to complete the work and finally the report was submitted on 30 December 2020 (**Annex B**).

27. Surface water quality samples in 10 locations, ground water quality samples in 6 locations, ambient air quality samples in 6 locations, and existing noise and vibration levels (24hrs) in 4 locations were collected by the Central Engineering Consultancy Bureau (CECB). The summary of the outcome is given in **Table 2-5**.

Table 2-5: Summary of the Environmental Quality Monitoring Results in UECP-ICB-2B area

Environmental component	Sample collection dates	Sample Reference/ Locations [6]	Conclusions from the test results
Ambient Air Quality	16.03.2020 to 18.03.2020 (L1 and L2) 14.07.2020 to 15.07.2020 (L0 and L8)	L1, L2, L 8	Levels of Particulate Matter (PM2.5), Particulate Matter (PM10), Sulphur dioxide, Nitrogen dioxide, Carbon monoxide and Ozone for all location comply within the limits of ambient air quality standards stipulated by Central Environmental Authority (CEA) of Sri Lanka under the Gazette of the Democratic Socialist Republic of Sri Lanka, No. 1562/22 - FRIDAY, AUGUST 15, 2008

[6] L0-Tunnel 1 inlet; L1 – Crusher Plant; L2 -Tunnel 1 Outlet; L5- Section 'D' Puwakpitiya stream; L7- Kabarawa river, bridge No 2; L8 – Tunnel 2 Outlet; L9 - Settling tank, Tunnel 2 Inlet; L10 - Stream 3, tunnel 2 outlet.

Noise & Vibration Levels		L0, L1, L2, L8	The measured noise levels at locations L1 and L2 during daytime and night-time, location L8 between 13 00 hours and 18 00 hours were exceeded the maximum permissible levels while measured noise levels at L0 were within the permissible levels. At locations L1, L2 and L8, noise of cicada was dominated specially during night-time and this could be a probable reason for higher noise levels.
Water quality	16.07.2020	L0, L5, L7, L9, L10	Except the levels of Biochemical Oxygen Demand (BOD) at the location L9 and Total Suspended Solids (TSS) at locations L9 and L10, levels of other water quality parameters at all locations are within the guideline of Category C (waters for fish and aquatic life) of ambient water quality standards for Inland waters of Sri Lanka (Central Environmental Authority of Sri Lanka, 2019).

28. The Draft report submitted by CECB on the above environmental quality monitoring is included in **Annex B**.

2.3 Health & Safety Highlights in the UECP area during reporting period

29. Health & safety (H&S) aspects are covered by the focal point for H&S based in CRE office oversee all active packages under MWSIP, Dambulla, and one H&S Officer based in RE office of UECP-ICB-2B under PMDSC focusing on construction monitoring of UECP active packages,

30. There were no any Covid 19 positive cases reported during the reporting period in UECP area, and hence there was no requirement of closing the site.

31. **Table 2-6** summarizes the key issues and corrective measures attended for the reporting period in NWPCP area, and the preventive measures adopted for Covid 19. However, precautionary measures were continued, and close supervision was carried out including arranging random PCR tests for the contractor's and Engineer's staff on priority vulnerable basis.

Table 2-6: H&S Highlights related to UEPCP during the reporting period

Package	Accident /incident observed	Corrective actions/recommendations.
UECP-ICB-1 UECP-ICB-2B	No major accidents occurred	▪ All UEC Contractors applied healthcare measures to prevent from COVID 19 - and submitted Health & Safety Plans for COVID 19. ▪ Awareness sessions on Covid 19 have been conducted with the participation of MOH & PHI which organized by PMDSC-HSO for PMDSC, PIU and contractor employees ▪ No employee affected with COVID 19 ▪ Random PCR test for PMDSC and PIU staffs have been conducted by MOH Laggala. ▪ Awareness trainings have been conducted by PMDSC –HSO ▪ The tunnel ventilation system and power distribution system which were not up to the required level, have been improved and developed by the contractor as per the PMDSC-HSO's instruction.

		Regular site safety inspections have been conducted by PMDSC and issued instructions in writing and followed up the rectifications. ▪ Regular site safety inspections have been conducted by PMDSC and issued instructions in writing and followed up the rectifications. ▪ Monthly vehicle and machinery inspection have been conducted

3 CONSULTATIONS, MEETING CARRIED OUT UNDER UECP DURING THE REPORTING PERIOD

32. **Table 3-1** summarizes the construction-based activities, joint visits involved by the Employer and the PMDSC with the Contractor and other key stakeholder agencies during the monitoring period.

Table 3-1: Construction based events carried out during the monitoring period

Date	Activity	Location
2020.07.01	Special joint site inspection carried out with the participation of ES-PMU, ES-PMDSC and site HSE officers	Kabarawa and Lel Oya
2020.08.14	Field visit to Rambukoluwa, Kabarawa and Wilgamuwa to observe reforestation lands under WMP with FD officers	Rambukoluwa / Wilda-muwa
2020.08.25	Field visit to Kabarawa and Lel oya work sites with IEMS-PMU	Kabarawa / Lel Oya
2020.08.26	Field visit to Naula forest range on supervision of replanting pro-gramme under the WMP with IEMS-PUM	Naula
2020.08.28	Site inspection carried out with the Secretary to the Ministry of Irriga-tion	Elahera/Lel Oya
2020.09.03	Field visit to section “d” with DWC officers to observe the elephant fences	Poththotawela
2020.09.24	Field visit to section “d” access road with the participation of Divi-sional Secretary-Laggala	Poththotawela
2020.10.07	Field visit to Kirimetiya tank to search the areas for Invasive species control (Gaint Momosa)	Kirimetiyawewa
2020.10.13	Field visit to Ambukoluwa 10ha replanting land under Contractor for compensating the damage to critical habitat	Rambukoluwa
2020.10.13	Joint site inspection carried out with farmers for diverting the existing irrigation canal at Lel oya	Lel Oya
2020.10.14	Field visit to Elahera, Konduruwawa, and Yakalla to see the site with government officers and political authority	Elahera, Yakalla
2020.10.27	Site inspection carried out to UEC ICB-2A with attending PMU, PIU, PMDSC officers	Sigiriya
2020-ii-25	Joint site inspection carried out with PMU, PIU and PMDSC officers	UEC- ICB -1
2020.10.11	Site inspection carried out to UEC ICB-2A with PMU, PIU, PMDSC officers	Southern portal and Northern portal
2020.12.15	Joint site inspection carried out with PIU, PMDSC, Contractor and IEMS	UEC ICB-1
2020.12.16	Joint site inspection carried out with PIU, PMDSC, Contractor and IEMS	UEC ICB-2B

33. Several meetings and training programs were carried out during the monitoring period with the participation of relevant officers representing PMU, PIU, the Engineer, PMDSC and the Contractor. A summary of the details is given in **Table 3-2**.

Table 3-2: Summary of the meetings and training conducted during the monitoring period

Date	Activity	Location
2020.07.03	Monthly Progress review meeting KMTC	RE's office- KMTC
2020.07.09	Monthly Progress review meeting UEC ICB1	RE's office Elahera
2020.07.30	Environmental monthly progress meeting -UEC ICB-1	RE's office -Elahera
2020.07.31	Environmental monthly progress meeting-KMTC	RE office -KMTC
2020.08.12	Monthly Progress review meeting KMTC	RE's office, Elahera
2020.08.13	Field visit to work site and special meeting held with Design Engineer -PMDSC-head office	RE office, Elahera
2020.09.09	Monthly Progress review meeting -KMTC	RE's office, KMTC
2020.09.10	Monthly Progress review meeting-UEC ICB-1	RE office -Elahera
2020.09.29	Workshop on progress review of the environmental safeguards	Dambulla CRE office
2020.10.06	Environmental monthly progress review meeting	Kabarawa site office
2020.11.04	Meeting held with ADB mission (team technology)	PUM office
2020.11.12	Monthly progress review meeting KMTC (Team technology)	RE office -KMTC
2020.11.13	Monthly progress review meeting KMTC (Zoom technology)	RE office -Elahera
2020.12.10	Special meeting had for UEC ICB-2A with participating office PMDSC, PIU, PUM key staff	PD office -Maragahakanda
2020.11.13	Monthly progress review meeting -UEC ICB-1	RE office- Elahera
2020.12.15	Monthly progress review meeting -KMTC	RE office -KMTC
2020 12. 16	Special meeting had with ISMS participating key staff - PMDSC.	RE office -KMTC

4 PROPOSED ACTIVITIES FOR NEXT REPORTING PERIOD (JANUARY TO JUNE 2021)

34. The key activities to be carried out by the Employer and PMDSC jointly during the next reporting period are summarized in **Table 4-1.**

Table 4-1: Key activities planned for next reporting period

Construction related
• Critical species translocation in UECP-ICB-2A area • Tree removal, and UECP-ICB-2A construction monitoring, document approval
Baseline Environmental Quality Monitoring (Air/ Noise/ Vibration) in UECP-ICB-2A
Additional Surveys
• Preparing addendum / supplementary EIA for the scope changes in UECP-ICB-2A, NCPCP-3, NCPCP-5 packages

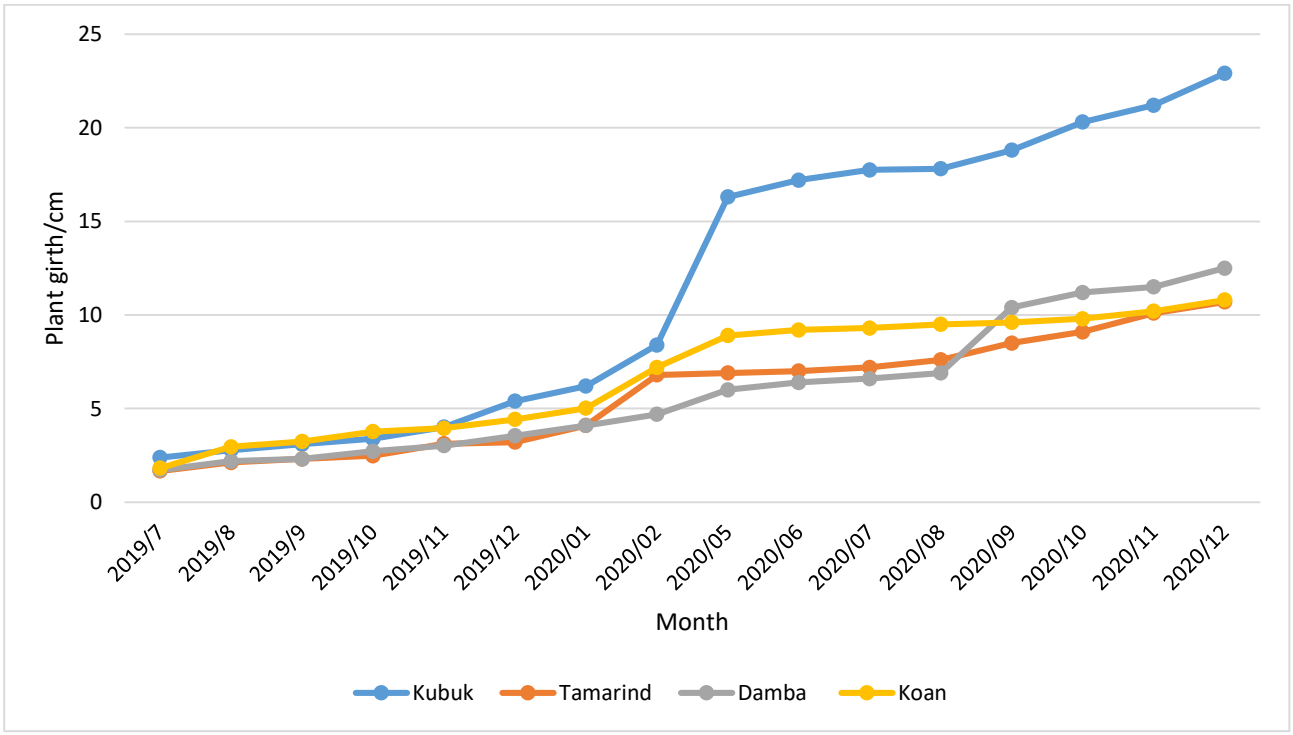
Annex A: Reforestation Progress in the UECP-ICB-1 canal reservations

Reforestation progress of the UECP-ICB-1 up to Dec. 2020

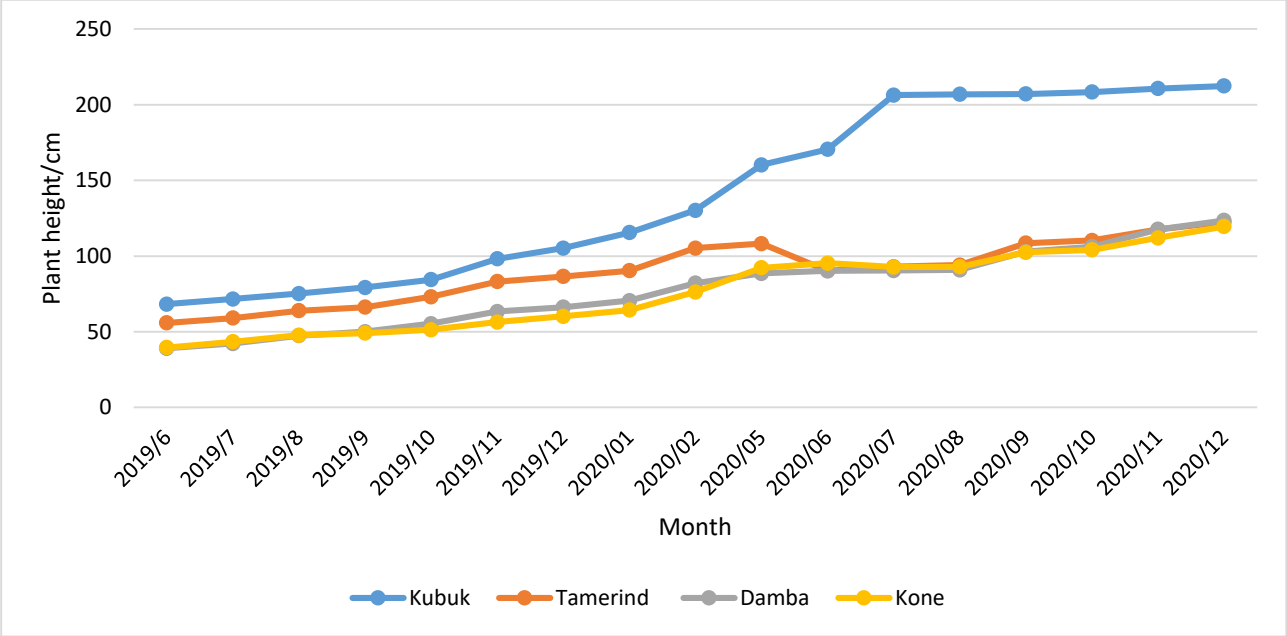
- **Block No: 001, from 0+986Km to 1+070 km**
- **Extent: 1680 m^2**
- **Time of planting: January 2019**

Plant species (Common Name- Number) Random sampling methods			Average girth of trees/cm (24/12/2020)	Average height of trees/cm (24/12/2020)
Scientific Name	Common name	Number of plants selected for each type		
Terminalia arjuna	Kubuk	12	22.9	212.4
Tamarindus indica	Tamarind	5	10.7	122.4
Syzygium cumini	Damba	5	12.5	123.5
Schleichera oleosa	Koan	4	10.8	119.5

Plant girth



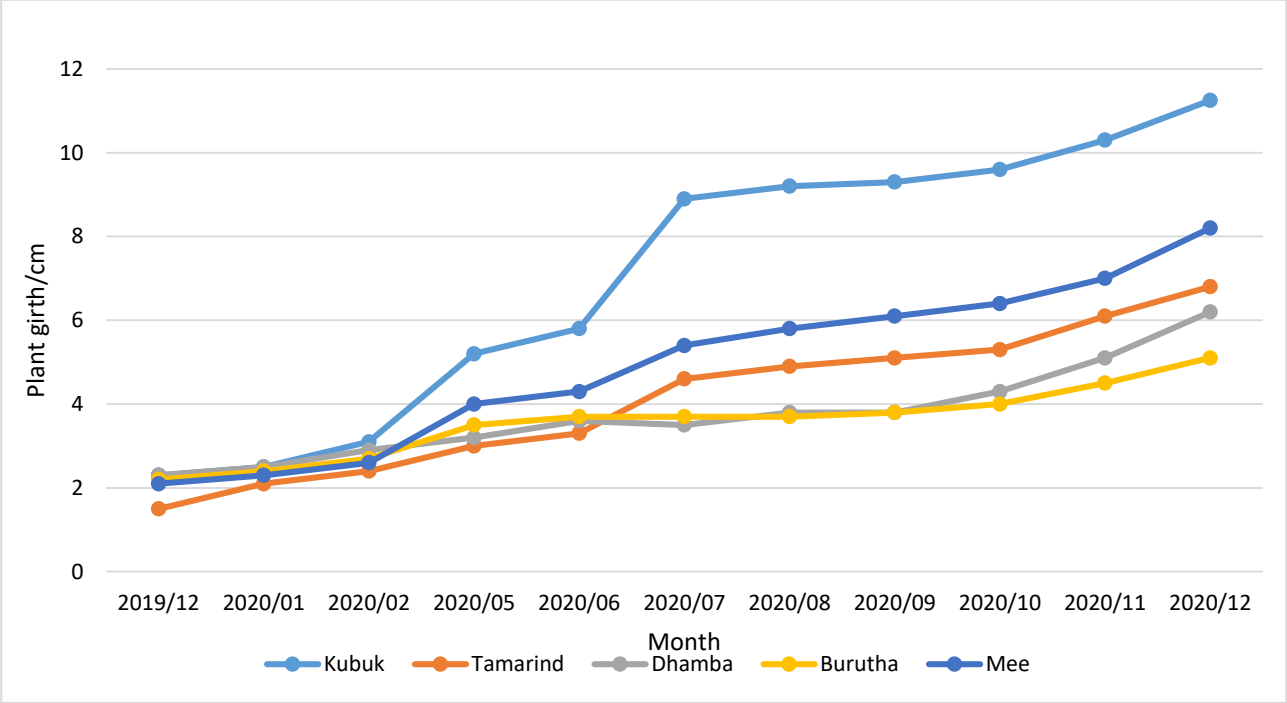
Plant height



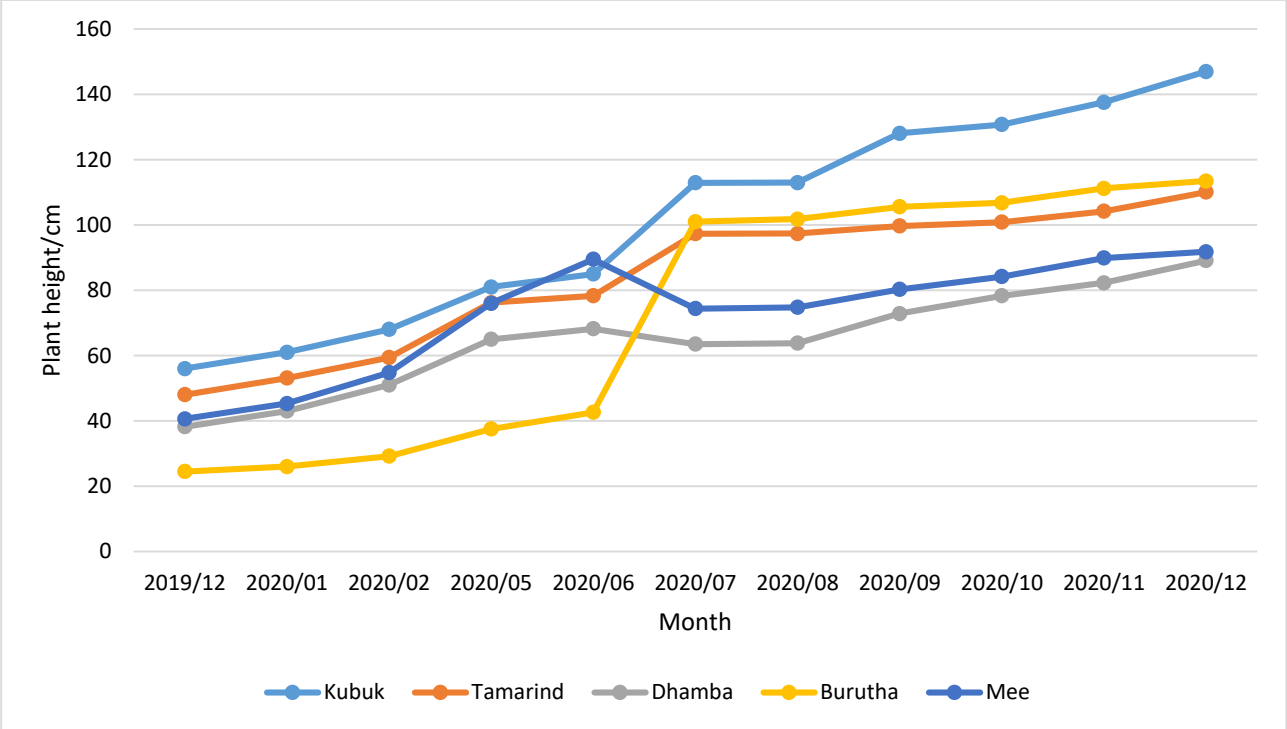
- **Block No: 002, from 0+986 to 1+150 km**
- **Extent: 2400 m^2**
- **Time of planting: December 2019**

Plant species (Common Name- Number) Random sampling methods			Average girth of trees/cm (24/12/2020)	Average height of trees/cm (24/12/2020)
Scientific Name	Common name	No. of plant selected from each type		
Terminalia arjuna	Kubuk	14	11.3	147
Tamarindus indica	Tamarind	6	6.8	110.1
Syzygium cumini	Damba	4	6.1	89.1
Chloroxyclon swietania	Burutha	3	5.1	113.5
Madhuca longifolia	Mee	5	8.2	91.8

Plant girth



Plant height



Annex B: Environmental Quality Monitoring Report UECP-ICB-2B area

TEST REPORT ON ENVIRONMENTAL QUALITY MONITORING DATA COLLECTION

CONSTRUCTION OF UPPER ELAHERA CANAL,

KALU-GANGA-MORAGAHAKANDA TRANSFER CANAL (KMTC)

Report No : LD/ENV/20206413

Contractor

SINOHYDRO Corporation Limited
Kaluganga-Moragahakanda Transfer Canala Project
Contract No : MMDE/MWSIP/ADB/UECP/ICB-2BIP47381-005-SRI/ICB/2016/026

Subcontractor

Natural Resources Management & Laboratory Services,
CENTRAL ENGINEERING CONSULTANCY BUREAU
No.11, Jawatta Road,
Colombo 05,
Sri Lanka.

11th December 2020

CONTENTS

ENVIRONMENTAL MONITORING REPORT ON AIR QUALITY, NOISE AND VIBRATION

Project: Environmental Quality Monitoring Data Collection of Kaluganga-Moragahakanda Transfer Canal (KMTC) under UECP ICB 2B

1. Scope

The client, SINOHYDRO CORPORATION LTD, requested Laboratory services of Central Engineering Consultancy Bureau (CECBLS) to carry out environmental monitoring works for air quality, water quality, noise and vibration measurements at proposed project area.

In this regard officers of CECBLS visited the respective site for the environmental monitoring program for time period mentioned in Table 1.

Table 1: Period of monitoring

Component of the monitoring program	Date/time period of field visit
Air sampling	2020.03.16 - 2020.03.18 (L1 and L2) 2020.07.14 - 2020.07.15 (L0 and L8)
Noise and vibration measurements	
Water sampling	2020.07.16

1.1 Staff involved

Dr. A.G.P. Aravinna - In Charge, Environmental Monitoring Services
L.M.T.U. de Silva - Coordinator, Testing and analysis of air quality monitoring
K.T.G. Fernando - Laboratory Technician
W.M.U.S.B. Widanegedara - Laboratory Technician
D.T.M. Wijesinghe - Technical Assistant
D.P.S.M. Dissanayaka- Technical Assistant

2. Description of the Study Area

The monitoring area includes two main tunnels of approximate total length of 8 km, two aqueducts and access roads, areas for contractor facilities including labour camps, batching plants, crusher plants, laboratories and disposal yards etc. The map of the areas is shown in Annex 1. The proposed project area is a rural setting.

3 Air Quality Study

3.1 Measuring instruments

Hi-Volume Sampler : Analitica Strumenti Hi-Volume Sampler
Portable Sampler : COM2|HE Air cube– Analitica Strumenti
Carbon Monoxide Analyser : Environnement SA – CO12M

3.2 Method of measurement

Measurements of Particulate Matter smaller than 2.5 µm ($PM_{2.5}$) and Particulate Matter smaller than 10 µm (PM_{10}) were carried out in accordance with the ASTM 4096-91 (2009). Ambient air was sampled through 10 µm and 2.5 µm size selective heads, respectively and the analysis was done by gravimetric method in the laboratory.

Sulphur oxides (SO_X) were determined in accordance with ASTM 2914 - 2001. Ambient air was bubbled through absorbing reagent and the analysis was done by West-Gaeke method in the laboratory. Total sulphur oxide content is reported as SO_2.

Nitrogen oxides (NO_X) were determined in accordance with ASTM 1607- 1991. Ambient air was bubbled through absorbing reagent and the analysis was done by Griess-Saltzman method in the laboratory. Nitrogen oxides content is reported as NO_2.

Carbon monoxide (CO) was measured by using non-dispersive Infrared Spectroscopy method.

3.3 Description of measuring locations

Specific air pollution sources were observed in the study area other than the vehicles moving along the road. GPS Coordinates of air quality monitoring locations are given in Table 1 and the locations are shown in Figure 1.

Table 2: Details of the air quality monitoring locations

Location	GPS coordinates	Specific air pollution sources
L1	479594 E 838005 N	Crusher plant
L2	479673 E 837168 N	Tunnel 1 Outlet
L8	475131 E 841627 N	Tunnel 2 Outlet

3.4 Measuring conditions

All measurements were taken at the height of about 2 m from the ground level by following ASTM D1357-95 (2011) standard.

Figure 1: Google Earth image of the study area showing air quality monitoring locations

3.5 Test Results

Test results of air quality parameters at selected locations are given in Table 3a and Table 3b.

Table 3a: Levels of Particulate Matter

Parameter	Unit	Results		
		L1	L2	L8
Particulate Matter smaller than 10 µm (PM_{10})	µg/m^3	39	27	28
Particulate Matter smaller than 2.5 µm ($PM_{2.5}$)	µg/m^3	25	15	18

Minimum Detection Limit of the PM_{10} and $PM_{2.5}$ methods are respectively 1 µg/m^3

Table 3b: Levels of Sulphur dioxide and Nitrogen dioxide

Parameter	Unit	Results								
		L1			L2			L8		
Monitoring time (hours)		08:00 - 16:00	16:00 – 00:00	00:00 – 08:00	08:00 - 16:00	16:00 – 00:00	00:00 – 08:00	08:00 - 16:00	16:00 – 00:00	00:00 – 08:00
Sulphur dioxide (SO_2)	µg/m^3	< 25	< 25	< 25	< 25	<25	< 25	< 25	< 25	< 25
Nitrogen dioxide (NO_2)	µg/m^3	6	5	< 4	< 4	< 4	< 4	< 4	< 4	< 4

Minimum Detection Limit of SO_2 and NO_2 are 25 µg/m^3 and 4 µg/m^3, respectively

Table 3c: Levels of Carbon monoxide

Time (hours)	Results (ppm)		
	L1	L2	L8
10:00 - 11:00	-	-	-
11:00 - 12:00	0.81	-	-
12:00 - 13:00	1.30	-	-
13:00 - 14:00	1.38	1.05	-
14:00 - 15:00	1.30	1.46	-
15:00 - 16:00	1.22	0.89	-
16:00 - 17:00	1.30	1.05	1.70
17:00 - 18:00	1.30	1.87	1.70
18:00 - 19:00	1.22	1.22	1.62
19:00 - 20:00	0.81	0.89	1.54
20:00 - 21:00	0.89	1.38	1.70
21:00 - 22:00	0.57	1.05	1.70
22:00 - 23:00	0.32	0.89	1.70
23:00 - 00:00	0.41	1.05	1.46
00:00 - 01:00	0.73	0.97	0.97
01:00 - 02:00	0.81	0.81	0.73
02:00 - 03:00	0.73	0.81	0.65
03:00 - 04:00	0.73	0.73	0.65
04:00 - 05:00	0.73	0.73	0.65
05:00 - 06:00	0.81	0.73	0.73
06:00 - 07:00	1.05	0.81	0.73
07:00 - 08:00	0.57	1.46	0.49
08:00 - 09:00	0.81	1.14	0.16
09:00 - 10:00	-	1.70	0.32
10:00 - 11:00	-	1.38	0.81
11:00 - 12:00	-	1.22	0.81
12:00 - 13:00	-	1.30	0.89
13:00 - 14:00	-	-	0.81
14:00 - 15:00	-	-	1.14
15:00 - 16:00	-	-	1.38

Minimum Detection Limit of the CO is 0.04 ppm.

3.6 Maximum permissible levels

Maximum permissible levels of ambient air quality stipulated by Central Environmental Authority of Sri Lanka under the Gazette of the Democratic Socialist Republic of Sri Lanka, No. 1562/22 - FRIDAY, AUGUST 15, 2008 and given in Table 4.

Table 4: Maximum Permissible Levels of the pollutants

Pollutant	Averaging time	Maximum Permissible Level	
		µg/m³	ppm
Particulate Matter, PM_{10}	24 hours	100	-
Particulate Matter, $PM_{2.5}$	24 hours	50	-
Nitrogen Dioxide (NO_2)	8 hours	150	0.08
	24 hours	100	0.05
Sulphur Dioxide (SO_2)	8 hours	120	0.05
	24 hours	80	0.03
Carbon Monoxide (CO)	1 hour	30,000	26
	8 hours	10,000	9

3.6 Conclusions

Levels of Particulate Matter ($PM_{2.5}$), Particulate Matter (PM_{10}), sulphur dioxide, nitrogen dioxide, carbon monoxide and ozone for all location lie within the limits of ambient air quality standards stipulated by Central Environmental Authority of Sri Lanka under the Gazette of the Democratic Socialist Republic of Sri Lanka, No. 1562/22 - FRIDAY, AUGUST 15, 2008.

4 Water Quality Study

4.1 Method of sampling and Analysis

Water quality study was limited to some surface water bodies in the area. Surface water samples were analysed for seventeen parameters. Analysed water quality parameters and methods of analysis are given in Table 4. *In-situ* measurements were taken for pH, Temperature, Electrical Conductivity (EC) and Turbidity. Dissolved Oxygen (DO) was fixed at the site and tested according to the Winkler method. Water sampling, sample preservation, storage of samples and analysis were performed in accordance with standard guidelines described under the methods given in Table 4.

Table 4: Water quality parameters, methods of analysis

Parameter	Method	Units	Minimum Detection Limit
pH	ASTM D 1293-99	-	0.1
Electrical Conductivity	APHA 2510-B	µS/cm	1
Turbidity	USEPA 180.1	NTU	0.1

Parameter	Method	Units	Minimum Detection Limit
Biochemical Oxygen Demand (BOD_5)	APHA 5210-B	mg/l	0.1
Chemical Oxygen Demand (COD)	APHA 5220-B	mg/l	0.1
Dissolved Oxygen (DO)	APHA 5210-B	mg/l	0.1
Nitrate (as NO_3^-)	APHA-4500-NO3--B	mg/l	0.1
Kjeldahl Nitrogen (as N)	APHA 4500-N	mg/l	0.05
Dissolved Phosphate (as PO_4)	APHA-4500-P-E	mg/l	0.01
Oil & Grease	APHA 5520-B	mg/l	0.1
E-coli Bacteria	SLS 614: 1983 - 2	E-coli/100mL	1
Total Suspended Solids (TSS)	APHA-2540-D	mg/l	1
Total Dissolved Solids (TDS)	APHA-2540-C	mg/l	1
Iron	In house test method	mg/l	0.02
Arsenic	In house test method	mg/l	0.001
Cadmium	In house test method	mg/l	0.001
Chromium	In house test method	mg/l	0.01
Lead	In house test method	mg/l	0.01

APHA - Standard Methods for Examination of Water and Waste Water, American Public Health Association, Washington DC, 20th Ed., 1998
USEPA - Standard Methods of United States Environmental Protection Agency
ASTM - Standard Methods of American Society for Testing and materials

4.2 Sampling locations

Water quality testing was carried out for eight locations. Details of five sampling locations are given in Table 5 and locations shown are in Figure 2.

Table 5: Details of the water sampling locations

Location	GPS coordinates	Location description (surface water bodies)
L0	480975 E 835837 N	Tunnel 1 inlet
L5	471969 E 837542 N	Section 'D' Puwakpitiya stream
L7	475096 E 841626 N	Kabarawa river, bridge No 2
L9	479394 E 837323 N	Settling tank, Tunnel 2 Inlet
L10	475601 E 841800 N	Stream 3, tunnel 2 outlet

Figure 2: Google Earth image of the study area showing water sampling locations (provided by the client)

4.3 Test Results

Test results of water quality parameters at selected locations are given in Table 6.

Table 6: Test results of water quality parameters at L0, L5, L7, L9 and L10 locations

Parameter	Unit	Results				
		L0	L5	L7	L9	L10
pH	-	6.5 at 24.4 °C	6.9 at 24.6 °C	6.6 at 24.7 °C	7.7 at 24.6 °C	7.3 at 24.5 °C
Electrical Conductivity	µS/cm	198.3 at 24.4 °C	94 at 24.6 °C	62.4 at 24.7 °C	609 at 24.6 °C	353 at 24.5 °C
Turbidity	NTU	0.6	1.2	1.3	936	24.5
Total Suspended Solids (TSS)	mg/l	12	6	2	819	133
Total Dissolved Solids (TDS)	mg/l	101.1	47.4	31.4	318	182
Biochemical Oxygen Demand (BOD_5)	mg/l	1.1	0.7	1.3	4.7	1.2
Chemical Oxygen Demand (COD)	mg/l	1.2	1.5	0.3	4.8	7.6
Dissolved Oxygen (DO)	mg/l	5.2	7.9	8.2	5.5	4.6
Oil & Grease	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1
Kjeldahl Nitrogen	mg/l	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Iron	mg/l	< 0.02	0.06	0.50	0.74	0.50
Chromium	mg/l	ND	ND	ND	ND	0.02
Arsenic	mg/l	ND	ND	ND	ND	0.006
Cadmium	mg/l	ND	ND	ND	ND	ND
Lead	mg/l	ND	ND	ND	ND	0.02
Dissolved phosphates (as PO_4)	mg/l	0.02	< 0.01	< 0.01	0.01	0.02
E-coli Bacteria	E-coli/100ml	735	936	1088	705	896

4.4 Permissible Levels

Permissible levels of water for different purposes are given in Table 7 for comparison with the water quality results obtained in this study.

Table 7: Permissible levels

Parameter	Units	Ambient water quality standard for Inland waters of Sri Lanka (CEA 2019), Category C, waters for fish and aquatic life	Ambient water quality standard for Inland waters of Sri Lanka (CEA 2019), Category E, waters for irrigation and agriculture
pH	-	6.0-8.5	6.0-8.5
Electrical Conductivity	µS/cm	ND	700
Turbidity	NTU	-	ND
Chemical Oxygen Demand (COD)	mg/l	15	ND
Dissolved Oxygen (DO)	mg/l	5*	3*
Biochemical Oxygen Demand (BOD_5)	mg/l	4	12
Oil & Grease	mg/l	0.1	ND
Total Suspended Solids (TSS)	mg/l	40	2100
Total Dissolved Solids (TDS)	mg/l	ND	ND
Dissolved Phosphate (as PO_4)	mg/l	ND	ND
Kjeldahl Nitrogen (as N)	mg/l	ND	ND
Iron	mg/l	ND	ND
Chromium	mg/l	20	ND
Arsenic	mg/l	50	ND
Cadmium	mg/l	5	ND
Lead	mg/l	2 (total Hardness<120) 3 (120<Hardness<180) 4(180<Hardness)-	ND
E-coli Bacteria	E-coli/100ml	ND	ND

* Minimum permissible levels
ND – Not Defined

4.5 Conclusions

Except the levels of Biochemical Oxygen Demand (BOD) at the location L9 and Total Suspended Solids (TSS) at locations L9 and L10, levels of other water quality parameters at all locations are within the guideline of Category C (waters for fish and aquatic life) of ambient water quality standards for Inland waters of Sri Lanka (Central Environmental Authority of Sri Lanka, 2019).

5 Noise Level Measurements

5.1 Measuring instrument

Sound level meter : RION NA 28
Calibrator : RION NC 74 – IEC 60942:2003, class1

The sound level meter conforms to the requirements of both IEC 61672-12002 class 1 and JIS C 1509-1:2005 class 1

5.2 Method of measurement

Sound measurements are carried out in accordance with the methods laid down in International Organisation for Standardization (ISO) 1996 (part 1 and 2) and British Standard (BS) 4142: 1997, as stipulated in National Environmental Noise Control Regulations. Equivalent continuous A-weighted sound pressure Levels (L_{Aeq}) were measured at given locations. Reference time intervals (T_r) of measurements are 60 minutes with integrated time of one second at the fast selection mode of the meter.

5.3 Weather conditions

Dry weather with fairly scattered wind was prevailed during the monitoring period.

5.4 Measuring conditions

All measurements were taken at the height of about 2 m from the ground level and 3.5 m away from the identified reflecting sources other than the ground.

5.5 Description of measuring locations

Sound levels were monitored at four locations which were specified by the client. GPS Coordinates of monitoring locations are given in Table 8 and locations are shown in Figure 3.

Specific sources of noise were not observed in the study area. In addition to natural sound from wild animals, the vehicle movement along the nearby roads were accounted for the background noise.

Table 8: Noise monitoring locations

Location	GPS coordinates	Location description with chainage
L0	480975 E, 835837 N	Tunnel 1 inlet
L1	479594 E, 838005 N	Crusher plant
L2	479673 E, 837168 N	Tunnel 1 outlet
L8	475131 E, 841627 N	Tunnel 2 outlet

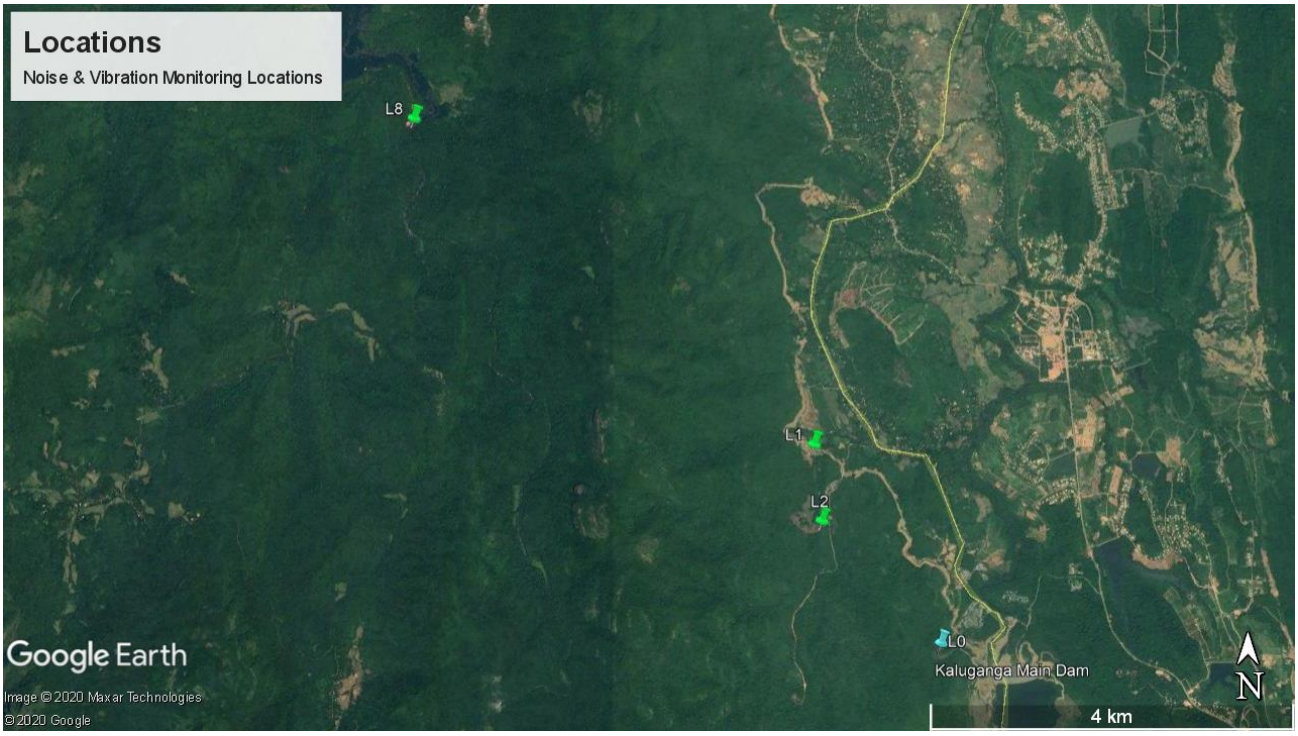


Figure 3: Google Earth image of the study area showing Noise and Vibration monitoring locations (provided by the client)

5.6 Results

Equivalent continuous A-weighted sound pressure Levels (L_{Aeq}) of the locations are given in Table 9.

Table 9: Noise levels at selected locations

Time (hours)	LA_{eq} (dB)			
	L1	L2	L8	L0*
10:00 - 11:00,	-	73	-	-
11:00 - 12:00	58	74	-	-
12:00 - 13:00	56	65	-	-
13:00 - 14:00	57	61	52	-
14:00 - 15:00	56	64	55	52
15:00 - 16:00	57	64	55	52
16:00 - 17:00	58	65	55	55
17:00 - 18:00	57	64	50	49
18:00 - 19:00	57	67	54	40
19:00 - 20:00	56	69	52	42
20:00 - 21:00	61	63	51	42
21:00 - 22:00	60	79	50	43
22:00 - 23:00	59	63	50	42

23:00 - 00:00	49	65	48	-
00:00 - 01:00	54	64	49	-
01:00 - 02:00	56	63	48	-
02:00 - 03:00	58	65	48	-
03:00 - 04:00	59	69	55	-
04:00 - 05:00	58	64	60	-
05:00 - 06:00	50	65	62	-
06:00 - 07:00	50	66	64	-
07:00 - 08:00	57	63	68	-
08:00 - 09:00	68	62	62	-
09:00 - 10:00	61	65	64	-
10:00 - 11:00	62	-	69	-
11:00 - 12:00	-	-	69	-
12:00 - 13:00	-	-	62	-
13:00 - 14:00	-	-	-	-
14:00 - 15:00	-	-	-	-
15:00 - 16:00	-	-	-	-

* Due to the security concerns, measurements were taken only for eight hours.

5.7 Maximum permissible noise levels

The project area and noise monitoring points are located within the Pradesiya Sabha area of Laggala. These areas could be considered as low noise area and allowable noise levels are 55 dB(A) during day time and 45 dB(A) during night time. However, during construction the allowable noise levels at the boundaries can be considered as 75 dB(A) during day time and 50 dB(A) during night time.

5.8 Conclusions

The measured noise levels at locations L1 and L2 during day time and night time, location L8 between 13 00 hours and 18 00 hours were exceeded the maximum permissible levels while measured noise levels at L0 were within the permissible levels. At locations L1, L2 and L8, noise of cicada was dominated specially during night time and this could be a probable reason for higher noise levels.

6 Vibration Measurements

6.1 Measuring instrument

Vibration meter: Instantel Micro Mate

6.2 Method of measurement

Vibration measurements were carried out in accordance with the methods laid down in International Organisation for Standardization (ISO) 4866: 1990. Peak Particulate Velocity (ppv) is measured at given locations.

6.3 Measuring conditions

Continuous 5 minute vibration levels were recorded in the monitoring. The recording time of the instrument is 30 seconds at the rate of 1024 samples per second in continuous mode and at geo range of 31.7 mm/s. Vibration monitoring was conducted from 9:00 am to 4:00 pm.

6.4 Description of measuring locations

Vibration levels were monitored at four locations which were specified by the client. All locations were selected along the proposed Central Expressway trace and close proximity to the boundary of it. GPS Coordinates of monitoring locations are given in table 10 and those are shown in Figure 1.

6.4 Results

Maximum vibration levels in ppv with their frequencies (F) at monitoring locations are given in Table 10.

Table 10: Vibration levels at selected locations

Time	Vibration levels with frequency							
	L1		L2		L8		L0	
	ppv/ mm s^{-1}	F/Hz	ppv/ mm s^{-1}	F/Hz	ppv/ mm s^{-1}	F/Hz	ppv/ mm s^{-1}	F/Hz
10:00 - 11:00	0.4	49	-	-	-	-	-	-
11:00 - 12:00	0.4	57	0.4	> 100	-	-	-	-
12:00 - 13:00	0.4	8	0.3	< 1.0	-	-	-	-
13:00 - 14:00	0.4	3.1	0.3	< 1.0	-	-	-	-
14:00 - 15:00	0.2	64	0.4	39	-	-	0.2	22
15:00 - 16:00	0.3	73	0.3	47	0.2	64	0.1	< 1.0
16:00 - 17:00	0.4	51	0.4	> 100	0.3	85	0.1	< 1.0
17:00 - 18:00	0.3	39	0.3	59	0.3	73	0.1	11
18:00 - 19:00	0.3	42	0.5	43	0.2	> 100	0.1	11
19:00 - 20:00	0.2	37	0.4	73	0.1	11	0.1	39
20:00 - 21:00	0.2	47	0.2	57	0.1	85	0.1	27
21:00 - 22:00	0.1	11	0.1	39	0.2	> 100	0.1	37
22:00 - 23:00	0.1	13	0.1	64	0.2	> 100	-	-
23:00 - 00:00	0.1	64	0.1	> 100	0.2	85	-	-
00:00 - 01:00	0.2	73	0.2	39	0.1	> 100	-	-
01:00 - 02:00	0.2	57	0.1	55	0.1	64	-	-
02:00 - 03:00	0.1	12	0.1	57	0.1	57	-	-
03:00 - 04:00	0.2	9.1	0.2	47	0.2	85	-	-
04:00 - 05:00	0.1	13	0.1	85	0.1	85	-	-
05:00 - 06:00	0.1	11	0.1	34	0.4	85	-	-

Time	Vibration levels with frequency							
	L1		L2		L8		L0	
	ppv/ mm s^{-1}	F/Hz	ppv/ mm s^{-1}	F/Hz	ppv/ mm s^{-1}	F/Hz	ppv/ mm s^{-1}	F/Hz
06:00 - 07:00	0.1	18	0.1	64	0.1	64	-	-
07:00 - 08:00	0.1	31	0.2	32	0.1	85	-	-
08:00 - 09:00	0.3	28	0.3	26	0.2	> 100	-	-
09:00 - 10:00	0.1	47	0.5	> 100	0.1	39	-	-
10:00 - 11:00			0.2	51	0.1	39	-	-
11:00 - 12:00	-	-	-	-	0.1	43	-	-
12:00 - 13:00	-	-	-	-	0.1	73	-	-
13:00 - 14:00	-	-	-	-	0.2	> 100	-	-
14:00 - 15:00	-	-	-	-	0.4	73	-	-
15:00 - 16:00	-	-	-	-	-	-	-	-

* Due to the security concerns, measurements were taken only for eight hours at location (L0)

6.5 Maximum Permissible Levels

The maximum permissible interim vibration levels stipulated by the Central Environmental Authority of Sri Lanka for different type of structures are summarised in table 10.

Table 10: Maximum Permissible Levels of vibration

Structure Type	Type of Vibration	Frequency of Vibration (Hz)	Vibration in ppv (mm/sec)
Type 1 structures – Multi story buildings of reinforced concrete or structural steel, with filling panels of block work, brick work or precast units not designed to resist earthquakes	Continuous	0 - 10	5.0
		10 - 50	7.5
		Over 50	15.0
	Intermittent	0 - 10	10.0
		10 - 50	15.0
		Over 50	30.0
Type 2 structures – Two-storey domestic houses and buildings constructed of made of reinforced block work, precast units, and reinforced floor & roof construction, or wholly of reinforced concepts or similar, not designed to resist earthquakes.	Continuous	0 - 10	2.0
		10 - 50	4.0
		Over 50	8.0
	Intermittent	0 - 10	4.0
		10 - 50	8.0
		Over 50	16.0
Type 3 structures – Single and two storey houses and buildings made of lighter construction, using lightweight materials such as bricks, cement blocks etc, not designed to resist earthquakes.	Continuous	0 - 10	1.0
		10 - 50	2.0
		Over 50	4.0
	Intermittent	0 - 10	2.0
		10 - 50	4.0
		Over 50	8.0

Structure Type	Type of Vibration	Frequency of Vibration (Hz)	Vibration in ppv (mm/sec)
Type 4 structures – Structures that, because of their sensitivity to vibration, do not correspond to those listed above 1,2 & 3, & declared as archeologically preserved structures by the Department of Archaeology	Continuous	0 - 10	0.25
		10 - 50	0.5
		Over 50	1.0
	Intermittent	0 - 10	0.5
		10 - 50	1.0
		Over 50	2.0

6.6 Conclusions

Measured vibration levels at all locations were well below the levels stipulated for the Type 1 , Type 2, Type 3 and Type 4 structures in the Interim vibration standard stipulated by the Central Environmental Authority of Sri Lanka.

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Environmental Monitoring Officer
CECB Laboratory Services
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In-Charge Environmental Monitoring Services
CECB Laboratory Services
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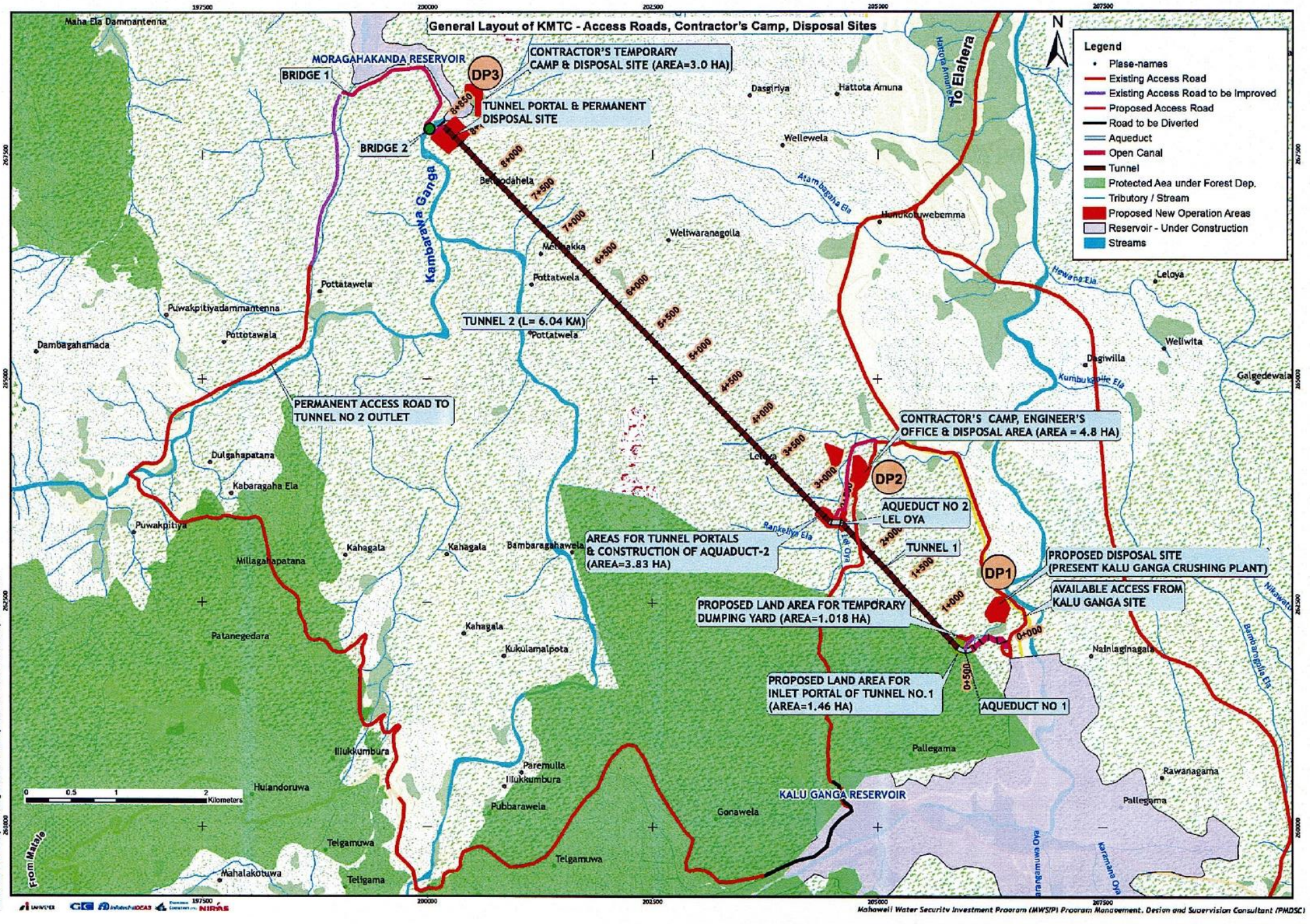
- End of the report -

Annex 1



Mahaweli Water Security Investment Program (MWSIP) Program Management, Design and Supervision Consultant (PMDSC)

Annex C: Photographic Evidence for Chapter 3

	
Toolbox meeting for raising awareness of the workers 16 July 2020	**Field visit with FD officers at Rambukoluwa 14 August 2020**
	
Meeting with FD officers at damaged area Laggala RFO office 14 August 2020	**Site inspection with IEMS-PMU, Rambukoluwa replanting area 25 August 2020**
	
Site inspection with Secretary to the Ministry of Mahaweli 28 August 2020	**Field visit to the access road section-d with DWC officers 03 Sept. 2020**

Monthly progress review meeting held at Contractor's meeting room 09 Sept 2020

Field visit to the access road section-d with DS - Laggala 24 Sept 2020

Workshop on progress review of safeguards aspects of the programme 29 Sept. 2020

Field visit to Kirimetiya tank for finding the location of Gaint Momosa 07 Oct 2020

Joint site inspection with farmers to shift the irrigation canal at Lel oya 13 Oct. 2020

Field visit to 10ha land for supervising the replanting work- Rambukoluwa 13 Oct. 2020

	
Germ sterilizing in the KMTC office 27 Nov. 2020	**PCR test for Covid -19 was carried out for random sample of Contractor and PMDSC staff 30 Dec 2020**
	
File visit to the Elahera, Yakkala with attending the government officers and political authority 14 Oct. 2020	**Joint site inspection had participating PUM, PIU and PMDSC-Northern portal-UEC ICB -2A** **10 Dec. 2020**
	
Joint inspection with ISMS-UCE ICB-1 15 Dec. 2020	**Meeting had with ISMS-KMTC 16 Dec. 2020**