

Addendum to the Environmental Impact Assessment

September 2017
Project Number: 47381-001

SRI: Mahaweli Water Security Investment Program

Tranche 1 and 2
Upper Elahera Canal Project

Main Report

Prepared by Ministry of Mahaweli Development and Environment with the assistance of Program Management, Design and Supervision Consultant (Joint Venture Lahmeyer International GmbH – GeoConsult ZT GmbH) for Democratic Socialist Republic of Sri Lanka and the Asian Development Bank.

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Mahaweli Water Security Investment Program

SUPPLEMENTARY INFORMATION RELATED TO INFRASTRUCTURE DESIGN CHANGES FOR THE UPPER ELAHERA CANAL PROJECT

VOLUME 1: EIA UPDATES FOR TRANCHE 1 AND TRANCHE 2 COMPONENTS

September 2017



Program Management, Design and Supervision Consultant

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VOLUME 1: EIA UPDATES FOR TRANCHE 1 AND TRANCHE 2 COMPONENTS

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ABBREVIATIONS

ADB	Asian Development Bank
APs	Affected Persons
BOD	Biological Oxygen Demand
BoQ	Bill of Quantities
CEA	Central Environmental Authority
CEMP	Contractor's Environmental Management Plan
DoI	Department of Irrigation
DWC	Department of Wildlife Conservation
EA	Executive Agency
EIA	Environment Impact Assessment
EMC	Environmental Monitoring Committee
EO	Environmental Officer
EPL	Environmental Protection License
ERP	Emergency Recovery Plan
FD	Forest Department
FFPO	Fauna & Flora Protection Ordinance
FO	Forest Ordinance
GoSL	Government of Sri Lanka
GRC	Grievance Redress Committee
GRM	Grievance Redress Mechanism
GSMB	Geological Survey & Mines Bureau
H&S	Health and Safety
IAS	Invasive Alien Species
ID	Irrigation Department
IEE	Initial Environmental Examination
IEER	Initial Environmental Examination Report
IMS	Information Management System
KMTC	Kalu Ganga - Moragahakanda Transfer Canal
LB	Left Bank
LGA	Local Government Authority
MDP	Mahaweli Development Program
MFF	Multi Tranche Financing Facility
MLBCRP	Minipe Left Bank Canal Rehabilitation Project
MLLD	Ministry of Land and Land Development
MMDE	Ministry of Mahaweli Development and Environment
MOH	Medical Officer in Health
MRB	Mahaweli River Basin
MWSIP	Mahaweli Water Security Investment Program
NATM	New Austrian Tunnelling Method
NCPCP	North Central Province Canal Project
NWPCP	North Western Province Canal Project
PD	Project Director (of PIU)
PD-PMU	Program Director - Program Management Unit
PHI	Public Health Inspector
PIU	Project Implementation Unit
PMDSC	Project Management & Design Supervision Consultant
PMU	Project Management Unit
PSC	Program Steering Committee
RE	Resident Engineer
SEA	Strategic Environment Assessment
TBM	Tunnel Boring Machine
TDS	Total Dissolved Oxygen
TSS	Total Suspended Solids
UECP	Upper Elahera Canal Project

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1 OVERVIEW

1.1 Introduction

1. This document has been prepared by the Project Management & Design Supervision Consultant (PMDSC) of the Mahaweli Water Security Investment Program (MWSIP), in conjunction with the Program Management Unit (PMU) established under the Ministry of Mahaweli Development and Environment, as an addendum to the Environmental Impact Assessment (EIA) for the proposed Upper Elehera Canal (UEC) project, dated June 2015¹ and approved by the Central Environmental Authority (CEA) on 31 March 2016.

2. The project areas covered by the entire three-tranche UEC investment program are shown in **Figure 1**.

1.2 Purpose of the EIA Addendum

3. Since the submission of the 2015 EIA study, a number of design changes have been made to the proposed UEC. This is understandable, given that Phase 1 of the MWSIP is now under construction, and so fine-level design decisions are being made.

4. This Addendum updates the 2015 EIA for the Tranche 1 and Tranche 2 components of the UEC. The environmental implications of the design changes to be made to Tranche 3 components will be dealt with in a separate EIA Addendum, to be completed once designs for the four Tranche 3 components have been finalized.

1.3 Structure of the EIA Addendum

5. This document consists of three additional sections. Section 2 presents a description of the design changes that have been made since the EIA was produced in 2015. The section is organized to match the individual contract “packages” as they are currently known. For each new aspect of design, a brief assessment of “environmental implication” is made, along with a description of new primary environmental survey investigations undertaken in May 2017.

6. The third section of the Addendum describes the existing environment in the areas where the design changes may have an effect.

7. The fourth section outlines anticipated environmental impacts associated with the new design changes, and proposes mitigatory measures where necessary.

8. Sections 3 and 4 are supported by Environmental Codes of Practice, which can be found in **Annex 1**. **Annex 2** and **Annex 3** will include the list of invasive species and fauna species recorded during the rapid ecological survey carried out by PMDSC. **Annex 4** includes the maps included in the EIA report to make a better comparison of design changes highlighted in this document, and **Annex 5** provides enlarged version of maps included in the text, to improve the readability.

¹ Mahaweli Authority of Sri Lanka (2015), Environmental Impact Assessment Report. Modifications to Configurations of Moragahakanda-Kaluganga Projects. Proposed Upper Elehera Canal (UEC) from Mannakkattiya Tank to Mahakanadarawa Tank and Kaluganga-Moragahakanda Link Canal Project. Prepared by Mahaweli Consultancy Bureau Pvt Ltd. June.

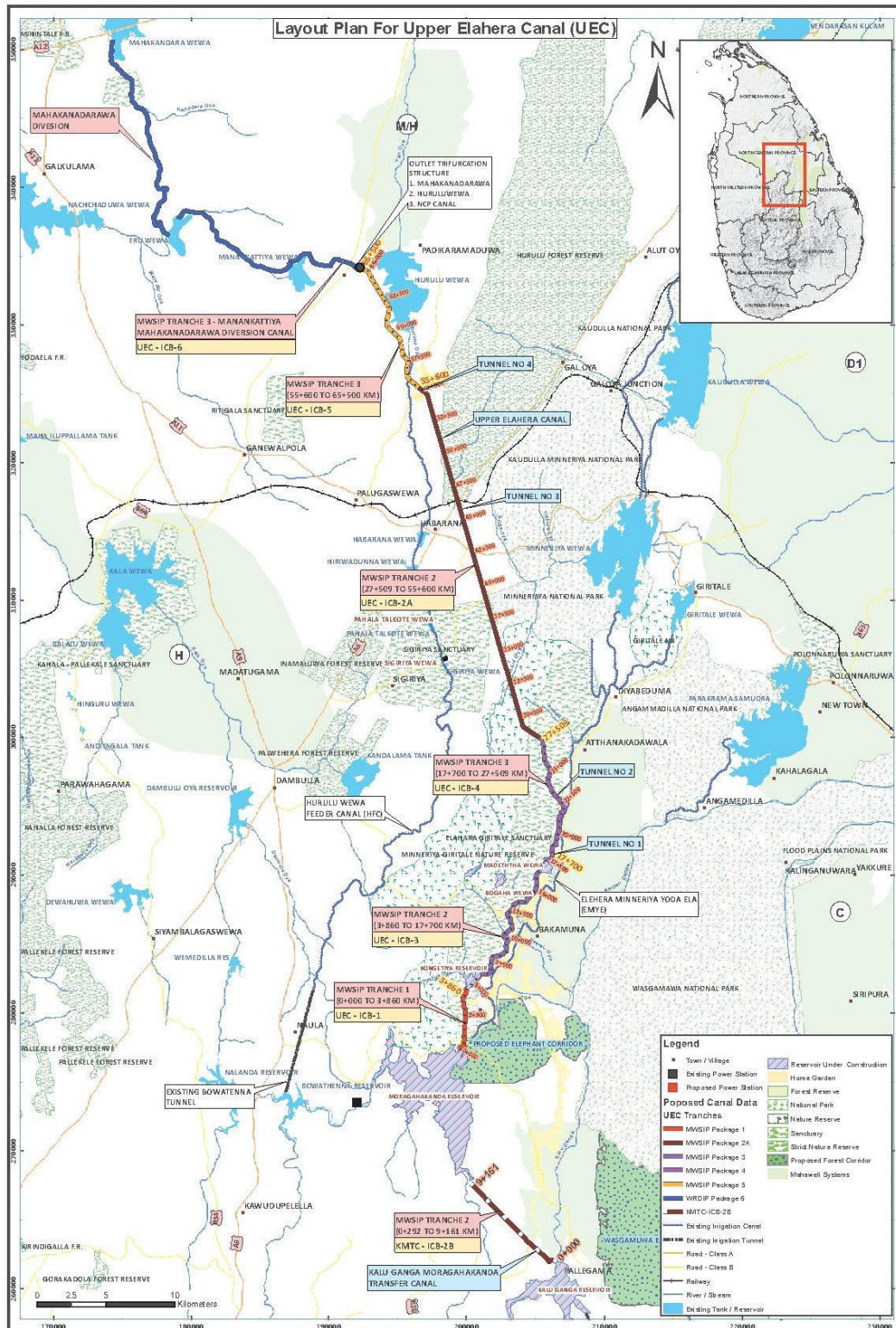


Figure 1 : Overall Layout Plan for Upper Elahera Canal

9. **Annex 6** includes a summary of community consultation carried out with respect to UEC-ICB-2A design changes and the **Annex 7** describes the NCR location numbers denoted in the critical flora species distribution Table 9 under section 3 of the report.
10. Section 5 of the report provides the information related to Stakeholder and Public Consultation carried out over the design changes.
11. In addition, detailed Environmental Management Plans (EMPs) for the Tranche 1 component and for the two Tranche 2 components are included in a separate Volume 2.

2 DESCRIPTION OF PROPOSED DESIGN CHANGES

2.1 Introduction

12. This section examines the design changes that have been made to Tranche 1 and Tranche 2 components, from south to north. It also assesses the environmental implications of these changes, and the consequent need for new primary environmental survey work. It should be noted that comparison with the 2015 EIA (Pls refer Annex 4 for the relevant maps included in the EIA) has been challenging, as specific contract packages were not in existence when the EIA was produced.

2.2 Kalu Ganga – Moragahakanda Transfer Canal (KMTC): UEC-ICB-2B (Tranche 2)

13. The package (UEC-ICB-2B) is for the construction of the Kalu Ganga – Moragahakanda Transfer Canal (KMTC). The KMTC will transfer water from the Kalu Ganga Reservoir to the Moragahakanda Reservoir in Phase 1, and in Phase 2² also provide the means to convey the additional water from the Randenigala-Kalu Ganga Transfer Canal (RKTC). General layout for the KMTC, along with proposed access roads and site works, is shown in **Figure 2**.

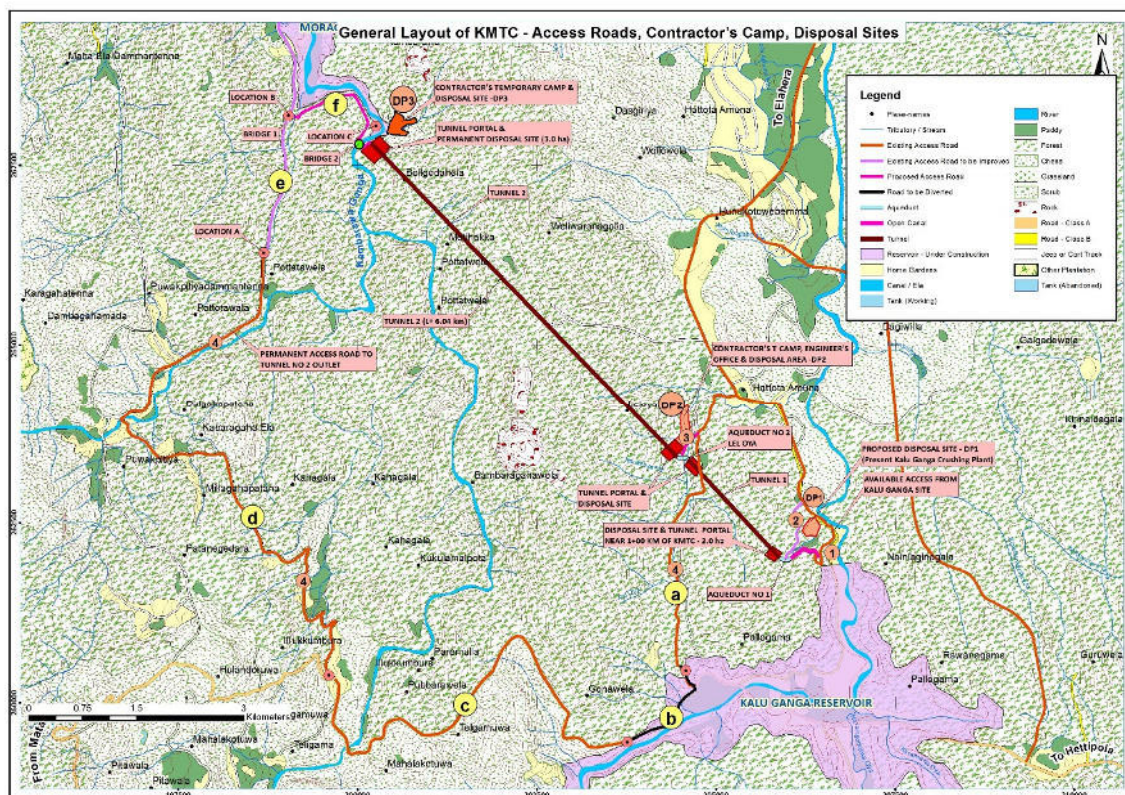


Figure 2 : KMTC Layout and Access Roads

² Phase 2 will include 6 investment projects: Randenigala-Kalu Ganga Transfer Canal (subject to approval of the route); Lower Uma Oya Reservoir project; Hasalaka Oya Reservoir Project; Heen Ganga Reservoir project; Ka-linga Nuwara Pumping project; and, North Central Province Canal.

2.2.1 Main Design Components

14. Apart from a short stretch of open canal, and two short aqueducts, KMTC will consist entirely of tunnels. Details of the tunnel design are presented in the Design Report of September 2016³. The general alignment of the KMTC is from the southeast to the northwest, with the following features:

(i) KMTC Tunnel 1 is 1,940 m in length (chainage 0+557.77 to 2+467.77 km), with overburden varying between 5 to 80 m.

15. KMTC Tunnel 2 is 6,040 m in length (chainage 2+732.77 to 8+772.77 km), with overburden varying between 6 to 378 m.

16. Both tunnels will be constructed according to the principles of the New Austrian Tunneling Method (NATM), which is a sequential tunnel excavation method successfully applied in a wide range of ground conditions. Excavation will be by drill and blast or by mechanical means in unfavorable rock conditions (e.g., excavator or hydraulic hammer). Support consists of shotcrete reinforced with wire mesh, rock bolts, lattice girders and advance support (e.g. forepoling) where required. For both tunnels, excavation will proceed from both portals at the same time.

17. Design Differences

18. The main design changes since the 2015 EIA consist of: (i) Tunnels 1 and 2 being constructed by NATM rather than TBM; (ii) more certainty about the route and design of access roads to the outlet (northern portal) of Tunnel 2; and, (iii) more certainty about the locations and capacities of required disposal sites.

19. **Table 1** summarizes these design changes. The final two columns introduce the environmental implications of the proposed changes, and the investigation work that has been undertaken to enable environmental implications to be properly assessed and mitigation planned.

Table 1 : Summary of KMTC Design Differences

Component	Original Design	Current Proposal	Summary Environmental Implications	Environmental Investigation Work Undertaken (reported on in Section 3)
Tunnel construction method	TBM	NATM drill and blast (Note: Tunnel design for NATM has recently been changed to a D-shaped waterway. This produces a smaller volume of muck than the D-shaped tunnel). See discussion in: Technical Note 5 Rev. A (7 December 2016): Tunnel Design Parameters and Optimizations of Drill and Blast Tunnels	NATM requires removing muck at both ends of the tunnel (as against one end for the original TBM proposal). This will therefore entail the development of a new permanent waste disposal site (see below).	See “dumping sites” below:

³ KMTC Tunnel 1 and 2 Draft Design Report, PMDSC, September 2016.

Component	Original Design	Current Proposal	Summary Environmental Implications	Environmental Investigation Work Undertaken (reported on in Section 3)
Tunnel lengths	Tunnel 1: 1.84km Tunnel 2: 6.0km	Tunnel 1: 1.91km Tunnel 2: 6.04 km	No environmental implications	
Access roads	New road to provide access to north portal of Tunnel 2 (section f in Figure 2) Existing road from Haththota to Lel Oya (to be improved)	Extent of work required to sections a, c, d, e, and f (ref. fig. 2) was given preliminary consideration during site visit on 7 February 2017. All road sections apart from 'f' were included in the 2015 EIA. Some minor upgrades may be required for sections a, c, and d. These upgrades will not result in widening, except where there is a need for passing bays. These will be identified at a later date. The stretch between Location A and Location B (section 'e') is currently not readily usable by road vehicles, and needs regrading. A new road required for section 'f'. Section b to be moved northwest and away from the footprint of the Kalu Ganga Reservoir (Relocation of section b is the responsibility of the proponent working on the Kalu Ganga Reservoir).	Construction of section 'f' will require clearing of vegetation for the 1.8 kms of required new road.	Rapid Ecological survey undertaken for access road stretches 'e' and 'f' (Figure 2).
Dumping sites	Three dumping sites proposed. Site no. 1 at lat: 7.562181. long: 80.824840 (2 ha dumping site at southern end of Tunnel 1) Site no.2 at lat: 7.579162 and long: 80.815520 (2 ha dumping site at the southern end of Tunnel 2)	Site DP1 (at lat: 7.56538226. long: 80.831186677), already in use by Kalu Ganga Reservoir contractor. Site DP2 (at lat: 7.576726648 and long: 80.814987804) was approved as part of the 2015 EIA. Site DP3 (at lat: 7.616385759 and long: 80.778980874) is new. All dumping sites will be permanent.	Possible environmental implications associated with the siting of DP3 (4.5ha), which is in the Moragahakanda reservoir reservation (within HFL) under Mahaweli Authority owned land area. Present land use is abandoned paddy and home gardens (leftover of relocated families under Moragahakanda project)	Rapid Ecological surveys undertaken in vicinity of proposed DP3.

Component	Original Design	Current Proposal	Summary Environmental Implications	Environmental Investigation Work Undertaken (reported on in Section 3)
	Third site at lat: 7.614251 and long: 80.775171 (2 ha dumping site at north portal of Tunnel 2)			
Power to sites	No discussion. EIA indicates that electricity supply is "being discussed with CEB".	Power requirements for tunneling at portals will be met by generators. Requirements for worker camp sites will be met from existing CEB transmission lines.	No new environmental implications.	

20. The aspect of new design that may have the most potential impact is access roads. It should be noted that the original EIA document foresaw the need for a new "temporary access road" for the final stretch of access to the north portal of Tunnel 24. Given the NATM's need for tunnel construction access at both ends, the final stretch of access road (section 'f') will now be required on a permanent basis. As a result of this design change, this section was the subject of a new ecological survey in May 2017.

21. Access to the south portal of Tunnel 1 is via the existing crusher and materials processing plant location occupied by the Kalu Ganga Dam Contractor and along the wayleave of the proposed cut and cover section. Access to the northern portal of Tunnel 1 and the southern portal of Tunnel 2 is via an existing gravel track at less than 2 km distance from the main road. The trackway may be widened and minor realignments made to access both portals.

22. Following first stage flooding of the Moragahakanda Reservoir in January 2016, access to the north portal of Tunnel 2 is only possible from a single roadway to the south, as shown in Figure 2. The roadway connects with the main road near the main working site at the south portal of Tunnel 2 and runs a circuitous route to the north portal, a distance of some 29 km. The roadway currently terminates at Location A, some 7 km short of the portal location. There is an existing forestry track beyond Location A, which is unpassable to road vehicles (section 'e'). The access ceases completely beyond Location B, approximately 1.8 km from the portal. Considerable work will be required at the outset of the contract to enable the Contractor to both reinstate the existing track between Locations A and B and construct a completely new roadway from Location B to the portal location (section 'f').

23. The width, condition and usability of the existing road, (Sections a, b, c & d), varies considerably and is not obvious from the existing plan of the area.

- (i) Section 'a', from the stretches from the main work site to the limit of the future flooded area of Kalu Ganga Reservoir. Its approximately 5 km is a recently improved roadway up to 7 m in width, part asphalt and part compacted clay surfacing.
- (ii) Section 'b' comprises 2 km of good quality 5 m wide road which will require rerouting prior to the flooding of Kalu Ganga Reservoir. This will be done by the Contractor of Kalu Ganga Dam.
- (iii) Section 'c' comprises a 4 m wide single track mountain road with numerous hair pin bends. Road surfacing is asphalt and in good condition throughout its 8 km distance. There is little scope for

⁴ Reference footnote 3, Table 2.8, page 65.

increasing the width of the road due to the terrain, other than increasing the turning area at some of the hairpin bends and installing occasional passing bays.

- (iv) Section 'd' is a 4 m wide single-track roadway of variable quality and surfacing. It is less demanding with respect to hairpin bends and general topography than the previous Section 'c'. Potholes and worn road surfaces are present at numerous locations along the 10 km distance. Considerable improvement work will be required although there is little scope for increasing the general width of the roadway.

24. Removal of tunnel spoil along this access road is considered both extremely impractical and also unsafe. It is therefore considered essential to ensure that all spoil from the tunneling activities through the northern portal can be permanently stored in the area close to the portal, shown as site DP3 in Figure 2. This is presently abandoned paddy land.

25. DP3 is part of the new design, and its development presently belongs to the Mahaweli Authority as it is already acquired for Moragahakanda reservoir development project. Approval from the Forest Department is granted for access road rehabilitation (Refer Table 12 for consultation summary).

2.3 Upper Elehera Canal: UEC-ICB-1 (Tranche 1)

26. The canal starting from Moragahakanda reservoir from 0+100 km to 3+860 km is covered by the UEC ICB 1 contract package. It was subject to a deviation of the alignment between 2+820 km and 3+860 km after the contract award (see **Figure 3**). The reason for this design change lies in the fact that UEC-ICB-1 was one of PMDSC's "advance packages". For this package, it was not possible to consider a precise canal strip survey and it had to be solely based on the 1:10,000 scale topographic map, which is known to be imprecise in the vertical direction.

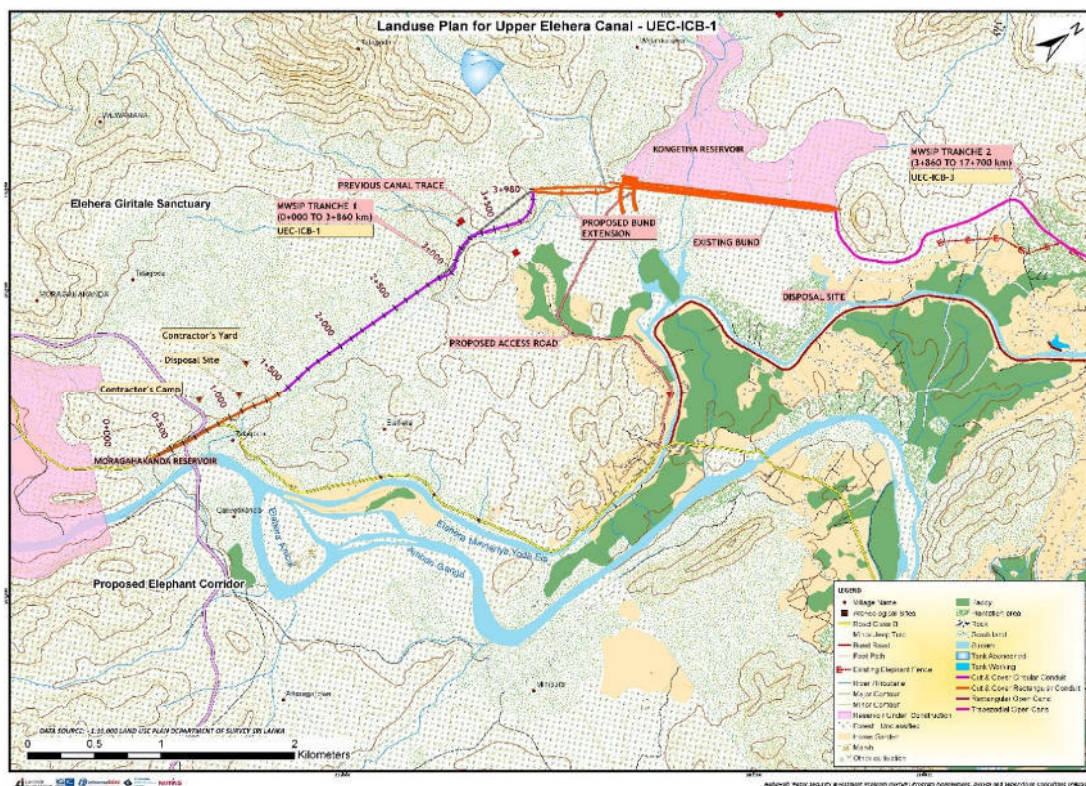


Figure 3: UEC-ICB-1 Showing Canal Deviation

27. The cut-and-cover canal on the original alignment was designed to have a maximum overburden of 10 to 15 m. After a detailed site survey, this amount increased locally to 25 to 30 m, which would have led to a very substantial increase of excavation, backfill, concrete and reinforcement quantities. Moreover, maintaining the previous alignment would have substantially increased the area of temporary land use for the canal trench, and it would have consequently required a far higher number of trees to be felled than with the new, deviated canal alignment.

28. The land use is noted as scrub forest and planted Teak forest including some stream crossings and the Welankatuwa anicut (Figure 4 and Figure 5).



Figure 4: Stream Network Associated with Welankatuwa Stream



Figure 5: Teak Forest and Scrub

2.4 Upper Elahera Canal: UEC-ICB-2A (Tranche 2)

29. The package covers the tunnel sections (27.7 km) of the UEC, between chainages 27+700 km and 55+400 km, and cut-and-cover sections between chainages 27+509 and 27+700, and 55+400 and 55+600. Tunnels 3 will be 26.6km in length, and Tunnel 4 will be 1.1km. It is the most technically

challenging element of the MWSIP, and the biggest single investment of the program. The general layout of the package is shown in **Figure 6**.

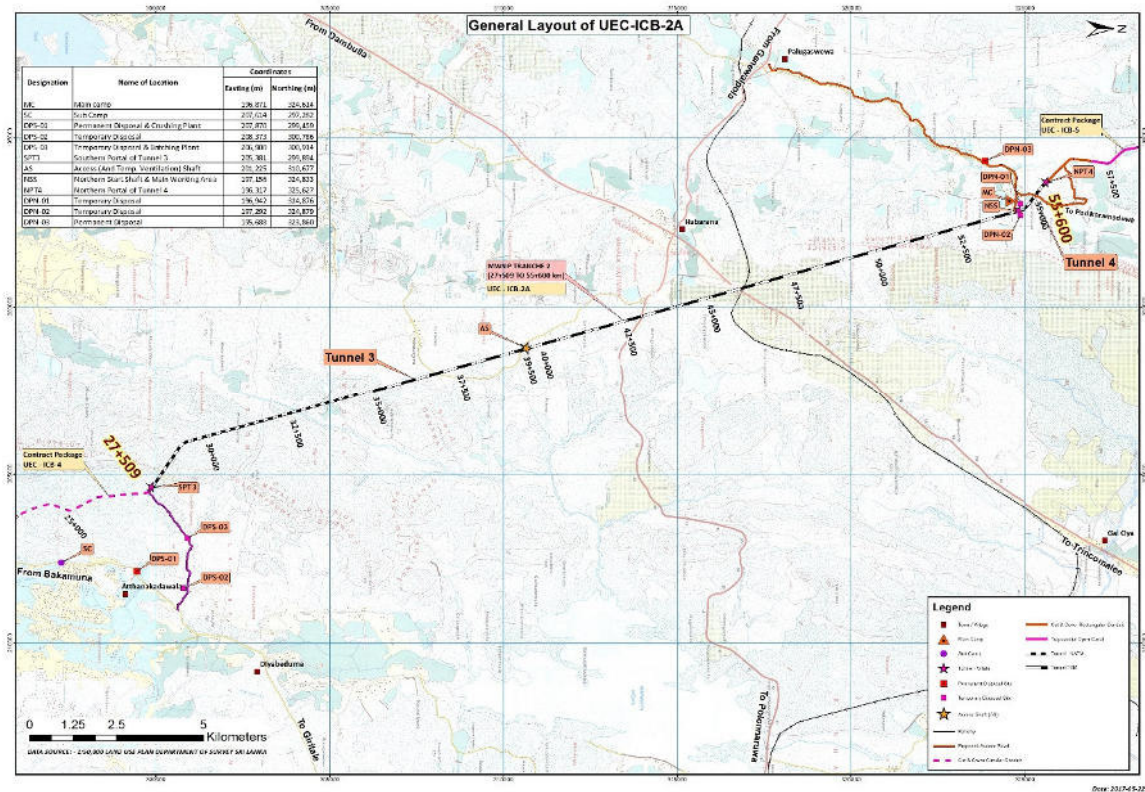


Figure 6: Layout Plan for UEC-ICB-2A

30. Design Differences

31. Quite significant changes in design have been made to this stretch of the UEC since the approval of the original EIA study. These are shown in summary form in **Table 2** and **Table 3**, and explained in more detail in the text that follows each table. The main design changes are to Tunnels 3 and 4. They are as follows:

- (i) confirmation of Option B for Tunnel 3 as described in Special Report 3⁵. This design has a TBM drive from the north and NATM drill-and-blast drive from the south;
- (ii) power, site, and access to southern portal of Tunnel 3;
- (iii) access shaft (diameter 4 m) around 39+400 (30 m x 40 m spoil pile);
- (iv) fine-level details of works required at the Tunnel 3 northern portal;
- (v) start shaft (diameter 26 m) required at 55+290; and,
- (vi) Tunnel 4 replaces the original proposed section of deep cut and cover canal to the north of Tunnel 3 and will be constructed by NATM.

⁵ Special Report 3. UEC Tunnel 3: Selection of Construction Method and Comparison of Construction Options. June 2016.

2.4.1.1 Tunnel 3

32. Site investigations were undertaken in December 2016, and updated with visits in January and February 2017. The findings and recommendations of the main site investigations from December relate to the location of the Tunnel 3 portals, and are presented in full in Technical Note No. 12. The main working locations for the southern portal are shown in Figure 7, and the design differences and environmental implications are presented in **Table 2**.

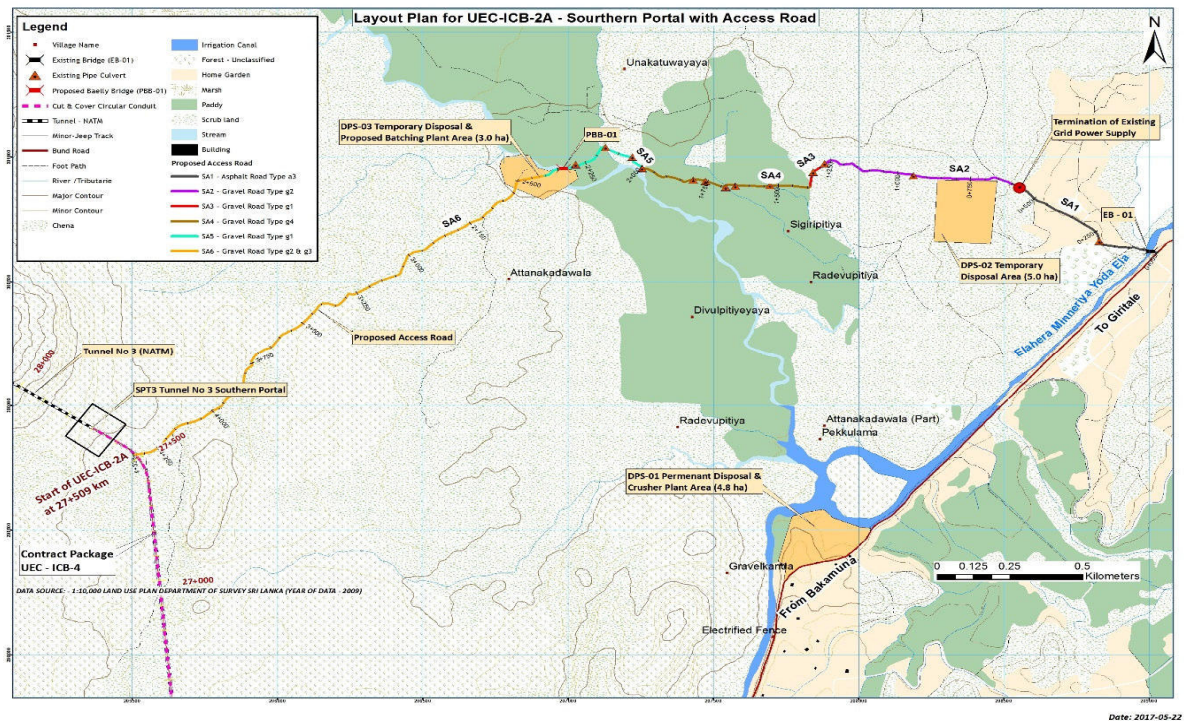


Figure 7: Tunnel 3 Southern Portal Land Use

Table 2 : UEC-ICB-2A Design Differences Tunnel 3

Component	Original Design	Current Proposal	Summary Environmental implications	Environmental Investigation Work Undertaken (reported on in Section 3)
Tunnel construction method (Tunnel 3)	Single TBM starting from the northern portal (as proposed in MMDE feasibility study and PPTA).	Single TBM for construction of 20.2 km from the northern portal and New Austrian Tunneling Method (NATM) drill-and-blast from the southern portal (6.4 km).	Increase in construction activities due to change to NATM, with additional noise and dust.	See below
Southern Portal				
Access roads	4.5 km access road from Diyabeduma to 27 + 500km	General road route is the same as in original design.	Some realignment and road improvement may require widening, and with possible impact on vegetation.	Longitudinal ecological survey undertaken. Annex 6 provides the summary note on the community consultation conducted

Component	Original Design	Current Proposal	Summary Environmental implications	Environmental Investigation Work Undertaken (reported on in Section 3)
				relevant to the design changes.
Installation site	Location for dismantling/exit of TBM near 27 + 500km. Required site area: 2ha	Installation site at the southern portal with area of approximately 1ha	Potential impacts associated with site clearance, noise and dust, water requirements and wastewater disposal.	No new environmental work required. Installation area assessed in 2015 EIA.
Disposal sites	One disposal site at Dibayema. Lat: 7.9300438 Long: 80.8620003 Abandoned borrow area	Disposal sites required for additional muck of 48,000m ³ Temporary disposal areas at locations DPS-02 (3ha of open grassland) and DPS-03 (5ha of scrubland). Permanent disposal area at Location DPS-01 (4.8ha of old rock quarry adjacent to main road alongside EMYE Canal). This location would also have a crushing plant.	All three proposed disposal sites are in the Elahera Giritala Sanctuary. Site DPS-01 would need to be banded (if not already) to ensure that there is no escape of material to the EMYE.	Ecological survey undertaken in the vicinity of all three proposed disposal sites.
Power	No mention in EIA	Generator at the portal. Power for the crushing plant at disposal site DPS-01 would be from CEB mains.	No significant environmental implications, except associated with noise from generators.	No new environmental work required.
Northern Portal				
Installation site	Location for assembly of TBM near 54 + 000km 2ha required	More detail on specifics of site installation. In Figure 6, site installations (A) (8.2 ha), main site (B) (5.0 ha), and stilling pond (C) (1.0ha). A total of 14.2ha.	Potential impacts associated with site clearance, noise and dust, water requirements and wastewater disposal	Rapid ecological survey work undertaken in vicinity of proposed installation site. Groundwater monitoring at regular intervals from chainages 54+165km through to 55+085km has been undertaken on a 2-weekly basis since February 2017.
Access roads	1.6 km widening of Ganewalpola – Palugaswewa Rd to 55 + 900”km 1.5 km widening of Ganewalpola – Palugaswewa Rd to 57 + 30km	Road route to 55 +900km is the same as in original design. The first half of the road needs resurfacing, and extending from 4m to 5m. The second half needs new asphalt surface and	No significant environmental implications	No new environmental work required. Road widening approved in 2015 EIA.

Component	Original Design	Current Proposal	Summary Environmental implications	Environmental Investigation Work Undertaken (reported on in Section 3)
		widening from 3.5m to 4m.		
Disposal sites	Temporary disposal site 200m X 50m along the canal. 48,000m ³ required	Spoil storage and locations 1 (3.5ha) and 2 (4ha) (temporary at location 1 and permanent at location 2). (Figure 6) Small permanent spoil storage at location 3 (1.4ha) (Figure 6)	Area is abandoned cleared land, occasionally used for chena within an area of unreserved State land.	Ecological survey undertaken in the vicinity of all three proposed disposal sites.
Power	No mention in EIA	10,000kw required. All from generators	No significant environmental implications, except associated with noise from generators.	

33. As can be seen from Figure 5, Tunnel 3 southern portal is located within the Elahera Giritale Sanctuary on the side of an escarpment. The adoption of NATM construction for the southern portion of Tunnel 3 will result in the following additional impacts:

- (i) Installation site at the southern portal with site area of approximately 10,000 m², and potential impacts associated with site clearance, noise and dust, water requirements and waste water disposal;
- (ii) Increase in construction activities due to change to NATM, with additional noise and dust;
- (iii) Improved access for heavy machinery and site access, with the need for road realignment and widening; and

34. Additional muck disposal site for approximately 48,000 m³

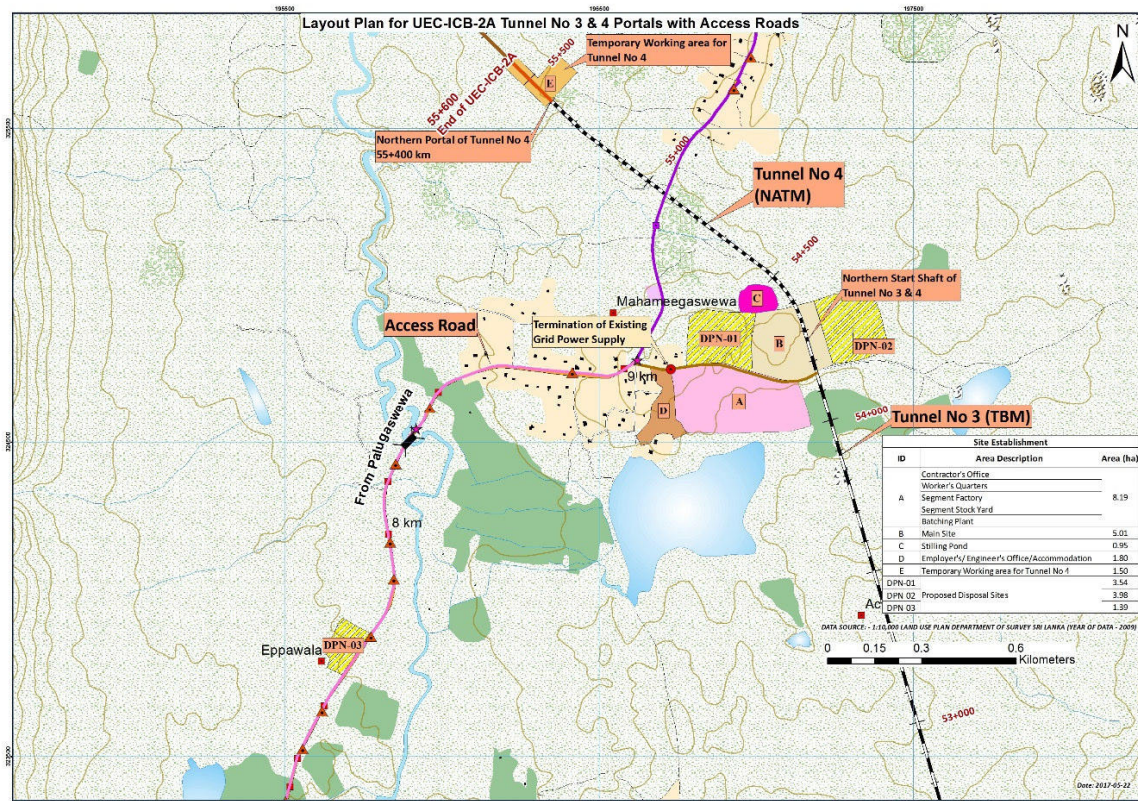
35. The site is currently accessed via an existing track (approximately 3 m width) from the lowlands to the north east of the site, where the forest gives way to scrubland and eventually a short swathe of grassland and paddy fields. Beyond this point, it continues a further 1 km in scrubland and village, and then via a steel bridge over the EMYE canal to the main road. Total distance from the portal to the main road is approximately 5.5 km.

36. During the site inspections three potential sites were identified for either temporary and/or permanent spoil disposal (sites DPS-01 to 03 on Figure 5). All three sites are within the Elahera Giritale Sanctuary. Area DPS 01 (4.8 ha) is situated directly adjacent to the main road alongside the EMYE canal. It has been previously used as a quarry site for gravel and rock, and is partially backfilled. There is water and grid power available at the site, and it is therefore suitable for installation of a rock crushing and materials processing plant. The site is large enough to handle the volume of waste material from the southern portal.

37. Area DPS-02 is situated at the foot of the escarpment approximately 3 km from the portal. The site is approximately 3.0 ha of open grassland, and would be suitable for temporary storage of tunnel spoil and/or location of plant for materials processing. Area DPS-03 (5.0 ha) is scrubland located at the edge of paddy fields.

38. The existing access road, in its current state, is unsuitable to support the transport of plant and mucking material to and from the planned construction site. The section of existing track between the portal to Area DPS-03 is the only viable route, and it passes through the Elahera Giritale Sanctuary.

39. Proposed land uses around Tunnel 3 northern portal are show in **Figure 8**.



40. Figure 8: Tunnel 3 Northern Portal and Tunnel 4 - Land Use

41. The working shaft for both the TBM (T3) and Tunnel 4 (NATM) is located within this area. The area will be used for all immediate surface support facilities for driving both tunnels, and will, for some period of time, be concurrent for both tunnels. The figure shows the location of site installations (A) (8.2 ha), main site (B) (5.0 ha), stilling pond (C) (1.0 ha), and three proposed disposal sites (site DPN-1: 3.5 ha, site DPN-2: 4.0 ha and site DPN-3: 1.4 ha).

42. The site installation at the northern temporary access shaft comprises the following: segment factory and storage area, tunnel ventilation facilities, processing plant for excavation material, aggregate and cement storage, temporary storage of excavation materials, concrete mixing plants, train workshop, emergency supply generators, water treatment plant and retention pool, material testing laboratory, office space, workers building and canteen. The installations will require an estimated area of 54,000 m² and power requirement of 10,000 kW, which includes the power needed by the TBM.

43. Site visits have confirmed that spoil storage is possible at either location DPN-1 or DPN-2, and that both areas are currently uncultivated scrubland. It is envisaged that they will be used initially as temporary disposal sites, and with area DPN-2 possibly suitable for future permanent storage. A small permanent spoil disposal area (Area DPN-3) has been identified approximately 2 km to the south of the main site. It is currently abandoned cleared land, occasionally used for chena within an area of unreserved State land, and immediately adjacent to the main road. It should be noted that all three

disposal sites may not be needed. A decision on the required number of disposal sites will not be possible until construction starts and the amount of muck generated is better understood.

44. The northern portal site is 10 km from the main road at Palugaswewa. The first 4 km of roadway was recently asphalted and is in good condition, with a width of 4.5 m and no sharp bends and flat gradient. The road could be widened to 6 m, with the proviso that a culvert at the main road junction be lowered. The balance of the length of the access road is 3.5 m wide and of variable state of repair. It requires widening and repairs, including replacement of a bridge at chainage 8+300 km.

45. Tunnel 4

46. In general, the change from cut and cover canal to a tunnel yields a number of environmental, social and resettlement benefits. They largely stem from a substantial reduction of earthmoving volumes (excavation and backfill) and from the fact that the tunnel represents a containment without direct connection to the surface. Proposed land uses around Tunnel 4 are shown in **Figure 8**. The design differences and possible environmental implications are presented in **Table 3**.

Table 3 : UEC-ICB-2A Design Differences Tunnel 4

Component	Original Design	Current Proposal	Summary Environmental Implications	Environmental Investigation Work Undertaken (reported on in Section 3)
Tunnel construction method	Cut and cover	New Austrian Tunneling Method (drill and blast)	Substantial reduction of earthmoving volumes (excavation and backfill). Benefits include lower impact on groundwater levels, virtual elimination of the need for a land use corridor during construction (from 55 ha to zero), and lower levels of dust, noise and vibration.	
Access roads	1.6 km widening of Ganewalpola – Palugaswewa Rd to 55 + 900km 1.5 km widening of Ganewalpola – Palugaswewa Rd to 57 + 300km	Road route to 55 +900km is the same as in original design. The first half of the road needs resurfacing, and extending from 4m to 5m. The second half needs new asphalt surface and widening from 3.5m to 4m.	No significant environmental implications	No new environmental work required. Road widening approved in 2015 EIA.
Installation site	Location for assembly of TBM near 54 + 000km 2ha required	Same as for northern portal of Tunnel 3	Same as for northern portal of Tunnel 3	Same as for northern portal of Tunnel 3
Disposal sites	Temporary disposal site 200m X 50m	Same as for northern portal of Tunnel 3	Same as for northern portal of Tunnel 3	Same as for northern portal of Tunnel 3

	along the canal. 48,000m ³ required			
Power	No mention in EIA	Generators.	No significant environmental implications, except associated with noise from generators.	

47. The benefits include lower impact on groundwater levels, virtual elimination of the need for a land use corridor during construction (from 55 ha to zero), and lower levels of dust, noise and vibration.

48. Road access to the north portal of Tunnel 4 will be along an existing road. This road may need widening at points, but no new road construction will be required.

49. Removal of tunnel spoil back to the main working site (T3/T4) is envisaged unless re-landscaping of an area near the portal is allowable.

3 DESCRIPTION OF NEW ECOLOGICAL SURVEY WORK UNDERTAKEN: EXISTING ENVIRONMENTAL CONDITIONS

3.1 Introduction

51. The tables presented in Section 2 outline the rapid ecological survey work that was required as a result of the design changes made to UEC Tranche 2 components since the submission of the original EIA in 2015. This section presents the outcomes of the survey work.

3.2 Kalu Ganga – Moragahakanda Transfer Canal (KMTC) : UEC-ICB-2B

52. As indicated in **Table 1**, the two areas where new ecological survey work needed to be undertaken are the proposed disposal site DP3, and the stretches of road between Location A and the northern portal of Tunnel 2 (sections 'e' and 'f' in **Figure 2**). **Figure 9** presents the existing land use of DP3 and road section "f", where DP3 area consist of abandoned agricultural lands, scrublands, home gardens which were used by the former community in that village, those who resettled under Moragahakanda project and the lands are acquired by Mahaweli Authority. Streams and streamside vegetation make up the major habitat/vegetation types in the vicinity of Disposal Site 3. Forests, streams and streamside vegetation are the major habitat/vegetation types in both road sections (section 'e' and section 'f'), and the new road section "f" is located within the Moragahakanda reservoir reservation, which is under the FD under the category of "Other state forest"⁶. However, under Moragahakanda EIA, the reservation of the reservoir is proposed for a protected area, but not yet implemented.

53. Seventeen endemic plant species, 4 nationally endangered plant species, 9 nationally vulnerable plant species, and 13 nationally near-threatened plant species were observed during a field visit undertaken in May 2017, and presented in **Table 4**. In addition, 8 species are considered to have a Global Conservation Status as "vulnerable".



DP 3 Location (abandoned paddy and home gardens)

⁶ The State Forest or the Village Forest categories are no more available, and hence this kind of forest areas are named as Proposed Conservation Forest.



Figure 9: Existing Habitat/Vegetation Types. Access Road Section 'e' and Section 'f' and Disposal Site 3 of UEC-ICB-2B

Table 4 : Conservation Status of Observed Plant Species

Family Name	Scientific Name	Common Name	HA	TS	NCS	GCS	Road		DP
							RF	RE	
Achariaceae	<i>Hydnocarpus venenata</i>	Makulu	T	E			+	+	
Anacardiaceae	<i>Mangifera zeylanica</i>	Etamba	T	E		VU	+	+	
Anacardiaceae	<i>Semecarpus nigro-viridis</i>	Badulla	T	E		VU	+	+	
Annonaceae	<i>Uvaria spheonocarpa</i>		C	E			+	+	
Annonaceae	<i>Xylopia nigricans</i>	Heen Kenda	T	E	NT		+	+	
Apocynaceae	<i>Anodendron paniculatum</i>	As Wel	C	N	VU		+	+	
Apocynaceae	<i>Carissa inermis</i>	Maha Karamba	C	N	VU		+	+	
Calophyllaceae	<i>Calophyllum tomentosum</i>	Tel Keena	T	E	VU	VU	+	+	
Celastraceae	<i>Salacia oblonga</i>	Gal Himbutu	C	N	EN	VU	+	+	
Celastraceae	<i>Salacia reticulata</i>	Kotala Himbutu	C	N	EN		+	+	
Clusiaceae	<i>Garcinia morella</i>	Gokatu	T	N	NT		+	+	
Clusiaceae	<i>Garcinia quaesita</i>	Rat Goraka	T	E		VU	+	+	
Clusiaceae	<i>Garcinia spicata</i>	Ela Gokatu	T	N	NT		+	+	
Clusiaceae	<i>Garcinia terpnophylla</i>		T	E	EN		+	+	
Combretaceae	<i>Combretum albidum</i>	Kaduru Ketiya Wel	C	N	NT		+	+	
Cornaceae	<i>Alangium salviifolium</i>		S	N	NT		+	+	
Cycadaceae	<i>Cycas nathorstii</i>	Madu	T	N	VU	VU	+	+	
Ebenaceae	<i>Diospyros oocarpa</i>	Ela Thimbiri	T	N	NT		+	+	
Erythroxylaceae	<i>Erythroxylum zeylanicum</i>		S	E			+	+	
Euphorbiaceae	<i>Homonoia riparia</i>		S	N	NT		+		
Euphorbiaceae	<i>Mallotus resinousus</i>	Ma Endaru	T	E			+	+	

Family Name	Scientific Name	Common Name	HA	TS	NCS	GCS	Road		DP
							RF	RE	3
Fabaceae	<i>Derris parviflora</i>	Kala Wel	C	E			+	+	
Lamiaceae	<i>Vitex altissima</i>	Milla	T	N	NT		+	+	+
Lauraceae	<i>Alseodaphne semecarpifolia</i>	Wewarana	T	N	VU		+	+	
Malvaceae	<i>Pterygota thwaitesii</i>	Galnawa	T	E	VU		+	+	
Meliaceae	<i>Dysoxylum ficiforme</i>		T	N	NT	VU	+	+	
Myrtaceae	<i>Eugenia willdenowii</i>		T	E			+	+	
Pandanaceae	<i>Pandanus ceylanicus</i>	O Keyiya	S	E	VU		+		
Phyllanthaceae	<i>Cleistanthus pallidus</i>		T	E			+	+	
Phyllanthaceae	<i>Margaritaria indicus</i>	Karawu	T	N	VU		+	+	
Primulaceae	<i>Ardisia pauciflora</i>		S	N	NT		+	+	
Putranjivaceae	<i>Drypetes gardneri</i>	Gal Wira	T	E	NT		+	+	
Rutaceae	<i>Chloroxylon swietenia</i>	Buruta	T	N	VU	VU	+	+	+
Rutaceae	<i>Zanthoxylum rhetsa</i>	Katu Keena	T	N	EN			+	
Salicaceae	<i>Scolopia pusilla</i>	Katu Kenda	T	E			+	+	
Sapotaceae	<i>Madhuca longifolia</i>	Mi	T	N	NT		+	+	
Ulmaceae	<i>Holoptelea integrifolia</i>	Goda Kirilla	T	N	NT		+	+	+

Abbreviations: **HA** – Habitat, **T** – Tree, **S** – Shrub, **C** – Climber or Creeper, **TS** – Taxonomic Status, **E** – Endemic, **N** – Native, **NCS** – National Conservation Status, **GCS** – Global Conservation Status, **EN** – Endangered, **VU** – Vulnerable, **NT** – Near Threatened, **RF** – New Access Road (section ‘f’), **RE** – Existing Access Road (section ‘e’), **DP3** – Disposal Site 3

54. Two invasive alien plant species were found in the general area of road sections 'e' and 'f', and near DP3. These were *Panicum maximum* (Rata Tana), *Lantana camara* (Gandapana). They are listed, along with other invasive plants found along the UEC during this ecological survey work, in **Annex 2**.

55. Fauna species identified during the May 2017 survey are recorded in **Annex 3**. This shows that: 4 birds are either near-threatened or vulnerable (Black Eagle, Great Racket-Tailed Drongo, Sri Lanka Junglefowl, Crimson-Fronted Barblet); 4 dragonflies are either near-threatened or vulnerable (Adam's Gem, Shining Gossamerwing, Aggressive Riverhawk, Indigo Dropwing); 3 fish are either critically-endangered or vulnerable (Blotched Filamented Barb, Stone Sucker, Martenstyni's Barb); 2 mammals are endangered (Purple-faced Leaf Monkey, Elephant); and, 2 mammals are near-threatened (Barking deer, Pangolin). Four species are also considered to be endangered according to their Global Conservation Status. Almost all of these 'species of concern' are evident in the forest habitat surrounding road section 'f'.

3.3 Upper Elahera Canal: UEC-ICB-2A

56. The extent of new design for ICB-2A was shown in **Figure 4**, **Figure 5**, and **Figure 6**. The ecological survey work undertaken in May 2017 focused on the design changes made to access roads and disposal sites at the southern portal of Tunnel 3 and the combined site of the northern portal of Tunnel 3/southern portal of Tunnel 4.

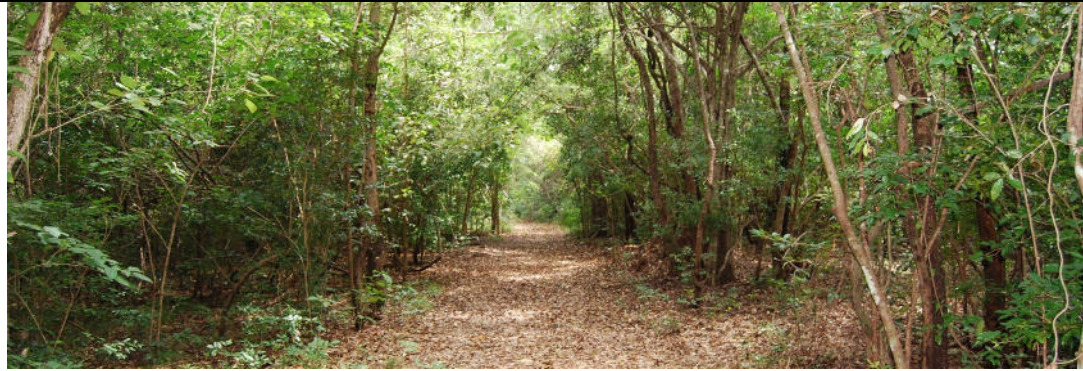
3.3.1 Tunnel 3 Southern Portal

3.3.1.1 Access Roads

57. **Figure 7** shows the current alignment of the 4.5km access road to the southern portal of Tunnel 3. The general route is the same as in the original design, but with some realignment and road improvement that may require widening. A portion of the road traverses Elahera – Giritale sanctuary.

58. Photos of the existing habitat types along the access road are shown in **Figure 10**. Habitats consist of forests, abandoned lands, streams and streamside vegetation, waterlogged areas, paddy lands, and scrublands. Seven endemic species of plants; two endangered species (Kotala Himbutu and Kaluwara); four nationally-vulnerable species; and ten nationally near-threatened plant species were observed during the May 2017 field visit. In addition, one plant species is considered to have a Global Conservation Status as "vulnerable".

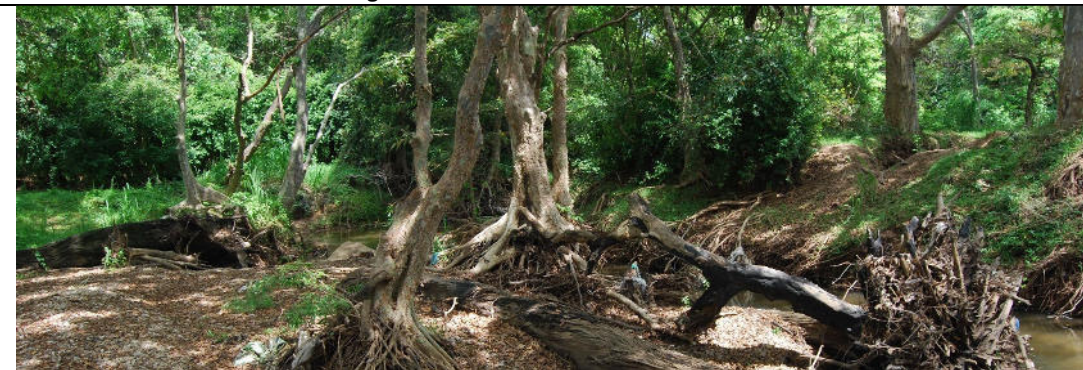
59. The flora survey results are shown in **Table 5**.



Existing Track within the Forest



Existing Track within the Abandoned Land section



Stream and Streamside Vegetation



Existing Track within the area of Scrublands

Figure 10: Existing Habitat/Vegetation Types; Road Section within the Sanctuary – to SPT3, DPS3 and DPS2

Table 5 : Conservation Status of Observed Plant Species

Family	Scientific Name	Common Name	HA	TS	NCS	GCS	RDS					
							FO	AB	RR	WA	PD	SC
Achariaceae	<i>Hydnocarpus venenata</i>	Makulu	T	E			+		+			
Annonaceae	<i>Xylopia nigricans</i>	Heen Kenda	T	E	NT		+					
Asteraceae	<i>Vernonia zeylanica</i>	Pupula	C	E			+					+
Celastraceae	<i>Salacia reticulate</i>	Kotala Himbutu	C	N	EN		+					
Clusiaceae	<i>Garcinia spicata</i>	Ela Gokatu	T	N	NT		+		+			
Combretaceae	<i>Combretum albidum</i>	Kaduru Ketiya Wel	C	N	NT		+		+	+		+
Cornaceae	<i>Alangium salviifolium</i>		S	N	NT		+					
Ebenaceae	<i>Diospyros affinis</i>	Eta Thimbiri	T	N	NT		+					
Ebenaceae	<i>Diospyros ebenum</i>	Kaluwara	T	N	EN		+					
Fabaceae	<i>Derris parviflora</i>	Kala Wel	C	E			+		+	+		+
Lamiaceae	<i>Vitex altissima</i>	Milla	T	N	NT		+		+			+
Lauraceae	<i>Alseodaphne semecarpifolia</i>	Wewarana	T	N	VU		+					+
Loganiaceae	<i>Strychnos nux-vomica</i>	Godakaduru	T	N	VU		+					+
Malvaceae	<i>Diplodiscus verrucosus</i>	Dik Wenna	T	E			+					+
Malvaceae	<i>Helicteres isora</i>	Lihiniya	T	N	NT							+
Myrtaceae	<i>Eugenia willdenowii</i>		T	E			+					+
Putranjivaceae	<i>Drypetes gardneri</i>	Gal Wira	T	E	NT		+					
Rutaceae	<i>Chloroxylon swietenia</i>	Buruta	T	N	VU	VU	+					+
Sapotaceae	<i>Madhuca longifolia</i>	Mi	T	N	NT				+	+		
Sapotaceae	<i>Manilkara hexandra</i>	Palu	T	N	VU		+					+
Ulmaceae	<i>Holoptelea integrifolia</i>	Goda Kirilla	T	N	NT		+					+

Abbreviations: HA – Habitat, T – Tree, S – Shrub, C – Climber or Creeper, TS – Taxonomic Status, E – Endemic, N – Native, NCS – National Conservation Status, GCS – Global Conservation Status, EN – Endangered, VU – Vulnerable, NT – Near Threatened, RDS – Road Section within the Sanctuary, FO – Forests, AB – Abandoned Lands, RR – Streams and Streamside Vegetation, WA – Waterlogged Areas, PD – Paddy Lands, SC – Scrublands

60. *Panicum maximum* (Rata Tana), *Lantana camara* (Gandapana), *Mimosa invisa*, *Leucaena leucocephala* (Ipil Ipil) were the observed invasive alien plant species along the road route.

61. With regard to fauna, only one vulnerable bird and one endangered mammal (elephant) were observed along the route.

3.3.1.2 Disposal Sites

62. All three proposed disposal sites (DPS 1, 2, and 3) lie within the boundaries of the Elahera - Giritale sanctuary. Site DPS 3 lies entirely within an area of abandoned land. DPS 2 sits within an area of scrubland, and DPS 1 is partly within an abandoned borrow site and partly in secondary forest. Photos of existing habitat types are shown in **Figure 11**.



Figure 11 : Existing Habitat/Vegetation Types; Tunnel 3 Southern Portal Disposal Sites

63. Four endemic plant species, two nationally-vulnerable plant species, and two nationally near-threatened plant species were observed during the field visit (see **Table 6**). In addition, one plant species is considered to have a Global Conservation Status as “vulnerable”.

Table 6 : Conservation Status of Observed Plant Species

Family	Scientific Name	Common Name	HA	TS	NCS	GCS	DPS		
							1	2	3
Asteraceae	<i>Vernonia zeylanica</i>	Pupula	C	E				+	+
Fabaceae	<i>Derris parviflora</i>	Kala Wel	C	E			+	+	
Lamiaceae	<i>Vitex altissima</i>	Milli	T	N	NT		+	+	
Loganiaceae	<i>Strychnos nux-vomica</i>	Godakaduru	T	N	VU		+	+	
Malvaceae	<i>Diplodiscus verrucosus</i>	Dik Wenna	T	E			+	+	
Myrtaceae	<i>Eugenia willdenowii</i>		T	E				+	
Rutaceae	<i>Chloroxylon swietenia</i>	Buruta	T	N	VU	VU	+	+	
Ulmaceae	<i>Holoptelea integrifolia</i>	Goda Kirilla	T	N	NT		+	+	

Abbreviations: HA – Habit, T – Tree, S – Shrub, C – Climber or Creeper, TS – Taxonomic Status, E – Endemic, N – Native, NCS – National Conservation Status, EN – Endangered, VU – Vulnerable, NT – Near Threatened, DPS – Disposal Sites 1, 2, 3

64. *Panicum maximum* (Rata Tana), *Lantana camara* (Gandapana), and *Mimosa invisa* were observed invasive alien plant species in the area.

3.3.2 Tunnel 3 Northern Portal/Tunnel 4 Southern Portal

65. The design changes proposed around the combined northern portal of Tunnel 3 and southern portal of Tunnel 4 are shown in Figure 6. Ecological survey work was undertaken in the vicinity of the main camp, northern start shaft (for Tunnel 4), the disposal sites (DPN 1, and 2) and the road section that links these. Separate ecological survey work was undertaken on disposal site DPN 3.

66. Of the three proposed disposal sites, DPN 1 and DPN 2, together with northern start shaft, are connected to each other. As the photos in Figure 12 indicate, the main habitat/vegetation type in this area is scrubland. The main camp is situated within seasonal agricultural land and DPN 3 is within abandoned land. Scrublands and seasonal agricultural lands are the main habitats/vegetation types beside the existing track.



Figure 12: Existing Habitat/Vegetation Types; Northern Disposal Sites, NSS, Main Camp, and Access Road Section

67. Five endemic plant species, five nationally-vulnerable plant species, and two nationally near-threatened plant species were observed during the field visit. In addition, one plant species is considered to be endangered according to its Global Conservation Status (see **Table 7**).

Table 7 : Conservation Status of Observed Plant Species

Family	Scientific Name	Common Name	H A	T S	NC S	G C S	R S	DPN			M C	NS S	VT S
								1	2	3			
Asteraceae	<i>Vernonia zeylanica</i>	Pupula	C	E			+	+	+		+	+	
Ebenaceae	<i>Diospyros nummulariifolia</i>		T	E		EN			+				
Fabaceae	<i>Derris parviflora</i>	Kala Wel	C	E			+	+	+		+	+	+
Lamiaceae	<i>Vitex altissima</i>	Milla	T	N	NT			+	+		+	+	
Lauraceae	<i>Alseodaphne semecarpifolia</i>	Wewarana	T	N	VU				+				
Loganiaceae	<i>Strychnos nux-vomica</i>	Godakaduru	T	N	VU			+	+		+	+	
Loganiaceae	<i>Strychnos potatorum</i>	Ingin	T	N	VU								+
Malvaceae	<i>Diplodiscus verrucosus</i>	Dik Wenna	T	E				+	+		+	+	+
Malvaceae	<i>Helicteres isora</i>	Lihiniya	T	N	NT								+
Myrtaceae	<i>Eugenia willdenowii</i>		T	E				+	+		+	+	+
Rubiaceae	<i>Psilanthus wightianus</i>		S	N	VU								+
Rutaceae	<i>Chloroxylon swietenia</i>	Buruta	T	N	VU			+	+		+	+	

Abbreviations: HA – Habit, T – Tree, S – Shrub, C – Climber or Creeper, TS – Taxonomic Status, E – Endemic, N – Native, NCS – National Conservation Status, EN – Endangered, VU – Vulnerable, NT – Near Threatened, RS – Access Road to DPN1, DPN2, NSS, MC, DPN – Disposal Sites, MC – Main Camp, NSS – Northern Start Shaft, VTS –

68. *Panicum maximum* (Rata Tana), *Lantana camara* (Gandapana), and *Leucaena leucocephala* (Ipil Ipil) were observed invasive alien plant species in the area.

69. Only one vulnerable bird was observed in the study area.

3.4 Analysis of Project Impacts on the Critical Habitats and Species

70. The EIA carried out for the UEC including KMTC has done a further analysis of the project impacts on the nationally and globally threatened or the listed species, and this is a supplementary assessment for the project areas where the design changes are proposed and are not covered in the EIA study.

71. The rapid environmental screening carried out in the project area subjected to the design changes with respect to Tranche 1 and 2, described in the previous sections of this chapter identified that the project activities would cause some impacts on the “Natural habitats”⁷ and “Critical habitats”⁸ associated

⁷ Land and water areas where the biological communities are formed largely by native plant and animal species, and where human activity has not essentially modified the area’s primary ecological functions (ADB SPS – 2009)

⁸ Critical habitat includes areas with high biodiversity value, including habitat required for the survival of critically endangered or endangered species; areas having special significance for endemic or restricted-range species; sites that are critical for the survival of migratory species; Critical habitats include those areas either legally protected or officially proposed for protection.

with the proposed access road (section “f”) under the KMTC (UEC ICB 2B) describe under the section 3.2 and the area identified for the southern portal of Tunnel 3 proposed under UEC ICB 2A package.

72. Southern portal of Tunnel 3 proposed under UEC ICB 2A is within the protected areas under the Department of Wildlife Conservation (DWC) and proposed access road (section “f”) under the KMTC (UEC ICB 2B) is in an area belongs to the Forest Department. Further, the trace identified for the road section “f” is within the Moragahakanda reservoir reservation area, which is proposed for a protected area⁹ under DWC and FD, as per the Moragahakanda EIA conditional approval made by the former Ministry of Agriculture, forestry, food and cooperative development (Ref. 3/1/1/950 dated as 26.10.2001).

73. Considering ecological significance of the area, both the areas encountered some critical species (Endemic, Nationally Threatened, Nationally Near Threatened and Globally Threatened Fauna/Flora Species) which triggers the ADB safeguard requirements 1 (Environment) related to natural and critical habitats. However, this road section “f” is the only option to reach the tunnel portal, and considered by the project subjected to relevant approvals and stakeholder consultation. As per the CEA conditional approval issued for the EIA stated that any changes to the proposed UECP would follow concurrence from the relevant approving agency, and hence, the stakeholder consultation is done by the PIU-UECP for the new access and approval is granted by FD (**Annex 7-A**).

74. The areas identified in the Elahera Girithale sanctuary and the forest habitat associated with the Moragahakanda reservoir reservation (proposed protected area under Moragahakanda EIA) for the new access road section “f” are the key concern for the impacts on the natural and critical habitats due to the project activities. Moreover, the access road area located in the Moragahakanda reservation has become a vulnerable habitat for the elephants and other small mammals those who isolated due to Moragahakanda inundation. Hence, it is suggested to carry out a detail ecological survey prior to land clearance for the proposed access road, and implement the management measures combined with the Wildlife Management Plan prepared by IUCN for the project affected area. It is recommended that out of the identified 9 critical fauna species (5 Endangered, 3 Critically Endangered and 1 Near Threatened as explained in Table 9), the less mobile species of 2 Fish species, 3 land snail species to be translocated under a proper translocation and monitoring plan to a suitable habitat. The identified Flora species are not point endemic or restricted range species, and hence the reforestation using similar species would be the most realistic mitigation measure to compensate the loss of species.

75. The list of recorded fauna and flora species in the respective sites based on their conservation and taxonomic status are given in the previous sections of this chapter 3, and the recorded threatened /critical flora and fauna species that are identified as endangered (EN), critically endangered (CR), near threatened (NT) or vulnerable (VU) are summarized in the **Table 8** and **Table 9** identified as per the National Red List (2012) and IUCN Global Red list.

Table 8: Critical Flora Species Recorded in the Project Area of Concern

Family	Scientific Name	Common Name	HA	TS	NCS	GCS
Ebenaceae	<i>Diospyros ebenum</i>	Kaluwara	T	N	EN	DD
Ebenaceae	<i>Diospyros nummulariifolia</i>		T	E		EN

⁹ It is mentioned in the Moragahakanda EIA conditional approval issued by former Ministry of Agriculture, Forestry, Food and Cooperative Development, Section 5.2 : Necessary steps should be taken to declare Moragahakanda catchment and area surrounding the reservoir as protected area to preserve habitat, taking into consideration the area lost due to dam construction become a new protected area. And in the JICA Moragahakanda Preparatory Study (2010), the status of above condition is updated as Agreed by the MASL. Details being developed in concert with the Department of Wildlife Conservation. Expected to be Nature Reserve initially and then a National Park (Southern part is a Forest Reserve.)

**SUPPLEMENTARY INFORMATION RELATED TO
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Clusiaceae	<i>Garcinia terpnophylla</i>		T	E	EN	
Celastraceae	<i>Salacia oblonga</i>	Gal Himbutu	C	N	EN	VU
Celastraceae	<i>Salacia reticulata</i>	Kotala Himbutu	C	N	EN	
Rutaceae	<i>Zanthoxylum rhetsa</i>	Katu Keena	T	N	EN	

Abbreviations: HA – Habit, T – Tree, C – Climber or Creeper, TS – Taxonomic Status, E – Endemic, N – Native, NCS – National Conservation Status, GCS – Global Conservation Status, EN – Endangered, VU – Vulnerable, DD – Data Deficient

Table 9: Critical Fauna Species Recorded in the Project Area of Concern

Family	Scientific Name	English Name	TA	NCS	GCS
	Dragonflies				
Libellulidae	<i>Onychothemis tonkinensis</i>	Aggressive riverhawk	N	EN	
	Fishes				
Cyprinidae	<i>Dawkinsia srilankensis</i>	Blotched filamented barb	E	CR	
Cyprinidae	<i>Systomus martenstyni</i>	Martenstyni's barb	E	CR	EN
	Mammals				
Cercopithecidae	<i>Macaca sinica</i>	Sri Lanka toque monkey	E		EN
Cercopithecidae	<i>Semnopithecus vetulus</i>	Purple-faced leaf monkey	E	EN	
Elephantidae	<i>Elephas maximus</i>	Elephant	N	EN	EN
Manidae	<i>Manis crassicaudata</i>	Pangolin	N	NT	EN
	Land Snail				
Ariophantidae	<i>Euplecta layardi</i>		E	EN	
Cyclophoridae	<i>Micraulax coeloconus</i>		N	CR	
Glessulidae	<i>Glessula lankana</i>		E	EN	

Abbreviations: TS – Taxonomic Status, E – Endemic, N – Indigenous, NCS – National Conservation Status, GCS – Global Conservation Status, CR – Critically Endangered, EN – Endangered

3.4.1 Species distribution in Sri Lanka

76. **Distribution of critical flora:** The distribution of critical flora species¹⁰ were analysed based on the available literature and considering the personnel observations of the consultant Ecologist, and found that none of the species are either point endemic or restricted range species, but forest species that are considered as threatened species due to the increased both legal and illegal deforestation activities taking place throughout the country. **Table 10** summarize the distribution of recorded flora species in Sri Lanka and the relevant location denoted by National Conservation Review (NCR) location numbers are explained in the Annex 7.

¹⁰ The distribution of critical Flora species is described as per the National Conservation Review (NCR) (cited as IUCN & WCMC (1997), Designing an Optimum Protected Areas System for Sri Lanka's Natural Forests, Vol. 1 & 2. Forest Department, Ministry of Forestry and Environment, Battaramulla) and based on the personnel observation of the consultant Ecologist (T. N. Peries) during his ecological studies carried out for the past 15 years.

Table 10: Summary of the distribution of critical flora species in Sri Lanka

Species	Habitat	Distribution	NCR Locations	Personal Observation (other than listed)
<i>Diospyros ebenum</i>	Forests	Mainly in dry and intermediate zones	80/96/101/113/136/144/160/161/256/277/279/280/281/318/333/335/336/376/384/392/395/400/407/410/438/442/458/460/463/464/489/502/522/526/530/535/536/538/539/560/561/562/567/568/569/570 in NCR	
<i>Diospyros nummulariifolia</i>	Forests and Scrublands	Mainly in dry zone.	502 in NCR, Vavuniya District (Near Vavuniya road to Anuradhapura, Road Vavuniya to Madhu, Thunkai near Vavuniya), Batticaloa District (Kalmunai, Low sea dunes), Colombo District (Pamunugama in Negombo) as per Flora of Ceylon	Vavuniya District (Forests around Per Aru reservoir area,), Ampara District (on sand dunes at Komari, Sangamankanda, Potuvil, Shastrawela), Trincomalee District (Forest around Yan Oya near Gomarankadawala, Coastal forests in Kuchchaweli area, Kappalture, Sober Island), Anuradhapura District (Medagama near Horowupotana, Forests around Mahakanadarawa, Wahalkada and Padaviya Tanks), Mullativu & Kilinochchi District (Forests around Kalmadu Tank & Iranamadu Tank), Kilinochchi District (Ottusudan), Monaragala District (Kotiyagala)
<i>Garcinia terpnophylla</i>	Forests	Mainly in wet and intermediate zones	19/37/38/65/68/69/77/112/120/129/147/166/175/184/191/192/205/208/289/293/303/369/414/456/459	

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EIA UPDATED FOR TRANCHE 1 AND TRANCHE 2 COMPONENTS**

Species	Habitat	Distribution	NCR Locations	Personal Observation (other than listed)
			/486/505/506/509/547/549/551 in NCR	
<i>Salacia oblonga</i>	Forests	Mainly in dry and intermediate zone	82/96/144/280/281/318/335/336/376/395/400/401/407/410/442/458/460/463/464/489/522/536/537/560/562/567/568/569/570 in NCR	
<i>Salacia reticulata</i>	Forests	All zones	19/24/28/37/38/39/62/65/66/69/70/71/77/78/79/101/112/120/129/138/147/160/161/166/173/175/178/184/186/187/201/205/208/217/237/253/256/263/269/274/280/281/288/289/293/298/303/315/329/336/343/369/384/388/390/395/398/407/414/432/438/442/453/455/456/458/459/463/471/476/486/487/489/497/498/499/500/501/504/505/506/507/508/509/511/512/522/528/530/531/532/533/534/535/538/541/545/547/549/550/569/570 in NCR	
<i>Zanthoxylum rhetsa</i>	Forests	Mainly in intermediate zone	335/336/522/534 in NCR, Nalanda in Matale District, Wellawaya in Monaragala District as per Flora of Ceylon	Matale District (Forests around Kalu Ganga reservoir area, Forest around new Laggala-Pallegama city area, Knuckles Forest)

Note: The relevant location denoted by NCR location numbers are explained in the Annex 7

77. **Distribution of critical fauna:** The most recent publications on the key faunal taxonomic groups were referred to describe distribution of the recorded critical fauna species in the project area, and personnel observations also mentioned to validate the locations of some fauna groups to fill the data gaps.

78. The two critically endangered (02) fish species (**Figure 13**), *Dawkinsia srilankensis* (Blotched filamented barb) and *Systomus martenstyni* (Martenstyni's barb), recorded in the Kambarawa oya stream at the Northern portal of Tunnel 2 of KMTC are point endemic and restricted to the Knuckles forest range and Mahaweli basin. However, the many of the prime habitats of these two species is already disturbed by the Kaluganga and Moragahakanda projects, and the part of the stream is already within the Kaluganga inundation area. Hence the impact due to KMTC is less significant. However, prior to disturbance of the habitat during the construction of KMTC, it is recommended to translocate the species to another area to conserve the species.



	
<i>Systemus martenstyni</i> (Martenstyni's barb)	<i>Dawkinsia srilankensis</i> (Blotched filamented barb)

Figure 13: Plates of two critically endangered (02) fish species

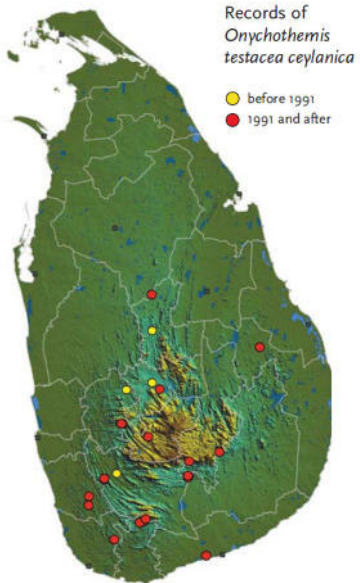
79. Among the other critical faunal species, land snail *Micraulax coeloconus* is the other critically endangered species recorded in the Elahera – Girithale sanctuary area at the site southern portal of Tunnel 3 proposed under UEC ICB 2A package. This species is mainly found in the dry zone forest area, but there are very limited research publications available about the distribution of this land snail species.

80. The summary of the distribution of recorded critical fauna species identified in addition to the EIA stage are given in the **Table 11**. The species distribution and the relevant details related to the 2 mammal species *Macaca sinica* (Sri Lanka toque monkey) and *Elephas maximus* (Elephant), is described under the section 3.2.6 (Para 339 and 340) of the EIA report prepared in June 2015.

81. The design changes are done almost within the study area subjected to EIA of UECP, and mitigatory measures proposed under EIA for this particular area shall be implemented. It indicates that the area identified for new access road section “f” supports a rich faunal diversity. There was evidence to indicate frequent animal movements within the project area, and hence detail study on to understand the species population density and number of trees to be fell shall be assessed prior to habitat disturbance by the contractor and species translocation programs shall be carried out for the threatened/Red list species.

82. As explained in the EIA report, the main risk of construction activities in this area is increased access to forested areas by humans during construction, and opening of formerly relatively undisturbed areas to humans leads to increased poaching, clearance of forest patches, setting fires, removal of timber, non-timber forest products such as medicinal plants, ornamental plants, stones, sand and gravel from stream beds, and introduction of alien invasive species etc. Therefore, strict monitoring is required over the above impacts and the area need to be restricted only for the construction and supervision staff.

Table 11: Summary of the distribution of critical fauna species

Species	Habitat	Distribution	Locations	Personal Observation (other than listed)	Note
Dragonflies					
<i>Onychothemis tonkinensis</i>	Moderately slow running, partly shaded streams and rivers with rich surrounding vegetation from the lowlands to the mid-hills.	Mainly in wet and intermediate zone.	 <p>Records of <i>Onychothemis testacea ceylanica</i></p> <p>● before 1991 ● 1991 and after</p>	-	-
Fishes					
<i>Dawkinsia srilankensis</i>	Prefers fast flowing streams and rivers with sandy substrate. Recently recorded from irrigation canals connected to the upper	Restricted to the Knuckles area.	<p>Pallegama, Meemure, Reverston, Gammaduwa, Raththota (De Silva et al., 2015).</p> <p>Also sighted in Elahera, Bakamuna, Hasalaka area (De Silva et al., 2015).</p>	Angamedilla	<p>Many prime habitats of <i>Dawkinsia srilankensis</i> destroyed due to ongoing Moragahakanda and Kalu Ganga reservoir projects.</p> <p>Although they have been recently sighted in the</p>

Species	Habitat	Distribution	Locations	Personal Observation (other than listed)	Note
	reaches of Kalu River.				outside of the Knuckles area (Elahera, Bakamuna, Hasalaka, Angamedilla) its prime habitats found in the Knuckles area.
<i>Systomus martenstyni</i>	Clear, well oxygenated mountain streams with sandy or rocky substrata in both shaded and open areas. Prefers areas with deep rock pools.	Restricted to the Knuckles area.	Sudugune, Pallegama, Puwak-pitiya, Meemure area (De Silva et al., 2015).		Many prime habitats of <i>Systomus martenstyni</i> destroyed due to ongoing Moragahakanda and Kalu Ganga reservoir projects.
Mammals					
<i>Macaca sinica</i>	Forests	All zones.	Species found in many areas in the country. Refer section 3.2.6 (Para 339) of the EIA for UECF report prepared in June 2015		They also associated with human habitations, visitor gathering (cultural sites) and roadsides. Sub species <i>Macaca sinica sinica</i> mainly found in the dry lowlands.
<i>Semnopithecus vetulus</i>	Forests	All zones.	Species found in many areas in the country.		Sub species <i>Semnopithecus vetulus philbricki</i> found in the northern dry and intermediate zone. Although they have preferred forests, they also found in home gardens

Species	Habitat	Distribution	Locations	Personal Observation (other than listed)	Note
					and tall plantations (Rubber).
<i>Elephas maximus</i>	Forests, Scrublands, Grasslands	Mainly in dry and intermediate zone.	Species found in many areas in the country.		Refer section 3.2.6 (Para 340) of the EIA for UECF report prepared in June 2015
<i>Manis crassicaudata</i>	Mix of forest habitats from dry thorn scrub to wet zone forests, where its main food termites and ants is found	Distributed upto the mid hills to about 1,050 m and distribution coincides with its main prey	They are of variable abundance in Sri Lanka, with few known locations in both wet and dry zones of the country where Pangolins are rather frequently encountered or regularly caught by locals. However, no records of the abundance and population numbers are available, and the species is rarely observed due to its secretive, solitary, and nocturnal habits. ¹¹		No reliable site, and can be observed during night safaris on roads through forests <i>Manis crassicaudata</i> is the least studied species of all Asiatic pangolin species and, is the solitary pangolin species recorded in Sri Lanka. Growing concerns over their population decline due to poaching and trading has triggered conservation status.
Land Snail					
<i>Euplecta layardi</i>	Forests	Mainly in dry zone.		Vavuniya District (Forests around Per Aru reservoir area), Puttalam District (Forests in Aruwakkalu limestone quarry area),	

¹¹ Perera et al. Pangolins (*Manis crassicaudata*) in Sri Lanka: A Review of Current Knowledge, Threats and Research Priorities Journal of Tropical Forestry and Environment Vol. 07, No. 01 (2017) 1-14

Species	Habitat	Distribution	Locations	Personal Observation (other than listed)	Note
				Batticaloa District (Forests in Thoppigala area)	
<i>Micraulax coeloconus</i>	Forests	Mainly in dry zone.		Vavuniya District (Forests around Per Aru reservoir area), Puttalam District (Forests in Aruwakkalu limestone quarry area), Batticaloa District (Forests in Thoppigala area)	
<i>Glessula lankana</i>	Forests	Mainly in dry zone.		Vavuniya District (Forests around Per Aru reservoir area), Batticaloa District (Forests in Thoppigala area)	

3.4.2 Habitat availability and relative importance in Sri Lanka

83. With the development boost, many forest lands are being cleared and the habitat availability for the faunal species has become an alarming status. Considering the identified critical species, the two-fish species and land snail species is critically endangered with respect to their conservation status a of National Red listing (2012).

84. The endemic species recorded among critical species are important as such species can be seen only in Sri Lanka. Fish species, *Dawkinsia srilankensis* (Blotched filamented barb), *Systomus martenstyni* (Martenstyni's barb) which is a point endemic to the Knuckles region and it is in imminent danger of going extinct due to loss of their prime habitats of shallow and clear streams affected by Moragahakanda reservoir development.

85. The loss and conversion of forest lands and other vegetative areas would affect the population and distribution of endemic and critical mammal species and other land snail species recorded in the project area.

3.4.3 Additional mitigatory measures to manage possible impacts to the species

86. As recommended in the original EIA and stipulates by the CEA approval (Ref. No. 2.1 of EIA approval No. 08/EIA/Water/04/2012 dated 31/03/2016), the task of preparing a "Wildlife Management Plan including Human Elephant Conflict Management Plan (WMP)" was given to IUCN as a one-year assignment from August 2016 following the National Procurement Procedure.

87. The draft WMP was submitted to PMU in August 2017 and is now being reviewed by the PMU in consultation with the following four stakeholder parties;

- Design consultants of the Project (i.e. PMDSC) together with the PIU officials,
- Key individual experts on wildlife management in the Country and Senior officials of relevant key government authorities (i.e. DWC, FD, CEA, ID, MASL, NLUPLD, NPPD etc.),
- Relevant officials of regional level offices of key government authorities (i.e. DS, AGD, DWC, FD, CEA, ID, MASL),
- The appointed Technical Review Committee (TRC), which comprises of nationally recognized subject specialists and Decision-making level officers from relevant Ministries and Authorities.

88. The draft WMP proposes mitigations under the following major sectors both on long term and short-term perspectives during construction as well as operational phases of the project;

- Improving the overall habitat availability for Wildlife,
- Mitigating direct negative impacts,
- Mitigation of human Elephant Conflict.

89. It is scheduled that the revised WMP incorporating TRC comments (which compiles all comment raised at other review consultations as well) to be submitted in mid-September 2017 and PMU accepted final WMP to be submitted to CEA for the formal approval at the last week of September 2017.

90. Nevertheless, the timely needed, prioritized mitigations (like critical species translocation/transplanting ahead of canal trace clearing) will be implemented by PMU/ PIU with specific approval and guidance of Wildlife or Forest Department as relevant. This was practiced for construction of the UEC-

ICB-1 package for which the separate approval was obtained from DWC (Annex 8-A) to implement the proposal made by IUCN for priority species translocation from UEC ICB 1 area prior to habitat clearing. Some funding has been allocated under Tranche 2 under environmental mitigation costs to undertake some of the recommendations of the WMP once approved. Remainder of actions will be funded by government and under Tranche 3 of the project.

91. The road section “f” requires clearing of forest area in the Moragahakanda reservation (proposed protected area under Moragahakanda EIA), which can lose a considerable amount of primary forest habitat, as well as the additional clearance of forest habitats and enabling access to the vehicles, workers would negatively affect the isolated animals (elephants and small mammals). Hence it is considering an alternative option or to manage with existing access by constructing bridges where necessary to access over the Kaluganga inundation area is the first priority.

92. In the design perspective, the proposed road section “f” seems to be the most possible access path, due to the inundation of proposed access during the EIA stage. Similarly, the consideration of alternative sites is not possible for the identified areas for tunnel portal under UEC ICB 2A, which is in the Elahera Girithale sanctuary area, and hence as guided in the Safe guard regulation 1 (Environment) of SPS (2009), para 30, it is required to consider these impacts in the preparation of Wildlife Management Plan (WMP) by MMED and implementing the propose mitigations simultaneously with the project activities.

93. Carrying out a detail biotic resource survey in the project impact area is required due to the lack of detailed ecological baseline data. Hence, a detail ecological survey to be carried out in the impacted and surrounding area including a population density study, and then to decide whether there is a significant impact on the distribution and population of the identified critical species due to project activities.

94. Identifying suitable alternative habitats for the critical species and habitat enrichment using native forest species, increase protected areas by combining such alternative habitats would be ideal to manage the population and distribution of threatened species.

95. For the less mobile species, depending on their population density and presence of alternative habitats, species translocation program to be done through a group of expertise including a long-term monitoring program to ensure its effectiveness.

4 ANTICIPATED ENVIRONMENTAL IMPACTS AND PROPOSED MITIGATION MEASURES

4.1 Introduction

96. In keeping with the approach taken so far in this EIA Addendum, this section points to the anticipated environmental impacts associated with the design changes outlined in Section 2, for each of the proposed Tranche 1 and Tranche 2 contract packages. As such, it draws on the ecological survey work presented in Section 3. Where impacts have been identified, and these have not been dealt with in the 2015 EIA, this section discusses appropriate mitigation measures.

97. Mitigation measures are presented for each construction package, and this section concludes with mitigation recommendations that are generally relevant for all components.

98. Detailed environmental management plans for each component dealt with in this Addendum (ICB-1, ICB-2A, and ICB-2B) are presented in the separate Volume 2, titled: “Addendum to the EIA for Upper Elahera Canal Project. Volume 2: Updated EMPs for Tranche 1 and Tranche 2 Components”.

4.2 Kalu Ganga – Moragahakanda Transfer Canal (KMTC): UEC-ICB-2B

99. Table 1 makes it clear that the main possible environmental concerns with design changes to ICB-2B are associated with access road section ‘f’, and with a new disposal site DP 3 (see Figure 2), where road section ‘f’ is situated within Forests Department land comes under the category of “other state forest” and DP3 site is located within an already acquired land by Mahaweli Authority under Moragahakanda Project. Considering existing land use of the proposed disposal site of DP3 which is an abandoned paddy and home garden, the environmental impact is very low. Proposed disposal site DP 3 was not included in the CEA approval of the 2015 EIA. This will be a 4.5ha permanent site, needed because it is not feasible to transport spoil from the northern tunnel portal along the winding access road. The site is currently mostly cleared, and is surrounded by habitat of less value than is the case for access road section “e” and “f”.

100. Clearing of approximately 1.6 ha will be required to enable the road to be constructed under section “f” of the access road. The forest quality is good through most of this section, and Section 3.2 indicates that there are a number of endangered, vulnerable, and near-threatened species of flora and fauna that use this forest as habitat.

101. The approval for clearing forest area to construct access road section “f” is granted by the Conservator Forest of Forest Department (Annex 8C) stating that Forest Department has no objection for the construction of road section shown as “f” on the given map subject to obtaining approval for “addendum to Environmental Impact Assessment” by CEA, since the proposed road section, which slightly deviate from the access road given in the original EIA due to practical reasons, is located within the same forest reserve that was studied and included in the approved EIA. The final designs for section ‘f’ requires to be finalized with consultation of Forest Department and CEA, and it would be intimately involved with the construction .

4.3 The relevant approvals granted by the respective stakeholder agency, for the design changes are described in detail under the Section 5 of this report. Upper Elahera Canal: UEC – ICB – 1 (Tranche 1)

102. The Central Environmental Authority’s approval letter for the 2015 EIA required the proponent to obtain fresh approval if the project was to be altered. Given that the deviation is still within the EIA study

area of 500m from the center line of the canal tranche, there is no requirement to undertake a separate environmental assessment. However, construction work in this area is on temporary hold until the CEA approves the deviation.

103. The deviated trace falls mainly within an area of Forest Department reserve, and a separate approval has already been provided by the Department in a letter dated April 20, 2017. Furthermore, IUCN has undertaken an ecological significance study along the deviated trace¹. IUCN's work has included translocation of significant species, as part of a wider study to prepare a Wildlife Management Plan that complies with one of the CEA's EIA approval conditions.

104. The significance of possible environmental impact along the deviated section is comparatively low. The deviation will result in reduced blasting activities. Anticipated impacts are common to the entire UEC-ICB-1 area, as the alignment is located within an ecologically sensitive area associated with the stream network of Welankatuwa stream. The revised updated EMP for UEC-ICB-1 addresses the general impacts and proposed mitigation measures. The EMP is presented in a separate Volume 2.

4.4 Upper Elahera Canal: UEC-ICB-2A

105. As indicated in Section 2.4, the design changes proposed for ICB-2A are relatively significant. The most significant is the decision for Tunnel 3 to change from entirely TBM (driven from the north), to a combination of TBM from the north and NATM drill-and-blast from the south. Another alteration has Tunnel 4 changing from cut-and-cover to NATM.

4.4.1 Tunnel 3 Southern Portal

106. The significance of the design change on Tunnel 3 is that an additional 48,000 m³ of muck will now need to be removed and disposed of. This has resulted in the need for three new disposal sites. As indicated in Figure 5, sites DPS 2 (5 ha) and DPS 3 (3 ha) will be temporary, and site DPS 1 (4.8 ha) will be permanent.

107. All three of the proposed new disposal sites, and almost the entire length of the proposed access road, are within the boundaries of the Elahera Giritala Sanctuary. This sanctuary is one of 61 managed by the Department of Wildlife Conservation. As defined by regulation, sanctuaries exist to ensure the protection of wildlife which is outside State land. They may therefore include private lands. Human activities are allowed within sanctuaries, and permits are not required for entry.

4.4.1.1 Access Road

108. In general, the route for the access road to the southern portal was approved as part of the 2015 EIA. However, a more detailed survey of the proposed route has since been undertaken, and this has included the ecological survey undertaken in May 2017.

109. The only stretches of the access road where widening and road improvement may require the removal of vegetation are length SA2/SA3, and length SA5/SA6 (**Figure 7**). SA2/3 runs through scrubland for approximately 1 km. Only minor localized realignments are required to avoid the worst stretches of track, and in some cases, there are two or more tracks running about potholes. It is unlikely that these realignments will result in anything other than minor clearing of scrubland.

110. Sections SA5/6 pass through approximately 2 km of forests and scrubland, all within the sanctuary. Habitats include a small number of species which are either endangered, vulnerable, or near-

¹ IUCN (2017), Priority Species Translocation from Package 01 Areas of UECP: Activity Completion Report. May 15th.

threatened. The road needs upgrading along this stretch, and can be realigned to avoid a number of large trees.

111. As part of mitigation and management, all work required on the 4.5 km of access road, and particularly on the 2 km of SA5/6 will be approved by the Department of Wildlife Conservation prior to the start of work. The Department will also be invited to review contractor environmental management plans.

112. The last part of the proposed access road traverses through a good forest patch that will require felling a considerable number of trees. If the road can be turned from the point marked in the Figure 14 (GPS N 070 54.244; E 0800 49.492) and thus traversing a degraded area, mostly scrubland, it is possible to save some trees and wildlife habitat.



Figure 1: Last 200 m of the proposed access to the Southern Portal of Tunnel 3 (SPT3)

4.4.1.2 Disposal Sites

113. Figure 7 shows the proposed positioning of the three new disposal sites (DPS 1, 2, 3). Collectively, these sites will sterilize 12.8 ha of land, although DPS 1 and DPS 2 will be temporary. DPS 1 will be a permanent disposal area, and will host a crusher plant. It sits on the southern edge of the Elahera Minneriya Yoda Ela. It is abandoned land, and was the site of an old quarry. On its northern edge, it is already naturally banded, although this aspect of the containment will need to be made completely secure, given its proximity to the river.

114. DPS 2 is a proposed 5 ha disposal site, immediately inside an eastern boundary of the sanctuary, and consisting mostly of scrubland. No significant flora species are evident, and the site will be returned to its existing state after completion of Tunnel 3 construction. Mitigatory measures need to be followed as per the updated EMP in Volume 2, and conditional approvals from DEA and DWC.

115. DPS 3 is a smaller temporary disposal site, sitting on the western edge of an area of paddy fields. It sits totally within an area of abandoned land, and does not contain flora of any special significance.

116. The area is associated with a good stream network and the bank of the main stream and water-logged area is close to the access to DPS3. Since the batching plant is to be installed here, precautions need to be taken to avoid waste water discharges to the natural stream network. Further, dust and sedimentation impacts could be significant during the construction stage, hence appropriate mitigation actions will need to be taken. These are outlined in the updated EMP presented in Volume 2.

4.4.2 Tunnel 3 Northern Portal/Tunnel 4 Southern Portal

117. The only aspect of the Tunnel 3 northern portal/Tunnel 4 southern portal design that was approved as part of the 2015 EIA is the office/construction camp at site A (see Figure 8). All other components, such as the northern start shaft main site; and the three disposal sites (DPN 1, 2, 3) are all part of the new design. Apart from site A and site D (accommodation and offices), the remaining components would be sited within Forest Department reserved land.

118. DPN 1 (3.54 ha) and DPN 2 (3.98 ha) currently consist of uncultivated scrubland. These disposal sites would be temporary. The smaller site DPN 3 (1.39 ha) is abandoned cleared land, occasionally used chena within an area of unreserved State land. It should be noted that at least some of the area currently proposed for disposal sites would not be required. It is probably that either of DPN 1, 2, or 3 could be considered to be backup. Given that all three disposal sites are within Forest Department land; the agency's approval would be required before construction begins.

119. There will be a need to constantly monitor groundwater levels during construction. As shown in the relevant Environmental Code of Practice in Annex 1, groundwater level monitoring has taken place on a 2-weekly basis since February 2017. At present, there are four boreholes and four dug wells near the northern portal of Tunnel 3 (between chainages 54+165 km and 55+085 km). Closer to the start of construction, extensive monitoring of groundwater levels will take place in a 500 m band along the center line, under an inventory sub-contract. An additional 14 boreholes with depths varying from 20 m to 53 m have been specified under the contract. Monitoring of water levels in these boreholes will commence early after the contract award.

4.5 Overall

120. Overall, the environmental implications of the proposed design changes since the 2015 EIA would appear to 'net negative', but with only minor significance.

121. As previously discussed, two of the design changes (lack of need for a spillway from Bogahawewa, and the change from cut-and-cover for Tunnel 4 to NATM) will result in positive environmental outcomes.

122. Where the environmental implications of design changes are negative, this is primarily because of the taking of extra land for construction, access, and spoil disposal. The 2015 EIA estimated that 160 ha of land would be 'sterilized' by UEC construction and operation. The new design changes outlined in this Addendum will require an extra 37.82 ha of land, although it should be stressed that not all of this will be vegetated, and a considerable portion will be returned to original or better condition after construction activities have ceased.

123.

124. Commitments made in the 2015 EIA to 'no net loss of biodiversity', resulted in a recommendation to reforest 500ha of land on the eastern side of the UEC, from chainage 60+700 to 65+200. Even when the extra land 'take' of 37.82 ha is added, and the total area of land sterilized by UEC raises from 160 ha to 197.82, the offset ratio is still high at 2.53.

125. Although the environmental implications of the design changes will likely not be significant, they will add incrementally to the overall cumulative impact of new water supply schemes in the Mahaweli. The issue of cumulative impact is dealt with at length in the Strategic Environmental Assessment for the North Central Province Canal Project.

5 STAKEHOLDER & PUBLIC CONSULTATION OVER THE DESIGN CHANGES

126. The stakeholder consultation is being made in national, regional and site level, over the design changes related to UEC Tranche 1 and Tranche 2 packages. The key government stakeholder agencies of CEA, DWC and FD have been consulted about the changes during the discussions held at the Head office of agencies, with the Divisional Directors of concern, and the national level awareness made about the key project components and design changes during the ADB Fact finding mission, Stakeholder meeting held on 7th June 2017. The agencies participated for key consultative sessions with the specific purpose and the conclusion arrived / outcome is given in the Table 12.

127. A separate national level stakeholder consultation session has been scheduled by MMDE for 29th September 2017, chaired by Secretary of MMDE with the participation of MMDE, FD, DWC, CEA, GSMB, NBRO, RDA, DS, CS, PMU, PIU and PMDSC.

128. In addition, the stakeholder consultation sessions and meetings with DWC and FD carried out by IUCN for the preparation of WMP for UECP, also addressed these design changes and management options over the anticipated impacts.

129. Table 12 summarize the consultative sessions undertaken related to the design changes discussed in this addendum for Tranche 1 and Tranche 2 packages of UECP. The photographic evidences available for some of the consultations are given in the Figure 14 and relevant consent letters already obtained from the regional level stakeholder agencies are given in the Annex 7.



Figure 14-1: Archeological Dept visit to UEC ICB 1 area (2017.01.26)



Figure 14-2: Field inspection by FD Kaluganga Tunnel area (2017.02.28)



Figure 14-3: Species Translocation program in UEC ICB 1 (2017.03.05-07)



Figure 14-4: FD official Visit to proposed access to KMTTC (2017.03.28)



Figure 14-4: FD official Visit to proposed access to KMTTC (Section "f") (2017.03.28)



Figure 14-5: Field visit with DWC and FD to identify the locations for tree planting (2017.07.18)



Figure 14-6: Field visit with DWC to the disposal area Kongketiyawa (2017.07.14)



Figure 14-8: Field visit with STC to the deviated canal trace (UEC ICB 1) (2017.07.19)

Figure 2: The photographic evidences available for some of the consultations

Table 12: Summary of Consultative Sessions Undertaken on the Design Changes of UECP that Appeared in the Addendum to EIA

Date	Location/ Purpose	Participants	Outcome/ Remarks
2017.01.26	Field inspection/ survey along the canal trace of ICB -1 including the deviated section	Department of Archaeology (Polonnaruwa District Office), PIU	Approval of Archaeological Dept. granted to commence the construction – ICB -1
2017.02.28	Field inspection/ survey at proposed tunnel infrastructure facility areas of KMTTC	FD (Naula & Laggala Pallegama range offices), PIU	Recommendation was granted to the DFO of Matale for releasing of lands as to the Project.
2017.03.05, 06 & 07	Ecological survey along deviated canal trace	DWC (Elehera, Bakamuna offices), IUCN, PIU	Priority fauna and flora species were identified & collected from canal trace fauna species release to similar habitats and flora species transferred to temporary plant nursery established at DWC, Elehera
2017.03.28	Poththatawela, Kaluganga; Field inspection/ discussion along new Access Road trace (c & f)	FD (Naula & Laggala Pallegama range offices), PIU	Approval for rehabilitation of access road to tunnel No. T2 granted by FD (Near Moragahakanda Reservoir)
2017.04.26	Moragahakanda-Kaluganga Link tunnel trace observation	FD (DFO office Matale, Naula & Laggala Pallegama range offices), PIU	Components related to construction of KMTTC Tunnel (Tunnel portal areas, Disposal sites, Accommodation sites etc.) observed by officials of FD. Recommendation of FD, Matale already sent to Head Office of FD.
2017.06.01	Konduruwawa; Field visit	FD (Polonnaruwa DFO office, Elahera range office), DWC (Elehera, Bakamuna offices), PIU	Attendance sheet attached. Officials of FD and DWC visited to observe the areas of tunnel components of the Tunnel 3 (T3) and Tunnel 4 (T4) to observe the trace including changes.
2017.07.14	Kongetiyawewa; Proposed disposal area inspection	DWC (Elehera, Bakamuna offices), PIU	Field visit with DWC who agreed to allocate this site as disposal site and recommended to DWC head office for releasing to Project.

**SUPPLEMENTARY INFORMATION RELATED TO INFRASTRUCTURE DESIGN CHANGES FOR THE UEC
VOLUME 1 : EIA UPDATED FOR TRANCHE 1 AND TRANCHE 2 COMPONENTS**

Date	Location/ Purpose	Participants	Outcome/ Remarks
2017.07.18	Identification of locations for reforestation/ enrichment tree planting-ICB-1 (within the Elahera-Girithale sanctuary along the canal trace including deviated sections)	DWC (Elehera, Bakamuna offices), FD (Polonaruwa DFO office), PIU	Attendance sheet attached. Proposal for tree planting activities were prepared considering the outcomes of discussion of DWC and FD.
2017.07.19	Field visit along the deviated canal trace	STC (Minneriya Office), PIU	Field visit were carried out with officials of STC, Minneriya in order to observe the trees which area situated deviated canal trace of ICB-1.
2017.08.09	Head Office of Forest Department; Presented overall design changes to key staff	FD (Divisional Heads in Colombo Office), PMU, PIU, PMDSC	FD officers agreed in principal for proposed revised trace and construction methodology.
2017.08.21	Head Office of DWC; Presented overall design changes & proposed mitigations in Wildlife Management Plan to key staff	DWC (Divisional Heads in Colombo Office), PMU, PIU, PMDSC	All parties agreed upon adoptable environmental/ wildlife impact mitigations in relation to the proposed deviations in trace with construction designs & methodology as well as
2017.09.07	MMDE; Present the design changes & current progress to key stakeholders	MMDE, FD, DWC, CEA, GSMB, NBRO, RDA, DS, CS, PMU, PIU, PMDSC	Scheduled to be held to obtain views/ concerns in relation to the current progress and future implementation of UECP in order to ensure smooth execution.

130. The overall comments raised at multiple stakeholder consultation sessions (enlisted in Table 12) upon each design change and the responsive actions adopted/ conclusions reached are briefed as follows;

a) Kalu Ganga – Moragahakanda Transfer Canal (KMTC): UEC-ICB-2B (Tranche 2)	Tunnel construction methodology	The Forest Department as the managing authority of the lands along canal trace proposed to keep provisions to execute additional boreholes to monitor water level fluctuations and potential ecological impacts from water ingress during construction as a precautionary measure. Accepting this proposal, the provisions are kept in the contract documents for additional borehole drilling & a monitoring regime.
	Changes to the access road to Northern portal of KMTC-Tunnel No. 2	<p>The sections “e” and “f” of the access road falls within “Naula” local authority area and under the “other state forests” category reserve of the Forest Department.</p> <p>The approval has been granted by the Divisional Forest Officer (DFO) Matale (Annex 8-B) to PIU for widening of the road section “e” (existing road shown in Figure 2).</p> <p>The consent of Forest Department has been granted (Annex 8-C) by the Conservator of Forests (Environment Conservation & Management) for construction of new road section “f” (shown in Figure 2).</p> <p>The local authority of “Naula” also has granted permission for the proposed rest of the road improvements associated with KMTC access (Annex 8-D).</p>
b) Upper Elahera Canal: UEC-ICB-1 (Tranche 1)		The approval of Wildlife Conservation Department, Forest Department and the Central Environmental Authority were granted for the proposed changes as respectively given in Annex 8-A, 8-E and Annex 8-F.
c) Upper Elahera Canal: UEC-ICB-2A (Tranche 2)		The difference here from the original EIA is the construction methodology and the canal trace of this section falls on protected areas managed by DWC and FD. These agencies have accepted in principle the proposed change in construction methodology and pointed out to keep provisions

		to execute additional boreholes to monitor water level fluctuations and potential ecological impacts from water ingress during construction as a precautionary measure. Accepting this proposal, the provisions are kept in the contract documents for additional borehole drilling & a monitoring regime.
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