

Environmental and Social Screening Report & Environment and Social Management Plan (ESMP)

Rehabilitation of Right Bank Main Canal of Walawe Reservoir

Integrated Watershed and Water Resources Management Project (IWWRMP)



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Irrigation Department, Ministry of Mahaweli Development and Environment

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1. Introduction

a. About the IWWRMP

Water availability is becoming more variable and uncertain and studies show that these trends are likely to exacerbate, and the wetter areas of the country would eventually become wetter and the drier areas drier. As a response, to the expected economic, social and environmental losses, the Government of Sri Lanka has developed The Sri Lanka Water Resources Management Project (IWWRMP). The systematic implementation of this project is expected to address and adapt to some of the adverse climate change impacts projected for the country. The project is designed around four components:

- Component 1: Watershed Management (USD 25 million).
- Component 2: Infrastructure Improvement (USD 129 million)
- Component 3: Strengthening Water Resources Management Institutions (US\$ 10 Million).
- Component 4: Contingent Emergency Response (US\$ 0.0 million)
- Component 5: Project Management (US\$ 6 million)

The aim of Component 2 is to enhance the safety and durability of hydraulic assets and support the rationalization of institutional arrangements for ensuring their safety and durability. This component is thus expected to finance the works, goods and consultancy services to rehabilitate headworks and downstream water resources infrastructure to enhance safety as well as related irrigation canal systems that require rehabilitation to improve their operational efficiency and durability.

Of the various sub-project (dams and canal systems) that have been proposed for rehabilitation under Component 2 of the Project, one of them includes the '**Rehabilitation of the Right Bank Main Canal of Udawalawe Reservoir**' with a project brief as follows:

Project title	Rehabilitation of Right Bank Main Canal of Udawalawe Reservoir
Project Proponent	Mahaweli Authority of Sri Lanka
Proposed start date	October 2019
Proposed completion date	4 years from project commencement
Estimated total cost	Rs 978 million

b. Project Description and Justification

Walawe is the largest river basin (2442 km²) in the southern part of Sri Lanka, spreading over four administrative districts. The river originates in the southern part of the central uplands at the altitude of 2395 MSL and travels 84.9 km southwards before it flows into the Indian Ocean near Ambalantota town (Fig.1).

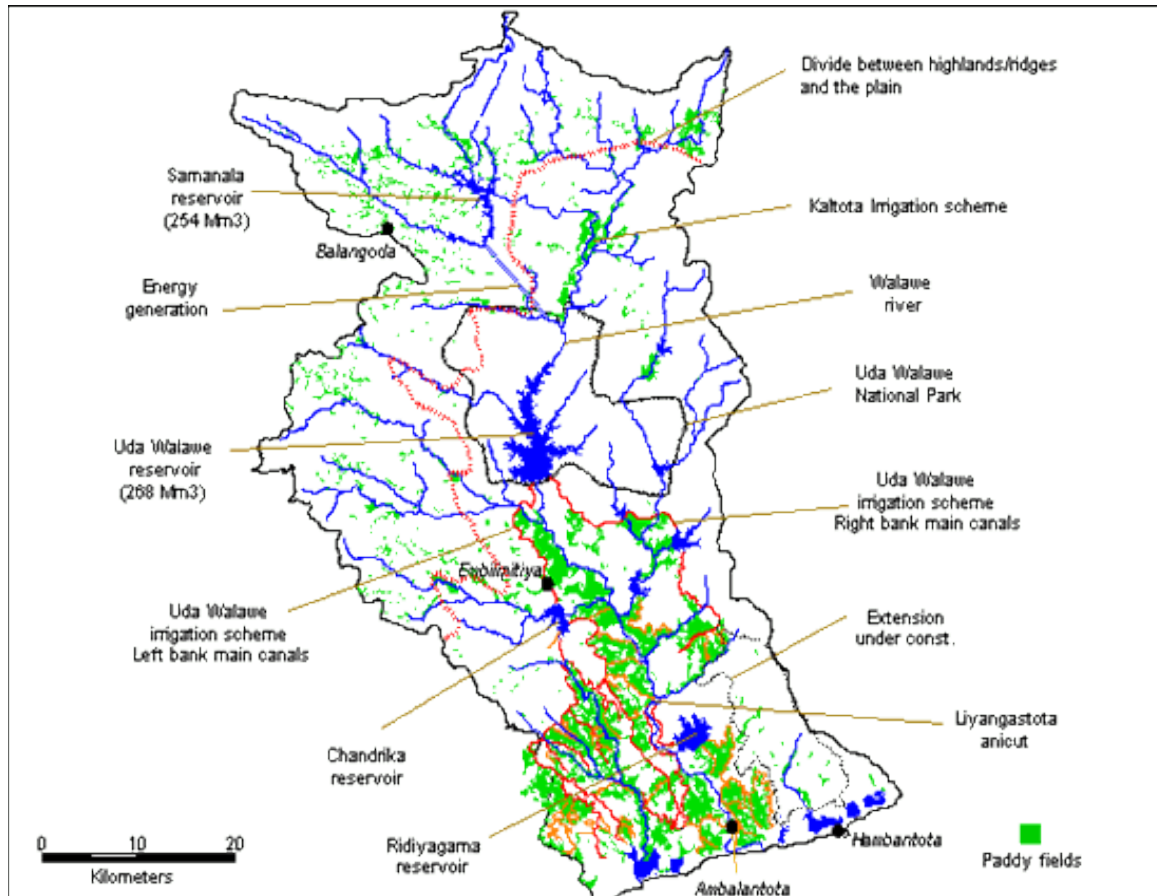


Figure 1: Walawe River Basin

Uda Walalwe Reservoir Data

Length of the Main Canal	51 KM
Command Area	12,000 Ha
Full supply level (FSL) of the reservoir	El.88.39 MSL
Catchments area	1175 Km ²
Water surface Area at FSL	3413 HA
Capacity at FSL	268.65 MCM
Dam type	Earth fill dam
Height of dam	Max. 36.57 m
Width of crest of spill	11.0 m

This project covers rehabilitation of the 51 KM long Right Bank Main Canal of the Udawalawe Reservoir
Canal Inventory of the Right Bank area

BLOCK	SERVED AREA (ha)	FIELD CANAL LENGTH (km)	DITRIBUTORY CANAL LENGTH (km)	BRANCH CANAL LENGTH (km)
Chandrikawewa	3379.260	168.544	50.058	19.240
Murawasihena	4402.810	239.029	75.664	28.290
Angunakolapelessa	3765.760	209.541	71.860	28.210
Total Area	11547.830	617.114	197.582	75.740

The Right Bank of the Uda Walawe is the largest irrigation project located in this river basin. About 40% of the catchment area is cultivated under irrigated agriculture and 20% under rain fed agriculture. Natural and planted forests constitute another 20% and the balance area is home gardens, wetlands and degraded lands. Irrigation development has been the major strategy for livelihood enhancement of the people in the basin. Two major reservoirs for irrigation and hydropower generation have been constructed on the main river. The two major reservoirs Samanalawewa (upstream, in 1993) and Udawalawe (middle reaches, in 1967) with a total capacity of 486 MCM, supply water for hydropower and irrigation schemes.

The main objective of the proposed project is to rehabilitate the 51 Km long Right Bank Main Canal of the Uda Walawe reservoir managed by Mahaweli Authority of Sri Lanka (MASL).

Rehabilitation interventions of the Main System focuses on the **following aspects;**

Design Consideration	Proposed Interventions
The geometry assumed in the original design of the canal Cross section is no more in existence as it has naturally transformed in to a stable parabolic shape.	<ul style="list-style-type: none"> Based on study of water profile behaviour using model software and physical survey of the present profile in the main canal, dredging and reshaping the main canal to design parameters will be carried out.
Adequacy of discharge from the outlet structures (based on the new water profile) to irrigate the maximum command area under each structure.	<ul style="list-style-type: none"> Rehabilitation of damaged structures and replacement with new structures.
Calculation of water requirement of each outlet structure assuming cultivation of paddy as it consumes the highest water duty.	<ul style="list-style-type: none"> Outlet pipes in certain structures that are inadequate will be modified to new design requirements. Each outlet will be hydraulically fine-tuned so that water issues from outlets from Main Canals can be measured in volume basis.

Design Consideration	Proposed Interventions
	<ul style="list-style-type: none"> • Display Boards will be fixed along the Main Canal at the head of each Distributary Canal as communication method to update the Farmers weekly about water consumption level. Fig 2 is a sample Display Boards fixed at calibrated outlet canal.
<p>Verification of cross canal structures for their performance and dimensions to ensure compatibility with canal discharge and required head for water delivery.</p>	<ul style="list-style-type: none"> • Structural modifications to cross canal structures.
<p>Rehabilitation of damaged major structures made out of rubble masonry.</p>	<ul style="list-style-type: none"> • As rehabilitation has to be carried out while water issues are on or during short off seasons, complete demolition of structure and rebuilding will not be feasible. Therefore, if the said structures are stable, such RR masonry walls will be fortified by covering lean RF concrete lining/curtain.
<p>Arresting leakage unlined canal sections.</p>	<ul style="list-style-type: none"> • Some canal sections will be lined where leakages through the bunds are observed as well as in sections close to structure where necessary.
<p>Arresting canal bank erosion throughout the entire canal.</p>	<ul style="list-style-type: none"> • Canal bank erosion has been observed as the major problem throughout entire canal. In addition to conventional methods it is proposed to introduce environmentally friendly bioengineered canal embankment strengthening (see annex 1). These solutions will be used in locations where physical preventive solutions such as retaining walls and lining are found to be unsustainable.
<p>Reinstatement of canal bunds and roads.</p>	<ul style="list-style-type: none"> • Sustainable solution will be detailed in the design criteria. Also special attention would be given to weak stretches of Canal Bund which cause flooding of settlement areas located downstream of the canal.
<p>Reinstatement of all hydro mechanical components including lifting devices of the structures which are malfunctioning.</p>	<ul style="list-style-type: none"> • Hydro mechanical components have to be repaired/or replaced either in full or parts as appropriate. • All the Head Managed radial gates and components have to be repainted as per standard specifications.
<p>Design specifications for downstream control gates will be provided if necessary to use in the future when BWA concept is applied in managing the Main Canal. Possibilities of gate automation will also have to be studied.</p>	

Table 1: Proposed interventions vis a viz the design criteria used



Figure 2: Display Boards fixed at calibrated outlet canal

All the above different hydraulic structural designs were based on the detailed engineering design criteria report prepared for different types of structures. (Reference: Chapter 1 of Volume 1 of the Feasibility Study for details of design including drawings)

Refer Annex 1 for detailed project interventions on the RBMC

c. Project Justification

Fifty years have passed since the completion of Uda Walawe Right Bank (RB) Project in 1967. Most of the structures now require rehabilitation. Though some rehabilitation took place in the 1980s focusing on selected areas, they were not properly implemented. Also, the design assumptions used in the original design were tailored to cropping patterns, soil fertility, land ownerships etc. at that time, which have now changed from original theoretical expectations. For example, the water requirement for irrigation in RB area is being gradually reduced due to increased water productivity as a result of crop diversification from rice to other crops. One of the main reasons behind this reduction of water duty is Banana cultivation introduced in the RB area since 1992. Though there is reduction in water consumption, the required flexibility in providing water to upland crops, at the right time in right quantity has not yet been achieved in RB area. Therefore, there is a need to consider this new management requirement in the design criteria which would then need to be adapted to structural rehabilitation. Also, most of the canals are in a state of disrepair and need to be rehabilitated structurally. This particular project addresses only the rehabilitation needs of the Main Canal. The balance rehabilitation work in downstream areas has been identified as its second phase.

The resilience of agriculture, to cope with climate change impact, is more critical for the project area as it has suffered from frequent droughts. Rationalization of water usage, selection of drought-resistant high-value crops, crop diversification, reforestation, and maintenance of local biodiversity are the measures that need early attention in rehabilitation. Based on already available data of similar rehabilitation projects such as the Mahaweli Restructuring and Rehabilitation Project (MRRP) in System H, benefits after irrigation rehabilitation has been estimated as follows.

- Increase of Water Productivity by 30%
- Increase of Farmer income by 36%
- Increase of Cropping intensity increased up to 165%

(Source: Various Publications indicated in Annexure 2 on MRRP after its completion in 2004).

It has to be noted that the main reason behind the above achievements is the management improvements introduced in parallel to hardware rehabilitation. Therefore, it is expected that similar management improvement measures will be implemented in Uda Walawe also based on lessons learnt from System H.

The proposed rehabilitation work in the Uda Walawe RB canal will also accrue benefits other than Irrigation. There are multiple users having water rights from the Uda Walawe Reservoir which is the main water source for the Right Bank Canal. They include;

- Irrigation Department
- Mahaweli Authority
- Agrarian Service Department
- Water Supply and Drainage Board
- Electricity Board (Non Consumptive User)

Both water towers delivering water to the right and left bank main canals are equipped with turbines and electricity is generated as a byproduct of irrigation water release. These turbines produce an average of 15 GWh per year. Also, there is an agreement between the Ceylon Electricity Board (who uses Samanala Wewa as their water source for electricity generation) and other agencies such as Mahaweli Authority and Irrigation Department who uses water for irrigated agriculture that priority will be given to agriculture in situations of water scarcity. The RB canal also provides water to several Aquatic Fish Breeding Centres. Refer (Annex 2 for mapping of stakeholders using the RB canal for water supplies.)

There is also a request from the National Water Board to allocate 5% of the annual water quota presently allocated for irrigation for drinking water supply. Calculations indicate that the annual requirement for drinking water is 80,000 Cubic Meters. The preferred source for drinking water supply by the National Water Board is the Chandrika Wewa where the water is less polluted with agricultural waste (in comparison to other downstream tanks). In addition to the above traditional stakeholders, new demand would be created with the development activities in Hambontota Area. Therefore, rehabilitation of Irrigation System under Right Bank area is a must to save water as it is the major stakeholder using water.

d. Land ownership

Main canal and its reservations are owned by Mahaweli Authority of Sri Lanka (MASL). Irrigable lands other than reservations allocated for downstream canal network and natural stream reservations are owned by farmers. Marking of canal reservation using land marks and live fences is expected to be carried out in parallel to rehabilitation work. The field observations and consultations indicate that there are no squatters. However, if any squatters are identified during the implementation that will be affected due to live fences, the project will follow the RPF and prepare Resettlement Action Plans (RAP) to pay compensation for structures and loss of crop to the squatters.

Burrow site and gravel sites needed to source construction material has not been yet identified. It would be the responsibility of the contractor to source these sites and seek necessary approvals from the relevant authorities as well as implement safeguard measures in opening and closing such sites.

e. Alternatives

The proposed project is a project to rehabilitate the RB canal of the Walawe Irrigation scheme. The canal trace is already defined, and the infrastructure is already in place. The proposed rehabilitation work aims to fix critical problems within the scheme and to hydraulically fine tune existing water delivery structures to suit current and emerging water consumption needs through certain physical improvements. Hence, there is no alternative to the project and the proposal rehabilitation work must be carried out in order to maintain infrastructure as well as to gain enhanced irrigation and other water use efficiencies.

With regard to canal conveyance improvement, performance alternatives have been considered for the RB main canal. For example, reducing friction by introducing concrete lining at selected stretches, modification of cross canal structures provided they are economically viable, etc and the most technically and economically viable options have been suggested.

Subject numerous limitations, addressing management needs of the system after rehabilitation has also been considered as one alternative under the proposed rehabilitation process. Bulk Water Allocation (BWA) strategy, as now being adapted in other Mahaweli Areas, has been proposed as the best option to meeting this challenging situation. In BWA approach, the main canal outlets to each distributary canal has been treated as the interface for sharing responsibilities between the already existing Distributary Canal Farmer Organizations and the Main Canal Management Staff.

f. Project Management Team

The project will be implemented through the Project Management Unit (PMU) under the supervision of the Mahaweli Authority.

See **Annex 3** for pictures on main issues of Walawe RB

g. Project Location

Project is located near Embilipitiya Town in the Hambantotoa District of Southern Province of Sri Lanka. Rehabilitation work is located in Embilipitiya, Angunakolapellassa and Ambalantota Divisional Secretariats in the Hambantota district, in the Southern Province of Sri Lanka.

See **Annex 4** for a close-up location map.

h. Project area of influence

The project area of influence will include the entire canal trace of 51Kms, canal reservations and material burrowing sites and haulage routes. The Project expects to carry out the proposed interventions during close/dry periods. However, in the event that a water draw-down in the canal becomes necessary to facilitate rehabilitation work, the command areas and villages that benefit from water in the canal will also become part of the direct impact zone. Once the project's implementation plan is finalized, expected by July 2019, the direct impact zone will be known. Once the direct zone is known, the project will follow the due diligence guidelines elaborated in the RPF prepared for the project, and accordingly prepare and implement resettlement action plans, livelihood support assistance packages, to account for land, livelihood and income loss.

i. Objectives of the ESSR and ESMP

The objective of the ESSR is to conduct environmental and social screening of the proposed project interventions, identify potential issues and public concerns and determine the level of environmental and social analysis the project warrants.

The aim of the Environmental and Social Management Plan (ESMP) for the Rehabilitation of Walawe RB canal is to have a site-specific and well-documented set of mitigation, monitoring and institutional actions to be taken before and during implementation of the project. These measures seek to address adverse environmental and social impacts, offset them or reduce them to acceptable levels. The ESMP has been developed in accordance with the Environment and Social Management Framework (ESMF) and the Resettlement Policy Framework (RPF) developed for the overall Integrated Watershed & Water Resources Management Project (IWWRMP).

2. Legal Framework and World Bank’s Safeguards Policies

This ESMP has been prepared in compliance with the national regulations as well as the World Bank’s safeguards policies and is in accordance with the ESMF and the RPF prepared for the overall IWWRMP.

a. National Laws, Regulations and Policies

The Constitution of the Democratic Socialist Republic of Sri Lanka under Chapter VI Directive Principles of State policy and Fundamental duties in section 27-14 and in section 28-f proclaim “The state shall protect, preserve and improve the environment for the benefit of the community”, “The duty and obligation of every person in Sri Lanka to protect nature and conserve its riches” thus showing the commitment by the state and obligations of the citizens.

The overall environmental and non-land related social concerns are addressed by the National Environmental Act No. 47 of 1980 (and subsequent amendments by act no 56 of 1988 and act no 53 of 2000). Besides, there are several other sectoral legislative enactments that are in place as elaborated in the ESMF prepared for the overall IWWRMP. Table 3 indicates the applicability of these legislations to the context of the Walawe RB Irrigation Rehabilitation project.

Table 3: Applicability of National Laws and Policies

	Permit/Clearance	Yes	No	TBD	Remarks
1	National Environmental (Amendment) Act, Certified on 18 th August, 2000			√	Clearance from Hambantota Regional Central Environmental Authority to implement the project shall be obtained. However, this will not come under prescribed projects category of the National Environmental Act and hence there is no need to carry out an EIA or IEE. However Environmental Protection License (EPL) from CEA /respective Divisional Secretariat for identifying waste dumping sites.
2	Soil Conservation (Amendment) Act No. 24 of 1996		√		As work sites are not located in vulnerable area declared by National Building Research Organization, it is not necessary to obtain clearance.
3	Coast Conservation Act No 57 of 1981.		√		Not relevant
4	Fauna and Flora (Amended) Act No 49 of 1993)		√		As per the Fauna and flora Protection (Amendment) Act, No.49 of 1993, there

					are no conservation sites located within DS divisions. Hence, clearance is not required.
5	Local Authority Act No.23 of 1992	√			Approval shall be obtained for new constructions. Local Authority/ Pradeshiya Sabha for waste collection and to issue machinery permits. Setting of the burrow pits.
6	Irrigation (Amendment) Act (No. 48 of 1968)	√			It has been received.
7	Mahaweli Authority of Sri Lanka Act 23 of 1979	√			It has been received.
8	Archaeological Ordinance No. 9 of 1940, Acts No.2 of 1955, No. 22 of 1955, No.2 of 1998 and No. 12 of 2005		√		The list of conservation sites along the DS division has been obtained. Project construction sites are not in close proximity to any archaeological site. However, Department of Archaeological, will be informed.
9	Agrarian Development Act No. 46 of 2000 (Section 32)			√	The encroached area is cultivated with paddy and converting such paddy lands to construct/ rehabilitate Main canal require written permission of Commissioner General of Agrarian Services Department.
10	Mines & Minerals Act No. 33 of 1992			√	Obtain from Geological Survey and Bureau an Industrial Mining License (IML). For operation of burrow pits and the rock extraction all site should obtain approval from GSMB
11	Felling of Trees Control Act No. 9 of 1951 as amended through Act No. 30 of 1953	√			Approval required from Divisional Secretariat followed by respective Grama Niladhari for removal of timber logs. These logs would have to be removed as per the requirement set forth by the DS and the Timber Cooperation.

b. World Bank's Safeguards Policies

Projects and programs funded by IBRD resources need to comply with and satisfy the requirements of the World Bank's operational policies, in addition to conformity with national regulations. The World Bank's safeguards policies triggered under the overall IWWRMP include: OP/BP/GP 4.01: Environmental

Assessment, OP/BP 4.04: Natural Habitats, OP/BP 4.36: Forests, OP/BP 4.11: Physical Cultural Resources, OP/BP 4.12: Involuntary Resettlement and OP/BP 4.37: Safety of Dams. However, not all these policies are applicable in the context of the 'Rehabilitation of Walawe RB' sub-project for the reasons provided in Table 3.

Table 4: Applicability of WB Safeguard Policies Triggered by the Project

Safeguard Policies Triggered by the Project	YES	NO	Explanation
Environmental Assessment (OP/BP/GP 4.01)	X		This policy is applicable because the project will support the rehabilitation of existing RB main canal and several irrigation structures along it which will involve earth works, civil works, burrowing for construction material etc and hence requires proper screening and impact mitigation.
Natural Habitats (OP/BP 4.04)	X		On a precautionary basis, the NH is considered applicable as sites selected for burrowing could impinge on natural habitats.
Forests OP/BP 4.36		X	The applicability of this policy is not relevant in this case as no forest resources are threatened as a result of the project.
Physical Cultural Resources (OP 4.11)		X	The applicability of this policy is not relevant in this case as no known PCR resources are threatened as a result of the project.
Involuntary Resettlement (OP/BP 4.12)	X		This policy is applicable as implementation may result in loss of livelihood and access to natural resources for a variety of stakeholders' dependent on the RB canal. Proposed marking and live fencing of canal reservation may lead to additional losses of income and access to natural resources.

Safety of Dams (OP/BP 4.37)	X		This policy is applicable as the safety of the RB canal depends on the safety of the Uda Walawe dam.
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In addition to applicable OP’s presented above, the World Bank Group’s General Environmental Health and Safety Guidelines, Guidelines on Managing the Risks of Adverse Impacts on Communities from Temporary Project Induced Labour Influx, and Good Practice Note on GBV for low risk projects, as recommended by the WB’s GBV task force, are also applicable for this project and will be followed when relevant.

3. Environmental and Social Characteristics

a. Physical Features

Topography and Terrain

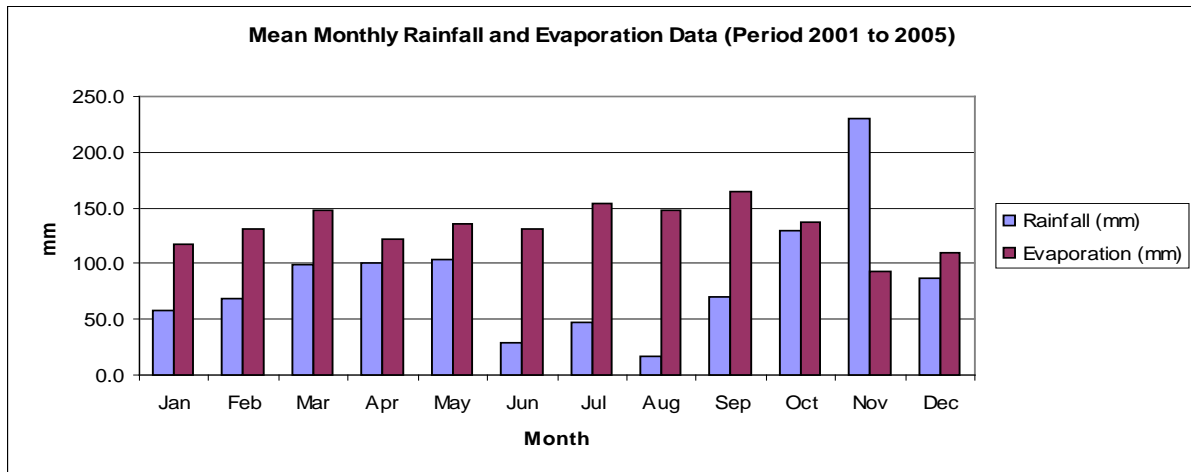
The Walawe river basin covers an area of approximately 3,000 km² and extends from the ridge of the central highlands of Sri Lanka, at an altitude of over 2,000 meters, down to the southern coast. The Uda Walawe Irrigation and Resettlement Project (UWIRP to which Walawe RB belongs to) is located in the lower part of the basin. This reservoir is built across the Walawe Ganga, which is the fifth largest river in Sri Lanka. The river is 136 Km long and has a catchment area of 1200 km². The Uda Walawe reservoir was constructed during the period 1963 –1967, as part of a plan to develop irrigation infrastructure in 32,000 ha of land in the dry zone of southern Sri Lanka (ADB 1969)¹. It is an earth fill dam, with a live storage capacity of 240 Million Cubic Meters (MCM). There are two main canals the Right Bank Main Canal (RBMC), and the Left Bank Main Canal (LBMC). The original plan was to develop 20,000 hectares of land for irrigation under the project(Nippon Koei 1996)². Command area was planned to irrigate with a network of canals based on 42 km long RBMC and 31 km long LBMC. See **Annex 5 for soil type and Annex 6** for hydrology of the area.

The Right Bank is divided into three Zones namely Zone 6, 7 & 8 and each Zone is sub divided into number of Management Units for easy post construction management purposes. The Project area (Zones 6 to 8 of System ‘B’) would cover development of 14,000 ha for irrigated agriculture and other social infrastructure.

Climate

Dry Monsoon forest climate with an annual rainfall of about 1520mm has mean day and night temperature of 29 and 24 degrees centigrade respectively. Variation of monthly rain falls within a year in the RB area is indicated in the following graph

¹ ADB. (1969). Appraisal of Walawe Development Project in Ceylon. Unpublished report, Asian Development Bank
² Nippon Koei (1996). Detailed design report on Walawe left bank Irrigation Upgrading and Extension Project, Nippon Koei Co. LTD., Japan, Tokyo.



Rainfall and Evaporation data in Udawalawe

Soil Type and Quality

According to the Sri Lankan Soil map in **Annex 5**, this area consists of “Reddish Brown Earth”. These residual soils form as a result of weathering of parent rocks and the well graded particles size distribution of these soils show good compactive properties. It is possible that soil erosion might occur at the construction sites where earth movement and excavations for foundations are expected. None of the canal reaches are located within vulnerable zones declared by National Building Research Organization.

Surface Water

The Uda Walawe reservoir and the main canals are the key surface water sources in the area. Approximately half the precipitation is transformed into runoff and the remainder is either used by vegetation or evaporates. Some of the runoff percolates into shallow groundwater aquifers located in the plains but aquifer levels fall quickly after the rainy season ends. Precipitation and aquifers feed the Walawe river, which has an average discharge to the sea of 1.1 billion cubic meters per year. The Uda Walawe reservoir is located in the middle of the basin and supplies water to downstream areas through two main canals known as the Right Bank Main Canal (RBMC) and the Left Bank Main Canal (LBMC).

Surface water uses in the area is mainly for irrigation of paddy and other crops like banana, papaw and other crops. Surface waters are also used freshwater fish breeding activities in the area, bathing and washing, drinking water and electricity generation.

Surface water quality varies. Drainage water contaminated with agro-chemicals is considered a possible source of water pollution. There is also a pollution threat from the drainage canal originating from the Embilipitiya town that is draining into the RB canal. However, proper water quality assessments are lacking and it is recommended that such is carried out for the safety and hygiene of various users.

Ground water

The main canal which is an unlined canal replenishes ground water along its 41 KM long route. People obtain water from shallow wells which is used primarily for drinking purposes. However, the water quality in the shallow wells are now questionable due to pollution from pesticides, fertilizers etc. Ground water levels closely follow the changes in canal water releases and according to recent studies canal seepage accounts for 74% of ground water recharge (Boelee and van der Hoek (2002)³). (Reference Economics and Politics of Water Resources – Uda Walawe Project Sri Lanka (IWMI Research⁴). About 15 water bodies around level crossings along the main canal also help replenish ground water in the area even when there is no water issue in the main canal. Current water quality analysis results of the drinking water wells selected within the proposed project area is not available.

Flooding

Since the Main Canal is located in upstream of flood prone areas in the landscape such as major streams, flooding is not a major issue. Historical flood data are not available in the area. However, flashfloods occur near the Rakwana River Crossing (at the 4km mark) and each year there are about 2-3 deaths when crossing. This is because the crossing is a causeway bridge. Therefore there is a request from the local community for a raised bridge.

Air quality

Since the project is located in a rural area, air quality is deemed to be within the limits of National Ambient Air Quality Standards. Similarly, noise levels commensurate with rural activity in the area.

b. Ecological Features

Vegetation

Vegetation of the inside of the canal embankment is limited to shrubs and herbs but the roadside vegetation beside the canal is quite lush with some tree species. Trees such as Palu, Weera Burutha, Milla, Nedun, Godakirala, Damminna, Heelamba, Karanda, Kumbuk, Midella, Ahetu, Ma-dan, .Bulu, Halmilla, Gammalu, Nika, Etteriya, Karamba, Ehela and divul among others formed the natural vegetation mainly limited to the home gardens, cultivated lands and the hedges of the boundaries. A fairly high vascular plant diversity was recorded for the areas studied (see **Annex 7** for full rapid biodiversity assessment report for locations and species tables) with 236 species. Only 4 endemic species were recorded and only 6 species identified have been classified as “threatened” in the IUCN Red List. See table below. Only *Croton caudatus* is considered endangered under the inventory and this too is now found quite abundantly.

³ Boelee, E.; van der Hoek, W. 2002. Impact of irrigation on drinking water availability in Sri Lanka. ICID-CIID 18th Congress on Irrigation and Drainage, 21-28 July, Montreal, Canada. Paper No. Q51/R5.7 (http://www.cancid.org/tech_papers.htm#IWMI). International Commission on Irrigation and Drainage

⁴ Molle, F., Renwick, M., 2005. Economics and politics and of water resources development: Uda Walawe Irrigation Project, Sri Lanka. . Research Report 87. International Water Management Institute (IWMI), Colombo, Sri Lanka

Species	Sinhala Name	Conservation status
<i>Cryptolepis dubia</i>	Val rukaththana	Vulnerable
<i>Strychnos potatorum</i>	Ihini	Vulnerable
<i>Corchorus olitorius</i>	Saani	Vulnerable
<i>Margaritaria indica</i>	Karavi	Vulnerable
<i>Chloroxylon swietania</i>	Burutha	Vulnerable
<i>Croton caudatus</i>	Val Kappetiya	Endangered

Aquatic macrophyte (plants) beds in the RBMC at the downstream of Chandrika reservoir are provided in the pictures below. Aquatic macrophytes play a crucial role in maintaining the integrity of aquatic ecosystems. Although reed beds hinder the canal flow, it provides good habitat for many avifauna and keeps the water quality in a good condition. Hence, a compromise has to be made when removing this vegetation.

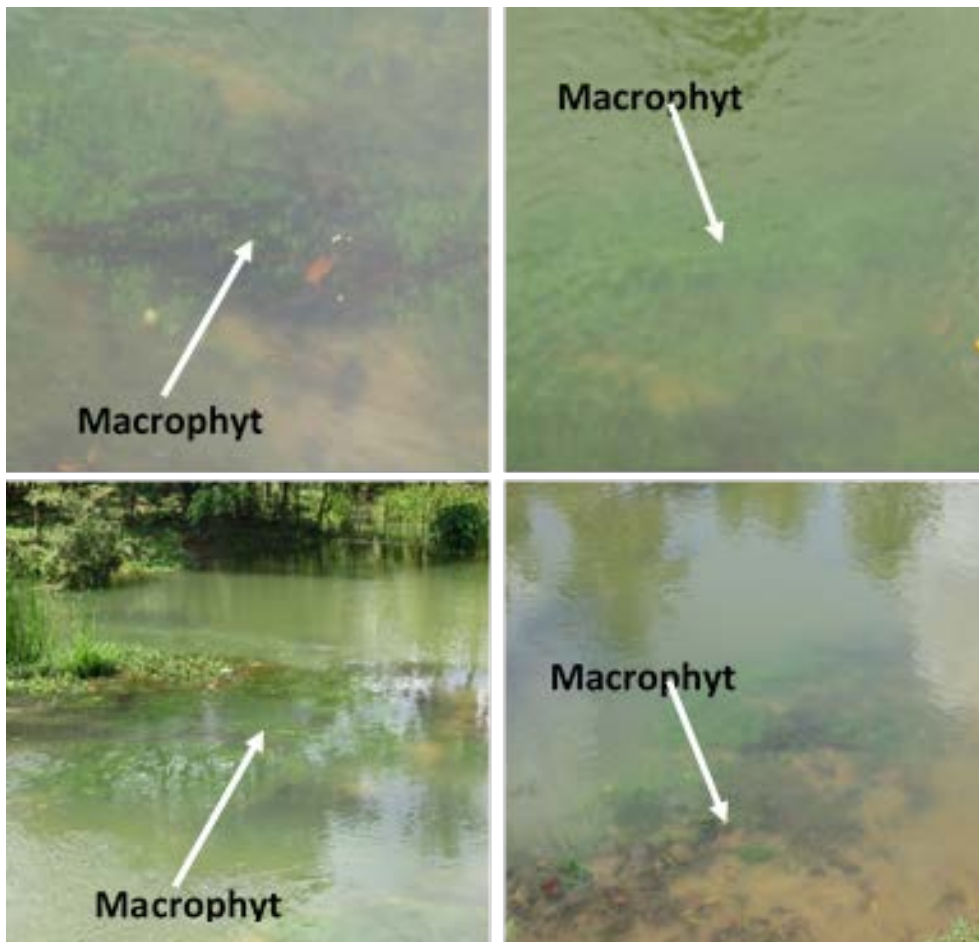


Figure 3. Macrophyte (aquatic plant) beds found in the RBMC

Mitigatory measures that could be adopted to improve the vegetation along the RBMC include:

Presence of wetlands

RBMC is a lotic ecosystem (flowing water system) that maintain connectivity between the upstream and downstream. There is large number of village tanks and level crossings (isolated water bodies – around 10) located along the RB main canal. There are 30 village tanks located within the downstream areas below the RBMC. In addition to storing water, those isolated tanks play the role of wetlands in the landscape. The RBMC consists of an array of microhabitats along the canal that supports a diverse group of fauna and flora. Under this context, the level crossings has a significant role to support biodiversity in this system, as there are associated freshwater wetland ecosystems. Wetlands are among the most important ecosystems on earth act as sources, sinks and transformers of multitude of chemical, biological and genetic materials. There are many wetlands closely link with the RBMC via level crossings and are depicted in the pictures below.



Figure 4. Wetlands associated with level crossings of the RBMC .It consist of an array of microhabitats along the canal that supports a diverse group of fauna and flora

Fish and wildlife habitats

Athukorala and Amarasinghe (2010)⁵ recorded 13 and 16 fish species at the landing sites of Uda Walawe and Chandrika Reservoir. Therefore, maintaining the connectivity along the RBMC is crucial to maintain the indigenous fish population in this system. Further, same authors observed freshwater eels (*Anguilla bicolor bicolor*) in the fish catch of Chandrika Reservoir. Eels are catadromous fish who migrate to marine environment for spawning and, juveniles return to the freshwaters to complete their life cycle. Rapid biodiversity assessment carried out showed fresh water fish diversity of this canal to be quite low compared to other natural streams and irrigation canals of the dry zone, probably due to the invasive nature of Mozambique Tilapia (*Oreochromis mossambicus*). This species is regularly introduced to the reservoir for harvesting. During the study (rapid and limited areas) only 13 species were recorded with all except one being native and one endemic species - *Dawkinsia singhala* (Sri Lanka Filamented Barb). None of the species are considered threatened. Full list of species is available in Annex 7. Eleven amphibian species were recorded with all being native and one endemic species *Polypedates cruciger* (common hourglass tree frog). Only one species *Duttaphrynus scaber* (Schneider's frog) is considered vulnerable. 16 reptile species were also recorded all of them having the least concern conservation status.

The presences of damselfly and different varieties of dragonfly indicates that the existing ecosystem is not severely polluted or contaminated. Dragon flies and damselflies composed a more diverse group with only 16 species but with 3 endemic species and the others being native. Five species fall within the threatened category (refer Annex 7 for names). 44 species of butterflies were recorded with all being native except for one introduced species. All were common species with low conservation status.

Refer Annex 7 for the Aquatic Resources Assessment Report

Birds

Out of the 70 species of avifauna recorded 03 species are migratory and arrive in Sri Lanka only during the North-South migratory period. None of these species are recognized as globally threatened migratory species thus they have a low conservation priority. Since the survey was carried out at the end of the migratory season, very few species were recorded here. However, the habitats in the area have reported that it is important for many migrants that use the site as a feeding ground as well as a roosting site.

⁵ Athukorala, D., Amarasinghe, U., 2010. Status of the fisheries in two reservoirs of the Walawe river basin, Sri Lanka: a case of participation of fishers in management. *Asian Fisheries Science* 23, 284-300



Aquatic fauna spotted at RBMC

Presence of special habitat areas

There are no special habitats within the proposed project area that are either designated as protected areas or identified as critical habitats⁶. The overall habitats have been considered as moderately rich in biodiversity but do not support and significantly threatened or endangered species of major concern. The study area is a part of a larger habitat complex that supports some apex species that occupies larger home ranges such as raptors like Grey-headed Fish-eagle, White-bellied Sea-eagle, Brahminy Kite and medium sized carnivorous mammals like the Fishing Cat. Although the adjacent Udawalawe national park bares many wild elephants, the project area has no impact by stray elephants unlike other similar areas in the country due to the well-maintained elephant fence at the park.

c. Socio-Economic Factors

RBMC serves a multitude of water requirements of different government agencies with direct outlets from the left bank side of the canal at different locations. These outlets feed: i) supplementary irrigation

⁶ A critical habitat is defined here as an protected area officially declared or proposed by the government, area initially recognized as protected by traditional local communities, a site that maintain conditions vital for the viability of these protected areas, area with known high suitability for bio-diversity conservation, a site that is critical for rare, vulnerable, migratory, or endangered species (according to the definition given in Worldbank Operational Policy 4.04 revised on April 2013).

requirements of Tract 5 (843 ha) of adjoining Muruthawela irrigation scheme maintained by the Irrigation Department (ID) through a long supply canal; ii) five outlets feeding several minor irrigation schemes adjoining the RBMC and are overseen by the Agrarian Services Department (ASD); iii) drinking and irrigation water requirements of the Sugar Cane Research Institute located adjoining the RBMC; and iv) drinking and inland fisheries water requirements of the Thilapia and Carf Fish Breeding Centers located adjoining the RBMC. In addition, the National Water Supply and Drainage Board (NWSDB) abstracts water from Uda Walawe and Uda Walawe reservoirs for drinking water supply. The RBMC serves non-consumptive water use by the Ceylon Electricity Board (CEB) at one of the micro-hydro plant installed in the RBMC. The table below shows the various stakeholders alongside the number of dependent HHs (where available) and the water requirement.

Table 5. Stakeholders and their water requirement from RBMC

Stakeholder	Water requirement (M ³ Per day)
Udawalawa Water Board	4,000
Thilapia Breeding Centre RB1/D2	350
Sugarcane Research Institute RB1/D3	1,000
Sugarcane Research Institute RB1/D4	1,000
Carf Breeding Centre RB1/D5A	14,000
Carf Breeding Centre RB1/D5B	2,400
Carf Breeding Centre RB1/D6	12,600
Embilipitiya Water Board	9,000
Suwadivi Community Water Project	700
Mahasen Community Water Project	1,800
Mahajandura Community Water Project (160 HHs)	70
Murawesihena Community Water Project (150 HHs)	60
Handunkatuwa Community Water Project (150 HHs)	90
Athbatuwa Community Water Project (150 HHs)	70
Mamadala Community Water Project (260 HHs)	130
Gamaralagama Community Water Project (40 HHs)	20
Dikwewa Community Water Project (250 HHs)	120
Water from Eraminiyaya Tank (Water Board)
Water from Kattakaduwa Tank (Water Board)

Land ownership and usage patterns

The legal ownership of the Walawe RBMC and the canal reservation lie with the MASL. The left bank canal bund road is used by the community as a main access road. Moreover, it is the O&M road for the canal. On the right bank side, several small and medium residential tourist hotels have flourished. Most of these hotels have direct drinking water supply by the NWSDB but some of these hotels abstract water directly from the RBMC using small water pumps.

Residential/Sensitive Areas

Places such as hospitals, school etc. are not situated within the project's immediate area of influence. This is a rural setting and people have to travel 4-5 km to reach these facilities. There are number of temporary bridges and bathing spots which have been introduced within last few decades along the RBMC in residential areas. Most of them do not have necessary safety arrangements or the width for even a tractor to cross.

Traditional economic and cultural activities

Paddy cultivation is the main traditional economic activity in the area. Uda Walawe contains a rich ancient history of irrigation that dates back about 2000 years to the days of the Ruhuna Kingdom, which is followed by a long period of abandonment. In the late nineteenth century, British colonialists initiated agricultural development activities in the basin, including irrigation. In the postcolonial period, the development of the Uda Walawe basin eventually became known as the Uda Walawe Irrigation and Resettlement Project (UWIRP). Udawalawe Right Bank has 11308 hectares of asweddumaised land for cultivation. Around 12,000 farmer families are beneficiaries.

Production and value of the output of RBMC Udawalawe

Crop cultivated	Area				Production				Value			
	2014 Ha	2015 Ha	2016 Ha	2017 Ha	2014 Mt	2015 Mt	2016 Mt	2017 Mt	2014 Rs.Min	2015 Rs.Min	2016 Rs.Min	2017 Rs.Min
Paddy	14,280	14,871	13,868	4,144	85,680	89,226	83,208	24,864	2,999	3,123	2,912	870
O.F.C	1,533	1,174	1,296	892	13,932	10,670	12,995	11,333	733	561	620	533
Fruits	5,018	5,065	5,007	5,146	92,945	93,816	93,175	1,08,363	3,264	3,295	3,271	3,805
Coconut & pepper	1,273	1,289	1,334	1,351	8,911	8,511	8,849	8,555	821	784	837	846
Other	15	73	67	67	79	382	288	623	3	13	10	22
Total	22,119	22,472	21,572	11,600	2,01,547	2,02,605	1,98,513	1,53,738	7,820	7,776	7,651	6,076

Sources – Resident Project Manager Office Mahaveli Authority Udawalawe

Traditionally, both men and women are involved in agriculture whilst the age-wise participation in agriculture shows the participation of the younger generation is less. This suggests some degree of internal migration out of the project area and the unwillingness of the younger generation to be engaged in the agriculture sector.

Archeological resources

Project area under consideration is not in close proximity to any archeological resources and is not in close proximity to any ancient village tank.

4. Environmental and Social Impacts

The social and environmental screening for the Walawe RBMC sub-project based on the administering of the Environmental and Social Screening Report and consultations with local communities and other relevant stakeholders indicate that all the potentially adverse effects associated with the project can be classified as construction related impacts and are mitigatable with known technology. Public concern does not warrant further assessment. Therefore, as per the ESMF prepared for the IWWRMP, a stand-alone Environmental and Social Assessment is not required, and an **Environmental and Social Management Plan** is considered sufficient to move forward. However, given the possible loss of income and access to natural resources during construction, a Livelihood Support Assistance (LSA) plan will be developed during the first year of implementation as these issues can only be realistically be identified while actual construction is in progress. Below is a summary of the key social and environmental impacts associated with the subproject with the results of the social and environment screening checklist provided in Table 7.

Loss of access to resources

The need to provide un-interrupted supply of water for the multiple agencies and communities mentioned above makes the MASL very difficult to keep the canal fully closed over prolonged periods during the rehabilitation/construction phase. The risk will be minimized with MASL's operational plan for fulfilling water supply obligations to those stakeholders.

Impacts on livelihoods

It will be a challenge for the MASL to undertake the rehabilitation works only during the limited time window of irrigation close/dry seasons within the three-year implementation period. The proposed arrangement is to carry out rehabilitation works during the close/dry seasons initially and once the contractors are fully mobilized, to close one cultivation season later to be able to complete the works.

The risk will be minimized by the development of a strategy and an action plan (referred to as LSA) for dealing with the foregone livelihoods, incomes, and water availability for drinking and other uses during the construction/rehabilitation phase and a budget to meet the related expenses.

Alteration of vegetation

Not many trees will be removed, however, 70ha of area will be cleared of vegetation including the cutting of overhanging tree branches of 100 trees. Further water weed clearance and root clearance will be carried out in 35 sqm for rehabilitation interventions. The risk is low with possible impacts potentially not significant.

Areas involving embankment stabilization will involve bioengineering methods where trees will be grown along the canal. This is a significant positive impact.

Burrowing for material

Burrow sites are yet to be identified. A few potential sites identified by the MASL are presented in **Annex 9**. All the borrow sites need sound managements to avoid or minimize pollution potential and best practices for managing sites should be adopted. All borrow areas will be accepted for material exploitation

only if proper approvals from the relevant authorities are obtained. Borrow site that could be potentially located in the tank bed must be utilized with extra precaution and with a proper rehabilitation and safety plan for the protection of fauna inhabiting the area. **A guideline for burrow site management is attached as part of the ESMP and must be adopted by the contractor with necessary changes.**

The risk is moderate with possible impacts potentially significantly negative.

Managing Soil Erosion

Soil erosion during the rehabilitation activity is expected with burrowing in the canal, removal of trees, stripping of topsoil, etc. This is likely to increase the turbidity of water and may impact downstream users.

Water turbidity will have to be monitored and soil erosion will have to be minimized by only removal of required vegetation and once removed, work is completed and the area quickly rehabilitated.

Risks and vulnerabilities to public safety

The risks and vulnerabilities to public due to construction activities can be expected at points of civil works undertaken. However, such risks are considered to be low since the construction activities only involve rehabilitation-related works.

The risk is moderate with possible impacts potentially not significant.

Temporary loss of access

The communities' request to replace a culvert cum causeway at 4 km 400m location with a new bridge, if taken onboard, is justifiable because the culvert restricts transport and mobility across the stream and causes deaths of about 3-4 persons annually during floods.

If elevated bridge construction is undertaken, it will disrupt a main public crossing point and this may be over an extended period of time.

The risk is moderate with possible impacts potentially not significant.

Impact at operational stage

Upon completion of the rehabilitation interventions, the outcomes are expected to be positive with increased water productivity which will benefit all the users and reduce soil erosion. Impact is significantly positive.

Table 7: Environmental and Social Screening Checklist

	Screening question	Yes	No	Significance of the effect	Remarks
Project Design					
a. General					
1	Will the sub project include any physical construction work?	√		Moderate	
2	Does the project include upgrading or rehabilitation of existing physical facilities?	√		Moderate	-DO-
b. Rehabilitation of dam head works and rip rap associated irrigation infrastructure					
3	Will improvements to tank bund including the headworks and rip rap structures require the water level in the reservoir to be artificially drawn down?		√		The project will not involve work on the tank bund and rip rap.
4(i)	If yes, can this lead to any alteration of water flows in surface as well as groundwater sources, especially in the dry season?		N/A		
4(ii)	Will the water draw down affect the ecology of the tank and other important wetlands that depend on the main lake and canal system to maintain water level?		N/A		There are about 15 water bodies called level crossing along the Main Canal in addition to regulating reservoirs such as Chandrika Wewa. Also there about 30 Village Tanks spread all over downstream areas below the main canal Those water bodies can store without depend on Main Canal issues. A minimum base flow to be maintained during the canal rehabilitation period

	Screening question	Yes	No	Significance of the effect	Remarks														
5	<p>Will repairs to irrigation canals require temporary suspension of water issuance in order to facilitate civil works? Can this lead to diminishing of other downstream water uses that can result in social issues such as community bathing, drinking water supplies, irrigation of home gardens etc.</p>		√		<p>Temporary suspension of water issuance is likely required at some intakes for civil works but at the moment this is yet to be fully confirmed.</p> <p>There are several uses of water from the RBMC (see annex 1) and temporary stoppage of water (due to interventions in the intake structures) is likely to affect the following key stakeholders who depend on water directly supplied from the RBMC.</p> <table border="1"> <thead> <tr> <th>Stakeholder</th> <th>Water demand</th> </tr> </thead> <tbody> <tr> <td>Tilapia Breeding Centre</td> <td>350 m3 a day</td> </tr> <tr> <td>Sugarcane Research Institute</td> <td>1000 m3 a day</td> </tr> <tr> <td>Carf Breeding Centre</td> <td>14,000 m3 a day</td> </tr> <tr> <td>Carf Breeding Centre</td> <td>2400 m3 a day</td> </tr> <tr> <td>Carf Breeding Centre</td> <td>12,600 m3 a day</td> </tr> <tr> <td>Paddy farmers receiving water from D9 – D 26 distribution canals</td> <td></td> </tr> </tbody> </table> <p>Water users downstream of Chandrike wewa will not be affected as there would be enough supply from the Chandrika wewa. Also, the Drinking Water Projects managed by Water Board will not be affected as water levels of Chandrika wewa will be maintained for a continuous supply.</p> <p>In addition, there are about 30 Village Tanks spread all over downstream areas below the main canal which will help replenish ground water aquifers providing water to dug wells, they also can</p>	Stakeholder	Water demand	Tilapia Breeding Centre	350 m3 a day	Sugarcane Research Institute	1000 m3 a day	Carf Breeding Centre	14,000 m3 a day	Carf Breeding Centre	2400 m3 a day	Carf Breeding Centre	12,600 m3 a day	Paddy farmers receiving water from D9 – D 26 distribution canals	
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Paddy farmers receiving water from D9 – D 26 distribution canals																			

	Screening question	Yes	No	Significance of the effect	Remarks
					<p>serve as temporary community bathing spots and supplying , irrigation water for home gardens.</p> <p>Walawe Right Canal is rich in biodiversity, there is a need to keep at least a base flow in this canal to support these biological communities. It was confirmed that 3 cumec of water will be maintained at a minimum.</p>
6	Will civil works lead to diminishing of other downstream water uses as a result of water quality impairment?	√		Moderate	Civil works involving reprofiling of the canal bed, embankment strengthening, rip-rap rearrangement, rehabilitation of water infrastructure etc is expected to impact on the water quality during the rehabilitation work with sediment runoff increasing. This may affect those using water downstream for bathing and other purposes.
7	Will there be changes to original design levels of the head works that will result in inundation of new land in the catchment		√		There will be no work carried out in the headworks.
8	Will the rehabilitated scheme serve new areas of paddy under its command?		√		No, the extent of paddy cultivation in the command area will remain the same.
c. Additional supplementary facilities					
9	Will there be construction of new irrigation or drainage canals or widening of existing canals?		√		<p>No, there will be no new irrigation or drainage canals or widening beyond original design parameters. Only canal reprofiling to original design levels will be made.</p> <p>However, construction of foot bridges, canal tractor crossing, reinforced concrete curtains bridge over canal is anticipated. The path is not defined and hence the exact ecological impacts are unknown however, it is not expected to be significant.</p>

	Screening question	Yes	No	Significance of the effect	Remarks
9(i)	If yes, will new/modified canal trace/alignments interfere with existing land uses (habitats, home gardens) in a negative way?		N/A		No
9(ii)	If yes, will the trace interfere with other sensitive infrastructure such as roads, pedestrian paths, schools and temples?		N/A		No
Project Construction					
10	Will construction and operation of the Project involve actions which will cause physical changes in the locality (topography, land use, changes in waterbodies, etc)		√		The project is a rehabilitation one where existing structures will be rehabilitated, and few new structures constructed. This rehabilitation including the installation of a water allocation monitoring will have a significant beneficial impact on the irrigation system and improve the overall efficiency and reduce water scarcity experience in the region. However, there will be no change topography, land use or changes to water bodies and their storage capacities.
11	Will construction of the project cause soil erosion within the site due to steep grade or soil content?	√		Moderate	Exposed areas of the canal and slopes are susceptible to erosion during construction. Removal of vegetation, stripping top soil, receiving new earth for embankment strengthening including disposal away from the site, excavation for new civil works (of 5000m m) ³ involving transport of suitable material to location, transport of spoil for disposal etc will increase the likelihood of soil erosion. In addition, rock excavation for canal embankment work including transport to location for use as construction materials, earth borrowing and haulage from borrow area will add on to the likelihood of erosion. However, the terrain is flat and if the construction work is under taken during the dry season the soil erosion can be controlled.

	Screening question	Yes	No	Significance of the effect	Remarks
					Operation of borrow pits would increase the chances of erosion of sides in borrow areas. Borrow pits need to be properly closed to avoid loss of topsoil, vegetation and habitat. Borrow material once brought to the site has to be unloaded and stockpiled carefully and away from the water body.
12	Will the Project involve dredging and disposal of dredge material as well as other solid wastes during construction?	√		Moderate	Desilting or dredging of the canal bed is not identified will be carried out especially in the water stagnant D/S area and unclear path of canal. Solid waste will be generated in during rehabilitation where old structures will be removed and replaced with new ones. Food items disposed by the laborer's at the construction site even in small quantities may attract stray animals and lead to pollution. Unless a waste management plan is in place for the disposal of the various types of waste generated the impact can be potentially significant.
13	Will the Project release pollutants or any hazardous, toxic or noxious substances to air?		√		There will be no hazardous, toxic or noxious substances released into the air, other than fumes emanated by a few construction vehicles. Further, construction activities that would produce airborne dust are temporary and limited to short durations and will be restricted to a small area.
14	Will the Project cause noise and vibration or release of light, heat energy or electromagnetic radiation?	√		Low	Noise and vibration are likely to be low due to the small-scale nature of construction activities. Noise generating activities

	Screening question	Yes	No	Significance of the effect	Remarks
					include material haulage and use of heavy machinery used in demolition and construction work. If a raised bridge is to be put up at the Rakwana river crossing, this will have a moderate impact as piling activities may have to be undertaken. This should be reviewed again if it is included in the project.
15	Will the Project lead to risks of contamination of land or water from releases of pollutants onto the ground or into surface waters, groundwater?	√		Low	Other than pollutants such as petroleum, oil and grease that can be released from construction vehicles and machinery, no other sources of pollution with the potential to cause land and water pollution are envisaged. Irrigation rehab projects generally do not have much waste water discharges (other than irrigation drainage) Sanitation units in labour camps can cause pollution if they are poorly sited, constructed and are leaking. But this risk can be mitigated with good planning and supervision. Servicing of construction vehicles, if occurs at the site, can also lead to release of pollutants.
16	Will the project cause localized flooding and poor drainage during construction? Is the project area located in a flooding location?		√		The project is not in a known flooding area. During construction obstruction of natural drainage path may lead to temporary flooding unless managed but this is highly unlikely to be an issue.
17	Are there any areas or features of high landscape or scenic value on or around the location which could be affected by construction activity?		√		No such location has been identified in the project area.

	Screening question	Yes	No	Significance of the effect	Remarks
18	Are there any other areas on or around the location which are important or sensitive for reasons of their ecology e.g. wetlands, watercourses or other waterbodies, the coastal zone, mountains, forests which could be affected by the project?	√		Low	The Right Bank Main Canal itself crosses about 10 level crossings along its route. Also there are about 30 village tanks located within the downstream areas below the RBMC. In addition to storing water, those isolated tanks play the role of wetlands in the landscape. These may be impacted temporarily with the project with soil erosion and potential reduced water flows.
19	Are there any areas on or around the location which are used by protected, important or sensitive species of fauna or flora e.g. for breeding, nesting, foraging, resting, migration, which could be affected by the project?	√		Moderate	There are important fruit trees, medicinal plants and fauna species in the project area including indigenous fish prevalent in the canal (Rapid assessment of RBMC). Impacts such as increased turbidity due to soil erosion may pose temporary impacts on these populations. The maintenance of minimum base flow will provide required habitats for endemic and indigenous species.
20	Will any part of the project's construction activities be located in a previously undeveloped area where there will be loss of greenfield land?		√		No. This is a rehabilitation project, hence no new areas will be opened up.
d. Land related impacts					
21	Will the sub-project require acquisition of land and or other assets?		√		Since this is a rehabilitation project of canal, no land acquisitions will be required. The lands available for stores and contractors site office in the form of reservations of irrigation system
22	Is land for material mobilization or transport for the civil work available within the identified work site / Right of way?		√		Site are located outside the work site. Rapid assessment preliminary survey was conducted on the availability of quarry sites for gravel and coarse aggregate in the area. Potential quarry sites are given in the annexes.
23	Is the site chosen for this work free from any encumbrances (e.g. squatters, encroachers)?	√			

	Screening question	Yes	No	Significance of the effect	Remarks
24(i)	If the land parcel is to be acquired, is the actual plot size and ownership status known? If so, how much?		N/A		
24(ii)	Will the affected land/structure owners likely to lose less than 10% of their land/structures area?		N/A		
24(iii)	If any land required for the work is privately owned, will this be purchased or obtained through voluntary donation?		N/A		
24(iv)	Are the land/structure owners willing to voluntarily donate the required land for this sub- project?		N/A		
25	Is the project likely to cause partially or fully damage to, or loss of housing, shops, or other resource use?		√		
26	Are there any routes or facilities on or around the location which are used by the public for access to recreation or other facilities, which could be affected by the project?		√		
e. Livelihoods Related Impacts					
27	Are there any non-titled people (squatters) who are living/ or doing business who may be partially or fully affected because of the civil works?		√		
28	Will there be damage to agricultural lands, standing crops, trees, etc.?	√		Moderate	There are 2 cultivation seasons in a year. Components which affects water levels from the Main Canal under rehabilitation will be attended to during canal closure periods in between the 2 cultivation seasons. It is planned that the base flow will be maintained in the canal to ensure water supply for environment and domestic consumption.

	Screening question	Yes	No	Significance of the effect	Remarks
					Any adverse impacts caused by decreases in water levels will be minimized by the development of a strategy and an action plan (referred to as LSA) for dealing with the foregone livelihoods, incomes, and water availability for drinking and other uses during the construction/rehabilitation phase. The plan will have adequate budget to meet the related expenses.
29	Will there be any permanent or temporary loss of income and livelihoods as a result of the civil works? If so, for what period?	√		Moderate	<p>The proposed arrangement is to carry out rehabilitation works during the close/dry seasons initially, and once the contractors are fully mobilized, to close one cultivation season later to be able to complete the works.</p> <p>The risks of decreases in water flows will be mitigated by the development of a strategy and an action plan (referred to as LSA) for dealing with the foregone livelihoods, incomes, and water availability for drinking and other uses during the construction/rehabilitation phase. Adequate budget will be earmarked to meet the related expenses.</p>
29(i)	Have these people/ businesses who may suffer temporary loss of incomes or livelihoods been surveyed and identified for payment of any financial assistance?		√		
29(ii)	Are there any vulnerable households affected?		√		
29(iii)	Will people permanently or temporarily lose access to facilities, services, or natural resources?		√		
f. Impacts on community resources, public services, cultural/historical sites, etc					
30	Are there any areas on or around the location which are densely populated or built-up, which could be affected by the project?		√		The project site is in a rural setting with sparse populations and spaced out dwellings with generally large homesteads.

	Screening question	Yes	No	Significance of the effect	Remarks
31	Are there any areas or features of historic or cultural importance on or around the location which could be affected by the project?		√		No such places are found within the project area.
32	Are there any areas on or around the location which are occupied by sensitive land uses e.g. hospitals, schools, places of worship, community facilities, which could be affected by the project		√		No such sensitive receptors in the zone of influence.
33	Are there any areas on or around the location which are already subject to pollution or environmental damage e.g. where existing legal environmental standards are exceeded, which could be affected by the project?		√		Not as per the information available and site observations. However, a drainage canal which originates from Embilipitiya town and empties into the upstream areas of the RBMC has been identified. However, water quality of the incoming drainage water and the impacts in the RBMC has not been yet investigated.
34	Will the project cause the removal of trees in the locality?		√		Site Clearance involve the clearance of vegetation in a total area along RBMC of 75ha. This will include cutting tree branches but does not identify removal of trees. However, there is no significant tree removal. This activity is expected to increase the tree cover along the bank.
35	Are there existing land uses or socio-economic activities on or around the location which could be affected by the project?	√		Moderate	There could be short term impacts on community in terms of bathing and accessing of water for drinking due to increased sedimentation during civil works and also due to the actual rehabilitation interventions in locations. These are expected to be temporary.
35(i)	Are there bathing spots that will be unusable during the construction period?	√		Low	The tank and its associated system is used for bathing. Bathing steps will be rehabilitated under this project thus will not be

	Screening question	Yes	No	Significance of the effect	Remarks
					usable during the civil works. Effect is considered low as there are alternative bathing locations that can be used during this period.
35(ii)	Is there subsistence fishing taking that will get disturbed due to canal rehabilitation		√		Canal is rarely used for fishing.
35(iii)	Are there any home gardening and other industrial, agricultural activities that will get disturbed due to construction activity				There is likely to be lowered water levels in the RBMC to facilitate rehabilitation work. This is yet to be fully determined, if so there will be impacts on agricultural activities including home gardening. As stated above, the key industrial activities are Tilapia breeding and Carp breeding which will get affected from water stoppage when rehabilitation of respective intake structures are done.
35(iv)	Are there drinking water supply sources located in the project area that may be rendered unusable during construction period?	√		Moderate	None of the rural and urban drinking water schemes that depend on the RBMC will be affected as all of them are located downstream of Chandrika Wewa which will buffer against any water shortages caused by rehabilitation work. However, there are about 40 wells in the vicinity of the RBMC which provides drinking water to households and which depend on the RBMC for water level maintenance. These wells may get affected as a result of low water levels in the RBMC.
35(v)	Are there tourism activities taking place in the project area that will get disturbed by construction activity?		√		No. There is tourism activity in the surrounding areas – Embilipitiya and Udawalawe, however, the project area is not directly linked to these activities.
g. Construction related impacts (labor influx, community health and safety, etc)					
36	Will there be any risks and vulnerabilities to public safety due to physical hazards during construction of the Project?	√		Low	There will be to some extent with operation of heavy machinery in the project area and with material haulage along transport routes. However, this is not a major issue and can be avoided by adopting safety regulations at construction sites.
37	Are there local village roads that will become unsafe due to contractor's usage		√	No	

	Screening question	Yes	No	Significance of the effect	Remarks
38	Are there any transport routes on or around the location which are susceptible to congestion or which cause social and environmental problems, which could be affected due to construction work?	√		Moderate	Material transport, stockpiling especially for graveling the canal road, rip rap, construction, installation of hydrol Mechanical works will impact the neighboring communities and access temporarily. Constructing the canal, bridges, by passes, road rehabilitation etc. will obstruct the movements along the canal bund for the community. Also, movement of trucks through Embilipitiya town can lead to slightly increased congestion.
39	Will the project require significant number of workers (skilled and unskilled)	√		Low	The labour requirement is estimated to be as follows; Skill -87 labour days Unskilled- 1337 labour days Period – 2 years Large gangs of labour are not expected to be mobilized at a given time. There may be one or two contracts implemented in parallel with separate labour gangs, however a large influx of migratory labour is not expected as the general practice is to source unskilled labour from the local area.
39(i)	Will the project attract significant number of migrant workers to the area?	√		Low	Going by previous Dam Safety project, large influx of labour are not expected to be fielded for rehabilitation work at a given time. Also, the general practice is for most of the unskilled labour to be sourced from the local area.
40	Will construction activity lead to burrowing of earth, gravel and sand? And/or quarrying for rock?	√		Moderate	Yes, earth and gravel will be needed for the work on the canal embankments and canal bund road. These sites are not yet identified. However, burrow and gravel sites can potentially have significant impacts because contractors pay little attention to properly siting, operating and closing such sites.
41	Will the project increase the risk of introduction of alien invasive species to the locality	√		Moderate	There is a risk of new alien invasive species to be introduced along with soil brought from outside. In selecting burrow sites, an observation of the type of alien invasive plants at the identified

	Screening question	Yes	No	Significance of the effect	Remarks
					burrow sites should be made and when selecting such sites it is best to choose locations within the close proximity of the RBMC in order to minimize the risk.
Operational Impacts					
42	Will the project lead to stagnant water and drainage problems causing increased mosquito breeding	√		Moderate	Unless burrow pits on quarry, earth, gravel borrowing on the RBMC closure conforms to regulated conditions.
43	Will the project involve removal and disposal of aquatic invasive species?		√		This will be minimal if at all.
44	Will the project involve regular maintenance dredging of the canal network		√		
45	Will the scheme after rehabilitation serve a larger command area?		√		Command area will remain same as there is no capacity enhancement of the tank planned.

Significance of impact = Low, Moderate, High

5. Public Consultation and Disclosure

Consultation with the key stakeholders has been conducted in the following manner;

Public consulted/Location	Consultation method and Participants	Date	Details/Issues raised
Meeting at MASL- Office of the Resident Project Manager, Walawe Special Area Embilipitiya Office	Presentation and discussion. Survey consultants presented field survey assessment. Mainly MASL officials, WB consultants and a few farmer representatives.	05.03. 2019	<ul style="list-style-type: none"> • The nature of interventions. • Bioengineering techniques. • Water users that will be impacted during the project. <p>For detailed notes refer Annex 8</p>
Stakeholder Consultation held at Udawalawe D5 Bedum Ela Farmer Organization Hall	Focused group discussion with Farmers of D5 Bedum Ela Farmer organization	06.03.2019	<ul style="list-style-type: none"> • Need for livelihood support if they are to forego a season. Anyway it will affects their other crops as they need water at least once in 10 days. • Need for a raised bridge at the 4km intervention identified. • Potable drinking water scarcity in the area is significant. • Need to address issues of encroachment <p>Refer Annex 8 for detailed account.</p>
Stakeholder Consultation held at MASL Murawesihena Block Manager's Office.	Focused group discussion with the Farmer Organization representatives in the areas with a few MASL local officers.	06.03.2019	<ul style="list-style-type: none"> • Need for livelihood support if they are to forego a season. It will affect their other crops as they need water at least once in 10 days. • Involve FOs during the civil works. • Special support maybe needed for some vulnerable families to be identified through the FOs. • Need to address issues of encroachment. <p>Refer Annex 8 for detailed account.</p>

Famer Leaders, Officials from Water Board, Officials from Embilipitiya Urban Council.	Participants were presented with the criteria that will be used in the future after the rehabilitation phase, for water issue from the Main Canal when Bulk Water Approach is adapted	17th Feb 2018	<ul style="list-style-type: none"> • Provision of potable drinking water from Chandrika Wewa to the project area of influence. • Maintenance of feeder canals in Chandrika wewa unpolluted from urban wastes in Embilipitiya Town. • Unfair/ malpractices in water allocation among farmer organization • Inadequate water quantity during dry weather period • Frequent faced with agriculture water scarcity issues
Farmer Leaders and Officials from Resident Project Manager's Office	Framers were explained various improvements planned to be introduced under Main Canal Rehabilitation. Among them, cattle crossings was one item discussed.		<ul style="list-style-type: none"> • Farmer Leaders promised to identify and inform the design team, the most appropriates locations for such crossing after discussing with their fellow farmers.
Younger generation from the Project Area	Telephone discussion Suresh Madushan Director Ideal Six (PVT) LTD M:071-9369091 Email:sureshmadushan net@gmail.com		Contacted a person who has devised an App to check wastes disposal locations in Embilipitiya town with community support. He is willing to improve it to detect Invasive Plants in the Project area and also pollution in Main Canals.
Material suppliers in the vicinity	Nilantha Soil supplier 0717486479		This supplier guided us to quarry sites and provide details of material suppliers.

Besides these consultations, additional consultations will be carried out during implementation. This will involve:

- Discussions will be conducted with the residents who reside along the vicinity of the project site

- Residents will be briefed about the project, purpose and design and outcomes via a documented community consultation session
- The community consultation session will be organized immediately after the contractor is mobilized.
- The contractor will take note of all impacts, especially safety hazards that will be of concern to the residents and take necessary measures as stipulated in the ESMP to mitigate them.
- The contractor will maintain a log of any grievances/complains and actions taken to resolve them.

6. Environmental and Social Management Plan

Based on the potential social and environmental impacts identified, an Environmental and Social Management Plan (ESMP) (Table 8) has been prepared in accordance with the national regulations, World Bank's safeguards policies triggered for the Project, and the ESMF and the RPF prepared for the IWWRMP.

This ESMP and relevant guidelines will be included as a Special Condition in the Bid Document; and ESMP will be attached to contract to form part of the contract requirement. The ESMP will also be equally applicable to sub-contractors including nominated sub-contractors if any. The Contractor will be responsible for the compliance with the requirements of the ESMP. With the assistance of the "Engineer" on behalf of the Employer the Project Proponent (PP) will monitor the compliance of the ESMP by the Contractor.

The bidders will be advised to carefully consider the ESMP requirements during construction stage when preparing the bid and pricing the items of work. In particular, prior to bidding the associated costs is to be provided as a provisional sum and/or as part of the engineering cost. The prescriptions and clauses detailed in the ESMP are integral components of the specifications for relevant item of work unless separate items are included in the Bill of Quantities.

The Contractor through an appointed Environmental and Social Officer will assist the "Engineer" to conduct his/her duties as required in the ESMP implementation by:

- a) maintaining up to date records on actions taken by the Contractor with regard to the implementation of ESMP recommendations
- b) through timely submission of reports, information and data to the employer through the Engineer,
- c) via participating in the meetings conveyed by the Engineer or any relevant line agency and
- d) any other assistance requested by the "Engineer".

In case the Contractor or the sub-contractor/s fails to implement the actions specified in the ESMP, the Contractor will be informed in writing. If corrective actions are still not taken, the Engineer will take whatever actions it is deemed necessary to ensure that the ESMP is properly implemented.

Table 8: Environmental and Social Management Plan for the Walawe RBMC

	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
Design Stage					
1.	Incorporation of softer engineering such as Bioengineering and vegetation in to sub-project design	<ul style="list-style-type: none"> ■ Design for the sub-project will consider bio-engineering solutions as much as possible ■ It has been documented that post floods, many areas that remained in good condition were areas that were well vegetated and had well established root systems. These act as natural erosion protection and are encouraged to be included as part of the design. ■ Some benefits of bio-engineering besides aesthetics and fish and wildlife habitat enhancement include: <ul style="list-style-type: none"> - Regulation of temperature and humidity close to the surface, thus promoting growth; - Improvement of the soil water regime via interception, evapotranspiration and storage; - Soil improvement and top soil formation; - Improvement of and provision of riparian habitat. ■ Bioengineering methods proposed by consultants will be discussed with experienced MASL officers and Farmer Organizations to ensure that the best options are adopted based on past experiences as well. 	Design Cost	MASL in collaboration with the Farmer Organizations and PMU	MASL/PMU
2.	Incorporation of Green Design	<ul style="list-style-type: none"> ■ Green infrastructure guidelines will be followed in designing and construction. ■ The use of natural material sourced from sustainable sources, such as natural rocks, choir, soil strengthening grasses etc. will be used for design of river protection infrastructure such as rip rap and bank strengthening 	Design Cost	MASL in collaboration with the PMU and Farmer Organizations	MASL/PMU

	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
		<p>interventions (these may not be sourced from within any protected areas), where suitable.</p> <ul style="list-style-type: none"> ■ Structures built will incorporate earthy and natural colors that will mingle in with the natural scape and not hinder the aesthetic value of the area. ■ Where possible, the use of alternate energy sources will be explored. ■ Canal rehabilitation will consider retaining some of the aquatic vegetation on the canal embankments and peripheral canal beds as they provide breeding grounds for aquatic organisms and also filter pollution in the water. Efforts will be made to balance between conveyance and ecological needs. 			
3.	Consensus with all the legal water users of the canal on alternative sources etc during the civil works period.	<ul style="list-style-type: none"> ■ Consultations will be carried out with the Farmer Organizations on the duration and periods that they will have to undergo low water quantities for the agricultural activities. ■ Consultations with other water users such as NWSDB (already done), NAQDA, Agrarian Services, Sugar Research Institute, other rural potable water supply entities, etc. on alternative water sources during the civil works period. ■ Development of LSA (during first year) <ul style="list-style-type: none"> - Wage assistance under the LSA; - Fish-fingerlings under LSA; - Drinking water under LSA; ■ Training for up to two members of affected households to receive skills and vocational training; Training will ensure gender equality during provision of skills and 	Design Cost	IA the Site in collaboration with the IA/PMU	MASL/PMU

	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
		<p>vocational training. As per the request made by women during consultations, priority would be given to women to receive skills and vocational training. Hence, out of the two members in a household selected for trainings, at least one member would be a female beneficiary to receive skills and vocational training.</p> <ul style="list-style-type: none"> ■ Assistance in securing employment in the project civil works. Priority will also be given for female community members to secure employment opportunities with the contractor to ensure gender equality and inclusiveness. Project will also request contractors to create conducive and safe working conditions for women encouraging more women to apply and work in the construction sector. 			
4.	Demarcation of Buffer Zones and encroachments within the buffer areas to ensure sustainability and enhancement of rehabilitation to be undertaken.	<ul style="list-style-type: none"> ■ Identification and clear demarcation of canal buffer zones ■ Awareness among encroached communities about the importance of maintaining the RBMC areas void of solid waste and any destructive activity. ■ Payment of compensation for loss of crop, assets or structures. ■ Improvement of buffer zones with natural vegetation. Possibilities of involving those that have encroached in improving the areas and making them responsible for their sustenance will be explored. Similarly, plants that provide some economic benefit to those people, will also be considered. 	Design Cost	MASL in the Site in collaboration with the MASL/PMU	MASL/PMU

	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
		<ul style="list-style-type: none"> The above will require a strategic plan in managing the widespread encroachment of the canal buffer zone. 			
5.	Identification of special areas for Buffalo bathing to reduce degradation of canal embankment and pollution	<ul style="list-style-type: none"> Alternative areas for buffalo bathing will be explored as it is a major pollution concern in the area. Embankment degradation is also partially attributed to buffalo movement. 	Design Cost	MASL in the Site in collaboration with the MASL/PMU/ Buffalo owners	MASL/PMU
6.	Labor quota to be taken from the local community	<ul style="list-style-type: none"> Possibility of introducing a requirement to hire local labor (at least a percentage) by the contractor will be explored. This will be done through the Farmer Organizations in the area that will be affected by the project interventions. 	Contractor	PMU/Contractor	PMU
7.	Monitoring of drainage outfall from Embilipitiya town to the canal.	<ul style="list-style-type: none"> Water quality monitoring will be carried out at the drainage outfall to the RBMC from the Embilipitiya town as it poses a risk of pollution to the canal system with the increasing urbanization trends and a lack of a central sewer and wastewater system. Consultations will be initiated with the local authority on setting up a monitoring system. 	Design Cost	MASL in the Site in collaboration with the MASL/PMU	MASL/PMU
8.	Environmental and Social Management Plan (ESMP)	<ul style="list-style-type: none"> This ESMP and relevant guidelines will be included as a Special Condition in the Bid Document; and ESMP will be attached to contract to form part of the contract requirement. The ESMP will also be equally applicable to sub-contractors including nominated sub-contractors if any. 	Prior to bidding	To be provided as a provisional sum and/or as part of the engineering cost	PMU

	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
		<p>The Contractor will be responsible for the compliance with the requirements of the ESMP. With the assistance of the “Engineer” on behalf of the Employer the Project Proponent (PP) will monitor the compliance of the ESMP by the Contractor.</p> <ul style="list-style-type: none"> ■ The bidders are advised to carefully consider the ESMP requirements during construction stage when preparing the bid and pricing the items of work. The prescriptions and clauses detailed in the ESMP are integral components of the specifications for relevant item of work unless separate items are included in the Bill of Quantities. ■ In case the Contractor or his sub-contractor/s fails to implement the ESMP recommendations. After informing in writing to the Contractor, the Engineer will take whatever actions it is deemed necessary to ensure that the ESMP is properly implemented. ■ The Contractor through an Appointed Environmental Officer (AEO) shall assist the “Engineer” to conduct his duties as required in the ESMP implementation by: <ul style="list-style-type: none"> (a) maintaining up to date records on actions taken by the Contractor with regard to the implementation of ESMP recommendations (b) through timely submission of reports, information and data to the employer through the Engineer, (c) via participating in the meetings conveyed by the Engineer or any relevant line agency and (d) any other assistance requested by the “Engineer”. 			

	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
		<ul style="list-style-type: none"> In the case of non-compliance with the ES measures by the Contractor as stipulated in the ESMP, the borrower reserves the right to withhold a certain percentage (the amount decided by the borrower) from the payment to contractor. 			
Pre-Construction/Site preparation phase					
9	Site Access Closure	<ul style="list-style-type: none"> All public access to the site will be controlled via adequate fencing and signage, in order to avoid risk to the public. The site entrance will include adequate signage indicating the details of the proposed subproject, implementing agencies etc as well as safety signage to keep public away. A fence shall be erected to cover the construction area using cost effective fence materials consisting of chain link fence fabric, concrete post, etc. as specified in the Technical Specifications in order to ensure, animals and public are unable to access the site. <ul style="list-style-type: none"> To avoid land disturbance and movement, the fence shall generally follow the contour of the ground. Grading shall be performed where necessary to provide a neat appearance. 	Engineering Cost	Contractor in collaboration with the MASL/PMU	MASL/PMU
10.	Material Sourcing	<ul style="list-style-type: none"> The contractor will be required to ensure that all construction materials, including gravel, sand, earth as well as other quarry material for construction is sourced from licensed sources or properly approved sites. 	Engineering Cost	Contractor	MASL/PMU

	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
		<ul style="list-style-type: none"> ■ The contractor will be required to maintain the necessary licenses and environmental clearances for all burrow and quarry material they are sourcing – including soil, fine aggregate and coarse aggregate. ■ Sourcing of any material from protected areas and/or designated natural areas, including tank beds of protected reservoirs, will be strictly prohibited. ■ Burrowing earth from other tank beds will be carried out after a full investigation of the safe depth for burrowing and with full clearance from the Engineer. ■ If the contractor uses a non-commercial burrow/quarry sites, the sites will be remediated per the guidance provided in this ESMP. Guidelines for burrow pit is attached at the end of the ESMP. ■ The contractor is required to submit in writing all the relevant copies, numbers and relevant details of all pre-requisite licenses etc. and report of their status to the engineer on a quarterly basis. ■ Any damages to roads during transport of material will be rehabilitated with the expense of the contractor 			
11.	Establishing coffer dams.	<ul style="list-style-type: none"> ■ The contractor will prepare the method statement for coffer damming where relevant and have it approved by the engineer prior to commencement or work or use the method statement provided by the project proponent with designs. ■ Coffers dams will be made from material such as sand bags and sheet piles and avoid the use of loose earth. 	Engineering Cost	Contractor	MASL/PMU

	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
12.	Work Site Management	<ul style="list-style-type: none"> ■ The contractor will identify an area onsite to store construction materials and equipment which will be approved by the engineer and demarcated for material storage as per the site plan. ■ Parking, repairing vehicles, machinery and equipment will be stationed only at the work site and/or in any other designated areas by the engineer. ■ The contractor will provide instruction and advice will be given to drivers and operators (both company owned and hired) to park vehicles and store equipment at this designated area. 	Engineering Cost	Contractor	MASL/PMU
13.	Labor Camps	<ul style="list-style-type: none"> ■ Due to safety and public health issues prevalent at the site, no labor camps will be established on site. ■ Resting facilities and the site office will be located closer to the site entrance and away from the waste mound. ■ The location, layout and basic facility provision of labor camps to be set up will be submitted to the Engineer prior to establishment. ■ The establishment of labor camps will commence only upon the written approval of the Engineer. ■ Resting and sanitary facilities will be provided separately for both men and women laborers. ■ The contractor will be required maintain necessary living accommodation and ancillary facilities in functional and hygienic manner and as approved by the Engineer. 	Engineering Cost	Contractor	MASL/PMU

	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
		<ul style="list-style-type: none"> ■ All temporary accommodation will be established and maintained in such a fashion that uncontaminated water is available for drinking, cooking and washing. ■ The sewage system for the camp, if not available, will be planned and implemented with concurrence from the Local Public Health Officer (PHI) 			
14.	Labor Training and Code of Conduct	<ul style="list-style-type: none"> ■ The contractor is required to develop a labor code of conduct and translated it in to local languages upon clearance from the Engineer. The code of conduct will be made available to all staff and displayed in the work site in local languages. ■ Labor awareness programs to educate the laborers about the code of conduct, general conduct, the Environmental and Social Management Plan, Occupational Health and Safety etc. should be conducted throughout the contract period as agreed in the contracts Environmental and Social Management Plan. ■ No labor under the age of 18 will be hired for work under this contract. 	Engineering Cost	Contractor	MASL/PMU
15.	Tree Removal	<ul style="list-style-type: none"> ■ Only trees required to be removed along the river bank where deemed necessary and justified via the technical design may be removed. These trees shall be marked and cleared by the Engineer prior to felling. ■ Contractor shall adhere to the guidelines and recommendations made by the Central Environmental Authority, forest department, if any, with regard to felling of trees and removal of vegetation. ■ The following will be conducted at minimum: 	Engineering Cost	Contractor	MASL/ Divisional Secretariat of /PMU

	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
		<ul style="list-style-type: none"> ○ Contractor shall make every effort to avoid removal and/or destruction of trees of religious, cultural and aesthetic significance. ○ If such action is unavoidable the Engineer shall be informed in advance and carry out public consultation and report on the same should be submitted to the Engineer. ○ Trees shall be removed from the construction sites before commencement of construction with prior permission from the Engineer, Divisional Secretariat a followed by respective Grama Niladhari depending on the location. ○ During removing, attention shall be paid to maintain minimum disturbances to soil cover and also care should be taken not to damage adjoining trees. ○ Protection will be provided to any trees that fall in the shoulders /corridor of impact shall be the prime focus during Construction/post construction ○ Masonry tree guards, Low level RCC tree guards, Circular Iron Tree Guard with Bars, use of plate compactors near trees may also be considered where necessary ○ Remove the logs, branches of trees; Stack them properly until removal; Remove roots and rehabilitate the bund and toe areas where tree were uprooted. ○ The easily decomposable vegetation could either be utilized as a soil conditioner after drying or be 			

	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
		<p>composted in a proper manner. Large vegetation parts could be sold or else be used as firewood.</p> <ul style="list-style-type: none"> ○ Removed trees of economic value shall be handed over to the Timber Corporation. ■ Compensatory Planting <ul style="list-style-type: none"> ○ Compensatory plantation by way of Re-plantation of at least twice the number of trees cut shall be carried out in the project area. (<i>embankment work proposes a line of trees to planted along the boundary of the canal reservation, hence this will compensate</i>) ○ All planted trees will be native species to match removed ones where possible. ○ Growth and survival of trees planted shall be ensured and monitoring done at least for a period of 3 years. ○ Survival status shall be reported on monthly basis to Engineer in charge. ○ All planting locations shall be consulted with the Engineer/PMU before final determination. ■ Additional Tree Removal <ul style="list-style-type: none"> ○ Additional trees and vegetation shall be felled / removed only if that impinges directly on the permanent works or necessary temporary works and only if fully justified with no viable alternative. In all such cases contractor shall take prior approval from the Engineer/PMU. ○ If any trimming/pruning of roots of existing trees anticipated during construction, it shall be consulted with the Environmental Specialist and 			

	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
		<p>Team of the PMU, prior to undertaking the identified trimming of roots.</p> <ul style="list-style-type: none"> ▪ This will be to ensure that the health and stability of the tree will not be impacted from trimming. 			
16.	Removal of Utilities	<ul style="list-style-type: none"> ■ The common utilities to be affected by project activities such as: telephone cables, electric cables, electric poles, water pipelines, public water taps, etc. will be identified prior. ■ Affected utilities shall be relocated with prior approval of the concerned agencies before construction starts in collaboration with the agencies, which include the Ceylon Electricity Board (CEB), Water Board, and Sri Lanka Tele Com. ■ All efforts will be made to ensure that there will be no/or minimal disruption to services during this process. <ul style="list-style-type: none"> ○ Ensure community consensus and minimum impact to common utilities like telephone cable, electric cables, electric poles, water taps and etc., ○ The contractor will take all measures to inform the effected public of the process prior to commencing work. ■ Proper clearance will be obtained from the concerned authorities and sent to the PMU before commencement of works. 	Engineering Cost	Contractor	MASL/PMU/CEB/ Water Board/Sri Lanka Tele Com.
17.	Pre preparation measures prior to dredging/	<ul style="list-style-type: none"> ■ Silt and sediment quality in the canal shall be established to determine the most suitable disposal method for the excavated debris and sediments. 			

Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
			Implementation	Monitoring
sediment removal from canal bed.	<ul style="list-style-type: none"> ■ If contamination is established according to accepted reference criteria, the following mitigation measures are proposed to be implemented. <ul style="list-style-type: none"> (a) Location of disposal site: <ul style="list-style-type: none"> ○ The contractor shall identify sites for debris disposal which would be finalized prior to commencement of canal rehabilitation taking into account the following: <ul style="list-style-type: none"> (i) The dumping does not affect natural drainage courses and is located far away from any water bodies (ii) The dumping site does not have a high-water table (iii) No endangered/rare fauna or flora is affected by such dumping. The contractor will take reasonable precaution to prevent workmen or any other persons from removing and damaging any flora (plant/vegetation) and fauna (animal) including fishing in any water body and hunting of any animal. (iv) Should be located in non –residential areas located on the downwind side (v) Avoid disposal on productive land (vi) Should be located with the consensus of the ID. ■ If contamination is ruled out, the excavated matter along with other construction debris will be disposed in solid waste dumping site operated by the local authority or used for land filling if suitable. 			

	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
		<ul style="list-style-type: none"> ■ A location for temporary dumping of wet debris should also be collaboratively identified by the PMU, ID and the Contractor as wet debris may not be able to be transported immediately to a distance of 10km. ■ The contractor shall obtain the prior approval to use this temporary site from the ID. It will also be necessary to cover the material fully to prevent any particles from being air borne. ■ Any accidental leakages will be immediately attended to by the contractor and the area should be cleaned up before the public can be exposed to any hazards. ■ If the sediment analysis confirms the water way to contain contaminated sediments, the contractor should be instructed to carry out excavation in such a way that bottom sediments/debris is isolated (to the extent possible) from the rest of soil/spoilage, so that quantities needing special disposal would be minimal. ■ Separating excavated soil from the bank from the rest of the debris will be pursued if the soil is considered suitable as a backfill for the gabions. 			
18.	Information Disclosure among Stakeholders	<ul style="list-style-type: none"> ■ Discussions will be conducted with the residents who reside along the vicinity of the project site <ul style="list-style-type: none"> ○ Residents must be briefed of the project, purpose and design and outcomes via a documented community consultation session ○ This should be done immediately once the contractor is mobilized. ○ The contractor should take note of all impacts, especially safety hazards that will be of concern 	Engineering Cost	Contractor/MASL/PMU	MASL/PMU

	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
		<p>to the residents and take necessary measures as stipulated in the ESMP to mitigate them.</p> <ul style="list-style-type: none"> ■ The contractor will maintain a log of any grievances/complains and actions taken to resolve them. ■ A grievance / complaints box will be maintained physically and electronically through email / telephone to be notified to all stakeholders. ■ A copy of the ESMP will be available always at the project supervision office on site. 			
Construction/Intervention Phase					
19.	Site Clearance and Land Development	<ul style="list-style-type: none"> ■ Prevention of removal of trees will be maintained as far as possible. ■ During removing, attention will be given in order to maintain minimum disturbances to soil cover and also care will be taken not to damage adjoining trees. Degraded state land identified for forestry activities will be improved to compensate for the trees removed as 1:2 at least ■ Water spraying will be done at a regular interval to avoid dust generation due to site clearance 	Engineering Cost	Contractor	MASL/PMU
20.	Disposal of Debris and Spoil	<ul style="list-style-type: none"> ■ All debris and residual spoil material including any left earth shall be disposed only at locations approved by the engineer for such purpose and subjected to the following clauses: ■ The contractor shall obtain the approval from the relevant Local Authority such as Prdeshiya Sabha, Municipal Council and other government agencies (as 	Engineering Cost	Contractor	MASL/PMU

	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
		<p>required) for disposal and spoil at the specified location, as directed by the Engineer</p> <ul style="list-style-type: none"> ■ Private land that will be selected for disposal should also require written consent from the land owner ■ The debris and spoil shall be disposed in such a manner that; <ul style="list-style-type: none"> ○ waterways and drainage paths are not blocked ○ the disposed material should not be washed away by runoff and ○ should not be a nuisance to the public ■ All material that is reusable or recyclable shall be used for such purposes either by the contractor or through dealers. ■ The debris and residual spoil material including any left earth shall be used, to refill the burrow areas as directed by the engineer, subjected to laying of topsoil as per recommendations for conservation and reuse of top soil provided below. ■ Excavated earth materials and all debris materials shall be disposed immediately without allowing to stockpile at identified locations for debris disposal, recommended by the engineer. During transportation, dispose materials should be covered with tarpaulin. ■ If approved by the engineer, contractor can dispose the debris and spoil as a filling material provided that the contractor can ensure that such material is used for legally acceptable purposes with disposed in an environmentally acceptable manner. ■ Explore potential burrow pits that require fill material so that any remaining waste can be directed to them. 			

	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
21.	Conservation and Reuse of Topsoil	<ul style="list-style-type: none"> ■ Top soil of productive areas where it has to be removed for the purpose of this project shall be stripped to a specified depth of 150mm and stored in stockpiles of height not exceeding 2m, if directed by the engineer. If the contractor is in any doubt on whether to conserve the topsoil or not for any given area he/she shall obtain the direction from the engineer in writing ■ Removed top soil could be used as a productive soil when replanting/establishing vegetation ■ Stockpiled topsoil shall be returned to cover the areas where the topsoil has been removed due to project activities. Residual topsoil must be distributed on adjoining/proximate barren areas as identified by the engineer in a layer of thickness of 75mm – 150mm. ■ Topsoil thus stockpiled for reuse shall not be surcharged or overburdened. As far as possible multiple handling of topsoil stockpiles should be kept to a minimum. 	Engineering Cost	Contractor	MASL/PMU
22.	Transport and Storage of construction materials	<ul style="list-style-type: none"> ■ The contractor shall avoid over loading trucks that transport material to construction sites. ■ During transportation, materials shall be covered with tarpaulin. ■ Peak hours in roads with moderate to high traffic will be avoided. ■ The contractor shall minimize possible public nuisance due to dust, traffic congestion, air pollution, etc., due to such haulage; 	Engineering Cost	Contractor	IA/PMU

	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
		<ul style="list-style-type: none"> ■ If local roads are used, routes are to be selected based on the truck load; loads will be divided to prevent damages to local roads and bridges. ■ Speed limits as nationality stipulated for haulage shall be maintained. ■ All vehicles used for haulage shall be in good condition. ■ If there are damages to local roads and other utilities due to hauling in roads caused by the contractor, the contractor shall attend to repair all damaged infrastructure/ roads, if needed through relevant authorities ■ If congested areas are encountered along the route, flagmen shall be deployed and all necessary safety measures such as signage etc should be deployed. 			
23.	Emission of Dust during cover application and construction.	<ul style="list-style-type: none"> ■ All construction materials such as sand, soil, metal, etc. shall be transported under cover to the site and stored under cover at the sight. ■ Plastic sheeting (of about 6 mm minimum thickness) can be used and held in place with weights, such as cinder blocks, with the edges of the sheeting buried, or by the use of other anchoring systems, in order to minimize the levels of airborne dust. ■ Mud patches caused by material transporting vehicles in the access road shall be cleaned immediately. ■ Continual water sprinkling shall be carried out in the work and fill areas and the access road if dust stir is observed. ■ Water sprinkling shall be done more frequently on days that are dry and windy (at least four time's day) 	Engineering Cost	Contractor	MASL/PMU

	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
		<p>as the levels of dust can be elevated during dry periods.</p> <ul style="list-style-type: none"> ■ Dust masks shall be provided to all laborers for the use at required times 			
24.	Prevention of soil erosion during site preparation	<ul style="list-style-type: none"> ■ Debris material shall be disposed in such a manner that waterways, drainage paths would not get blocked. ■ Drainage paths associated with the infrastructure shall be improved / erected to drain rain water properly. ■ Silt traps will be constructed to avoid siltation into water ways where necessary. ■ To avoid siltation, drainage paths shall not be directed to any waterway directly and they should be separated. ■ Barricades such as humps will be erected at excavated areas for culverts, silt traps, toe walls, filling and lifting with proper sign boards, (all work will be carried out during the dry season). To prevent soil erosion in these excavated areas, proper earth drain system should be introduced. ■ Embankment slopes, slopes of cuts, etc. shall not be unduly exposed to erosive forces. These exposed slopes shall be graded and covered by grass or other suitable materials per the specifications. ■ All fills, back fills and slopes shall be compacted immediately to reach the specified degree of compaction and establishment of proper mulch. ■ All work will be carried out during the dry season. If such activities need to be continued during rainy 	Engineering Cost	Contractor	MASL/PMU

	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
		<p>season prior approval must be obtained from the Engineer by submitting a proposal on actions that will be undertaken by the contractor to prevent erosion.</p> <ul style="list-style-type: none"> ■ The work, permanent or temporary shall consist of measures as per design or as directed by the engineer to control soil erosion, sedimentation and water pollution to the satisfaction of the engineer. Typical measures include the use of berms, dikes sediment basins, fiber mats, mulches, grasses, slope drains and other devices. All sedimentation and pollution control works and maintenance thereof are deemed, as incidental to the earthwork or other items of work and no separate payment will be made for their implementation. 			
25.	Burrowing of Earth and Management of Self Operated Burrow Sites	<ul style="list-style-type: none"> ■ In the event the contractor will use a self-operated burrow site: <ul style="list-style-type: none"> ○ Approval from the Geological Survey and Mines Bureau will have to be sought for extraction and transport. Burrow areas shall not be opened without having a valid mining license from the GSMB⁷. ○ A site operational plan for opening and closing the burrow site, for any new burrow site, will be prepared and submitted to the engineer for clearance. Guidelines for burrow site provided in the ESMF. ■ The contractor shall comply with the environmental requirements/guidelines issued by the Central 	Engineering Cost	Contractor	MASL/PMU

⁷ GSMB- Geological Survey and Mines Bureau

	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
		<p>Environmental Authority (CEA) and the respective local authorities with respect of locating burrow areas and with regard to all operations related to excavation and transportation of earth from such sites.</p> <ul style="list-style-type: none"> ■ Contractor can also find suitable soil materials from currently operated licensed burrow pits, subject to approval of the engineer ■ No burrow-sites be used (current approved) or newly established within areas protected under FFPO⁸ and FO⁹ ■ The location, depth of excavation and the extent of the pit or open cut area shall be as approved by the engineer. ■ All burrow pits/areas shall be rehabilitated at the end of their use by the contractor in accordance with the requirements/guidelines issued by the CEA and the respective local authority and guidelines presented in the ESMF. ■ Establishment of burrow pits/areas and its operational activities shall not cause any adverse impact to the near-by properties and people. ■ Contractor shall take all steps necessary to ensure the stability of slopes including those related to temporary works and burrow pits. 			
26.	Machinery Operation	<ul style="list-style-type: none"> ■ Only experienced and well-trained workers shall be used for the handling of machinery, equipment and material processing plants. 	Engineering Cost	Contractor	MASL/PMU

⁸ FFPO- Fauna and Flora Protection Ordinance

⁹ FO-Forest Ordinance

	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
27.	Noise from vehicles, machinery, equipment and construction activities.	<ul style="list-style-type: none"> ■ Noise generating work shall be limited to day time (6:00AM to 6:00PM). No work that generates excessive noise shall be carried out during night hours (from 6:00PM to 6:00AM on the following day). ■ All equipment and machinery shall be operated at noise levels that do not exceed the permissible level of 75 dB¹⁰ (during construction) for the day time. ■ For all construction activities undertaken during the night time, it is necessary to maintain the noise level at below 50 dB as per the CEA noise control regulations ■ All equipment shall be in good serviced condition. Regular maintenance of all construction vehicles and machinery to meet noise control regulations stipulated by the CEA in 1996 (Gazette Extra Ordinary, No 924/12) will be conducted for vehicles/machinery that will be used in construction on site and for transport. ■ Ideally noise generating work will not be carried out during public holidays and religious days. ■ Laborers will be required to work with minimum noise. Strict labor supervision shall be undertaken in this respect. ■ No night time residency of laborers on site will be encouraged, post work hours. ■ Idling of temporary trucks or other equipment shall not be permitted during periods of loading / unloading or when they are not in active use. ■ These practices will be ensured especially near residential and sensitive areas. 	Engineering Cost	Contractor	MASL/PMU

¹⁰ dB-Decibels

	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
		<ul style="list-style-type: none"> ■ Stationary construction equipment will be kept at least 100m from the site periphery, which has proximity to households. All possible and practical measures to control noise emissions during drilling shall be employed. ■ Contractor shall submit the list of high noise/vibration generating machinery & equipment to the engineer for approval. ■ Servicing of all construction vehicles and machinery shall be done regularly and during routine servicing operations, the effectiveness of exhaust silencers will be checked and if found defective will be replaced. ■ Maintenance of vehicles, equipment and machinery shall be regular and up to the satisfaction of the Engineer to keep noise levels at the minimum. 			
28.	Pollution of Soil and Water via Fuel and Lubricants	<ul style="list-style-type: none"> ■ The contractor shall ensure that all construction vehicle parking locations, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance and refueling site shall be located away from the canal that is adjacent to the site by least 200m away. ■ Contractor shall ensure that all vehicle/machinery and equipment operation, maintenance and refueling will be carried out in such a fashion that spillage of fuels and lubricants does not further contaminate the ground. ■ Contractor shall arrange for collection, storing and disposal of oily wastes to the pre-identified disposal sites (list to be submitted to Engineer) and approved by the Engineer. 	Engineering Cost	Contractor	MASL/PMU

	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
		<ul style="list-style-type: none"> ■ All spills and collected petroleum products will be disposed of in accordance with standards set by the CEA/MMDE¹¹. ■ Engineer will certify that all arrangements comply with the guidelines of CEA/MMDE or any other relevant laws. 			
29.	Preventing Loss of minor water sources and disruption to water users	<ul style="list-style-type: none"> ■ Contractor shall make employees aware on water conservation and waste minimization in the construction process. <ul style="list-style-type: none"> ○ Arrange adequate supply of water for the project purpose throughout the construction period. ○ Will not obtain water for project purposes, including for labor camps, from public or community water supply schemes without a prior approval from the relevant authority. ○ Will not extract water from ground water or surface water bodies without the permission from engineer & relevant authority. ○ Obtain the permission for extracting water prior to the commencing of the project, from the relevant authority. ■ Contractor shall protect sources of water (potable or otherwise) such as water sources used by the community so that continued use these water sources will not be disrupted by the work. In case the closer of such sources is required on temporary basis, contractor shall provide alternative arrangement for supply (this may be necessary during the rehabilitation of the 	Engineering Cost	Contractor	MASL/PMU

¹¹ MMDE-Ministry of Mahaweli Development and Environment

	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
		<p>bathing steps). Alternative sources such as wells thus provided shall be within acceptable distance to the original sources and accessible to the affected community.</p> <ul style="list-style-type: none"> ○ In case the contractor's activities going to adversely affect the quantity or quality of water, the contractor shall serve notice to the relevant authorities and downstream users of water sufficiently in advance. ○ Apply best management practices to control contamination of run-off water during maintenance & operation of equipment. ○ Maintain adequate distance between stockpiles & water bodies to control effects to natural drainage paths. 			
30.	Preventing siltation into water bodies	<ul style="list-style-type: none"> ■ Contractor shall take measures to prevent siltation of water bodies because of construction work including, construction of temporary / permanent devices to prevent water pollution due to siltation and increase of turbidity. These shall include the measures against erosion highlighted in this ESMP ■ Construction materials containing small / fine particles shall be stored in places not subjected to flooding and in such a manner that these materials will not be washed away by runoff. ■ Temporary soil dumps shall be placed at least 200m away from all water bodies ■ If temporary soil piles are left at the site for a long time those piles shall be covered with thick polythene sheets 	Engineering Cost	Contractor	MASL/PMU

	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
		<ul style="list-style-type: none"> All fills, back fills and slopes shall be compacted immediately to reach the specified degree of compaction and establishment of proper mulch 			
33.	Preventing contamination of water from construction wastes	<ul style="list-style-type: none"> Measures as stipulated in this ESMP shall be taken to prevent the wastewater produced in construction from entering directly into streams, water bodies or the irrigation systems. The discharge standards promulgated under the National Environmental Act shall be strictly adhered to. 	Engineering Cost	Contractor	MASL/PMU
34.	Managing alteration of drainage paths	<ul style="list-style-type: none"> Contractor shall not close or block existing canals and streams permanently. If diversion or closure or blocking of canals and streams is required for the execution of work (e.g. for construction of bypass), contractor must first obtain the Engineers approval in writing. Contractor shall carry out an investigation and report to the Engineer, if an investigation is requested by the Engineer. Contractor shall also obtain the approval from the relevant agencies such as ID/ /Divisional Secretary prior to such action is taken. Contractors shall restore the drainage path back to its original status once the need for such diversion or closure or blockage is no longer required. All work will only be undertaken during the dry season. 	Engineering Cost	Contractor	MASL/PMU
35.	Public Safety	<ul style="list-style-type: none"> At all times the site will restrict the entry of public on to the site. Safety signboards and signboards prohibiting entrance and risks, shall be displayed at all necessary locations. 	Engineering Cost	Contractor	MASL/PMU

	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
		<ul style="list-style-type: none"> ■ The contractor shall obtain a Third-party insurance to compensate any damages, injuries caused to the public or laborers during the construction period. ■ Material loading and unloading shall be done only within the project site. 			
36.	Safety of Workers	<ul style="list-style-type: none"> ■ Contractor shall comply with the requirements for safety of the workers as per the ILO Convention No. 62 and Safety & Health Regulations of the Factory Ordinance of Sri Lanka to the extent that those are applicable to this contract. ■ The contractor shall supply all necessary safety measures at site- including provision of first aid kits and fire extinguishers. ■ Signage providing instructions on first aid management, emergency contact and emergency operational procedures in local languages shall be displayed at the site office. ■ Basic onsite safety training shall be conducted for all laborers during the ESMP training prior to the start of the construction activities. ■ The training to laborers shall also include a brief on the risks of working on a dam rehabilitation site. ■ The contractor shall obtain a Third-party insurance to compensate any damages, injuries caused to laborers during the construction period. ■ Protective footwear and protective goggles should be provided to all workers employed on mixing of materials like cement, concrete etc. ■ Welder's protective eye-shields shall be provided to workers who are engaged in welding works. 	Engineering Cost	Contractor	MASL/PMU

	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
		<ul style="list-style-type: none"> ■ Earplugs shall be provided to workers exposed to loud noise, and workers working in crushing, compaction, or concrete mixing operation. ■ The contractor shall supply all necessary safety equipment such as safety goggles, helmets, safety belts, ear plugs, mask etc. to workers and staff. ■ In addition, the contractor shall maintain in stock at the site office, gloves, ear muffs, goggles, dust masks, safety harness and any other equipment considered necessary. ■ A safety inspection checklist will be prepared taking into consideration what the workers are supposed to be wearing and monitored monthly and recorded. 			
37.	Prevention of accidents	<ul style="list-style-type: none"> ■ Prevention of accidents involving human beings or vehicles or accidents during construction period will be done via adequate training and guidance to all workers. ■ A readily available first aid unit including an adequate supply of sterilized dressing materials and first aid supplies will be available at the site office at all times. <ul style="list-style-type: none"> ○ Availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital should also be insured. ○ Names and contact information for emergency services such as Ambulance services, hospitals, police and the fire brigade should be prepared as a sign board and displayed at the work site. 	Engineering Cost	Contractor	MASL/PMU
38.	Operation of labor camps	<ul style="list-style-type: none"> ■ A supply of sufficient quantity of potable water in every workplace/labor camp site at suitable and easily 	Engineering Cost	Contractor	MASL/PMU

	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
		<p>accessible places and regular maintenance of such provisions should be maintained.</p> <ul style="list-style-type: none"> ■ The sewage system for the offsite labor camp, if newly established, are designed, built and operated in such a fashion that no health hazards occurs and no pollution to the air, ground water or adjacent water courses take place. ■ Adequate water supply is to be provided in all toilets and urinals. ■ The contractor shall provide garbage bins in the camps and ensure that these are regularly emptied and disposed of in a hygienic manner. 			
39.	Handling Environmental Issues during Construction	<ul style="list-style-type: none"> ■ The Contractor will appoint a suitably qualified Environment and Social Officer (ESO) following the award of the contract. The ESO will be the primary point of contact for assistance with all environmental issues during the pre-construction and construction phases. He/ She shall be responsible for ensuring the implementation of ESMP. ■ The Contractor shall appoint a person responsible for community liaison and to handle public complaints regarding environmental/ social related matters. All public complaints will be entered into the Complaints Register. The Environmental Officer will promptly investigate and review environmental complaints and implement the appropriate corrective actions to arrest or mitigate the cause of the complaints. A register of all complaints is to be passed to the Engineer within 24 hrs. They are received, with the action taken by the Environmental Officer on complains thereof. 	Engineering Cost	Contractor	MASL/PMU

	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
		<ul style="list-style-type: none"> Contractor shall prepare detailed Environmental Method Statement (EMS) clearly stating the approach, actions and manner in which the ESMP is implemented. The EMS shall be updated regularly and submit for Engineers review. 			
40.	Grievance Redress Mechanism (GRM)	<ul style="list-style-type: none"> The contractor's will be required to establish a Grievance Redress mechanism for all direct workers and contracted workers (and, where relevant, their organizations) to raise workplace concerns related to labor and working conditions. Contractor's grievance mechanism will be a separate one to the one established for PAPs and other stakeholders because workplace concerns are usually different from issues raised by project affected parties and other stakeholders. However, this parallel GRM operated by the contractor will include processes to refer complaints to the project GRM so as to ensure that an accurate understanding of the project's complaints is always available. Contractors GRM process and costs associated in establishing a GRM will be submitted with the bid documents. 	Engineering Cost	Contractor	MASL/PMU
41.	Management of Chance found Archeological Property	<ul style="list-style-type: none"> All fossils, coins, articles of value of antiquity and structures and other remains or things of geological or archaeological interest etc. discovered on the site and/or during construction work shall be the property of the Government of Sri Lanka, and shall be dealt with as per provisions of Antiquities Ordinance of 1940 (Revised in 1956 & 1998) 	Engineering Cost	Contractor	MASL/PMU

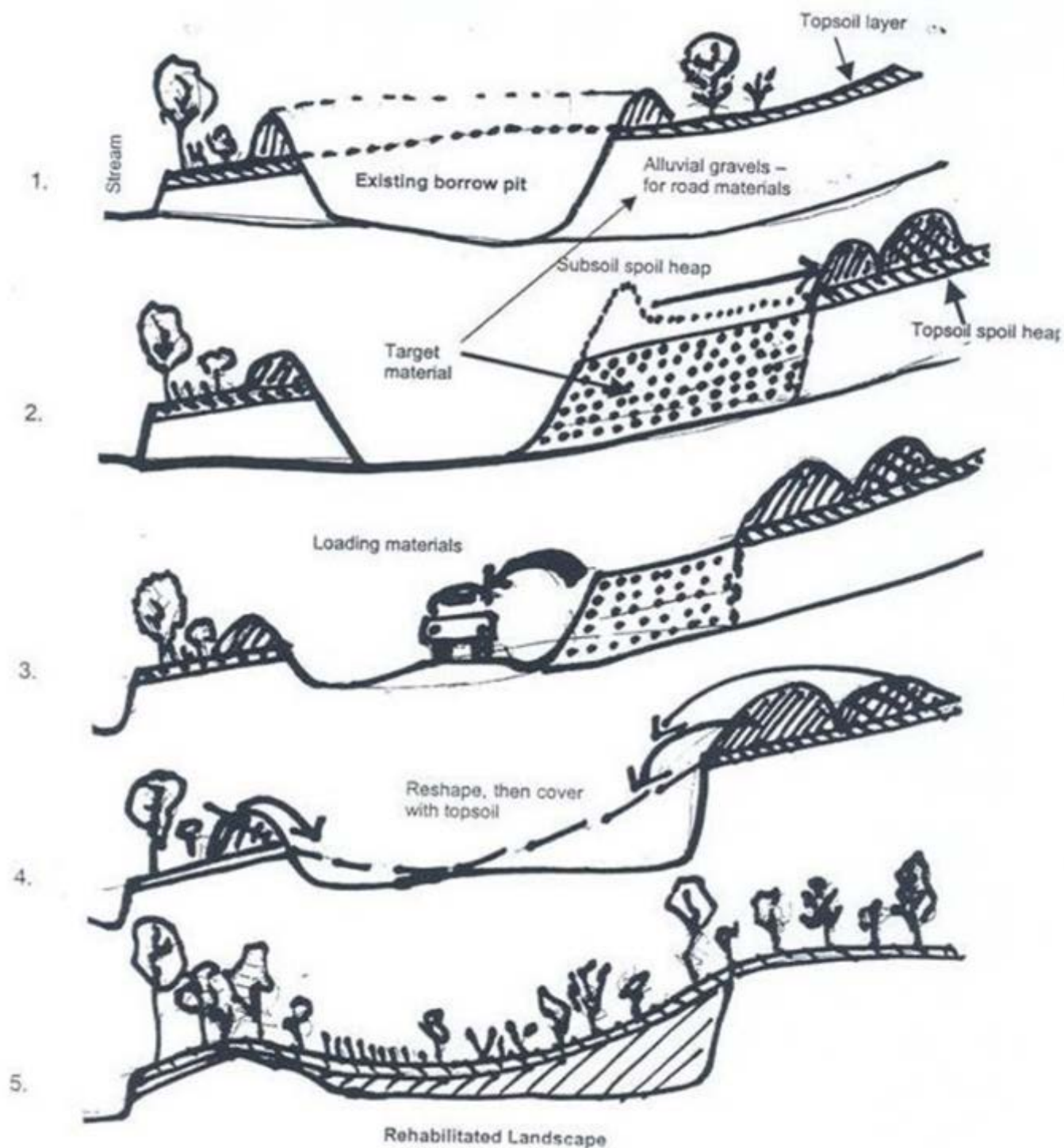
	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
		<ul style="list-style-type: none"> ■ The contractor shall take reasonable precaution to prevent his workmen or any other persons from removing and damaging any such article or thing and shall, immediately upon discovery thereof and before removal acquaint the Engineer of such discovery and carry out the Engineer's instructions for dealing with the same, awaiting which all work shall be stopped within 100m in all directions from the site of discovery. ■ If directed by the Engineers, the Contractor shall obtain advice and assistance from the Department of Archaeological of Sri Lanka on conservation measures to be taken with regard to the artifacts prior to recommencement of work in the area. 			
42.	Chance found important Flora/Fauna	<ul style="list-style-type: none"> ■ Flora <ul style="list-style-type: none"> ○ While any rare/threatened/endangered flora species will be identified and removed prior to construction, during construction if by chance such species are found, it shall be immediately informed to the PMU by the contractor. ○ All activities that could destroy such flora and/or its habitat shall be stopped with immediate effect. Such activities shall be started only after obtaining the Engineer's approval. Contractor shall carry out all activities and plans that the Engineer instructed him to undertake to conserve such flora and/or its habitat. ■ Fauna <ul style="list-style-type: none"> ○ All works shall be carried out in such a manner that the destruction or disruption to the fauna and their habitats is minimum. 	Engineering Cost	Contractor	IA/PMU

	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
		<ul style="list-style-type: none"> ○ Construction workers shall be instructed to protect fauna including birds and aquatic life as well as their habitats. ○ During construction, if any faunal species is found, it shall be immediately informed to the PMU by the contractor. All activities that could destroy such fauna and/or its habitat shall be stopped with immediate effect. Such activities shall be started only after obtaining the Engineer's approval. Contractor shall carry out all activities and plans that the Engineer instructed him to undertake to conserve such fauna and/or its habitat. ○ Establish buffalo passes and fish ladders for crossing of fish 			
43.	Site Closure and Demobilization	<ul style="list-style-type: none"> ■ The contractor will remove all excess material, equipment, vehicles from the project site prior to complete demobilization. ■ Cofferdams, if erected need to be completely removed and associated debris has to be cleared from the. ■ All temporary site offices will be dismantled and removed from the site. ■ If the parking site has been dilapidated in any way as per the evaluation of the engineer, the contractor will reinstate it to the original condition prior to demobilization. 	Engineering Cost	Contractor	MASL/PMU
	Prevention of issues (e.g. GBV)	<ul style="list-style-type: none"> ■ The project will avoid or reduce labour influx where possible 			

	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
	related to labour influx	<ul style="list-style-type: none"> ■ Contractors will be required implement robust measures to prevent sexual harassment, gender-based violence (GBV) ■ Training of workforce – on unacceptable conduct ■ informing workers about national laws ■ Worker Code of Conduct as part of the employment contract ■ introduce sanctions for non-compliance (e.g., termination) ■ Cooperation with law enforcement agencies will be established 			
Post Construction/Operation and Maintenance Phase					
44.	Greening and maintenance of earthen embankment	<ul style="list-style-type: none"> ■ Only native species of plants shall be used for the planting process- Vetiver grass is recommended as a suitable species that grows well on sandy loam soils and toxic conditions and has good potential to control soil erosion. ■ Attempts will be made to also identify suitable “living filter” plant species that are known to minimize the amounts of toxins in a given environment. ■ A supply of water will be made available for the routine maintenance of the vegetation until it succeeds naturally. ■ Routine maintenance of planted species will be conducted to identify issues with establishment on site. ■ Replacement planting will be conducted as appropriate. Kumbuk, Puwak and Bata have been identified so far for strengthening of embankments. 	Operational Cost	MASL, Farmer Organizations	MASL, CEA

	Activities and Associated Impacted	Protection and preventive measures	Mitigation cost	Responsibility	
				Implementation	Monitoring
		The most appropriate ones will be established looking at the pros and cons of the species. Discussions will also be carried out with the Farmers to ensure that the local knowledge is also incorporated in to the designs.			
45.	Flood management infrastructure	<ul style="list-style-type: none"> Routine desilting and clearing of sediment traps, waste traps and silt traps shall be included in the operations and maintenance plan for the sites and conducted as per the guidelines of the Central Environmental Authority. 	Operational Cost	MASL	MASL, CEA
46.	Buffer zone enhancement	<ul style="list-style-type: none"> If any buffer zone enhancement programs are initiated for encroached areas, a regular monitoring program shall be in place to ensure its sustainability. 	Operational Cost	MASL	MASL/PMU

Guidelines for the Rehabilitation of Burrow Pits



Mitigatory Measures to be Implemented

The following conditions must follow by the contractor during the construction period in burrowing earth:

- The sides of the pits will be sloped with a minimum angle of 1:3, to enable the escape of animals that may accidentally fall into the pits.
- The burrow pits will be restored by filling them or when it is not practical to rehabilitate them as small tanks/water holes enabling wild animals to use as a water source

- The earth burrowing activity at the identified site will be carried out only during the given time period of from 6.00 am to 6.00 pm
- Burrowing earth, transportation and unloading will be carried out under the inspection of Assistant Director (Mahaweli/Irrigation) or an officer appointed by him
- A 15-cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- Suitable drainage ditches or conduits shall be constructed or installed to avoid conditions where small pools of water that are, or are likely to become noxious, or foul, collect or remain on the burrow area. Surface drainage must be designed to minimize erosion during runoff and major rainfall events.
- Burrow Pit shall be backfilled with clean or inert fill. There shall be no material of deleterious nature (i.e. any material that would be classed as hazardous or waste). Please refer to the diagram above for the Illustration on burrow pit rehabilitation.
- Non-usable material including overburden, screenings and rocks, will be placed in the pit bottom and covered with Topsoil stripped from the surface so as to facilitate water seepage, planting grass and tree planting to be carried out using the Native trees.
- Once the site is reclaimed, any fences where they exist shall be removed to permit re-vegetation.
- Access and haul roads to the pit must be restored in a mutually agreeable manner where these are considered unnecessary after extraction has been completed.
- Above conditions will be included in the contract document and must monitor whether they are followed.
- Precautions must be taken to minimize spreading of the listed invasive species.
 - Destroy the listed invasive plants as much as possible prior to burrowing material.
 - Surface soil of the burrow site will be separated and stored to prevent transporting seeds of the invasive plants to the tank. This surface soil can use when restoring the burrow pit.
 - When restoring the invasive plants if any germinated in soil will be removed and burn.
 - Wash down of all vehicles that use to transport burrow materials before leaving the site

7. Livelihood Support Assistance

As mentioned in the earlier sections, once the impact on the farmers, fishing communities and other stakeholders identified are determined and verified by the project, and inventory of loss will be prepared in consultation with the affected households and appropriate compensations and livelihood support will be paid by the project following the RPF and ESMF.

8. Implementation Arrangements and Monitoring Plans

The Project Director for IWWRMP will be the overall in-charge of the project management team. Resident Project Manager for Walawe Irrigation Scheme and the relevant Director from the MASL will be responsible for handling matters from the head office on behalf of the MASL. The Regional Director of Irrigation (Anuradhapura), District Irrigation Engineer (Anuradhapura) stationed at

The overall responsibility of ensuring compliance with safeguard requirements lie with the PMU supported by the WB while the contractor will be responsible for implementing the provisions in the ESMP that are related to the construction stage. In addition, the contractor will be directly responsible for developing and implementing the contractor's ESMP. The overall supervision will be carried out by the District Irrigation Engineer of the Irrigation Department and the PMU (MASL) that is responsible for the overall design and supervision of the proposed sub-project. Any consequent design modification will be reflected in the project cost.

Environmental and monitoring will be carried out largely through compliance monitoring using the checklist provided in the ESMF by the Environmental Officer of the PMU and the contractor jointly. The Environmental and social officer(s) of the PMU will visit the site on a regular basis and report to PMU on the contractor's performance on the implementation of the ESMP.

In addition, the contractor shall inform the progress of EMP implementation formally through a monthly monitoring report submit to the PMU through the engineer. The contractor will hire an Environmental and Social Officer (ESO) to plan and manage the implementation of the ESMP. The project will also consider mobilizing supervision consultants for the monitoring the safeguards compliance of the contractor.

The PMU shall report the progress of ESMP implementation on the Walawe RB canal rehabilitation through the bi-annual environment monitoring report and the quarterly progress report submitted to the WB and flag any issues on a timely manner.

9. Grievance Redress Mechanism

a. GRM for project affected parties and other stakeholders

A three-tier grievance redress system has been envisaged for the IWWRMP that will function at local (GN level) and regional level (Divisional level), with recourse to a national-level body for appeal and for ensuring high-level government commitment, policy support and coordination for the process. The most immediate for the needs of the Walawe project will be the local (GN level) GRM. The national level GRC will only be convened when a complaint or grievance is raised by an affected person that cannot be resolved at the lower levels Accordingly, the following measures will be taken:

- The social and environmental officers of the PO, PMU and the District Irrigation Engineer of the Irrigation Department will be responsible for creating awareness about the GRM, including its structure, functionalities of the GRM, mechanisms for registering complaints, and the procedures that would have to be followed by the different tiers of the GRM.
- The GRM process/procedures will be publicized among the General Public, Public Officers, Social Organizations, Contractors and Divisional Secretaries in the respective areas. A variety of methods will be adopted for communicating information to the relevant stakeholders. These methods will include display of posters in public places such as in government offices, project offices, community centers, hospitals and health clinics of the area

- The performance of the GRM will be monitored as part of the project’s monitoring system. All complaints will be registered and tracked in the system. The system will quarterly and annual summaries of: the number of complaints raised & resolved, and the time taken to resolve them. A bi-annual evaluation would also be conducted to assess the effectiveness and efficiency of the GRM to improve the performance of the GRM.
- The contractor will also create awareness grievance redress mechanism (GRM) established by the PMU for the project

Composition of Grievance Redress Committee (GRC) – Grama Niladhari Level

This is the most basic, first level committee that will operate at site level, most likely as a committee at GN Division level. The Committee will try to resolve the grievances of persons who live in the immediate project area. The proposed composition of the committee would include a combination of government and community representatives who would try to resolve grievances in an amicable manner through a process aimed at achieving consensus.

Grama Niladari of the area	Chairman
Representative from the local PMU Site Office	Secretary
Representative of Supervision Consultant (as appropriate)	Member
Representative of Contractor (if required)	Member
Representative of a local social organization (NGO/CBO)	Member
A representative of the community or local religious leader	Member

Composition of Grievance Redress Committee (GRC) – Divisional Secretary Level

This committee is expected to address complaints and disputes that cannot be resolved by the Grama Niladhari level committee. In addition to hearing appeal cases coming from lower level (GN level) committees, this committee could support the national level committee, providing information and administrative support. This committee will review decisions coming from GN level committees within 15 working days and will communicate its decision to the claimants and GN level committee within five working days for follow-up actions. The committee consists of following members:

Divisional Secretary of the area or a representative nominated by the DS	Chairman
Representative from the PMU Head Office	Secretary
Grama Niladhari of the area from which the grievance was registered	Member
A representative from an NGO/CBO operative in the area	Member
A respected religious leader/clergy of the area or Community Leader	Member

Composition of Grievance Redress Committee (GRC) - National level

This GRC will be located in the Ministry of Mahaweli Development and Environment and shall be chaired by an Additional Secretary of the Ministry or a designated representative. The Project Director would serve as the secretary to the committee. As well as guiding and supervising the grievance system, this committee would review appeals from people who are not satisfied with the decisions of the lower level committees. The committee would comprise the following members:

Additional Secretary/ MMDE	Chairman
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Project Director (of the PMU)	Secretary
Representative of the Supervision firm	Member
Representative from construction firm (if necessary)	Member
District Secretary of the District or a representative nominated by the	Member
Divisional Secretary of the area or a representative nominated by the DS	Member
Representatives from a Social Organization (if necessary) (A national level NGO/CBO operating in the field and have operations in project area)	Member

b. Handling GBV cases in GRM

For GBV complaints, there are risks of stigmatization, rejection and reprisals against survivors. This creates and reinforces a culture of silence so survivors may be reticent to approach the project directly. The GRM will have multiple channels through which complaints can be registered in a safe, ethical and confidential manner keeping survivor information confidential and anonymous. The GRM committee will be trained on how to respond to GBV cases in a sensitive manner. During community consultations, effective channels will be identified (e.g. local community organizations, health providers, etc.) and GBV Service Providers will be mapped and identified in order to refer cases as required. Thus, the role of the GRM will be to refer cases to the service providers and to the police to investigate the cases and provide appropriate services to the survivors. The GBV Services Provider, and IA representatives involved in the GBV case resolution may report GBV cases to Police in accordance with the law. In the case of a child abuse, the incident will also be reported to the NCPA (National Child Protection Authority).

The GRM will also have in place processes to immediately notify both the IA and the World Bank of any GBV complaints with the consent of the survivor. If the investigations revealed that the probability of the incident of GBV occurring was either created or exacerbated by the project, then corrective actions would be taken by the Borrower and the Bank to increase safety and security in the site locations.

The identified GBV Services Provider will have its own case management process which will be used to gather the necessary detailed data to support the complainant and facilitate resolution of the case referred by the GRM operator. This information should not go beyond the resolution of the incident, the date the incident was resolved, and that the case is closed. Service providers are under no obligation to provide case data to anyone without the survivor’s consent. If the survivor consents to case data being shared the service provider can share information when and if doing so is safe, meaning the sharing of data will not put the survivor or service provider at risk for experiencing more violence.

To measure the effectiveness of the GRM addressing GBV-related complaints, data will be gathered for the following indicators: number of GBV grievances that have been referred to GBV Service Providers disaggregated by adult/children, the number of cases closed, and the average time they were open.

c. Contractor’s GRM process to deal with the grievances related to labor and working conditions

The contractor’s will be required to provide a Grievance Redress mechanism for all direct workers and contracted workers (and, where relevant, their organizations) to raise workplace concerns related to labor and working conditions. Contractor’s grievance mechanism will be a separate one to the one established for PAPs and other stakeholders because workplace concerns are usually different from issues raised by project affected parties and other stakeholders. However, this parallel GRM operated by the contractor will include processes to refer complaints to the project GRM so as to ensure that an accurate understanding of the project’s complaints is always available.

Workers will be informed of the grievance mechanism at the time of recruitment and the measures put in place to protect them against reprisal for its use. The contractor then will be required to make available relevant

information throughout project duration in manner that is clear, understandable, and accessible to workers, for example by including it in workers' handbooks, on notice boards, or similar communication mechanisms.

The Contractor's will be required to address concerns promptly, using an understandable and transparent process that provides timely feedback to those concerned in a language they understand, without any retribution, and will operate in an independent and objective manner. It is important that the grievance mechanism be accessible to all direct and contracted workers, taking into account their different characteristics, for example female workers, migrant workers or workers with disabilities. Where appropriate, consideration can be given to allowing concerns to be raised anonymously and/or to a person other than an immediate supervisor.

The grievance mechanism may utilize existing grievance mechanisms, providing that they are properly designed and implemented, address concerns promptly, and are readily accessible to such project workers. Hence, existing grievance mechanisms may be supplemented as needed with project-specific arrangements. The grievance mechanism will not impede access to other judicial or administrative remedies that might be available under the law or through existing arbitration procedures, or substitute for grievance mechanisms provided through collective agreements.

10. Budget

Most of the mitigation measures described in the ESMP are deemed as incidental to construction work and included in the contract. However, the costs provided in the ESMP need to be considered as specific mitigation costs including for the establishment and operation of the GRM:

Description	Cost (rs)
Social, Environment and Safety Officer for 20 months	2,000,000
Investigations for water pollution status	2,000,000
General mitigation works (including safety measures, signage, GRM operations etc.)	1,500,000
Total	5,500,000

ANNEXES

Annex 1: Canal Inventory for Rehabilitation

Udawalawe Right Bank Main Canal Rehabilitation Project - list of works

No.	Chainage (Km)	Name of the structure (further details have been submitted to MASL)	Defect	Works to be attended	Ref. Dwg.
	0+250	Gated weir water board	Hydromechanical repairs to be attended	Refer list of works hydro-mechanical works	
1	0+500	Level crossing	Some portions are eroded	Repairing of eroded sections and protection with tree planting	
	0+740	D1-Radial bypass gate	Recently rehabilitated by DSWRP project		
2	1+230	Turnout D2	Structure needs repairs	Structure to be Replaced	ST/TO/IL-01
	1+650	road bridge	No repairs observed.		
3	1+750	Turnout D3	No outlet structure.	Inlet structure to be replaced	ST/TO/IL-01
4	2+380	Turnout D4	No outlet Structure.	total Structure to be replaced	ST/TO-06
5	2+492	Foot bridge cum morning Glory No.1	Inlet and outlet of structure eroded and need repairs.	new bridge to be constructed of 16m clear span, 10m gabion protection up and downstream of structure is proposed	ST/FBR-09
6	2+725	Turnout D5	Gates are eroded, Farmers complains insufficient water flow	Structure to be replaced with 450 dia. X 2 (double barrel)	ST/TO-2-07
7	2+760	Turnout D5a	inlet sill level to be changed	Structure to be replaced with lowered sill levels	ST/TO-2-07
8	3+120	Turnout D5b	inlet sill level to be changed	Structure to be replaced with lowered sill levels	ST/TO-2-07
9	3+535	Morning Glory No. 2	LS up & down streams of the structure are highly eroded, surface of the spill is highly eroded	10m long gabion embankment protection for both sides. Surface concreting over the spill surface as directed by the engineer	ST/GB-14
10	3+950	Syphon Inlet	Barrel leaks are observed, Hydro mechanical repairs to inlet gate require. Trash rack to be installed.	epoxy water proofing application through out the entire length of syphon is proposed (400m) with required repairs to RF and shotcreting (50 mm the) as directed by the engineer. Refer list of works of HM works regarding HM works to be attended.	N.R
11	4+100	Causeway	Road surface of the causeway damaged and to be repaired.	31m long, 4m wide, 150mm thick surface concreting with y10@150 reinforcement	N.R
12	4+325	Syphon outlet	Outlet submerged with water. Road side bund of the outlet is severely eroded ~ 200 m.	Repairing works of outlet structure and road side of the canal bund	N.R

13	4+540	Turnout D7	Upstream structure needs repairs. Downstream Structure OK but weir broken	Replacement of Inlet structure and construction of approach staircase to inlet structure	ST/TO/IL-01
14	5+002	Turnout D8	gates eroded, inlet structure scoured	Gate to be replaced, Dia 450mm, measuring weir required, inlet structure to be replaced and approach staircase to be constructed	ST/TO/IL-02
15	5+375	Turnout D9	US structure to be improved. DS structure OK but weir broken	Inlet structure to be replaced, approach staircase to be constructed to inlet structure	ST/TO-06
16	5+610	Morning Glory No. 3	upstream and downstream embankments on LS is hevearily eroded	Construction of 10m long gabion embankment protection for both sides. Surface concreting over the spill surface as directed by the engineer	ST/GB-14
17	5+720	Turnout to D10	Weir broken, inlet structure eroded	Replacement of weir and inlet structure.	
18	5+965	Road Bridge	Structure OK. Hand rails need repairs	Replacement of Handrails.	ST/HR-01
19	6+025 to 6+400	Level Crossing.	Road bund severely eroded and need repairs.	Gabion mattress with canal bank improvements to be lined along the left bank	ST/GB-14
20	6+410	Turnout to D11a	inlet structure is not a standard structure	Replacement of Inlet structure.	ST/TO/IL-01
21	6+475	Spill cum Causeway to LC	Structure condition OK. Road section concrete need to be repaired. Canal bank eroded after the causeway.	Replacement of 2 panels 5.4m wide, 4.5m long and 150mm thick with bottom reinforcement net. 10 nos of guard stones to be replaced. 30m long gabion protection to be provided	ST/GB-14
22	6+650	Turnout to D11b	structure is in deplorable conditions	Replacement of entire structure.	ST/TO-06
23	6+700	Canal bank protection	60m of canal bank eroded	60m long 3m high gabion wall to be aligned along the canal bank	ST/GB-14
24	6+980	Turnout to D12	U/S gate has been repaired. DS stricture condition OK but RR masonry Head Wall needs repairs. DS canal lined as flume section. Water seeps through MC around the structure.	Replacement of downstream structure headwall.	ST/HR-01
25	7+090	Turnout to D13	structure is in deplorable conditions	Replacement of Entire structure.	ST/TO-06
26	7+350	Turnout to D14	Gates are corroded	Replacement of gates, Dia 300mm and Head wall on D/S side	ST/TO/OL-1
27	7+400	canal bank protection	Canal bank to be protected	embankment improvement works with gabion mattress protection	ST/GB-14
28	7+350	Radial gated Regulator No.1		Complete overhaul needed on HM works. Refer list of works of HM works	
29	7+850	Foot Bridge	New-poorly Constructed	No repairs observed.	

30	8+010	Aqueduct - 4 spans 5mx5m	both embankments leading to aqueduct severely eroded. Hand rails are damaged. RS embankment downstream of the structure eroded	Replacement of Handrails and 100m of Right hand side canal embankment upstream to the structure to be improved with bio engineering canal improvement techniques, 15m of right hand side canal improvement with bio engineering technique downstream of the structure, Epoxy lining for entire aqueduct	ST/BF/CW/CI-07
31	8+00 to 8+100	Level Crossing	100m of right-hand side of canal is eroded	3.1m high canal embankment improvement with gabion mattress of 100m length	ST/GB-14
32	8+620	Turnout to D 15.	structure is in deplorable conditions	Replacement of entire structure.	
33	8+900 to 9+000	Level Crossing	300m of canal embankment eroded	1m high canal improvement with bioengineering for 300m length	ST/BF/CW/CI-07
34	9+190	Road Bridge	Handrails are fully damaged	Replacement of Handrails	ST/HR-01
35	9+290	Turnout to D16 with Bathing Step.	structure is in deplorable conditions	Replacement of Structure.	ST/TO-2-07, ST/BS-01
36		Level Crossing	left bank side of the canal eroded for 210m length	Construction of 3.2m high, 210m long canal embankment with gabion mattress.	ST/GB-14
37	9+570	Morning Glory No.3	Upstream of the structure road side bund eroded and needs repairs.	100m of lining with canal improvement and bio engineering	ST/BF/CW/CI-07
38	9+840	DUC	No repairs observed.	40m of concrete canal lining above for the protection of the structure	ST/CL-02
39	10+085	Turnout to D 17.	inlet structure and barrel is damaged. The downstream structure retaining wall is damaged	Replacement of the Inlet structure and barrel and replacement of Downstream retaining wall.	ST/TO-06
40	10+200 to 10+450	Level Crossing			
41	10+475	Turnout to D18 with bathing Steps.	US structure repaired. DS structure in concrete and condition is OK. Weir Broken.	Replacement of weir.	ST/TO/OL-1
43	10+520	Radial Gated Regulator No.2	Complete overhaul needed on HM works. Civil structure condition good.	Refer HM list of works	
44	10+680	Road Bridge (RVDB)	RVDB Bridge. Needs repairs to handrails.	Replacement of hand rails.	ST/HR-01
45	11+270	Causeway cum Spillway.	Road Slab Needs Repairs.	Replacement of 5.4m wide, 4.5m long, 150mm thick two concrete panels with bottom reinforcement.	
47	11+710	Foot Bridge (3 Wheel size)	Condition good. Canal in cut section starts here.		

48	11+825	Turnout to D 19	US & DS structures need repairs as structure is damaged. d/s is submerged before the drop in D' Canal	reconstruct of the structure with reduced barrel length of 14.5m	ST/TO/IL-03,ST/TO/OL-03
49	12+065	Turnout to D20.	US structure needs repairs. DS OK but weir broken. DS canal lined as a flume section.	Re-construction of the inlet structure and weir.	ST/TO/IL-03,ST/TO/OL-03
50	12+050 to 12+400	Level Crossing	No Repairs needed		
51	12+455	Turnout to D 21 with bathing steps.	inlet structure needs repairs	Repairing of the inlet structure.	ST/TO/IL-03
52	12+515	Road Bridge to a Tarred Road.	Condition OK. Needs minor repairs.	Minor repair work of road bridge	
53	12+690	Turnout to D 22 - MASL	Canal Belongs to DAS. Structure needs repairs.	Replacement of the Structure.	ST/TO/IL-03,ST/TO/OL-03
54	13+030	Turnout to D23 - DAS	Canal Belongs to DAS. Structure needs repairs.	Re-construction of the inlet structure and weir	ST/TO/IL-02
55	13+190	Foot Bridge (Beam Only)			
56	13+895	Road Bridge (RVDB) - Hingura Ara Rd.	Condition OK. US and DS eroded. Hand rails damaged	Construction of 6m high, 20m long 2 gabion walls to protect canal embankments	ST/GB-14
57	13+960	Partly Completed Bridge - new			
58	14+175	Causeway with undercrossing.	Structure needs repairs. Double bank canal concrete lined up to main road.-	Replacement of approach canal bed of 6m wide and 10m long with reinforced concrete	ST/CL-02
59	14+368	Single Beam foot Bridge			
60	14+490	Turnout to D 24 - DAS	inlet structure is not in good condition and weir broken	Re-construction of inlet structure and weir.	ST/TO/IL-01
61	14+850	Turnout to D25 - DAS	structure is in deplorable conditions	Replacement of the structure	ST/TO-06
62	15+210	DUC	DUC is encroached by land owners for shopping		ST/CL-02
63	15+260	Main Road Bridge	Bridge condition OK.		
64	15+275	Drop Structure	Structure condition OK. US and DS protection provided.		
65	15+300	DUC	Embankment on the main canal to be repaired	Repairing of Dia 500, Headwall and embankment on the main canal to be repaired	ST/CL-02

66	15+480	Turnout 26 belong to DAS running along boundary of Filling station of Town - New	inlet structure and weir need repairs	Repairing of the inlet structure and weir.	ST/TO/IL-03
67	16+035	Foot Bridge	structure is in deplorable conditions	Re-reconstruction of foot bridge	ST/FBR-08
68	16+360	New Town Bridge	Condition good.		
69	16+400	Outlet cum Regulator to Moraketiya BC	civil work in good condition	Regulator constructed by WLBP. Structure submerged needs to be inspected. Outlet gates OK. Replacement of Lifting mechanism and Hand Rails of Foot Bridge.	
70	16+400	Foot bridge of Regulator Structure.	hand rails to be replaced	Replacement of hand rails.	
71	17+000	TO 27 to DAS	gates are in bad condition. Canal Belongs to DAS.	Replacement of Gates.	W/RB/MC/SG-01
72	17+400	Road Bridge to Concrete Yard/School Road.	Eroded around abutments and needs repairs.	Construction of gabion walls on right and left hand sides	ST/GB-14
Downstream of Kachchigala Tank					
73	23+440	Outlet from Kachchigala Tank	Structure condition looks OK. Gate hoists installed few years back.	Refer list of works of HM works	
74	23+557	Partial Flume	Structure condition good. Us and DS approach lining needs repairs. Canal RB side bund severely eroded due to bend.	Reported that MASL has awarded a contract to repair same but not completed yet. (after the inspection made on 29 Jan 2019 , DRPM requested to include this rehab work under this contract)t. Construction of 100m long canal embankment filling with gabion mattress on both side and repairing of US and DS side of Partial Flume lining section 5M length X 4 Nos.	
75	24+180	DUC	Canal lining to be provided over the DUC	Construction of Canal lining over the DUC	ST/CL-02
76	24+200	Turnout to RB12FC 2	Weir to be replaced	Replacement of the Weir.	
77	24+510	Foot Bridge	Hand rails to be repaired. Canal bank RB side eroded up to foot bridge.	Canal protection with gabion mattresses	ST/GB-14
78	24+750	Bathing steps on right-side	Damaged	Replacement of the structure.	ST/BS-01
79	24+850	Turnout to RB12FC 3 & 4	Outlet box to be constructed. Bund protection on both sides of up stream head walls	350m long gabion mattresses protection on LS	ST/GB-14
80	25+120	Road Bridge - new	In good condition		
81	24+870 to 24+790	Level Crossing.	In good condition		

82	25+380	Causeway for LC	In good condition		
83	25+395	Turnout to FC 5	In good condition		
84	25+485	Foot Bridge (3 W)	Hand rails to be replaced.	Replacing of Handrails.	ST/HR-01
85	25+730	Foot Bridge(JVP bridge - 3W) - new	Hand rails to be replaced	Replacing of Handrails.	ST/HR-01
86	25+835	Turnout to D1	In good condition		
87	26+120	Road Bridge to Kuttigala (Skew B) -new	Canal protection for all four sides required	Construction of 4m high gabion mattresses for all four sides	ST/GB-14
88	25+839 to 26+050	Level Crossing.			
89	26+155	Turnout to D2	Gates to be replaced	Replacement of Gates.	W/RB/MC/SG-01
90	26+220	Gated Regulator No. 1	Condition of structure very good. Gate planks furnished recently. Painting of HM parts and repair of hand rails needed	Refer List of Works of HM Works.	ST/HR-01
91	26+295 to 26+455	Level Crossing.			
92	26+490	Road Bridge	hand rails to be replaced. U/S and D/S protection to be attended	protection with gabion mattresses as required	ST/GB-14
93	26+910	Foot Bridge (3 W)	Good condition		
94	26+960	Turnout to D3	Good Condition, Weir damaged	Replacement of the Weir.	
95	26+270	Turnout to FC6	Good Condition, Gates to be replaced, Weir damaged	Replacement of the Gate and the weir.	W/RB/MC/SG-01
96	27+500	Foot Bridge	Good condition		
97	27+500 to 27+600	Level Crossing.			
98	27+750	Causeway for LC	Good condition		
99	27+825	Foot Bridge	Good Condition	Replacement of Handrails.	ST/HR-01
100	27+830	Turnout to FC7	Good Condition, Weir damaged	Replacement of the Weir.	
101	28+145	Turnout to FC8	Good Condition, Weir damaged, gate to be replaced	Replacement of Gates and the Weir.	W/RB/MC/SG-01

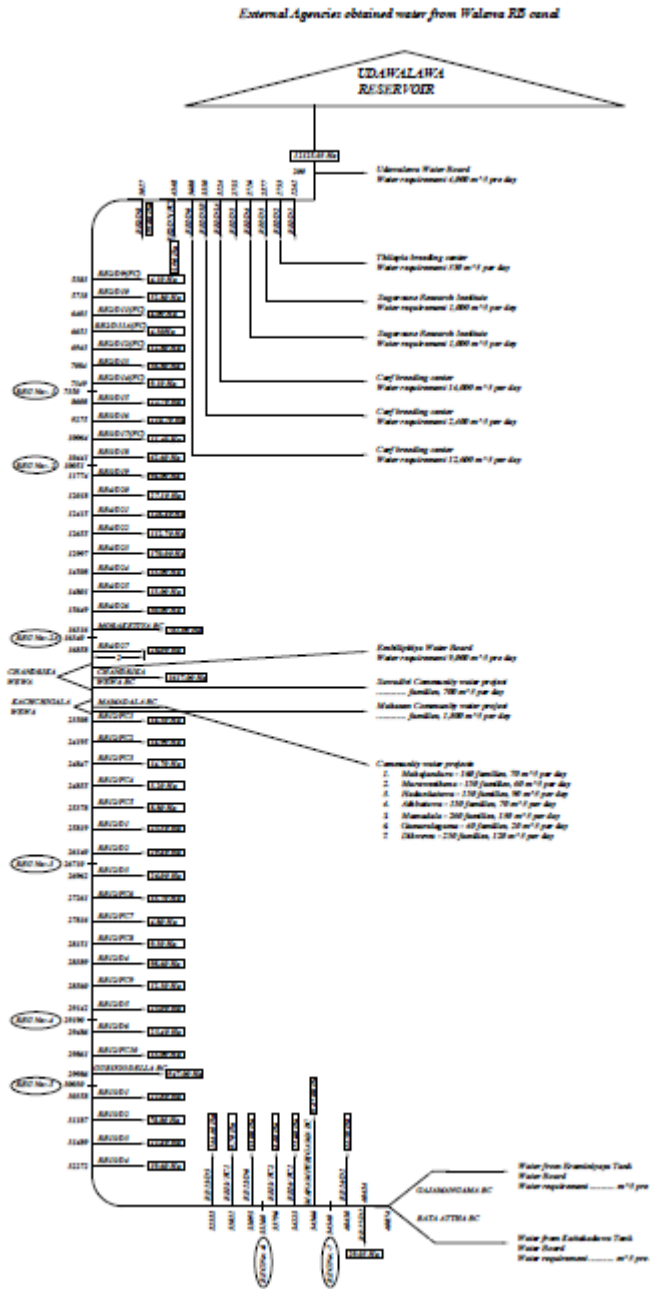
102	28+255	Road Bridge	Condition good		
103	28+305 to 28+495	Level Crossing.			
104	25+550	Turnout to D4	turnout box to be improved, gates to be replaced	Improvement of Turn Out Box and Replacement of the Weir.	W/RB/MC/SG-01
105	25+560	Turnout to FC9	Good Condition, Weir damaged	Replacement of the Weir.	
106	28+590	Abundant Regulator	Partly completed gabion wall at the DS side road of the structure.	No repairs needed.	
107	28+600 to 28+895	Level Crossing.			
108	29+130	Turnout to D5	Good Condition, Weir damaged	Replacement of the Weir.	
109	29+170	Gated Regulator No 2	Same as Regulator No.1. Condition of structure very good. Gate planks furnished recently. Painting of HM parts and repair of hand rails needed. One Gate is stuck and hoist needs to be repaired.	Refer list of work of HM works.	
110	29+480	Turnout to D6	Good Condition, Weir damaged	Replacement of the Weir.	
111	29+500	Buffalo entry		Construction of new Structure.	ST/BF/CW/CI-07
112	29+450 to 29+550	Level Crossing.			
113	29+725	Causeway for LC	structure verified., Good condition		
114	29+870	Turnout to FC 10	Door to be replaced, good condition, weir damaged	Replacement of the Weir.	
115	29+985	Outlet to Gurugodella BC	Structure is in good condition. Gate is in good condition. Spindle and lifting mechanism to be replaced with geared arrangement, D/S TO box to be constructed	Refer List of Works of HM Works.	
116	30+000 to 30+250	Level Crossing.			

117	30+030	Road Bridge/ Regulator	New regulator to be designed. Hand rail for the bridge is required	Construction of new Regulator replacement of Lifting mechanism and Hand Rails of Foot Bridge.	ST/HR-01
118	30+350	New Steel Road Bridge	Condition v good.		
119	30+360	TO D1	Structure is in good condition, weir damaged	Replacement of the Weir.	
120	31+000	Buffalo entry	New Structure to be constructed	Construction of new Structure.	ST/BF/CW/CI-07
121	31+050	Causeway for LC -new	Good condition		
122	30+750 to 31+000	Level Crossing.			W/RB/MC/SG-02
123	30+180	Turnout to D2	Gates to be replaced. Hand rail on down stream side on head wall required. 900mm Hump pipe extension of 70m long after down stream head wall is required. Area to be filled after that	Replacement of Gates and Hand rail on down stream side on head wall.	
124	31+225	Road Bridge	Good condition		
125	31+380	Gated Regulator No 3 cum foot Bridge	Condition of structure very good. Gate planks furnished recently. Painting and servicing of HM parts needed.	Refer list of works of hydro mechanical works	W/RB/MC/SG-02
126	31+480	Turnout to D3	Good condition, Gates to be replaced, Weir damaged	Replacement of the Gate and the weir.	
127	31+690	Buffalo entry		Structure to be constructed	
128	32+270	Causeway - new	Good condition		
129	32+270	Turnout to D4	Structure condition good. Weirs broken	Replacement of the weir.	
130	32+300	Road Bridge			W/RB/MC/SG-01
131	32+550	Turnout to D5	Extension bar to be replaced, TO box to be constructed	Replacement of extension bar and re-construction of turn out box.	ST/TO/OL-1
132	33+100	Turnout to FC1	Outlet structure to be constructed, gate door to be replaced	Re-construction of outlet structure and replacement of gate door.	
133	33+095	Turnout to D6	Good Condition, Gate to be replace, outlet structure to be repaired	Re-construction of Outlet structure.	

134	33+160	Gated Regulator No 4 cum Foot Bridge	Condition of civil structure good. All the gates are removed for repairs. HM components to be painted and serviced. Hand Rails good. Only one hoist with spindle at site. Narrow foot bridge - 2ft.	Refer List of Works of HM works.	
135	33+810	Turnout to FC2	good condition, weir damaged. Canal Bund eroded on road side. Contract awarded by MASL for repair around 100m. Near Smabodhi Society of Galle Land with a boundary wall.	Replacement of the weir.	
136	33+860 to 33+900	Siphon cum causeway	Constriction of Retaining wall is in progress in both bunds between bridge and Syphon.		
137	34+000	Main Road Bridge	Bridge condition good.		
138	34+240	Turnout to FC1	weir damaged	Replacement of the weir.	
139	34+300	Causeway	Good condition		
140	34+380	Off take to Manamperigam BC	Structure condition good. Canal bund repair under construction.		ST/BF/CW/CI-07
141	34+540	Gated Regulator No 5 cum Foot Bridge	Structure condition very good. No side spill walls. Hand rails and HM repairs and servicing needed. New timber planks provided. 2 gates are partially closed and welded the spindles to control the water level to mamamperigama Canal. Spindle size appears to be too small. US & DS protected up to 20m either side in all 5 regulators.	Refer list of works of hydro mechanical works	
142	31+690	Buffalo entry		Construction of newly proposed Buffalo Crossing Structure.	
143	34+810	New Canal inlet under Construction	Under construction.		
144	35+150	Muruthawela Canal over-crossing cum foot bridge			
145	35+820	DUC - 3/3-6' dia	To be repaired	Construction of 40m of concrete canal lining above the duc to protect the structure	ST/CL-02
146	36+350	Muruthawela Canal over-crossing cum foot bridge	Bund road eroded. Repair needed up to 50m till existing Gabion Wall.	Canal improvement with bioengineering techniques	ST/BF/CW/CI-07
147	36+780	Drainage under crossing	To be repaired	Construction of 40m of concrete canal lining above the duc to protect the structure	ST/CL-02
148	37+080	DUC - 1X600 dia	To be repaired	Construction of 40m of concrete canal lining above the duc to protect the structure	ST/CL-02
149	37+150	DUC - 2x600 dia	To be repaired	Construction of 40m of concrete canal lining above the duc to protect the structure	ST/CL-02

150	37+200	New Steel Road Bridge	Condition V. Good.		
151	37+770	DUC - 3x3-6' dia	To be repaired	Construction of 40m of concrete canal lining above the duc to protect the structure	ST/CL-02
152	38+100	Road Bridge	Hand rails to be repaired	Replacement of hand rails,	
153	38+150	DUC - 3x 2'-0' dia	To be repaired	Construction of 40m of concrete canal lining above the duc to protect the structure	ST/CL-02
154	38+420	Foot Bridge	To be widen as tractor crossing	Construction of new bridge.	ST/FBR-09
155	31+500	Buffalo entry	Newly proposed Buffalo Crossing Structure to be constructed	Construction of Buffalo Crossing Structure.	ST/BF/CW/CI-07
156	38+430	Outlet to Muruthawela scheme -new (to right side)	Structure is in good condition. Outlet box with measuring device is required (structure on the bund side- RB)	Construction of the outlet structure.	
157	38+500	Buffalo Entry (Cattle pond - 106,107)		Construction of Buffalo Crossing Structure.	
158	38+750	DUC - 2x 600 dia	foot bridge	construction of 40m of concrete canal lining above the duc to protect the structure	ST/CL-02
159	31+790	Buffalo entry	needed.	Construction of Buffalo Crossing Structure.	ST/BF/CW/CI-07
160	38+900	Foot Bridge (steel)	to be newly constructed	Construction of foot bridge.	
161	39+500	Drop structure	US& DS sides eroded and need to be repaired.	Repairing of U/S and D/S of the structure,	ST/DS-06
162	39+590	Foot Bridge	To be widened	Widening of the foot bridge.	ST/FBR-09
163	39+840	Drop structure	US& DS sides eroded and need to be repaired.	Repairing of drop structure.	ST/DS-06
164	39+980	Foot Bridge cum drop	US& DS sides eroded and need to be repaired.	Repairing of drop structure.	ST/FBR-09,ST/DS-06
165	40+470	Bridge cum drop cum turnout to both side R17D1, L14D1	US& DS sides eroded and need to be repaired.	Construction of new drop structure.	ST/DS-06, ST/BR-13
166	40+490	Drop structure	Completely damaged. Need to construct newly.	Construction of new drop structure.	ST/DS-06
168	40+870	Bifurcation to Bataatha(1653.21Ha) and Gajamangama(1076.48Ha) BCC	Combined structure civil works are in good condition. Timber gates to be replaced. Spindle size is 50 mm dia. HM components need complete overhaul.	Refer hydro mechanical list of works	

Annex 2: Mapping of Stakeholders Using the RB Canal for Water Supplies

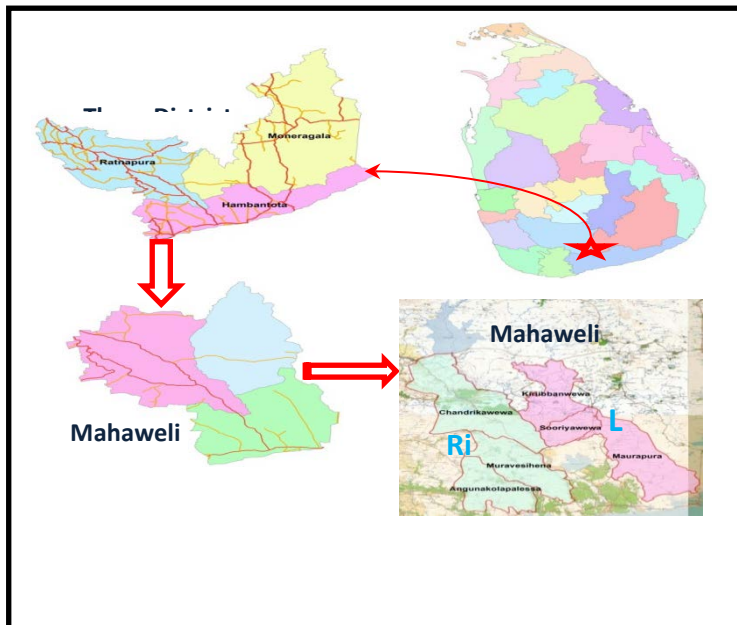


Annex 3: Pictures on Main Issues of the Walawe RBMC

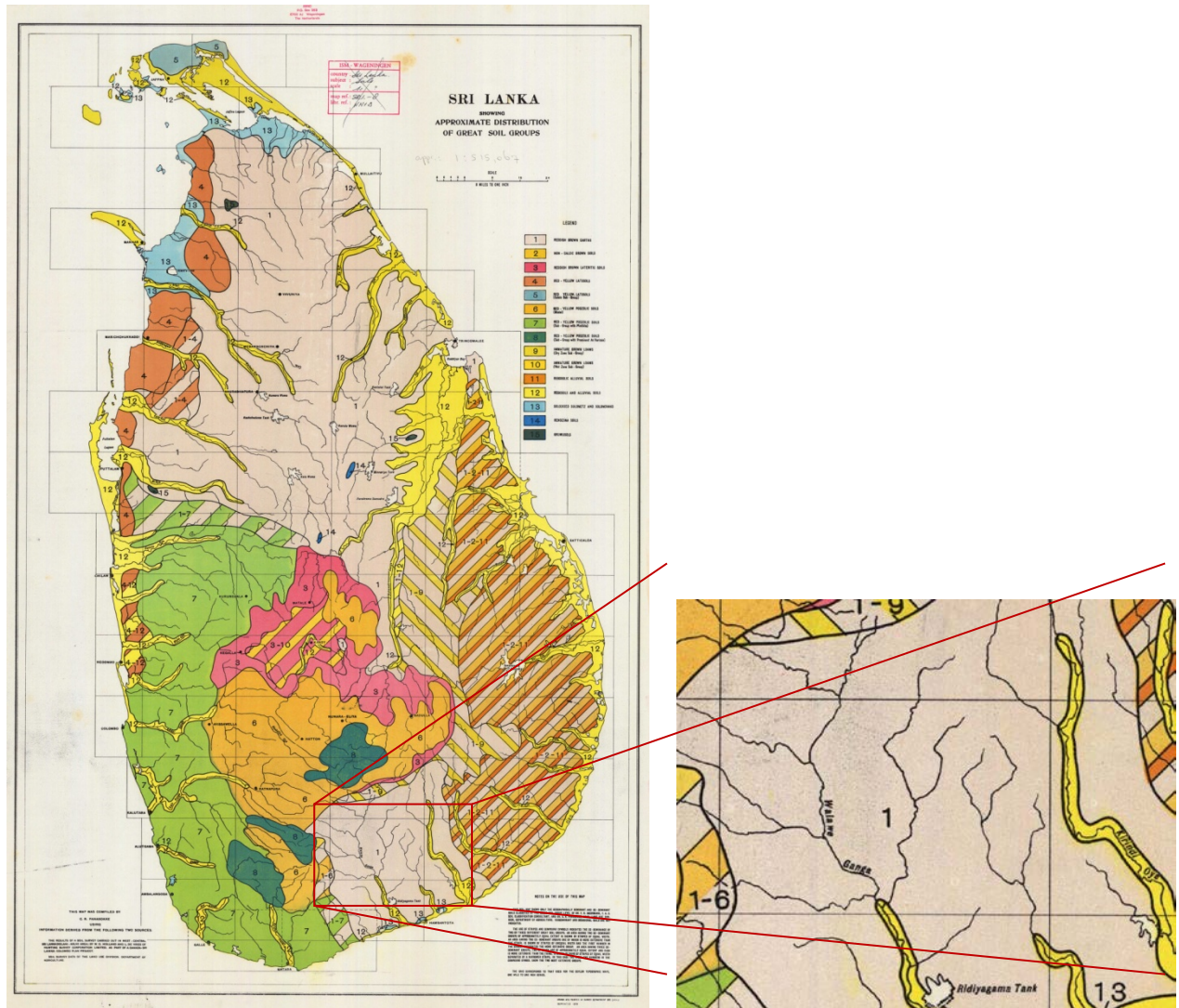


Fig 2. Different locations of the RBMC (A: Outlet of the Uda Walawe reservoir, B: in between Chandrika Reservoir and Embilipitiya Town, C: Close to the Chandrika Reservoir, D & E: Downstream of Chandrika reservoir, F: Main dividing point of the canal)

Annex 4: Location Map of project area

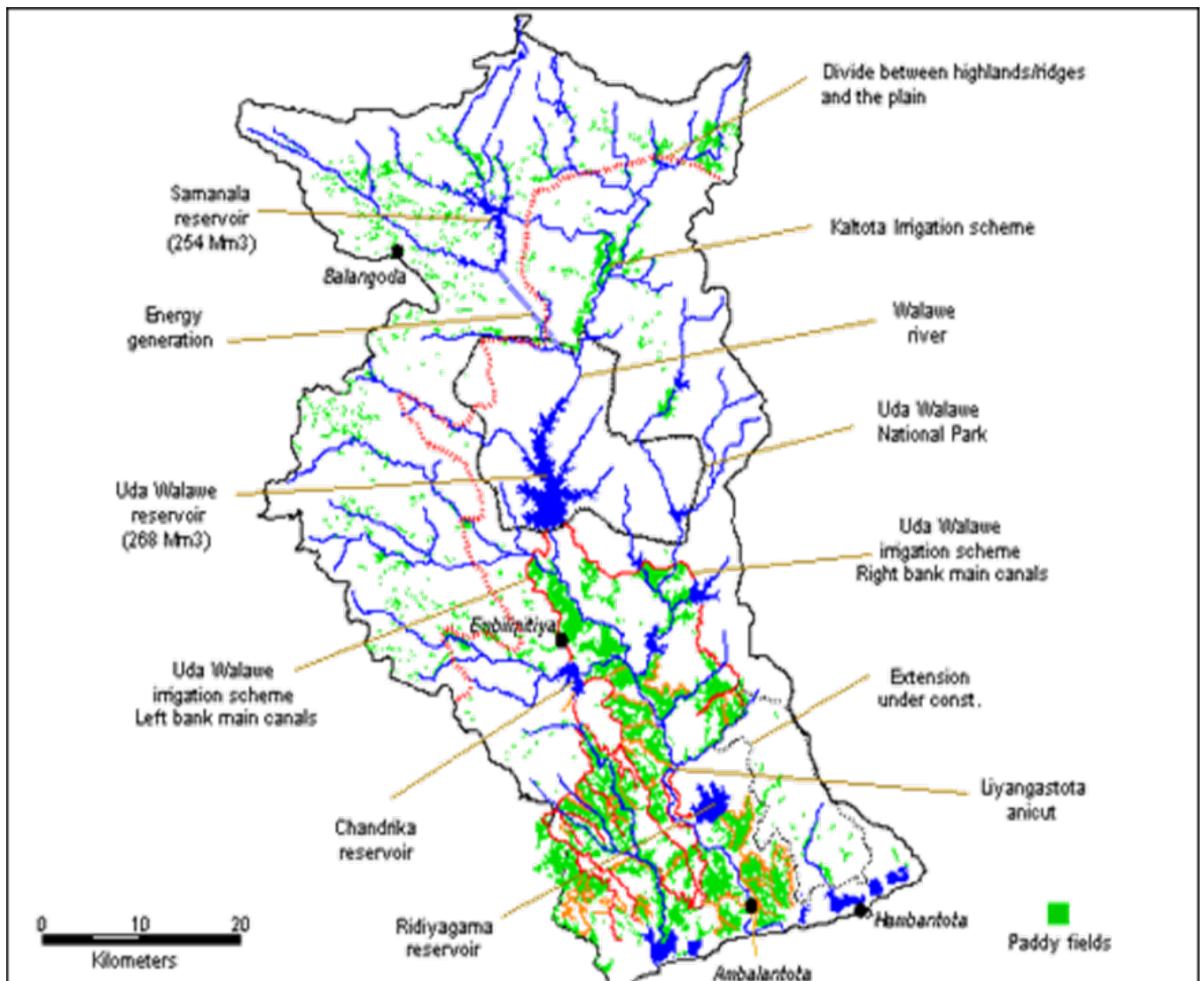


Annex 5: Soil Type in the Udawalawe Region



General Soil map in Sri Lanka showing “Reddish brown earth” materials in Udawalawe region

Annex 6: The Hydrology of the Walawe Basin



Annex 7: Aquatic Ecological Assessment For The Walawe Right Bank Canal

Aquatic Ecological Assessment For The Walawe Right Bank Canal



April 2019

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1. Introduction

The government of Sri Lanka (GOSL) with financing from the World Bank (WB) has proposed to undertake an Integrated Watershed & Water Resources Management Project (IWWRMP). One of the main development objective of the project is to improve the development and management of water resources within the country, reduce water induce hazards to the public and enhance the effectiveness of water related investments. It has been revealed through the studies that the major dams of the country are aging and suffering from the various structural deficiencies and shortcoming in the operation and monitoring facilities. This situation threatens safety and operation efficiency of the dams and its appurtenant structures and as result increase the vulnerability of the downstream population and socio- economic infrastructure. As the project fund USD 170 Million to be received from the donor to the project. The proposed project intends to address these issues through its dam safety and operational improvements for 80 dams & 58 Irrigation infrastructure.

Under above-mentioned 58 Irrigation infrastructure, Walawa 41km Right Bank main canal was selected from Mahaweli Authority of Sri Lanka to the fully rehabilitation.

Uda Walawa reservoir is one of the major irrigation projects in Sri Lanka which is built across the Walawe river. Walawe river receives the precipitation of the Southern escarpment of the central highlands which starts to drain water from Horton Plains National Park. The river collects the water of tributaries namely Belihul Oya, Kiriketi Oya and Weali Oya and when it reaches the Uda Walawe reservoir and the waters of Mau Ara reaches the main river down stream of the reservoir. Immediate catchment of the reservoir is protected as a national park and it is mainly focusing on providing habitats for Asian Elephants. Uda Walawe reservoir has two main canals where the Right Bank (R/B) canal was the first to built. The R/B Main Canal of Walawe was constructed in 1968 and government of Sri Lanka did the last rehabilitation in 1989. It serves total irrigation command area of 11,548 ha organized under three irrigation block areas; Chandrikawewa

Block (3379 ha); Muravasihena Block (4403 ha); and Angunukolapalessa Block (3766 ha). This Canal is 41 km long single bank contour canal that traverse passing 17 small tanks and Chandrikawewa reservoir as level crossings and 400 m long syphon structure.

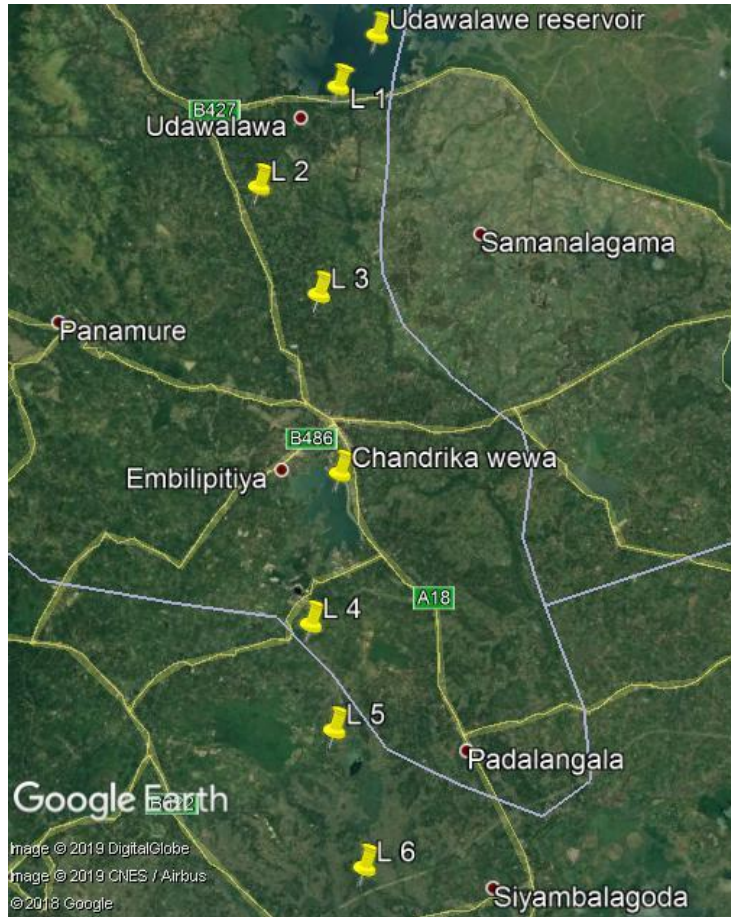
The 41 km long R/B main canal starts at the Southern dry zone and its tail end reaches the narrow strip of intermediate zone in Southern Sri Lanka. This area receiving an annual rainfall of 1500 – 2000 mm, mainly from the North-East monsoon rains in December to February. It receives some rains in April from intermonsoon rains, while other months of the year remains dry. July and August are the driest months of the year, where the shrubby plants tend to shed their leaves leaving only the thorny branches. Temperature of the area ranges between 29 – 33 °C and its humidity ranges between 65 – 85 %. Vegetation of the area is classified as 'moist monsoon forests' which can be seen in Udawalawe national park, just upstream of the project area. The project area is subjected to anthropogenic activities since the Udawalawe reservoir project was established. Hence this area has lost its natural habitats for at least 50 years, after it naturally reforested since the collapse of ancient civilization. Most of the land consist of cultivated areas of Paddy and Banana and the rest is human settlements with large home gardens.

An ecological study along the canal was conducted with the aim of facilitating and directing the proposed rehabilitation work of the R/B main canal to mitigate the ecological impact, which is reported here.

2. Methodology

2a. Study Area: The study area is mostly a mildly sloping terrain with some undulations located in the climatic zones of dry zone and intermediate zone. It belongs to the DL1 agro ecological zone, dry zone bioregion (bioregion 2) and floristic region A2 (lowland dry zone). The area consists of Alluvial soils along the river valley and reddish-brown earths in the high ground.

2b. Period of field survey, sampling frequency and time: The survey was carried out during three days in April 2019. Initially, the whole study site was studied using available literature and google maps and got an idea about micro habitats and their locations along the canal. Based on this initial study, sampling points and transects were selected for various taxonomic groups as well as to cover all the micro habitats identified. All the sampled sites were accessed by travelling along the dirt road along the left bank side of the canal. Six sites were thoroughly studied, and ad hoc studies were done when a different micro habitat was found while traveling along the canal. The field survey team comprised of four persons with expertise on flowering plants, terrestrial fauna and ichthyofauna. The same sampling points and transects were used for the flowering plants and terrestrial fauna while some of those points were not sampled for fish, since those locations are not providing good habitats for them. All the studies were done during the day time. At the time of the survey some rains had been received, but it was sunny during the sampled dates except for some hours in the first day, which was cloudy. All the sampling points are shown in map 1.



Map 1: The location map of surveyed points along the Walawa R/B canal.

Following are the co-ordinates and their micro habitats of the sampling sites.

Location	Latitude	Longitude	Micro habitat
L1	6.424171	80.832271	scrubland
L2	6.390065	80.816475	Stagnant water body + cultivated land
L3	6.36298	80.84138	Stagnant water body + home garden
L4	6.268936	80.861998	Irrigation tank
L5	6.240777	80.875925	Home gardens + reed bed
L6	6.204579	80.893748	Home gardens

Each sampling site was visited only once due to the time limitation. All vertebrate fauna as well as some indicator groups of invertebrates such as butterflies and dragonflies were studied. Floral study focused on all the families of flowering plants (Angiosperms) while lower plants were not considered. Sampling method used for each group is as follows.

2c. Sampling methods:

Fauna: Line transects survey, variable circular plots survey and opportunistic observations were used to determine the status of terrestrial fauna. Either direct or indirect evidence were used to record the existence of the species. An 8 x 42 binocular was used to aid in the sampling of birds, butterflies and dragonflies. Fish samples were collected in selected locations covering major aquatic habitats (Map 1) using cast nets (10 random casts/site) and hand traps. Further information was collected from riparian community on the local names of fish found in the canal.

Flora: Plots of 10 m width and variable lengths were selected along the canal and dirt road to conduct the terrestrial flora survey. Floating and emergent aquatic plants were identified by direct visual observations. Submerged plants were identified by observing through water surface, when the water is clear enough to see the bottom. Plants that could not be identified in the field were photographed in detail using a DSLR camera fitted with a macro lens, and later identified using literature.

Techniques used for each taxonomic group are listed in the following table.

Taxonomic Group	Technique
Birds	Variable circular plots in selected locations in different times of the day, Line transect observations at accessible routes (both direct observations and indirect observations such as calls were used for identification)
Mammals	Opportunistic observations in the study area (both direct and indirect observations such as scat and foot prints were used for identification) Traps were not used for the study of small mammals due to limited time available
Reptiles	Opportunistic observations (direct observations only), plot clearing in selected locations
Amphibians	Opportunistic observations with special attention in wet places such as canals, ponds and undergrowth. Log turning was also done in terrestrial habitats.
Fish	Cast nets (10 random casts/site), hand traps in selected locations, Opportunistic observations by surface viewing.

Butterflies	Line transects and opportunistic observations (both adult stage and larval stage were identified)
Dragonflies	Opportunistic observation (only the adult stage) with special attention at water bodies.

Observed species were identified using most recent field guides which are given follow.

Flora: Vlas & Vlas (2014), Vlas & Vlas (2008), Dassanayake & Fosberg (1980 – 1991), Dassanayake, Fosberg & Clayton (1994 – 1995), Dassanayake & Clayton (1996 – 2000) and Dassanayake, Clayton & Shaffer-Fehre (2006)

Birds: Kotagama & Rathnaweera (2010), Warakagoda *et. al.* (2012), Harrison (2011)

Mammals: Phillips (1935), Yapa & Rathnaweera (2013), Kotagama and Goonatilake (2013)

Reptiles: Somaweera (2006), Somaweera & Somaweera (2009)

Amphibians: Manamendra-Arachchi & Pethiyagoda (2006)

Fish: de Silva *et. al.* (2015), Goonathilake (2007)

Butterflies: Jayasinghe (2015), Jayasinghe *et. al.* (2016)

Dragonflies: Sumanapala (2017), Bedjanič *et. al.* (2007), Bedjanič *et. al.* (2014)

Nomenclature for fauna used in this document are mainly in accordance with the National Red list 2012 of Sri Lanka, with some minor changes according to recent scientific updates. The plant list is according to the - Angiosperms Phylogeny Group ver. IV (2018). Conservation status of the Flora and Fauna are also according to the National Red list 2012 (MoE, 2012). For migratory birds, the global conservation status is mentioned. Note that the conservation status was not provided for the introduced fish and introduced plants as introduced species and migratory species was not assessed during the national redlisting process.

3. Study Findings

3a. Habitats

The study site was mainly consisting of aquatic habitats, mainly the canal and pooled water bodies at certain places along the canal which are used as level crossings. Mostly the canal is a single bank construction except a double cutting area after Chandrika wewa which goes through a ridge at a high ground. Some sections of the canal are lined with concrete walls and gabion walls while most of the area remains earthen slopes, which has vegetation, thus providing habitats for terrestrial fauna. Since the embankment at the left-hand side of the canal, it provides deep waters while the canal becomes shallower towards the right-hand side until it reaches the natural ground. Right-hand side provides grassy vegetation and other floating vegetation such as *Ipomoea aquatica*, *Alternanthera sessilis* and *Limnocharis flava* due to its shallowness. This vegetation provides habitats for many dragonflies, who are associated with water. Male dragonflies use this vegetation as their breeding territories, since they live as aquatic creatures in their nymphal stage for a long period.

Level crossings are quite large, stagnant water bodies with reed vegetations and other floating aquatic plants such as *Nelumbo nucifera* and *Nymphoides indica*. These pools provide much better habitats for water birds and raptors. The trees adjacent to these pools provide roosting places and breeding grounds for some birds such as Black-crowned Night-heron, Grey Heron, Black-headed Ibis and Indian Cormorant. These pools preferred by fish species such as Scribbled Goby, Murrel, Spotted Snakehead and Common Spiny Loach, who need stagnant water. Floating vegetation in these pools provide breeding grounds and safe shelter for juveniles of Murrel, which is a harvested fish by local people.

Flowing water of the canal is preferred by fish species such as Giant Danio and Narrow line Rasbora. Since the floating vegetation is minimal, dragonflies are scarce in these habitats.

Vegetation of the inside of the canal embankment is limited to shrubs and herbs since regular weeding is necessary to maintain the canal. But the roadside vegetation beside the canal is quite lush with some tree species. Scrublands are dominated by the species such as *Streblus asper*, *Grewia damine*, *Grewia orientalis*, *Azima tetracantha* and *Croton aromaticus*.

Natural tree species consisted of *Syzygium cumini*, *Bridelia retusa*, *Limonia acidissima*, *Lepisanthes tetraphylla*, *Sapindus emarginatus*, *Schleichera oleosa* and *Chloroxylon swietania*. Natural vegetation was limited to a very small sections throughout the canal, while most of the land consisted of home gardens, cultivated lands and hedges of their boundaries. People tend to cultivate coconut and banana just down the embankment and seepages of the canal provide good water source for these cultivations. Tree species of the home gardens included food crops such as *Artocarpus altilis* & *Artocarpus heterophyllus* and timber species such as *Tectona grandis* and *Berrya cordifolia*.

3b. Species

Flora

A total of 236 angiosperm species belonging to 61 families were identified within the study area. Highest number of species were represented by the family Fabaceae (35 species) followed by family Malvaceae (12 species). 29 families were represented by only a single species (Table 1). The detailed list of plant species observed in the study site is given in Annex 1 Table 1.

Table 1. Plant families that make up the vegetation observed in different micro ecosystems and number of species belonging to each family.

Family	Number of species	Family	Number of species
Fabaceae	35	Solanaceae	2
Malvaceae	25	Alismataceae	1
Euphorbiaceae	13	Bignoniaceae	1
Compositae	11	Cannabaceae	1
Lamiaceae	11	Celastraceae	1
Convolvulaceae	10	Cleomaceae	1
Phyllanthaceae	10	Lauraceae	1
Rubiaceae	8	Linderniaceae	1
Acanthaceae	7	Malpighiaceae	1
Apocynaceae	7	Menyanthaceae	1
Moraceae	7	Molluginaceae	1
Poaceae	6	Muntingiaceae	1
Rutaceae	6	Musaceae	1
Amaranthaceae	5	Myrtaceae	1
Sapindaceae	5	Nelumbonaceae	1
Combretaceae	4	Nyctaginaceae	1

Araceae	3	Oleaceae	1
Arecaceae	3	Onagraceae	1
Boraginaceae	3	Orchidaceae	1
Cucurbitaceae	3	Oxalidaceae	1
Verbenaceae	3	Pandanaceae	1
Anacardiaceae	2	Passifloraceae	1
Annonaceae	2	Plantaginaceae	1
Capparaceae	2	Plumbaginaceae	1
Commelinaceae	2	Polygonaceae	1
Loganiaceae	2	Salvadoraceae	1
Loranthaceae	2	Sapotaceae	1
Lythraceae	2	Ulmaceae	1
Meliaceae	2	Vitaceae	1
Menispermaceae	2	Zygophyllaceae	1
Rhamnaceae	2		

Among the total number of recorded species, 1176 (74.58%) species including four endemic species (*Rhinacanthus polonnaruwensis*, *Vernonia zeylanicum*, *Argyreia kleiniana* and *Premna procumbens*) were native to Sri Lanka while the remaining 60 (25.42 %) species are either naturalized exotic species or invasive alien species. *Rhinacanthus polonnaruwensis* was a locally common herbaceous species in shady undergrowth of hedges along the dirt road. This species was initially described from a population around Polonnaruwa (North Central province), but it is found in similar type of habitats through out the dry zone. *Vernonia zeylanicum* was the commonest endemic species found in the study site. It prefers well lit sunny scrublands and its one of the good nectar sources for local butterflies such as Silverlines, Common Gulls, Jezebels etc. The beautiful flowered vine *Argyreia kleiniana* was found only at the lower reaches of the canal, since it prefers wet zone habitats rather than dry zone habitats found in the upper reaches. It was usually found together with *Ipomoea triloba*, another Convolvulaceae species. The endemic straggling vine *Premna procumbens* was an occasionally found species at the hedges of cultivated lands. Most of the native plants in the site were common species, where 161 of them were listed as ‘Least Concern’ and 7 species as ‘Near threatened’ in National Red Data List, 2012. Only six species which are considered as ‘threatened’ were recorded in the proposed project area (Table 2).

Table 2. The threatened species recorded in the study site

Species	Sinhala name	Distribution status	Conservation status
<i>Cryptolepis dubia</i>	වැල් රුක් අත්තන, කිරි වැල්	Native	VU
<i>Strychnos potatorum</i>	ඉහිනි	Native	VU
<i>Corchorus olitorius</i>	සානි	Native	VU
<i>Margaritaria indica</i>	කරව්, මහ කරව්	Native	VU
<i>Chloroxylon swietania</i>	බුරුත	Native	VU
<i>Croton caudatus</i>	වැල් කැප්පෙටියා	Native	EN

Abbreviations used: EN - Endangered; VU - Vulnerable

Croton caudatus was evaluated as ‘Endangered’ in the previous red data list due to its lack of herbarium specimens, but there are considerable number of records of the occurrence of the species in the recent past. This species prefers edges of water bodies in the dry zone and it was a quite regularly found species even within the study site. *Chloroxylon swietania* got its threatened status due to its high demand for timber. Fully grown trees of this species was regularly seen along the edge of the dirt road. The tree species *Margaritaria indica* also was a regularly seen plant, although many of them were immature trees. This is a water preferred plant and grows near water. Regular weeding of the canal embankment could be a reason for not having the mature trees in the proposed project area. *Strychnos potatorum* found only once near the ‘location 4’ at the reservoir embankment. This species usually prefers the driest parts of the country. *Corchorus olitorius* is a tall herb found in secondary vegetation of the dry zone. This species was occasionally found along the canal embankment, where the weeding was not done. The liana, *Cryptolepis dubia* found only once at the road edge scrolling on other shrubs. This is an abundant species around Wellawaya and Koslanda.

Since this area is subjected to human activities, many exotic plant species established in this habitat and comprises a large portion of the vegetation. Some species such as *Stachytarpheta urticifolia* are naturalized in this habitat help to uplift the eco system diversity by being a good nectar source for butterflies and bees. Apart from these species and naturalized harmless species, there are several alien invasive species spread throughout the study site. During the study, 08 out of the 33 plant species listed as invasive alien species and three out of the 15 species listed as potentially invasive alien species were recorded within the study site (Table 3).

Table 3. Invasive alien species and potentially invasive alien species recorded in the study site.

Scientific Name	Common Name
Alien invasive species	
<i>Chromolaena odorata</i>	පොඩි සිඤ්ඤොමරන්, ලොක්කන් නට්ටං
<i>Mikania cordata</i>	ගම් පාළු, වතු පාළු, දෙමළ වැල්
<i>Tithonia diversifolia</i>	වල් සුරියකාන්ත, වට සුරිය, නත්ත සුරිය
<i>Cuscuta campestris</i>	අග මුල නැති වැල්
<i>Panicum maximum</i>	ගිණි තණ, රට තණ, ගිනිකීරුප්ප
<i>Pennisetum polystachion</i>	
<i>Lantana camara</i>	ගඳපාන, කටු හිඟුරු, රට හිඟුරු
<i>Leucaena leucocephala</i>	ඉපිල් ඉපිල්
Potential alien invasive species	
<i>Ludwigia peruviana</i>	බෙරු දියනිල්ල, වෙල් කරාඹු
<i>Muntingia calabura</i>	ජෑම්
<i>Acacia auriculiformis</i>	

Most abundant invasive species were *Panicum maximum*, *Lantana camara* and *Mikania cordata*. The annual tall grass *Panicum maximum* was found throughout the trace of the canal where there are sunny openings. This species grows profusely during the North-east monsoon period by controlling other species and it is a threat to nearby cultivated lands as well. Dead *Panicum* plants prone to fire in August, at the driest period of the year, destroying nearby vegetation as well. This destroyed vegetation is invaded by the *Panicum* grass during the next rainy season and the process is continuing. *Lantana camara* is a shrub which is also preferring sunny habitats. This species got its invasive nature by attracting many pollinators to flowers and attracting many seed dispersers (here the small birds). However, it has less impact in the study site than in the nearby Udawalawe national park. *Mikania cordata* was common in the places that has seepages, since it requires more wetness. It was seen that this vine grows on top of banana plantations right at the edge of the canal. *Leucaena leucocephala* was found abundantly beside the canal near the Udawalawe reservoir. This species was associated with a potentially invasive species, *Acacia auriculiformis* and *Muntingia calabura*. Most importantly, all the water bodies got only slight impacts from these invasive plant species.

Fauna

The recorded fauna of the study area comprised of 125 vertebrates and 60 invertebrate species (Table 4). Avifauna is the most diverse taxa observed with 70 species while butterflies are the second diverse group with 44 species. Most of the recorded species are common and widespread species with low conservation status. Only six species recorded are listed as threatened species in the 2012 National Red List of Sri Lanka. Even among those, no Critically Endangered species were recorded. Wild populations of Rock Pigeon – *Columba livia* is considered as nationally threatened, but here all the individuals recorded during the survey were feral breeds. The detailed list of animal species observed in the study site is given in Annex 1, Tables 2-8.

Table 4. Summary of the Faunal Species Recorded During the Study.

Taxa	Species	Endemics	Exotic ¹	Threatened				NT
				CR	EN	VU	Total	
Dragonflies	16	3	0	0	1	2	3	2
Butterflies	44	1	1	0	0	0	0	0
Freshwater Fish	13	1	1	0	0	0	0	0
Amphibians	11	1	0	0	0	1	1	0
Reptiles	16	2	0	0	0	0	0	1
Birds	70	2	3	0	0	0	0	4
Mammals	15	1	0	0	1	1	2	0
Total	185	11	5	0	2	4	6	7

Abbreviations used: **1** - Migratory species of birds were listed under this category; **CR** - Critically Endangered; **EN** - Endangered; **VU** - Vulnerable; **NT** - Near Threatened

Eleven endemic species of fauna were recorded during the survey period within the study area. These comprised of two bird species, Sri Lanka Lesser Flameback (*Dinopium psarodes*) and Sri Lanka Barbet (*Psilopogon rubricapillus*), two reptiles namely Termite hill gecko (*Hemidactylus lankae*) and Common lankaskink (*Lankascincus fallax*), one mammal, Sri Lanka toque monkey (*Macaca sinica*), one amphibian Common hourglass tree frog (*Polypedates cruciger*), one fresh water fish Sri Lanka Filamented Barb (*Dawkinsia singhala*) one butterfly Sri Lankan Lesser Albatross (*Appias galene*) and three dragonfly species, namely Sri Lanka Green's Gem (*Libellago greeni*), Sri Lanka Adam's Gem (*Libellago adami*) and Sri Lanka Jungle Threadtail (*Elattonneura caesia*). Out of these all the dragonfly

species are recognized as a species with the risk of extinction at the national level while others are widespread, common endemics.

Out of the 70 species of avifauna recorded 03 species are migratory and arrive in Sri Lanka only during the North-South migratory period. None of these species are recognized as globally threatened migratory species thus they have a low conservation priority. Since the survey was carried out at the end of the migratory season, very few species were recorded here. However, the habitats in the area has reported that it is important for many migrants that use the site as a feeding ground as well as a roosting site.

The study area is a part of a larger habitat complex that supports some apex species that occupies larger home ranges such as raptors like Grey-headed Fish-eagle, White-bellied Sea-eagle, Brahminy Kite and medium sized carnivorous mammals like the Fishing Cat. Although the adjacent Udawalawe national park bares many wild elephants, the project area has no impact by stray elephants unlike other similar areas in the country due to the well-maintained elephant fence at the park. The canal and the level crossings provide water sources for many fauna including some bird species and small mammals. Although this water source is not available for them during the driest part of the year, when the canal is closed after cultivation.

Fresh water fish diversity of this canal is quite low compared to other natural streams and irrigation canals of the dry zone, probably due to the invasive nature of Mozambique Tilapia (*Oreochromis mossambicus*). This species is regularly introduced to the reservoir for harvesting.

4 Conclusions and Recommendations

Based on the findings of the field surveys, the study site supports a moderately rich assemblage of fauna and flora including few species of endemic and threatened species. Once a terrestrial eco system has now being changed in to an aquatic eco system and this habitat has become naturalized since it is about 40 years old. However, there are many drivers of change operating on the man-made ecosystem, which is an obvious feature of the system. One of the adverse impacts observed is the spreading of alien invasive species, which is a threat to natural flora and fauna species as well as for humans. Putting waste material such as logs by the people living adjacent to the canal has hinders the regular flow in the canal. However, drainages to the canal bring only very slight amount of garbage such as plastics. Among these plastics, some bottles of weedicides and pesticides were observed, and the water may contaminate with these toxic chemicals. Eventhough this is a man made eco system, it is worth to concern on natural species and their relationship with the environment, when it comes to a development project.

Based on the findings of this study the following recommendations can be made.

1. Level crossings contains the most faunal diversity in the canal system. Damages to the vegetation in these sites must be minimum during the construction.
2. Although reed beds hinder the canal flow, it provides good habitat for many avifauna. A compromise has to be made when removing this vegetation.
3. Water quality paly a major role in the diversity of fish and aquatic insects, thus do the same on the higher ranks of the food chain. It is better to monitor the water quality of the canal at regular intervals by this project and to make nessasary actions if the quality is poor.
4. At present the project area supports only a moderately rich biodiversity. Therefore, it is recommended that the habitat quality of the roadside be increased by planting more native species that attracts more species into the site such as butterflies and birds. This planting process can be done in the places that used for temporary site huts and storages during the construction period.
5. Invasive species management plan should be developed for the site to remove or replace the existing exotic and invasive alien species along the canal. Construction processes should not encourage the spread of these species.
6. Water of the canal and level corssings must keep accessible to small mammals in the vicinity, which is useful for them in the dry spell.

7. Hedges with natural vegetation (especially the area near Chandrika wewa) should keep unaltered during the construction since these are the only remaining natural vegetations in the area.
8. Steps should be taken to stop all the illegal anthropogenic activities such as setting fire to vegetation, encroachment, disposal of soiled waste and construction waste.
9. Chemicals should not be released in to the water both during construction and operational stage of any activities that are carried out in the project area.
10. Construction activities to be carried out must have a proper solid waste management plan.
11. Labors must be adhered to the solid waste management plan and they should prevent from poaching wild animals.

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Annex 1

Table 1. Detailed list of flowering plants observed at the study site

Abbreviations used: **DS** - Distribution Status; **NCS** - National Conservation Status; **DD** - Data Deficient; **EN** - Endangered; **LC** - Least Concern; **NE** - Not Evaluated; **NT** - Near Threatened; **VU** - Vulnerable.

No.	Family	Species	Sinhala name	DS	NCS 2012	L 1	L 2	L 3	L 4	L 5	L 6
1	Acanthaceae	<i>Hygrophila auriculata</i>	කටු ඉකිරිය, නිරමුල්ලිය, එකිරිය	Native	LC		1	1	1	1	
2	Acanthaceae	<i>Justicia adhatoda</i>	අගල් ආධාර, ආඩකෝඩ, වනේපලා, දන් අනෝදා	Native	LC		1	1		1	1
3	Acanthaceae	<i>Lepidagathis fasciculata</i>		Native	LC				1		
4	Acanthaceae	<i>Nicotiba betonica</i>	සුදු පුරුක්	Native	LC	1	1			1	1
5	Acanthaceae	<i>Rhinacanthus polonnaruwensis</i>		Endemic	LC	1		1	1	1	
6	Acanthaceae	<i>Ruellia prostrata</i>	නිල් පුරුක්	Native	LC	1	1	1	1		1
7	Acanthaceae	<i>Rungia pectinata</i>		Native	LC				1	1	
8	Alismataceae	<i>Limnocharis flava</i>	දිය ගෝවා	Exotic	NE		1	1			
9	Amaranthaceae	<i>Achyranthes aspera</i>	කරල් හැබ, ගස් කරල් හැබ, කරල්සැබෝ	Native	LC	1	1		1	1	1
10	Amaranthaceae	<i>Aerva lanata</i>	පොල්කුඩු පලා, පොල් පලා	Native	LC	1		1	1	1	
11	Amaranthaceae	<i>Alternanthera sessilis</i>	මුකුණුවැන්න, මී කන් පලා	Native	LC		1	1	1	1	
12	Amaranthaceae	<i>Amaranthus viridis</i>	කුර තම්පලා, සුදුකුර	Native	LC		1	1	1	1	1
13	Amaranthaceae	<i>Gomphrena celosioides</i>		Exotic	NE	1	1	1			
14	Anacardiaceae	<i>Anacardium occidentale</i>	කජු	Exotic	NE			1		1	1
15	Anacardiaceae	<i>Lannea coromandelica</i>	හික්	Native	LC		1		1		
16	Annonaceae	<i>Huberantha cerasoides</i>	පත් උල්කෙන්නේද	Native	LC				1		
17	Annonaceae	<i>Monoon longifolium</i>	දේවදාරු, මිවිල, ඊපෙන්න, මිවිල	Native	LC				1		
18	Apocynaceae	<i>Calotropis gigantea</i>	වරා, එළ වරා	Native	LC	1		1		1	

19	Apocynaceae	<i>Carissa spinarum</i>	හීන් කරඹ, කරඹ	Native	LC	1					
20	Apocynaceae	<i>Cryptolepis dubia</i>	වැල් රුක් අත්තන, කිරි වැල්	Native	VU		1				
21	Apocynaceae	<i>Hemidesmus indicus</i>	හීන් ඉරමුසු, ඉරමුසු	Native	LC	1	1	1	1		1
22	Apocynaceae	<i>Ichnocarpus frutescens</i>	ගැරඬි දුල්, ගෝපි, කිරි වැල්, ප්‍රියවර්ණ, මහ ඉරමුසු වැල්	Native	LC	1					
23	Apocynaceae	<i>Rauwolfia tetraphylla</i>		Exotic	NE	1		1	1	1	1
24	Apocynaceae	<i>Wattakaka volubilis</i>	අඟුණ, අනුක්කොළ, කිරි අඟුණ, තිත්ත අඟුණ	Native	LC		1	1			1
25	Araceae	<i>Colocasia esculenta</i>	ගහල, දේසි අල, කිරි අල, ඇත් හෙඬල, ගරුඬ, හබරල, කඳු කෙඬල, සෙවෙල් අල	Native	LC			1	1	1	1
26	Araceae	<i>Lasia spinosa</i>	කොහිල, ඇහිලි කොහිල, මහ කොහිල, කොහොවිල	Native	LC			1	1	1	1
27	Araceae	<i>Pothos scandens</i>	පෝටා වැල්	Native	LC					1	
28	Arecaceae	<i>Areca catechu</i>	සුවක්	Exotic	NE			1	1		1
29	Arecaceae	<i>Caryota urens</i>	කිතුල්	Native	LC			1		1	
30	Arecaceae	<i>Cocos nucifera</i>	පොල්, තැඹිලි, තෙරළු	Exotic	NE					1	1
31	Bignoniaceae	<i>Stereospermum tetragonum</i>	ලුණුමිදෙල්ල, දුණු මඩල, ලුණුමඩල	Native	LC			1			
32	Boraginaceae	<i>Cordia dichotoma</i>	දෙබු ලෝඵ	Native	LC	1					
33	Boraginaceae	<i>Ehretia aspera</i>	අදුල්ල	Native	LC	1	1	1			
34	Boraginaceae	<i>Heliotropium indicum</i>	දිම්බිය, ඇත් හොඬ, ඇත් සැටිය, ඇත්සොඬ	Native	LC			1	1	1	
35	Cannabaceae	<i>Trema orientale</i>	ගැඬුඹ	Native	LC	1			1		1
36	Capparaceae	<i>Capparis sepiaria</i>	රිලා කටු	Native	LC	1				1	
37	Capparaceae	<i>Crateva adansonii</i>	ලුණුවරණ	Native	LC	1			1	1	
38	Celastraceae	<i>Reissantia indica</i>		Native	LC	1	1			1	
39	Cleomaceae	<i>Cleome rutidosperma</i>		Exotic	NE				1	1	1
40	Combretaceae	<i>Combretum indicum</i>		Exotic	NE			1	1	1	
41	Combretaceae	<i>Terminalia arjuna</i>	කුඹුක්, කුම්බළු, පොලඟුණ	Native	LC			1		1	1
42	Combretaceae	<i>Terminalia bellirica</i>	බු	Native	LC						1
43	Combretaceae	<i>Terminalia catappa</i>	කොට්ටම්බා, කොට්ටන්	Exotic	NE				1		1
44	Commelinaceae	<i>Commelina benghalensis</i>	දිය මෙහෙරිය	Native	LC	1	1			1	1

45	Commelinaceae	<i>Commelina diffusa</i>	ගිරා පළා, තණ පළා	Native	LC	1	1	1		1	
46	Compositae	<i>Ageratum conyzoides</i>	හුලන්තළා	Exotic	NE	1		1		1	
47	Compositae	<i>Chromolaena odorata</i>	පොඩි පිඤ්ඤොමරන්, ලොක්කන් නව්වං	Exotic	NE	1		1	1	1	1
48	Compositae	<i>Cyanthillium cinereum</i>	මහල් කුඹුරුවැන්න, මොණරකුඩුම්බිය, වතු පාඵ	Native	LC	1	1	1	1	1	1
49	Compositae	<i>Eclipta prostrata</i>	කිකිරිදි, සුදු කිරිදි, කබරි, කිපලන්	Native	LC		1	1	1	1	
50	Compositae	<i>Eleutheranthera ruderalis</i>		Exotic	NE	1		1	1	1	1
51	Compositae	<i>Mikania cordata</i>	ගම් පාඵ, කෙහෙල් පාඵ, මහ කිහිඹිය, වතු පාඵ, දෙමළ වැල්	Exotic	NE	1	1	1	1	1	1
52	Compositae	<i>Spilanthes iabadicensis</i>	හින් අක්මැල්ල	Native	LC		1		1	1	
53	Compositae	<i>Synedrella nodiflora</i>		Exotic	NE	1		1		1	1
54	Compositae	<i>Tithonia diversifolia</i>	වල් සුරියකාන්ත, වට සුරිය, නත්ත සුරිය, පදිමැල්ල	Exotic	NE					1	1
55	Compositae	<i>Tridax procumbens</i>	වසු සුද	Exotic	NE	1	1	1			1
56	Compositae	<i>Vernonia zeylanicum</i>	හින් බෝටිය, පුපුල, වල් පුපුල	Endemic	LC	1	1				
57	Convolvulaceae	<i>Argyreia kleiniana</i>	ගිරිකිල්ල	Endemic	LC				1		1
58	Convolvulaceae	<i>Camonea pilosa</i>	කිරි මදු, මහ මදු	Native	LC	1					
59	Convolvulaceae	<i>Cuscuta campestris</i>	අග මූල නැති වැල්	Native	LC		1	1		1	
60	Convolvulaceae	<i>Evolvulus nummularius</i>	සුදු විශ්ණුකුරාන්ති	Exotic	NE	1			1		1
61	Convolvulaceae	<i>Hewittia malabarica</i>	වල් තුස්තවා	Native	LC	1	1	1		1	
62	Convolvulaceae	<i>Ipomoea aquatica</i>	කංකුං	Native	LC		1		1		
63	Convolvulaceae	<i>Ipomoea obscura</i>	මහ මදු, තැල් කොළ, මහ තැල්, තැල් වැල්, දුවද, දුමුදු	Native	LC			1		1	1
64	Convolvulaceae	<i>Ipomoea sagittifolia</i>	රස තැල් කොළ	Native	LC		1	1	1	1	1
65	Convolvulaceae	<i>Ipomoea triloba</i>	වස තැල්ල	Exotic	NE	1			1		
66	Convolvulaceae	<i>Merremia emarginata</i>	කොතුරු බැද්ද	Native	NT		1	1	1	1	
67	Cucurbitaceae	<i>Coccinia grandis</i>	කෝවක්කා, කෙම් කැකිරි	Native	LC	1	1	1	1	1	
68	Cucurbitaceae	<i>Cucumis maderaspatanus</i>	හින් කැකිරි, ගොන් කැකිරි, ලේන් කැකිරි, කැකිරි, එලලු, වතු කැකිරි	Native	NT	1		1			
69	Cucurbitaceae	<i>Diplocyclos palmatus</i>	පසුහිල්ල	Native	LC	1	1		1		1
70	Euphorbiaceae	<i>Acalypha indica</i>	කුස්පමේනිය	Native	LC		1	1		1	1

71	Euphorbiaceae	<i>Croton aromaticus</i>	වැල් කැප්පෙටියා	Native	LC	1		1		1	1
72	Euphorbiaceae	<i>Croton bonplandianus</i>		Exotic	NE	1		1	1	1	
73	Euphorbiaceae	<i>Croton caudatus</i>	වැල් කැප්පෙටියා	Native	EN		1		1		
74	Euphorbiaceae	<i>Croton hirtus</i>	ගං වෙද, වල් තිප්පිලි	Exotic	NE	1				1	1
75	Euphorbiaceae	<i>Euphorbia heterophylla</i>		Exotic	NE	1		1		1	
76	Euphorbiaceae	<i>Euphorbia hirta</i>	බු දඳ කීරිය, කිරි තලා	Native	LC			1	1	1	1
77	Euphorbiaceae	<i>Jatropha curcas</i>	රට එඬරු, වැට එඬරු	Exotic	NE	1	1	1		1	
78	Euphorbiaceae	<i>Jatropha gossypifolia</i>	රතු එඬරු	Exotic	NE				1		1
79	Euphorbiaceae	<i>Macaranga peltata</i>	කැන්ද, පත් කැන්ද	Native	LC	1				1	1
80	Euphorbiaceae	<i>Mallotus philippensis</i>	හම්පිල්ල, මොලබේ, කම්පිල්ල, හම්පිරිල්ල	Native	LC	1		1			
81	Euphorbiaceae	<i>Mallotus repandus</i>	වැල් කැප්පෙටියා	Native	LC		1		1		
82	Euphorbiaceae	<i>Ricinus communis</i>	එඬරු, තෙල් එඬරු	Exotic	NE			1	1	1	1
83	Lamiaceae	<i>Anisomeles indica</i>	යක් වනස්ස, යක් වනසු	Native	LC	1					
84	Lamiaceae	<i>Gmelina asiatica</i>	දෙමට, හීන් දෙමට, ගැට දෙමට, දෙඹට	Native	LC	1			1		
85	Lamiaceae	<i>Mesosphaerum suaveolens</i>	අලි තල	Exotic	NE	1	1	1		1	1
86	Lamiaceae	<i>Leucas biflora</i>	ගැට තුඹ, විලඳවැන්න	Native	LC	1		1		1	
87	Lamiaceae	<i>Leucas zeylanica</i>	ගැට තුඹ	Native	LC		1	1	1	1	1
88	Lamiaceae	<i>Ocimum americanum</i>	හීන් තලා, වල් තලා, සුවඳ තලා	Native	LC	1		1		1	
89	Lamiaceae	<i>Ocimum gratissimum</i>	ගස් තලා, ඹි තලා	Native	LC		1		1		
90	Lamiaceae	<i>Ocimum tenuiflorum</i>	මදුරු තලා, හීන් මදුරු තලා, තුල්සි	Native	LC	1		1	1	1	1
91	Lamiaceae	<i>Premna procumbens</i>	ලේ කොළ පලා	Endemic	LC	1	1				
92	Lamiaceae	<i>Premna tomentosa</i>	සේරු, බු සේරු	Native	LC	1		1	1		
93	Lamiaceae	<i>Tectona grandis</i>	තේක්ක	Exotic	NE			1		1	1
94	Lauraceae	<i>Litsea glutinosa</i>	බෝම්බි, බෝම්	Native	LC		1	1			
95	Fabaceae	<i>Abrus precatorius</i>	ඔලිඳ	Native	LC	1				1	1
96	Fabaceae	<i>Acacia auriculiformis</i>		Exotic	NE	1					
97	Fabaceae	<i>Aeschynomene americana</i>		Exotic	NE	1		1	1	1	
98	Fabaceae	<i>Aeschynomene indica</i>	දිය සියඹලා, හීන් දිය සියඹලා	Native	LC		1		1		

99	Fabaceae	<i>Bauhinia racemosa</i>	මයිල	Native	LC	1		1			
100	Fabaceae	<i>Centrosema pubescens</i>		Exotic	NE		1		1		
101	Fabaceae	<i>Clitoria ternatea</i>	කටරොඩු, නිල් කටරොඵ, නිල් කටරොඩු, එළ කටරොලු	Native	LC	1	1	1			
102	Fabaceae	<i>Crotalaria pallida</i>		Native	LC	1		1		1	
103	Fabaceae	<i>Crotalaria retusa</i>	කහ අඬනහිරිය	Native	LC		1	1	1		
104	Fabaceae	<i>Crotalaria verrucosa</i>	නිල් අඬනහිරිය, යක් බේරිය	Native	LC	1					
105	Fabaceae	<i>Derris scandens</i>	කල වැල්, අල වැල්, බෝ කල වැල්, බොකල වැල්	Native	LC	1	1		1	1	
106	Fabaceae	<i>Desmanthus virgatus</i>		Exotic	NE	1	1	1		1	1
107	Fabaceae	<i>Desmodium triflorum</i>	හින් උදුපියලිය, සුදු ගැටදිය	Native	LC	1	1	1	1	1	1
108	Fabaceae	<i>Dichrostachys cinerea</i>	අන්දර, කටු අන්දර	Native	LC	1	1				
109	Fabaceae	<i>Gliricidia sepium</i>	කෝන, වැටමාර, ගිනිසුරිය, නන්චි, වැටහිරිය	Exotic	NE			1		1	1
110	Fabaceae	<i>Indigofera colutea</i>		Native	NT			1			
111	Fabaceae	<i>Leucaena leucocephala</i>	ඉපිල් ඉපිල්	Exotic	NE	1	1	1		1	1
112	Fabaceae	<i>Mimosa diplotricha</i>	වැල් නිදිකුම්බා	Exotic	NE	1	1				
113	Fabaceae	<i>Mimosa pudica</i>	නිදිකුම්බා, දැදින්තාරු, හින් නිදිකුම්බා	Exotic	NE	1		1	1	1	1
114	Fabaceae	<i>Pithecellobium dulce</i>	පිනිකරල්, මැනිල සියඹලා	Exotic	NE			1		1	1
115	Fabaceae	<i>Pongamia pinnata</i>	මහල් කරද, කරද, ගල් කරද	Native	LC				1		
116	Fabaceae	<i>Pueraria phaseoloides</i>		Exotic	NE			1			
117	Fabaceae	<i>Samanea saman</i>	පිනි මාර, මාර, පාරෙ මාර, පැණි කරල්, වැහි ගස්	Exotic	NE				1	1	1
118	Fabaceae	<i>Senegalia intsia</i>	හිහුරු, හිහුරු වැල්, හිහුරු පට්ට, පච්චි හිහුරු	Native	LC	1			1		
119	Fabaceae	<i>Senna alata</i>	බු කෝර, රට කෝර, ඇත් කෝර, රත් කෝර	Exotic	NE			1		1	1
120	Fabaceae	<i>Senna occidentalis</i>	පැණි කෝර, හිවල් කෝර	Native	LC	1	1				
121	Fabaceae	<i>Senna siamea</i>	අරමාන, වා	Native	LC			1			
122	Fabaceae	<i>Senna sophera</i>	ඌරු කෝර, ඌරු කෝන	Native	LC	1	1	1		1	
123	Fabaceae	<i>Senna tora</i>	පෙති කෝර	Native	LC	1	1		1	1	1
124	Fabaceae	<i>Tamarindus indica</i>	සියඹලා	Exotic	NE			1	1	1	1
125	Fabaceae	<i>Tephrosia noctiflora</i>	එළ පිල	Exotic	NE	1		1			

126	Fabaceae	<i>Tephrosia pumila</i>		Native	LC	1	1	1	1		
127	Fabaceae	<i>Tephrosia purpurea</i>	පිල, කතුරු පිල, ගම් පිල, කටු පිල, පණු පිල	Native	LC	1	1	1	1	1	
128	Fabaceae	<i>Tephrosia villosa</i>	බු පිල	Native	LC	1	1	1	1	1	1
129	Fabaceae	<i>Teramnus labialis</i>	වල් කොල්ලු	Native	LC	1	1	1		1	1
130	Linderniaceae	<i>Bonnaya antipoda</i>	විල, කණකොක් විල	Native	LC		1	1	1		
131	Loganiaceae	<i>Mitrasacme indica</i>		Native	NT	1		1	1	1	1
132	Loganiaceae	<i>Strychnos potatorum</i>	ඉහිනි	Native	VU				1		
133	Loranthaceae	<i>Dendrophthoe falcata</i>	දේම් පිළිල	Native	LC		1	1	1		1
134	Loranthaceae	<i>Scurrula parasitica</i>		Native	LC					1	1
135	Lythraceae	<i>Lawsonia inermis</i>	මරකොණ්ඩි	Native	LC			1		1	1
136	Lythraceae	<i>Rotala indica</i>		Native	DD		1		1		
137	Malpighiaceae	<i>Hiptage benghalensis</i>	පුවක් ගෙඩිය වැල්	Native	LC				1		
138	Malvaceae	<i>Abutilon hirtum</i>		Native	LC	1					
139	Malvaceae	<i>Abutilon indicum</i>	අනෝදා, බේන් අනෝදා, වක් අනෝදා, පතා ගෙඩි	Native	LC	1		1	1	1	1
140	Malvaceae	<i>Berrya cordifolia</i>	හල්මිල්ල	Native	LC			1		1	
141	Malvaceae	<i>Ceiba pentandra</i>	පුළුන් ඉඹිල්, කොට්ට, කොට්ට පුලුන්	Native	LC			1	1		1
142	Malvaceae	<i>Corchorus aestuans</i>	ජලාදර	Exotic	NE	1			1		
143	Malvaceae	<i>Corchorus olitorius</i>	සානි	Native	VU		1	1		1	
144	Malvaceae	<i>Grewia damine</i>	දම්ණිය, දම්ණු	Native	LC	1					
145	Malvaceae	<i>Grewia orientalis</i>	වැල් කැලිය, වැල් මැදිය	Native	LC		1		1		
146	Malvaceae	<i>Helicteres isora</i>	ලීනිය	Native	NT			1	1		1
147	Malvaceae	<i>Hibiscus lobatus</i>		Native	LC	1		1	1		
148	Malvaceae	<i>Hibiscus micranthus</i>	බැබිල, සිරිවැඩි බැබිල	Native	LC	1	1			1	1
149	Malvaceae	<i>Hibiscus tilliaceus</i>	බෙලි පට්ට, වල් බෙලි	Native	LC		1	1	1		
150	Malvaceae	<i>Hibiscus vitifolius</i>	මහ ඇපල	Native	LC	1		1	1		1
151	Malvaceae	<i>Malvastrum coromandelianum</i>		Native	LC		1	1	1	1	1
152	Malvaceae	<i>Melochia corchorifolia</i>	ගස් කුර, ගල් කුර, මහ ගල් කුර	Native	LC	1					1
153	Malvaceae	<i>Microcos paniculata</i>	කොහු කිරිල්ල	Native	LC				1		

154	Malvaceae	<i>Pterospermum suberifolium</i>	වෙලන්, ගල් වෙලන්, කටු වෙලන්, ඊ	Native	LC	1		1				
155	Malvaceae	<i>Sida acuta</i>	ගස් බැබිල, කේසර බැබිල	Native	LC	1	1	1	1	1	1	1
156	Malvaceae	<i>Sida cordata</i>	බැබිල, වැල් බැබිල	Native	LC	1						
157	Malvaceae	<i>Sida cordifolia</i>	හින් අනෝදා, වල් බැබිල, සුළු බු බැබිල, සුදු බැබිල	Native	LC			1	1			
158	Malvaceae	<i>Sida mysorensis</i>	සිරිවැඩි බැබිල	Native	LC	1						
159	Malvaceae	<i>Sida rhombifolia</i>	හින් බැබිල	Native	LC	1	1	1		1	1	
160	Malvaceae	<i>Thespesia populnea</i>	සුරිය, ගං සුරිය	Native	LC				1	1	1	
161	Malvaceae	<i>Urena sinuata</i>	පට්ට ඇපල, හින් ඇපල	Native	LC	1		1	1			1
162	Malvaceae	<i>Waltheria indica</i>	පුන්තික්කි	Native	LC		1	1		1		
163	Meliaceae	<i>Azadirachta indica</i>	කොහොඹ	Exotic	NE	1		1	1			1
164	Meliaceae	<i>Melia azedarach</i>	කිරි හොහොඹ, ලුණුමිදෙල්ල, වල් කොහොඹ	Exotic	NE			1				
165	Menispermaceae	<i>Cissampelos pareira</i>	දියමිත්ත, යුස	Native	LC	1	1			1	1	1
166	Menispermaceae	<i>Tinospora sinensis</i>	බු කිඳ, වල් කිඳ, රස කිඳ	Native	DD	1		1	1			
167	Menyanthaceae	<i>Nymphoides indica</i>	ඕ, මහ ඇඹල, කුමුදු, ඇඹල	Native	LC		1	1				
168	Molluginaceae	<i>Mollugo pentaphylla</i>		Native	LC			1	1	1		
169	Moraceae	<i>Artocarpus altilis</i>	රට දෙල්, දෙල්	Exotic	NE			1		1	1	
170	Moraceae	<i>Artocarpus heterophyllus</i>	කොස්	Exotic	NE		1				1	
171	Moraceae	<i>Ficus amplissima</i>	එළ නූග	Native	LC		1					
172	Moraceae	<i>Ficus benghalensis</i>	මහ නූග	Native	LC						1	
173	Moraceae	<i>Ficus racemosa</i>	අට්ටික්කා, දිඹුල්	Native	LC			1	1			
174	Moraceae	<i>Ficus religiosa</i>	බෝ	Exotic	NE					1		
175	Moraceae	<i>Streblus asper</i>	ගැට නෙටුල්, ගැට නිටොල්, ගැට නිකුල්	Native	LC	1	1	1	1			
176	Muntingiaceae	<i>Muntingia calabura</i>	ජෑම්	Exotic	NE	1	1	1			1	
177	Musaceae	<i>Musa x paradisiaca</i>	කෙහෙල්, ගල් කෙසෙල්, රඹ	Exotic	NE		1	1		1	1	
178	Myrtaceae	<i>Syzygium cumini</i>	මා දං, දං	Native	LC	1		1	1			1
179	Nelumbonaceae	<i>Nelumbo nucifera</i>	නෙළුම්, සුදු නෙළුම්, එළ නෙළුම්, පියුම්	Native	LC					1	1	

180	Nyctaginaceae	<i>Boerhavia diffusa</i>	පිට සුදු පලා, පිට සුදු සාරණ	Native	LC			1			
181	Oleaceae	<i>Jasminum angustifolium</i>	වේ කැන්ද, වල් පිව්ව, වල් සමන්පිව්ව	Native	LC	1		1			
182	Onagraceae	<i>Ludwigia peruviana</i>	බෙරු දියනිල්ල, වෙල් කරාබු	Exotic	NE		1				
183	Orchidaceae	<i>Vanda testacea</i>		Native	LC				1		
184	Oxalidaceae	<i>Oxalis barrelieri</i>		Exotic	NE		1	1	1	1	
185	Pandanaceae	<i>Pandanus kaida</i>	වැටකෙයියා	Native	LC		1			1	
186	Passifloraceae	<i>Passiflora foetida</i>	පඩ ගෙඩි, පඩ වැල්, උඩහළු, වැල් දෙළුම්	Exotic	NE	1	1	1	1		
187	Phyllanthaceae	<i>Brenya androgyna</i>	මැල්ල දුම්කොළ, ජපන් බඩු	Native	LC			1		1	1
188	Phyllanthaceae	<i>Bridelia retusa</i>	කැට කැල	Native	LC	1			1		
189	Phyllanthaceae	<i>Flueggea leucopyrus</i>	හීන් කටු පිළ, කටු පිළ	Native	LC	1					
190	Phyllanthaceae	<i>Margaritaria indica</i>	කරව්, මහ කරව්	Native	VU		1	1	1		
191	Phyllanthaceae	<i>Phyllanthus amarus</i>	පිටවක්කා	Native	LC	1		1		1	1
192	Phyllanthaceae	<i>Phyllanthus maderaspatensis</i>		Native	LC	1	1	1	1		
193	Phyllanthaceae	<i>Phyllanthus polyphyllus</i>	කුරටිය, ඇමටිල්ල	Native	LC					1	
194	Phyllanthaceae	<i>Phyllanthus reticulatus</i>	වැල් කයිල, ගස් දුම්මැල්ල, කයිල	Native	LC	1		1	1		
195	Phyllanthaceae	<i>Phyllanthus urinaria</i>	රත් පිටවක්කා	Native	LC			1	1		1
196	Phyllanthaceae	<i>Phyllanthus virgatus</i>		Native	LC					1	1
197	Plantaginaceae	<i>Scoparia dulcis</i>	වල් කොත්තමල්ලි	Exotic	NE	1	1	1	1	1	1
198	Plumbaginaceae	<i>Plumbago zeylanica</i>	එළ නිකුල්	Native	LC			1	1		
199	Poaceae	<i>Bambusa vulgaris</i>	කහ උණ	Exotic	NE		1				
200	Poaceae	<i>Eleusine indica</i>	බැල තණ, වල් කුරක්කන්, වල් මල් කුරක්කන්	Native	LC		1	1	1	1	1
201	Poaceae	<i>Imperata cylindrica</i>	ඉලුක්, ගාල, පුෂ්	Native	LC	1				1	
202	Poaceae	<i>Panicum maximum</i>	ගිණි තණ, රට තණ, ගිනිකීරැස්ස	Exotic	NE	1	1	1		1	1
203	Poaceae	<i>Pennisetum polystachion</i>		Exotic	NE			1			
204	Poaceae	<i>Setaria barbata</i>		Exotic	NE				1	1	1
205	Polygonaceae	<i>Persicaria glabra</i>		Native	LC		1		1		
206	Rhamnaceae	<i>Ventilago maderaspatana</i>	යක්ක වැල්, යකඩ වැල්, කොබෝවක්කා, පටම්බර, වම් බොදිය	Native	LC	1					

			වැල්, කොළවක්කා, මොණර පෙනත්										
207	Rhamnaceae	<i>Ziziphus mauritiana</i>	මහ දෙබර, එරමිණියා, මසන්, දෙබර	Native	LC	1							
208	Rubiaceae	<i>Adina cordifolia</i>	කොළොන්	Native	LC	1				1			
209	Rubiaceae	<i>Canthium coromandelicum</i>	කර	Native	LC	1				1			
210	Rubiaceae	<i>Ixora pavetta</i>	මහ රතඹලා	Native	LC	1	1	1	1				
211	Rubiaceae	<i>Mitracarpus hirtus</i>		Exotic	NE				1			1	1
212	Rubiaceae	<i>Mitragyna parvifolia</i>	හැලඹ	Native	LC		1	1	1				
213	Rubiaceae	<i>Morinda coreia</i>	හින් අඹ	Native	LC	1						1	
214	Rubiaceae	<i>Nauclea orientalis</i>	බක් මී, රට බක් මී, බකිනි, මල බකිනි, පිය, පියල්	Native	LC					1			
215	Rubiaceae	<i>Spermacoce articularis</i>		Native	LC	1		1			1	1	
216	Rutaceae	<i>Chloroxylon swietania</i>	බුරුන	Native	VU	1		1					
217	Rutaceae	<i>Glycosmis pentaphylla</i>	දොඩම් පනා, දොඩම් කහ, දොඩම් පැන්න, වැ කුරුඳු	Native	LC			1	1				
218	Rutaceae	<i>Limonia acidissima</i>	දිවුල්, ජුල්	Native	LC	1				1	1		
219	Rutaceae	<i>Murraya koenigii</i>	කරපිංචා, කර බැඹිය	Native	LC				1		1	1	
220	Rutaceae	<i>Murraya paniculata</i>	ඇට්ටේරියා, ඇට්ටර, යජුර	Native	LC					1			
221	Rutaceae	<i>Toddalia asiatica</i>	කුඩුමිරිස්ස	Native	LC	1	1				1	1	
222	Salvadoraceae	<i>Azima tetraacantha</i>	වැල් දෙහි, කටු නියද	Native	LC	1							1
223	Sapindaceae	<i>Allophylus cobbe</i>	බු කොබ්බෑ, කොබ්බෑ, මුදු කොබ්බෑ, වල් කොබ්බෑ, කොබෝ	Native	LC	1	1	1					
224	Sapindaceae	<i>Cardiospermum halicacabum</i>	පෙනෙල වැල්, වැල් පෙනෙල	Native	LC			1	1	1	1		
225	Sapindaceae	<i>Lepisanthes tetraphylla</i>	සිවුපත් ගල්කුම	Native	LC	1				1			
226	Sapindaceae	<i>Sapindus emarginatus</i>	පෙනෙල, කහ පෙනෙල, ඇඹිල්ල, ගස් පෙනෙල	Native	LC							1	
227	Sapindaceae	<i>Schleichera oleosa</i>	කෝන්, අලොන් ගස්	Native	LC	1		1	1				1
228	Sapotaceae	<i>Madhuca longifolia</i>	මී, ගම් මී, ගාලු පුෂ්ප, තෙල් මී, ගුල පුෂ්ප	Native	NT				1	1			
229	Solanaceae	<i>Datura metel</i>	අත්තන, කටු අත්තන, එළ අත්තන	Exotic	NE					1	1		
230	Solanaceae	<i>Solanum torvum</i>	ගෝන බටු, තිබ්බටු	Native	LC				1				1
231	Ulmaceae	<i>Holoptelea integrifolia</i>	ගොඩ කිරිල්ල	Native	NT	1	1			1			

232	Verbenaceae	<i>Lantana camara</i>	ගඳපාන, කටු හිඟුරු, රට හිඟුරු	Exotic	NE	1	1	1	1	1	1
233	Verbenaceae	<i>Phyla nodiflora</i>	හිරිමන දැන්ත	Native	LC		1	1	1		
234	Verbenaceae	<i>Stachytarpheta urticifolia</i>		Exotic	NE				1	1	1
235	Vitaceae	<i>Cissus quadrangularis</i>	හිරිස්ස, සිරස්ස, හිරිස්ස පළු, සිව්ඊස්ස	Native	LC	1				1	
236	Zygophyllaceae	<i>Tribulus terrestris</i>	ගොකටු, සෙම්බු නෙරෙන්ච්, හින් නෙරෙන්ච්, හින් ගොකටු	Native	LC	1				1	

Table 2: The checklist of recorded butterfly species with conservation status

Abbreviations used: **DS** - Distribution Status; **NCS** - National Conservation Status; **EN** - Endangered; **LC** - Least Concern; **NT** - Near Threatened; **VU** - Vulnerable.

N o.	Family	Scientific name	English name	Sinhala name	NC S	DS	L 1	L 2	L 3	L 4	L 5	L 6
1	Papilionidae	<i>Pachliopta aristolochiae</i> (Fabricius, 1775)	Common Rose	සුලබ සෙවිවන්දියා	LC	Native	1					
2	Papilionidae	<i>Papilio demoleus</i> Linnaeus, 1758	Lime Butterfly	පැහිරි පැපිලියා	LC	Native		1		1	1	
3	Papilionidae	<i>Papilio polytes</i> Linnaeus, 1758	Common Mormon	සුලබ පැපිලියා	LC	Native			1		1	
4	Papilionidae	<i>Graphium agamemnon</i> (Linnaeus, 1758)	Tailed Jay	පෙදැනි ජවසැරියා	LC	Native		1				
5	Pieridae	<i>Leptosia nina</i> Fabricius, 1793	Psyche	මනහාරි	LC	Native				1		
6	Pieridae	<i>Delias eucharis</i> Drury, 1773	Jezebel	පිළිල-රිසියා	LC	Native			1			1
7	Pieridae	<i>Appias albina</i> (Boisduval, 1836)	Common Albatross	සුලබ සුදනා	LC	Native	1	1	1	1		
8	Pieridae	<i>Appias galene</i> (C. & R. Felder, 1865)	Sri Lankan Lesser Albatross	ශ්‍රී ලංකා සුදනා	LC	Endemic			1			
9	Pieridae	<i>Catopsilia pyranthe</i> (Linnaeus, 1758)	Mottled Emigrant	ලපවන් පිම්-සැරියා	LC	Native	1		1	1	1	
10	Pieridae	<i>Catopsilia pomona</i> (Fabricius, 1775)	Lemon Emigrant	කහවන් පිම්-සැරියා	LC	Native			1			
11	Pieridae	<i>Catopsilia scylla</i> (Linnaeus, 1763)	Orange Migrant	දෙපැහැ පිම්-සැරියා	LC	Introduced		1				
12	Pieridae	<i>Eurema hecabe</i> (Linnaeus, 1758)	Common Grass Yellow	දෙනින් තෘණ-ජීතයා	LC	Native			1	1	1	
13	Pieridae	<i>Eurema blanda</i> (Boisduval, 1836)	Three-Spot Grass Yellow	තෙතින් තෘණ-ජීතයා	LC	Native					1	
14	Nymphalidae	<i>Tirumala limniace</i> (Cramer, 1775)	Blue Tiger	නීල ගෝමරා	LC	Native			1			
15	Nymphalidae	<i>Parantica aglea</i> (Stoll, 1782)	Glassy Tiger	පළිඟු ගෝමරා	LC	Native	1	1				
16	Nymphalidae	<i>Danaus chrysippus</i> (Linnaeus, 1758)	Plain Tiger	පහන් ගෝමරා	LC	Native	1	1	1	1	1	
17	Nymphalidae	<i>Danaus genutia</i> (Cramer,	Common Tiger	අග්නි ගෝමරා	LC	Native			1			

		[1779])																	
18	Nymphalidae	<i>Euploea core</i> (Cramer, 1780)	Common Crow	සුලබ කාකයා	LC	Native							1	1	1				
19	Nymphalidae	<i>Phalanta phalantha</i> (Drury, 1773)	Common Leopard	සුලබ කොටිනියා	LC	Native		1											
20	Nymphalidae	<i>Acraea terpsicore</i> (Linnaeus, 1758)	Tawny Coster	ලැසිසැරියා	LC	Native						1	1						
21	Nymphalidae	<i>Junonia lemonias</i> (Linnaeus, 1758)	Lemon Pansy	බිමැසුරු සඳැසියා	LC	Native								1	1				
22	Nymphalidae	<i>Junonia atlites</i> (Linnaeus, 1763)	Grey Pansy	අළු සඳැසියා	LC	Native						1							
23	Nymphalidae	<i>Junonia iphita</i> (Cramer, 1779)	Chocolate Soldier	බොර සඳැසියා	LC	Native								1	1	1			
24	Nymphalidae	<i>Junonia almana</i> (Linnaeus, 1758)	Peacock Pansy	මයුර සඳැසියා	LC	Native							1	1					
25	Nymphalidae	<i>Neptis hylas</i> (Linnaeus, 1758)	Common Sailor	සුලබ ලිහිසැදියා	LC	Native	1	1	1	1									1
26	Nymphalidae	<i>Euthalia aconthea</i> (Cramer, 1777)	Baron	සුලබ දිලින්නා	LC	Native							1						
27	Nymphalidae	<i>Melanitis leda</i> (Linnaeus, 1758)	Common Evening Brown	සුලබ ගොම්මන්-ගුරුවා	LC	Native								1	1				
28	Nymphalidae	<i>Ypthima ceylonica</i> Hewitson, 1864	White Four-ring	සිහිර මුදුවා	LC	Native	1	1	1							1	1		
29	Lycaenidae	<i>Spindasis vulcanus</i> (Fabricius, 1775)	Common Silverline	සුලබ රිදී-නීලයා	LC	Native													1
30	Lycaenidae	<i>Prosotas nora</i> (C. Felder, 1860)	Common Lineblue	සුලබ ඉරි-නීලයා	LC	Native										1	1		
31	Lycaenidae	<i>Prosotas dubiosa</i> (Semper, [1879])	Tail-Less Lineblue	හින් ඉරි-නීලයා	LC	Native										1			
32	Lycaenidae	<i>Jamides bochus</i> (Stoll, [1782])	Dark Cerulean	උදුල සෙරුලියා	LC	Native													1
33	Lycaenidae	<i>Jamides alecto</i> (C. Felder, 1860)	Metallic Cerulean	දිලි සෙරුලියා	LC	Native		1											
34	Lycaenidae	<i>Catochrysops strabo</i> (Fabricius, 1793)	Forget-me-not	සුලබ රනිලයා	LC	Native							1	1					
35	Lycaenidae	<i>Castalius rosimon</i> (Fabricius, 1775)	Common Pierrot	සුලබ ගෝමර-නීලයා	LC	Native		1											
36	Lycaenidae	<i>Zizeeria karsandra</i> (Moore, 1865)	Dark Grass Blue	අඳුරු කෘණ-නීලයා	LC	Native							1	1	1				
37	Lycaenidae	<i>Zizina otis</i> (Fabricius, 1787)	Lesser Grass Blue	හින් කෘණ-නීලයා	LC	Native										1			

38	Lycaenidae	<i>Zizula hylax</i> (Fabricius, 1775)	Tiny Grass Blue	හිච්චි කෘණ-නීලයා	LC	Native	1	1	1	1		
39	Lycaenidae	<i>Chilades lajus</i> (Stoll, 1780)	Lime Blue	පැහිරි මලවියා	LC	Native			1			
40	Hesperiidae	<i>Badamia exclamationis</i> (Fabricius, 1775)	Brown Awl	ගුරු බඩිල්ලා	LC	Native				1		
41	Hesperiidae	<i>Spialia galba</i> (Fabricius, 1793)	Grizzled Skipper	ගෝමර-පිම්මා	LC	Native			1	1		
42	Hesperiidae	<i>Suastus gremius</i> (Fabricius, 1798)	Oriental Palm Bob	මහ කාලහරයා	LC	Native					1	
43	Hesperiidae	<i>Iambrix salsala</i> (Moore, [1866])	Chestnut Bob	කඹලවන් බිමැසුරුවා	LC	Native						1
44	Hesperiidae	<i>Taractrocera maevius</i> (Fabricius, 1793)	Common Grass Dart	බිම්සැරියා	LC	Native	1					

Table 3: The checklist of recorded odonata species with conservation status

Abbreviations used: **DS** - Distribution Status; **NCS** - National Conservation Status; **DD** – Data Deficient; **EN** - Endangered; **LC** - Least Concern; **NE** - Not Evaluated; **NT** - Near Threatened; **VU** - Vulnerable.

No	Family	Scientific Name	English Name	NCS_2012	DS	L1	L2	L3	L4	L5	L6
1	Chlorocyphidae	<i>Libellago adami</i> Fraser, 1939	Sri Lanka Adam's Gem	VU	Endemic				1	1	
2	Chlorocyphidae	<i>Libellago greeni</i> (Laidlaw, 1924)	Sri Lanka Green's Gem	EN	Endemic				1		
3	Coenagrionidae	<i>Agriocnemis pygmaea</i> (Rambur, 1842)	Wandering Wisp	LC	Native		1			1	
4	Coenagrionidae	<i>Ceriagrion coromandelianum</i> (Fabricius, 1798)	Yellow Waxtail	LC	Native			1		1	
5	Coenagrionidae	<i>Pseudagrion microcephalum</i> (Rambur, 1842)	Blue Sprite	LC	Native					1	
6	Platycnemididae	<i>Copera marginipes</i> (Rambur, 1842)	Yellow Featherleg	LC	Native				1		
7	Protoneuridae	<i>Elattonaura caesia</i> (Hagen in Selys, 1860)	Sri Lanka Jungle Threadtail	VU	Endemic				1		
8	Libellulidae	<i>Orthetrum glaucum</i> (Brauer, 1865)	Asian Skimmer	NT	Native		1			1	
9	Libellulidae	<i>Orthetrum sabina</i> (Drury, 1770)	Green Skimmer	LC	Native						1
10	Libellulidae	<i>Brachythemis contaminata</i> (Fabricius, 1793)	Asian Groundling	LC	Native				1		
11	Libellulidae	<i>Crocothemis servilia</i> (Drury, 1770)	Oriental Scarlet	LC	Native	1		1			
12	Libellulidae	<i>Diplacodes trivialis</i> (Rambur, 1842)	Blue Percher	LC	Native	1	1	1	1	1	
13	Libellulidae	<i>Neurothemis intermedia</i> (Rambur, 1842)	Paddyfield Parasol	NT	Native		1			1	
14	Libellulidae	<i>Neurothemis tullia</i> (Drury, 1773)	Pied Parasol	LC	Native			1			
15	Libellulidae	<i>Trithemis aurora</i> (Burmeister, 1839)	Crimson Dropwing	LC	Native				1	1	1
16	Libellulidae	<i>Tramea limbata</i> (Desjardins, 1832)	Sociable	LC	Native				1		

				Glider									
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Table 4. The recorded fish species during field survey and their taxonomic, conservation status.

Abbreviations used: **DS** - Distribution Status; **NCS** - National Conservation Status; **DD** - Data Deficient; **EN** - Endangered; **LC** - Least Concern; **NE** - Not Evaluated; **NT** - Near Threatened; **VU** - Vulnerable.

N o.	Family	Scientific Name	English Name	Sinhala name	NCS_2 012	DS	L 1	L 2	L 3	L 4	L 5	L 6
1	Adrianichthyidae	<i>Oryzias dancena</i>	Common Blue Eye	හන්දි හඳයා	DD	Indigenous			1			
2	Cyprinidae	<i>Dawkinsia singhala</i>	Sri Lanka Filamented Barb	දංකොළ පෙනියා	LC	Endemic		1		1		
3	Cyprinidae	<i>Devario malabaricus</i>	Giant Danio	රත් කයිලයා	LC	Indigenous						
4	Cyprinidae	<i>Rasbora microcephalus</i>	Narrow line Rasbora	කීර් දණ්ඩියා, කුඩමස්සා	LC	Indigenous		1	1	1		
5	Gobiidae	<i>Awaous melanocephalus</i>	Scribbled Goby	බලි වැලිගොව්වා	LC	Indigenous				1	1	
6	Anguillidae	<i>Anguilla bicolor</i>	Level Finned Eel	මඩ ආඳා, කක්කුටු ආඳා, කළපු ආඳා	LC	Indigenous			1			
7	Channidae	<i>Channa punctata</i>	Spotted Snakehead	මඩ කනයා, මඩ ආරා, මඩකරියා	LC	Indigenous		1		1		
8	Channidae	<i>Channa striata</i>	Murrel	ලූලා, හල්පත් මහ	LC	Indigenous			1	1	1	
9	Cichlidae	<i>Etroplus suratensis</i>	Green Chromide	කොරලියා, මල් කොරලියා	LC	Indigenous			1		1	
10	Anabantidae	<i>Anabas testudineus</i>	Climbing Perch	කාවයියා, පොල් කාවයියා	LC	Indigenous			1		1	
11	Cyprinidae	<i>Puntius vittatus</i>	Silver Barb	බණ්ඩි තිත්තයා, පොඩි පෙනියා, ඉපිලිකඩයා	LC	Indigenous		1		1		
12	Cobitidae	<i>Lepidocephalichthys thermalis</i>	Common Spiny	අහිරාවා, වයිරන් අහිරාවා	LC	Indigenous			1	1		

			Loach									
13	Cichlidae	<i>Oreochromis mossambicus</i>	Mozambique Thilapia	කිලාපියා / ජපන් බට්ටා	NE	Exotic		1		1		

Table 5: The checklist of recorded amphibian species with conservation status

Abbreviations used: **DS** - Distribution Status; **NCS** - National Conservation Status; **DD** - Data Deficient; **EN** - Endangered; **LC** - Least Concern; **NE** - Not Evaluated; **NT** - Near Threatened; **VU** - Vulnerable.

No	Family	Scientific Name	English Name	Sinhala Name	NCS_2012	DS	L1	L2	L3	L4	L5	L6
1	Bufonidae	<i>Duttaphrynus melanostictus</i> Schneider, 1799	Common toad	ගෙයි ගෙම්බා	LC	Native	1					
2	Bufonidae	<i>Duttaphrynus scaber</i> Schneider, 1799	Schneider's toad	ශ්‍රී ලංකා ගෙම්බා	VU	Native		1				
3	Microhylidae	<i>Kaloula taprobanica</i> (Parker, 1934)	Sri Lankan bullfrog	විසිතුරු රතු මැඩියා	LC	Native		1		1		
4	Microhylidae	<i>Ramanella variegata</i> (Stoliczka, 1872)	Variegated ramanella	බඩ සුදු මොට හොඹු මැඩියා	LC	Native	1					
5	Microhylidae	<i>Uperodon systoma</i> (Schneider, 1799)	Marbled balloon frog	බැලුන් මැඩියා	LC	Native				1	1	1
6	Dicroglossidae	<i>Euphlyctis hexadactylus</i> (Lesson, 1834)	Indian green frog	සයැහිලි පලා මැඩියා	LC	Native			1	1		
7	Dicroglossidae	<i>Fejervarya cf. syhadrensis</i> (Annandale, 1919)	Common paddy field frog	වෙල් මැඩියා	LC	Native	1	1	1	1		1
8	Dicroglossidae	<i>Sphaerotheca breviceps</i> (Schneider, 1799)	Short-headed burrowing frog	තුන්තිවි වැලි දිය මැඩියා	LC	Native			1	1		
9	Dicroglossidae	<i>Sphaerotheca rolandae</i> (Dubois, 1983)	Roland's burrowing frog	ලපවන් වැලි දිය මැඩියා	LC	Native	1			1		
10	Rhacophoridae	<i>Polypedates cruciger</i> Blyth, 1852	Common hourglass tree frog	සුලබ පහිඹු ගස් මැඩියා	LC	Endemic		1				
11	Rhacophoridae	<i>Polypedates maculatus</i> (Gray, 1834)	Spotted tree frog	සුල්ලි ගස් මැඩියා	LC	Native					1	

Table 6: The checklist of recorded reptile species with conservation status

Abbreviations used: **DS** - Distribution Status; **NCS** - National Conservation Status; **DD** - Data Deficient; **EN** - Endangered; **LC** - Least Concern; **NE** - Not Evaluated; **NT** - Near Threatened; **VU** - Vulnerable.

No.	Family	Scientific Name	English Name	Sinhala name	NCS_2012	DS	L1	L2	L3	L4	L5	L6
1	Bataguridae	<i>Melanochelys trijuga</i> (Schweigger, 1812)	Black turtle	ගල් ඉබ්බා	LC	Native			1			
2	Testudinidae	<i>Geochelone elegans</i> (Schoepff, 1795)	Indian star tortoise	මේවර ඉබ්බා, කාරකා ඉබ්බා	NT	Native					1	1
3	Agamidae	<i>Calotes calotes</i> (Linnaeus, 1758)	Green garden lizard	පළා කටුස්සා	LC	Native	1	1				
4	Agamidae	<i>Calotes versicolor</i> (Daudin, 1802)	Common garden lizard	ගරා කටුස්සා	LC	Native	1	1	1	1	1	1
5	Gekkonidae	<i>Hemidactylus frenatus</i> Schlegel in Duméril & Bibron, 1836	Common house-gecko	සුලබ ගේ හුනා	LC	Native					1	
6	Gekkonidae	<i>Hemidactylus lankae</i> Deraniyagala, 1953	Termite hill gecko	හුඹිස් හුනා	LC	Endemic			1	1		
7	Gekkonidae	<i>Hemidactylus parvimaclulatus</i> Deraniyagala, 1953	Spotted housegecko	සුල්ලි ගේ හුනා	LC	Native				1		
8	Scincidae	<i>Eutropis carinata</i> (Schneider, 1801)	Common skink	සුලබ හිකනලා	LC	Native	1					
9	Scincidae	<i>Lankascincus fallax</i> (Peters, 1860)	Common lankaskink	සුලබ ලක්භීරළුවා	LC	Endemic		1				
10	Varanidae	<i>Varanus bengalensis</i> (Daudin, 1802)	Land monitor	තලගොයා	LC	Native			1	1	1	
11	Varanidae	<i>Varanus salvator</i> (Laurenti, 1768)	Water monitor	කබරගොයා	LC	Native				1		1
12	Pythonidae	<i>Python molurus</i> (Linnaeus, 1758)	Indian python	පිඹුරා	LC	Native		1				
13	Colubridae	<i>Ptyas mucosa</i> (Linnaeus,	Rat snake	ගැරඬියා	LC	Native					1	

		1758)											
14	Elapidae	<i>Naja naja</i> (Linnaeus, 1758)	Indian cobra	නයා, නාගයා	LC	Native							1
15	Viperidae	<i>Daboia russelii</i> (Shaw & Nodder, 1797)	Russell's viper	කින් පොළගා	LC	Native	1						
16	Viperidae	<i>Hypnale hypnale</i> (Merrem, 1820)	Merrem's Hump nose viper	පොළොන්නෙලියා	LC	Native				1			

Table 7: The checklist of recorded bird species with conservation status

Abbreviations used: **DS** - Distribution Status; **NCS** - National Conservation Status; **DD** - Data Deficient; **EN** - Endangered; **LC** - Least Concern; **NE** - Not Evaluated; **NT** - Near Threatened; **VU** - Vulnerable.

No.	Family	Scientific Name	English name	Sinhala Name	NCS_2012	DS	L 1	L 2	L 3	L 4	L 5	L 6
1	Columbidae	<i>Columba livia</i> Gmelin, 1789	Rock Dove	පරවියා	CR	Resident					1	
2	Phasianidae	<i>Pavo cristatus</i> Linnaeus, 1758	Indian Peafowl	මොණරා	LC	Resident				1	1	1
3	Columbidae	<i>Spilopelia suratensis</i> (Gmelin, 1789)	Western Spotted Dove	අළු-කොබෙයියා	LC	Resident	1	1	1	1	1	1
4	Columbidae	<i>Treron bicinctus</i> (Jerdon, 1840)	Orange-breasted Green-pigeon	ළය-රන් බටගොයා	LC	Resident						1
5	Columbidae	<i>Ducula aenea</i> (Linnaeus, 1766)	Green Imperial-pigeon	නිල් මහගොයා	LC	Resident					1	
6	Apodidae	<i>Cypsiurus balasiensis</i> (Gray, 1829)	Asian Palm-swift	ආසියා තල්-කුර්කයා	LC	Resident				1	1	
7	Cuculidae	<i>Centropus sinensis</i> (Stephens, 1815)	Greater Coucal	මහා ඇටිකුකුළා	LC	Resident	1	1	1			
8	Cuculidae	<i>Phaenicophaeus viridirostris</i> (Jerdon, 1840)	Blue-faced Malkoha	වකනිල් මල්කොහා	LC	Resident						1
9	Rallidae	<i>Amaurornis phoenicurus</i> (Pennant, 1769)	White-breasted Waterhen	ළය-සිදු කොරවක්කා	LC	Resident				1	1	
10	Ciconiidae	<i>Anastomus oscitans</i> (Boddaert, 1783)	Asian Openbill	විවරකුඩුවා	LC	Resident					1	1

11	Threskiornithidae	<i>Threskiornis melanocephalus</i> (Latham, 1790)	Black-headed Ibis	හිස-කළු දැකුත්තා	LC	Resident			1	1		
12	Ardeidae	<i>Ardeola grayii</i> (Sykes, 1832)	Indian Pond-heron	කණ-කොකා	LC	Resident			1	1	1	1
13	Ardeidae	<i>Bubulcus ibis</i> (Linnaeus, 1758)	Cattle Egret	ගෙර්-කොකා	LC	Resident				1	1	1
14	Ardeidae	<i>Ardea cinerea</i> Linnaeus, 1758	Grey Heron	අළු කොකා	LC	Resident	1					
15	Ardeidae	<i>Ardea alba</i> Linnaeus, 1758	Great White Egret	සුදු මහ කොකා	LC	Resident				1		
16	Ardeidae	<i>Ardea intermedia</i> Wagler, 1829	Intermediate Egret	සුදු මැදි කොකා	LC	Resident	1					
17	Pelecanidae	<i>Pelecanus philippensis</i> Gmelin, 1789	Spot-billed Pelican	තින්හොට පැස්තුඩුවා	LC	Resident				1		
18	Phalacrocoracidae	<i>Microcarbo niger</i> (Vieillot, 1817)	Little Cormorant	පුංචි දියකපුටා	LC	Resident	1	1				
19	Phalacrocoracidae	<i>Phalacrocorax fuscicollis</i> Stephens, 1826	Indian Cormorant	ඉන්දු දියකාලා	LC	Resident				1	1	
20	Anhingidae	<i>Anhinga melanogaster</i> Pennant, 1769	Oriental Darter	අහිකාලා	LC	Resident				1		
21	Charadriidae	<i>Vanellus indicus</i> (Boddaert, 1783)	Red-wattled Lapwing	රත් යටිමල් කිරලා	LC	Resident			1	1	1	1
22	Strigidae	<i>Otus bakkamoena</i> Pennant, 1769	Indian Scops-owl	කරපටි කන්බස්සා	LC	Resident						1
23	Accipitridae	<i>Spilornis cheela</i> (Latham, 1790)	Crested Serpent-eagle	සිඵ සරපකුස්සා	LC	Resident				1		
24	Accipitridae	<i>Accipiter badius</i> (Gmelin, 1788)	Shikra	කුරුළුගොයා	LC	Resident					1	
25	Accipitridae	<i>Haliaeetus leucogaster</i> (Gmelin, 1788)	White-bellied Sea-eagle	කුස-ඇලි මුහුදුකුස්සා	LC	Resident			1			
26	Accipitridae	<i>Haliastur indus</i> (Boddaert, 1783)	Brahminy Kite	බමුණු පියාකුස්සා	LC	Resident	1	1	1			
27	Bucerotidae	<i>Anthracoseros coronatus</i> (Boddaert, 1783)	Malabar Pied Hornbill	පෝරු කැදැත්තා	LC	Resident				1	1	
28	Meropidae	<i>Merops orientalis</i> Latham,	Asian Green Bee-	පුංචි	LC	Resident	1	1	1	1	1	1

		1802	eater	බිභුහරයා									
29	Alcedinidae	<i>Alcedo atthis</i> (Linnaeus, 1758)	Common Kingfisher	මල් පිළිහුඩුවා	LC	Resident		1	1	1	1		
30	Alcedinidae	<i>Ceryle rudis</i> (Linnaeus, 1758)	Pied Kingfisher	ගෝමර-පිළිහුඩුවා	LC	Resident				1	1	1	
31	Alcedinidae	<i>Pelargopsis capensis</i> (Linnaeus, 1766)	Stork-billed Kingfisher	මානා-තුඩු මහ-පිළිහුඩුවා	LC	Resident				1			
32	Alcedinidae	<i>Halcyon smyrnensis</i> (Linnaeus, 1758)	White-breasted Kingfisher	ගෙල-සිදු මැදි-පිළිහුඩුවා	LC	Resident					1	1	
33	Megalaimidae	<i>Psilopogon haemacephalus</i> (Müller, 1776)	Coppersmith Barbet	රත්-පිය කොට්ටෝරුවා	LC	Resident		1	1				
34	Megalaimidae	<i>Psilopogon rubricapillus</i> (Gmelin, 1788)	Sri Lanka Barbet	ශ්‍රී ලංකා කොට්ටෝරුවා	LC	Resident				1			
35	Megalaimidae	<i>Psilopogon zeylanicus</i> (Gmelin, 1788)	Brown-headed Barbet	පොළොස් කොට්ටෝරුවා	LC	Resident	1				1	1	
36	Psittacidae	<i>Psittacula eupatria</i> (Linnaeus, 1766)	Alexandrine Parakeet	ලබු ගිරවා	LC	Resident			1				
37	Psittacidae	<i>Psittacula krameri</i> (Scopoli, 1769)	Rose-ringed Parakeet	රූන ගිරවා	LC	Resident				1	1	1	
38	Oriolidae	<i>Oriolus xanthornus</i> (Linnaeus, 1758)	Black-hooded Oriole	කහකුරුල්ලා	LC	Resident	1			1			
39	Campephagidae	<i>Pericrocotus cinnamomeus</i> (Linnaeus, 1766)	Small Minivet	පුංචි මිණිවිත්තා	LC	Resident	1	1					
40	Campephagidae	<i>Lalage melanoptera</i> (Rüppell, 1839)	Black-headed Cuckoo-shrike	කළු-හිස් සැරටිත්තා	LC	Resident		1		1			
41	Aegithinidae	<i>Aegithina tiphia</i> (Linnaeus, 1758)	Common Iora	පොදු අයෝරාවා	LC	Resident	1			1			
42	Rhipiduridae	<i>Rhipidura aureola</i> Lesson, 1830	White-browed Fantail	බැම-සිදු පවන්පෙන්නා	LC	Resident		1			1		
43	Dicruridae	<i>Dicrurus caerulescens</i> (Linnaeus, 1758)	White-bellied Drongo	කවුඩා	LC	Resident							1

44	Monarchidae	<i>Terpsiphone paradisi</i> (Linnaeus, 1758)	Indian Paradise Flycatcher	ධහැන්මාරා	LC	Resident		1				
45	Corvidae	<i>Corvus macrorhynchos</i> Wagler, 1827	Large-billed Crow	කළු කපුටා	LC	Resident			1			
46	Cisticolidae	<i>Prinia hodgsonii</i> Blyth, 1844	Gray-breasted Prinia	ලයළු ප්‍රීනියා	LC	Resident			1	1	1	1
47	Cisticolidae	<i>Prinia inornata</i> Sykes, 1832	Plain Prinia	සරල ප්‍රීනියා	LC	Resident					1	
48	Cisticolidae	<i>Orthotomus sutorius</i> (Pennant, 1769)	Common Tailorbird	බට්ටිව්වා	LC	Resident		1	1	1		1
49	Hirundinidae	<i>Cecropis hyperythra</i> (Blyth, 1849)	Sri Lanka Swallow	ශ්‍රී ලංකා ලක්ෂිභීනියා	LC	Resident	1				1	
50	Pycnonotidae	<i>Pycnonotus cafer</i> (Linnaeus, 1766)	Red-vented Bulbul	කොණ්ඩියා	LC	Resident	1	1	1	1	1	
51	Pycnonotidae	<i>Pycnonotus luteolus</i> (Lesson, 1841)	White-browed Bulbul	බැම-සුදු කොණ්ඩියා	LC	Resident	1			1		
52	Zosteropidae	<i>Zosterops palpebrosus</i> (Temminck, 1824)	Oriental White-eye	පෙරදිග සිතැසියා	LC	Resident		1				1
53	Timaliidae	<i>Dumetia hyperythra</i> (Franklin, 1831)	Tawny-bellied Babbler	කුස-කහ ලඳු-දෙමලිව්වා	LC	Resident						1
54	Leiotrichidae	<i>Turdoides affinis</i> (Jerdon, 1845)	Yellow-billed Babbler	දෙමලිව්වා	LC	Resident	1		1	1		
55	Sturnidae	<i>Acridotheres tristis</i> (Linnaeus, 1766)	Common Myna	මයිනා	LC	Resident	1	1	1	1	1	
56	Muscicapidae	<i>Copsychus saularis</i> (Linnaeus, 1758)	Oriental Magpie-robin	පොල්කිව්වා	LC	Resident			1	1	1	1
57	Muscicapidae	<i>Saxicoloides fulicatus</i> (Linnaeus, 1766)	Indian Robin	කළුකිව්වා	LC	Resident				1	1	1
58	Dicaeidae	<i>Dicaeum erythrorhynchos</i> (Latham, 1790)	Pale-billed Flowerpecker	ලාතුඩු පිළිලිව්වා	LC	Resident		1	1		1	
59	Nectariniidae	<i>Nectarinia zeylonica</i> (Linnaeus, 1766)	Purple-rumped Sunbird	නිකඹ දම් සූරික්කා	LC	Resident	1		1	1	1	
60	Nectariniidae	<i>Cinnyris asiaticus</i> (Latham, 1790)	Purple Sunbird	දම්-සූරික්කා	LC	Resident	1	1	1			

61	Estrildidae	<i>Lonchura striata</i> (Linnaeus, 1766)	White-rumped Munia	නිතඹ-සුදු විකුරුල්ලා	LC	Resident	1					1	
62	Estrildidae	<i>Lonchura punctulata</i> (Linnaeus, 1758)	Scaly-breasted Munia	ළය-කායුරු විකුරුල්ලා	LC	Resident			1	1	1	1	
63	Cuculidae	<i>Cacomantis passerinus</i> (Vahl, 1797)	Grey-bellied Cuckoo	කුසළු අනුකොහා	NE	Migrant							1
64	Laridae	<i>Chlidonias hybrida</i> (Pallas, 1811)	Whiskered Tern	අළුපිය කාහුල්-ලිහිණියා	NE	Migrant					1		
65	Picidae	<i>Dinopium psarodes</i> (Lichtenstein, 1793)	Lesser Sri Lanka Flameback	ශ්‍රී ලංකා ගිනිපිට පිළි-කුරලා	NE						1		
66	Laniidae	<i>Lanius cristatus</i> Linnaeus, 1758	Brown Shrike	බොර සබරින්නා	NE	Migrant		1	1	1			
67	Ciconiidae	<i>Ciconia episcopus</i> (Boddaert, 1783)	Asian Woollyneck	පාදිලි මානාවා	NT	Resident						1	
68	Ardeidae	<i>Ixobrychus sinensis</i> (Gmelin, 1789)	Yellow Bittern	කහ මැටි-කොකා	NT	Resident						1	
69	Ardeidae	<i>Nycticorax nycticorax</i> (Linnaeus, 1758)	Black-crowned Night-heron	රැ කණ-කොකා	NT	Resident		1					
70	Accipitridae	<i>Ichthyophaga ichthyaetus</i> (Horsfield, 1821)	Grey-headed Fish-eagle	අළු-හිස් මසුකුස්සා	NT	Resident			1				

Table 8: The checklist of recorded mammal species with conservation status

Abbreviations used: DS - Distribution Status; NCS - National Conservation Status; DD - Data Deficient; EN - Endangered; LC - Least Concern; NE - Not Evaluated; NT - Near Threatened; VU - Vulnerable.

No.	Family	Scientific Name	English name	Sinhala name	NCS_2012	DS	L 1	L 2	L 3	L 4	L 5	L 6
1	Pteropodidae	<i>Pteropus giganteus</i> (Brunnich, 1782)	Flying fox	මා-වවුලා	LC	Native				1		1
2	Cercopithecidae	<i>Macaca sinica</i> (Linnaeus, 1771)	Sri Lanka toque monkey	රිලවා	LC	Endemic				1		
3	Canidae	<i>Canis aureus</i> Linnaeus, 1758	Jackal	නරියා, හිවලා	LC	Native			1			

4	Felidae	<i>Prionailurus viverrinus</i> (Bennett, 1833)	Fishing cat	හඳුන් දිවියා	EN	Native			1				
5	Herpestidae	<i>Herpestes edwardsii</i> (Geoffroy, 1818)	Grey mongoose	අළු මුහටියා	LC	Native						1	
6	Mustelidae	<i>Lutra lutra</i> (Linnaeus, 1758)	Otter	දිය-බල්ලා	VU	Native			1				
7	Viverridae	<i>Viverricula indica</i> (Desmarest, 1817)	Ring-tailed civet	උරුලුවා	LC	Native						1	
8	Tragulidae	<i>Moschiola meminna</i> Erxleben, 1777	Sri Lanka mouse-deer	ශ්‍රී ලංකා මීමින්නා	LC	Native	1						
9	Hystriidae	<i>Hystrix indica</i> (Kerr, 1792)	Porcupine	ඉත්තෑවා	LC	Native		1					
10	Muridae	<i>Bandicota bengalensis</i> (Gray 1835)	Mole rat	හීන් උරු-මීයා	LC	Native					1		
11	Muridae	<i>Rattus rattus</i> (Linnaeus, 1758)	Common rat	පොදු හේ මීයා	LC	Native			1				
12	Muridae	<i>Tatera indica</i> (Hardwicke, 1807)	Antelope rat	වැලි-මීයා	LC	Native						1	
13	Sciuridae	<i>Funambulus palmarum</i> (Linnaeus, 1766)	Palm squirrel	ලේනා	LC	Native		1	1				
14	Sciuridae	<i>Ratufa macroura</i> (Pennant, 1769)	Giant squirrel	දඬු ලේනා	LC	Native					1		
15	Leporidae	<i>Lepus nigricollis</i> Cuvier, 1823	Black-naped hare	වල් හාවා	LC	Native						1	1

Annex 2: Plates

Habitats



Shady embankments



Grassy embankments



Shallow waters on right bank with overtopping vegetation



Home gardens



Stagnant water at a level crossing



Reed beds

Fauna species



Oreochromis niloticus



Common Blue Tail



Asian Groundling



Water Monitor

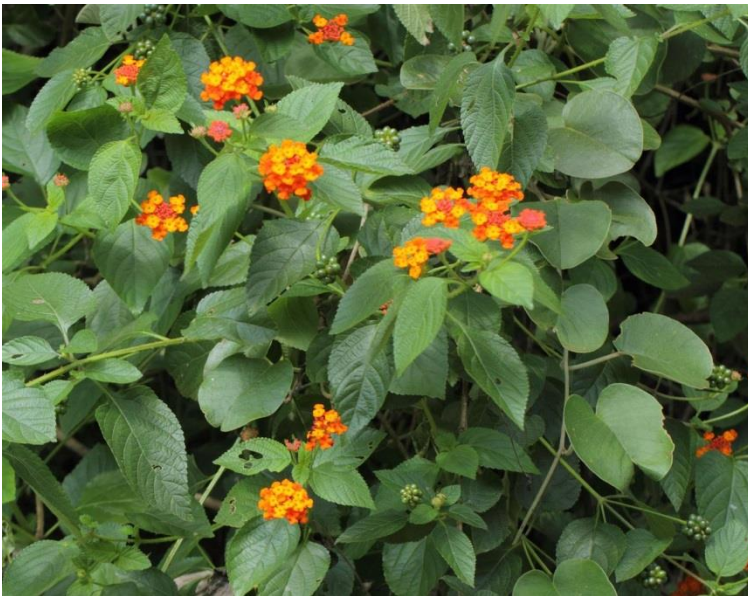


Common Toad

Flora species



Leucas zeylanica



Lantana camara



Anisomeles indica



Premna procumbens



Allophylus cobbe



During the field inspection

Annex 8: Consultation Notes

Meeting at MASL-Office of the Resident Project Manager, Walawe Special Area Embilipitiya Office on 05.03.2019, 10.30 a.m. – 1.00pm.

Meeting was attended by:

1. A.L. Osman e Silva, RPM, MASL
2. Thilak Ranasinghe, DRPM (Tn), MASL
3. T. Ranasinghe, DD (DSD), MASL
4. W.H.S.B. Wijerathna, Civil Engineer MASL
5. Mahinda Panapitiya, Consultant Civil Engineer, Richfield Lanka (Pvt) Ltd
6. Ganila Paranawithara, Consultant Civil Engineer, Richfield Lanka (Pvt) Ltd
7. R. U. Karunaratne, T.A., Richfield Lanka (Pvt) Ltd
8. R.B. Punchihewa, PRPM. MASL
9. W.M.R.I Wijerathna, Civil Engineer, MASL
10. R.K.S. PushpaKumara, Civil Engineer, MASL
11. K.P.G.H. Kumararatne, Technical Engineer, MASL
12. D.R. Wenaka, DRPM (Aq), MASL
13. B.G. Kulatunga (Farmer Organization Member)
14. K.K. Karunaratne (Farmer Organization Member)
15. S. Karunasena (Farmer Organization Member)
16. Nihal Fernando, Consultant, WB
17. Sithara Atapattu, Consultant, WB

Meeting was Chaired by the Resident Project Manager. He introduced the situation of the Walawe Right Bank Main Canal – established in 1968 and last rehabilitated in 1988 and 1989 by CECB. Poor condition of the canal is causing lowered water productivity with a large loss of water due to leaks in the system. Total are of the Right Bank Canal is 41.8 km.

The meeting was thereafter conducted by the Richfield Lanka (Pvt) Ltd Consultants as they presented the detailed study that they had conducted for the full length of the Canal. They presented the main intervention types and the issues to be considered. They presented bioengineering options and also mitigations to be considered to ensure environmental sustainability during civil work design. All detailed have been provided in the Final Consultancy Report handed over to MASL.

The main points raised during the discussion are:

- Water level in the canal will be maintained at around 3 cumec (about 1 foot of water) at all times – even during civil works.
- Cofferdams will be used around the immediate intervention locations where need to carry out the interventions without blocking water flow.
- There is a need to have discussions with all the water users such as all Farmer Organizations, Sugar Research Institute NWSDB (discussions already held), NAQDA (Aquaculture Development Centres for Tilapia and Carp), Agrarian Services, etc on water allocations and hindrances during the civil works so that alternate sources can be identified temporarily.
- Bidding documents will be divided in 4 components

- Hydro mechanical
- Environmental mitigations including monitoring and reporting.
- Civil Works of Main Canal – Start to Chandrika Wewa
- Civil Works of Main Canal – Chandrika Wewa to the end.

Mr Fernando of WB said it may be better to have more than 2 contractors doing smaller stretches so that the work will get completed sooner. This would mean breaking the bidding documents further. It was also noted that staffing and capacity has to be in line with the way the project is being broken down for implementation.

- The survey consultants also noted that there is a drainage from Embilipitiya Town which has been there for a long time as a drainage canal. However, with rapid urbanization in the area there is a lot of wash water and kitchen water entering the drainage system which could be a future source of serious pollution to the Canal if it is not monitored and mitigated now.
- Burrow pits have now been identified (about 16 km away) all locations provided in the Consultant's report. However, quality of material has not yet been tested.
- Waste disposal is believed not to be a problem. Exact plan has not yet been identified by MASL believe that disposal will not be a problem. It was agreed however, that they would identify specific locations along the length of the canal for construction waste disposal. Quarry pits were suggested as they are looking for fill material. It was proposed that they do a pilot quarry fill with total rehabilitation. This would serve as a best practice example.
- Representatives of the Farmer Organizations raised the following points:
 - Forest areas have been destroyed due to encroachment. Therefore, awareness has to be raised on these issues. Buffer areas and protected areas need to be clearly marked and get those who have encroached to be part of management system. This includes farmers as well as hotels.
 - Farmers will be ok to forego even a few seasons but they need to be properly informed of exactly what is happening – there were only rumors so far.
 - There is an urgent requirement of a bridge at the Rakwana River Crossing – currently a causeway and there are flash floods here and there are about 2-3 deaths every year.
 - Also mentioned that the branch canals and other small canals have been given to the farmers to manage, however, they do not have the capacity to maintain and manage these.

This meeting was followed by a field visit along the main canal from Udawalawe Reservoir to Chandrika Wewa from 2pm to 5pm. The Survey Consultants took the WB team and some MASL officials to show the nature of interventions planned along the way. See pictures below:



Example of embankment erosion



Overgrown intake at the Thilapia Center



Example of existing bridge that will be widened and example of human interventions of trying to increase the water levels at specific intakes.

Stakeholder Consultation held at Udawalawe D5 Bedum Ela Farmer Organization Hall.

06.03.2019, 9am – 10.30 am.

Meeting was attended by:

1. Mr. J.T. Wawas, D5 Bedum Ela Farmer Organisation
- 2 Mr. K. Gamini, D5 Bedum Ela Farmer Organisation
- 3 Mr. P.O. rajith Premasiri, D5 Bedum Ela Farmer Organisation
- 4 Mr. J.A. Wilmut, D5 Bedum Ela Farmer Organisation
- 5 N.Kumaranaya, D5 Bedum Ela Farmer Organisation
- 6 Mr. P. K. Saman Indika, D5 Bedum Ela Farmer Organisation
- 7 Mr. K. Jamis, D5 Bedum Ela Farmer Organisation
- 8 Mr. A.K. Sanath, D5 Bedum Ela Farmer Organisation
- 9 Mr. G. Samarsinghe, D5 Bedum Ela Farmer Organisation
- 10 Mr. A.K. Wimalarathne, D5 Bedum Ela Farmer Organisation
- 11 Mrs. U.C. Premawathi, D5 Bedum Ela Farmer Organisation
- 12 Mrs. U.C. Hemawathi, D5 Bedum Ela Farmer Organisation
- 13 Mr. R. Darmadasa, D5 Bedum Ela Farmer Organisation
- 14 Mr. G.L Sunil, D5 Bedum Ela Farmer Organisation
- 15 Mr. S. Karawadu, D5 Bedum Ela Farmer Organisation
- 16 Mr. M.S. Ransinghe, D5 Bedum Ela Farmer Organisation
- 17 Mr. K.B. Wimalarathne, D5 Bedum Ela Farmer Organisation
- 18 Mr. U.G. Somapala, D5 Bedum Ela Farmer Organisation
- 19 Mr. M. Darmasena, D5 Bedum Ela Farmer Organisation
- 20 Mr. M.G.A. Wickrampala, D5 Bedum Ela Farmer Organisation
- 21 Mrs. M. Kusumawathi, D5 Bedum Ela Farmer Organisation
- 22 Mrs. O.G. Senerath, D5 Bedum Ela Farmer Organisation
- 23 Mr. D.M. Senadira, D5 Bedum Ela Farmer Organisation
- 24 Mr. M. O.Ariyadasa, D5 Bedum Ela Farmer Organisation
- 25 Mr. M. Chandra Rupshinghe, D5 Bedum Ela Farmer Organisation
- 26 Mr. L.B. Piyasoma, D5 Bedum Ela Farmer Organisation
- 27 Mrs. G. Dilrukshi, D5 Bedum Ela Farmer Organisation
- 28 Mrs. I Ajanthi, D5 Bedum Ela Farmer Organisation
- 29 Mr. B.Gamini. Kulathunga, D5 Bedum Ela Farmer Organisation
- 30 Nihal Fernando, Consultant WB
31. Sithara Atapattu, Consultant, WB

The D5 Bedum Ela Farmer organization is next to the Sugar Cane Research institute and the former sugar factory. 84 ha formerly land belonging to the sugar factory was distributed among 15 families initially for the purpose of growing sugar cane when the factory closed. Later these lands were converted to paddy and other crops mainly bananas and papaw. As it stands now it is about 60% paddy and 40% other crops. The work force is about 60% male and 40% female.

The branch canals were handed over to the farmer organizations to maintain but they do not have the capacity for this.

Mr Nihal Fernando of the WB explained the need to lower water sourcing during the interventions and the farmers said they would be able to forego a season or even two of paddy but their other crops need water atleast once in 10 days. So an alternative water source would be required during the civil works.

The FO members inquired into the possibility of agricultural wells atleast on a temporary basis which can supply water to multiple farmer lots.

Potable water scarcity is an existing problem as canal cannot be used due to pollution. Wells are also not an option for drinking water in the area. Those residing close to the canal have to go 2-3 km to get their drinking water. Other farmers that reside outside, carry their drinking water from the home.

Water for bathing and washing clothes will not be a problem during civil works as they are used to using alternative sources during the low water area. They go to the Walawe river or use other places.

Presence of encroachment identified as a problem by FO members. They request these people to be identified and made responsible for the maintenance of the buffer areas.

FO members requested the development of the bund road. They are requesting it to be carpeted to increase accessibility especially since that has now become one of the main travel routes of the people in the area.

Request for alternative livelihood training/capacity building especially for women. Areas identified were to cater for the tourism industry in the area – cookery to cater for the local hotels and to improve their employability. Also home-based livelihoods such as ornamental fishery, flower cultivation and coconut based productions (ornaments, oil, etc).

Also to involve local labor force during the civil works. This can also create income generation during the days that they have to forego cultivation.

Request for a regulator for the area. It was noted that a detailed study would be carried out on the syphen by CECB in the future to identify all issue to be rectified (Nihal Fernando).

FO noted that civil works should be of good quality so that it survives atleast another 50 years. Recent intervention have been of low quality and they do not last.



Stakeholder Consultation held at MASL Murawesihena Block Manager's Office.

06.03.2019 11.30 – 12.30

Meeting was attended by:

1. K.D. Jayarathne, D 16 No 2
2. K.G. Gunadasa ,D 2
3. R.W. Gunaratne, D12-14
4. K.A. Amarasena, Yaya 10 D3

5. L.P. Piyadasa, Yaya 10
6. P.P. Athrayas, Yaya10 DO Gamunu
7. P.A. Lakmal, Yaya10 DO Gamunu
8. L.P. Landusa, Yaya8 D 3
9. H.G. Sami, Yaya D1
10. M.R. Indrasiri, Yaya D3
11. P.V. Piyasili, Yaya 9 D6
12. I. Thilakawardena, Yaya 9 D/6
13. Liyanage, D9 Ekamuth Armi Ela
14. E.A.P. Wewbasilena, 8 D / 3 Jayabima
15. T.G.Sugathadasa, D15 no 2
16. G.Munasinghe, D15 no 2
17. T. Nilantha Chamara, D3 Farmer Organisation
18. W.E. Siserum, Yaya 10
19. M.P. Gurusinghe, Parakrama Hen Farmer Organization
20. L.A. Dayanada, Jayabima Farmer Organisation
21. W.A.C.N Kumari, Coordination Office, MASLr
22. Yamuna C. Dahanayaka, Divisional Management Officer, MASL
23. E.M.A.S. Ekanayaka, Technical Officer, MASL
24. E.S. Sadurdeen -Assistant Engineer, MASL
25. V.G. Bandula, Engineer, MASL
26. Nihal Fernando – WB Consultant
27. Sithara Atapattu – WB Consultant

This meeting was chaired by the MASL Divisional Management Officer. Farmers present were mainly male with 5 female representatives.

Farmers mainly involved in paddy cultivation but cultivate other crops as well as they have been asked to maintain a 60:40 ratio of paddy and other crops. About 75% of the farmers have land ownership and others don't.

Most women unemployed as there are no opportunities. Livelihood opportunities that are home based would be highly beneficial. There are several women's organizations that could engage directly in such activities. They requested that market linkages also be created.

Livelihood support would be necessary during periods that they would have to forgo cultivation, especially vulnerable (poor) families. These families should be identified through the Farmer Organizations.

Farmers requested labor employment during the civil works to be considered. This would also involve them in the activity directly to ensure that all work is done to the expected standard for long term sustenance. These recruitments should also be done through the Farmer Organizations.

Encroachment of buffer zones are said to be a big problem, so the areas should be demarcated and those farmers should also take responsibility in the maintenance of the area.

Another important area identified by the farmers is having separate demarcated areas for buffalos.

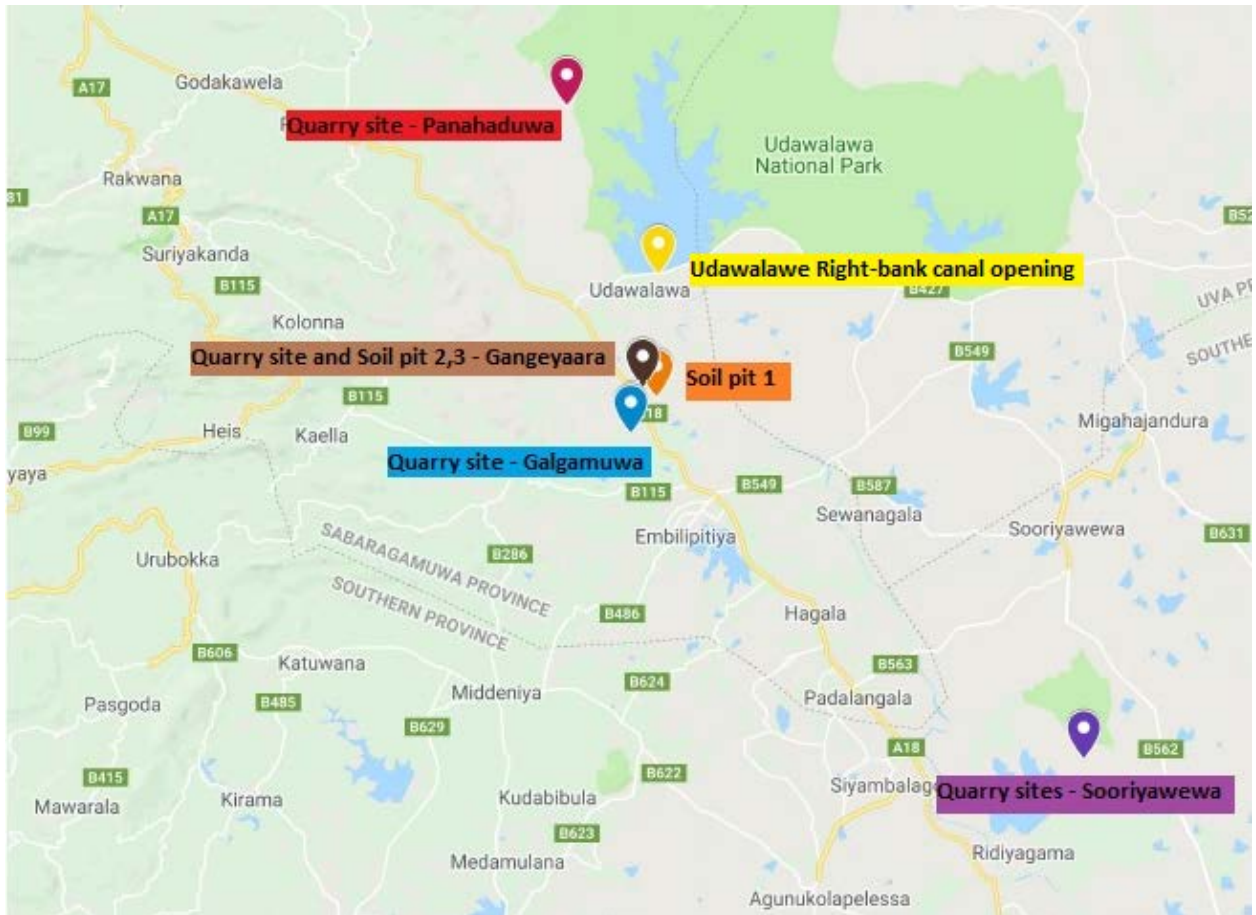
Drinking water alternatives will have to be identified for the areas during civil works as rural water schemes provide the drinking water that is taken from the canal system.

MASL Engineer (Mr Bandula) notes a few points based of past experiences.

- Importance of having a water usage plan and allocating only the required amount. This would minimize wastage.
- Water gauges will have to be secured as existing ones have been broken.
- Determining the suitability of technologies adopted especially securing of embankments. There have been instances where Kumbuk trees planted under other programs have led to maintenance issues.



Annex 9: Location of potential Burrow Pits



Quarry site in Panahaduwa, Udawalawa



Quarry site in Galvaguwa, Embilipitiya



Quarry site in Gageyaara, Udawalawa



(a)



(b)



(c)

Three quarry sites in Sooriyawewa, Hambantota



Two soil borrow pits in Gangeyaara, Udawalawa region