Environmental Monitoring Report

Semi-Annual Report
For the period covered July to December 2016
Project Number: 47381-002
May 2017

SRI: Mahaweli Water Security Investment Program

Final (Main Report, Annex 1 and 2)

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

Democratic Socialist Republic of Sri Lanka
Ministry of Mahaweli Development and Environment

Mahaweli Water Security Investment Program

SEMI-ANNUAL ENVIRONMENTAL MONITORING REPORT

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Period: July - December 2016

Prepared for:

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Mahaweli Water Security Investment Program
Program Management Unit
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ABBREVIATIONS

ADB	Asian Development Bank
CEA	Central Environmental Authority
DFC	Department of Forest Conservation
DS	Divisional Secretariat
DWLC	Department of Wild Life Conservation
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
GRM	Grievance Redress Mechanism
ICB	International Contractor's Bidding
ID	Irrigation Department
IEER	Initial Environmental Examination Report
MCA	Multi Criteria Analysis
MLBCR	Minipe Left Bank Canal Rehabilitation
MWSIP	Mahaweli Water Security Investment Program
NBRO	National Building Research Organization
NCB	National Contractor's Bidding
NCPCP	North Central Province Canal Project
NWPC	North Western province Canal
PIU	Project Implementation Unit
PMDSC	Project Management Design Supervision Consultant
PMU	Programme Management Unit
SEA	Strategic Environmental Assessment
ToR	Terms of Reference
UEC	Upper Elahera Canal

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1. INTRODUCTION

1.1 Overview of MWSIP

1. The Mahaweli Water Security Investment Program (MWSIP) was commenced in December 2015, under the Ministry of Mahaweli Development and Environment (MMDE) of the Government of Sri Lanka (GoSL), funded by the Asian Development Bank (ADB) (Loan No. 47381-002-SRI (SF) and GoSL, and is aimed at achieving the goal of maximizing the productivity of the Mahaweli River Basin (MRB) water resources by transferring available water to the north and north western dry zone areas for irrigation, drinking and commercial purposes.

2. The Program Director (PD) is working as the head of the Program and operates the Program Management Unit (PMU) in the Colombo office, located at 493 1/1, T. B. Jayah Mawatha, Colombo 10. A safeguards cell is established in the PMU, which is responsible for overseeing the overall monitoring and verification of the environmental and resettlement activities of the investment Program with the assistance of three[1] Project Implementation Units (PIUs) and the Project Management, Design and Supervision Consultants (PMDSC).

3. The three PIU offices and the three Resident Engineers' (RE) offices are operated at site level to monitor closely the performance of Contractors' constructing infrastructure in connection with the Program. The organization structure of the MWSIP is shown in **Figure 1-1**. The visions, mission, organizational set up, and the communication protocol of the "Environmental Cell" to ensure the MWSIP complies with ADB safeguard policies (SPS 2009), and National Environmental Law (Act No. 47 of 1980 and amendments) in order to bring the MWSIP deliverables within the sustainable development goals ratified by GOSL, is given in **Annex 1**[2].

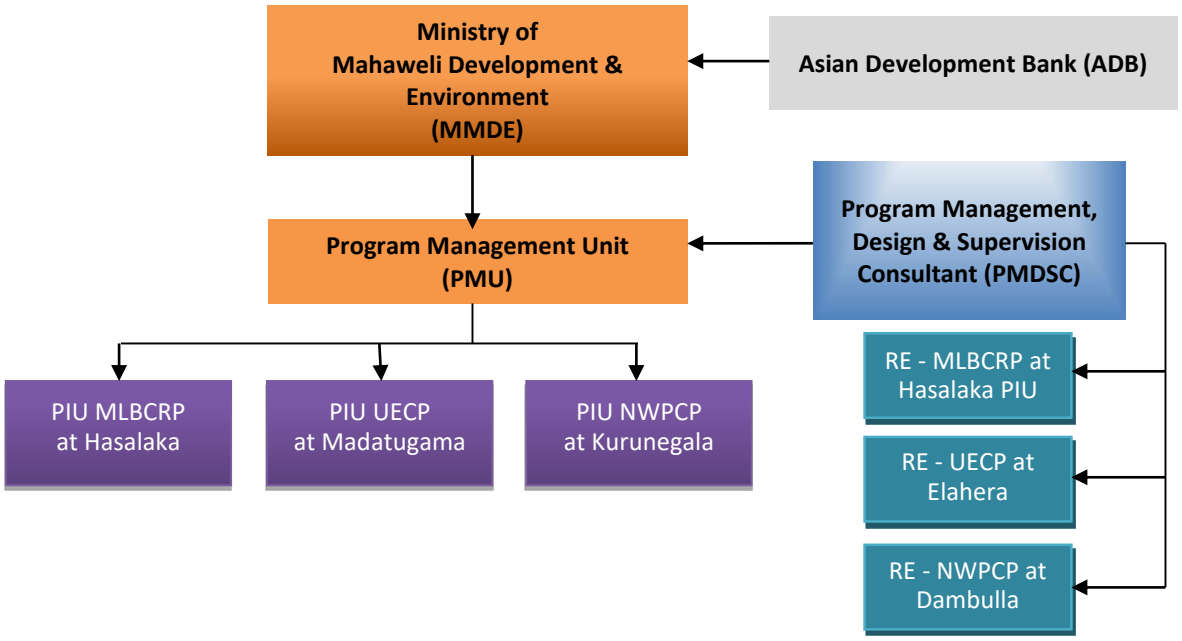


Figure 1-1 : Organization Structure of MWSIP

[1] One for each of the three projects: Minipe Left Bank Canal Rehabilitation (MLBCR), Upper Elahera Canal (UEC), and North Western Province Canal (NWPC).
[2] Environmental Organization and Communication Protocol.

1.2 Project at a Glance

4. The investment program comprises three main individual investment projects:

(i) **Minipe Left Bank Canal Rehabilitation Project (MLBCRP)**

MLBCRP, located in the downstream reaches of the Mahaweli Ganga, will: (a) add upstream storage by heightening the diversion weir by 3.5 m, (b) construct new automated intake gates to the left bank canal, and emergency spill weirs to both left and right bank canals; and (c) rehabilitate the 74 km Minipe Left Bank Canal to improve conveyance and reliability of service to existing farmers.

(ii) **Upper Elahera Canal Project (UECP)**

The UECP comprises two components: The first component is the 9 km Kalu Ganga-Moragahakanda Transfer Canal (including 8 km of tunnel) that transfers water between the Kalu Ganga and Moragahakanda reservoirs. The second component is the Upper Elahera Canal that connects the Moragahakanda reservoir to the existing reservoirs: Huruluwewa, Eruwewa and Mahakanadarawa via 84 km of canals (including a 26 km tunnel). These reservoirs supply existing irrigation and water supply schemes.

(iii) **North Western Canal Project (NWPCP)**

The NWPCP will construct 96 km of new and upgraded canals and two new earth gravity dams impounding the Mahakithula and Mahakirula reservoirs. It will transfer water from the Dambulu Oya river and the existing Nalanda and Wemedilla reservoirs to command existing irrigation and water supply reservoirs. The detail designs are yet to be finalized with the tunnelling sections and new dams.

5. By January 2017, the contract packages of MLBCR-NCB-1 (Rehabilitation of Minipe LB Canal from 0+000 km to 30+140 km), UEC-ICB-1 (0+100 km to 6+226 km), and NWPC-NCB-1 (Wemedilla sluice and LBMC from reservoir to Nebadagahawatta from 0+000 km to 5+ 250 km) were awarded, respectively, to Edward and Christie, CML-MTD Construction Ltd., and NEM Construction (Pvt.) Ltd.

6. Preparation of Wild Life Management Plan (WMP) is a prerequisite of the CEA and Department of Wildlife Conservation (DWC) to commence the construction activities of the NWPCP and UECP. IUCN (selected agency through national procurement process for preparation of WMP) submitted the Inception Report in September 2016 (**Annex 2**[3]); TRC commented in November 2016.

1.3 Scope of the Report

7. The purpose of this report is to ensure that the project is implemented with due concern for environment and social safeguards according to the ADB's Safeguard Policy Statement (SPS) 2009, and specifically to ensure that these issues are adequately addressed in compliance with the requirements of ADB. Further, this report is to assess the progress with implementation of the program in complying with the approved EIA/IEE reports and Environmental Management Plan (EMP).

8. Since the construction contracts are at early stages, this report addresses the progress of environment performances of all three projects in one combined report for the period of six months from July to December 2016. NWPCP and UECP are Category A/EIA level projects, MLBCRP is a Category B/IEE level project, as per ADB Safeguard Policy Statement (SPS 2009), and National Environmental Law (Act No. 47 of 1980) respectively.

[3] Inception Reports of IUCN WMP for UEC and NWPC.

2. PROGRESS OF MLBCRP

2.1 Environmental Approvals and Documentation

9. MLBCRP is classified as Category "B" according to ADB's SPS (2009) and the conditional approval granted by CEA for the prepared IEE, which includes an EMP that describes mitigation measures to be adopted during design, construction and operation.

10. An addendum addressing required design changes for the MLBCRP was submitted and obtained CEA concurrences in January 2017. The updated EMP had been submitted in August 2016 and CEA approval was granted through letter Ref. CEA/CPO/KY/07/929/12 dated as 11.01.2017 (**Annex 3**).

11. The CEA and Department of Archaeology and local authority in Hasalaka were formally informed about commencement of the construction in August 2016, as per the stipulations mentioned in the CEA approval.

12. The updated Environmental Management Plan (EMP) specifying mitigation measures, monitoring and implementation mechanism of the same, based on the finalized designs and intended construction program, was also submitted to CEA in August 2016.

2.2 Construction Monitoring

2.2.1 Contractor's Orientation

13. Contract MLBCR-NCB-1 to rehabilitate the Minipe LB canal (0+000 km to 30+140 km) was awarded to Edward and Christie, on 15 September 2016. A Contractor Awareness session was carried out on 08 November 2016 at the Hasalaka Resident Engineer's office on the preparation of the Contractor's Environmental Management Plan (CEMP), and introduced other related environmental safeguard requirements, reporting procedures and monitoring requirements.

14. The updated EMP, other reference documents such as the approved IEE, the letter including conditions laid down by CEA, draft formats for the Environmental Method Statement (EMS), Environmental Issue Log, Grievance Log and the content to be prepared for the Monthly Environmental Monitoring report were introduced to the contractor. The formats shared with the contractor are given in **Annex 4**.

15. There is one Environmental Officer appointed by the contractor to look after the construction related safeguard aspects including self-monitoring and reporting.

16. **Preparation of the CEMP** is in progress under the guidance of PMDSC's Environmental Specialist and the Environmental Officer of the contractor is working on the 2nd version, incorporating revisions highlighted by PMDSC.

17. **A Draft Environmental Activity Plan** for environmental safeguard management was prepared with the involvement of the Environmental Officers of the contractor and of PIU. This plan was submitted to PMU and PIU for the endorsement

2.2.2 Approval and Preparation of Contractor's Facilities

18. Identification of sites for the contractor's office, concrete batching plants and disposal areas were completed by carrying out site visits with the participation of PMDSC Environmental Specialist (National) and Environmental Officers of PIU and the contractor assigned for the Minipe contract. **Figure 2-1** shows the map of the MLBCR-NCB-1 contractor's facilities.

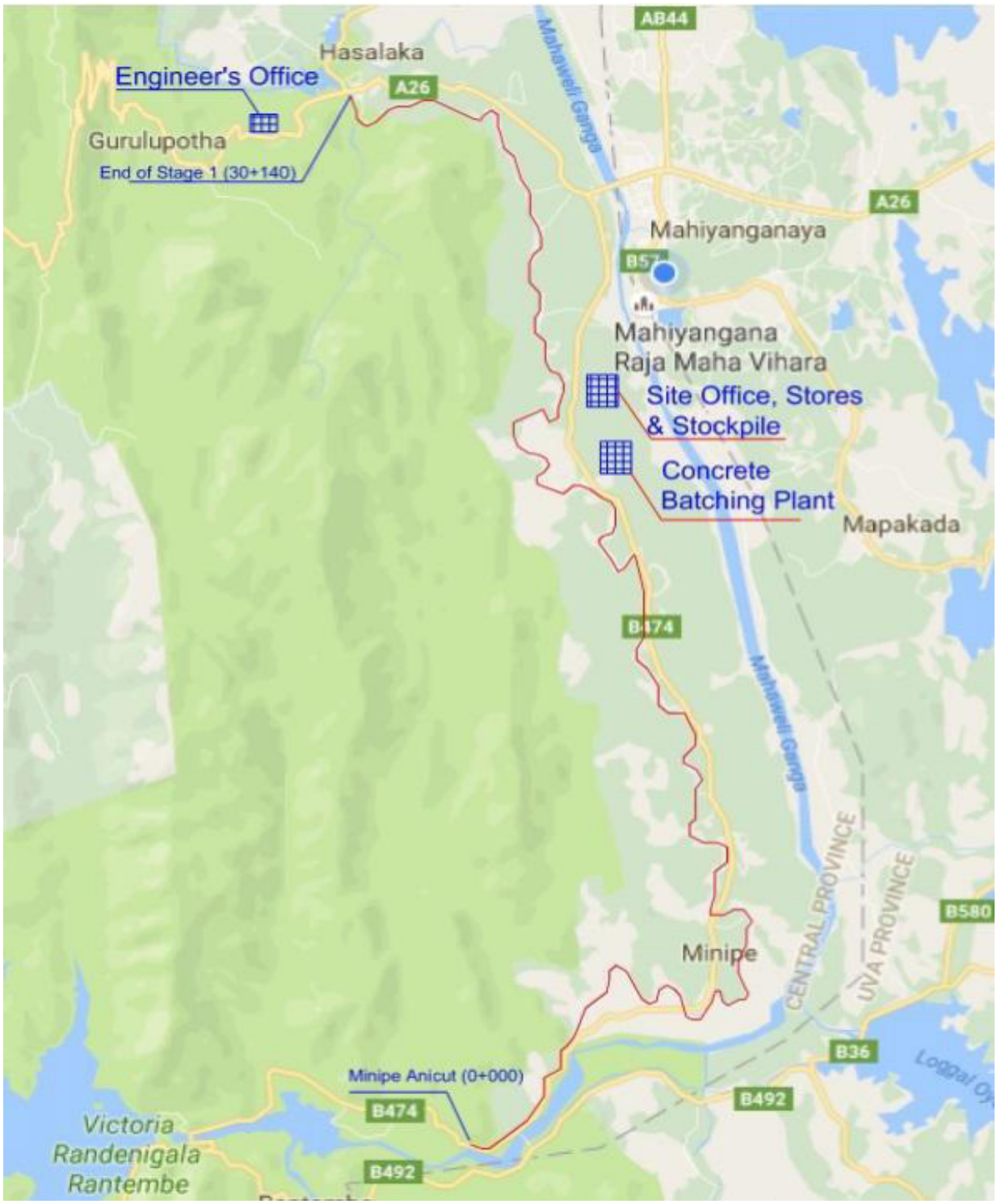


Figure 2-1 : Map of the MLBCR-NCB-1 Contractor's Facilities

19. The areas for stock piling and waste disposal are identified and the approval from the Pradeshiya Sabha (local authority) is in progress. Most of the identified sites are existing borrow areas, in which the land owners voluntarily provide the lands to get filled the areas by the project and reinstate the lands for them to use later for cultivation purposes. The disposal and borrow areas were identified outside the wildlife reservation in compliance with ADB SPS (2009) and GoSL environmental conditions.

20. The sites recommended by the Environmental Specialist of PMDSC for construction waste disposal based on the field inspection findings and their owners are listed below:

Site No.	Owner	Location
Site 1	Mr Lakshman Bandara	Lat: 7° 17.000' N / Lon: 80° 59.517' E
Site 2	Ms K. G. Jayanthi	Lat: 7° 16.872' N / Lon: 80° 59.482' E

21. The contractor was advised to commence operation only after obtaining the required approvals and after submitting a detailed environmental method statement including a restoration plan.

22. Out of two gravel sites, the site No. 2 located at Lat: 7° 12.573' N / Lon: 80° 58.726' E was found to fall within Victoria/Randenigala/Rantambe (VRR) sanctuary area. The particular land identified is located only a little higher by elevation but close to settlements and, hence, found not to be environmentally feasible.

23. A third gravel site, owned by Mr. W.G. Nimal Chandana, Lat: 7° 13.331' N / Lon: 80° 59.735' E was identified as environmentally feasible.

24. Details of the contractor's facilities are given in **Table 2-1**.

Table 2-1 : Approval Status of the Contractor's Facilities and Activities

Facility/ Activity	Location	Ownership	Licence Type	Licence Details	Validity Period	
				Number	From	To
Metal Crusher	Paragaha Kalee, Mahiyanganaya	Dhassana Metal Crusher	Environmental Protection Licence (EPL)	Pending	-	-
			Trade Licence (TL)	Pending	-	-
Metal Quarry	Kovilyaya, Mahiyanganaya	Mr. K. U. Vidanagamage - Private	EPL	06204(R1)(F1)	2016-08-19	2017-08-18
			TL	Pending	-	-
			Mining Licence (ML)	IML/B/HO/3059/LR/3	2016-06-22	2017-06-21
Borrow Pit	Wewatha, Mahiyanganaya	Mrs. H. M. C. Hemalatha - Private	ML	IML/B/HO/6019LR/02	2016-12-29	2017-08-28
Sand Mining	Ambagahapalassa, Minipe	Mr. J.G.D.N. Kulasooriya	ML	AL/A/KAN/1799	2016-11-23	2017-11-23
Concrete Batching Plant	No. 35/7, Morayaya, Minipe	Edward and Christie	Environmental Recommendation for construction is issued by Central Provincial Office of CEA through the letter Ref. CEA/CPO/KY/07/1597/2016 dated as 30.12.2016			
Stock yard	Morayaya, Minipe	Department of Irrigation	Consent of the Divisional Secretary is granted for these locations to use for the identified purpose			
	No. 3, Morayaya, Minipe	Private land				

2.2.3 Project Physical Progress

25. The construction activities are not allowed to commence until the pre-conditions and documentation are satisfied, including approval of Environmental Method Statements and CEMP. However, an emergency situation occurred in mid of November 2016, due to breaching of a small section of the Minipe LB canal within the MLBCR-NCB-1 contract package area.

26. Meeting the urgent requirement of rehabilitating the breached section, the contractor was requested to initiate work under the close monitoring and supervision of the RE's staff. **Figure 2-2** shows the rectified section as at mid of December 2016.

Figure 2-2 : Rehabilitated Breach Section of MLBCR-NCB-1

2.2.4 Environmental Risks and Safeguard Compliance

27. The site identified for the concrete batching plant had been granted approval by the Central Province office of the CEA for the construction of the plant; construction is in progress. The identified site is close to a stream and, hence, the environmental risk associated with construction and operation is high. Therefore, the contractor was advised to prepare the site without polluting the nearby stream environment.

28. The key environmental aspects, identified as "high risk" to "moderate risk", and the summary of self-monitoring findings of the contractor were listed during the site preparatory and construction work. **Table 2-2** summarizes the findings.

Table 2-2 : Summary of Significant Environmental Impacts and Measures Adopted

Activity	Observed Impact	Risk Level	Adopted Mitigation Measure	Effectiveness of Mitigation	Actions Recommended by PMU
Survey and site clearance	Spreading Alien Invasive Species (AIS)	Moderate	• Manual removal of AIS and collection, transport to the waste disposal area and burning immediately • Washing and cleaning transported vehicles	Moderate	
Rehabilitating canal breach section	Soil erosion and sedimentation	High	• None	-	Placing silt traps
Transport construction material	Spillage of construction material during transportation	Moderate	• Covering Transport vehicles during transportation	Moderate	
Construction of batching plant	Soil erosion at Batching plant area	High	• Turfing • Land preparation with embankments around the plant	Moderate	
	Inadequacy of water and air pollution controls	High	• Installing waste water treatment unit and dust arrester	Moderate	

2.2.5 Management of Environmental Issues and Grievances

29. Environmental Issue Log and Grievance Log are maintained at the site office. However, there are no records for the period of June to December 2016.

30. The Grievance Redress mechanism was established in the MLBCRP. **Annex 5** summarizes the actions adopted to establish the so-called mechanism in the MLBCRP area.

2.3 Additional Surveys and Stakeholder, Public Consultation

31. On 20 December 2016, a site visit was made with the participation of PMDSC Environmental Specialist, Senior Construction Engineer, Environmental Officers and relevant other officers representing PIU and the contractor (Edward and Christie). The visit covered the MLBCR-NCB-1 project area from 0+000 km to 33+000 km with the objective of identifying the possible reforestation areas along the canal bank.

32. Baseline data collection for environmental parameters of surface water quality, noise, vibration, and ambient air quality, sediment levels was planned to commence through a third party. The Request

for Quotation of Work (RFQW) was issued for four shortlisted national bidders (accredited laboratories) in September 2016, based on the ToR for Baseline Data Collection attached as **Annex 6**.

33. Followed by the initial key stakeholder awareness session on 05 August 2016, a site level special consultation session was conducted on 08 August 2016 (Photo 8 of **Annex 5**) at the District Secretariat Office in Trincomalee with political authority of eastern province, Allai farmer leaders and senior government officers in the district. The high-level officers of Irrigation Department and ministry decided to formulate a new project to resolve problems associated with Allai Irrigation Water Supply scheme. Nevertheless, the participants were convinced that Minipe dam raising would not cause a water shortage on the Allai scheme located downstream of Mahaweli River.

3. PROGRESS OF UECP

3.1 Environmental Approvals and Documentation

34. UECP is classified as Category "A" according to ADB's SPS (2009) and the conditional approval granted by CEA for the EIA in October 2016, which includes an EMP that describes mitigation measures to be adopted during design, construction and operation.

35. The updated EMP for the UEC-ICB-1 was prepared by PMDSC. The final version incorporating PMU comments was submitted to PMU in late December 2016 to facilitate obtaining CEA concurrences.

36. Prior to contractor mobilization approval for the tree felling and site access was obtained from the Department of Wildlife Conservation (DWC). DWC is the main stakeholder agency for UEC-ICB-1 package as it is located within the Elahera-Girithale sanctuary area.

37. The PMU requested to wave off the following stipulation of the EIA approval:

(i) No. 3.1: Preparation of Wildlife Management Plan (WMP) - PMU requested on 17 June 2016 to allow starting of construction of ICB-1 package, in parallel to progress of WMP preparation aiming to be completed in August 2017. Adopting CEA guidance to undertake an "Ecological Assessment within ICB-1 impact zone", the IUCN submitted the report to CEA in December 2016 (**Annex 7**[4]). The CEA is awaiting DWC comments to conclude on the PMU request.

38. Upon the request of PIU made in November 2016, the DWC released the "Canal Trace for Constructions" in December 2016. The proposal for relocation of priority plant and animal species (**Annex 8**) was submitted to DWC for approval.

39. CEA was formally informed about the commencement of project construction in December 2016, the Department of Archaeology in October 2016 as per the stipulations of the CEA approval.

40. The Environmental Management Plan (EMP) specifying mitigations-monitoring and implementation of the same, based on final designs. The intended construction program of UEC-ICB-1 was finalized and submitted in January 2017.

3.2 Construction Monitoring

3.2.1 Contractor's Orientation

41. UEC-ICB-1 contract, which mainly includes water conveyance system from 0+100 km to 3+860 km, will be constructed as cut-and-cover conduits with rectangular cross sections, associated structures and in- and outlet transitions to Kongetiya Level Crossing.

42. The improvements to the existing Kongetiya Level Crossing of 2,343.6 m length are not part of this contract and excluded from the contractor's scope. In addition to above, Naula - Elahera New Road Deviation is included under the contract package covering requirements for a 350 m long, 2-lane public road by constructing one 1.5 m x 1.5 m culvert at a specified location. Design and construction will be by the Road Development Authority (RDA), Sri Lanka.

43. The UEC-ICB-1 construction contract was awarded to CML-MTD Construction Ltd. on 07 December 2016. A Contractor Awareness session was held on 21 December 2016 at the Elahera RE's office to make the contractor aware of the requirements for Contractor's Environmental Management Plan (CEMP)

[4] Ecological Survey for UEC-ICB-1.

preparation, and about other related environmental safeguard requirements, reporting procedures and monitoring requirements.

44. The updated EMP, other reference documents such as the approved EIA, the letter including conditions laid down by CEA, and draft formats were introduced to the contractor for the Environmental Method Statement (EMS), Environmental Issue Log, Grievance Log and the required content in preparing Monthly Environmental Monitoring reports.

3.3 Additional Surveys and Stakeholder, Public Consultation

45. On 17 November 2016, a meeting was held with PD, PIU (UEC) at the RE office Elahera, attended by the Environmental Officer (PIU-UEC). A site visit was made to finalize locations of camp sites and disposal areas for UEC-ICB-1 package. Discussions were held relating to the impacts which water releases by the Moragahakanda project will have on the first 900 m canal of UEC-ICB-1. During the same visit discussions also focused on a required road deviation at chainage 0+900 m of UEC-ICB-1.

46. A tree enumeration survey was carried out in the second week of October 2016 in the UEC-ICB-1 area, which included a rapid ecological survey to identify the critical species and sensitive habitats in the project area. Findings and appropriate mitigatory measures were included in the updated EMP.

47. The environmental screening was carried out in September 2016 and November 2016, including a rapid ecological assessment by the PMDSC Environmental Specialist (National) with the assistance of a consultant ecologist, to study the proposed access roads for UEC-ICB-3 package and to identify the disposal areas.

4. PROGRESS OF NWPCP

4.1 Environmental Approvals and Documentation

48. NWPCP is classified as Category "A" according to ADB's SPS (2009) and conditional approval granted by CEA for EIA in October 2016, which includes an EMP that describes mitigation measures to be adopted during design, construction and operation.

49. The updated EMP for the NWPC-NCB-1 was prepared by PMDSC. The final version, incorporating PMU comments, was submitted to PMU in late November 2016 to facilitate obtaining CEA concurrences.

50. The EIA is being updated by preparing an addendum highlighting the design changes and anticipated environmental impacts. The addendum to the EIA shall be submitted to the CEA and ADB for their approval prior to commencement of the particular construction works.

51. CEA, Department of Archaeology and Local Authority - Galewela were formally informed about the commencement of project construction in December 2016 as per the stipulations of the CEA approval.

52. The updated Environmental Management Plan (EMP), specifying mitigations-monitoring and implementation of the same, based on the finalized designs and intended construction program of NCB-1 were submitted to CEA in December 2016.

53. The PMU requested to wave off the following stipulations over the EIA approval:

(i) No. 3.1 - Preparation of the Wild Life Management Plan (WMP): PMU requested on 17 June 2016, to allow commencing the construction of NCB 1 package, while in parallel to progress with WMP preparation aiming to be completed in August 2017. CEA summoned a special TEC meeting on 03 November 2016. The meeting advised to undertake an ecological assessment within NWPC-NCB-1 impact zone. This was undertaken by IUCN in November 2016. The report was submitted to CEA in December 2016 (**Annex 9**[5]).

(ii) No. 3.8 - Establishment of Hakwatunaweva Elephant Corridor (Hak. E.C.)[6]: PMU, followed by a discussion with the DWC, requested on 21 June 2016 to alter above allowing to progress construction whilst sharing 50% of financial expenditure for establishing Hakwatunaweva elephant corridor by the Ministry of Mahaweli Development. This was also taken up at the special TEC meeting on 03 November 2016. PMU was advised to sign a MOU with the DWC to consider waving the stipulation. The content of the MOU is being formulated by PMU in consultation with DWC. Meanwhile PMU and PIU actively participated in events related to establishing the Hak. E.C.:

   (a) Sought approval of District Coordinating Committee (DCC-Kurunegala) to establish Hak. E.C. on 15 August 2016; approval was obtained on 05 December 2016.

   (b) Summoned a meeting by Secretary/MMDE for line agencies (DWC, CEA, Divisional Secretary (DS) and Ministry/Wildlife Management-WM) on 04 November 2016; an Action Plan was prepared and circulated on 17 November 2016.

[5] Ecological Survey for NWPCP-NCB-1.

[6] Note: The DWC and DS-Polopitigama take the lead role on this whilst the PMU extend assistance with technical expertise and logistic engagements.

(c) Attend at discussion at DS office to outline resettlement scheme related to Hak. E.C. on 28 November 2016; the action plan was presented at Parliament Subcommittee meeting summoned by Hon. Minister of WM for line agencies on 30 November 2016.

4.2 Construction Monitoring

4.2.1 Contractor's Orientation

54. NWPCP-NCB-1 contract, which mainly includes improvements to 5.25 km of the existing Dewahuwa Feeder Canal (presently named as Wemedilla Left Bank Main Canal) up to Nebadagahawatta, including provision of a new sluice in the Wemedilla tank and a 600 m long Tail Canal to increase the diversion from Wemedilla tank, was awarded to NEM Construction (Pvt.) Ltd. on 01 December 2016. The contractor awareness is planned for 19 January 2017, once the contractor is mobilized to the site.

4.2.2 Management of Environmental Issues and Grievances

55. The Grievance Redress mechanism was established in the NWPCP. **Annex 10** summarizes the actions adopted to establish the so-called mechanism in the NWPCP area.

4.3 Additional Surveys and Stakeholder, Public Consultation

56. The project area of NWPC-ICB-1 falls entirely within the authority of the Wildlife Conservation Department, Sri Lanka, and approval is subject to the submission of a "Wildlife Management Plan Emphasizing Human-Wildlife Conflict", which is an ongoing assignment being implemented by the IUCN.

57. Access to the project area during the construction phase is a challenging task, due to the surrounded elephant fencing and intensive elephant movements existing in the area. The EIA report mentions five access roads to be improved under the project:

Herathgama - Mahakithula	- 2.2 km
Herathgama - Pothuwila	- 2.6 km
Pothuwila - Mahadambe	- 2.4 km
Pothuwila - Mahakithula	- 4.6 km
Mahakithula Tunnel site	- 4.2 km

58. The Kahalla - Pallekele sanctuary (at present) is proposed to be upgraded as a National Park soon. The Wildlife Department therefore has restrictions on improving or introducing new access into the wildlife area. Hence, some of the roads identified during the EIA stage were slightly changed regarding the alignments and dimensions to ensure that the Wildlife Department's requirements are fulfilled. Identified access roads within Kahalla-Pallekele Sanctuary are selected based on the road network proposed by the DWC and as per their proposals to elevate this sanctuary to a "National Park". A summary of key consultative sessions is listed in Table b of **Annex 10.**

59. The identification of the final alignments for the access roads was carried out through holding several discussions with the Wildlife Department officers. In order to comply with ADB safeguard policy (SPS, 2009) a Due Diligence Report (DDR) was prepared addressing all possible environmental impacts. This was done by carrying out a Rapid Environmental Screening covering the direct impact area of the activities related to access road improvement.

60. The environmental screening was carried out in September 2016 and November 2016, including a rapid ecological assessment by the PMDSC Environmental Specialist (National) with the assistance of a consultant ecologist. They studied the access road deviations and the proposed borrow and disposal areas under NWPCP-ICB-1 and NWPC-ICB-2 packages.

61. Considering the site requirements and to ensure the minimal environmental impacts, the access road sections (i) Herathgama to Kirula Ela (3.8 km), (ii) access road to Mahakirula dam (1.4 km), (iii) access road from Pothuwila to Moragolla (11.1 km), and (iv) access road to Mahakithula dam (2 km) were identified for use during the construction of the NWPC-ICB-1 and NWPC-ICB-2 contract packages.

5. KEY ACTIVITIES FOR NEXT TWO QUARTERS (Q1 & Q2 2017)

62. The next two quarters of the project from January to June 2017 are important, as three more contract packages will be awarded under MLBCRP. Further, the contract mobilizations of NWPCP-NCB-1 and UECP-ICB-1 are scheduled for this period. Environmental monitoring needs to be finalized with a proper reporting mechanism. At the end of this reporting period, no officer had been designated nor had a mechanism been developed at the field level for the contractors' EMP monitoring.

63. Several environmental and ecological surveys are planned in connection with design changes related to packages UEC-ICB-2A and UEC-ICB-2B. Further, tree enumeration are planned for the NWPC-ICB-1 area, where Mahakithula and Mahakirula reservoirs are to be constructed, involving clearing areas within the Kahala-Pallekele sanctuary (proposed National Park area).

64. Preparation of addenda for EIAs on NWPC-ICB-1 and NWPC-ICB-2 packages and addendum for the UEC Tranche 2 packages are priority documents which require submission to CEA for their concurrence on the design changes.

65. Further, preparation is planned within next two quarters of updated EMPs for the remaining Tranche 1 and Tranche 2 packages for submission with the bid documents and approval by CEA.

66. Baseline data collection for the environmental parameters (ground and surface water quality, air quality, noise, vibration) is planned to be implemented for Tranche 1 and Tranche 2 UECP and NWPC areas by calling quotations for work following ADB requirements and identifying the successful bidders through evaluating technical and financial proposals.

ANNEX 1 : ENVIRONMENTAL ORGANIZATION AND COMMUNICATION PROTOCOL OF MWSIP

1. The Vision, Mission & Organizational set up of the Environmental Management Cell of MWSIP

1.1 Vision & Mission statements

VISION :-

"Ensure Sustainability of Each Project under the MWSIP"

MISSION :-

Work in partnership with Project implementing as well as other line agencies and affected parties to;

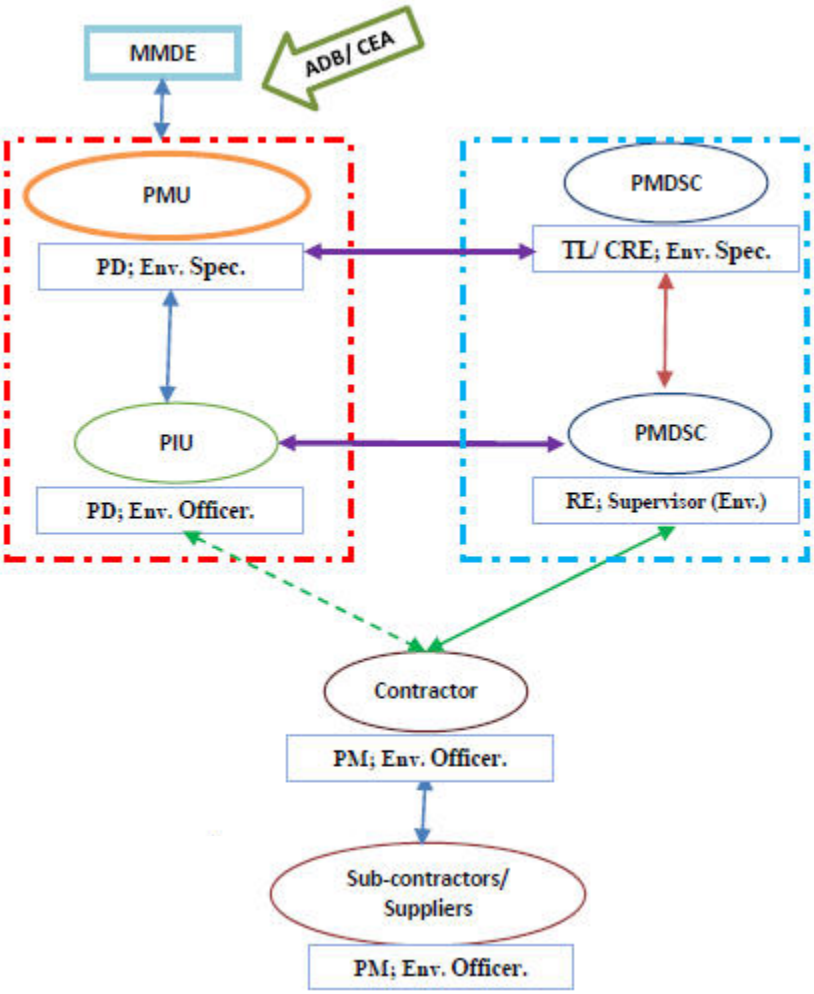
Maintain full compliance with CEA regulatory requirements,

Maintain full compliance with ADB safeguard (SPS-2009) requirements,

Methodically and constructively address 100% of the Environmental GRIEVENCES,

Fully implement the EIA/ IEE recommendations through the EMP & CEMP.

1.2 The Organizational Setup



2. The Environmental Communication Protocol - Monitoring and recording/ reporting events

No.	Mode	Frequency	Purpose/ Action	Agency Responsible
1	Site surveillance	Regular	Promote awareness on environmental compliance requirements by workers & sub-contractors	Contractor
			Daily site monitoring record	
2	Construction supervision	Regular	Inspections based environment monitoring record	Engineer
3	Site supervision	Daily records	Compliance monitoring on a given format	Engineer (RE's staff) with Client (EO-PIU)
4	Ambient environment quality monitoring	As and when required-self monitoring	Ensure compliance particularly for parameters having critical impacts (e.g. noise/ vibration)	Contractor with Engineer & Client counterpart staffs
5	Reporting and reviewing	Weekly	Weekly compliance monitoring report and review mitigations	Engineer (RE) with Client (EO-PIU)
6	Site audit	Weekly-regular	Site environment monitoring walk round by EO-PIU with RE's and Contractor's relevant staffs	EO-PIU with Engineer and Contractor
7	Site audit	Monthly-regular	Site environment inspection by RE and PD with participation of ES-PMU, EO-PIU & other relevant staffs	EO-PIU with Engineer and Contractor counterpart staffs
8	Surprise site audit	Two Monthly	Un noticed site inspection by ES-PMU and ES-PMDSC	ES-PMU
9	Monthly EMR	Monthly-regular	Concise summary of environment management during past month; 2 weeks in advance of Monthly Progress meeting	Produce-Contractor Review- Engineer/ Client
10	Monthly Project Progress Meeting	Monthly-regular	Key environment events/ concerns will be taken up at PD and RE level	PD-PIU, RE-PM….. etc. and ES-PMU & EO-PIU
11	Monthly Environment Meeting	Monthly-regular	As a follow-up meeting to sort out matters arising at MPPM and in the MEM Report or any new developments	EO-PIU with Engineer and Contractor counterpart staffs
12	Ambient environment quality monitoring	Baseline-prior to start, Predefined intervals during construction & Post completion	Ambient Water & Air quality, Noise and vibration levels through an independent, accredited institute	EO-PIU to coordinate and Engineer & Contractor counterpart staff to facilitate
13	Environment Monitoring Committee	Quarterly or as advice by CEA	Site monitoring, review of reports and mitigations adopted as decide by the EMC	EO-PIU to coordinate
14	Periodical EMR	Annually to ADB and CEA	A summary of Project environment management over the last year, including self-monitoring findings, issues with mitigations and independent ambient environment monitoring results, progress in grievance redress and forecast for next year etc.	Produce-Engineer Review & Submit to ADB & CEA-Client

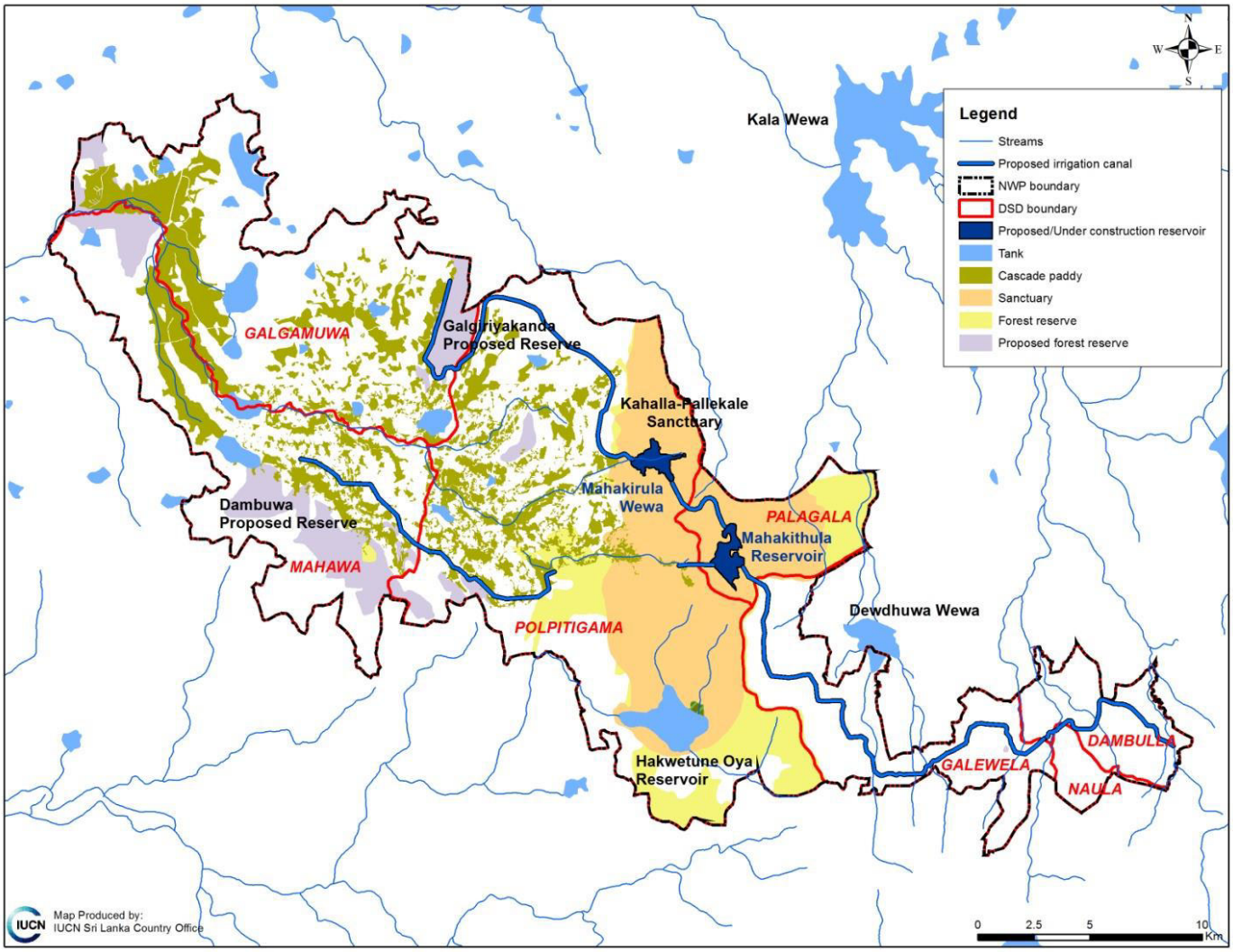
Note: The items 1 and 2 may be updated as and when required to enhance efficiency & effectiveness as the Program progresses.

ANNEX 2 : INCEPTION REPORTS OF IUCN WMP FOR NWPCP AND UEC

Preparation of Human Elephant Conflict Management Plan for North Western Province Canal Project (NWPCP)

MMDE / MWSIP/ ADB/ NWPCP/ 3267-3268- SRI / Consult / HECM / NCB / 2016 / 005

Inception Report



Consultancy undertaken for the Mahaweli Water Security Investment Project, Ministry of Mahaweli Development and Environment

September, 2016

IUCN, International Union for Conservation of Nature, Sri Lanka Country Office

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List of Acronyms

CEA	Central Environmental Authority
DAD	Department of Agrarian Development
DSD	Divisional Secretariat Divisions
DWC	Department of Wildlife Conservation
ECA	Elephant Conservation Areas
EIA	Environmental Impact Assessment
FD	Forest Department
GND	*Grama niladari* divisions
HEC	Human-elephant Conflict
ID	Irrigation Department
IUCN	IUCN, International Union for Conservatiion of Nature
MASL	Mahaweli Authority of Sri Lanka
MCM	Million cubic metres
MER	Managed Elephant Ranges
MMD&E	Ministry of Mahaweli Development and Environment
NWPCP	Northwestern Province Canal Project
PA	protected areas
HECMP	Human-elephant Conflict Management Plan

1. Introduction and Background

1.1 Introduction

This document reports on the work carried out during the Inception Phase of the preparation of Human-Elephant conflict management plan for the Northwestern Province Canal Project (NWPCP) and provides the plan for the execution phase. The Inception Phase commenced on 2nd August 2016, upon the award of the project and included initial discussions with the Project management Unit to define the scope of the project, as well as deliverables. Also, during the inception phase, all the available literature, reports etc., have been collected and reviewed to document, *inter alia*, already available information on the project, its predicted impacts, proposed mitigation measures, terms and conditions laid down by project approving agency. During the inception phase, several negotiation meetings with the Project Director and several internal meetings were held, in order to define the detailed methodological approach that will be taken to develop the Human-Elephant conflict management plan, which is presented in Chapter 2 of this document. Based on the agreed methodological approach, the detailed work plan for completing the project was developed and presented in Annex I.

1.2 General project description

The North Western Province Canal project involves a trans-basin diversion of water from the Mahaweli River to the Hakwatuna Oya and Upper Mi Oya Basins. (See Figure 1.)

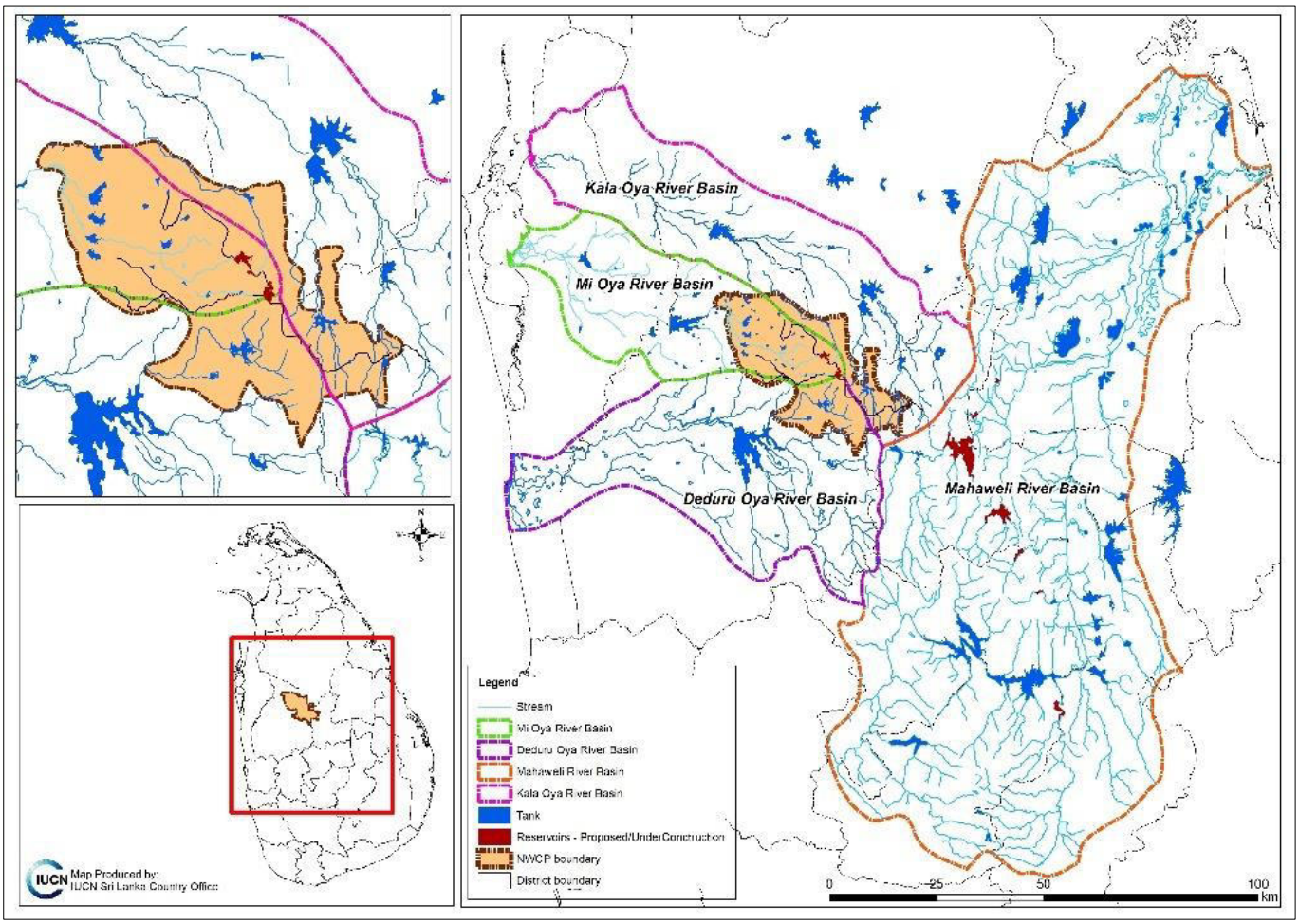


Figure 1. Location of the NWC Project

This project will be carried out in two stages:

Stage 1 (2015-2019) will involve diverting 30 MCM of water from Nalanda reservoir through Wemedilla reservoir, Dewahuwa feeder canal, to the proposed Maha Kithula and Maha Kiriula reservoirs and Palukadawala, Ambakolawewa, Attaragalla, and Mediyawa reservoirs, feeding parts of the right bank of the upper catchment of the Mi Oya basin. This will involve construction of new canals, renovation of existing canals and various structures associated with tanks and canals, renovation and enhancing the carrying capacity of two reservoirs. (See Figure 2.)

During ***Stage 2*** (2018-2024), a further 100 MCM will be transferred annually to this system from downstream of the Bowatenna irrigation tunnel through Lenadora once the Moragahakanda and Kaluganga reservoirs and Upper Elahera Canal are completed (2019). (See Figure 3.)

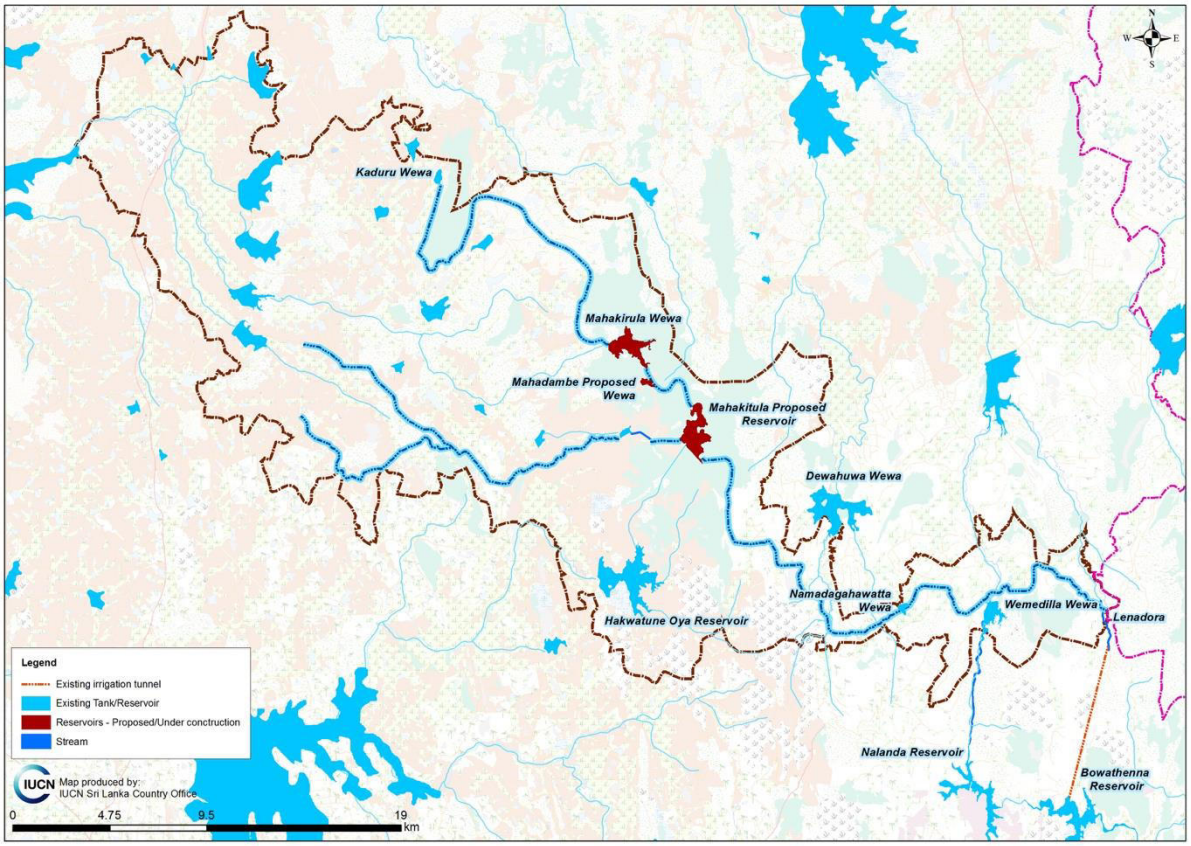


Figure 2. Map of the entire Northwestern Canal Project
(Source: Perera, 2016)

Table 1. North Western Province Canal Project specifications
(Source: Perera, 2016)

Conveyance system	90 km canal system <u>Stage 1</u> • Improvement to a part of Dewahuwa Feeder Canal (5.25 km) • Canal from improved Dewahuwa Feeder Canal to Maha Kithula Reservoir (18.0 km) • Canal from Maha Kithula Reservoir to Maha Kiriula Reservoir (3.66 km)

	• Canal from Maha Kiriula Reservoir to Galgiriyawa (13.73 km) Stage 2 • Canal from Bowatenna tunnel outlet to Devahuwa Feeder Canal (8.4 km) • Conveying water from Maha Kithula to Pothuwila Wewa along Mi Oya (2.99 km) • Canal from Pothuwila Wewa to Mediyawa (20.0 km) • Yapahuwa canal (11.2 km) • Canal from Galgiriyawa to Kaduruwewa (7.6 km)
Reservoirs	• Mahakirula (capacity: 10 MCM; dam height=25 m) • Mahakitula (capacity: 15 MCM; dam height=25 m)
Total irrigable land	12,000 ha
Total number of families that will benefit	13,000; overall 40,000
Total cost of project	Rupees 16 billion (123 million USD)

The main objectives of the project are to

- Provide increased water supplies to about 12,000 ha of land under drought-prone irrigation schemes in the northernwestern parts of Sri Lanka. The water diverted to and stored in the Mahakirula and Mahakitula Reservoirs will be used to augment the Upper Mi Oya basin and Hakwatuna Oya basin. This augmentation will increase the cropping intensity of approximately 12,000 ha of land from the current level of 1.2 to 1.7 once the project is completed in 2024. The targeted cultivation areas include:
    - cultivation areas under Mi Oya Small Reservoir System (3,846 ha) during entire year;
    - command areas of Mediyawa, Ambakola wewa, Attaragalla and Palukadawala Reservoirs facing water shortages (2,124 ha);
    - cultivation area fed by Hakwatuna Oya Reservoir (2,579 ha) during entire year; and
- In addition, annually, the diverted water will supply up to 3.5 MCM to meet the drinking and industrial water needs in the project area. This is expected to help alleviate Chronic Kidney Disease problem in NWC project area (Polpithigama /Nikawewa) (EIA for NWP Canal project, 2015).

1.3 Environmental impacts of the NWPC project

Whilst these activities will enhance the water availability for agriculture, thereby increasing agricultural production, as well as improving the socio-economic status of communities, the project will also have significant short and long-term environmental impacts, especially on the wildlife that inhabits the project affected area. Based on the findings of the EIA study conducted for the NWP canal project three major impacts on wildlife have been identified. These include:

Loss of habitat

Construction of the two reservoirs, *Mahakirula* and *Makakithula* and a 1.4 km long, earthen canal linking the two reservoirs will be carried out within the Kahalla-Pallekele Sanctuary, one

of the few protected areas found in the northwestern region of Sri Lanka. These activities will result in an estimated 400 ha of habitat loss in the Kahalla-Pallekele Sanctuary (325 ha will be inundated with the construction of the two reservoirs and 75 ha will be cleared to establish the link canal).

Habitat fragmentation and loss of critical species

The project will result in the establishment of the NWP canal with an estimated length of 78.6 km. Establishment of the canal will have two main impacts on the wildlife that is found in the habitats traversed by the canal. Firstly, it will impair the free movement of terrestrial species, as the canal will function as a direct physical barrier. Secondly, animals attempting to cross the canal may fall into the canal, resulting in injury or death to such animals. The establishment of the canal and the two reservoirs will also result in removal of vegetation present along the canal trace and the tank beds of the two proposed tanks. These areas may be inhabited by critical species (rare, endemic or threatened species), which are incapable of moving out of these areas without human assistance and therefore, will perish resulting in local or total extirpation of such species.

Escalation of Human-elephant Conflict

The area that will receive water under the project can be classified as a high Human-elephant Conflict (HEC) area. At present, most of the crop fields are not cultivated during the *Yala* season because of the scarcity of irrigation water. As a result, elephants use such lands as their dry season feeding grounds. When the project augments irrigation water supply to these areas, cultivation will take place in the *Yala* season as well, which will deprive elephants of their feeding grounds (an estimated extent of 10,000 to 12,000 ha of seasonal elephant habitat will be lost due to changes in cropping patterns). This will lead to an escalation of the human-elephant conflict, which, in turn, will result in the reduction of the project benefits.

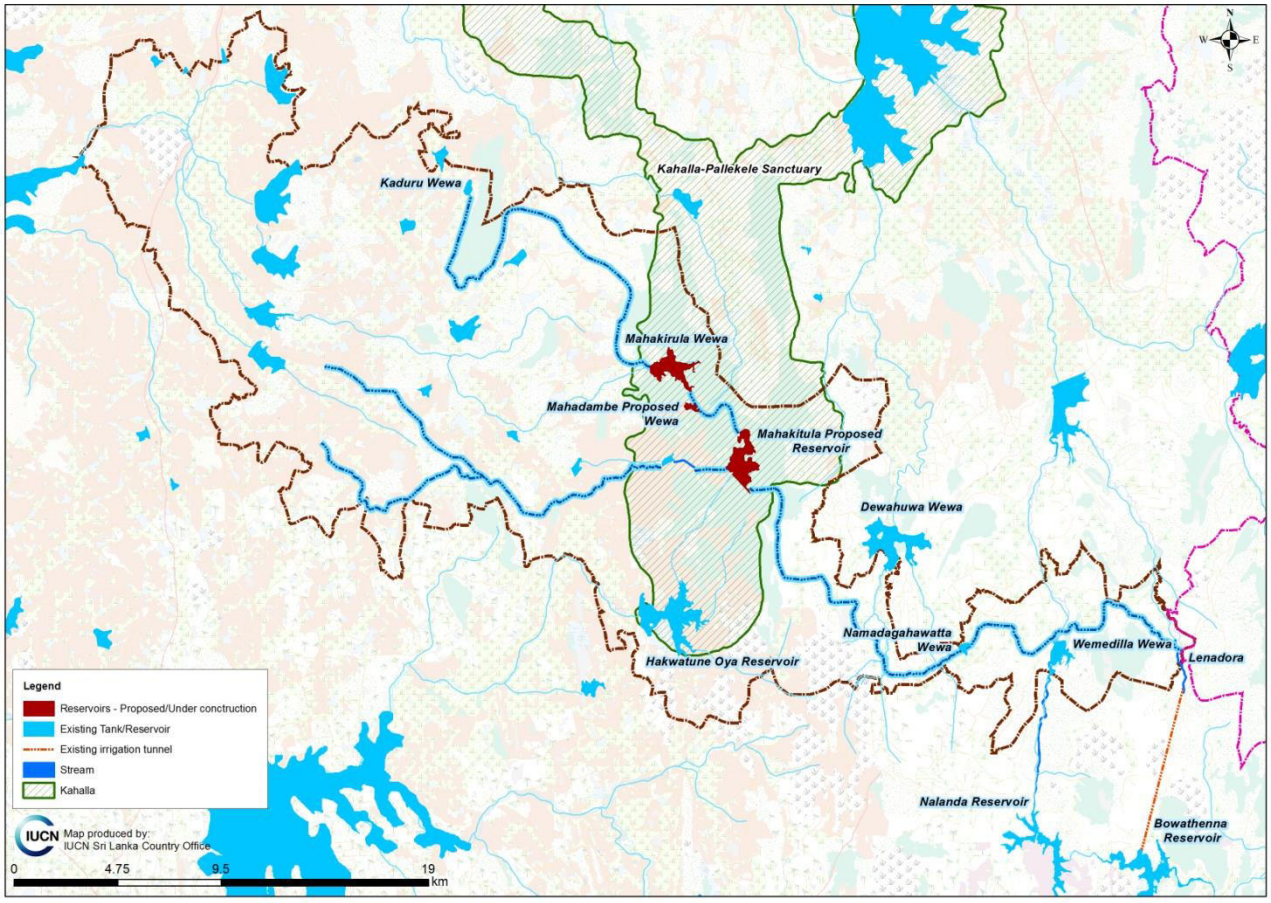


Figure 3. Map of the Northwestern Canal Project in relation to existing protected areas

Therefore, one of the conditions imposed by the project approving agency — the Central Environmental Authority (CEA) — during project approval is to prepare and implement a Human-elephant Conflict Management Plan (HECMP), with a special emphasis on mitigation of human-elephant conflict in the area. The project proponent, in turn, contracted IUCN, Sri Lanka Country Office to prepare the said HECMP.

The preparation of the HECMP will hereinafter be referred to as the Project, while North Western Province Canal project will be referred to as the NWPCP.

The aim of this report is to provide the detailed methodological approach for the preparation of the HECMP for the Northwestern Canal Project.

1.4 Overall project approach

Initially, a reconnaissance visit will be carried out with the entire strategic management plan preparation team in order to familiarize the team with the project area as well as the sites that will be affected. This visit will be followed by a literature survey to document all available published information on the project area. Once all available information is documented, a series of stakeholder meetings will be held, to gather unpublished information that is relevant for the preparation of the HECMP. Data adequacy for the preparation of HECMP will be checked and field investigations will be carried out to acquire data to address identified gaps in available information.

Finally, the primary and secondary data gathered will be analysed and used for the development of site-specific actions that should be included in the HECMP. These actions will be screened for social, economic and engineering feasibility and the draft HECMP will be

developed. The draft HECMP will be presented to a broader stakeholder group to obtain their views on the proposed management prescriptions. The final HECMP will be prepared after incorporating the views and opinions of the stakeholders, providing institutional arrangements for implementation, time frames, estimated budgets, training and communication needs and the monitoring framework to ensure that HECMP is implemented in an adaptive manner. The specific activities involved under each of these broader areas of work are given in Chapter 2 of this document.

1.5 Project Inception phase

The project inception phase started on 2nd August 2016 and will be concluded on 15th September 2016. During this period, a detailed methodological approach to complete the HECMP plan for the NWP canal was developed. Initially two rounds of discussions were held with the Project management unit to a) define the scope of the project; b) clarify the implementation mechanisms; c) clearly identify expectations from the project proponent's side and) clearly identify the expectations of the IUCN HECMP plan preparation team by the project proponent. Further, all available information on the project including feasibility reports, EIA report, project designs, layout maps etc., were obtained from the project proponent and evaluated carefully to extract the necessary baseline information on the project.

The team leader and the field team leader also attended a stakeholder meeting organised by the project director held in Kurunegala on 8th September 2016, where the overall approach for preparing the HECMP for the NWP canal was presented and the views of the stakeholders were obtained. At this meeting the IUCN team leader made a presentation which is given in Annex II.

Several internal meetings were held to discuss the detailed methodology, responsibilities of individual experts and finalisation of detailed work plans to complete the assignment. These are presented in later in this report and in Annex I of this report.

A list of species in the Project area derived from the literature survey is present in Annex III.

2. Project Work Plan

2.1 Rationale

The development of an HECMP for the NWP canal project requires the implementation of a robust and integrated work plan which will collect, collate and synthesise information across a range of disciplines and locations. The work plan will require integration of the experts involved in the preparation of the HECMP plan, as well as collaboration with government and non-government organisations in order to obtain a holistic understanding of the critical issues, essential for developing an effective HECMP.

In order to address major project aspects and tasks, four core teams have been assembled: 1) the biodiversity team; 2) the HEC team; 3) socio-economic team; and 4) the mapping team. Core teams will have the responsibility of gathering information on their specific individual tasks and the activities which support these tasks. However, all the tasks within the work plan have been designed to fulfil specific roles, in order to deliver on the final goal of providing management prescriptions to address the three significant long-term impacts predicted for the project.

2.2 Project Area

The area considered in the HECMP for management interventions include

a. the entire canal trace;

b. the two reservoirs that will be established in the Kahalla-Pallekelle Sanctuary;

c. the areas that will receive additional water under the project and therefore subjected to changes in cropping intensity;

d. areas that are under the management of Forest Department (FD) and Department of Wildlife Conservation (DWC) within the project area; and

e. all natural areas that does not receive any protection at present but can be used to improve the present status of the wildlife either by enhancing the available extent of habitat or facilitating free movement.

2.3 Tasks

The objective of the HECMP for NWP canal project is to provide site-specific management prescriptions for the three significant on the wildlife impacts anticipated as a consequence of the implementation of the project. The strategic approach that will be taken to address these impacts are as follows.

1. *The issue pertaining to loss of wildlife habitat due to the project*

   This issue can be addressed through two strategic approaches. Firstly, expanding the existing protected area network by annexing all available natural/semi-natural areas, as well as taking steps to link, through corridors, the scattered natural forests in the area. Secondly, enhancing the carrying capacity of the existing protected areas through habitat improvement within these protected areas.

2. *The direct negative impacts arising due to the project interventions on wildlife, during both construction and operation phase*

   Many of the mitigation measures have already been identified and incorporated into the project design, as well as the environment management plan of the project. These mitigation measures will be studied further and additional mitigation measures will be

provided where it is deemed necessary. Further, the HEC management plan will provide a rescue and translocation/ transplantation plan for priority wildlife species with no/low mobility inhabiting the areas that will be cleared for construction work (mainly the canal and two tanks) to safe locations.

3. *Providing a set of site specific reasonable and acceptable solution to the human-elephant conflict that will arise in the area that will receive irrigation under the project.*

The specific activities that will be carried out to gather both primary and secondary data required to identify these management prescriptions are provided below.

2.3.1 Improving the overall habitat availability for wildlife

A. *Assessment of the current status of the existing protected areas in the project area and potential management actions to improve the habitat quality in these protected areas:*

   i. A list of protected areas (PAs) located within the project impact area will be compiled.

   ii. Protected area managers will be consulted to identify challenges and potential improvements to current management practices. In the process, any documentation available pertaining to management undertaken by the park management such as management plans, monitoring reports will be reviewed.

   iii. The boundaries of the protected areas will be obtained from the respective line agencies, if available in GIS format. For those PAs where boundaries are not available in GIS format, new maps will be prepared.

   iv. Field studies will be undertaken in each protected area to gather data on the present ecological status of the protected area (*inter alia* with regard to species composition; type of invasive alien species present and their distribution within the protected area; areas that needs restoration/ reforestation or habitat management; potential ecosystem services; water availability within the protected area; especially during the dry periods) and the effectiveness of current management practices undertaken by the relevant line agency.

B. *Identification of habitats with the potential to be enriched through assisted regeneration, eradication of invasive species, improvement of water holes etc., in order to enhance the carrying capacity of protected areas.*

   i. The information gathered through activities A (i) through A (iv) will be fed in to a GIS database to develop a map depicting the spatial arrangement of proposed activities (for example, habitat management, restoration, reforestation, creation of water holes).

   ii. Preparation of detailed management prescriptions for each of the proposed interventions (for example, for restoration/ reforestation or habitat management the geographic coordinates, extent to be restored/reforested, types of plant species that should be used for the activity, the ratio of the species, planting sequence, guidelines for planting etc., will be provided). The information necessary for such planning will be derived through a biodiversity survey conducted in the protected areas under activity I(iv). The detailed methodology that will be followed for such biodiversity assessments is provided in Annex IV.

iii. Site selection for potential habitat restoration or management will be based on a set of criteria[1] that will be developed, taking into consideration key principles of restoration ecology. Therefore, a prioritization exercise will be carried out before assigning areas for restoration/ reforestation or habitat management based on an evaluation carried out using these developed criteria.

C. *Identification of areas that can be annexed with existing protected areas, areas that can provide connectivity between remaining forest areas including already identified elephant corridors to be established for mitigation of human-elephant conflict.*

i. A base map will be developed using GIS tools for the project area, indicating the natural forest cover and all designated protected areas.

ii. Based on this map, natural habitats lying outside the protected area network that can function as potential corridors to maintain connectivity between protected areas and as wildlife habitats will be identified tentatively.

iii. Field investigations will be conducted to ascertain the present status (*inter alia*, ownership, condition of habitat, long-term viability, feasibility of using the area as a corridor or annexing it to the closest protected area) of these additional areas that have been identified to be used as connectivity corridors or potential areas that can be annexed to the present PA network.

iv. Preparation of a map indicating the boundaries of the additional areas identified to be annexed to the PA network and to provide the optimal connectivity between existing protected areas. This map will include detailed information on land ownership, habitat conditions, and the steps that should be taken in order to declare the identified areas as wildlife corridors or annexing to the protected areas.

D. *Identification of sensitive and vulnerable ecosystems in the NWPC Project area and potential mechanisms to protect them*

i. A field survey will be carried out and a base map will be developed for the project area indicating wildlife distribution, with special emphasis on distribution of threatened and/or endemic species, natural forest cover, and protected areas.

ii. Based on this map, sensitive and vulnerable ecosystems will be identified within the project areas.

iii. An action plan will be developed to protect such sensitive and vulnerable ecosystems, if they are not already included in the existing protected area network.

[1] Restoration of areas that are in advanced seral stages (an intermediate stage found in ecological succession in an ecosystem) are more beneficial than restoration of areas that are at a lower seral stage, as higher seral stages can support higher niche diversity and therefore, higher species diversity. Similarly, restoration provides higher conservation benefits compared to reforestation, as restored areas will reach climax status much faster than reforested areas and therefore, will support higher biodiversity. However, sometimes reforestation is desired, as it may provide other benefits such as soil conservation and improve catchment functions. Also, in some case, keeping certain areas in lower seral stages is beneficial, especially for edge species such as Asian elephants. Therefore, before undertaking any reforestation or restoration activity, a prioritisation exercise will be carried out using these criteria.

2.3.2 Mitigating direct negative impacts on wildlife

1. Preparing a map the proposed mitigation measures on the layout plan of the project.
2. Conducting a survey in the area identified for land clearing for project activities (the canal trace, trace of any new roads — both temporary and permanent — and tank beds of Maha Kirula and Maha Kithula) to document species present in these sites and to identify potential animal corridors that lie across the canal trace.
3. Based on the findings of the survey, identifying additional mitigation needs required over and above the mitigation measures proposed in the environment management plan of the project design, as well providing alternative solutions for the proposed mitigation measures as needed.
4. The species observed in the area that is identified for land clearing will be evaluated to identify whether any of the species observed required translocation or transplantation in a safer site. If such species are found to be present develop a rescue programme to trans-locate/ transplant the identified animal or plant species from locations that will be affected by project activities. The activities involved in preparation of the rescue programme are as follows:
    i. A species list will be compiled based on available information in the area as well as data collected by the team during detailed biodiversity assessments conducted under this project.
    ii. These lists will be evaluated using a set of criteria to identify priority species that need to be rescued from the project affected areas prior to implementation of construction work. See box below.

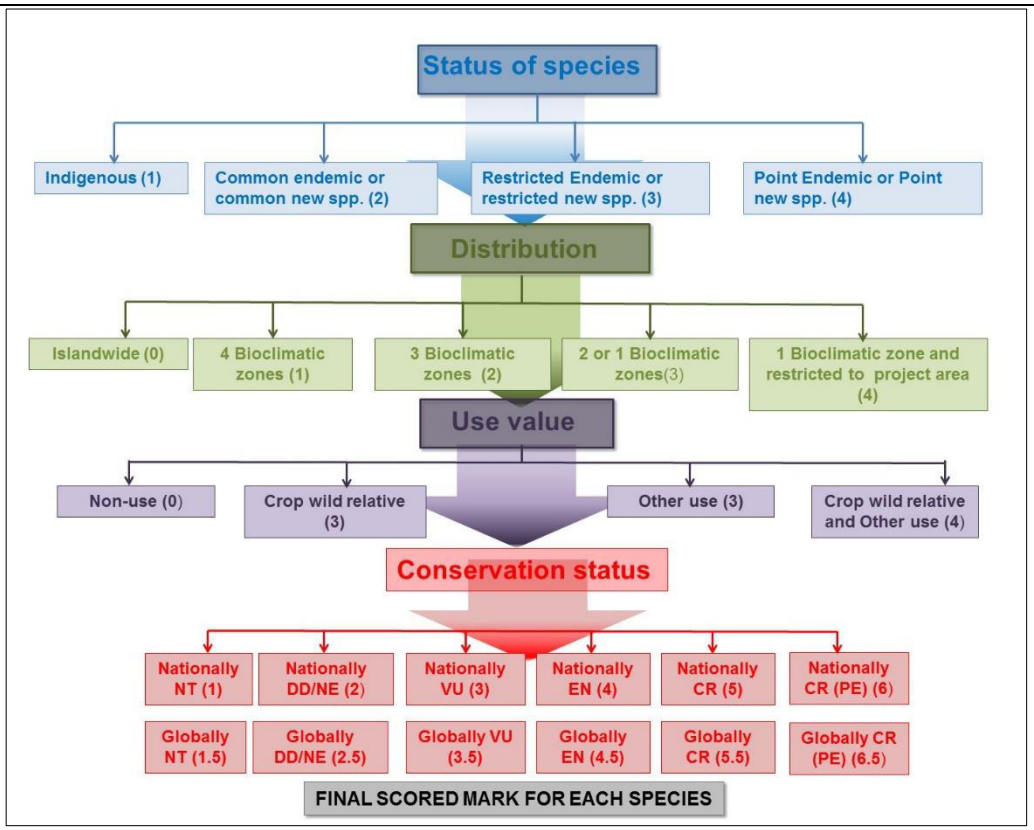
Criteria for selection of priority species and the process of selection (this may be refined later)

The process of selection of priority species is a means by which species are shortlisted for translocation or transplanting. For each criterion, there alternatives, each of which has a score. Each species is scored against the criteria, and those with the higher scores are chosen.

For flora

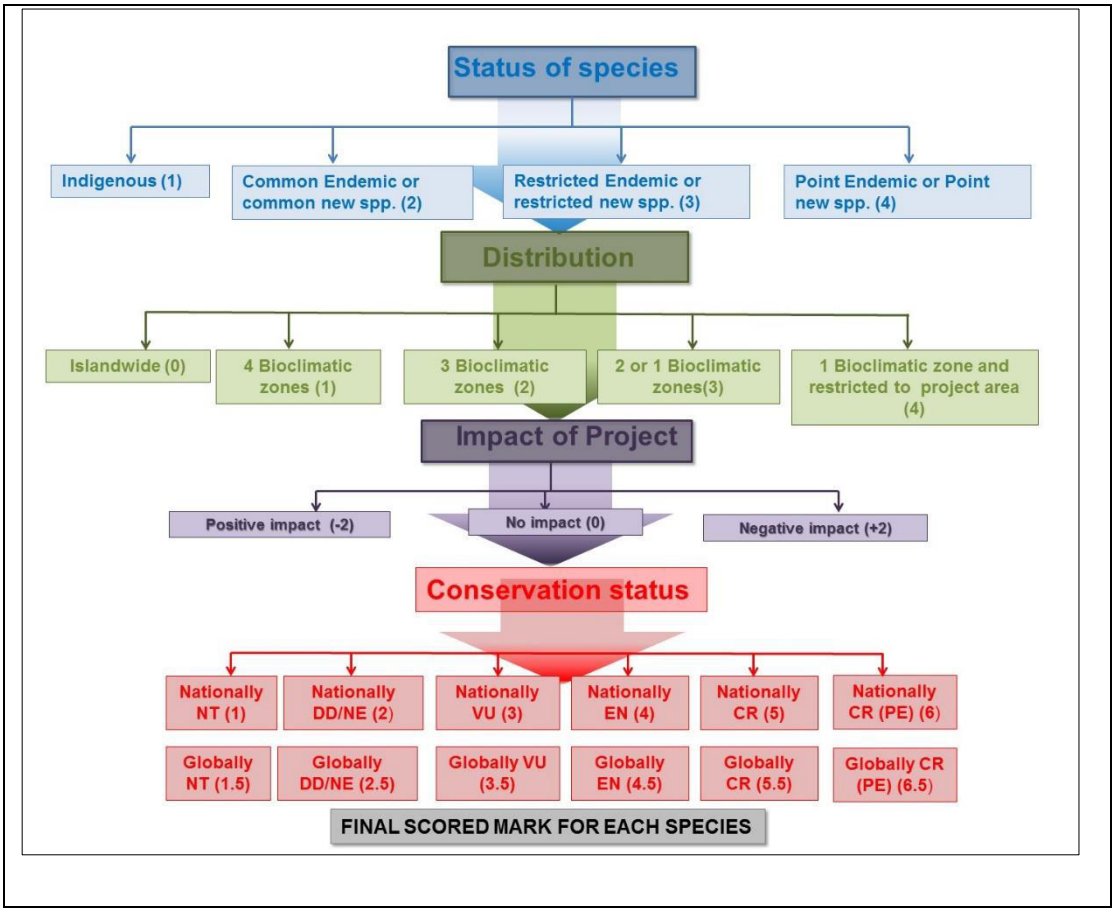
For flora, four selection criteria were defined. The score is presented in parentheses.

1. **Status of species:** indigenous (1); common endemic or common new spp. (2); restricted endemic or restricted new spp. (3) point endemic or point new spp. (4).
2. **Distribution**: islandwide (0), 4 bioclimatic zones (1); 3 bioclimatic zones (2); 2 or 1 bioclimatic zones (3); 1 Bioclimatic zone and restricted to project area (4).
3. **Use value**: Non-use (0); crop wild relative (3); other use (3); crop wild relative and other use (4)
4. **Conservation**: Nationally NT (1); Nationally DD/NE (2); Nationally VU (3); Nationally EN (4); Nationally CR (5); Nationally CR (PE) (6); Globally NT (1.5); Globally DD/NE (2.5); Globally VU (3.5); Globally EN (4.5); Globally CR (5.5); Globally CR (PE) (6.5).



For fauna

1. **Status of species:** indigenous (1); common Endemic or common new spp. (2); restricted Endemic or restricted new spp. (3); point endemic or point new spp. (4).
2. **Distribution**: islandwide (0); 4 bioclimatic zones (1); 3 bioclimatic zones (2); 2 or 1 bioclimatic zones (3); 1 bioclimatic zone and restricted to project area (4).
3. **Impact of Project**: Positive impact (-2); no impact (0); negative impact (+2).
4. **Conservation**: Nationally NT (1); Nationally DD/NE (2); Nationally VU (3); Nationally EN (4); Nationally CR (5); Nationally CR (PE) (6); Globally NT (1.5); Globally DD/NE (2.5); Globally VU (3.5); Globally EN (4.5); Globally CR (5.5); Globally CR (PE) (6.5).



iii. If such priority species are discovered, detailed rescue plans will be prepared for each species so that they may be translocated/ transplanted to a safer location.

iv. These translocation guidelines will be based on IUCN species translocation protocols modified to suit local conditions.

v. For each species that require translocation/transplantation, suitable sites will be identified based on the habitat requirements of each species.

vi. A protocol for monitoring the translocated or transplanted species will also be developed and included in the HECMP.

2.3.3 Mitigation of Human-Elephant conflict

A. Establishing a baseline with respect to elephants and HEC in the project area

The NWPC project will result in a potential permanent loss of about 400 ha of natural habitat in Kahalla-Pallekelle Sanctuary. In addition, there will be an estimated loss 10,000 to 12,000 ha of seasonal elephant habitats as a consequence of changes in cropping intensity that will result from receiving irrigation water from NWP canal. This increase in cropping intensity will prevent access of elephants to these areas during the dry months of the year. The combined effect of this NWC project activity and its desired result will be an escalation of the existing level of human-elephant conflict (HEC) in the area. Therefore, it is important to document the current level of human elephant conflict that exists in the area, as well as the current cropping pattern as well as the projected change in cropping pattern for once the irrigation water becomes

available. These will help predict how the conflict will change with the proposed land use and landscape changes, which is a crucial step in the development of mitigation measures for the HEC in the project area.

Therefore, an assessment of the distribution, land use patterns and existing levels of human elephant conflict in the study area and its immediate surroundings will be carried out using a grid-based survey, where both primary and secondary data will be recorded. These data will be used to establish baseline conditions with respect to elephant distribution, demography, temporal and spatial land use patterns and human-elephant conflict as well as to predict changes in the present level of human-elephant conflict due to implementation of the project.

The specific information collected will include:

i. ***Movement patterns of elephants within the study area***

This will be established based on satellite telemetry data collected by the Centre for Conservation and Research, in collaboration with Department of Wildlife Conservation. An assessment will be made to identify whether additional radiotelemetry studies are needed in specific areas.

ii. ***Existing level of HEC***

This will be based on data collected through the grid based surveys.

iii. ***Patterns of conflict***

Spatial and temporal patterns of conflict will be determined using GIS-based analysis of the primary and secondary conflict data collected.

iv. ***Mitigation measures adopted at present in the project area by government agencies***

This will be documented based on information gathered during stakeholder consultations, from the Department of Wildlife Conservation, and data collected during the grid-based survey.

v. ***Mitigation measures adopted at present in the project area by farmers***

This will be documented based on information gathered during the stakeholder consultations and the grid-based survey.

vi. ***Evaluation of the feasibility of establishing the identified elephant corridors*** A detailed assessment of the identified elephant corridors will be carried out during the field investigations to determine the feasibility of establishing the corridor, considering the land ownership within the identified corridor, habitat conditions, and whether the corridor will contribute to the reduction in HEC. Further, based on the data gathered during the stakeholder consultation and field studies, new corridors, if present, will be proposed to mitigate the HEC.

B. Assess current institutional efforts at mitigating HEC

i. Evaluate the existing electric fences (state built, as well as privately erected) within the project area (for example, design, placement, mechanisms for maintenance, community perceptions) and to recommend new ways, means, methods and any additional specifications to improve the functioning of electric fences to manage

the human elephant conflict. This will be achieved through following set of activities:

a. Compile a list of electric fences present in the study area through information collected from relevant line agencies;

b. Map all electric fences by walking along each electric fence and obtaining GPS coordinates at 25 m intervals or where the direction changes;

c. Document fence parameters for each fence such as type of energizer, wire, posts and fence design;

d. Assess the status of each fence based on documentation of fence defects — such as low voltage, vegetation touching wires, wires broken, posts leaning or on the ground;

e. Assess the functionality of the fence through observation of elephant sign on either side of the fence, as well as other indicators of elephant presence — such as secondary fences, tin can fences, watch huts — and through conducting interview surveys of local community, obtaining their perceptions regarding the fence;

f. Collect information on the construction and maintenance mechanism of the fence and perceptions of success/failure through meetings held with stakeholders and information gathered during surveys;

g. Using GIS-based analysis, identify whether the placement of fence is at the correct ecological boundary; and

h. Using above information, evaluate its use as a HEC measure in the area.

ii. Evaluate other barriers such as bio fences and ditches. This will be achieved through following set of activities:

a. Compile a list of barriers present in the study area through information collected from relevant line agencies;

b. Map all barriers by walking along each and obtaining GPS coordinates at 25 m intervals or where the direction changes;

c. Document parameters for each barrier: for bio fence: type of plant, how many planted (if information is available), design etc.; for ditches: when constructed, design etc.;

d. Assess the status of barrier: for bio-fence: how many plants are currently alive, growth state, gaps etc.; for ditches: width, depth at 10 m intervals, current state etc.;

e. Assess the functionality of the barrier through observation of elephants/ elephant sign on either side of it, as well as other indicators of elephant presence such as secondary fences, tin can fences, watch huts etc., and through conducting interview surveys of local community, obtaining their perceptions regarding the fence;

f. Collect information on the construction and maintenance mechanism of the fence and perceptions of success/failure through meetings held with stakeholders and information gathered during surveys; and

g. Using above information, evaluate its use as a HEC measure in the area.

iii. Evaluate elephant translocation. This will be achieved through following set of activities:

a. Obtain information of elephant translocations in the area over the past five years from DWC;

b. Conduct literature survey on translocation success/failure;

c. Collect information on perceptions of success/failure through meetings held with stakeholders and information gathered during surveys; and

d. Using above information, evaluate its use as a HEC measure in the area.

iv. Evaluate elephant drives. This will be achieved through following set of activities:

a. Obtain, from the DWC, information on elephant drives in the area over the past five years;

b. Conduct literature survey on drive success/failure;

c. Collect information on perceptions of success/failure through meetings held with stakeholders and information gathered during surveys; and

d. Using above information, evaluate its use as a HEC measure in the area.

v. Evaluate elephant chasing and distribution of elephant thunders (*ali-wedi*). This will be achieved through following set of activities:

a. Obtain, from the DWC, information on distribution of elephant thunders in the area over the past five years;

b. Collect information on perceptions of success/failure through meetings held with stakeholders and information gathered during surveys; and

c. Using above information, evaluate its use as a HEC measure in the area.

vi. Identify HEC mitigatory measures to be utilised in areas impacted by the NWPCP. This will be achieved through following set of activities:

a. Based on a detailed assessment of the identified elephant distribution, elephant movement, land use patterns, habitat conditions, and patterns of HEC, determine the feasibility of establishing Elephant Corridors, Managed Elephant Ranges (MER) and Elephant Conservation Areas (ECA). Based on this analysis, identify specific activities that need to be undertaken by the NWPCP;

b. Based on the data collected during field investigations, literature review and stakeholder meetings identify areas where conflict is likely to occur or increase due to changes in the landscape to the NWPCP;

c. Prioritise the conflict areas on a low medium and high scale using a set of criteria — such as current level of HEC, landscape changes caused by NWPCP and projected changes in cropping patterns;

d. For each conflict area suggest the best mitigation method that can be used and outline the procedure that should be followed for its implementation; and

e. Provide site specific solutions to each of the conflict areas identified including the details of electric fencing.

vii. Assess the feasibility of community based electric fencing as a HEC mitigation measure to be implemented through the NWPCP. This will be achieved through following set of activities:

a. Based on GIS analysis and ground truthing, prepare a map showing villages and paddy fields that need to be protected with community-based electric fences;

b. Identify the approximate alignment of electric fences and calculate the length of the electric fence that will be needed for each location;

c. Provide a guideline for fence design as well as how the affected community will contribute for the construction and maintenance of the electric fence;

d. Provide a guideline for training members of the community on maintenance of electric fences;

e. Provide a guideline for the establishment of revolving fund that will be used for long term maintenance of electric fences; and

f. Prepare a training module including material for officers of relevant line agencies to implement community based fences.

viii. Identify awareness and communication needs for mitigating human elephant conflict. This will be achieved through following set of activities:

1. Based on the findings during stakeholder meetings and social surveys, prepare a list of communication needs for mitigating the human elephant conflict;

2. Identify the types of communication tools that can be used to create awareness among affected communities on how to minimize HEC; and

3. Prepare a training module, including material for relevant staff of line agencies to be able to conduct awareness programs on HEC mitigation.

ix. Identify mechanisms for effective compensation of people impacted by HEC. This will be achieved through following set of activities:

a. Based on the findings of stakeholder meetings, compensation data available at DWC and other agencies that provide compensation and social surveys, identify the shortcomings of current compensation schemes; and

b. Provide a set of recommendations as to how the current shortcomings can be overcome including testing the feasibility of introducing a crop insurance scheme.

x. Identify efficient institutional arrangements required for managing HEC. This will be achieved through following set of activities:

a. Conduct a review of the present institutional arrangements for managing the HEC;

b. Identify gaps, barriers and shortcomings in the current system; and

c. Propose ways to overcome these barriers and develop a mechanism for various line agencies to work together to provide a long-term solution for the HEC.

C. Preparation of a Draft Plan for HEC management as well as other wildlife related issues in the project area with special emphasis on minimizing the human-elephant conflict in the project area

D. Presenting the draft HEC management plan to a wider stakeholder group to get their feedback on the proposed actions

E. Preparation of a final HEC management plan incorporating the comments and concerns made by the stakeholders

F. Estimation of the implementation cost of each of the proposed site specific activities and preparation of the detailed budget that is required for implementation of HEC Management Plan for the NWPC project including the cost of establishing a revolving fund to facilitate long term

G. Preparation of the schedule of implementation and monitoring program of the HEC management plan

2.4 Deliverables

There are three main deliverables of the project:

Inception Report — due 15th September 2016;

Interim Report — due 15th January 2017;

Draft HEC Management Plan — due 30th June 2017; and

Final HEC Management Plan — 30th July 2017.

The major expected outputs arising from this study will be:

I. The HEC Management Plan, with a special emphasis on managing the human-elephant conflict in the direct and indirect influence area of the Northwestern Province Canal Project. The HEC management plan will provide details of activities that need to be carried out in a site-specific manner in order to minimise the predicted impacts of the NWPC project. The activities proposed in this plan will be in accordance with the scope of consultancy assignment and will contain:

- An assessment of the current status of each of the protected area found within the study area and recommendations and specifications to improve their management, including proposals to enhance the availability of food and water for wildlife during the dry season;
- For each protected area, a map indicating areas identified for habitat enrichment, eradication of invasive plants, improvement of water holes and restoration or reforestation that can be undertaken to enhance the carrying capacity of these protected areas for target species. Further a detailed list of activities that need to be carried out under each of the proposed management interventions will be provided;
- A map indicating the boundaries of the additional areas proposed to be annexed to the existing protected area network in the project area in order to enhance the habitat availability for wildlife and to provide connectivity between

remaining forest areas to facilitate free movement of wildlife without coming into conflict with humans;

- A detailed assessment of the identified elephant corridors with relevant maps and details such as feasibility of establishing the corridor taking in to consideration, the land ownership within the identified corridor, habitat conditions, and assessment whether the corridor will contribute to reduction in HEC;
- The steps that should be taken to declare the areas identified to be annexed to the existing PA or areas that should be set aside as elephant corridors;
- A map indicating sensitive and vulnerable ecosystems identified within the project area that lie outside the protected area network and the proposed mechanism to protect such sites;
- Details of the proposed rescue programme to translocate/ transplant identified species from areas where large scale habitat loss is expected due to the proposed project activities and the locations selected for receiving the translocated/ transplanted species.
- A set of site-specific mitigatory measures to minimise the human-elephant conflict including places where temporary or permanent electric fences are recommended and the role of the community and the local administration in establishing and maintenance of such electrical fences;
- Assessment of the functional efficiency of the existing system of electric fences including the suitability of fence design, placement of the fence, mechanism for fence maintenance, ability of the fence to reduce HEC and perceptions of the local community that benefits from the fence. Recommendation for improving the functional efficiency of the fence will be provided if a fence or section of a fence is found to be ineffective;
- Proposal of an efficient institutional arrangement for managing HEC;
- The estimated budget for implementing the activities proposed in the HEC Management Plan with special emphasis on measures needed to minimise human-elephant conflict management. Further a proposal will be submitted detailing how a revolving fund can be established in order to continue to carry out management practices that are found to be useful beyond the project period;
- The HEC management plan will also include a time-bound implementation schedule identifying the agency(ies) responsible for carrying out the action and agency(ies) that should provide support; and
- The HEC management plan will also include a monitoring program with monitoring indicators, monitoring frequency, a monitoring mechanism and a mechanism to make adaptive changes to the HEC management plan based on the outcome of the monitoring results.

II. A final report including a synopsis — based on the literature review — and an overall analysis of the conservation status of the wildlife in the area — based on the primary and secondary data generated through the consultancy — lessons learned and how the proposed actions would help improve the conservation status of the wildlife in the area.

III. A set of trained officers in the Mahaweli Authority of Sri Lanka (MASL), Irrigation Department (ID) and Ministry of Mahaweli Development and Environment (MMD&E) to undertake similar activities in the future.

2.5 Planning team and responsibilities

The team engaged in developing the HECMP for NWC project comprises experts from a range of disciplines. The required studies have been devolved into four discrete work areas, with specific teams of experts assigned to each work area. The following table details the full team, their expertise and the responsibilities that are assigned to them.

Name of Staff	Area of Expertise	Position Assigned	Task/s Assigned
Prof. Devaka Weerakoon	Wildlife Ecology	Team Leader	• Overall management and coordination of the entire assignment including preparation of reports and data analysis; • Coordination and execution of the study including presentations to the Client; and • Compilation of draft and final reports including proposed work program, budget estimates, schedules, staffing and other necessary support services in identification of mitigation measures for the HEC management plan including other wildlife related issues.
Dr. Sriyanie Miththapala	Biodiversity	Biodiversity Expert	• Oversight of the biodiversity-related activities; • Compilation of biodiversity-related individual consultant's outputs; and • Assisting the Team Leader in compilation of progress, draft and final reports.
Dr. Prithiviraj Fernando	Elephant ecology	Elephant expert/ Ecologist	• Responsible for assessment of elephants and their movements, their behavior patterns, human-elephant conflict and recommending of measures to manage human-elephant conflict;

Name of Staff	Area of Expertise	Position Assigned	Task/s Assigned
			• Identification of additional areas for elephant corridors and Protected Areas; and • Evaluation of the efficacy of existing HEC management plans (HECMP) including HEC management practices.
Dr. Sandun Perera	Fauna	Fauna Specialist	• Identification of impact of the proposed HEC management plan on overall faunal diversity of the area; • Responsible for supervision of the following activities included in the HECMP; • Identification of critical floral species present in the areas identified for land clearing for project activities; • Identification of ecologically sensitive habitats; • Provide inputs for habitat enrichment; • Identify threats from invasive alien species to wildlife habitats; • Identification of translocation sites; and • Assessing food and water availability during the dry season.
Mr. Sarath Ekanayake	Flora	Flora Ecologist	• Identification of impact of the proposed HEC management plan on overall floral diversity of the area; Responsible for supervision of the following activities included in the HECMP; • Identification of critical floral species present in the areas identified for land clearing for project activities; • Identification of ecologically sensitive habitats; • Provide inputs for habitat enrichment; and

Name of Staff	Area of Expertise	Position Assigned	Task/s Assigned
			• Identify threats from invasive alien species to wildlife habitats • Identification of transplantation sites.
Mr. P. D. Leelaratne	Sociology	Sociologist	• Responsible for designing and implementation of HEC related socio-economic data gathering from the project area; • Facilitation of stakeholder consultations; • Compiling a report on current status and projected changes in cropping patterns and intensities under the NWPC project.
Eng. Anura Ranwala	Engineering	Civil Engineer	• Oversee the engineering aspects of the project; • Responsible for assisting the team in relation to any civil engineering and infrastructure related interventions; • Assist the sociologist in compiling the predicted changes in cropping patterns and intensities by providing hydrological information; • Responsible for providing technical advice in planning, designing and implementing of relevant mitigatory measures; • Identification of potential issues that may arise due to proposed structural design interventions of the HECMP including HECM.
Mr. Shamen Vidanage	Environmental Economics	Environmental Economist	• Responsible for activities related to environmental economics; and • Preparation of the cost estimates of the HECMP.
Mrs. Darshani Wijesinghe	GIS	GIS Specialist	• Responsible for activities regarding GIS application and remote sensing and preparation of GIS maps.

Name of Staff	Area of Expertise	Position Assigned	Task/s Assigned
Mr. Sampath de Alwis Goonatilake	Field Coordinator	Biodiversity	• Providing assistance to corresponding key-staff members in gathering of identified primary and secondary data and data analyses.
Mr. Sampath Ekanayake	Field Coordinator	Human-elephant conflict	• Providing assistance to corresponding key-staff member in gathering of identified primary and secondary data and data analyses.
Field Assistants	4 members	Biodiversity 2; HEC 1; socio-economics 1	• Assist field coordinators to collect field information and data entry

2.6 Baseline surveys

There will be four teams involved in the baseline surveys. These comprise

1. *The biodiversity team*: This team will be led by the biodiversity field coordinator, with guidance from the biodiversity expert and assistance of the fauna expert, flora expert and civil engineer. The team will conduct rapid biodiversity assessment methodologies in places identified as necessary and waterhole counts where applicable; collect information regarding status of the protected areas within the project area, habitat management requirements, restoration needs, invasive species management requirements, analysis of proposed mitigation measures and their adequacy, identification of species that needs translocation/ transplantation, identification of areas that can be annexed to PA network and potential corridors that can be used to link PAs.
2. *The HEC team*: This team will be led by the elephant expert and will be responsible for collection of data regarding the movement patterns of elephants, current status of the HEC, management measures employed by government institutes and local communities and their effectiveness.
3. *The Socio-economics team*: This team will be led by the sociologist with assistance from the environment economist and civil engineer. The team will collect information on social aspects of the identified GN divisions, the details regarding the command area — such as current cropping patterns and intensities, changes in water availability in the command area as a result of NWP canal project and the accompanied changes in the cropping patterns and intensities and information on current level of HEC in the command area of the NWP canal project.
4. *The GIS team*: This team will be led by the GIS expert and assisted by the other three teams to collect and map spatial data on HEC, HEC management measures, tanks that receive water under the NCP canal project and their command areas and boundaries of the existing PAs and other natural areas that are not protected.

2.7 Development of the Human-Elephant Conflict Management Plan

The ultimate goal of the project will be to develop a robust and implementable HECMP that is acceptable to the wider stakeholders that are directly or indirectly associated with the plan. The entire team will take part in the HECMP development. The outcomes of each of the baseline studies will be used as the key source of information for the development of specific

management prescriptions of the HECMP. The HECMP will also be aligned with the existing National Policies and plans of work, especially with the Elephant policy and Wildlife Policy. A draft of the HECMP will be developed and circulated for comments and feedback to the key stakeholders and the final HECMP will be prepared incorporating the comments and suggestions made by the stakeholders.

2.8 Stakeholder consultation

As indicated in the previous section the HECMP should be a stakeholder-driven process, as one of its main aims is to provide much needed relief to the communities whose livelihoods are affected by lack of water and human wildlife conflict. While the NWP canal project will ensure water security in its command area this is likely to escalate the present level of human-elephant conflict, which will prevent the accrual of full benefits that can be derived by the project. Therefore, the local community will be a major stakeholder of the project, as they will not only benefit from the project but are expected to actively contribute to HECMP through labour or finances or both. The local government authorities such as district secretaries, divisional secretaries and *grama niladharis* will also have to play key roles, as community engagement will be mobilised through them. Government agencies such as the Department of Wildlife Conservation, Forest department, Mahaweli Environmental Authority, Irrigation Department and Department of Agrarian Development (DAD) will also have to play key roles during the implementation phase of the HECMP and therefore, will be considered key stakeholders of this HECMP. Each of these stakeholders will be consulted during the initial phase of base line surveys to obtain their experiences, views and perceptions regarding the current status of HEC in the area, as well as other wildlife-related issues faced by them. They will be consulted during the later phase of HECMP development to obtain their views and comments regarding the proposed management solutions included in the HECMP.

2.9 Meeting with DWC

The Department of Wildlife Conservation is a key stakeholder, as resolution of human-elephant conflict comes directly under their mandate of work. However, it should be noted that the HECMP that will be developed under this project shall not be an alternative to their plan of work but is meant to supplement their work, by ensuring the safety of the farmer communities that benefit from the NWP canal project, until a long lasting solution can be provided by the DWC once the national elephant conservation plan is fully implemented by them. Therefore, DWC should become an active partner in the HECMP development process and as such, they will be consulted through project inception to completion.

2.10 Data Needs

Data needed from Irrigation Department /Mahaweli Authority /Department of Agrarian Development

1. List of small tanks supplied with following details for each:
    - GPS location;
    - Whether capacity will be increased; if so current and projected;
    - Cropping pattern under tank and envisaged change (*Maha* only → *Maha* and *Yala* etc.)
    - Whether there will be any change in extent cultivated; If so, current extent cultivated and envisaged change in extent;

- Whether there will be any change in crops cultivated; If so, current crops cultivated and envisaged change; and
- Is there a farmer society for the tank? If so name of farmer society, address, contact details and number of members.

2. Map of feeder canal network (shape files/GPS) indicating:
   - Whether existing or to be constructed;
   - Whether concrete-lined or natural-stream;
   - Width and depth; and
   - Proposed water release scheme (months),

   Data needed from the DWC

   1. List of HEC mitigation measures adopted in project area;
   2. Map of identified elephant corridors — shape files/GPS locations;
   3. List of current electric fences; GPS locations/tracks/shape files;
   4. List of alternative elephant barriers (trenches, bio fences, bee fences); GPS locations/tracks/shape files;
   5. List of elephant translocations from or to the project area in the last 5 years:
      - Capture location and date;
      - Release location and date;
      - Cost;
      - Whether monitored and if so how; and
      - Result, if known.
   6. List of elephant drives within the project area in the last 5 years:
      a) Start location and date;
      b) End location and date;
      c) Number of people participating, number of elephant crackers used, number of cartridges used;
      d) Cost;
      e) Whether monitored and if so how; and
      f) Result, if known.
   7. Number of elephant thunders distributed in project area monthly at the level of DWC office and GS division

2.11 Work plan

A detailed work plan is presented in Annex I.

3. Conclusions

This is the first time a HECMP will be developed with a special emphasis on human-elephant conflict mitigation for a major irrigation project in Sri Lanka. This is a significant undertaking, considering the fact that the principal goal of the HECMP is to mitigate human-elephant conflict in the northwestern province, where the highest level of human-elephant conflict exists at present. The successful delivery of this Project is contingent on multiple studies and the cooperation and input of many individuals and organisations. Even though the Project presents unique technical and logistical challenges, the potential benefits that it can confer on the farming communities of the NWP canal project are immense. Furthermore, if this HECMP is successfully implemented there is great potential to scale up the process to other regions facing a similar situation.

References

Angiosperm Phylogeny Group (2009) An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG III. *Botanical Journal of the Linnean Society,* Vol 161. 105-121pp.

Ashton, M., Gunatilleke, S., de Zoysa N., Dassanayake, M.D., Gunatilleke, N., and Wijesundara, S. (1997). *A field guide to the common trees and shrubs of Sri Lanka*. WHT Publication Ltd. Sri Lanka. 431pp.

Bahir, M. M. & Yeo, D. C. J., (2005). A revision of the genus *Oziotelphusa* Müller, 1887 (Crustacea: Decapoda: Parathelphusidae), with descriptions of eight new species In: D. C. J. Yeo, P. K. L. Ng & R. Pethiyagoda, eds 2005. *Contributions to Biodiversity Exploration and Research in Sri Lanka. The Raffles Bulletin of Zoology, Supplement,* 12, pp.77–120.

Bedjanic, M., Conniff, K., and Wijeyeratne, G de S (2007) *A photographic Guide to the Dragonflies of Sri Lanka.* Jetwing Eco Holidays, Colombo, Sri Lanka. 248pp.

Bedjanic, M., Conniff, K., Van der pooten N. and Salamun A. (2014) *Dragonfly fauna of Sri Lanka distribution and biology with threat status of its endemics,* Pensoft, Sofia. 321pp.

D'Abreira, B. (1998) *The butterflies of Ceylon*. Wildlife Heritage Trust, Colombo, Sri Lanka. 221pp.

Dassanayake, M.D. and Fosberg, F.R. (*eds)* (1980 - 1991) *Revised handbook to the flora of Ceylon*, Vols. I-VII. Amerind Publ., New Delhi.

Dassanayake, M.D. and Clayton, W.D. (*eds*) (1996 - 1999) *Revised handbook to the flora of Ceylon,* Vols. X - XIII. Amerind Publ., New Delhi.

Dassanayake M.D., Fosberg, F.R. and Clayton, W.D. (*eds*) (1994 - 1995) *Revised handbook to the flora of Ceylon,* Vols. VIII - IX. Amerind Publ., New Delhi.

Department of Irrigation (2015). *EIA Study of the Proposed North Western Province (Nwp) Canal Project*. Final Report. 454 pp.

de Vlas – de Jong, J., and de Vlas, J. (2008). *Illustrated Field Guide to the Flowers of Sri Lanka*. Mark Booksellers and Distributors (Pvt) Ltd: Sri Lanka. Vol 1.

de Vlas – de Jong, J., and de Vlas, J. (2013). *Illustrated Field Guide to the Flowers of Sri Lanka*. Mark Booksellers and Distributors (Pvt) Ltd: Sri Lanka. Vol 2.

Goonatilake, S. de A. (2007) *Freshwater fishes of Sri Lanka*. Biodiversity Secretary of Ministry of Environment and Natural Recourses. (*Sinhala book*). 133pp.

Harrison, J. (1999) *A field guide to the Birds of Sri Lanka*. Oxford University Press Inc., New York. 219pp.

Jayasinghe, H.D., Rajapaksha, S.S. and C. de Alwis (2013) *A pocket guide to the Butterflies of Sri Lanka* (second edition). Butterfly Conservation Society of Sri Lanka. 183pp.

Kotagama S.W. and Goonatilake S. de A. (2013) Pictorial Pocket Guide to the Mammals of Sri Lanka (revised and expanded), Field Ornithology Group of Sri Lanka, University of Colombo, 153pp.

Kovařík, F., Lowe, G., Ranawana, K.B., Hoferek, D., JayarathneV.A.S., Plíšková, J. & F. Šťáhlavský (2016) Scorpions of Sri Lanka (Scorpiones: Buthidae, Chaerilidae, Scorpionidae) with description of four new species of the genera Charmus Karsch, 1879 and Reddyanus Vachon, 1972, stat. in *Euscorpius — Occasional Publications in Scorpiology*. 2016, No. 220.

MASL (2005) *Kala Oya River basin: Survey of the biodiversity & wetland issues and options for their sustainable management, final report.* River basin planning Division, Mahaweli Authority of Sri Lanka.

MOE (2012) *The National Red List 2012 of Sri Lanka; Conservation Status of the Fauna and Flora*. Ministry of Environment, Colombo, Sri Lanka. viii + 476pp.

MMD&E (2015) *A Guide to Invasive Alien Species of Sri Lanka: A descriptive account of National Priority and Potentially Invasive Alien Species*.

Phillips, W.W.A. (1935) *Manual of the Mammals of Ceylon*. Ceylon Journal of Science, Dulau and Company, London. 371pp.

Pocock, R. I., (1900). *The Fauna of British India, including Ceylon and Burma. Arachnida:I-XII.* London: Taylor andFrancis.

Raheem, D. and F. Naggs (2006) An Illustrated guide to the land snails of Sri Lankan Natural forests and Cultivated lands. Department of Zooology Natural Historyl Museum. 12p.

Red List (2007) Database, IUCN.

Senarathna, L.K. (2001) *A Checklist of the flowering Plant of Sri Lanka*. Pub.No.22 MAB Checklist and Handbook series *National Science Foundation*. Colombo. Sri Lanka. 451pp.

Somaweera, R. and Somaweera, N. (2009) *Lizards of Sri Lanka, A colour guide with Field Keys.* Andreas S. Brahm, Heddernheimer Landstre. Germany. 303pp.

Somaweera, R. (2006) *Sri Lankave Sarpayan.* Wildlife Heritage Trust (Pvt) Company Limited, Colombo, Sri Lanka. (Sinhala text). 297pp.

Warakagoda, D., Inskipp,C., Inskipp, T., and Grimmett, R. (2012) *Helm Field Guides. Birds of Sri Lanka*. Christopher Helm.

Annex I. The detailed work plan

No	Activity numbers and related activities		Month																																										
			1				2				3				4				5				6				7				8				9				10				11				12			
			Aug-16				Sep-16				Oct-16				Nov-16				Dec-16				Jan-17				Feb-17				Mar-17				Apr-17				May-17				Jun-17				Jul-17			
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1		Assessment of threats, vulnerable ecosystems and identification of habitat enrichment programmes related to wildlife issues and human-Elephant conflict (HEC) within the project area																																														
1.1	3. (a)	Literature survey and documentation of biodiversity and HEC mitigation measures adopted in the project area at present																																														
		Inception report submission																																														
1.2a	3(b)iii.	3(b)iii. Identification and implementation of habitats enrichment programs such as eradication of invasive plants, improvement of water holes to enhance carrying capacity of protected areas																																													
1.3b	3(b)vi,	Identification of sensitive and vulnerable eco systems in the NWPC Project area and mitigatory propose mechanisms to protect them. - Prioritize DS divisions where the high level of conflict occur and high value of wildlife occur																																													
1.4c	3(b)ix,	3(b)ix, Proposals to enhance food and water requirements during dry seasons in the protected areas																																													
1.5		GIS mapping of related to activity 01 - prioritized Area																																													
2		Identification and declaration of additional area as protected areas to provide connectivity between remaining forest areas for migration of wild animals																																													
2.1	(3(b)ii.	Identification and for declaration of additional areas as protected areas to provide connectivity between remaining forest areas and wildlife reserves																																													
2.2		GIS mapping of related to activity 02																																														
3		Planning of animal rescue and release and flora transplanting programmes																																													
3.1	3(b) iv.	Identification of animal rescue and translocation programs																																													
3.2		GIS mapping of related to activity 03																																														
3.3		Submission interim report																																													

No	Activity numbers and related activities		Month																																								
			1				2				3				4				5				6				7				8				9				10				11				12			
			Aug-16				Sep-16				Oct-16				Nov-16				Dec-16				Jan-17				Feb-17				Mar-17				Apr-17				May-17				Jun-17				Jul-17			
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
4		Identification and prediction of Human Elephant Conflict areas and Community based mitigation measures																																															
4.1		Field surveys to identification of mainly HEC issues within the Project area (DS level)																																															
4.1a	3(b)i,	Establishment of identified elephant corridors in consultation with relevant stakeholders (Department of Wildlife Conservation (DWC)/ Forest Department (FD) & others).																																														
4.2b	3(b)v,	Identification of reasons and details for poor functioning of the relevant existing nature reserves and protected areas and to recommend measures and specification to improve them in consultation with relevant stakeholders (DWC/FD & others).																																														
4.3c	3(b) vii,	Identification of reasons and details for poor functioning of the existing system of electric fences and to recommend new ways, means, methods and any additional specifications to improve the functioning of electric fences to manage the human Elephant Conflict.																																														
4.4d	3(b)x,	Identification of areas to be protected by the elephant fences.																																														
4.5e	3(b)xii,	Identification of traditional methods and implementation of such to mitigate human Elephant conflicts																																														
	3(b)xiii,	Identification of mitigatory measures to protect human settlements and paddy fields from wild elephants																																														
	3(b)viii,	Identification of efficient institutional arrangement with necessary funds, resources, facilitate transport etc. for managing human Elephant conflict																																														
	3(b)xi.	Community training mechanism for the maintenance of elephant fences																																														
	3(b)xiv,	Any other mitigatory measures identified for the management of Human Elephant Conflict																																														
	3(b)xvi,	Establishment of a revolving fund for the long term maintenance of electric fences as well as for payment of compensation for affected parties																																														
	(C.)	Obtaining of a complete understanding of the present situation through consultation meeting of stakeholders																																														

No	Activity numbers and related activities		Month																																															
			1				2				3				4				5				6				7				8				9				10				11				12			
			Aug-16				Sep-16				Oct-16				Nov-16				Dec-16				Jan-17				Feb-17				Mar-17				Apr-17				May-17				Jun-17				Jul-17			
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
	3(b)xv,	**Estimated budgetary allocation required for the implementation of Human Elephant Conflict management plan (HEC MP)**																																																
	(d)	**Preparation of a Draft Plan for the management of human-elephant conflict through stakeholder consultation including field level**																																																
4.6		**Submission of draft Final report**																																																
	(e)	**Preparation of a final plan for the management of human-elephant conflict by consulting selected group of relevant technical experts and stakeholders**																																																
		Submission of Final report																																																

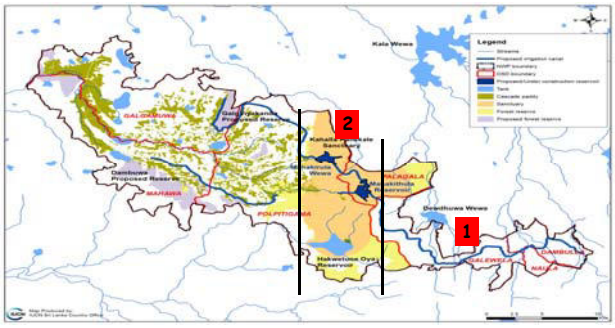
Annex II. Presentation made by the Team Leader at the Stakeholders meeting

Preparation of Human Elephant Conflict Management Plan for the North Western Province Canal Project (NWPCP)

IUCN Sri Lanka Country Office

INTERNATIONAL UNION FOR CONSERVATION OF NATURE

Northwestern Canal Project



- Passing through mainly human use areas
- The two storage tanks and the canal linking the tanks are located in Kahalla-Pallekele Sanctuary

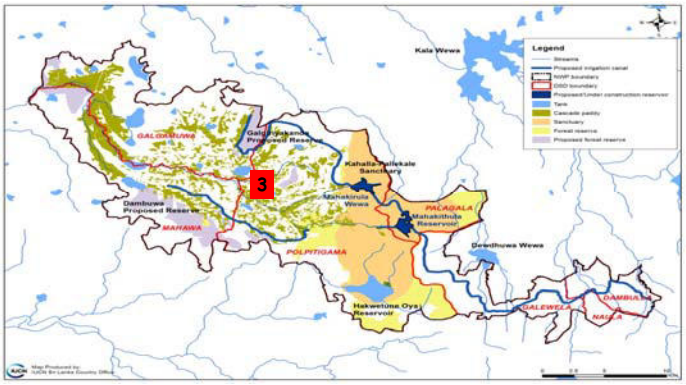
2

NWP Canal Project

- Canal passes through 3 natural habitats – Dry mixed evergreen forest, Scrublands, Riverine forest
- Further Teak and Eucalyptus plantations
- Flora - 133 sp
  - 10 Endemic Species, 1 EN species and 3 VU species
- Fauna - 181 faunal species
  - 18 Endemic species, 5 Nationally EN and 3 Globally EN species, 2 Nationally VU and 2 Globally VU sp

3

Northwestern Canal Project



- Command Area – 12,000 ha mostly in high HEC area

4

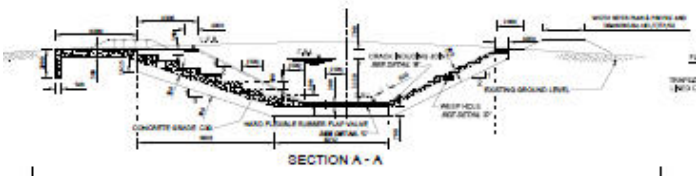
Main Impacts of NWP Canal Project

- Loss of Wildlife habitat - 340 ha in Kahalla-Pallekelle due to establishment of the two reservoirs and link canal
- Mitigation:
  1. Annexing additional areas to existing protected area network
  2. Enhance the carrying capacity of the existing protected areas

5

Main Impacts of NWP Canal Project

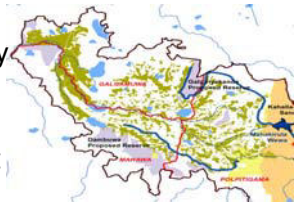
- Disruption of movement patterns and death and injury due to animals falling into the canal
- Mitigation:
  1. Cut and cover sections
  2. Simulating natural water ways
  3. Cross over or escape points at 500 m intervals



Main Impacts of NWP Canal Project

Escalation of human-wildlife conflict

- The proposed project will result in loss of habitat especially for Wild elephants
- Direct loss is around 340 ha
- Indirect loss due to changes in the cropping patterns (lose access to dry season feeding areas)
- Mitigation:
  1. Enhance carrying capacity of PAs and facilitate free movement
  2. Site specific management actions outside PA's



Objectives of the Assignment

Overall objective is to develop a wildlife management plan with special emphasis on mitigating the Human-Elephant Conflict (HEC) in the areas where landscape and land use characteristics will change with the North Western Province Canal project.

Activities Related to the WMP

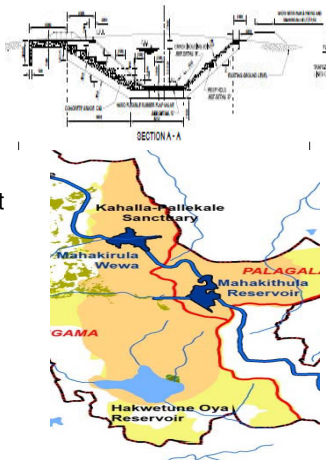
A. Improving the overall habitat availability for wildlife:

1. The current status of the existing PAs in the project area and potential management actions to improve the habitats in these PAs.
2. Identification of habitats with the potential to be enriched through assisted regeneration, eradication of invasive species, improvement of water holes to enhance the carrying capacity of PAs.
3. Identification of areas that can be annexed with existing PAs, areas that can provide connectivity between remaining forest areas including already identified elephant corridors to be established for mitigation of HEC.
4. Identification of sensitive and vulnerable ecosystems in the NWPC Project area and potential mechanisms to protect them.

Activities related to the WMP … cont…

B. Mitigating direct negative impacts on wildlife

1. Identify additional needs over and above mitigation measures proposed in the environment management plan of the project design
2. Develop a rescue programme to trans-locate or transplant identified animal and plant species from locations that will be affected by project activities.



Activities related to the WMP … cont…

C. Mitigation of Human-Elephant conflict

1. Establish baseline with respect to elephants and HEC in the project area

- Movement patterns of elephants within the study area.
- Existing level of HEC and patterns of conflict.
- Mitigation measures adopted at present in the project area by government agencies.
- Mitigation measures adopted at present in the project area by farmers.
- Evaluation of the feasibility of establishing the identified elephant corridors.

Activities related to the WMP … cont…

C. Mitigation of Human-Elephant conflict...cont...

2. Evaluation of current efforts at mitigating HEC

- Evaluate the existing electric fences within the project area and to recommend new ways, means, methods and any additional specifications to improve the functioning of electric fences to manage the HEC.
- Evaluate other barriers such as bio fences and ditches.
- Evaluate elephant translocation, drives, and chasing and distribution of elephant thunders.
- Identify HEC mitigatory measures to be utilized In areas impacted by the NWCP.
- Assess the feasibility of community based electric fencing as a HEC mitigation measure to be implemented through the NWCP
- Identify awareness and communication needs for mitigating HEC.
- Identify mechanisms for effective compensation of people impacted by HEC
- Identify efficient institutional arrangements required for managing HEC.

Activities related to the WMP … cont…

6. Preparation of a Draft WMP with special emphasis on minimizing the HEC in the project area.
7. Presenting the draft WNP to a wider stakeholder group to get their feedback on the proposed actions.
8. Preparation of a final WMP incorporating the comments and concerns made by the stakeholders.
9. Estimation of the implementation cost of each of the proposed site specific activities and preparation of the detailed budget that is required for implementation of WMP for the NWPC project including the cost of establishing a revolving fund to facilitate long term.
10. Preparation of the schedule of implementation and monitoring program of the WMP.

WMP Preparation Team

- Prof. Devaka Weerakoon (Team Leader and biodiversity expert)
- Dr. Sriyanee Miththapala, (Biodiversity expert)
- Dr. Prithiviraj Fernando (Elephant Expert)
- Dr. Sandun Perera (Fauna Expert)
- Eng. Anura Ranwala (Civil Engineer)
- Mr. Sarath Ekanayake (Flora expert)
- Mr. P D Leelaratne (Sociologist)
- Mr. Shamen Vidanage (Environmental Economist)
- Mrs. Darshani Wijesinghe (GIS expert)
- Mr. Sampath Goonatilake (Field Coordinator - Biodiversity)
- Mr Sampath Ekanayake (Field Coordinator - HEC)
- Data Enumerators

Proposed Work Plan for the Preparation of WMP

No	Activity	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
1	Literature survey												
2	Inception report												
3	Identification of habitats enrichment needs												
4	Identification of sensitive and vulnerable eco systems												
5	Proposals to enhance food and water requirements												
6	Identification of additional areas as protected areas												
7	Planning of species rescue and release/ transplantation												
8	Submission interim report												
9	Identification and prediction of Human Elephant Conflict areas												
10	Field surveys to identification of mainly HEC issues												
11	Establishment of identified elephant corridors												
12	Identification of status of the relevant existing nature reserves												
13	Identification of traditional methods to mitigate HEC												
14	Evaluation of current management practices												
15	Identification of areas to be protected by electric fences												
16	Identification of institutional arrangements to mitigate HEC												
17	Preparation of draft management plan												
18	Presentation of management plan tp stakeholders												
19	Submission of draft Management plan												
20	Preparation of final HEC management plan												
21	Submission of final HEC management plan												

Information Required from Stakeholders

- Ministry of Mahaweli Development and Environment (MMDE)
- Department of Wildlife Conservation (DWC)
- Forest Department (FD)
- Divisional Sectaries (DS)
- Department of Irrigation (DI)
- Department of Agrarian Development (DAD)

Information Required from Stakeholders

Ministry of Mahaweli Development and Environment

- Facilitate a reconnaissance visit for the team to become familiarize with the proposed project activities
- Arrange meetings with relevant stakeholders
- Provide general lay out plans, maps, spatial data and relevant reports
- Details regarding the proposed enhancement of irrigation water supply – distribution network and list of tanks receiving water
- Facilitate obtaining of permits needed to enter protected areas

Information Required from Stakeholders

Department of Wildlife Conservation

- Permission to enter PA's for conducting studies
- Protected areas and their boundaries
- Protected area management plans
- Identified habitat and water enrichment needs
- Records on human elephant conflict
- Identified IAS management needs in PAs
- Details regarding current HEC management practices
- Proposed plans for HEC mitigation within the project area

Information Required from Stakeholders

Forest Department

- Permission to enter PA's for conducting studies
- Protected areas and their boundaries
- Protected area management plans
- Identified habitat enrichment needs
- Identified IAS management needs in PAs

Information Required from Stakeholders

Divisional Sectaries

- Records on human elephant conflict
- Facilitate field investigations through the Grama Nildharis
- Facilitate stakeholder meetings at DS level
- Details regarding the socio-economic conditions of the communities living in the project affected area

Information Required from Stakeholders

Department of Irrigation

- List of tanks managed by irrigation department within the command area of the NWP canal – tank name, tank capacity, command area, types of crops cultivated, cropping patterns
- Layout plans

Information Required from Stakeholders

Department of Agrarian Development

- List of tanks managed by DAD within the command area of the NWP canal – tank name, tank capacity, command area, types of crops cultivated, cropping patterns
- Layout plans

Thank you…..

Annex III List of Species found in the Project Area

Derived from the EIA (2015); Kala Oya Basin Project (2005); Red List 2007 database.

BrR	Breeding Resident	**SU**	Status Unknown	**R**	Resident	**Pro:endemic**	Proposed endemic
WV	Winter Visitor	**SV**	Summer Visitor	**UWV**	Uncertain Winter Visitor	**END**	Endemic
WVa	Winter Vagrant	**PM**	Passage Migrant	**UBr**	Uncertain Breeding Resident	**IND**	Indigenous
Va	Vagrant	**EXO**	Exotic	**DOM**	Domestic		
LC	Least Concern	**NT**	Near Threatened	**EN**	Endangered	**SpS**	Species Status
DD	Data deficient	**VU**	Vulnerable	**CR**	Critically Endangered	**CoS**	Conservation Status

Flora

No	Family (APG III)	Species	English	Sinhala	Tamil	SpS	CoS
1	Acanthaceae	*Hygrophila schulli*	Marsh barble, Long leaved barleria	Katu ikiriya	Nirmulli	IND	LC
2	Acanthaceae	*Justicia betonica*		Sudu puruk, Sudupuruk		IND	LC
3	Achariaceae	***Hydnocarpus venenata***	Marothi tree	Makulu, Makula	Makul / Maravetti	END	LC
4	Alismataceae	*Limnophyton obtusifolium*	Blunt arrowhead			IND	LC
5	Alismataceae	*Limnocharis flava*	Yellow velvetleaf	Diya Gova		EXO	NE
6	Amaranthaceae	*Achyranthes aspera*	Pickly chaff flower	Karal haba, Gas-karalheba	Nayururi	IND	LC
7	Amaranthaceae	*Aerva lanata*	Aerva	Polkudu pala, Polpala	Cerupulai	IND	LC
8	Amaranthaceae	*Alternanthera sessilis*	Sessile joyweed, Tangle mat	Mukunuwenna	Ponan kani	IND	LC
9	Amaranthaceae	*Gomphrena celosioides*	Soft khaki weed			EXO	NE
10	Amaryllidaceae	*Crinum defixum*		Heen tolabo		IND	LC
11	Anacardiaceae	*Buchanania axillaris*		Kiripalu	Kolamau	IND	EN
12	Anacardiaceae	*Mangifera indica*	Mango	Amba	Manga / Ma	EXO	NE
13	Anacardiaceae	*Nothopegia beddomei*		Bala, Andum Teageddi		IND	LC
14	Anacardiaceae	*Spondias pinnata*	Hog plum tree, Wild mango Hog-pulm	Amberella, Wal ambarella	Ampallai	IND	VU
15	Anacardiaceae	*Lannea coromandelica*	Wodier Jhingam	Hik	Odi	IND	LC
16	Annonaceae	*Mitrephora heyneana*		Kanu		IND	NT

No	Family (APG III)	Species	English	Sinhala	Tamil	SpS	CoS
17	Annonaceae	*Polyalthia korinti*		Miwenna, Ul Kenda	Uluvintai	IND	LC
18	Annonaceae	***Uvaria sphenocarpa***				END	LC
19	Annonaceae	***Xylopia nigricans***		Heen Kenda	See-vindai	END	NT
20	Annonaceae	*Miliusa indica*		Kekili Messa, Kukulu messa		IND	LC
21	Annonaceae	*Polyalthia coffeoides*		Ketilla, Omara, O mora	Katilla / Nedunarai	IND	LC
22	Apocynaceae	*Alstonia scholaris*	Devil tree	Ruk-Attana, Eth-mada	Elilaipattai	IND	LC
23	Apocynaceae	*Carissa carandas*	Ceylon damson	Maha-Karamba	Kalaka	IND	DD
24	Apocynaceae	*Ichnocarpus frutescens*	Ichnocarpus, Gopi	Gerandi-Dul, Gopi, Kiri-wel	Udargodi	IND	LC
25	Apocynaceae	*Thevetia peruviana*	Lucky-nut, Yellow oleander	Kaha kaneru	Pachaiyalari	EXO	NE
26	Apocynaceae	*Carissa spinarum*		Heen-Karamba, Karamba	Chiru-kila	IND	LC
27	Apocynaceae	***Wrightia angustifolia***				END	LC
28	Apocynaceae	*Calotropis gigantea*	Giant milkweed, Crown flower,	Ela Wara, Hela Wara	Errukalai / Erukku	IND	LC
29	Apocynaceae	*Pergularia daemia*		Langali, Maha-medahangu	Achanimuli	IND	LC
30	Apocynaceae	*Sarcostemma viminale*	Moon plant , Moon creeper	Muwa kiriya, Muwakiriya Wel	Kodikkalli	IND	NT
31	Apocynaceae	*Dregea volubilis*		Anguna, Anukkola	Kodi-palai kurincha	IND	LC
32	Apocynaceae	*Hemidesmus indicus*	Indian sarssaparilla	Heen-iramusu, Iramusu	Nannari	IND	LC
33	Aponogetonaceae	*Aponogeton natans*				IND	VU
34	Araceae	***Cryptocoryne wendtii***		Athiudayan		END	VU
35	Araceae	*Lasia spinosa*		Kohila, Engili-Kohila	Kohila	IND	LC
36	Araceae	*Pistia stratiotis*	Water lettuce	Diya-paradel	Agasatamari	IND	LC
37	Araceae	*Lemna minima*				EXO	NE
38	Araliaceae	*Schefflera stellata*		Itta, Itta-wel, Maha-itta-wel, Maha itta		IND	LC
39	Arecaceae	*Areca catechu*	Areca-nut / Betel nut	Puwak	Kamuku / Paakku	EXO	NE
40	Arecaceae	*Borassus flabellifer*	Palmyrah / Plam	Thal	Panai	EXO	NE
41	Arecaceae	*Caryota urens*	Fish-tail palm, Kitul palm,	Kithul	Kitul tippilipana	IND	LC
42	Arecaceae	*Cocos nucifera*	Coconut, King coconut	Pol , Thembili	Tennai	EXO	NE
43	Arecaceae	*Phonix dactylifera*	Date palm / Edible date	Rata indi	Perichchampalam	EXO	NE
44	Asparagaceae	*Asparagus racemosus*	Wild asparagus	Hatawariya, Heen hathavariya	Chattavari	IND	LC
45	Asperagaceae	*Sansevieria zeylanica*	Snake Plant, Bow-string hemp	Niyanda, Maha niyanda, Nagawalli, Muruwa	Maral	IND	NT
46	Asteraceae	*Ageratum conyzoides*	Goat weed, White weed	Hulan tala, Hulantala	Pumpillu	EXO	NE

No	Family (APG III)	Species	English	Sinhala	Tamil	SpS	CoS
47	Asteraceae	*Chromolaena odorata*	Siam Weed, Devil weed,	Podi singno maran, Lokkannattan		EXO	NE
48	Asteraceae	*Eclipta prostrata*	Marsh Daisy, Trailing Eclipta	Kikirindi, Sindu kirindi	Karippan / Kaikechi / Kaivichillai	IND	LC
49	Asteraceae	*Mikania cordata*	Mile-a-minute	Gam palu, Kehel palu,	Tuni-kodi	EXO	NE
50	Asteraceae	*Sphaeranthus indicus*	East indian globe thistle	Aet-maha-mahana, Mudu-mahana	Kottakkarandai	IND	LC
51	Asteraceae	*Tridax procumbens*	Kurunagala daisy, Coat buttons	Wasu suda, Tridax		EXO	NE
52	Asteraceae	*Vernonia cinerea*	Little iron weed, Ash fleabane,	Maugul-Kumburu-venna,	Ehitiviyarchenkalainir	IND	LC
53	Asteraceae	***Vernonia zeylanica***		Hin-botiya, Papula, Wal-Pupula	Kappilay	END	LC
54	Asteraceae	*Wedelia chinensis*	Wedelia, Chinese wedelia	Ranwan-kikirindi	Patalaikaiantagerai	IND	LC
55	Asteraceae	*Xanthium indicum*	Rough cocklebur, Bur-weed	Wal-rambutang, Uru-kossa, Awadi	Marlumutta	IND	LC
56	Balsaminaceae	*Hydrocera triflora*	Marsh henna	Diya kudalu, Wal kudalu		IND	LC
57	Bignoniaceae	*Sterospermum colais*		Lunumidella, Dunu-madala, Lunumadala	Padri	IND	LC
58	Boraginaceae	*Cordia monoica*		Lolu	Naruvili / Ponnaruvili	IND	LC
59	Boraginaceae	*Heliotropium indicum*	Indian turnsole	Dimi-biya, Et-honda, Et-setiya, Ethsonda	Tedkodukku	IND	LC
60	Boraginaceae	*Ehretia microphylla*	Ceylon boxwood	Hin-Thambala	Pakkuvetti	IND	LC
61	Burseraceae	*Commiphora caudata*		Simbilla, Ensalu		IND	LC
62	Calophyllaceae	*Calophyllum inophyllum*	Alexandrian laurel	Domba , Tel-domba	Dommakottai / Punnaigum / Punnai	IND	LC
63	Calophyllaceae	*Mesua ferrea*	Iron wood	Na	Naka / Veillutta-champakam	IND	LC
64	Cannabaceae	*Celtis timorensis*		Gurenda	Pinari	IND	LC
65	Cannabaceae	*Trema orientalis*	Charcoal tree	Gadumba		IND	LC
66	Capparaceae	*Crateva adansonii*	Three-leaved caper	Lunuwarana	Navala	IND	LC
67	Capparaceae	*Capparis zeylanica*	Ceylon caper, Caper plant	Sudu-wellangiriya, Wellangiriya	Kattoddi / Vennachchi	IND	LC
68	Capparaceae	*Capparis sepiaria*		Rila Katu		IND	LC
69	Caricaceae	*Carica papaya*	Papaw, papaya, Pawpaw	Gas-Labu, Papol	Pappali	EXO	NE
70	Celastraceae	***Cassine glauca***		Neralu		END	LC
71	Celastraceae	*Gymnosporia emarginata*		Katu pila		IND	LC
72	Celastraceae	***Maytenus fruticosa***				END	CR(PE)
73	Celastraceae	*Pleurostylia opposita*		Panakka, Piyari	Chiru piyari	IND	LC

No	Family (APG III)	Species	English	Sinhala	Tamil	SpS	CoS
74	Celastraceae	*Reissantia indica*				IND	LC
75	Celastraceae	*Salacia oblonga*		Himbutu, Gal Himbutu		IND	EN
76	Celastraceae	*Salacia reticulata*		Kotala-himbutu, Himbutu-wel, Himbutu		IND	EN
77	Ceratophyllaceae	*Ceratophyllum demersum*				IND	LC
78	Cleomaceae	*Cleome viscosa*	Yellow spider flower,	Wal-aba, Ran-manissa	Nayikadugu	IND	LC
79	Clusiaceae	*Garcinia spicata*		Gonapana, Gokatu, Ela-goraka	Kokottai	IND	NT
80	Colchicaceae	*Gloriosa superba*	Glory lily, Flame lily	Niyagala	Karti kai kilanku / Ventonti	IND	LC
81	Combretaceae	*Combretum albidum / ovalifolium ?*		Kaduru-ketiya wel		IND	NT
82	Combretaceae	*Terminalia arjuna*	Arjun	Kumbuk, Kumbalu	Marutu	IND	LC
83	Combretaceae	*Terminalia catappa*	Country almond, Indian Almond	Kottamba / Kottan	Amandi-maram	EXO	NE
84	Commelinaceae	*Commelina clavata*		Gira-pala		IND	VU
85	Connaraceae	*Connarus monocarpus*		Radaliya, Ela radaliya, Ratu radaliya	Chettupulukodi	IND	LC
86	Connvolvulaceae	*Argyreia osyrensis*		Dumbada		IND	LC
87	Connvolvulaceae	*Evolvulus alsinoides*	Little glory, Dwarf morning glory	Visnu-kranthi, Nil Vishnukranthi	Vichna-kiranthi / Vishnu kiranthi	IND	LC
88	Connvolvulaceae	*Ipomoea aquatica*	Cancun, Water spinash	Kankun	Koilangu / Sarkareivalli	IND	LC
89	Connvolvulaceae	*Ipomoea obscura*	Lesser glory	Maha madhu / Tel kola, Maha Tel, Tel Wel	Chirudali / Kuruguttali	IND	LC
90	Connvolvulaceae	*Merremia tridentata*	African morning vine	Hawari-madu, Heen-madu	Mudiyakuntai	IND	LC
91	Crassulaceae	*Kalanchoe pinnata*	Airplant, Coirama	Akkapana, Rata-gowa	Runakalli / Malaikkalli	EXO	NE
92	Cucurbitaceae	*Coccinia grandis*	Ivy gourd	Kowakka	Kovvai	IND	LC
93	Cyperaceae	*Actinoscirpus grossus*				IND	LC
94	Cyperaceae	*Schoenoplectus articulatus*		Maha-geta-pan		IND	LC
95	Cyperaceae	*Cyperus spp.*				EXO	
96	Cyperaceae	*Fimbristylis spp.*					
97	Dioscoreaceae	*Dioscorea tomentosa*		Uyala		IND	LC
98	Ebenaceae	*Diospyros malabarica*	Gaub persimmon / Riber ebony	Thimbiri	Panichchai	IND	LC
99	Ebenaceae	*Diospyros oocarpa*		Kalu-Kadumberiya, Ela-thimbiri, Kalu	Vellai-karunkkali	IND	NT

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100	Ebenaceae	*Diospyros sylvatica*		Sudu-Kadumberiya, Hompilla	Karruppu-thoveria	IND	VU
101	Ebenaceae	*Diospyros walkeri*	Bastard ebony	Kadum-Beriya, Kaluwelle,		IND	VU
102	Ebenaceae	*Diospyros ebenum*	Ebony	kaluwara		IND	EN
103	Ebenaceae	***Diospyros nummulariifolia***				END	LC
104	Ebenaceae	*Diospyros ovalifolia*		Habara, Kunumella	Vedukkanari / Vedukunari	IND	LC
105	Ebenaceae	*Diospyros spp*				END	
106	Ebenaceae	*Diospyros ferrea*				END	
107	Erythroxylaceae	*Erythroxylum monogynum*	Bastard sandal	Devadaram, Agil, Lanka agil	Chemanatti	IND	NT
108	Erythroxylaceae	***Erythroxylum zeylanicum***				END	LC
109	Euphorbiaceae	*Croton aromaticus*		Wel-Keppetiya	Teppaddi	IND	LC
110	Euphorbiaceae	*Croton bonplandianus*	Bonpland's croton			EXO	NE
111	Euphorbiaceae	*Croton caudatus*		Wel-Keppetiya		IND	EN
112	Euphorbiaceae	*Croton hirtus*		Gan-veda, Val-tippili		EXO	NE
113	Euphorbiaceae	*Croton laccifer*		Gas-Keppetiya, Keppetiya	Teppaddi	IND	LC
114	Euphorbiaceae	*Croton officinalis*		Podiarisi		IND	LC
115	Euphorbiaceae	*Dimorphocalyx glabellus*		Weliwenna, Ten-kuttiya	Tentuikki	IND	LC
116	Euphorbiaceae	*Euphorbia antiquorum*	Spurge cactus, Fleshy spurge	Daluk	Chatura kalli	IND	LC
117	Euphorbiaceae	*Euphorbia heterophylla*	Mexican fireweed,	Wal Rabber, Kepumkeeriya		EXO	NE
118	Euphorbiaceae	*Euphorbia indica*	Hypericum-leaf spurge	Ela-dada-kiriya		IND	LC
119	Euphorbiaceae	*Jatropha curcas*	Physic nut / Purging nut	Rata-Endaru, Weta endaru	Kaddamanakku	EXO	NE
120	Euphorbiaceae	*Macaranga peltata*	Roxburgh's lotus croton	Kenda, Pat-Kena, Pat-Kenda	Vattakanni	IND	LC
121	Euphorbiaceae	***Mallotus eriocarpus***		Bulu-petta, Vel-keppetiya		END	LC
122	Euphorbiaceae	*Mallotus repandus*		Wel keppetiya		IND	LC
123	Euphorbiaceae	*Sapium indicum*	Mock willow	Kirimakulu, Kiri-Makulu, Muhudu Kaju		IND	VU
124	Euphorbiaceae	*Sapium insigne*		Tel-Kadura, Kaduru	Tilai	IND	LC
125	Euphorbiaceae	*Tragia involucrata*	Indian stinging nettle	Wel-Kahmbiliya	Kancori / Kandudi/ Amby	IND	LC
126	Euphorbiaceae	*Mallotus rhamnifolius*		Molabe, Bulu-hulu-keppetiya		IND	LC

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127	Euphorbiaceae	*Ricinus communis*		Edaru		EXO	NE
128	Fabaceae	*Bauhinia racemosa*		Maila	Atti / Arai	IND	LC
129	Fabaceae	*Cassia ferruginea*				EXO	LC
130	Fabaceae	*Cassia roxburghii*	Ceylon cassia, Red Cassia	Ratu-Wa	Vakai	IND	LC
131	Fabaceae	***Derris parviflora***		Kala-wel, Sudu-kala-wel		END	LC
132	Fabaceae	*Abrus precatorius*	Crab's eyes, Indian liquorice	Olinda, Hunida	Kundu-mani / Kuntu-mani	IND	LC
133	Fabaceae	*Acacia caesia*	Soap bark	Hinguru, Heenguru-wel		IND	LC
134	Fabaceae	*Acacia leucophloea*		Katu-Andara, Maha-Andara	Velvalayam	IND	LC
135	Fabaceae	*Acacia melanoxylon*	Australian black wattle,			EXO	
136	Fabaceae	*Acacia pennata*		Goda-Hinguru, Hinguru	Indu	IND	LC
137	Fabaceae	*Aeschynomene aspera*	Pith plant, Shola, Shola-pith	Maha-diya-siyambala	Attuneddi	IND	LC
138	Fabaceae	*Albizia lebbeck*	Parrot tree / Siris tree	Mara, Suriyamara	Kona / Vakai / Vagei	IND	NT
139	Fabaceae	*Bauhinia tomentosa*	Bell bauhinia, Wild champak	Kaha-Petan, Petan	Tiruvathi / Tiruvatti	IND	LC
140	Fabaceae	*Caesalpinia bonduc*	Gray nicker	Kalu-Wavul-Atiya, Kumburu-Wel	Punai kkalaichchi	IND	LC
141	Fabaceae	*Cassia fistula*	Indian laburnum,	Ehela, Erahandi, Erahendi	Kavani / Konnei / Tirukkontai	EXO	
142	Fabaceae	*Cassia obtusifolia*				EXO	
143	Fabaceae	*Clitoria ternatea*	Butterfly pea	Katarodu, Nil-katarolu, Nil katarodu	Chirupatarru / Karuttappu	IND	LC
144	Fabaceae	*Crotalaria laburnifolia*	Rattle Box, Bird Flower	Yak-beriya		IND	LC
145	Fabaceae	*Crotalaria verrucosa*	Blue andana, Blue rattlesnake	Nil-andana-hiriya, Yak-bairiye	Kilukiluppai	IND	LC
146	Fabaceae	*Derris scandens*	Forest beanstalk	Kala-wel,Ala-wel,Bo-kala-wel	Kalungu kodi	IND	LC
147	Fabaceae	*Desmodium triflorum*	Creeping tick threefoil, Tick clover	Heen-undupiyaliya	Sirupulladi	IND	LC
148	Fabaceae	*Dialium ovoideum*	Velvet tamarind	Gas-Siyambala	Kaddupuli	IND	VU
149	Fabaceae	*Dichostachys cinerea*	Sickle bush, Chinese Intern tree	Andara, Katu andara	Vindattai / Anatter	IND	LC
150	Fabaceae	*Entada rheedii*	Mackay Bean	Pus wel, Us-wel		IND	LC
151	Fabaceae	*Gliricidia sepium*	Mexican lilac	Kona, Vetamara, Ginisooriya, Nanchi	Kona	EXO	
152	Fabaceae	*Leucaena leucocephala*	Wild tamarind, Ipil ipil	Ipil-Ipil	Nattucavundal	EXO	
153	Fabaceae	*Mimosa pudica*	Sensitive plant, Touch me not	Nidi-kumba	Tottal-vadi	EXO	
154	Fabaceae	*Neptunia oleracea*	Water mimosa,	Diya-nidikumba, Goradiya / Goda diya	Suntaikkirai	IND	LC

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155	Fabaceae	*Pithecellobium dulce*	Madras thorn, Manila tamarind	Pinikaral, Menila Siyambala	Kodai kaapulli	EXO	
156	Fabaceae	*Pongamia pinnata*	Indian beech, Mullikulam tree	Magul-Karanda, Karanda, Gal karanda	Poona / Punka / Punku	IND	LC
157	Fabaceae	*Senna auriculata*	Matara tea, Tanner's cassia	Ranawara	Avarai	IND	VU
158	Fabaceae	*Senna tora*	Pot cassia,	Peti-tora	Vaddutakarai	IND	LC
159	Fabaceae	*Tamarindus indica*	Indian date, Tamarind	Siyambala, Maha-siyambala	Puli / Indam / Egin palap / Amilam	EXO	
160	Fabaceae	*Tephrosia purpurea*	Common tephrosia,	Pila, Katuru pila, Gam pila	Kavilai / Kawati / Kolinchi	IND	LC
161	Gentianaceae	*Fagraea ceilanica*		Etamburu		IND	NT
162	Hernandiaceae	*Gyrocarpus americanus*		Diya-labu-gas, Hima, Heiya	Tanakku	IND	LC
163	Hydrocharitaceae	*Blyxa auberti*		Diyahawariya		IND	LC
164	Hydrocharitaceae	*Ottelia alismoides*	Ducklettuce			IND	LC
165	Hypoxidaceae	*Curculigo orchioides*	Black musli	Bim thal, Heen-bin-tal, Sudu-kela	Wolappanai	IND	LC
166	Lamiaceae	*Clerodendrum inerme*		Burende, Gulinda		IND	
167	Lamiaceae	*Leucas zeylanica*	Thumbe	Geta-Thumba	Mudi-tumpai	IND	LC
168	Lamiaceae	***Leucas zeylanica***				EQ	
169	Lamiaceae	*Premna tomentosa*		Bu-Sera		IND	LC
170	Lamiaceae	*Gmelina asiatica*	Asiatic beech berry	Demata, Heen Demmata, Gatta demata	Kumil / Vikarini / Gumadi / Nela-kumi	IND	LC
171	Lamiaceae	***Premna corymbosa***		Gal-Kera		END	LC
172	Lamiaceae	*Premna tomentosa*		Seru / Bu seru / Boo sairoo gas	Kolkutti / Kollay-cottaynellay / Koluk-kutti	IND	LC
173	Lamiaceae	*Vitex altissima*		Milla,Kaha-Milla,		IND	NT
174	Lamiaceae	*Vitex altissima*		Milla		IND	
175	Lamiaceae	*Vitex leucoxylon*		Nebeda, Nebedda, Ne-bedda	Nirnochi	IND	LC
176	Lamiaceae	*Vitex negundo*	Chaste-tree, Indian privet	Nika, Helarika, Sudu-Nika, Nil nika	Nirnichchi / Vennochchi / Nochchi	IND	LC
177	Lauraceae	*Alseodaphne semecarpifolia*		Wewarana	Ranai / Yavaranai	IND	VU
178	Lauraceae	*Cinnamomum cassia*	Wild cinnamon	Dawul-Kurundu,		IND	LC

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179	Lauraceae	*Litsea glutinosa*	Common Tallow Laurel	Bombi, Bomi	Elumpurukki / Maida-lakti	IND	LC
180	Lecythidaceae	*Barringtonia acutangula*	Indian oak	Era-Midella, Ela midella	Adampu / Kadambu	IND	LC
181	Lecythidaceae	*Careya arborea*	Pathana-oak	Kahata	Kachaddai	IND	LC
182	Lentibulariaceae	*Utricularia aurea*	Yellow baldderwort	Diya-pasi		IND	LC
183	Linaceae	*Hugonia mystax*	Climbing flax	Bu-Getiya, Maha-Getiya,	Motirakanni	IND	LC
184	Loganiaceae	*Strychnos potatorum*	Clearing-nut	Ingini	Tetta maram	IND	VU
185	Loganiaceae	*Strychnos nux-vomica*	Nux-vomica	Goda-Kaduru	Eddi / Kanchurai	IND	VU
186	Loranthaceae	*Dendrophthoe falcata*		Delum pilia		IND	LC
187	Malpighiaceae	*Hiptage benghalensis*	Bengal Hiptage, Clustered hiptage	Puwak-Gediya-wel	Madhavi / Asigam	IND	LC
188	Malvaceae	*Abutolon indicum*	Indian mallow, Country mallow	Anoda, Beth anoda,	Peruntulli / Peruntutti	IND	LC
189	Malvaceae	*Hibiscus furcatus*		Napiriththa	Kontagomgura	IND	LC
190	Malvaceae	*Hibiscus tiliaceus*		Belipatta, Wal Beli	Artia / Nir-parathi	IND	LC
191	Malvaceae	*Hibiscus vitifolius*	Tropical rose-mallow	Maha-epala	Vaddattutti	IND	LC
192	Malvaceae	*Sida acuta*	Common wireweed	Gas-Bevila, Gas bebila		IND	LC
193	Malvaceae	*Thespesia populnea*	Tulip tree, Pacific rosewood,	Suriya, Gansuriya	Kavarachu / Puvarachu	IND	LC
194	Malvaceae	*Berrya coridifolia*	Trincomalee wood	Halmilla	Chavandalali	IND	LC
195	Malvaceae	*Ceiba pentandra*	Kapok tree, Sillk cotton tree	Pulun, Imbul, Kotta	Ilavum	IND	LC
196	Malvaceae	***Diplodiscus verrucosus***		Dikwenna / Dik-andhe	Vid-pani / Yakada-maram	END	LC
197	Malvaceae	*Grewia helicterifolia*		Bora-daminiya,	Taviddai	IND	LC
198	Malvaceae	*Sterculia foetida*		Telabu / Thelembu	Kaduthengu / Pinari	IND	LC
199	Malvaceae	*Helicteras isora*	Screw tree, Screw fruit bush	Liniya	Kawa / Vallampani / Vellampidi	IND	NT
200	Malvaceae	*Pterospermum suberifolium*	Fishing rod tree	Welang, Welan	Taddaemarum	IND	LC
201	Malvaceae	*Sterculia balanghas*		Nava		IND	LC
202	Malvaceae	*Grewia damine*	Dhaman	Daminiya, Damunu	Cadachi / Chadachchi	IND	LC
203	Malvaceae	*Grewia orientalis*		Wel-keliya, Wel-mediya		IND	LC
204	Malvaceae	*Microcos paniculata*	Microcos	Kelia, Kohu-kirilla	Kapila	IND	LC
205	Malvaceae	*Muntingia calabura*	Jamaican chrry, Jam-tree	Jam		EXO	
206	Martyniaceae	*Martynia annua*	Tiger claw / Devil's claw	Naga-Darana	Naga-tali / Naka-tali	EXO	
207	Melastomataceae	***Memecylon petiolatum***				END	NT

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208	Melastomataceae	***Memecylon capitellatum***		Dedi-Kaha, Dodan-Kaha	Katti kaya / Venkali-kaya	END	LC
209	Melastomataceae	*Memecylon umbellatum*	Blue mist	Kora-Kaha	Kaya / Kuree-kaya	IND	LC
210	Meliaceae	*Aglaia elaeagnoidea*				IND	LC
211	Meliaceae	*Chukrasia tabularis*	Chittagong wood	Hulanhik, Hiri-kita	Aglai / Kaloti	IND	NT
212	Meliaceae	*Azadirachta indica*	Margosa, Neem	Kohomba	Vembu	EXO	
213	Meliaceae	*Cipadessa baccifera*		Hal-Bembiya, Baderuda	Pulippan-cheddi	IND	LC
214	Meliaceae	*Melia azadarach*	Bead tree, Indian lilac	Kiri-kohomba, Lunumidella	Malai-vembu	OQ	
215	Meliaceae	*Munronia pinnata*		Bin-Kohonba		IND	EN
216	Meliaceae	*Walsura trifoliolata*		Kiri koan / Mal petta	Chadavakku / Chokala / Kanjimaran	IND	
217	Meliaceae	*Walsura trifoliolata*		Kirikon, Malpetta		IND	LC
218	Menispermaceae	*Anamirta cocculus*	Fish berry / Crow killer	Titta-wel	Garalaphala	IND	LC
219	Menispermaceae	*Tinospora sinensis*		Bu-kinda, Wal-kinda, Rasa Kinda	Pachindil	IND	DD
220	Menyanthaceae	*Nymphoides hydrophylla*	Crested snowflakes	Heen-Olu, Heen ambala		IND	LC
221	Menyanthaceae	*Nymphoides indica*		Olu, Maha-ambala		IND	LC
222	Moraceae	*Ficus racemosa*	Cluster fig, Gulafig	Attikka	Adam / Anai / Atti	IND	LC
223	Moraceae	*Artocarpus heterophyllus*	Jak, Yak, Jak fruit	Kos	Pila / Pla / Pala	EXO	
224	Moraceae	*Ficus arnottiana*		Kaputu-Bo, Kaudu-bo	Kallarasu / Kotiyarasu	IND	LC
225	Moraceae	*Ficus benghalensis*	Banyan	Maha-Nuga	Al / Arla	IND	LC
226	Moraceae	*Ficus benghalensis*	Krishna bo, Krishna's cup	Gotu nuga		EXO	
227	Moraceae	*Ficus hispida*	Wild fig, Devil fig	Kota-Dimbula	Peyatti / Kattatti	IND	LC
228	Moraceae	*Ficus microcarpa*		Panu-nuga, Iti	Kallichi	IND	LC
229	Moraceae	*Ficus mollis*		Wal-Aralu		IND	LC
230	Moraceae	*Ficus religiosa*	Peepul, Sacred bo	Bo	Arachu / Arasu	EXO	
231	Moraceae	*Streblus taxoides*	Fig-lime	Gongotu, Katupila, Polkatu		IND	LC
232	Moraceae	*Streblus asper*	Crooked rough-bush	Geta-Netul, Geta nitol	Patpirai	IND	LC
233	Myrtaceae	*Eugenia bracteata*		Tembiliya	Kaya/Venkali kaya	IND	Not Evaluated
234	Myrtaceae	*Eucalyptus alba*	Timor white gum			EXO	
235	Myrtaceae	*Psidium guajava*	Guava	Pera	Koyya / Sengoyya	EXO	

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236	Myrtaceae	*Syzygium cumini*	Java plum, Jambol, Black plum	Ma-Dan, Dan	Naval / Perunaval	IND	LC
237	Nelumbonaceae	*Nelumbo nucifera*	Lotus, Sacred bean, Indian lotus,	Nelum, Sudu Nelum	Tamarai	IND	LC
238	Nymphaeaceae	*Nymphaea pubescens*	Egyptian lotus, Water lily	Et-olu, Olu		IND	LC
239	Ochnaceae	*Ochna lanceolata*		Bo-Kera, Mal-Kera Gal Keral,	Katharai / Katkarai	IND	LC
240	Olacaceae	*Olax imbricata*		Telatiya		IND	NT
241	Oleaceae	*Jasminum angustifolium*	Wild jasmine	We-Kenda, Wal-pichcha		IND	
242	Oleaceae	*Chionanthus zeylanicus*		Geratiya, Geri-Eta, Dambu	Kattimuruchan	IND	LC
243	Oleaceae	*Jasminum angustifolium*		Wal pichcha/ Wekonda	Adigal	IND	LC
244	Oleaceae	*Jasminum angustifolium*				IND	
245	Oleaceae	*Jasminum auriculatum*	Needle flower jasmine	Wal pichcha / Wekanda	Usimalligai	IND	LC
246	Onagraceae	*Ludwigia adscendens*	Creeping water primrose	Beru-diyanilla		IND	LC
247	Onagraceae	*Ludwigia perennis*		Piduruwella		IND	LC
248	Orchidaceae	*Cymbidium aloifolium*				IND	LC
249	Orchidaceae	*Eulophia epidendraea*				IND	LC
250	Orchidaceae	*Oberonia thwaitesii*				IND	NT
251	Orchidaceae	*Vanda tessellata*	Ichneumon plant	Retta" Rassana		IND	VU
252	Pandanaceae	*Pandanus kaida*		Watta-Keiya, Arulu,		IND	LC
253	Passifloraceae	*Passiflora foetida*	Goat-scented passion flower	Pada Gedi, Pada wel	Siruppunaikkali	EXO	
254	Phyllanthaceae	*Phyllanthus reticulatus*		Wel-Kaliya, Gas dummella, Kaila	Mipullanti / Pulla / Pullanti	IND	LC
255	Phyllanthaceae	*Phyllanthus urinaria*		Rat-pitawakka	Kilkaynelli	IND	LC
256	Phyllanthaceae	*Phyllanthus polyphyllus*		Kuratiya, Embitilla		IND	LC
257	Phyllanthaceae	***Cleistanthus pallidus***		Olupeliya, Visa		END	LC
258	Phyllanthaceae	*Antidesma alexiteria*		Hin-Embilla, Heen-embilla		IND	LC
259	Phyllanthaceae	*Blachia umbellata*		Kos-Atta, Goda-ratmal		IND	LC
260	Phyllanthaceae	*Bridelia retusa*		Keta-Kela	Mul-venkai	IND	LC
261	Phyllanthaceae	*Cleistanthus patulus*		Wa, Hankenda, Heenkenda		IND	LC
262	Phyllanthaceae	*Flueggea leucopyrus*	Water caltrop / Spinous fluggea	Heen Katu pila, Hen katu pila, Katupila	Mudpulanti / Pulanji	IND	LC
263	Picrodendraceae	*Mischodon zeylanicus*		Thammanna, Tammanna	Tampanai	IND	LC
264	Plantaginaceae	*Scoparia dulcis*	Sweet broom weed	Wal koththamalli		EXO	

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265	Plantaginaceae	*Limnophila aquatica*	Giant ambulia	Reewul Puruk Wila		IND	LC
266	Poaceae	*Bambusa vulgaris*	Una, Bambos	Kaha una, Bamboo	Ponmungil	OQ	
267	Poaceae	*Cymbopogon nardus*	New citronella grass	Heen-pengiri, Lena-batu	Kavattampillu / Kamachipillu	IND	LC
268	Poaceae	*Cynodon dactylon*	Bermuda grass, Doob grass,	E thana / Ruha	Arugampullu	IND	LC
269	Poaceae	*Hygroryza aristata*	Bengal wild rice	Go-jabba	Vallippul	IND	NT
270	Poaceae	*Imperata cylindrica*		Iluk		IND	LC
271	Poaceae	*Panicum maximum*	Guinea grass	Gini tana / Rata tana, Ginikeeressa		EXO	
272	Polygonaceae	*Persicaria glabra*	Pink rod, Common marsh buckwheat			IND	LC
273	Pontederiaceae	*Eichhornia crassipes*	Water hyacinth	Japan-jabara		EXO	
274	Pontederiaceae	*Monochoria vaginalis*	Pickerel weed, Lesser water hyacinth	Diya-habarala, Jabara	Karimkuvalam	IND	LC
275	Potamogetonaceae	*Potomogeton nodosus*				IND	LC
276	Putranjiavaceae	*Drypetes sepiaria*		Wira	Virai	IND	LC
277	Rhamnaceae	*Ventilago maderaspatana*		Yaccka-wel,		IND	LC
278	Rhamnaceae	*Zizyphus mauritiana*	Indian Jujube, Chinese apple,	Maha-Debara,	Ilantai / Illantai	IND	LC
279	Rhamnaceae	*Scutia myrtina*				IND	LC
280	Rhamnaceae	*Zizyphus oenopila*	Jacka / Jujube	Hin-Eraminia	Churai/Perilantai	IND	LC
281	Rubiaceae	*Benkara malabarica*		Pudan, Maha-geta-kulu		IND	LC
282	Rubiaceae	*Discospermum sphaerocarpum*				IND	LC
283	Rubiaceae	*Haldina cordifolia*	Turmeric wood	Kolon	Manchal-kadampa / Raja-murunkai	IND	LC
284	Rubiaceae	*Ixora coccinea*	Jungle fame, Jungle Flame Ixora	Rathambala, Rath-mal	Vedchi	IND	LC
285	Rubiaceae	*Ixora pavetta*	Toarch tree	Maha-Rathambala	Kanmuttankirai	IND	LC
286	Rubiaceae	***Canthium campanulatum***				END	NT
287	Rubiaceae	*Canthium coromandelicum*		Kara	Karai	IND	LC
288	Rubiaceae	***Canthium puberulum***				END	NT
289	Rubiaceae	*Canthium rheedei*				IND	NT
290	Rubiaceae	*Catunaregam spinosa*	Spiny randia, Enetic-nut,	Kukuruman,	Karai	IND	LC
291	Rubiaceae	*Ixora coccinea*				EXO	
292	Rubiaceae	*Ixora coccinea*				EXO	
293	Rubiaceae	*Mitragyna parvifolia*		Helamba		IND	LC

No	Family (APG III)	Species	English	Sinhala	Tamil	SpS	CoS
294	Rubiaceae	*Mitragyna tubulosa*		Helamba		IND	EN
295	Rubiaceae	*Morinda coreia*	Morinda tree	Ahu	Manchavanna	IND	LC
296	Rubiaceae	*Mussaenda frondosa*	White mussaenda	Mussenda,	Vellai / Lai	IND	LC
297	Rubiaceae	*Psydrax dicoccos*	Ceylon boxwood	Pana-Karaw,	Vatchikuran / Yerkoli	IND	LC
298	Rubiaceae	*Tarenna asiatica*		Tarana, Maha Tarana	Karanai	IND	LC
299	Rutaceae	*Atalantia ceylanica*		Yakinaran,	Pey-kuruntu	IND	LC
300	Rutaceae	*Chloroxyclon swietania*	Satinwood	Burutha	Moodudad-marum / Muritai	IND	VU
301	Rutaceae	*Glycosmis mauritiana*				IND	LC
302	Rutaceae	*Pleiospermium alatum*		Tunpath-Kurundu		IND	LC
303	Rutaceae	*Clausena indica*		Migon-Karapincha	Pannai / Purankainari	IND	LC
304	Rutaceae	*Glycosmis pentaphylla*		Dodan-Pana	Kulapannai	IND	LC
305	Rutaceae	*Limonia acidissima*	Elephant-apple, Wood-apple	Divul	Mayaladikkuruntu / Vila / Vilatti	IND	LC
306	Rutaceae	*Murraya koenigii*	Curry leaf	Karapincha	Karivempu	IND	LC
307	Rutaceae	*Murraya paniculata*	Orange jessamine	Etteriya	Eli-muchum-pallam	IND	LC
308	Rutaceae	*Triphasia trifolia*		Kasthuri dehi		EXO	
309	Salvadoraceae	*Azima tetracantha*	Needle bush, Bee sting bush	Wel dehi, Katu Niyanda	Ichanku / Iyanku	IND	LC
310	Sapindaceae	*Dimocarpus longan*	Longan / Dragon eye	Mora, Rasa-mora, Peni Mora	Nurai	IND	LC
311	Sapindaceae	*Lepisanthes senegalensis*		Gal-kuma	Kal-kuma	IND	LC
312	Sapindaceae	***Lepisanthes tetraphylla***				END	LC
313	Sapindaceae	*Allophylus cobbe*		Bu-Kobbe, Kobbe,	Amarai	IND	LC
314	Sapindaceae	*Cardiospermum halicacabum*	Ballon vine	Penela-wel, Wel penela		IND	LC
316	Sapindaceae	*Filicium decipiens*		Pihimbiya	Chitteraivempu	IND	LC
317	Sapindaceae	*Sapindus emarginatus*	Soap nut tree	Penela, Kaha Penela,		IND	LC
318	Sapindaceae	*Schleichera oleosa*	Ceylon oak / Lac tree	Kon	Kula / Puvu / Kolama	IND	LC
319	Sapotaceae	*Madhuca longifolia*	Mousey mi / Butter tree	Mi, Gam-mi, Galu-pushpa	Illupai / Kuligam	IND	NT
320	Sapotaceae	*Manilkara hexandra*	Obtuse leaved mimusops	Palu	Palai / Sivandi	IND	VU
321	Sapotaceae	*Mimusops elengi*	Bullet-wood tree	Munamal, Muguna,	Makil / Mukalai / Vilva-padri	IND	NT

No	Family (APG III)	Species	English	Sinhala	Tamil	SpS	CoS
322	Solanaceae	*Datura metel*	Devil's trmput, Thorn apple	Attana, Katu-Attana, Ela attana	Venumattai	EXO	
323	Solanaceae	*Physalis peruviana*	Cape gooseberry, Gooseberry tomato			EXO	
324	Typhaceae	*Typha agustifolia*	Bullrush, Cat-tail, Lessar bulsrush	Hambu-pan		IND	LC
325	Ulmaceae	*Holoptelea integrifolia*	Indian elm	Goda-Kirilla	Ayil / Kauchia / Velaylii	IND	NT
326	Verbenaceae	*Tectona grandis*	Indian oak, Tek, Teak tree	Thekka / Takku	Tekku	EXO	
327	Verbenaceae	*Lantana camera*	Common lantana, Pickly lantana,	Ganda-pana, Garda-pana	Arisimalar	EXO	
328	Verbenaceae	*Phyla nodiflora*	Cape weed, Cidron, Fogweed,	Herimana-detta	Podutalai	IND	LC
329	Verbenaceae	*Stachytarpheta jamaicensis*	Berbena, Blue porterweed,	Balu-nakuta, Rata-nil-nakuta		EXO	
330	Vitaceae	*Cissus latifolia*		Wal diya labu / Heen thuvalla		IND	LC
331	Vitaceae	*Cissus quadrangularis*	Weld grape, Edible-stemmed vine	Heeressa, Sirassa	Arugani / Kiritti / Pirandai / Indiravalli	IND	LC
332	Vitaceae	*Cayratia pedata*		Gerandi-dul-wel	Naralai / Kattuppirandai	IND	LC
333	Vitaceae	*Cissus vitiginea*		Wal Nivithi		IND	LC
334	Vitaceae	*Leea indica*	Bandicoot berry	Burulla, Gurulla	Nyckki otta-nali / Nalava	IND	LC

Fauna

No	Family	Scientific Name	English Name	Sinhala Name	Tamil Name	SpS	CoS
Butterflies							
1	Papilionidae	*Graphium agamemnon*	Green jay / Tailed jay	Kola papilia		IND	LC
2	Papilionidae	*Graphium doson*	Common jay	podu papilia		IND	LC
3	Papilionidae	*Graphium nomius*	Spot swordtail	Thith kaga-waligaya		IND	VU
4	Papilionidae	*Graphium sarpedon*	Blue bottle	Nil papilia		IND	LC
5	Papilionidae	*Pachliopta aristolochiae*	Common rose	Podu rosa papilia		IND	LC
6	Papilionidae	*Pachliopta hector*	Crimson rose	Maha rosa papilia		IND	LC
7	Papilionidae	*Papilio clytia*	Mime	Rawana papilia		IND	LC
8	Papilionidae	*Papilio crino*	Banded peacock	Monara papilia		IND	VU
9	Papilionidae	*Papilio demoleus*	Lime butterfly	Kaha papilia		IND	LC
10	Papilionidae	*Papilio polymnestor*	Blue mormon	Maha nilaya		IND	LC
11	Papilionidae	*Papilio polytes*	Common mormon	Kalu papilia		IND	LC
12	Papilionidae	*Troides darsius*	Common birdwing	Maha kurulu piya papiliya		END	LC
13	Pieridae	*Appias galane*	Lesser albatross	Kuda sudana		END	LC
14	Pieridae	*Catopsilia pomona*	Lemon emigrant	Kaha piyasariya		IND	LC
15	Pieridae	*Catopsilia pyranthe*	Mottled emigrant	Thith-piya piyasariya		IND	LC
16	Pieridae	*Colotis amata*	Small salmon arab	Punchi rosa sudana		IND	LC
17	Pieridae	*Delias eucharis*	Jezebel	Podu Maha-sudda		IND	LC
18	Pieridae	*Eurema blanda*	Three-spot grass yellow	Thun-thith kahakolaya		IND	LC
19	Pieridae	*Eurema hecabe*	Common grass yellow	Maha kahakolaya		IND	LC
20	Pieridae	*Hebomoia glaucippe*	Great orange tip	Yoda sudana		IND	LC
21	Pieridae	*Leptosia nina*	Psyche	Kalu-thith sudda		IND	LC
22	Pieridae	*Pareronia ceylanica*	Blue wanderer	Anduru nil piyasariya		IND	LC
23	Nymphalidae	*Acraea violae*	Tawny costor	Thambily panduru-boraluwa		IND	LC
24	Nymphalidae	*Charaxes psaphon*	Tawny rajah	Maha kumaraya		IND	NT
25	Nymphalidae	*Charaxes solon*	Black rajah	Kalu raja-kumaraya		IND	NT
26	Nymphalidae	*Danaus chrysippus*	Plain tiger	Podu koti-thambiliya		IND	LC
27	Nymphalidae	*Danaus genutia*	Common tiger	Iri Koti-thambiliya		IND	LC
28	Nymphalidae	*Dophla evelina*	Red spot duke	Rathu-thith Kumaraya		IND	LC
29	Nymphalidae	*Euploea core*	Common crow	Podu kaka-kotithiyaya		IND	LC

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30	Nymphalidae	*Hypolimnas bolina*	Great eggfly	Maha alankarikya		IND	LC
31	Nymphalidae	*Hypolimnas misippus*	Danaid Eggfly	Kela Alankarikya		IND	LC
32	Nymphalidae	*Ideopsis similis*	Blue glassy tiger	Maha nil-kotithiya		IND	VU
33	Nymphalidae	*Junonia almana*	Peacock pansy	Monera alankarikya		IND	LC
34	Nymphalidae	*Junonia atlites*	Grey pansy	Aluwan alankarikya		IND	LC
35	Nymphalidae	*Junonia iphita*	Chocolate soldier	Podu alankarikya		IND	LC
36	Nymphalidae	*Junonia lemonias*	Lemon pansy	Dumburuwan alankarikya		IND	LC
37	Nymphalidae	*Melanitis leda*	Common evening brown	Podu dumburuwa		IND	LC
38	Nymphalidae	*Melanitis phedima*	Dark evening brown	Anduru dumburuwa		IND	NT
39	Nymphalidae	*Mycalesis perseus*	Common bushbrown	Podu panduru-dumburuwa		IND	LC
40	Nymphalidae	*Neptis hylas*	Common sailor	Gomara selaruwa		IND	LC
41	Nymphalidae	*Neptis jumbah*	Chestnut-streaked sailor	Thambala-iri selaruwa		IND	LC
42	Nymphalidae	*Orsotriaena medus*	Medus Brown /Nigger	Maha-iri panduru-dumburuwa		IND	LC
43	Nymphalidae	*Parantica aglea*	Glassy tiger	Suduwan nil-kotithiya		IND	LC
44	Nymphalidae	*Phalantha phantha*	Leopard	Podu thith-thambiliya		IND	LC
45	Nymphalidae	*Tirumala limniace*	Blue tiger	Podu nil-kotithiya		IND	LC
46	Nymphalidae	*Ypthima ceylonica*	White four-ring	Podu heen-dumburuwa		IND	LC
47	Lycaenidae	*Caleta decidia*	Angled Pierrot	Gomara Mal-nilaya		IND	LC
48	Lycaenidae	*Castalius rosimon*	Common Pierrot	Podu Mal-nilaya		IND	LC
49	Lycaenidae	*Chilades lajus*	Lime Blue	Podu Panu-nilaya		IND	LC
50	Lycaenidae	*Chilades putli*	Grass Jewel	Ran Thruna-nilaya		IND	LC
51	Lycaenidae	*Curetis thetis*	Indian sunbeam	Maha hiru-nilaya		IND	LC
52	Lycaenidae	*Neopithicops zalmora*	Quaker	Maha thith Dumburu-nilaya		IND	LC
53	Lycaenidae	*Prosotas nora*	Common Lineblue	Podu Nil-iriya		IND	LC
54	Lycaenidae	*Zizina otis*	Lesser Grass Blue	Podu Thruna-nilaya		IND	LC
Dragonflies							
1	Euphaeidae	*Euphaea splendens*	Shining Gossamerwing			END	NT
2	Coenagrionidae	*Ceriagrion coromandelianum*	Yellow Waxtail			IND	LC
3	Coenagrionidae	*Pseudagrion microcephalum*	Blue Sprite			IND	LC
4	Platycnemididae	*Copera marginipes*	Yellow Featherleg			IND	LC
5	Protoneuridae	*Prodasineura sita*	Stripe-headed Threadtail			END	LC
6	Libellulidae	*Orthetrum sabina*	Green Skimmer			IND	LC

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7	Libellulidae	*Brachythemis contaminata*	Asian Groundling			IND	LC
8	Libellulidae	*Crocothemis servilia*	Oriental Scarlet			IND	LC
9	Libellulidae	*Diplacodes trivialis*	Blue Percher			IND	LC
10	Libellulidae	*Trithemis aurora*	Crimson Dropwing			IND	LC
11	Libellulidae	*Rhyothemis variegata*	Varigated Flutter			IND	LC
12	Libellulidae	*Pantala flavescens*	Wandering Glider			IND	LC
Land snails							
1	Ariophantidae	*Cryptozona bistrialis*				IND	LC
2	Camaenidae	*Beddomea tifasciatus*				END	VU
3	Cyclophoridae	*Theobaldius bairdi*				END	VU
4	Corbiculidae	*Polymesoda impressa*				IND	NE
5	Lymnaeidae	*Lymnaea pinguis*				IND	NE
6	Pilidae	Pila layardi				IND	NE
7	Planorbidae	*Indoplanorbis exustus*				IND	NE
8	Thiaridae	*Melanoides turberculata*				IND	NE
9	Thiaridae	*Thiara scabra*				IND	NE
10	Unionidae	*Lamellidens marginalis*				IND	NE
11	Unionidae	*Paludomus sp.*				END	NE
12	Vivaparidae	*Bellamya ceylonica*				END	NE
13	Amaenidae	*Beddomea sp.*				END	NE
14	Cyclophoridae	*Aulopoma sp.*				END	NE
15	Cyclophoridae	*Pterocyclus sp.*				END	NE
16	Cyclophoridae	*Theobaldius sp.*				END	NE
Fishes							
1	Heteropneustidae	*Heteropneustes fossilis*	Stinging catfish	Hunga		IND	LC
2	Gobiidae	*Awaous melanocephalus*	Scribbled goby	Bali Weligouva		IND	LC
3	Mastacembelidae	*Mastacembelus armetus*	Marbled spiny eel	Gan theliya / Oya theliya		IND	LC
Amphibians							
1	Bufonidae	*Duttaphrynus melanostictus*	Common house toad	Sulaba geai gemba		IND	LC

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2	Dicroglossidae	*Euphlyctis cyanophlyctis*	Skipper frog	Utpatana madiya		IND	LC
3	Dicroglossidae	*Euphlyctis hexadactylus*	Sixtoe green frog	SaEangili pala madiya		IND	LC
4	Dicroglossidae	*Zakerana shyadrensis*	Common paddy field frog	Sulaba vel madiya		IND	LC
5	Dicroglossidae	*Hoplobatrachus crassus*	Jerdon's bull frog	Jerdonge hala madiya		IND	LC
6	Rhacophoridae	*Polypedates maculatus*	Spotted tree frog	Pulli gas madiya		IND	LC
7	Ranidae	*Hylarana gracilis*	Sri Lanka wood frog	Lanka bandi madiya		END	LC
			Reptiles				
1	Crocodylidae	*Crocodilus porosus*	Mugger crocodile	Hala kimbula		IND	NT
2	Crocodylidae	*Crocodilus palustris*	Estuarine crocodile	Gata kimbula		IND	EN
3	Trionychidae	*Lissemys ceylonensis*	Flapshell turtle	Kiri ibba		END	LC
4	Agamidae	*Calotes calotes*	Green garden lizard	Pala katussa		IND	LC
5	Agamidae	*Calotes ceylonensis*	Painted lip lizard	Thola-visituru katussa		END	NT
6	Agamidae	*Calotes versicolor*	Common garden lizard	Gara katussa		IND	LC
7	Agamidae	*Otocryptis nigristigma*	Black spotted kangaroo lizard	Wiyali Pinum katussa		END	LC
8	Agamidae	*Otocryptis wiegmanni*	Sri Lankan kangaroo lizard	Pinum katussa		END	LC
9	Gekkonidae	*Hemidactylus frenatus*	Common house-gecko	Sulaba gehuna		IND	LC
10	Gekkonidae	*Hemidactylus brookii*	Spotted giant-gecko	Davanta tit huna		END	EN
11	Gekkonidae	*Hemidactylus lankae*	Termite hill gecko	Humbas huna		END	LC
12	Scincidae	*Eutropis carinata*	Common skink	Sulaba hikanala		IND	LC
13	Scincidae	*Lankascincus fallax*	Common lankaskink	Sulaba lakhiraluva		END	LC
14	Scincidae	*Nessia sarasinorum*	Sarasin's snakeskink	Sarasinge sarpahiraluva		END	VU
15	Varanidae	*Varanus bengalensis*	Land monitor	Talagoya		IND	LC
16	Varanidae	*Varanus salvator*	Water monitor	Kabaragoya		IND	LC
17	Pythonidae	*Python molurus*	Indian python	Pimbura		IND	LC
18	Colubridae	*Ahaetulla nasuta*	Green vine snake	Ahaetulla		IND	LC
19	Colubridae	*Boiga forsteni*	Forsten’s cat snake	Naga mapila		IND	NT
20	Colubridae	*Coeloganthus helena*	Trinket snake	Katakaluwa		IND	LC
21	Colubridae	*Dendrelaphis tristis*	front Spot bronze back	Handa haldanda		IND	LC
22	Colubridae	*Ptyas mucosa*	Rat snake	Gerandiya.		IND	LC
23	Natricidae	*Amphiesma stolatum*	Buff striped keelback	Aharukuka		IND	LC
24	Natricidae	*Xenochrophis cf. piscator*	Checkered Keelback	Diya bariya		END	LC
25	Elapidae	*Bungarus caeruleus*	The common krait	Thel karawala		IND	LC

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26	Elapidae	*Naja naja*	Indian cobra	Naya		IND	LC
27	Viperidae	*Daboia russelii*	Russell's viper	Tith polonga.		IND	LC
28	Viperidae	*Hypnale hypnale*	The Merrem's hump nose viper	Polon thelissa		IND	LC
Birds							
1	Phasianidae	*Galloperdix bicalcarata*	Sri Lanka Spurfowl	Sri Lanka Haban-kukula		END	NT
2	Phasianidae	*Gallus lafayetii*	Sri Lanka Junglefowl	Sri Lanka Wali-kukula		END	LC
3	Phasianidae	*Pavo cristatus*	Indian Peafowl	Monora		BrR	LC
4	Anatidae	*Dendrocygna javanica*	Lesser Whistling-duck	Heen Thamba-seruwa		BrR	LC
5	Anatidae	*Nettapus coromandelianus*	Cotton Pygmy-goose	Mal-seruwa		BrR	NT
6	Picidae	*Dendrocopus nanus*	Brown-capped Pygmy Woodpecker	Bora Esasi Gomara-karela		BrR	LC
7	Picidae	*Dinopium benghalense*	Lesser Goldenback			BrR	LC
8	Ramphastidae	*Megalaima zeylanica*	Brown-headed Barbet	Polos Kottoruwa		BrR	LC
9	Ramphastidae	*Megalaima flavifrons*	Sri Lanka Yellow-fronted Barbet	Sri Lanka Ranmhunatha Kottoruwa		END	LC
10	Ramphastidae	*Megalaima rubricapilla*	Crimson-fronted Barbet	Rathmhunath Kottoruwa		PRE	LC
11	Ramphastidae	*Megalaima haemacephala*	Coppersmith Barbet	Rathlaye Kottoruwa		BrR	LC
12	Bucerotidae	*Ocyceros gingalensis*	Sri Lanka Grey Hornbill	Sri Lanka Alu Kandaththa		END	LC
13	Bucerotidae	*Anthracoceros coronatus*	Malabar Pied Hornbill	Poru-Kandaththa		BrR	LC
14	Upupidae	*Upupa epops*	Common Hoopoe	Podu Poroluwa		BrR	LC
15	Coraciidae	*Coracias benghalensis*	Indian Roller	Dumbonna		BrR	LC
16	Alcedinidae	*Alcedo atthis*	Common Kingfisher	Mal Pilihuduwa		BrR	LC
17	Alcedinidae	*Halcyon smyrnensis*	White-throated Kingfisher	Layasudu Madi-pilihuduwa		BrR	LC
18	Alcedinidae	*Halcyon pileata*	Black-capped Kingfisher	Kalu Esasi Madi-pilihuduwa		WV	NE
19	Alcedinidae	*Ceryle rudis*	Pied Kingfisher	Gomara-pilihuduwa		BrR	LC
20	Meropidae	*Merops orientalis*	Green Bee-eater	Punchi Binguharaya		BrR	LC
21	Meropidae	*Merops philippinus*	Blue-tailed Bee-eater	Nilpenda Binguharaya		BrRWV	NE
22	Meropidae	*Merops leschenaulti*	Chestnut-headed Bee-eater	Thambala-hisa Binguharaya		BrR	LC
23	Cuculidae	*Clamator jacobinus*	Pied Cuckoo	Gomara Kondakoha		BrR	LC
24	Cuculidae	*Clamator coromandus*	Chestnut-winged Cuckoo	Thambala-piya Kondakoha		WV	NE
25	Cuculidae	*Cuculus micropterus*	Indian Cuckoo	Indu Kookilaya		SU	NE
26	Cuculidae	*Surniculus lugubris*	Drongo Cuckoo	Kawudukoha		BrR	NT
27	Cuculidae	*Eudynamys scolopacea*	Asian Koel	Kowula		BrR	LC

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28	Cuculidae	*Phaenicophaeus viridirostris*	Blue-faced Malkoha	Wathanil Malkoha		BrR	LC
29	Cuculidae	*Centropus sinensis*	Greater Coucal	Ati-kukula		BrR	LC
30	Psittacidae	*Loriculus beryllinus*	Sri Lanka Hanging Parakeet	Sri Lanka Giramaliththa		END	LC
31	Psittacidae	*Psittacula eupatria*	Alexandrine Parakeet	Labu Girawa		BrR	LC
32	Psittacidae	*Psittacula krameri*	Rose-ringed Parakeet	Rana Girawa		BrR	LC
33	Psittacidae	*Psittacula cyanocephala*	Plum-headed Parakeet	Pandu Girawa		BrR	NT
34	Apodidae	*Cypsiurus balasiensis*	Asian Palm Swift	Asiaa Thal-thurithaya		BrR	LC
35	Apodidae	*Apus affinis*	House Swift	Punchi Thurithaya		BrR	LC
36	Strigidae	*Ketupa zeylonensis*	Brown Fish Owl	Bora Kewul-bakamoona		BrR	LC
37	Caprimulgidae	*Caprimulgus asiaticus*	Common Nightjar	Indu Bimbassa		BrR	LC
38	Columbidae	*Columba livia*	Rock Pigeon	Podu Paraviya		BrR	CR
39	Columbidae	*Streptopelia chinensis*	Spotted Dove	Alu Kobeiyya		BrR	LC
40	Columbidae	*Chalcophaps indica*	Emerald Dove	Neela-Kobeiyya		BrR	LC
41	Columbidae	*Treron bicincta*	Orange-breasted Green-pigeon	Laya-ran Batagoya		BrR	LC
42	Columbidae	*Treron pompadora*	Pompadour Green-pigeon	Pompadoru Batagoya		PRE	LC
43	Columbidae	*Ducula aenea*	Green Imperial Pigeon	Neela Mahagoya		BrR	LC
44	Rallidae	*Amaurornis phoenicurus*	White-breasted Waterhen	Laya-sudu Korawakka		BrR	LC
45	Rallidae	*Porphyrio porphyrio*	Purple Swamphen	Dam Medi-kithala		BrR	LC
46	Rallidae	*Gallinula chloropus*	Common Moorhen	Podu Gallinuwa		BrR	LC
47	Scolopacidae	*Gallinago gallinago*	Common Snipe	Podu Kaswatuwa		WV	NE
48	Scolopacidae	*Tringa stagnatilis*	Marsh Sandpiper	Waguru Silibilla		WV	NE
49	Scolopacidae	*Actitis hypoleucos*	Common Sandpiper	Podu Siliththa		WV	NE
50	Jacanidae	*Hydrophasianus chirurgus*	Pheasant-tailed Jacana	Savul-penda Diyasaana		BrR	LC
51	Burhinidae	*Burhinus oedicnemus*	Eurasian Thick-knee	Golu-kiraluwa		BrR	LC
52	Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt	Kalupiya Ipalpawa		BrR	LC
53	Charadriidae	*Vanellus indicus*	Red-wattled Lapwing	Rath-yatimal Kirella		BrR	LC
54	Laridae	*Chlidonias hybrida*	Whiskered Tern	Alupiya Kangul-lihiniya		WV	NE
55	Accipitridae	*Elanus caeruleus*	Black-wing Kite	Kaluuris Pathannkussa		BrR	NT
56	Accipitridae	*Haliastur indus*	Brahminy Kite	Bamunu Piyakussa		BrR	LC
57	Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea-eagle	Kusa-ali Muhudukussa		BrR	LC
58	Accipitridae	*Ichthyophaga ichthyaetus*	Grey-headed Fish-eagle	Alu-his Masukussa		BrR	NT
59	Accipitridae	*Spilornis cheela*	Crested Serpent Eagle	Silu Sarapakussa		BrR	LC
60	Accipitridae	*Accipiter badius*	Shikra	Kurulugoya		BrR	LC

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61	Accipitridae	*Ictinaetus malayensis*	Black Eagle	Kalukussa		BrR	NT
62	Accipitridae	*Spizaetus cirrhatus*	Changeable Hawk Eagle	Perali Kondakussa		BrR	LC
63	Podicipedidae	*Tachybaptus ruficollis*	Little Grebe	Punchi Gembithuruwa		BrR	LC
64	Anhingidae	*Anhinga melanogaster*	Oriental Darter	Abikava		BrR	LC
65	Phalacrocoracidae	*Phalacrocorax niger*	Little Cormorant	Punchi Diyakava		BrR	LC
66	Phalacrocoracidae	*Phalacrocorax fuscicollis*	Indian Cormorant	Indu Diyakava		BrR	LC
67	Ardeidae	*Egretta garzetta*	Little Egret	Punchi Anu-koka		BrR	LC
68	Ardeidae	*Ardea cinerea*	Grey Heron	Alu Koka		BrR	LC
69	Ardeidae	*Ardea purpurea*	Purple Heron	Karawal Koka		BrR	LC
70	Ardeidae	*Casmerodius albus*	Great Egret	Sudu maha-koka		BrR	LC
71	Ardeidae	*Mesophoyx intermedia*	Intermediate Egret	Sudu Madi-koka		BrR	LC
72	Ardeidae	*Bubulcus ibis*	Cattle Egret	Geri-koka		BrR	LC
73	Ardeidae	*Ardeola grayii*	Indian Pond Heron	Kana-koka		BrR	LC
74	Ardeidae	*Ixobrychus sinensis*	Yellow Bittern	Kaha Mati-koka		BrR	NT
75	Ardeidae	*Ixobrychus flavicollis*	Black Bittern	Kalu Mati-koka		BrR	LC
76	Threskiornithidae	*Threskiornis melanocephalus*	Black-headed Ibis	Hisakalu Dakaththa		BrR	LC
77	Pelecanidae	*Pelecanus philippensis*	Spot-billed Pelican	Thithhota Pasthuduwa		BrR	LC
78	Ciconiidae	*Anastomus oscitans*	Asian Openbill	Vivarathuduwa		BrR	LC
79	Ciconiidae	*Ciconia episcopus*	Woolly-necked Stork	Padili Manawa		BrR	NT
80	Pittidae	*Pitta brachyura*	Indian Pitta	Avichchiya		WV	NE
81	Chloropseidae	*Chloropsis cochinchinensis*	Blue-winged Leafbird	Nilpiya Kolarisiya		BrR	LC
82	Laniidae	*Lanius cristatus*	Brown Shrike	Bora Sabariththa		WV	NE
83	Artamidae	*Artamus fuscus*	Ashy Woodswallow	Alu Wanalihiniya		BrR	LC
84	Oriolidae	*Oriolus xanthornus*	Black-hooded Oriole	Kahakurulla		BrR	LC
85	Dicruidae	*Dicrurus caerulescens*	White-bellied Drongo	Kawuda		BrR	LC
86	Rhipiduridae	*Rhipidura aureola*	White-browed Fantail	Bama-sudu Pawanpenda		BrR	LC
87	Monarchidae	*Hypothymis azurea*	Black-naped Monarch	Kalu-gelasi Radamara		BrR	LC
88	Monarchidae	*Terpsiphone paradisi*	Asian Paradise- flycathcher	Asia Rahanmara		BrR/WV	LC
89	Corvidae	*Corvus splendens*	House Crow	Kolamba Kaputa		BrR	LC
90	Corvidae	*Corvus levaillantii*	Large-billed Crow	Kalu Kaputa		BrR	LC
91	Campephagidae	*Coracina melanoptera*	Black-headed Cuckooshrike	Kalu-his Kovul-saratiththa		BrR	LC
92	Campephagidae	*Pericrocotus cinnamomeus*	Small Minivet	Punchi Miniviththa		BrR	LC
93	Campephagidae	*Pericrocotus flammeus*	Scarlet Minivet	Dilirath Miniviththa		BrR	LC

No	Family	Scientific Name	English Name	Sinhala Name	Tamil Name	SpS	CoS
94	Campephagidae	*Coracina macei*	Large Cuckooshrike	Maha Kovul-saratiththa		BrR	LC
95	Campephagidae	*Tephrodornis pondicerianus*	Common Woodshrike	Podu Wana-saratiththa		PRE	LC
96	Campephagidae	*Hemipus picatus*	Bar-winged Flycatcher-shrike	Wairapiya Masi-saratiththa		BrR	LC
97	Aegithinidae	*Aegithina tiphia*	Common Iora	Podu Iorawa		BrR	LC
98	Muscicapidae	*Muscicapa daurica*	Asian Brown Flycatcher	Asia Bora Masimara		WV	NE
99	Muscicapidae	*Cyornis tickelliae*	Tickell's Blue Flycatcher	Tickel Nil-masimara		BrR	LC
100	Muscicapidae	*Copsychus saularis*	Oriental Magpie Robin	Polkichcha		BrR	LC
101	Muscicapidae	*Copsychus malabaricus*	White-rumped Shama	Wana Polkichcha		BrR	LC
102	Muscicapidae	*Saxicoloides fulicata*	Indian Robin	Indu Kalukichcha		BrR	LC
103	Sturnidae	*Acridotheres tristis*	Common Myna	Mayna		BrB	LC
104	Hirundinidae	*Hirundo rustica*	Barn Swallow	Atu Wahilihiniya		WV	NE
105	Hirundinidae	*Hirundo daurica*	Red-rumped Swallow	Nithamba rathu Wahilihiniya		PRE	LC
106	Pycnonotidae	*Pycnonotus melanicterus*	Black-crested Bulbul	Kalu Hisasi Kondaya		PRE	LC
107	Pycnonotidae	*Pycnonotus cafer*	Red-vented Bulbul	Kondaya		BrR	LC
108	Pycnonotidae	*Pycnonotus luteolus*	White-browed Bulbul	Bamasudu Kondaya		BrR	LC
109	Cisticolidae	*Cisticola juncidis*	Zitting Cisticola	Iri Pawansariya		BrR	LC
110	Cisticolidae	*Prinia hodgsonii*	Grey-breasted Prinia	Grey-breasted Prinia		BrR	LC
111	Cisticolidae	*Prinia socialis*	Ashy Prinia	Alu Priniya		BrR	LC
112	Cisticolidae	*Prinia inornata*	Plain Prinia	Sarala Priniya		BrR	LC
113	Zosteropidae	*Zosterops palpebrosus*	Oriental White-eye	Peradigu Sithasiya		BrR	LC
114	Sylviidae	*Acrocephalus dumetorum*	Blyth's Reed Warbler	Blyths Panraviya		WV	NE
115	Sylviidae	*Orthotomus sutorius*	Common Tailorbird	Battichcha		BrR	LC
116	Sylviidae	*Phylloscopus trochiloides*	Greenish Warbler	Kola Gassraviya		WV	NE
117	Timalidae	*Pellorneum fuscocapillum*	Sri Lanka Brown-capped Babbler	Sri Lanka Boraga-demalichcha		END	LC
118	Timalidae	*Dumetia hyperythra*	Tawny-bellied Babbler	Kusakaha Landu-demalichcha		BrR	LC
119	Timalidae	*Rhopocichla atriceps*	Dark-fronted Babbler	Wathanduru Panduru-demalichcha		BrR	LC
120	Timalidae	*Chrysomma sinense*	Yellow-eyed Babbler	Nethkaha Thana-demalichcha		BrR	LC
121	Timalidae	*Turdoides affinis*	Yellow-billed Babbler	Demalichcha		BrR	LC
122	Alaudidae	*Mirafra affinis*	Rufous-winged Bushlark	Rathpiya Akul-thulikawa		BrR	LC
123	Dicaeidae	*Dicaeum erythrorhynchos*	Pale-billed Flowerpecker	Lathudu Pililichcha		BrR	LC
124	Nectariniidae	*Nectarina zeylonica*	Purple-rumped Sunbird	Nithamba Dam Sutikka		BrR	LC
125	Nectariniidae	*Nectarina asiatica*	Purple Sunbird	Dam Sutikka		BrR	LC

No	Family	Scientific Name	English Name	Sinhala Name	Tamil Name	SpS	CoS
126	Nectariniidae	*Nectarina lotenia*	Loten's Sunbird	Lotenge Sutikka		BrR	LC
127	Motacillidae	*Dendronanthus indicus*	Forest Wagtail	Wana-halapenda		WV	NE
128	Motacillidae	*Motacilla cinerea*	Grey Wagtail	Alu Halapenda		WV	NE
129	Motacillidae	*Anthus rufulus*	Paddyfield Pipit	Keth Varatichcha		BrR	LC
130	Ploceidae	*Ploceus philippinus*	Baya Weaver	Ruk Wadukurulla		BrR	LC
131	Estrididae	*Lonchura striata*	White-rumped Munia	Nithamba Sudu Weekurulla		BrR	LC
132	Estrididae	*Lonchura punctulata*	Scaly-breasted Munia	Laya Kayuru Weekurulla		BrR	LC
133	Estrididae	*Lonchura malacca*	Black-headed Munia	Hisakalu Weekurulla		BrR	LC
Mammals							
1	Manidae	*Manis crassicaudata*	Pangolin	Kaballewa		IND	NT
2	Hipposideridae	*Hipposideros galeritus*	Dekhan leaf-nosed bat	Kesdiga Pathnehe-vavula		IND	VU
3	Megadermatidae	*Megaderma spasma*	Long-eared vampire bat	Kandiga Boru Ley-vavula		IND	VU
4	Pteropodidae	*Cynopterus sphinx*	Short-nosed fruit bat	Thala-vavula		IND	LC
5	Pteropodidae	*Pteropus giganteus*	Flying fox	Ma-vavula		IND	LC
6	Vespertillionidae	*Kerivoula picta*	Painted bat	Visithuru Kehel-vavula		IND	NT
7	Vespertillionidae	*Pipistrellus coromandra*	Indian pipistrel	Indu Koseta-vavula		IND	VU
8	Vespertillionidae	*Pipistrellus tenuis*	Pigmy pipistrel	Heen Koseta-vavula		IND	LC
9	Cercopithecidae	*Macaca sinica*	Sri Lanka toque monkey	Sri Lanka Rilawa		END	LC
10	Cercopithecidae	*Semnopithecus priam*	Grey langur	Eli-wdura		IND	LC
11	Cercopithecidae	*Semnopithecus vetulus*	Purple-faced leaf monkey	Sri Lanka Kalu-wandura		END	EN
12	Lorisidae	*Loris lydekkerianus*	Grey slender loris	Alu Unahapuluwa		IND	NT
13	Canidae	*Canis aureus*	Jackal	Nariya / Hiwala		IND	LC
14	Felidae	*Felis chaus*	Jungle cat	Wal Balala		IND	NT
15	Felidae	*Panthera pardus*	Leopard	Kotiya/ Diviya		IND	EN
16	Felidae	*Prionailurus rubiginosus*	Rusty-spotted cat	Kola Diviya / Balal Diviya		IND	EN
17	Felidae	*Prionailurus viverrinus*	Fishing cat	Handun Diviya		IND	EN
18	Herpestidae	*Herpestes fuscus*	Brown mongoose	Bora Mugatiya		IND	LC
19	Herpestidae	*Herpestes edwardsii*	Grey mongoose	Alu Mugatiya		IND	LC
20	Herpestidae	*Herpestes smithii*	Black-tipped or Ruddy mongoose	Rath Mugatiya / Hothambuwa		IND	LC
21	Mustelidae	*Lutra lutra*	Otter	Diya-balla		IND	VU
22	Ursidae	*Melursus ursinus*	Sloth bear	Walaha		IND	EN

No	Family	Scientific Name	English Name	Sinhala Name	Tamil Name	SpS	CoS
23	Viverridae	*Paradoxurus hermaphoditus*	Palm civet	Uguduwa		IND	LC
24	Viverridae	*Viverricula indica*	Ring-tailed civet	Urulewa		IND	LC
25	Elephantidae	*Elephas maximus*	Elephant	Etha / Aliya		IND	EN
26	Bovidae	*Bubalus bubalis*	Domestic water buffalo	Mee Haraka		DOM	NE
27	Bovidae	*Bos indicus*	Domestic hump-backed cattle	Sinhala Elaharaka/ Batu Haraka		DOM	NE
28	Cervidae	*Axis axis*	Spotted deer	Tith Muwa		IND	LC
29	Cervidae	*Rusa unicolor*	Sambur	Gõna		IND	NT
30	Cervidae	*Muntiacus muntjak*	Barking deer	Olu Muwa / Weli Muwa		IND	NT
31	Suidae	*Sus scrofa*	Wild boar	Wal Ura		IND	LC
32	Suidae	*Sus domesticus*	Domestic pig	Gam Ura		DOM	NE
33	Tragulidae	*Moschiola meminna*	Sri Lanka mouse-deer	Sri Lanka Meminna		END	LC
34	Hystricidae	*Hystrix indica*	Porcupine	Ittewa		IND	LC
35	Muridae	*Bandicota indica*	Malabar bandicoot	Uru-miya		IND	LC
36	Muridae	*Vandeleuria oleracea*	Long-tailed tree mouse	Gas-miya		IND	VU
37	Muridae	*Tatera indica*	Antelope rat	Weli-miya		IND	LC
38	Sciuridae	*Funambulus palmarum*	Palm squirrel	Leena		IND	LC
39	Sciuridae	*Ratufa macroura*	Giant squirrel	Dandu-leena		IND	LC
40	Leporidae	*Lepus nigricollis*	Black-naped hare	Wal Hawa		IND	LC

Annex IV. Methodologies that will be Used for Rapid Biodiversity Assessments

The rapid biodiversity assessment will include surveys on flora and fauna of the proposed NWPC area and covers both terrestrial and aquatic habitats. Endemic and threatened species[1] will be listed in accordance with the National Red List 2012 of Sri Lanka (MoE, 2012) and IUCN global List of Threatened Species (IUCN, 2013), and any invasive species recorded from the project area will be identified based on the latest National List of Alien Invasive Fauna and Flora.

Flora survey

Species and population parameters for higher plants in diverse vegetation types found in the project area will be studied using standard scientific techniques, with appropriate modifications to suit field conditions. The floral survey will focus on documenting the plant species in both aquatic and terrestrial habitats within the project area. The natural vegetation types observed during the reconnaissance survey within a site will be surveyed using the visual encounter survey approach, under two major categories - forests (tree dominated vegetation types/riparian habitats), and non-forest vegetation (shrub lands, grasslands, aquatic vegetation, vegetation dominated by shrubs and herbaceous life forms). Vegetation will be sampled using a 5 x 50 m belt sampling technique, as recommended by Sutherland (1996). In addition, occurrence records will be made through random encounter surveys.

Floral species will be identified and classified using the latest published guides and keys available in Sri Lanka. In addition, the specimens deposited in the National Herbarium will be referred to for the purpose of species authentication.

A list of key references that will be used for plant species identification is presented in the table below.

Table 1. Key references used in the floral survey

Subject	Source
Invasive species	MoE (2015)
Taxonomic identification	Ashton *et al.* 1997; Dassanayake and Fosberg (1980 - 1991); Dassanayake *et al.* (1994-1995); Dassanayake and Clayton (1996 -1999), Senaratne, 2001; Vlas and Vlas, 2008 & 2013.
Plant classification and conservation status	MoE, (2012).

Faunal survey

The same belt transect (5 x 50 m) used for the floral survey will be used to sample the fauna. All groups of vertebrates (freshwater fish, amphibians, reptiles, birds and mammals) and selected invertebrate taxa as surrogate taxa[2] encountered at the site will be identified, and documented. All efforts will be made to document the animals in a non-destructive manner. Details of the specific techniques that will be used to sample different faunal taxa are presented in the table below.

[1] The term 'threatened species' refers to species that are classified as Critically Endangered (CR), Endangered (EN) or Vulnerable (VU) in the Global or National list of threatened species.

[2] Surrogate taxa are used as a mean of representing other taxa for which data are sparse or absent.

Table 2. Faunal sampling techniques

Subject	Taxon	Source
Taxonomic identification	Centipedes	Pocock (1900)
	Scorpions	Kovařík et al., (2016)
	Freshwater crabs	Bahir and Yeo (2005)
	Land snails	Raheem and Naggs, (2006)
	Dragonflies	Bedjanic *et al.* 2007; Bedjanic *et al.* (2014).
	Butterflies	D' Abrera, 1998; Jayasinghe *et al.,* 2013. van der Poorten, & van der Poorten, (2016)
	Freshwater fish	Goonatilake (2007)
	Amphibians	Manamendra-arachchi and Pethiyagoda (2006)
	Reptiles	Somaweera, 2006; Somaweera and Somaweera, 2009
	Birds	Harrison, 1999; **Warakagoda, et al., (2012)**
	Mammals	Phillips, (1935); Kotagama and Goonatilake, (2013).
	Invasive Fauna	Marambe, *et al*. (2011)
Nomenclature	All	MoE, (2012).
Conservation status	All	MoE, (2012).

Faunal species will be identified and classified using the latest published guides and keys available in Sri Lanka. In addition, the specimens deposited in the National Museum will be referred if there is need of further species authentication.

A list of key references that will be used in the faunal survey is presented in the table below.

Table 3. Key references used in the faunal survey

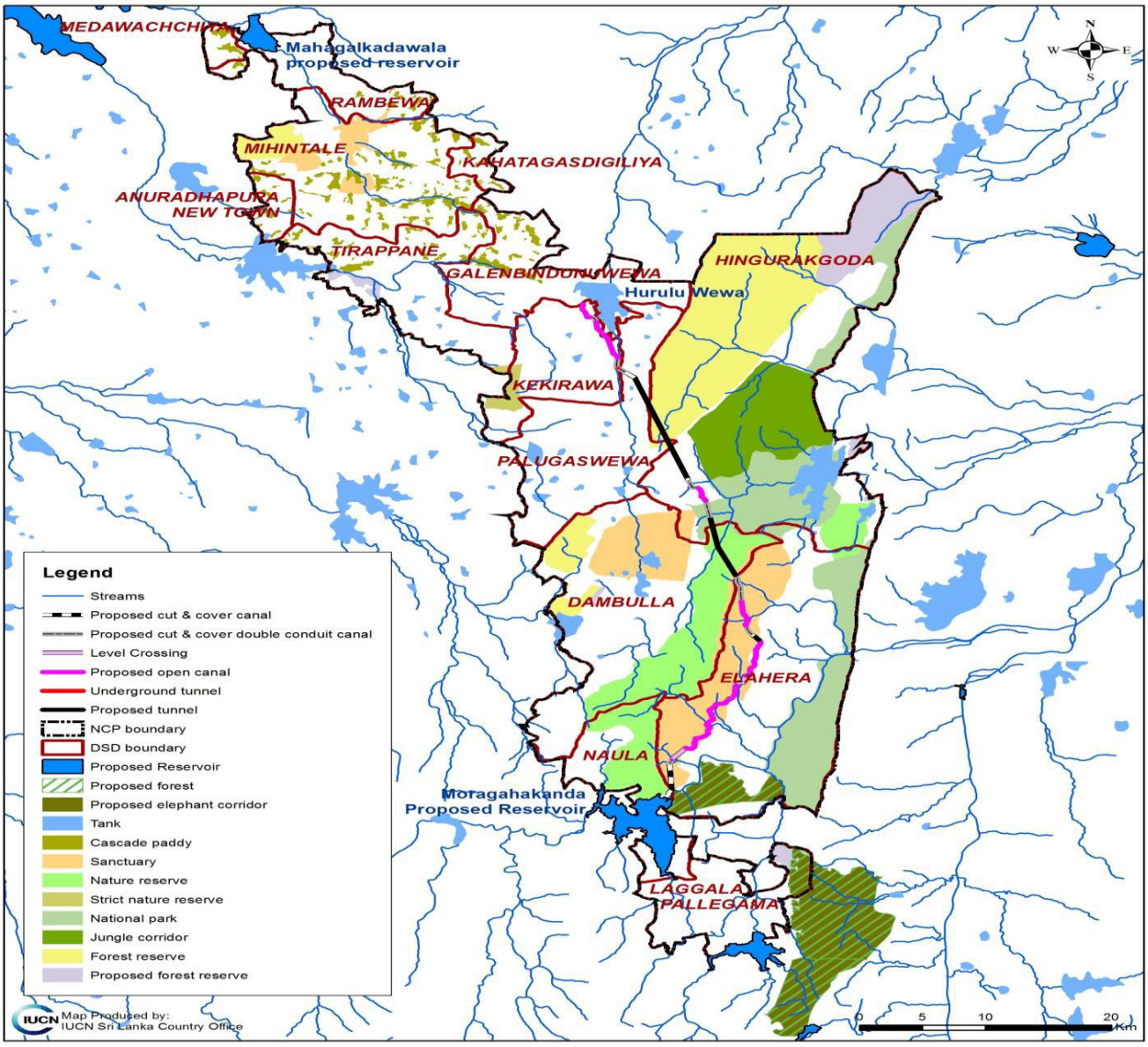
Subject	Taxon	Source
Taxonomic identification	Centipedes	Pocock (1900)
	Scorpions	Pocock (1900), Tikader, and Bastawade, (1983)
	Freshwater crabs	Bahir and Yeo (2005)
	Land snails	Naggs and Raheem (2000)
	Dragonflies	Bedjanic *et al.* (2007)
	Butterflies	D' Abrera (1998); van der Poorten and. van der Poorten (2016).
	Freshwater fish	Goonatilake (2007)
	Amphibians	Manamendra-arachchi and Pethiyagoda (2006)

Subject	Taxon	Source
	Reptiles	Somaweera (2006); Somaweera and Somaweera (2009)
	Birds	Harrison (1999); Kotagama and Ratnavira (2010)
	Mammals	Phillips (1935); Kotagama & Goonatilake (2013)
	Invasive Fauna	Marambe, *et al*. (2011)
Nomenclature	All	MoE (2012)
Conservation status	All	MoE (2012); IUCN (2016)

Preparation of Human Elephant Conflict Management Plan for Upper Elehera Canal Project (UECP)

MMDE / MWSIP/ ADB/ NWPCP/ 3267-3268- SRI / Consult / HECM / NCB / 2016 / 004

Inception Report



Consultancy undertaken for the Mahaweli Water Security Investment Project, Ministry of Mahaweli Development and Environment

September, 2016

IUCN, International Union for Conservation of Nature, Sri Lanka Country Office

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List of Acronyms

CEA	Central Environmental Authority
DAD	Department of Agrarian Development
DSD	Divisional Secretariat Divisions
DWC	Department of Wildlife Conservation
ECA	Elephant Conservation Areas
EIA	Environmental Impact Assessment
FD	Forest Department
GND	*Grama niladari* divisions
HEC	Human-elephant Conflict
HECMP	Human-Elephant Conflict Management Plan
ID	Irrigation Department
IUCN	IUCN, International Union for Conservation of Nature
MASL	Mahaweli Authority of Sri Lanka
MCM	Million cubic metres
MER	Managed Elephant Ranges
MMD&E	Ministry of Mahaweli Development and Environment
PA	protected areas
UECP	Upper Elahera Canal Project

1. Introduction and Background

1.1 Introduction

This document reports on the work carried out during the Inception Phase of the preparation of Human-Elephant conflict management plan for the Upper Elahera Canal (UEC) Project and provides the plan for the execution phase. The Inception Phase commenced on 2nd August 2016, upon the award of the project and included initial discussions with the Project management Unit to define the scope of the project, as well as deliverables. Also, during the inception phase, all the available literature, reports etc., have been collected and reviewed to document, *inter alia*, already available information on the project, its predicted impacts, proposed mitigation measures, terms and conditions laid down by project approving agency. During the inception phase, several internal meetings were held in order to define the detailed methodological approach that will be taken to develop the Human-Elephant conflict management plan, which is presented in Chapter 2 of this document. Based on the agreed methodological approach, the detailed work plan for completing the project was developed and presented in Annex 1.

1.2 General project description

The Upper Elahera Canal Project (UECP) involves a trans-basin diversion of water from the Mahaweli River to the North Central and Northern Provinces.

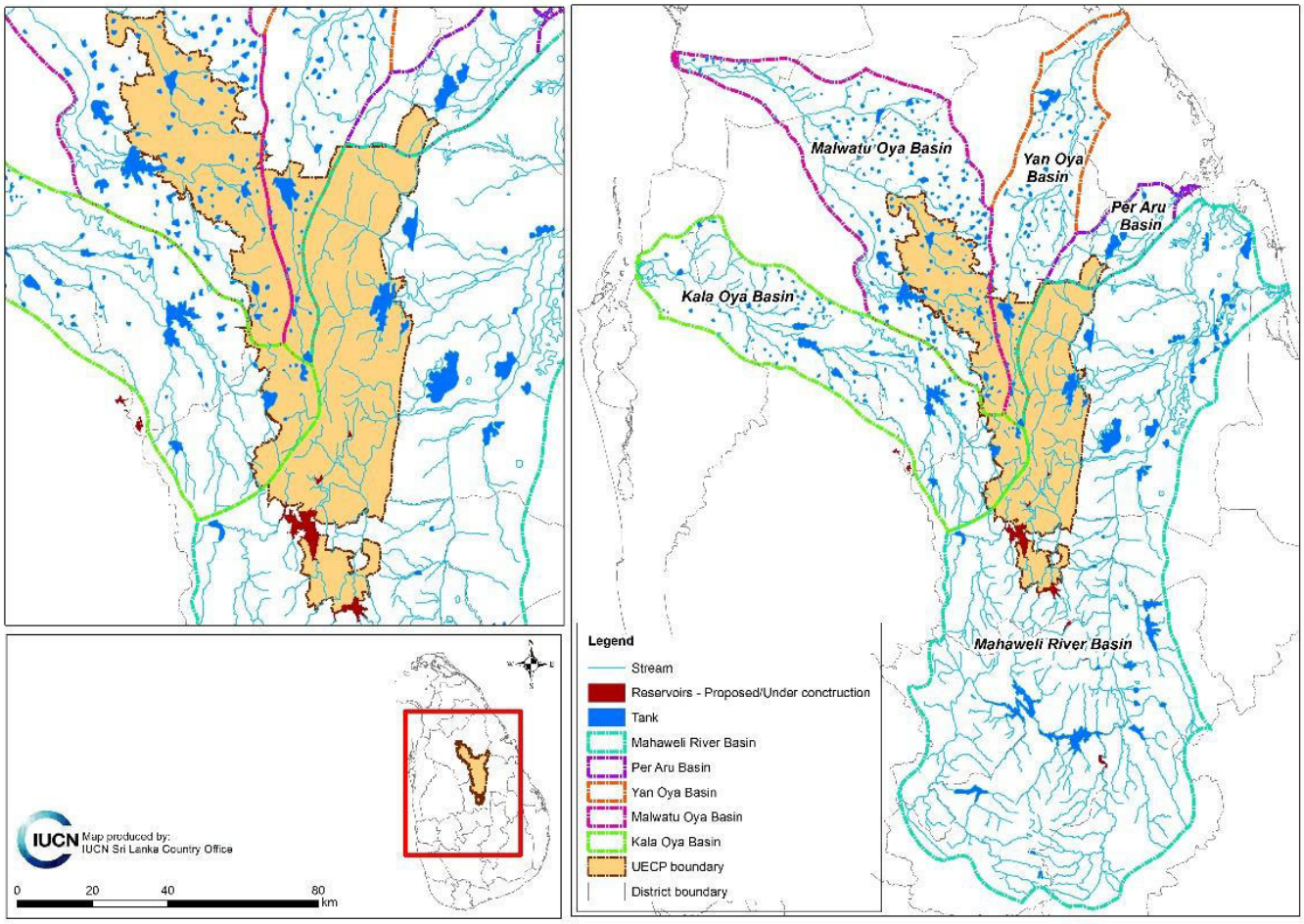


Figure 1. Location of the UEC Project

Water will be transferred from the Kalu Ganga reservoir to Moragahakanda, by the Kalu Ganga Moragahakanda Transfer Canal (KMTC). The Upper Elahera Canal (UEC) will then transfer water from Moragahakanda to Mahakanadarawa, via Mannankattiya Reservoir and Eru Wewa. It also will discharge water to Hurulu Wewa.

This project includes:

- Construction of a transfer tunnel/canal from Kaluganga reservoir to Moragahakanda Reservoir - the Kalu Ganga Moragahakanda Transfer Canal (KMTC) (containing both tunnel and canal sections: 9.2 km);
- Construction of the Upper Elehera Canal (UEC) from Moragahakanda reservoir to Yakalla (65.5 km);
- From Yakalla water will be diverted to Mannankattiya, Eru Wewa and Mahakandarawa through existing canals, natural streams and new constructions (30 km).
- Approximately 975 MCM of water (with the NCP canal component) will be conveyed along these canals.

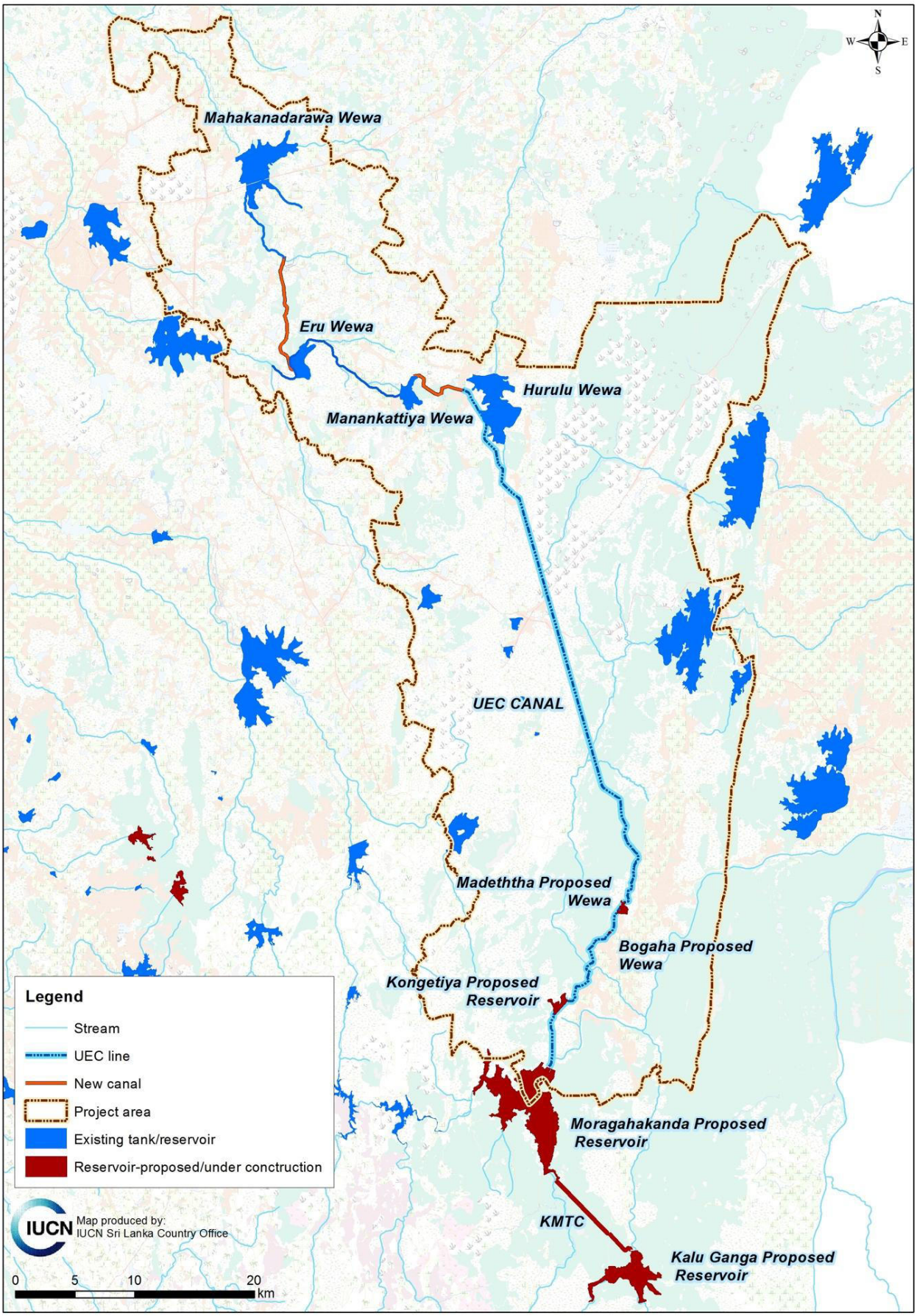


Figure 2. Detail of Upper Elahera Canal Project
(Source: Perera, 2016)

Table 1. Upper Elahera Canal (UEC) Project specifications
(Source: Perera, 2016)

Conveyance system	95.5 km canal system (Dec 2016 – Dec 2021) • Kalu Ganga Moragahakanda Transfer Canal (KMTC) (9.2 km) (constructed under the Moragahakanda - Kalu Ganga project) • Upper Elahera Canal (UEC) (65.5 km) • Construction of canals from Mannakkattiya to Eru Wewa to Mahakanadarawa Irrigation System (30 km)
Total irrigable land	10,000 ha
Total number of families that will benefit	25,000
Total cost of project	Rupees 56 billion (433 million USD)

The main objective of the project is to

- Provide increased water supplies to about 10,000 ha of land in water-deficit areas in the North Central Province of Sri Lanka. The water diverted will be used to augment three tanks in the upper Malwathu Oya basin and one in the Yan Oya basin. This augmentation will increase the cropping intensity of approximately 10,000 ha of land from the current level of 1.2 to 1.8 once the project is completed in 2021. The targeted cultivation areas are the command areas of:
    - Mannakkattiya Reservoir (Malwathu Oya basin);
    - Eru Wewa (Malwathu Oya basin);
    - Mahakanadarawa Reservoir (Malwathu Oya basin); and
    - Hurulu Wewa (Yan Oya basin).

1.3 Environmental impacts of the NCP UEC project

Whilst the above activities will enhance the water availability for agriculture, thereby increasing agricultural production, as well as improving the socio-economic status of communities, the project will also have significant short and long-term environmental impacts, especially on the wildlife that inhabits the project affected area.

During the formulation of the EIA, several changes were made to minimise impacts on the environment, such as (i) decreasing the length of the UEC within protected areas and where ever the terrain was steep (ii) changing the design from open canals to buried tunnels within protected areas and iii) changing from drilling and blasting to use of a tunnel boring machine for tunnel excavation, which has less negative environmental impacts than blasting.

However, both the KMTC and the UEC will pass through protected areas under the jurisdiction of both the Forest Department (FD) and the Department of Wildlife Conservation (DWC) and therefore, will have a substantial influence on the wildlife in the area. Sixty-eight percent of the UEC canal passes through protected areas. These are Elahera-Giritale Sanctuary, Minneriya Giritale Nature Reserve, Minneriya National Park (under the jurisdiction of the Department of Wildlife Conservation) and Hurulu Forest Reserve (under the jurisdiction of the Forest Department). Of these, the Elahera-Giritale Sanctuary will be most affected, as 40% of the canal trace passes through this sanctuary as an open canal or cut and cover sections. Here 120 ha of natural habitat will be lost (1% of the entire

sanctuary). However, Minneriya National Park and Hurulu Forest Reserve are the least affected as in these areas the trace is an underground tunnel.

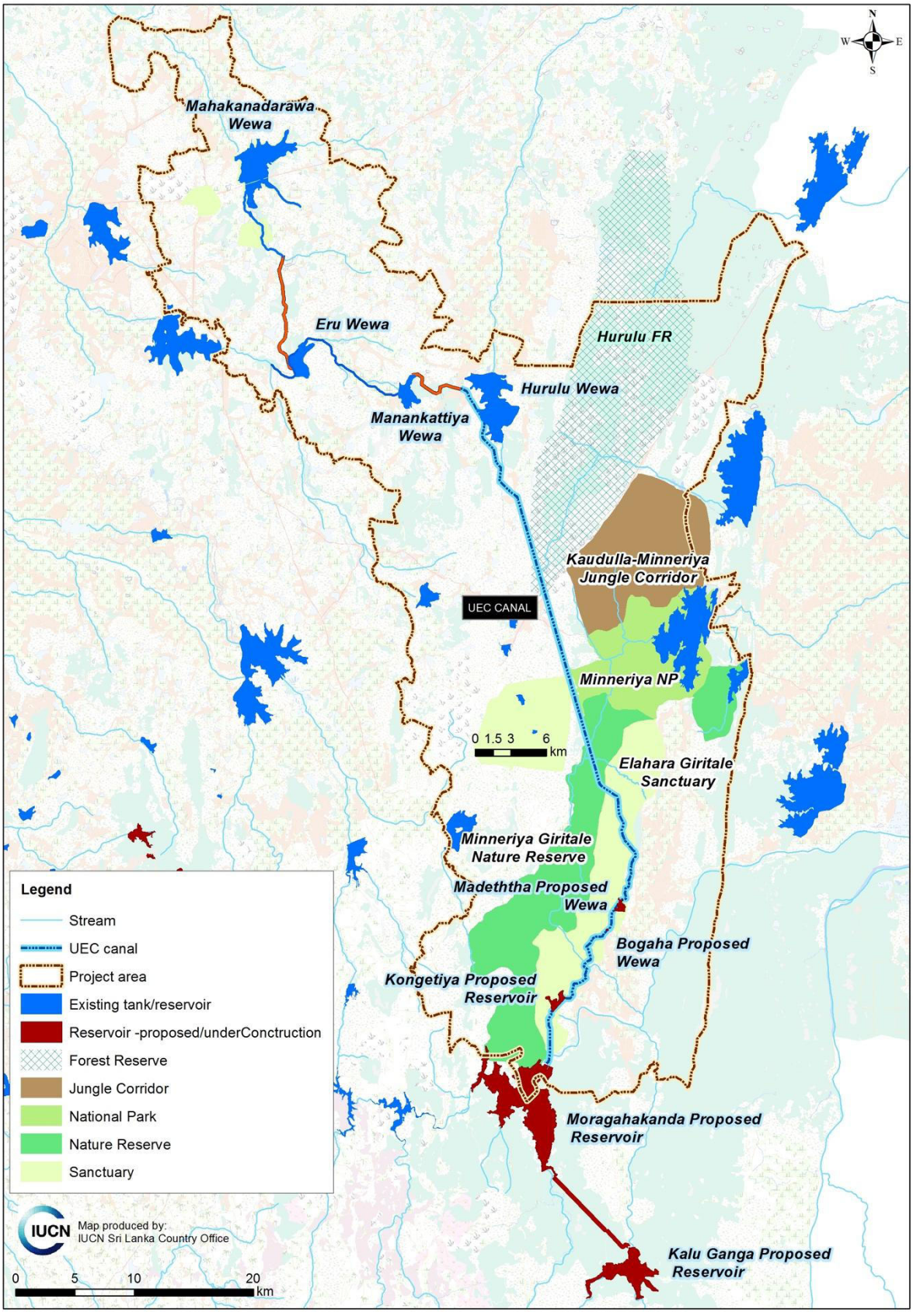


Figure 3.Protected areas found in the UEC trace area

Based on the findings of the EIA study conducted for the NCP canal project three major impacts on wildlife have been identified. These include:

Loss of habitat

The construction of the two major canals and associated structures will result in an estimated 190 ha of habitat loss in the Elahera-Giritale Sanctuary; as well as 15 ha in Minneriya National Park.

Habitat fragmentation and loss of critical species

The project will result in the establishment of the KMTC and the UEC with estimated lengths of 9.2 km and 65.5 km respectively. Establishment of these canals will have two main impacts on the wildlife that is found in the habitats traversed by the open canal sections. Firstly, it will impair the free movement of terrestrial species, as the canal will function as a direct physical barrier. Secondly, animals attempting to cross the canal may fall into the canal, resulting in injury or death to such animals. The establishment of the canal other than the tunnel sections will also result in removal of vegetation present along the canal trace. These areas may be inhabited by critical species (rare, endemic or threatened species), which are incapable of moving out of these areas without human assistance and therefore, will perish resulting in local or total extirpation of such species.

Escalation of Human-elephant Conflict

The area that will receive water under the project can be classified as a medium Human-elephant Conflict (HEC) area, especially the command areas of the Hurulu Wewa, Manakkatiya Wewa and Eru Wewa that will receive increased irrigation water under the project and the settlements and cultivations located near the Elahera-Giritale Sanctuary. The UEC project, which will enhance irrigation water availability in for the Hurulu wewa, Eru Wewa and Manakkatiya Wewa, will result in a change in the cropping intensity in the command areas of these tanks and therefore will lead to an escalation of the human-elephant conflict, which, in turn, will result in the reduction of the project benefits.

Therefore, one of the conditions imposed by the project approving agency — the Central Environmental Authority (CEA) — during project approval is to prepare and implement a Human-elephant Conflict Management Plan (HECMP), with a special emphasis on mitigation of human-elephant conflict in the area. The project proponent, in turn, contracted IUCN, Sri Lanka Country Office to prepare the said HECMP.

The preparation of the HECMP will hereinafter be referred to as the Project, while Upper Elahera Canal project will be referred to as the UEC project.

The aim of this report is to provide the detailed methodological approach for the preparation of the HECMP for the Upper Elahera Canal Project.

1.4 Overall project approach

Initially, a reconnaissance visit will be carried out with the entire strategic management plan preparation team in order to familiarize the team with the project area as well as the sites that will be affected. This visit will be followed by a literature survey to document all available published information on the project area. Once all available information is documented, a series of stakeholder meetings will be held, to gather unpublished information that is relevant for the preparation of the HECMP. Data adequacy for the preparation of HECMP will be checked and field investigations will be carried out to acquire data to address identified gaps in available information.

Finally, the primary and secondary data gathered will be analysed and used for the development of site-specific actions that should be included in the HECMP. These actions

will be screened for social, economic and engineering feasibility and the draft HECMP will be developed. The draft HECMP will be presented to a broader stakeholder group to obtain their views on the proposed management prescriptions. The final HECMP will be prepared after incorporating the views and opinions of the stakeholders, providing institutional arrangements for implementation, time frames, estimated budgets, training and communication needs and the monitoring framework to ensure that HECMP is implemented in an adaptive manner. The specific activities involved under each of these broader areas of work are given in Chapter 2 of this document.

1.5 Project Inception phase

The project inception phase started on 2nd August 2016 and will be concluded on 15th September 2016. During this period, a detailed methodological approach to complete the HECMP plan for the UEC was developed. Initially two rounds of discussions were held with the Project management unit to a) define the scope of the project; b) clarify the implementation mechanisms; c) clearly identify expectations from the project proponent's side and) clearly identify the expectations of the IUCN HECMP plan preparation team by the project proponent. Further, all available information on the project including feasibility reports, EIA report, project designs, layout maps etc., were obtained from the project proponent and evaluated carefully to extract the necessary baseline information on the project.

Several internal meetings were held to discuss the detailed methodology, responsibilities of individual experts and finalisation of detailed work plans to complete the assignment. These are presented in later in this report and in Annex I of this report.

A list of species in the Project area derived from the literature survey is present in Annex II.

2. Project Work Plan

2.1 Rationale

The development of an HECMP for the UECP requires the implementation of a robust and integrated work plan which will collect, collate and synthesise information across a range of disciplines and locations. The work plan will require integration of the experts involved in the preparation of the HECMP, as well as collaboration with government and non-government organisations in order to obtain a holistic understanding of the critical issues, essential for developing an effective HECMP.

In order to address major project aspects and tasks, four core teams have been assembled: 1) the biodiversity team; 2) the HEC team; 3) socio-economic team; and 4) the mapping team. Core teams will have the responsibility of gathering information on their specific individual tasks and the activities which support these tasks. However, all the tasks within the work plan have been designed to fulfil specific roles, in order to deliver on the final goal of providing management prescriptions to address the three significant long-term impacts predicted for the project.

2.2 Project Area

The area considered in the HECMP for management interventions include

a. the entire canal trace;

b. the areas that will receive additional water under the project and therefore subjected to changes in cropping intensity;

c. areas that are under the management of Forest Department (FD) and Department of Wildlife Conservation (DWC) within the project area; and

d. all natural areas that does not receive any protection at present but can be used to improve the present status of the wildlife either by enhancing the available extent of habitat or facilitating free movement.

2.3 Tasks

The objective of the HECMP for UECP is to provide site-specific management prescriptions for the three significant on the wildlife impacts anticipated as a consequence of the implementation of the project. The strategic approach that will be taken to address these impacts are as follows.

1. *The issue pertaining to loss of wildlife habitat due to the project*

   This issue can be addressed through two strategic approaches. Firstly, expanding the existing protected area network by annexing all available natural/semi-natural areas, as well as taking steps to link, through corridors, the scattered natural forests in the area. Secondly, enhancing the carrying capacity of the existing protected areas through habitat improvement within these protected areas.

2. *The direct negative impacts arising due to the project interventions on wildlife, during both construction and operation phase*

   Many of the mitigation measures have already been identified and incorporated into the project design, as well as the environment management plan of the project. These mitigation measures will be studied further and additional mitigation measures will be provided where it is deemed necessary. Further, the HEV management plan will provide a rescue and translocation/ transplantation plan for priority wildlife

species with no/low mobility inhabiting the areas that will be cleared for construction work (mainly the canal and two tanks) to safe locations.

3. *Providing a set of site-specific reasonable and acceptable solution to the human-elephant conflict that will arise in the area that will receive irrigation under the project.*

The specific activities that will be carried out to gather both primary and secondary data required to identify these management prescriptions are provided below.

2.3.1 Improving the overall habitat availability for wildlife

A. *Assessment of the current status of the existing protected areas in the project area and potential management actions to improve the habitat quality in these protected areas:*

   i. A list of protected areas (PAs) located within the project impact area will be compiled.

   ii. Protected area managers will be consulted to identify challenges and potential improvements to current management practices. In the process, any documentation available pertaining to management undertaken by the park management such as management plans, monitoring reports will be reviewed.

   iii. The boundaries of the protected areas will be obtained from the respective line agencies, if available in GIS format. For those PAs where boundaries are not available in GIS format, new maps will be prepared.

   iv. Field studies will be undertaken in each protected area to gather data on the present ecological status of the protected area (*inter alia* with regard to species composition; type of invasive alien species present and their distribution within the protected area; areas that needs restoration/ reforestation or habitat management; potential ecosystem services; water availability within the protected area; especially during the dry periods) and the effectiveness of current management practices undertaken by the relevant line agency.

B. *Identification of habitats with the potential to be enriched through assisted regeneration, eradication of invasive species, improvement of water holes etc., in order to enhance the carrying capacity of protected areas.*

   i. The information gathered through activities A (i) through A (iv) will be fed in to a GIS database to develop a map depicting the spatial arrangement of proposed activities (for example, habitat management, restoration, reforestation, creation of water holes).

   ii. Preparation of detailed management prescriptions for each of the proposed interventions (for example, for restoration/ reforestation or habitat management the geographic coordinates, extent to be restored/reforested, types of plant species that should be used for the activity, the ratio of the species, planting sequence, guidelines for planting etc., will be provided). The information necessary for such planning will be derived through a biodiversity survey conducted in the protected areas under activity I(iv). The detailed methodology that will be followed for such biodiversity assessments is provided in Annex II.

iii. Site selection for potential habitat restoration or management will be based on a set of criteria[1] that will be developed, taking into consideration key principles of restoration ecology. Therefore, a prioritization exercise will be carried out before assigning areas for restoration/ reforestation or habitat management based on an evaluation carried out using these developed criteria.

C. *Identification of areas that can be annexed with existing protected areas, areas that can provide connectivity between remaining forest areas including already identified elephant corridors to be established for mitigation of human-elephant conflict.*

i. A base map will be developed using GIS tools for the project area, indicating the natural forest cover and all designated protected areas.

ii. Based on this map, natural habitats lying outside the protected area network that can function as potential corridors to maintain connectivity between protected areas and as wildlife habitats will be identified tentatively.

iii. Field investigations will be conducted to ascertain the present status (*inter alia*, ownership, condition of habitat, long-term viability, feasibility of using the area as a corridor or annexing it to the closest protected area) of these additional areas that have been identified to be used as connectivity corridors or potential areas that can be annexed to the present PA network.

iv. Preparation of a map indicating the boundaries of the additional areas identified to be annexed to the PA network and to provide the optimal connectivity between existing protected areas. This map will include detailed information on land ownership, habitat conditions, and the steps that should be taken in order to declare the identified areas as wildlife corridors or annexing to the protected areas.

D. *Identification of sensitive and vulnerable ecosystems in the UEC Project area and potential mechanisms to protect them*

i. A field survey will be carried out and a base map will be developed for the project area indicating wildlife distribution, with special emphasis on distribution of threatened and/or endemic species, natural forest cover, and protected areas.

ii. Based on this map, sensitive and vulnerable ecosystems will be identified within the project areas.

iii. An action plan will be developed to protect such sensitive and vulnerable ecosystems, if they are not already included in the existing protected area network.

[1] Restoration of areas that are in advanced seral stages (an intermediate stage found in ecological succession in an ecosystem) are more beneficial than restoration of areas that are at a lower seral stage, as higher seral stages can support higher niche diversity and therefore, higher species diversity. Similarly, restoration provides higher conservation benefits compared to reforestation, as restored areas will reach climax status much faster than reforested areas and therefore, will support higher biodiversity. However, sometimes reforestation is desired, as it may provide other benefits such as soil conservation and improve catchment functions. Also, in some case, keeping certain areas in lower seral stages is beneficial, especially for edge species such as Asian elephants. Therefore, before undertaking any reforestation or restoration activity, a prioritization exercise will be carried out using these criteria.

2.3.2 Mitigating direct negative impacts on wildlife

1. Preparing a map the proposed mitigation measures on the layout plan of the project.
2. Conducting a survey in the area identified for land clearing for project activities (the canal trace, trace of any new roads, both temporary and permanent) to document species present in these sites and to identify potential animal corridors that lie across the canal trace.
3. Based on the findings of the survey, identifying additional mitigation needs required over and above the mitigation measures proposed in the environment management plan of the project design, as well providing alternative solutions for the proposed mitigation measures as needed.
4. The species observed in the area that is identified for land clearing will be evaluated to identify whether any of the species observed required translocation or transplantation in a safer site. If such species are found to be present develop a rescue programme to trans-locate/ transplant the identified animal or plant species from locations that will be affected by project activities. The activities involved in preparation of the rescue programme are as follows:
    i. A species list will be compiled based on available information in the area as well as data collected by the team during detailed biodiversity assessments conducted under this project.
    ii. These lists will be evaluated using a set of criteria to identify priority species that need to be rescued from the project affected areas prior to implementation of construction work. See box below.

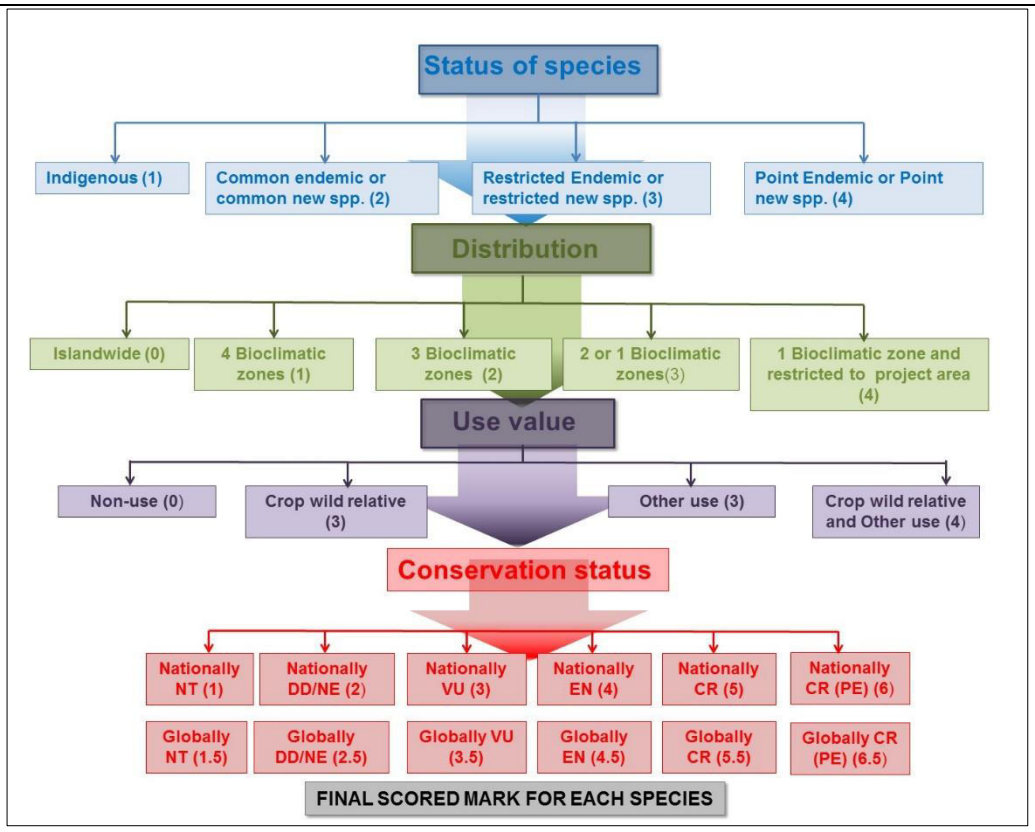
Criteria for selection of priority species and the process of selection (which may be refined later)

The process of selection of priority species is a means by which species are shortlisted for translocation or transplanting. For each criterion, there alternatives, each of which has a score. Each species is scored against the criteria, and those with the higher scores are chosen.

For flora

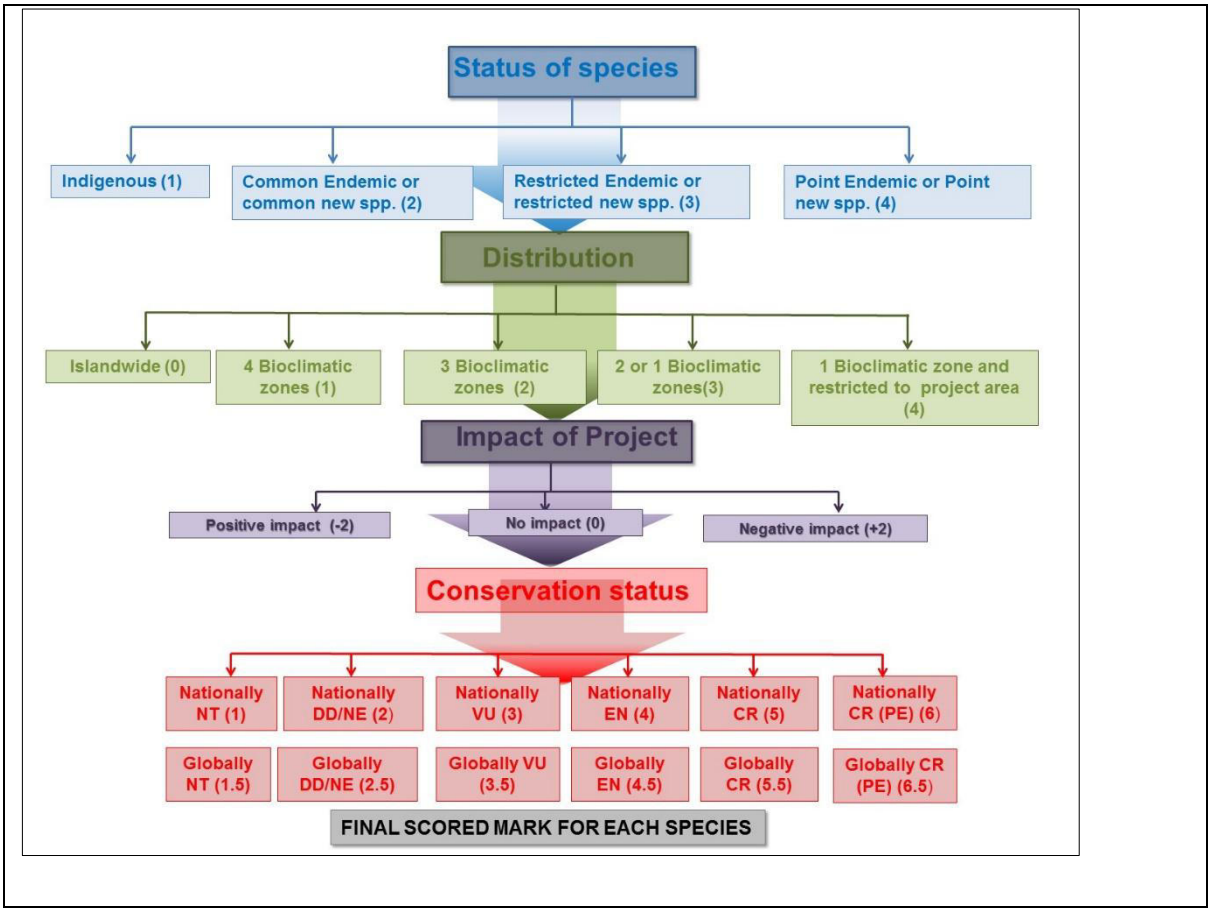
For flora, four selection criteria were defined. The score is presented in parentheses.

1. **Status of species:** indigenous (1); common endemic or common new spp. (2); restricted endemic or restricted new spp. (3) point endemic or point new spp. (4).
2. **Distribution**: islandwide (0), 4 bioclimatic zones (1); 3 bioclimatic zones (2); 2 or 1 bioclimatic zones (3); 1 Bioclimatic zone and restricted to project area (4).
3. **Use value**: Non-use (0); crop wild relative (3); other use (3); crop wild relative and other use (4)
4. **Conservation**: Nationally NT (1); Nationally DD/NE (2); Nationally VU (3); Nationally EN (4); Nationally CR (5); Nationally CR (PE) (6); Globally NT (1.5); Globally DD/NE (2.5); Globally VU (3.5); Globally EN (4.5); Globally CR (5.5); Globally CR (PE) (6.5).



For fauna

1. **Status of species:** indigenous (1); common Endemic or common new spp. (2); restricted Endemic or restricted new spp. (3); point endemic or point new spp. (4).
2. **Distribution**: islandwide (0); 4 bioclimatic zones (1); 3 bioclimatic zones (2); 2 or 1 bioclimatic zones (3); 1 bioclimatic zone and restricted to project area (4).
3. **Impact of Project**: Positive impact (-2); no impact (0); negative impact (+2).
4. **Conservation**: Nationally NT (1); Nationally DD/NE (2); Nationally VU (3); Nationally EN (4); Nationally CR (5); Nationally CR (PE) (6); Globally NT (1.5); Globally DD/NE (2.5); Globally VU (3.5); Globally EN (4.5); Globally CR (5.5); Globally CR (PE) (6.5).



iii. If such priority species are discovered, detailed rescue plans will be prepared for each species so that they may be translocated/ transplanted to a safer location.

iv. These translocation guidelines will be based on IUCN species translocation protocols modified to suit local conditions.

v. For each species that require translocation/transplantation, suitable sites will be identified based on the habitat requirements of each species.

vi. A protocol for monitoring the translocated or transplanted species will also be developed and included in the HECMP.

2.3.3 Mitigation of Human-Elephant conflict

A. Establishing a baseline with respect to elephants and HEC in the project area

The UEC project will result in a potential permanent loss of about 205 ha of natural habitat in Elehera-Giritale Sanctuary and Minneriya National Park. In addition, there will be an estimated loss of 10,000 ha of seasonal elephant habitats as a consequence of changes in cropping intensity that will result from receiving irrigation water from UEC project. This increase in cropping intensity will prevent access of elephants to these areas during the dry months of the year. The combined effect of this UEC project activity and its desired result will be an escalation of the existing level of human-elephant conflict (HEC) in the area. Therefore, it is important to document the current level of human elephant conflict that exists in the area, as well as the current cropping pattern as well as the projected change in cropping pattern

for once the irrigation water becomes available. These will help predict how the conflict will change with the proposed land use and landscape changes, which is a crucial step in the development of mitigation measures for the HEC in the project area.

Therefore, an assessment of the distribution, land use patterns and existing levels of human elephant conflict in the study area and its immediate surroundings will be carried out using a grid-based survey, where both primary and secondary data will be recorded. These data will be used to establish baseline conditions with respect to elephant distribution, demography, temporal and spatial land use patterns and human-elephant conflict as well as to predict changes in the present level of human-elephant conflict due to implementation of the project.

The specific information collected will include:

i. ***Movement patterns of elephants within the study area***

This will be established based on satellite telemetry data collected by the Centre for Conservation and Research, in collaboration with Department of Wildlife Conservation. An assessment will be made to identify whether additional radiotelemetry studies are needed in specific areas.

ii. ***Existing level of HEC***

This will be based on data collected through the grid based surveys.

iii. ***Patterns of conflict***

Spatial and temporal patterns of conflict will be determined using GIS-based analysis of the primary and secondary conflict data collected.

iv. ***Mitigation measures adopted at present in the project area by government agencies***

This will be documented based on information gathered during stakeholder consultations, from the Department of Wildlife Conservation, and data collected during the grid-based survey.

v. ***Mitigation measures adopted at present in the project area by farmers***

This will be documented based on information gathered during the stakeholder consultations and the grid-based survey.

vi. ***Evaluation of the feasibility of establishing the identified elephant corridors*** A detailed assessment of the identified elephant corridors will be carried out during the field investigations to determine the feasibility of establishing the corridor, considering the land ownership within the identified corridor, habitat conditions, and whether the corridor will contribute to the reduction in HEC. Further, based on the data gathered during the stakeholder consultation and field studies, new corridors, if present, will be proposed to mitigate the HEC.

B. Assess current institutional efforts at mitigating HEC

i. Evaluate the existing electric fences (state built, as well as privately erected) within the project area (for example, design, placement, mechanisms for maintenance, community perceptions) and to recommend new ways, means, methods and any additional specifications to improve the functioning of

electric fences to manage the human elephant conflict. This will be achieved through following set of activities:

a. Compile a list of electric fences present in the study area through information collected from relevant line agencies;

b. Map all electric fences by walking along each electric fence and obtaining GPS coordinates at 25 m intervals or where the direction changes;

c. Document fence parameters for each fence such as type of energizer, wire, posts and fence design;

d. Assess the status of each fence based on documentation of fence defects — such as low voltage, vegetation touching wires, wires broken, posts leaning or on the ground;

e. Assess the functionality of the fence through observation of elephant sign on either side of the fence, as well as other indicators of elephant presence — such as secondary fences, tin can fences, watch huts — and through conducting interview surveys of local community, obtaining their perceptions regarding the fence;

f. Collect information on the construction and maintenance mechanism of the fence and perceptions of success/failure through meetings held with stakeholders and information gathered during surveys;

g. Using GIS-based analysis, identify whether the placement of fence is at the correct ecological boundary; and

h. Using above information, evaluate its use as a HEC measure in the area.

ii. Evaluate other barriers such as bio fences and ditches. This will be achieved through following set of activities:

a. Compile a list of barriers present in the study area through information collected from relevant line agencies;

b. Map all barriers by walking along each and obtaining GPS coordinates at 25 m intervals or where the direction changes;

c. Document parameters for each barrier: for bio fence: type of plant, how many planted (if information is available), design etc.; for ditches: when constructed, design etc.;

d. Assess the status of barrier: for bio-fence: how many plants are currently alive, growth state, gaps etc.; for ditches: width, depth at 10 m intervals, current state etc.;

e. Assess the functionality of the barrier through observation of elephants/ elephant sign on either side of it, as well as other indicators of elephant presence such as secondary fences, tin can fences, watch huts etc., and through conducting interview surveys of local community, obtaining their perceptions regarding the fence;

f. Collect information on the construction and maintenance mechanism of the fence and perceptions of success/failure through meetings held with stakeholders and information gathered during surveys; and

g. Using above information, evaluate its use as a HEC measure in the area.

iii. Evaluate elephant translocation. This will be achieved through following set of activities:

a. Obtain information of elephant translocations in the area over the past five years from DWC;

b. Conduct literature survey on translocation success/failure;

c. Collect information on perceptions of success/failure through meetings held with stakeholders and information gathered during surveys; and

d. Using above information, evaluate its use as a HEC measure in the area.

iv. Evaluate elephant drives. This will be achieved through following set of activities:

a. Obtain, from the DWC, information on elephant drives in the area over the past five years;

b. Conduct literature survey on drive success/failure;

c. Collect information on perceptions of success/failure through meetings held with stakeholders and information gathered during surveys; and

d. Using above information, evaluate its use as a HEC measure in the area.

v. Evaluate elephant chasing and distribution of elephant thunders (*ali-wedi*). This will be achieved through following set of activities:

a. Obtain, from the DWC, information on distribution of elephant thunders in the area over the past five years;

b. Collect information on perceptions of success/failure through meetings held with stakeholders and information gathered during surveys; and

c. Using above information, evaluate its use as a HEC measure in the area.

vi. Identify HEC mitigatory measures to be utilised in areas impacted by the UEC Project. This will be achieved through following set of activities:

a. Based on a detailed assessment of the identified elephant distribution, elephant movement, land use patterns, habitat conditions, and patterns of HEC, determine the feasibility of establishing Elephant Corridors, Managed Elephant Ranges (MER) and Elephant Conservation Areas (ECA). Based on this analysis, identify specific activities that need to be undertaken by the UEC project;

b. Based on the data collected during field investigations, literature review and stakeholder meetings identify areas where conflict is likely to occur or increase due to changes in the landscape to the UEC project;

c. Prioritise the conflict areas on a low medium and high scale using a set of criteria — such as current level of HEC, landscape changes caused by UEC project and projected changes in cropping patterns;

d. For each conflict area suggest the best mitigation method that can be used and outline the procedure that should be followed for its implementation; and

e. Provide site specific solutions to each of the conflict areas identified including the details of electric fencing.

vii. Assess the feasibility of community based electric fencing as a HEC mitigation measure to be implemented through the UEC project. This will be achieved through following set of activities:

a. Based on GIS analysis and ground truthing, prepare a map showing villages and paddy fields that need to be protected with community-based electric fences;

b. Identify the approximate alignment of electric fences and calculate the length of the electric fence that will be needed for each location;

c. Provide a guideline for fence design as well as how the affected community will contribute for the construction and maintenance of the electric fence;

d. Provide a guideline for training members of the community on maintenance of electric fences;

e. Provide a guideline for the establishment of revolving fund that will be used for long term maintenance of electric fences; and

f. Prepare a training module including material for officers of relevant line agencies to implement community based fences.

viii. Identify awareness and communication needs for mitigating human elephant conflict. This will be achieved through following set of activities:

1. Based on the findings during stakeholder meetings and social surveys, prepare a list of communication needs for mitigating the human elephant conflict;

2. Identify the types of communication tools that can be used to create awareness among affected communities on how to minimize HEC; and

3. Prepare a training module, including material for relevant staff of line agencies to be able to conduct awareness programs on HEC mitigation.

ix. Identify mechanisms for effective compensation of people impacted by HEC. This will be achieved through following set of activities:

a. Based on the findings of stakeholder meetings, compensation data available at DWC and other agencies that provide compensation and social surveys, identify the shortcomings of current compensation schemes; and

b. Provide a set of recommendations as to how the current shortcomings can be overcome including testing the feasibility of introducing a crop insurance scheme.

x. Identify efficient institutional arrangements required for managing HEC. This will be achieved through following set of activities:

a. Conduct a review of the present institutional arrangements for managing the HEC;

b. Identify gaps, barriers and shortcomings in the current system; and

c. Propose ways to overcome these barriers and develop a mechanism for various line agencies to work together to provide a long-term solution for the HEC.

C. Preparation of a Draft Plan for management of Human Elephant Conflict and other wildlife related issues in the project area with special emphasis on minimizing the human-elephant conflict in the project area

D. Presenting the draft plan to a wider stakeholder group to get their feedback on the proposed actions

E. Preparation of a final HEC management plan incorporating the comments and concerns made by the stakeholders

F. Estimation of the implementation cost of each of the proposed site specific activities and preparation of the detailed budget that is required for implementation of HEC Management Plan for the UEC project including the cost of establishing a revolving fund to facilitate long term

G. Preparation of the schedule of implementation and monitoring program of the HEC management plan

2.4 Deliverables

There are three main deliverables of the project:

Inception Report — due 15th September 2016;

Interim Report — due 15th January 2017;

Draft Human Elephant Conflict Management Plan — due 30th June 2017; and

Final Human Elephant Conflict Management Plan — 30th July 2017.

The major expected outputs arising from this study will be:

I. The Human Elephant Conflict Management Plan, with a special emphasis on managing the human-elephant conflict in the direct and indirect influence area of the UEC Project. The HEC management plan will provide details of activities that need to be carried out in a site-specific manner in order to minimise the predicted impacts of the UEC project. The activities proposed in this plan will be in accordance with the scope of consultancy assignment and will contain:

- An assessment of the current status of each of the protected area found within the study area and recommendations and specifications to improve their management, including proposals to enhance the availability of food and water for wildlife during the dry season;

- For each protected area, a map indicating areas identified for habitat enrichment, eradication of invasive plants, improvement of water holes and restoration or reforestation that can be undertaken to enhance the carrying capacity of these protected areas for target species. Further a detailed list of activities that need to be carried out under each of the proposed management interventions will be provided;
- A map indicating the boundaries of the additional areas proposed to be annexed to the existing protected area network in the project area in order to enhance the habitat availability for wildlife and to provide connectivity between remaining forest areas to facilitate free movement of wildlife without coming into conflict with humans;
- A detailed assessment of the identified elephant corridors with relevant maps and details such as feasibility of establishing the corridor taking in to consideration, the land ownership within the identified corridor, habitat conditions, and assessment whether the corridor will contribute to reduction in HEC;
- The steps that should be taken to declare the areas identified to be annexed to the existing PA or areas that should be set aside as elephant corridors;
- A map indicating sensitive and vulnerable ecosystems identified within the project area that lie outside the protected area network and the proposed mechanism to protect such sites;
- Details of the proposed rescue programme to translocate/ transplant identified species from areas where large scale habitat loss is expected due to the proposed project activities and the locations selected for receiving the translocated/ transplanted species.
- A set of site-specific mitigatory measures to minimize the human-elephant conflict including places where temporary or permanent electric fences are recommended and the role of the community and the local administration in establishing and maintenance of such electrical fences;
- Assessment of the functional efficiency of the existing system of electric fences including the suitability of fence design, placement of the fence, mechanism for fence maintenance, ability of the fence to reduce HEC and perceptions of the local community that benefits from the fence. Recommendation for improving the functional efficiency of the fence will be provided if a fence or section of a fence is found to be ineffective;
- Proposal of an efficient institutional arrangement for managing HEC;
- The estimated budget for implementing the activities proposed in the HEC Management Plan with special emphasis on measures needed to minimize human-elephant conflict management. Further a proposal will be submitted detailing how a revolving fund can be established in order to continue to carry out management practices that are found to be useful beyond the project period;
- The HEC management plan will also include a time-bound implementation schedule identifying the agency(ies) responsible for carrying out the action and agency(ies) that should provide support; and

- The HEC management plan will also include a monitoring program with monitoring indicators, monitoring frequency, a monitoring mechanism and a mechanism to make adaptive changes to the HEC management plan based on the outcome of the monitoring results.

II. A final report including a synopsis — based on the literature review — and an overall analysis of the conservation status of the wildlife in the area — based on the primary and secondary data generated through the consultancy — lessons learned and how the proposed actions would help improve the conservation status of the wildlife in the area.

III. A set of trained officers in the Mahaweli Authority of Sri Lanka (MASL), Irrigation Department (ID) and Ministry of Mahaweli Development and Environment (MMD&E) to undertake similar activities in the future.

2.5 Planning team and responsibilities

The team engaged in developing the HECMP for UEC project comprises experts from a range of disciplines. The required studies have been devolved into four discrete work areas, with specific teams of experts assigned to each work area. The following table details the full team, their expertise and the responsibilities that are assigned to them.

Name of Staff	Area of Expertise	Position Assigned	Task/s Assigned
Prof. Devaka Weerakoon	Wildlife Ecology	Team Leader	• Overall management and coordination of the entire assignment including preparation of reports and data analysis; • Coordination and execution of the study including presentations to the Client; and • Compilation of draft and final reports including proposed work program, budget estimates, schedules, staffing and other necessary support services in identification of mitigation measures for the HEC management plan including HECM.
Dr. Sriyanie Miththapala	Biodiversity	Biodiversity Expert	• Oversight of the biodiversity- related activities; • Compilation of biodiversity-related individual consultant's outputs; and • Assisting the Team Leader in compilation of progress, draft and final reports.
Dr. Prithiviraj Fernando	Elephant ecology	Elephant expert/ Ecologist	• Responsible for assessment of elephants and their movements, their behavior patterns, human-

Name of Staff	Area of Expertise	Position Assigned	Task/s Assigned
			elephant conflict and recommending of measures to manage human-elephant conflict; • Identification of additional areas for elephant corridors and Protected Areas; and • Evaluation of the efficacy of existing HEC management plans including HEC management practices.
Dr. Sandun Perera	Fauna	Fauna Specialist	• Identification of impact of the proposed HEC management plan on overall faunal diversity of the area; • Responsible for supervision of the following activities included in the HECMP; • Identification of critical floral species present in the areas identified for land clearing for project activities; • Identification of ecologically sensitive habitats; • Provide inputs for habitat enrichment; • Identify threats from invasive alien species to wildlife habitats; • Identification of translocation sites; and • Assessing food and water availability during the dry season.
Mr. Sarath Ekanayake	Flora	Flora Ecologist	• Identification of impact of the proposed HEC management plan on overall floral diversity of the area; • Responsible for supervision of the following activities included in the HECMP; • Identification of critical floral species present in the areas identified for land clearing for project activities; • Identification of ecologically sensitive habitats; • Provide inputs for habitat enrichment; and

Name of Staff	Area of Expertise	Position Assigned	Task/s Assigned
			• Identify threats from invasive alien species to wildlife habitats • Identification of transplantation sites.
Mr. P. D. Leelaratne	Sociology	Sociologist	• Responsible for designing and implementation of HEC related socio-economic data gathering from the project area; • Facilitation of stakeholder consultations; • Compiling a report on current status and projected changes in cropping patterns and intensities under the UEC project.
Eng. Anura Ranwala	Engineering	Civil Engineer	• Oversee the engineering aspects of the project; • Responsible for assisting the team in relation to any civil engineering and infrastructure related interventions; • Assist the sociologist in compiling the predicted changes in cropping patterns and intensities by providing hydrological information; • Responsible for providing technical advice in planning, designing and implementing of relevant mitigatory measures; • Identification of potential issues that may arise due to proposed structural design interventions of the HECMP including HECM.
Mr. Shamen Vidanage	Environmental Economics	Environmental Economist	• Responsible for activities related to environmental economics; and • Preparation of the cost estimates of the HECMP. • Overall coordination of The Ptoject
Mrs. Darshani Wijesinghe	GIS	GIS Specialist	• Responsible for activities regarding GIS application and remote sensing and preparation of GIS maps.
Mr. Naalin Perera	Field Coordinator	Biodiversity	• Providing assistance to corresponding key-staff members in gathering of identified primary and

Name of Staff	Area of Expertise	Position Assigned	Task/s Assigned
			secondary data and data analyses.
Mr. Sampath Ekanayake	Field Coordinator	Human-elephant conflict	• Providing assistance to corresponding key-staff member in gathering of identified primary and secondary data and data analyses.
Field Assistants	4 members	Biodiversity 2; HEC 1; socio-economics 1	• Assist field coordinators to collect field information and data entry

2.6 Baseline surveys

There will be four teams involved in the baseline surveys. These comprise

1. *The biodiversity team*: This team will be led by the biodiversity filed coordinator, with guidance from the biodiversity expert and assistance of the fauna expert, flora expert and civil engineer. The team will conduct rapid biodiversity assessments in places identified as necessary including waterhole counts where applicable; collect information regarding status of the protected areas within the project area, habitat management requirements, restoration needs, invasive species management requirements, analysis of proposed mitigation measures and their adequacy, identification of species that needs translocation/ transplantation, identification of areas that can be annexed to PA network and potential corridors that can be used to link PAs.
2. *The HEC team*: This team will be led by the elephant expert and will be responsible for collection of data regarding the movement patterns of elephants, current status of the HEC, management measures employed by government institutes and local communities and their effectiveness.
3. *The Socio-economics team*: This team will be led by the sociologist with assistance from the environment economist and civil engineer. The team will collect information on social aspects of the identified GN divisions, the details regarding the command area — such as current cropping patterns and intensities, changes in water availability in the command area as a result of UEC project and the accompanied changes in the cropping patterns and intensities and information on current level of HEC in the command area of the UEC project.
4. *The GIS team*: This team will be led by the GIS expert and assisted by the other three teams to collect and map spatial data on HEC, HEC management measures, tanks that receive water under the UEC project and their command areas and boundaries of the existing PAs and other natural areas that are not protected.

2.7 Development of the Human-Elephant Conflict Management Plan

The ultimate goal of the project will be to develop a robust and implementable HECMP that is acceptable to the wider stakeholders that are directly or indirectly associated with the plan. The entire team will take part in the HECMP development. The outcomes of each of the baseline studies will be used as the key source of information for the development of specific management prescriptions of the HECMP. The HECMP will also be aligned with the existing

National Policies and plans of work, especially with the Elephant policy and Wildlife Policy. A draft of the HECMP will be developed and circulated for comments and feedback to the key stakeholders and the final HECMP will be prepared incorporating the comments and suggestions made by the stakeholders.

2.8 Stakeholder consultation

As indicated in the previous section the HECMP should be a stakeholder-driven process, as one of its main aims is to provide much needed relief to the communities whose livelihoods are affected by lack of water and human wildlife conflict. While the UEC project will ensure water security in its command area this is likely to escalate the present level of human-elephant conflict, which will prevent the accrual of full benefits that can be derived by the project. Therefore, the local community will be a major stakeholder of the project, as they will not only benefit from the project but are expected to actively contribute to HECMP through labour or finances or both. The local government authorities such as district secretaries, divisional secretaries and *grama niladharis* will also have to play key roles, as community engagement will be mobilised through them. Government agencies such as the Department of Wildlife Conservation, Forest department, Mahaweli Environmental Authority, Irrigation Department and Department of Agrarian Development (DAD) will also have to play key roles during the implementation phase of the HECMP and therefore, will be considered key stakeholders of this HECMP. Each of these stakeholders will be consulted during the initial phase of base line surveys to obtain their experiences, views and perceptions regarding the current status of HEC in the area, as well as other wildlife-related issues faced by them. They will be consulted during the later phase of HECMP development to obtain their views and comments regarding the proposed management solutions included in the HECMP.

2.9 Data Needs

Data needed from Irrigation Department / Mahaweli Authority /Department of Agrarian Development

1. List of small tanks supplied with following details for each:
    - GPS location;
    - Whether capacity will be increased; if so current and projected;
    - Cropping pattern under tank and envisaged change (*Maha* only → *Maha* and *Yala* etc.)
    - Whether there will be any change in extent cultivated; If so, current extent cultivated and envisaged change in extent;
    - Whether there will be any change in crops cultivated; If so, current crops cultivated and envisaged change; and
    - Is there a farmer society for the tank? If so name of farmer society, address, contact details and number of members.
2. Map of feeder canal network (shape files/GPS) indicating:
    - Whether existing or to be constructed;
    - Whether concrete-lined or natural-stream;
    - Width and depth; and
    - Proposed water release scheme (months),

Data needed from the DWC

1. List of HEC mitigation measures adopted in project area;
2. Map of identified elephant corridors — shape files/GPS locations;
3. List of current electric fences; GPS locations/tracks/shape files;
4. List of alternative elephant barriers (trenches, bio fences, bee fences); GPS locations/tracks/shape files;
5. List of elephant translocations from or to the project area in the last 5 years:
    - Capture location and date;
    - Release location and date;
    - Cost;
    - Whether monitored and if so how; and
    - Result, if known.
6. List of elephant drives within the project area in the last 5 years:
    a. Start location and date;
    b. End location and date;
    c. Number of people participating, number of elephant crackers used, number of cartridges used;
    d. Cost;
    e. Whether monitored and if so how; and
    f. Result, if known.
7. Number of elephant thunders distributed in project area monthly at the level of DWC office and GS division

2.10 Meeting with DWC

The Department of Wildlife Conservation is a key stakeholder, as resolution of human-elephant conflict comes directly under their mandate of work. However, it should be noted that the HECMP that will be developed under this project shall not be an alternative to their plan of work but is meant to supplement their work, by ensuring the safety of the farmer communities that benefit from the UEC project, until a long lasting solution can be provided by the DWC once the national elephant conservation plan is fully implemented by them. Therefore, DWC should become an active partner in the HECMP development process and as such, they will be consulted through project inception to completion.

2.11 Work plan

A detailed work plan is presented in Annex 1.

3. Conclusions

This is the first time a HECMP will be developed with a special emphasis on human-elephant conflict mitigation for a major irrigation project in Sri Lanka. This is a significant undertaking, considering the fact that the principal goal of the HECMP is to mitigate human-elephant conflict in the command areas of the UEC project, where a moderate level of human-elephant conflict exists at present. The successful delivery of this Project is contingent on multiple studies and the cooperation and input of many individuals and organisations. Even though the Project presents unique technical and logistical challenges, the potential benefits that it can confer on the farming communities of the UEC project are immense. Furthermore, if this HECMP is successfully implemented there is great potential to scale up the process to other regions facing a similar situation.

References

Angiosperm Phylogeny Group (2009) An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG III. *Botanical Journal of the Linnean Society,* Vol 161. 105-121pp.

Ashton, M., Gunatilleke, S., de Zoysa N., Dassanayake, M.D., Gunatilleke, N., and Wijesundara, S. (1997). *A field guide to the common trees and shrubs of Sri Lanka*. WHT Publication Ltd. Sri Lanka. 431pp.

Bahir, M. M. & Yeo, D. C. J., (2005). A revision of the genus *Oziotelphusa* Müller, 1887 (Crustacea: Decapoda: Parathelphusidae), with descriptions of eight new species In: D. C. J. Yeo, P. K. L. Ng & R. Pethiyagoda, eds 2005. *Contributions to Biodiversity Exploration and Research in Sri Lanka. The Raffles Bulletin of Zoology, Supplement,* 12, pp.77–120.

Bedjanic, M., Conniff, K., and Wijeyeratne, G de S (2007) *A photographic Guide to the Dragonflies of Sri Lanka.* Jetwing Eco Holidays, Colombo, Sri Lanka. 248pp.

Bedjanic, M., Conniff, K., Van der pooten N. and Salamun A. (2014) *Dragonfly fauna of Sri Lanka distribution and biology with threat status of its endemics,* Pensoft, Sofia. 321pp.

D'Abreira, B. (1998) *The butterflies of Ceylon*. Wildlife Heritage Trust, Colombo, Sri Lanka. 221pp.

Dassanayake, M.D. and Fosberg, F.R. (*eds)* (1980 - 1991) *Revised handbook to the flora of Ceylon*, Vols. I-VII. Amerind Publ., New Delhi.

Dassanayake, M.D. and Clayton, W.D. (*eds*) (1996 - 1999) *Revised handbook to the flora of Ceylon,* Vols. X - XIII. Amerind Publ., New Delhi.

Dassanayake M.D., Fosberg, F.R. and Clayton, W.D. (*eds*) (1994 - 1995) *Revised handbook to the flora of Ceylon,* Vols. VIII - IX. Amerind Publ., New Delhi.

Department of Irrigation (2015). *EIA Study of the Modification to Configuration of Moragahakanda-Kaluganga Projects, Proposed Upper Elehara Canal (UEC), Canal from Mannakkattiya Tank to Mahakanadarawa Tank and Kaluganga-Moragahakanda link Canal Project, Mahaweli Consultancy Bureau (Pvt) Ltd No 11,*. Final Report. 490 pp.

de Vlas – de Jong, J., and de Vlas, J. (2008). *Illustrated Field Guide to the Flowers of Sri Lanka*. Mark Booksellers and Distributors (Pvt) Ltd: Sri Lanka. Vol 1.

de Vlas – de Jong, J., and de Vlas, J. (2013). *Illustrated Field Guide to the Flowers of Sri Lanka*. Mark Booksellers and Distributors (Pvt) Ltd: Sri Lanka. Vol 2.

Goonatilake, S. de A. (2007) *Freshwater fishes of Sri Lanka*. Biodiversity Secretary of Ministry of Environment and Natural Recourses. (*Sinhala book*). 133pp.

Harrison, J. (1999) *A field guide to the Birds of Sri Lanka*. Oxford University Press Inc., New York. 219pp.

Jayasinghe, H.D., Rajapaksha, S.S. and C. de Alwis (2013) *A pocket guide to the Butterflies of Sri Lanka* (second edition). Butterfly Conservation Society of Sri Lanka. 183pp.

Kotagama S.W. and Goonatilake S. de A. (2013) Pictorial Pocket Guide to the Mammals of Sri Lanka (revised and expanded), Field Ornithology Group of Sri Lanka, University of Colombo, 153pp.

Kovařík, F., Lowe, G., Ranawana, K.B., Hoferek, D., JayarathneV.A.S., Plíšková, J. & F. Šťáhlavský (2016) Scorpions of Sri Lanka (Scorpiones: Buthidae, Chaerilidae, Scorpionidae) with description of four new species of the genera Charmus Karsch, 1879 and Reddyanus Vachon, 1972, stat. in *Euscorpius — Occasional Publications in Scorpiology*. 2016, No. 220.

MASL (2005) *Kala Oya River basin: Survey of the biodiversity & wetland issues and options for their sustainable management, final report.* River basin planning Division, Mahaweli Authority of Sri Lanka.

MOE (2012) *The National Red List 2012 of Sri Lanka; Conservation Status of the Fauna and Flora*. Ministry of Environment, Colombo, Sri Lanka. viii + 476pp.

MMD&E (2015) *A Guide to Invasive Alien Species of Sri Lanka: A descriptive account of National Priority and Potentially Invasive Alien Species*.

Perera, Eng. G.M.R.A (2016). North Western Province (NWP) Canal Project. Presentation.

Phillips, W.W.A. (1935) *Manual of the Mammals of Ceylon*. Ceylon Journal of Science, Dulau and Company, London. 371pp.

Pocock, R. I., (1900). *The Fauna of British India, including Ceylon and Burma. Arachnida:I-XII.* London: Taylor andFrancis.

Raheem, D. and F. Naggs (2006) An Illustrated guide to the land snails of Sri Lankan Natural forests and Cultivated lands. Department of Zooology Natural Historyl Museum. 12p.

Red List (2007) Database, IUCN.

Senarathna, L.K. (2001) *A Checklist of the flowering Plant of Sri Lanka*. Pub.No.22 MAB Checklist and Handbook series *National Science Foundation*. Colombo. Sri Lanka. 451pp.

Somaweera, R. and Somaweera, N. (2009) *Lizards of Sri Lanka, A colour guide with Field Keys.* Andreas S. Brahm, Heddernheimer Landstre. Germany. 303pp.

Somaweera, R. (2006) *Sri Lankave Sarpayan.* Wildlife Heritage Trust (Pvt) Company Limited, Colombo, Sri Lanka. (Sinhala text). 297pp.

Warakagoda, D., Inskipp,C., Inskipp, T., and Grimmett, R. (2012) *Helm Field Guides. Birds of Sri Lanka*. Christopher Helm.

Annex I. The detailed work plan

No	No given in TOR	Activity numbers and related activities	Month																																							
			1				2				3				4				5				6				7				8				9				10				11				12			
			Aug-16				Sep-16				Oct-16				Nov-16				Dec-16				Jan-17				Feb-17				Mar-17				Apr-17				May-17				Jun-17				Jul-17			
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1		Assessment of threats vulnerable ecosystems and identification of habitat enrichment programmes related to wildlife, issues and HEC within the area																																															
1.1	3. (a)	Literature survey and documentation of biodiversity and HEC mitigation measures adopted in the project area at present.																																															
1.1.1		Submission of Inception report																																															
1.2a	3(b) iii.	3(b)iii. Identification and for implementation of habitats enrichment programs such as eradication of invasive plants etc. improvement of water holes, to																																															

No	No given in TOR	Activity numbers and related activities	Month																																														
			1				2				3				4				5				6				7				8				9				10				11				12			
			Aug-16				Sep-16				Oct-16				Nov-16				Dec-16				Jan-17				Feb-17				Mar-17				Apr-17				May-17				Jun-17				Jul-17			
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
		enhance carrying capacity of protected areas.																																																
1. 3b	3(b) iv.	3(b)iv. Identification of sensitive and vulnerable ecosystems in the UEC Project area and propose mitigatory mechanisms to protect them.																																																
1. 4c	3(b) ix,	3(b)ix, Proposals to enhance food and water requirements during dry seasons in the protected areas.																																																
1. 5		GIS mapping of related to activity 01 - prioritized Area																																																
2		Identification and declaration of additional area as protected areas to provide connectivity between remaining forest areas for migration of wild animals.																																																
2. 1	(3(b)ii.	Identification and for declaration of additional areas																																																

No	No given in TOR	Activity numbers and related activities	Month																																					
			1				2				3				4				5				6				7				8				9				10				11				12			
			Aug-16				Sep-16				Oct-16				Nov-16				Dec-16				Jan-17				Feb-17				Mar-17				Apr-17				May-17				Jun-17				Jul-17			
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
		as protected areas to provide connectivity between remaining forest areas and wildlife reserves.																																															
2.2		GIS mapping of related to activity 02																																															
3		Planning of animal rescue and release and flora transplanting programmes.																																														
3.1	3(b) iv.	Identification of animal rescue and translocation programs.																																														
3.2		GIS mapping of related to activity 03																																														
3.3		Submission interim report																																														
4		Identification and prediction of Human Elephant Conflict areas and Community based mitigation measures																																														
4.1		Field surveys to identification of mainly HEC issues within the Project area (DS level)																																														
4.1a	3(b) i,	Establishment of identified elephant																																														

No	No given in TOR	Activity numbers and related activities	Month																																			
			1				2				3				4				5				6				7				8				9				10			
			Aug-16				Sep-16				Oct-16				Nov-16				Dec-16				Jan-17				Feb-17				Mar-17				Apr-17				May-17			
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
		corridors in consultation with relevant stakeholders (Department of Wildlife Conservation (DWC)/ Forest Conservation Department (FD) & others).																																								
4. 2b	3(b) v,	Identification of reasons and details for poor functioning of the relevant existing nature reserves and protected areas and to recommend measures and specification to improve them in consultation with relevant stakeholders (DWC/FD & others).																																								
4. 3c	3(b) vii,	Identification of reasons and details for poor functioning of the existing system of electric fences and to recommend new ways, means, methods and any additional specifications to improve the																																								

No	No given in TOR	Activity numbers and related activities	Month																																					
			1				2				3				4				5				6				7				8				9				10				11				12			
			Aug-16				Sep-16				Oct-16				Nov-16				Dec-16				Jan-17				Feb-17				Mar-17				Apr-17				May-17				Jun-17				Jul-17			
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
		functioning of electric fences to manage the human elephant conflict.																																															
4. 4d	3(b) x,	Identification of areas to be protected by the elephant fences.																																															
4. 5e	3(b) xii,	Identification of traditional methods and implementation of such to mitigate human elephant conflicts																																															
	3(b) xiii,	Identification of mitigatory measures to protect human settlements and paddy fields from wild elephants.																																															
	3(b) viii,	Identification of efficient institutional arrangement with necessary funds, resources, facilitate transport etc. for managing human elephant conflict.																																															
	3(b) xi.	Community training mechanism for the maintenance of elephant																																															

No	No given in TOR	Activity numbers and related activities	Month																																					
			1				2				3				4				5				6				7				8				9				10				11				12			
			Aug-16				Sep-16				Oct-16				Nov-16				Dec-16				Jan-17				Feb-17				Mar-17				Apr-17				May-17				Jun-17				Jul-17			
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
		fences.																																															
	3(b) xiv,	Any other mitigatory measures identified for the management of human-elephant conflict.																																															
	3(b) xvi,	Establishment of a revolving fund for the long term maintenance of electric fences as well as for payment of compensation for affected parties.																																															
	(C.)	Obtaining of a complete understanding of the present situation through consultation meeting of stakeholders.																																															
	3(b) xv,	Estimated budgetary allocation required for the implementation of human-elephant conflict management plan (HECMP).																																															
	(d)	Preparation of a Draft Plan for the management of human-elephant conflict through																																															

No	No given in TOR	Activity numbers and related activities	Month																																															
			1				2				3				4				5				6				7				8				9				10				11				12			
			Aug-16				Sep-16				Oct-16				Nov-16				Dec-16				Jan-17				Feb-17				Mar-17				Apr-17				May-17				Jun-17				Jul-17			
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
		stakeholder consultation including field level.																																																
4.6		Submission of draft Final report																																																
	(e)	Preparation of a final plan for the management of human-elephant conflict by consulting selected group of relevant technical experts and stakeholders.																																																
		Submission of Final report																																																

Annex II List of Species found in the Project Area

Derived from the EIA (2015); Kala Oya Basin Project (2005); Red List 2007 database.

BrR	Breeding Resident	**SU**	Status Unknown	**R**	Resident	**Pro:endemic**	Proposed endemic
WV	Winter Visitor	**SV**	Summer Visitor	**UWV**	Uncertain Winter Visitor	**END**	Endemic
WVa	Winter Vagrant	**PM**	Passage Migrant	**UBr**	Uncertain Breeding Resident	**IND**	Indigenous
Va	Vagrant	**EXO**	Exotic	**DOM**	Domestic		
LC	Least Concern	**NT**	Near Threatened	**EN**	Endangered	**SpS**	Species Status
DD	Data deficient	**VU**	Vulnerable	**CR**	Critically Endangered	**CoS**	Conservation Status

Flora

No	Family (APG III)	Species	English	Sinhala	Tamil	SpS	CoS
1	Acanthaceae	*Barleria prionitis*	Yellow hedge barleria, Common yellow nail dye	Katu Karandu, Katu karanda	Shemmulli	IND	LC
2	Acanthaceae	*Blepharis maderaspatensis*	Creeping blepharis			IND	LC
3	Acanthaceae	*Lepidagathis fasciculata*				IND	LC
4	Acanthaceae	*Stenosiphonium cordifolium*		Bu nelu		IND	LC
5	Acanthaceae	*Alphonsea sclerocarpa*				IND	NT
6	Acanthaceae	*Miliusa indica*		Kekili Messa, Kukulu messa			
7	Acanthaceae	*Miliusa tomentosa*					
8	Acanthaceae	*Mitrephora heyneana*				IND	LC
9	Acanthaceae	*Polyalthia korinti*		Miwenna, Ul Kenda	Uluvintai	IND	LC
10	Acanthaceae	*Xylopia nigricans*		Heen Kenda	See-vindai	END	NT
11	Ebenaceae	*Diospyros affinis*		Kaluwelle, Pati-chamara, Eta Thimbiri	Semel panachai	IND	NT
12	Ebenaceae	*Diospyros ebenoides*		Kalu-habaraliya		END	EN
13	Ebenaceae	*Diospyros ebenum*	Ebony	kaluwara		IND	EN
14	Ebenaceae	*Diospyros malabarica*	Gaub persimmon / Riber ebony	Thimbiri	Panichchai	IND	LC
15	Ebenaceae	*Diospyros oocarpa*		Kalu-Kadumberiya, Ela-thimbiri, Kalu	Vellai-karunkkali	IND	NT
16	Ebenaceae	*Diospyros ovalifolia*		Habara, Kunumella	Vedukkanari / Vedukunari	IND	LC
17	Euphorbiaceae	*Croton aromaticus*		Wel-Keppetiya	Teppaddi	IND	LC
18	Euphorbiaceae	*Croton laccifer*		Gas-Keppetiya, Keppetiya	Teppaddi	IND	LC
19	Euphorbiaceae	*Croton officinalis*		Podiarisi		IND	LC
20	Euphorbiaceae	*Dimorphocalyx glabellus*		Weliwenna, Ten-kuttiya	Tentuikki	IND	LC
21	Euphorbiaceae	*Euphorbia antiquorum*	Spurge cactus, Fleshy spurge	Daluk	Chatura kalli	IND	LC
22	Euphorbiaceae	*Mallotus rhamnifolius*		Molabe, Bulu-hulu-keppetiya		IND	LC
23	Euphorbiaceae	*Sapium insigne*		Tel-Kadura, Kaduru	Tilai	IND	LC
24	Euphorbiaceae	*Sebastiania chamaelea*	Creeping sebastiana	Rat-pitawakka		IND	LC
25	Euphorbiaceae	*Suregada lanceolata*				IND	LC
26	Euphorbiaceae	*Tragia involucrata*	Indian stinging nettle	Wel-Kahmbiliya	Kancori / Kandudi/ Amby	IND	LC

No	Family (APG III)	Species	English	Sinhala	Tamil	SpS	CoS
27	Loranthaceae	*Dendrophthoe falcata*		Delum pilia		IND	LC
28	Loranthaceae	*Scurrula parasitica*				IND	LC
29	Melastomataceae	*Memecylon angustifolium*	Blue mist	Kora-Kaha		IND	EN
30	Melastomataceae	*Memecylon petiolatum*				END	NT
31	Myrtaceae	*Syzygium cumini*	Java plum, Jambol, Black plum	Ma-Dan, Dan	Naval / Perunaval	IND	LC
32	Phyllanthaceae	*Cleistanthus pallidus*		Olupeliya, Visa		END	LC
33	Phyllanthaceae	*Meineckia parvifolia*		Wal-rambutan		IND	NT
34	Phyllanthaceae	*Phyllanthus polyphyllus*		Kuratiya, Embitilla		IND	LC
35	Putranjiavaceae	*Drypetes gardneri*		Gal-Wira, Eta-Wira, Yakilda		END	NT
36	Putranjiavaceae	*Drypetes sepiaria*		Wira	Virai	IND	LC
37	Rubiaceae	*Benkara malabarica*		Pudan, Maha-geta-kulu		IND	LC
38	Rubiaceae	*Canthium coromandelicum*		Kara	Karai	IND	LC
39	Rubiaceae	*Catunaregam spinosa*	Spiny randia, Enetic-nut, False guava	Kukuruman, Kukurummuwan, Pupuru Maha	Karai	IND	LC
40	Rubiaceae	*Discospermum sphaerocarpum*				IND	LC
41	Rubiaceae	*Ixora pavetta*	Toarch tree	Maha-Rathambala	Kanmuttankirai	IND	LC
42	Rubiaceae	*Mussaenda frondosa*	White mussaenda	Mussenda, Mus-Wenna, Wel-Butsarana	Vellai / Lai	IND	LC
43	Rubiaceae	*Oldenlandia herbacea*		Wal koththamalli	Nonnanampullu	IND	LC
44	Rubiaceae	*Oldenlandia umbellata*	Chay-root	Saummal / Saya, Chaya	Chaya	IND	LC
45	Rubiaceae	*Psydrax dicoccos*				IND	
46	Rubiaceae	*Spermacoce hispida*		Hin-geta-kola	Yar / Nattaichchuri	IND	LC
47	Rubiaceae	*Tarenna asiatica*		Tarana, Maha Tarana	Karanai	IND	LC

Fauna

No	Family	Scientific Name	English Name	Sinhala Name	Tamil Name	SpS	Co S
Butterflies							
1	Papilionidae	*Troides darsius*	Common birdwing / Ceylon birdwing	Maha kurulu piya papiliya		**END**	LC
2	Papilionidae	*Pachliopta hector*	Crimson rose	Maha rosa papilia		IND	LC
3	Papilionidae	*Papilio crino*	Banded peacock	Monara papilia		IND	VU
4	Papilionidae	*Papilio polytes*	Common mormon	Kalu papilia		IND	LC
5	Papilionidae	*Papilio polymnestor,*	Blue mormon	Maha nilaya		IND	LC
6	Papilionidae	*Graphium doson*	Common jay	podu papilia		IND	LC
7	Papilionidae	*Graphium agamemnon*	Green jay / Tailed jay	Kola papilia		IND	LC
8	Pieridae	*Delias eucharis*	Jezebel	Podu Maha-sudda		IND	LC
9	Pieridae	*Pareronia ceylanica*	Blue wanderer / Dark wanderer	Anduru nil piyasariya		IND	LC
10	Nymphalidae	*Euploea core*	Common crow	Podu kaka-kotithiyaya		IND	LC
11	Nymphalidae	*Junonia iphita*	Chocolate soldier	Podu alankarikya		IND	LC
12	Nymphalidae	*Pantoporia hordonia*	Common lasker	Kaha selaruwa		IND	NT
13	Nymphalidae	*Neptis jumbah*	Chestnut-streaked sailor	Thambala-iri selaruwa		IND	LC
14	Nymphalidae	*Dophla evelina*	Red spot duke	Rathu-thith Kumaraya		IND	LC
15	Nymphalidae	*Melanitis leda*	Common evening brown	Podu dumburuwa		IND	LC
16	Nymphalidae	*Ypthima ceylonica*	White four-ring	Podu heen-dumburuwa		IND	LC
Fishes							
1	Cyprinidae	*Garra ceylonensis*	Stone sucker	Gal Pandiya		**END**	VU
2	Cyprinidae	*Dawkinsia singhala*	Filamented Barb	Dankola Pethiya		**END**	LC
3	Cyprinidae	*Esomus thermoicos*	Flying barb	Revul Dandiya		**END**	LC
Amphibians							
1	Rhacophoridae	*Polypedates cruciger*	Common hour-glass tree frog	Sulabha pahimbu gas madiya		END	LC

No	Family	Scientific Name	English Name	Sinhala Name	Tamil Name	SpS	Co S
Reptiles							
1	Trionychidae	*Lissemys ceylonensis*	Flapshell turtle	Kiri ibba		**END**	LC
2	Agamidae	*Calotes calotes*	Green garden lizard	Pala katussa		IND	LC
3	Agamidae	*Calotes ceylonensis*	Painted lip lizard	Thola-visituru katussa		**END**	NT
4	Agamidae	*Otocryptis nigristigma*	Black spotted kangaroo lizard	Wiyali Pinum katussa		**END**	LC
5	Gekkonidae	*Geckoella yakhuna*	Blotch bowfinger gecko / Demon gecko	Lapavan vakaniyahuna / Yak huna		**END**	VU
6	Gekkonidae	*Hemidactylus leschenaultii*	Bark gecko / Sycamore gecko	Kimbul huna / Gas huna / Kumbuk huna		IND	LC
7	Gekkonidae	*Hemidactylus lankae*	Termite hill gecko	Humbas huna		**END**	LC
8	Scincidae	*Dasia halianus*	Haly's treeskink	Helige rukhiraluva		**END**	NT
9	Scincidae	*Lankascincus fallax*	Common lankaskink	Sulaba lakhiraluva		**END**	LC
10	Scincidae	*Lygosoma punctatus*	Dotted skink	Tit hiraluhikanala		IND	LC
11	**Scincidae**	*Eutropis* floweri	Taylor's skink	Taylorge hikanala		**END**	EN
12	Scincidae	*Eutropis greeri*	Lowland Bronzegreen little skink	Pahatharata Pingu hikanala		**END**	NE
Birds							
1	Phasianidae	*Gallus lafayetii*	Sri Lanka Junglefowl	Sri Lanka Wali-kukula		**END**	LC
2	Ramphastidae	*Megalaima rubricapilla*	Crimson-fronted Barbet	Rathmhunath Kottoruwa		**Pro: END**	LC
3	Ramphastidae	*Megalaima haemacephala*	Crimson-fronted Barbet	Rathmhunath Kottoruwa		**Pro: END**	LC
4	Bucerotidae	*Ocyceros gingalensis*	Sri Lanka Grey Hornbill	Sri Lanka Alu Kandaththa		**END**	LC
5	Bucerotidae	*Anthracoceros coronatus*	Malabar Pied Hornbill	Poru-Kandaththa		BrR	LC
6	Cuculidae	*Hierococcyx varius*	Common Hawk Cuckoo	Ukusukoha		BrR & UWV	EN
7	Cuculidae	*Surniculus lugubris*	Drongo Cuckoo	Kawudukoha		BrR	NT
8	Cuculidae	*Phaenicophaeus viridirostris*	Blue-faced Malkoha	Wathanil Malkoha		BrR	LC
9	Apodidae	*Collocalia unicolor*	Indian Swiftlet	Indu Upa-thurithaya		BrR	LC
10	Charadriidae	*Vanellus malabaricus*	Yellow-wattled Lapwing	Kaha-yatimal Kirella		**BrR**	LC

No	Family	Scientific Name	English Name	Sinhala Name	Tamil Name	SpS	Co S
11	Laridae	*Sterna albifrons*	Little Tern	Punchi Muhudulihiniya		**BrR**	
12	Accipitridae	*Elanus caeruleus*	Black-wing Kite	Kaluuris Pathannkussa		**BrR**	NT
13	Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea-eagle	Kusa-ali Muhudukussa		**BrR**	LC
14	Accipitridae	*Ichthyophaga ichthyaetus*	Grey-headed Fish-eagle	Alu-his Masukussa		**BrR**	NT
15	Phalacrocoracidae	*Phalacrocorax carbo*	Great Cormorant	Maha Diyakava		**BrR**	NT
16	Pelecanidae	*Pelecanus philippensis*	Spot-billed Pelican	Thithhota Pasthuduwa		**BrR**	LC
17	Ciconiidae	*Ciconia episcopus*	Woolly-necked Stork	Padili Manawa		**BrR**	NT
18	Dicruidae	*Dicrurus paradiseus*	Great Racket-tailed Drongo	Maha Kawuda		**BrR**	NT
19	Monarchidae	*Hypothymis azurea*	Black-naped Monarch	Kalu-gelasi Radamara		**BrR**	LC
20	Muscicapidae	*Copsychus malabaricus*	White-rumped Shama	Wana Polkichcha		BrR	LC
21	Pycnonotidae	*Pycnonotus melanicterus*	Black-crested Bulbul	Kalu Hisasi Kondaya		**Pro: END**	LC
22	Timalidae	*Pellorneum fuscocapillum*	Sri Lanka Brown-capped Babbler	Sri Lanka Boraga-demalichcha		**END**	LC
23	Alaudidae	*Mirafra affinis*	Rufous-winged Bushlark	Rathpiya Akul-thulikawa		BrR	LC
24	Dicaeidae	*Dicaeum agile*	Thick-billed Flowerpecker	Mathudu Pililichcha		BrR	NT
Mammals							
1	Manidae	*Manis crassicaudata*	Pangolin	Kaballewa		IND	NT
2	Cercopithecidae	*Macaca sinica*	Sri Lanka toque monkey	Sri Lanka Rilawa		**END**	LC
3	Cercopithecidae	*Semnopithecus priam*	Grey langur	Eli-wdura		IND	LC
4	Cercopithecidae	*Semnopithecus vetulus*	Purple-faced leaf monkey	Sri Lanka Kalu-wandura		**END**	EN
5	Lorisidae	*Loris lydekkerianus*	Grey slender loris	Alu Unahapuluwa		IND	NT
6	Herpestidae	*Herpestes fuscus*	Brown mongoose	Bora Mugatiya		IND	LC
7	Viverridae	*Paradoxurus zeylonensis*	Golden Dryzone palm civet	Sri Lanka Ran Hothambuva		**END**	EN
8	Elephantidae	*Elephas maximus*	Elephant	Etha / Aliya		IND	EN
9	Bovidae	*Bubalus arnee*	Wild buffalo	Kulu Haraka / Wal Meema		IND	VU
10	Cervidae	*Axis axis*	Spotted deer	Tith Muwa		IND	LC
11	Cervidae	*Rusa unicolor*	Sambur	Gõna		IND	NT

No	**Family**	**Scientific Name**	**English Name**	**Sinhala Name**	**Tamil Name**	**SpS**	**Co S**
12	Cervidae	*Muntiacus muntjak*	Barking deer	Olu Muwa / Weli Muwa		IND	NT
13	Suidae	*Sus scrofa*	Wild boar	Wal Ura		IND	LC
14	Tragulidae	*Moschiola meminna*	Sri Lanka mouse-deer	Sri Lanka Meminna		**END**	LC
15	Hystricidae	*Hystrix indica*	Porcupine	Ittewa		IND	LC
16	Leporidae	*Lepus nigricollis*	Black-naped hare	Wal Hawa		IND	LC

Annex III. Methodologies that will be Used for Rapid Biodiversity Assessments

The detailed biodiversity assessment will include surveys on flora and fauna of the proposed UEC area and covers both terrestrial and aquatic habitats. Endemic and threatened species[2] will be listed in accordance with the National Red List 2012 of Sri Lanka (MoE, 2012) and IUCN global List of Threatened Species (IUCN, 2013), and any invasive species recorded from the project area will be identified based on the latest National List of Alien Invasive Fauna and Flora.

Flora survey

Species and population parameters for higher plants in diverse vegetation types found in the project area will be studied using standard scientific techniques, with appropriate modifications to suit field conditions. The floral survey will focus on documenting the plant species in both aquatic and terrestrial habitats within the project area. The natural vegetation types observed during the reconnaissance survey within a site will be surveyed using the visual encounter survey approach, under two major categories - forests (tree dominated vegetation types/riparian habitats), and non-forest vegetation (shrub lands, grasslands, aquatic vegetation, vegetation dominated by shrubs and herbaceous life forms). Vegetation will be sampled using a 5 x 50 m belt sampling technique, as recommended by Sutherland (1996). In addition, occurrence records will be made through random encounter surveys.

Floral species will be identified and classified using the latest published guides and keys available in Sri Lanka. In addition, the specimens deposited in the National Herbarium will be referred to for the purpose of species authentication.

A list of key references that will be used for plant species identification is presented in the table below.

[2] The term 'threatened species' refers to species that are classified as Critically Endangered (CR), Endangered (EN) or Vulnerable (VU) in the Global or National list of threatened species.

Table 1. Key references used in the floral survey

Subject	Source
Taxonomic identification	Ashton *et al.* (1997); Dassanayake and Fosberg (1980 - 1991); Dassanayake *et al.* (1994 - 1995); Dassanayake and Clayton (1996 - 1999); de Vlas & Jong (2008), de Vlas and de Vlas, (2008).
Nomenclature	Senaratne (2001)
Invasive species	Bambaradeniya (2002), Ranwala *et al.,* (2012)
Conservation status	MOE (2012): IUCN (2013)

Faunal survey

The same belt transect (5 x 50 m) used for the floral survey will be used to sample the fauna. All groups of vertebrates (freshwater fish, amphibians, reptiles, birds and mammals) and selected invertebrate taxa as surrogate taxa[3] encountered at the site will be identified, and documented. All efforts will be made to document the animals in a non-destructive manner. Details of the specific techniques that will be used to sample different faunal taxa are presented in the table below.

Table 2. Faunal sampling techniques

Taxon	Method	Technique
Centipedes, scorpions, freshwater crabs and snails	Direct	Visual encounter survey and litter clearances within the belt transect.
Dragonflies and butterflies	Direct	Visual encounter survey within the transect.
Freshwater fish	Direct	Bank counts and hand net catch.
Amphibians	Direct	Visual encounter survey within the transect and nocturnal survey.
Reptiles	Direct and indirect	Visual encounter survey within the transect.
Birds	Direct and indirect	Visual and auditory observations.
Mammals	Direct and indirect	Visual observations and indirect signs of presence including tracks, scats, faecal matter, feeding signs and vocalizations.

Faunal species will be identified and classified using the latest published guides and keys available in Sri Lanka. In addition, the specimens deposited in the National Museum will be referred if there is need of further species authentication.

A list of key references that will be used in the faunal survey is presented in the table below.

[3] Surrogate taxa are used as a mean of representing other taxa for which data are sparse or absent.

Table 3. Key references used in the faunal survey

Subject	Taxon	Source
Taxonomic identification	Centipedes	Pocock (1900)
	Scorpions	Pocock (1900), Tikader, and Bastawade, (1983)
	Freshwater crabs	Bahir and Yeo (2005)
	Land snails	Naggs and Raheem (2000)
	Dragonflies	Bedjanic *et al.* (2007)
	Butterflies	D' Abrera (1998) van der Poorten and. van der Poorten (2016).
	Freshwater fish	Goonatilake (2007)
	Amphibians	Manamendra-arachchi and Pethiyagoda (2006)
	Reptiles	Somaweera (2006); Somaweera and Somaweera (2009)
	Birds	Harrison (1999); Kotagama and Ratnavira (2010)
	Mammals	Phillips (1935); Kotagama & Goonatilake (2013)
	Invasive Fauna	Marambe, *et al*. (2011)
Nomenclature	All	MoE (2012)
Conservation status	All	MoE (2012); IUCN (2016)